MITIGATION PLAN

Final

December 8, 2017

LONE HICKORY MITIGATION SITE
Yadkin County, NC
NCDEQ Contract No. 6897
DMS ID No. 97135

Yadkin River Basin
HUC 03040101

USACE Action ID No. SAW-2017-00100
RFP #: 16-006706

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

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

REPLY TO
ATTENTION OF:

November 30, 2017

Regulatory Division

Re: NCIRT Review and USACE Approval of the Lone Hickory Mitigation Site Draft Mitigation Plan; SAW-2017-00100; DMS Project #97135

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 review for the Lone Hickory Mitigation Site Draft Mitigation Plan, which closed on November 13, 2017. These comments are attached for your review.

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

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) application for Nationwide permit (NWP) approval of the project along with a copy of this letter. Issues identified in the attached memos must be appropriately 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 appropriate USACE field 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 questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please contact Andrea Hughes at (919) 554-4884 extension 59.

Sincerely,
HUGHES.ANDREA.WADE.125833916
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for
Henry M. Wicker, Jr.
Deputy Chief, Regulatory

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Paul Wiesner, NCDMS

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

REPLY TO
ATTENTION OF:

CESAW-RG/Browning November 14, 2017

MEMORANDUM FOR RECORD

SUBJECT: Lone Hickory Mitigation Site - NCIRT Comments during 30-day Mitigation Plan Review

PURPOSE: The comments listed below were posted to the NCDMS Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCDMS Project Name: Lone Hickory Mitigation Site, Yadkin County, NC

USACE AID#: SAW-2017-00100

NCDMS #: 97135

30-Day Comment Deadline: November 13, 2017

Mac Haupt, NCDWR, November 13, 2017:

1. DWR questions whether there is enough hydraulic energy that supports constructing a channel at the toe of the slope for tribs UT2B and UT2A. In addition, it would seem historically at this landscape position there would be a toe of slope wetland that then may transition to a single thread channel.

2. DWR notes that on Figure 11.1 that there are stream gauges planned to be installed on tribs UT2A and UT2B. DWR would like those gauges installed no further down than mid reach. DWR recommends the placement of the gauge for UT2A just before the proposed wetland polygon on Figure 11.1.

3. In Section 4.0, the functional uplift is discussed based on the Stream Pyramid. While the discussion was fine, given the fact that there seems to be a lot of potential for functional uplift, DWR recommends that the measurements are performed related to the Quantification Tool to provide more quantifiable evidence of the actual uplift. If discussions of the Stream Pyramid are undertaken, DWR likes to see the Quantification Tool and the tables included in the Mitigation Plan (for future projects).

4. Section 7.2.2, Groundwater Modeling, discussed the approach for determining the wetland hydrologic performance criteria. DWR accepts the 9.2% wetland saturation standard arrived at from modeling, other site data and discussions with the IRT on-site. DWR would like to caution,

however, that when grading the wetland site that no more than 12 inches of cut is taken, anymore would result in wetland creation rather than re-establishment.

5. Page 40 (first paragraph) references Table 22 and should reference Table 21.

6. Section 8.0, Performance Standards, references the April 2003 USACE Stream Guidelines as the basis for the guidance of the performance criteria. This document should have referenced the October 2016 Mitigation Update from the IRT. While DWR realizes the project was initiated before the 2016 Guidance came out, the Mitigation was written and finalized well after that date.

7. In the Monitoring Components Section, Table 23, I believe there should be 15 total plots.

8. Buffer width calculations-DWR would like Wildlands to perform the buffer width calculations based on the new method.

9. There appears to be a significant impact on current jurisdictional wetlands for the upper reach of UT1. DWR realizes that this is the old pond bed where the headcut is currently active. DWR would like to know what steps will be undertaken to minimize the effect on the wetlands or will there be other measures to offset the loss other than the proposed wetland re-establishment.

10. On the Design sheets for UT1 DWR noted several areas of high slope with long riffles and no grade control structures (stations 116+00, 121+00, and 125+00). One riffle starting at approximately sta 120+25 is about 170 feet long. One concern is that there will be a lot of rock in the channel and the other concern is of stability given the slope and length. DWR would like a justification for this approach for these areas.

11. DWR would caution the design of the meander at sta 307+50 along UT3. The design ratio of curvature seems pretty tight for this meander and DWR would ask that Wildlands look again at this section.

12. DWR noted that for UT1, all of the grade control structures involve rock or log sills at the end of a type of constructed riffle. In addition, for the typicals shown on Design sheet 6.3, neither the log or rock sills show footers. DWR is concerned with the ultimate stability of these structures in these high gradient environments. Is Wildlands discontinuing the use of rock cross vanes? How have these structures performed on other projects?

13. DWR was not able to attend the July 19, 2016 site visit to see the entire site. DWR would appreciate if you could send some photos of reach UT1, particularly reach 2A and 2B. Given the amount of bedrock on this reach, it would be nice to see some evidence of the incision, stream banks or bedform to justify moving the channel.

Kim Browning, USACE, November 13, 2017:

1. UT2A and UT2B—The field notes from July 19, 2016 indicate the concern for lack of flow and creating a possible wetland complex. Flow monitoring/gauges needed.

2. Figure 2 Site Map and Figure 6 Concept Map show a channel labeled as UT2C. While Figure 8.1 Concept Map and Figure 11.1 Monitoring Plan shows the same channel labeled UT2B.

3. Section 4 Functional Uplift Potential, page 15: The functional pyramid is cited to show existing conditions for each category, and was used to describe the functional uplift potential of the project, which is appreciated. Please note that the functional pyramid and QT tool have not been approved for use in determining success for mitigation projects. No standards for collection protocol are addressed in the plan, nor are score sheets, sampling location and number of samples discussed.

4. Section 7.7.1, page 37: NRCS stands for Natural Resources Conservation Service. Please correct the text in the last paragraph on the page.

5. Section 8.0 Performance Standards, page 41: The plan states, "Wildlands may propose to terminate stream and/or vegetation monitoring after five years." The monitoring program should be implemented for 7 years.

6. Page 40: The text references Table 22, but the table is labeled Table 21.

7. Section 8.2 Vegetation, page 42: Please include a discussion on vigor (vegetation height).

8. Section 8.3 Wetlands, page 42: The text reads, "If a gage does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed and the hydrograph will be compared to that of the reference wetlands." Please keep in mind that performance standards for wetland hydrology must be met.

9. Section 7.6, pages 35-36: The removal of existing dams is discussed. Please expand on your description on how the existing pond bed will be handled, and where the sediment will be spread.

10. Section 12.0, page 48: the first paragraph references Table 27. I believe this was meant to be Table 26.

11. Section 8.0, Performance Standards, references the April 2003 USACE Stream Guidelines; however, Section 12.0, Determination of Credits, references the October 2016 USACE guidance for Additional Credits for buffers. While the USACE encourages establishing buffers that exceed minimum standard widths, it would be preferable if only one guidance document was referred to for consistency.

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Kim Browning
Mitigation Specialist
Regulatory Division

MEMORANDUM

TO: Paul Wiesner, NC DMS

FROM: Emily Reinicker, PE

DATE: December 8, 2017

RE: Lone Hickory Mitigation Site
Yadkin County, NC
USACE AID#: SAW-2017-00100, NCDMS #: 97135
FINAL Mitigation Plan – IRT Comment Response

This memo documents NCIRT's Mitigation Plan review comments (*in italics*) received from Kim Browning's letter dated 11/14/17, the project team's responses, and where the revisions have been included in the final Mitigation Plan.

Mac Haupt, NCDWR, November 13, 2017:

1. *DWR questions whether there is enough hydraulic energy that supports constructing a channel at the toe of the slope for tribs UT2B and UT2A. In addition, it would seem historically at this landscape position there would be a toe of slope wetland that then may transition to a single thread channel.*
    a. Wildlands acknowledges this concern referenced in comments #1, 14, and 25. Due to the contributing drainage area, the defined upstream channel on UT2A, and the observed groundwater hydrology inputs on UT2B, it is appropriate to develop the site design treating these features as restored stream channels. We acknowledge that if these features do not meet the prescribed success criteria for functioning stream features at the end of the monitoring period, then we will not receive stream credits for the affected reach(es). No revisions have been made to the Mitigation Plan.

2. *DWR notes that on Figure 11.1 that there are stream gauges planned to be installed on tribs UT2A and UT2B. DWR would like those gauges installed no further down than mid reach. DWR recommends the placement of the gauge for UT2A just before the proposed wetland polygon on Figure 11.1.*
    a. Wildlands will install the a stream gage at midreach on UT2A and UT2B. The Mitigation Plan text on page 42, Section 8.1.5 Hydrology has been modified to state that "low flow channels (UT1 Reach 1, UT2A, and UT2B) will each have a stream gage pressure transducer installed midreach to document 30 consecutive days of baseflow." Figure 11.1 has been revised to show the proposed stream gage and monitoring cross sections located upstream of the proposed wetland polygon on UT2A.

3. *In Section 4.0, the functional uplift is discussed based on the Stream Pyramid. While the discussion was fine, given the fact that there seems to be a lot of potential for functional uplift,*

DWR recommends that the measurements are performed related to the Quantification Tool to provide more quantifiable evidence of the actual uplift. If discussions of the Stream Pyramid are undertaken, DWR likes to see the Quantification Tool and the tables included in the Mitigation Plan (for future projects).

   a. Wildlands used observations and terminology from the functional pyramid to qualitatively describe stream conditions on the site, as requested in DMS's newest mitigation plan template as required within our DMS contract. Wildlands does not propose to use the functional pyramid to determine the success of the mitigation site. The following text changes have been made in Section 4.0- Functional Uplift Potential on page 15 of the Mitigation Plan based on this comment: "The potential for functional uplift is qualitatively described in this section using terminology from the Stream Functions Pyramid (Harman, 2012). The Stream Functions Pyramid describes a hierarchy of five stream functions, each of which supports the functions above it on the pyramid (and sometimes reinforces those below it). The five functions in order from bottom to top are hydrology, hydraulics, geomorphology, physicochemical, and biology. Neither the Stream Functions Pyramid nor the Quantification Tool are proposed to determine success of the mitigation site." See also comment #16.

4. *Section 7.2.2, Groundwater Modeling, discussed the approach for determining the wetland hydrologic performance criteria. DWR accepts the 9.2% wetland saturation standard arrived at from modeling, other site data and discussions with the IRT on-site. DWR would like to caution, however, that when grading the wetland site that no more than 12 inches of cut is taken, anymore would result in wetland creation rather than re-establishment.*
   a. As discussed during the Post-Contract IRT Site Walk for Wetland Soils Evaluation (January 25, 2017 notes included in Appendix 9), overburden removal will generally be limited to 12 inches. There is obvious crowning between the two major ditches draining the proposed wetland area. Some grading in this area is slightly deeper than 12 inches; this grading was discussed and approved at the Post-Contract IRT Site Walk for Wetland Soils Evaluation based on the obvious manipulation of the site for agriculture. Additionally, grading around stream channels to tie the proposed streams to the proposed wetland area may result in grading depths just over 12 inches. This is a byproduct of grading the streams into the wetland valley and is not a result of the wetland design. As stated on page 39 of the report, "Cut depth is limited to approximately 12 inches throughout the site." No changes have been made to the Mitigation Plan based on this comment.

5. *Page 40 (first paragraph) references Table 22 and should reference Table 21.*
   a. This reference has been updated to Table 21.

6. *Section 8.0, Performance Standards, references the April 2003 USACE Stream Guidelines as the basis for the guidance of the performance criteria. This document should have referenced the October 2016 Mitigation Update from the IRT. While DWR realizes the project was initiated before the 2016 Guidance came out, the Mitigation was written and finalized well after that date.*
   a. Section 8.0- Performance Standards on page 41 of the Mitigation Plan has been updated as follows: "The stream and wetland performance standards for the project have been developed based on guidance presented in the DMS Mitigation Plan Template (October

2015), the Annual Monitoring Template (April 2015), and the Stream and Wetland Mitigation Guidance issued October 2016 by the USACE. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, vegetation, and wetland hydrology. Performance criteria will be evaluated throughout the seven year post-construction monitoring period."

   b. Several of the performance standards have been updated to reference details of the 2016 guidance:
      i. *A note has been added to Section 8.1.1- Dimension: "*Please note that UT3 Reach 3 is designed to incise as it transitions to meet the invert of South Deep Creek and this reach is expected to have a bank height ratio greater than 1.0 and an entrenchment ratio less than 2.2.
      ii. *Section 8.1.5- Hydrology has been edited: "*The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented within the seven-year monitoring period. The four bankfull events must occur in separate years. In addition, low flow channels (UT1 Reach 1, UT2A, and UT2B) will each have a stream gage pressure transducer installed midreach to document 30 consecutive days of baseflow.
      iii. *Section 8.2- Vegetation has been edited: "*The final vegetative performance standard will be the survival of 210 planted stems per acre in the planted riparian areas at the end of the required seven-year monitoring period. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of monitoring year three (MY3) and at least 260 stems per acre at the end of MY5. Trees in each plot will average 7 feet in height at MY5 and 10 feet in height at MY7." See also comment #24.

7. *In the Monitoring Components Section, Table 23, I believe there should be 15 total plots.*
   a. Table 23 has been revised to show 15 plots total, comprised of 10 permanent and 5 mobile plots.

8. *Buffer width calculations-DWR would like Wildlands to perform the buffer width calculations based on the new method.*
   a. Wildlands has verified that the mitigation credit adjustment for non-standard buffer widths are based on Table 2 of the October 24, 2016, USACE guidance. No changes have been made to the Mitigation Plan based on this comment.

9. *There appears to be a significant impact on current jurisdictional wetlands for the upper reach of UT1. DWR realizes that this is the old pond bed where the headcut is currently active. DWR would like to know what steps will be undertaken to minimize the effect on the wetlands or will there be other measures to offset the loss other than the proposed wetland re-establishment.*
   a. Full valley restoration, which includes excavation of the former pond beds (which are filled with sediments and cattle waste), has been the proposed approach since the beginning of this project. Wildlands discussed this approach during the IRT post-contract site meeting, as included in the meeting notes in Appendix 9. The imminent failure of the dam will not only destroy these wetlands but will be a mass sediment/animal waste input to the downstream system. No direct offset measures are proposed but we do expect wetlands to form on the restored floodplain and vernal pools. The restoration of the historic valley discussed in Section 5.3- 401/404 on page

21 of the Mitigation Plan, has been edited to add: "The valley floor will be restored at or near its historic gradient. The restoration will impact the wetlands that have formed around the impoundments; however, new riparian wetlands associated with the Priority 1 stream restoration are likely to form on the restored valley floor, and the real and present threat posed by the advancing headcuts as they cut into the old pond beds will be eliminated." The IRT has expressed concern on past projects of the constructability of stream channels in former pond beds containing unconsolidated materials. The proposed valley restoration is the most holistic ecological uplift approach for the site.

10. *On the Design sheets for UT1 DWR noted several areas of high slope with long riffles and no grade control structures (stations 116+00, 121+00, and 125+00). One riffle starting at approximately sta 120+25 is about 170 feet long. One concern is that there will be a lot of rock in the channel and the other concern is of stability given the slope and length. DWR would like a justification for this approach for these areas.*
    a. The structure detail for these long riffles shows log and rock steps with micropools throughout. This will be built in the field and each step and micropool was not detailed in the profile callouts. A sample plan & profile sheet with a photo of the newly constructed channel is attached at the end of this letter to demonstrate how this approach was implemented at the Candy Creek Mitigation Site last year. No changes have been made to the plans as a result of this comment.

11. *DWR would caution the design of the meander at sta 307+50 along UT3. The design ratio of curvature seems pretty tight for this meander and DWR would ask that Wildlands look again at this section.*
    a. This meander has a radius of 38 feet and a radius of curvature ratio of 2.3, which is within the reference and design parameters. Brush toe is also provided in the bend, which will protect against toe scour. No changes have been made to the plans as a result of this comment.

12. *DWR noted that for UT1, all of the grade control structures involve rock or log sills at the end of a type of constructed riffle. In addition, for the typicals shown on Design sheet 6.3, neither the log or rock sills show footers. DWR is concerned with the ultimate stability of these structures in these high gradient environments. Is Wildlands discontinuing the use of rock cross vanes? How have these structures performed on other projects?*
    a. Wildlands reserves the use of rock vanes for discrete locations such as upstream of bridges or adjacent to infrastructure with limited working space. We have not found rock cross vanes to be the best use of resources. We have revised the rock and log vane structure details on Sheets 6.1-6.4 to include footers.

13. *DWR was not able to attend the July 19, 2016 site visit to see the entire site. DWR would appreciate if you could send some photos of reach UT1, particularly reach 2A and 2B. Given the amount of bedrock on this reach, it would be nice to see some evidence of the incision, stream banks or bedform to justify moving the channel.*
    a. Photos of these reaches have been added to Appendix 4.

Kim Browning, USACE, November 13, 2017:

14. *UT2A and UT2B—The field notes from July 19, 2016 indicate the concern for lack of flow and creating a possible wetland complex. Flow monitoring/gauges needed.*
    a. Wildlands will install a stream gage at midreach on UT2A and UT2B. The Mitigation Plan text on page 42, Section 8.1.5 Hydrology has been modified to state that "low flow channels (UT1 Reach 1, UT2A, and UT2B) will each have a stream gage pressure transducer installed midreach to document 30 consecutive days of baseflow."

15. *Figure 2 Site Map and Figure 6 Concept Map show a channel labeled as UT2C. While Figure 8.1 Concept Map and Figure 11.1 Monitoring Plan shows the same channel labeled UT2B.*
    a. Labels have been verified on the figures.

16. *Section 4 Functional Uplift Potential, page 15: The functional pyramid is cited to show existing conditions for each category, and was used to describe the functional uplift potential of the project, which is appreciated. Please note that the functional pyramid and QT tool have not been approved for use in determining success for mitigation projects. No standards for collection protocol are addressed in the plan, nor are score sheets, sampling location and number of samples discussed.*
    a. Wildlands used observations and terminology from the functional pyramid to qualitatively describe stream conditions on the site, as requested in DMS's newest mitigation plan template as required within our DMS contract. Wildlands does not propose to use the functional pyramid to determine the success of the mitigation site. The following text changes have been made in Section 4.0- Functional Uplift Potential on page 15 of the Mitigation Plan based on this comment: "The potential for functional uplift is qualitatively described in this section using terminology from the Stream Functions Pyramid (Harman, 2012). The Stream Functions Pyramid describes a hierarchy of five stream functions, each of which supports the functions above it on the pyramid (and sometimes reinforces those below it). The five functions in order from bottom to top are hydrology, hydraulics, geomorphology, physicochemical, and biology. Neither the Stream Functions Pyramid nor the Quantification Tool are proposed to determine success of the mitigation site." See also comment #3.

17. *Section 7.7.1, page 37: NRCS stands for Natural Resources Conservation Service. Please correct the text in the last paragraph on the page.*
    a. Text has been corrected.

18. *Section 8.0 Performance Standards, page 41: The plan states, "Wildlands may propose to terminate stream and/or vegetation monitoring after five years." The monitoring program should be implemented for 7 years.*
    a. The early termination reference has been deleted. The text in Section 8.0- Performance Standards on page 41 now simply states: "Performance criteria will be evaluated throughout the seven-year post-construction monitoring period."

19. *Page 40: The text references Table 22, but the table is labeled Table 21.*
    a. The text has been revised.

20. *Section 8.2 Vegetation, page 42: Please include a discussion on vigor (vegetation height).*
    a. The following statement has been added to Section 8.2- Vegetation on page 42: "Trees in each plot will average 7 feet in height at MY5 and 10 feet in height at MY7."

21. *Section 8.3 Wetlands, page 42: The text reads, "If a gage does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed and the hydrograph will be compared to that of the reference wetlands." Please keep in mind that performance standards for wetland hydrology must be met.*
    a. Wildlands acknowledges this comment and the fact that success criteria must be met for the mitigation site to qualify for wetland credits. No changes have been made to the Mitigation Plan based on this comment.

22. *Section 7.6, pages 35-36: The removal of existing dams is discussed. Please expand on your description on how the existing pond bed will be handled, and where the sediment will be spread.*
    a. The existing dams and pond bed sediments will be excavated to restore the historic valley topography. Wildlands is under option to purchase the entirety of the parcels comprising the mitigation site. We are still working on grading plans, but in general we expect this material will be placed in the agricultural field to the east of UT1 Reach 1. Fill will not be placed in jurisdictional stream or wetland features.
23. *Section 12.0, page 48: the first paragraph references Table 27. I believe this was meant to be Table 26.*
    a. The text has been revised.

24. *Section 8.0, Performance Standards, references the April 2003 USACE Stream Guidelines; however, Section 12.0, Determination of Credits, references the October 2016 USACE guidance for Additional Credits for buffers. While the USACE encourages establishing buffers that exceed minimum standard widths, it would be preferable if only one guidance document was referred to for consistency.*
    a. Section 8.0- Performance Standards on page 41 of the Mitigation Plan has been updated as follows: "The stream and wetland performance standards for the project have been developed based on guidance presented in the DMS Mitigation Plan Template (October 2015), the Annual Monitoring Template (April 2015), and the Stream and Wetland Mitigation Guidance issued October 2016 by the USACE. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, vegetation, and wetland hydrology. Performance criteria will be evaluated throughout the seven-year post-construction monitoring period."
    b. Several of the performance standards have been updated to reference details of the 2016 guidance:
        i. *A note has been added to Section 8.1.1- Dimension: "*Please note that UT3 Reach 3 is designed to incise as it transitions to meet the invert of South Deep Creek and this reach is expected to have a bank height ratio greater than 1.0 and an entrenchment ratio less than 2.2.
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bankfull events must occur in separate years. In addition, low flow channels (UT1 Reach 1, UT2A, and UT2B) will each have a stream gage pressure transducer installed midreach to document 30 consecutive days of baseflow.

iii. *Section 8.2- Vegetation has been edited: "*The final vegetative performance standard will be the survival of 210 planted stems per acre in the planted riparian areas at the end of the required seven-year monitoring period. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of monitoring year three (MY3) and at least 260 stems per acre at the end of MY5. Trees in each plot will average 7 feet in height at MY5 and 10 feet in height at MY7." See also comment #6.

Steven Kichesfski, USACE, November 15, 2017 email to Kimberley Browning

25. *I wanted to put on the record somewhere with this site my concerns for some of the features like the upper portion of UT2a (and probably UT2b) based on my jd site visit (I haven't seen the proposed mit plan). This channel seemed to barely meet jurisdiction as a WoUS and seems risky if lifted onto the floodplain that it will maintain enough flow to stay a stream in this broad floodplain, especially if flow is dispersed to create adjacent wetland areas. I'm not suggesting that this is an inappropriate design, simply that it may be a future monitoring/credit issue to demonstrate that it is functioning as stream. I mentioned this to Wildlands in the field and thought it should be in the file (if not already) so it's not a surprise during monitoring/credit release discussions.*
    a. Wildlands acknowledges this concern referenced in comments #1, 14, and 25. Due to the contributing drainage area, the defined upstream channel on UT2A, and the observed groundwater hydrology inputs on UT2B, it is appropriate to develop the site design treating these features as restored stream channels. We acknowledge that if these features do not meet the prescribed success criteria for functioning stream features at the end of the monitoring period, then we will not receive stream credits for the affected reach(es). No revisions have been made to the Mitigation Plan.

FINAL MITIGATION PLAN

LONE HICKORY MITIGATION SITE

Yadkin County, NC
NCDEQ Contract No. 6897
DMS ID No. 97135
Yadkin River Basin
HUC 03040101

USACE Action ID No. SAW 2017-00100

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

PREPARED BY:

Wildlands Engineering, Inc.
1430 South Mint Street, Suite 104
Charlotte, NC 28203
Phone: (704) 332-7754

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:

Emily Reinicker, PE, CFM *Project Manager*
Shawn Wilkerson, *Principal in Charge*
Ian Eckardt, PWS, *Wetland Delineations*
Christine Blackwelder, *Mitigation Plan Development*
Aaron Earley, PE, CFM, *Stream and BMP Design*
Eric Neuhaus, PE, *Wetland Design*
Jesse Kelley, *Construction Documents*
Jake McLean, PE, CFM, *Lead Quality Assurance*

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TABLES

FIGURES

APPENDICES

1.0 Introduction

The Lone Hickory Mitigation Site (Site) is in Yadkin County approximately 3.5 miles south of the town of Yadkinville and approximately 24 miles west of the city of Winston-Salem, NC (Figure 1). The Site is within the NC Division of Mitigation Services (DMS) targeted watershed for the Yadkin River Basin Hydrologic Unit Code (HUC) 03040101130020 and the NC Division of Water Resources (DWR) Subbasin 03-07-02, and will provide stream mitigation units (SMUs) and riparian wetland mitigation units (WMUs) in the Yadkin River Basin HUC 03040101 (Yadkin 01).

The Site contains two valleys, separated by a ridge that runs north to south through the project limits. South Deep Creek flows along the northern boundary of the project. On the east side of the ridge (herein referenced as the East Side), UT1 flows through a steep, narrow valley that gradually widens and flattens in slope as it flows downstream to the South Deep Creek floodplain. UT1 is joined by UT1A and UT1B within the Site limits before flowing offsite to join South Deep Creek. On the west side of the ridge (herein referenced as the West Side), UT2 and UT3 flow out of steep, narrow valleys into the broad, flat floodplain of South Deep Creek. UT2A and UT2B join UT2 before the stream's confluence with South Deep Creek.

The Site is currently in agricultural crop cultivation and has a history of use for both crop production and as a dairy farm. The streams throughout the Site are in various stages of impairment related to the current and historical agricultural uses. The project proposes to restore and preserve 13,370 existing linear feet of 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 13,164 SMUs and 9.5 WMUs, and will be protected in perpetuity by a 103 acre conservation easement. The Site Protection Instrument detailing the proposed terms and restrictions of the conservations easement is in Appendix 1.

Table 1: Project Attribute Table Part 1 – *Lone Hickory Mitigation Site*

Project Information	
Project Name	Lone Hickory Mitigation Site
County	Yadkin
Project Area (acres)	103
Project Coordinates (latitude and longitude)	36° 5' 39.16"N 80° 40' 2.14"W
Planted Acreage (acres of woody stems planted)	99

2.0 Watershed Approach and Site Selection

The Site was selected based on its potential to support the objectives and goals of multiple conservation and watershed planning documents, outlined below.

- In 2008, the Yadkin River DWR Basinwide Water Quality Plan noted that, approximately 3.3 miles downstream from the Site, South Deep Creek was impaired for aquatic life due to turbidity. Additionally, less than a mile downstream from the Site, the Town of Yadkinville has a water plant intake on South Deep Creek, resulting in a DWR critical area classification of South Deep Creek at the intake. The Site is within the water supply watershed to this facility.
- Downstream of the Site, South Deep Creek is included on the 2014 North Carolina Water Quality Assessment 305(b) report as exceeding criteria for fish tissue mercury and turbidity.

- The 2009 Upper Yadkin Pee Dee River Basin Restoration Priorities (RBRP) outlined general goals of restoration of water quality and aquatic habitat on impaired streams in the watershed, and implementation of agricultural BMPs to limit sediment and nutrient input from active farming operations.
- The 2005 North Carolina Wildlife Resource Commission's (WRC) Wildlife Action Plan (WAP) discusses the Upper Yadkin river basin as a priority watershed for freshwater conservation.

The project will directly and indirectly address stressors identified in the DWR Basinwide Plan, the RBRP, and the WAP by stabilizing eroded stream banks, reconnecting incised stream to floodplains, restoring historically drained wetlands to the floodplain of South Deep Creek, installing BMPs to treat areas of concentrated agricultural inputs, and restoring and preserving wide, forested buffers averaging twice of that required to achieve mitigation credit. These actions will reduce nutrient and sediment inputs to Site streams, and ultimately to South Deep Creek, while providing improved instream and terrestrial (riparian) habitats, stream stability, and overall hydrology.

3.0 Baseline and Existing Conditions

The Site watershed (Table 2 and Figure 3) is in the southeastern portion of the Yadkin 01. It is situated in the rural countryside in Yadkin County near Yadkinville, NC. The following sections describe the existing conditions of the Site, watershed, and watershed processes, including disturbance and response.

Table 2: Project Attribute Table Part 2 – *Lone Hickory Mitigation Site*

Project Watershed Summary Information			
Physiographic Province	Piedmont		
Ecoregion	Northern Inner Piedmont		
River Basin	Yadkin River		
USGS HUC (8 digit, 14 digit)	03040101, 03040101130020		
NCDWR Sub-basin	03-07-02		
Project Drainage Area (acres)	286 (East Side), 170 (UT2 - West Side), 392 (UT3 – West Side)		
Project Drainage Area Percentage of Impervious Area	3% (UT1 - East Side), 1% (UT2 – West Side), 2% (UT3 – West Side)		
2011 NLCD Land Use Classification	East Side	West Side	
	UT1	UT2	UT3
Forest	39%	31%	57%
Cultivated	42%	40%	22%
Grassland	4%	9%	5%
Shrubland	7%	10%	10%
Urban	8%	0%	3%
Open Water	0%	10%	3%

3.1 Landscape Characteristics

3.1.1 Physiography and Topography

The Site is in the Inner Piedmont Belt of the Piedmont physiographic province. 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. The Site is divided by a low, north to south running ridge, and most of the project area on the West Side is in the broad, gently sloping floodplain of South Deep Creek. The East Side is characterized by moderate and steep contours. The valley through the project transitions from a steep, moderately confined valley to a broad, alluvial floodplain at the bottom as it approaches South Deep Creek.

3.1.2 Geology and Soils

The Site is in the Inner Piedmont lithotectonic belt which consists of intrusive and metamorphic rocks (NCGS, 1985). The underlying geology of the Site is mapped as late Proterozoic to Cambrian (1 billion to 500 million years in age) metamorphic rocks biotite gneiss and schist (CZbg) and Cambrian to Ordovician (455-540 million years in age) intrusive metamorphosed granitic rock (OCg) (NCGS, 1985). The Proterozoic to Cambrian biotite gneiss and schist is described as "inequigranular and megacrystic; abundant potassic feldspar and garnet; interlayered and gradational with calc-silicate rock, sillimantite-mica schist, mica schist, and amphibolite that contains small masses of granitic rock." The Cambrian to Ordovician metamorphosed granitic rock intrusion is described as "equigranular to megacrystic, foliated to massive", and "includes Toluca Granite".

The proposed project is mapped by the Web Soil Survey for Yadkin County. Project area soils are described below in Table 3. Figure 5 is a soil map of the Site, which includes observed instances of exposed bedrock.

Table 3: Project Soil Types – *Lone Hickory Mitigation Site*

Soil Name	Description
Clifford Series: Fine Sandy Loam	These soils are on gently sloping uplands with a slope of 2-6 %. Clifford soils are very deep and well drained. They have a sandy loam surface layer and a clay loam subsoil. Includes a moderately eroded component of sandy clay loam with a gravelly loamy surface layer. The parent material consists of saprolite derived from granite and gneiss and/or schist.
Codorus loam	This series consists of somewhat poorly drained soils, on nearly level floodplains and valleys with a slope of 0- 2%. These soils are subject to occasional flooding, and they have a loamy surface layer and subsoil. The parent material consists of loamy alluvium derived from igneous and metamorphic rock.
Dan River and Codorus soils	This series consists of 50% Dan River and 40% Codorus soil on nearly level valleys and floodplains with a slope of 0-2%. Dan River soils are very deep and well drained. They have a loamy surface layer and loamy subsoil. Codorus soils are very deep and somewhat poorly drained. They have a loamy surface layer and subsoil. These soils are subject to occasional flooding. The parent material consists of loamy alluvium derived from igneous and metamorphic rock.
Dan River and Comus soils	This series consists of 50% Dan River and 40% Comus soils on nearly level to gently sloping valleys and floodplains with a slope of 0-4%. Dan River soils are very deep and well drained. They have a loamy surface layer and loamy subsoil. Comus soils are very deep and well drained. They have a loamy surface layer and subsoil. These soils are subject to occasional flooding. The parent material consists of loamy and sandy alluvium derived from igneous and metamorphic rock.
Delila Fine Sandy Loam	This series consists of nearly level to gently sloping soils along drainageways and in slight depressions on uplands with 0-6 % slopes. Delila soils are very deep and poorly drained. They have a loamy surface layer and a clayey subsoil. The parent material consists of alluvium and/or colluvium over saprolite derived from granite and gneiss.
Fairview sandy loam	This series consists of sloping soils on uplands, ridges and hills, with slopes from 10-25%. Fairview soils are very deep and well drained. They have a thin loamy surface layer and a clayey subsoil. Includes a moderately eroded and severely eroded component. The parent material consists of saprolite residuum weathered from granite and gneiss and/or schist.

Soil Name	Description
Fairview sandy clay and clay loam	This series consists of sloping soils on uplands, ridges and hills, with slopes from 10-25%. These map units are very deep and well drained. The parent material consists of saprolite derived from granite and gneiss and/or schist.
Fairview-Stott Knob complex	This series consists of 60% Fairview and 28% Stott Knob soils, on steep hillslopes, ridges, and uplands, with 25-45% slopes. Fairview soils are very deep and well drained. They have a cobbly, loamy surface layer and a clayey subsoil. Stott Knob soils are well drained and have weathered bedrock within a depth of 20 to 40 inches. They have a cobbly, loamy surface layer and subsoil. Stones are widely scattered on the soil surface. The parent material consists of saprolite derived from schist and/or gneiss.
Nathalie sandy clay loam	This series consists of gently sloping soils on uplands with 2-6 % slopes. Nathalie soils are very deep and well drained. They have a loamy surface layer and a clayey subsoil. The parent material consists of saprolite derived from granite and gneiss and/or schist.
Rhodhiss-Stott Knob complex, stony	This series consists of 75% Rhodhiss and 20% Stott Knob soils on strongly sloping hillslopes, ridges and uplands of 8-25% slopes. The compositions changes to 40% Rhodhiss and 20% Stott Knob from 25-45% slopes. Rhodhiss soils are very deep and well drained. Stott Knob soils are well drained and have soft (rippable) bedrock within a depth of 20 to 40 inches. Both soils have a loamy surface layer and subsoil. There are widely scattered stones on the soil surface. The parent material consists of residuum weathered from granite and gneiss and/or schist.
Siloam sandy loam	This series consists of strongly sloping to steep soils on hillslopes, ridges, and uplands from 25-50% slopes. Siloam soils are well drained and have soft (rippable) bedrock within a depth of 10 to 20 inches. They have a loamy surface layer and subsoil. The parent material consists of residuum weathered from diorite and/or gabbro and/or diabase and/or gneiss.
Starr loam	This series consists of nearly level soils in upland drainageways and depressions with a slope of 0-6 %. Starr soils are very deep and well drained. They have a loamy surface layer and a loamy subsoil. These soils rarely experience flooding. The parent material consists of loamy alluvium derived from igneous and metamorphic rock.
Toast fine sandy loam and sandy clay loam	This series consists of soils on moderately steep hillslopes, ridges and uplands with a slope of 15-25%. Toast soils are very deep and well drained. They have a loamy surface layer and a clayey subsoil. The parent material consists of saprolite derived from granite and gneiss and/or schist. Also, includes a moderately eroded component (sandy clay loam)
Woolwine-Fairview-Westfield Complex	This series consists of 47% Woolwine, 24% Fairview and 10% Westfield components on steep uplands with slopes ranging from 25-45% and include a stony component. Woolwine soils have weathered (rippable) bedrock within a depth of 20 to 40 inches. They have a gravelly, loamy surface layer and a clayey subsoil. Fairview soils are very deep. They have a gravelly, loamy surface layer and a clayey subsoil. Westfield soils have soft (rippable) bedrock within a depth of 40 to 60 inches. They have a gravelly, loamy surface layer and a clayey subsoil. Parent material consists of saprolite derived from schist and/or gneiss.

Source: USDA-NRCS Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Wildlands contracted a licensed soil scientist (LSS) to further investigate the soil types and potential for hydric soil development on the West Side of the Site. Details regarding this soils investigation and how it relates to the wetland restoration design are detailed in Section 7.7 – Proposed Wetland Design Overview. During the LSS's investigation, he made note of a sand and rounded gravel substrate layer found at a depth of 42 to 48 inches at the location shown on Figure 6.1. This substrate is different from other substrates found at this depth within the West Side floodplain, and the LSS noted that these were stream sediments. Wildlands uncovered similar substrates at a depth of 44 to 54 inches while installing GWG3, which is located just north of the soil scientist's findings.

Wildlands conducted a watershed walk on November 10, 2016 to gain an understanding of the various sources of sediment to Site streams. Three major sources of sediment to the East Side were identified during the watershed walk: runoff from the agricultural watershed and the actively tilled portions of the stream buffer in crop production; Site stream bank erosion; and failing in-line pond embankments. The agricultural watershed and adjacent fields contribute fine sediments, the onsite stream bank erosion contributes a mix of small gravels and cobbles and fines, while the failing pond embankments contribute fine sediments both from the eroding embankment and the pond bed sediments. UT1A and UT1B are both eroded upstream of the Site boundary. UT1A upstream of the project reach has alternating bank erosion and a small plume of stream bed and bank sediments is present at the confluence of UT1A and UT1. A road crossing directly upstream of the Site boundary on UT1B appears to detain the eroded stream bank sediment from reaching the Site. Offsite stream bank erosion was determined to be a minor potential source of stream sediments.

On the West Side of the project, there are two sources of sediment to the project streams: agricultural field and watershed stream bank erosion. The runoff from the agricultural fields contributes fines while the watershed stream bank erosion contributes a varied mix of fines, small gravels, and cobbles. During the West Side watershed walk, UT2 and UT3 typically had one or both banks eroding, generally on alternating banks. In areas where the valley narrowed, streams tended towards incision, whereas in areas where the valley widened, the streams tended to have lower bank heights and better connection to the valley floor. In the wider floodplain areas, valley bottoms functioned as active alluvial floodplains, providing storage for eroded bank sediments transported during larger storm events. Culverted stream crossings leftover from the old logging roads were observed throughout the watershed. While these culverts likely function as barriers to aquatic species passage, they also prevent upstream head cut migration and provide storage for eroded bank sediments to drop out before reaching the downstream waters. Because of the two types of sediment sinks observed within the watershed, coupled with the absence of in-stream sediment plumes inside the Site, limited sediment load from the watershed is believed to reach UT2 and UT3. UT2A's watershed is small and well-vegetated. The ephemeral stream channel in the watershed is clay bed, but appears to be in equilibrium and not a substantial source of eroded channel sediments; therefore, limited sediment load is also anticipated from this watershed. Currently, much of UT2B's watershed drainage bypasses the channel and is routed through a ditch network that splays near the confluence of UT2B and UT2. The sediment splay at the ditch outlet is active, and although the ditch itself is a fine sediment source, observations of flow through the ditch network during rain events confirm that runoff entering the ditch network from the agricultural fields is sediment-laden.

West Side streams were visually inspected several times between 2015 and 2017, and sediment movement into the Site from the UT2, UT2A, and UT3 watersheds appears modest, with only minor changes observed in bars within the Site limits. No sediment movement was observed in UT2B due to the upstream ditch network. Franklin Shore, the tenant farmer who has managed this land for over 15 years, indicated that most of the fine sediments within the existing streams on the West Side originate from South Deep Creek backwater flooding, and that the depth of the channels limits their ability to flush the fine sediments back into South Deep Creek (Shore, 2017).

3.2 Land Use/Land Cover

Land use and land cover, both past and present, were investigated throughout the Site and its watershed using historical aerials from 1963-2016 and through the November 10, 2016 watershed reconnaissance survey. Future land use potential was examined by reviewing the Yadkin County zoning boundaries and the 2011 Yadkin County Land Plan (Anthony et al.). Historic aerials are presented in Appendix 4.

3.2.1 East Side

Within the eastern valley, the onsite streams have been manipulated through ditching, impoundments, and land use changes since at least 1963. UT1's riparian land use is currently sparsely forested in the valley bottoms of the upper watershed with forest on the valley walls and agricultural fields beyond. Moving downstream, as the valley bottom widens, the land use transitions to agricultural row crops in the valley bottom, forested valley walls, and agricultural fields beyond.

UT1 features a series of former inline impoundments, several of which contain old embankments and sediments visible today (Figure 6.2). In the 1963 aerial, one large inline impoundment (Former Pond 1) is visible on UT1 and one impoundment is visible in drainage to UT1 (Former Pond 2). By the 1982 aerial, an additional inline impoundment (Former Pond 3) appears immediately upstream from Pond 1 and farm roads are visible over the impoundment dams. Evidence of tree clearing within the UT1 valley is apparent in this aerial as well. In the 1993 aerial, Pond 1 appears drained with a large downstream headcut progressing through a field. Pond 3 also appears greatly reduced in size, and a fourth impoundment (Former Pond 4) is visible upstream from Pond 2. Pond 4 is not visible in 2006 in aerial imagery. In present day, legacy sediments remain in place at the site of Ponds 1, 2, and 3 but there is no evidence of Pond 4.

Prior to 1982, UT1's streamside buffer was forested and showed cultivated fields beyond the forested buffer. In the 1982 aerial, UT1's forested buffer is cleared for cultivation. The headwaters of UT1, upstream of former Pond 1, are also completely deforested. In 2007, the eastern farm field and hillslopes surrounding former Pond 3 were planted in loblolly pine (*Pinus taeda*). From 1950 until 1994, an active dairy farm operated on the southernmost farm field above UT1. Buildings associated with the dairy farm were demolished a few years after the dairy closed and are not visible in the 2005 aerial.

The project on the East Side begins at the intermittent call on UT1, and approximately 85% of the watershed stream length is contained within the Site limits. UT1's watershed is bound roughly by the ridge that bisects the Site, Lone Hickory Road, and Route 601. UT1A and UT1B's watersheds, which are encompassed by UT1's overall watershed, both extend to Route 601, and are within the Yadkin County Future Land Use Plan 'Primary Growth Area'. Yadkin County intends to focus on providing infrastructure such as water, sewer, and road improvements in this area to promote growth. The land within these watersheds is zoned for Highway Business, Manufactured Home Parks, Manufacturing, and Residential Limited.

3.2.2 West Side

Within the project limits on the West Side, the predominate land use is agricultural crop land in the South Deep Creek floodplain, with some areas of forest along the valley walls. The West Side has a history of agricultural land use, and UT2, UT2A, and UT2B have been ditched and re-routed several times, as evidenced by the series of aerial images presented in Appendix 4.

The watershed to the West Side has been a consistent mix of forest and agriculture from 1963 to 1993. Between the 1993 and 1998 aerial, a large portion of UT3's watershed and a small area of UT2's watershed was logged. In 1998, the network of logging roads and a few trees remained in the logged areas. By the 2005 aerial, the areas had revegetated. A new area of logging in the upper watershed appears in the 2006 aerial. This area showed vegetation in the succeeding aerials, and remains vegetated in present day. The West Side watershed is predominantly zoned rural/agricultural and is not anticipated to develop.

3.3 Existing Vegetation

Throughout the East Side, the floodplains include native hardwood species such as red maple (*Acer rubrum*), sycamore (*Platanus occidentalis*), and tulip poplar (*Liriodendron tulipifera*). The slopes surrounding a collapsed boulder dam contains several species of oak trees including swamp chestnut oak (*Quercus michauxii*), northern red oak (*Quercus rubra*), white oak (*Quercus alba*), and water oak (*Quercus nigra*). Other mature hardwoods along UT1 include black willow (*Salix nigra*), American beech (*Fagus grandifolia*), and umbrella magnolia (*Magnolia tripetala*). The understory has sparse shrubby growth but does include species such as mountain laurel (*Kalmia latifolia*), American hop-hornbeam (*Ostrya virginiana*), and young sassafras (*Sassafras albidum*). The ground cover contains several herbaceous species, including various ferns and moss populations on rock crops and stream banks, along with a small patch of horsetail (*Equisetum* sp.) further downstream. There are discrete areas of invasive species present throughout, which include a population of the princess tree (*Paulownia tomentosa*), Chinese privet (*Ligustrum sinense*), thick Japanese stiltgrass (*Microstegium vimineum*), and Japanese honeysuckle (*Lonicera japonica*).

Throughout the West Side, the floodplain is actively row cropped and the valley walls around the floodplain are primarily forested. Several species of pine are seen in these wooded areas, such as loblolly and pitch (*Pinus rigida*), along with the same hardwood species observed along UT1. The streams on this side of the Site are ditched through the South Deep Creek floodplain. The herbaceous plants along the ditches are typical wildflowers and weeds seen in open pastures and fields such as goldenrod (*Salidago* sp.), ironweed (*Vernonia* sp.), henbit deadnettle (*Lamium amplexicaule*), and creeping buttercup (*Ranunculus repens*). Some Chinese privet is present at the downstream extent of UT2.

3.4 Project Resources

Wildlands investigated on-site jurisdictional waters of the United States (US) within the proposed project area. Potential jurisdictional areas were delineated using the US Army Corps of Engineers (USACE) Routine On-Site Determination Method. This method is defined by the 1987 Corps of Engineers Wetlands Delineation Manual and the subsequent Eastern Mountain and Piedmont Regional Supplement. Streams were classified using North Carolina Department of Water Resources (NCDWR) Classification Forms. Jurisdictional waters of the US were surveyed for inclusion on plans and figures. Wetland determination forms representative of on-site jurisdictional areas as well as non-jurisdictional upland areas are included in Appendix 2.

The results of the on-site investigation include seven jurisdictional stream channels (UT1, UTA, UT1B, UT2, UT2A, UT2B, and UT3), three open waters (A-C), and five wetlands (E-I) within the project area, and are discussed below by their location within the Site. NCDWR stream identification forms are in Appendix 3. Tables 4 and 5 provide a summary of water resources within the project limits. Existing conditions are also illustrated in Figures 6.1 and 6.2. Reach specific cross sections and geomorphic summaries are provided in Appendix 4.

3.4.1 East Side Resources

Project resources on the East Side of the Site include UT1, UT1A, and UT1B, and Wetlands E, F, G, and H.

<u>UT1 to South Deep Creek</u>

UT1 originates just upstream of the project limits as an ephemeral stream, and transitions to intermittent and perennial within the Site limits. The stream flows through two sediment-filled ponds (Pond 3 and Pond 1) with breached dams before entering the lower valley and flowing offsite to join South Deep Creek. UT1’s valley is narrow in the headwaters and gradually widens downstream as it approaches South Deep Creek, where the valley bottom is a broad, alluvial floodplain. There are four distinct morphological reaches on UT1, discussed below, and several artificial wetlands, all summarized in Table 4 at the end of this section.

UT1 Reach 1

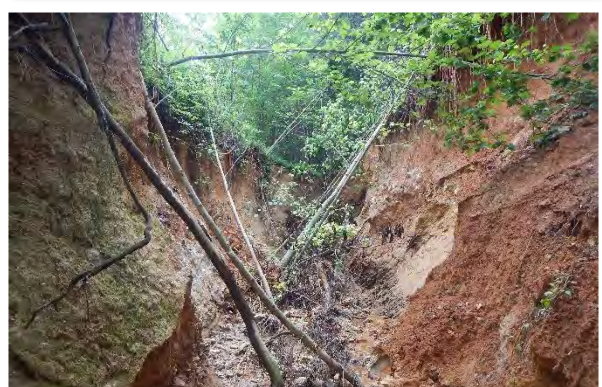

Incised, eroding UT1 Reach 1

UT1 Reach 1 begins approximately 40 LF downstream of the conservation easement boundary, where the stream drops over a headcut and becomes intermittent. The valley slope is 6.5% and UT1 is deeply incised into clay subsoil with very little pattern development and several small active headcuts. UT1 transitions to a perennial channel just upstream of Pond 3, approximately 200 LF downstream of the intermittent stream break. The top of the accumulated sediment of Pond 3 has a longitudinal slope of 1.7%. UT1 flows through Wetland E, which has developed in the sediment deposition behind the old pond embankment. The bed and banks are weakly defined here as the stream flows through the old pond bed. A deeply incised, ephemeral drainage ditch carrying a heavy sediment load from the farm fields enters from the left bank. Downstream from the ditch, UT1 flows through Wetland F. Wetland F ends where UT1 drops over an active headcut.

Below the headcut, UT1 is deeply incised, with steep banks, mass wasting, and moderate bank erosion on alternating banks. UT1 is characterized here by moderate pattern and coarse gravels, and cross sections 1 and 2 were taken here which classify the channel as an incised (bank height ratio of 3.8), unstable Rosgen E5b-type stream. Approximately 300 feet downstream of the headcut, UT1 reaches a 30-foot tall embankment undergoing mass wasting with series of small headcuts leading to a steep boulder cascade. This embankment is clearly visible on the 1993 historical aerial as an old farm road. Beyond the boulder cascade, UT1 enters Wetland G, which has formed within the accumulated sediments in Pond 1.


UT1 Reach 1 flowing through old pond bed of Pond 1

Within the old pond bed UT1 has weakly defined bed and banks and is braided with several concurrent flowpaths. The top of the accumulated sediment of Pond 1 has a longitudinal slope of 1.7%. Flow continues for 250 feet through the old pond bed before the weakly defined channel begins to follow a ditch. Several headcuts occur along this ditch and the stream becomes incised. This slightly meandering, incised section continues for 150 feet until reaching another breaching dam with an active, 10-foot headcut. Banks around the base of this headcut are 12-20 feet above the streambed, and are mass-wasting with several visible root masses undermined by erosion. Over the course of 18


8-foot headcut on UT1 Reach 1 at Pond 1

months of site investigations, the headcut has rapidly progressed, advancing an average of 1 foot per month. A photo log of the headcut progression is included in Appendix 4.

The area of mass wasting subsides within 60 feet, as the stream takes a sharp turn to the northeast, and the hillslope gradually comes down to meet the new elevation of the streambed. The breaching dams and active headcuts are a significant fine sediment source. These headcuts will inevitably continue to advance upstream through the old ponds beds and exponentially increase the sediment load by cutting through easily eroded sediments. Further, the advancing headcuts will perch the existing wetlands well above the potentiometric surface and the artificially induced hydrology currently supporting the wetlands in this landscape position will no longer be present.

As discussed, UT1 Reach 1's valley slope is varied along its alignment due to the man made impoundments and the accumulated sediments behind them. If the former pond dams and accumulated sediments were not present, the approximate valley slope through the reach would be 6.3%.

UT1 Reach 2

UT1 Reach 2 begins where UT1 takes a sharp turn back to the north approximately 100 feet below the 10 foot headcut at Pond 1 and immediately downstream from Wetland H. Reach 2 is confined against the right valley wall and is perched above the lowest point in the valley, suggesting historic relocation. A review of historic aerials shows that UT1 has occupied near the same alignment since 1963. Wetland H is hydrologically connected to Pond 1 through a drainage pipe that contributes to the hydrology of this wetland and may be the remnant UT1 channel prior to its impoundment. A series of bedrock outcrops also begin to appear in Reach 2, and continue to influence the streambed throughout the reach.

UT1 Reach 2– confined against right valley wall, cleared for row crops to top of bank

Approximately 100 feet downstream from the northward turn, the entire valley bottom is cleared for row crops with UT1 occupying the right valley toe. The Reaves family recount that their grandfather ditched UT1 along the valley wall to open the field for farming (Reaves, 2015). Moderate to mild bank erosion occurs throughout this length of UT1 due to the confinement of the channel and the lack of stabilizing vegetation. The reach is predominantly incised, but regains some floodplain connection in areas where bedrock outcrops are present in the channel and in isolated areas where bankfull benches have developed within the incised channel. Due to confinement against the right valley wall, the stream has very little pattern. Long riffles and short, shallow pools dominate the streambed. Due to the steepness of the right valley wall, mass wasting is present in areas where the stream has eroded into it. Cross sections 3 and 4 were taken here and classify the stream as a Rosgen G4-type stream channel. The valley slope of UT1 Reach 2 varies down its length, but is approximately 3% on average.

Two perennial tributaries (UT1A and UT1B) join UT1 along Reach 2. The tributaries are not part of the project, except where they join UT1 within the conservation easement, and are discussed briefly later in this section.

UT1 Reach 3

UT1 Reach 3 begins at a ford crossing, where the stream takes a turn to the northwest, and the channel is then confined against the left valley wall. The left valley wall is forested, with a typical width of 100 feet or more, beyond which is cultivated field. The valley bottom, to the right of the channel, is cleared and in cultivation. Active bank erosion and incision are present throughout this reach with occasional areas of more severe mass wasting. Cross sections 5 and 6 were taken midway through the reach and classify the stream as a straightened, incised Rosgen E4-type stream, with a bank height ratio of 1.7. This reach continues until a large bedrock outcrop, where the stream regains stability.

UT1 Reach 4

Reach 4 of UT1 to South Deep Creek begins where large bedrock outcrops begin to dominate the stream bed. This reach has a stable meander pattern with little active erosion. A narrow, approximately 10-foot wide forested buffer begins on the right bank until the channel turns further northwest into a mature bottomland forest.

UT1A and UT1B to South Deep Creek

UT1A and UT1B both originate outside the project limits, and enter the Site from the east as perennial streams. Both streams have well-established forested buffer on both banks and have stable riffle-pool morphology with low bank heights and narrow floodprone areas within naturally confined valleys.

UT1A – Stable with riffle/pool morphology

Wetlands E, F, G, and H

Wetland features E, F, and G have formed in former farm pond beds on UT1. These concave landforms contain legacy sediments behind breached and actively eroding dams. The features exhibit a high water table, saturated soils, and shallow surface water. Evidence of hydric soil is indicated by a depleted matrix and redox features within closed depressions. Hydrophytic vegetation includes arrowleaf tearthumb (*Polygonum sagittatum*), black willow (*Juglans nigra*), Canadian clearweed (*Pilea pumila*), devil's beggartick (*Bidens frondosa*), marsh dayflower (*Murdannia keisak*), rice cutgrass (*Leersia oryzoides*), and spotted ladysthumb (*Polygonum persicaria*). Wetland H is a small seep that originates at the base of a former impoundment (Wetland G) and which receives hydrology through a small pipe emanating from the old pond. This feature exhibited several hydrology indicators including shallow surface water, a high water table, saturation, and drift deposits. Sandy soils within the feature met the "depleted below dark surface" hydric soil indicator. Much of Wetland H was devoid of vegetation.

Table 4: East Side Project Attribute Table Part 3 – *Lone Hickory Mitigation Site*

East Side Reach Summary Information					
Parameter		**UT1 (R1: intermittent portion)**	**UT1 (R1: perennial portion, R2, R3, R4)**	**UT1A**	**UT1B**
Existing Length of Reach (LF)		198	6,476	230	48
Valley Confinement (confined, moderately confined, unconfined)		Confined	Confined to moderately confined	Confined	Confined
Existing Drainage Area (acres)		10	286	92	31
Perennial, Intermittent, Ephemeral		I	P	P	P
NCDWR Water Quality Classification		WS-III			
Stream Classification[1]	**Existing**	G	Straightened E/G	Not classified, preservation only	
	Proposed	Ba	Ba/B/C		
Evolutionary Trend (Simon)[1]		III	III/IV/V	VI	VI
FEMA Classification		None	Last 400 LF in Zone AE backwater from South Deep Creek	None	None

East Side Wetland Summary Information				
Parameter	**E**	**F**	**G**	**H**
Size of Wetland (acres)	0.8	0.10	0.84	0.05
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian Riverine			
Mapped Soil Series	Delila/ Fairview	Delila	Delila/Fairvie w	Delila
Drainage Class	Poorly drained/ well drained	Poorly drained	Poorly drained/ well drained	Poorly drained
Soil Hydric Status	Yes/No	Yes	Yes/No	Yes
Source of Hydrology	Groundwater & stream baseflow	Groundwater & stream baseflow	Groundwater & stream baseflow	Groundwater
Restoration or enhancement method (hydrologic, vegetative, etc.)	Permanent impact	Permanent impact	Permanent impact/ preservation	Permanent impact

1. The Rosgen classification system (Rosgen, 1994) and Simon Channel Evolution Model (Simon, 1989) is for natural streams. These channels have been heavily manipulated by man and therefore may not fit the classification category or channel evolution as described by these models. Results of the classification and model are provided for illustrative purposes only.

3.4.2 West Side Resources

There are four streams on the West Side of the Site, including UT2, UT2A, UT2B, and UT3. UT2A is intermittent for approximately 643 LF within the Site before transitioning to a perennial stream. All other streams are perennial. The streams are buffered by agricultural fields which are routinely farmed up to the top of bank. The streams and wetlands are periodically dredged, and were last dredged 4 years ago (Shore, 2017).

The West Side streams have been ditched and re-routed through the South Deep Creek floodplain since before 1963, as evidenced by the historic aerials in Appendix 4. UT2B followed a flow path parallel to UT2 in 1963, but was re-routed and shortened in length by the 1982 aerial. Between 1982 and 1993, a series of hillside ditches was installed to carry most of UT2B's watershed drainage across the hill to the eastern edge of the farm field. Ditching and re-routing of UT3, a primary drainage feature on the West Side, began prior to 1957 per a historical survey, provided in Appendix 4. The historical survey shows UT3 connecting straight out to South Deep Creek; however, at least three parallel farm ditches connected the UT3 hydrology through UT2 in the 1963 aerial. The main connection between UT3 and UT2 flowed through what is now Open Water A (Figure 6.1). This connection was removed sometime between 1998 and 2005. Currently, all surface water flow to UT3 is routed along the western parcel boundary where it drains directly to South Deep Creek. John Kessler, a landowner along UT3, indicated that his wife's family has owned the land adjacent to this field for generations, and that UT3 once ran across the open floodplain of South Deep Creek and joined South Deep Creek near its current confluence with UT2. Mr. Kessler said that the farmer excavated a ditch along the property boundary and routed UT3 into it as part of the agricultural management of the parcel (J. Kessler, personal communication, December 29, 2015). This anecdotal evidence was substantiated with both Wildlands and the soil scientist's discovery of a rounded, alluvial substrate vein running across South Deep's floodplain, as depicted in Figure 2 and discussed in Section 3.1.2.

Manipulation of topography for agricultural use is evident throughout the Site. The valley toes on the north facing slope of the West Side bottomlands appear to have been cut to increase the size of agricultural fields. Material from the valley cut was potentially spread over the agricultural fields as an attempt to dry out the floodplain fields and relic wetlands.

<u>UT2 to South Deep Creek</u>
UT2 enters the Site as a perennial stream, and flows through a narrow valley before entering the broad, flat floodplain of South Deep Creek. Upstream of the proposed conservation easement, UT2 drains a steeply sloping watershed dominated by hardwoods. There are three distinct morphological reaches on UT2 due to slope breaks as discussed below.

UT2 Reach 1
Reach 1's valley is moderately confined and has a slope of approximately 2%. UT2 is pinched between the left valley wall and a dirt farm road paralleling the right bank. UT2 Reach 1 is deeply incised with a bank height ratio over 4 and active bank erosion throughout its length. The stream receives sediment-laden runoff from the existing farm road and the agricultural field beyond. Cross sections 1 and 2 were taken in the middle of the reach and classify the stream as a Rosgen G4-type stream.

UT2 Reach 2
UT2 Reach 2 begins at an existing culvert outlet where UT2 leaves its valley and enters the broad, flat floodplain of South Deep Creek. Reach 2 follows a straight trajectory until just downstream of its confluence with UT2A and UT2B, where it curves gradually northeast, terminating at the wood-line. At its confluence of UT2A, inner berms vegetated with annual species are a consistent channel feature. Throughout its entire length, UT2 Reach 2 is ditched, incised with low entrenchment ratios and high bank height ratios, and straightened. Bedform diversity is poor with only low sloped runs and shallow pools for habitat. Cross sections 3 and 4 classify the stream as a Rosgen G5-type stream.

UT2 Reach 2 – ditched below culvert in South Deep's floodplain

UT2 Reach 3
UT2 Reach 3 begins at the wood-line and continues its straightened, northeast trajectory until its confluence with South Deep Creek. UT2 Reach 3 is ditched against the right valley toe; the left floodplain

is actively farmed. The overall valley slope is 0.9%, and UT2 Reach 3 incises to meet the lower invert of South Deep Creek. The stream bed morphology is dominated by runs and shallow pools with a few deeper pools forming around tree roots on the right bank. Cross sections 11 and 12 classify UT2 Reach 3 as a Rosgen G5-type stream.


UT2A – looking upstream

UT2A to South Deep Creek

UT2A to South Deep Creek enters the Site flowing north through a failing concrete culvert. Upstream of the culvert, an ephemeral channel drains a steeply sloping hardwood forest. Just downstream from the culvert, UT2A becomes intermittent. UT2A here is ditched, deeply incised, and straightened. Approximately 100 LF upstream of UT2A's confluence with Open Water A (a field ditch), the stream becomes perennial. The perennial stream takes a sharp right turn to the east at its confluence with Open Water A, and flows straight until its perpendicular confluence with UT2. UT2A is joined by Open Water B and C between its confluence with Open Water A and UT2. Site soil probes found gravel stream deposits in the cultivated area to the west of UT2A. Cross sections 9 and 10 classify UT2A as a Rosgen G5-type stream.

UT2B to South Deep Creek

UT2B to South Deep Creek begins within the conservation easement as a perennial channel at a spring under a bedrock slab. UT2B has been ditched and straightened, and is incised with low-sloped runs and shallow pool bed features until its confluence with UT2. UT2B's existing drainage area is only 6 acres; however, a ditch network just upstream of UT2B routes the watershed flows to UT2B across a hillside and into the floodplain of UT2 downstream of UT2B. The true drainage area to UT2B, if this ditch network were not present, is 35 acres. Cross sections 13 and 14 classify UT2B as a Rosgen G5-type stream.

UT3 to South Deep Creek

UT3 to South Deep Creek, a perennial stream, originates outside the project limits, enters the project at the southwestern corner of the Site, and flows directly along the property boundary in a manmade and maintained ditch to its confluence with South Deep Creek. There are two distinct morphological reaches on UT3 due to slope breaks, discussed below.

UT3 Reach 1

UT3 Reach 1 flows through a narrow, 4% valley and is confined against the left valley wall. The stream was likely relocated to its current location to maximize the agricultural field in the right floodplain. As evidence, site soil probes found stream gravel deposits in the cultivated area to the east of UT3. UT3 Reach 1 has riffle-pool morphology, but is incised with eroded stream banks. Cross sections 5 and 6 classify UT3 Reach 1 as an incised (bank height ratio of 2.6) Rosgen G4-type stream.

UT3 Reach 2

UT3 Reach 2 begins at the valley slope transition, from the steeper valley to the broad, flat floodplain of South Deep Creek. Reach 2's valley is approximately 0.5%, and the stream is ditched and straightened along the property line before turning east to join South Deep Creek. Reach 2 lacks bedform diversity and exhibits signs of routine maintenance. Row cropping is present in the right floodplain, and the left top of bank and beyond is actively mowed and maintained. Cross sections 7 and 8 classify UT3 Reach 2 as an incised (bank height ratio of 1.4) Rosgen G5c-type stream.

UT3 Reach 2 – maintained as a ditch

<u>Open Waters A, B, C & Wetland I</u>

Open Waters A-C are wide, linear ditches within the floodplain of South Deep Creek that contain standing water and are primarily devoid of vegetation as a result of on-going maintenance. Indicators of hydric soils within the open waters include depleted matrix and redoximorphic (redox) features. These areas have been manipulated and maintained for surrounding row-crop agricultural activities. Wetland I is a small sparsely vegetated concave area of saturation and shallow inundation with a thin layer of muck at the base of a hillslope along UT2 Reach 1. Hydric soil indicators in Wetland I include a stripped matrix and mucky sandy mineral soil. Sparse hydrophytic vegetation includes rice cutgrass and Canadian clearweed. This area experiences significant impacts from surrounding row-crop agricultural activities.

Table 5: West Side Project Attribute Table Part 3 – *Lone Hickory Mitigation Site*

West Side Reach Summary Information						
Parameter		**UT2**	**UT2A (upper)**	**UT2A (lower)**	**UT2B**	**UT3**
Existing Length of Reach (LF)		2,527	643	541	699	2,008
Valley Confinement (confined, moderately confined, unconfined)		Moderately confined to unconfined	Unconfined	Unconfined	Unconfined	Moderately confined to unconfined
Existing Drainage Area (acres)		170	16	27	6	392
Perennial, Intermittent, Ephemeral		P	I	P	P	P
NCDWR Water Quality Classification		WS-III				
Stream Classification[1]	**Existing**	G	G	G	G	G
	Proposed	B/C	C	C	Cb/C	B/Cb/C
Evolutionary Trend (Simon)[1]		III/IV/V	III	IV/V	IV/V	IV/V
FEMA Classification		Zone AE backwater from South Deep Creek				

West Side Resource Summary Information				
Parameter	**A (Open Water)**	**B (Open Water)**	**C (Open Water)**	**I (Wetland)**
Size of Resource (acres)	0.15	0.15	0.11	0.01
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian Riverine			
Mapped Soil Series	Codorus loam/ Dan River and Comus soils		Dan River and Comus soils	Delila
Drainage Class	Somewhat poorly drainage/well drained		Well drained	Poorly drained
Soil Hydric Status	Yes/No		No	Yes
Source of Hydrology	Groundwater			Surface water & out of bank events
Restoration or enhancement method (hydrologic, vegetative, etc.)	Permanent impact			

1. The Rosgen classification system (Rosgen, 1994) and Simon Channel Evolution Model (Simon, 1989) is for natural streams. These channels have been heavily manipulated by man and therefore may not fit the classification category or channel evolution as described by these models. Results of the classification and model are provided for illustrative purposes only.

4.0 Functional Uplift Potential

The potential for functional uplift is qualitatively described in this section using terminology from the Stream Functions Pyramid (Harman, 2012). The Stream Functions Pyramid describes a hierarchy of five stream functions, each of which supports the functions above it on the pyramid (and sometimes reinforces those below it). The five functions in order from bottom to top are hydrology, hydraulics, geomorphology, physicochemical, and biology. Neither the Stream Functions Pyramid nor the Quantification Tool are proposed to determine success of the mitigation site.

4.1 East Side

4.1.1 Hydrology

Apart from periodic forestry activities, the major watershed disturbance on the East Side of the Site has been the intensive management of the watershed for agriculture, which includes removing mature, woody vegetation and routinely harvesting and plowing the fields. These alterations in land cover typically result in reductions in rainfall interception and evapotranspiration which lead to increases in runoff and water yield (Dunne and Leopold, 1978). The primary result of these changes is an increase in both peak flows and base flows. However, increases in water yield usually change over time as vegetation regrows and crops are planted. The hydrology to UT1 was also altered through the years through the creation and complete or partial abandonment of Ponds 1, 2, 3, and 4. When ponds provide storage, they can shave peaks off storm flows or result in sustained periods of higher flows when compared to an uncontrolled watershed. Ponds 2 and 4 are no longer in place, and Ponds 1 and 3 are breached, but may still provide some storage and reduce peak flows downstream.

The East Side has a low percentage of contributing impervious area with potential for urban growth in the UT1A and UT1B watersheds, which are in the targeted 'Primary Growth Area' for the town of Yadkinville. These sub-watersheds make up 44% of UT1's watershed area. The future growth would follow installation of public utilities in the area, of which there are no current plans for extension of the utilities, suggesting that urbanization is in the distant future.

Approximately 85% of the streams in the watershed are located within the conservation easement boundary, so the watershed land use directly adjacent to the stream will be shifted from agriculture to forest as part of the project. The remnant impoundments will be removed and the valley topography will be restored throughout the former impoundment areas. Additionally, three points of concentrated agricultural input will be treated with BMPs, resulting in a lift to hydrologic function of Site streams after development of the project.

4.1.2 Hydraulics

UT1 is hydraulically impaired due to its lack of consistent floodplain connection. Large headcuts more than 8 feet tall are advancing through the remnant dams at former Pond 1 and former Pond 3 and into the unconsolidated pond sediments. Outside of the influence of the ponds, the streams continue to be affected by the historic channelization, confinement against the valley walls, and incision with bank height ratios ranging from 1.7 to 2.3. Removing the embankments, restoring the valley topography, and reconnecting the streams to the floodplain will provide the in-stream relief needed to improve the hydraulic function of UT1. Bankfull and greater flow velocities and channel shear stresses will be reduced. The overall water table is expected to rise to meet the restored elevation of the stream channel, which may result in pocket wetland formation in the restored valley bottom.

4.1.3 Channel Geomorphology

The past impoundment, channelization, incision, and on-going bank erosion place UT1 in Stages III and IV of the Simon Channel Evolution Model. Approximately 62% of UT1's stream banks are actively eroding. The bedform diversity is moderate, with pool to pool spacing ratio ranging from 0.8 to 4.7, and the streambed is estimated to consist of 60% riffles. Bank migration and lateral stability were not measured for this project due to its straightened status; however, the active retreat of the headcuts at the failing pond embankments was informally measured at 1 linear foot per month. Overall, the existing geomorphologic function on UT1 ranges from moderate in areas where bedform diversity has formed despite prior channelization, to very poor near the former pond areas.

There is a significant opportunity to improve the geomorphologic function on the Site. The incision and bank erosion will be corrected. Large woody debris (LWD) will be added to the system through construction of instream structures and bank revetments. A riparian buffer will be planted, resulting in improved long-term geomorphic function of UT1.

4.1.4 Physicochemical

No water quality sampling has been conducted on UT1 and there are no water quality monitoring stations within the Lone Hickory watershed; however, the 2009 Upper Yadkin Pee Dee RBRP noted the importance of reducing sediment and nutrient input from farming operations. The watershed to UT1 contains three defined points of concentrated agricultural inputs; ephemeral UT1, which drains a small adjacent farm utility barn area; the drainage from old Pond 2, which continues to funnel sediment laden runoff from the agricultural fields to UT1, and a ditch which drains an adjacent farm in the right floodplain of UT1 Reach 3. Additionally, the sediment accumulated behind the old Pond 1 and 3 embankments poses a real threat to water quality as headward erosion continues through dam embankments and into the old pond beds. Sediment and the nutrients stored in those pond beds would be rapidly mobilized, creating water quality issues downstream.

As a result of these persistent and on-going threats, there is great potential to improve the physicochemical functioning of UT1 and its watershed through execution of the project. Beyond the proposed stream activities, BMPs will be installed at all three points of concentrated agricultural input to reduce both sediment inputs from the adjacent farm fields. Additionally, the sediment accumulated behind the old Pond 1 and 3 embankments will be removed from the valley bottom and stabilized in the uplands to prevent mobilization of those sediments and attached nutrients into UT1. A riparian buffer will be established and agricultural fields within the conservation easement will be taken out of production, thus reducing nutrient-laden runoff and erosion of nutrient-rich bank sediments. Water will flow over instream structures that will provide reaeration, trees will be planted in the riparian zone to eventually shade and cool stream flow and help reduce and filter runoff, the stream will be reconnected to its floodplain and adjacent riparian wetlands to provide storage and treatment of overbank flows, and streambank erosion will be greatly reduced to nearly eliminate a source of sediment and nutrients. However, the potential improvements to physicochemical functioning on UT1 will not happen immediately and some aspects will not occur until a mature canopy is established. Therefore, physicochemical improvements will not be explicitly monitored for success, although visual observations should show that the improvements are in place and functioning.

4.1.5 Biology

There are no available biological data for the Site; however, the habitat conditions on UT1 vary from poor in areas that are actively incising to moderate in downstream reaches that exhibit more stable bedforms. The massive headcuts through Pond 1 and Pond 3 are barriers to aquatic organism passage, and while the riparian wetlands currently present in the beds of these old ponds provide floodplain habitat diversity, they are transient features that will be eroded away as the headcuts progress through the dams. Wooded areas in the riparian buffers of UT1 provide some permanent habitat, but the agricultural fields in the floodplain of the project provide little habitat value for terrestrial species.

There is opportunity to improve the instream and riparian habitat on UT1. Habitat will be improved by removing the embankments and restoring the valley profile through the old pond beds. Instream structures with a variety of rock and woody materials, pools of varying depths, and woody bank revetments will be added to UT1 to increase instream habitat diversity, and a wide riparian buffer that will shade the stream and improve terrestrial habitat will be planted. Despite these immediate improvements, the biological response may be slow. The ultimate level of improvement in biology may not occur until after the completion of the seven-year monitoring period. Although the biological response of the project will not be explicitly monitored, improvements in biologic activity of the Site will likely be noted during visual assessments of the project.

4.2 West Side

4.2.1 Hydrology

The watersheds to the West Side streams have been subject to intensive agricultural production and pockets of logging within the forest. These alterations in land cover typically result in reductions in rainfall interception and evapotranspiration which lead to increases in runoff and water yield (Dunne and Leopold, 1978), resulting in an increase in both peak flows and base flows. There is a very low percentage of impervious area in the West Side watershed, and the entire watershed is zoned for rural/agriculture, suggesting that this area is unlikely to urbanize.

A stream restoration project performed at a specific site does not often result in uplift to hydrology (Harman, 2012). Trees will be planted within the conservation easement and BMPs will be installed to treat concentrated agricultural runoff, but this will not significantly improve the rainfall-runoff relationship for this watershed.

4.2.2 Hydraulics

Streams on the West Side of the Site are hydraulically impaired due to the extent of ditching, channelization, and resulting disconnection of the streams from their floodplains. Bank height ratios range from 1.4 to 7.2. Entrenchment ratios for streams in broad, flat floodplains such as UT2 and UT3 should be quite high; however, most flood flows are confined to the channelized ditches, as evidenced by entrenchment ratios ranging from 1.1 to 2.4 for all reaches except UT3 Reach 2, which does have flood access to the broad floodplain during high flows. Reconnecting the streams to the floodplain will provide the in-stream relief needed to lift the hydraulic function of the West Side streams. Bankfull and greater flow velocities and channel shear stresses will be reduced. The overall water table level is expected to rise to meet the new, higher elevation of the stream channel, supporting the adjacent wetland restoration.

4.2.3 Channel Geomorphology

The past channelization, incision, and on-going bank erosion place most of the West Side stream reaches in Stages II, III, and IV of the Simon Channel Evolution Model. Inner berm formation on UT2 Reach 2 suggests that this reach may have advanced to Stage V of the model; however, this inner berm may be due to deposition from backwater flooding from South Deep Creek as opposed to the evolution of the channel from watershed and in-channel processes. Bedform diversity throughout the West Side streams is extremely poor from agricultural maintenance practices such as dredging. Overall, the existing geomorphology function on the West Side streams ranges from moderate in UT2 Reach 1 and UT3 Reach 1 to very poor for the rest of the reaches.

There is a significant opportunity to improve the geomorphology function on the West Side streams. The incision and bank erosion will be corrected. LWD will be added to the system through construction of instream structures and bank revetments and a riparian buffer will be planted, resulting in lifted geomorphic function.

4.2.4 Physicochemical

No water quality sampling has been conducted on the West Side Streams and there are no water quality monitoring stations within the Lone Hickory watershed; however, the 2009 Upper Yadkin Pee Dee RBRP noted the importance of reducing sediment and nutrient input from farming operations. The watershed to the West Side features two defined points of concentrated agricultural inputs; a dirt farm road that directs concentrated drainage to UT2 Reach 1, and an agricultural ditch network upstream of UT2B.

The physicochemical functioning of the West Side streams will be improved through installation of a BMP at the concentrated agricultural input point upstream of UT2B to reduce both sediment and nutrients from the adjacent farm fields. The concentrated agricultural runoff from the farm road at the upstream end of UT2 Reach 1 will be treated either through decommissioning the road or through installation of a BMP. The streams throughout the West Side will be restored with proper dimension, and wetlands will be re-established within the floodplain. In-stream flows will reaerate over drop structures, trees planted in the riparian zone will eventually shade and cool stream flow and help filter runoff, the stream will be reconnected to its floodplain and riparian wetlands restored in the floodplain will provide storage and treatment of overbank flows. However, the potential improvements to physicochemical functioning on the West Side streams will not happen immediately and some aspects will not occur until a mature canopy is established. Therefore, physicochemical improvements will not be explicitly monitored for success, although visual observations should show that the improvements are in place and functioning.

4.2.5 Biology

There are no available biological data for the Site; however, the habitat conditions on the West Side streams vary from very poor in areas that are channelized and incised to moderate in upstream reaches that exhibit more stable bedforms. While Open Waters A, B, and C may provide some habitat value, they are stagnant and likely experience algal blooms and low dissolved oxygen from agricultural nutrient inputs, making them unsuitable for most aquatic species.

There is great opportunity to improve the instream and riparian habitat on the West Side streams in addition to the physicochemical function. Instream structures with a variety of rock and woody materials, pools of varying depths, and woody bank revetments will be added to the streams to increase instream habitat diversity. A wide, consistent riparian buffer that will shade the stream and improve terrestrial habitat will be planted. Wetland development within the floodplain will diversify the available habitats for both terrestrial and aquatic species. Despite these immediate improvements, the biological response may be slow. The ultimate level of improvement in biology may not occur until after the completion of the seven-year monitoring period. Although the biological response of the project will not be explicitly monitored, improvements in biologic activity of the Site will likely be noted during visual assessments of the project.

4.3 Overall Functional Uplift Potential

Overall, the Lone Hickory Site has great functional uplift potential, from the improvement in watershed hydrology that will be seen on the East Side, to the improvements in stream hydraulics that will be seen throughout the Site with the stream restoration and BMP installations, to the improvements in geomorphology that will come with restoring streams that are suited to the valley types throughout the Site. Physicochemical and biological improvements are a likely result of the project. However, there is no existing basis for classifying the existing condition of these functions and the likely improvements will occur gradually after construction.

4.4 Site Constraints to Functional Uplift

There are no known Site constraints that will affect the functional uplift of the project. The valley width on the Site will allow for the development of pattern and dimensions to restore stable, functioning streams and wetlands. The degree to which the physicochemical and biology functions can improve on the Site is limited by the watershed conditions beyond the project limits, upstream water quality, and the presence of source communities upstream and downstream of the Site.

5.0 Regulatory Considerations

Table 6, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 5.1-5.3.

Table 6: Project Attribute Table Part 4 – *Lone Hickory Mitigation Site*

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 5
Historic Preservation Act	Yes	Yes	Appendix 5
Coastal Zone Management Act	No	No	N/A
FEMA Floodplain Compliance	Yes	No	N/A[2]
Essential Fisheries Habitat	No	N/A	N/A

1. PCN to be provided to IRT with Final Mitigation Plan.
2. A floodplain development permit application will be submitted to the local floodplain administrator.

5.1 Biological and Cultural Resources

A Categorical Exclusion for the Lone Hickory Mitigation Site was submitted to DMS on June 24, 2016, and approved on September 6, 2016. 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 "any incidental take that may results from the associated activities [from the project] is exempt under the 4(d) rule." All correspondence with USFWS and a list of Threatened and Endangered Species in Yadkin County, NC is included in Appendix 5. The conclusion for cultural resources per the Categorical Exclusion research and response by the State Historic Preservation Office is that there are no historic resources that would be affected by this project. For additional information and regulatory communications please refer to the Categorical Exclusion document in Appendix 5.

5.2 FEMA Floodplain Compliance and Hydrologic Trespass

The Site is represented on the Yadkin and Davie County Flood Insurance Rate Map Panel 5804, with an Effective date of 5/18/2009. The Site is located within a Zone AE Special Flood Hazard Area (SFHA) regulatory floodplain associated with South Deep Creek. None of the project streams are mapped under the regulatory authority of FEMA. Current Effective FEMA mapping for the Site is overlain with project streams on Figure 7. The Effective hydraulic model for South Deep Creek has been obtained from the NC Floodplain Mapping Program. The stream, wetland, and floodplain grading within the regulatory floodplain of South Deep Creek will be designed to achieve a no-rise condition and a floodplain development permit will be obtained from the Yadkin County floodplain administrator.

The proposed design associated with the Site has limited or no risk of potential hydrologic trespass since the upper reaches are steeply sloped, allowing for restoration profiles to tie-in with minimal backwater effects. In addition, wide buffers adjacent to project streams are protected under conservation eliminating the risk to adjacent farm fields. A Temporary Construction Easement (TCE) has been recorded for the adjacent landowners to allow for filling the UT3 channel along the east property line and relocating the channel into the flat floodplain field away from the property line. UT3A will be extended to join the new UT3 channel within the project limits. The old UT3 channel will be partially filled below its confluence with Drainage A to provide positive drainage to South Deep Creek.

5.3 401/404

On the East Side of the Site, Wetlands E, F, and G formed in-line on UT1 behind former impoundments which have filled with sediment and subsequently been dewatered through dam breaches. Wetland H originates at the base of a former impoundment downstream from Wetland G and appears to receive flow from the upstream pond remnant through an existing pipe emanating from the direction of the old pond. These wetland areas are currently at risk of being dewatered by headcuts advancing through the old pond embankments. The design on this side of the Site focuses on valley and stream restoration to reconnect aquatic resources currently disconnected by massive, advancing head cuts formed through the failing embankments. The impoundments and the accumulated sediments behind the old dams will be excavated and placed in the uplands. The valley floor will be restored at or near its historic gradient. The restoration will impact the wetlands that have formed around the impoundments; however, new riparian wetlands associated with the Priority 1 stream restoration are likely to form on the restored valley floor, and the real and present threat posed by the advancing headcuts as they cut into the old pond beds will be eliminated.

On the West Side of the Site, several open water features and one wetland (Open Water A, B, and C, and Wetland I) formed in maintained agricultural ditches installed to promote field drainage. The design on this side of the Site focuses on restoration of a broad, wetland stream complex. The wetland and stream restoration will impact these existing maintained features but will restore a stream-wetland complex.

Wetlands on the Site that are within the conservation easement and outside of the limits of disturbance will be flagged with safety fence during construction to prevent unintended impacts. This will be denoted in the final construction plans.

Table 7 estimates the anticipated impacts to wetland areas on this project. The Pre-Construction Notification, including this data, will be submitted to the IRT with the Final Mitigation Plan.

Table 7: Estimated Impacts to Project Wetlands – *Lone Hickory Mitigation Site*

Jurisdictional Feature	Classification	Acreage	Permanent (P) or Temporary (T)	Type of Activity	Impact Area (acres)
Open Water A	Riparian Riverine	0.15	P	Stream Realignment and Wetland Creation	0.15
Open Water B		0.15	P		0.15
Open Water C		0.11	P		0.11
Wetland E		0.08	P	Stream Realignment	0.08
Wetland F		0.10	P	Dam removal, Stream Realignment Stream Realignment	0.10
Wetland G		0.84	P		0.84
Wetland H		0.05	P		0.05
Wetland I		0.01	P	Stream Realignment	0.01

6.0 Mitigation Site Goals and Objectives

The project will improve stream functions as described in Section 4 through stream restoration, conversion of maintain agricultural fields into riparian buffer, and through developing wetlands within the broad floodplain of South Deep Creek. 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 8.

Table 8: Mitigation Goals and Objectives – *Lone Hickory Mitigation Site*

Goal	Objective	Expected Outcomes	Function Supported
Improve stream channel stability.	Restore 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. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to protect restored streams.	Significantly reduce sediment inputs from bank erosion. Reduce shear stress on channel boundary. Support all stream functions above hydrology.	Hydraulic, Geomorphology, Physicochemical, Biology
Reconnect channels with historic floodplains and re-establish wetland hydrology and function in relic wetland areas.	Remove man-made impoundments, remove culvert crossings, and restore historic valley profile. Remove historic overburden from farm fields. Reconstruct stream channels with bankfull dimensions relative to the floodplain. Restore stream plan form to promote development of mutually beneficial stream/wetland complex.	Raise water table and hydrate riparian wetlands. Allow more frequent flood flows to disperse on the floodplain and create overbank floodplain and depression storage for overland flow retention. Decrease direct runoff, increase infiltration. Support all stream functions above hydrology.	Hydraulic, Geomorphology, Physicochemical, Biology
Improve instream habitat.	Remove man-made impoundments and culvert crossings within easement. Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. 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
Reduce sediment and nutrient input from adjacent farm fields	Construct two step pool stormwater conveyance and three dry detention BMPs to slow and treat runoff from farm fields before entering Site streams.	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
Restore and enhance native floodplain and wetland vegetation.	Plant native tree and understory species in riparian zone where currently insufficient.	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 all stream functions.	Hydrology (local), Hydraulic, Geomorphology, Physicochemical, Biology
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site.	Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands. Support all stream functions.	Hydraulic, Geomorphic, Physicochemical, Biology

7.0 Design Approach and Mitigation Work Plan

7.1 Design Approach Overview

The design approach for this Site was developed to meet the goals and objectives described in Section 6 which were formulated based on the potential for uplift described in Section 4. The design is also intended to provide the expected outcomes in Section 6, though these are not tied to performance criteria. The project streams proposed for restoration on the Site will be reconnected with an active floodplain and the channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. On the West Side, the overburden from years of tilling and crowning will be removed from the floodplain, and the relic wetlands will be restored. The riparian buffer and wetlands will be planted with native tree species. Instream structures will be constructed in the channels to help maintain stable channel morphology and improve aquatic habitat. The entire project area will be protected in perpetuity by a conservation easement.

The design approach for this Site utilized a combination of analog and analytical approaches for stream restoration, and also relies on empirical data and prior experiences and observations. Reference reaches and reference wetlands were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis which uses a combination of empirical and analytical data as described within this report. Designs were then verified and/or modified based on sediment transport analysis. Wetland hydrology was assessed with groundwater gages and modeled to predict hydrologic outcomes based on the proposed post-project conditions. These design approaches have been used on many successful Piedmont restoration projects and is appropriate for the goals and objectives for this Site.

7.2 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. Eight reference reaches were identified for this Site and used to support the design of streams on the West and East Sides of the Site (Figure 9). These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. Due to the variety of slopes and project stream types present on the Site, the distribution of reference reaches is wide, throughout North Carolina's foothills and western Piedmont. Geomorphic parameters for these reference reaches are summarized in Appendix 4. The references to be used for the specific streams are shown in Table 9. A description of each reference reach is included below.

Table 9: Stream Reference Data Used in Development of Design Parameters: *Lone Hickory Mitigation Site*

	Design Stream	UT1				UT2		UT2A	UT2B	UT3		
	Reach	1	2A	2B	3	1	2			1	2	3
Reference Stream	Stream Type											
UT to Kelly Branch	A4	X										
Pilot Mountain Trib	B4		X			X						
Lone Hickory – UT3 Ref	B4c			X	X					X		
UT to South Crowders	E4				X		X			X		
UT to South Fork Catawba (Vile Preserve)	E5						X	X	X		X	X
UT to Lyle Creek	C5							X	X			X
Deep Creek Mitigation	C5							X	X			X
Cooleemee Plantation	C5							X	X		X	X

7.2.1 UT to Kelly Branch
The UT to Kelly Branch reference reach is a small, locally steep (6.5%), headwater channel located in the McDowell County. It has a drainage area of 0.08 square miles. The reach classifies as an A4 step-pool channel, but pool depths are unreliable as a reference as they are filled with sediment from an upstream source. Bankfull channel dimensions of riffle features were consistent throughout the reach, with a bank height ratio of 1.0. The channel sinuosity of 1.2 is high for a steep gradient system, but planform is stable and makes use of the valley bottom where possible. Several long gravel/cobble riffles were observed that cascaded into pools over root mass, woody debris or a boulder step at the tail of riffle.

7.2.2 Pilot Mountain Tributary
Pilot Mountain Tributary is a small, steep (3.8%) B4 stream channel in Surry County, NC. The stream flows through the northern side of Pilot Mountain State Park, just upstream of Black Mountain Road. The stream flows along the left valley wall, which is vegetated with rhododendron thickets, while the right valley has a single line of mature hardwoods with a maintained overhead utility easement corridor beyond. The stream is relatively straight as it flows through the 4.0% valley, and bedform is diverse with steep riffles, boulder steps, and in-line pools formed near roots and in backwater areas between steps.

7.2.3 Lone Hickory UT3 – Onsite Reference
Lone Hickory UT3 is located on the main stem of UT3 upstream of the Site boundary, within the wooded watershed. The UT3 headwaters follow a pattern of narrow valleys with steep, eroded streams, and areas where the valley bottom widens, and a gentler sloped, alluvial floodplain is present. This B4c stream is located within one of the wider valley bottom points, and has a drainage area of 0.17 square miles. The valley slope is 1.9% and the stream slope is 1.8%. UT3 has a diverse bedform with riffles, meander pools, and pools formed near logs and debris. The stream banks are gently sloped and vegetated with grasses and young trees. This reference reach is valuable to the project design, particularly to the East side design, because its boundary conditions are so similar to the Site in part due to its proximity.

7.2.4 UT to South Crowders
UT to South Crowders is a perennial stream located in Crowder Mountain State Park that receives 0.22 square miles of drainage from the forested mountain side. The stream is quite sinuous given the 2.57% valley, with a sinuosity of 2.2. UT to South Crowders is an example of a classic, small E4 stream within a higher sloped setting, with a width to depth ratio ranges from 5.7 to 8.2 and a high entrenchment ratio ranging from 3.7 to 4.2. The stream is fully connected to its alluvial floodplain, and supports varied habitats including root mats, deep meander pools, rock riffles, and woody debris in the channel.

7.2.5 UT to South Fork Catawba – Vile Preserve
UT to South Fork Catawba River - Vile Preserve is a perennial stream located in the floodplain of the South Fork Catawba River. The stream flows through a broad, flat, wetland floodplain complex, which receives runoff from adjacent agricultural uplands. The stream is completely connected to the floodplain wetlands with a bank height ratio of 1.0 and an entrenchment ratio over 30. The reach has a low slope with a sandy substrate and classifies as a Rosgen E5 stream type. The channel dimension, interaction with the floodplain wetland, and similar stream substrate make it an applicable reference reach for design of the streams within the wetlands on the West side of the project.

7.2.6 UT to Lyle Creek
UT to Lyle Creek is a perennial stream flowing through the broad, flat floodplain of Lyle Creek. UT to Lyle's watershed is wooded, and the stream is fully connected to the floodplain with a bank height ratio of 1.0 and an entrenchment ratio of over 2.5. The width-to-depth ratio ranges from approximately 15 to 18, and the overall valley slope is approximately 0.8%. UT to Lyle Creek has a sinuosity of 1.1 and

classifies as a straight, C5 stream channel. In-stream habitat features within this reach include shallow pools, woody debris, and small sections of tree roots.

7.2.7 Deep Creek Mitigation

Deep Creek Mitigation Bank is in the Yadkin River basin in southeast Yadkin County, NC. Originally designed and constructed in 2003, the intent of the mitigation effort was to restore a Bottomland Hardwood Forest Wetland by restoring wetland hydrology in borderline hydric soil areas. Stream restoration efforts included fillings ditches and modifying stream dimension, pattern, and profile. Wildlands identified that the site location, project intent, and soil conditions were like that of the West Side of the Lone Hickory Mitigation Site. After visiting the site, it was determined that hydric soil conditions had been re-established throughout the wetland restoration area. Based on the field visit and site evaluation, a reference wetland gage was placed on site to monitor hydrologic conditions and compare them to the existing and estimated proposed conditions of the wetland re-establishment areas planned for the Lone Hickory Mitigation Site. Reference gage data from Deep Creek Mitigation Site is included in Appendix 4. Wildlands will continue to monitor wetland hydrology within Deep Creek Mitigation site to use for baseline hydrology information at Lone Hickory Mitigation Site. A short profile and cross-section of the restored C-type channel were surveyed to evaluate its stability and similarity to the proposed reaches at the Lone Hickory Mitigation Site. The low-sloped, moderate width-depth ratio channel was consistent with project goals at Lone Hickory Mitigation Site.

7.2.8 Cooleemee Plantation

The Cooleemee Plantation Reference Reach is in southeast Davie County, NC approximately 9 miles east of Mocksville, NC. The reference tributary flows through the wider floodplain of the Yadkin River. A detailed survey of the stream was conducted in January 2017. The C-type stream channel has a 0.68 square mile drainage area with a width to depth ratio between 15 and 24. The valley and stream slope are relatively flat (less than 0.5%). Soils on the site were mapped as Chewacla and were similar in texture and grain size to those found at the Lone Hickory Mitigation Site. Vegetation on the site included white oak, red oak, river birch, green ash, sycamore, tulip poplar, and American beech. The site was selected as a reference reach due to its similarity in valley setting, stream type, slope, soil composition, and drainage area to the west side reaches.

7.3 Design Channel Morphological Parameters

Reference reaches were a primary source of information to develop the pattern and profile design parameters for the streams. Ranges of pattern parameters were developed within the reference reach parameter ranges with some exceptions based on best professional judgement and knowledge from previous projects. For example, for meandering C designs, radius of curvature ratio is kept above 1.8 on all reaches and meander width ratio is kept above a 2.4. Meandering designs have pool widths to be 1.2 to 1.5 times the width of riffles to provide adequate point bars and riffle pool transition zones. Wildlands has found these minimum ratios to support stable geometry. Designer experience was used for pool design as well. Pool depths were designed to be a minimum of 3 times deeper than riffles to provide habitat variation. Cross-section parameters such as area, depth, and width were designed based on the design discharge and stable bank slopes. In some cases, the width to depth ratio was increased beyond reference parameters as dictated by prior project experience to provide stable bank slopes prior to the development of a fully vegetated streambank. Key morphological parameters for the Site are listed in Tables 10-15 for East Side and West Side streams. Complete morphological tables for existing, reference, and proposed conditions are in Appendix 4.

Due to the extensive agricultural manipulation of the West Side streams, post-construction drainage areas vary for several reaches. The hillside ditch network that currently routes part of UT2B's watershed flows away from the channel will be removed, resulting in an increase in drainage area from 6 acres to

35 acres. UT3 will be relocated away from the property boundary ditch into the South Deep Creek floodplain near its historic alignment. UT3 Reach 2 and UT2 Reach 2 join within the broad floodplain to create UT3 Reach 3, which will flow out to South Deep Creek. As a result of this realignment, UT3 Reach 3 will receive the entire 562 acre drainage from the entire West Side.

Table 10: Summary of Morphological Parameters for East Side Streams – *Lone Hickory Mitigation Site*

Parameter	UT1 Reach 1			UT1 Reach 2A		
	Existing	Reference: UT to Kelly Branch	Proposed	Existing	Reference: Pilot Mountain Trib	Proposed
Valley Width (ft)	30-170	N/A	30-50	45-85	N/A	45-85
Contributing Drainage Area (acres)	46	51	46	75	173	75
Channel/Reach Classification	E5b	B4/B4a	B4a	G4	B4	B4
Design Discharge Width (ft)	4.8	6.4	6.5	8.9	8.6	7.8
Design Discharge Depth (ft)	0.8	0.7	0.5	0.8	0.7	0.5
Design Discharge Area (ft^2)	3.8	4.5	3.0	7.2	6.0	4.2
Design Discharge Velocity (ft/s)	2.9	4.4	4.1	2.1	5.3	3.7
Design Discharge (cfs)	11	19	11	15	32	15
Water Surface Slope (ft/ft)	0.0295[1]	0.03-0.065	0.0622	0.0256	0.0378	0.0290
Sinuosity	1.08	1.2	1.04	1.04	1.05	1.08
Width/Depth Ratio	7.2	9.2	14.2	11.0	12.5	14.6
Bank Height Ratio	3.2	1.0	1.0	2.6	1.0	1.0
Entrenchment Ratio	2.2	1.4	2.2+	1.5	1.5	2.2+

1: Local slope at cross section – existing water surface slope varies widely on UT1 Reach 1 due to the impoundments.

Table 11: Summary of Morphological Parameters for East Side Streams – *Lone Hickory Mitigation Site*

Parameter	UT1 Reach 2B			UT1 Reach 3			
	Existing	Reference: Lone Hickory On-Site Reference	Proposed	Existing	Reference: Lone Hickory On-Site Reference	Reference: UT to South Crowders	Proposed
Valley Width (ft)	45-85	N/A	45-85	100-240	N/A	N/A	100-240
Contributing Drainage Area (acres)	206	109	206	279	109	141	279
Channel/Reach Classification	G4	C4	C4	E4	C4	E4	C4
Design Discharge Width (ft)	8.9	6.7	10.7	10.0	6.7	6.1-8.4	11.8
Design Discharge Depth (ft)	0.8	0.5	0.8	1.3	0.5	1.0-1.1	0.8
Design Discharge Area (ft^2)	7.2	3.6	8.1	13.4	3.6	6.4-8.7	9.5
Design Discharge Velocity (ft/s)	4.2	3.2	3.8	4.1	3.2	2.9	4.0
Design Discharge (cfs)	30	12	30	38	12	22	38
Water Surface Slope (ft/ft)	0.0256	0.0185	0.0180	0.0101	0.0185	0.0091	0.0156
Sinuosity	1.04	1.32	1.25	1.13	1.32	2.2	1.30
Width/Depth Ratio	11.0	13.4	14.3	7.5	13.4	5.8-8.0	14.6
Bank Height Ratio	2.6	1.0	1.0	1.7	1.0	1.4-2.1	1.0
Entrenchment Ratio	1.5	3.0	2.2+	3.1	3.0	3.7-4.3	2.2+

Table 12: Summary of Morphological Parameters for West Side Streams – *Lone Hickory Mitigation Site*

Parameter	UT2 Reach 1			UT2 Reach 2			
	Existing	Reference: Pilot Mountain Trib	Proposed	Existing	Reference: UT to South Crowders	Reference: UT to S Fork Catawba (Vile Preserve)	Proposed
Valley Width (ft)	17-130+	N/A	17-130+	120-500+	N/A	N/A	120-500+
Contributing Drainage Area (acres)	88	173	88	170	141	602	170
Channel/Reach Classification	G4	B4	B4	G5	E4	E5	C4
Design Discharge Width (ft)	8.7	8.6	7.5	7.7	6.1-8.4	6.1-6.2	11
Design Discharge Depth (ft)	0.7	0.7	0.5	0.8	1.0-1.1	0.7-0.8	0.7
Design Discharge Area (ft^2)	5.7	6.0	3.9	6.1	6.4-8.7	4.5-5.3	7.8
Design Discharge Velocity (ft/s)	2.5	5.3	3.4	3.3	2.9	11.0	2.6
Design Discharge (cfs)	14	32	14	20	22	54	20
Water Surface Slope (ft/ft)	0.0154	0.0378	0.020	0.0062	0.0091	0.0068	0.0030-0.012
Sinuosity	1.01	1.05	1.1	1.02	2.2	1.03	1.3
Width/Depth Ratio	13.1	12.5	14	9.8	5.8-8.0	7.4-8.3	15.5
Bank Height Ratio	4.4	1.0	1.0	2.3	1.4-2.1	1.0	1.0
Entrenchment Ratio	1.4	1.5	1.4-2.2+	1.1	3.7-4.3	30+	2.2+

Table 13: Summary of Morphological Parameters for West Side Streams – *Lone Hickory Mitigation Site*

Parameter	Existing		References				Proposed	
	UT2A	UT2B	UT to S. Fork Catawba (Vile Preserve)	UT to Lyle Creek	Deep Creek Mitigation	Cooleemee Plantation	UT2A	UT2B
Valley Width (ft)	500+	100-475+	500+	N/A	N/A	500+	500+	100-475+
Contributing Drainage Area (acres)	27	6	602	160	429	435	27	35[1]
Channel/Reach Classification	G5	G5	E5	C5	C5	C5	C4	C4b
Design Discharge Width (ft)	3.4-4.7	3.9-4.1	6.1-6.2	7.0-8.6	12.9	14.7-18.1	5.5	7.5
Design Discharge Depth (ft)	0.5-0.7	0.3	0.7-0.8	0.5	1.4	0.8-1.0	0.4	0.5
Design Discharge Area (ft^2)	2.2-2.3	1.3-1.4	4.5-5.3	3.5-4.1	17.1	13.6-14.9	2.1	4.1
Design Discharge Velocity (ft/s)	1.6-1.8	1.7-1.8	N/A	4.7	2.4	1.8	1.9	2.0
Design Discharge (cfs)	4	8	54	18	41	26	4	8
Water Surface Slope (ft/ft)	0.0052	0.0107	0.0068	0.0057	0.0028	0.0027	0.0050-0.0140	0.0040-0.028
Sinuosity	1.00	1.00	1.03	1.1	1.6	1.1	1.2	1.2
Width/Depth Ratio	5.1-9.5	11.4-13.0	7.4-8.3	14.9-18.3	9.6	14.6-24.1	14	14
Bank Height Ratio	2.7-3.1	6.5-7.2	1.0	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.6-2.4	1.2-1.6	30+	5.7-6.4	10.5	8.8+	1.4-2.2+	1.4-2.2+

1: UT2B's watershed increases post-restoration due to the removal of the ditch network that currently diverts its watershed flow.

Table 14: Summary of Morphological Parameters for West Side Streams – *Lone Hickory Mitigation Site*

Parameter	UT3 Reach 1				UT3 Reach 2			
	Existing	References		Proposed	Existing	References		Proposed
		Lone Hickory UT3	UT to South Crowders			UT to S. Fork Catawba (Vile Preserve)	Cooleemee Plantation	
Valley Width (ft)	110-250	N/A	N/A	110-250	500+	500+	500+	500+
Contributing Drainage Area (acres)	378	109	141	378	392	602	435	419
Channel/Reach Classification	G4	B4c	E4	B4c	G5c	E5	C5	C4
Design Discharge Width (ft)	11.2	6.7	6.1-8.4	13	10.0	6.1-6.2	14.7-18.1	16.2
Design Discharge Depth (ft)	1.2	0.5	1.0-1.1	0.9	1.0	0.7-0.8	0.8-1.0	1.0
Design Discharge Area (ft^2)	13.7	3.6	6.4-8.7	12.1	10.2	4.5-5.3	13.6-14.9	16.2
Design Discharge Velocity (ft/s)	4.0	3.2	2.9	3.6	2.0	N/A	1.8	2.7
Design Discharge (cfs)	45	12	22	45	45	54	26	45
Water Surface Slope (ft/ft)	0.0107	0.0185	0.0091	0.0110	0.0034	0.0068	0.0027	0.0020-0.0110
Sinuosity	1.06	1.32	2.2	1.1	1.01	1.03	1.1	1.4
Width/Depth Ratio	9.1	13.4	5.8-8.0	14.4	9.9	7.4-8.3	14.6-24.1	16.2
Bank Height Ratio	2.6	1.0	1.4-2.1	1.0	1.4	1.0	1.0	1.0
Entrenchment Ratio	1.3	3.0	3.7-4.3	1.4-2.2+	14.9+	30+	8.8+	2.2+

Table 15: Summary of Morphological Parameters for West Side Streams – *Lone Hickory Mitigation Site*

Parameter	Existing	References				Proposed
	UT2 Reach 3	**UT to S. Fork Catawba**	**UT to Lyle Creek**	**Deep Creek Mitigation**	**Cooleemee Plantation**	**UT3 Reach 3**
Valley Width (ft)	270-340	500+	N/A	N/A	500+	350-500+
Contributing Drainage Area (acres)	170	602	160	429	435	562
Channel/Reach Classification	G5	E5	C5	C5	C5	C4
Design Discharge Width (ft)	8.4	6.1-6.2	7.0-8.6	12.9	14.7-18.1	19.0
Design Discharge Depth (ft)	0.7	0.7-0.8	0.5	1.4	0.8-1.0	1.1
Design Discharge Area (ft^2)	5.7	4.5-5.3	3.5-4.1	17.1	13.6-14.9	21.1
Design Discharge Velocity (ft/s)	1.8	N/A	4.7	2.4	1.8	1.8
Design Discharge (cfs)	21	54	18	41	26	55
Water Surface Slope (ft/ft)	0.0043	0.0068	0.0057	0.0028	0.0027	0.0020
Sinuosity	1.05	1.03	1.1	1.6	1.1	1.2
Width/Depth Ratio	12.3	7.4-8.3	14.9-18.3	9.6	14.6-24.1	17.1
Bank Height Ratio	3.1	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.5	30+	5.7-6.4	10.5	8.8+	2.2+

7.4 Design Discharge Analysis

Multiple methods were used to develop bankfull discharge estimates for each of the project restoration reaches: the NC Rural Piedmont regional curve (Harman et al., 1999), NC Piedmont/Mountain regional curve (Walker, unpublished), a Wildlands regional USGS flood frequency analysis, a site-specific reference reach curve, existing bankfull indicators using Manning's equation, and data from previous successful design projects. The resulting values were compared and best professional judgment was used to determine the specific design discharge for each restoration reach. Each data source is plotted on Figure 10 to show the relationship of the data to the design discharge selections.

7.4.1 Regional Curve Data

Discharge was estimated using the published NC Rural Piedmont Curve (Rural Data on Figure 10) as well as the updated curve for rural Piedmont and Mountain streams, shown as the Alan Walker Curve on Figure 10.

7.4.2 Wildlands Regional USGS Rural Piedmont Calculator

Wildlands developed a regional flood frequency analysis tool that tailored the USGS 2009 publication *Magnitude and Frequency of Rural Floods in the Southeastern United States, through 2006* to the Piedmont of North Carolina. Of the 103 stations referenced in the publication, 23 were used in the development of the tool. To fill gaps in data, five additional stations were added by Wildlands to represent streams with drainage areas less than one square mile. The Hosking and Wallis homogeneity test was performed in R© to identify the most appropriate gages based on homogeneity (Hosking and Wallis, 1993). The gages used were:

- USGS 02096740 – Gun Branch near Alamance, NC (DA = 4.06 mi^2)
- USGS 02096846 – Cane Creek near Yadkin Grove, NC (DA = 7.54 mi^2)
- USGS 02097010 – Robeson Creek near Pittsboro, NC (DA = 1.71 mi^2)
- USGS 02101030 – Falls Creek near Bennett, NC (DA = 3.43 mi^2)
- USGS 0210166029 – Rocky River at SR1300 near Crutchfield Crossroads, NC (DA = 7.42 mi^2)

The data from these 28 gage stations were used to develop flood frequency curves for the 1.2-year and 1.5-year recurrence interval discharges. These relationships can be used to estimate discharge of those recurrence intervals for ungaged streams in the same hydrologic region, and were solved for each project reach's discharge with the drainage area as the input. The discharge estimates are shown on Figure 10 as the USGS Rural Piedmont Calculator 1.2-yr Predictions.

7.4.3 Site Specific Reference Reach Curve

Eight reference reaches were identified for this project. Each reference reach was surveyed to develop information for analyzing drainage area-discharge relationships as well as development of design parameters. Stable cross-sectional dimensions and channel slopes were used to compute a bankfull discharge with the Manning's equation for each reference reach. The resulting discharge values were plotted with drainage area on Figure 10 (Reference Reach Curve) and compared the other discharge estimation methods.

7.4.4 Maximum Discharge (Manning's Equation)

A riffle cross-section was surveyed on each design reach on the Site. Due to the dredged condition of UT2A and UT2B and the lack of defined riffles and pools, two run sections were surveyed on each of these reaches, totaling 15 riffle/run cross-sections across the Site. Due to the existing impairments throughout Site streams, bankfull indicators were weak and not considered reliable for estimating a bankfull discharge. Instead, Manning's equation was used to calculate a discharge associated with the top of banks for all project streams. Stream slope was calculated from the surveyed channel slope, and roughness was estimated using guidelines from Chow (1959). This corresponding discharge was plotted on Figure 10 (Qmax – Existing Site Streams) and considered as an upper limit for potential bankfull discharge values throughout the Site.

7.4.5 Design Discharge Analysis Summary

One of the main design goals at Lone Hickory is to reconnect streams with their natural valleys and to restore riparian floodplain or wetland hydrology. On the East Side, this is first achieved by removing the remnant impoundments and the accumulated legacy sediments behind them to restore the natural valley topography. Then, the streams will be raised to meet the invert of the existing or restored valleys. On the West Side, overburden will be removed to restore the floodplain wetlands and the incised, ditched streams will be raised to meet the invert of the floodplain. Because of the desire to achieve frequent floodplain interaction, design discharges were selected close to the lower end of the range of values produced by the estimation methods. Tables 16-18 give a summary of the discharge analysis, while Figure 10 illustrates the design discharge data.

Table 16: Summary of East Side Design Discharge Analysis – *Lone Hickory Mitigation Site*

		UT1			
		Reach 1	Reach 2A	Reach 2B	Reach 3
DA (acres)		46	75	206	279
DA (sq. mi.)		0.07	0.12	0.32	0.44
NC Rural Piedmont Regional Curve (cfs)		13	19	39	49
Alan Walker Curve (cfs)		7	10	23	29
Wildlands Regional USGS Flood Frequency Analysis (cfs)	1.2-year event	11	16	34	42
	1.5-year event	16	24	48	61
Site Specific Reference Reach Curve		10	13	25	31
Max Q from Manning's Eq. from XS survey (cfs)		601	304	304	218
Final Design Q (cfs)		11	15	30	38

Table 17: Summary of West Side Design Discharge Analysis – *Lone Hickory Mitigation Site*

		UT2		UT2A	UT2B[1]
		Reach 1	Reach 2		
DA (acres)		88	170	27	35
DA (sq. mi.)		0.14	0.26	0.04	0.05
NC Rural Piedmont Regional Curve (cfs)		21	33	5	11
Alan Walker Curve (cfs)		12	19	3	6
Wildlands Regional USGS Flood Frequency Analysis (cfs)	1.2-year event	18	29	4	9
	1.5-year event	27	42	7	13
Site Specific Reference Reach Curve		15	22	4	8
Max Q from Manning's Eq. from XS survey (cfs)		331	75	52	124
Final Design Q (cfs)		14	20	4	8

1: UT2B post restoration will capture the entire watershed, including the portion that is currently ditched along the valley toe.

Table 18: Summary of West Side Design Discharge Analysis – *Lone Hickory Mitigation Site*

		UT3		
		Reach 1	Reach 2	Reach 3[1]
DA (acres)		378	416	562
DA (sq. mi.)		0.59	0.65	0.88
NC Rural Piedmont Regional Curve (cfs)		61	65	81
Alan Walker Curve (cfs)		37	40	50
Wildlands Regional USGS Flood Frequency Analysis (cfs)	1.2-year event	53	56	71
	1.5-year event	75	81	101
Site Specific Reference Reach Curve		38	38	48
Max Q from Manning's Eq. from XS survey (cfs)		370	39	N/A[1]
Final Design Q (cfs)		45	45	55

1: UT3 Reach 3 post-restoration combines flow from the existing conditions UT2 Reach 3 and UT3.

7.5 Sediment Transport Analysis

As discussed in Section 3.2.1, the conservation easement East Side of the project captures 85% of the watershed streams. Restoration of UT1 will involve removal of the old Pond 1 and 3 embankments, removal of the accumulated sediments behind the dam, and restoration of the approximate historic valley profile. UT1 will be restored through the new valley with bankfull depth relative to the valley floor. The buffers will also be converted from agricultural fields to planted native woody tree and shrub species. The restored buffer will provide filtration for overland flow from remaining upland agricultural fields. Additionally, three BMPs will be constructed to treat points of concentrated agricultural runoff. The project stream and valley restoration will address the major sediment sources within the watershed by protecting stream banks, removing unconsolidated alluvial deposits, and reducing channel shear stress. The post-construction streams will not be capacity limited; therefore, the focus of sediment transport analysis for design was to verify that the designed channels will be stable over time and have the competence to pass the sediment that continues to be delivered by the watershed.

The design on the West Side of the Site will restore a wetland stream complex, reconnecting streams to their floodplains, and providing positive stream slope down to South Deep Creek. The ditch network that currently bypasses UT2B will be removed, and a BMP will be installed to capture fine sediments from the upland fields prior to entering the Site. Similarly, an agricultural road that delivers fine sediments to upper UT2 will either be decommissioned and stabilized or it will be routed into a BMP, where sediments can settle out before reaching Site streams. With the BMPs, the post-construction streams will not be capacity limited; therefore, the focus of sediment transport analysis for design was to verify that the designed channels will be stable over time and have the competence to pass the sediments that continue to be delivered by the watershed.

7.5.1 Competence Analysis

Competence analyses were performed during design for each of the restoration reaches by comparing shear stress associated with the design bankfull discharge, proposed channel dimensions, and proposed channel slopes with the size distribution of the existing bed load. The analysis utilized standard equations based on a methodology using the Shields (1936) curve and Andrews (1984) equation described by Rosgen (2001). Channel slope and design dimensions were varied until the resulting design verified that the stream reach could move the bed load supplied to the stream. The results of the analysis are shown in Tables 19-21.

Table 19: Results of East Side Competence Analysis – *Lone Hickory Mitigation Site*

	UT1			
	Reach 1	**Reach 2A**	**Reach 2B**	**Reach 3**
Dbkf (ft)	0.46	0.53	0.75	0.81
Schan (ft/ft)	0.0622	0.0290	0.0180	0.0156
Bankfull Shear Stress, t (lb/sq ft)	1.74	0.95	0.75	0.76
Dmax Bar/Subpavement (mm)	50	78	78	98
Dcrit (ft)	0.06	0.32	0.51	0.56
Scrit (ft/ft)	0.0078	0.0173	0.0122	0.0109
Movable particle size (mm)	228	146	123	125
Predicted Shear Stress to move Dmax	0.22	0.40	0.40	0.55

Table 20: Results of West Side Competence Analysis – *Lone Hickory Mitigation Site*

	UT2		UT3 Reach 1
	Reach 1	Reach 2	
Dbkf (ft)	0.52	0.70	0.90
Schan (ft/ft)	0.0200	0.0400	0.0110
Bankfull Shear Stress, t (lb/sq ft)	0.66	1.66	0.61
Dmax Bar/Subpavement (mm)	81	48	52
Dcrit (ft)	0.39	0.10	0.34
Scrit (ft/ft)	0.0152	0.0070	0.0034
Movable particle size (mm)	112	221	106
Predicted Shear Stress to move Dmax	0.43	0.21	0.23

The initial competence analysis was based on the size material naturally found in the stream to mimic potential bed load. The results were used to inform further design of the reach. The excess shear throughout all Site streams influenced the design of rock and wood step structures to provide grade control and increase roughness within the channel. Riffles with larger materials, such as chunky riffles, were also integrated into the design as grade control. The proposed D_{50} and D_{100} for the constructed riffles on all stream reaches will be sized so that the reconstructed channels will not produce enough shear stress to entrain the largest particles in these structures. This will ensure a stable pavement while allowing for bed load material to be active within the system.

7.6 Project Implementation

7.6.1 East Side

The primary stressors to UT1 are sediment-laden impoundments, concentrated agricultural runoff inputs, confinement against the valley wall, active stream incision and head cutting, and lack of stabilizing streamside vegetation due to agriculture practices. Wildlands' approach to restoring UT1 will focus on treating concentrated inputs of agricultural runoff, removing breached and eroding dams and sediments behind them, reconnecting the stream to its floodplain and stabilizing active headcuts, returning the stream to the center of its valley, and replacing sinuosity that was likely removed during agricultural ditching. At the beginning of UT1, upstream of the jurisdictional stream call, BMP1 will be installed to treat concentrated agricultural runoff from a small neighboring farm area. BMP1 is designed as a Step Pool Conveyance System (SPSC), fitted within the steep, ephemeral portion of UT1 to filter the agricultural runoff through sand and promote groundwater infiltration. Below this, at the headcut where UT1 becomes intermittent and begins to incise, UT1 will be reconnected to the valley bottom using Priority 1 restoration. Full restoration is proposed instead of enhancement on this intermittent reach to allow for reconnection of the system to the valley bottom without the use of Priority 2 restoration further downstream. UT1 transitions to a perennial channel within 200 feet of its inception. UT1's valley here is over 6%, and the stream is designed as a Rosgen Ba with energy dissipated vertically over steps. Steps will be intermixed with cascade riffles modeled after the steep riffles observed on the reference stream UT to Kelly Creek. Step spacing was guided by measurements from UT to Kelly Creek and by the step pool geometric scaling documented in Chartrand and other's paper on step-pools (Chartrand et. al, 2011). Although designed as an Ba-type stream, which generally exists within a V-shaped valley, UT1's valley provided some space for a small floodplain, and one is provided consistently along UT1 Reach 1's length.

Another BMP (BMP2) will be installed where concentrated agricultural inputs enter UT1 from the left floodplain, at the location of historic Pond 2. BMP2 is designed as a sediment basin to capture the high volume of fine sediments that runoff the contributing agricultural fields. A rock outlet channel will convey the treated runoff down to the UT1 valley bottom.

Remnant dams at Pond 1 and Pond 3 will be removed, and pond sediments will be excavated to restore the approximate historic valley bottom. The design here could classify as a Priority 2 due to the necessary excavation to restore the valley profile. The stream design continues as a Rosgen Ba-type stream until the downstream extent of Pond 3, where Reach 1 ends and Reach 2A begins. The valley slope here drops to 3.1%, and the design transitions to a Rosgen B-type stream. The stream will be relocated away from its ditched location at the right valley toe, and aligned in the center of the floodplain. Energy will be dissipated over steps and long riffles. At the confluence with UT1A, the valley slope flattens again to 2.3%, and the design transitions to a meandering Rosgen C-type stream, where energy is dissipated laterally in pools and vertically over long riffles. UT1 will continue to occupy the center of the floodplain, and UT1A, a preservation stream, will be extended to meet the alignment of the newly restored UT1. At UT1's confluence with UT1B, the valley slope drops slightly to 2.0%, and the drainage area increases. UT1 Reach 3 continues below this point as a Rosgen C-type design, but with slightly larger dimensions to accommodate the increased watershed size. At a concentrated flow point of an ephemeral ditch entering from the right floodplain, a SPSC BMP (BMP3) will be installed to treat the agricultural runoff and arrest the ditch erosion before entering UT1. UT1 Reach 3 is a Priority 1 design until just upstream of the Reach 3/Reach 4 break, when a short length of Priority 2 restoration is used to bring UT1 down to meet the invert of the existing stream channel. UT1 Reach 4 is a preservation reach, but some minor enhancements including bank stabilization and the addition of a few habitat structures will be completed to transition the stream from restoration to preservation.

The function of the BMPs on the East Side is to trap sediment and nutrients coming from outside the conservation easement while the Site stabilizes. The BMPs will not be monitored or maintained, and are intended to evolve over time to provide more passive treatment associated with natural areas. The SPSCs (BMP1 and BMP3) may fill gradually over time and transition to a stable channel. The sediment basin (BMP2) will fill with sediment and vegetate, transitioning its function to a vegetative filter. The outlet of BMP2 will remain the low spot, and flows from this area will still enter the riparian zone through the rock stabilized channel.

The concept plan for East Side Site restoration is illustrated in Figure 8.2.

7.6.2 West Side

The primary stressors to streams on the West Side are the extensive agricultural manipulation through ditching, deep incision, and the lack of bedform diversity. Wildlands' focus on this side of the Site is to holistically restore the bottomland by removing drainage ditches, removing the overburden material and rebuilding the valley toe that was previously excavated, and restoring the streams and wetlands to their natural position in the South Deep Creek floodplain. UT3's ditch, which runs along the property boundary, will be filled in and the drainage will be restored using Priority 1 restoration through a broad floodplain to connect with UT2 and the other West Side tributaries. A temporary construction easement has been secured to allow for UT3's relocation off the property boundary. UT3's alignment mimics the historic alignment described by neighbor John Kessler and runs across the areas where buried stream sediments were encountered. UT3A, a non-project stream which joins UT3 in the northeast corner of the West Side, will be extended to join UT3 within the Site limits. The old UT3 channel, below the Drainage A confluence will be partially filled and graded as a swale with positive drainage towards South Deep Creek to allow Drainage A to flow. UT2A will also be restored using Priority 1 restoration to connect with UT3 at a location upstream of the UT2 confluence. Full restoration was selected instead of enhancement on intermittent stream UT2A due to the ditched condition of the existing stream and its lack of bedform diversity. The series of farm ditches that currently divert UT2B's flow to the hillside ditch will be filled in, and UT2B will be restored to the center of its valley and meandered downstream using Priority 1 restoration to join UT2. To address the heavy fine sediment contribution coming from the agricultural drainage upstream of UT2B, a dry detention basin BMP (BMP4) will be installed upstream from UT2B's inception point. Additional buffer will be planted at the upper end of UT2B to stabilize ephemeral ditches and intercept concentrated runoff. To treat the sediment-laden runoff from the agricultural road in the right floodplain or UT2 Reach 1, the road will either be decommissioned and stabilized, or it will be routed into an additional dry detention basin BMP (BMP5). To ensure that road drainage reaches the BMP, a temporary construction easement will be secured to regrade the offsite road into a ditch which will outlet to the BMP. This work will be depicted in the final construction plans, if implemented.

Below the UT2, UT2A, UT2B, and UT3 confluence, the proposed channel (UT3 Reach 3) will be meandered through the right floodplain of South Deep Creek north of the stream's approximate existing alignment to join the channel network with South Deep Creek more directly. A short length of UT3 Reach 3 is designed to be incised as it drops to meet the invert of South Deep Creek; however, step height is limited to no more than 0.5' to allow for aquatic species from South Deep to navigate into the newly restored design reaches. It is expected that, under backwater conditions, refuge in the tributaries will not be problematic as structures will drown out.

In-stream structures on West Side streams will include various types of constructed riffles, log sills, boulder sills, lunker logs, and j-hooks. The structures will reinforce channel stability and serve as habitat features. The constructed riffles will be comprised of excavated on-site riffle material from the adjacent hillslopes where possible, or quarry stone may be used if an on-site source cannot be found. The riffles will incorporate woody brush material and logs. The diverse range of constructed riffle types will provide grade control, diversity of habitat, and will create varied flow vectors. Log -j-hooks will deflect flow vectors away from banks while adding to habitat diversity. Log 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. Lunker logs in combination with sod mats will also be used to provide pool habitat variability.

The function of the BMPs on the West Side is to trap sediment and nutrients coming from outside the conservation easement while the Site stabilizes. The BMPs will not be monitored maintained, and are intended to evolve over time to provide more passive treatment associated with natural areas. The dry detention basins (BMP4 and BMP5) will fill with sediment and vegetate, transitioning its function to a vegetative filter. The outlets of these BMPs will remain the low spot, and flows from these areas will still enter the riparian zone through the rock stabilized channel.

The concept plan for Site restoration is illustrated in Figure 8.1.

7.7 Proposed Wetland Design Overview

The proposed design includes the restoration of 9.5 acres of historically altered wetlands which will be re-established as a stream and wetland complex through the West Side bottomland floodplain of South Deep Creek. Wildlands performed a multilevel analysis of the proposed wetland area to holistically understand farming and anthropogenic effects, current and proposed hydrologic conditions, and the potential for hydric soil development.

7.7.1 Hydric Soil Investigation

After reviewing the Natural Resource Conservation Service's (NRCS) web soil survey mapping and performing site visits to evaluate potential for wetland restoration on-site, Wildlands contracted a LSS to perform a detailed hydric soil evaluation of the site to determine the site's potential for hydric soil development. Ninety-five soil borings were performed on a 100-foot grid within the soils study area to assess the presence or absence of hydric soil indicators. At boring locations, the depth below the existing land surface to appropriate hydric soil indicators was noted. Soil borings were classified into three categories based on the depth to hydric soil: hydric indicators from 0 to 10-inches of depth, buried hydric indicators (below 10-inches of depth), and non-hydric. The report from the LSS (Appendix 9) supported Wildlands' initial impressions that the site has been heavily altered for use as an agricultural field. Current topographic mapping suggests that the toe of the hillslopes surrounding the proposed wetland area have been removed and used to crown the agricultural fields to increase agricultural production. A volumetric estimation of these hillslope projections indicates that 60,000 cubic yards of soil could have been removed from this hill toe area and used to crown the 16 acre field by 28 inches.

After the completion of the LSS hydric soils evaluation, Wildlands met with the Interagency Review Team (IRT) on-site to confirm the findings within the hydric soils evaluation. Based on the meeting with the IRT, the overall presence of potential hydric soils was confirmed and for further clarification Wildlands developed three zones of potential wetland area. The zones of potential wetland area were developed based on the depth to hydric soil indicators and the hydric soil criteria based on individual indicators (F3 versus F19). Potential wetland area zones with less than 12-inches of depth to hydric soils and obvious hydrologic manipulation were chosen as the areas with the most potential for wetland restoration through re-establishment. Areas with greater than 12-inches of depth to hydric soil indicators and limited hydrologic manipulation were excluded from the potential wetland restoration zone. These zones, along with the groundwater modeling outlined below, were used to aid in the development of the wetland restoration grading plan for the Site.

7.7.2 Groundwater Modeling

To further inform the wetland restoration design, an analysis of the existing and proposed conditions for groundwater hydrology was performed using DrainMod (version 6.1). Existing and proposed groundwater hydrology conditions were simulated as water table depth over time. DrainMod was selected for this application because it is a well-documented modeling tool for assessing wetland hydrology (NCSU, 2010) and is commonly used in wetland restoration projects.

A representative groundwater gage model was developed and calibrated to evaluate the existing and proposed conditions within a central location of the wetland restoration zone. The locations and raw data from the pre-project monitoring wells are shown in Figure 6.1 and Appendix 4, respectively. Resulting model output was used to validate the wetland restoration plan and to develop a basic water budget for the site.

DrainMod models are built using site hydrology, soil, and climate data. Temperature and precipitation data were obtained from nearby weather station Yadkinville 6E (Station GHCN:USC00319675) which is operated by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service. The Yadkinville 6E weather station is located approximately 7 miles away from the proposed mitigation site. Observed hydrograph peaks align with the precipitation data, indicating that the precipitation trends are consistent between the weather station and the mitigation site. These data were used to calibrate the model and perform the long-term simulation.

The existing calibration and proposed models were developed using the conventional drainage option with the hydrologic analysis of wetlands feature incorporated to best simulate the drainage of the site. The analyzed gage was installed in November of 2016 and recorded groundwater depth twice per day with In-situ Level TROLL® pressure transducers. The period from January through the end of March 2017 was used as the calibration period for the groundwater models. Recordings from November 2016 to

December 2016 were not used for the calibration due to drought conditions creating atypical groundwater levels.

A baseline soil input file was developed using published soil survey data collected for the mapped soils found on-site (NRCS, 2017). The soil file was refined by adjusting certain parameters for the mapped soils using in-situ soil profiles and characterizations. To calibrate the model, soil parameters not measured in the field were adjusted within the limits typically encountered under similar soil and geomorphic conditions. After calibration of the model was complete, the calibrated model was used as the basis for the proposed conditions model. Plots showing the calibration result are included in Appendix 4.

Trends in the observed data are well-represented by the calibration simulations. Although hydrograph peaks between plots of observed and simulated data do not match exactly and the model results under-predict water levels during some periods, relative changes in water table hydrology because of precipitation events correspond well between observed data and model results and under predictions indicate that proposed conditions model results will be conservative.

The proposed conditions model was developed based on the calibrated existing conditions model to predict whether wetland criteria would be met over a long period of historical climate data. Proposed plans for the site include realigning the streams to increase sinuosity and raising the stream bed inverts. In addition, existing ditches that currently drain the site will be filled. Grading is proposed within the wetland zone to remove overburden and restore the natural valley topography of the site. The proposed grading will decrease the surface elevation of the existing site to bring hydric soils within the top 12 inches of the soil. Cut depth is limited to approximately 12 inches throughout the site. The proposed wetland areas will be disked and planted with native wetland plants.

Settings for the proposed conditions model were altered to reflect the proposed design changes of the site. Ditch spacing values were edited to account for filled ditches and restored stream alignments. Proposed grading and raised channel beds related to stream restoration were modeled by reducing depths from the soil surface to the draining channels for the modeled well. Surface storage values were increased to account for proposed roughening and planting of herbaceous plants on site. Once the proposed conditions model was developed, the model was run for a 59-year period from January 1958 through December 2016 using temperature and precipitation data from the Yadkinville 6E NOAA weather station.

The calibrated existing conditions model was compared with the proposed conditions scenario to determine the effect of proposed practices on local hydrology. Model simulations were then analyzed to predict the success of the groundwater hydrology function on the site. The wetland performance standard evaluated is that the water table must be within 12 inches of the ground surface for a minimum of 9.2% (19 consecutive days) of the growing season (April 4 through October 27). Sources used to set the wetland performance standard for the site include discussions with the IRT and LSS, Table 1 (wetland saturation threshold values) within the Wilmington District Stream and Wetland Compensatory Mitigation Update dated October 24, 2016, reference well data from the Deep Creek Mitigation Site, and past project experience. Growing season dates were defined by the Yadkinville 6E North Carolina WETS table for 50% probability of soil temperatures greater than 28 degrees Fahrenheit.

The model run simulations indicate that the modeled groundwater gage (GWG4, Figure 6.1 and 11.1), would not meet the required wetland performance standard with the site in its current condition any of the 59 modeled years. Average periods of inundation for the site without any changes sustain for approximately 4 days. Once proposed design changes are incorporated into the model, 52 out of the 59 modeled years meet the wetland performance standard with periods of inundation lasting anywhere from 19 to 60 days depending on precipitation patterns.

DrainMod computes daily water balance information and outputs summaries that describe the loss pathways for rainfall over the model simulation period. Table 21 below summarizes the average annual amount of rainfall, infiltration, drainage, runoff, and evapotranspiration estimated for the modeled location onsite. Infiltration represents the amount of water that percolates into the soil. Drainage is the loss of infiltrated water that travels through the soil profile and is discharged to the drainage ditches or to underlying aquifers. Runoff is water that flows overland and reaches the drainage ditches before infiltration. Evapotranspiration is water that is lost by the direct evaporation of water from the soil or through the transpiration of plants. The water balance results provided in the table show evapotranspiration increasing in the proposed condition when compared to the existing condition due to more standing surface water available to evaporation. Runoff remains virtually the same, as initial abstraction rates are changed minimally. Drainage values are reduced by approximately 9 cm of depth across the site by reducing the depth of adjacent streams and the filling of onsite ditches.

Table 21: Summary of Water Balance for Gauge 4 – *Lone Hickory Mitigation Site*

Hydrologic Parameter	Existing Conditions		Proposed Conditions	
	Average Annual Amount (cm of water)	Average Annual Amount (% of precip)	Average Annual Amount (cm of water)	Average Annual Amount (% of precip)
Precipitation	114.7	100%	114.7	100%
Infiltration	111.7	97%	111.3	97%
Evapotranspiration	67.0	58%	73.7	64%
Drainage	44.7	38%	37.5	33%
Runoff	2.9	3%	3.4	3%

The model results and water budget, in concurrence with the reference wetland data and the hydric soils investigation, support that the proposed design changes to the Site will restore wetland hydrologic processes required for hydric soil development and re-establish the proposed stream and wetland complex.

7.8 Vegetation and Planting Plan

The objective of the planting plan is to establish, over time, a thriving riparian buffer composed of native tree species. This restored buffer will improve riparian and wetland habitat, help the restored streams stay stable, shade the streams, and provide a source for LWD and organic material to the streams. The Site will also generate SMUs and WMUs for the Yadkin 01 CU. Non-forested areas within the conservation easement will be planted, which includes additional buffer areas far beyond the minimum requirement of 50 feet from top of bank as shown in Appendix 9. Riparian buffers will be seeded and planted with early successional native vegetation chosen to develop species diversity like a Piedmont Bottomland Forest community (Schafale, 2012). The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian buffers adjacent to the Site, 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 Sheet 4.0 of the Draft Plans located in Appendix 6.

The riparian buffer and wetland areas will be planted with bare root seedlings. In addition, the stream banks of larger cross section reaches will be planted with live stakes and the channel toe will be planted with multiple herbaceous species. Permanent herbaceous seed will be spread on streambanks, floodplain areas, and disturbed areas within the project easement.

Invasive species within the riparian buffers of restoration reaches will be treated at the time of construction. The extent of invasive species coverage will be monitored, mapped, and controlled as necessary throughout the required monitoring period. Please refer to Appendix 7 for the invasive species plan. Additional monitoring and maintenance issues regarding vegetation are in Sections 8 and 9 and Appendix 8.

7.9 Project Risk and Uncertainties

In general, this project is low risk. The land use surrounding the project is currently in agricultural production, so there is not a potential for accidental livestock access. Wildlands holds an option to purchase fee simple the Site parcels and most of the agricultural fields in the watershed. We will be able to influence or dictate agricultural practices that occur adjacent to the conservation easement. Due to the rural nature of the area, the potential for the urban development of UT1A and UT1B's watershed to occur soon is quite low, and the remaining watersheds are zoned to remain rural.

8.0 Performance Standards

The stream and wetland performance standards for the project have been developed based on guidance presented in the DMS Mitigation Plan Template (October 2015), the Annual Monitoring Template (April 2015), and the Stream and Wetland Mitigation Guidance issued October 2016 by the USACE. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, vegetation, and wetland hydrology. Performance criteria will be evaluated throughout the seven year post-construction monitoring period. An outline of the performance criteria components follows.

8.1 Streams

8.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. All riffle cross-sections should fall within the parameters defined for the designated stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Remedial action would not be taken if channel changes indicate a movement toward stability. Please note that UT3 Reach 3 is designed to incise as it transitions to meet the invert of South Deep Creek and this reach is expected to have a bank height ratio greater than 1.0 and an entrenchment ratio less than 2.2.

8.1.2 Pattern and Profile

Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability.

8.1.3 Substrate

Restoration reaches should show maintenance of coarser materials in the riffle features and smaller particles in the pool features. A reach-wide pebble count will be performed in each restoration reach each monitoring year for classification purposes. A pebble count will be performed at each surveyed riffle to characterize the pavement during the baseline monitoring only. Riffles may fine over the course of monitoring due to the stabilization of contributing watershed sediment sources.

8.1.4 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent of mid-channel bars or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

8.1.5 Hydrology

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented within the seven-year monitoring period. The four bankfull events must occur in separate years. In addition, low flow channels (UT1 Reach 1, UT2A, and UT2B) will each have a stream gage pressure transducer installed midreach to document 30 consecutive days of baseflow.

8.2 Vegetation

The final vegetative performance standard will be the survival of 210 planted stems per acre in the planted riparian areas at the end of the required seven-year monitoring period. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of monitoring year three (MY3) and at least 260 stems per acre at the end of MY5. 42: "VThe extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

8.3 Wetlands

The final performance standard for wetland hydrology will be a free groundwater surface within 12 inches of the ground surface for 19 consecutive days (9.2 percent) of the defined growing season for Yadkin County (April 4 through October 27) under typical precipitation conditions. This performance standard was determined through model simulations of post restoration conditions and comparison to reference wetland systems. A detailed discussion of the modeling approach to determining this performance standard as well as definitions and determinations of a target hydroperiod are included in Section 7.7.2 of this report. If a gage does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed and the hydrograph will be compared to that of the reference wetlands to assess whether atypical weather conditions occurred during the monitoring period.

8.4 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above.

9.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met and project goals and objectives are achieved. Annual monitoring data will be reported using the DMS Annual Monitoring Reporting Template (April 2015). The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes, and assist in close-out decision making.

Using the DMS As-Built Baseline Monitoring Report Template (February 2014), a baseline monitoring document and as-built record drawings of the project will be developed following the planting completion and monitoring installation on the restored site. Monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS by November 30. These reports will be based on the DMS Annual Monitoring Template (April 2015) and Closeout Report Template (March 2015). The closeout monitoring period will extend seven years beyond completion of construction or until performance standards have been met. If all performance criteria have been successfully met and at least two bankfull events have occurred during separate years, Wildlands may propose to terminate stream and/or vegetation monitoring after five years.

Table 22, below, describes how the monitoring plan is set up to verify that project goals and objectives have been achieved.

Table 22: Monitoring Plan – *Lone Hickory Mitigation Site*

Goal	Treatment	Performance Standards	Monitoring Metric	Outcome	Likely Functional Uplift
Improve stream channel stability.	Restore stream channels with bankfull channel dimension and pattern suited to the valley type.	Bank height ratios stay below 1.2. Visual assessments showing progression towards stability.	Cross-section monitoring and Visual assessment.	Stable stream channels with bank height ratios below 1.2.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.
Reconnect channels with historic floodplains and re-establish wetland hydrology and function in relic wetland areas.	Remove man-made impoundments, accumulated sediments, and culvert crossings from streams. Remove historic farm overburden from relic wetlands. Restore stream channels with bankfull dimensions relative to the floodplain. Restore stream plan form to promote development of mutually beneficial stream/wetland complex.	Streams: Stream profile and pattern must remain stable (note description of stability in Section 8.1). Wetlands: Free groundwater surface within 12 inches of the ground surface for 9.2 % (19 consecutive days) of the growing season (April 4 through October 27) for wetland areas.	Cross-section monitoring, Visual assessment, and groundwater gage monitoring	Stable stream channels with entrenchment ratios over 2.2 and bank height ratios below 1.2.[1]	Dispersion of high flows on the floodplain, increase in biogeochemical cycling within the system, and recharging of riparian wetlands.
Improve instream habitat.	Remove man-made impoundments and culvert crossings within easement. Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	There is no required performance standard for this metric.	Visual assessment	The visual inspection of instream aquatic habitat would progress, showing increase complexity over time.	Increase in available habitat niches for macroinvertebrates and fish leading to an increase in biodiversity over time.

Goal	Treatment	Performance Standards	Monitoring Metric	Outcome	Likely Functional Uplift
Reduce sediment and nutrient input from adjacent farm fields	Construct two step pool stormwater conveyance and up to three dry detention BMPs to slow and treat runoff from farm fields before entering Site streams.	There is no required performance standard for this metric.	None	Stormwater conveyance and dry detention BMPs remain functional, trap sediment and treat agricultural runoff.	Reduction in floodplain sediment inputs from runoff, improved aquatic habitat and water quality.
Restore and enhance native floodplain and wetland vegetation.	Plant native tree and understory species in open and shaded riparian areas where currently insufficient.	In open areas planted; Survival of 210 planted stems per acre at MY7. Interim survival of at least 320 planted stems at MY3 and at least 260 planted stems per acre at MY5. No success criteria is associated with shaded area planting.	Permanent and mobile 100 square meter vegetation plots within planted open areas. Shaded areas planted will be visual assessed.	Planted open area stem densities will be at or above 210 planted stems per acre at MY7.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased LWD and organic material in streams, increased biogeochemical cycling in floodplain, and improved riparian habitat.
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site.	Record and close conservation easement prior to implementation.	Visual assessment	Site remains protected by conservation easement in perpetuity.	Protection of the Site from encroachment into the conservation easement and direct impact to stream and wetlands. Supports all functions.

9.1 Monitoring Components

Project monitoring components are listed in more detail in Table 23 and 24. Approximate locations of the proposed vegetation plots and groundwater gage monitoring components are illustrated in Figure 11.1 and 11.2.

Table 23: East Side Monitoring Components – *Lone Hickory Mitigation Site*

Parameter	Monitoring Feature	Quantity/Length by Reach						Frequency	Notes
		UT1 Reach 1	UT1 Reach 2	UT1 Reach 3	UT1 Reach 4	UT1A	UT1B		
Dimension	Riffle Cross-sections	1	4	2	N/A	N/A	N/A	Year 1, 2, 3, 5, and 7	1
	Pool Cross-sections	1	3	2	N/A	N/A	N/A		
Pattern	Pattern	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	
Substrate	Reach wide (RW) Pebble Count	1 RW	1 RW	1 RW	N/A	N/A	N/A	Year 1, 2, 3, 5, and 7	3
Hydrology	Crest Gage (CG) and/or Transducer (SG)	1 SG	1 CG & SG					Semi-Annual	4
Vegetation	CVS Level 2/Mobile Plots	15 (10 permanent, 5 mobile)			N/A	N/A	N/A	Year 1, 2, 3, 5, and 7	5
Visual Assessment		Y	Y	Y	N/A	N/A	N/A	Semi-Annual	
Exotic and nuisance vegetation								Semi-Annual	6
Project Boundary								Semi-Annual	7
Reference Photos	Photographs	18			1	1	1	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 and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers, if used, will be set to record stage once every 2 hours. The transducer will be inspected and downloaded semi-annually. A transducer will be installed on the intermittent portion of UT1 Reach 1 and UT2A to document 30 days of continuous flow.
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 (30.66 Ac) will be monitored with permanent plots within the first 50' stream buffer and 1% of the open planted acreage (36.5 Ac) will be monitored with mobile plots beyond the first 50' stream buffer. 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 m^2 square/rectangular plot. Planted shaded areas will be visually assessed.
6. Locations of exotic and nuisance vegetation will be mapped
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

Table 24: West Side Monitoring Components – *Lone Hickory Mitigation Site*

Parameter	Monitoring Feature	Quantity/Length by Reach								Frequency	Notes
		UT2 Reach 1	UT2 Reach 2	UT2A	UT2B	UT3 Reach 1	UT3 Reach 2	UT3 Reach 3	Wetland Re-establishment		
Dimension	Riffle Cross-sections	1	2	2	2	1	1	1	N/A	Year 1, 2, 3, 5, and 7	1
	Pool Cross-sections	1	1	2	2	1	1	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
Stream Hydrology	Crest Gage(CG) and/or Transducer (SG)	1 CG & SG		1 CG & SG	1 CG & SG	1 CG & SG			N/A	Semi- Annual	4
Wetland Hydrology	Groundwater Gages								9	Quarterly	
Vegetation	CVS Level 2/Mobile Plots	25 (15 permanent, 10 mobile)								Year 1, 2, 3, 5, and 7	5
Visual Assessment		Y	Y	Y	Y	Y	Y	Y	Y	Semi- Annual	
Exotic and nuisance vegetation										Semi- Annual	6
Project Boundary										Semi- Annual	7
Reference Photos	Photographs	20								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 and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers, if used, will be set to record stage once every 2 hours. The transducer will be inspected and downloaded semi-annually. A transducer will be installed on the intermittent portion of UT2A to document 30 days of continuous flow.
5. 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 m^2 square/rectangular plot. 2% of the non-shaded planted acreage will be monitored with permanent plots within the 50' stream buffer, and 1% of the non-shaded planted acreage will be monitored with mobile plots beyond the 50' stream buffer. Planted shaded areas will be visually assessed.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

10.0 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. 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 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. No livestock, fencing, or crossings are currently present or planned for the project area. Any future 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 1.

Table 25: Long-term Management Plan – *Lone Hickory Mitigation Site*

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 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 annual inspections 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.

11.0 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 8). If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions.

12.0 Determination of Credits

Mitigation credits presented in Table 26 are projections based upon the proposed design. The Site is submitted for mitigation credit in the Yadkin 03040101. Upon completion of construction, the project components and credits data will be revised to be consistent with the as-built condition.

The credit ratios proposed for the Site have been developed in consultation with the Interagency Review Team (IRT) as summarized in technical memoranda dated July 19, 2016, and January 25, 2017. This correspondence is included in Appendix 9.

1. The requested stream restoration credit ratio is 1:1, for mitigation activities that include reconstruction of the channels to a stable form and connection of the channels to the adjacent floodplain and will be generally performed on channels that are "not functioning" from the existing conditions functional pyramid assessment. This work will result in restoration of the dimension, pattern, and profile of the channels. The riparian buffers will be removed from agricultural production and planted with native tree species. Best management practices will be installed upstream of UT1 Reach 1, UT1 Reach 3, and UT2B to treat concentrated agricultural runoff as part of the restoration work.
2. The requested Preservation credit ratio is 10:1, for reaches that are properly "functioning" (F) and do not require additional work for ecological uplift. These reaches have been protected in perpetuity by a conservation easement. This credit ratio is consistent with the most recent IRT guidance for preservation reaches.
3. The entire length of UT1 Reach 4 is proposed for preservation credit at 10:1 credit, but the upstream most 400 LF will receive Enhancement I-type treatment as a transition from the upstream restoration reach. Additionally, buffer restoration will occur in the right floodplain.

Buffers proposed throughout the Site meet the minimum required 50-foot standard width for Piedmont streams, and in most cases, far exceed it. Approximately 75% of restoration reaches have buffers greater than the buffer standard (75 to greater than 150 feet for purposes of credit calculation). A detailed buffer credit calculation based on the October 24, 2016, USACE guidance for Additional Credit for Buffers Exceeding Minimum Standard Widths was completed to accurately account for credit additions throughout the Site. Wildlands analyzed buffer width across the project site to calculate credit increases based on buffer widths. To complete these calculations, CAD software was used to offset the proposed easement in toward the creek by a standard 50-foot buffer. This standard buffer width was reviewed to assess where the buffer was wider than standard based on the belt width of the stream at outer meander bends. Figures in Appendix 9 illustrate the variances from a standard buffer width of 50 feet. Credit percent increases were cut in half and applied to either the left or right bank as appropriate. Appendix 9 contains detailed credit calculations.

Table 26: Project Asset Table – *Lone Hickory Mitigation Site*

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Riparian Buffer		
Type	R	RE	R	RE	R	RE	R	RE	
Totals	13,058	106	9.5	N/A	N/A	N/A	N/A	N/A	
Project Components									
Project Component or Reach ID		**Existing Footage/ Acreage**	**Proposed Stationing Location**	**Approach (P1, P2, etc.)**	**Restoration (R) or Restoration Equivalent (RE)**	**Restoration Footage/ Acreage**	**Mitigation Ratio**	**Proposed Credit[1, 2]**	
UT1 R1, R2a, R2b, R3		6,015	101+39 - 158+60	P1, P2	R	5,721	1	6,698	
UT1 R4		659	158+60 – 165+19	P4, Preservation	RE	659	10	66	
UT1A		230	180+00 - 182+82	Preservation	RE	282	10	28	
UT1B		48	190+00 - 191+24	Preservation	RE	124	10	12	
UT2 R1, R2		2,527	200+00 – 217+03	P1, P2	R	1,703	1	1,933	
UT2A		1,184	400+34 - 406+89	P1	R	655	1	699	
UT2B		699	500+00 – 507+84	P1, P2	R	784	1	893	
UT3 R1, R2, R3		2,008	300+13 – 327+15	P1, P2	R	2,702	1	2,835	
West Side Wetlands		N/A	N/A	Re-establishment	R	9.5	1	9.5	
Component Summation									
Restoration Level			**Proposed Stream (LF)**	**Riparian Wetland (Acres)**	**Non-Riparian Wetland (AC)**		**Buffer (sq.ft.)**	**Upland (AC)**	
Restoration			11,565	9.5	N/A		N/A	N/A	
Preservation			1,065	N/A	N/A		N/A	N/A	

Notes:

1. No direct credit for BMPs.
2. Credits reported have been adjusted based on buffer width deviations from standard 50-foot buffer width. Detailed calculations included in Appendix 9.

13.0 References

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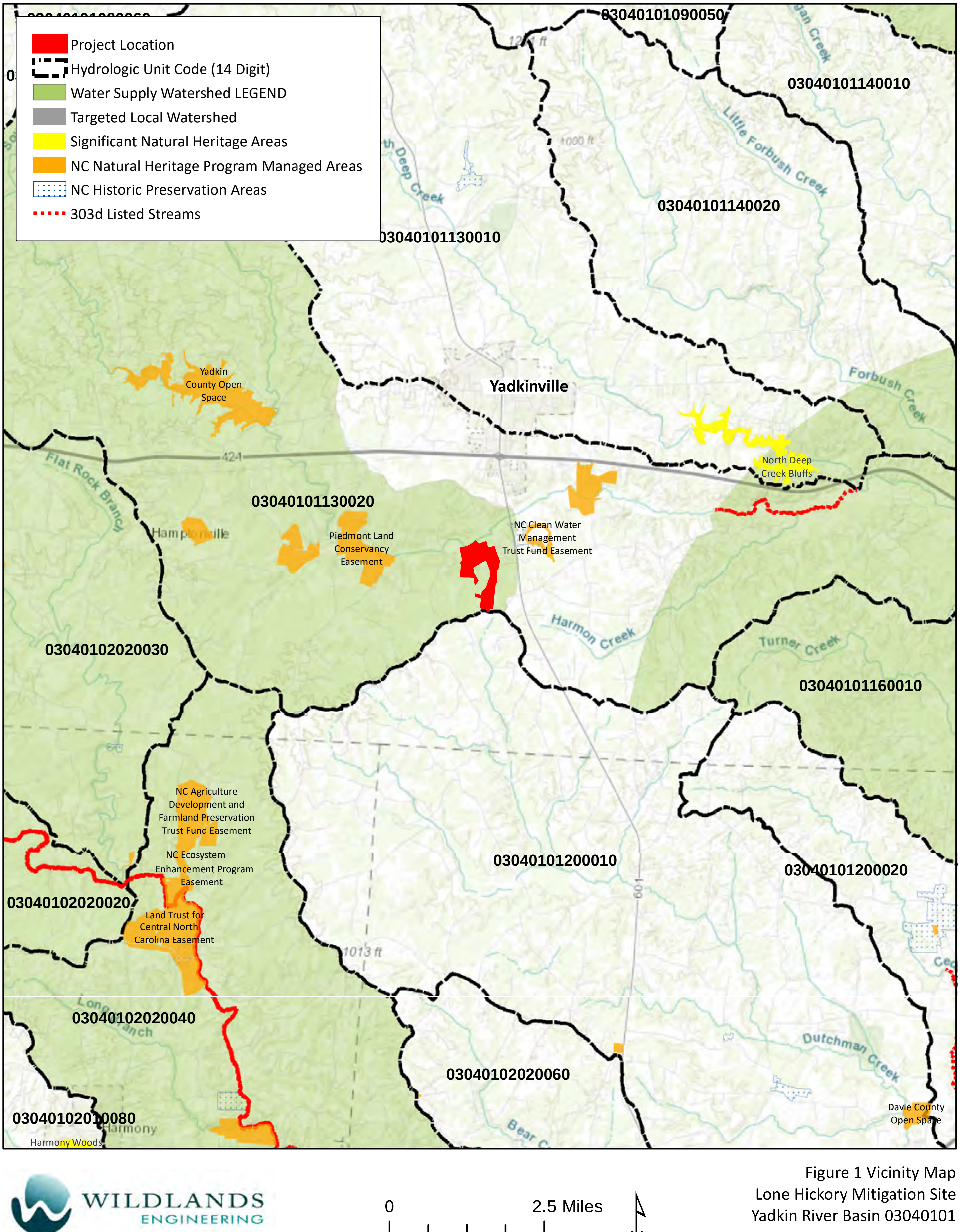
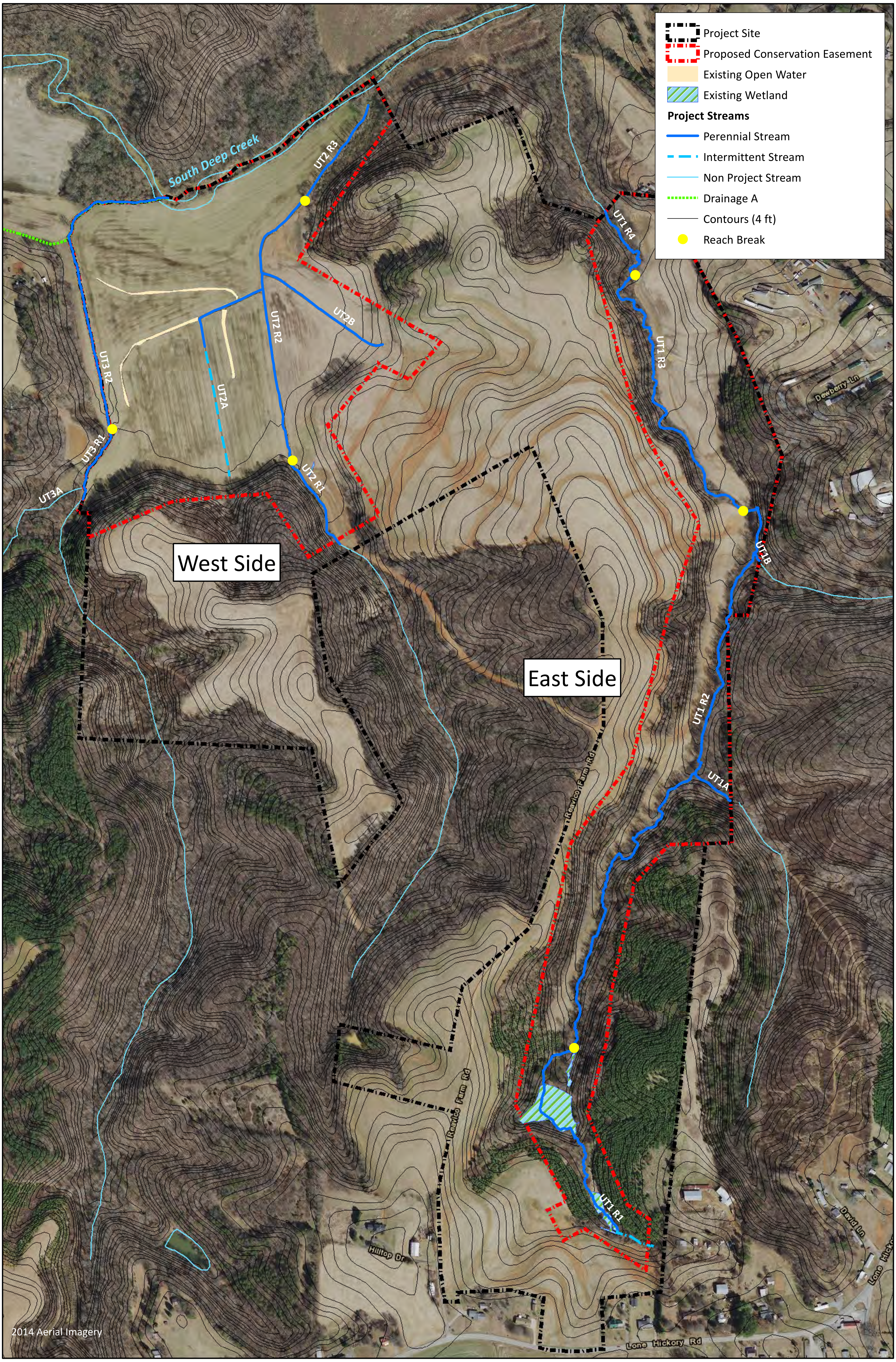
FIGURES



WILDLANDS ENGINEERING

Figure 1 Vicinity Map
Lone Hickory Mitigation Site
Yadkin River Basin 03040101

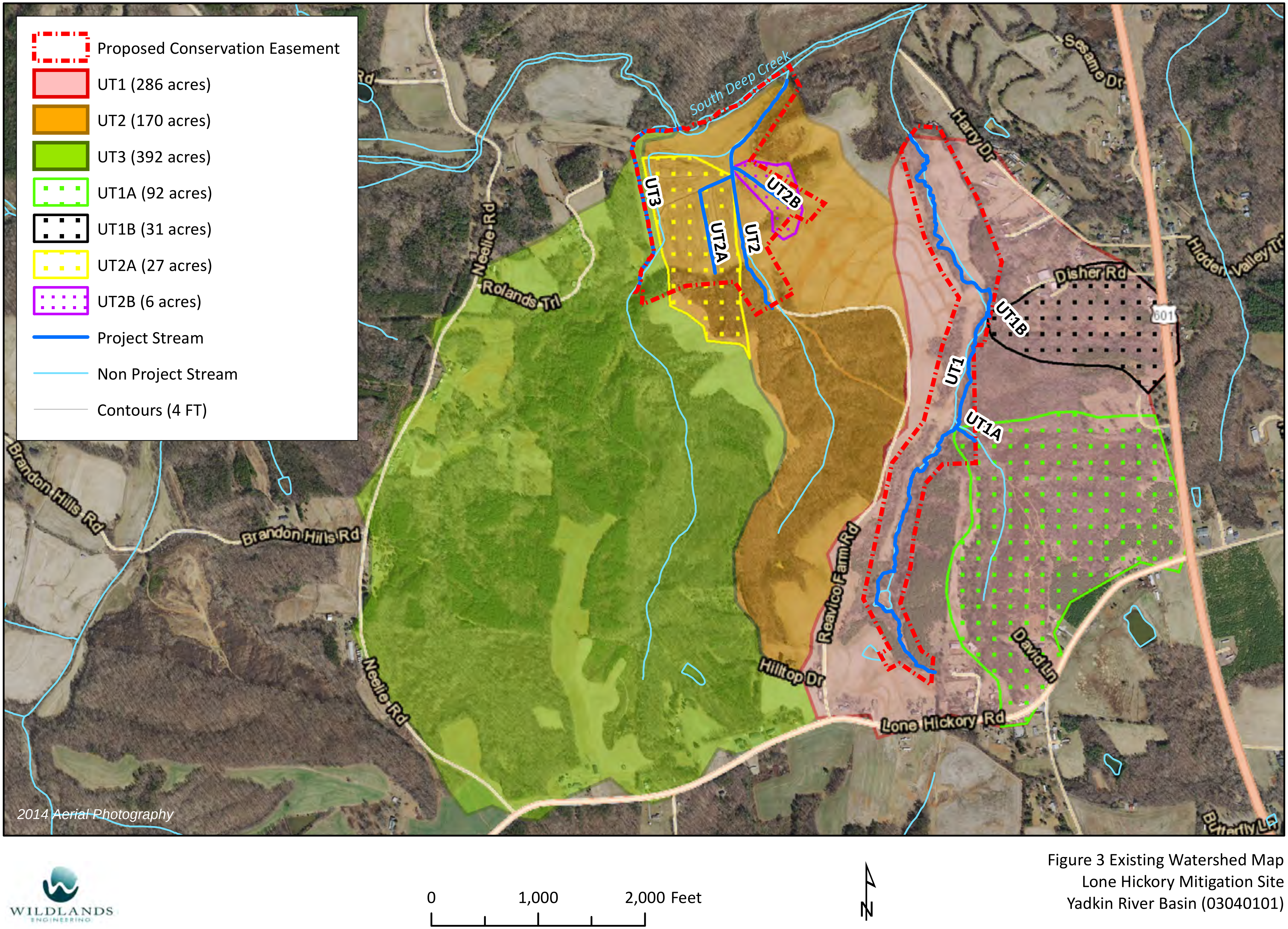
Yadkin County, NC



WILDLANDS ENGINEERING

Figure 2 Site Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

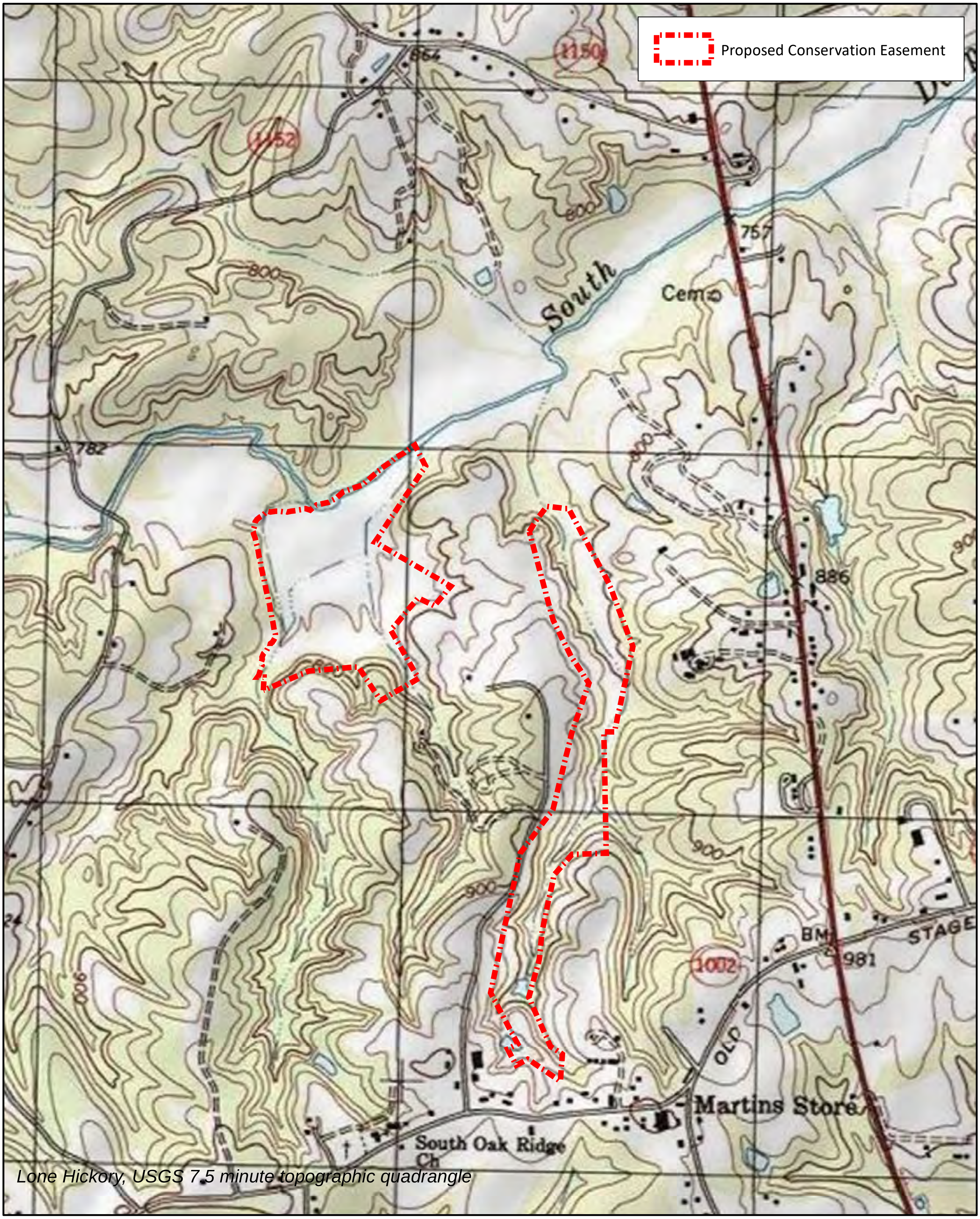
Yadkin County, NC



WILDLANDS ENGINEERING

Figure 3 Existing Watershed Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC



0 1,200 2,400 Feet

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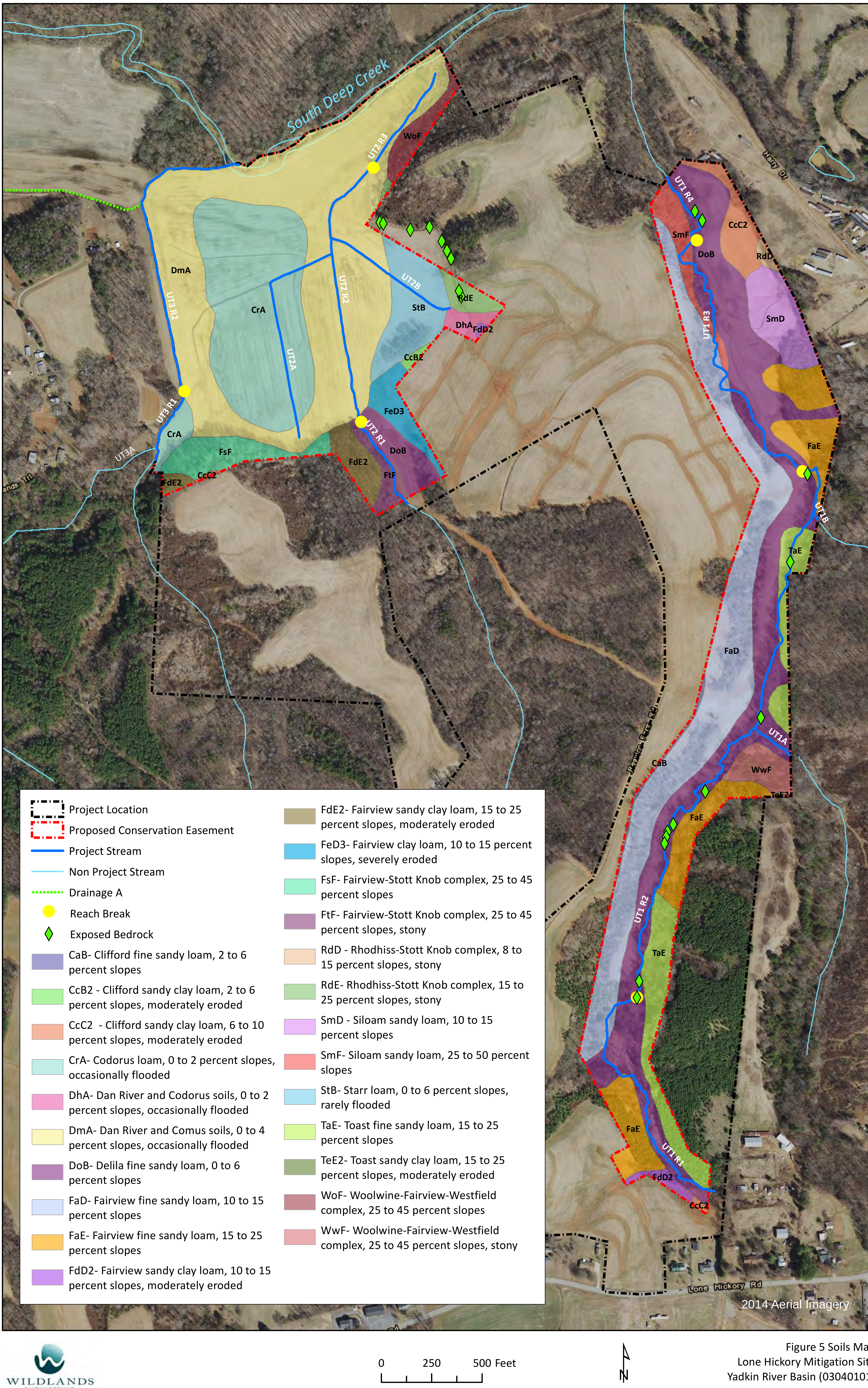
Figure 4 Topographic Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

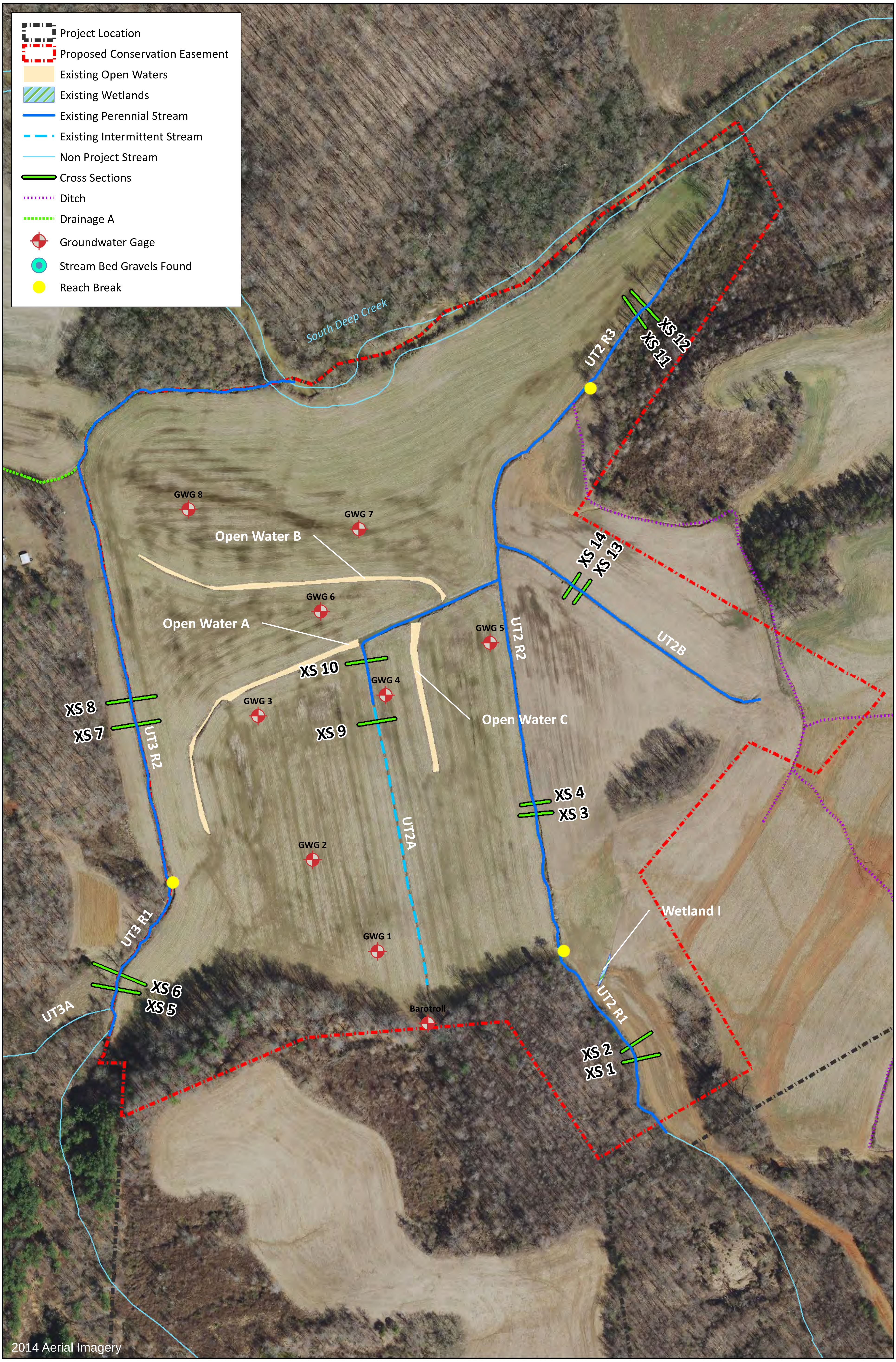
Yadkin County, NC



WILDLANDS ENGINEERING

Figure 5 Soils Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

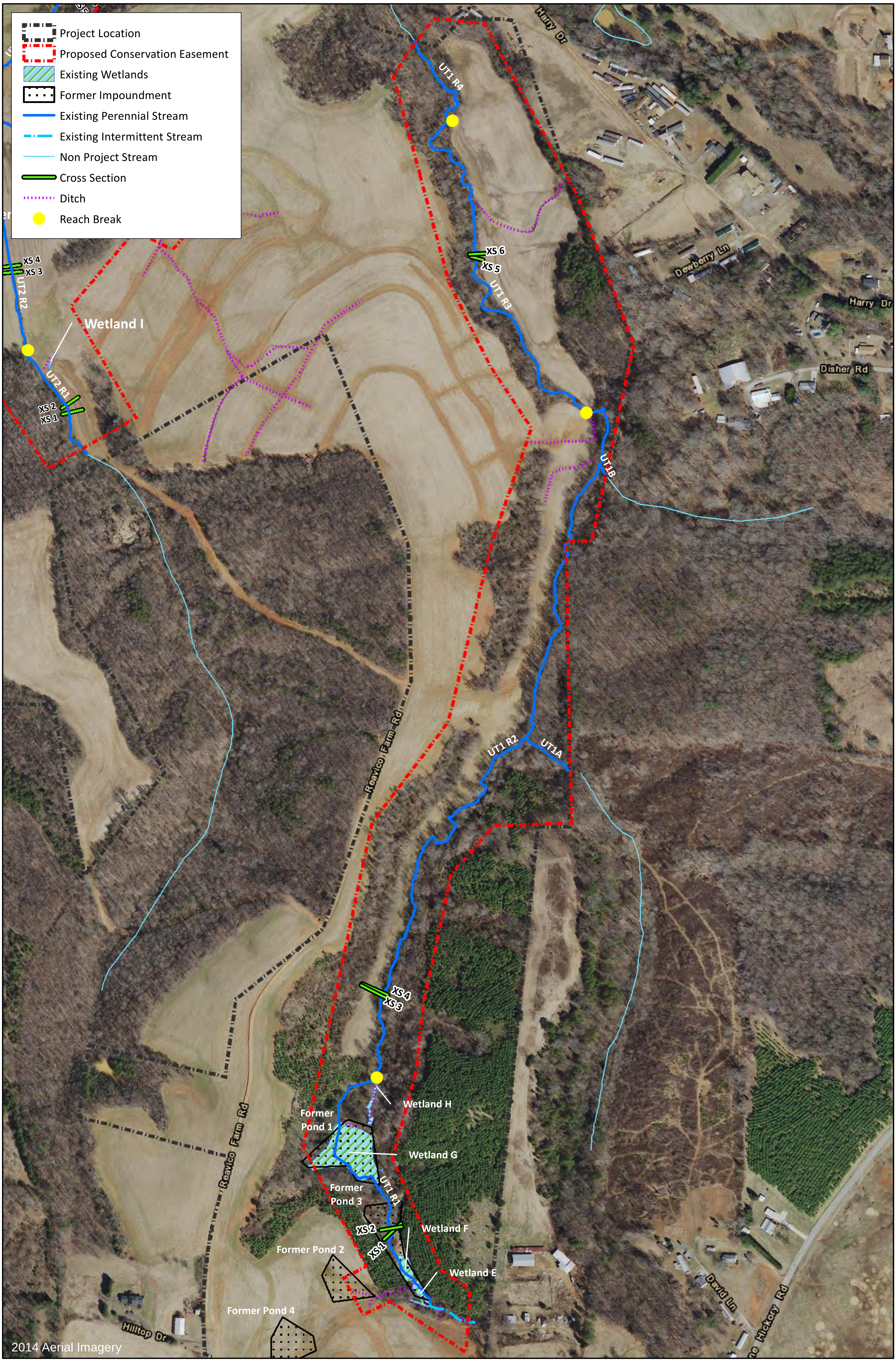
Yadkin County, NC



0 250 500 Feet

Figure 6.1 Existing Conditions Map - West Side
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

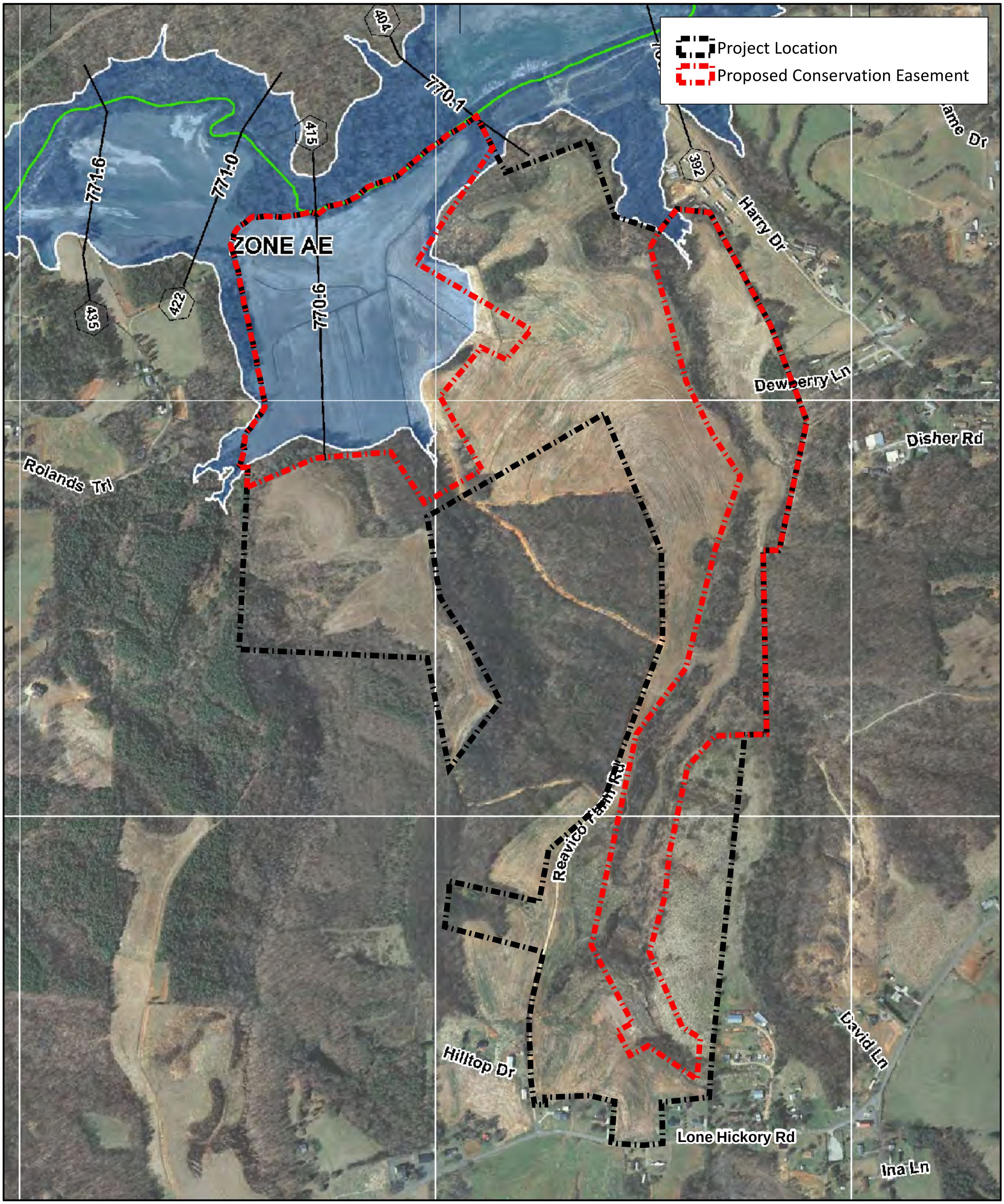
Yadkin County, NC



WILDLANDS ENGINEERING

Figure 6.2 Existing Conditions Map - East Side
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC



WILDLANDS ENGINEERING

0 500 1,000 Feet

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Figure 7 FEMA Floodplain Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

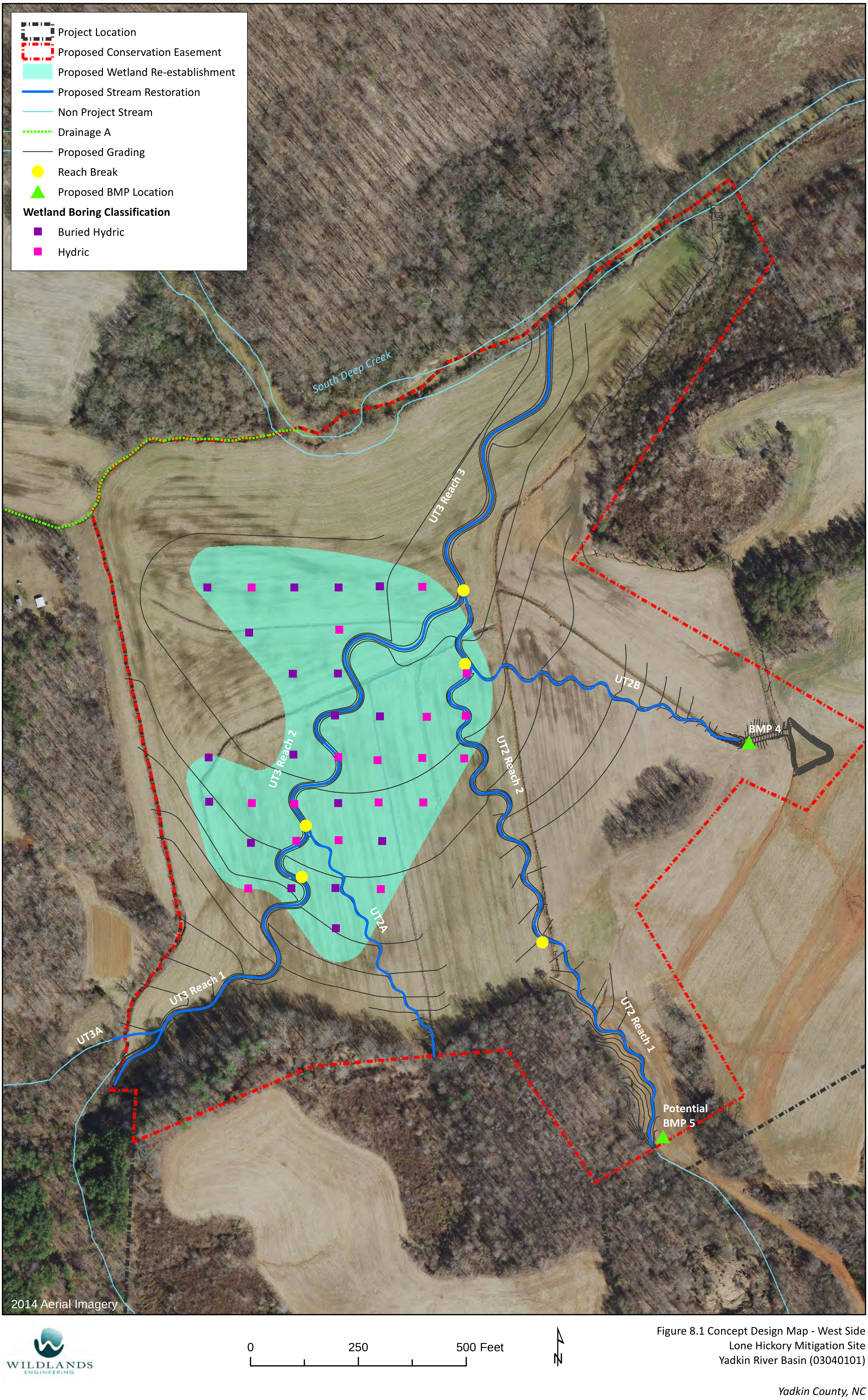


Figure 8.1 Concept Design Map - West Side
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

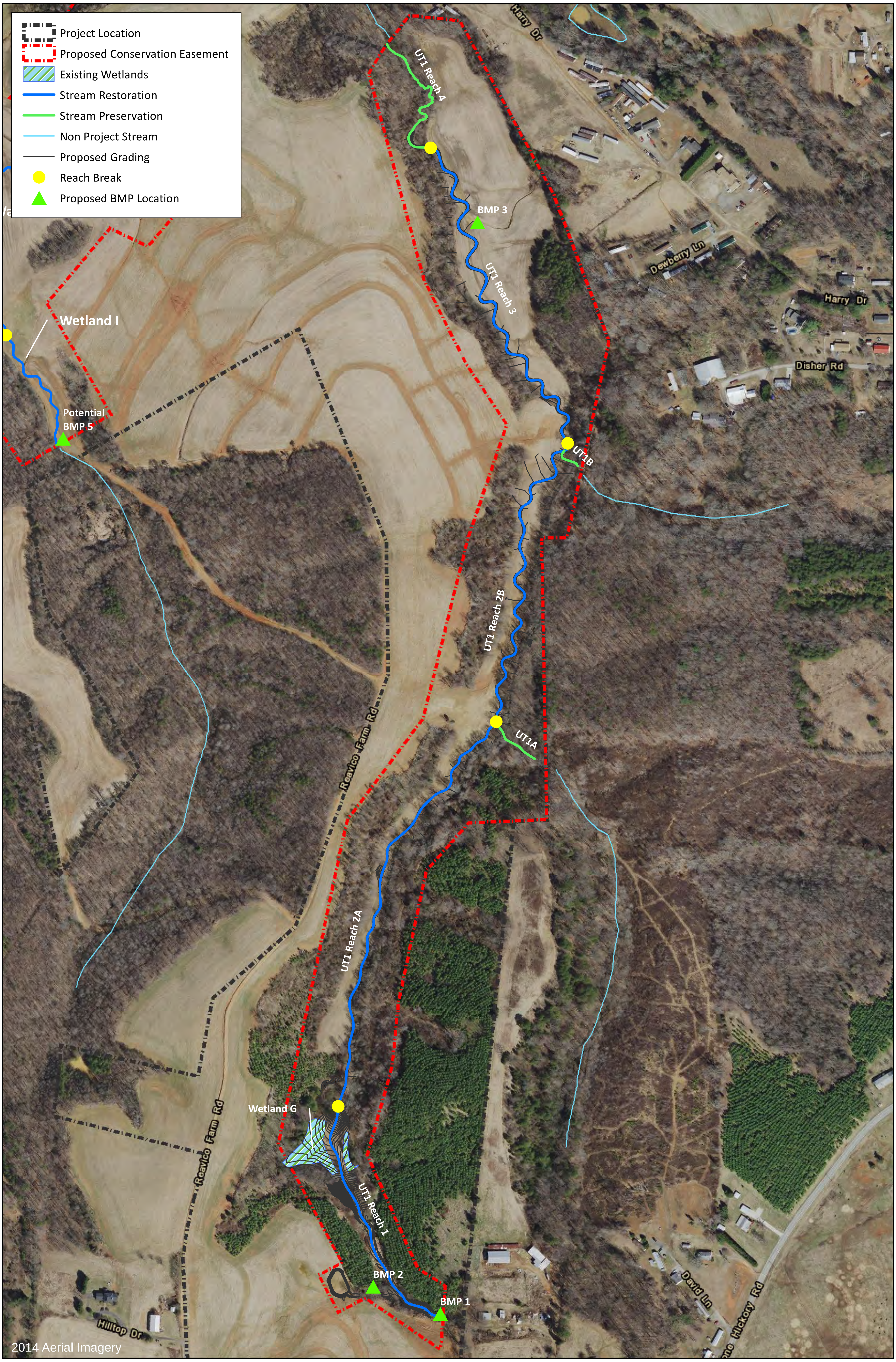
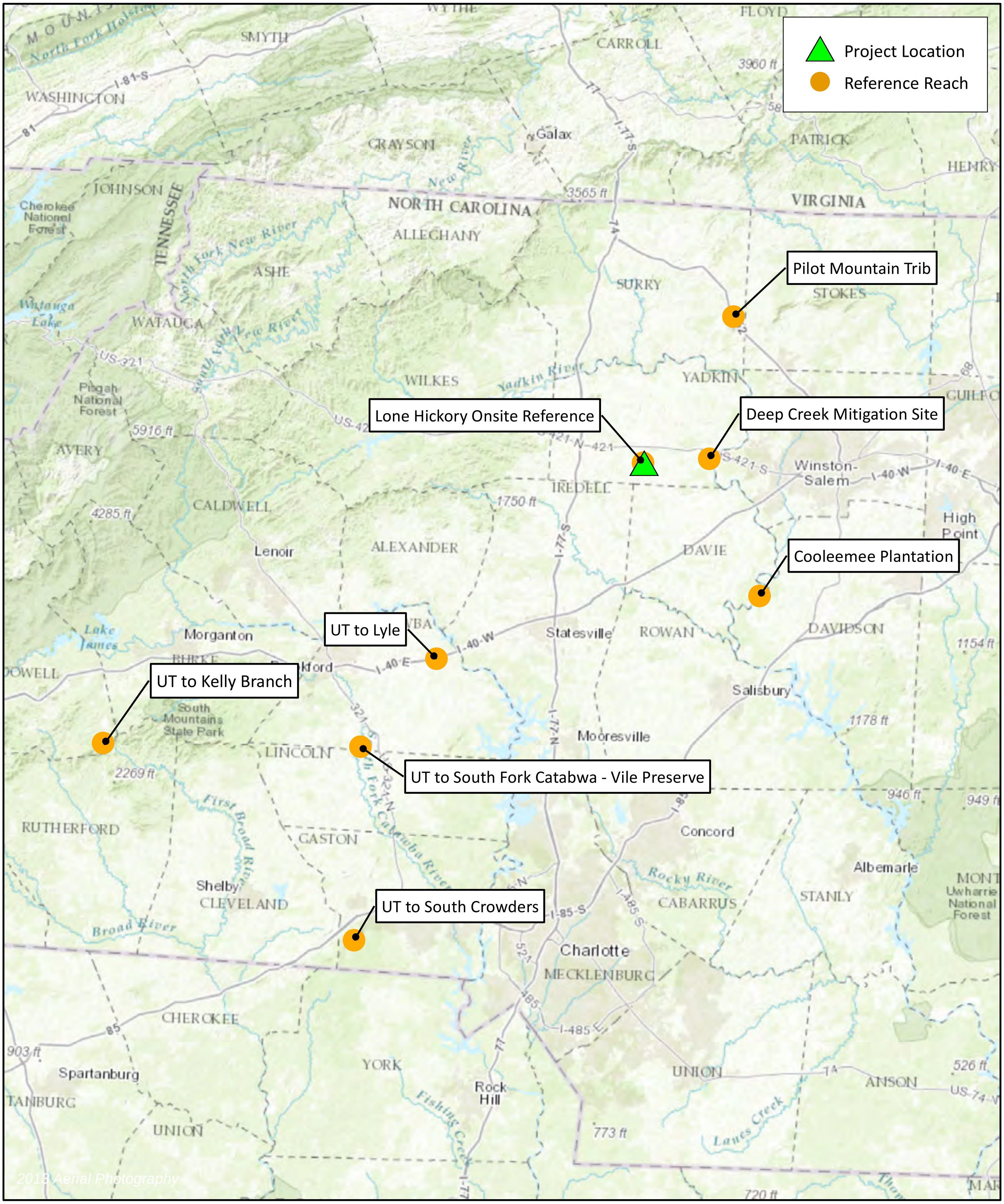


Figure 8.2 Concept Design Map - East Side
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC



WILDLANDS ENGINEERING

0 10 20 Miles

N

Figure 9 Reference Reach Vicinity Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

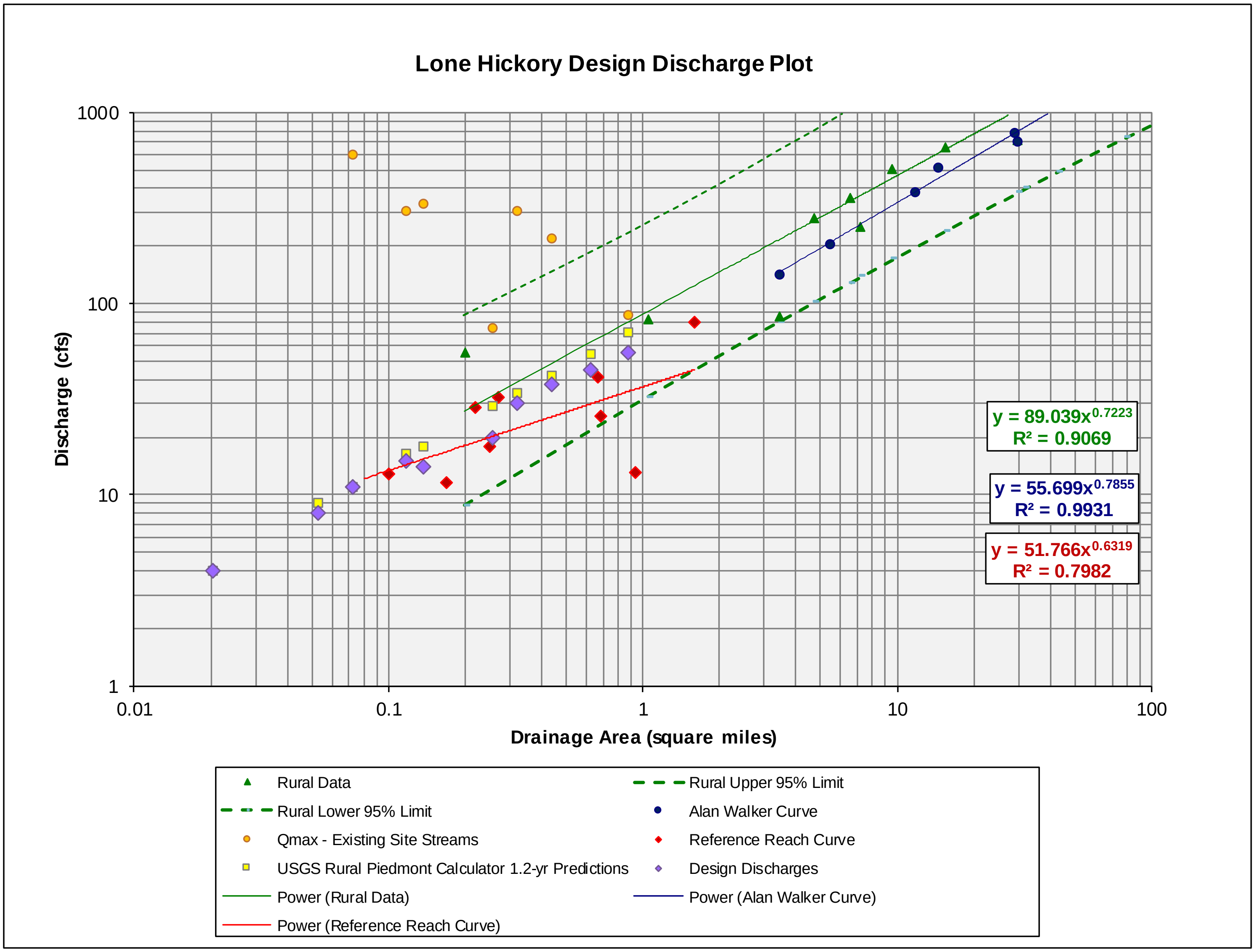
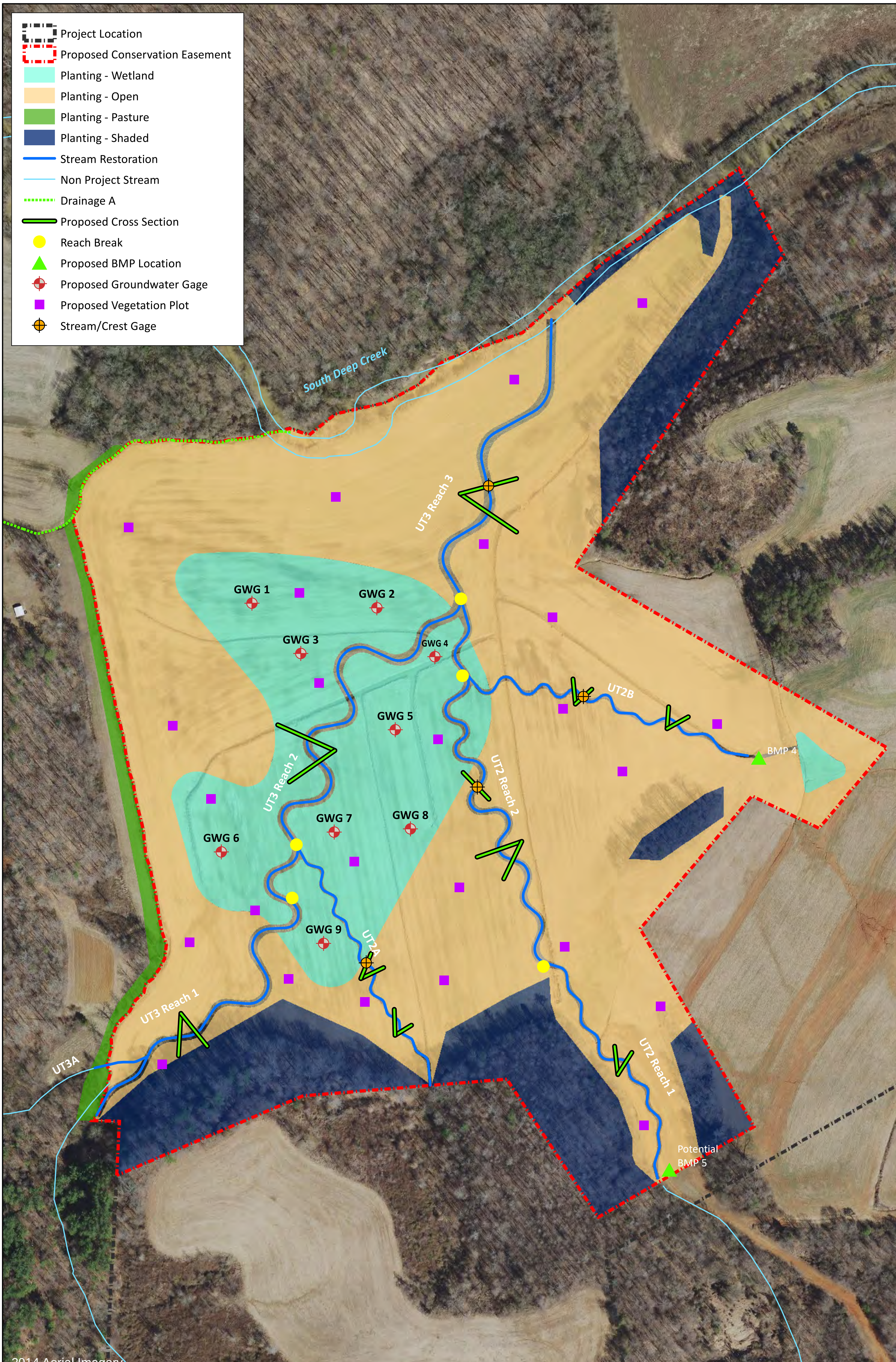


Figure 10 Discharge Analysis
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC



WILDLANDS ENGINEERING

Figure 11.1 Monitoring Plan - West Side
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

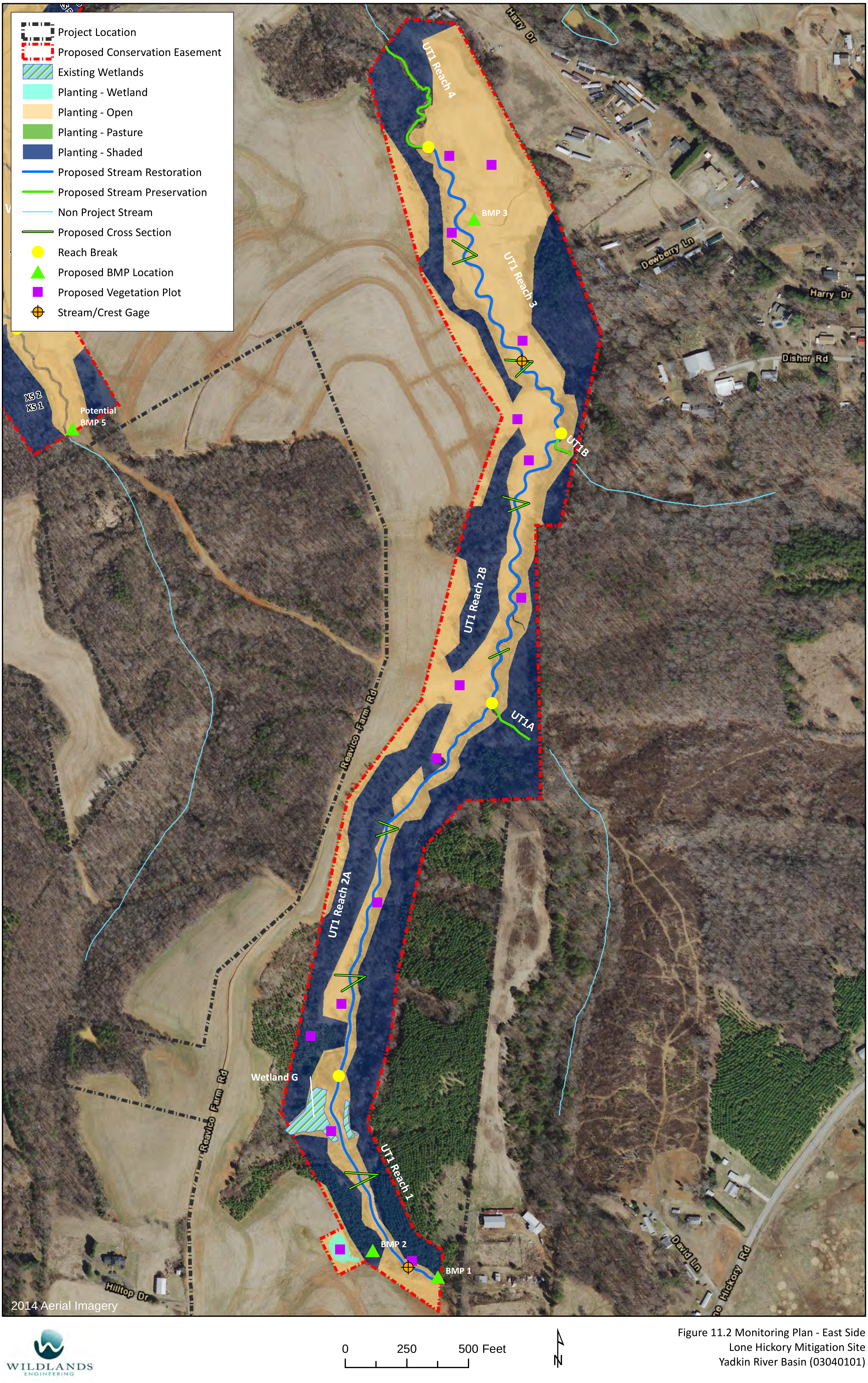


Figure 11.2 Monitoring Plan - East Side
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

WILDLANDS ENGINEERING

Figure 12 Stream and Wetland Impacts
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

APPENDIX 1
SITE PROTECTION INSTRUMENT

Appendix 1 Site Protection Instrument

The land required for construction, management, and stewardship of this mitigation project includes portions of the parcels listed in Table 1. All parcels are optioned for purchase by Wildlands Engineering, Inc. (Wildlands). Upon transfer of lands to Wildlands, a conservation easement will be recorded on the parcels and includes streams and wetlands being restored and preserved along with their corresponding riparian buffers. A temporary construction access easement is also recorded on adjacent parcels which allows the fill and relocation of UT3 off the property boundary and onto the Site.

The recorded temporary construction easements are included in this appendix.

Table 1: Site Protection Instrument – *Lone Hickory Mitigation Site*

Current Landowner	PIN	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
Reavico Farms, Inc.	580500888433 580500847703 580500677286	Yadkin	Yes	DB: 1173 PG: 0001	87.10
Ann R. Steelman Howard F. Steelman	580500785291	Yadkin	Yes	DB: 1173 PG: 0019	11.78
Nancy R. Shore Michael S. Shore Hughes M. Reavis Cynthis H. Reavis Joel D. Reavis Jennifer B. Reavis Janet R. Wall Charles M. Wall	580500778441	Yadkin	Yes	DB: 1173 PG: 0008	4.30
Danny W. Williams* Sherrie Williams*	580500672235	Yadkin	No	DB: 01174 PG:384-395	N/A
John J. Kessler* Allison Kessler*	580500681228	Yadkin	No	DB: 01174 PG:384-395	N/A
Ruth H. Myers*	5805586073	Yadkin	No	DB: 01174 PG:384-395	N/A

*Agreement for temporary construction easement

The conservation easement template that will be used for recordation is included in this appendix. 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.

STATE OF NORTH CAROLINA

DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT

_______________ COUNTY

SPO File Number:
DMS Project Number:

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this ________day of ________________, 20__, by ________________ *Landowner name goes here* , ("**Grantor**"), whose mailing address is ______ *Landowner address goes here* ________, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between *(insert name and address of full delivery contract provider)* and the North Carolina Department of Environment and Natural Resources, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environment and Natural Resources Purchase and Services Contract Number __________.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Division of Mitigation Services (formerly Ecosystem Enhancement Program) is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Division of Mitigation Services (formerly Ecosystem Enhancement Program) with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Division of Mitigation Services in the Department of Environment and Natural Resources, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in __________ Township, ___________ County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately ________ acres and being conveyed to the Grantor by deed as recorded in **Deed Book _____ at Page ____** of the _________ County Registry, North Carolina; and

WHEREAS, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of ***if known, insert name of stream, branch, river or waterway here***.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access.

The Conservation Easement Area consists of the following:

Tracts Number ________________ containing a total of _________ **acres** as shown on the plats of survey entitled "Final Plat, Conservation Easement for North Carolina Division of Mitigation Services, Project Name: ___________, SPO File No.__________, EEP Site No. ___________, Property of _________________________," dated ___________, 20__ by *name of surveyor*, PLS Number __________ and recorded in the ______________ County, North Carolina Register of Deeds at **Plat Book _______ Pages __________.**

See attached "**Exhibit A**", Legal Description of area of the Property hereinafter referred to as the "Conservation Easement Area"

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat.

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. **Damage to Vegetation.** Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

H. **Roads and Trails.** There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement.

All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

I. Signs. No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. Conservation Easements are purchased to protect the investments by the State (Grantee) in natural resources. Livestock within conservations easements damages the investment and can result in reductions in natural resource value and mitigation credits which would cause financial harm to the State. Therefore, Landowners (Grantor) with livestock are required to restrict livestock access to the Conservation Easement area. Repeated failure to do so may result in the State (Grantee) repairing or installing livestock exclusion devices (fences) within the conservation area for the purpose of restricting livestock access. In such cases, the landowner (Grantor) must provide access to the State (Grantee) to make repairs.

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by such breach. If the breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover damages, as well as injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Division of Mitigation Services Program Manager
NC State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

and

General Counsel
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

TO HAVE AND TO HOLD, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

_________________________________ (SEAL)

NORTH CAROLINA
COUNTY OF _________________

I, _____________________________, a Notary Public in and for the County and State aforesaid, do hereby certify that ________________________, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the __________ day of ___________________, 20__.

____
Notary Public

My commission expires:

____

Exhibit A

[INSERT LEGAL DESCRIPTION]

FILED
YADKIN COUNTY, NC
ARIC WILHELM
REGISTER OF DEEDS

FILED	Jan 15, 2016
AT	01:35:16 pm
BOOK	01174
START PAGE	0384
END PAGE	0395
INSTRUMENT #	00198

RECORDING REQUESTED BY AND WHEN RECORDED MAIL TO:

Wildlands Engineering, Inc.
1430 S. Mint Street, Suite 104
Charlotte, NC 28203
Attention: Lee Knight Caffery

SPACE ABOVE THIS LINE FOR RECORDER'S USE

TEMPORARY ACCESS AND CONSTRUCTION EASEMENT

This temporary access and construction easement is between **Danny R. Williams, Sherrie Williams, John J. Kessler, and Allison Kessler,** individuals (collectively "**Grantors**"), and **Wildlands Engineering, Inc., a North Carolina corporation** ("**Grantee**"). This temporary access and construction easement will become effective on the date the Grantee pays Grantor : as set forth in paragraph 1 below (the "**Effective Date**").

A. Grantors are the owners of three parcels of real property comprised of approximately 1.3. 29.9, and 1.9 acres located off of Roland's Trail Road in Yadkinville, Yadkin County, North Carolina, recorded in the Yadkin County Register of Deeds at Book 0650 Page 494, Book 1016 Page 389, and Book 9 Page 213 (the "**Property**"). The Property is also identified as Tax Identification Numbers 580500672235, 5805586073, and 580500681228.

B. Grantee has an option to purchase, the adjacent parcel comprised of approximately 70.5 acres located off Reavico Farms Road in the Yadkinville, Yadkin County, North Carolina, recorded in the Yadkin County Register of Deeds at Book 117 Page 209 (the "**Adjacent Parcel**"). The Adjacent Parcel is also identified as Tax Identification Number 580500677286.

C. If Grantee exercises its option to purchase the Adjacent Grantee plans to relocate, restore, enhance, plant, and protect the streams and wetlands on the Adjacent Parcel as part of a stream restoration project (the "**Stream Restoration Project**").

D. Grantors have agreed to grant Grantee a temporary access and construction easement on the approximate 0.88 acre area shown on Exhibit A.

Grantors and Grantee therefore agree as follows:

1. **Grant of Temporary Access and Construction Easement.** In consideration of the sum of $[redacted] to be prorated to the owner of record of each parcel that comprises the Property by the total number of acres in the easement, (the "**Purchase Price**") Grantors grant to Grantee, a temporary access and construction easement in, upon, over, under and across the Property as generally shown in exhibit A (the "**Easement**"). Grantee will pay $[redacted] of the Purchase Price within five days after the last party signs this temporary access and construction easement. If Grantee exercises its option to purchase a conservation easement on the Adjacent Parcel, Grantee will pay Grantors the remaining $[redacted] prior to the commencement of the Construction Activities and temporary access and construction easement will become effective. If Grantee does not exercise its option to purchase a conservation easement on the Adjacent Parcel, then this temporary access and construction easement is void and Grantee is not obligated to pay Grantors the remaining $[redacted]

2. **Construction Activities**. Grantee and its contractors, agents and assigns have the right to utilize the Easement for the purpose of grading and filling a ditch/stream located approximately on the property line between the Property and the Adjacent Parcel, redirecting flow to a newly restored stream channel on the Adjacent Parcel. Grantee and its contractors, agents and assigns shall stabilize, seed and straw all disturbed areas of the easement, and plant new native vegetation during the Stream Restoration Project. Grantee shall solicit Grantor's input into species of trees to be planted with in the easement and shall provide best faith effort to incorporate Grantor's input within the guidelines outlined by the Division of Mitigation Services. Grantee has the right to deposit tools, implements, and other material on the Easement, to utilize construction, automotive and other equipment in the Easement, transport fill dirt to be used in the Stream Restoration Project, and to install and maintain sediment and erosion control measures as necessary (the "**Construction Activities**").

3. **Easement Access**. Grantee may only access the Easement through the Adjacent Parcel and does not have the right of access through the Property from Roland's Trail.

4. **Boundary Survey**. Grantee will survey the Adjacent Parcel, identify the common property line and corners between the Adjacent Parcel and Grantors' Property and will install new iron pins to mark the common property corners between the Adjacent Parcel and the Property.

5. **Grantee's Representations**. Grantee represents that Grantee, its contractors, agents and assigns are qualified to perform the Construction Activities and will perform all Construction Activities under in accordance with all applicable laws.

6. **Indemnification**. Grantee shall indemnify Grantors from any and all damages, claims, liabilities expenses (including reasonable attorneys' fees) arising out of or as a result of the Construction Activities performed and entry onto the Property by Grantee, its contractors, agents and assigns.

7. **Termination**. The Easement terminates upon the earlier of (a) the completion of the Construction Activities and the removal of sediment and erosion control measures or (b) March 31, 2019. Grantee agrees that the Construction Activities shall be pursued as diligently and as expeditiously as reasonably possible and that upon completion of the Construction Activities, the Easement shall be evenly graded, stabilized and seeded and all construction debris, will be removed. Once the site is stabilized, sediment and erosion control measures will also be removed. Upon the termination of the Easement, the Grantee shall have no further obligation or liability in connection with the Property.

8. **Assignment**. Grantee may assign Grantee's rights in the Easement.

9. **Covenants Running with the Land**. This Easement and covenants created by this Easement shall be deemed to be covenants running with the land and shall be binding upon and inure to the benefit of the respective heirs, successors and assigns of the parties.

10. **Right to Convey**. Grantors covenant that they have the right to convey this temporary access and construction easement.

[SIGNATURE PAGE FOLLOWS]

Each party is signing this temporary access and construction agreement on the date stated below that party's signature.

GRANTEE:

WILDLANDS ENGINEERING, INC.,
a North Carolina corporation

By: Shawn D. Wilkerson
Shawn D. Wilkerson, President

Date: 1-14-2016

GRANTORS:

Danny R. Williams, Sherrie Williams, John J. Kessler, and Allison Kessler.

By: Danny R. Williams
Danny R. Williams

Date: 1-12-16

By: Sherrie Williams
Sherrie Williams

Date: 1-12-16

By: John J Kessler
John J. Kessler

Date: 1-12-16

By: Allison Kessler
Allison Kessler

Date: 1-14-16

By: Sherrie Williams POA
Ruth H. Myers by her attorney in fact: Sherrie Williams

Date: 1-12-16

List of Exhibits

Mecklenburg County, North Carolina

I certify that the following person personally appeared before me this day, acknowledging to me that he or she signed the foregoing document:

Shawn D. Wilkerson.

Name of principal

Date: 1-15-16

(Official Seal)

ROBERT W. BUGG
NOTARY PUBLIC
Mecklenburg County
North Carolina

Official Signature of Notary

Robert W. Bugg

Notary's printed or typed name

My commission expires: 8-23-16

Yadkin County, North Carolina

I certify that the following person personally appeared before me this day, acknowledging to me that he or she signed the foregoing document:

Danny B. Williams.
Name of principal

Date: 1-12-16

(Official Seal)

ROBERT W. BUGG
NOTARY PUBLIC
Mecklenburg County
North Carolina

Official Signature of Notary

Robert W. Bugg
Notary's printed or typed name

My commission expires: 8-23-16

Yadkin County, North Carolina

I certify that the following person personally appeared before me this day, acknowledging to me that he or she signed the foregoing document:

Sherrie Williams.
Name of principal

Date: 1-12-16

(Official Seal)

ROBERT W. BUGG
NOTARY PUBLIC
Mecklenburg County
North Carolina

Official Signature of Notary

Robert W. Bugg
Notary's printed or typed name

My commission expires: 8-23-16

Yadkin County, North Carolina

I certify that the following person personally appeared before me this day, acknowledging to me that he or she signed the foregoing document:

John J. Kessler.
Name of principal

Date: 1-12-16

(Official Seal)

ROBERT W. BUGG
NOTARY PUBLIC
Mecklenburg County
North Carolina

Official Signature of Notary

Robert W. Bugg
Notary's printed or typed name

My commission expires: 8-23-16

Jadkin County, North Carolina

I certify that the following person personally appeared before me this day, acknowledging to me that he or she signed the foregoing document:

Allison Kessler.
Name of principal

Date: 1-14-16

(Official Seal)

ROBERT W. BUGG
NOTARY PUBLIC
Mecklenburg County
North Carolina

Official Signature of Notary

Robert W. Bugg
Notary's printed or typed name

My commission expires: 8-23-16

Yadkin County, North Carolina

I certify that the following person personally appeared before me this day, acknowledging to me that he or she signed the foregoing document:

Sherrie Williams -POA for Ruth H. Myers
Name of principal

Date: 1-12-16

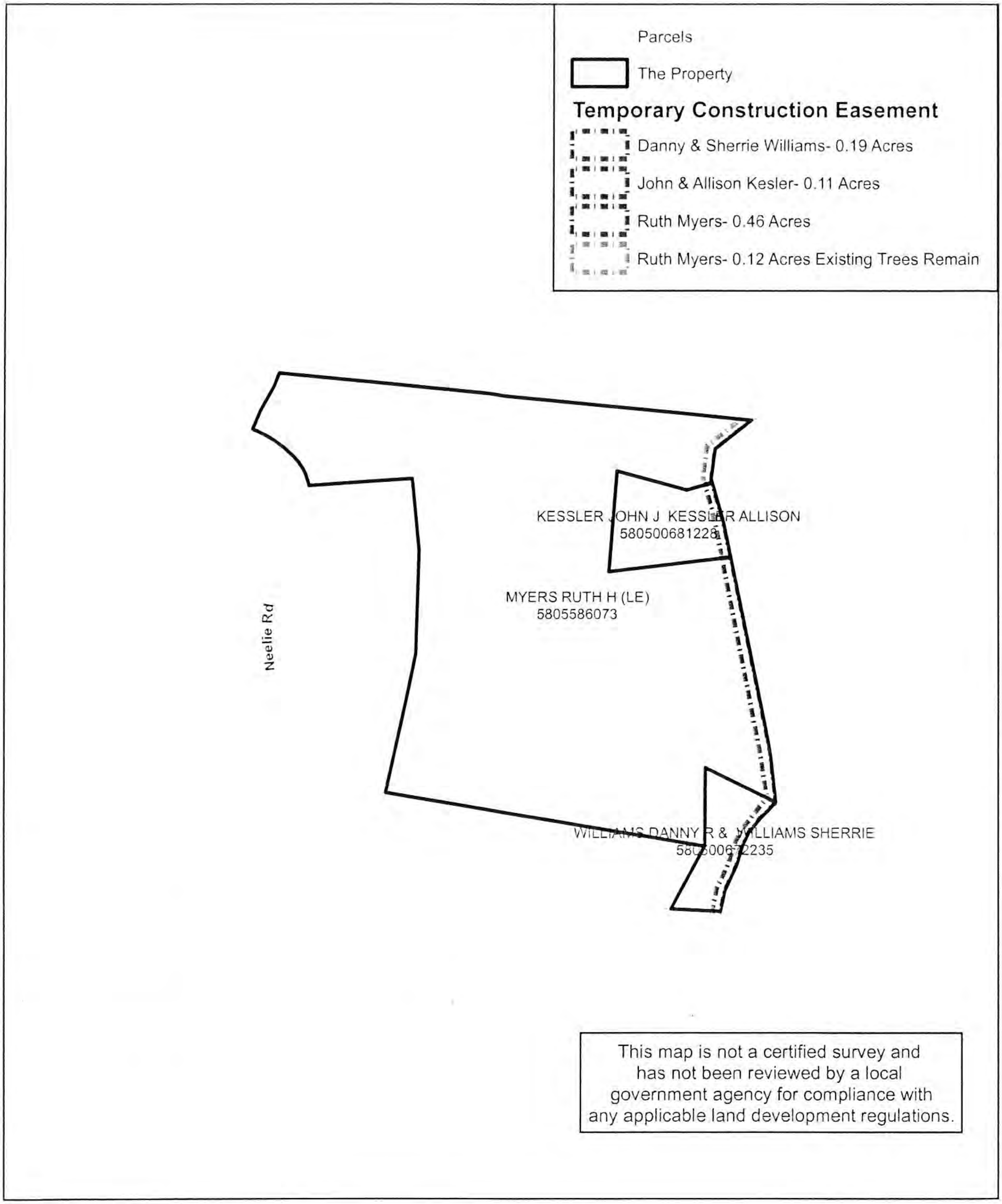
(Official Seal)

ROBERT W. BUGG
NOTARY PUBLIC
Mecklenburg County
North Carolina

Official Signature of Notary

Robert W. Bugg
Notary's printed or typed name

My commission expires: 8-23-16



WILDLANDS ENGINEERING

0 200 400 Feet

N

Exhibit A
Yadkin River Basin (03040101)

Yadkin County, NC

1/13/2016
jmeek

APPENDIX 2
WETLAND JD FORMS

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2017-00100** County: **Yadkin** U.S.G.S. Quad: **NC-Lone Hickory**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner:	**Reavico Farms**
	Nancy Shore
Address:	**1021 Deerfield Drive**
	Yadkinville, NC 27055
Telephone Number:	**336-816-5073**
E-mail:	

Size (acres)	**80.9**	Nearest Town	**Yadkinville**
Nearest Waterway	**UT Steelman Creek**	River Basin	**Upper Pee Dee**
USGS HUC	**03040101**	Coordinates	Latitude: **36.085587**
			Longitude: **-80.658424**

Location description: **The property is located at 1324 Lone Hickory Road, approximately 3.5 miles south of Yadkinville, NC**

Indicate Which of the Following Apply:

A. Preliminary Determination

☒ There appear to be **waters, including wetlands** 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, including wetlands** 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 **5/23/2017**. 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, including wetlands** 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, including wetlands** 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, including wetlands** at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the **waters, including wetlands** 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, including wetlands** 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, including wetlands** 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.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Reavico Farms , Nancy Shore	File Number: SAW-2017-00100	Date: 5/23/2017
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: **District Engineer, Wilmington Regulatory Division** **Attn: PM NAME** **Select Field Office Name** **U.S Army Corps of Engineers** **Select Field Office Street Address** **Select Field Office City**	If you only have questions regarding the appeal process you may also contact: Mr. Jason Steele, 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: PM NAME , 69 Darlington Avenue, Wilmington, North Carolina 28403

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. Jason Steele, 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: 5/23/2017

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Reavico Farms , Nancy , Shore, 1021 Deerfield Drive, Yadkinville, NC, 27055

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington District, PROJECT NAME, SAW-2017-00100

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: The property is located at 1324 Lone Hickory Road, approximately 3.5 miles south of Yadkinville, NC

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

State: North Carolina County: Yadkin City: Yadkinville
Center coordinates of site (lat/long in degree decimal format): Latitude: 36.085587 Longitude: -80.658424

Universal Transverse Mercator:

Name of nearest waterbody: UT Steelman Creek

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

☒ Office (Desk) Determination. Date: May 23, 2017

☒ Field Determination. Date(s):4/27/2017

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)

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:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .

☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

- ☐ Office concurs with data sheets/delineation report.
- ☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☐ U.S. Geological Survey Hydrologic Atlas: .

- ☐ USGS NHD data.
- ☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name: Lone Hickory 7.5 minute Quadrangle

☒ USDA Natural Resources Conservation Service Soil Survey. Citation: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at https://websoilsurvey.sc.egov.usda.gov/.

☐ National wetlands inventory map(s). Cite name: .

☐ State/Local wetland inventory map(s): .

☐ FEMA/FIRM maps: .

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

☒ Photographs: ☒ Aerial (Name & Date): 2014.
or ☐ Other (Name & Date):

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

☐ Other information (please specify): .

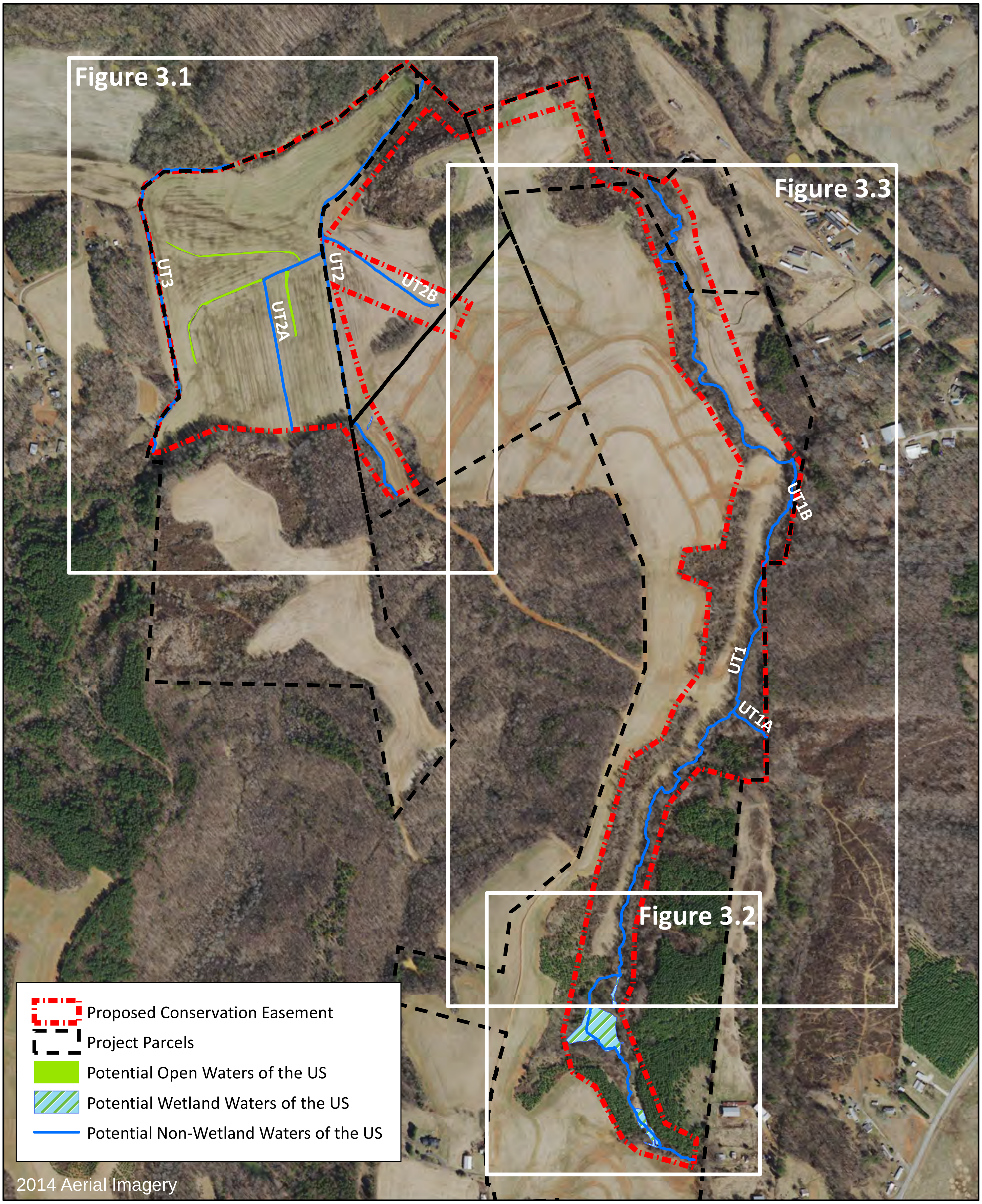
IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

William Elliott 5/23/2017
Signature and date of
Regulatory Project Manager
(REQUIRED)

[signature] 2/3/17
Signature and date of
person requesting preliminary JD
(REQUIRED, unless obtaining
the signature is impracticable)

Jurisdictional Features for Lone Hickory Mitigation Site

Site number	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
UT1 (Upper)	36.0839063°N	-80.6615488°W	Riverine	198 LF	non-section 10 – non-wetland
UT1 (Lower)	36.0840721°N	-80.6619519°W	Riverine	6,500 LF	non-section 10 – non-wetland
UT1A	36.0898337°N	-80.6602240°W	Riverine	219 LF	non-section 10 – non-wetland
UT1B	36.0930368°N	-80.6597847°W	Riverine	48 LF	non-section 10 – non-wetland
UT2	36.0931690°N	-80.6666952°W	Riverine	2,435 LF	non-section 10 – non-wetland
UT2A (Upper)	36.0940060°N	-80.6685095°W	Riverine	643 LF	non-section 10 – non-wetland
UT2A (Lower)	36.0958474°N	-80.6689807°W	Riverine	478 LF	non-section 10 – non-wetland
UT2B	36.0958421°N	-80.6660597°W	Riverine	699 LF	non-section 10 – non-wetland
UT3	36.0936995°N	-80.6709301°W	Riverine	1,941 LF	non-section 10 – non-wetland
Open Water A	36.0951630°N	-80.6702549°W	Palustrine, open water	0.15 Acres	non-section 10 – open water
Open Water B	36.096548°N	-80.669129°W	Palustrine, open water	0.15 Acres	non-section 10 – open water
Open Water C	36.095941°N	-80.668646°W	Palustrine, open water	0.11 Acres	non-section 10 – open water
Wetland E	36.084268°N	-80.662089°W	Palustrine, emergent	0.08 Acres	non-section 10 – wetland
Wetland F	36.084439°N	-80.662256°W	Palustrine, emergent	0.10 Acres	non-section 10 – wetland
Wetland G	36.0855927°N	-80.6628162°W	Palustrine, emergent	0.84 Acres	non-section 10 – wetland
Wetland H	36.0862963°N	-80.6627752°W	Palustrine, emergent	0.05 Acres	non-section 10 – wetland
Wetland I	36.0940960°N	-80.6672008°W	Palustrine, emergent	0.01 Acres	non-section 10 – wetland



WILDLANDS ENGINEERING

Figure 3 Site Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

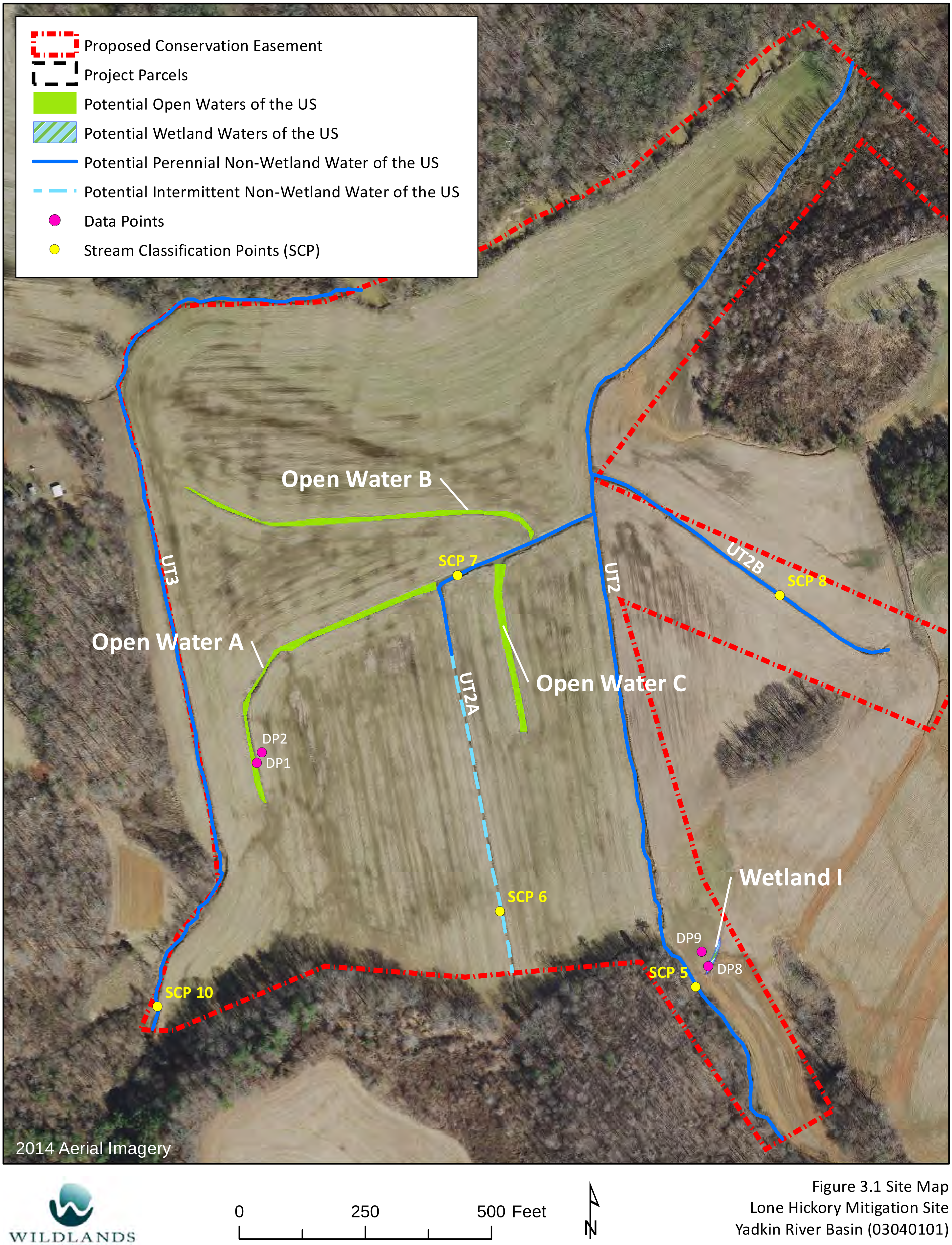
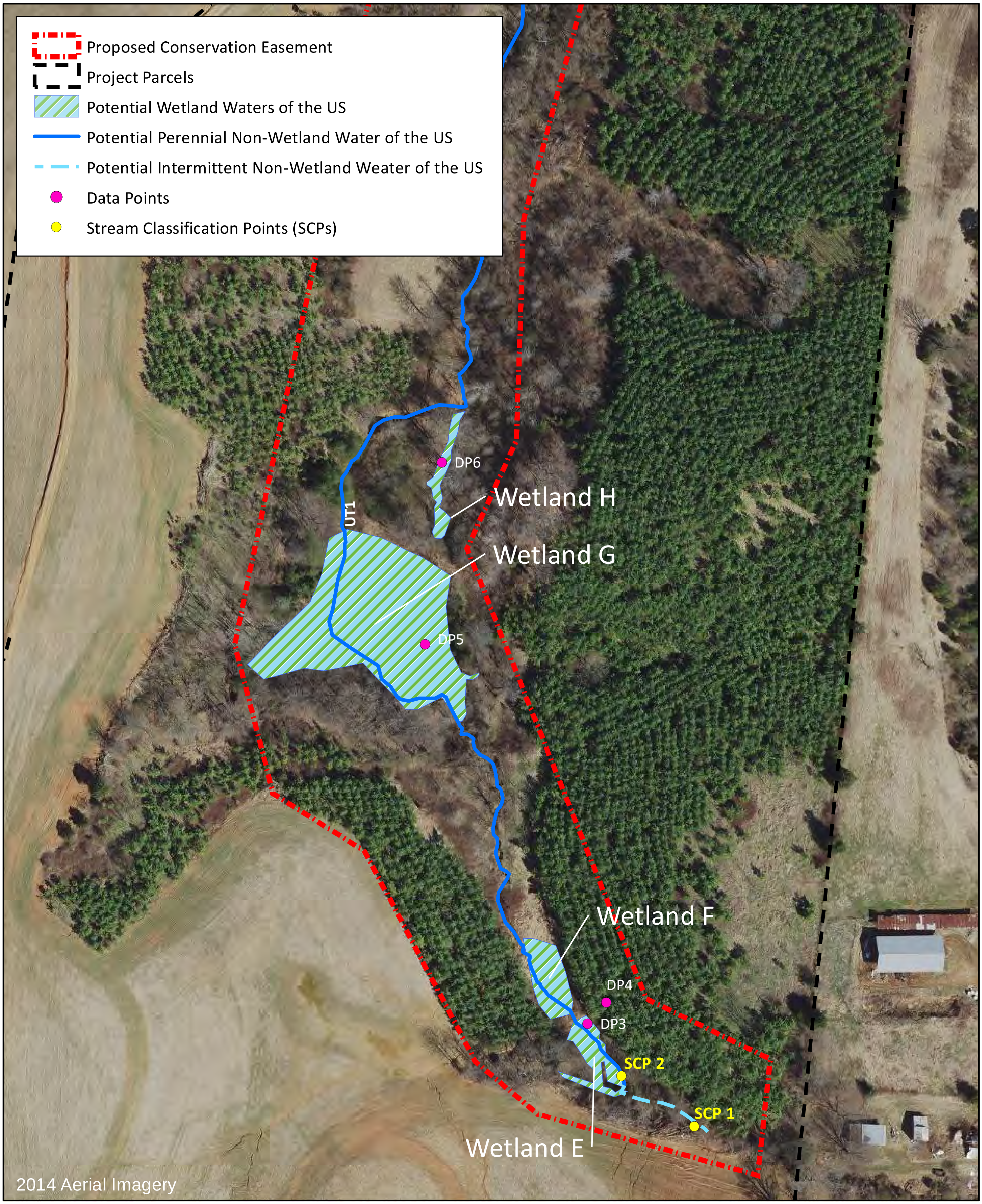


Figure 3.1 Site Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC



0 100 200 Feet

N

Figure 3.2 Site Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

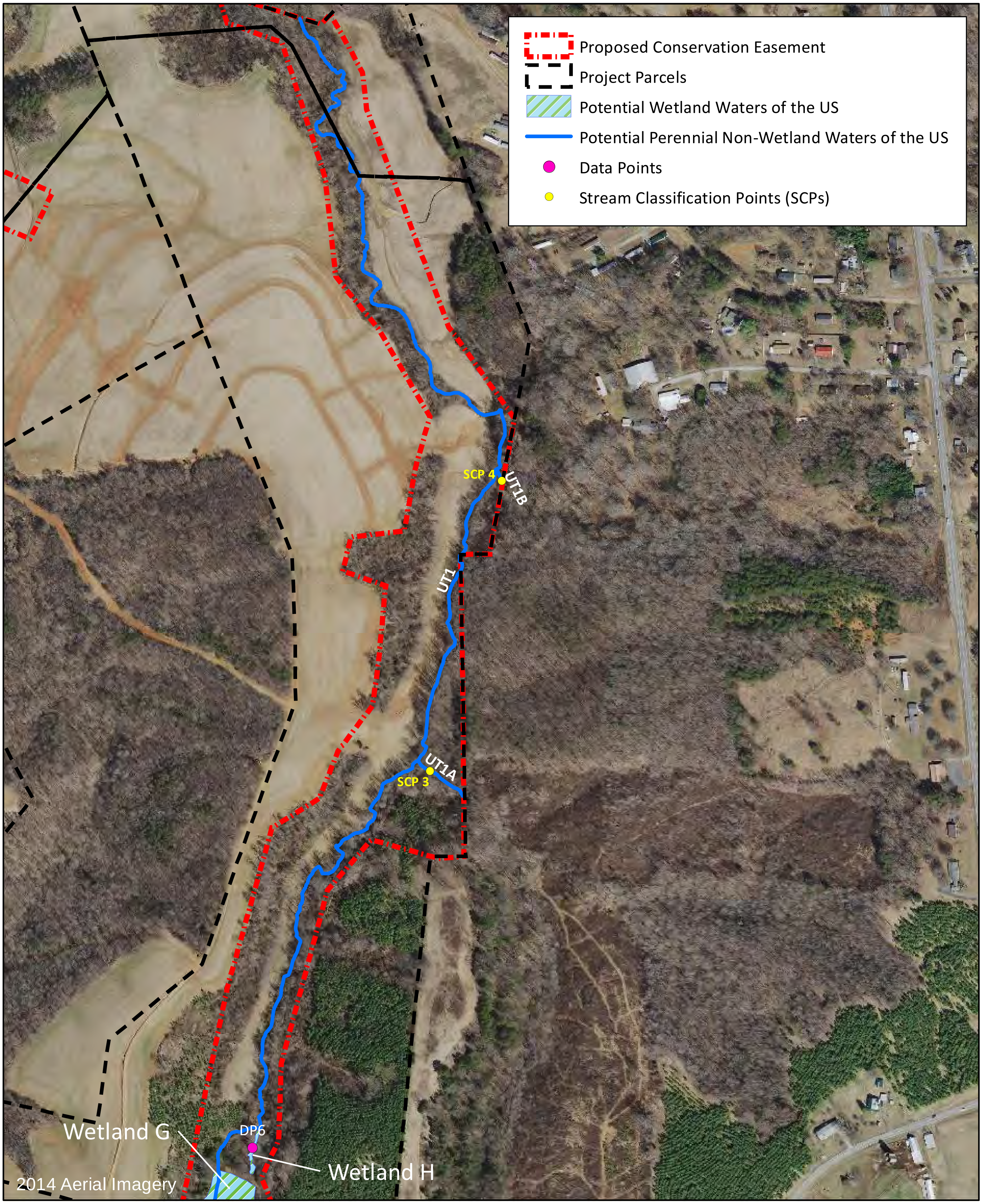


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Figure 3.3 Site Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Hickory FDP City/County: Yadkin Sampling Date: 7-13-2016

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: DP3- Wetland E and F

Investigator(s): Alea Tuttle, Tracey Marshall Section, Township, Range: Yadkinville

Landform (hillslope, terrace, etc.): old pond bed Local relief (concave, convex, none): concave Slope (%): unk

Subregion (LRR or MLRA): MLRA 136 (Southern Piedmont) Lat: 36.0842685° Long: -080.6620892° Datum: ____

Soil Map Unit Name: DoB (Delila fine sandy loam) NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ✓, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	**Is the Sampled Area within a Wetland?**	**Yes ✓ No ____**
Hydric Soil Present?	Yes ✓ No ____		
Wetland Hydrology Present?	Yes ✓ No ____		

Remarks:

Hydrology disturbed and soil naturally problematic, resulting from land use history of water retention structures. Several ephemeral drainage features and the intermittent UT1 channel contribute hydrologic and sediment inputs to Wetland E, Iron rich groundwater input provides the origin of perennial flow in UT1 at the southernmost edge of Wetland E, resulting in naturally problematic higher chroma soils. An old dam structure separates Wetland E and Wetland F, which share similar characteristics. The UT1 channel undergoes a series of deep headcuts advancing through legacy sediments of these old pond beds, resulting in dramatic changes in the base level of groundwater. As headcuts advance upstream, wetland hydrology is lost in the abandoned terrace, hydric vegetation gradually becomes less prevalent, and hydric soil indicators become less prominent. The surrounding landscape slopes steeply toward the old impoundments in a narrow valley bottom.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ✓ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____	
Water Table Present?	Yes ✓	No ____	Depth (inches): 2	
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0	**Wetland Hydrology Present? Yes ✓ No ____**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

previous inspection 1-7-2016, AT & IE

Remarks:

Intermittent portion of UT1, and other contributing ephemeral drainage ditches indicate rainwater naturally accumulates in this area. Some micro-topographic relief (microhighs) with indicators of hydrophytic vegetation and hydric soil.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DP3- Wetland E and F

Tree Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Juglans nigra	5	No	FACU
2. Salix nigra	10	Yes	OBL
3. Diospyros virginiana	5	No	FAC
4. Prunus serotina	5	No	FACU
5. Acer rubrum	10	Yes	FAC
6.			
	35 = Total Cover		

50% of total cover: 17.5 20% of total cover: 7

Sapling Stratum (Plot size: 15' radius)

1. none			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ____ 20% of total cover: ____

Shrub Stratum (Plot size: 15' radius)

1.			
2. none			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ____ 20% of total cover: ____

Herb Stratum (Plot size: 5' radius)

1. Microstegium vimineum	60	Yes	FAC
2. Bidens frondosa	5	No	FACW
3. Murdannia keisak	10	No	OBL
4. Polygonum sagittatum	10	No	OBL
5. Pilea pumila	5	No	FACW
6. Polygonum persicaria	2	No	FACW
7.			
8.			
9.			
10.			
11.			
	92 = Total Cover		

50% of total cover: 46 20% of total cover: 18.4

Woody Vine Stratum (Plot size: 30' radius)

1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: ____ 20% of total cover: ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
✓ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP3- Wetland E and F

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-2	7.5YR 4/4	100					SILT LOAM	PROBLEMATIC IRON-RICH GROUNDWATER
2-5	10YR 5/2	90	7.5YR 4/6	10	C	PL	SILT LOAM	
5-12	2.5Y 3/2	100					SAND	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ✓ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ✓ No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Hickory FDP City/County: Yadkin Sampling Date: 7-13-2016

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: DP4- Upland

Investigator(s): Alea Tuttle, Tracey Marshall Section, Township, Range: Yadkinville

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): ______

Subregion (LRR or MLRA): MLRA 136 (Southern Piedmont) Lat: 36.0843508° Long: -80.6620021° Datum: ______

Soil Map Unit Name: TaE (Toast fine sandy loam) NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	**Is the Sampled Area within a Wetland?**	**Yes** ____ **No** ✓
Hydric Soil Present?	Yes ____ No ✓		
Wetland Hydrology Present?	Yes ____ No ✓		

Remarks:

Data point is on a western facing hillslope draining toward wetlands E, F, and G. The area is in >10 year old pine plantation with closed canopy and very little understory.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DP4- Upland

Tree Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Pinus palustris	70%	Yes	FAC
2. Juglans nigra	20%	Yes	FACU
3.			
4.			
5.			
6.			
	90% = Total Cover		

50% of total cover: 45% 20% of total cover: 18%

Sapling Stratum (Plot size: 15' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Shrub Stratum (Plot size: 15' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Diospyros virginiana	5%	Yes	FAC
2. Rubus argutus	2%	Yes	FACU
3.			
4.			
5.			
6.			
	7% = Total Cover		

50% of total cover: 3.5% 20% of total cover: 1.4%

Herb Stratum (Plot size: 5' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	10%	Yes	FAC
2. Verbesina occidentalis	20%	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30% = Total Cover		

50% of total cover: 15% 20% of total cover: 6%

Woody Vine Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Vitis sp.	1%	Yes	NI
2.			
3.			
4.			
5.			
	1% = Total Cover		

50% of total cover: 0.5% 20% of total cover: 0.2%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	0	x 2 =
FAC species	85	x 3 = 255
FACU species	42	x 4 = 168
UPL species	0	x 5 =
Column Totals:	127 (A)	423 (B)

Prevalence Index = B/A = 3.33

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ______ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP4- Upland

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5 YR 4/6	100					sandy loam	
6-12	7.5 YR 4/6	90	5YR 5/8	10	C	PL	loam	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? Yes ______ No ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Hickory FDP City/County: Yadkin Sampling Date: 7-13-2016
Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: DP5- Wetland G
Investigator(s): Alea Tuttle, Tracey Marshall Section, Township, Range: Yadkinville
Landform (hillslope, terrace, etc.): old pond bed Local relief (concave, convex, none): concave Slope (%): unk
Subregion (LRR or MLRA): MLRA 136 (Southern Piedmont) Lat: 36.0855927° Long: -80.6628162° Datum: ______
Soil Map Unit Name: DoB (Delila fine sandy loam) NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No ✓
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ___	**Is the Sampled Area within a Wetland?** Yes ✓ No ___
Hydric Soil Present?	Yes ✓	No ___	
Wetland Hydrology Present?	Yes ✓	No ___	

Remarks:
Hydrology is disturbed, resulting from land use history of water retention structures. A perennial stream and several ephemeral drainage features contribute hydrologic and sediment inputs to Wetland G. Perennial stream UT1 cuts through the center of wetland and becomes braided in areas due to the change in slope and sediment load. Multiple headcuts are forming at the northernmost edge of the wetland, where a small drainage ditch and a drain pipe influence the hydrology, and UT1 returns to a single thread channel. The surrounding landscape slopes steeply toward the old impoundment. Occasional areas of standing surface water.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ✓ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ✓ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ___	Depth (inches): 1
Water Table Present?	Yes ✓	No ___	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes ✓	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DP5- Wetland G

Tree Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	10%	Yes	OBL
2.			
3.			
4.			
5.			
6.			
= Total Cover	10%		

50% of total cover: ______ 20% of total cover: ______

Sapling Stratum (Plot size: 15' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ______ 20% of total cover: ______

Shrub Stratum (Plot size: 15' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Liriodendron tulipifera	2%	Yes	FACU
2.			
3.			
4.			
5.			
6.			
= Total Cover	2%		

50% of total cover: 1% 20% of total cover: 0.5%

Herb Stratum (Plot size: 5' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Leersia oryzoides	25	Yes	OBL
2. Microstegium vimineum	25	Yes	FAC
3. Pilea pumila	10	No	FACW
4. Polygonum sagittatum	10	No	OBL
5. Dichanthelium clandestinum	10	No	FAC
6. Juncus effusus	5	No	FACW
7. Murdannia keisak	5	No	OBL
8. Solidago gigantea	5	No	FACW
9. Carex lurida	5	No	OBL
10.			
11.			
= Total Cover	100		

50% of total cover: 50 20% of total cover: 20

Woody Vine Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
= Total Cover			

50% of total cover: ______ 20% of total cover: ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ______

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP5- Wetland G

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y 3/1	90	2.5Y 4/4	10	C	PL	sandy silty loam	
4-12	2.5Y 4/2	100					mucky sandy loam	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ✓ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ✓ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Hickory FDP City/County: Yadkin Sampling Date: 7-13-2016

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: DP6 Wetland H

Investigator(s): Alea Tuttle, Tracey Marshall Section, Township, Range: Yadkinville

Landform (hillslope, terrace, etc.): valley bottom Local relief (concave, convex, none): concave Slope (%): ____

Subregion (LRR or MLRA): MLRA 136 (Southern Piedmont) Lat: 36.0862963° Long: -80.6627752° Datum: ____

Soil Map Unit Name: DoB (Delila fine sandy loam) NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	**Is the Sampled Area within a Wetland?**	**Yes ✓ No ____**
Hydric Soil Present?	Yes ✓ No ____		
Wetland Hydrology Present?	Yes ✓ No ____		

Remarks:

Hydrology is significantly disturbed; origin of saturation and flow emanating from the dam wall of Wetland G, where there is iron-rich groundwater seepage and a poorly functioning drainage pipe. This linear wetland has flowing water pressed against valley wall to east with access to a moderately wide floodplain bench to west, however there were no indicators of recent flooding on bench. Terminus of wetland at UT1 is stabilized by a large flat boulder as takes a sharp turn north.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ✓ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ✓ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ____ Depth (inches): 2

Water Table Present? Yes ✓ No ____ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DP6 Wetland H

Tree Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ______ 20% of total cover: ______

Sapling Stratum (Plot size: 15' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ______ 20% of total cover: ______

Shrub Stratum (Plot size: 15' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense	5%	Yes	FACU
2. Acer negundo	2%	Yes	FAC
3.			
4.			
5.			
6.			
= Total Cover	7%		

50% of total cover: 3.5 20% of total cover: 1.4

Herb Stratum (Plot size: 5' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Sanicula canadensis	1%	No	UPL
2. Polystichum acrostichoides	1%	No	FACU
3. Deparia acrostichoides	1%	No	FAC
4. Dryopteris carthusiana	1%	No	FAC
5. Polygonum pensylvanicum	1%	No	FACW
6. Carex sp.	5%	Yes	NI
7. Pilea pumila	5%	Yes	FACW
8. Microstegium vimineum	2%	No	FAC
9.			
10.			
11.			
= Total Cover	17		

50% of total cover: 8.5% 20% of total cover: 3.4%

Woody Vine Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
= Total Cover			

50% of total cover: ______ 20% of total cover: ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	6%	x 2 = 12
FAC species	6%	x 3 = 18
FACU species	6%	x 4 = 24
UPL species		x 5 =
Column Totals:	18 (A)	54 (B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP6 Wetland H

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-5	2.5Y 3/1	95%	2.5Y 5/4	5%	C	PL	sand	
5-12	2.5Y 4/1	98%	2.5Y 5/6	2%	C	PL	silty sand	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ✓ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ **No** ______

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Hickory FDP City/County: Yadkin Sampling Date: 7-13-2016

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: DP8 Wetland I

Investigator(s): Alea Tuttle, Tracey Marshall Section, Township, Range: Yadkinville

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): ______

Subregion (LRR or MLRA): MLRA 136 (Southern Piedmont) Lat: 36.0940960° Long: -80.6672008° Datum: ______

Soil Map Unit Name: DoB (Delila fine sandy loam) NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ✓, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ✓

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____
Hydric Soil Present?	Yes ✓	No ____
Wetland Hydrology Present?	Yes ✓	No ____

Is the Sampled Area within a Wetland? **Yes** ✓ **No** ____

Remarks:

Small sparsely vegetated concave area of saturation with thin layer of muck at the base of a hillslope in farmfield. Presence of culvert to drain under farm road suggests this area is perennially saturated under typical climatic conditions. Evidence of tilling and maintenance with herbicide due to location within a field planted in row crops.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ✓ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ✓ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 1
Water Table Present?	Yes ✓	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DP8 Wetland I

Tree Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Sapling Stratum (Plot size: 15' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Shrub Stratum (Plot size: 15' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Herb Stratum (Plot size: 5' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Leersia oryzoides	1%	Yes	OBL
2. Pilea pumila	1%	Yes	FACW
3. Ludwigia sp.	1%	Yes	OBL
4. Ipomoea sp.	1%	Yes	NI
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	4%		

50% of total cover: 2% 20% of total cover: <1%

Woody Vine Stratum (Plot size: 30' radius)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP8 Wetland I

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-1	2.5 Y 4/2	100%					organic muck	A10 indicator
1-9	2.5 Y 4/2	100%					mucky sand	S1 indicator
9-12	2.5 Y 3/1	80%	2.5 Y 4/3	20%	D	M	sand	S6 indicator

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ✓ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ✓ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________________

Depth (inches): ______________________

Hydric Soil Present? **Yes** ✓ **No** ______

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Hickory FDP City/County: Yadkin Sampling Date: 7-13-2016

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: DP9 - Upland

Investigator(s): Alea Tuttle, Tracey Marshall Section, Township, Range: Yadkinville

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): ____

Subregion (LRR or MLRA): MLRA 136 (Southern Piedmont) Lat: 36.0941224° Long: -80.6672458° Datum: ____

Soil Map Unit Name: DoB (Delila fine sandy loam) NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ✓, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No ✓

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ✓
Hydric Soil Present?	Yes ___	No ✓
Wetland Hydrology Present?	Yes ___	No ✓

Is the Sampled Area within a Wetland? **Yes** ___ **No** ✓

Remarks:

Data point in farm field adjacent to ditch, Planted in soybeans.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ____

Water Table Present? Yes ___ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ____

Wetland Hydrology Present? Yes ___ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: DP9 - Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: 5' radius)			
1. Glycine max	50%	Yes	NI
2. Dactylis sp.	10%	Yes	NI
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60% = Total Cover		
50% of total cover:	30%	20% of total cover:	12%

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ____ **No** ✓

Remarks: (Include photo numbers here or on a separate sheet.)

field planted in soybeans

SOIL

Sampling Point: DP9 - Upland

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	7.5YR 4/4	98%	2.5Y/R 3/6	2%	C	PL	silt loam	iron masses

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No ✓

Remarks:

soil in tilled field planted in row crops (soybeans)

APPENDIX 3

DWR STREAM IDENTIFICATION FORMS

Appendix 3 DWR Stream Identification Forms

The results of the DWR Stream Identification Forms are listed in the table below. DWR forms can be found in this appendix and in the digital submission to DMS. DWR forms were completed by Wildlands for all project streams.

Table 1: DWR Form Summary – *Lone Hickory Mitigation Site*

Stream	Geomorphology Score	Hydrology Score	Biology Score	Total Score
UT1 (Intermittent)	10.5	6	7	23.5
UT1 (Perennial)	11.5	11.5	7.5	30.5
UT1A	16	8.5	12	36.5
UT1B	15	8.5	10	33.5
UT2	22.5	9	12	43.5
UT2A (Intermittent)	4.5	9	7.5	21
UT2A (Perennial)	3.5	9	11.5	24*
UT2B	7.5	10.5	13	31
UT3	22	8.5	10.5	41

*This portion of UT2A scored below the NCDWR point threshold for perennial streams (30 points) however due the presence of fish (not mosquitofish, *Gambusia*) was classified as perennial.

NC DWQ Stream Identification Form Version 4.11

Date: 1-7-16	Project/Site: Lone Hickory	Latitude: 36.0839°
Evaluator: AT	County: Yadkin	Longitude: -80.6616°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* UT1 SCP1

A. Geomorphology (Subtotal = 10.5)	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

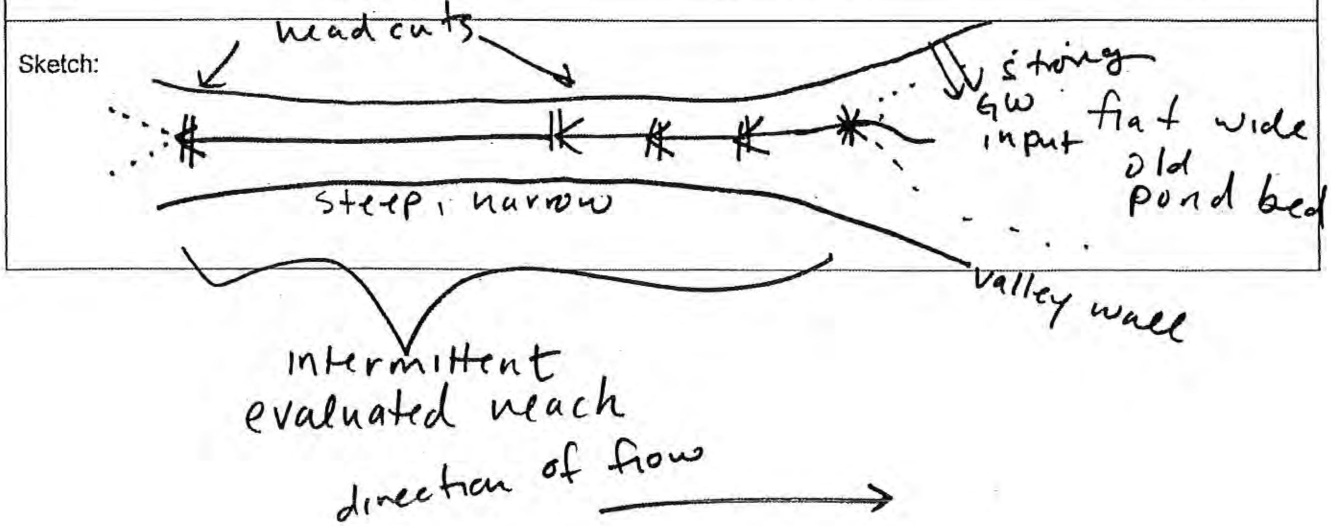
B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7)				
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			NA

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

Notes:

Sketch:



NC DWQ Stream Identification Form Version 4.11

Date: 1-7-16	Project/Site: Lone Hickory	Latitude: 36.0841°
Evaluator: AT	County: Yadkin	Longitude: -80.6620°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* UT1 SCP2

A. Geomorphology (Subtotal = 11.5)	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

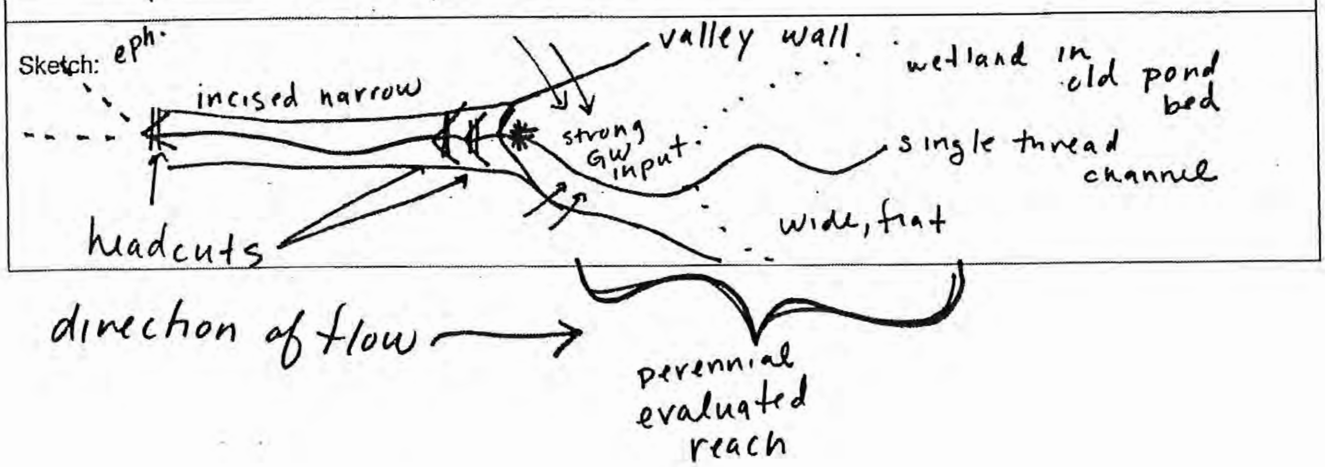
B. Hydrology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 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		N/A

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

Notes: aquatic worm, bioturbation

Sketch:



NC DWQ Stream Identification Form Version 4.11

Date: 1-7-16	Project/Site: Lone Hickory	Latitude: 36.0901°
Evaluator: I Eckardt	County: Yadkin	Longitude: -80.6606°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 36.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other UT1A *e.g. Quad Name:* SCP3

A. Geomorphology (Subtotal = 16)	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)				
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 = 12)				
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: Observed 1 cranefly ; 3 caddisflies 1 salamander
Abundant right handed snails

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1-7-16	Project/Site: Lone Hickory	Latitude: 36.0931'
Evaluator: I Eckardt	County: Yadkin	Longitude: -80.6599°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 33.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other UT1B *e.g. Quad Name:* SCP 4

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 = 8.5)				
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)				
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: Abundant right handed snails
1 crayfish

Sketch:
2-3' knickpoint at tree root ≅ 75' u/s of confluence.

NC DWQ Stream Identification Form Version 4.11

Date: 1-7-16	Project/Site: Lone Hickory	Latitude: 36.0941°
Evaluator: AT	County: Yadkin	Longitude: -80.6673°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 43.5	Stream Determination (~~circle one~~) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* UT2 SCP5

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

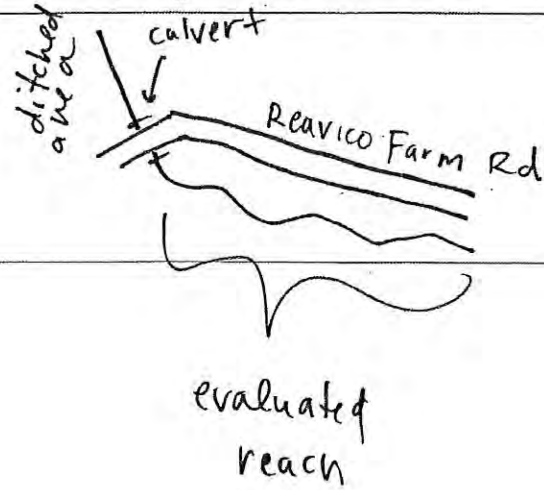
B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	~~0.5~~	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 12)				
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: Variety of caddis flies, abundant LH snails, mayfly (1)

Sketch:



NC DWQ Stream Identification Form Version 4.11

Date: 1-7-16	Project/Site: Lone Hickory	Latitude: 36.0944°
Evaluator: AT	County: Yadkin	Longitude: - 80.6686°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 21	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** UT2A *e.g. Quad Name:* SCP6

A. Geomorphology (Subtotal = 4.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank ditched	~~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 * no canopy	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)				
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: Juncus in bed + banks.

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7-15-16	Project/Site: Lone Hickory	Latitude: 36.0958
Evaluator: AT	County: UT2A Lower	Longitude: -80.6690
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 24	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* SCP7

A. Geomorphology (Subtotal = 3.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank ditched	~~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 no canopy	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 = 11.5)				
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:

juncus. bed+ banks vegetation

Sketch: maintained, standing water, artificially ditchd to drain farm field.

* low slope + artificial maintenance of channel dimension/ditching reduced geomorphology score. biology/hydrology indicators point to perennial feature

NC DWQ Stream Identification Form Version 4.11

Date: 7-15-16	**Project/Site:** Lone Hickory	**Latitude:** 36.09584
Evaluator: AT	**County:** Yadkin	**Longitude:** -80.6661
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 31	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** UT2B *e.g. Quad Name:* ScP8

A. Geomorphology (Subtotal = 7.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank ditched	~~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 = 13)				
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: juncus, tadpoles, fish (minnows)
many active crayfish burrows

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1-7-16	Project/Site: UT3 LONE HICKORY	Latitude: 36.0938°
Evaluator: AT	County: Yadkin	Longitude: -80.6709°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 41	Stream Determination (~~circle one~~) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* SCP10

A. Geomorphology (Subtotal = 22)	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)				
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 NA			

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

Notes: Variety of caddis flies, tipulid cranefly, water pennies LH snails. macros + mollusks readily found.

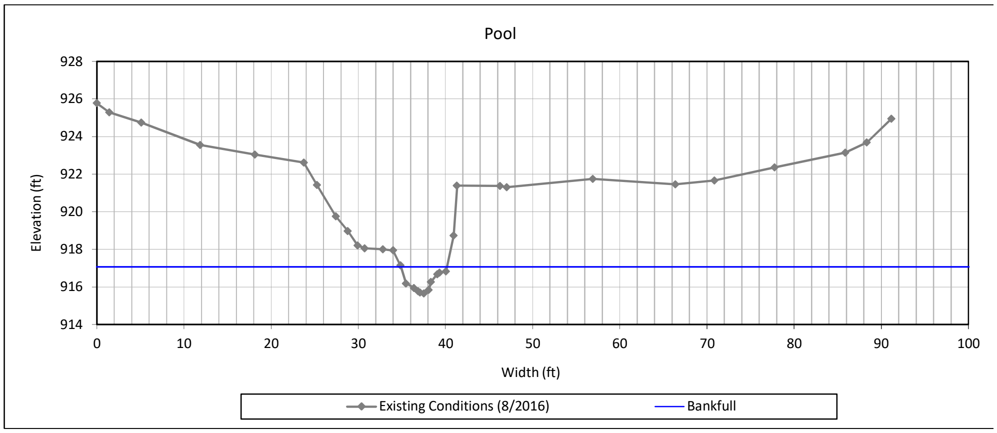
Sketch:

APPENDIX 4
DATA, ANALYSIS, SUPPLEMENTARY INFORMATION, FIGURES, AND MAPS

Existing Conditions Geomorphic Parameters								
Parameter	**Notation**	**Units**	**UT1 Reach 1**		**UT1 Reach 2**		**UT1 Reach 3**	
			min	**max**	**min**	**max**	**min**	**max**
stream type			E5b		G4		E4	
drainage area	DA	sq mi	0.07		0.37		0.45	
bankfull cross-sectional area	A_{bkf}	SF	3.8		7.2		13.4	
avg velocity during bankfull event	v_{bkf}	fps	2.9		4.8		4.1	
width at bankfull	w_{bkf}	feet	4.8		8.9		10.0	
maximum depth at bankfull	d_{max}	feet	1.4		1.3		1.9	
mean depth at bankfull	d_{bkf}	feet	0.8		0.8		1.3	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		6.2		11.0		7.5	
low bank height		feet	5.3		3.4		3.3	
bank height ratio	BHR		3.8		2.6		1.7	
floodprone area width	w_{fpa}	feet	13.1		13.2		31.1	
entrenchment ratio	ER		2.7		1.5		3.1	
max pool depth at bankfull	d_{pool}	feet	1.4		1.4		1.7	
pool depth ratio	d_{pool}/d_{bkf}		1.8		1.8		1.3	
pool width at bankfull	w_{pool}	feet	5.3		8.1		9.0	
pool width ratio	w_{pool}/w_{bkf}		1.1		0.9		0.9	
Bkf pool cross-sectional area	A_{pool}	SF	4.4		6.0		9.1	
pool area ratio	A_{pool}/A_{bkf}		1.2		0.8		0.7	
pool-pool pacing	p-p	feet	5	20	29	42	18	32
pool-pool spacing ratio	$p\text{-}p/W_{bkf}$		1.0	4.2	3.3	4.7	1.8	3.2
valley slope	S_{valley}	feet/foot	0.0411		0.0454		0.0049	
channel slope	$S_{channel}$	feet/foot	0.0295		0.0256		0.0101	
sinuosity	K		1.08		1.04		1.13	
belt width	w_{blt}	feet	6	12	N/A		12	14
meander width ratio	w_{blt}/w_{bkf}		1.3	2.5	N/A		1.2	1.4
meander length	L_m	feet	9	19	N/A		14	43
meander length ratio	L_m/w_{bkf}		1.9	4.0	N/A		1.4	4.3
linear wavelength	LW		25	41	N/A		38	51
linear wavelength ratio	LW/w_{bkf}		5.2	8.5	N/A		3.8	5.1
radius of curvature	R_c	feet	3	8	N/A		5	12
radius of curvature ratio	R_c/w_{bkf}		0.6	1.7	N/A		0.5	1.2

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 1, UT1 Reach 1



Bankfull Dimensions

4.4	x-section area (ft.sq.)
5.3	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
6.4	wetted parimeter (ft)
0.7	hyd radi (ft)
6.4	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
4.1	low bank height ratio

Survey Date: 12/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 1, UT1 Reach 1
longitudinal station: ---
alignment: straight line
feature

Bankfull Stage
elevation: 917.06 ---

Low Bank Height
elevation: 921.38

Flood Prone Area
width fpa: ---

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

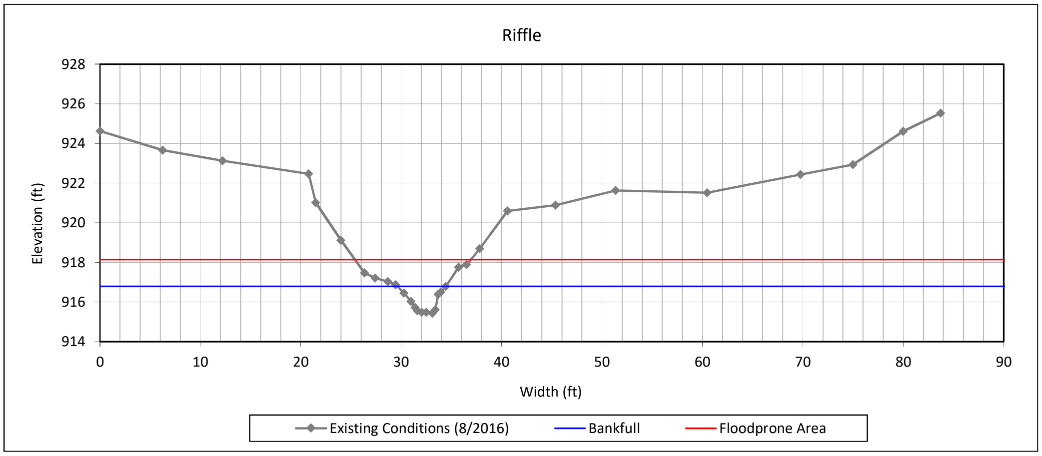
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	925.77	☐	(XS1)XS1
		1.43	925.28	☐	(XS1)XS1
		5.12	924.74	☐	(XS1)XS1
		11.86	923.55	☐	(XS1)XS1
		18.15	923.05	☐	(XS1)XS1
		23.76	922.61	☐	(XS1 ltb)XS1 I
		25.26	921.42	☐	(XS1)XS1
		27.42	919.76	☐	(XS1)XS1
		28.78	918.97	☐	(XS1)XS1
		29.94	918.21	☐	(XS1)XS1
		30.75	918.06	☐	(XS1)XS1
		32.85	918.01	☐	(XS1)XS1
		33.99	917.94	☐	(XS1 bkf)XS1
		34.84	917.14	☐	(XS1)XS1
		35.46	916.18	☐	(XS1)XS1
		36.41	915.94	☐	(XS1 lew)XS1
		36.87	915.77	☐	(XS1)XS1
		37.09	915.70	☐	(XS1)XS1
		37.52	915.65	☐	(XS1)XS1
		38.09	915.84	☐	(XS1 rew)XS1
		38.34	916.26	☐	(XS1)XS1
		39.06	916.68	☐	(XS1)XS1
		39.32	916.76	☐	(XS1 bkf)XS1
		40.06	916.83	☐	(XS1)XS1
		40.95	918.73	☐	(XS1)XS1
		41.33	921.38	☐	(XS1 rtb)XS1
		46.26	921.38	☐	(XS1)XS1
		47.04	921.31	☐	(XS1)XS1
		56.91	921.75	☐	(XS1)XS1
		66.39	921.46	☐	(XS1)XS1
		70.86	921.66	☐	(XS1)XS1
		77.78	922.36	☐	(XS1)XS1
		85.87	923.14	☐	(XS1)XS1
		88.35	923.68	☐	(XS1)XS1
		91.18	924.95	☐	(XS1 riffle)XS

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 2, UT1 Reach 1



Bankfull Dimensions

3.8	x-section area (ft.sq.)
4.8	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
5.9	wetted parimeter (ft)
0.6	hyd radi (ft)
6.2	width-depth ratio
13.1	W flood prone area (ft)
2.7	entrenchment ratio
3.8	low bank height ratio

Survey Date: 12/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section

reference ID	2, UT1 Reach 1
longitudinal station	---
alignment	straight line
feature	

Bankfull Stage

elevation	916.78 ---

Low Bank Height

elevation	920.59

Flood Prone Area

width fpa	13.1 11.5

Channel Slope

percent slope	---

Flow Resistance

Manning's "n"	---
D'Arcy - Weisbach "f"	---

For Stream Type:

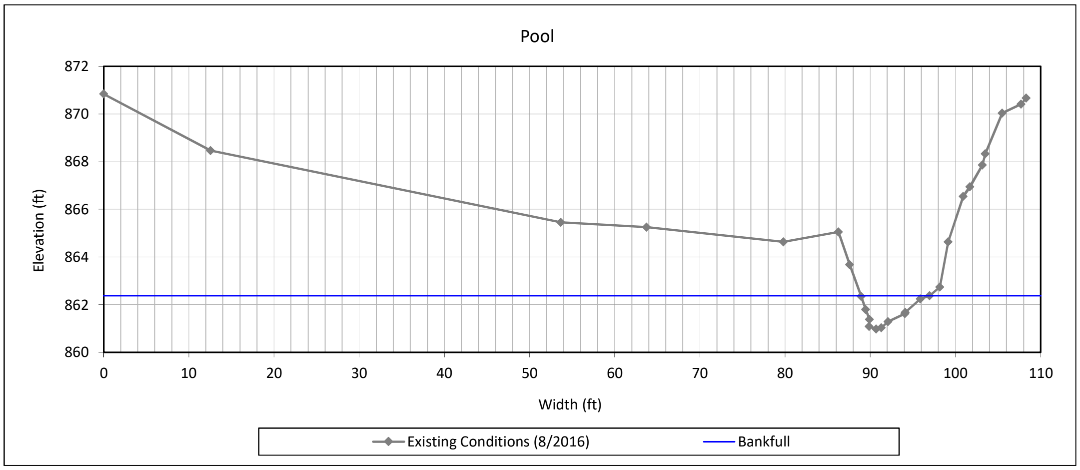
Is braided channel?	☐
Sinuosity, k	
D_{50}	---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	924.62	☐	(XS2)XS2
		6.26	923.65	☐	(XS2)XS2
		12.20	923.12	☐	(XS2)XS2
		20.77	922.46	☐	(XS2 ltb)XS2
		21.50	921.01	☐	(XS2)XS2
		24.01	919.10	☐	(XS2)XS2
		26.35	917.46	☐	(XS2)XS2
		27.40	917.21	☐	(XS2)XS2
		28.69	917.03	☐	(XS2 bkf)XS2
		29.45	916.86	☐	(XS2)XS2
		30.28	916.44	☐	(XS2)XS2
		30.99	916.03	☐	(XS2)XS2
		31.39	915.73	☐	(XS2)XS2
		31.63	915.56	☐	(XS2 lew)XS2
		32.07	915.48	☐	(XS2)XS2
		32.52	915.47	☐	(XS2)XS2
		33.12	915.43	☐	(XS2)XS2
		33.39	915.61	☐	(XS2 rew)XS2
		33.68	916.38	☐	(XS2)XS2
		33.93	916.50	☐	(XS2 bkf)XS2
		34.44	916.78	☐	(XS2)XS2
		35.71	917.76	☐	(XS2)XS2
		36.51	917.89	☐	(XS2)XS2
		37.83	918.69	☐	(XS2)XS2
		40.59	920.59	☐	(XS2 rtb)XS2
		45.38	920.88	☐	(XS2)XS2
		51.36	921.63	☐	(XS2)XS2
		60.47	921.51	☐	(XS2)XS2
		69.78	922.42	☐	(XS2)XS2
		75.01	922.93	☐	(XS2)XS2
		80.02	924.60	☐	(XS2)XS2
		83.73	925.53	☐	(XS2)XS2

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 3, UT1 Reach 2



Bankfull Dimensions

6.0	x-section area (ft.sq.)
8.1	width (ft)
0.7	mean depth (ft)
1.4	max depth (ft)
9.0	wetted parimeter (ft)
0.7	hyd radi (ft)
10.8	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
2.9	low bank height ratio

Survey Date: 12/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
- reference ID: 3, UT1 Reach 2
- longitudinal station: ---
- alignment: straight line
- feature:

Bankfull Stage
- elevation: 862.378 ---

Low Bank Height
- elevation: 865.05

Flood Prone Area
- width fpa: ---

Channel Slope
- percent slope: ---

Flow Resistance
- Manning's "n": ---
- D'Arcy - Weisbach "f": ---

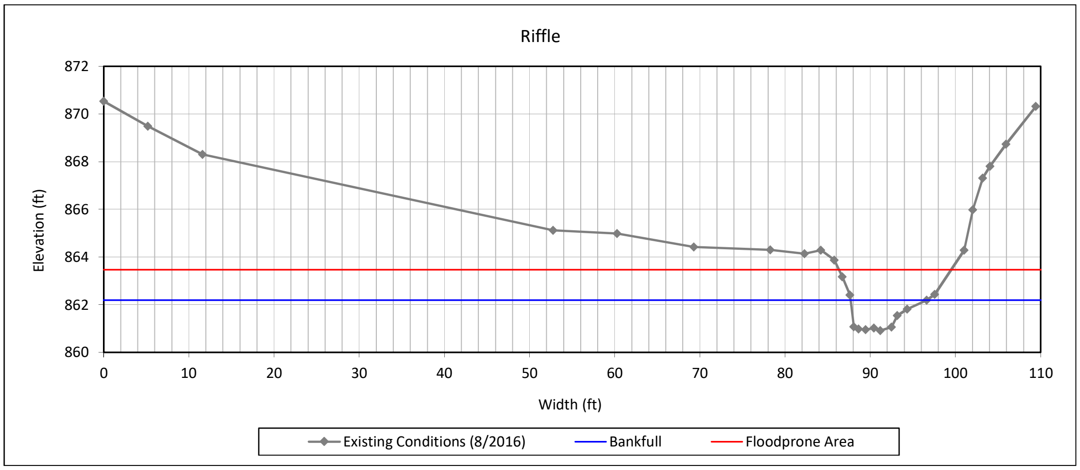
For Stream Type:
- Is braided channel? ☐
- Sinuosity, k:
- D_{50}: ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	870.84	☐	(XS3 pool)XS3
		12.55	868.47	☐	(XS3)XS3
		53.66	865.46	☐	(XS3)XS3
		63.74	865.25	☐	(XS3)XS3
		79.80	864.64	☐	(XS3)XS3
		86.26	865.05	☐	(XS3 ltb)XS3
		87.60	863.69	☐	(XS3)XS3
		88.95	862.34	☐	(XS3)XS3
		89.48	861.80	☐	(XS3)XS3
		89.92	861.38	☐	(XS3 lew)XS3
		89.87	861.09	☐	(XS3)XS3
		90.70	860.98	☐	(XS3)XS3
		91.29	861.04	☐	(XS3)XS3
		92.10	861.29	☐	(XS3 rew)XS3
		94.10	861.63	☐	(XS3)XS3
		94.14	861.68	☐	(XS3)XS3
		95.87	862.24	☐	(XS3)XS3
		96.99	862.38	☐	(XS3 bkf)XS3
		98.19	862.75	☐	(XS3)XS3
		99.16	864.63	☐	(XS3)XS3
		100.93	866.55	☐	(XS3)XS3
		101.72	866.94	☐	(XS3)XS3
		103.19	867.86	☐	(XS3)XS3
		103.53	868.34	☐	(XS3)XS3
		105.49	870.04	☐	(XS3)XS3
		107.72	870.42	☐	(XS3)XS3
		108.32	870.67	☐	(XS3)XS3
				☐	
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 4, UT1 Reach 2



Bankfull Dimensions

7.2	x-section area (ft.sq.)
8.9	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
10.0	wetted parimeter (ft)
0.7	hyd radi (ft)
11.0	width-depth ratio
13.2	W flood prone area (ft)
1.5	entrenchment ratio
2.6	low bank height ratio

Survey Date: 12/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section

reference ID	4, UT1 Reach 2	
longitudinal station		---
alignment	straight line	
feature		

Bankfull Stage

elevation	862.192	---

Low Bank Height

elevation	864.29

Flood Prone Area

width fpa	13.2	13.2

Channel Slope

percent slope		---

Flow Resistance

Manning's "n"		---
D'Arcy - Weisbach "f"		---

For Stream Type:

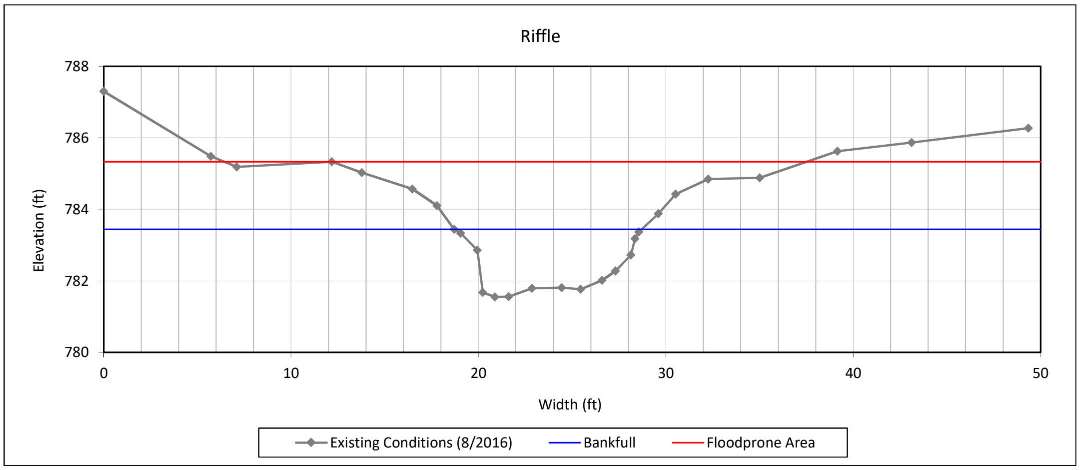
Is braided channel?	☐	
Sinuosity, k		
D_{50}		---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	870.54	☐	(XS4)XS4
		5.20	869.49	☐	(XS4)XS4
		11.63	868.31	☐	(XS4)XS4
		52.78	865.12	☐	(XS4)XS4
		60.28	864.99	☐	(XS4)XS4
		69.30	864.42	☐	(XS4)XS4
		78.29	864.30	☐	(XS4)XS4
		82.31	864.14	☐	(XS4)XS4
		84.21	864.29	☐	(XS4)XS4
		85.79	863.87	☐	(XS4)XS4
		86.71	863.17	☐	(XS4)XS4
		87.64	862.40	☐	(XS4)XS4
		88.06	861.08	☐	(XS4 lew)XS4
		88.63	860.98	☐	(XS4)XS4
		89.48	860.95	☐	(XS4)XS4
		90.45	861.01	☐	(XS4)XS4
		91.18	860.92	☐	(XS4)XS4
		92.52	861.06	☐	(XS4 rew)XS4
		93.18	861.54	☐	(XS4)XS4
		94.36	861.81	☐	(XS4)XS4
		96.63	862.19	☐	(XS4 bkf)XS4
		97.59	862.43	☐	(XS4)XS4
		101.05	864.28	☐	(XS4)XS4
		102.06	865.98	☐	(XS4)XS4
		103.23	867.31	☐	(XS4)XS4
		104.06	867.81	☐	(XS4)XS4
		105.94	868.73	☐	(XS4)XS4
		109.46	870.31	☐	(XS4 riffle)XS
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 5, UT1 Reach3



Bankfull Dimensions	
13.4	x-section area (ft.sq.)
10.0	width (ft)
1.3	mean depth (ft)
1.9	max depth (ft)
11.7	wetted parimeter (ft)
1.1	hyd radi (ft)
7.5	width-depth ratio
31.1	W flood prone area (ft)
3.1	entrenchment ratio
1.7	low bank height ratio

Survey Date: 12/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 5, UT1 Reach
longitudinal station: ---
alignment: straight line
feature

Bankfull Stage
elevation: 783.441 ---

Low Bank Height
elevation: 784.85

Flood Prone Area
width fpa: 31.1 31.1

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

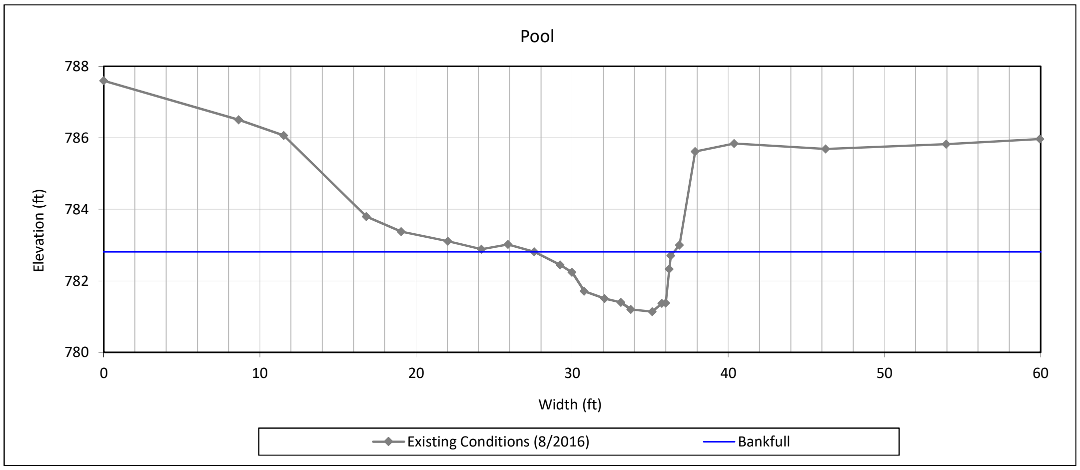
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	787.30	☐	(XS5)XS5
		5.72	785.48	☐	(XS5)XS5
		7.11	785.18	☐	(XS5 ltb)XS5 l
		12.18	785.33	☐	(XS5 ltb)XS5 l
		13.79	785.03	☐	(XS5)XS5
		16.48	784.57	☐	(XS5)XS5
		17.80	784.10	☐	(XS5)XS5
		18.71	783.44	☐	(XS5 bkf)XS5
		19.05	783.33	☐	(XS5 lew)XS5
		19.95	782.85	☐	(XS5 lew)XS5
		20.23	781.68	☐	(XS5 lew)XS5
		20.89	781.55	☐	(XS5)XS5
		21.62	781.56	☐	(XS5)XS5
		22.86	781.79	☐	(XS5)XS5
		24.45	781.81	☐	(XS5)XS5
		25.46	781.76	☐	(XS5)XS5
		26.60	782.01	☐	(XS5 rew)XS5
		27.31	782.27	☐	(XS5)XS5
		28.14	782.72	☐	(XS5)XS5
		28.36	783.18	☐	(XS5 bkf)XS5
		28.56	783.36	☐	(XS5)XS5
		29.60	783.87	☐	(XS5)XS5
		30.52	784.43	☐	(XS5)XS5
		32.26	784.85	☐	(XS5 rtb)XS5
		35.02	784.89	☐	(XS5)XS5
		39.17	785.62	☐	(XS5)XS5
		43.12	785.87	☐	(XS5)XS5
		49.36	786.27	☐	(XS5 riffle)XS
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 6, UT1 Upper Reach 3



Bankfull Dimensions	
9.1	x-section area (ft.sq.)
9.0	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
10.3	wetted parimeter (ft)
0.9	hyd radi (ft)
8.8	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
2.8	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 6, UT1 Upper Reach 3
longitudinal station: ---
alignment: straight line
feature

Bankfull Stage
elevation: 782.813 ---

Low Bank Height
elevation: 785.84

Flood Prone Area
width fpa: ---

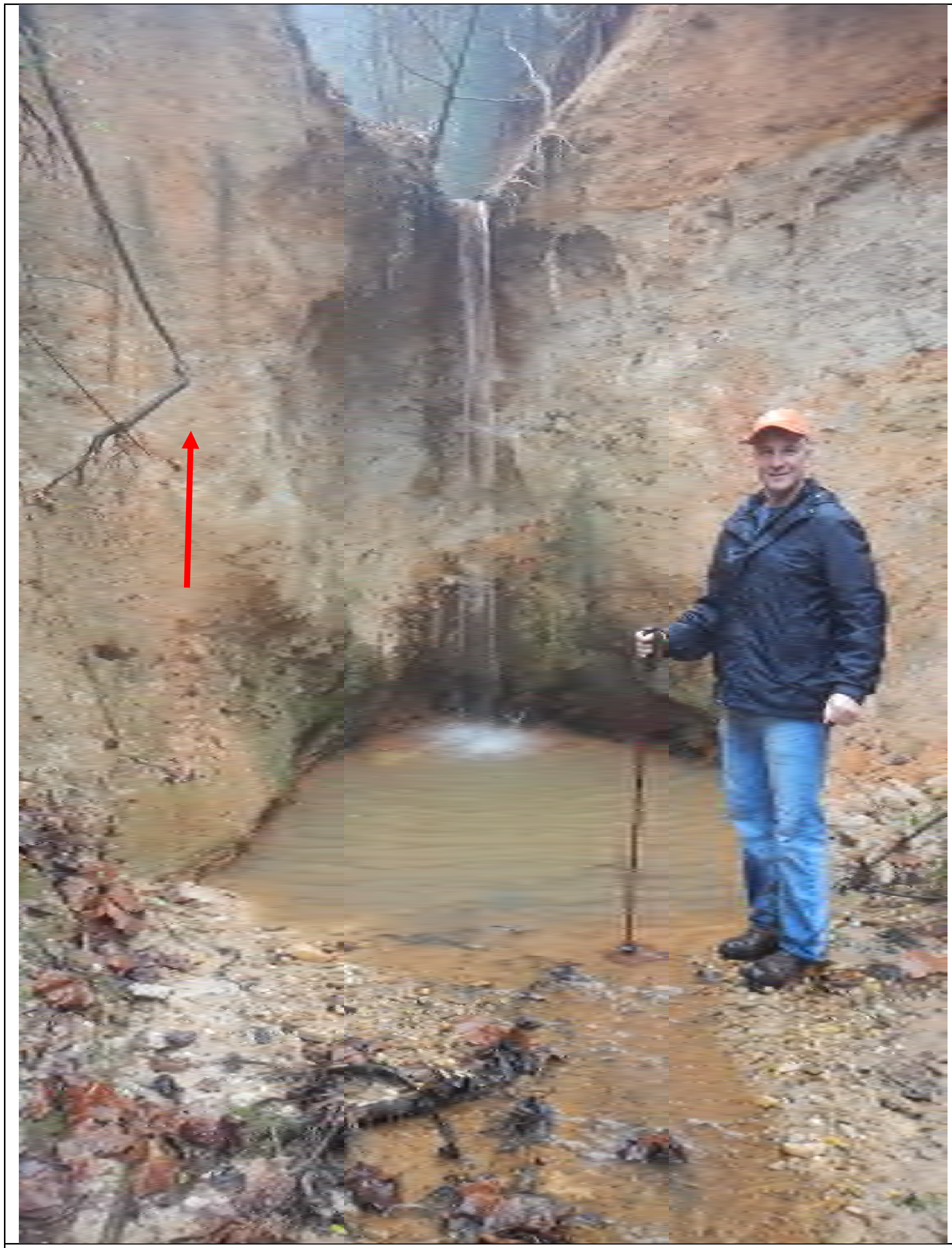
Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

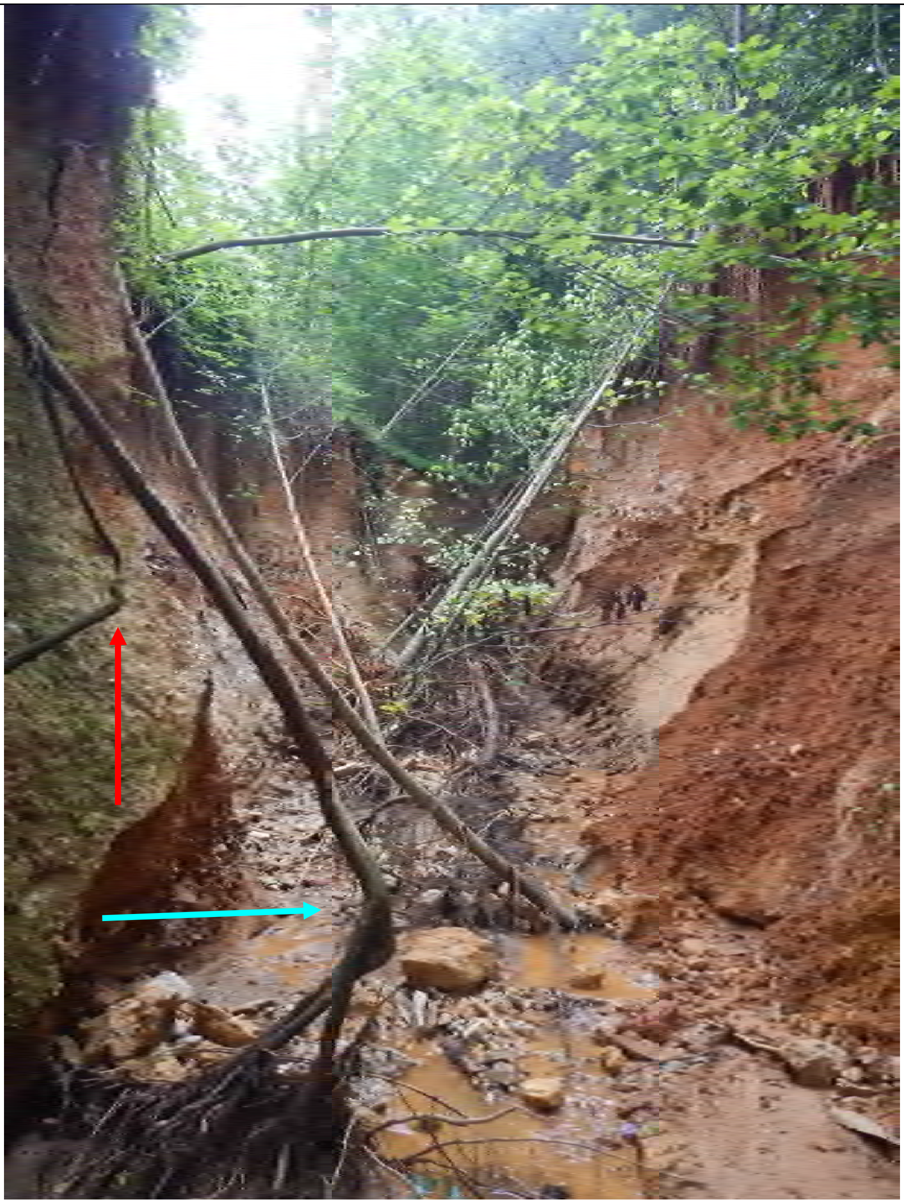
easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	787.60	☐	(XS6)XS6 poo
		8.66	786.51	☐	(XS6)XS6
		11.54	786.07	☐	(XS6 ltb)XS6 l
		16.83	783.80	☐	(XS6)XS6
		19.05	783.38	☐	(XS6)XS6
		22.05	783.11	☐	(XS6)XS6
		24.20	782.88	☐	(XS6)XS6
		25.90	783.02	☐	(XS6)XS6
		27.58	782.81	☐	(XS6 bkf)XS6
		29.23	782.45	☐	(XS6)XS6
		30.00	782.24	☐	(XS6)XS6
		30.77	781.71	☐	(XS6)XS6
		32.08	781.50	☐	(XS6 lew)XS6
		33.13	781.39	☐	(XS6)XS6
		33.77	781.20	☐	(XS6)XS6
		35.13	781.14	☐	(XS6)XS6
		35.76	781.37	☐	(XS6)XS6
		36.00	781.38	☐	(XS6 rew)XS6
		36.22	782.33	☐	(XS6)XS6
		36.33	782.70	☐	(XS6)XS6
		36.87	783.00	☐	(XS6)XS6
		37.88	785.62	☐	(XS6 rtb)XS6
		40.38	785.84	☐	(XS6)XS6
		46.23	785.69	☐	(XS6)XS6
		53.96	785.83	☐	(XS6)XS6
		59.96	785.97	☐	(XS6)XS6
				☐	
				☐	
				☐	
				☐	



12/22/2015; UT1 Pond 1 Headcut on initial site visit

12/29/2015; UT1 Pond 1 Headcut (1 wk)

	
1/7/2016; UT1 Pond 1 Headcut (2 wk)	**7/15/2016; UT1 Pond 1 Headcut (7 months)**



6/21/2017, UT1 Pond 1 Headcut (18 months)

UT1 – Reach 2A. Incision, bank erosion, and instream deposition of fines

UT1 – Reach 2A. Heavy sediment load, valley wall and bank erosion near bedrock outcrop

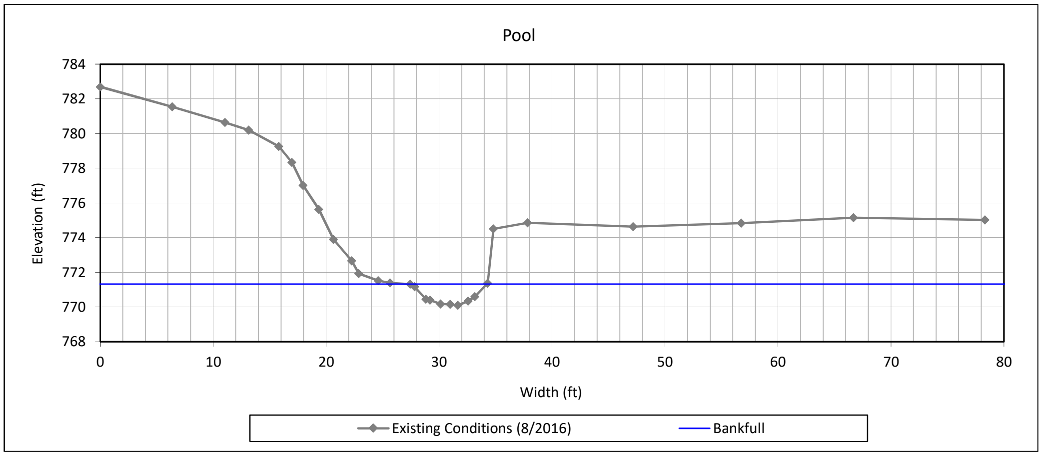
UT1 – Reach 2B, Consistent bank erosion, mass wasting of valley wall, and embedded riffle substrate.

UT1 – Reach 2B, Consistent bank erosion, fine sediments in stream channel.

Existing Conditions Geomorphic Parameters								
Parameter	Notation	Units	UT2 Reach 1		UT2 Reach 2		UT2 Reach 3	
			min	max	min	max	min	max
stream type			G4		G5		G5	
drainage area	DA	sq mi	0.14		0.26		0.27	
bankfull cross-sectional area	A_{bkf}	SF	5.7		6.1		5.7	
avg velocity during bankfull event	v_{bkf}	fps	3.4		2.3		1.8	
width at bankfull	w_{bkf}	feet	8.7		7.7		8.4	
maximum depth at bankfull	d_{max}	feet	0.9		1.2		1.1	
mean depth at bankfull	d_{bkf}	feet	0.7		0.8		0.7	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		13.1		9.8		12.3	
low bank height		feet	4.0		2.6		3.5	
bank height ratio	BHR		4.4		2.3		3.1	
floodprone area width	w_{fpa}	feet	12.3		10.7		13.0	
entrenchment ratio	ER		1.4		1.1		1.5	
max pool depth at bankfull	d_{pool}	feet	1.2		1.5		1.5	
pool depth ratio	d_{pool}/d_{bkf}		1.7		1.9		2.1	
pool width at bankfull	w_{pool}	feet	6.8		8.8		9.2	
pool width ratio	w_{pool}/w_{bkf}		0.8		1.1		1.1	
Bkf pool cross-sectional area	A_{pool}	SF	5.6		9.5		10.2	
pool area ratio	A_{pool}/A_{bkf}		1.0		1.6		1.8	
pool-pool pacing	p-p	feet	24	30	22	44	23	68
pool-pool spacing ratio	$p\text{-}p/W_{bkf}$		2.8	3.4	2.9	5.7	2.7	8.1
valley slope	S_{valley}	feet/foot	0.0205		0.0123		0.0086	
channel slope	$S_{channel}$	feet/foot	0.0154		0.0062		0.0043	
sinuosity	K		1.01		1.02		1.05	
belt width	w_{blt}	feet	N/A		N/A		N/A	
meander width ratio	w_{blt}/w_{bkf}		N/A		N/A		N/A	
meander length	L_m	feet	N/A		N/A		N/A	
meander length ratio	L_m/w_{bkf}		N/A		N/A		N/A	
linear wavelength	LW		N/A		N/A		N/A	
linear wavelength ratio	LW/w_{bkf}		N/A		N/A		N/A	
radius of curvature	R_c	feet	N/A		N/A		N/A	
radius of curvature ratio	$R_c/\ w_{bkf}$		N/A		N/A		N/A	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 1, UT2 Reach 1



Bankfull Dimensions

5.6	x-section area (ft.sq.)
6.8	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
7.4	wetted parimeter (ft)
0.8	hyd radi (ft)
8.3	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
3.9	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 1, UT2 Reach 1
longitudinal station: ---
alignment: straight line
feature

Bankfull Stage
elevation: 771.32 ---

Low Bank Height
elevation: 774.85

Flood Prone Area
width fpa: ---

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

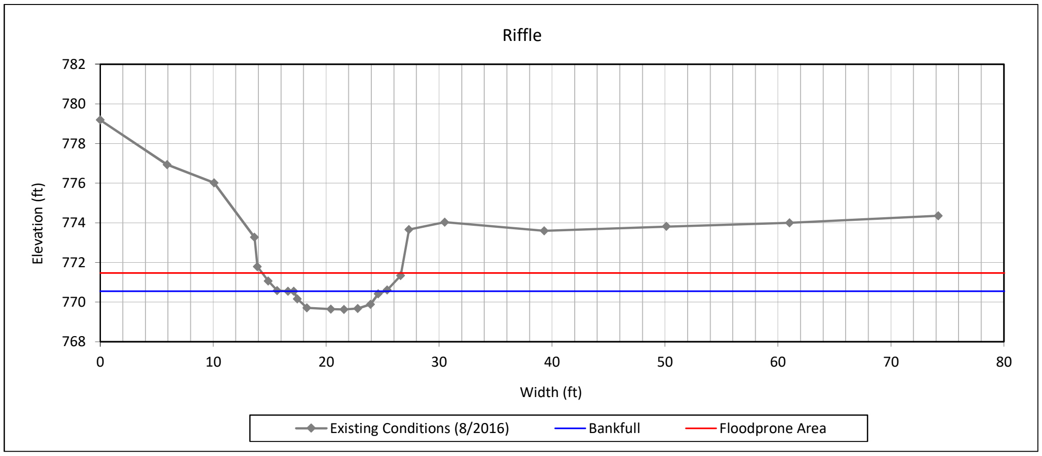
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50}: ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	782.69	☐	(XS1 POOL)X
		6.38	781.54	☐	(XS1)XS1
		11.06	780.64	☐	(XS1)XS1
		13.14	780.19	☐	(XS1)XS1
		15.80	779.26	☐	(XS1 LTB)XS1
		16.97	778.34	☐	(XS1)XS1
		17.97	777.01	☐	(XS1)XS1
		19.36	775.63	☐	(XS1)XS1
		20.66	773.89	☐	(XS1)XS1
		22.28	772.66	☐	(XS1)XS1
		22.89	771.91	☐	(XS1)XS1
		24.62	771.52	☐	(XS1)XS1
		25.67	771.39	☐	(XS1)XS1
		27.46	771.32	☐	(XS1 BKF)XS1
		27.85	771.16	☐	(XS1)XS1
		28.83	770.44	☐	(XS1)XS1
		29.20	770.40	☐	(XS1 LEW)XS
		30.13	770.17	☐	(XS1)XS1
		31.00	770.15	☐	(XS1)XS1
		31.66	770.10	☐	(XS1)XS1
		32.59	770.33	☐	(XS1 REW)XS
		33.17	770.60	☐	(XS1)XS1
		34.30	771.37	☐	(XS1)XS1
		34.82	774.49	☐	(XS1 RTB)XS1
		37.85	774.85	☐	(XS1)XS1
		47.20	774.63	☐	(XS1)XS1
		56.77	774.83	☐	(XS1)XS1
		66.70	775.14	☐	(XS1)XS1
		78.35	775.02	☐	(XS1)XS1
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 2, UT2 Reach 1



Bankfull Dimensions

5.7	x-section area (ft.sq.)
8.7	width (ft)
0.7	mean depth (ft)
0.9	max depth (ft)
9.2	wetted parimeter (ft)
0.6	hyd radi (ft)
13.1	width-depth ratio
12.3	W flood prone area (ft)
1.4	entrenchment ratio
4.4	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID 2, UT2 Reach 1
longitudinal station ---
alignment straight line
feature

Bankfull Stage
elevation 770.542 ---

Low Bank Height
elevation 773.65

Flood Prone Area
width fpa 12.3 12.3

Channel Slope
percent slope ---

Flow Resistance
Manning's "n" ---
D'Arcy - Weisbach "f" ---

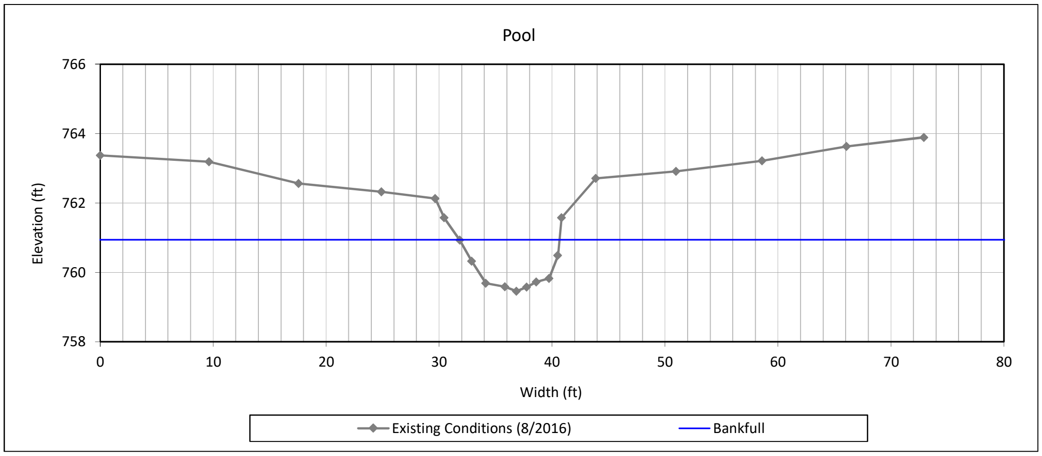
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	779.18	☐	(XS2)XS2
		5.94	776.93	☐	(XS2)XS2
		10.09	776.01	☐	(XS2 LTB)XS2
		13.66	773.27	☐	(XS2)XS2
		13.92	771.79	☐	(XS2)XS2
		14.88	771.06	☐	(XS2)XS2
		15.66	770.57	☐	(XS2)XS2
		16.63	770.54	☐	(XS2)XS2
		17.15	770.54	☐	(XS2 BKF)XS2
		17.45	770.16	☐	(XS2)XS2
		18.31	769.70	☐	(XS2 LEW)XS
		20.44	769.65	☐	(XS2)XS2
		21.59	769.62	☐	(XS2)XS2
		22.81	769.67	☐	(XS2)XS2
		23.93	769.89	☐	(XS2 REW)XS
		24.63	770.41	☐	(XS2)XS2
		25.40	770.60	☐	(XS2 BKF)XS2
		26.60	771.33	☐	(XS2)XS2
		27.34	773.65	☐	(XS2 RTB)XS2
		30.51	774.03	☐	(XS2)XS2
		39.32	773.59	☐	(XS2)XS2
		50.14	773.81	☐	(XS2)XS2
		61.04	773.99	☐	(XS2)XS2
		74.20	774.36	☐	(XS2)XS2

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 3, UT2 Reach 2



Bankfull Dimensions	
9.5	x-section area (ft.sq.)
8.8	width (ft)
1.1	mean depth (ft)
1.5	max depth (ft)
9.8	wetted parimeter (ft)
1.0	hyd radi (ft)
8.2	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.8	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 3, UT2 Reach 2
longitudinal station: ---
alignment: straight line
feature:

Bankfull Stage
elevation: 760.936 ---

Low Bank Height
elevation: 762.13

Flood Prone Area
width fpa: ---

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	763.37	☐	(XS3)XS3
		9.64	763.18	☐	(XS3)XS3
		17.56	762.56	☐	(XS3)XS3
		24.91	762.32	☐	(XS3)XS3
		29.67	762.13	☐	(XS3 LTB)XS3
		30.45	761.57	☐	(XS3)XS3
		31.84	760.93	☐	(XS3)XS3
		32.88	760.32	☐	(XS3)XS3
		34.13	759.69	☐	(XS3)XS3
		35.82	759.58	☐	(XS3)XS3
		36.84	759.45	☐	(XS3)XS3
		37.75	759.57	☐	(XS3)XS3
		38.61	759.72	☐	(XS3 LEW)XS3
		39.75	759.82	☐	(XS3)XS3
		40.52	760.49	☐	(XS3)XS3
		40.84	761.57	☐	(XS3)XS3
		43.87	762.71	☐	(XS3)XS3
		50.97	762.91	☐	(XS3)XS3
		58.61	763.21	☐	(XS3)XS3
		66.09	763.63	☐	(XS3)XS3
		72.92	763.89	☐	(XS3)XS3
				☐	
				☐	
				☐	
				☐	
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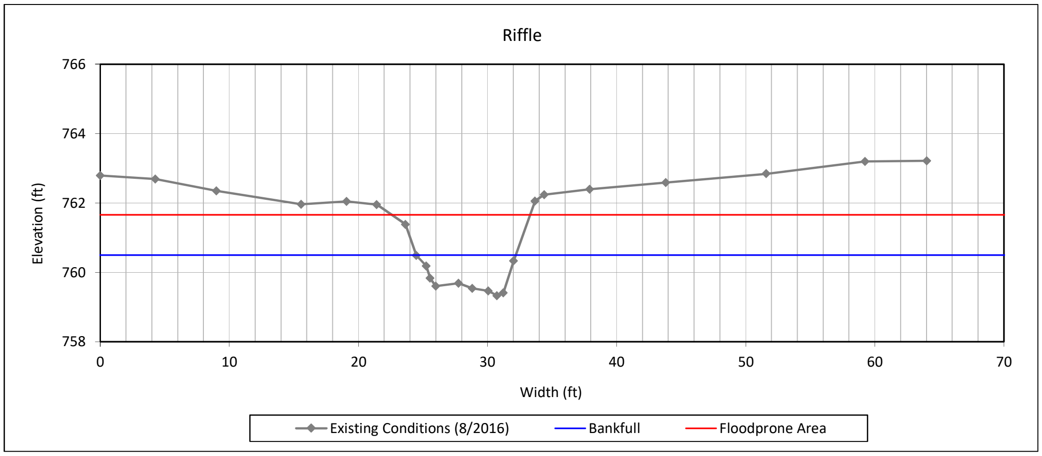
Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 4, UT2 Reach 2



Bankfull Dimensions	
6.1	x-section area (ft.sq.)
7.7	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
8.5	wetted parimeter (ft)
0.7	hyd radi (ft)
9.8	width-depth ratio
10.7	W flood prone area (ft)
1.4	entrenchment ratio
2.3	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID 4, UT2 Reach 2
longitudinal station ---
alignment straight line
feature

Bankfull Stage
elevation 760.49 ---

Low Bank Height
elevation 761.95

Flood Prone Area
width fpa 10.7 10.7

Channel Slope
percent slope ---

Flow Resistance
Manning's "n" ---
D'Arcy - Weisbach "f" ---

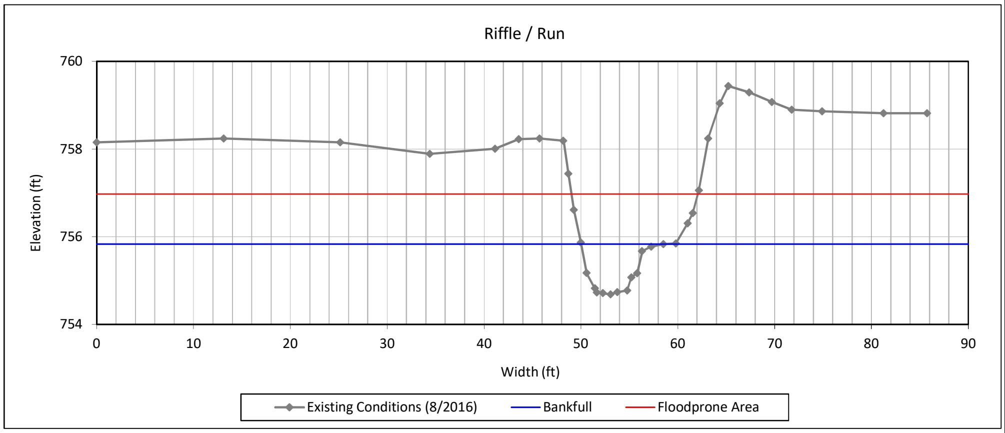
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	762.79	☐	(XS4 RIFFLE)X
		4.28	762.69	☐	(XS4)XS4
		9.01	762.34	☐	(XS4)XS4
		15.56	761.96	☐	(XS4)XS4
		19.10	762.04	☐	(XS4)XS4
		21.43	761.95	☐	(XS4)XS4
		23.66	761.38	☐	(XS4)XS4
		24.48	760.49	☐	(XS4)XS4
		25.27	760.18	☐	(XS4)XS4
		25.56	759.83	☐	(XS4)XS4
		26.00	759.60	☐	(XS4 LEW)XS4
		27.75	759.69	☐	(XS4)XS4
		28.83	759.53	☐	(XS4)XS4
		30.07	759.46	☐	(XS4)XS4
		30.74	759.33	☐	(XS4)XS4
		31.24	759.41	☐	(XS4 REW)XS
		32.02	760.32	☐	(XS4)XS4
		33.69	762.06	☐	(XS4)XS4
		34.40	762.24	☐	(XS4)XS4
		37.92	762.40	☐	(XS4)XS4
		43.83	762.59	☐	(XS4)XS4
		51.60	762.84	☐	(XS4)XS4
		59.26	763.20	☐	(XS4)XS4
		64.03	763.21	☐	(XS4)XS4
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 11, UT2 Reach 3



Bankfull Dimensions

5.7	x-section area (ft.sq.)
8.4	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
9.1	wetted parimeter (ft)
0.6	hyd radi (ft)
12.3	width-depth ratio
13.0	W flood prone area (ft)
1.5	entrenchment ratio
3.1	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID 11, UT2 Reach 3
longitudinal station ---
alignment straight line
feature

Bankfull Stage
elevation 755.83 ---

Low Bank Height
elevation 758.19

Flood Prone Area
width fpa 13 13.0

Channel Slope
percent slope ---

Flow Resistance
Manning's "n" ---
D'Arcy - Weisbach "f" ---

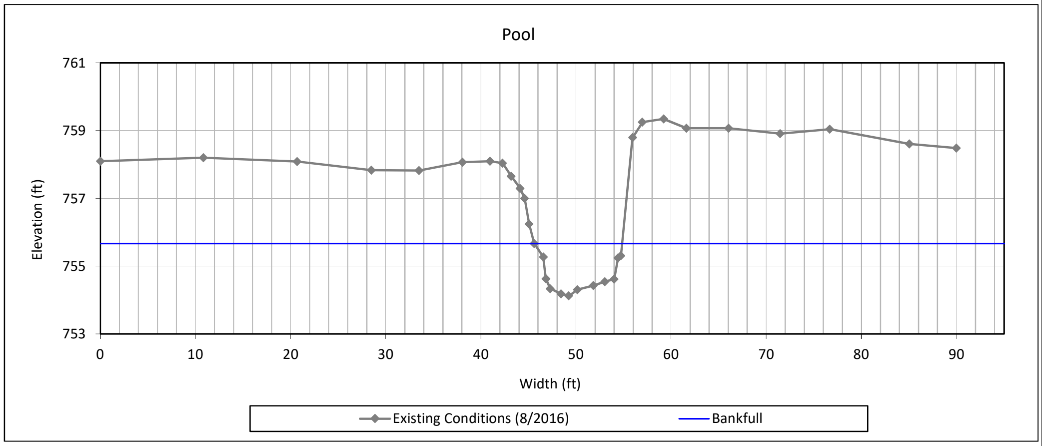
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	758.15	☐	(XS11 RIFFLE)
		13.14	758.24	☐	(XS11 RIFFLE)
		25.14	758.15	☐	(XS11 RIFFLE)
		34.39	757.89	☐	(XS11 RIFFLE)
		41.14	758.01	☐	(XS11 RIFFLE)
		43.58	758.22	☐	(XS11 RIFFLE)
		45.75	758.24	☐	(XS11)XS11
		48.20	758.19	☐	(XS11 LTB)XS
		48.71	757.43	☐	(XS11)XS11
		49.28	756.62	☐	(XS11)XS11
		49.99	755.86	☐	(XS11)XS11
		50.60	755.17	☐	(XS11)XS11
		51.45	754.82	☐	(XS11 LEW)XS
		51.66	754.73	☐	(XS11)XS11
		52.27	754.71	☐	(XS11)XS11
		53.06	754.69	☐	(XS11)XS11
		53.76	754.74	☐	(XS11)XS11
		54.79	754.77	☐	(XS11 REW)XS
		55.21	755.07	☐	(XS11)XS11
		55.82	755.17	☐	(XS11)XS11
		56.33	755.67	☐	(XS11 BKF)XS
		57.26	755.78	☐	(XS11)XS11
		58.52	755.83	☐	(XS11)XS11
		59.80	755.85	☐	(XS11)XS11
		61.03	756.31	☐	(XS11)XS11
		61.56	756.54	☐	(XS11)XS11
		62.18	757.06	☐	(XS11)XS11
		63.15	758.24	☐	(XS11)XS11
		64.35	759.04	☐	(XS11)XS11
		65.23	759.44	☐	(XS11 RTB)XS
		67.39	759.29	☐	(XS11)XS11
		69.74	759.07	☐	(XS11)XS11
		71.77	758.90	☐	(XS11)XS11
		74.91	758.86	☐	(XS11)XS11
		81.25	758.82	☐	(XS11)XS11
		85.74	758.82	☐	(XS11)XS11

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 12, UT2 Reach 3



Bankfull Dimensions	
10.2	x-section area (ft.sq.)
9.2	width (ft)
1.1	mean depth (ft)
1.5	max depth (ft)
10.5	wetted parimeter (ft)
1.0	hyd radi (ft)
8.4	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
2.6	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section

reference ID	12, UT2 Reac	
longitudinal station		---
alignment	straight line	
feature		

Bankfull Stage

elevation	755.67	---

Low Bank Height

elevation	758.1

Flood Prone Area

width fpa		---

Channel Slope

percent slope		---

Flow Resistance

Manning's "n"		---
D'Arcy - Weisbach "f"		---

For Stream Type:

Is braided channel?	☐	
Sinuosity, k		
D_{50}		---

Note:

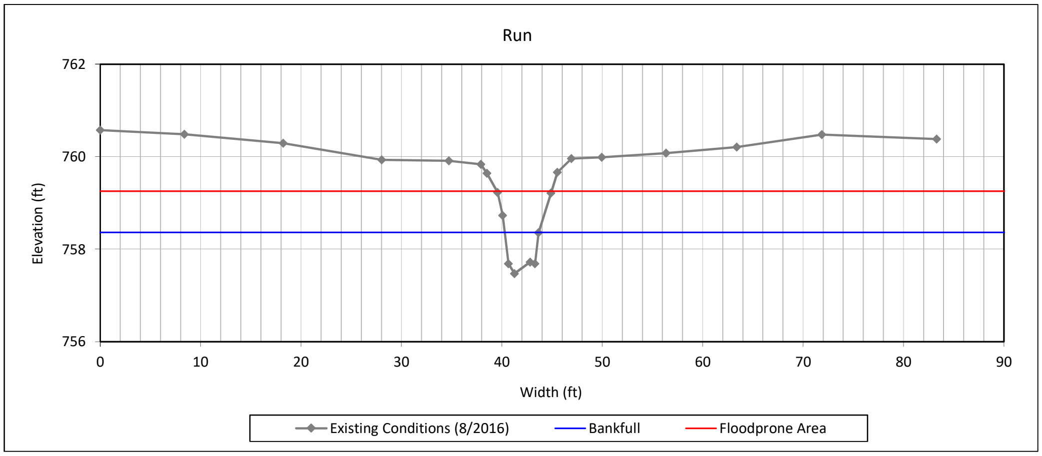
easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	758.09	☐	(XS12 POOL)X
		10.83	758.20	☐	(XS12)XS12
		20.69	758.09	☐	(XS12)XS12
		28.51	757.84	☐	(XS12)XS12
		33.50	757.82	☐	(XS12)XS12
		38.07	758.07	☐	(XS12)XS12
		40.98	758.10	☐	(XS12)XS12
		42.29	758.04	☐	(XS12 LTB)XS
		43.20	757.65	☐	(XS12)XS12
		44.14	757.30	☐	(XS12)XS12
		44.60	757.00	☐	(XS12)XS12
		45.08	756.24	☐	(XS12)XS12
		45.62	755.67	☐	(XS12 BKF)XS
		46.58	755.27	☐	(XS12)XS12
		46.85	754.63	☐	(XS12 LEW)X
		47.30	754.34	☐	(XS12)XS12
		48.43	754.18	☐	(XS12)XS12
		49.25	754.13	☐	(XS12)XS12
		50.14	754.31	☐	(XS12)XS12
		51.85	754.43	☐	(XS12)XS12
		53.03	754.54	☐	(XS12)XS12
		54.03	754.62	☐	(XS12 REW)X
		54.43	755.24	☐	(XS12 BKF)XS
		54.73	755.31	☐	(XS12)XS12
		55.96	758.79	☐	(XS12)XS12
		56.99	759.25	☐	(XS12 RTB)XS
		59.22	759.35	☐	(XS12)XS12
		61.63	759.07	☐	(XS12)XS12
		66.05	759.07	☐	(XS12)XS12
		71.47	758.91	☐	(XS12)XS12
		76.69	759.04	☐	(XS12)XS12
		85.05	758.61	☐	(XS12)XS12
		90.01	758.49	☐	(XS12)XS12

Existing Conditions Geomorphic Parameters						
Parameter	**Notation**	**Units**	**UT2A**		**UT2B**	
			min	**max**	**min**	**max**
stream type			G5		G5	
drainage area	DA	sq mi	0.02		0.04	
bankfull cross-sectional area	A_{bkf}	SF	2.2	2.3	1.3	1.4
avg velocity during bankfull event	v_{bkf}	fps	1.6	1.8	1.7	1.8
width at bankfull	w_{bkf}	feet	3.4	4.7	3.9	4.1
maximum depth at bankfull	d_{max}	feet	0.9		0.5	0.6
mean depth at bankfull	d_{bkf}	feet	0.5	0.7	0.3	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		5.1	9.5	11.4	13.0
low bank height		feet	2.4	2.7	3.3	4.0
bank height ratio	BHR		2.7	3.1	6.5	7.2
floodprone area width	w_{fpa}	feet	5.4	11.4	5.1	6.4
entrenchment ratio	ER		1.6	2.4	1.2	1.6
max pool depth at bankfull	d_{pool}	feet	N/A		N/A	
pool depth ratio	d_{pool}/d_{bkf}		N/A		N/A	
pool width at bankfull	w_{pool}	feet	N/A		N/A	
pool width ratio	w_{pool}/w_{bkf}		N/A		N/A	
Bkf pool cross-sectional area	A_{pool}	SF	N/A		N/A	
pool area ratio	A_{pool}/A_{bkf}		N/A		N/A	
pool-pool pacing	p-p	feet	N/A		N/A	
pool-pool spacing ratio	$p\text{-}p/W_{bkf}$		N/A		N/A	
valley slope	S_{valley}	feet/foot	0.0028		0.0027	
channel slope	$S_{channel}$	feet/foot	0.0052		0.0107	
sinuosity	K		1.00		1.00	
belt width	w_{blt}	feet	N/A		N/A	
meander width ratio	w_{blt}/w_{bkf}		N/A		N/A	
meander length	L_m	feet	N/A		N/A	
meander length ratio	L_m/w_{bkf}		N/A		N/A	
linear wavelength	LW		N/A		N/A	
linear wavelength ratio	LW/w_{bkf}		N/A		N/A	
radius of curvature	R_c	feet	N/A		N/A	
radius of curvature ratio	R_c/ w_{bkf}		N/A		N/A	

N/A - Channelized stream channel with limited pattern and bed form profile variability.

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 9, UT2A



Bankfull Dimensions	
2.2	x-section area (ft.sq.)
3.4	width (ft)
0.7	mean depth (ft)
0.9	max depth (ft)
4.3	wetted parimeter (ft)
0.5	hyd radi (ft)
5.1	width-depth ratio
5.4	W flood prone area (ft)
1.6	entrenchment ratio
2.7	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 9, UT2A
longitudinal station: ---
alignment: straight line
feature:

Bankfull Stage
elevation: 758.36 ---

Low Bank Height
elevation: 759.91

Flood Prone Area
width fpa: 5.4 5.4

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

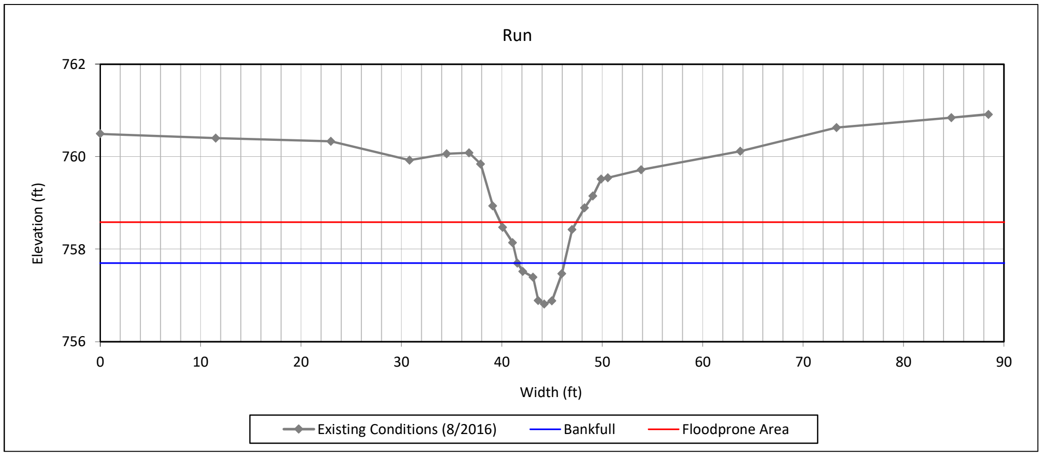
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	760.58	☐	(XS9 Run)XS9
		8.40	760.49	☐	(XS9)XS9
		18.24	760.29	☐	(XS9)XS9
		28.06	759.93	☐	(XS9)XS9
		34.75	759.91	☐	(XS9)XS9
		37.92	759.84	☐	(XS9 LTB)XS9
		38.54	759.64	☐	(XS9)XS9
		39.57	759.22	☐	(XS9)XS9
		40.08	758.73	☐	(XS9)XS9
		40.65	757.68	☐	(XS9 LEW)XS9
		41.26	757.47	☐	(XS9)XS9
		42.84	757.72	☐	(XS9)XS9
		43.32	757.69	☐	(XS9 REW)XS9
		43.66	758.36	☐	(XS9)XS9
		44.90	759.21	☐	(XS9)XS9
		45.55	759.66	☐	(XS9 RTB)XS9
		46.93	759.96	☐	(XS9)XS9
		49.98	759.98	☐	(XS9)XS9
		56.38	760.07	☐	(XS9)XS9
		63.40	760.21	☐	(XS9)XS9
		71.89	760.48	☐	(XS9)XS9
		83.31	760.38	☐	(XS9)XS9

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 10, UT2A



Bankfull Dimensions	
2.3	x-section area (ft.sq.)
4.7	width (ft)
0.5	mean depth (ft)
0.9	max depth (ft)
5.2	wetted parimeter (ft)
0.4	hyd radi (ft)
9.5	width-depth ratio
11.4	W flood prone area (ft)
2.4	entrenchment ratio
3.1	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 10, UT2A
longitudinal station: ---
alignment: straight line
feature

Bankfull Stage
elevation: 757.7 ---

Low Bank Height
elevation: 759.55

Flood Prone Area
width fpa: 11.4 7.6

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

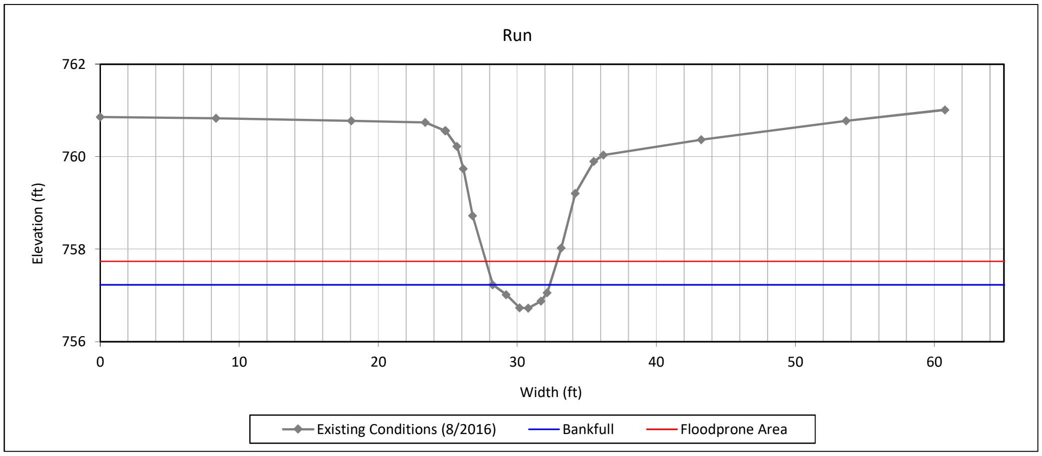
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	760.49	☐	(XS10 RUN)X
		11.51	760.40	☐	(XS10)XS10
		22.99	760.33	☐	(XS10)XS10
		30.81	759.93	☐	(XS10)XS10
		34.52	760.06	☐	(XS10)XS10
		36.75	760.09	☐	(XS10 LTB)XS
		37.90	759.84	☐	(XS10)XS10
		39.10	758.94	☐	(XS10)XS10
		40.10	758.47	☐	(XS10)XS10
		41.09	758.14	☐	(XS10)XS10
		41.57	757.70	☐	(XS10)XS10
		42.11	757.52	☐	(XS10 LEW)X
		43.13	757.39	☐	(XS10)XS10
		43.64	756.89	☐	(XS10)XS10
		44.24	756.82	☐	(XS10)XS10
		44.99	756.88	☐	(XS10)XS10
		45.97	757.47	☐	(XS10 REW)X
		47.01	758.43	☐	(XS10)XS10
		48.24	758.89	☐	(XS10)XS10
		49.06	759.15	☐	(XS10)XS10
		49.89	759.52	☐	(XS10)XS10
		50.57	759.55	☐	(XS10 RTB)XS
		53.88	759.72	☐	(XS10)XS10
		63.77	760.12	☐	(XS10)XS10
		73.36	760.63	☐	(XS10)XS10
		84.79	760.84	☐	(XS10)XS10
		88.47	760.92	☐	(XS10)XS10
				☐	
				☐	
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 13, UT2B



Bankfull Dimensions	
1.3	x-section area (ft.sq.)
4.1	width (ft)
0.3	mean depth (ft)
0.5	max depth (ft)
4.3	wetted parimeter (ft)
0.3	hyd radi (ft)
13.0	width-depth ratio
5.1	W flood prone area (ft)
1.2	entrenchment ratio
6.5	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 13, UT2B
longitudinal station: ---
alignment: straight line
feature:

Bankfull Stage
elevation: 757.23 ---

Low Bank Height
elevation: 760.03

Flood Prone Area
width fpa: 5.1 5.1

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

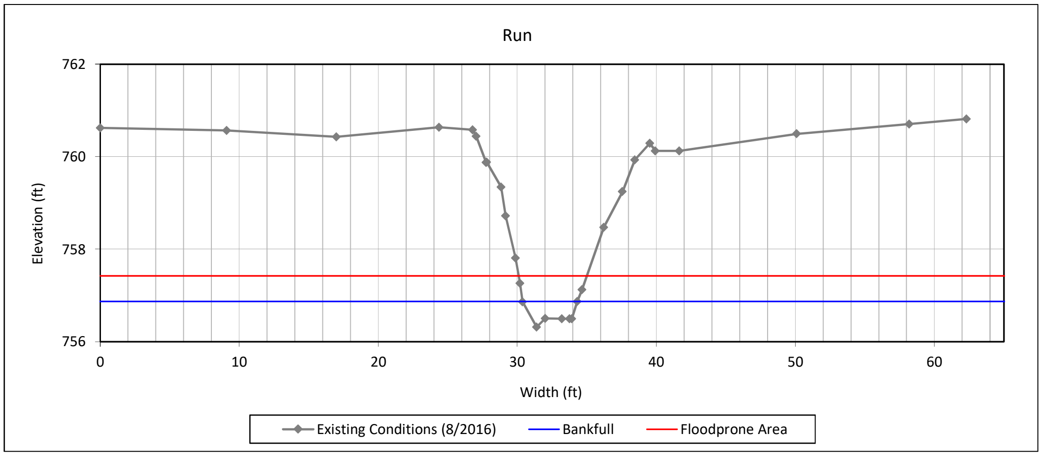
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	760.86	☐	(XS13 RUN)X
		8.33	760.83	☐	(XS13)XS13
		18.07	760.78	☐	(XS13)XS13
		23.39	760.74	☐	(XS13)XS13
		24.81	760.56	☐	(XS13 LTB)XS
		24.85	760.56	☐	(XS13)XS13
		25.66	760.22	☐	(XS13)XS13
		26.12	759.74	☐	(XS13)XS13
		26.79	758.72	☐	(XS13)XS13
		28.24	757.23	☐	(XS13)XS13
		29.20	757.01	☐	(XS13)XS13
		30.18	756.73	☐	(XS13)XS13
		30.79	756.72	☐	(XS13)XS13
		31.71	756.88	☐	(XS13)XS13
		32.16	757.06	☐	(XS13)XS13
		33.17	758.03	☐	(XS13)XS13
		34.18	759.20	☐	(XS13)XS13
		35.52	759.90	☐	(XS13)XS13
		36.21	760.03	☐	(XS13 RTB)XS
		43.24	760.37	☐	(XS13)XS13
		53.67	760.78	☐	(XS13)XS13
		60.77	761.01	☐	(XS13)XS13
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 14, UT2B



Bankfull Dimensions

1.4	x-section area (ft.sq.)
3.9	width (ft)
0.3	mean depth (ft)
0.6	max depth (ft)
4.3	wetted parimeter (ft)
0.3	hyd radi (ft)
11.4	width-depth ratio
6.4	W flood prone area (ft)
1.6	entrenchment ratio
7.2	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 14, UT2B
longitudinal station: ---
alignment: straight line
feature

Bankfull Stage
elevation: 756.87 ---

Low Bank Height
elevation: 760.29

Flood Prone Area
width fpa: 6.4 4.9

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

For Stream Type:
Is braided channel?
Sinuosity, k
D_{50} ---

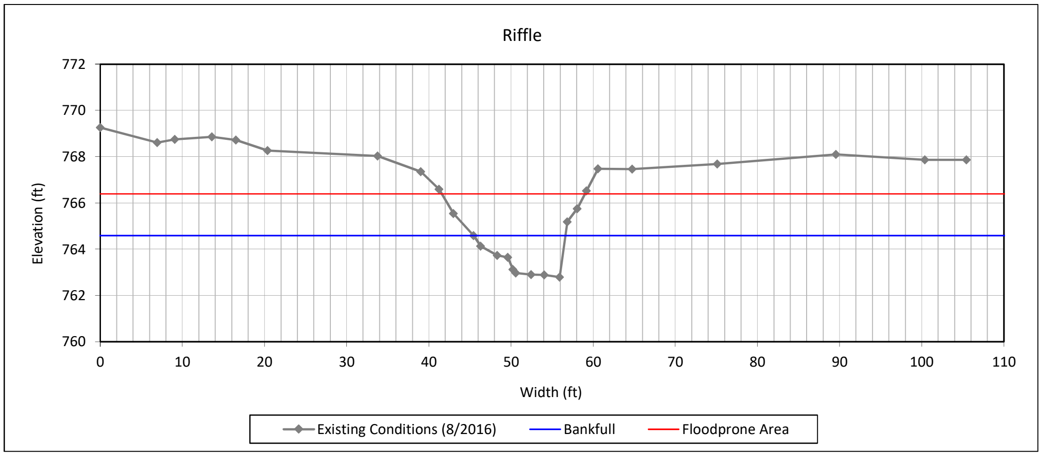
Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	760.62		(XS14 POOL)X
		9.10	760.56		(XS14)XS14
		16.99	760.43		(XS14)XS14
		24.37	760.64		(XS14)XS14
		26.78	760.58		(XS14 LTB)XS
		27.05	760.44		(XS14)XS14
		27.75	759.88		(XS14)XS14
		27.81	759.88		(XS14)XS14
		28.83	759.34		(XS14)XS14
		29.17	758.72		(XS14)XS14
		29.88	757.81		(XS14)XS14
		30.19	757.27		(XS14)XS14
		30.38	756.86		(XS14)XS14
		31.39	756.32		(XS14)XS14
		32.02	756.50		(XS14)XS14
		33.22	756.49		(XS14)XS14
		33.76	756.50		(XS14)XS14
		33.92	756.49		(XS14)XS14
		34.32	756.87		(XS14)XS14
		34.67	757.13		(XS14)XS14
		36.23	758.48		(XS14)XS14
		37.57	759.25		(XS14)XS14
		38.45	759.93		(XS14)XS14
		39.53	760.29		(XS14)XS14
		39.94	760.13		(XS14 RTB)XS
		41.66	760.12		(XS14)XS14
		50.09	760.49		(XS14)XS14
		58.20	760.71		(XS14)XS14
		62.31	760.82		(XS14)XS14

Existing Conditions Geomorphic Parameters						
Parameter	Notation	Units	UT3 Reach 1		UT3 Reach 2	
			min	max	min	max
stream type			G4		G5	
drainage area	DA	sq mi	0.59		0.65	
bankfull cross-sectional area	A_{bkf}	SF	13.7		10.2	
avg velocity during bankfull event	v_{bkf}	fps	4.0		2.0	
width at bankfull	w_{bkf}	feet	11.2		10.0	
maximum depth at bankfull	d_{max}	feet	1.8		2.1	
mean depth at bankfull	d_{bkf}	feet	1.2		1.0	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		9.1		9.9	
low bank height		feet	4.7		3.0	
bank height ratio	BHR		2.6		1.4	
floodprone area width	w_{fpa}	feet	17.4		>150	
entrenchment ratio	ER		1.3		>14.9	
max pool depth at bankfull	d_{pool}	feet	1.9		2.7	
pool depth ratio	d_{pool}/d_{bkf}		1.6		2.7	
pool width at bankfull	w_{pool}	feet	7.4		6.7	
pool width ratio	w_{pool}/w_{bkf}		0.7		0.7	
Bkf pool cross-sectional area	A_{pool}	SF	10.2		13.9	
pool area ratio	A_{pool}/A_{bkf}		0.7		1.4	
pool-pool pacing	p-p	feet	12	87	48	185
pool-pool spacing ratio	$p\text{-}p/W_{bkf}$		1.1	7.8	4.8	18.5
valley slope	S_{valley}	feet/foot	0.0145		0.0050	
channel slope	$S_{channel}$	feet/foot	0.0107		0.0034	
sinuosity	K		1.06		1.01	
belt width	w_{blt}	feet	4	10	N/A	
meander width ratio	w_{blt}/w_{bkf}		0.4	0.9	N/A	
meander length	L_m	feet	15	28	N/A	
meander length ratio	L_m/w_{bkf}		1.3	2.5	N/A	
linear wavelength	LW		22	61	N/A	
linear wavelength ratio	LW/w_{bkf}		2.0	5.4	N/A	
radius of curvature	R_c	feet	4	8	N/A	
radius of curvature ratio	$R_c/\ w_{bkf}$		0.4	0.7	N/A	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 5, UT3 Reach 1



Bankfull Dimensions	
13.7	x-section area (ft.sq.)
11.2	width (ft)
1.2	mean depth (ft)
1.8	max depth (ft)
12.8	wetted parimeter (ft)
1.1	hyd radi (ft)
9.1	width-depth ratio
17.4	W flood prone area (ft)
1.6	entrenchment ratio
2.6	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section

reference ID	5, UT3 Reach 1	
longitudinal station		---
alignment	straight line	
feature		

Bankfull Stage

elevation	764.59

Low Bank Height

elevation	767.48

Flood Prone Area

width fpa	17.4	17.4

Channel Slope

percent slope		---

Flow Resistance

Manning's "n"		---
D'Arcy - Weisbach "f"		---

For Stream Type:

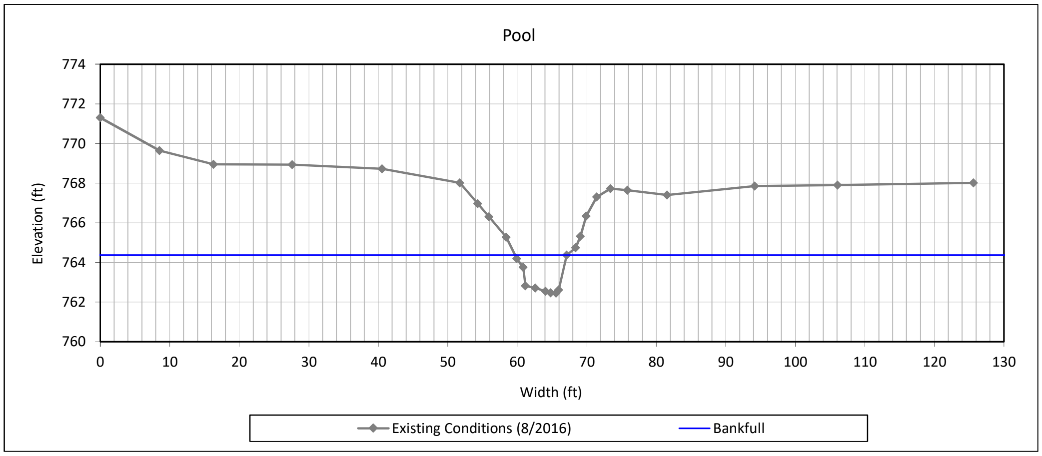
Is braided channel?	☐	
Sinuosity, k		
D_{50}		---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	769.25	☐	(XS5 RIFFLE)X
		6.93	768.61	☐	(XS5)XS5
		9.08	768.75	☐	(XS5)XS5
		13.61	768.86	☐	(XS5)XS5
		16.54	768.72	☐	(XS5)XS5
		20.37	768.27	☐	(XS5)XS5
		33.78	768.03	☐	(XS5)XS5
		39.04	767.34	☐	(XS5 LTB)XS5
		41.26	766.60	☐	(XS5)XS5
		43.01	765.54	☐	(XS5)XS5
		45.47	764.59	☐	(XS5)XS5
		46.32	764.13	☐	(XS5 BKF)XS5
		48.34	763.72	☐	(XS5)XS5
		49.61	763.64	☐	(XS5)XS5
		50.24	763.12	☐	(XS5)XS5
		50.60	762.96	☐	(XS5 LEW)XS
		52.47	762.90	☐	(XS5)XS5
		54.07	762.89	☐	(XS5)XS5
		55.92	762.79	☐	(XS5 REW)XS
		56.88	765.18	☐	(XS5)XS5
		58.07	765.75	☐	(XS5)XS5
		59.21	766.52	☐	(XS5)XS5
		60.60	767.48	☐	(XS5 RTB)XS5
		64.76	767.47	☐	(XS5)XS5
		75.14	767.68	☐	(XS5)XS5
		89.59	768.10	☐	(XS5)XS5
		100.38	767.86	☐	(XS5)XS5
		105.47	767.86	☐	(XS5)XS5
				☐	
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 6, UT3 Reach 1



Bankfull Dimensions

10.2	x-section area (ft.sq.)
7.4	width (ft)
1.4	mean depth (ft)
1.9	max depth (ft)
9.3	wetted parimeter (ft)
1.1	hyd radi (ft)
5.5	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
2.7	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section
reference ID: 6, UT3 Reach 1
longitudinal station: ---
alignment: straight line
feature:

Bankfull Stage
elevation: 764.369 ---

Low Bank Height
elevation: 767.72

Flood Prone Area
width fpa: ---

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

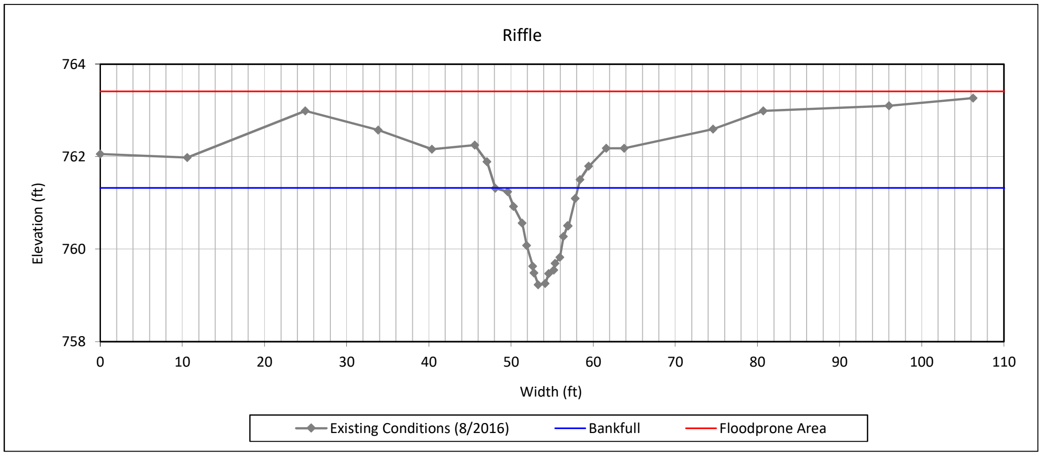
For Stream Type:
Is braided channel? ☐
Sinuosity, k
D_{50} ---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	771.30	☐	(XS6 POOL)X
		8.55	769.64	☐	(XS6)XS6
		16.33	768.95	☐	(XS6)XS6
		27.62	768.93	☐	(XS6)XS6
		40.55	768.73	☐	(XS6)XS6
		51.75	768.01	☐	(XS6 LTB)XS6
		54.31	766.97	☐	(XS6)XS6
		55.92	766.29	☐	(XS6)XS6
		58.41	765.27	☐	(XS6)XS6
		59.92	764.18	☐	(XS6)XS6
		60.87	763.75	☐	(XS6)XS6
		61.19	762.81	☐	(XS6 LEW)XS
		62.61	762.70	☐	(XS6)XS6
		64.08	762.54	☐	(XS6)XS6
		64.83	762.45	☐	(XS6)XS6
		65.57	762.45	☐	(XS6)XS6
		65.97	762.61	☐	(XS6 REW)XS
		67.11	764.37	☐	(XS6 BKF)XS6
		68.38	764.74	☐	(XS6)XS6
		69.09	765.32	☐	(XS6)XS6
		69.91	766.34	☐	(XS6)XS6
		71.43	767.30	☐	(XS6 RTB)XS6
		73.40	767.72	☐	(XS6)XS6
		75.87	767.64	☐	(XS6)XS6
		81.55	767.40	☐	(XS6)XS6
		94.17	767.85	☐	(XS6)XS6
		106.10	767.90	☐	(XS6)XS6
		125.64	768.02	☐	(XS6)XS6
				☐	
				☐	
				☐	

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

Cross Section 7, UT3 Reach 2



Bankfull Dimensions	
10.2	x-section area (ft.sq.)
10.0	width (ft)
1.0	mean depth (ft)
2.1	max depth (ft)
11.2	wetted parimeter (ft)
0.9	hyd radi (ft)
9.9	width-depth ratio
150.0	W flood prone area (ft)
14.9	entrenchment ratio
1.4	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Upstream

Cross Section
reference ID: 7, UT3 Reach 2
longitudinal station: ---
alignment: straight line
feature

Bankfull Stage
elevation: 761.32 ---

Low Bank Height
elevation: 762.18

Flood Prone Area
width fpa: 150 106.3

Channel Slope
percent slope: ---

Flow Resistance
Manning's "n": ---
D'Arcy - Weisbach "f": ---

For Stream Type:
Is braided channel?
Sinuosity, k
D_{50} ---

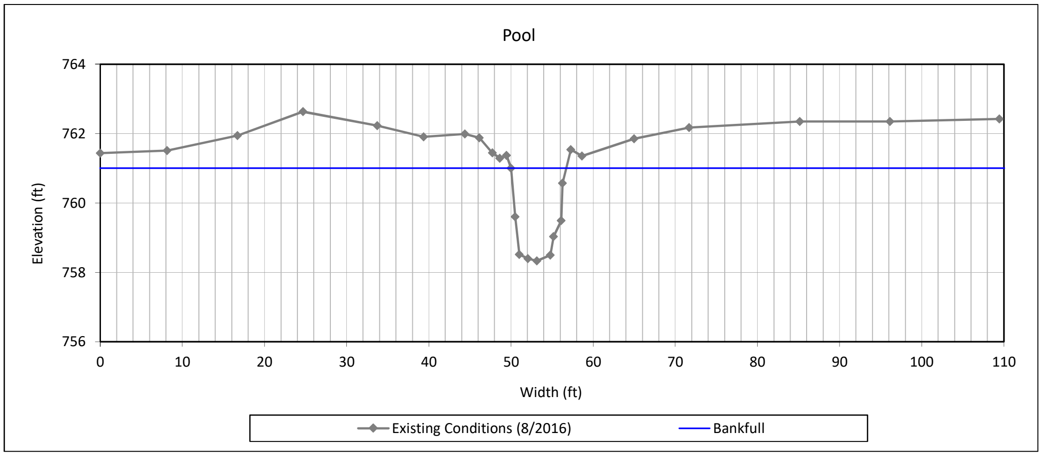
Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	762.06		(XS7 RIFFLE)X
		10.59	761.98		(XS7 RIFFLE)X
		24.96	762.99		(XS7 RIFFLE)X
		33.86	762.57		(XS7 RIFFLE)X
		40.38	762.16		(XS7 RIFFLE)X
		45.60	762.25		(XS7 LTB)XS7
		47.09	761.89		(XS7)XS7
		48.12	761.32		(XS7)XS7
		49.61	761.24		(XS7)XS7
		50.32	760.92		(XS7)XS7
		51.38	760.56		(XS7 BKF)XS7
		51.92	760.08		(XS7)XS7
		52.65	759.63		(XS7)XS7
		52.80	759.48		(XS7 LEW)XS7
		53.31	759.23		(XS7)XS7
		54.16	759.26		(XS7)XS7
		54.61	759.47		(XS7)XS7
		55.23	759.55		(XS7)XS7
		55.40	759.69		(XS7 REW)XS
		55.95	759.82		(XS7)XS7
		56.41	760.27		(XS7)XS7
		56.92	760.51		(XS7 BKF)XS7
		57.00	760.50		(XS7)XS7
		57.82	761.10		(XS7)XS7
		58.43	761.50		(XS7)XS7
		59.49	761.79		(XS7)XS7
		61.61	762.18		(XS7 RTB)XS7
		63.79	762.18		(XS7)XS7
		74.62	762.59		(XS7)XS7
		80.74	762.99		(XS7)XS7
		96.02	763.10		(XS7)XS7
		106.26	763.27		(XS7)XS7

Cross Section Plots
Lone Hickory Mitigation Site (DMS Project No. 97135)
Existing Conditions

761.44

Cross Section 8, UT3 Reach 2



Bankfull Dimensions

13.9	x-section area (ft.sq.)
6.7	width (ft)
2.1	mean depth (ft)
2.7	max depth (ft)
9.9	wetted parimeter (ft)
1.4	hyd radi (ft)
3.3	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.4	low bank height ratio

Survey Date: 8/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section

reference ID	8, UT3 Reach 2	
longitudinal station		---
alignment	straight line	
feature		

Bankfull Stage

elevation	761	---

Low Bank Height

elevation	762.17

Flood Prone Area

width fpa		---

Channel Slope

percent slope		---

Flow Resistance

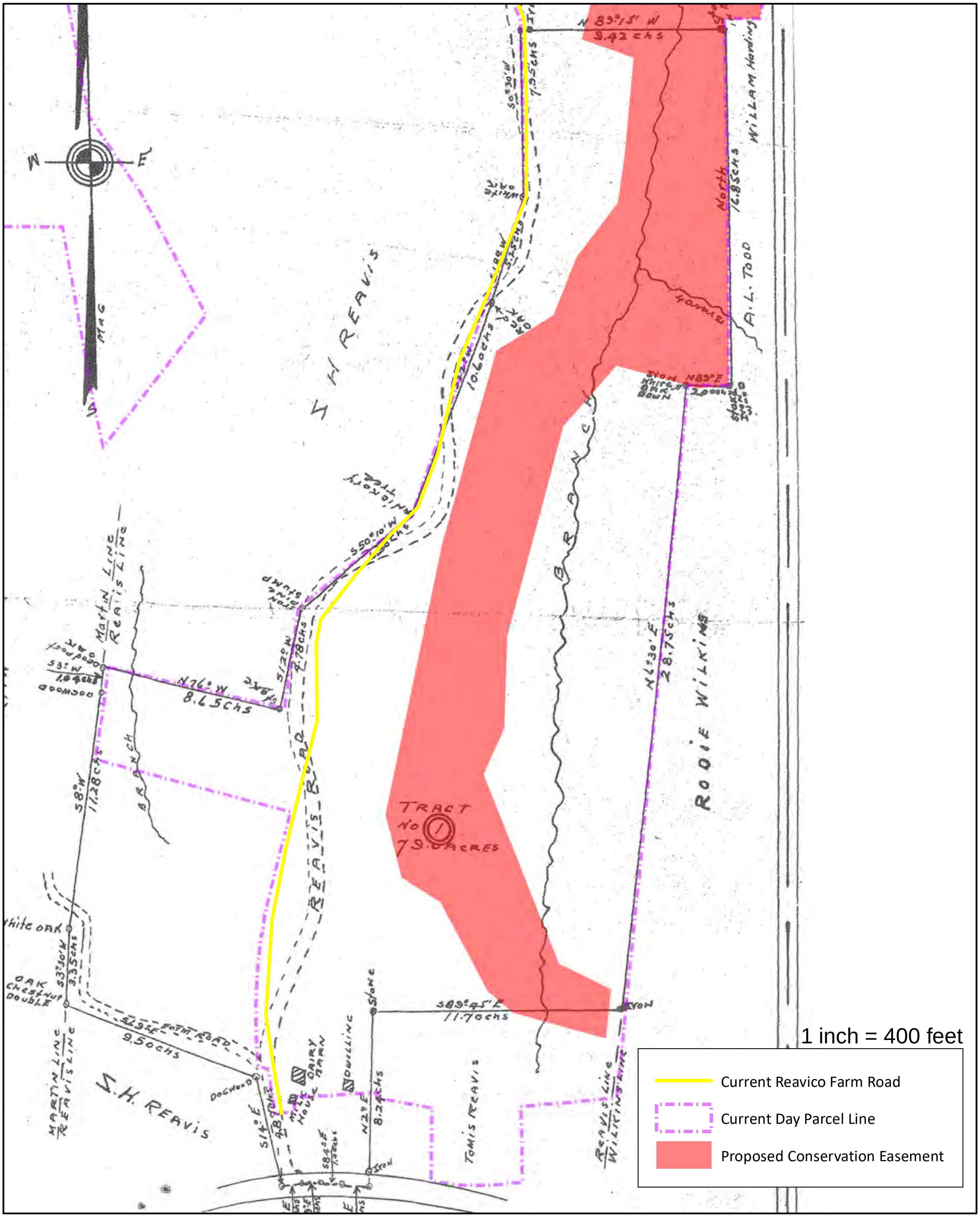
Manning's "n"		---
D'Arcy - Weisbach "f"		---

For Stream Type:

Is braided channel?	☐	
Sinuosity, k		
D_{50}		---

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0.00	761.44	☐	(XS8 POOL)XS
		8.15	761.51	☐	(XS8)XS8
		16.73	761.95	☐	(XS8)XS8
		24.70	762.63	☐	(XS8)XS8
		33.75	762.23	☐	(XS8)XS8
		39.39	761.90	☐	(XS8)XS8
		44.42	761.99	☐	(XS8)XS8
		46.17	761.88	☐	(XS8 LTB)XS8
		47.77	761.44	☐	(XS8)XS8
		48.65	761.29	☐	(XS8)XS8
		49.46	761.37	☐	(XS8)XS8
		50.01	761.00	☐	(XS8 BKF)XS8
		50.50	759.60	☐	(XS8 LEW)XS
		51.03	758.52	☐	(XS8)XS8
		52.09	758.40	☐	(XS8)XS8
		53.17	758.33	☐	(XS8)XS8
		54.79	758.50	☐	(XS8)XS8
		55.18	759.03	☐	(XS8)XS8
		56.12	759.49	☐	(XS8 REW)XS
		56.27	760.57	☐	(XS8)XS8
		57.30	761.53	☐	(XS8 RTB)XS8
		58.67	761.35	☐	(XS8)XS8
		64.99	761.85	☐	(XS8)XS8
		71.68	762.17	☐	(XS8)XS8
		85.18	762.35	☐	(XS8)XS8
		96.17	762.35	☐	(XS8)XS8
		109.47	762.42	☐	(XS8)XS8
				☐	
				☐	
				☐	
				☐	

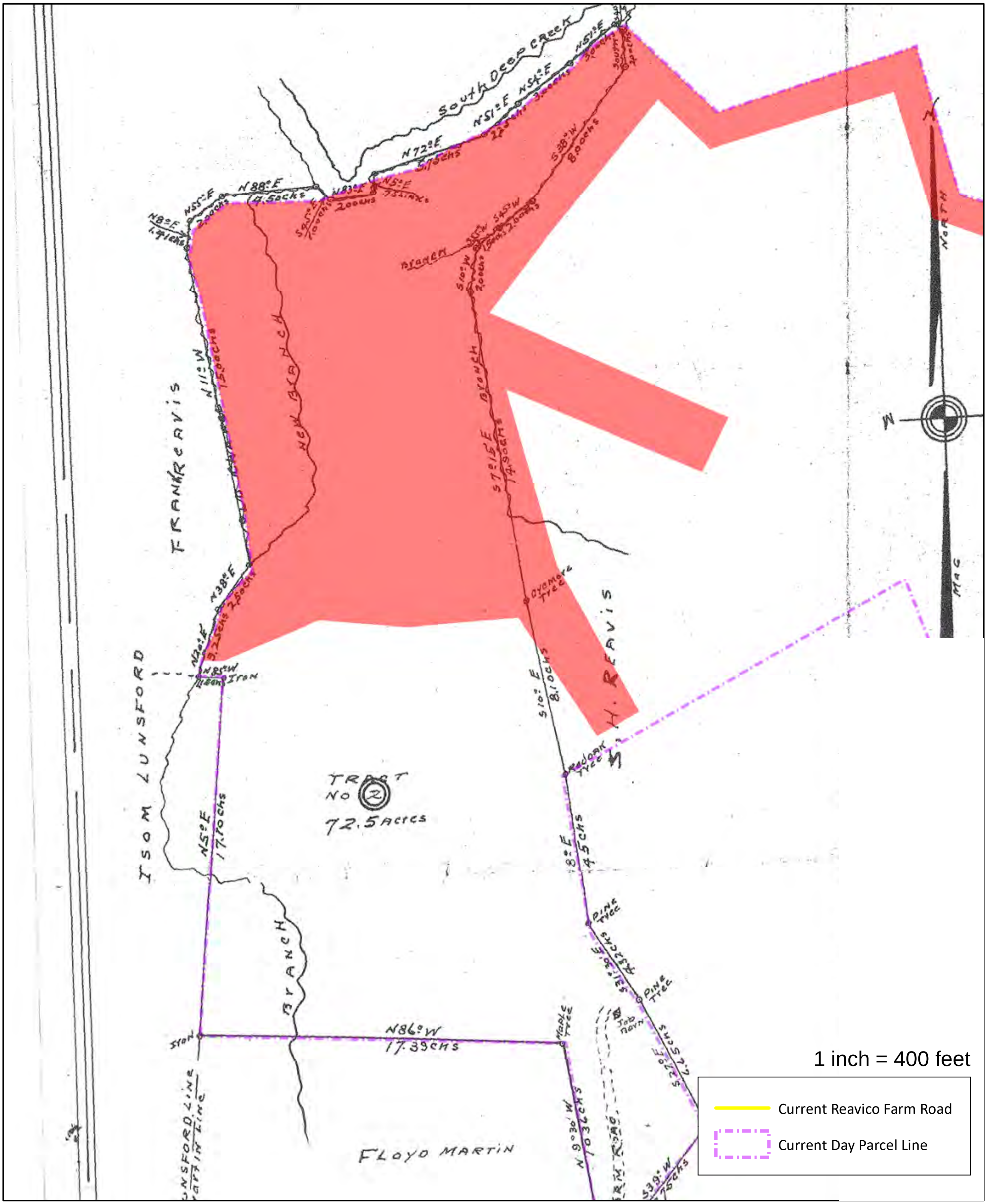


0 400 800 Feet

Reavico Farms Property 1957 survey (A)
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

WILDLANDS ENGINEERING



0 400 800 Feet

Reavico Farms Property 1957 survey (B)
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC


INQUIRY #: 4502666.1
YEAR: 1963
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 1963
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 1982
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 1982
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 1982
= 500'
N
EDR

INQUIRY #: 4502666.1
YEAR: 1993
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 1993
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 1998
= 750'
N
EDR


INQUIRY #: 4502666.1
YEAR: 2005
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 2005
= 500'
N


INQUIRY #: 4502666.1
YEAR: 2006
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 2006
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 2008
= 500'
N


INQUIRY #: 4502666.1
YEAR: 2008
= 500'
N


INQUIRY #: 4502666.1
YEAR: 2009
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 2009
N
EDR
= 500'


INQUIRY #: 4502666.1
YEAR: 2010
= 500'
N
EDR


INQUIRY #: 4502666.1
YEAR: 2010
= 500'
N

REFERENCE REACHES

Description	Notation	Units	UT to Kelly Branch		Pilot Mountain Trib		Lone Hickory UT3 - Onsite Reference		UT to South Crowders		UT to S. Fork Catawba - Vile Preserve		UT to Lyle Creek		Deep Creek Mitigation		Cooleemee Plantation	
			min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
stream type			A4		B4		C4		E4		E5		C5		C5		C5	
drainage area	DA	sq mi	0.08		0.27		0.17		0.22		0.94		0.25		0.67		0.68	
bankfull discharge	Q_{bkf}	cfs	19		32		12		22		54		18		41		26	
bankfull cross-sectional area	A_{bkf}	SF	4.5		6.0		3.6		6.4	8.7	4.5	5.3	3.5	4.1	17.1		13.6	14.9
average bankfull velocity	v_{bkf}	fps	4.4		5.3		3.2		2.9		11.0		4.7		2.4		1.8	
width at bankfull	w_{bkf}	feet	6.4		8.6		6.7		6.1	8.4	6.1	6.2	7.0	8.6	12.9		14.7	18.1
maximum depth at bankfull	d_{max}	feet	0.9		1.0		0.8		1.4		1.3	1.4	1.0	1.1	2.3		1.6	
mean depth at bankfull	d_{bkf}	feet	0.7		0.7		0.5		1.0	1.1	0.7	0.8	0.5		1.4		0.8	1.0
bankfull width to depth ratio	w_{bkf}/d_{bkf}		9.2		12.5		13.4		5.8	8.0	7.4	8.3	14.9	18.3	9.6		14.6	24.1
depth ratio	d_{max}/d_{bkf}		1.2		1.4		1.6		1.3	1.4	1.6	2.0	2.1	2.3	1.6		1.6	2.0
low bank height			0.9		1.0		0.8		2.0	2.9	1.4						1.6	1.8
bank height ratio	BHR		1.0		1.0		1.0		1.4	2.1	1.0		1.0		0.0		1.0	
floodprone area width	w_{fpa}	feet	9.1		13.3		20		26	31	200+		45	49	135		140+	
entrenchment ratio	ER		1.4		1.5		3.0		3.7	4.3	30+		5.7	6.4	10.5		8.8+	
sinuosity	K		1.2		1.05		1.32		2.2		1.03		1.1		1.6		1.1	
belt width	w_{blt}	feet	17.9	34.2	NA		12	31	81		NA		21		45	71	22	30
meander width ratio	w_{blt}/w_{bkf}		2.8	5.3	NA	NA	1.8	4.6	9.6	13.3	NA	NA	2.4	3.0	3.5	5.5	1.3	1.8
meander length	L_m	feet	27	94	NA	NA	55		45	72	NA	NA	39	44	95	130	58	70
meander length ratio	L_m/w_{bkf}		4.2	14.7	NA	NA	8.2		7.4	8.6	NA	NA	5.1	7.0	7.4	10.1	3.5	4.3
radius of curvature	R_c	feet	8	26	NA	NA			9	20	NA	NA	19	32	18	33	14	38
radius of curvature ratio	R_c/ w_{bkf}		1.2	4.1	NA	NA			1.5	2.4	NA	NA	2.7	3.7	1.4	2.6	0.9	2.3
valley slope	S_{valley}	feet/ foot	0.0491		0.0404		0.0194		0.0257		0.0070		0.0078		0.0068		0.0034	
channel slope	$S_{channel}$	feet/ foot	0.03 - 0.065		0.0378		0.0185		0.0091		0.0068		0.0057		0.0028		0.0027	
riffle slope	S_{riffle}	feet/ foot	N/A		0.0150	0.1200	0.0229	0.0615	0.0202	0.0664	0.0260		0.0055	0.0597	0.0019	0.0090	0.0027	0.0130
riffle slope ratio	$S_{riffle}/S_{channel}$		N/A		0.4	3.2	1.2	3.3	2.2	7.3	3.8		1.0	10.5	0.7	3.2	1.0	4.8
pool slope	S_{pool}	feet/ foot	N/A		0.000	0.011	0.001	0.009	0.000	0.006	0.001		0.000	0.001	0.000	0.003	0.000	0.013
pool slope ratio	$S_{pool}/S_{channel}$		N/A		0.00	0.30	0.06	0.49	0.03	0.61	0.14		0.00	0.23	0.00	0.89	0.00	4.81
pool-to-pool spacing	L_{p-p}	feet	N/A		7	52	13	77	28	63	45		15	28	29	103	19	35
pool spacing ratio	L_{p-p}/w_{bkf}		N/A		0.8	6.0	1.9	11.5	3.9	8.7	7.3		1.9	3.6	2.2	8.0	1.2	2.1
maximum pool depth at bankfull	d_{pool}	feet	N/A		1.6		2.0		1.3	3.0	1.4		1.3		3.2		2.0	
pool depth ratio	d_{pool}/d_{bkf}		N/A		2.3		4.0		1.3	3.0	2.0		2.9		2.3		2.2	
pool width at bankfull	w_{pool}	feet	N/A		8.0		10.5		8.0		4.5		6.1		19.6		13.3	
pool width ratio	w_{pool}/w_{bkf}		N/A		0.9		1.6		1.3		0.7		0.8		1.5		0.8	
pool bankfull cross-sectional area	A_{pool}	SF	N/A		9.6		9.5		9.2		4.5		4.0		19.6		14.8	
pool area ratio	A_{pool}/A_{bkf}		N/A		1.6		2.6		1.1	1.4	1.0		1.0	1.1	1.1		1.0	
Particle Size Distribution from			Riffle Count		Reachwide Count		Reachwide Count		Reachwide Count				Reachwide Count		Reachwide Count			
		d_{50}	medium gravel		Coarse Gravel		Gravel		Coarse Gravel				Very Coarse Sand		Fine Sand			
	d_{16}	mm	0.25		silt clay		0.2		0.8				-		Silt/Clay			
	d_{35}	mm	3.2		5.6		1.5		12.1				0.07		0.2			
	d_{50}	mm	9.4		20.1		16.8		19.7				0.17		0.2			
	d_{84}	mm	45		128.0		69.7		49.5				0.54		1.1			
	d_{95}	mm	140		322.5		115.7		75.9				4.0		8.9			
	d_{99}	mm			>2048		180.0		180.0				8.0		22.6			

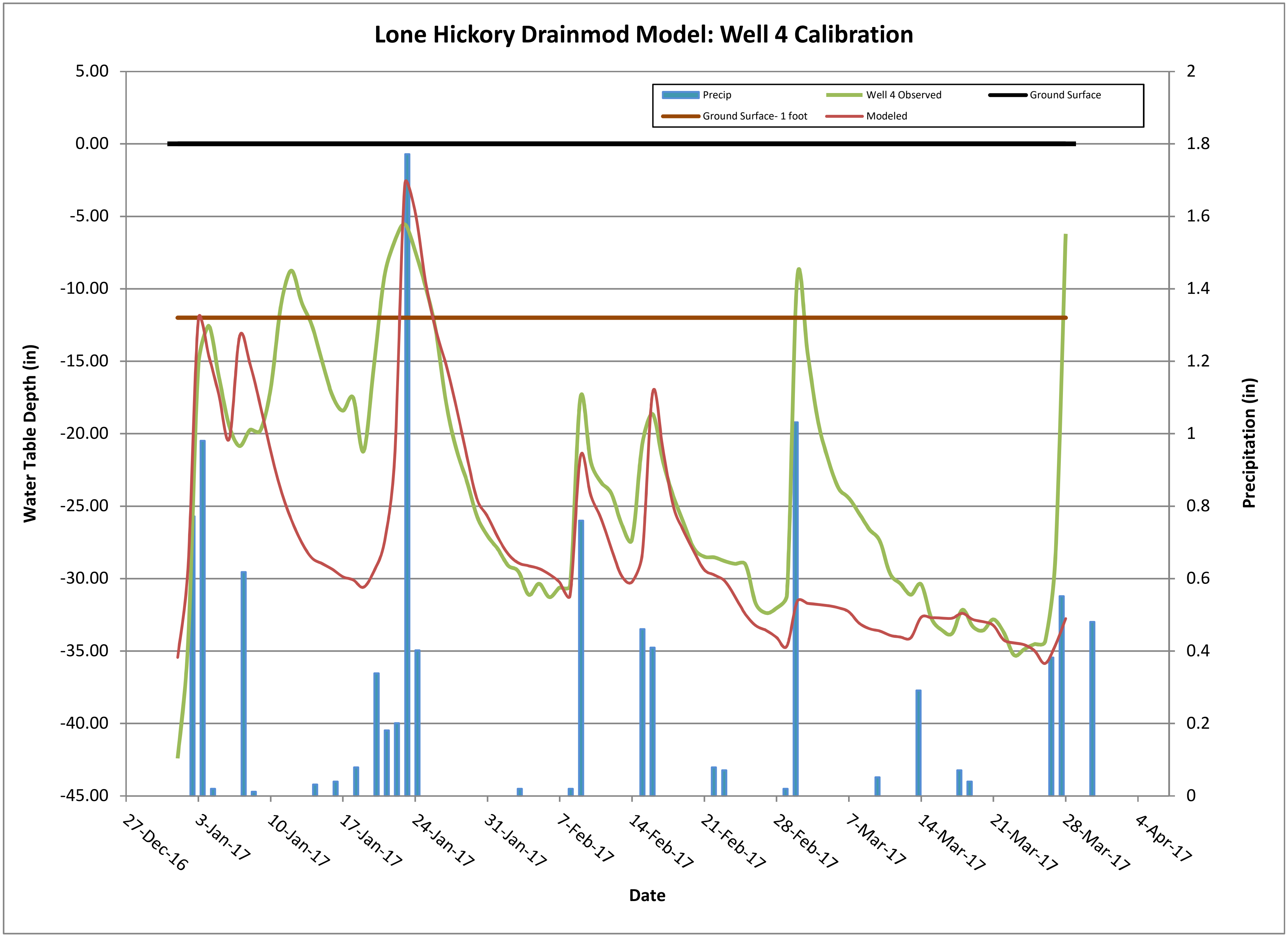
Design Geomorph Parameters

			EAST SIDE											
	Notation	Units	UT1 Reach 1			UT1 Reach 2A			UT1 Reach 2B			UT1 Reach 3		
			Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max
stream type			A4			B4			C4			C4		
drainage area	DA	sq mi	0.07			0.12			0.32			0.44		
design discharge	Q	cfs	11			15			30			38		
bankfull cross-sectional area	A_{bkf}	SF	3.0			4.2			8.1			9.5		
average velocity during bankfull event	v_{bkf}	fps	4.1			3.7			3.8			4		
Cross-Section														
width at bankfull	w_{bkf}	feet	6.5			7.8			10.7			11.8		
maximum depth at bankfull	d_{max}	feet	0.60			0.70			1.00			1.00		
mean depth at bankfull	d_{bkf}	feet	0.5			0.5			0.8			0.8		
maximum depth ratio	d_{max}/d_{avg}		1.3	1.2	1.6	1.3	1.2	1.6	1.3	1.3	1.5	1.2	1.2	1.5
bankfull width to depth ratio	w_{bkf}/d_{bkf}		14.2	12-14		14.6	13-16		14.3	12-14		14.6	12-14	
low bank height		feet	0.6			0.7			1			1.00		
bank height ratio	BHR		1.0	1.0	1.2	1.0	1.0	1.2	1.0	1.0	1.2	1.0	1.0	1.2
floodprone area width	w_{fpa}	feet		15	50		15	50		25	100		25	100
entrenchment ratio	ER			2.2+	2.2+		2.2+	2.2+		2.2+	2.2+		2.2+	2.2+
Slope														
valley slope	S_{valley}	feet/ foot	0.0648			0.0313			0.0225			0.0203		
channel slope	S_{chnl}	feet/ foot	0.0622			0.0290			0.0180			0.0156		
Profile														
riffle slope	S_{riffle}	feet/ foot		0.020	0.041		0.011	0.055		0.018	0.045		0.016	0.048
riffle slope ratio	S_{riffle}/S_{chnl}			0.32	0.66		0.39	1.9		1	2.48		1	3.04
pool slope	S_p	feet/ foot		0.000	0.0000		0.000	0.0000		0.000	0.0000		0.000	0.0000
pool slope ratio	S_p/S_{chnl}			0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
pool-to-pool spacing	L_{p-p}	feet		14	26		16	39		34	109		48	113
pool spacing ratio	L_{p-p}/w_{bkf}			2.2	4.0		2.1	5.0		3.2	10.2		4.1	9.6
pool cross-sectional area		SF	5			7.4			12			14.0		
pool area ratio			1.6			2			1.5			1.5		
maximum pool depth		feet	1.7			1.8			3.2			2.9		
pool depth ratio			3.7			3.4			4.3			3.6		
pool width at bankfull		feet	8.0			9.5			13.5			14.5		
pool width ratio			1.2			1.2			1.3			1.2		
Pattern														
sinuosity	K									1.247982115			1.30	
belt width	w_{blt}	feet								31	67		35	71
meander width ratio	w_{blt}/w_{bkf}									2.9	6.3		3.0	6.0
meander length	L_m	feet								102	190		102	196
meander length ratio	L_m/w_{bkf}									9.6	17.8		8.6	16.6
radius of curvature	R_c	feet								20	38		19	38
radius of curvature ratio	R_c/ w_{bkf}									1.869	3.6		1.61	3.2

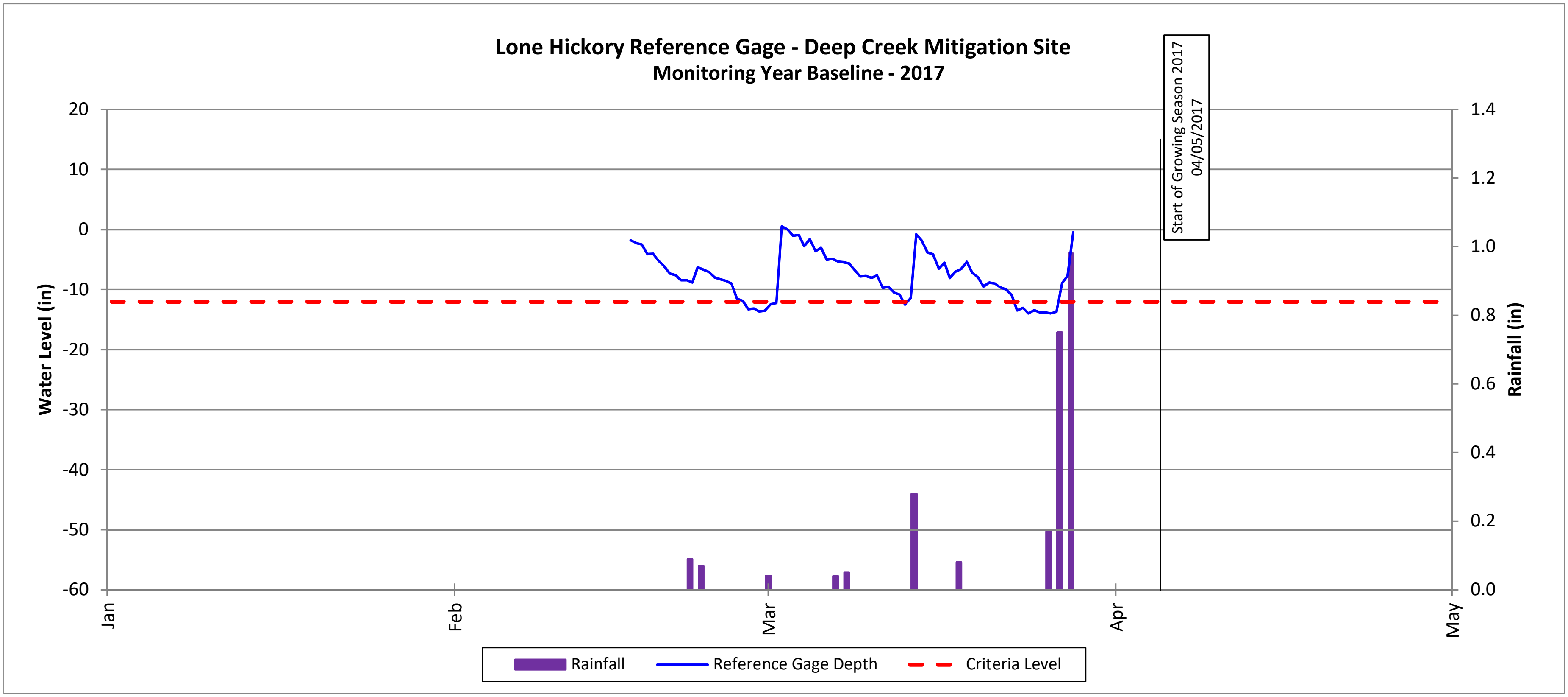
Design Geomorph Parameters

			WEST SIDE																				
	Notation	Units	UT2 Reach 1			UT2 Reach 2			UT2A			UT2B			UT3 Reach 1			UT3 Reach 2			UT3 Reach 3		
			Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max
stream type			B4			C4			C4			C/Cb4			B4c			C4			C4		
drainage area[1]	DA	sq mi	0.14			0.26			0.02			0.05			0.63			0.63			0.88		
design discharge	Q	cfs	14			20			4			8			45			45			55		
bankfull cross-sectional area	A_{bkf}	SF	3.9			7.8			2.1			4.1			12.1			16.2			21.1		
average velocity during bankfull event	v_{bkf}	fps	3.4			2.6			1.9			2.0			3.6			2.7			1.8		
Cross-Section																							
width at bankfull	w_{bkf}	feet	7.5			11			5.5			7.5			13			16.2			19.0		
maximum depth at bankfull	d_{max}	feet	0.8			1.00			0.60			0.90			1.40			1.70			2.00		
mean depth at bankfull	d_{bkf}	feet	0.5			0.7			0.4			0.5			0.9			1.0			1.1		
maximum depth ratio	d_{max}/d_{avg}		1.5	1.2	1.6	1.4	1.2	1.6	1.5	1.3	1.6	1.6	1.2	1.6	1.6	1.2	1.6	1.7	1.3	1.7	1.8	1.2	1.8
bankfull width to depth ratio	w_{bkf}/d_{bkf}		14	12-14		16	13-16		14	12-14		14	12-14		14.4	13-16		16.2	12-16		17.1	12-14	
low bank height		feet	0.8			1.00			0.6			0.9			1.4			1.7			2.00		
bank height ratio	BHR		1.0	1.0	1.2	1.0	1.0	1.2	1.0	1.0	1.2	1.0	1.0	1.2	1.0	1.0	1.2	1.0	1.0	1.2	1.0	1.0	1.2
floodprone area width	w_{fpa}	feet	120+	17	130+	250+	24	280	100+	12	150	100+	11	17	75	18	29	100+	36	81		42	219
entrenchment ratio	ER			1.4	2.2+		2.2+			2.2+			1.4	2.2+		1.4	2.2+		2.2+			2.2+	
Slope																							
valley slope	S_{valley}	feet/ foot	0.028				0.0045	0.013		0.0057	0.0170		0.0060	0.040	0.0120				0.0030	0.0140	0.0022		
channel slope	S_{chnl}	feet/ foot	0.020				0.0030	0.012		0.0050	0.0140		0.0040	0.028	0.0110				0.0020	0.0110	0.0020		
Profile																							
riffle slope	S_{riffle}	feet/ foot		0.020	0.034		0.003	0.025		0.006	0.045		0.004	0.056		0.012	0.017		0.002	0.022		0.002	0.008
riffle slope ratio	S_{riffle}/S_{chnl}			1.0	1.7		1.1	2.1		1.2	3.2		1.0	2.0		1.1	1.5		1.0	2.0		1.2	3.8
pool slope	S_p	feet/ foot		0.000	0.0040		0.000	0.0024		0.000	0.0028		0.000	0.006		0.000	0.0022		0.000	0.0022		0.000	0.0004
pool slope ratio	S_p/S_{chnl}			0.0	0.2		0.0	0.2		0.0	0.2		0.0	0.2		0.0	0.2		0.0	0.2		0.0	0.2
pool-to-pool spacing	L_{p-p}	feet		8	45		39	77		19	39		26	53		169	1014		57	113		67	133
pool spacing ratio	L_{p-p}/w_{bkf}			1.0	6.0		3.5	7.0		3.5	7.0		3.5	7.0		13.0	78.0		3.5	7.0		3.5	7.0
pool cross-sectional area		SF		4	10		8	19		2	5		4	10		18	30		16	40		21	53
pool area ratio				1.1	2.5		1.0	2.5		1.0	2.5		1.0	2.5		1.5	2.5		1.0	2.5		1.0	2.5
maximum pool depth		feet	1.8	1.1	1.8	2.4	1.1	2.5	1.3	0.6	1.4	1.6	0.8	1.9	3.1	1.9	3.3	3.5	1.5	3.5	3.9	1.7	3.9
pool depth ratio			3.5	2.0	3.5	3.4	1.5	3.5	3.3	1.5	3.5	2.9	1.5	3.5	3.4	2.0	3.5	3.5	1.5	3.5	3.5	1.5	3.5
pool width at bankfull		feet	10.5			16.0			7.5			11.0			16.0			19.8					25.0
pool width ratio			1.4			1.5			1.4			1.5			1.2			1.2					1.3
Pattern																							
sinuosity	K			1.1			1.3			1.2			1.20			1.1			1.4			1.20	
belt width	w_{blt}	feet	N/A[2]				39	88		19	44		26	60	N/A[2]				57	130		67	152
meander width ratio	w_{blt}/w_{bkf}		N/A[2]				3.5	8.0		3.5	8.0		3.5	8.0	N/A[2]				3.5	8.0		3.5	8.0
meander length	L_m	feet	N/A[2]				72	154		36	77		49	105	N/A[2]				105	227		124	26
meander length ratio	L_m/w_{bkf}		N/A[2]				6.5	14.0		6.5	14.0		6.5	14.0	N/A[2]				6.5	14.0		6.5	14.0
radius of curvature	R_c	feet	N/A[2]				20	39		10	19		14	23	N/A[2]				29	57		34	67
radius of curvature ratio	R_c/w_{bkf}		N/A[2]				1.8	3.5		1.8	3.5		1.8	3.0	N/A[2]				1.8	3.5		1.8	3.5

1. Proposed drainage areas may differ from existing based on the rework of the stream network.
2. Pattern data not applicable for B channels
3. Areas where stream and bankfull slopes are atypical for tying to existing reaches are not included within design parameter ranges



Lone Hickory Drainmod Model: Well 4 Calibration
Precip
Well 4 Observed
Ground Surface
Ground Surface- 1 foot
Modeled
Water Table Depth (in)
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
Precipitation (in)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
27-Dec-16
3-Jan-17
10-Jan-17
17-Jan-17
24-Jan-17
31-Jan-17
7-Feb-17
14-Feb-17
21-Feb-17
28-Feb-17
7-Mar-17
14-Mar-17
21-Mar-17
28-Mar-17
4-Apr-17
Date



Lone Hickory Reference Gage - Deep Creek Mitigation Site
Monitoring Year Baseline - 2017
Start of Growing Season 2017
04/05/2017
Water Level (in)
Rainfall (in)
20
10
0
-10
-20
-30
-40
-50
-60
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Jan
Feb
Mar
Apr
May
Rainfall
Reference Gage Depth
Criteria Level

Project:	**Lone Hickory Mitigation Site**											
DMS Project ID:	**97135**											
Wetland Component:	**Project Riparian Wetlands**											
Growing Season:	**April 4 to October 27**											
Units	**Inches**											
Gauge Type	**Groundwater**			**Groundwater**			**Groundwater**			**Groundwater**		
	Serial # 5E+05			**Serial # 480265**			**Serial # 479985**			**Serial # 479241**		
	Gauge ID : LH GWG-1			**Gauge ID: LH GWG-2**			**Gauge LH GWG-3**			**Gauge LH GWG-4**		
	Offset: 0			**Offset: 0**			**Offset: 0**			**Offset: 0**		
Date	**Depth**	**Q**	**S**	**Depth**	**Q**	**S**	**Depth**	**Q**	**S**	**Depth**	**Q**	**S**
11/1/2016	0.00	E	A	0.00	E	A	0.00	E	A	0.00	E	A
11/2/2016	0.00	E	A	0.00	E	A	0.00	E	A	0.00	E	A
11/3/2016	60.00			60.51			45.86			51.38		
11/4/2016	60.00			59.91			45.68			51.59		
11/5/2016	60.00			60.13			45.80			51.56		
11/6/2016	60.00			59.91			45.69			51.35		
11/7/2016	60.00			59.80			45.69			51.30		
11/8/2016	60.00			59.55			45.55			50.84		
11/9/2016	60.00			58.95			45.18			50.45		
11/10/2016	60.00			59.15			45.29			50.73		
11/11/2016	60.00			59.13			45.43			50.60		
11/12/2016	60.00			59.12			45.36			51.16		
11/13/2016	60.00			59.29			45.46			50.73		
11/14/2016	60.00			58.72			45.08			49.95		
11/15/2016	60.00			58.62			44.92			49.93		
11/16/2016	60.00			58.44			44.90			49.95		
11/17/2016	60.00			58.50			44.92			50.29		
11/18/2016	60.00			58.33			44.88			49.98		
11/19/2016	60.00			58.04			44.56			49.69		
11/20/2016	60.00			58.03			44.57			49.46		
11/21/2016	60.00			58.28			44.93			49.86		
11/22/2016	60.00			58.29			44.90			50.05		
11/23/2016	60.00			58.03			44.61			49.57		
11/24/2016	60.00			57.53			44.23			48.90		
11/25/2016	60.00			57.49			44.16			48.83		
11/26/2016	60.00			57.20			43.88			48.68		
11/27/2016	60.00			57.65			44.32			48.83		
11/28/2016	60.00			57.28			43.80			48.32		
11/29/2016	60.00			56.67			43.39			47.78		
11/30/2016	60.00			56.39			43.23			47.50		
12/1/2016	60.00			56.30			41.97			47.88		
12/2/2016	60.00			56.71			42.11			48.18		
12/3/2016	60.00			56.48			41.83			47.73		
12/4/2016	60.00			56.20			41.65			47.41		
12/5/2016	52.43			55.85			34.66			46.87		
12/6/2016	44.84			55.40			23.99			46.24		
12/7/2016	43.54			55.07			21.87			45.95		
12/8/2016	43.69			54.76			29.12			45.72		
12/9/2016	44.25			54.91			33.23			46.45		
12/10/2016	44.59			55.33			34.96			46.67		
12/11/2016	43.92			54.69			34.77			45.94		
12/12/2016	43.33			53.57			33.94			44.87		
12/13/2016	43.44			53.35			34.76			45.30		
12/14/2016	43.43			53.02			34.90			45.03		
12/15/2016	43.78			53.18			35.49			45.57		
12/16/2016	44.22			53.40			36.11			46.05		
12/17/2016	42.99			52.44			34.80			44.65		
12/18/2016	42.24			51.62			35.08			44.60		
12/19/2016	43.00			51.80			35.68			45.37		
12/20/2016	44.07			51.87			35.16			44.80		
12/21/2016	42.96			51.37			35.01			44.38		
12/22/2016	41.83			50.46			34.72			43.75		
12/23/2016	42.42			50.72			35.49			44.60		
12/24/2016	42.02			50.03			34.54			43.45		
12/25/2016	41.42			49.69			34.96			43.75		
12/26/2016	41.37			49.47			34.66			43.38		
12/27/2016	40.94			48.78			33.69			42.47		
12/28/2016	40.95			48.60			34.44			42.84		
12/29/2016	40.79			47.99			33.66			42.22		
12/30/2016	41.30			48.12			34.20			42.89		
12/31/2016	41.45			48.21			34.30			43.01		
1/1/2017	40.81			47.37			34.07			42.41		
1/2/2017	36.83			39.91			19.34			34.55		
1/3/2017	28.50			16.57			5.52			15.29		
1/4/2017	35.40			5.18			8.79			12.55		
1/5/2017	37.30			8.94			14.49			16.10		
1/6/2017	37.67			11.49			19.36			19.47		
1/7/2017	38.54			12.76			21.00			20.86		
1/8/2017	40.70			11.78			21.88			19.74		
1/9/2017	40.05			11.52			23.50			19.79		
1/10/2017	38.43			8.25			21.48			16.93		
1/11/2017	36.45			3.70			12.85			11.15		
1/12/2017	34.79			1.83			9.44			8.75		
1/13/2017	36.23			2.94			13.95			10.93		
1/14/2017	36.77			3.57			17.41			12.52		
1/15/2017	36.87			5.16			20.80			15.04		
1/16/2017	37.12			6.72			22.99			17.40		
1/17/2017	36.99			6.84			24.14			18.41		
1/18/2017	36.98			6.22			23.59			17.52		
1/19/2017	37.38			10.27			25.72			21.22		
1/20/2017	35.96			6.41			19.02			15.36		
1/21/2017	34.96			1.52			14.62			9.24		
1/22/2017	34.23			0.80			8.82			6.75		
1/23/2017	25.69			-0.05			4.71			5.55		
1/24/2017	32.75			1.32			6.55			7.40		
1/25/2017	35.33			2.59			11.30			9.85		
1/26/2017	35.79			4.20			16.43			12.88		
1/27/2017	37.16			8.46			21.72			17.90		
1/28/2017	37.58			11.66			24.42			21.09		
1/29/2017	37.45			13.77			26.16			23.27		
1/30/2017	37.87			16.18			28.00			25.72		
1/31/2017	38.12			17.75			29.01			27.05		
2/1/2017	37.85			18.72			29.58			27.96		
2/2/2017	38.01			19.95			30.24			29.09		
2/3/2017	38.02			20.65			30.49			29.51		

Project:	Lone Hickory Mitigation Site											
DMS Project ID:	97135											
Wetland Component:	Project Riparian Wetlands											
Growing Season:	April 4 to October 27											
Units	Inches											
Gauge Type	Groundwater			Groundwater			Groundwater			Groundwater		
	Serial # 5E+05			Serial # 480265			Serial # 479985			Serial # 479241		
	Gauge ID : LH GWG-1			Gauge ID: LH GWG-2			Gauge LH GWG-3			Gauge LH GWG-4		
	Offset: 0			Offset: 0			Offset: 0			Offset: 0		
Date	Depth	Q	S	Depth	Q	S	Depth	Q	S	Depth	Q	S
2/4/2017	38.66			22.34			31.63			31.11		
2/5/2017	37.98			21.69			30.88			30.35		
2/6/2017	38.21			22.62			31.56			31.28		
2/7/2017	37.87			22.31			30.96			30.62		
2/8/2017	37.81			22.30			30.88			30.49		
2/9/2017	37.22			8.00			20.68			17.54		
2/10/2017	37.84			13.43			25.72			21.92		
2/11/2017	37.59			14.00			27.03			23.35		
2/12/2017	37.52			14.62			27.59			24.12		
2/13/2017	37.88			17.19			29.19			26.24		
2/14/2017	38.14			19.06			29.87			27.31		
2/15/2017	37.37			12.45			24.72			20.71		
2/16/2017	37.60			10.41			24.33			18.64		
2/17/2017	37.67			13.44			26.74			21.92		
2/18/2017	37.94			15.57			28.43			24.30		
2/19/2017	37.99			17.50			29.52			26.16		
2/20/2017	38.19			19.66			30.60			27.92		
2/21/2017	38.09			20.74			30.76			28.48		
2/22/2017	37.70			20.81			30.77			28.54		
2/23/2017	37.81			19.82			30.92			28.80		
2/24/2017	37.89			20.14			31.03			28.98		
2/25/2017	37.69			20.42			30.90			29.04		
2/26/2017	38.48			23.56			32.82			31.75		
2/27/2017	38.42			24.72			32.96			32.37		
2/28/2017	38.23			24.82			32.64			32.03		
3/1/2017	37.77			24.10			31.96			31.13		
3/2/2017	33.73			2.23			9.70			9.26		
3/3/2017	36.86			6.42			18.84			14.41		
3/4/2017	38.02			10.70			24.03			19.09		
3/5/2017	38.16			13.33			26.42			21.80		
3/6/2017	38.19			15.17			28.07			23.75		
3/7/2017	38.02			15.71			28.57			24.44		
3/8/2017	37.85			16.50			29.35			25.51		
3/9/2017	38.06			18.62			30.05			26.62		
3/10/2017	37.92			19.67			30.49			27.41		
3/11/2017	38.45			22.38			31.85			29.68		
3/12/2017	38.17			23.33			32.11			30.35		
3/13/2017	38.56			24.52			32.51			31.11		
3/14/2017	38.01			23.26			32.09			30.40		
3/15/2017	38.75			25.08			33.80			32.75		
3/16/2017	38.99			26.05			34.08			33.55		
3/17/2017	38.88			26.44			34.00			33.79		
3/18/2017	38.06			25.11			32.51			32.15		
3/19/2017	38.35			26.16			33.50			33.30		
3/20/2017	38.64			26.72			33.59			33.58		
3/21/2017	38.09			26.33			33.11			32.82		
3/22/2017	38.10			27.22			33.77			33.72		
3/23/2017	38.79			29.10			34.90			35.28		
3/24/2017	38.46			28.96			34.48			34.87		
3/25/2017	38.21			28.81			34.27			34.52		
3/26/2017	38.05			28.82			34.37			34.35		
3/27/2017	38.01			23.69			32.76			28.58		
3/28/2017	30.74			3.48			5.50			6.20		

Project: DMS Project ID: Wetland Component: Growing Season: Units Gauge Type	Groundwater			Groundwater			Groundwater		
	Serial # 479239			Serial # 5E+05			Serial # 478764		
	Gauge LH GWG-5			Gauge LH GWG-6			Gauge LH GWG-7		
	Offset: 0			Offset: 0			Offset: 0		
Date	**Depth**	**Q**	**S**	**Depth**	**Q**	**S**	**Depth**	**Q**	**S**
11/1/2016	0.00	E	A	0.00	E	A	0.00	E	A
11/2/2016	0.00	E	A	0.00	E	A	0.00	E	A
11/3/2016	57.41			51.86			48.08		
11/4/2016	54.98			51.58			47.98		
11/5/2016	53.47			51.88			47.98		
11/6/2016	52.40			51.55			47.70		
11/7/2016	51.81			51.55			47.61		
11/8/2016	51.28			51.09			47.16		
11/9/2016	50.54			50.53			46.56		
11/10/2016	50.58			50.78			46.71		
11/11/2016	50.49			50.65			46.56		
11/12/2016	50.47			50.91			46.76		
11/13/2016	50.70			50.98			46.57		
11/14/2016	49.94			50.08			45.86		
11/15/2016	49.84			49.89			45.79		
11/16/2016	49.73			49.86			45.56		
11/17/2016	49.73			50.15			45.86		
11/18/2016	49.64			49.89			45.61		
11/19/2016	49.44			49.53			45.23		
11/20/2016	49.30			49.38			45.13		
11/21/2016	49.58			49.64			45.34		
11/22/2016	49.64			49.75			45.64		
11/23/2016	49.43			49.32			45.20		
11/24/2016	48.85			48.73			44.56		
11/25/2016	48.82			48.64			44.34		
11/26/2016	48.51			48.44			44.23		
11/27/2016	48.90			48.77			44.59		
11/28/2016	48.46			48.16			43.98		
11/29/2016	47.66			47.58			43.25		
11/30/2016	47.37			47.34			42.97		
12/1/2016	47.34			47.37			43.22		
12/2/2016	47.86			47.81			43.64		
12/3/2016	47.79			47.43			43.32		
12/4/2016	47.60			47.09			42.96		
12/5/2016	47.12			46.44			42.43		
12/6/2016	46.87			46.04			40.77		
12/7/2016	46.67			46.00			40.80		
12/8/2016	46.49			45.50			40.73		
12/9/2016	47.05			45.88			41.16		
12/10/2016	47.77			46.07			41.41		
12/11/2016	47.14			45.29			40.67		
12/12/2016	46.17			44.27			39.39		
12/13/2016	46.20			44.57			39.68		
12/14/2016	46.09			44.35			39.50		
12/15/2016	46.30			44.69			39.99		
12/16/2016	47.09			45.29			40.47		
12/17/2016	46.16			43.94			39.14		
12/18/2016	45.48			43.50			39.03		
12/19/2016	46.13			44.46			39.76		
12/20/2016	46.52			43.99			39.37		
12/21/2016	45.84			43.45			38.86		
12/22/2016	45.03			42.68			38.20		
12/23/2016	45.54			43.45			38.91		
12/24/2016	45.11			42.39			37.93		
12/25/2016	44.83			42.58			38.14		
12/26/2016	44.86			42.22			37.82		
12/27/2016	44.31			41.27			36.96		
12/28/2016	44.04			41.45			37.09		
12/29/2016	43.60			40.91			36.48		
12/30/2016	44.07			41.59			37.16		
12/31/2016	44.53			41.65			37.23		
1/1/2017	43.78			40.91			36.63		
1/2/2017	41.94			33.99			25.32		
1/3/2017	26.26			11.41			3.81		
1/4/2017	15.45			7.38			11.34		
1/5/2017	21.25			10.37			17.92		
1/6/2017	24.66			12.89			21.11		
1/7/2017	27.59			13.46			22.50		
1/8/2017	28.39			12.68			23.65		
1/9/2017	26.27			13.11			24.02		
1/10/2017	23.13			10.33			22.40		
1/11/2017	13.15			4.88			13.47		
1/12/2017	6.16			2.83			12.37		
1/13/2017	9.45			4.74			16.42		
1/14/2017	11.92			6.20			18.43		
1/15/2017	13.85			8.43			19.79		
1/16/2017	16.98			10.75			21.24		
1/17/2017	18.10			11.38			21.64		
1/18/2017	16.25			11.05			21.40		
1/19/2017	19.83			15.45			22.64		
1/20/2017	13.37			9.87			17.97		
1/21/2017	6.84			3.70			15.20		
1/22/2017	3.07			1.54			10.64		
1/23/2017	1.69			0.20			-3.14		
1/24/2017	2.86			1.44			-1.74		
1/25/2017	4.37			3.05			3.19		
1/26/2017	7.27			5.21			10.33		
1/27/2017	12.07			9.51			17.17		
1/28/2017	15.56			12.68			19.88		
1/29/2017	17.80			15.44			21.34		
1/30/2017	20.41			18.40			22.82		
1/31/2017	22.34			20.27			23.69		
2/1/2017	23.47			21.51			24.19		
2/2/2017	24.72			22.94			24.85		
2/3/2017	25.40			23.70			25.31		

Project:									
DMS Project ID:									
Wetland Component:									
Growing Season:									
Units									
Gauge Type	Groundwater			Groundwater			Groundwater		
	Serial # 479239			Serial # 5E+05			Serial # 478764		
	Gauge LH GWG-5			Gauge LH GWG-6			Gauge LH GWG-7		
	Offset: 0			Offset: 0			Offset: 0		
Date	Depth	Q	S	Depth	Q	S	Depth	Q	S
2/4/2017	27.07			25.49			26.48		
2/5/2017	26.59			25.03			26.04		
2/6/2017	27.42			25.90			26.51		
2/7/2017	27.38			25.78			26.36		
2/8/2017	27.50			25.79			26.28		
2/9/2017	11.72			11.87			23.18		
2/10/2017	17.95			17.42			24.46		
2/11/2017	19.70			18.76			24.56		
2/12/2017	20.69			19.65			24.70		
2/13/2017	23.21			22.01			25.71		
2/14/2017	25.30			23.36			26.10		
2/15/2017	17.30			16.57			24.23		
2/16/2017	14.62			15.01			23.91		
2/17/2017	18.89			18.14			24.60		
2/18/2017	21.59			20.55			25.36		
2/19/2017	23.76			22.29			25.94		
2/20/2017	25.91			24.06			26.60		
2/21/2017	26.63			24.75			26.69		
2/22/2017	26.84			24.93			26.26		
2/23/2017	25.74			25.31			26.11		
2/24/2017	25.09			25.64			26.22		
2/25/2017	25.20			25.64			25.97		
2/26/2017	28.24			27.66			27.72		
2/27/2017	29.63			28.35			28.23		
2/28/2017	29.91			28.52			28.13		
3/1/2017	29.27			27.96			27.38		
3/2/2017	3.83			5.58			16.92		
3/3/2017	10.43			11.56			22.71		
3/4/2017	15.38			16.28			24.56		
3/5/2017	18.52			18.97			25.31		
3/6/2017	20.83			20.89			25.83		
3/7/2017	21.59			21.62			25.83		
3/8/2017	22.44			22.66			26.22		
3/9/2017	24.29			23.95			26.68		
3/10/2017	25.43			24.56			26.82		
3/11/2017	27.77			26.43			27.98		
3/12/2017	28.48			27.04			28.08		
3/13/2017	29.69			27.96			28.52		
3/14/2017	28.79			27.52			27.90		
3/15/2017	30.09			29.57			29.31		
3/16/2017	30.96			30.43			29.83		
3/17/2017	31.35			30.84			30.06		
3/18/2017	30.37			29.63			29.00		
3/19/2017	31.09			30.59			29.46		
3/20/2017	31.75			31.02			29.88		
3/21/2017	31.21			30.36			29.28		
3/22/2017	31.71			31.18			29.59		
3/23/2017	33.37			32.70			30.73		
3/24/2017	33.37			32.42			30.33		
3/25/2017	33.08			32.21			30.03		
3/26/2017	33.16			32.16			29.85		
3/27/2017	26.60			31.84			29.64		
3/28/2017	8.47			5.01			8.24		

Project: DMS Project ID: Wetland Component: Growing Season: Units Gauge Type	Groundwater			Groundwater			Rain		
	Serial # 479257 Gauge LH GWG-8 Offset: 0			Serial # 450209 Gauge LH REF Offset: 0			Serial # Gauge RG1 Source: GHCND:USC00319675		
Date	Depth	Q	S	Depth	Q	S	Amount	Q	S
11/1/2016	0.00	E	A	0.00	E	A	0.00		
11/2/2016	0.00	E	A	0.00	E	A	0.00		
11/3/2016	57.38			0.00	E	A	0.00		
11/4/2016	53.78			0.00	E	A	0.00		
11/5/2016	51.47			0.00	E	A	0.00		
11/6/2016	50.25			0.00	E	A	0.00		
11/7/2016	49.62			0.00	E	A	0.00		
11/8/2016	49.55			0.00	E	A	0.00		
11/9/2016	49.08			0.00	E	A	0.00		
11/10/2016	49.35			0.00	E	A	0.00		
11/11/2016	49.52			0.00	E	A	0.00		
11/12/2016	49.76			0.00	E	A	0.00		
11/13/2016	50.17			0.00	E	A	0.00		
11/14/2016	49.85			0.00	E	A	0.00		
11/15/2016	49.77			0.00	E	A	0.00		
11/16/2016	49.81			0.00	E	A	0.00		
11/17/2016	50.06			0.00	E	A	0.00		
11/18/2016	50.10			0.00	E	A	0.00		
11/19/2016	49.99			0.00	E	A	0.00		
11/20/2016	49.94			0.00	E	A	0.00		
11/21/2016	50.30			0.00	E	A	0.00		
11/22/2016	50.64			0.00	E	A	0.00		
11/23/2016	50.48			0.00	E	A	0.00		
11/24/2016	50.13			0.00	E	A	0.03		
11/25/2016	50.20			0.00	E	A	0.00		
11/26/2016	49.99			0.00	E	A	0.00		
11/27/2016	50.67			0.00	E	A	0.00		
11/28/2016	50.28			0.00	E	A	0.00		
11/29/2016	49.76			0.00	E	A	0.00		
11/30/2016	49.58			0.00	E	A	0.55		
12/1/2016	49.40			0.00	E	A	0.36		
12/2/2016	49.73			0.00	E	A	0.00		
12/3/2016	49.67			0.00	E	A	0.00		
12/4/2016	49.47			0.00	E	A	0.10		
12/5/2016	49.01			0.00	E	A	0.57		
12/6/2016	48.70			0.00	E	A	0.20		
12/7/2016	48.03			0.00	E	A	0.66		
12/8/2016	46.89			0.00	E	A	0.02		
12/9/2016	46.60			0.00	E	A	0.00		
12/10/2016	46.82			0.00	E	A	0.00		
12/11/2016	46.13			0.00	E	A	0.00		
12/12/2016	45.10			0.00	E	A	0.00		
12/13/2016	44.91			0.00	E	A	0.00		
12/14/2016	44.66			0.00	E	A	0.00		
12/15/2016	44.81			0.00	E	A	0.00		
12/16/2016	45.30			0.00	E	A	0.00		
12/17/2016	44.36			0.00	E	A	0.00		
12/18/2016	43.86			0.00	E	A	0.04		
12/19/2016	44.22			0.00	E	A	0.00		
12/20/2016	44.32			0.00	E	A	0.00		
12/21/2016	43.91			0.00	E	A	0.06		
12/22/2016	43.32			0.00	E	A	0.00		
12/23/2016	43.83			0.00	E	A	0.00		
12/24/2016	43.21			0.00	E	A	0.01		
12/25/2016	43.08			0.00	E	A	0.05		
12/26/2016	43.18			0.00	E	A	0.00		
12/27/2016	42.46			0.00	E	A	0.02		
12/28/2016	42.56			0.00	E	A	0.00		
12/29/2016	41.94			0.00	E	A	0.03		
12/30/2016	42.35			0.00	E	A	0.00		
12/31/2016	42.54			0.00	E	A	0.00		
1/1/2017	41.96			0.00	E	A	0.00		
1/2/2017	29.60			0.00	E	A	0.89		
1/3/2017	4.33			0.00	E	A	0.59		
1/4/2017	5.46			0.00	E	A	0.00		
1/5/2017	9.49			0.00	E	A	0.00		
1/6/2017	11.63			0.00	E	A	0.00		
1/7/2017	9.06			0.00	E	A	0.66		
1/8/2017	10.17			0.00	E	A	0.00		
1/9/2017	10.96			0.00	E	A	0.00		
1/10/2017	7.99			0.00	E	A	0.00		
1/11/2017	4.99			0.00	E	A	0.00		
1/12/2017	4.99			0.00	E	A	0.00		
1/13/2017	7.11			0.00	E	A	0.00		
1/14/2017	8.38			0.00	E	A	0.00		
1/15/2017	11.19			0.00	E	A	0.00		
1/16/2017	12.80			0.00	E	A	0.06		
1/17/2017	11.52			0.00	E	A	0.00		
1/18/2017	12.62			0.00	E	A	0.00		
1/19/2017	17.53			0.00	E	A	0.00		
1/20/2017	12.08			0.00	E	A	0.00		
1/21/2017	4.88			0.00	E	A	0.44		
1/22/2017	4.01			0.00	E	A	0.24		
1/23/2017	2.04			0.00	E	A	2.09		
1/24/2017	3.33			0.00	E	A	0.36		
1/25/2017	5.25			0.00	E	A	0.12		
1/26/2017	8.60			0.00	E	A	0.01		
1/27/2017	14.18			0.00	E	A	0.00		
1/28/2017	17.05			0.00	E	A	0.00		
1/29/2017	18.51			0.00	E	A	0.00		
1/30/2017	21.95			0.00	E	A	0.00		
1/31/2017	23.77			0.00	E	A	0.00		
2/1/2017	24.87			0.00	E	A	0.00		
2/2/2017	25.99			0.00	E	A	0.00		
2/3/2017	26.06			0.00	E	A	0.03		

Project: DMS Project ID: Wetland Component: Growing Season: Units Gauge Type	Groundwater			Groundwater			Rain		
	Serial # 479257 Gauge LH GWG-8 Offset: 0			Serial # 450209 Gauge LH REF Offset: 0			Serial # Gauge RG1 Source: GHCND:USC00319675		
Date	Depth	Q	S	Depth	Q	S	Amount	Q	S
2/4/2017	27.59			0.00	E	A	0.00		
2/5/2017	26.36			0.00	E	A	0.05		
2/6/2017	27.68			0.00	E	A	0.00		
2/7/2017	27.08			0.00	E	A	0.00		
2/8/2017	27.22			0.00	E	A	0.02		
2/9/2017	16.51			0.00	E	A	0.43		
2/10/2017	23.50			0.00	E	A	0.00		
2/11/2017	23.98			0.00	E	A	0.00		
2/12/2017	24.42			0.00	E	A	0.00		
2/13/2017	26.90			0.00	E	A	0.00		
2/14/2017	27.47			0.00	E	A	0.00		
2/15/2017	22.89			0.00	E	A	0.46		
2/16/2017	23.14			1.75			0.00		
2/17/2017	25.12			2.34			0.00		
2/18/2017	26.47			4.03			0.00		
2/19/2017	27.75			5.67			0.00		
2/20/2017	28.84			7.45			0.00		
2/21/2017	28.92			8.42			0.00		
2/22/2017	28.15			7.53			0.09		
2/23/2017	27.15			6.87			0.07		
2/24/2017	27.43			8.13			0.00		
2/25/2017	27.65			8.78			0.00		
2/26/2017	30.90			11.67			0.00		
2/27/2017	31.69			13.21			0.00		
2/28/2017	31.54			13.57			0.00		
3/1/2017	30.29			12.35			0.04		
3/2/2017	14.18			-0.29			0.00		
3/3/2017	20.36			0.96			0.00		
3/4/2017	23.68			2.16			0.00		
3/5/2017	24.78			3.33			0.00		
3/6/2017	25.84			4.96			0.00		
3/7/2017	25.81			5.38			0.04		
3/8/2017	26.35			6.19			0.05		
3/9/2017	27.68			7.77			0.00		
3/10/2017	28.13			7.83			0.00		
3/11/2017	30.54			9.61			0.00		
3/12/2017	30.85			10.65			0.00		
3/13/2017	31.71			11.92			0.00		
3/14/2017	30.28			1.32			0.28		
3/15/2017	32.20			3.98			0.00		
3/16/2017	33.21			6.01			0.00		
3/17/2017	33.78			7.53			0.00		
3/18/2017	32.27			5.94			0.08		
3/19/2017	33.02			7.59			0.00		
3/20/2017	33.48			9.15			0.00		
3/21/2017	32.70			9.31			0.00		
3/22/2017	33.33			10.43			0.00		
3/23/2017	35.04			13.24			0.00		
3/24/2017	34.78			13.69			0.00		
3/25/2017	34.43			13.78			0.00		
3/26/2017	34.27			13.81			0.17		
3/27/2017	33.92			8.28			0.75		
3/28/2017	15.77			0.45			0.98		

APPENDIX 5

APPROVED FHWA CATEGORICAL EXLUSION FORM

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Lone Hickory Mitigation Site
County Name:	Yadkin County
EEP Number:	97135
Project Sponsor:	Wildlands Engineering, Inc
Project Contact Name:	Andrea S. Eckardt
Project Contact Address:	1430 South Mint Street, Suite 104, Charlotte, NC 28203
Project Contact E-mail:	aeckardt@wildlandseng.com
EEP Project Manager:	Paul Wiesner

Project Description

The Lone Hickory Mitigation Site is a stream and wetland mitigation project located 3.5 miles south of the Town of Yadkinville and 24 miles west of the City of Winston-Salem in Yadkin County, NC. The project includes 7 unnamed tributaries to South Deep Creek for a total of more than 13,000 linear feet of stream. Historically the site has been used for cattle and row crops. The site is currently used for row crop production. The project will provide stream and wetland mitigation units to the Division of Mitigation Services in the Yadkin River Basin (03040101).

For Official Use Only

Reviewed By:

9-6-16 Paul Wiesner

Date **EEP Project Manager**

Conditional Approved By:

Date **For Division Administrator FHWA**

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

Final Approval By:

9-6-16

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

Lone Hickory 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 Lone Hickory 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 June 29, 2016. While the target property was not listed in any of the Federal, State, or Tribal environmental databases searched by EDR, three Leaking Underground Storage Tank Sites (LUST) were identified within one-half mile of the project. The LUST site identified at the 1324 Lone Hickory Road residence is 0.2 miles southwest of the Lone Hickory Creek project area. The site was cleaned up in 2010. The second site, Renegar’s Food Mart, is 0.2 miles southeast of the project and was cleaned up in 1992. The final site is over 0.25 miles to the east of the project and was cleaned up in 2003. All three LUST sites have been closed and pose no environmental risk to the Lone Hickory Mitigation Site.

Overall, the EDR assessment revealed no evidence of any “recognized environmental conditions” in connection with the target property. 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.

Wildlands Engineering, Inc. (Wildlands) requested review and comment from the State Historic Preservation Office (SHPO) with respect to any archeological and architectural resources related to the Lone Hickory Mitigation Site on June 24, 2016. SHPO responded on July 8, 2016 and 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.

Lone Hickory 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 done by letter. A copy of the letter and email confirmation that each property owner received the information 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 Yadkin County listed endangered species includes the Northern long-eared bat (NLEB) (*Myotis septentrionalis*). The USFWS does not currently list any Critical Habitat Designations for the Federally-listed species within Yadkin County nor are they aware of any known occurrences of the NLEB within the County. As a result of a pedestrian survey conducted on December 29, 2015, suitable habitat was found for the NLEB on the project parcel, but no individual species were found to exist. The project site is over 60 miles from the nearest known hibernaculum.

Wildlands requested review and comment from the United States Fish and Wildlife Service (USFWS) on June 24, 2016 in respect to the Lone Hickory Mitigation Site and its potential impacts on threatened or endangered species. On August 9, 2016 a completed NLEB 4(d) Rule Streamlined Consultation Form was submitted by the Federal Highway Administration to the USFWS. USFWS acknowledged receipt of the form on August 9, 2016 and responded on August 31, 2016 stating that due to the project's distance from any known hibernation site or maternity roost that "any incidental take that may result from associated activities is exempt under the 4(d) rule."

All correspondence with USFWS is 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.

The Lone Hickory 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 Lone Hickory Mitigation Site includes stream restoration. Wildlands requested comment on the project from both the USFWS and the North Carolina Wildlife Resources Commission (NCWRC) on June 24, 2016. NCWRC responded on July 7, 2016 and stated that the project would "not impact wild trout resources or other known significant aquatic resources". USFWS responded on August 31, 2016 and had no objections to the project. 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 Lone Hickory Stream Mitigation Site from the USFWS in regards to migratory birds on June 24, 2016. The USFWS response on August 31, 2016, did not include any comments related to migratory bird species. All correspondence with USFWS is included in the Appendix.

Lone Hickory Mitigation Site
Categorical Exclusion

APPENDIX

Lone Hickory Mitigation Site
1044 Reavico Farm Road
Yadkinville, NC 27055

Inquiry Number: 4661375.2s
June 29, 2016

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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SECTION | **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

1044 REAVICO FARM ROAD
YADKINVILLE, NC 27055

COORDINATES

Latitude (North):	36.0863610 - 36˚ 5' 10.89''
Longitude (West):	80.6633820 - 80˚ 39' 48.17''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	530306.2
UTM Y (Meters):	3993379.0
Elevation:	934 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5947721 LONE HICKORY, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140524
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
1044 REAVICO FARM ROAD
YADKINVILLE, NC 27055

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
1	REAVIS RESIDENCE	1324 LONE HICKORY RD	LUST, LUST TRUST	Higher	577, 0.109, South
A2	RENEGAR'S FOOD MART	LANE HICKORY/FISH BR	LUST	Higher	882, 0.167, SE
A3	RENEGAR'S FOOD MARKE	1201 LONE HICKORY RD	UST, Financial Assurance	Higher	1092, 0.207, ESE
4	NCDOT-SEIDERS PROP	2448 US HWY 601	LUST, IMD	Higher	1617, 0.306, NE

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL - National Priority List
Proposed NPL - Proposed National Priority List Sites
NPL LIENS - Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL - National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY - Federal Facility Site Information listing
SEMS - Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE - Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS - Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF - RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG - RCRA - Large Quantity Generators
RCRA-SQG - RCRA - Small Quantity Generators
RCRA-CESQG - RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS - Land Use Control Information System
US ENG CONTROLS - Engineering Controls Sites List

US INST CONTROL - - - - - - - - - Sites with Institutional Controls

Federal ERNS list

ERNS - Emergency Response Notification System

State- and tribal - equivalent NPL

NC HSDS - - - - - - - - - - - - - - - - - - Hazardous Substance Disposal Site

State- and tribal - equivalent CERCLIS

SHWS - Inactive Hazardous Sites Inventory

State and tribal landfill and/or solid waste disposal site lists

SWF/LF - List of Solid Waste Facilities
OLI - Old Landfill Inventory

State and tribal leaking storage tank lists

LAST - Leaking Aboveground Storage Tanks
INDIAN LUST - - - - - - - - - - - - - - - Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST - - - - - - - - - - - - - - - - - Underground Storage Tank Listing
AST - AST Database
INDIAN UST - - - - - - - - - - - - - - - - Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

INST CONTROL - - - - - - - - - - - - - No Further Action Sites With Land Use Restrictions Monitoring

State and tribal voluntary cleanup sites

INDIAN VCP - - - - - - - - - - - - - - - - Voluntary Cleanup Priority Listing
VCP - Responsible Party Voluntary Action Sites

State and tribal Brownfields sites

BROWNFIELDS - - - - - - - - - - - - - Brownfields Projects Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS - - - - - - - - - - A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

HIST LF - Solid Waste Facility Listing
SWRCY - Recycling Center Listing
INDIAN ODI - - - - - - - - - - - - - - - - Report on the Status of Open Dumps on Indian Lands

ODI - Open Dump Inventory
DEBRIS REGION 9 - Torres Martinez Reservation Illegal Dump Site Locations

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL - Delisted National Clandestine Laboratory Register
US CDL - National Clandestine Laboratory Register

Local Land Records

LIENS 2 - CERCLA Lien Information

Records of Emergency Release Reports

HMIRS - Hazardous Materials Information Reporting System
SPILLS - Spills Incident Listing
SPILLS 90 - SPILLS 90 data from FirstSearch
SPILLS 80 - SPILLS 80 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR - RCRA - Non Generators / No Longer Regulated
FUDS - Formerly Used Defense Sites
DOD - Department of Defense Sites
SCRD DRYCLEANERS - State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR - Financial Assurance Information
EPA WATCH LIST - EPA WATCH LIST
2020 COR ACTION - 2020 Corrective Action Program List
TSCA - Toxic Substances Control Act
TRIS - Toxic Chemical Release Inventory System
SSTS - Section 7 Tracking Systems
ROD - Records Of Decision
RMP - Risk Management Plans
RAATS - RCRA Administrative Action Tracking System
PRP - Potentially Responsible Parties
PADS - PCB Activity Database System
ICIS - Integrated Compliance Information System
FTTS - FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS - Material Licensing Tracking System
COAL ASH DOE - Steam-Electric Plant Operation Data
COAL ASH EPA - Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER - PCB Transformer Registration Database
RADINFO - Radiation Information Database
HIST FTTS - FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS - Incident and Accident Data
CONSENT - Superfund (CERCLA) Consent Decrees
INDIAN RESERV - Indian Reservations
FUSRAP - Formerly Utilized Sites Remedial Action Program
UMTRA - Uranium Mill Tailings Sites
LEAD SMELTERS - Lead Smelter Sites
US AIRS - Aerometric Information Retrieval System Facility Subsystem
US MINES - Mines Master Index File
FINDS - Facility Index System/Facility Registry System
UXO - Unexploded Ordnance Sites

EXECUTIVE SUMMARY

DOCKET HWC	Hazardous Waste Compliance Docket Listing
COAL ASH	Coal Ash Disposal Sites
DRYCLEANERS	Drycleaning Sites
Financial Assurance	Financial Assurance Information Listing
NPDES	NPDES Facility Location Listing
UIC	Underground Injection Wells Listing
FUELS PROGRAM	EPA Fuels Program Registered Listing
ECHO	Enforcement & Compliance History Information

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto	EDR Exclusive Historic Gas Stations
EDR Hist Cleaner	EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS	Recovered Government Archive State Hazardous Waste Facilities List
RGA LF	Recovered Government Archive Solid Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incidents Management Database contains an inventory of reported leaking underground storage tank incidents. The data come from the Department of Environment, & Natural Resources’ Incidents by Address.

A review of the LUST list, as provided by EDR, and dated 02/05/2016 has revealed that there are 3 LUST sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
REAVIS RESIDENCE	***1324 LONE HICKORY RD***	***S 0 - 1/8 (0.109 mi.)***	***1***	***8***

Incident Phase: Closed Out
Incident Number: 37590
Current Status: File Located in Archives

RENEGAR'S FOOD MART Incident Phase: Response Incident Number: 14146 Current Status: File Located in House	LANE HICKORY/FISH BR	SE 1/8 - 1/4 (0.167 mi.)	A2	10
NCDOT-SEIDERS PROP Incident Phase: Closed Out Incident Number: 30203 Current Status: File Located in House	***2448 US HWY 601***	***NE 1/4 - 1/2 (0.306 mi.)***	***4***	***15***

LUST TRUST: This database contains information about claims against the State Trust Funds for reimbursements for expenses incurred while remediating Leaking USTs.

A review of the LUST TRUST list, as provided by EDR, and dated 04/11/2016 has revealed that there is 1 LUST TRUST site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
REAVIS RESIDENCE Site ID: 37590	***1324 LONE HICKORY RD***	***S 0 - 1/8 (0.109 mi.)***	***1***	***8***

State and tribal registered storage tank lists

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Environment & Natural Resources' Petroleum Underground Storage Tank Database.

A review of the UST list, as provided by EDR, and dated 02/05/2016 has revealed that there is 1 UST site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RENEGAR'S FOOD MARKE Tank Status: Current Tank Status: Removed Facility Id: 00-0-0000005751	***1201 LONE HICKORY RD***	***ESE 1/8 - 1/4 (0.207 mi.)***	***A3***	***11***

ADDITIONAL ENVIRONMENTAL RECORDS

Records of Emergency Release Reports

IMD: Incident Management Database.

A review of the IMD list, as provided by EDR, and dated 07/21/2006 has revealed that there is 1 IMD site within approximately 0.5 miles of the target property.

EXECUTIVE SUMMARY

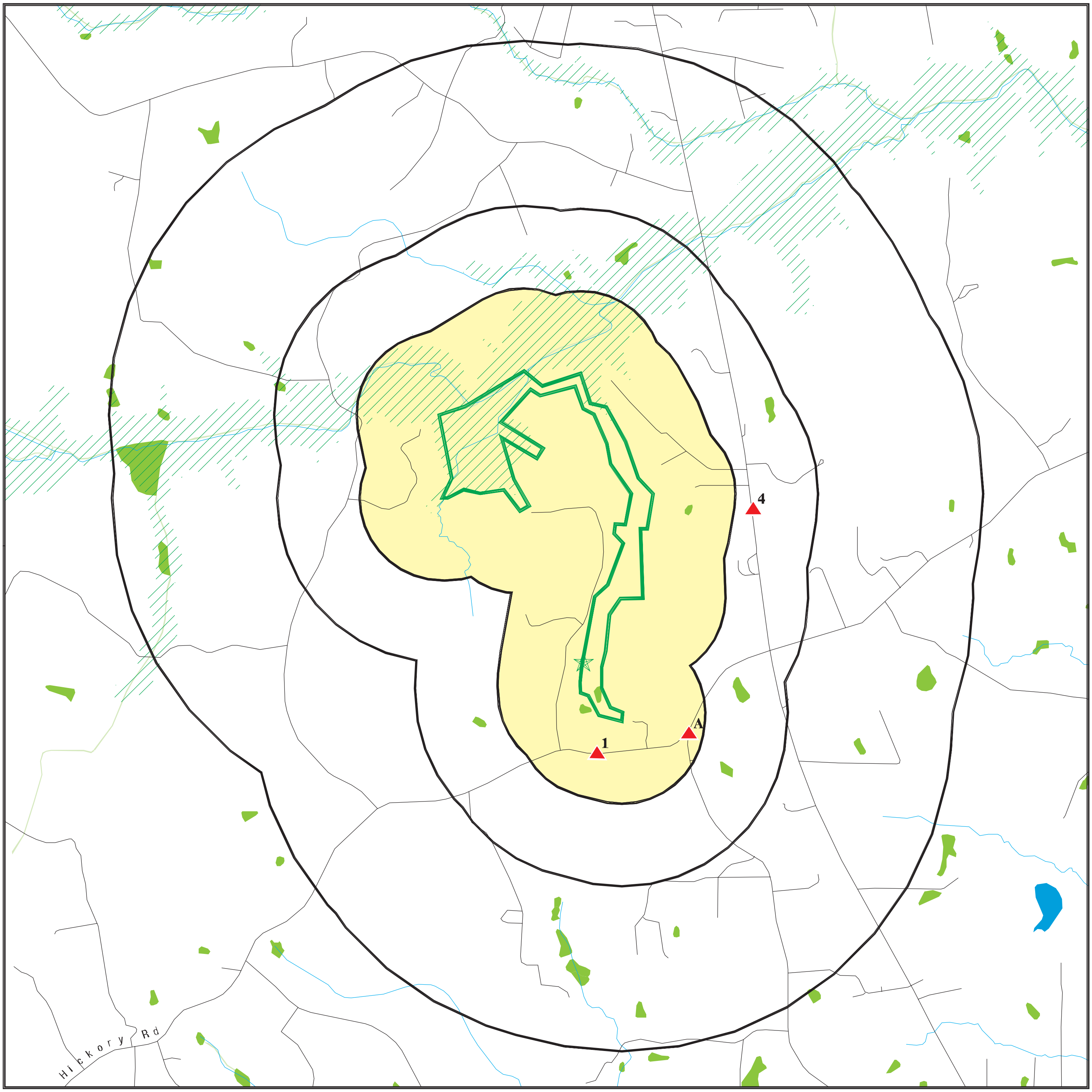
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
NCDOT-SEIDERS PROP Facility Id: 30203	***2448 US HWY 601***	***NE 1/4 - 1/2 (0.306 mi.)***	***4***	***15***

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 2 records.

Site Name	Database(s)
JOYNER REFUSE DUMP	OLI
YADKINVILLE REFUSE DISPOSAL	OLI

OVERVIEW MAP - 4661375.2S



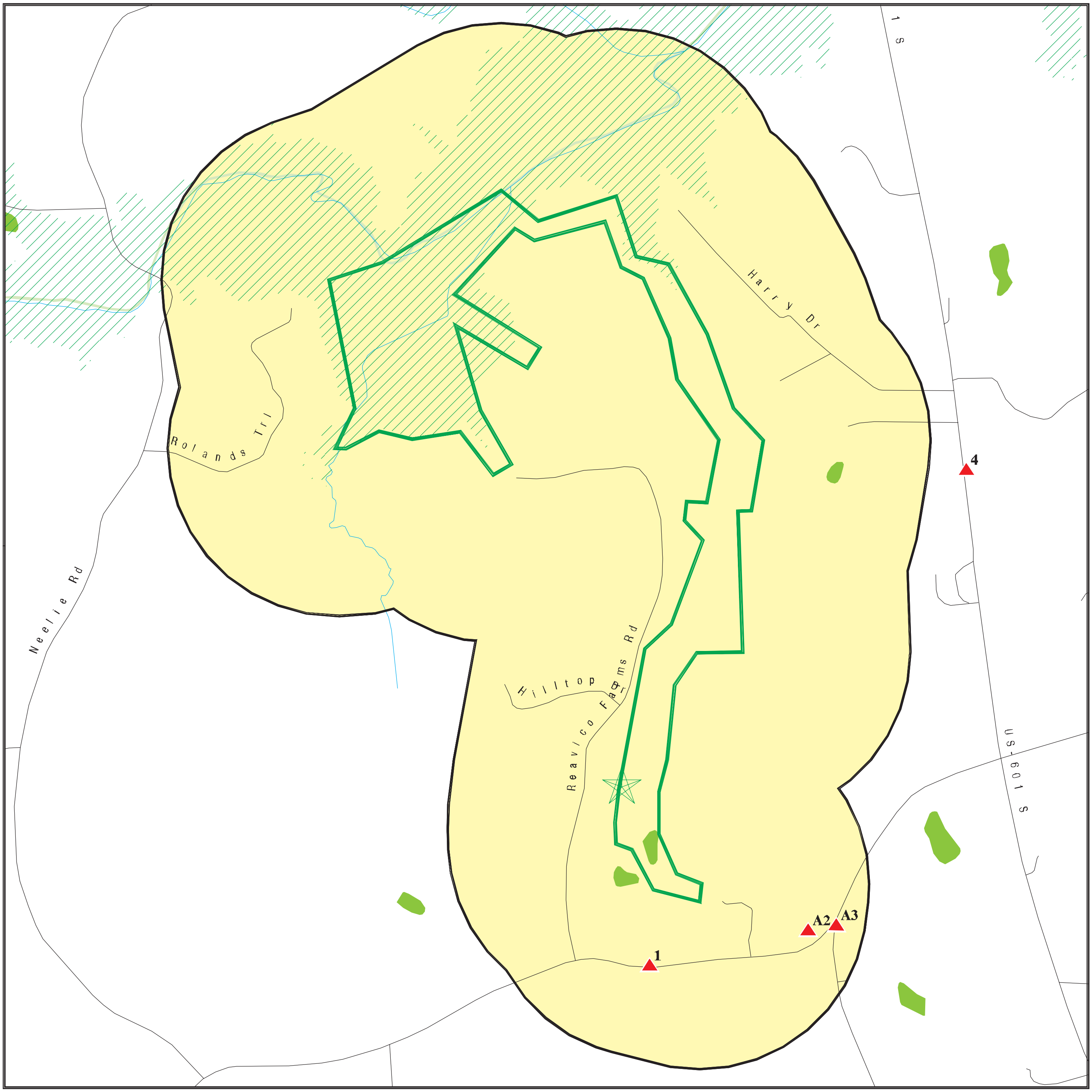
0 1/4 1/2 1 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Lone Hickory Mitigation Site	CLIENT:	Wildlands Eng, Inc.
ADDRESS:	1044 Reavico Farm Road Yadkinville NC 27055	CONTACT:	Ian Eckardt
		INQUIRY #:	4661375.2s
LAT/LONG:	36.086361 / 80.663382	DATE:	June 29, 2016 3:03 pm

DETAIL MAP - 4661375.2S



0 1/8 1/4 1/2 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites

- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands

- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

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	Yadkinville NC 27055	INQUIRY #:	4661375.2s
LAT/LONG:	36.086361 / 80.663382	DATE:	June 29, 2016 3:03 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
NC HSDS	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
OLI	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LAST	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LUST	0.500		1	1	1	NR	NR	3
INDIAN LUST	0.500		0	0	0	NR	NR	0
LUST TRUST	0.500		1	0	0	NR	NR	1
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	1	NR	NR	NR	1
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP	0.500		0	0	0	NR	NR	0
VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
HIST LF	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
IMD	0.500		0	0	1	NR	NR	1
SPILLS 90	TP		NR	NR	NR	NR	NR	0
SPILLS 80	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	2	2	2	0	0	6

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

1 **South** **< 1/8** **0.109 mi.** **577 ft.**	**REAVIS RESIDENCE** **1324 LONE HICKORY RD.** **YADKINVILLE, NC 27055**	**LUST** **LUST TRUST**	**S110143931** **N/A**

Relative:
Higher

Actual:
1007 ft.

LUST:

Facility ID: Not reported
UST Number: WS-8293
Incident Number: 37590
Contamination Type: SL
Source Type: Leak-underground
Product Type: P
Date Reported: 02/01/2010
Date Occur: 01/20/2010
Cleanup: 01/14/2010
Closure Request: Not reported
Close Out: 04/09/2010
Level Of Soil Cleanup Achieved: Soil to Groundwater
Tank Regulated Status: N
Of Supply Wells: 0
Commercial/NonCommercial UST Site: NON COMMERCIAL
Risk Classification: Not reported
Risk Class Based On Review: L
Corrective Action Plan Type: Not reported
NOV Issue Date: Not reported
NORR Issue Date: Not reported
Site Priority: Not reported
Phase Of LSA Req: Not reported
Site Risk Reason: Not reported
Land Use: Residential
MTBE: No
MTBE1: Unknown
Flag: No
Flag1: No
LUR Filed: Not reported
Release Detection: 0
Current Status: File Located in Archives
RBCA GW: Not reported
PETOPT: 4
RPL: True
CD Num: 536
Reel Num: 0
RPOW: True
RPOP: True
Error Flag: 0
Error Code: N
Valid: True
Lat/Long Decimal: 36.0806 -80.6712
Testlat: Not reported
Regional Officer Project Mgr: CHR
Region: WS
Company: W.BRYCE/MARY REAVIS
Contact Person: C/O JANET WALL
Telephone: 3368131543
RP Address: 129 NC HWY 801 S.
RP City,St,Zip: ADVANCE, NC 27006
RP County: Not reported
Comments: Not reported

REAVIS RESIDENCE (Continued) **S110143931**

5 Min Quad: Not reported

PIRF:

Facility Id:	37590
Date Occurred:	2010-01-20 00:00:00
Date Reported:	2010-02-01 00:00:00
Description Of Incident:	Soil contamination found at tank closure
Owner/Operator:	Not reported
Ownership:	4
Operation Type:	3
Type:	4
Location:	7
Site Priority:	Not reported
Priority Update:	Not reported
Wells Affected Y/N:	N
Samples Include:	Not reported
7#5 Minute Quad:	Y
5 Minute Quad:	Not reported
Pirf/Min Soil:	Not reported
Release Code:	Not reported
Source Code:	Not reported
Err Type:	2
Cause:	3
Source:	A
Ust Number:	P

Last Modified:	2010-04-09 00:00:00
Incident Phase:	**Closed Out**
NOV Issued:	Not reported
NORR Issued:	Not reported
45 Day Report:	Not reported
Public Meeting Held:	Not reported
Corrective Action Planned:	Not reported
SOC Signed:	Not reported
Reclassification Report:	Not reported
RS Designation:	Not reported
Closure Request Date:	Not reported
Close-out Report:	Not reported

LUST TRUST:

Facility ID:	Not reported
Site ID:	37590
Site Note:	Noncommercial; 100% eligible; $0 deductible.[CGS 6/23/10]
Site Eligible?:	True
Commercial Find:	100% Non-Commercial
Priority Rank:	Not reported
Deductable Amount:	0
3rd Party Deductable Amt:	0
Sum 3rd Party Amt Applied:	0

Click this hyperlink while viewing on your computer to access additional NC LUST TRUST: detail in the EDR Site Report.

A2 **RENEGAR'S FOOD MART** **LUST** **S108407952**
SE **LANE HICKORY/FISH BRANDON RD.** **N/A**
1/8-1/4 **YADKINVILLE, NC 27055**
0.167 mi.
882 ft. **Site 1 of 2 in cluster A**

Relative:
Higher

Actual:
1012 ft.

LUST:
Facility ID: 00-0-000
UST Number: WS-4361
Incident Number: 14146
Contamination Type: GW
Source Type: Leak-underground
Product Type: P
Date Reported: 04/18/1995
Date Occur: 07/31/1992
Cleanup: 07/31/1992
Closure Request: Not reported
Close Out: Not reported
Level Of Soil Cleanup Achieved: Not reported
Tank Regulated Status: R
Of Supply Wells: 0
Commercial/NonCommercial UST Site: COMMERCIAL
Risk Classification: H
Risk Class Based On Review: H
Corrective Action Plan Type: air sparging and soil vapor extraction
NOV Issue Date: 06/25/1997
NORR Issue Date: 01/09/1997
Site Priority: B115
Phase Of LSA Req: Not reported
Site Risk Reason: Gross contaminant levels
Land Use: Not reported
MTBE: No
MTBE1: Unknown
Flag: No
Flag1: No
LUR Filed: Not reported
Release Detection: 0
Current Status: File Located in House
RBCA GW: Not reported
PETOPT: 3
RPL: False
CD Num: 0
Reel Num: 0
RPOW: False
RPOP: False
Error Flag: 0
Error Code: N
Valid: False
Lat/Long Decimal: 36.0830 -80.6580
Testlat: Not reported
Regional Officer Project Mgr: SBW
Region: WS
Company: REAVIS OIL COMPANY
Contact Person: KENNETH REAVIS
Telephone: Not reported
RP Address: 215 EAST MAIN ST./PO BOX 184
RP City,St,Zip: YADKINVILLE, NC 27055
RP County: Not reported
Comments: Funding resumed NORR issued and request implementation of CAP on

RENEGAR'S FOOD MART (Continued) **S108407952**

1/26/2007. 4/22/2013 sampling event detected MTBE & Naphthalene above 2L in sample from MW-3, No contaminants detectyed in the 9 water supply wells sampled. Requested reactiof as/sve ssytem and resume quarterly monitoring to include supply wells 1 & 2

5 Min Quad: Not reported
Last Modified: Not reported
Incident Phase: Response
NOV Issued: Not reported
NORR Issued: 2007-01-26 00:00:00
45 Day Report: Not reported
Public Meeting Held: Not reported
Corrective Action Planned: Not reported
SOC Signed: Not reported
Reclassification Report: Not reported
RS Designation: Not reported
Closure Request Date: Not reported
Close-out Report: Not reported

A3
ESE
1/8-1/4
0.207 mi.
1092 ft.

RENEGAR'S FOOD MARKET
1201 LONE HICKORY RD
YADKINVILLE, NC 27055

Site 2 of 2 in cluster A

UST **U003562145**
Financial Assurance **N/A**

Relative:
Higher

Actual:
1003 ft.

UST:
Facility Id: 00-0-0000005751
Contact: HALL . RENEGAR
Contact Address1: 1221 LONE HICKORY RD
Contact Address2: DBA RENEGAR'S FOOD MARKET
Contact City/State/Zip: YADKINVILLE, NC 27055
FIPS County Desc: Yadkin
Latitude: 36.08298
Longitude: -80.65797

Tank Id: 01
Tank Status: Current
Installed Date: 06/30/1992
Perm Close Date: Not reported
Product Key: 3
Product Name: Gasoline, Gas Mix
Tank Capacity: 3000
Root Tank Id: 182321
Main Tank: Yes
Compartment Tank: Yes
Manifold Tank: 0
Commercial: Yes
Regulated: Yes
Tank Construction: Unknown
Piping Construction: Single Wall FRP
Piping System Key: Unknown
Other CP Tank: Not reported
Overfill Protection Key: 5
Overfill Protection Name: Ball Float Valve
Spill Protection Key: 4
Spill Protection Name: Catchment Basin
Leak Detection Key: Not reported
Leak Detection Name: Not reported
Decode for TCONS_KEY: Unknown

RENEGAR'S FOOD MARKET (Continued) **U003562145**

Decode for PCONS_KEY:	Single Wall FRP
Decode for PSYS_KEY:	Unknown

Tank Id:	01A
Tank Status:	Current
Installed Date:	06/30/1992
Perm Close Date:	Not reported
Product Key:	3
Product Name:	Gasoline, Gas Mix
Tank Capacity:	6000
Root Tank Id:	182321
Main Tank:	No
Compartment Tank:	Yes
Manifold Tank:	0
Commercial:	Yes
Regulated:	Yes
Tank Construction:	Unknown
Piping Construction:	Single Wall FRP
Piping System Key:	Unknown
Other CP Tank:	Not reported
Overfill Protection Key:	5
Overfill Protection Name:	Ball Float Valve
Spill Protection Key:	4
Spill Protection Name:	Catchment Basin
Leak Detection Key:	Not reported
Leak Detection Name:	Not reported
Decode for TCONS_KEY:	Unknown
Decode for PCONS_KEY:	Single Wall FRP
Decode for PSYS_KEY:	Unknown

Tank Id:	01B
Tank Status:	Current
Installed Date:	06/30/1992
Perm Close Date:	Not reported
Product Key:	3
Product Name:	Gasoline, Gas Mix
Tank Capacity:	3000
Root Tank Id:	182321
Main Tank:	No
Compartment Tank:	Yes
Manifold Tank:	0
Commercial:	Yes
Regulated:	Yes
Tank Construction:	Unknown
Piping Construction:	Single Wall FRP
Piping System Key:	Unknown
Other CP Tank:	Not reported
Overfill Protection Key:	5
Overfill Protection Name:	Ball Float Valve
Spill Protection Key:	4
Spill Protection Name:	Catchment Basin
Leak Detection Key:	Not reported
Leak Detection Name:	Not reported
Decode for TCONS_KEY:	Unknown
Decode for PCONS_KEY:	Single Wall FRP

RENEGAR'S FOOD MARKET (Continued) **U003562145**

Decode for PSYS_KEY: Unknown

Tank Id:	1
Tank Status:	Removed
Installed Date:	03/23/1976
Perm Close Date:	06/23/1992
Product Key:	3
Product Name:	Gasoline, Gas Mix
Tank Capacity:	2000
Root Tank Id:	Not reported
Main Tank:	No
Compartment Tank:	No
Manifold Tank:	Not reported
Commercial:	Yes
Regulated:	Yes
Tank Construction:	Single Wall Steel
Piping Construction:	Single Wall Steel
Piping System Key:	Unknown
Other CP Tank:	Not reported
Overfill Protection Key:	1
Overfill Protection Name:	Unknown
Spill Protection Key:	1
Spill Protection Name:	Unknown
Leak Detection Key:	-1
Leak Detection Name:	Unknown
Decode for TCONS_KEY:	Single Wall Steel
Decode for PCONS_KEY:	Single Wall Steel
Decode for PSYS_KEY:	Unknown

Tank Id:	2
Tank Status:	Removed
Installed Date:	03/23/1976
Perm Close Date:	06/23/1992
Product Key:	3
Product Name:	Gasoline, Gas Mix
Tank Capacity:	2000
Root Tank Id:	Not reported
Main Tank:	No
Compartment Tank:	No
Manifold Tank:	Not reported
Commercial:	Yes
Regulated:	Yes
Tank Construction:	Single Wall Steel
Piping Construction:	Single Wall Steel
Piping System Key:	Unknown
Other CP Tank:	Not reported
Overfill Protection Key:	1
Overfill Protection Name:	Unknown
Spill Protection Key:	1
Spill Protection Name:	Unknown
Leak Detection Key:	-1
Leak Detection Name:	Unknown
Decode for TCONS_KEY:	Single Wall Steel
Decode for PCONS_KEY:	Single Wall Steel
Decode for PSYS_KEY:	Unknown

RENEGAR'S FOOD MARKET (Continued) **U003562145**

Tank Id:	3
Tank Status:	Removed
Installed Date:	03/23/1978
Perm Close Date:	06/23/1992
Product Key:	3
Product Name:	Gasoline, Gas Mix
Tank Capacity:	2000
Root Tank Id:	Not reported
Main Tank:	No
Compartment Tank:	No
Manifold Tank:	Not reported
Commercial:	Yes
Regulated:	Yes
Tank Construction:	Single Wall Steel
Piping Construction:	Single Wall Steel
Piping System Key:	Unknown
Other CP Tank:	Not reported
Overfill Protection Key:	1
Overfill Protection Name:	Unknown
Spill Protection Key:	1
Spill Protection Name:	Unknown
Leak Detection Key:	-1
Leak Detection Name:	Unknown
Decode for TCONS_KEY:	Single Wall Steel
Decode for PCONS_KEY:	Single Wall Steel
Decode for PSYS_KEY:	Unknown

Tank Id:	4
Tank Status:	Removed
Installed Date:	03/21/1984
Perm Close Date:	09/30/1992
Product Key:	1
Product Name:	Diesel
Tank Capacity:	280
Root Tank Id:	Not reported
Main Tank:	No
Compartment Tank:	No
Manifold Tank:	Not reported
Commercial:	Yes
Regulated:	Yes
Tank Construction:	Single Wall Steel
Piping Construction:	Single Wall Steel
Piping System Key:	Unknown
Other CP Tank:	Not reported
Overfill Protection Key:	1
Overfill Protection Name:	Unknown
Spill Protection Key:	1
Spill Protection Name:	Unknown
Leak Detection Key:	-1
Leak Detection Name:	Unknown
Decode for TCONS_KEY:	Single Wall Steel
Decode for PCONS_KEY:	Single Wall Steel
Decode for PSYS_KEY:	Unknown

NC Financial Assurance 1:

Facility ID:	00-0-0000005751

RENEGAR'S FOOD MARKET (Continued) **U003562145**

Region: 1
Financial Responsibility Desc: Insurance & Risk Retension
Financial Responsibility Name: Colony Insurance Company
Started Date: Not reported
Ended Date: Not reported

4
NE
1/4-1/2
0.306 mi.
1617 ft.

NCDOT-SEIDERS PROP
2448 US HWY 601
YADKINVILLE, NC 27055

LUST **S105898019**
IMD **N/A**

Relative:
Higher

Actual:
950 ft.

LUST:
Facility ID: Not reported
UST Number: WS-6689
Incident Number: 30203
Contamination Type: SL
Source Type: Leak-underground
Product Type: P
Date Reported: 06/23/2003
Date Occur: 04/25/2003
Cleanup: 11/13/2003
Closure Request: Not reported
Close Out: 01/07/2015
Level Of Soil Cleanup Achieved: Not reported
Tank Regulated Status: R
Of Supply Wells: 0
Commercial/NonCommercial UST Site: COMMERCIAL
Risk Classification: H
Risk Class Based On Review: L
Corrective Action Plan Type: Not reported
NOV Issue Date: Not reported
NORR Issue Date: Not reported
Site Priority: Not reported
Phase Of LSA Req: 1
Site Risk Reason: Not reported
Land Use: Residential
MTBE: No
MTBE1: Unknown
Flag: No
Flag1: No
LUR Filed: Not reported
Release Detection: 0
Current Status: File Located in House
RBCA GW: Not reported
PETOPT: 3
RPL: True
CD Num: 0
Reel Num: Not reported
RPOW: False
RPOP: False
Error Flag: 0
Error Code: N
Valid: False
Lat/Long Decimal: 36.0933 -80.6539
Testlat: Not reported
Regional Officer Project Mgr: STF
Region: WS

NCDOT-SEIDERS PROP (Continued) **S105898019**

Company: WANDA SEIDERS
Contact Person: VICTOR SEIDERS
Telephone: 3364634791
RP Address: 1147 SESAME DRIVE
RP City,St,Zip: YADKINVILLE-COURTNEY, NC 27055
RP County: Not reported
Comments: NCDOT right of way survey dected TPH above 10ppm. LSA required. Wanda Seiders may not be statutory owner. Last living person to own and operate was Edith Hauser. Edith was eligible for trust fund reimbursement per letter dated 9/9/2003 from Leann Isha. Sent to CO on 01/06/2006.
5 Min Quad: Not reported

PIRF:
Facility Id: 30203
Date Occurred: 2003-04-25 00:00:00
Date Reported: 2003-06-23 00:00:00
Description Of Incident: Contaminated soil was discovered during NC DOT widening project.
Owner/Operator: Not reported
Ownership: 4
Operation Type: 6
Type: 3
Location: 8
Site Priority: Not reported
Priority Update: Not reported
Wells Affected Y/N: n
Samples Include: Not reported
7#5 Minute Quad: y
5 Minute Quad: Not reported
Pirf/Min Soil: Not reported
Release Code: Not reported
Source Code: Not reported
Err Type: 9
Cause: Not reported
Source: E
Ust Number: E

Last Modified: 2015-01-07 00:00:00
Incident Phase: **Closed Out**
NOV Issued: 2004-02-12 00:00:00
NORR Issued: 2003-07-24 00:00:00
45 Day Report: Not reported
Public Meeting Held: Not reported
Corrective Action Planned: Not reported
SOC Signed: Not reported
Reclassification Report: Not reported
RS Designation: Not reported
Closure Request Date: Not reported
Close-out Report: Not reported

IMD:
Region: WS
Facility ID: 30203
Date Occurred: 4/25/2003
Submit Date: 6/23/2003
GW Contam: No Groundwater Contamination detected
Soil Contam: Yes

NCDOT-SEIDERS PROP (Continued) **S105898019**

Incident Desc: Contaminated soil was discovered during NC DOT widening project.
Operator: VICTOR SEIDERS
Contact Phone: 3364634791
Owner Company: WANDA SEIDERS
Operator Address: 1147 SESAME DRIVE
Operator City: YADKINVILLE-COURTNEY
Oper City,St,Zip: YADKINVILLE-COURTNEY, NC 27055-
Ownership: Private
Operation: Commercial
Material: Not reported
Qty Lost 1: Not reported
Qty Recovered 1: Not reported
Source: Leak-underground
Type: Gasoline/diesel
Location: 8
Setting: Not reported
Risk Site: H
Site Priority: Not reported
Priority Code: Not reported
Priority Update: Not reported
Dem Contact: STF
Wells Affected: No
Num Affected: Not reported
Wells Contam: Not reported
Sampled By: y
Samples Include: Not reported
7.5 Min Quad: Not reported
5 Min Quad: Not reported
Latitude: 36.07694444
Longitude: -80.64861111
Latitude Number: 360437
Longitude Number: 803855
Latitude Decimal: 36.0769444444444
Longitude Decimal: 80.6486111111111
GPS: 7
Agency: DWM
Facility ID: 30203
Last Modified: Not reported
Incident Phase: RE
NOV Issued: 2/12/2004
NORR Issued: 7/24/2003
45 Day Report: Not reported
Public Meeting Held: Not reported
Corrective Action Planned: Not reported
SOC Sighned: Not reported
Reclassification Report: Not reported
RS Designation: Not reported
Closure Request Date: Not reported
Close-out Report: Not reported

June 24, 2016

Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

Subject: Lone Hickory Mitigation Site
Yadkin County, North Carolina

Dear Ms. Gledhill-Earley,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with the Lone Hickory Mitigation Site. A USGS Topographic Map and an Overview Site Map with approximate project areas are enclosed.

The Lone Hickory Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on several unnamed tributaries to South Deep Creek. The site has historically been disturbed due to agricultural use, including both cattle and row crops.

We ask that you review this site based on the attached information to determine the presence of any historic properties.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the project.

Sincerely,

Ruby M. Davis

Ruby M. Davis
Environmental Scientist
rdavis@wildlandseng.com

Attachment:
USGS Topographic Map
Overview Site Map

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Pat McCrory
Secretary Susan Kluttz

Office of Archives and History
Deputy Secretary Kevin Cherry

July 8, 2016

Ruby Davis
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, NC 28203

Re: Lone Hickory Mitigation Site, Yadkin County, ER 16-1139

Dear Ms. Davis:

Thank you for your letter of June 24, 2016, 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 M. Bartos

WILDLANDS
ENGINEERING

September 1, 2016

Reavico Farms, Inc.
Nancy R. and Michael S. Shore
Cynthia H. and Hughes M. Reavis
Jennifer B. and Joel D. Reavis
Janet R. and Charles M. Wall
Ann R. and Howard F. Steelman

Re: Lone Hickory Mitigation Site

Dear Nancy, Michael, Cynthia, Hughes, Jennifer, Joel, Janet, Charles, Anne and Howard:

In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Wildlands hereby notifies you that: (i) Wildlands believes that the fair market value of your property that is part of the Lone Hickory Mitigation Site is an amount equal to the purchase price; and (ii) Wildlands does not have the power of eminent domain.

Sincerely,

Shawn D. Wilkerson
President

Andrea Eckardt

From: Nancy Shore <mnshore214@yahoo.com>
Sent: Thursday, September 01, 2016 9:44 PM
To: Janet Wall
Cc: Robert Bugg
Subject: Re: Uniform Act Notification concerning our purchase of your property

Robert, Janet forwarded this e-mail to me when she saw my name was not on the original e-mail sent out. I am sending my response to let you know I have now received a forwarded e-mail.

Nancy Shore
Sent from my iPhone

On Sep 1, 2016, at 9:16 PM, Janet Wall <walljanet@gmail.com> wrote:

> Email from Robert.
>
> ---------- Forwarded message ----------
> From: "Robert Bugg" <rbugg@wildlandseng.com>
> Date: Sep 1, 2016 1:49 PM
> Subject: Uniform Act Notification concerning our purchase of your property
> To: "hmreavis@gmail.com" <hmreavis@gmail.com>, "Joel & Jennifer Reavis" <jreavishome@gmail.com>, "Janet Wall" <walljanet@gmail.com>, "hsteele@triad.rr.com" <hsteele@triad.rr.com>
> Cc: "Lee Caffery" <lcaffery@wildlandseng.com>
>
> Reavis family,
>
> As we work through details of the closing next year the NC Division of Mitigation Services has asked us to formally notify you that we that we believe that the purchase price of your property is equal to its fair market value and that you are aware that we do not have the power of eminent domain. (We are not purchasing your property via a government "taking".)
>
> Please see the attached letter. Will each of you please reply back with the simple words "Received" so we know you got it? Feel free to call if you have any questions.
>
> All is proceeding well with our process towards closing. Stream and wetland delineations are complete. Survey work is underway and will be completed as soon as your tenant farmer harvests his corn. (We can't see over it!) We are planning on making the additional option fee

Andrea Eckardt

From: Joel & Jennifer Reavis <jreavishome@gmail.com>
Sent: Thursday, September 01, 2016 8:21 PM
To: Robert Bugg
Cc: hmreavis@gmail.com; Janet Wall; Lee Caffery
Subject: Re: Uniform Act Notification concerning our purchase of your property

Received.

Joel Reavis

Sent from my iPad

On Sep 1, 2016, at 3:49 PM, Robert Bugg <rbugg@wildlandseng.com> wrote:

> Reavis family,
>
> As we work through details of the closing next year the NC Division of Mitigation Services has asked us to formally notify you that we that we believe that the purchase price of your property is equal to its fair market value and that you are aware that we do not have the power of eminent domain. (We are not purchasing your property via a government "taking".)
>
> Please see the attached letter. Will each of you please reply back with the simple words "Received" so we know you got it? Feel free to call if you have any questions.
>
> All is proceeding well with our process towards closing. Stream and wetland delineations are complete. Survey work is underway and will be completed as soon as your tenant farmer harvests his corn. (We can't see over it!) We are planning on making the additional option fee as required by our agreement in January and closing should be in early 4th quarter next year. No other news.
>
> Thanks for your reply to this email! I hope you are all doing well and enjoy a great Labor Day weekend.
>
> **Robert W. Bugg, ALC** | Director: Land Acquisition
> **O**: 704.332.7754 x105 **M**: 704.719.2100
>
> **Wildlands Engineering, Inc.**
> 1430 S. Mint St, Suite 104
> Charlotte, NC 28203
>
> <Uniform Act Notification Letter.pdf>

Andrea Eckardt

From: Janet Wall <walljanet@gmail.com>
Sent: Thursday, September 01, 2016 5:49 PM
To: Robert Bugg
Cc: hsteele@triad.rr.com; Joel Reavis; Hugh Reavis
Subject: Re: Uniform Act Notification concerning our purchase of your property

Received. I believe you left out the email for Nancy.

On Sep 1, 2016 1:49 PM, "Robert Bugg" <rbugg@wildlandseng.com> wrote:

> Reavis family,
>
> As we work through details of the closing next year the NC Division of Mitigation Services has asked us to formally notify you that we that we believe that the purchase price of your property is equal to its fair market value and that you are aware that we do not have the power of eminent domain. (We are not purchasing your property via a government "taking".)
>
> Please see the attached letter. Will each of you please reply back with the simple words "Received" so we know you got it? Feel free to call if you have any questions.
>
> All is proceeding well with our process towards closing. Stream and wetland delineations are complete. Survey work is underway and will be completed as soon as your tenant farmer harvests his corn. (We can't see over it!) We are planning on making the additional option fee as required by our agreement in January and closing should be in early 4th quarter next year. No other news.
>
> Thanks for your reply to this email! I hope you are all doing well and enjoy a great Labor Day weekend.
>
> **Robert W. Bugg, ALC** | Director: Land Acquisition
>
> **O**: 704.332.7754 x105 **M**: 704.719.2100
>
> **Wildlands Engineering, Inc.**

Andrea Eckardt

From: Hugh Reavis <hmreavis@gmail.com>
Sent: Thursday, September 01, 2016 6:19 PM
To: Robert Bugg; Joel & Jennifer Reavis; Janet Wall; hsteele@triad.rr.com
Cc: Lee Caffery
Subject: Re: Uniform Act Notification concerning our purchase of your property

Received
Hugh

On Thu, Sep 1, 2016, 3:49 PM Robert Bugg <rbugg@wildlandseng.com> wrote:

> Reavis family,
>
> As we work through details of the closing next year the NC Division of Mitigation Services has asked us to formally notify you that we that we believe that the purchase price of your property is equal to its fair market value and that you are aware that we do not have the power of eminent domain. (We are not purchasing your property via a government "taking".)
>
> Please see the attached letter. Will each of you please reply back with the simple words "Received" so we know you got it? Feel free to call if you have any questions.
>
> All is proceeding well with our process towards closing. Stream and wetland delineations are complete. Survey work is underway and will be completed as soon as your tenant farmer harvests his corn. (We can't see over it!) We are planning on making the additional option fee as required by our agreement in January and closing should be in early 4th quarter next year. No other news.
>
> Thanks for your reply to this email! I hope you are all doing well and enjoy a great Labor Day weekend.
>
> **Robert W. Bugg, ALC** | Director: Land Acquisition
>
> **O**: 704.332.7754 x105 **M**: 704.719.2100
>
> **Wildlands Engineering, Inc.**

Andrea Eckardt

From: Howard Steelman <hsteele@triad.rr.com>
Sent: Thursday, September 01, 2016 4:39 PM
To: Robert Bugg
Subject: RE: Uniform Act Notification concerning our purchase of your property

Received Ann Steelman

From: Robert Bugg [mailto:rbugg@wildlandseng.com]
Sent: Thursday, September 1, 2016 3:50 PM
To: hmreavis@gmail.com; Joel & Jennifer Reavis; Janet Wall; hsteele@triad.rr.com
Cc: Lee Caffery
Subject: Uniform Act Notification concerning our purchase of your property

Reavis family,

As we work through details of the closing next year the NC Division of Mitigation Services has asked us to formally notify you that we that we believe that the purchase price of your property is equal to its fair market value and that you are aware that we do not have the power of eminent domain. (We are not purchasing your property via a government "taking".)

Please see the attached letter. Will each of you please reply back with the simple words "Received" so we know you got it? Feel free to call if you have any questions.

All is proceeding well with our process towards closing. Stream and wetland delineations are complete. Survey work is underway and will be completed as soon as your tenant farmer harvests his corn. (We can't see over it!) We are planning on making the additional option fee as required by our agreement in January and closing should be in early 4th quarter next year. No other news.

Thanks for your reply to this email! I hope you are all doing well and enjoy a great Labor Day weekend.

Robert W. Bugg, ALC | Director: Land Acquisition
O: 704.332.7754 x105 **M**: 704.719.2100

Wildlands Engineering, Inc.
1430 S. Mint St, Suite 104
Charlotte, NC 28203

August 9, 2016

Marella Buncick
US Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801

Subject: Lone Hickory Mitigation Site -Yadkin County, North Carolina

Dear Ms. Buncick,

The Lone Hickory Mitigation Site (located at Reavico Farms Rd, Yadkinville, NC) is being developed to provide stream and wetland mitigation units to the Division of Mitigation Services in the Yadkin River Basin. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on several unnamed tributaries to South Deep Creek. The site has historically been disturbed due to agricultural use, including both cattle and row crops.

According to your website (http://ecos.fws.gov/tess_public/reports/species-by- current-rangecounty), the Northern long-eared bat is the only federally-listed species in Yadkin County.

A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Lone Hickory, 7.5-Minute USGS Topographic Quadrangles. The red boundary is the easement boundary. The new stream alignment will be through the pasture areas, so tree clearing is minimal.

Sincerely,

Andrea S. Eckardt

Andrea S. Eckardt
Sr. Environmental Planner

Attachment:
USGS Topographic Map and Overview Site Map

Andrea Eckardt

From: Brew, Donnie (FHWA) <Donnie.Brew@dot.gov>
Sent: Tuesday, August 09, 2016 10:33 AM
To: Marella_Buncick@fws.gov; andrew_henderson@fws.gov
Cc: Andrea Eckardt; Wiesner, Paul
Subject: NLEB 4(d) Rule streamlined consultation - Lone Hickory Mitigation site
Attachments: Lone Hickory Mitigation site NLEB 4(d) consultation form 8-9-16.pdf; Lone Hickory site cover letter & maps.pdf

Good morning Marella, Andrew,

The purpose of this message is to notify your office that FHWA will use the streamlined consultation framework for the Lone Hickory Mitigation Site in Yadkinville, NC.

Attached is a completed NLEB 4(d) Rule Streamlined Consultation form, in addition to background project information including maps.

Thank you and have a great day,

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

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]?	☐	X
2. Have you contacted the appropriate agency[2] to determine if your project is near known hibernacula or maternity roost trees?	X	☐
3. Could the project disturb hibernating NLEBs in a known hibernaculum?	☐	X
4. Could the project alter the entrance or interior environment of a known hibernaculum?	☐	X
5. Does the project remove any trees within 0.25 miles of a known hibernaculum at any time of year?	☐	X
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.	☐	X

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.): Donnie Brew, Federal Highway Administration, donnie.brew@dot.gov, 919-747-7017 and Wildlands Engineering, Inc., aeckardt@wildlandseng.com; 704-332-7754 ext. 101

Project Name: Lone Hickory Mitigation Site.

Project Location (include coordinates if known): Reavico Farms Rd, Yadkinville, NC (3.5 miles south of the Town of Yadkinville and 24 miles west of the City of Winston-Salem in Yadkin County, NC.)

Basic Project Description (provide narrative below or attach additional information): The Lone Hickory Mitigation Site is a stream and wetland mitigation project. The project includes 7 unnamed tributaries to South Deep Creek for a total of more than 13,000 linear feet of stream. Historically the site has been used for cattle and row crops. The site is currently used for row crop production. The project will provide stream and wetland mitigation units to the Division of Mitigation Services in the Yadkin River Basin (03040101).

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

General Project Information

	YES	NO
Does the project occur within 0.25 miles of a known hibernaculum?	☐	X
Does the project occur within 150 feet of a known maternity roost tree?	☐	X
Does the project include forest conversion[4]? (if yes, report acreage below)	X	☐
Estimated total acres of forest conversion	0.7 acre	
If known, estimated acres[5] of forest conversion from April 1 to October 31	0.7 acre	
If known, estimated acres of forest conversion from June 1 to July 31[6]	N/A	
Does the project include timber harvest? (if yes, report acreage below)	☐	X
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)	☐	X
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)	☐	X
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: 8-9-16

[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.

Andrea Eckardt

From: Buncick, Marella <marella_buncick@fws.gov>
Sent: Tuesday, August 09, 2016 1:48 PM
To: Brew, Donnie (FHWA)
Cc: andrew_henderson@fws.gov; Andrea Eckardt; Wiesner, Paul
Subject: Re: NLEB 4(d) Rule streamlined consultation - Lone Hickory Mitigation site

Thanks Donnie. Paul, is this a site that the IRT will be reviewing?

marella

On Tue, Aug 9, 2016 at 10:33 AM, Brew, Donnie (FHWA) <Donnie.Brew@dot.gov> wrote:

> Good morning Marella, Andrew,
>
> The purpose of this message is to notify your office that FHWA will use the streamlined consultation framework for the Lone Hickory Mitigation Site in Yadkinville, NC.
>
> Attached is a completed NLEB 4(d) Rule Streamlined Consultation form, in addition to background project information including maps.
>
> Thank you and have a great day,
>
> 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)

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Asheville Field Office
160 Zillicoa Street
Asheville, North Carolina 28801

August 31, 2016

Ruby Davis
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, North Carolina 28203

Dear Ms. Davis:

Subject: Lone Hickory Mitigation Project; Yadkin County, North Carolina
Log No. 4-2-16-574

The U.S. Fish and Wildlife Service (Service) has reviewed the information provided in your correspondence dated June 24, 2016 (received August 31, 2016). You requested our comments on potential impacts to federal trust resources that may result from the proposed project. The Service submits the following comments in accordance with the provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the National Environmental Policy Act (42 U.S.C. §4321 et seq.); and section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act).

<u>Project Description</u>
Based on the information provided, you intend to explore the potential to restore several unnamed tributaries of the South Deep Creek that occur within the project area to provide in-kind mitigation for unavoidable impacts to jurisdictional streams. The project area appears to be dominated by agricultural land cover and you indicate that the streams have been significantly degraded. However, beyond this information, no additional project details were included in your correspondence.

<u>Federally Listed Endangered and Threatened Species</u>
According to Service records, suitable summer roosting habitat may be present on site for the federally threatened northern long-eared bat. However, the final 4(d) rule (effective as of February 16, 2016), exempts incidental take of northern long-eared bat associated with activities

that occur greater than 0.25 miles from a known hibernation site, and greater than 150 feet from a known, occupied maternity roost during the pup season (June 1 – July 31). Based on the information provided, the project (which may require tree clearing) would occur at a location where any incidental take that may result from associated activities is exempt under the 4(d) rule.

The Service has record of no other federally protected species in the project area. Therefore, we consider the requirements under the Act to be complete and require no further action at this time. Please be aware that obligations under section 7 of the Act must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified in a manner that was not considered in this review, or (3) a new species is listed or critical habitat is determined that may be affected by the identified action.

We offer the following recommendations in the interest of protecting fish, wildlife, and other natural resources.

<u>Stream Channel and Bank Reconstruction/Restoration Activities</u>
A natural, stable stream system is one that is able to transport a wide range of flows and associated bed load (sediment) while maintaining channel features and neither degrading (accelerating the erosion of banks and scour of the channel bed) nor aggrading (accelerating the deposition of sediment within the channel). The majority of property damage associated with flood events in areas that contain, or are adjacent to, streams often can be tied to human-caused alterations within the stream corridor, such as the removal of streambank vegetation, channelization, and/or dredging of the stream and the placement of fill within floodplains. To avoid future damage and associated costs, it is critical that proposals to repair storm-damaged property within stream corridors emphasize the restoration of natural, stable stream conditions. Accordingly, we recommend the following:

1. All reconstruction work should follow natural channel design methodologies that are based on the bank-full, or channel-forming, stage of the stream. Natural channel conditions should be identified using a reference reach (nearby stream reaches that exemplify restoration goals). Restoration design should match the pattern, dimension, and profile of the reference reach to ensure the project's success.

2. All work in or adjacent to stream waters should be conducted in a dry work area to the extent possible.

3. Equipment should not be operated in the stream unless absolutely necessary. Machinery should be operated from the banks in a fashion that minimizes disturbance. Equipment should be: (a) washed to remove any contaminant residue prior to project construction, (b) in good working order, and (c) checked to ensure there are no leaks of potential contaminants (such as oil or other lubricants) prior to and during construction.

4. Deep-rooting woody vegetation should be established along banks where any channel work is accomplished. Tree and shrub plantings should be spaced at intervals no greater

than 10 feet along banks. Vegetated riparian zone widths should be as wide as practical but should extend at least 30 feet from the stream channel.

5. **Reconstruction work should be staged such that disturbed areas are stabilized with seeding, mulch, and/or biodegradable (coir) erosion-control matting prior to the end of each workday.** No erosion-control matting or blankets should contain synthetic (netting) materials. Matting should be secured in place with staples; stakes; or, wherever possible, live stakes of native trees. If rain is expected prior to temporary seed establishment, additional measures should be implemented to protect water quality along slopes and overburden stockpiles (for example, stockpiles may be covered with plastic or other geotextile material).

6. Cross-sections (at intervals based on restoration reach size), longitudinal profiles, and stream-pattern plans should be measured and mapped prior to and immediately following any channel work. In addition, photographs should be taken to document the condition of the project site prior to initiating the work and upon completion of the work. However, since a project's restoration success does not necessarily equate to biological success, the ecological goals of the project should be clearly defined and assessed for improvement after construction is completed.

Invasive Exotic Species

Without active management, including the revegetation of disturbed areas with native species, this project may become a corridor for the movement of invasive exotic plant species. Exotic species are a major contributor to species depletion and extinction, second only to habitat loss. Exotics are a factor contributing to the endangered or threatened status of more than 40 percent of the animals and plants on the *Federal List of Endangered and Threatened Wildlife and Plants*.[1] It is estimated that at least 4,000 exotic plant species and 2,300 exotic animal species are now established in the United States, costing more than $130 billion a year to control.[2] Additionally, the U.S. Government has many programs and laws in place to combat invasive species (see *www.invasivespecies.gov*). Specifically, Section 2(a)(3) of Executive Order 13112 - Invasive Species (February 3, 1999) directs federal agencies to "not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere." Despite their short-term erosion-control benefits, many exotic species used in soil stabilization seed mixes are persistent once they are established, thereby preventing the reestablishment of native vegetation. Many of these exotic plants[3] are also aggressive invaders of nearby natural areas, where they are capable of displacing already-established native species. Therefore, we strongly recommend that only species native to the natural communities within the project area be used in association with all aspects of this project.

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[1]D.S. Wilcove, D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience 48:607-615.
[2]D. Pimentel, L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and economic costs of nonindigenous species in the United States. BioScience 50:53-65.
[3]Lists of invasive exotic plants can be found at *http://www.tneppc.org/* and *http://www.invasive.org/eastern/srs/* (exotic wildlife links) on the Internet.

The Service supports the restoration objectives of this project. Please contact Mr. Byron Hamstead of our staff at 828/258-3939, Ext. 225, if you have any questions. In any future correspondence concerning this project, please reference our Log Number 4-2-16-574.

Sincerely,

- - original signed - -

Janet A. Mizzi
Field Supervisor

Ian Eckardt

From: Ian Eckardt
Sent: Friday, July 29, 2016 2:31 PM
To: 'Cortes, Milton - NRCS, Raleigh, NC'
Subject: Completed AD1006 Form - Lone Hickory Mitigation Site - Yadkin County, NC
Attachments: Lone Hickory - AD1006 Form (Completed 7.29.2016).pdf

Milton,

Thanks for your assistance with the AD1006 form. Please find attached the completed form for the Lone Hickory Mitigation Site. Please let me know if you need anything else for your records.

Ian Eckardt | *Environmental Scientist*
O: 704.332.7754 x108 **M**: 704.517-4988

Wildlands Engineering, Inc.
1430 S. Mint St, Suite 104
Charlotte, NC 28203

Ian Eckardt

From: Cortes, Milton - NRCS, Raleigh, NC <Milton.Cortes@nc.usda.gov>
Sent: Tuesday, July 12, 2016 5:40 PM
To: Ian Eckardt
Subject: RE: Request for AD1006 Form - Lone Hickory Mitigation Site - Yadkin County, NC
Attachments: Letter_Lone Hickory Mitigation Site.pdf; Lone Hickory - AD1006.pdf

Importance: High

Ian:

Please find attached the response to your request for AD1006 Form - Lone Hickory Mitigation Site - Yadkin County, NC

If you have any question please let me know

Milton Cortés
Assistant State Soil Scientist
USDA NRCS
Raleigh, NC 27609
(919) 873-2171
Helping People Help the Land...

From: Ian Eckardt [mailto:ieckardt@wildlandseng.com]
Sent: Wednesday, June 29, 2016 4:28 PM
To: Cortes, Milton - NRCS, Raleigh, NC <Milton.Cortes@nc.usda.gov>
Subject: Request for AD1006 Form - Lone Hickory Mitigation Site - Yadkin County, NC

Milton,

I have a request for a completed AD1006 form for another NCDENR Division of Mitigation Services (DMS) stream restoration project (Lone Hickory Mitigation Site) located in Yadkin County. Please find attached a Vicinity Map and Soils Map in addition to the AD1006 form with Parts I and III filled out. The soil breakdown is included on the Soil Map.

Thanks for your assistance and please let me know if you need any additional information.

Ian Eckardt | Environmental Scientist
O: 704.332.7754 x108 **M**: 704.517.4988

Wildlands Engineering, Inc.
1430 S. Mint St, Suite 104
Charlotte, NC 28203

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 6/29/16
Name Of Project Lone Hickory Mitigation Site	Federal Agency Involved FHWA - NCDMS
Proposed Land Use Stream Restoration	County And State Yadkin County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

	Yes	No	Acres Irrigated	Average Farm Size
Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	☑	☐	-NONE	75 acres

Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 174, 015 acres % 81	Amount Of Farmland As Defined in FPPA Acres: 153, 764 acres % 71
Name Of Land Evaluation System Used Yadlin Co. LESA	Name Of Local Site Assessment System None	Date Land Evaluation Returned By NRCS July 12, 2016 by email

PART III *(To be completed by Federal Agency)*	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	80.7			
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	80.7	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	37.8			
B. Total Acres Statewide And Local Important Farmland	10.9			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.03170			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	71.0			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*				

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points	Site A	Site B	Site C	Site D
1. Area In Nonurban Use	15	14			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	18			
4. Protection Provided By State And Local Government	20	20			
5. Distance From Urban Builtup Area	0	0			
6. Distance To Urban Support Services	0	0			
7. Size Of Present Farm Unit Compared To Average	10	7			
8. Creation Of Nonfarmable Farmland	25	5			
9. Availability Of Farm Support Services	5	5			
10. On-Farm Investments	20	15			
11. Effects Of Conversion On Farm Support Services	25	0			
12. Compatibility With Existing Agricultural Use	10	0			
TOTAL SITE ASSESSMENT POINTS	160				
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100				
Total Site Assessment *(From Part VI above or a local site assessment)*	160				
TOTAL POINTS *(Total of above 2 lines)*	260	135	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

This form was electronically produced by National Production Services Staff

Clear Form

Form AD-1006 (10-83)

June 24, 2016

Shannon Deaton
North Carolina Wildlife Resource Commission
Division of Inland Fisheries
1721 Mail Service Center
Raleigh, NC 27699

Subject: Lone Hickory Mitigation Site
Yadkin County, North Carolina

Dear Ms. Deaton,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with the proposed Lone Hickory Mitigation Site. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Lone Hickory, 7.5-Minute USGS Topographic Quadrangles.

The Lone Hickory Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on several unnamed tributaries to South Deep Creek. The site has historically been disturbed due to agricultural use, including both cattle and row crops.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

Ruby M. Davis

Ruby M. Davis
Environmental Scientist

Attachment:
USGS Topographic Map
Overview Site Map

1430 South Mint Street, Suite 104, Charlotte, NC 28203 ◦ (P) 704-332-7754 ◦ (F) 704-332-3306

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

July 7, 2016

Ruby Davis
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, NC 28203

SUBJECT: Lone Hickory Mitigation Site
UTs to South Deep Creek, Yadkin County

Dear Ms. Davis:

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) received your June 24, 2016 letter regarding a possible stream restoration project on unnamed tributaries (UTs) to South Deep Creek in Yadkin County. You requested information concerning any issues that might arise with respect to fish and wildlife. Our comments on this project are offered for your consideration under provisions of the Clean Water Act of 1977 (33 U.S.C. 466 et. seq.) and Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667d).

There was no information provided on project design or length.

This project will not impact wild trout resources or other known significant aquatic resources. We recommend that riparian buffers that are to be reestablished be as wide as possible, given site constraints and landowner needs. NCWRC generally recommends a woody buffer of 100 feet on perennial streams in order to maximize the benefits of buffers, including bank stability, stream shading, treatment of overland runoff, and wildlife habitat.

Thank you for the opportunity to review and comment on this project. Please contact me at (828) 558-6011 if you have any questions about these comments.

Sincerely,

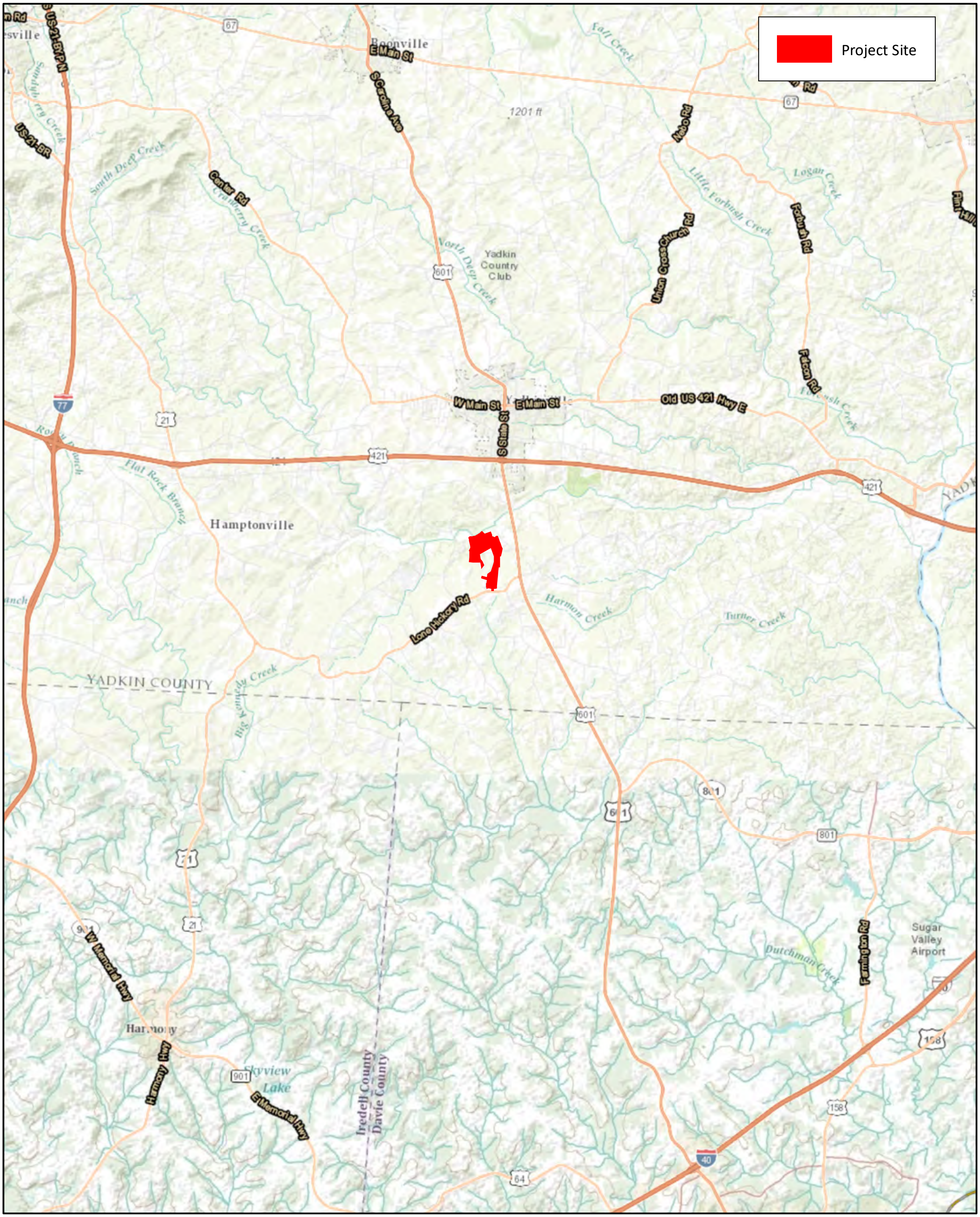
Andrea Leslie

Andrea Leslie
Mountain Region Coordinator, Habitat Conservation Program

Mailing Address: Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

Lone Hickory Mitigation Site
Categorical Exclusion

FIGURES

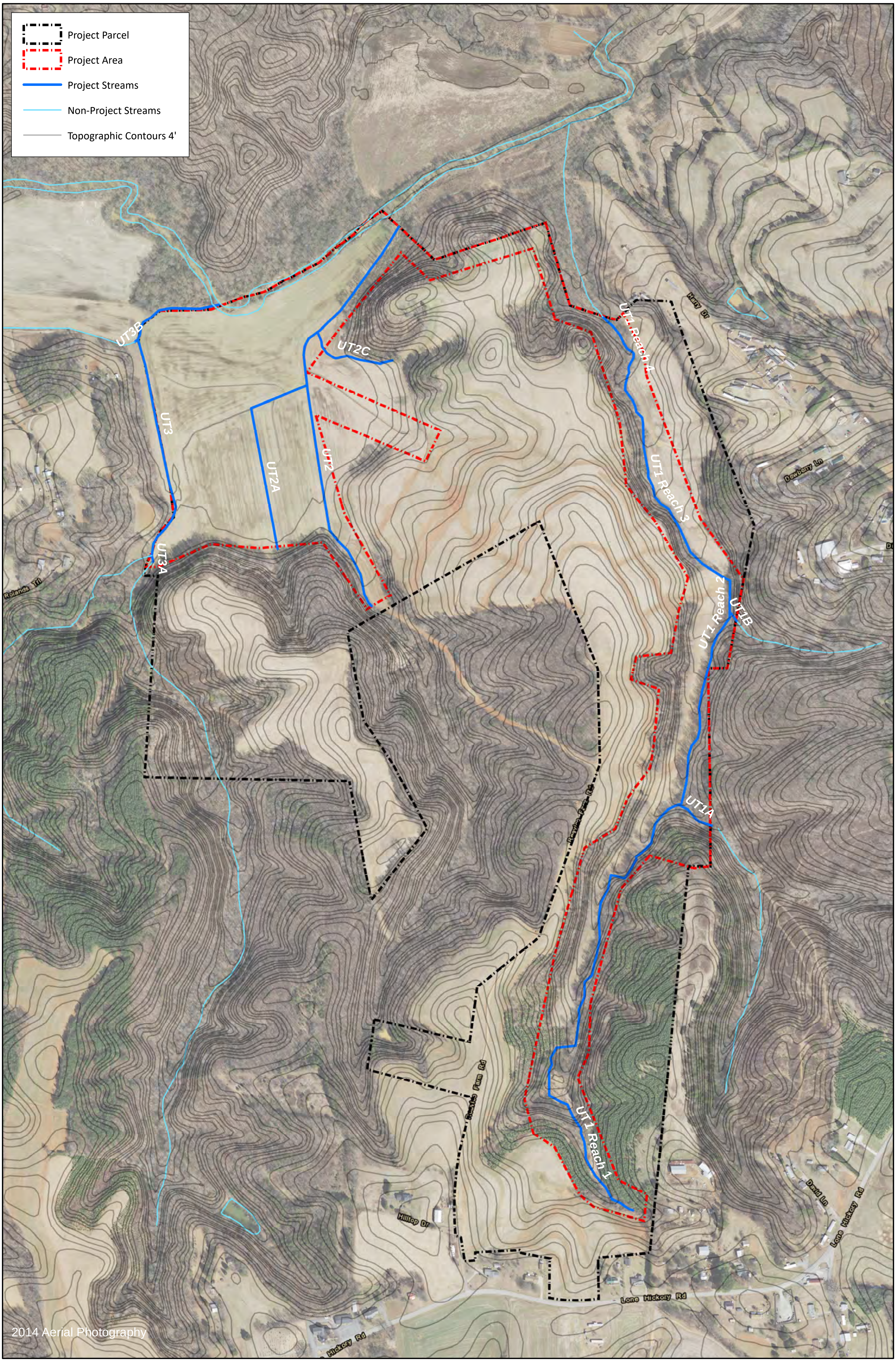


0 2 4 Miles

N

Vicinity Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

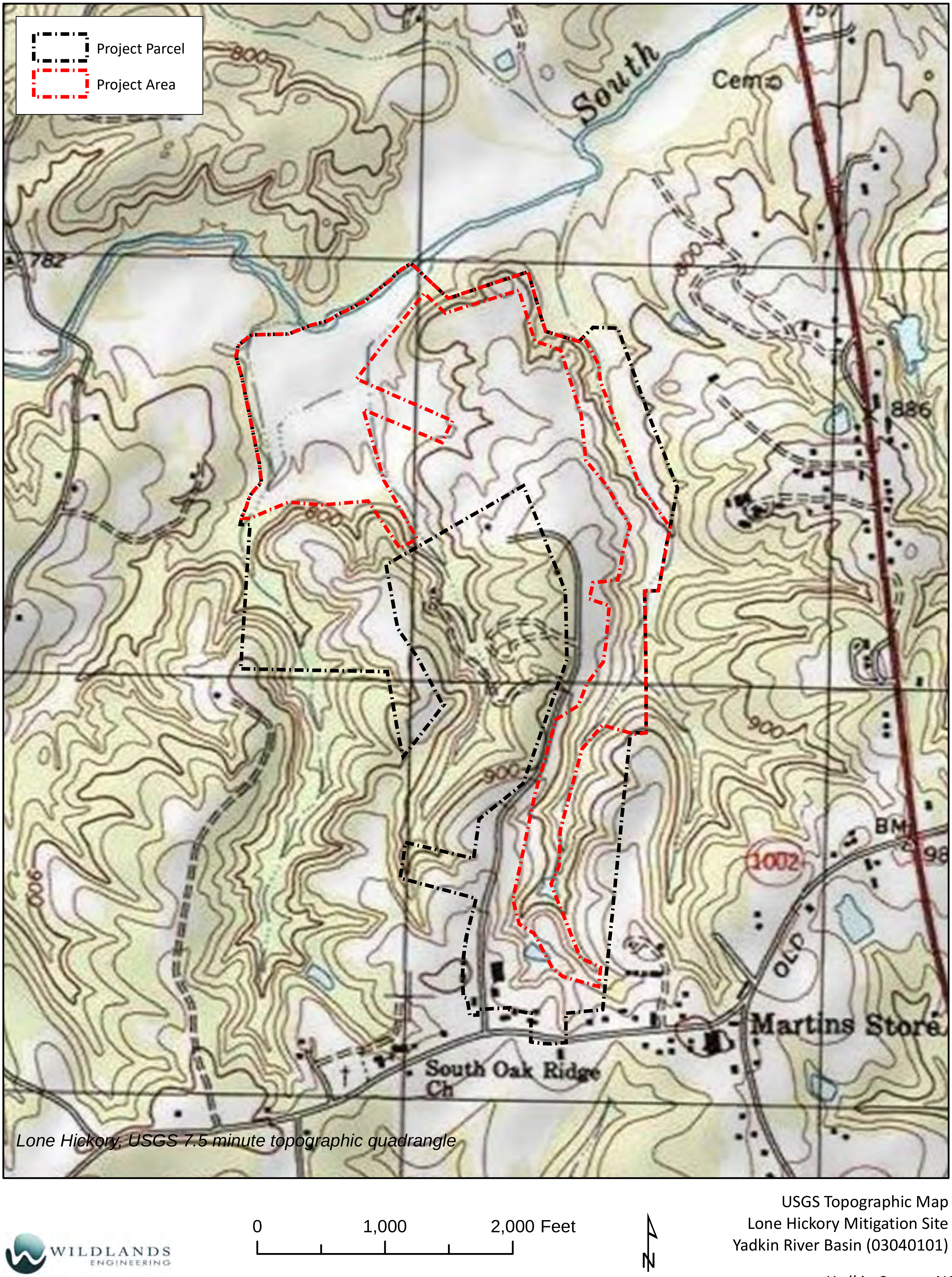
Yadkin County, NC



0 500 1,000 Feet

Overview Site Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

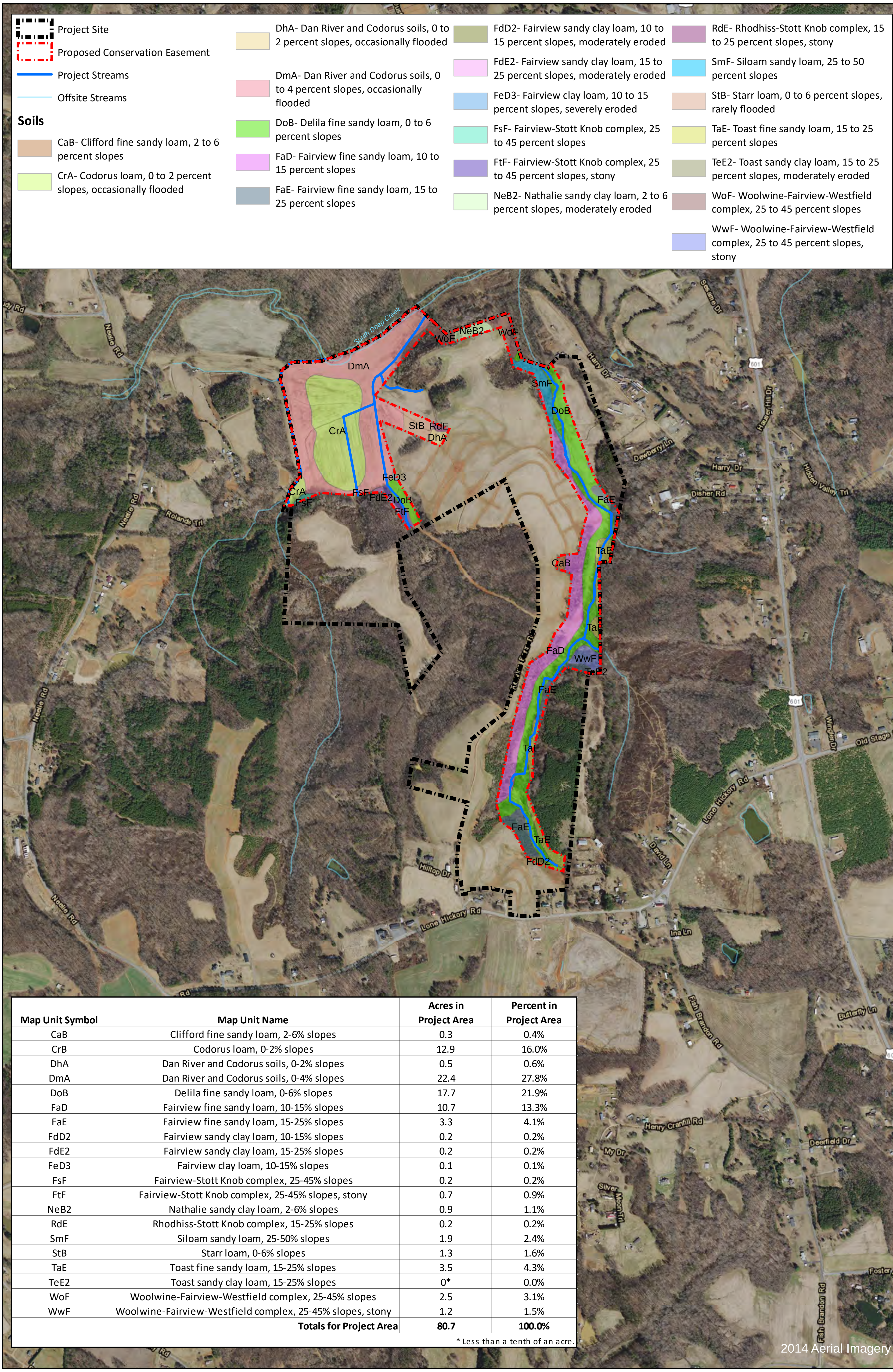
Yadkin County, NC



USGS Topographic Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

WILDLANDS ENGINEERING



Map Unit Symbol	Map Unit Name	Acres in Project Area	Percent in Project Area
CaB	Clifford fine sandy loam, 2-6% slopes	0.3	0.4%
CrB	Codorus loam, 0-2% slopes	12.9	16.0%
DhA	Dan River and Codorus soils, 0-2% slopes	0.5	0.6%
DmA	Dan River and Codorus soils, 0-4% slopes	22.4	27.8%
DoB	Delila fine sandy loam, 0-6% slopes	17.7	21.9%
FaD	Fairview fine sandy loam, 10-15% slopes	10.7	13.3%
FaE	Fairview fine sandy loam, 15-25% slopes	3.3	4.1%
FdD2	Fairview sandy clay loam, 10-15% slopes	0.2	0.2%
FdE2	Fairview sandy clay loam, 15-25% slopes	0.2	0.2%
FeD3	Fairview clay loam, 10-15% slopes	0.1	0.1%
FsF	Fairview-Stott Knob complex, 25-45% slopes	0.2	0.2%
FtF	Fairview-Stott Knob complex, 25-45% slopes, stony	0.7	0.9%
NeB2	Nathalie sandy clay loam, 2-6% slopes	0.9	1.1%
RdE	Rhodhiss-Stott Knob complex, 15-25% slopes	0.2	0.2%
SmF	Siloam sandy loam, 25-50% slopes	1.9	2.4%
StB	Starr loam, 0-6% slopes	1.3	1.6%
TaE	Toast fine sandy loam, 15-25% slopes	3.5	4.3%
TeE2	Toast sandy clay loam, 15-25% slopes	0*	0.0%
WoF	Woolwine-Fairview-Westfield complex, 25-45% slopes	2.5	3.1%
WwF	Woolwine-Fairview-Westfield complex, 25-45% slopes, stony	1.2	1.5%
	Totals for Project Area	**80.7**	**100.0%**

* Less than a tenth of an acre.

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Soils Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

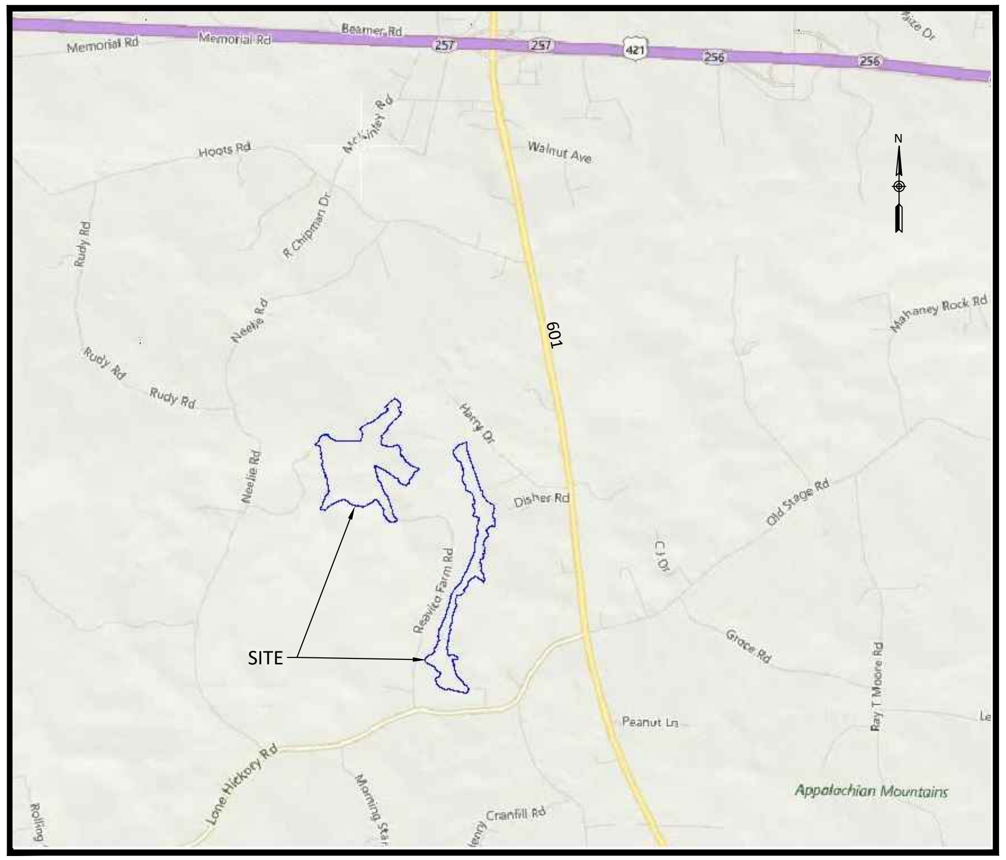
Yadkin County, NC

APPENDIX 6
PLAN SHEETS

Lone Hickory Mitigation Site

Yadkin County, North Carolina
for
NCDEQ
Division of Mitigation Services

Yadkinville, NC



Vicinity Map
Not to Scale

Environmental Quality

Sheet Index

Project Directory

Engineering:
Wildlands Engineering, Inc.
License No. F-0831
1430 South Mint Street, Ste 104
Charlotte, NC 28203
Emily G. Reinicker, PE
704-332-7754

Surveying:
Kee Mapping and Surveying, PA
88 Central Avenue
Asheville, NC 28801
Nolan Carmack, PLS
828-575-9021

Owner:
NCDEQ
Division of Mitigation Services
5 Ravenscroft Drive, Ste 102
Asheville, NC 28801
Paul Wiesner
828-273-1673

DMS Project No. 97135

Yadkin River Basin HUC 03040101

PRELIMINARY PLANS
ISSUED WITH FINAL MITIGATION PLAN
DECEMBER 8, 2017

BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

WILDLANDS ENGINEERING
1430 S. Mint Street, Ste 104
Charlotte, NC 28203
Tel: 704.332.7754
Fax: 704.332.3306
Firm License No. F-0831

PRELIMINARY
DO NOT
USE FOR
CONSTRUCTION

Lone Hickory Mitigation Site
Yadkin County, North Carolina
Title Sheet

Revisions:

Date: December 8, 2017
Job Number: 005-02163
Project Engineer: EPN, ASE
Drawn By: SJD, JCK
Checked By: EGR

0.1
Sheet

December 1, 2017

Existing Features

- Existing Property Line
- Existing Major Contour (100)
- Existing Minor Contour
- Existing Overhead Electric (OHE)
- Existing Power Pole
- Existing Temporary Construction Easement (TCE)
- Existing Fence
- Existing Storm Pipe
- Existing Farm Road
- Existing Wetland
- Existing Tree
- Existing Groundwater Well
- Existing Bedrock
- Existing Road
- Existing Treeline

Proposed Features

- Proposed Conservation Easement (CE)
- Proposed Temporary Construction Easement (TCE)
- Proposed Thalweg Alignment (10+00)
- Proposed Bankfull
- Proposed Major Contour (100)
- Proposed Minor Contour
- Proposed Back of Bench (B)
- Proposed Safety Fence (SAF)
- Proposed Silt Fence

Proposed Structures

- Proposed Various Constructed Riffles Per Plans
- Proposed Brush Toe
- Proposed Wetland Restoration
- Proposed Bank Grading in Preservation Areas

Proposed Structures

- Proposed Log Sill
- Proposed Lunker Log
- Proposed Log J-Hook
- Proposed Rock J-Hook
- Proposed Boulder J-Hook with Sill
- Proposed Log Vane
- Proposed Rock Sill
- Proposed Permanent Crossing
- Proposed Temporary Crossing
- Proposed Temporary Construction Entrance

PROJECT NOTES:

Topographic survey was completed by Kee Mapping and Surveying in February 2017.
Parcel boundary survey completed by Kee Mapping and Surveying in July 2017.

Topographic data outside proposed conservation easement supplemented with Lidar data from September 2015.

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

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Tel: 704.332.7754
Fax: 704.332.3306
Firm License No. F-0831

PRELIMINARY DO NOT USE FOR CONSTRUCTION

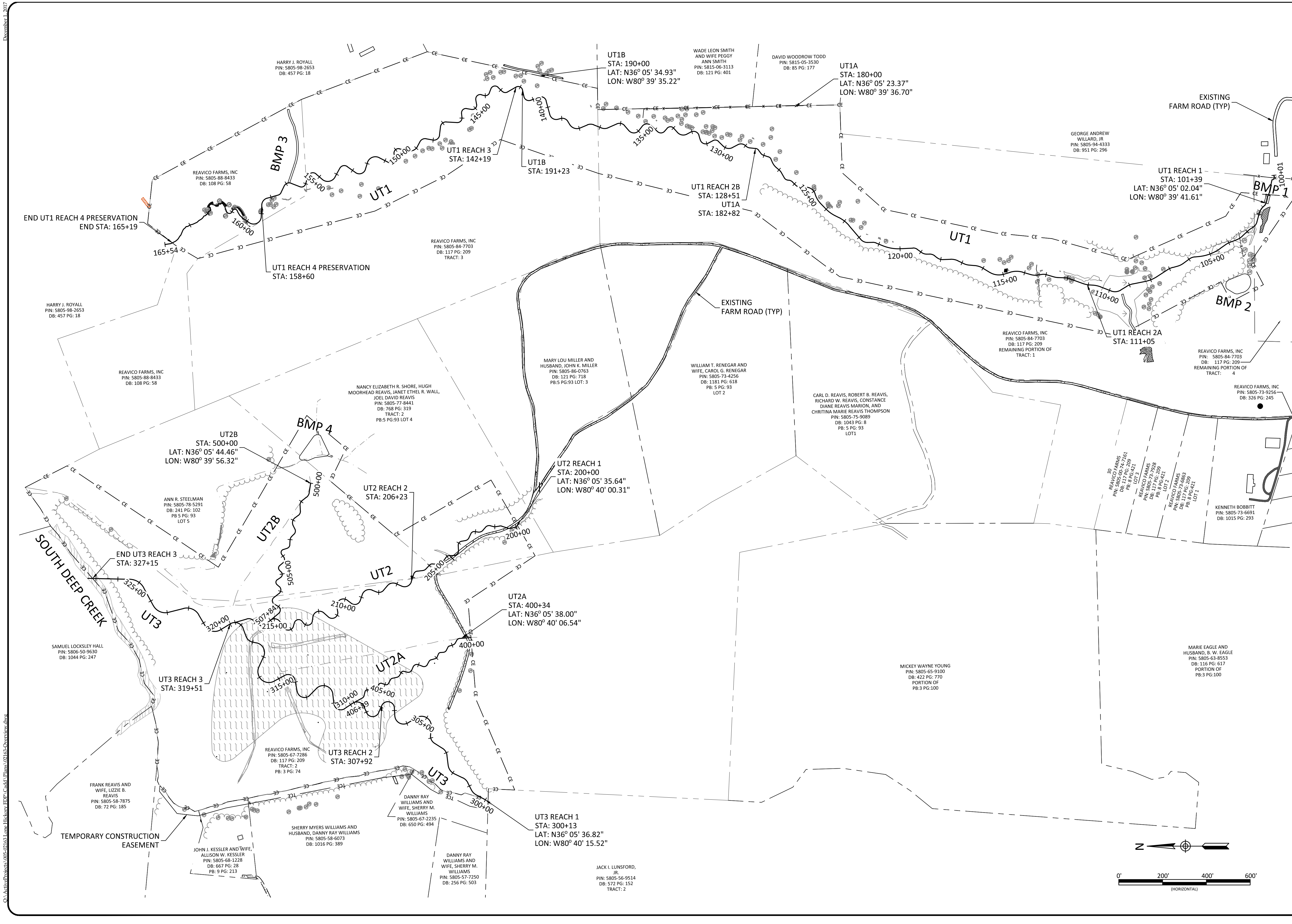
Lone Hickory Mitigation Site
Yadkin County, North Carolina

General Notes and Symbols

Revisions:

Date:	December 8, 2017
Job Number:	005-02163
Project Engineer:	EPN, ASE
Drawn By:	SJD, JCK
Checked By:	EGR

Sheet 0.2



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PRELIMINARY DO NOT USE FOR CONSTRUCTION

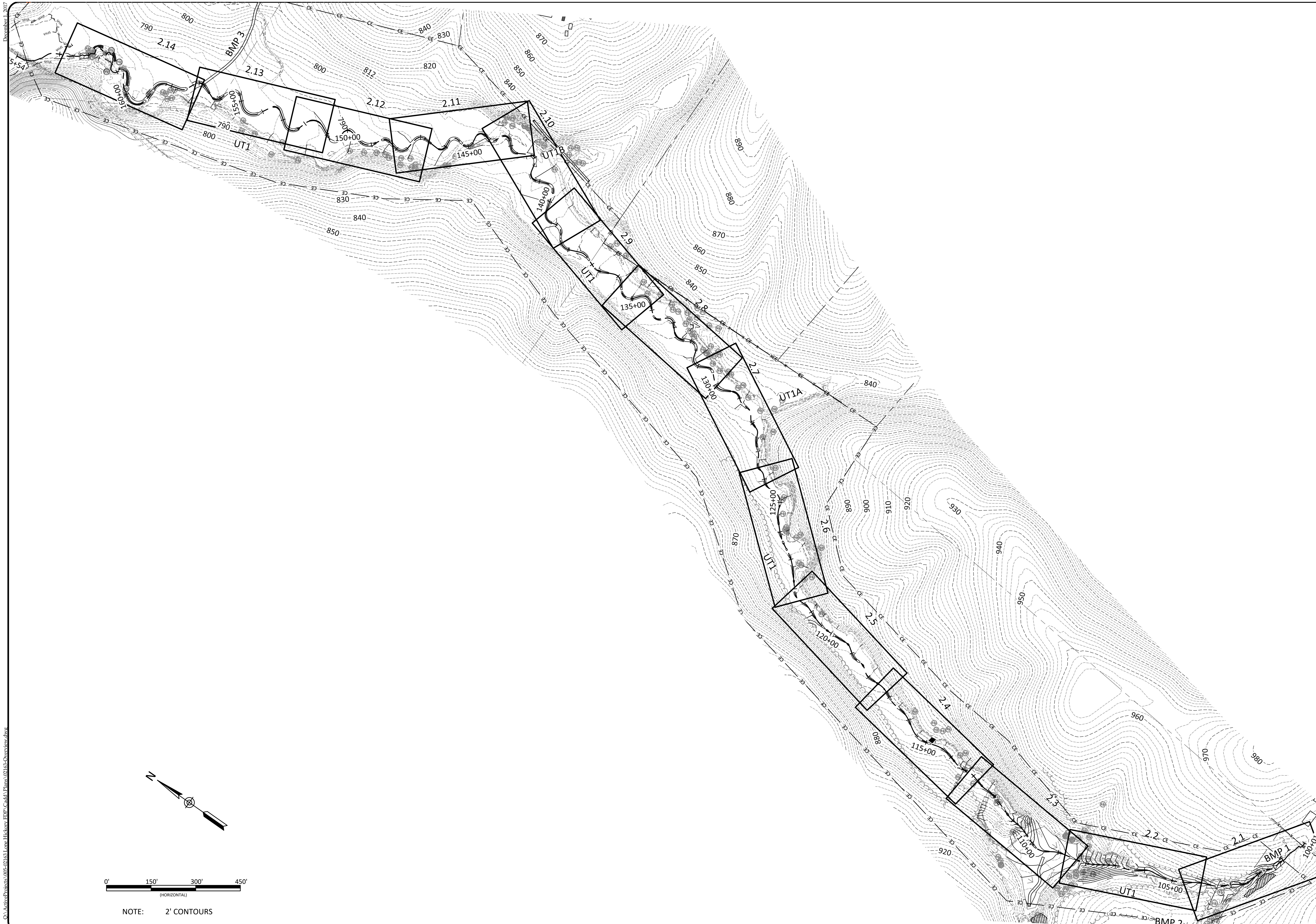
Lone Hickory Mitigation Site
Yadkin County, North Carolina

Project Overview

Revisions:

Date:	December 8, 2017
Job Number:	005-02163
Project Engineer:	EPN, ASE
Drawn By:	SJD, JCK
Checked By:	EGR

Sheet 0.3



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PRELIMINARY DO NOT USE FOR CONSTRUCTION

Lone Hickory Mitigation Site
Yadkin County, North Carolina

Project Overview - East

Revisions:

Date:	December 8, 2017
Job Number:	005-02163
Project Engineer:	EPN, ASE
Drawn By:	SJD, CK
Checked By:	EGR

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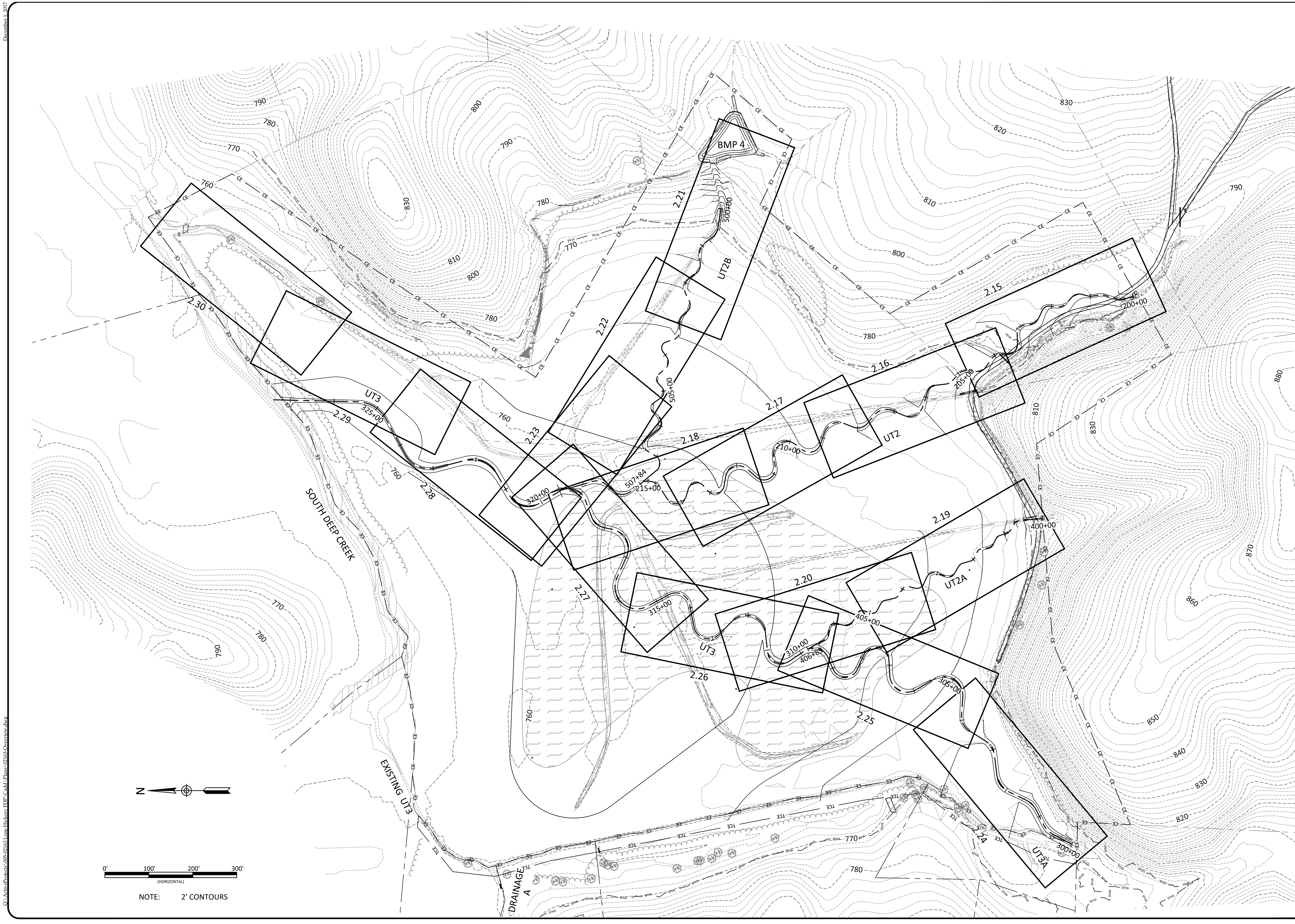
Sheet



Lone Hickory Mitigation Site
Yadkin County, North Carolina
Project Overview - West

PRELIMINARY DO NOT USE FOR CONSTRUCTION

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Revisions:

Date: December 8, 2017
Job Number: 005-02163
Project Engineer: EPN, ASE
Drawn By: SJD, JCK
Checked By: EGR

Sheet 0.5

December 1, 2017
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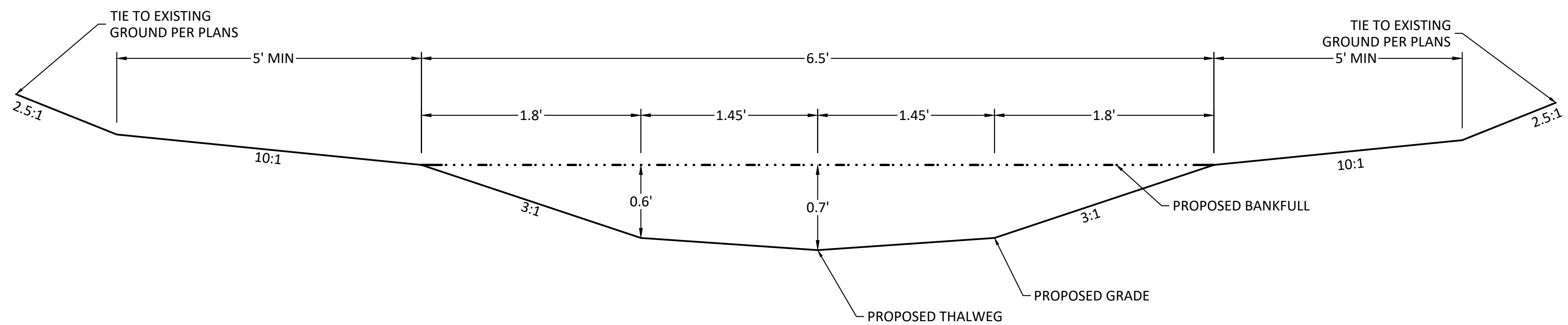
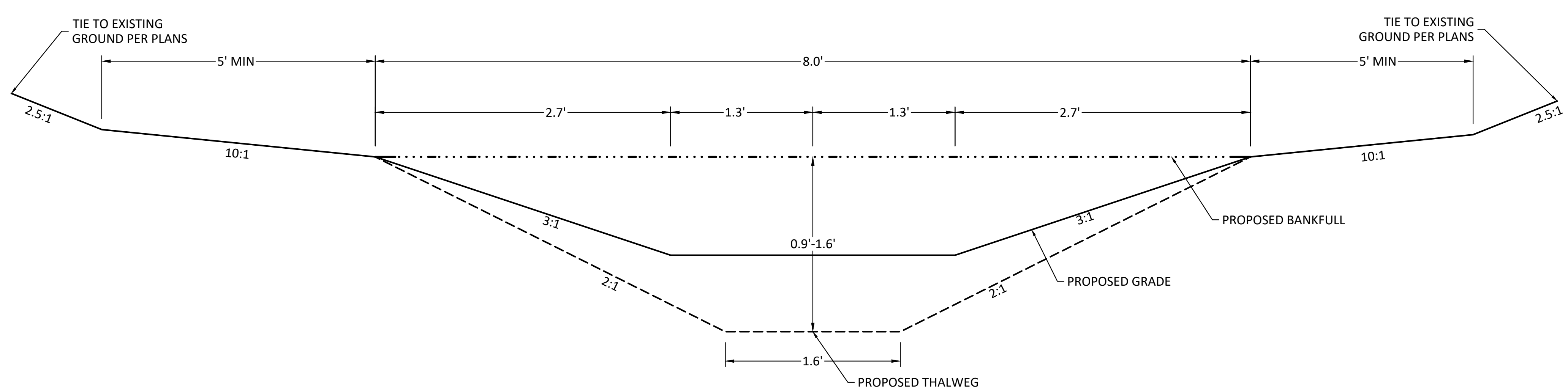


UT1 Reach 1 - Riffle
STA: 101+39 - 111+05



UT1 Reach 1 - Pool
STA: 101+39 - 111+05

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ENGINEERING
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Charlotte, NC 28203
Tel: 704.332.7754
Fax: 704.332.3306
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PRELIMINARY
DO NOT
USE FOR
CONSTRUCTION

Lone Hickory Mitigation Site
Yadkin County, North Carolina

UT1 Reach 1
Typical Sections

Revisions:

Date: December 8, 2017
Job Number: 005-02163
Project Engineer: EPN, ASE
Drawn By: SJD, CK
Checked By: EGR

Sheet 1.1

December 1, 2017

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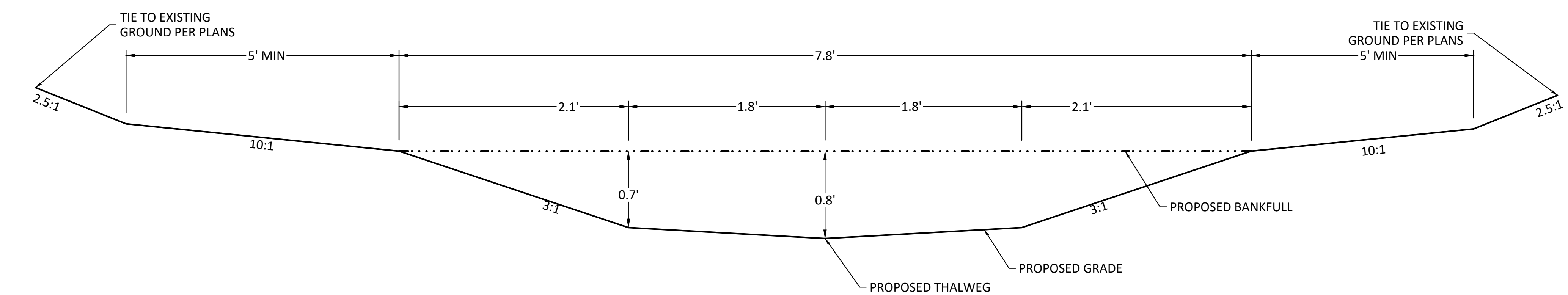
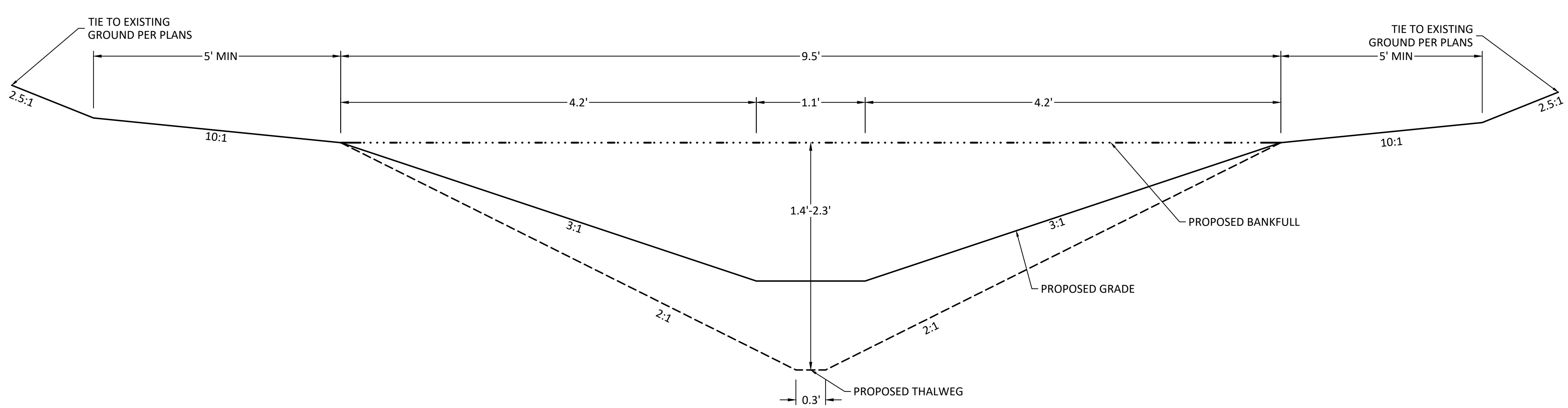


UT1 Reach 2A - Riffle
STA: 111+05 - 128+51



UT1 Reach 2A - Pool
STA: 111+05 - 128+51

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Lone Hickory Mitigation Site
Yadkin County, North Carolina

UT1 Reach 2A
Typical Sections

Revisions:

Date:	December 8, 2017
Job Number:	005-02163
Project Engineer:	EPN, ASE
Drawn By:	SJD, CK
Checked By:	EGR

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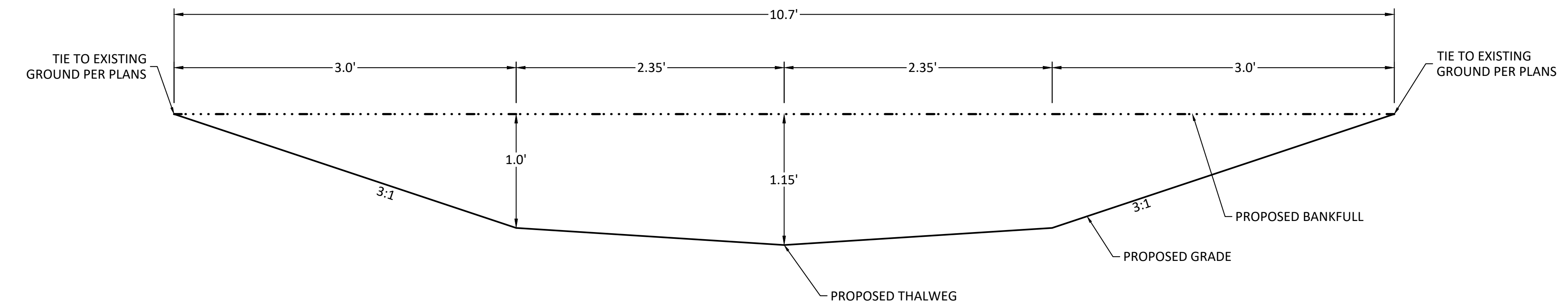
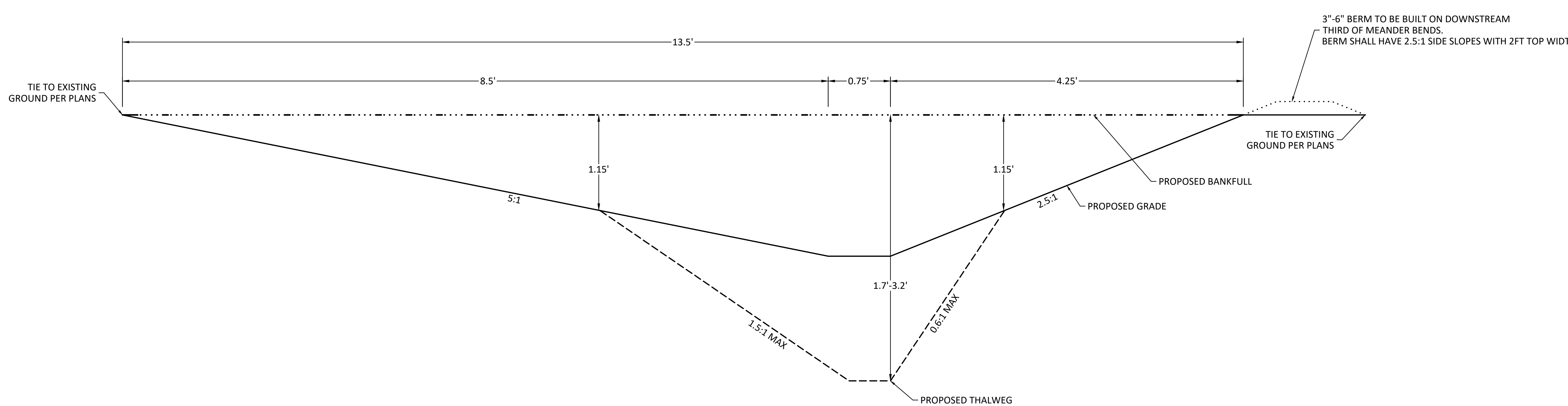


UT1 Reach 2B - Riffle
STA: 128+51 - 142+19



UT1 Reach 2B - Pool
STA: 128+51 - 142+19

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UT1 Reach 2B
Typical Sections

Revisions:

Date:	December 8, 2017
Job Number:	005-02163
Project Engineer:	EPN, ASE
Drawn By:	SJD, CK
Checked By:	EGR

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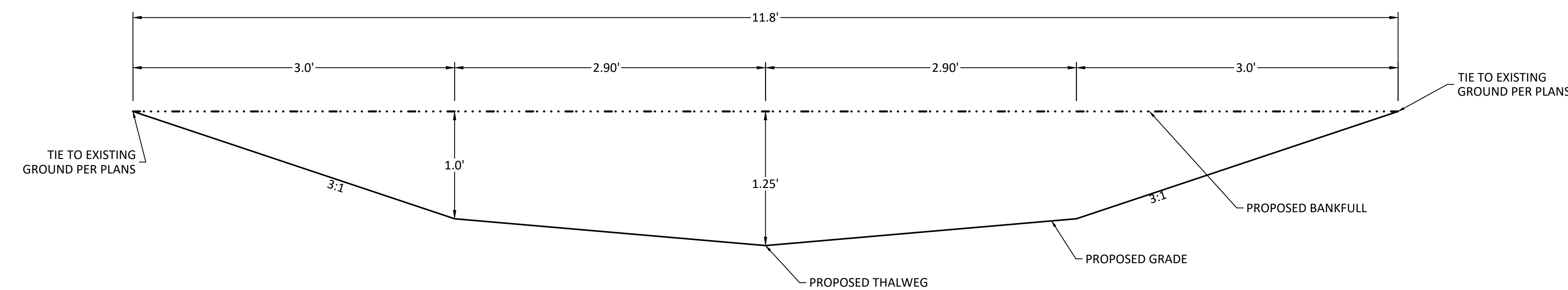
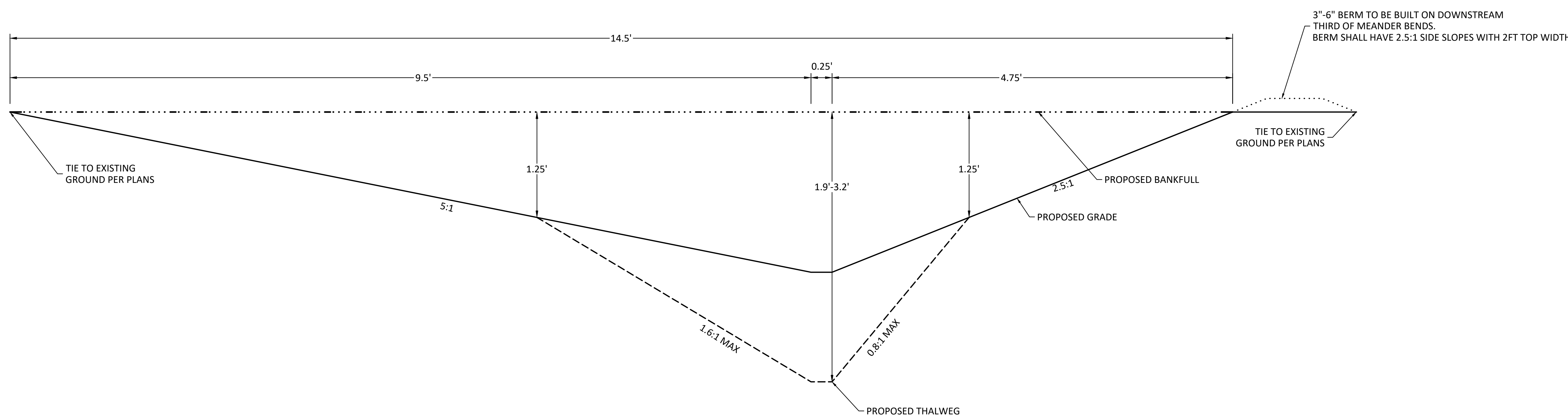


UT1 Reach 3 - Riffle
STA: 142+19 - 158+60



UT1 Reach 3 - Pool
STA: 142+19 - 158+60

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UT1 Reach 3
Typical Sections

Revisions:

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Job Number:	005-02163
Project Engineer:	EPN, ASE
Drawn By:	SJD, CK
Checked By:	EGR

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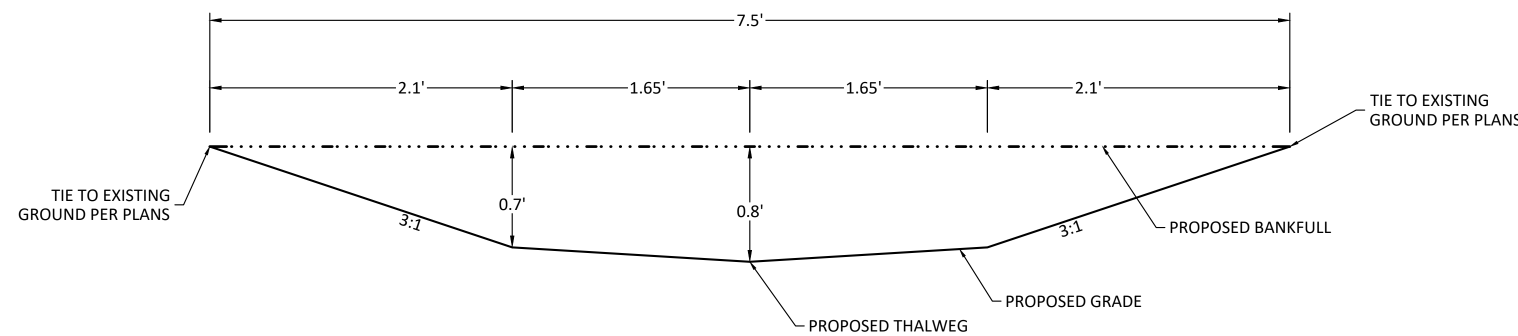
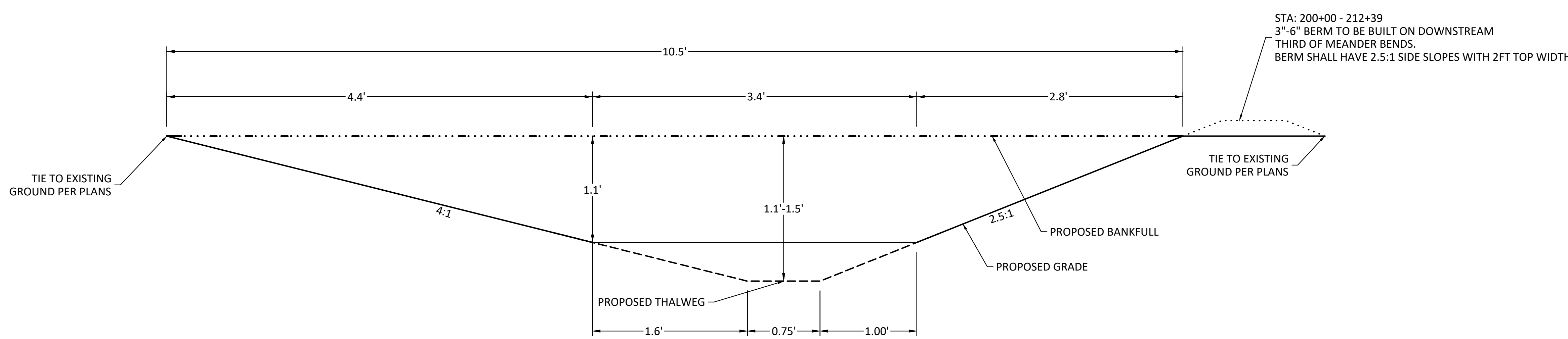


UT2 Reach 1 - Riffle
STA: 200+00 - 206+23



UT2 Reach 1 - Meander Pool
STA: 200+00 - 206+23

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Yadkin County, North Carolina

UT2 Reach 1
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Revisions:

Date: December 8, 2017
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Project Engineer: EPN, ASE
Drawn By: SJD, CK
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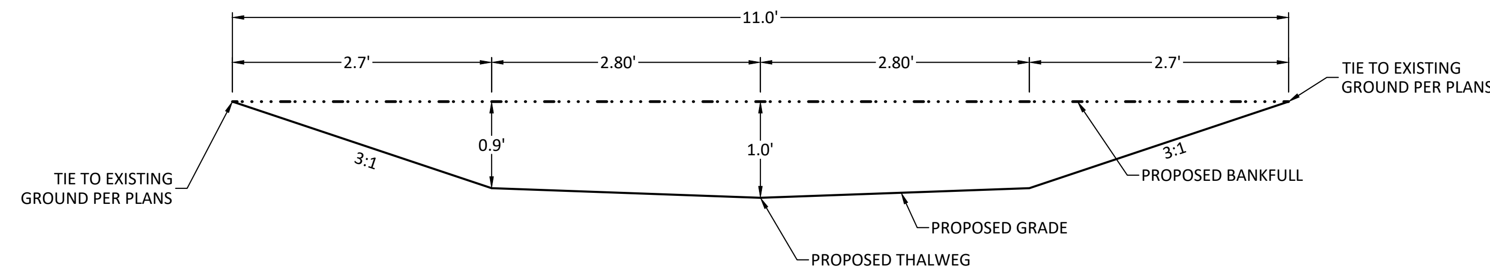
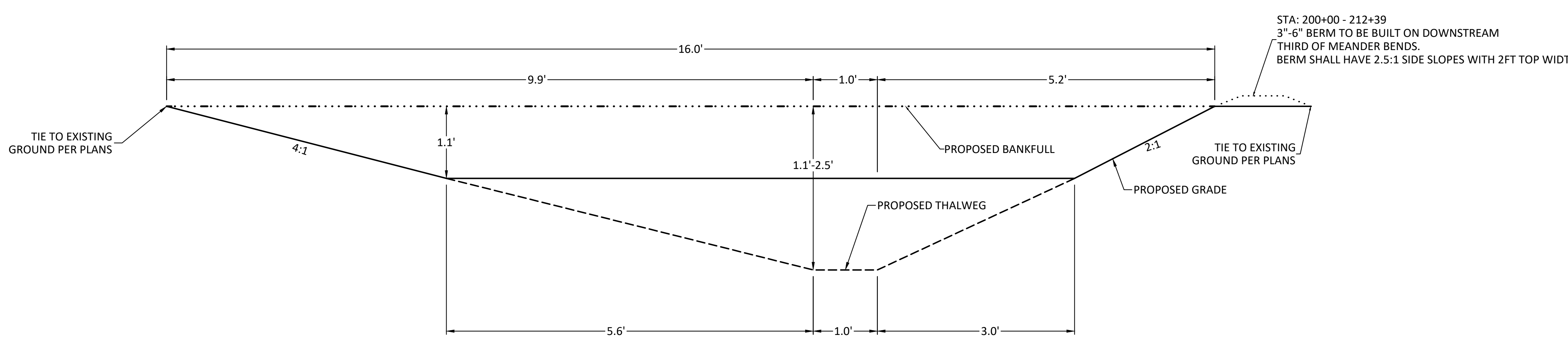


UT2 Reach 2 - Riffle
STA: 206+23 - 217+03



UT2 Reach 2 - Pool
STA: 206+23 - 217+03

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UT2 Reach 2
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Revisions:

Date: December 8, 2017
Job Number: 005-02163
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Drawn By: SJD, JCK
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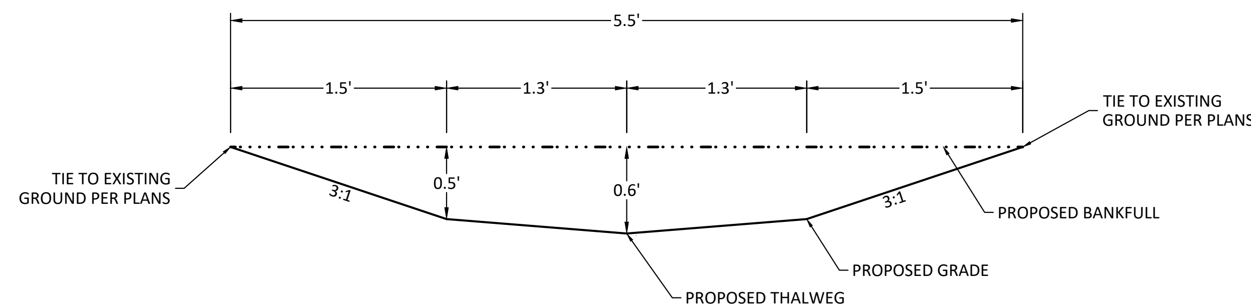
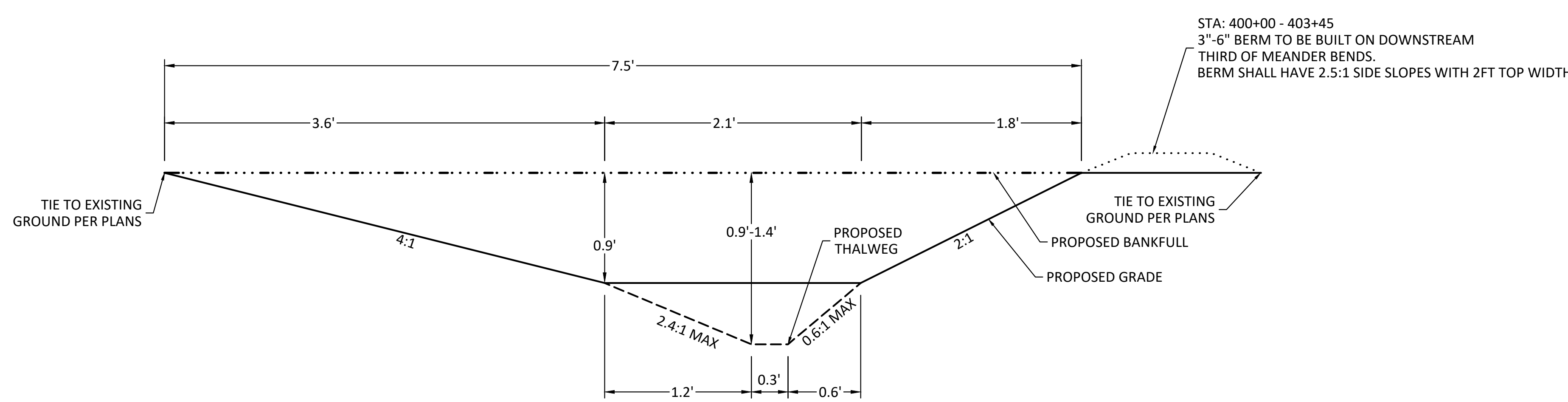


UT2A - Riffle
STA: 400+34 - 406+89



UT2A - Pool
STA: 400+34 - 406+89

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UT2A
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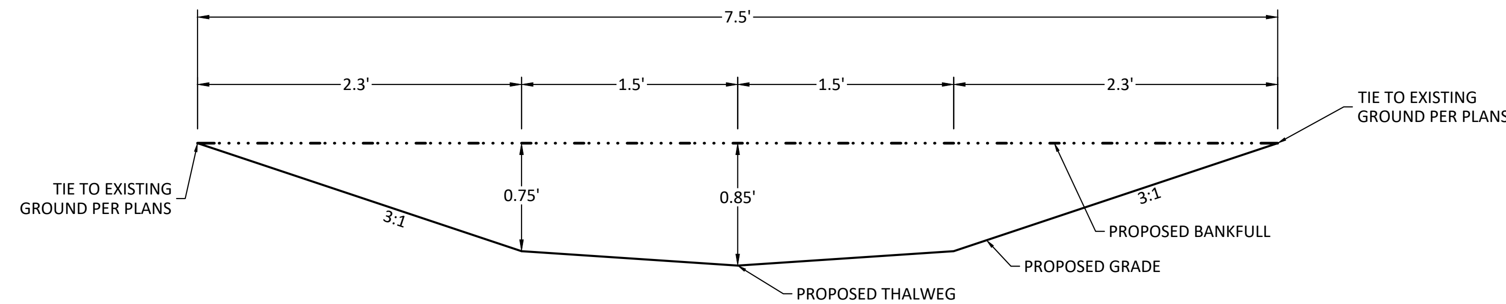
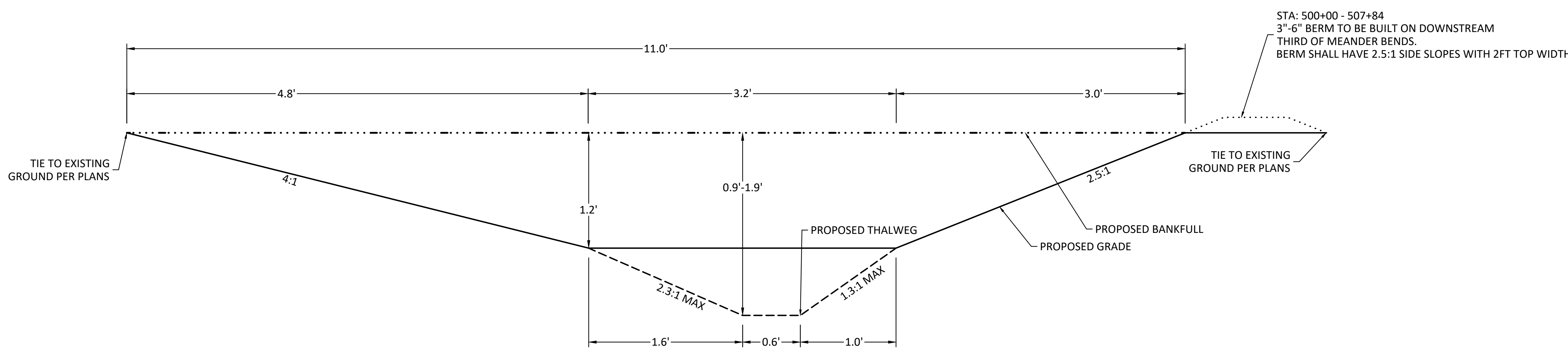
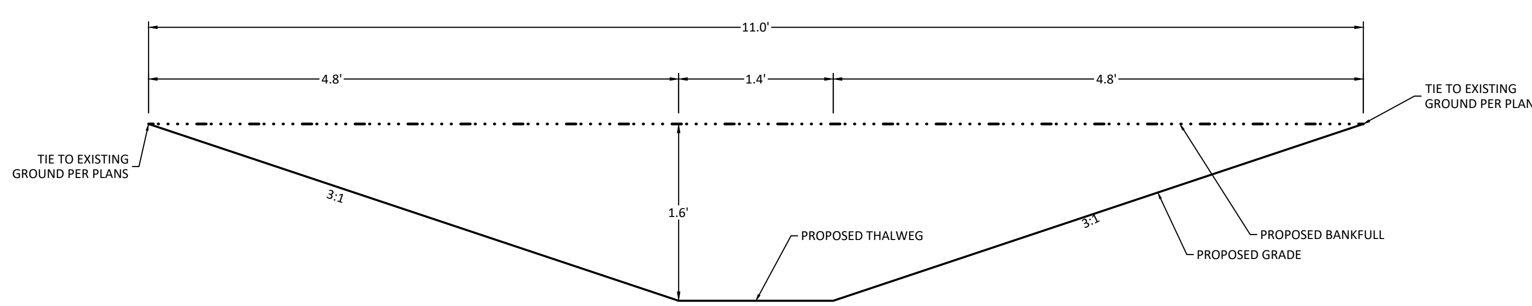


UT2B - Riffle
STA: 500+00 - 507+84



UT2B - Meander Pool
STA: 500+00 - 507+84



UT2B - In-Line Pool
STA: 500+00 - 507+84

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UT2B
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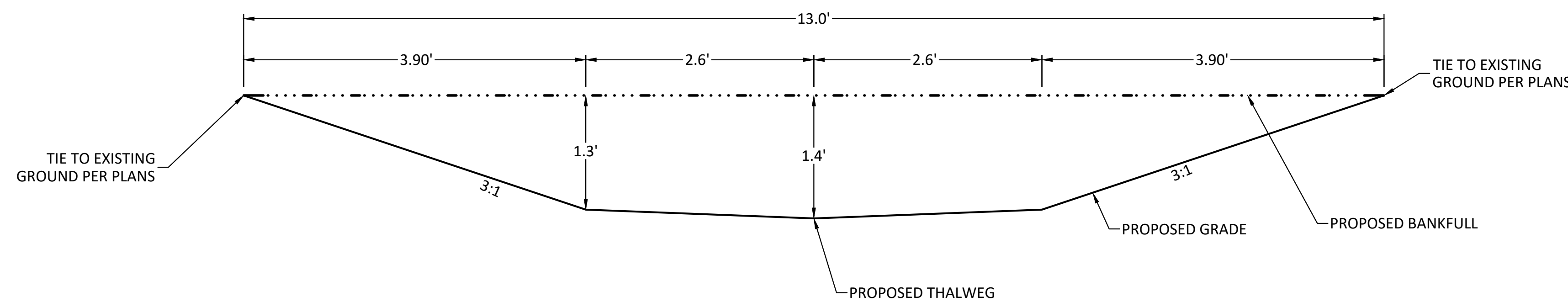
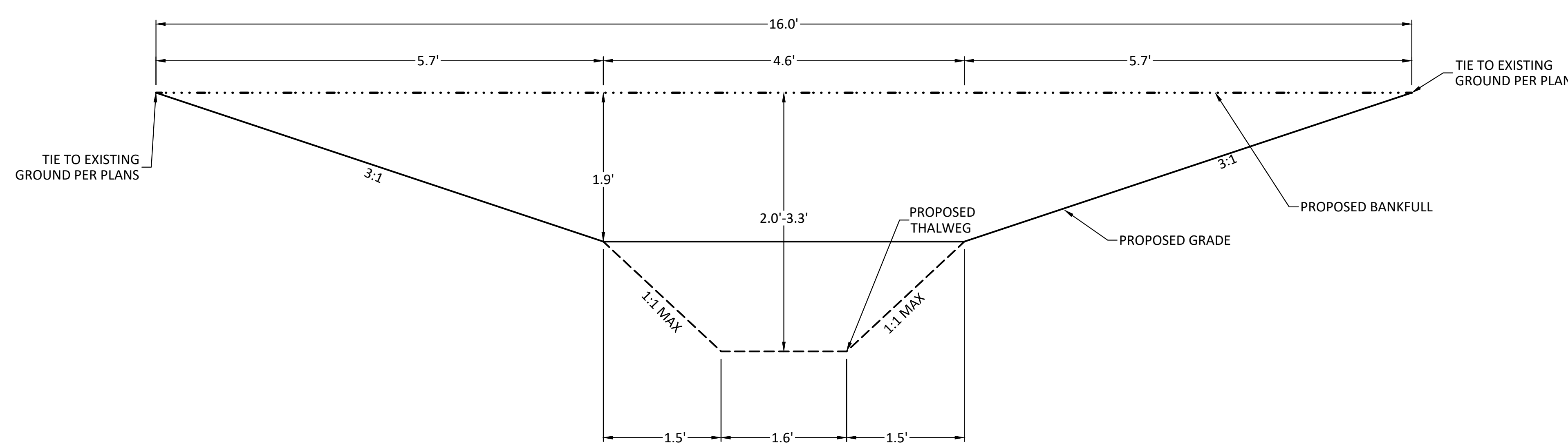


UT3 Reach 1 - Riffle
STA: 300+13 - 307+92



UT3 Reach 1 - Pool
STA: 300+13 - 307+92

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Lone Hickory Mitigation Site
Yadkin County, North Carolina

UT3 Reach 1
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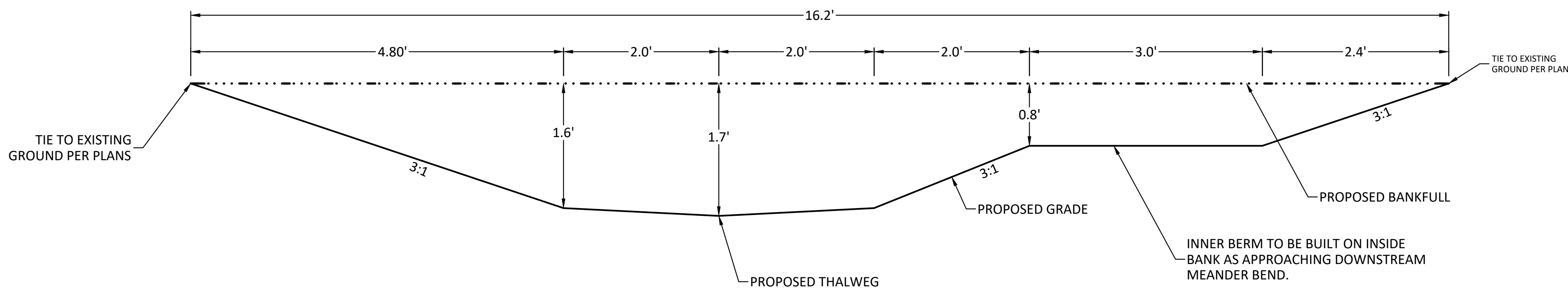
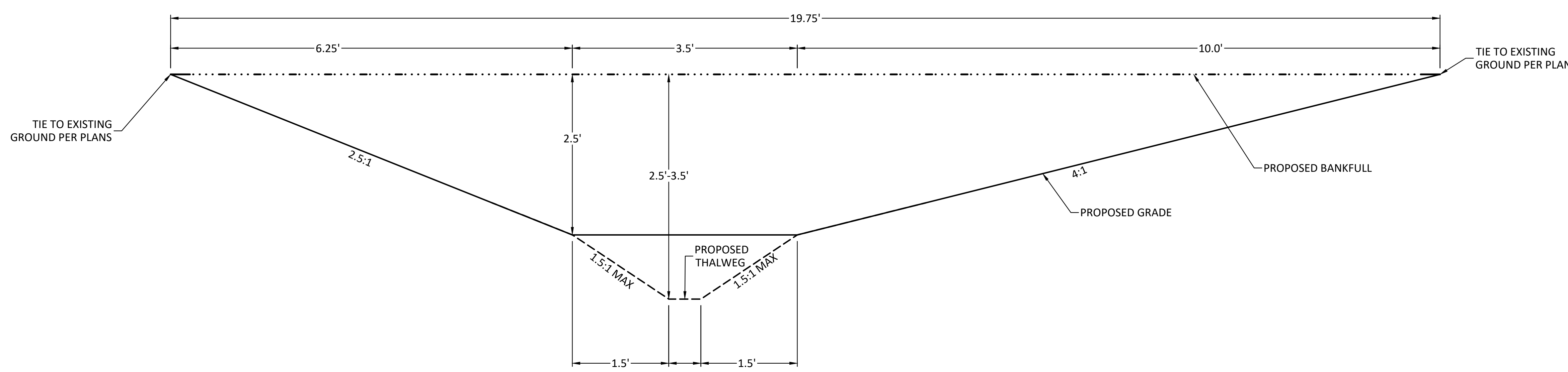


UT3 Reach 2 - Riffle
STA: 307+92 - 319+15



UT3 Reach 2 - Meander Pool
STA: 307+92 - 319+15

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UT3 Reach 2
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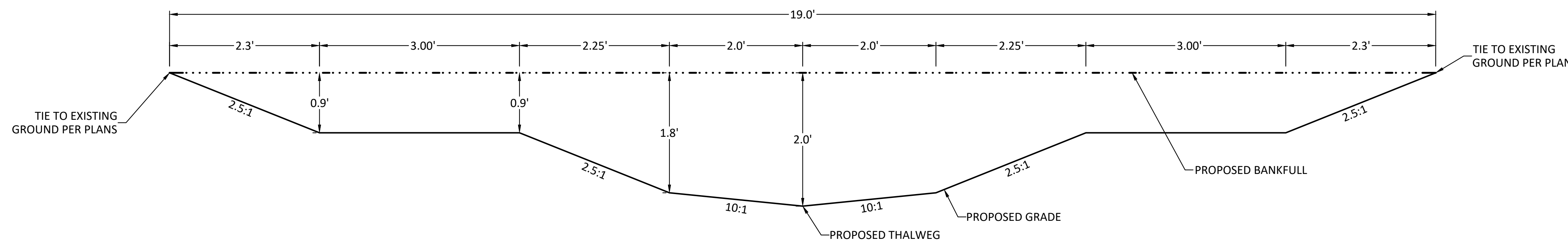
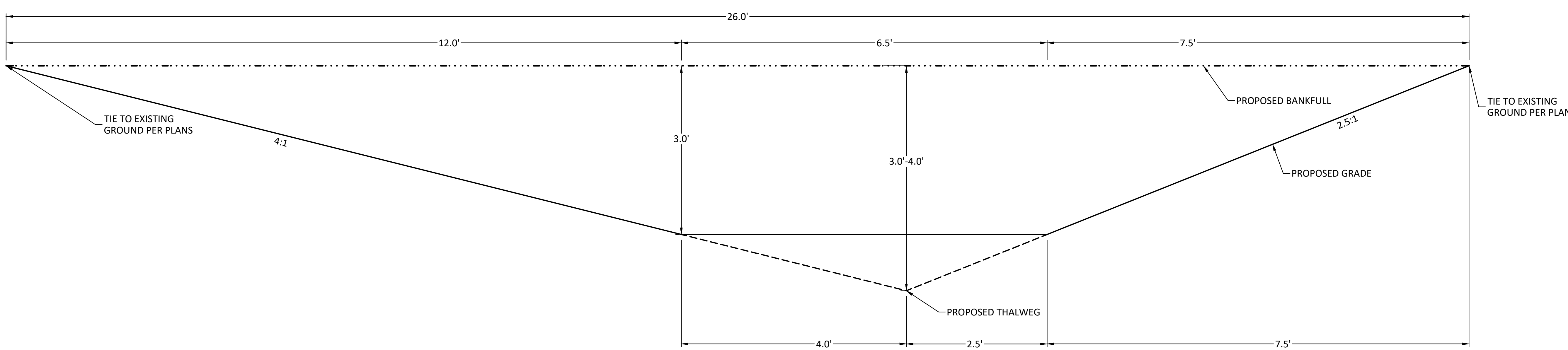


UT3 Reach 3 - Riffle
STA: 319+51 - 327+15



UT3 Reach 3 - Meander Pool
STA: 319+51 - 327+15

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UT3 Reach 3
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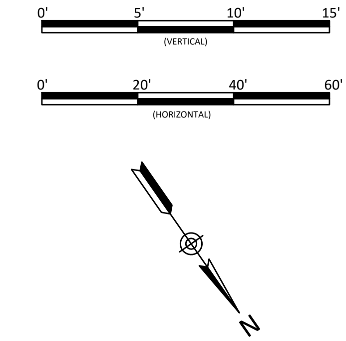

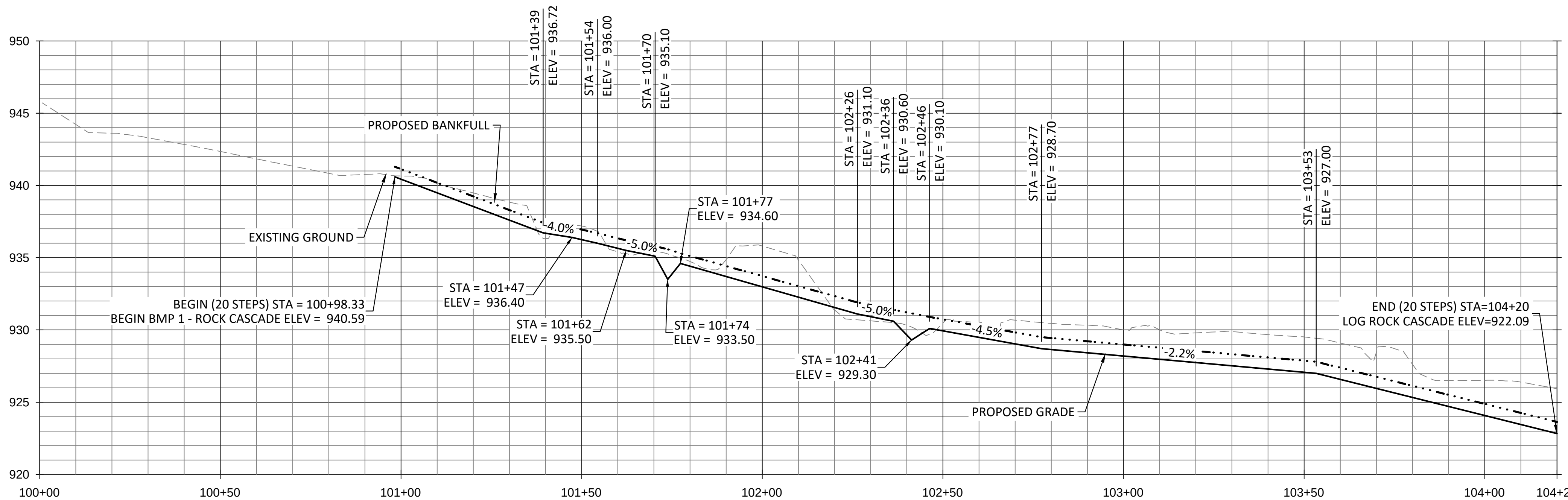

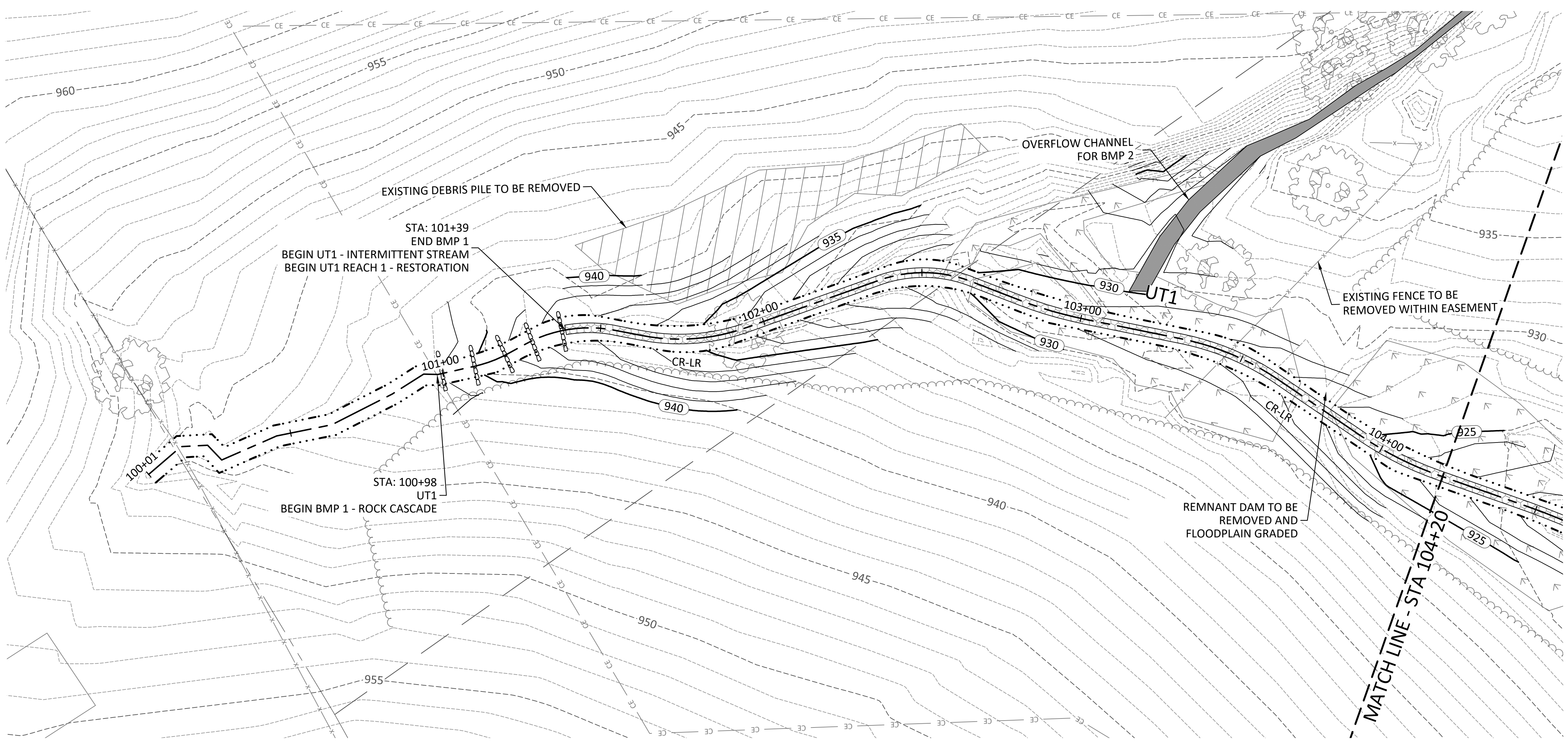

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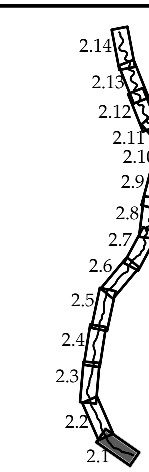

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UT1
Stream Plan and Profile

Revisions:

Date: December 8, 2017
Job Number: 005-02163
Project Engineer: EPN, ASE
Drawn By: SJD, JCK
Checked By: EGR

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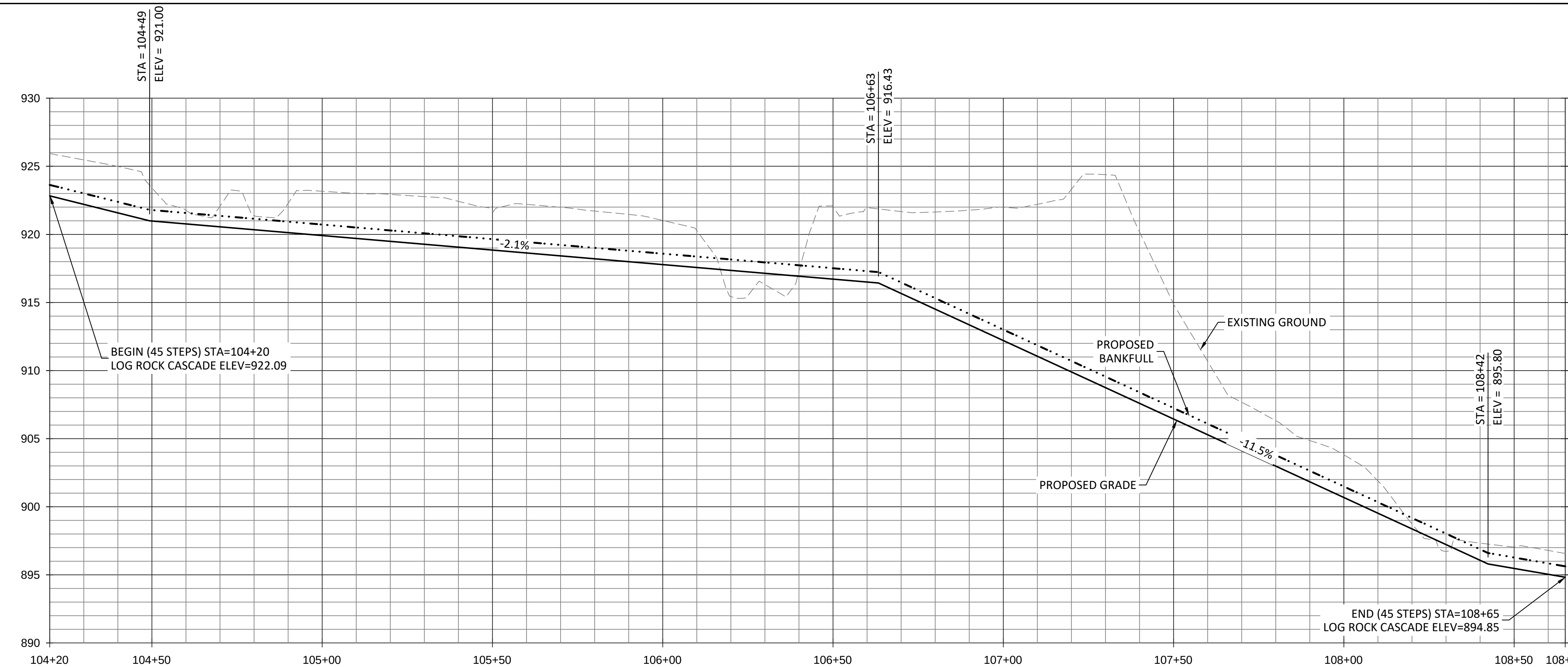

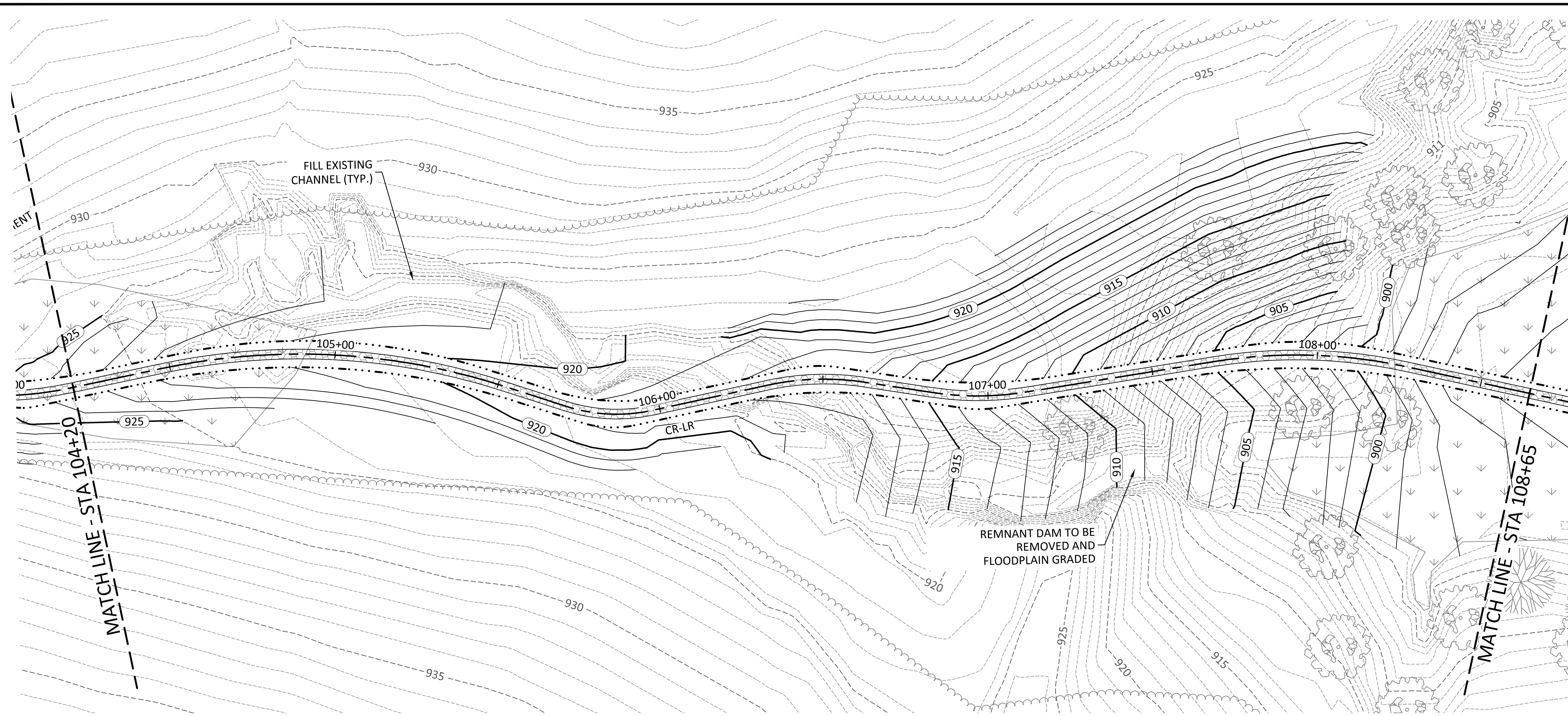

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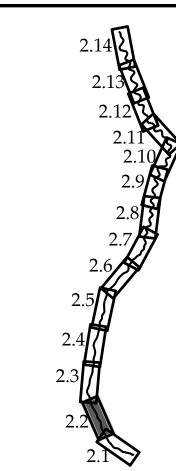

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Yadkin County, North Carolina

UT1
Stream Plan and Profile

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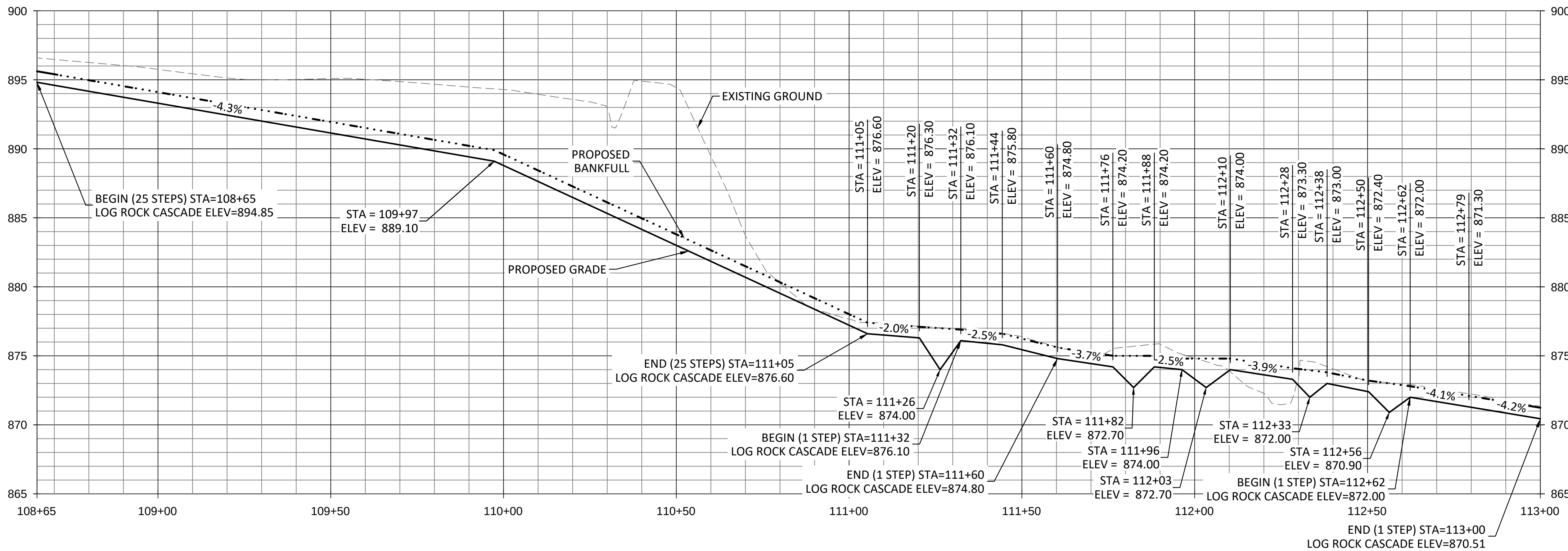

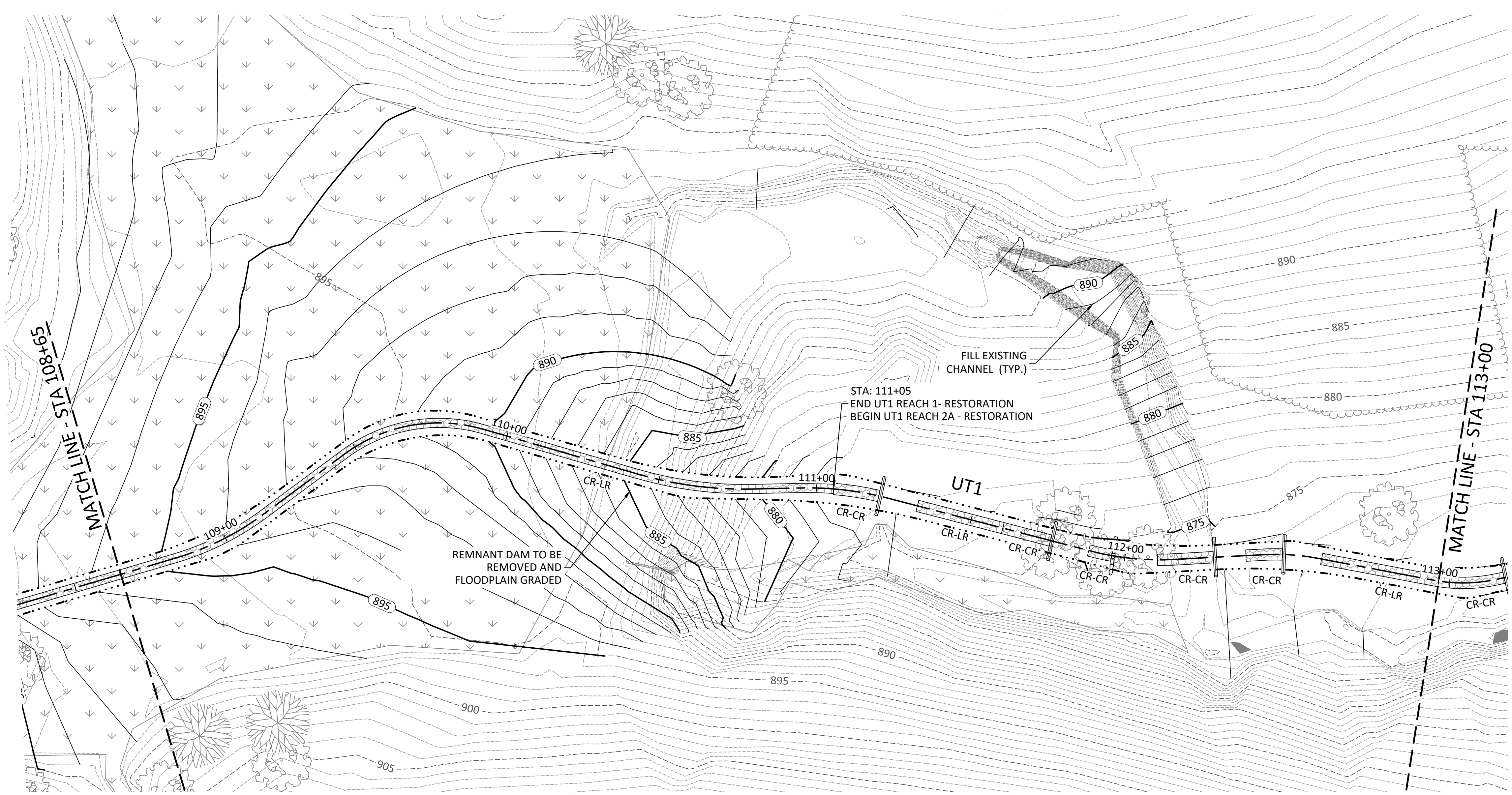

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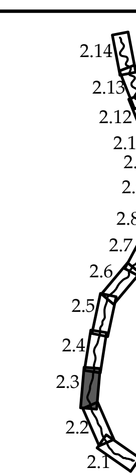

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Lone Hickory Mitigation Site
Yadkin County, North Carolina

UT1
Stream Plan and Profile

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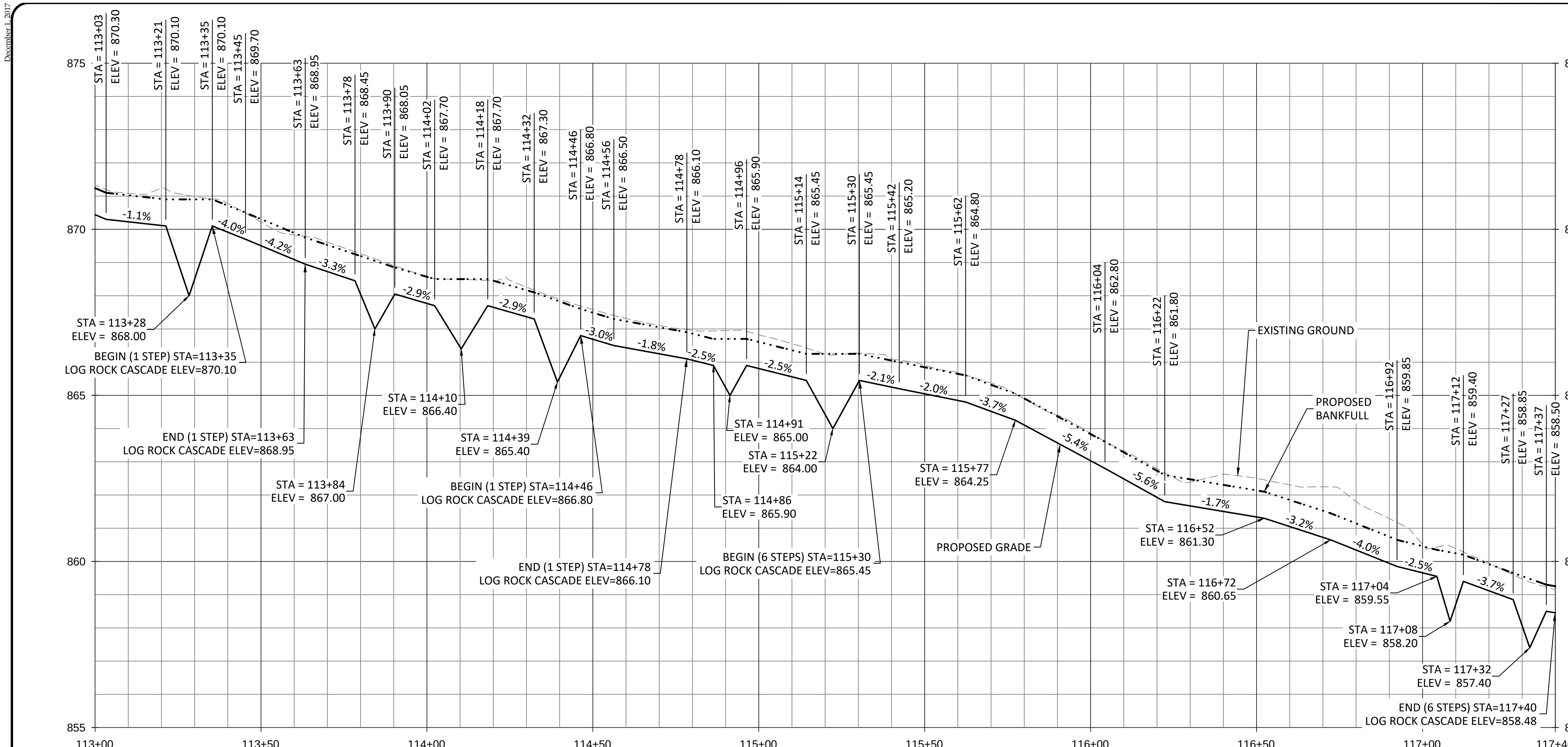

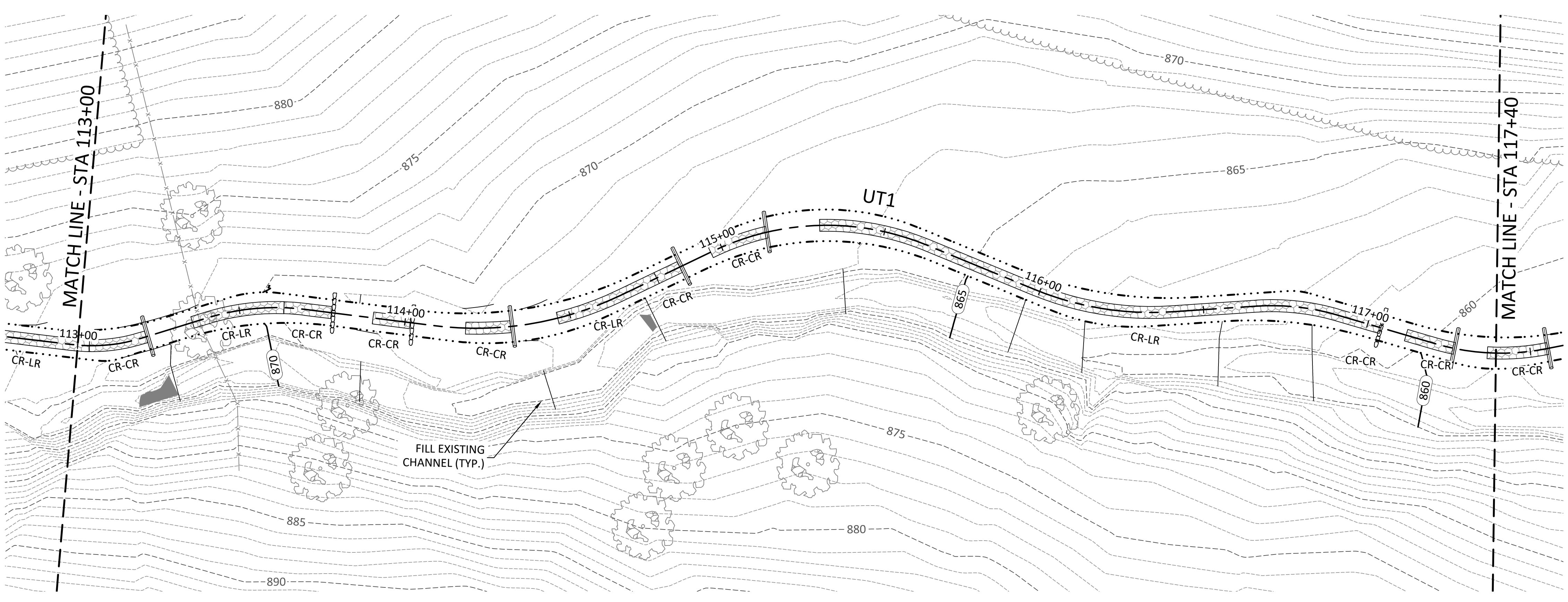

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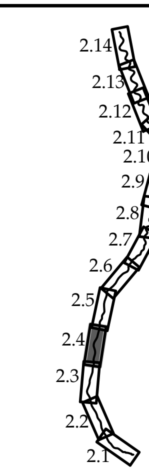

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UT1
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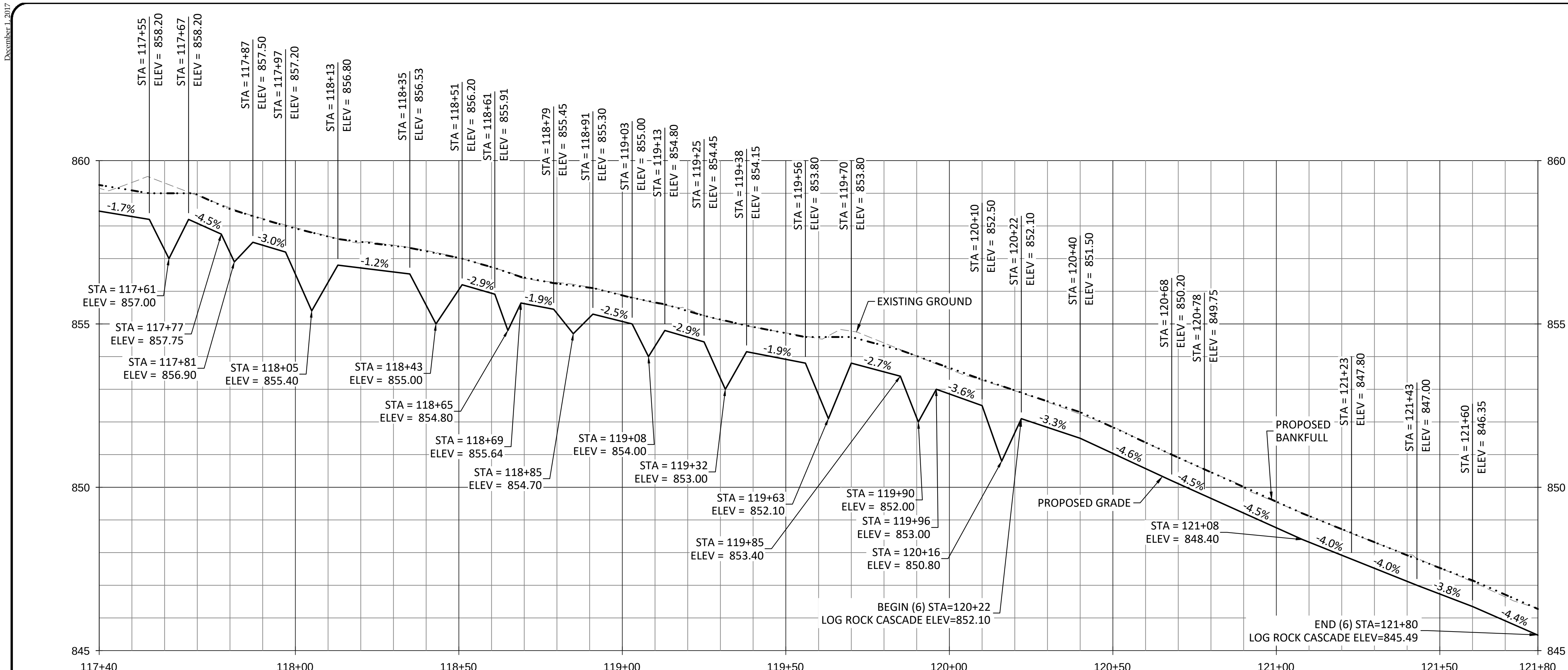

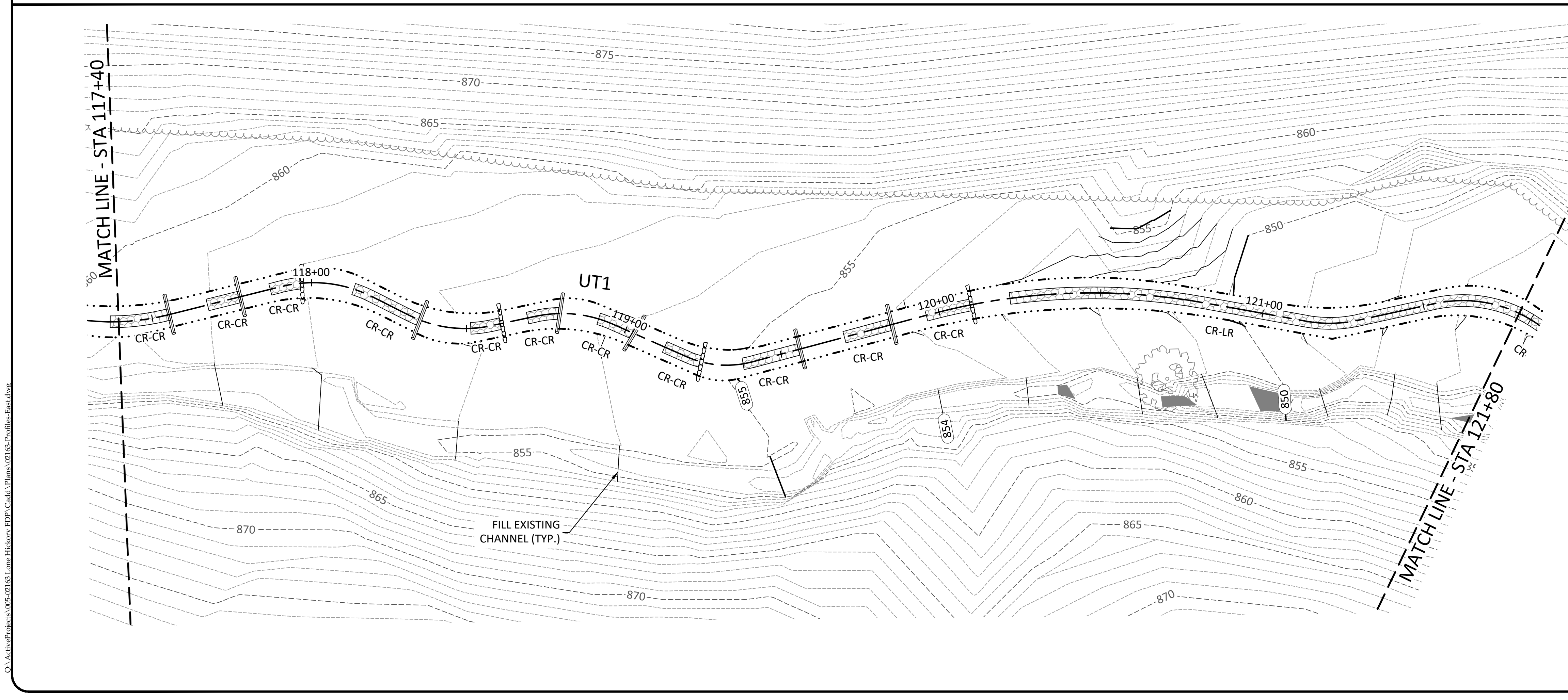

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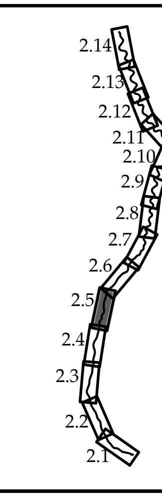

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UT1
Stream Plan and Profile

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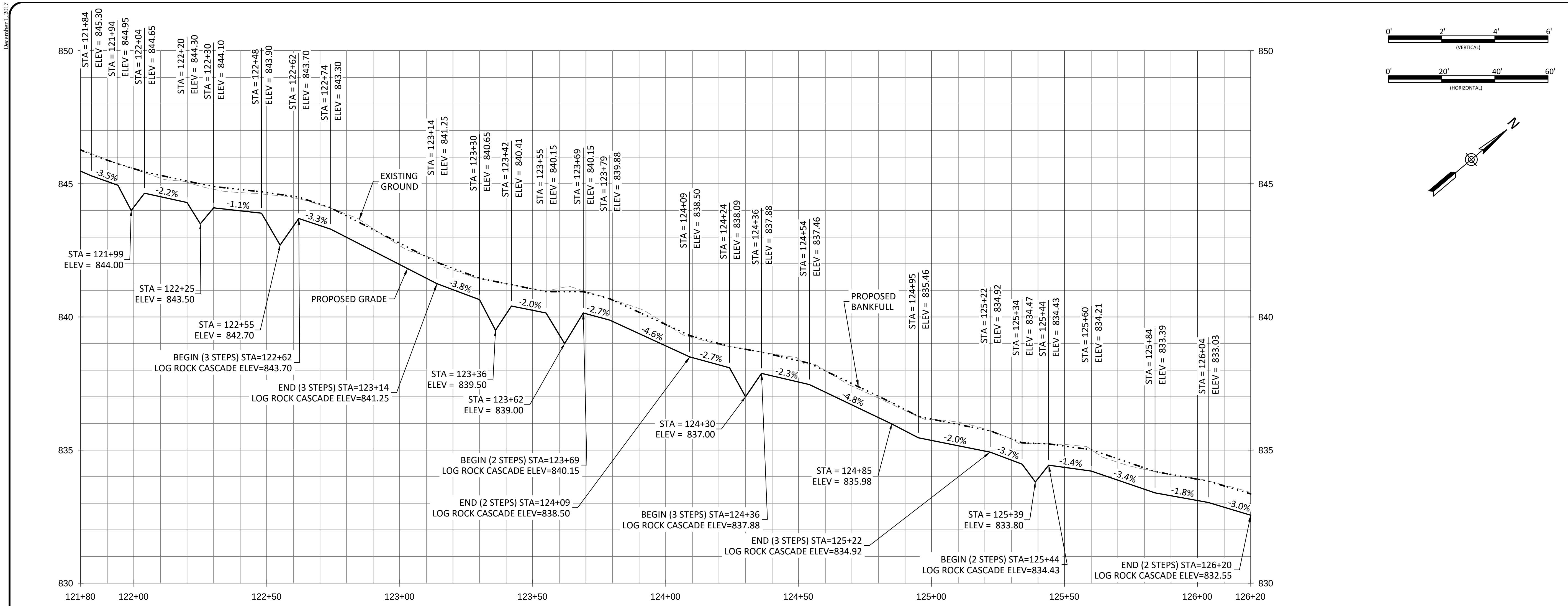

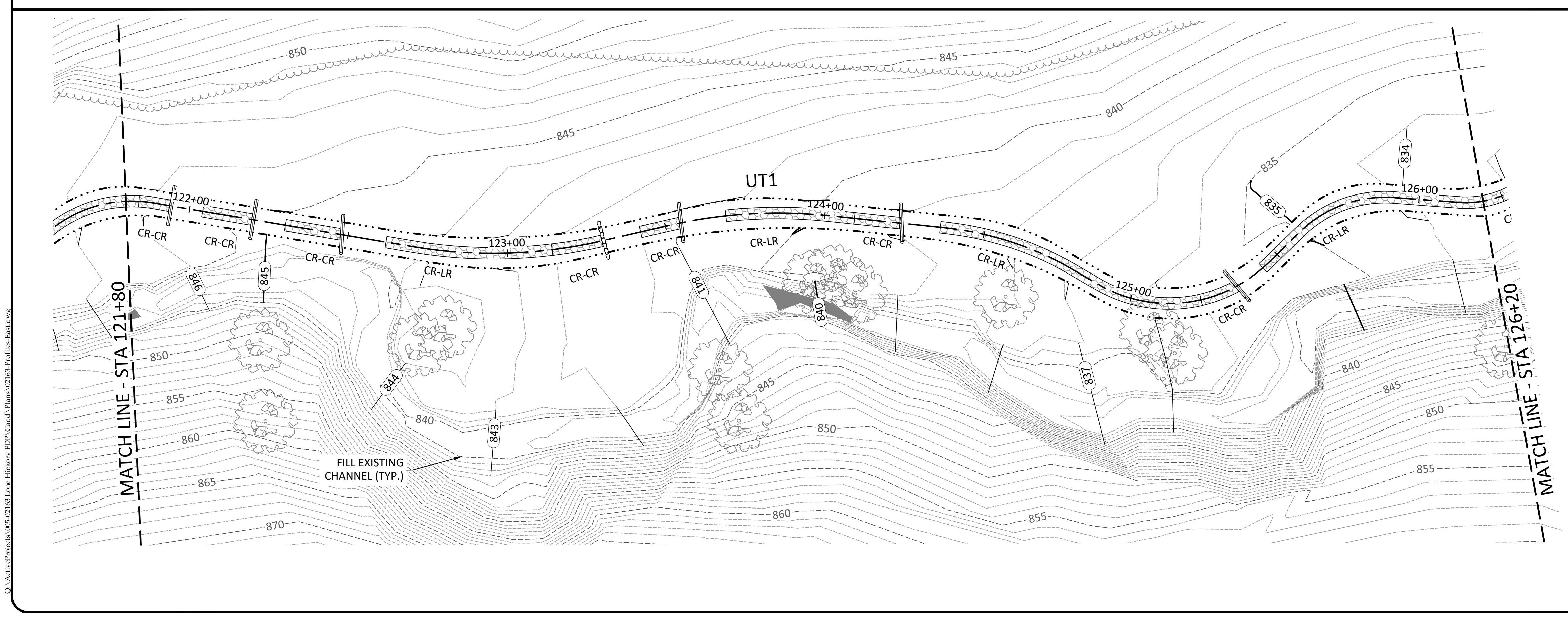

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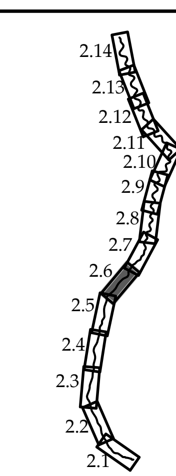

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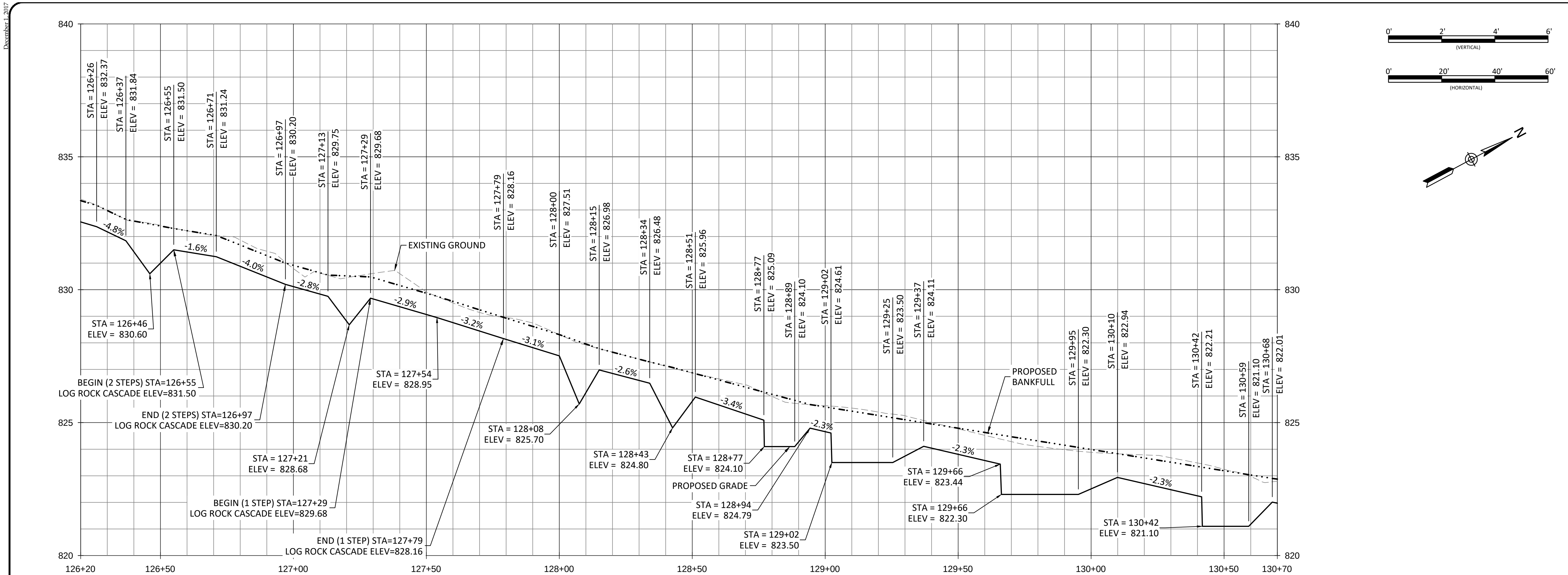

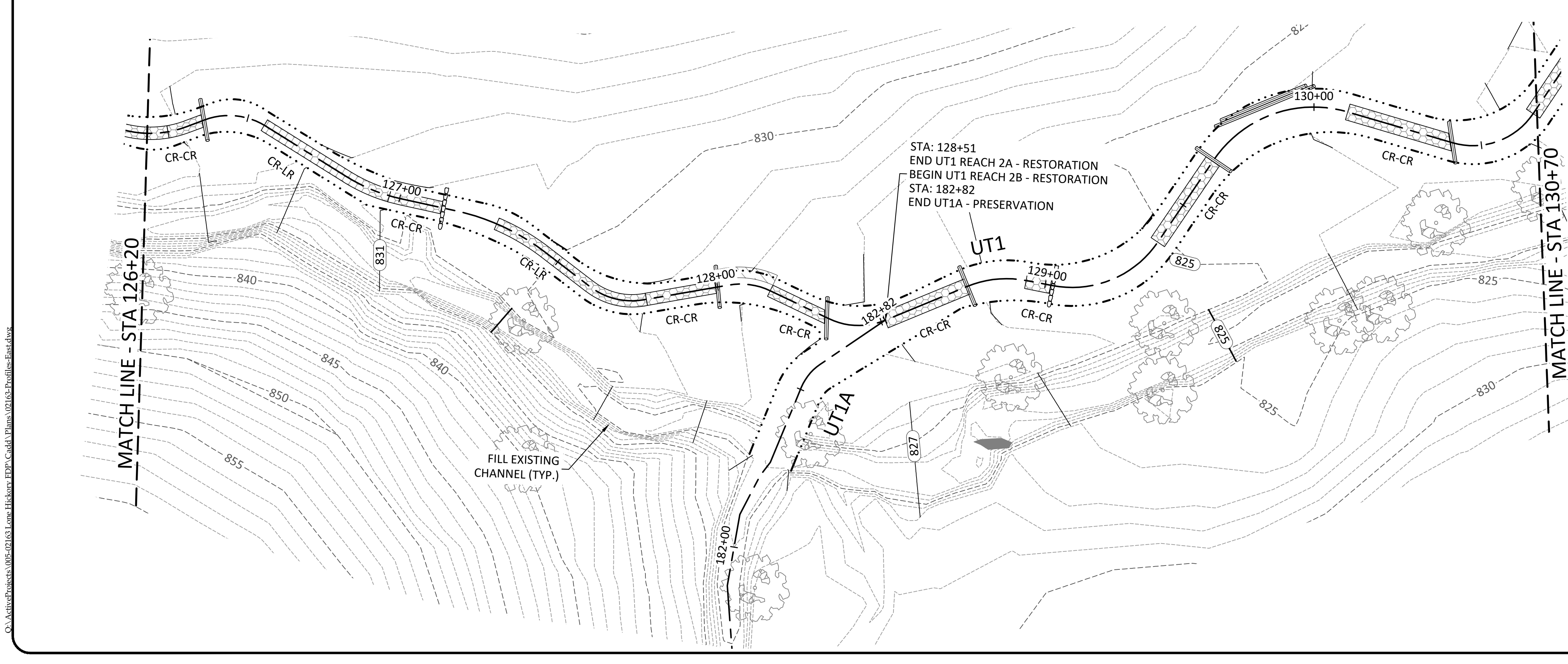

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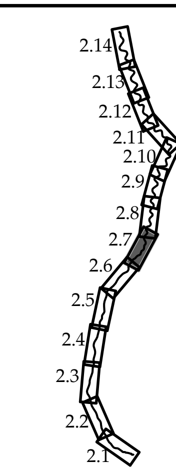

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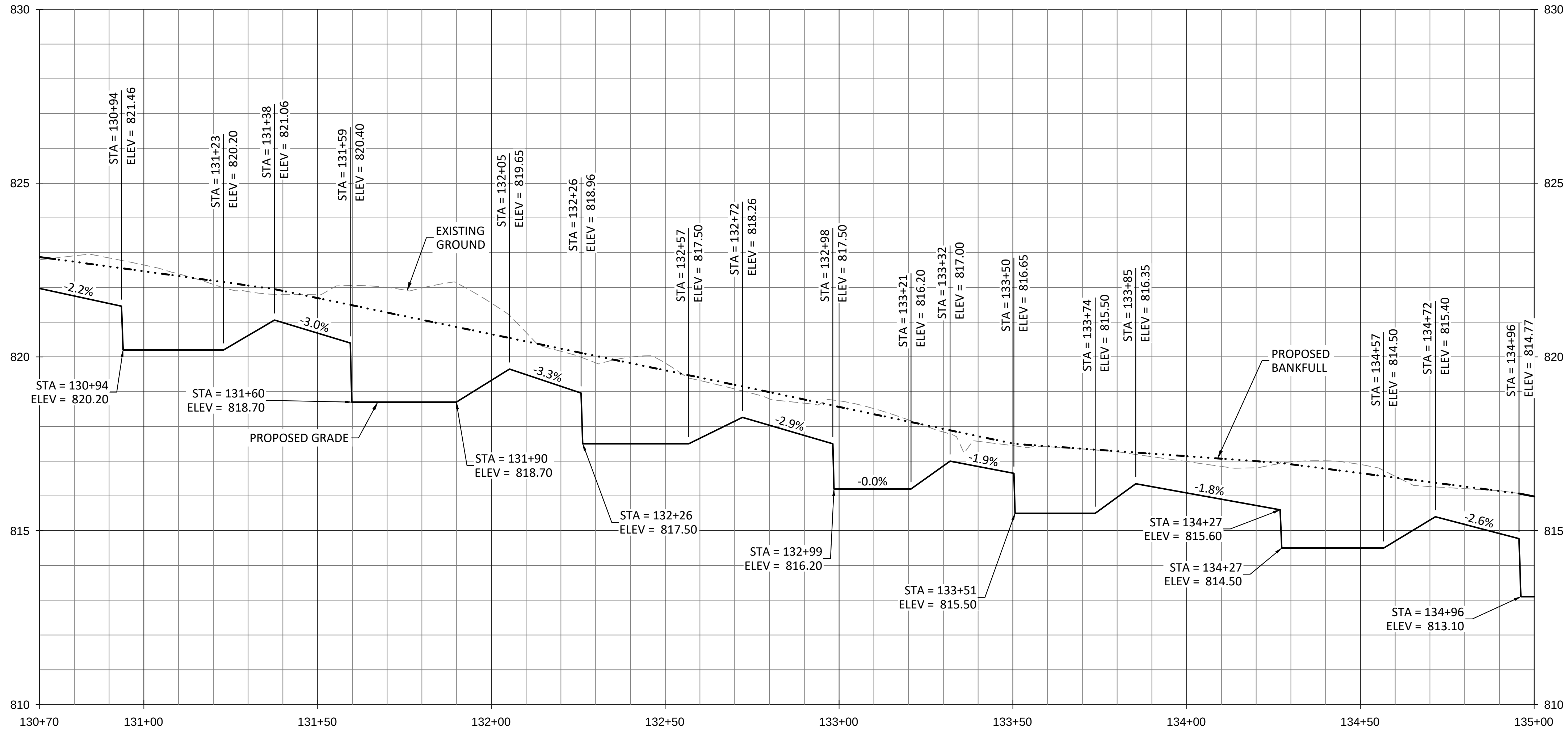

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0' 20' 40' 60'
(HORIZONTAL)

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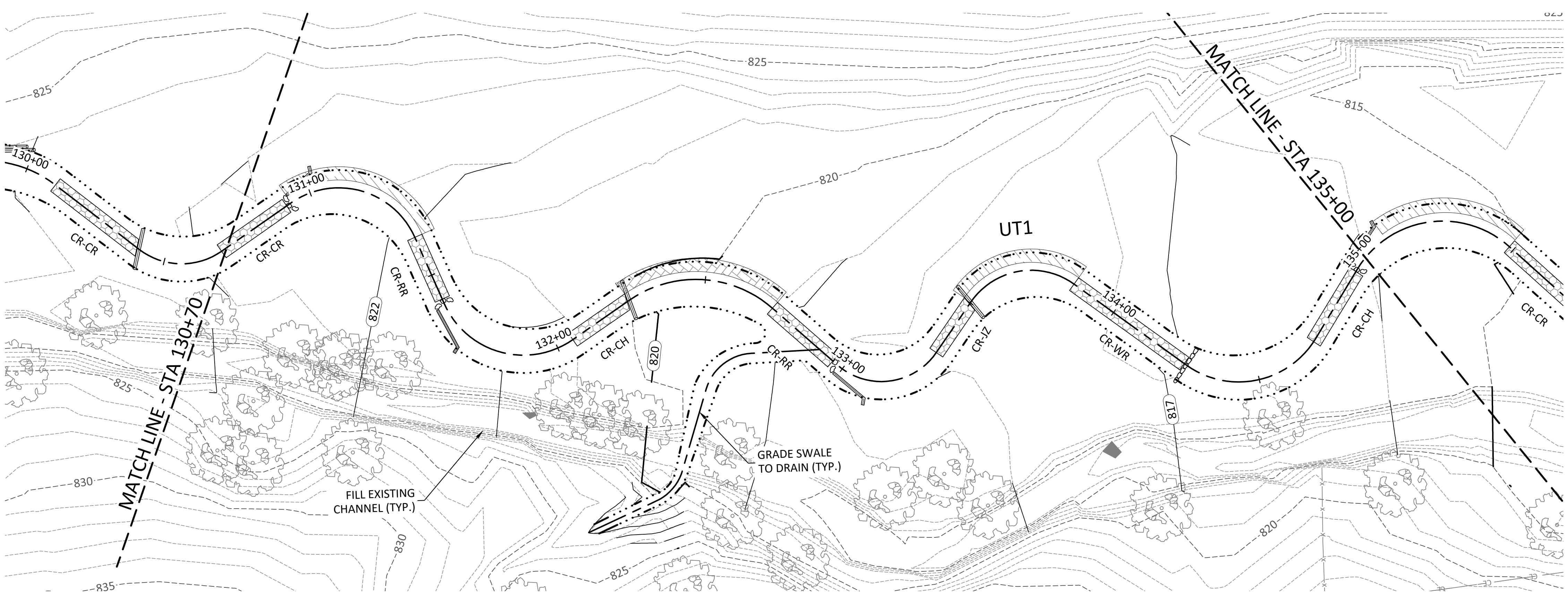

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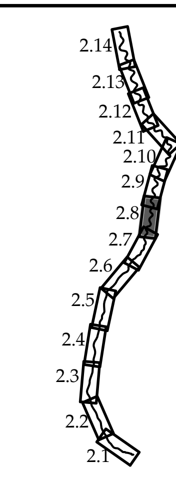

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Lone Hickory Mitigation Site
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UT1
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Project Engineer: EPN, ASE
Drawn By: SJD, JCK
Checked By: EGR

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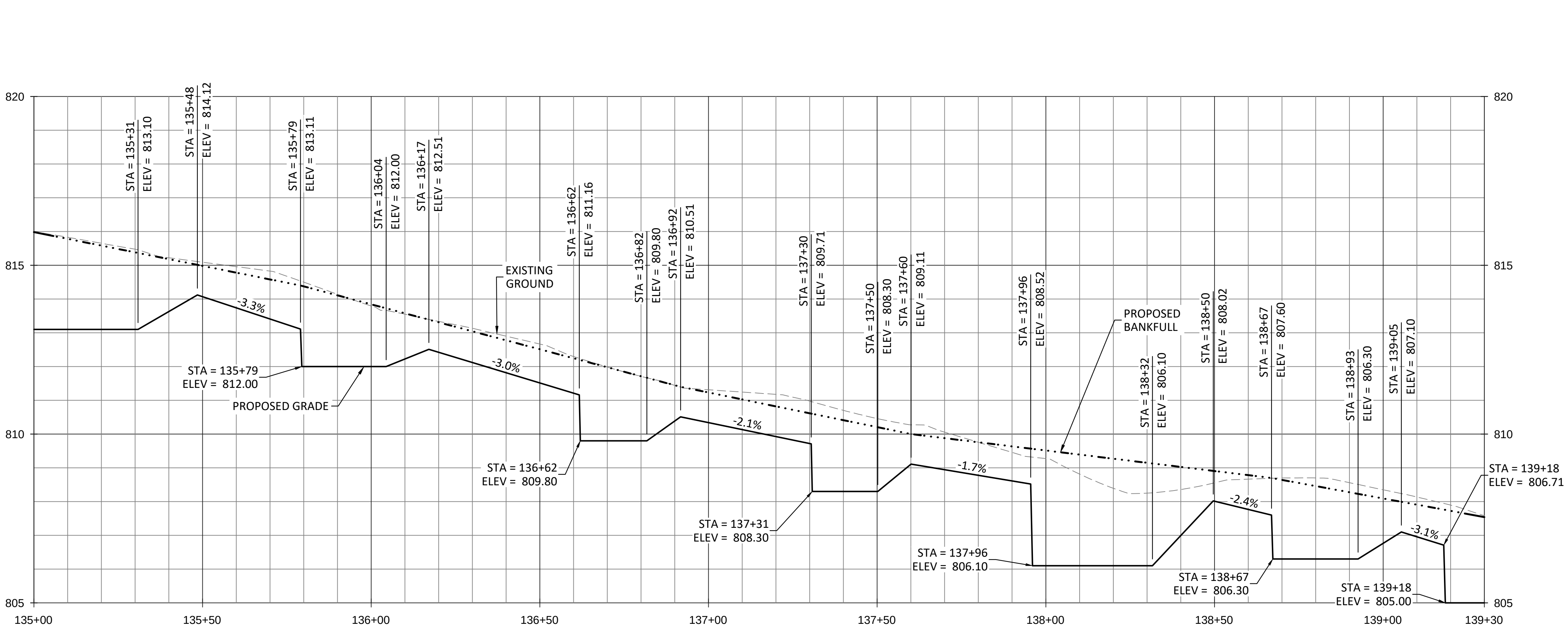

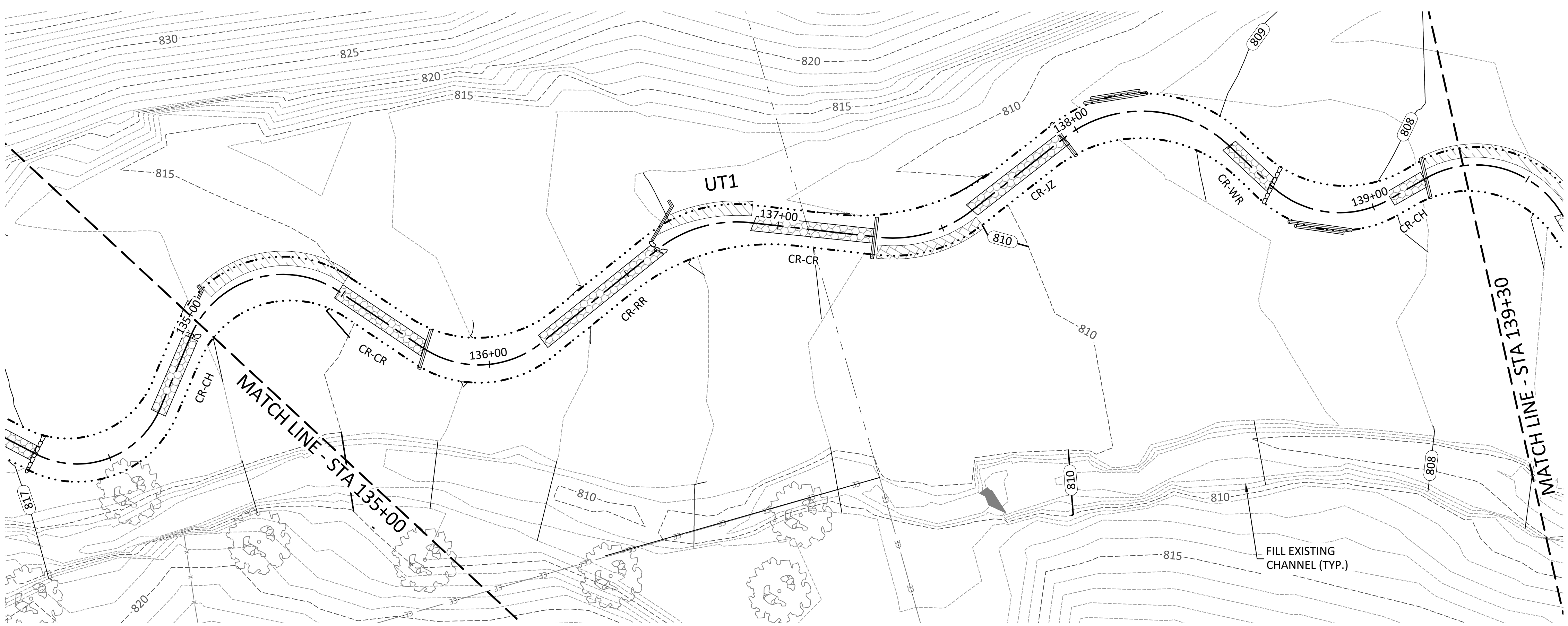

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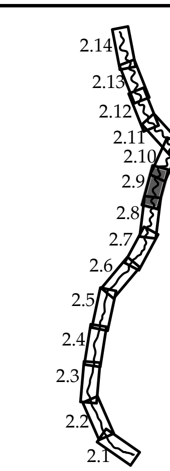

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Drawn By:	SJD, JCK
Checked By:	EGR

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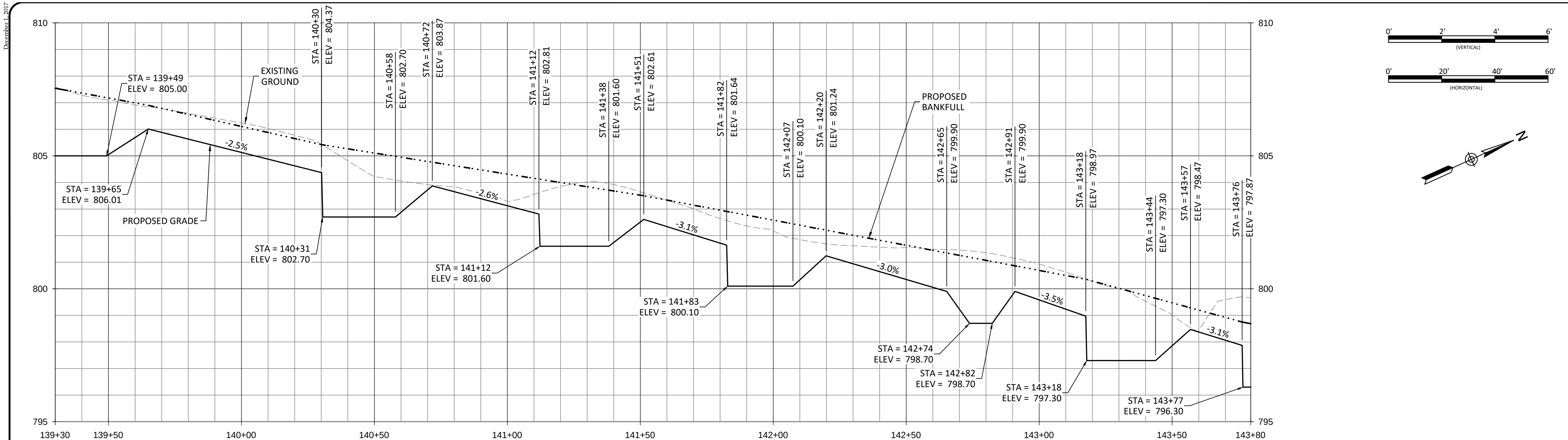

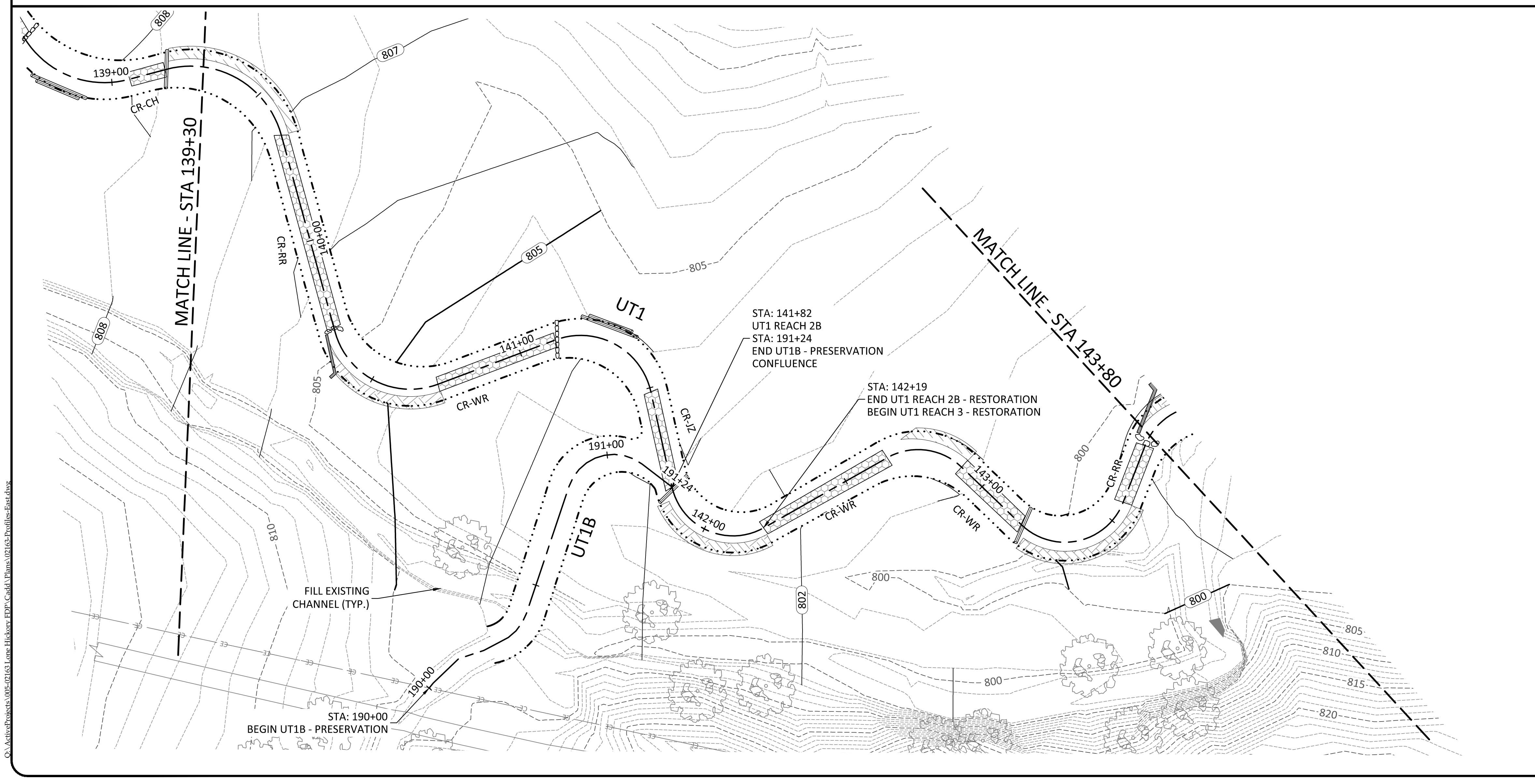

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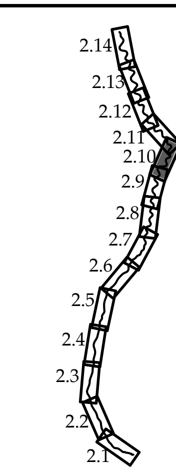

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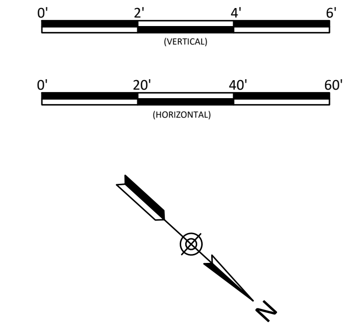

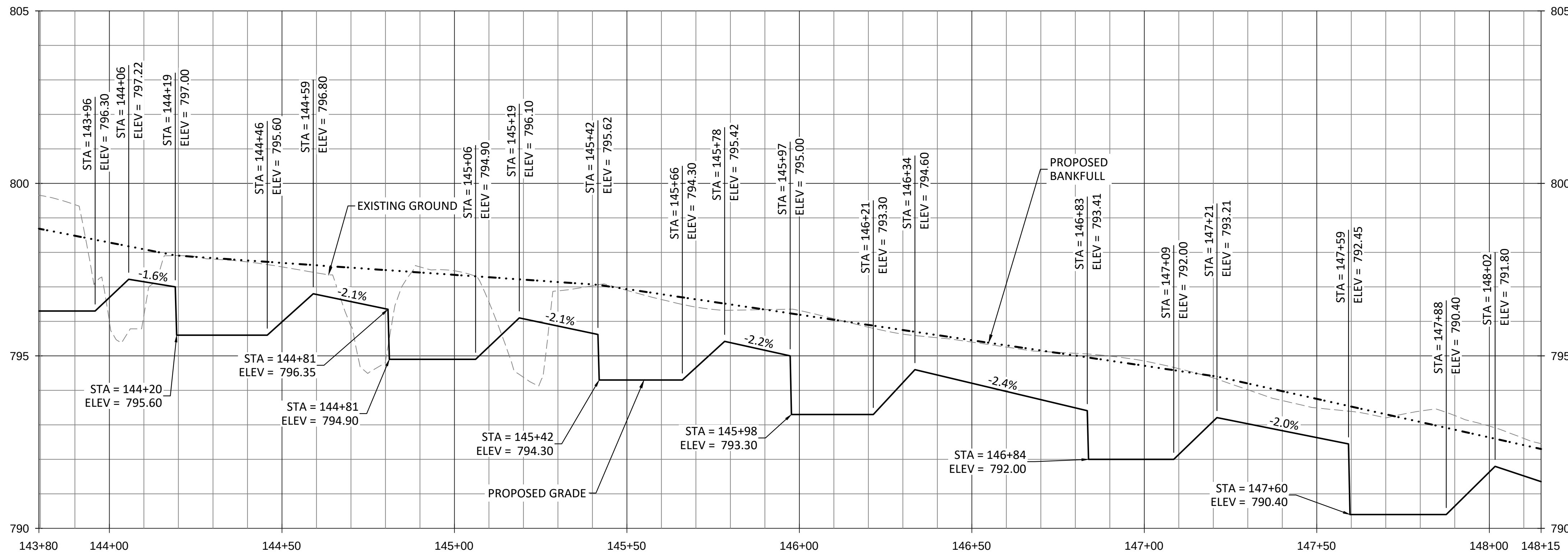

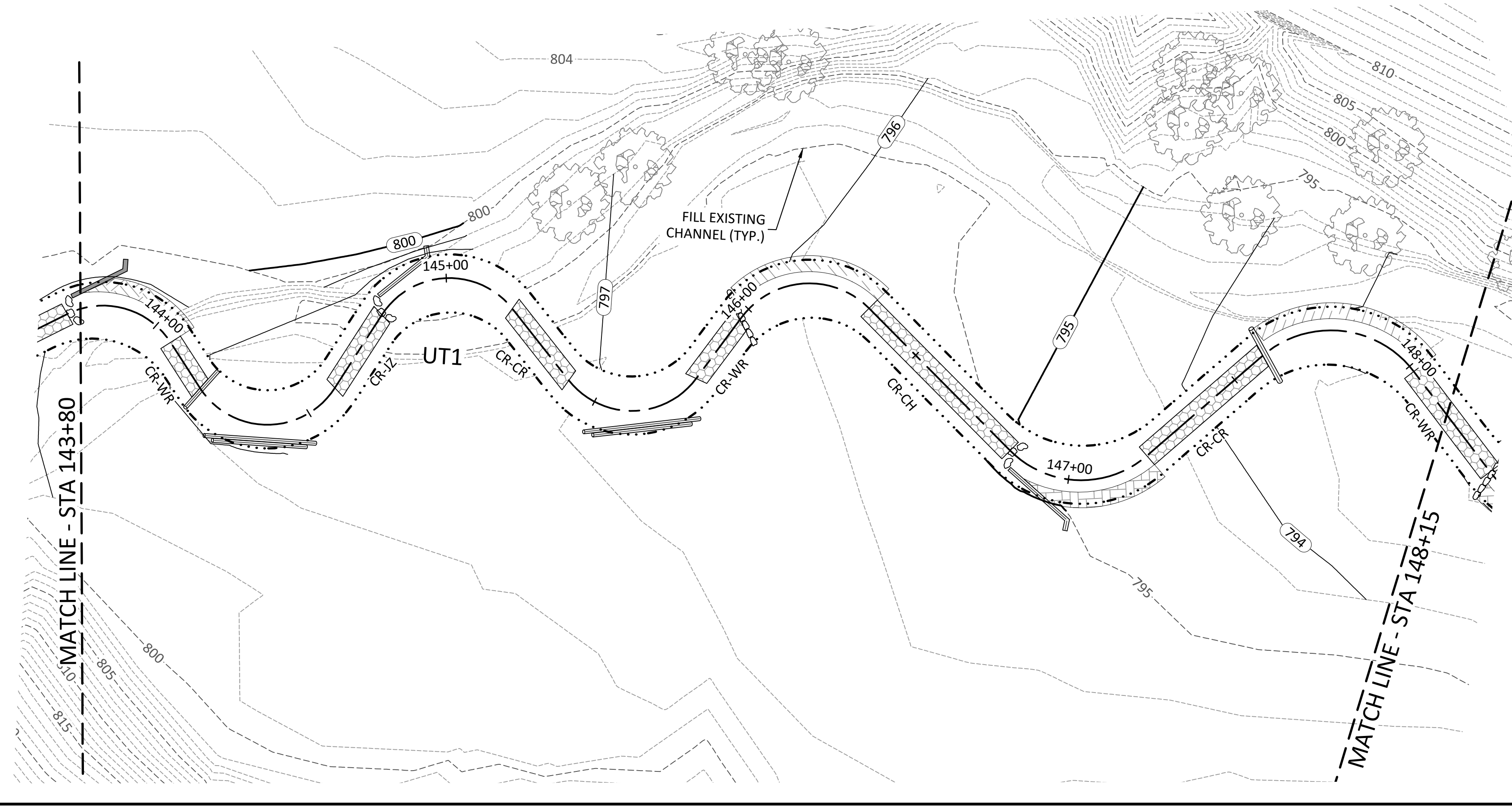

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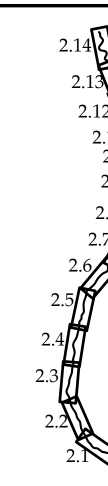

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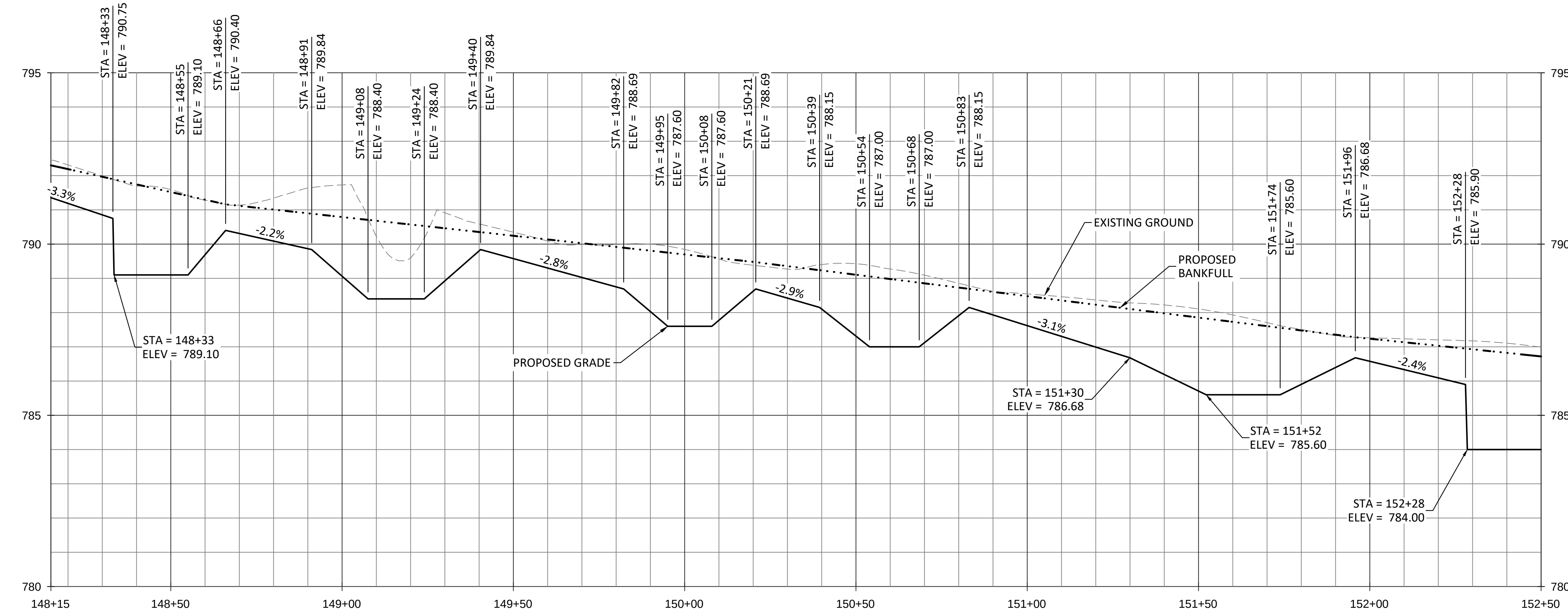

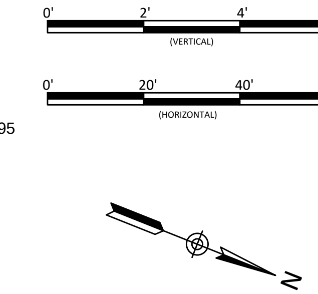

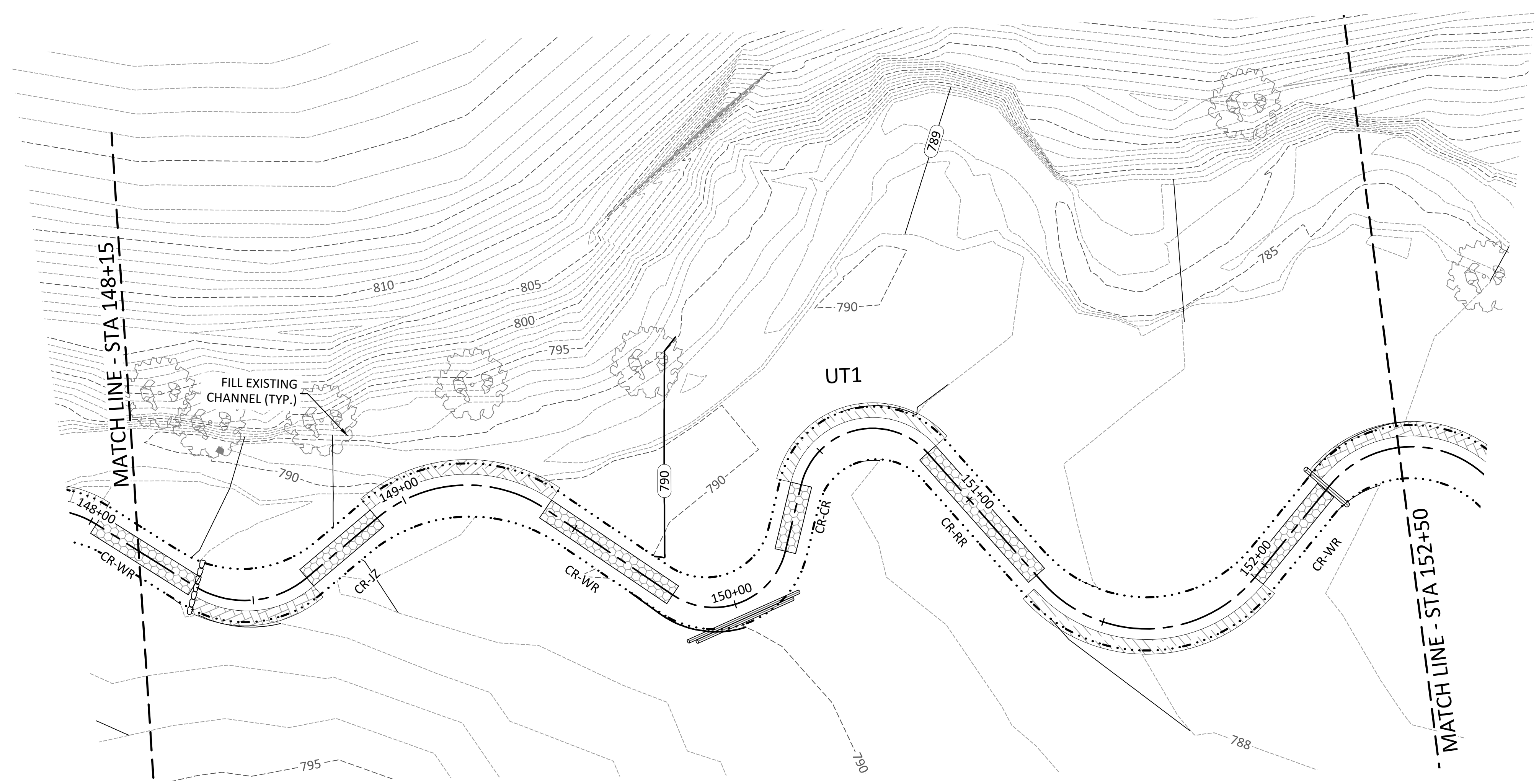

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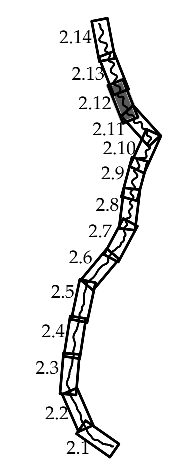

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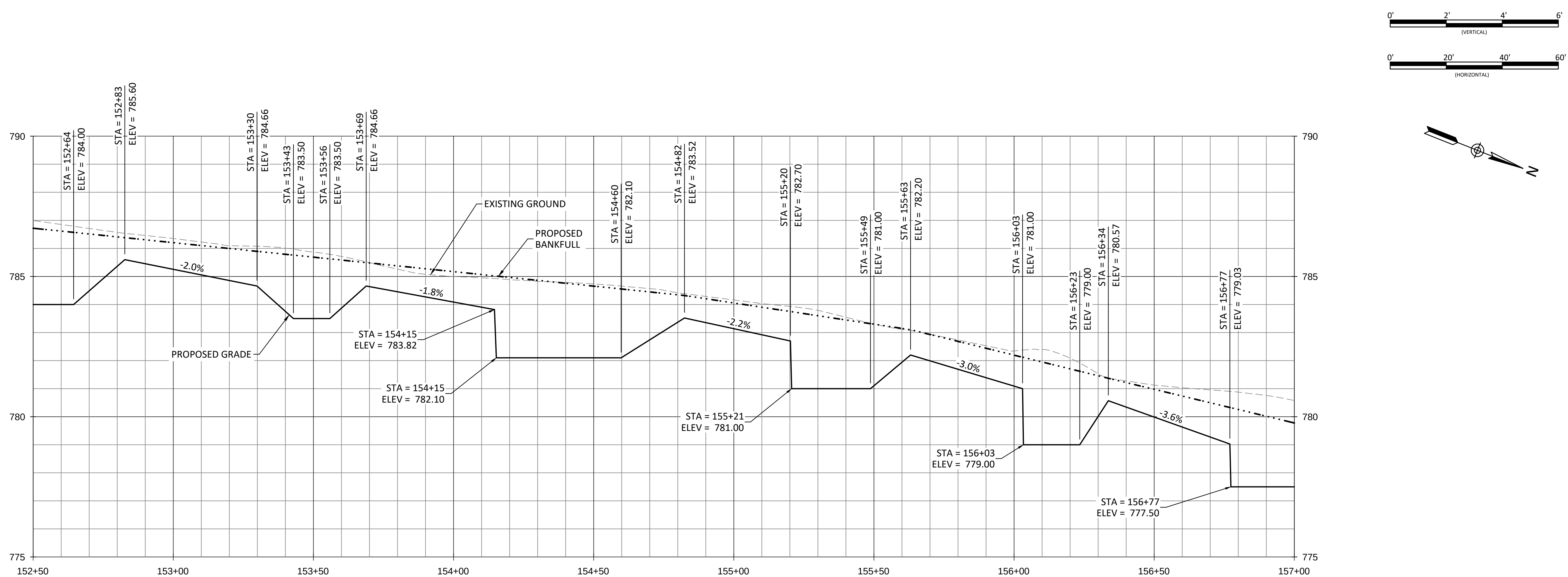

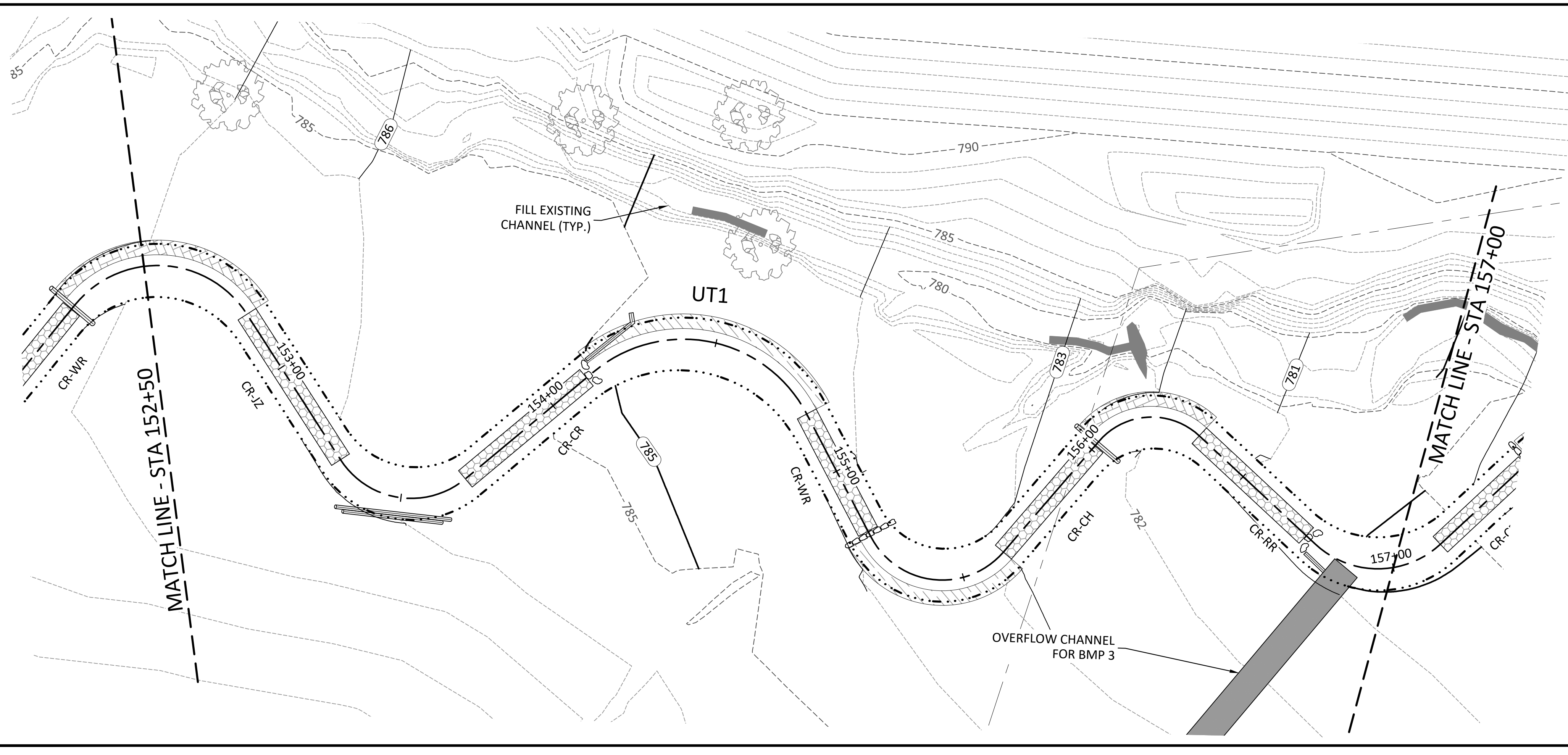

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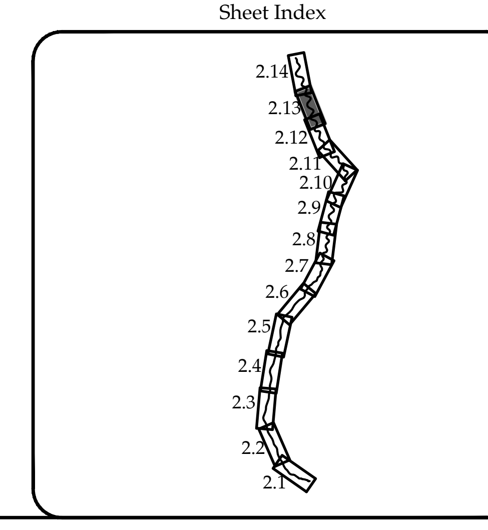

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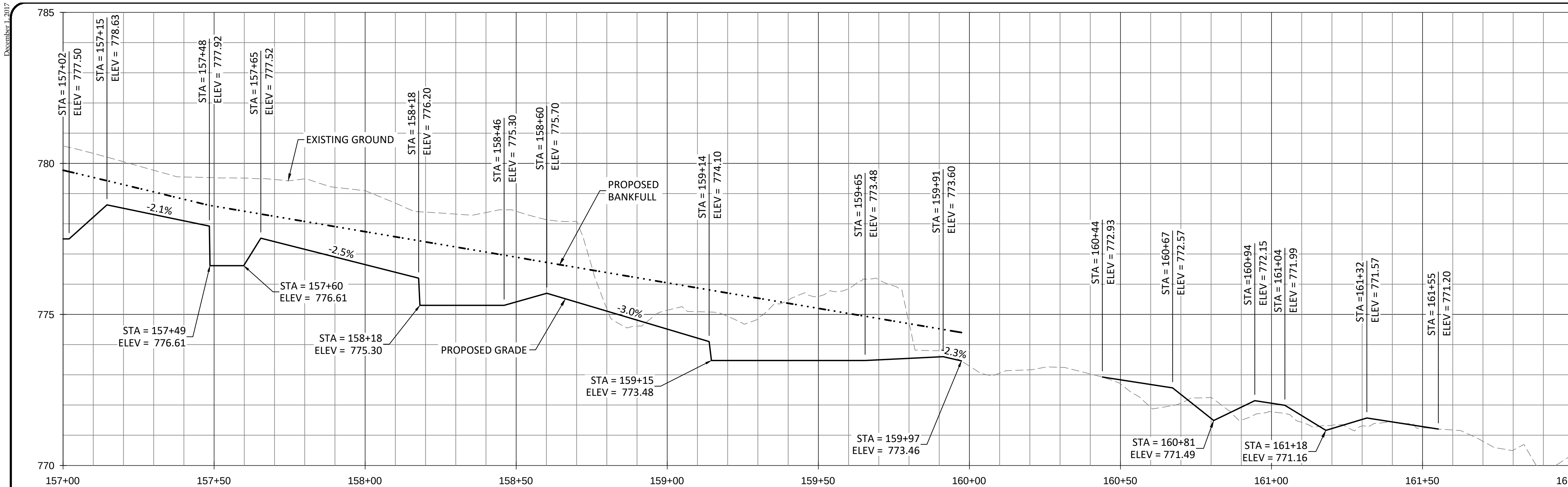

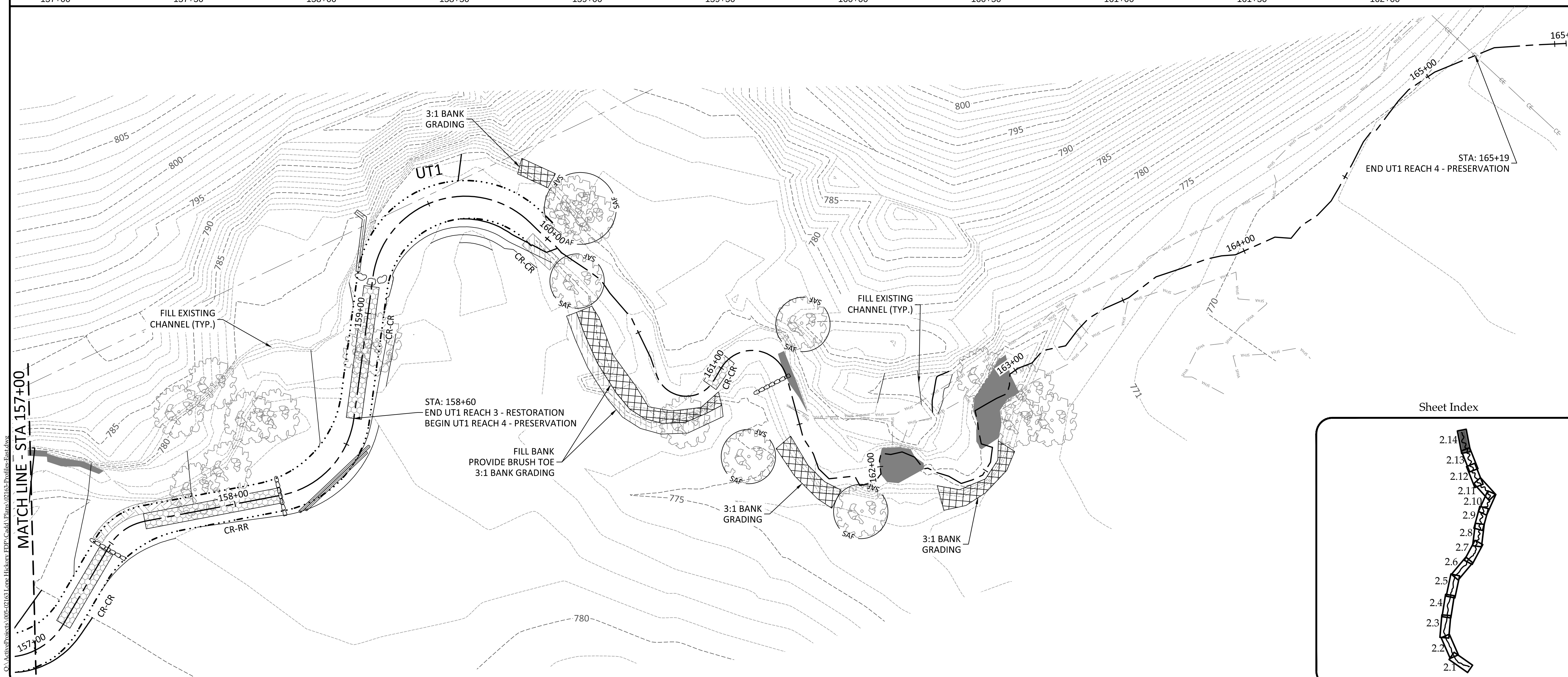

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

N

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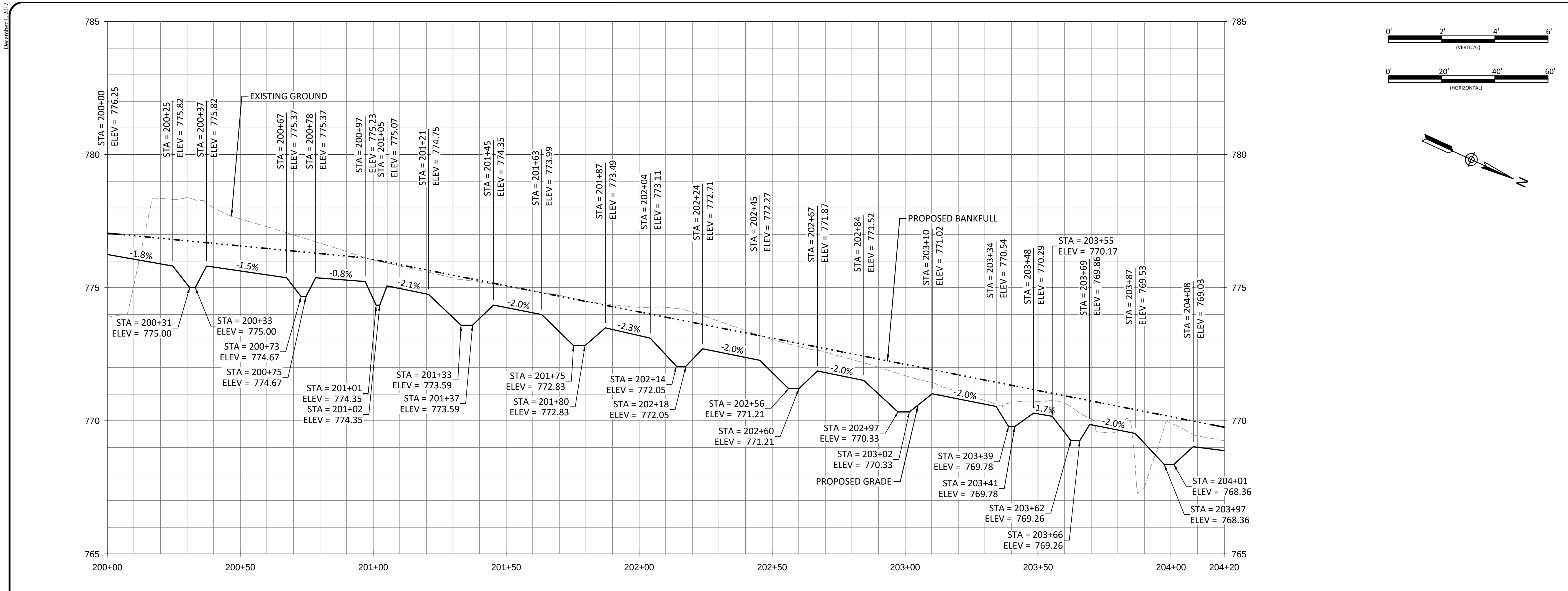

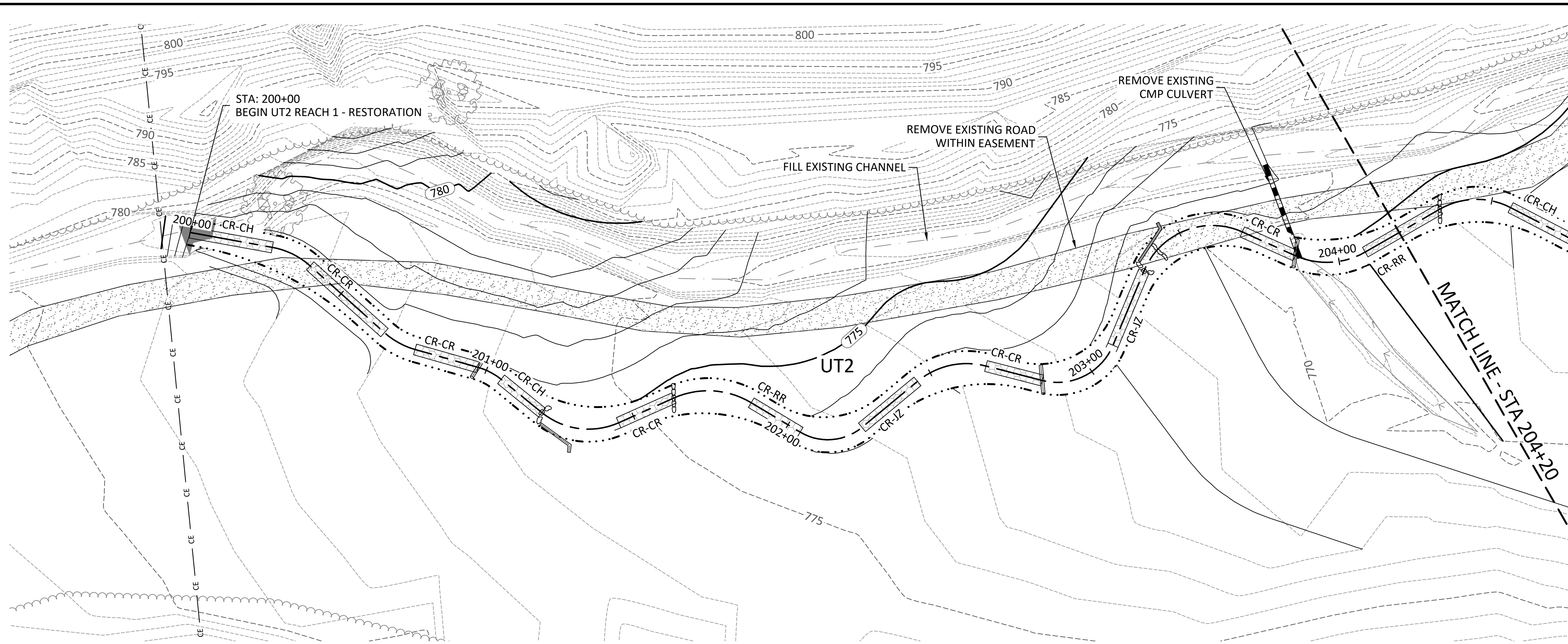

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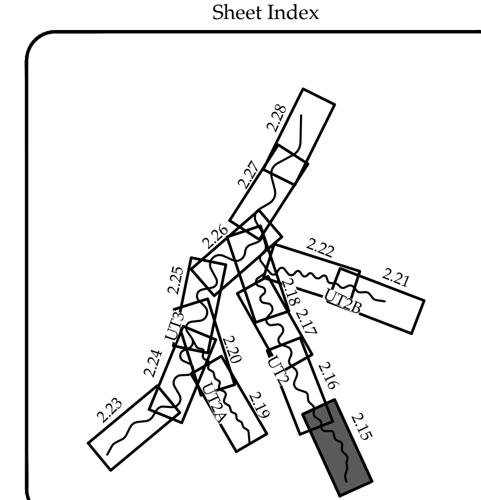

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UT2
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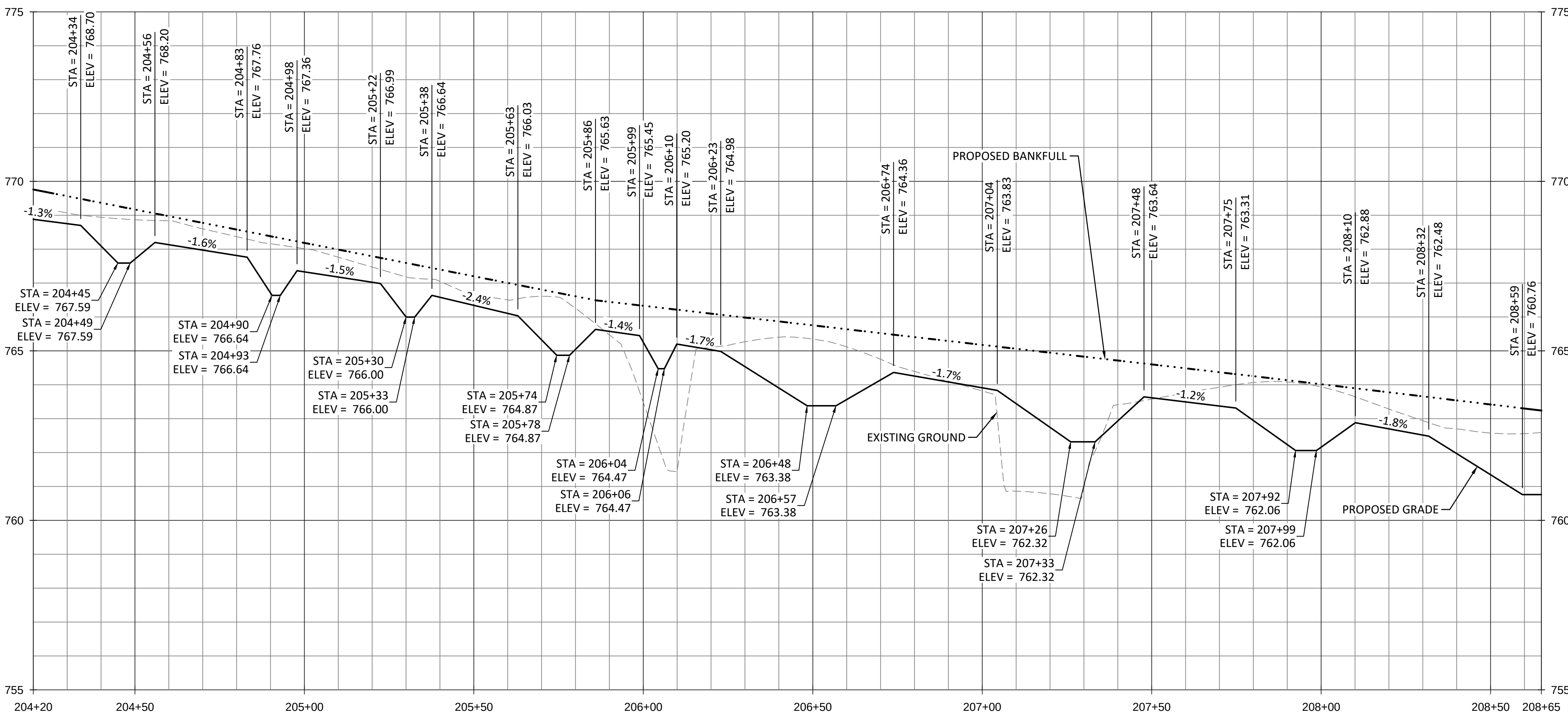
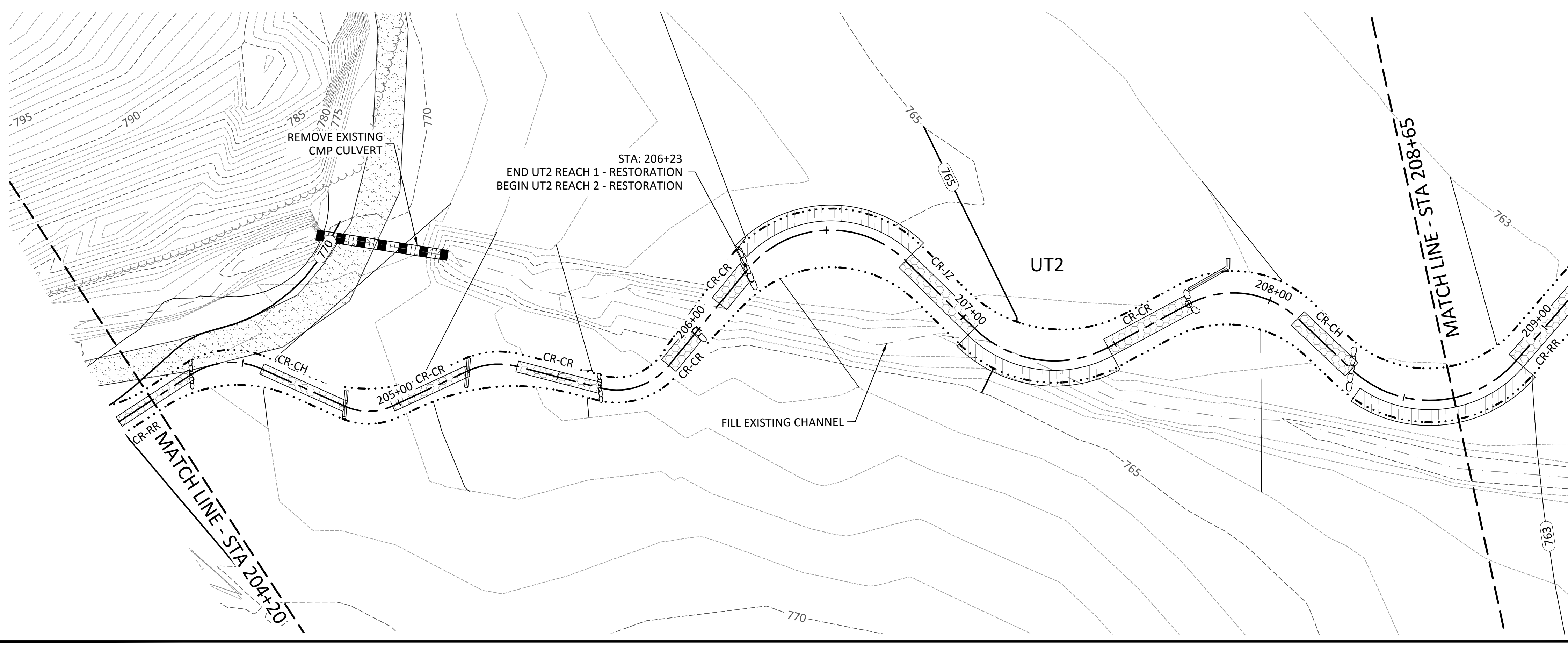
December 1, 2017





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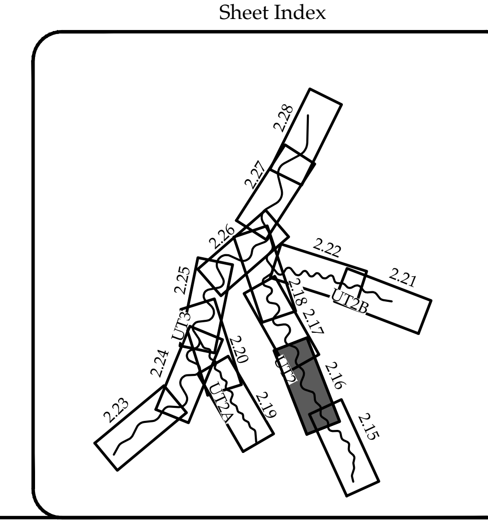

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UT2
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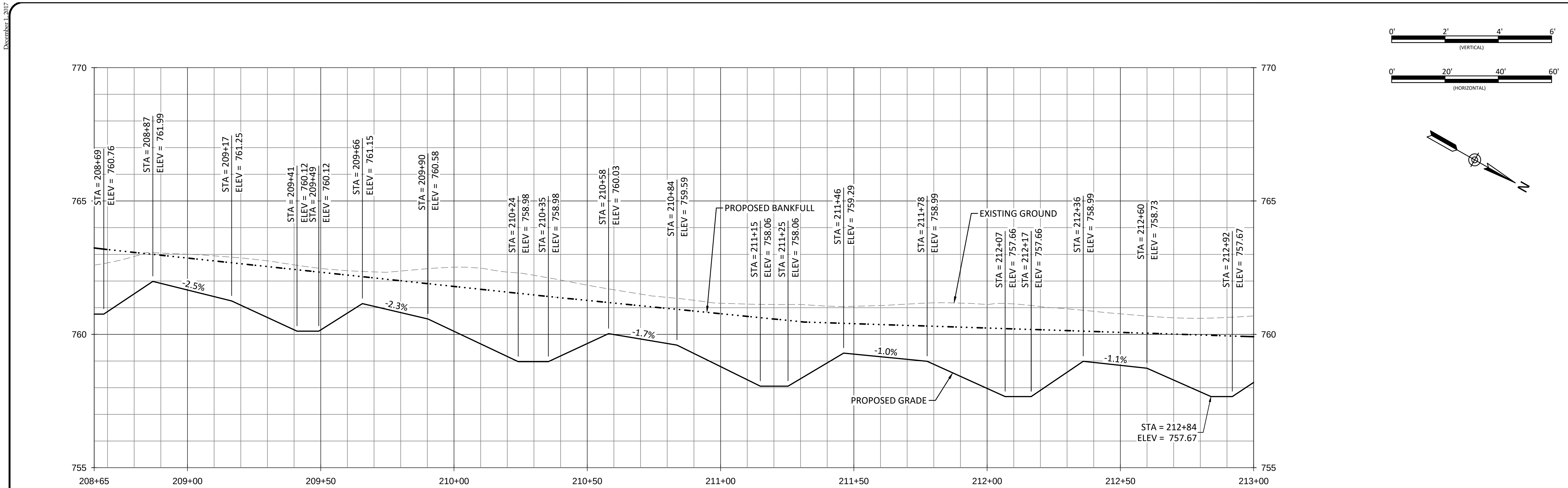

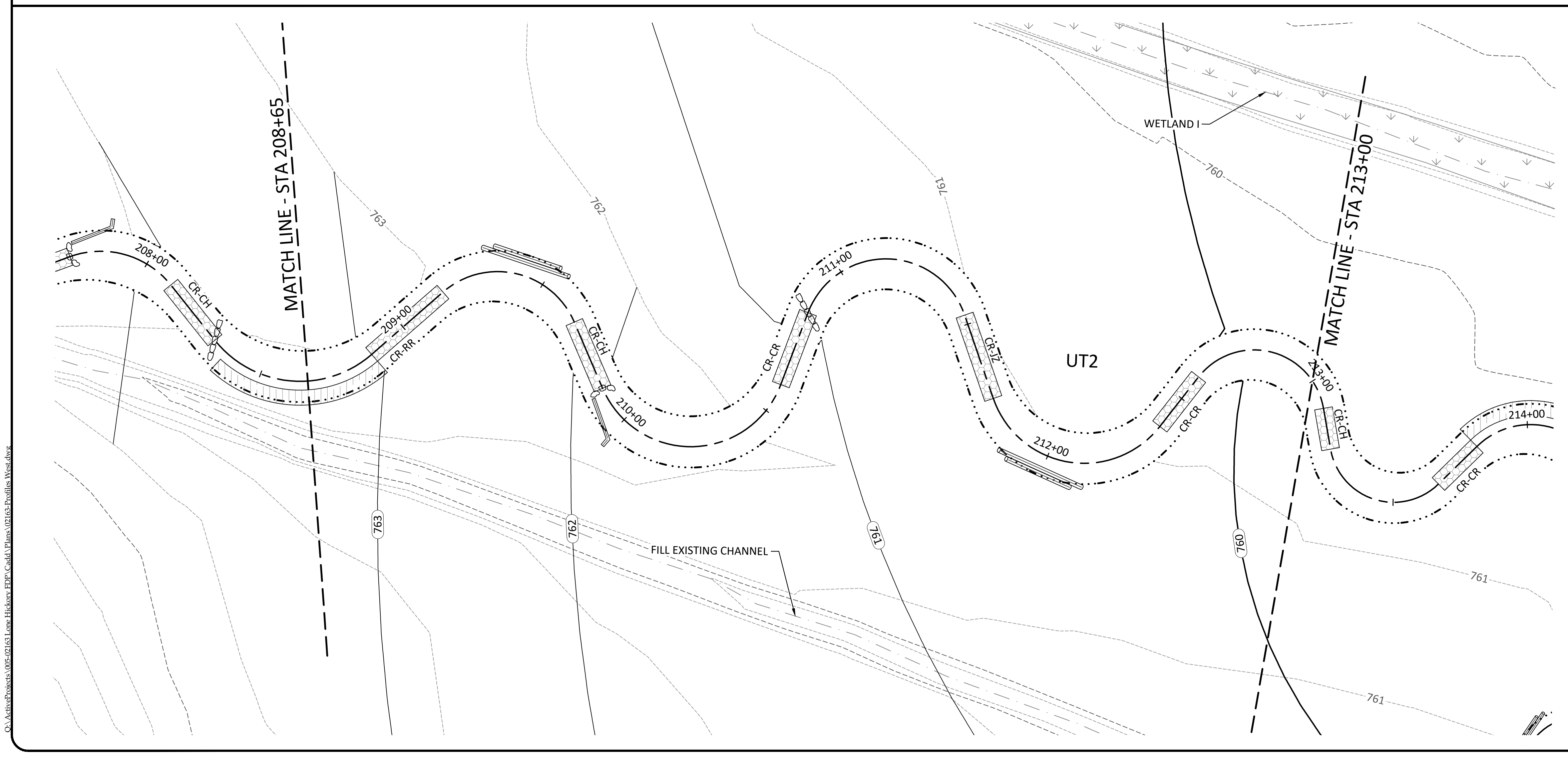

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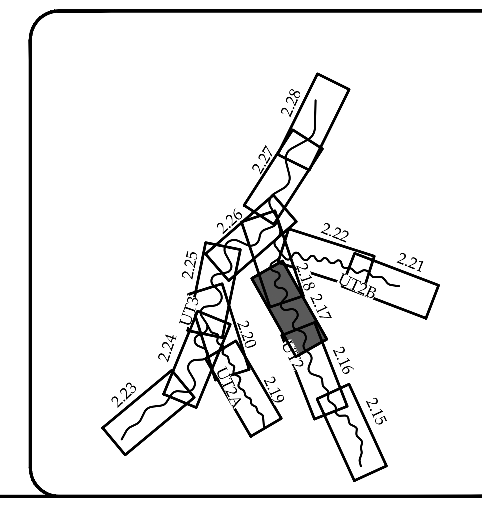

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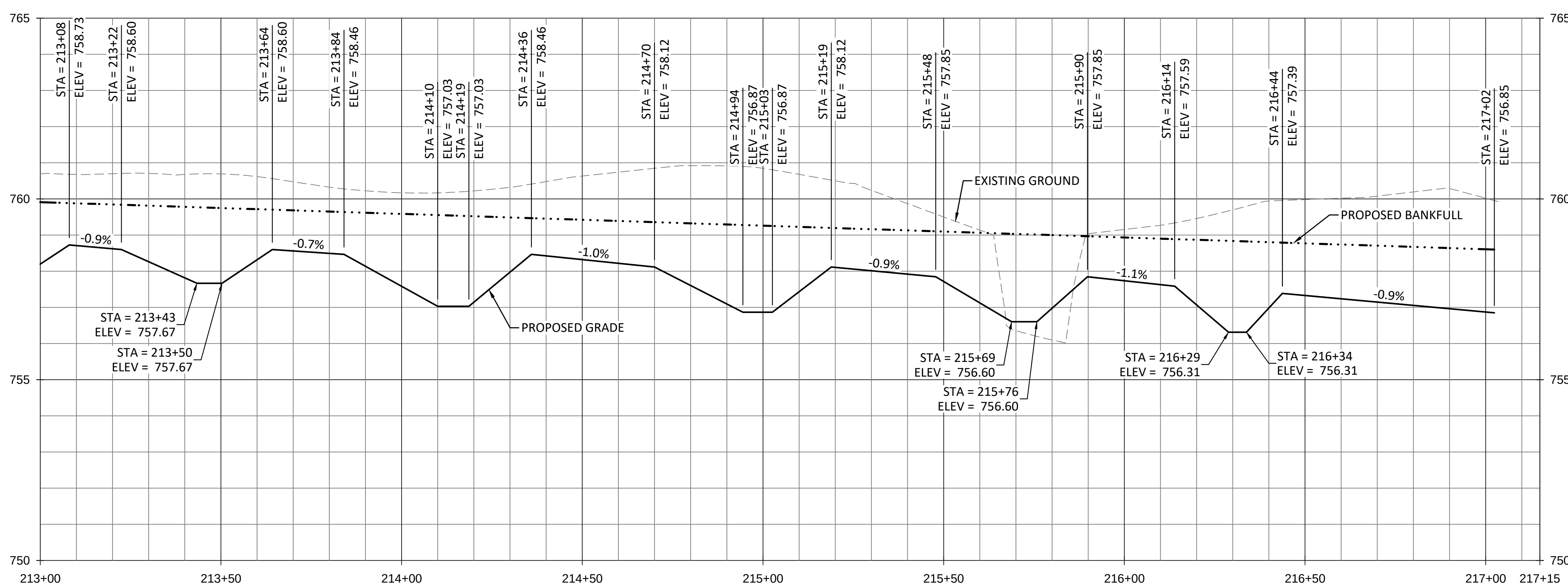

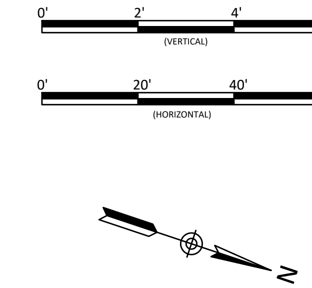

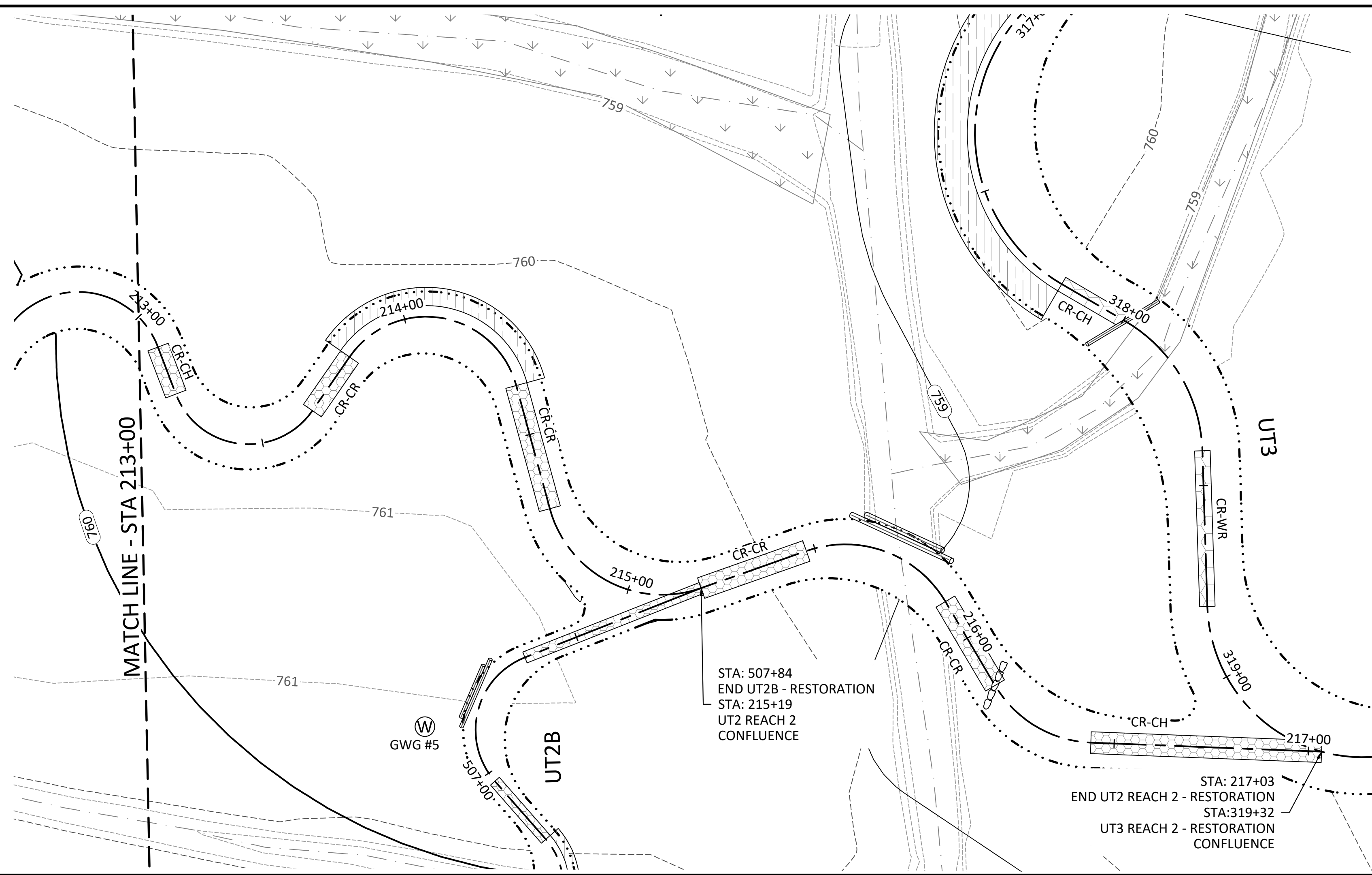

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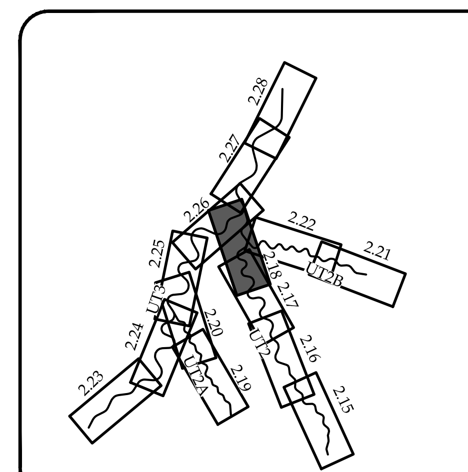

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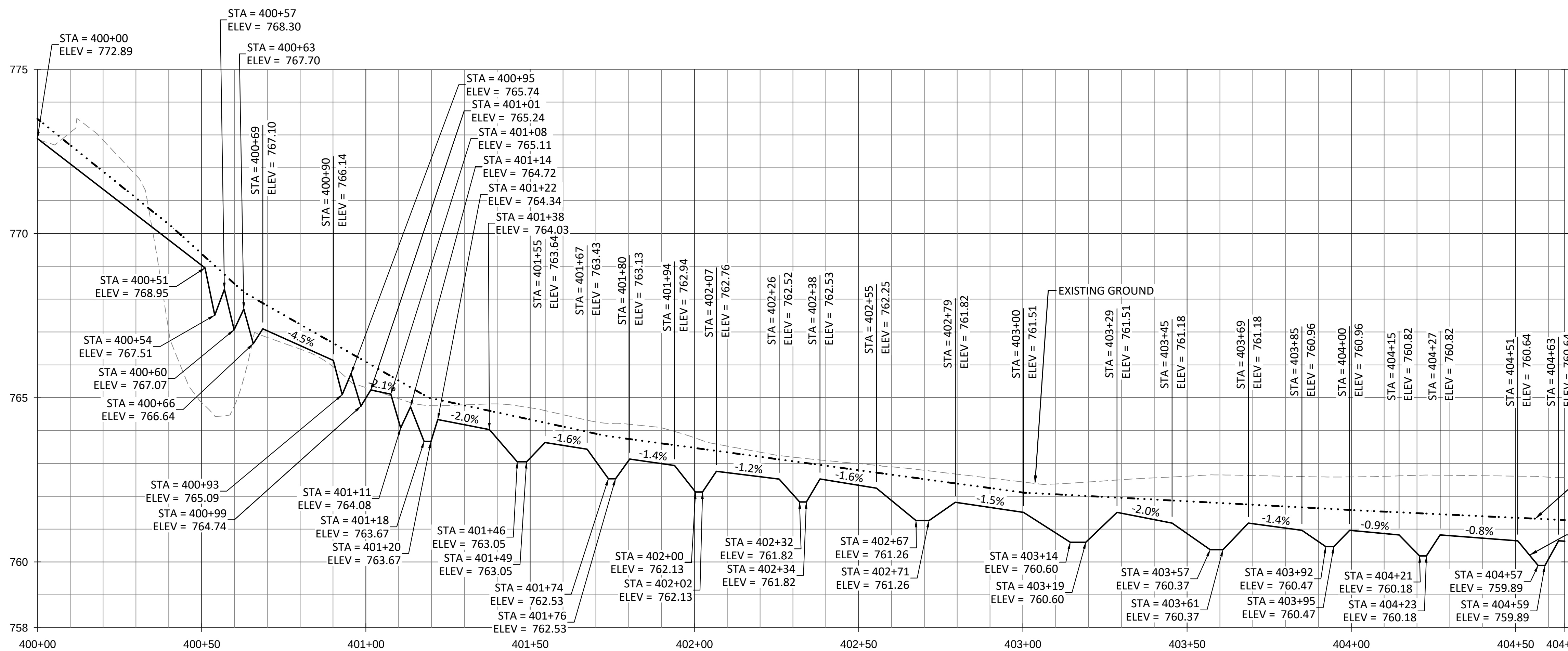

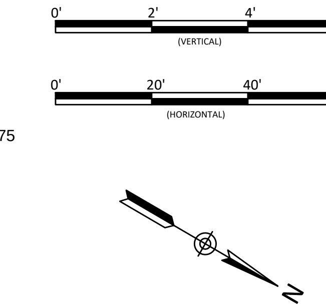

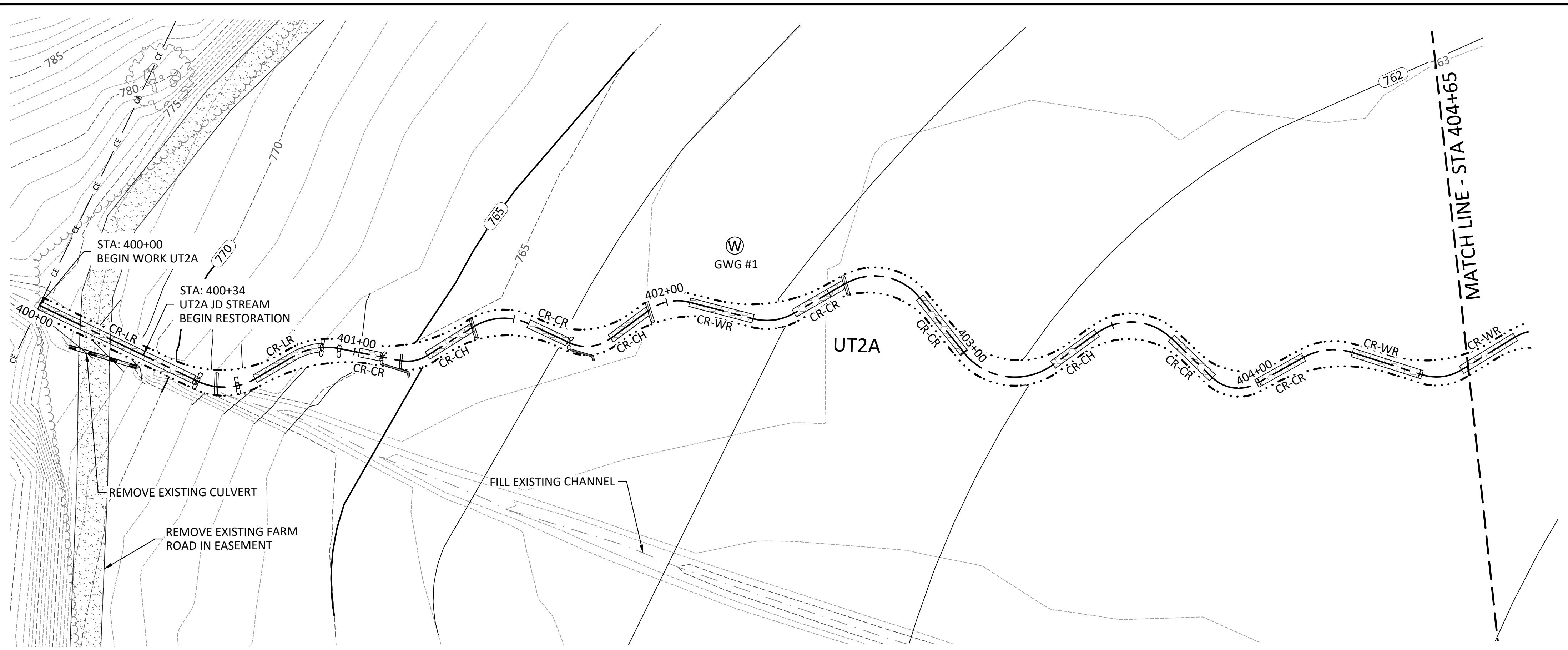

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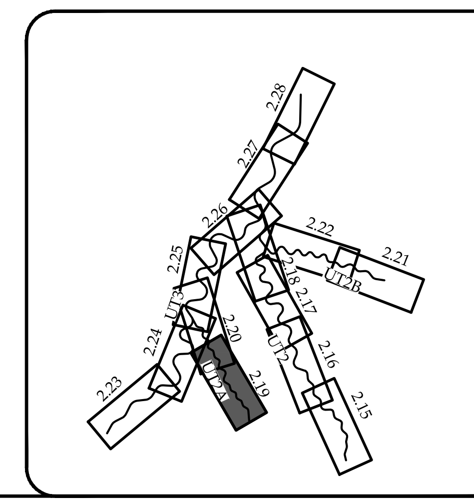

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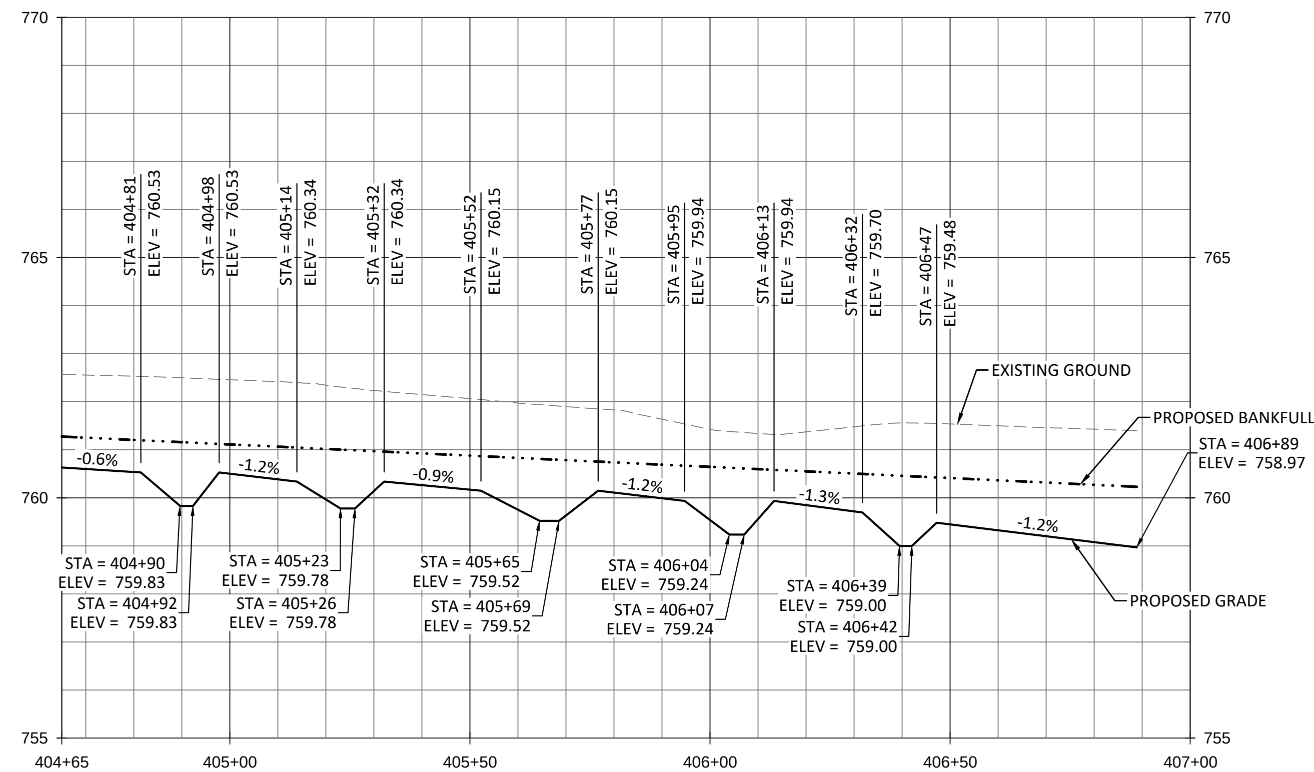

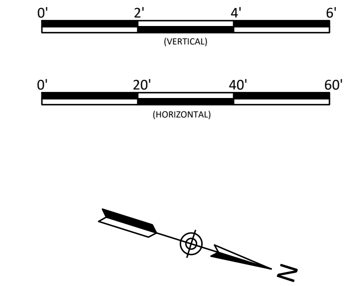

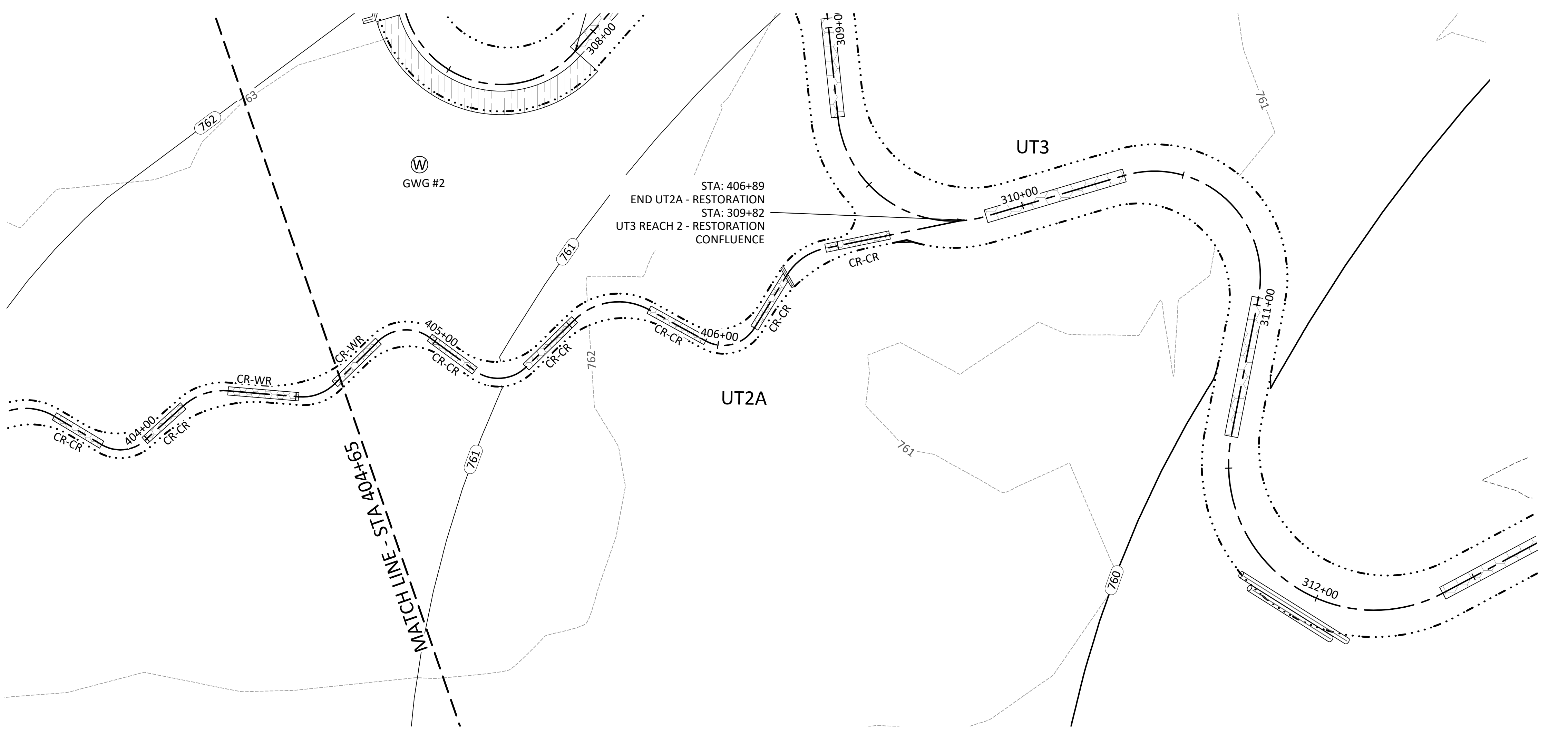

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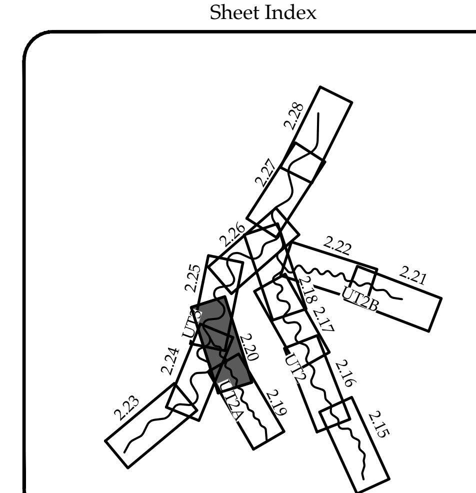

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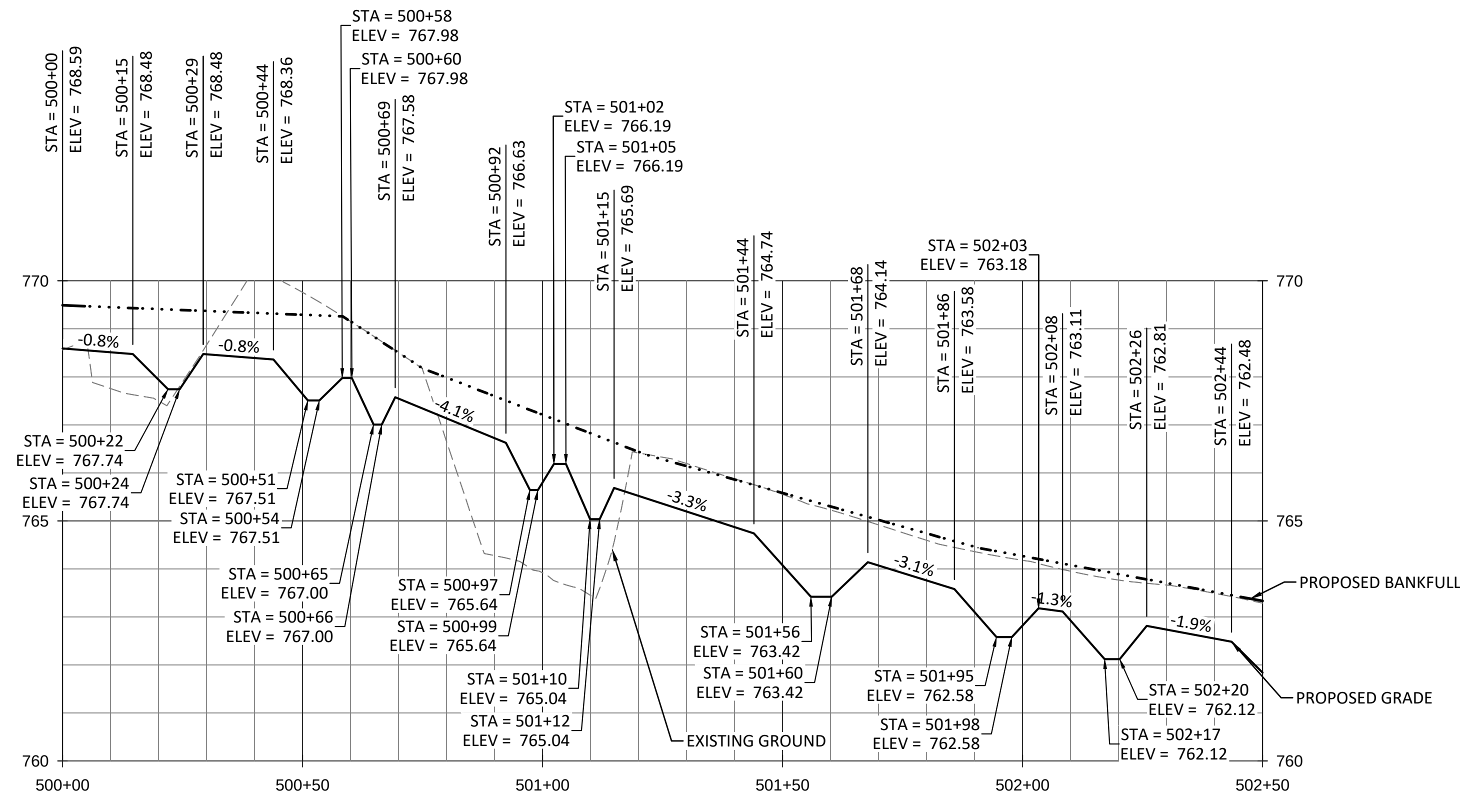

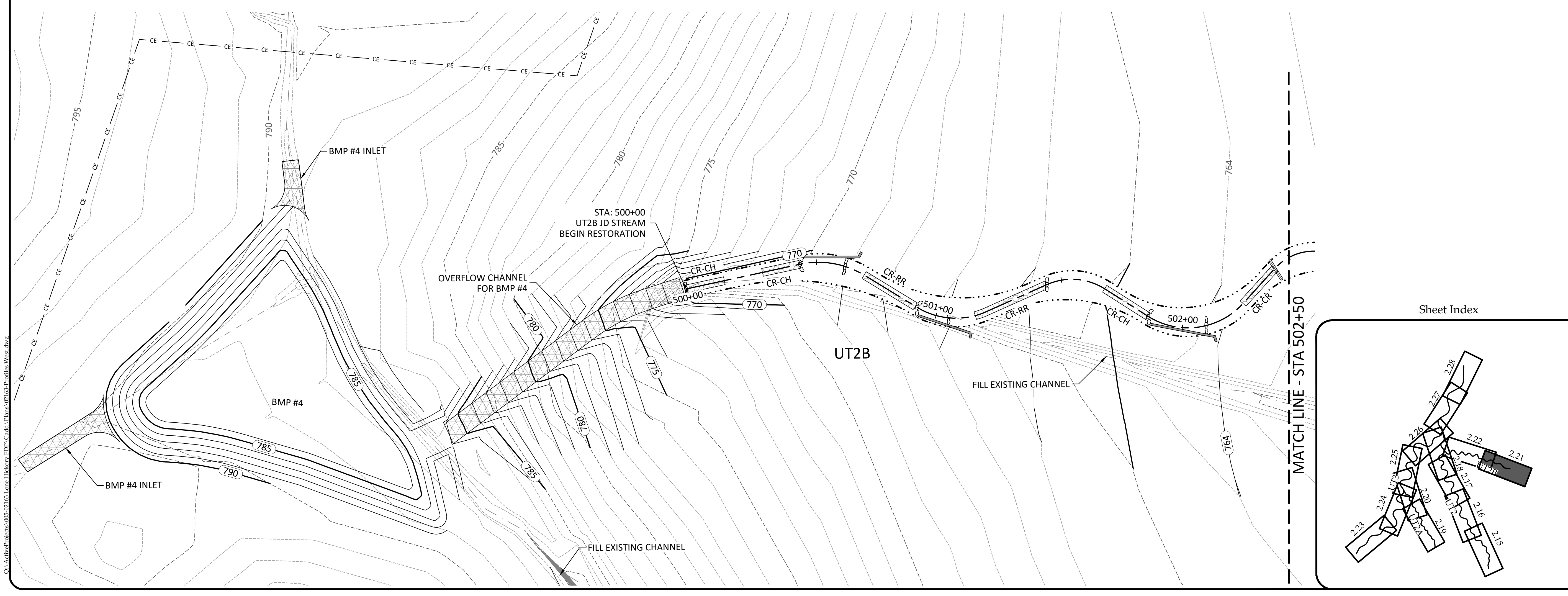

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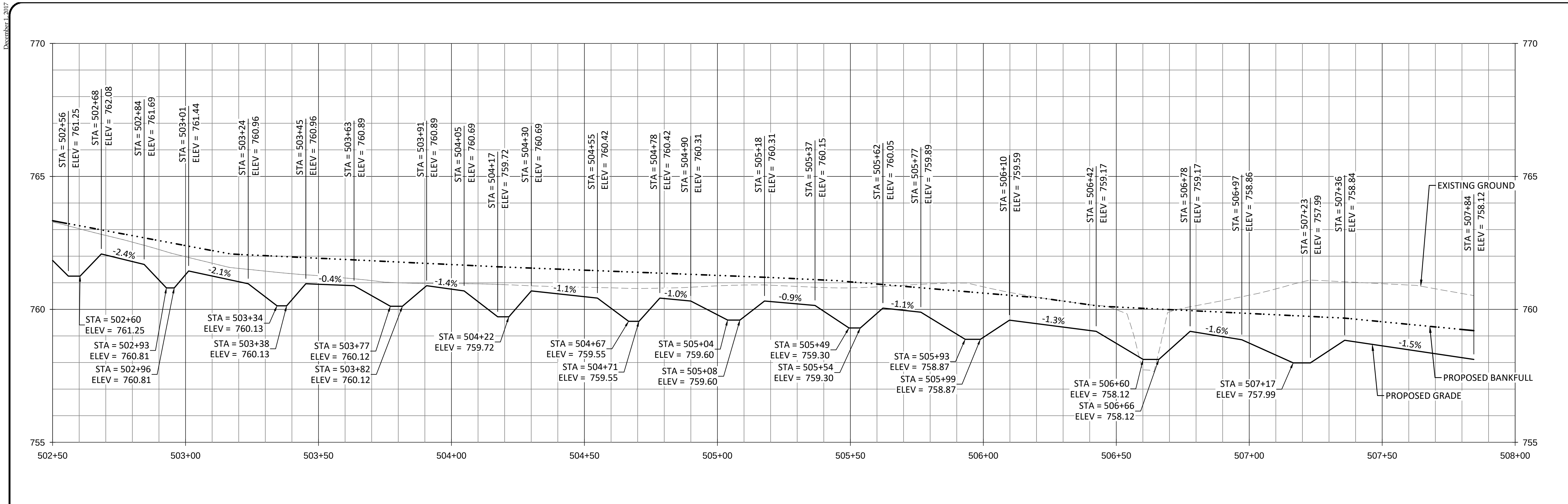

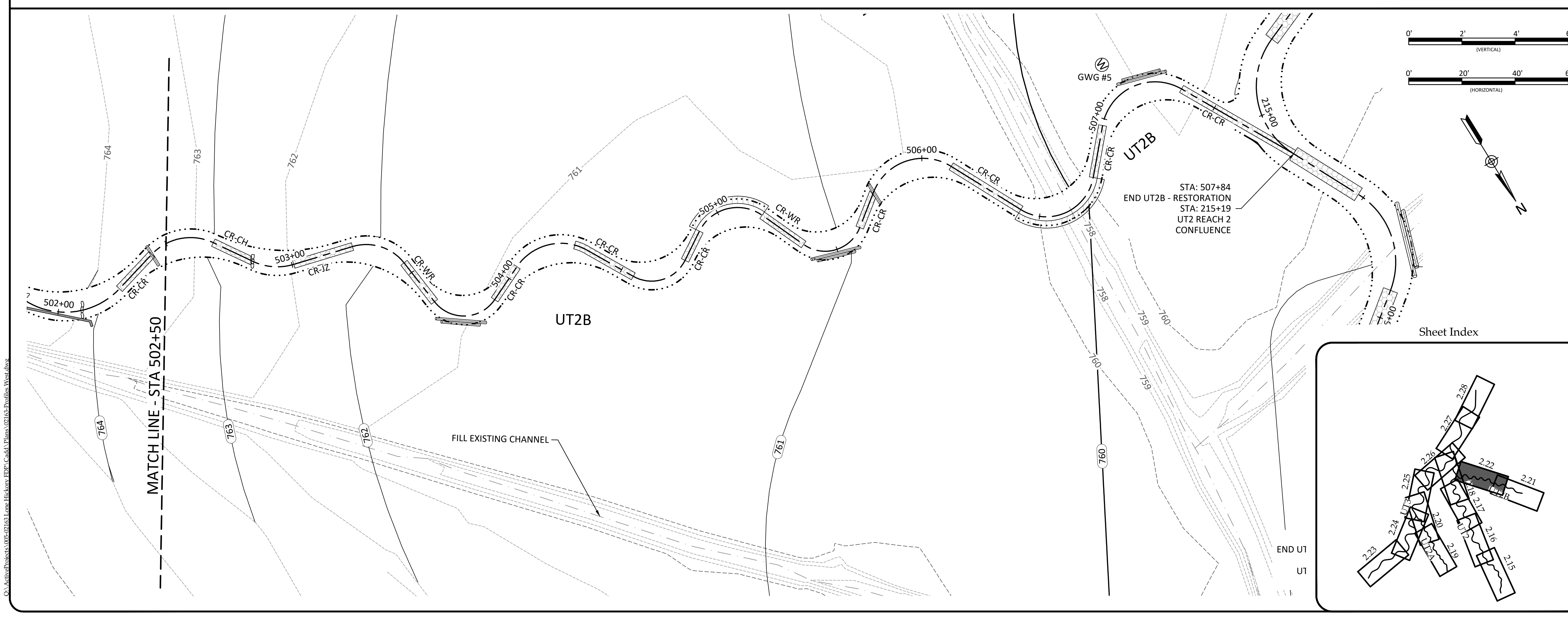

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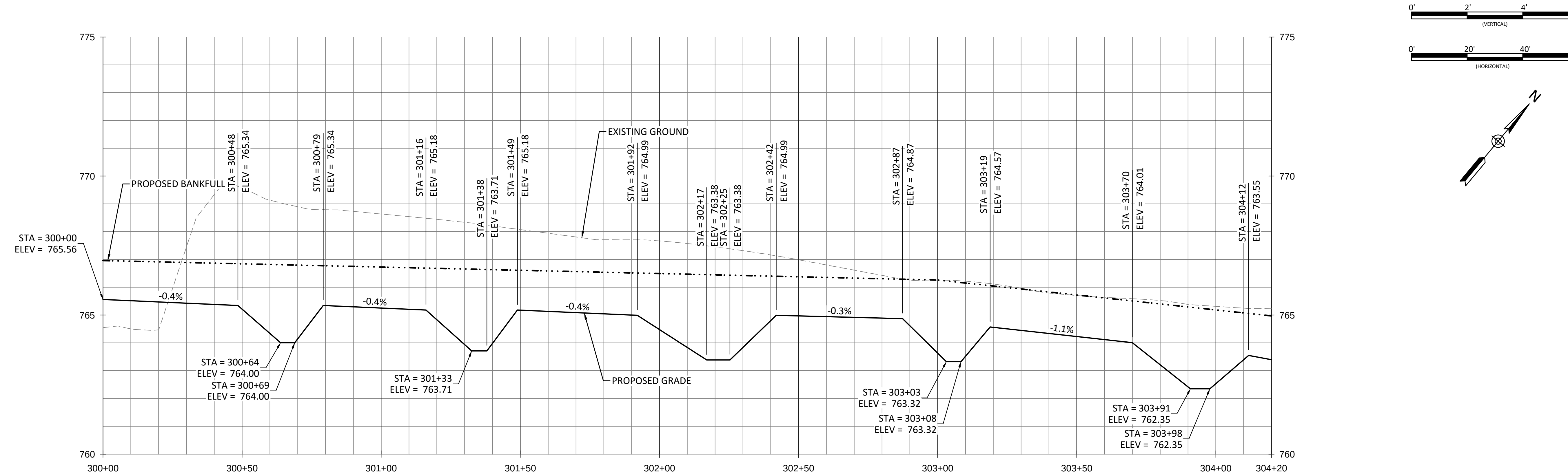

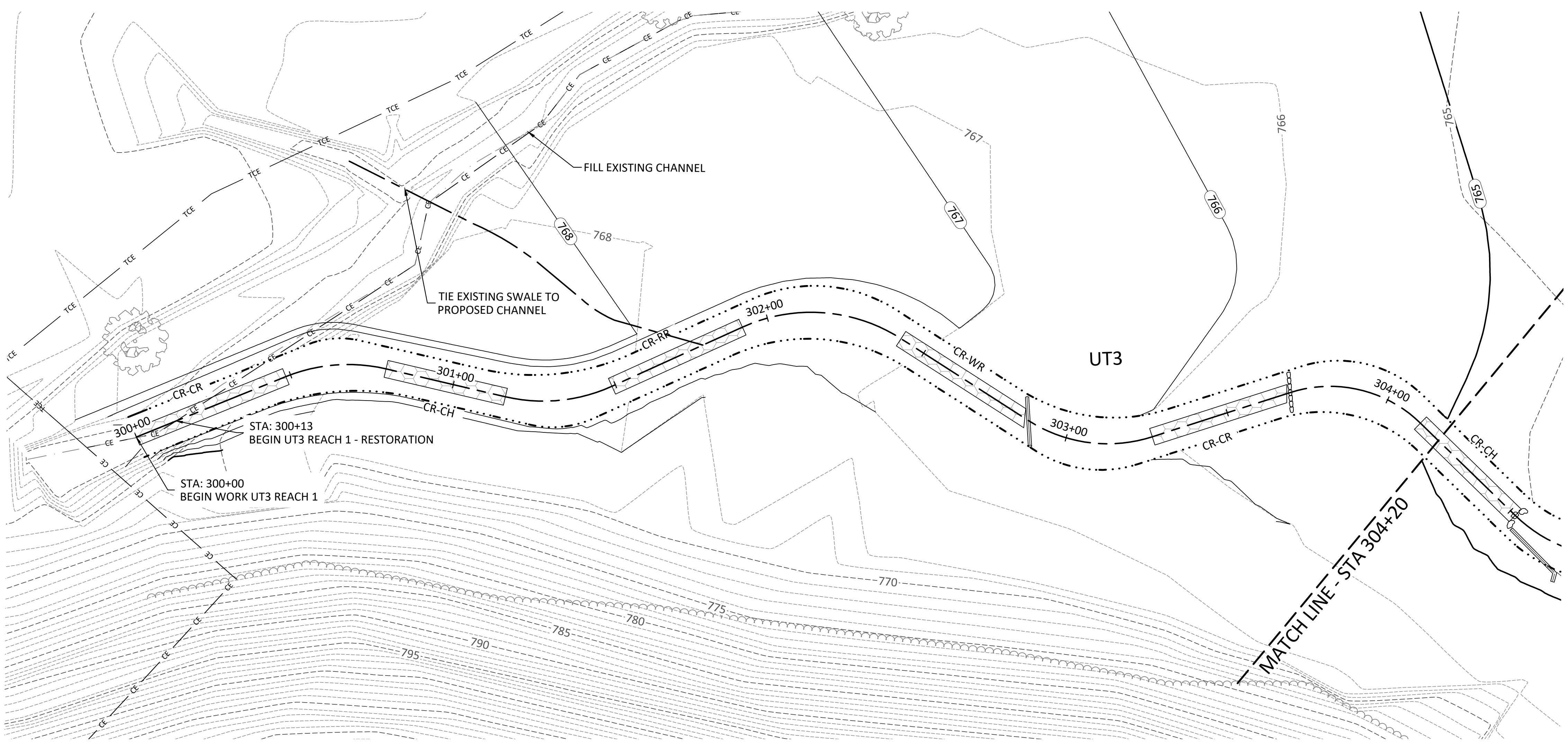

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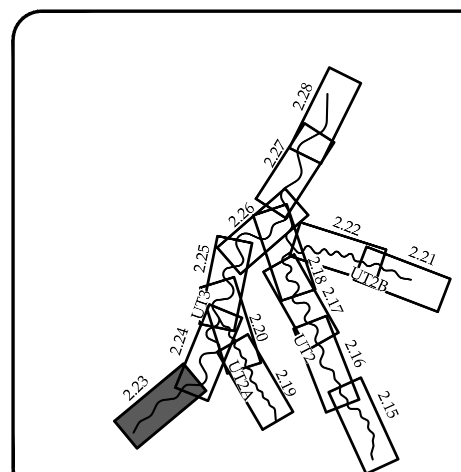

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UT3
Stream Plan and Profile

Revisions:

Date: December 8, 2017
Job Number: 005-02163
Project Engineer: EPN, ASE
Drawn By: SJD, JCK
Checked By: EGR

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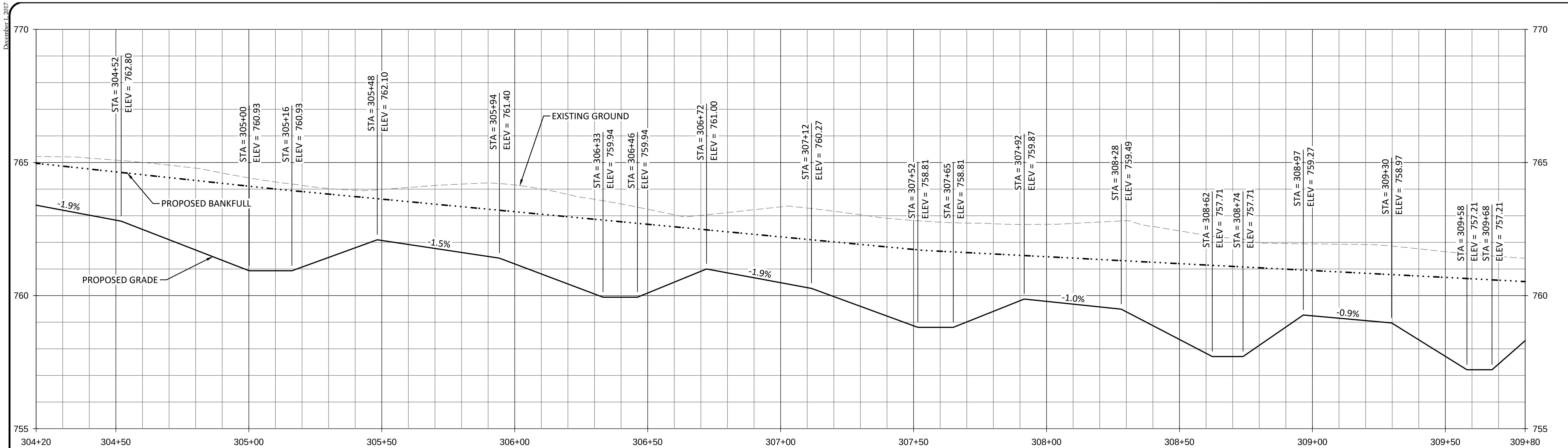

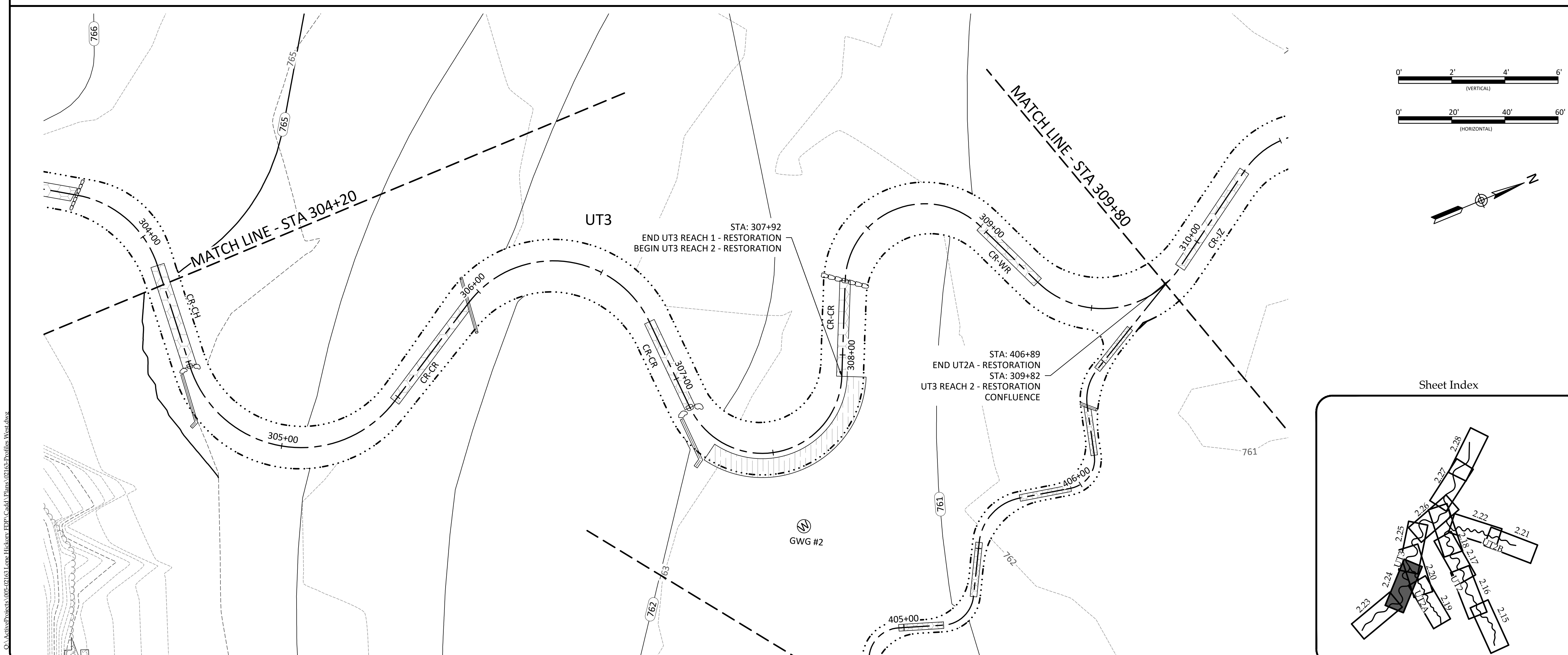

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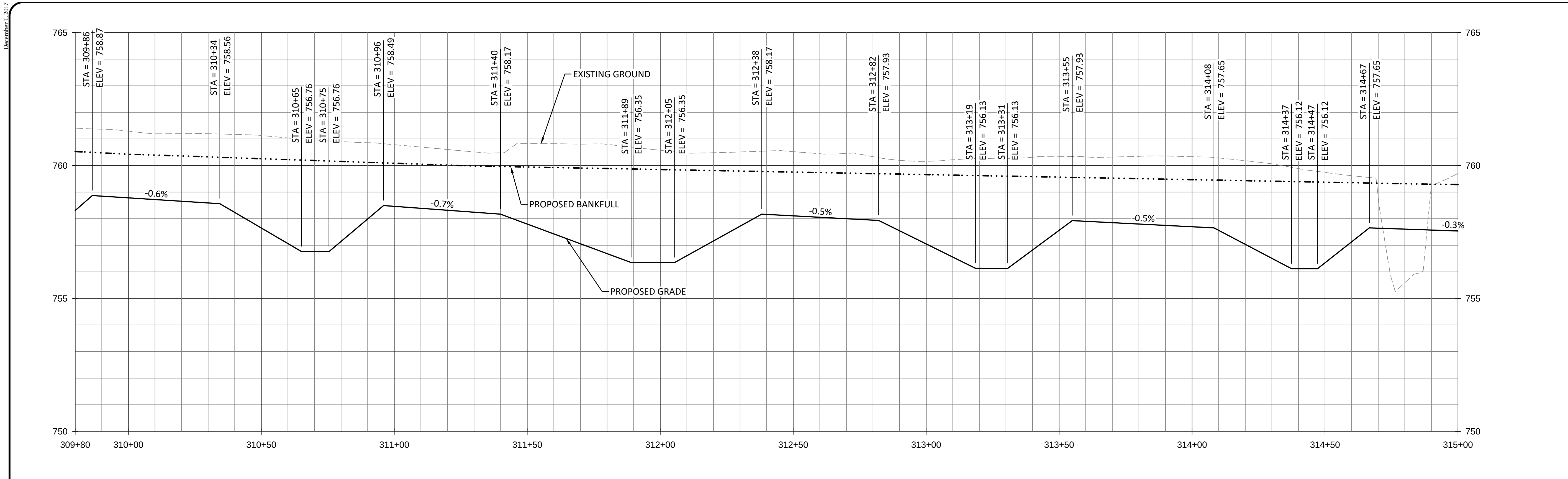

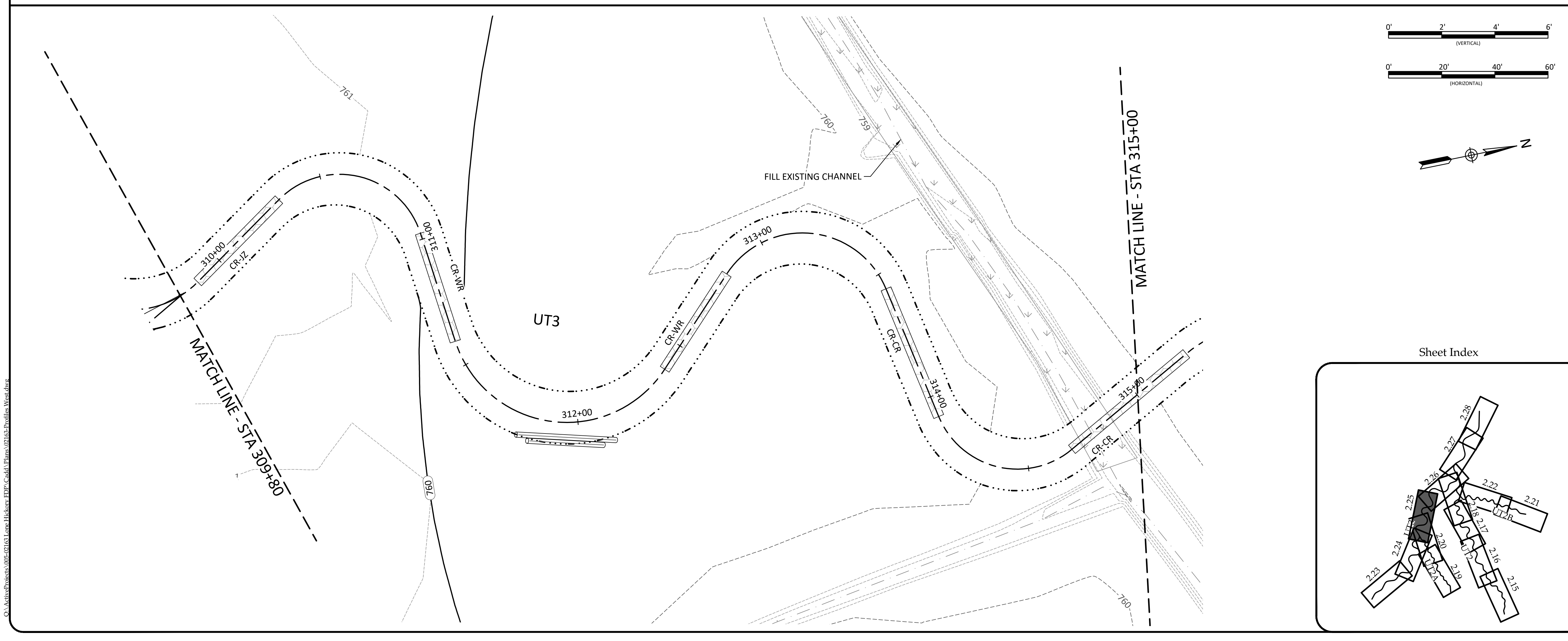

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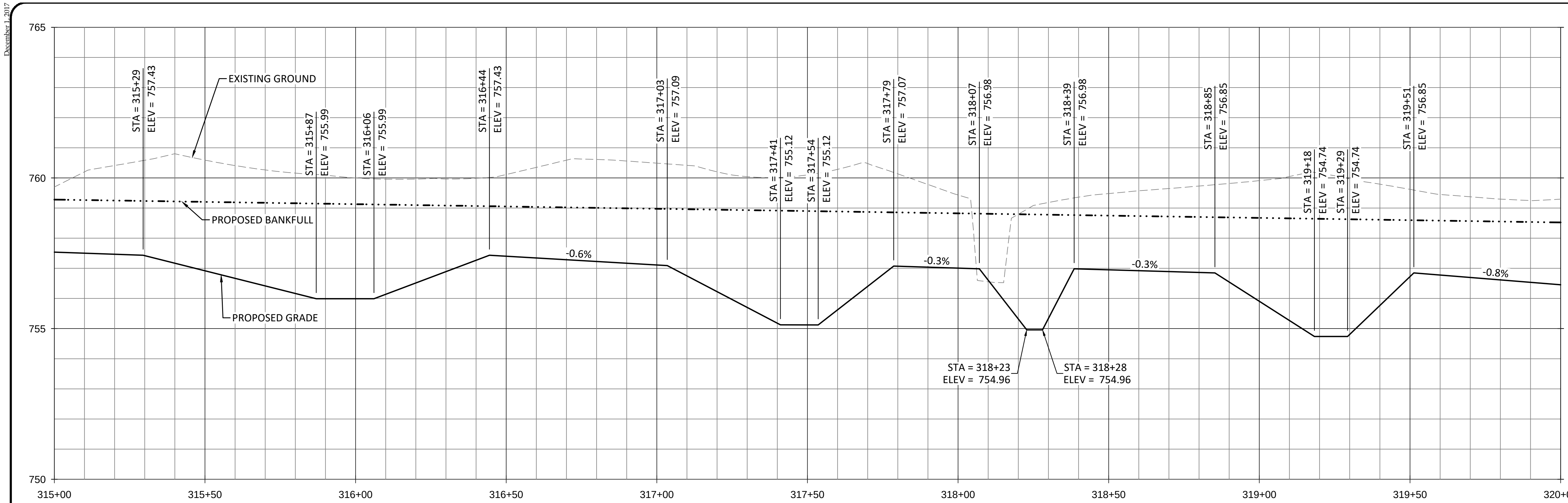

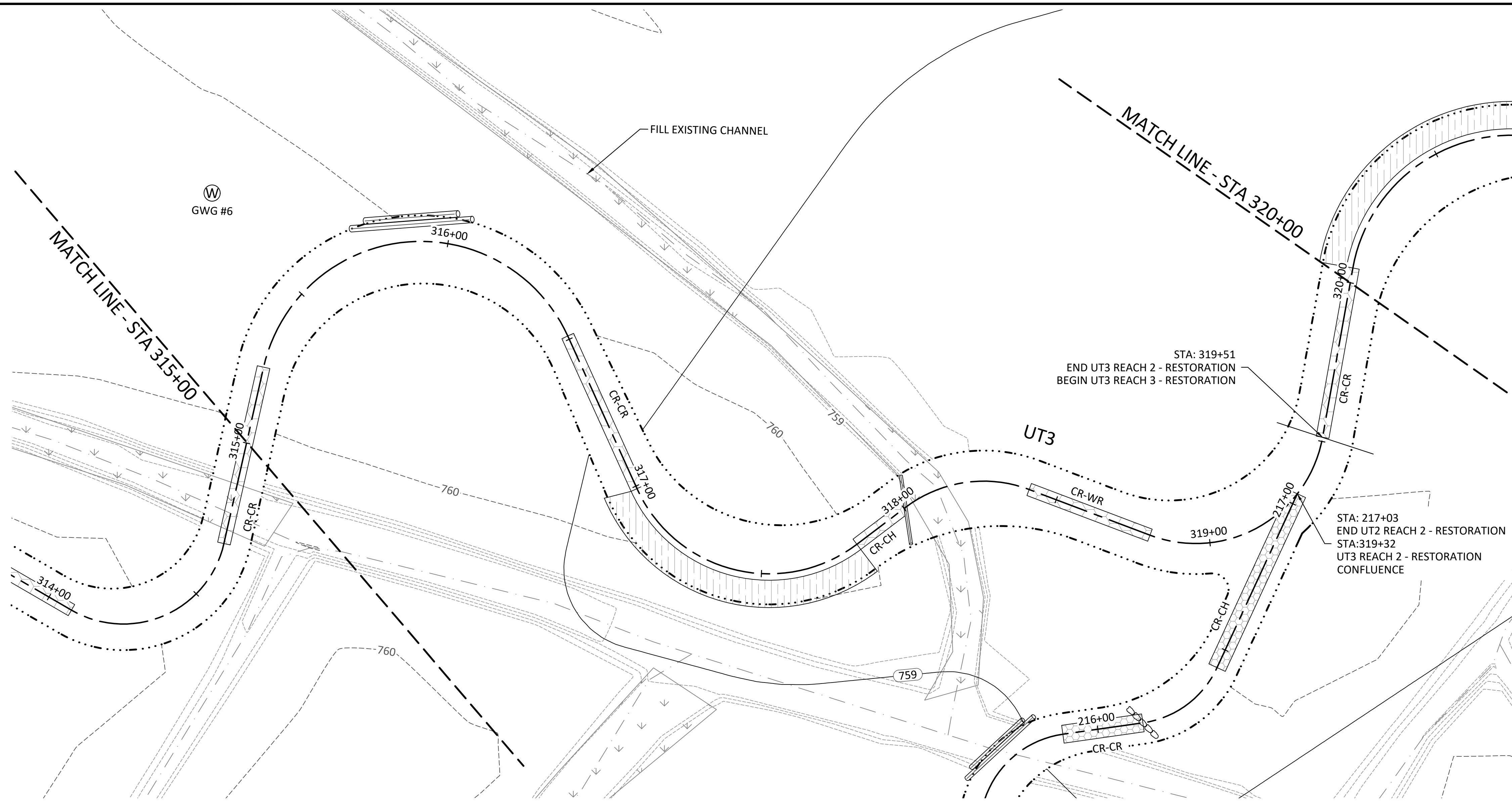

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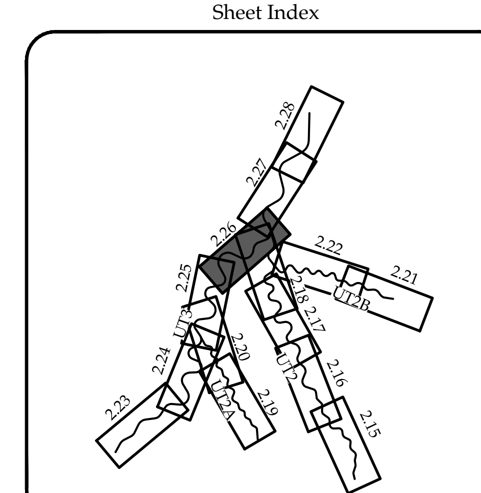

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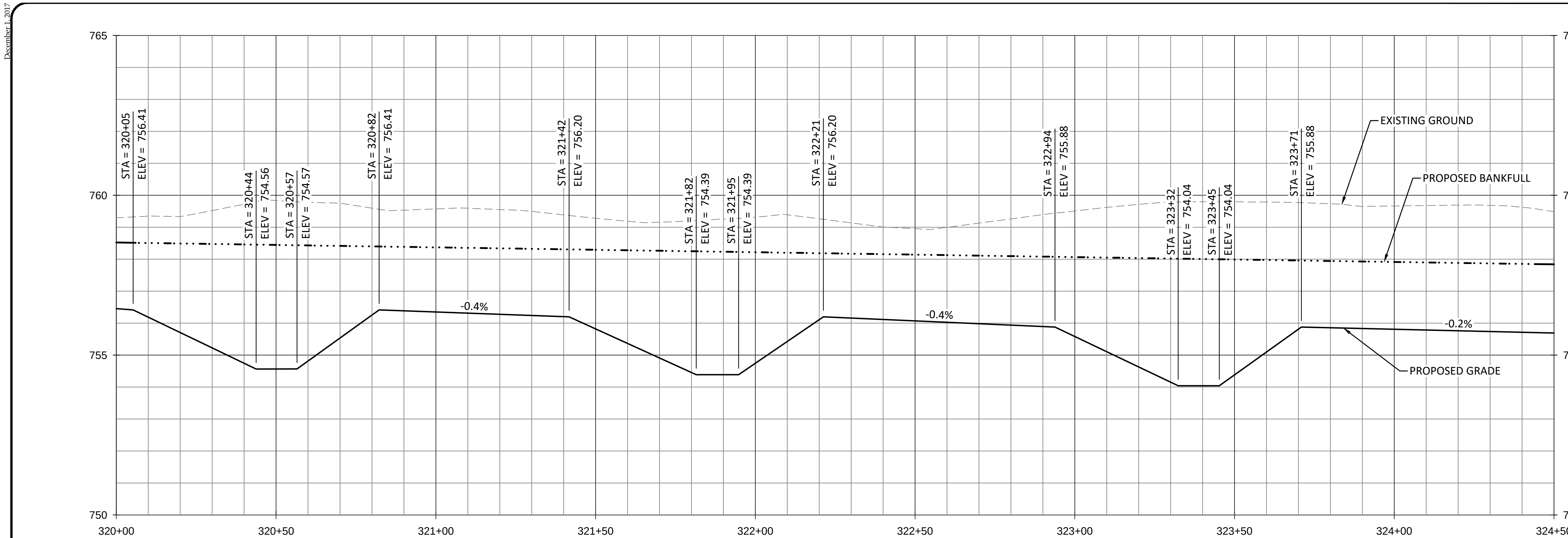

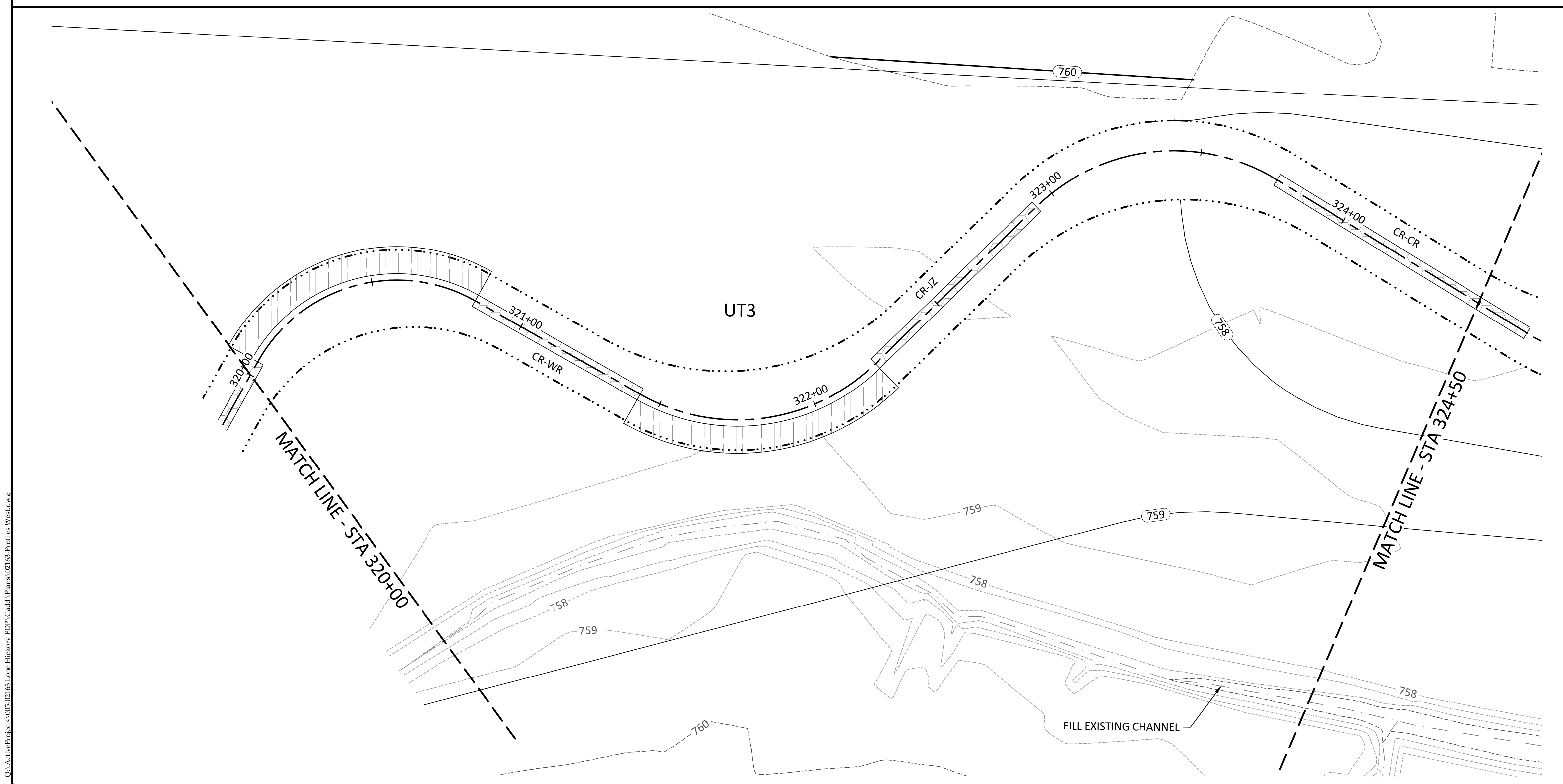

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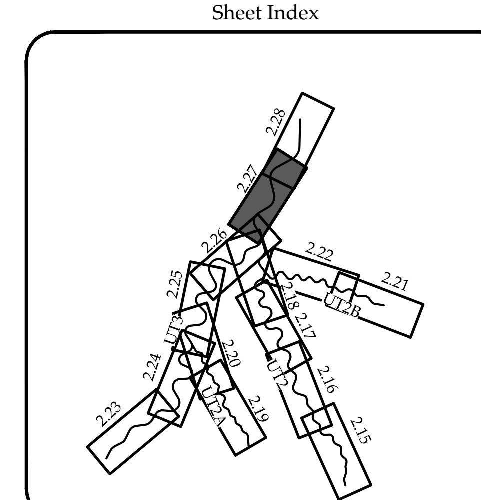

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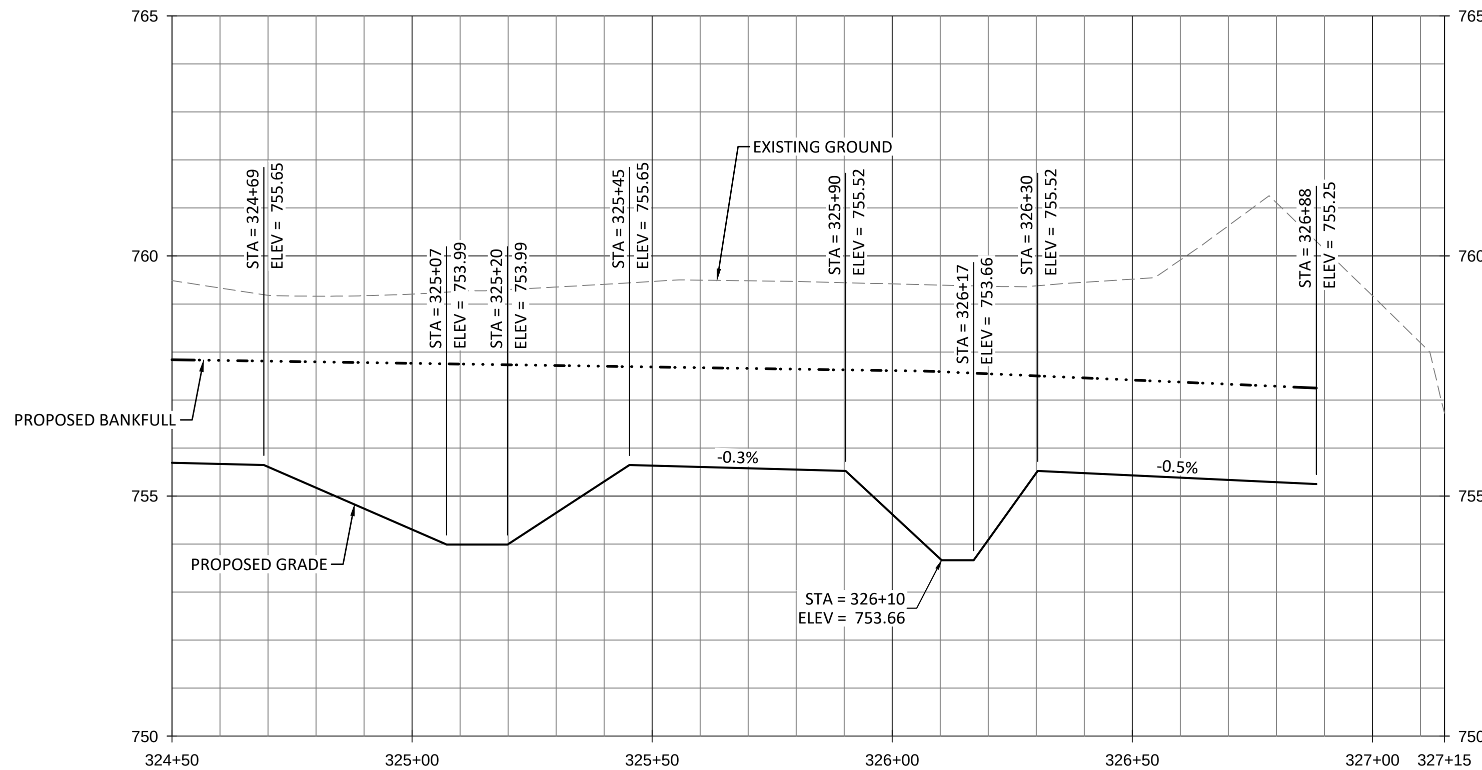

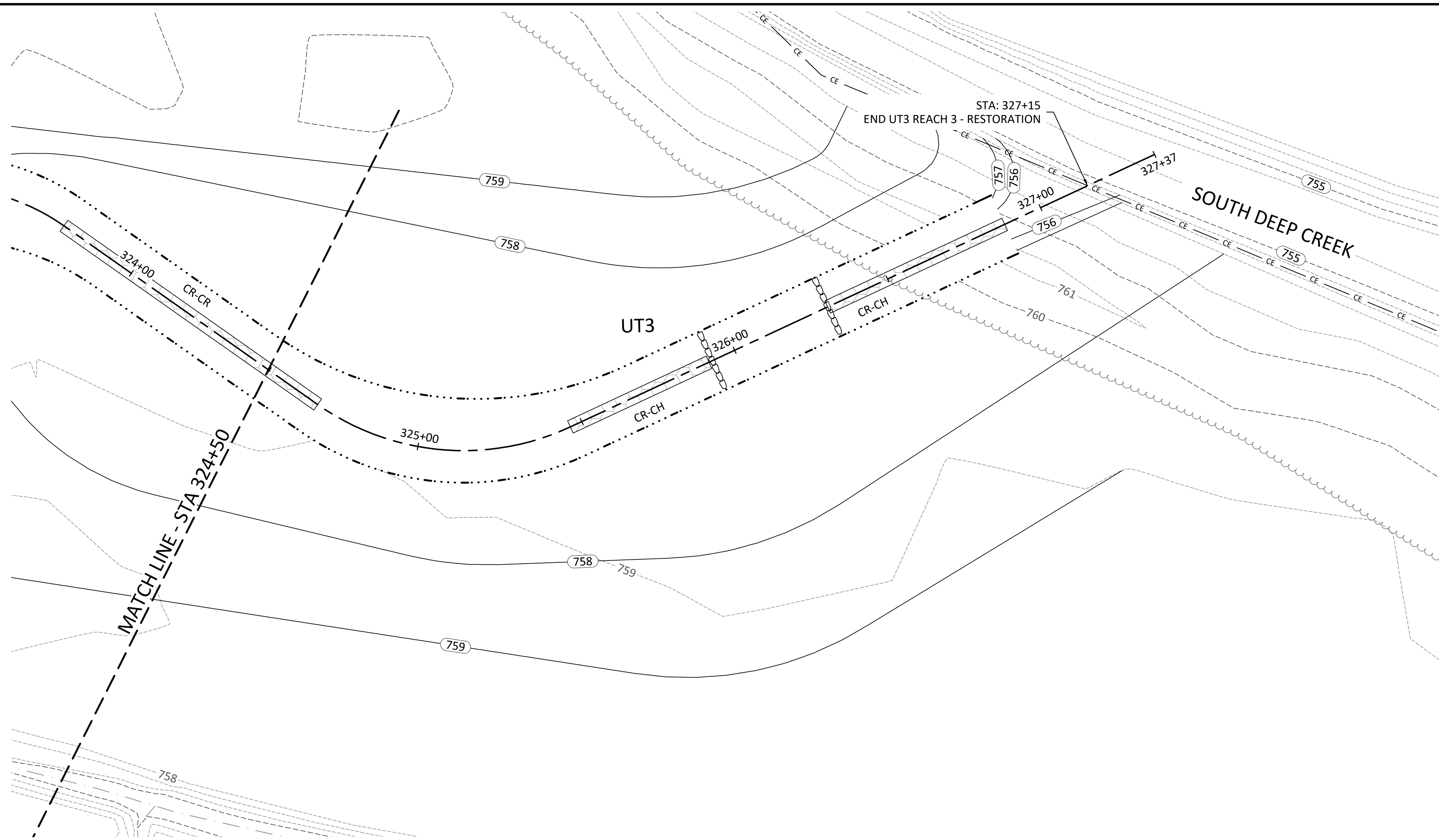

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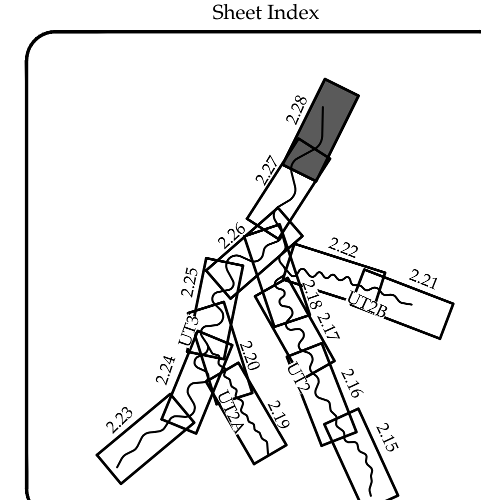

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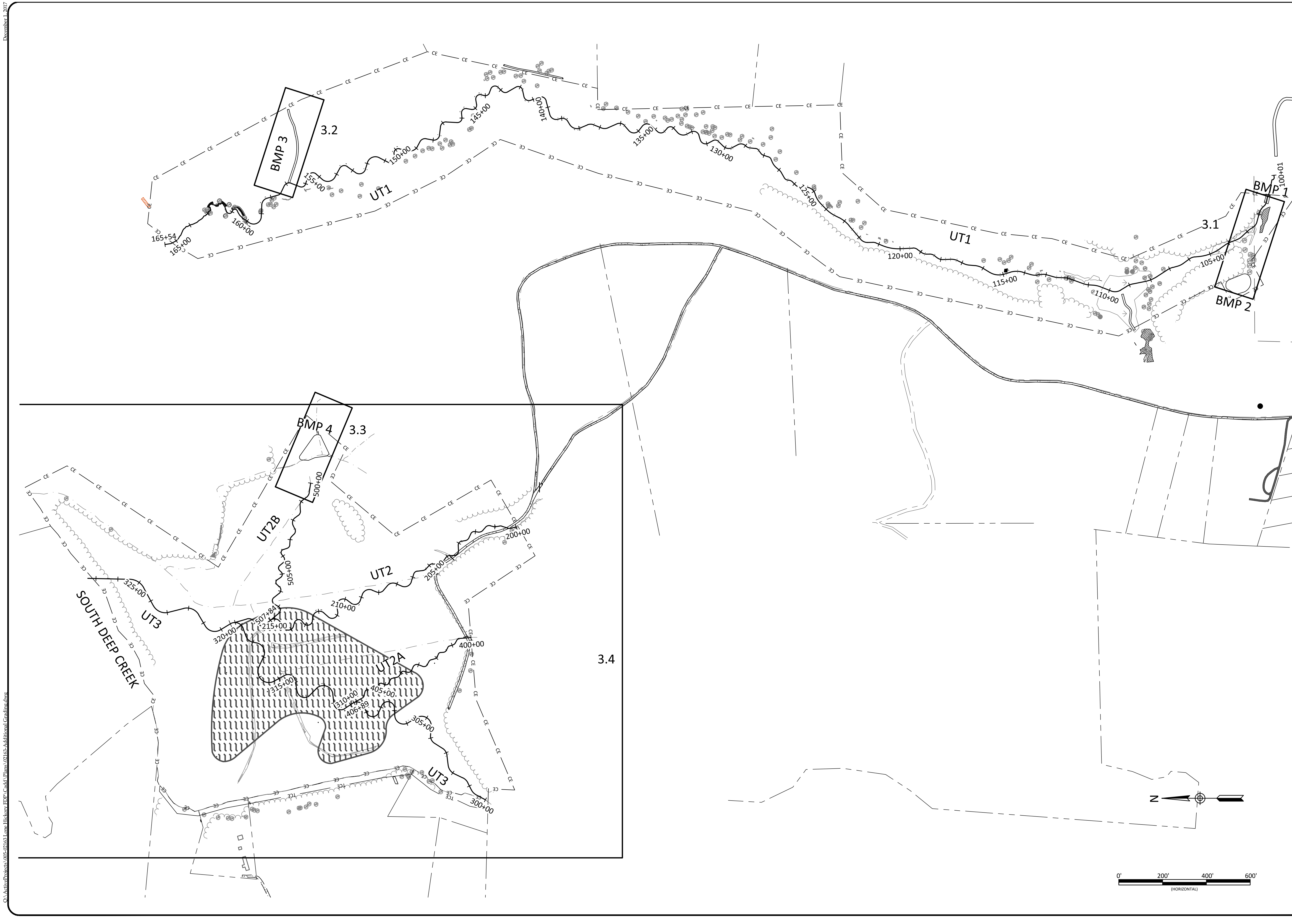

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Additional Grading Overview

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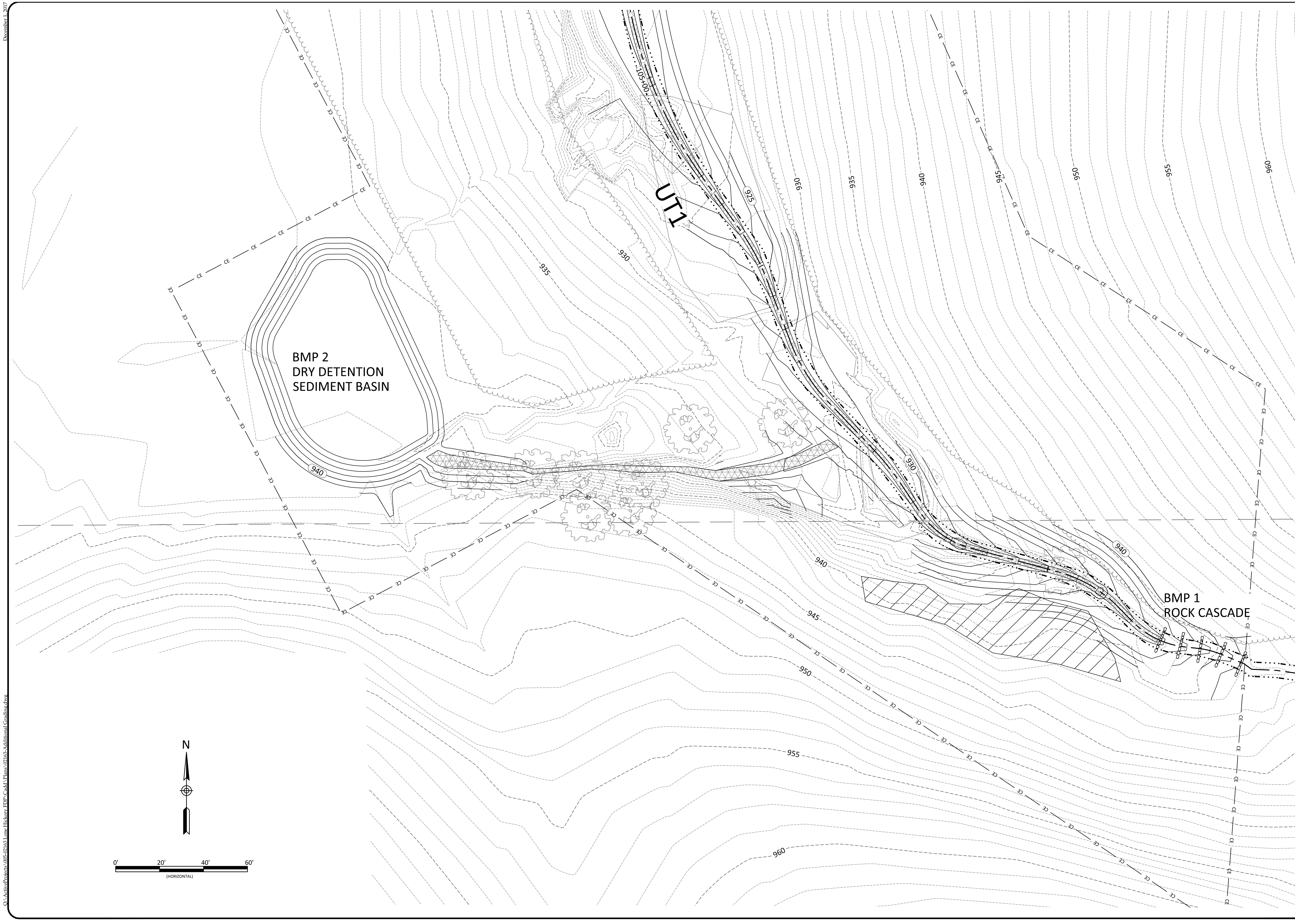

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BMP #1 & BMP #2
BMPs

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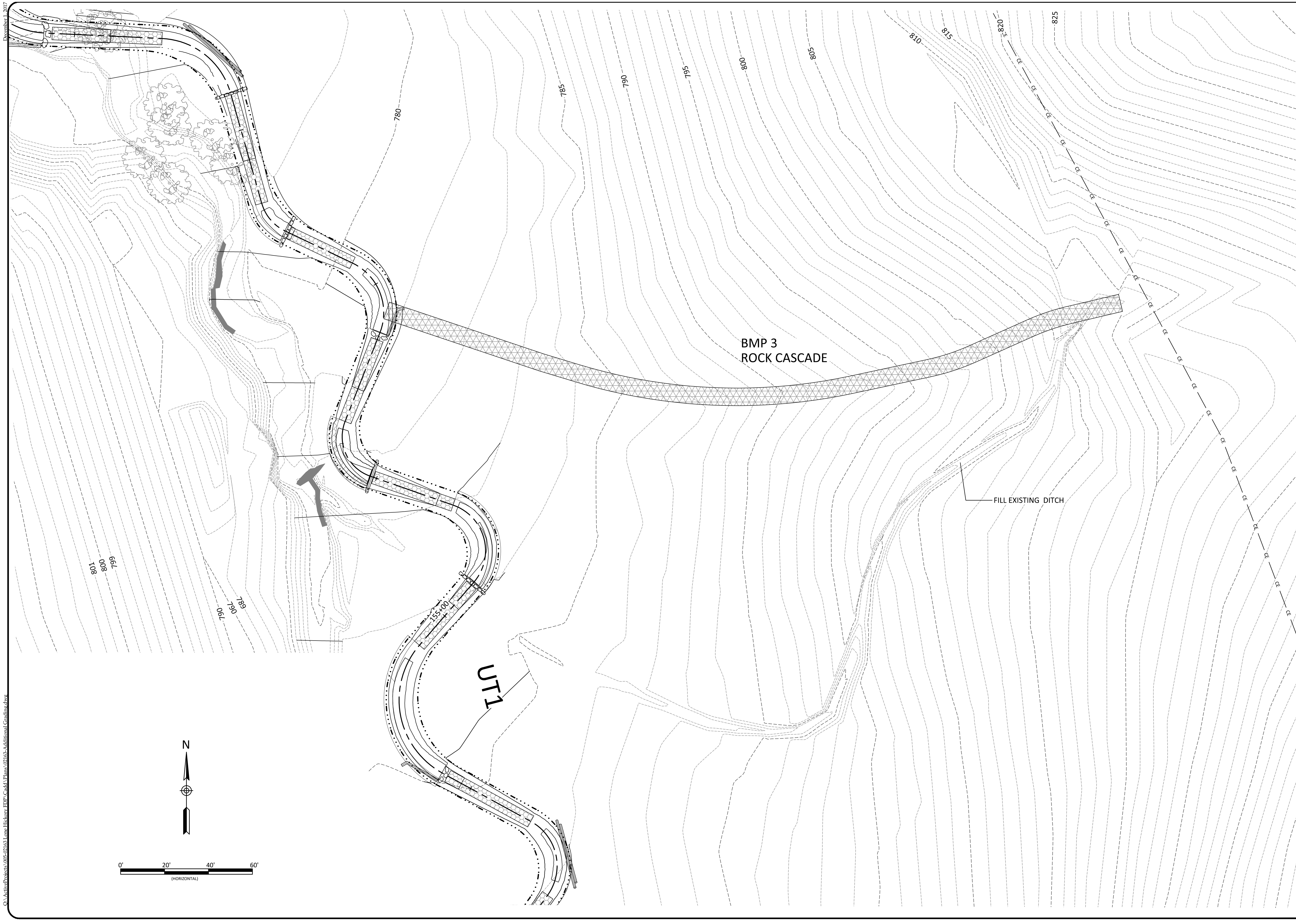

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BMP #3
BMPs

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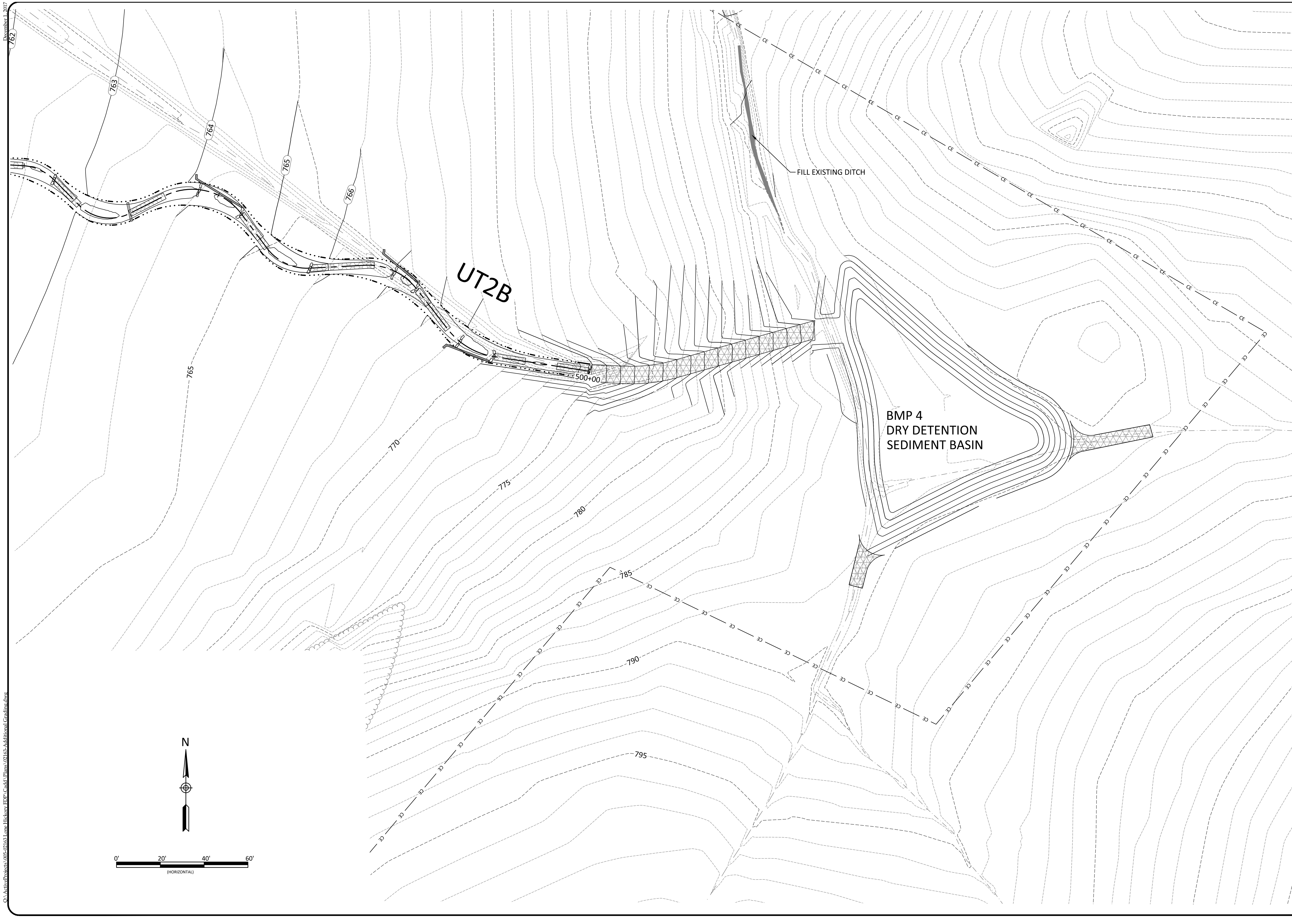

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BMP #4
BMPs

Revisions:

Date: December 8, 2017
Job Number: 005-02163
Project Engineer: EPN, ASE
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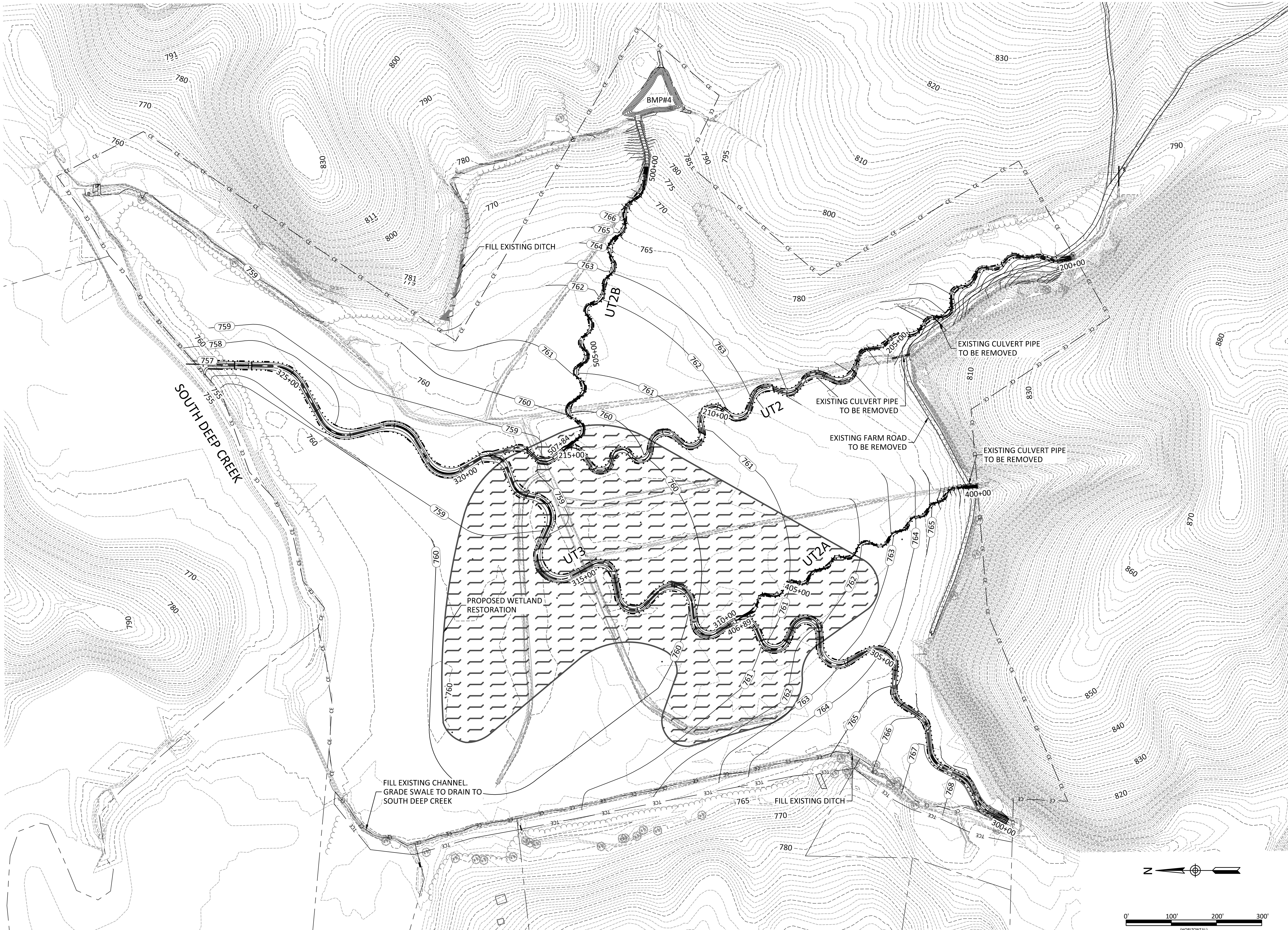

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Lone Hickory Mitigation Site
Yadkin County, North Carolina

Wetland Grading

Revisions:

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December 1, 2017

Buffer Planting Zone						
Open/Graded Bare Roots						
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	# of Stems
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Liriodendron tulipifera	Tulip Poplar	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Fraxinus pennsylvanica	Green Ash	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
						70%
Alternatives						
Alnus serrulata	Tag Alder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Quercus pagoda	Cherrybark Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Quercus michauxii	Swamp Chestnut Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%

Permanent Riparian Seeding - Open Canopy				
Pure Live Seed (20 lbs/ acre)				
Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	1.5
All Year	*Agrostis hyemalis*	Winter Bentgrass	Herb	4.0
All Year	*Chasmanthium latifolium*	River Oats	Herb	2.0
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	1.0
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	1.0
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	3.0
All Year	*Panicum clandestinum*	Deertongue	Herb	3.5
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	2.0
All Year	*Asclepias syrica*	Common Milkweed	Herb	0.2
All Year	*Baptisia australis*	Blue False Indigo	Herb	0.2
All Year	*Gaillardia pulchella*	Annual Gaillardia	Herb	1.0
All Year	*Echinacea purpurea*	Pale Purple Coneflower	Herb	0.6

Note:
Permanent Riparian seeding in all disturbed areas within Conservation Easement

Shaded Areas Bare Roots - Buffer Planting As Needed to Increase Density		
Species	Common name	# of stems
Platanus occidentalis	Sycamore	15%
Fraxinus pennsylvanicum	Green Ash	15%
Betula nigra	River Birch	10%
Liriodendron tulipifera	Tulip Poplar	10%
Quercus michauxii	Swamp Chestnut Oak	10%
Carpinus caroliniana	Ironwood	5%
Diospyros virginiana	Persimmon	5%
Quercus pagoda	Cherrybark Oak	5%
Acer saccharinum	Silver Maple	5%
Nyssa sylvatica	Black Gum	5%
Callicarpa americana	Beautyberry	5%
Cornus alternifolia	Pagoda Dogwood	5%
Euonymus americanus	American Strawberry Bush	1%
Calycanthus floridus	Sweetshrub	1%
Magnolia virginiana	Sweetbay Magnolia	1%
Hamamelis virginiana	Witch-Hazel	1%
Clethra alnifolia	Sweet Pepperbush	1%
		100%

Streambank Planting Zone						
Live Stakes						
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	% of Stems
Salix nigra	Black Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	10%
Cornus ammomum	Silky Dogwood	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	35%
Salix sericea	Silky Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	40%
Physocarpos opulifolius	Ninebark	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	15%
						100%
Herbaceous Plugs						
Juncus effusus	Common Rush	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	40%
Carex alata	Broadwing Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	40%
Panicum virgatum	Switchgrass	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	20%
						100%

Wetland Bare Root Planting		
Scientific Name	Common Name	%
Platanus occidentalis	Sycamore	15
Quercus phellos	Willow Oak	15
Betula nigra	River Birch	15
Fraxinus pennsylvanica	Green Ash	15
Quercus michauxii	Swamp Chestnut Oak	15
Acer rubrum	Red Maple	5
Diospyros virginiana	Persimmon	10
Populus deltoides	Eastern Cottonwood	10

Pasture areas outside easement.

Pasture Seeding				
Approved Date	Species Name	Stratum	Common Name	Density (lbs/acre)
All Year	*Festuca arundinacea*	Herb	Tall Fescue	80
All Year	*Trifolium repens*	Herb	White Clover	8

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Planting List
Planting

Revisions:

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Job Number: 005-02163
Project Engineer: EPN, ASE
Drawn By: SJD, JCK
Checked By: EGR

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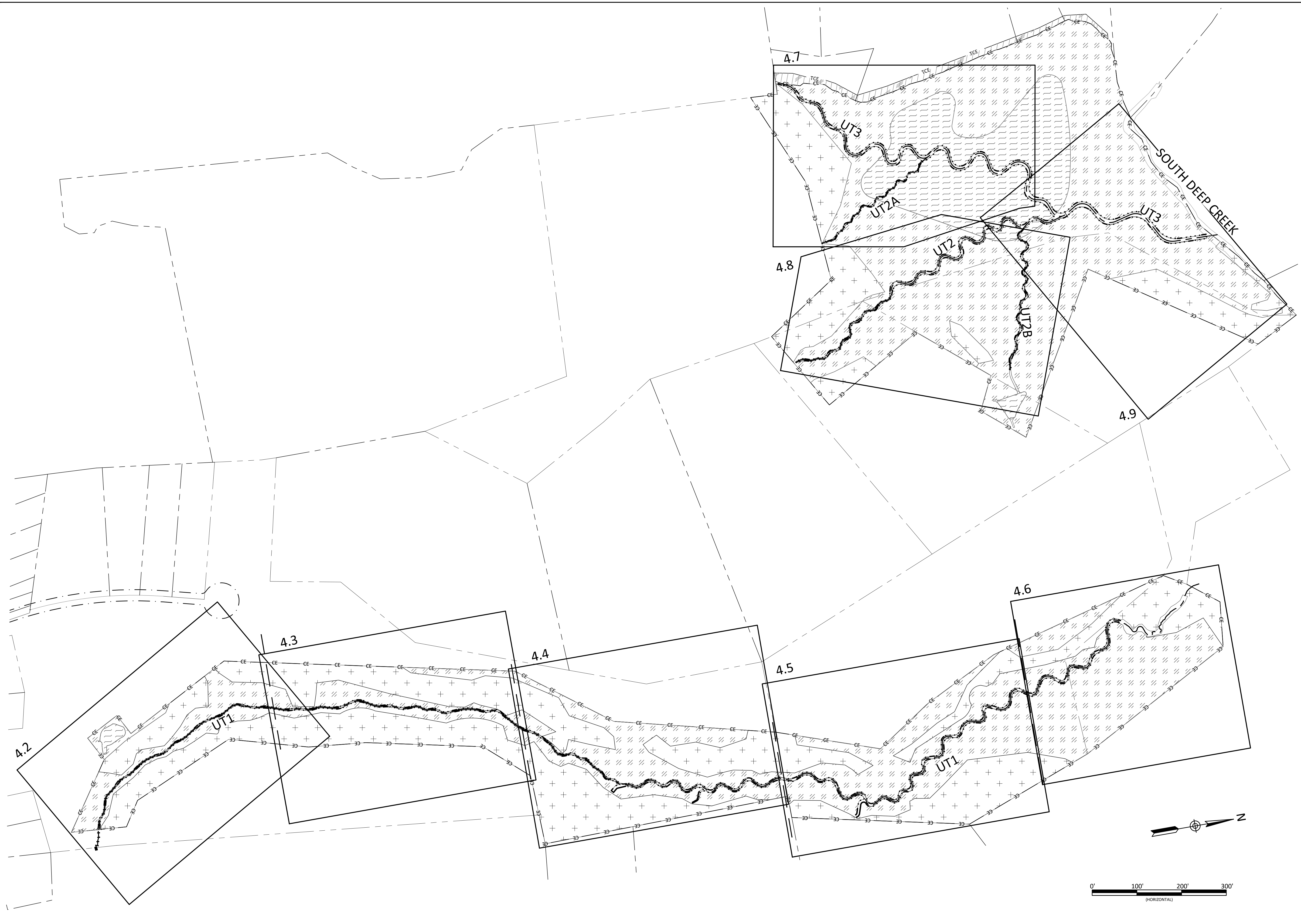

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Overall Planting Plan
Planting

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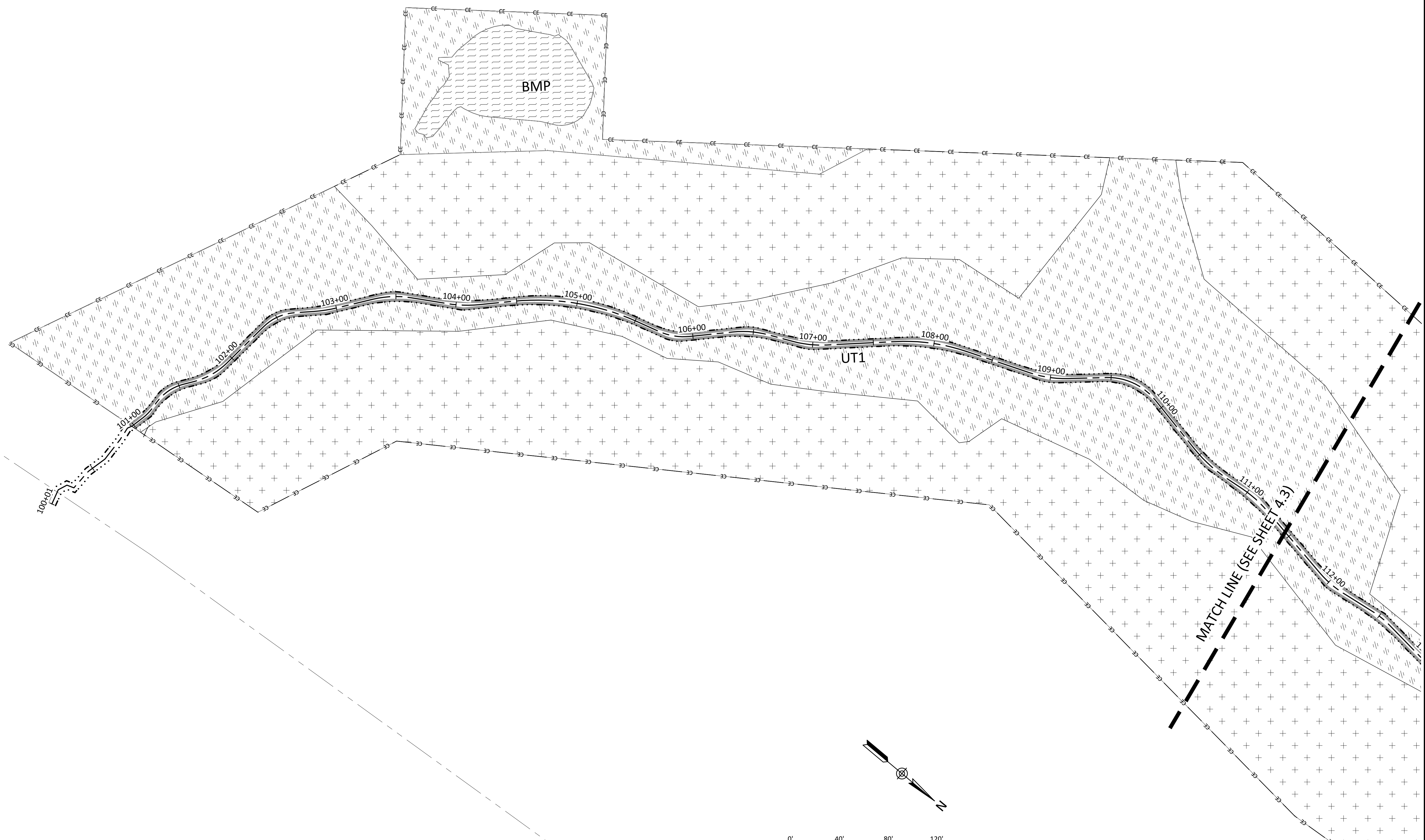

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UT1
Planting

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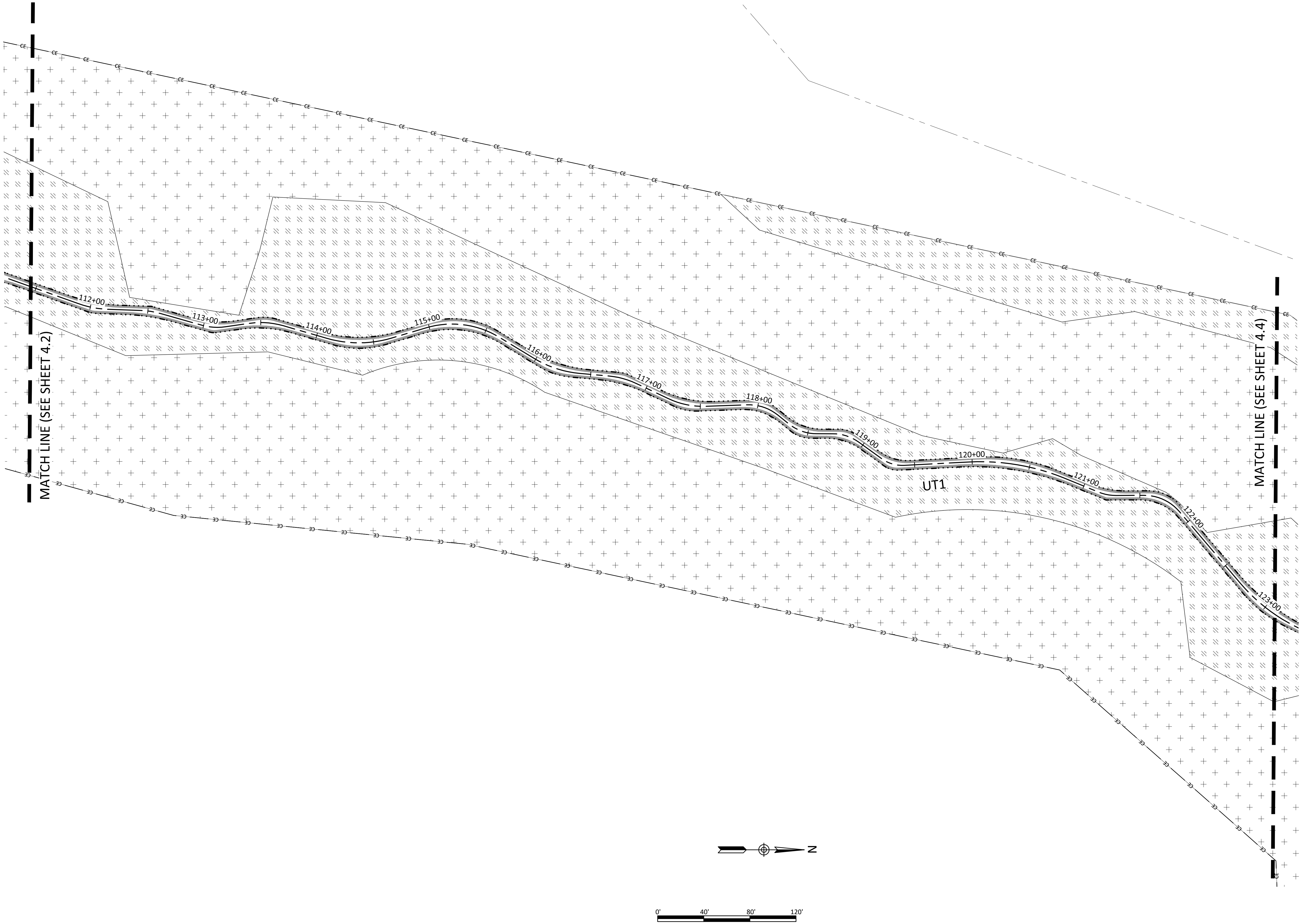

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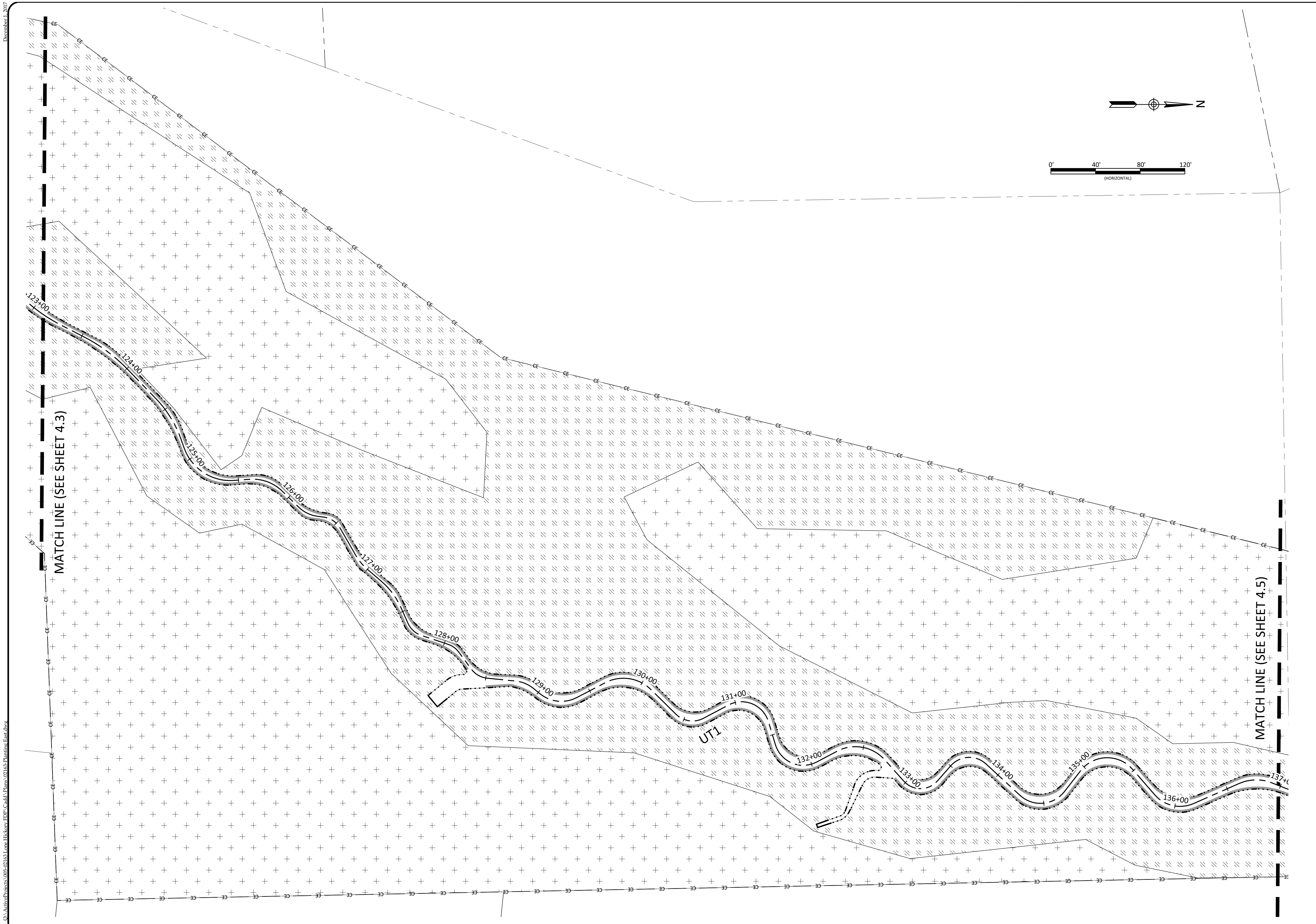

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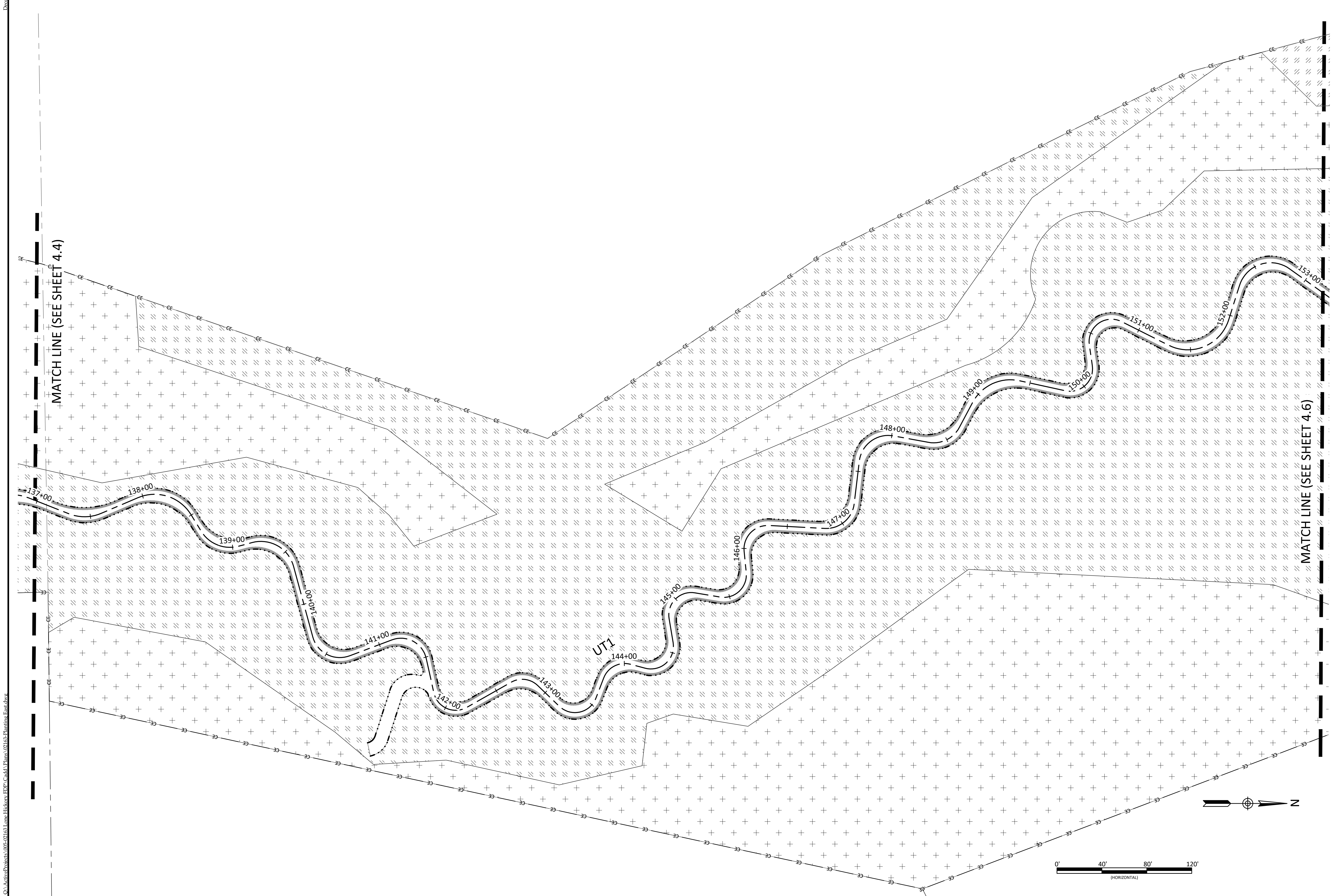

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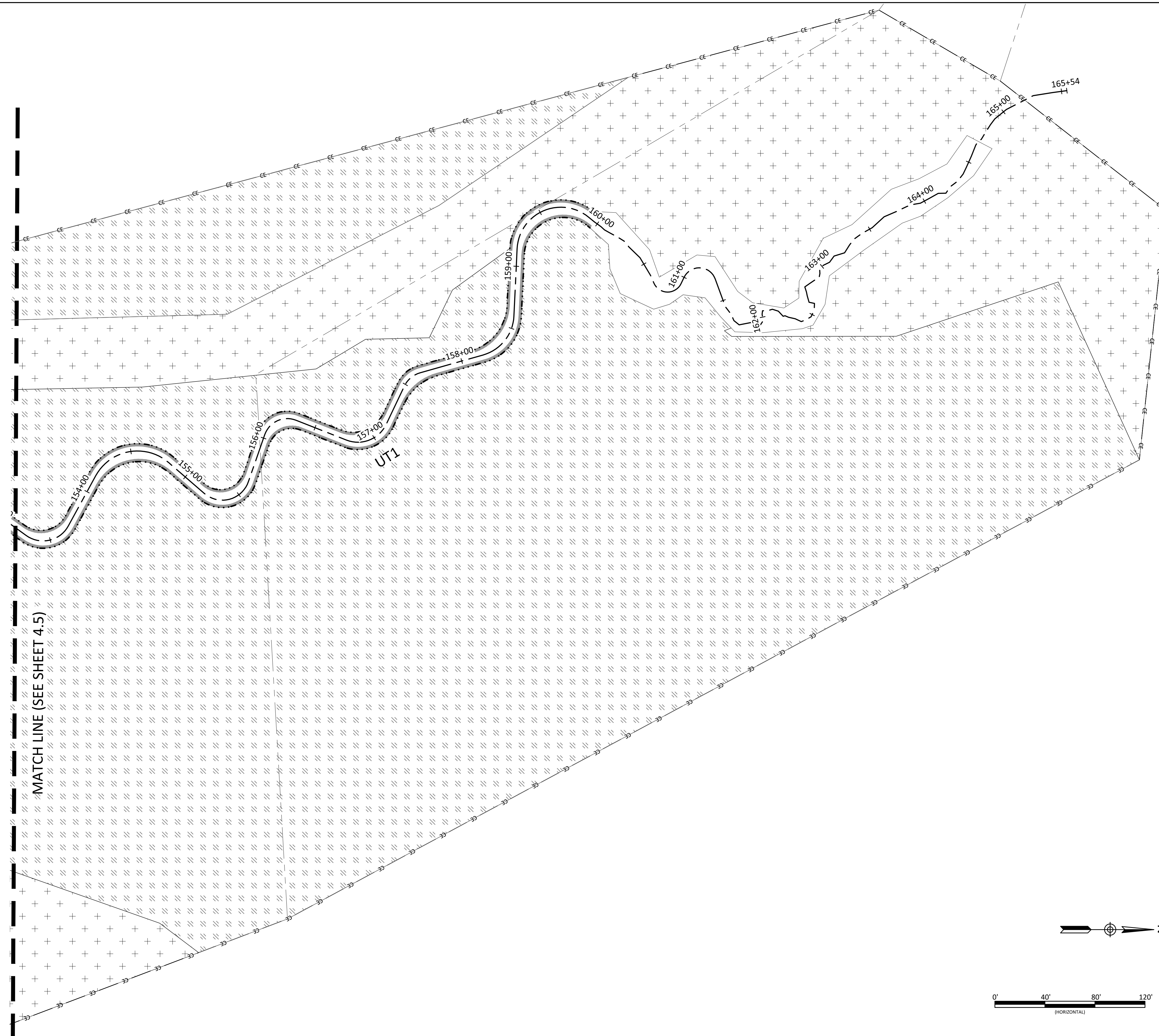

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UT3 and UT2A
Planting

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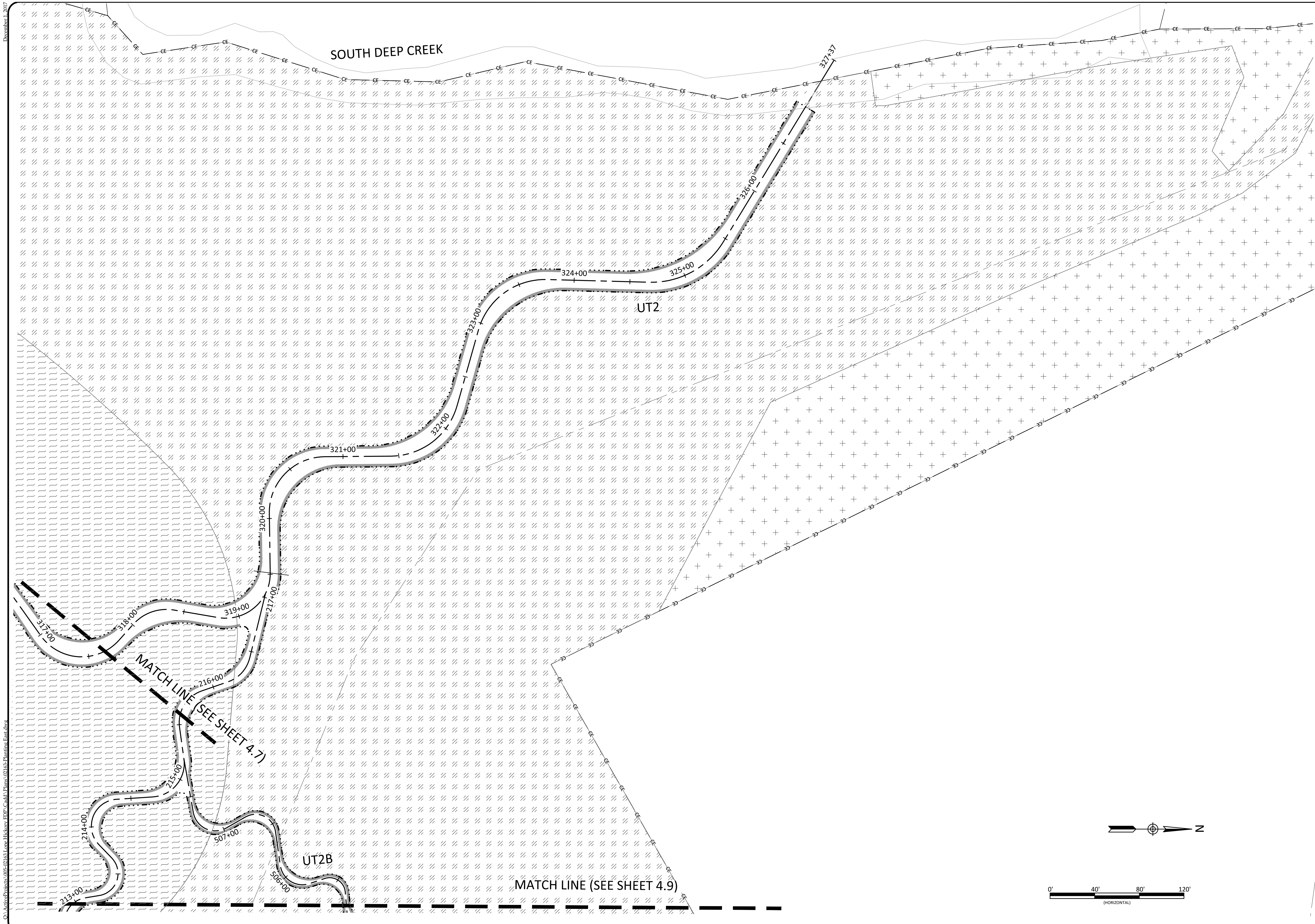

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UT3 and UT2B
Planting

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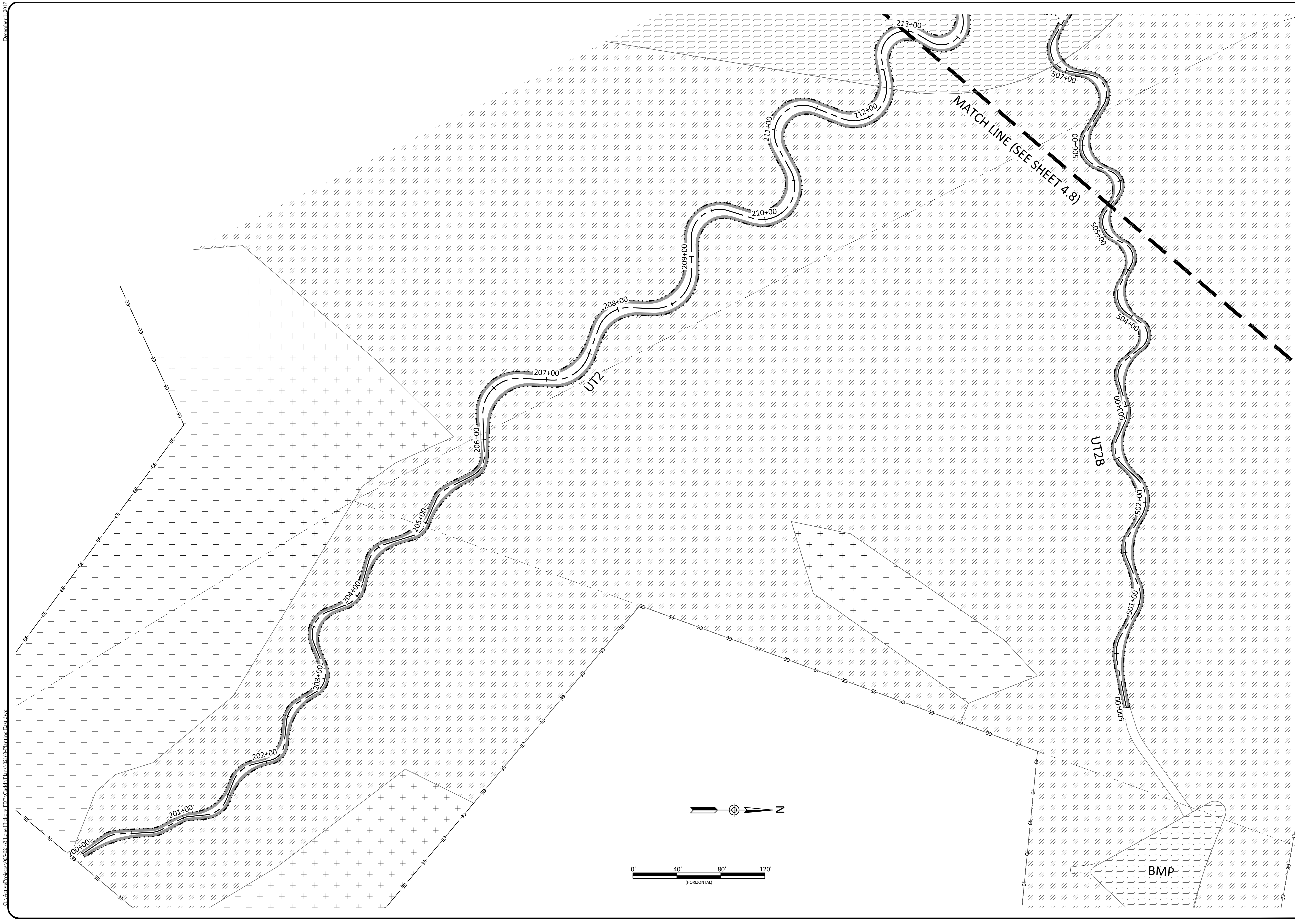

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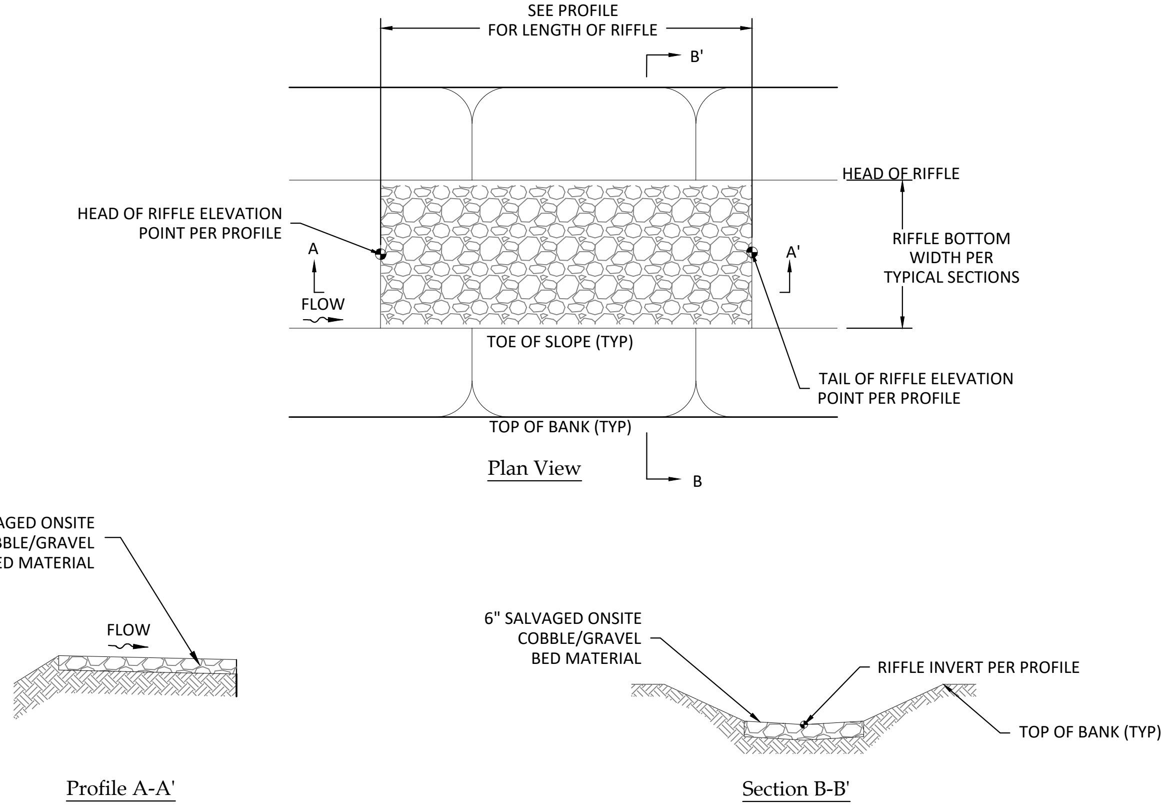
UT2 and UT2B
Planting

Revisions:

Date:	December 8, 2017
Job Number:	005-02163
Project Engineer:	EPN, ASE
Drawn By:	SJD, JCK
Checked By:	EGR

Sheet 4.9

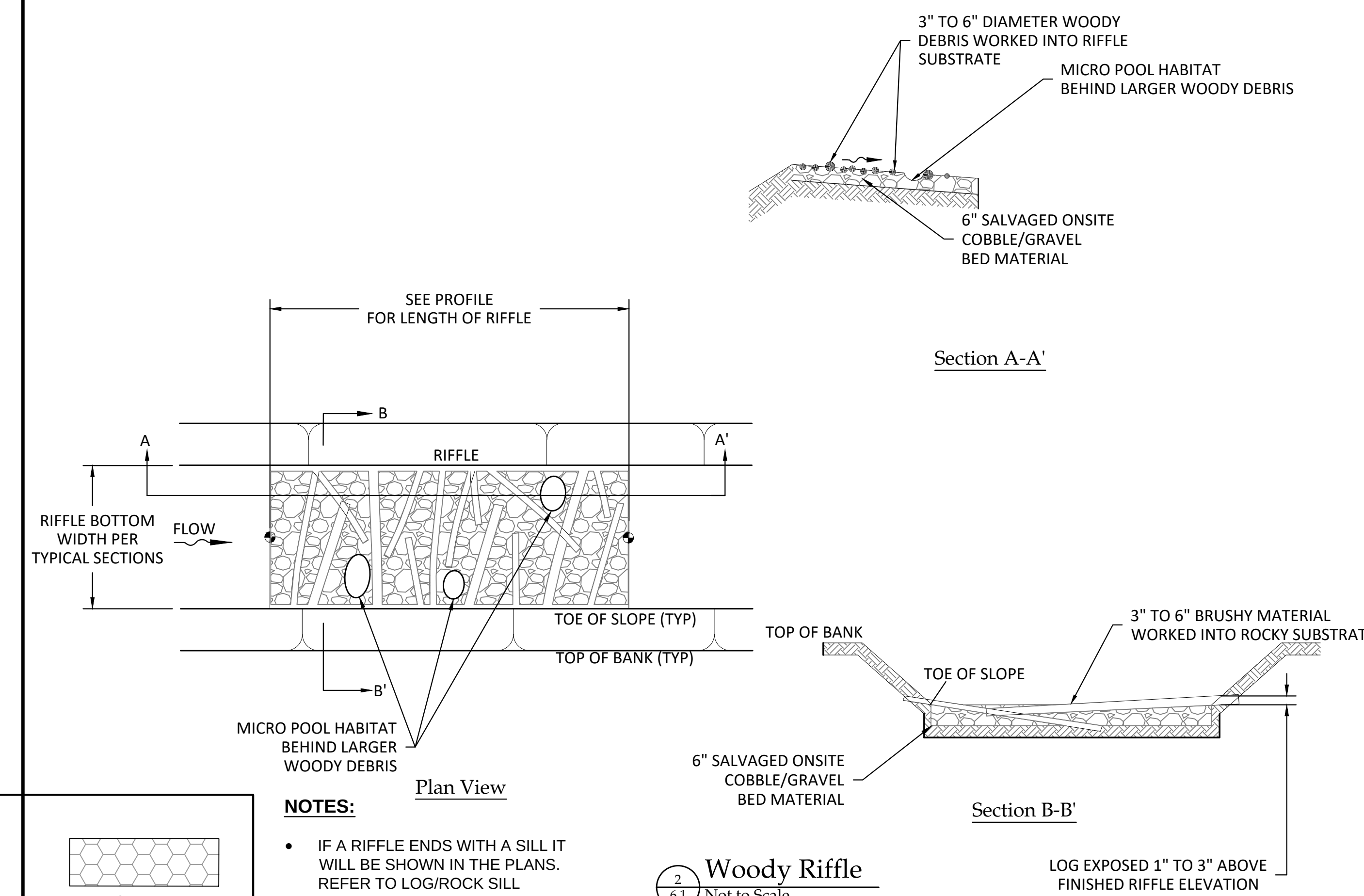
March 7, 2012



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.

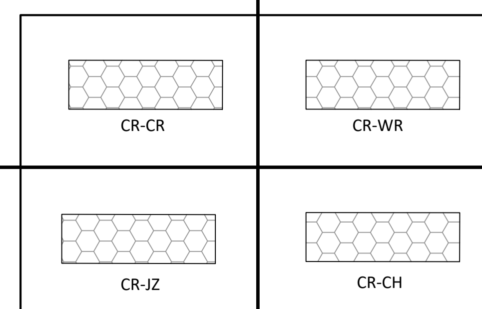
1/6.1 Constructed Riffle
Not to Scale

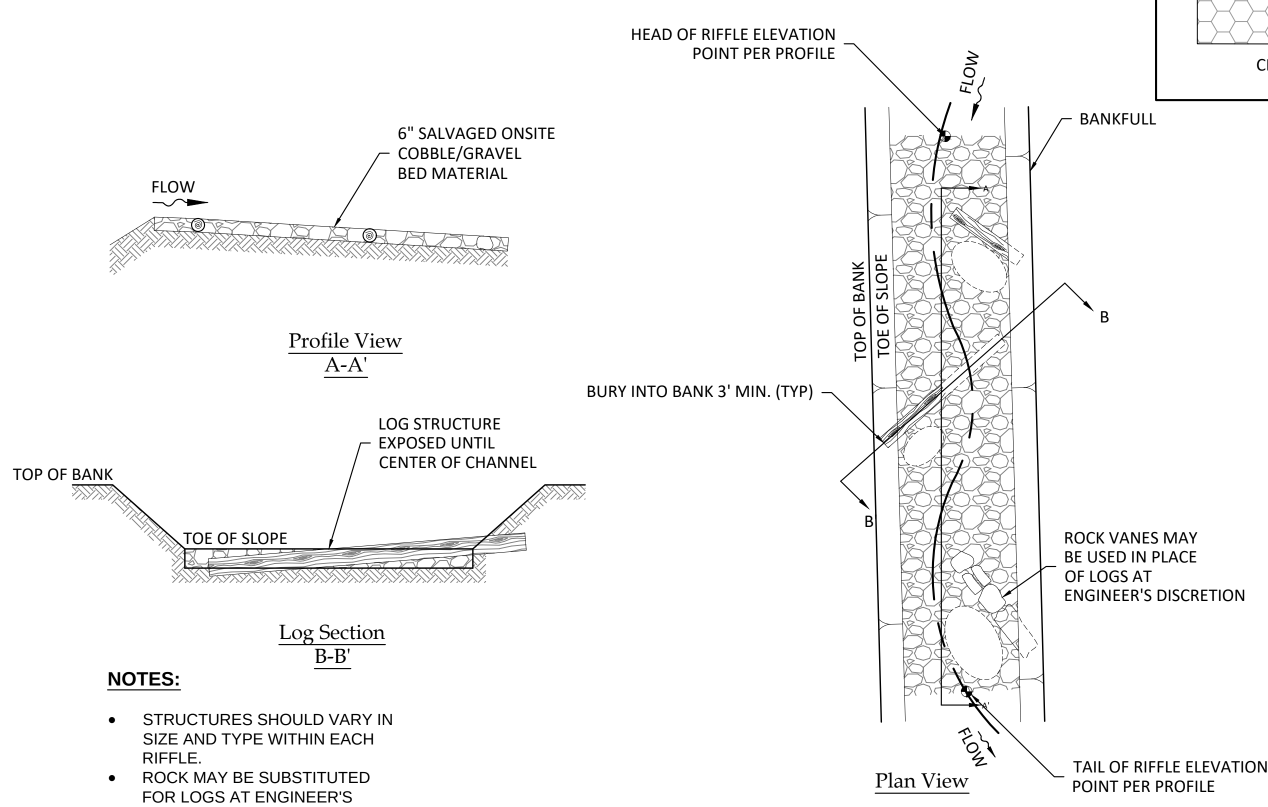


NOTES:

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

2/6.1 Woody Riffle
Not to Scale

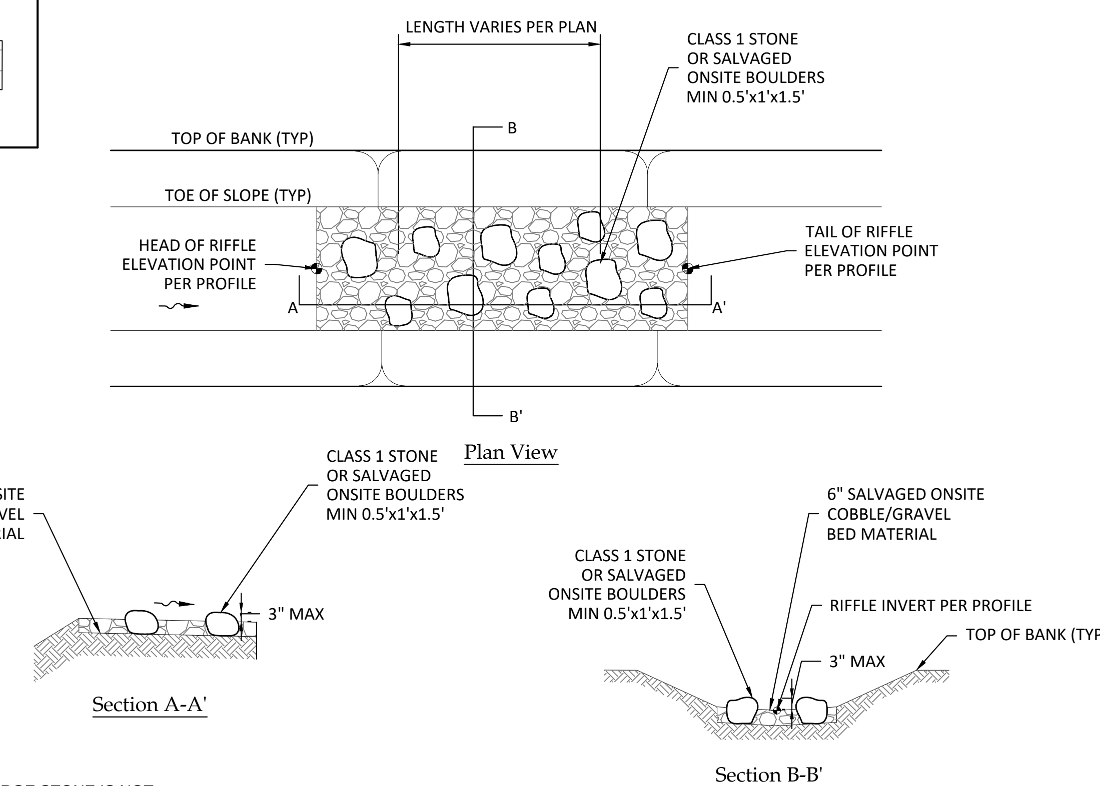




NOTES:

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

3/6.1 Jazz Riffle Structure
Not to Scale



NOTES:

- IF ONSITE LARGE STONE IS NOT AVAILABLE FOR BOULDERS RIFFLE SHOULD BE CHANGED TO JAZZ RIFFLE OR OTHER PER ENGINEER'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.

4/6.1 Chunky Riffle
Not to Scale

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Lone Hickory Mitigation Site
Yadkin County, North Carolina

Details

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Checked By:	EGR

Sheet 6.1

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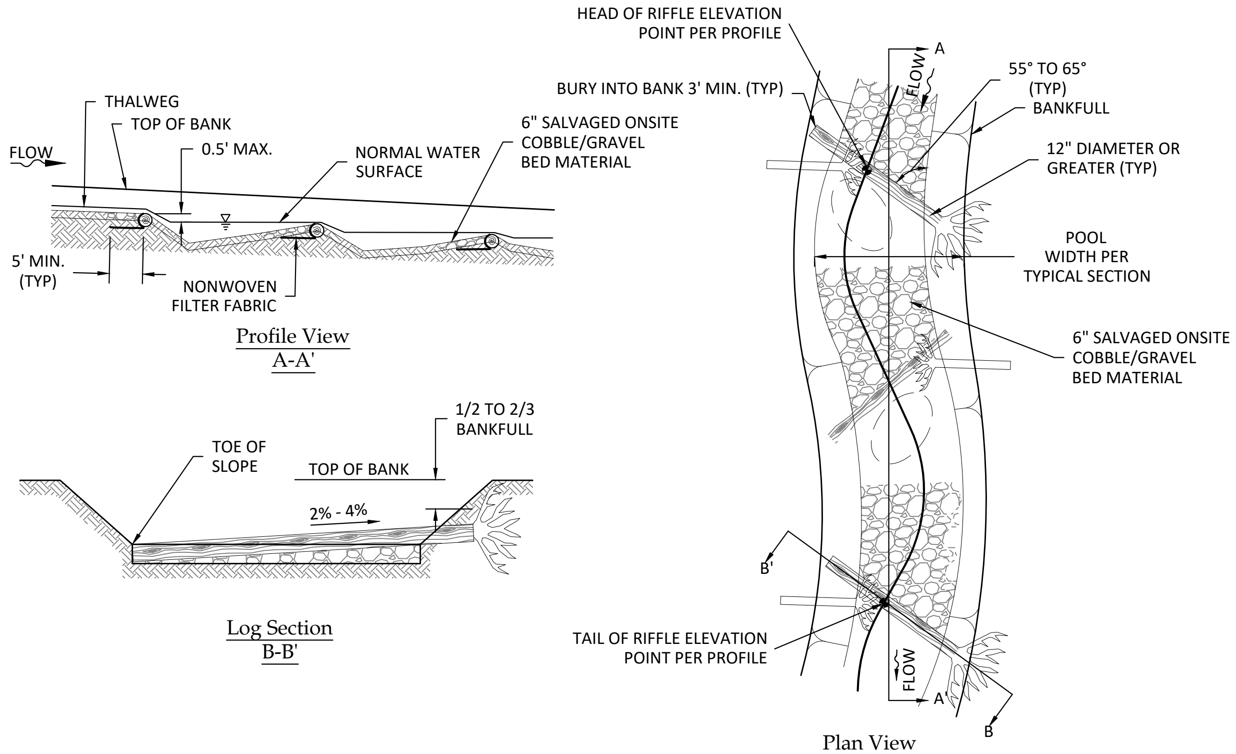
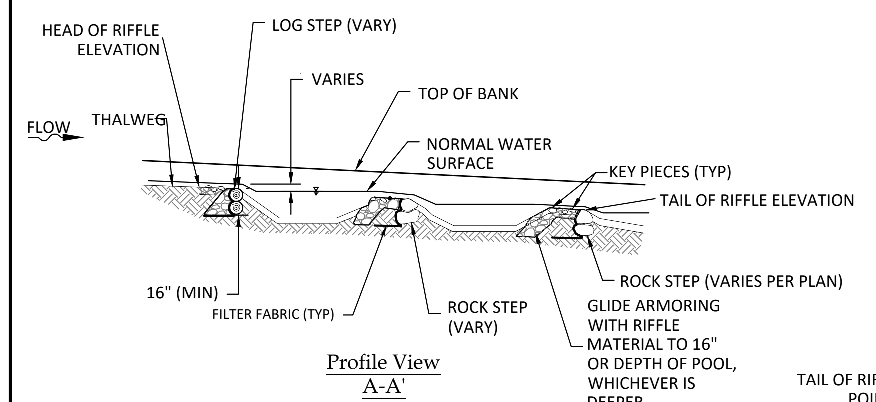
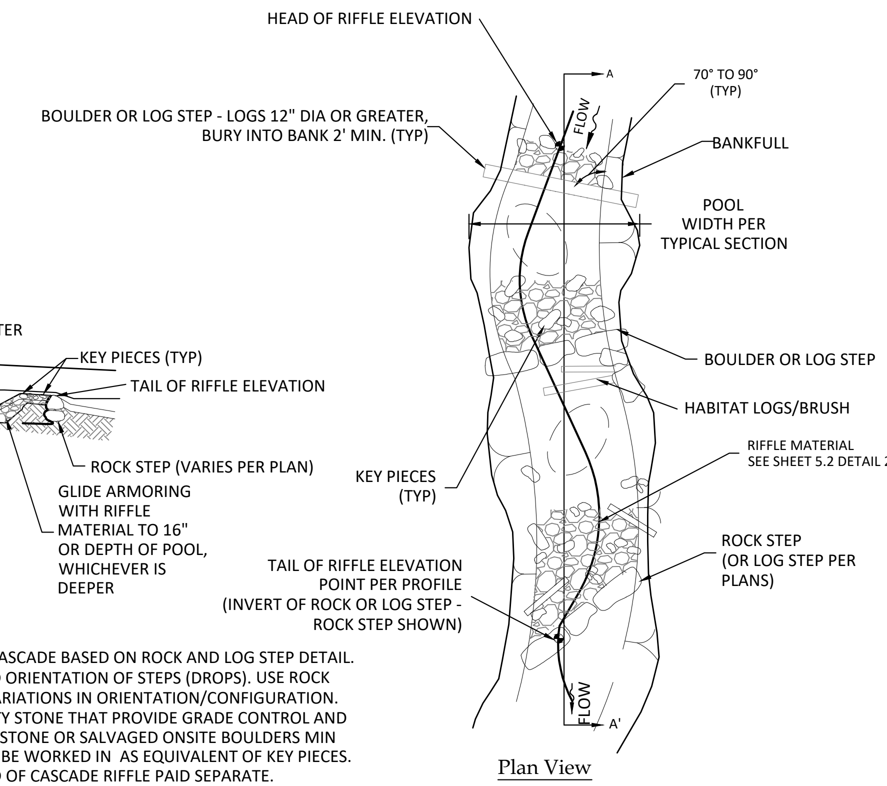


NOTES:
- LOGS WITHOUT ROOT MASS MAY BE USED ONLY IF APPROVED BY THE PROJECT ENGINEER.
- BOULDER MATERIAL CAN BE SUBSTITUTED IN PLACE OF ANGLED LOGS WITH APPROVAL OF ENGINEER.
- IF A RIFFLE ENDS WITH A SILL IT WILL BE SHOWN IN THE PLANS. REFER TO LOG/ROCK SILL DETAIL FOR THIS FINAL STRUCTURE.

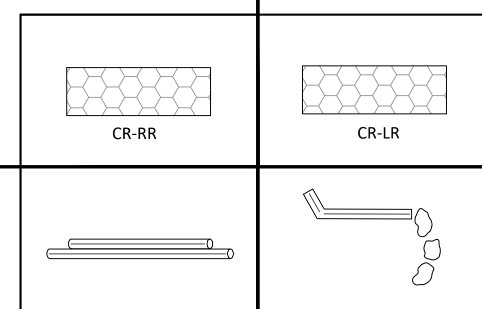
1 / 6.2 Rock and Roll Riffle
Not to Scale

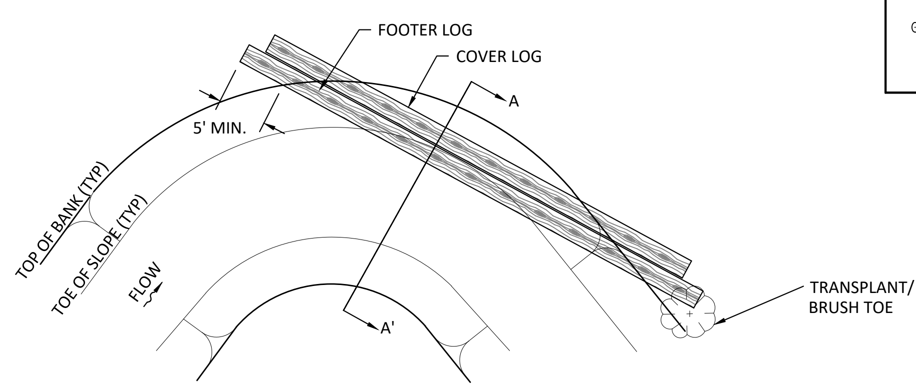


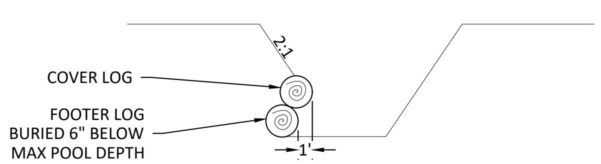


NOTES:
1. CONSTRUCT GRADE DROPS IN CASCADE BASED ON ROCK AND LOG STEP DETAIL.
2. VARY THE SEQUENCE, TYPE AND ORIENTATION OF STEPS (DROPS). USE ROCK STEP DETAIL AS A GUIDE FOR VARIATIONS IN ORIENTATION/CONFIGURATION.
3. KEY PIECES ARE LOWER MOBILITY STONE THAT PROVIDE GRADE CONTROL AND TOE PROTECTION. USE CLASS 1 STONE OR SALVAGED ONSITE BOULDERS MIN 0.5'x1'x1.5'. JAZZ LOGS SHOULD BE WORKED IN AS EQUIVALENT OF KEY PIECES.
4. ROCK STEP OR LOG STEP AT END OF CASCADE RIFFLE PAID SEPARATE.
5. NUMBER OF INTERNAL STEPS (INCLUDING STEPS AT THE BEGINNING OF A CASCADE SEQUENCE) VARIES BASED ON LENGTH AND SLOPE. RIFFLES SHALL BE 1.2 - 1.8 TIMES THE AVERAGE CHANNEL SLOPE. STEP DROPS SHALL BE BETWEEN 0.2-0.5' MEASURED AT THE WATER SURFACE.
6. FOOTER ROCK OR LOG SHOWN. FOOTER ONLY REQUIRED WHEN MINIMUM UNFOOTERED DIMENSION OF ROCK OR LOG IS NOT MET. A MINIMUM OF 16" OF RIFFLE MATERIAL SHALL BE PLACED OVER FILTER FABRIC TO PROTECT.
7. IF A RIFFLE ENDS WITH A SILL IT WILL BE SHOWN IN THE PLANS. REFER TO LOG/ROCK SILL DETAIL FOR THIS FINAL STRUCTURE.

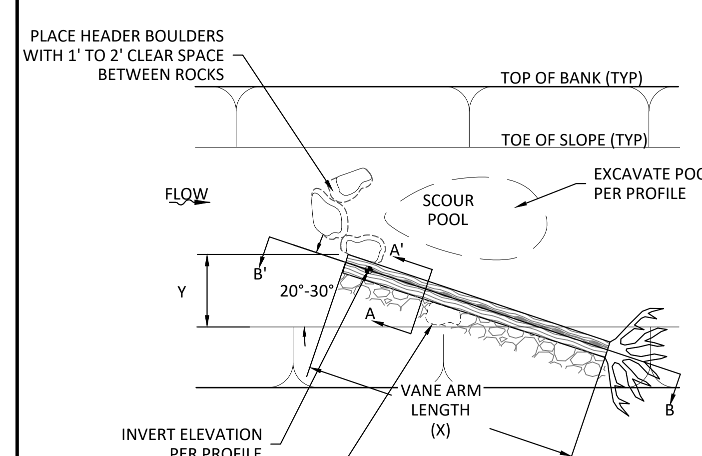
2 / 6.2 Log-Rock Cascade Riffle
Not to Scale

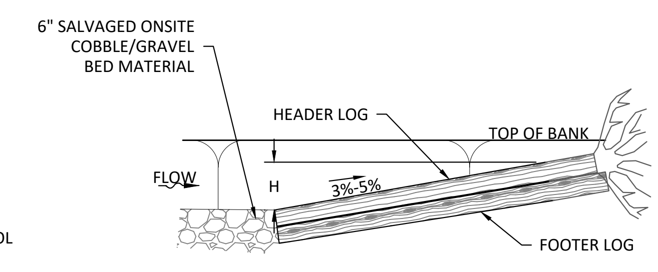


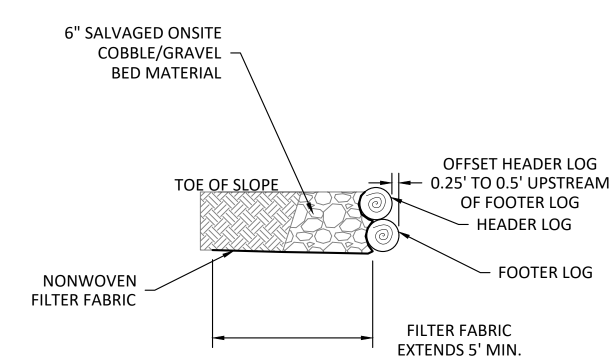




3 / 6.2 Lunker Log
Not to Scale







4 / 6.2 Log J-Hook
Not to Scale

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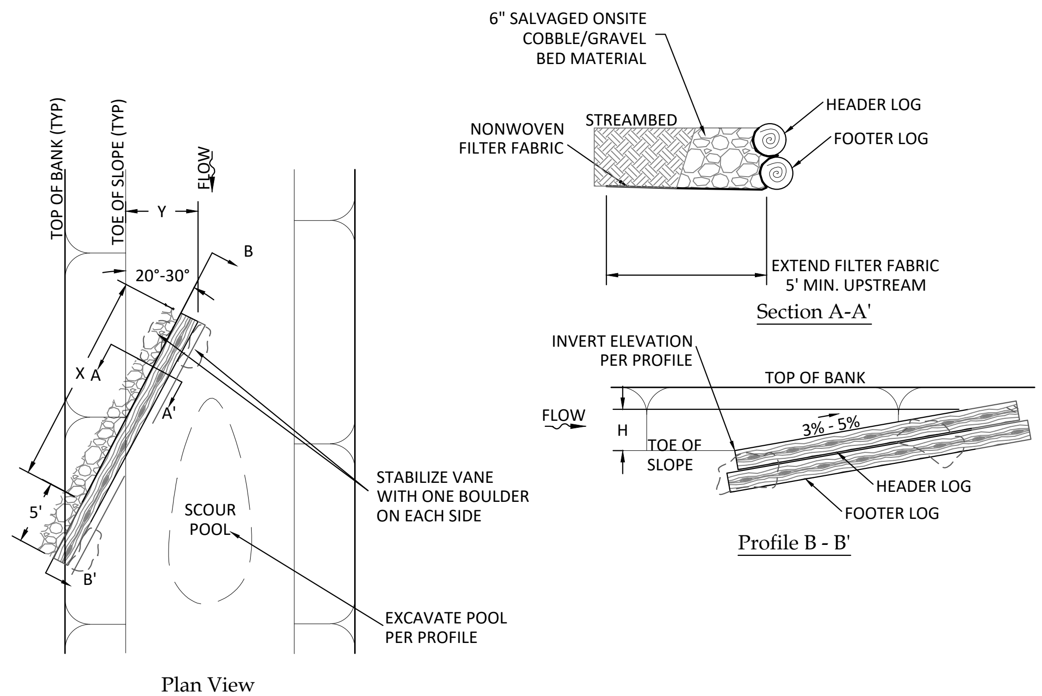
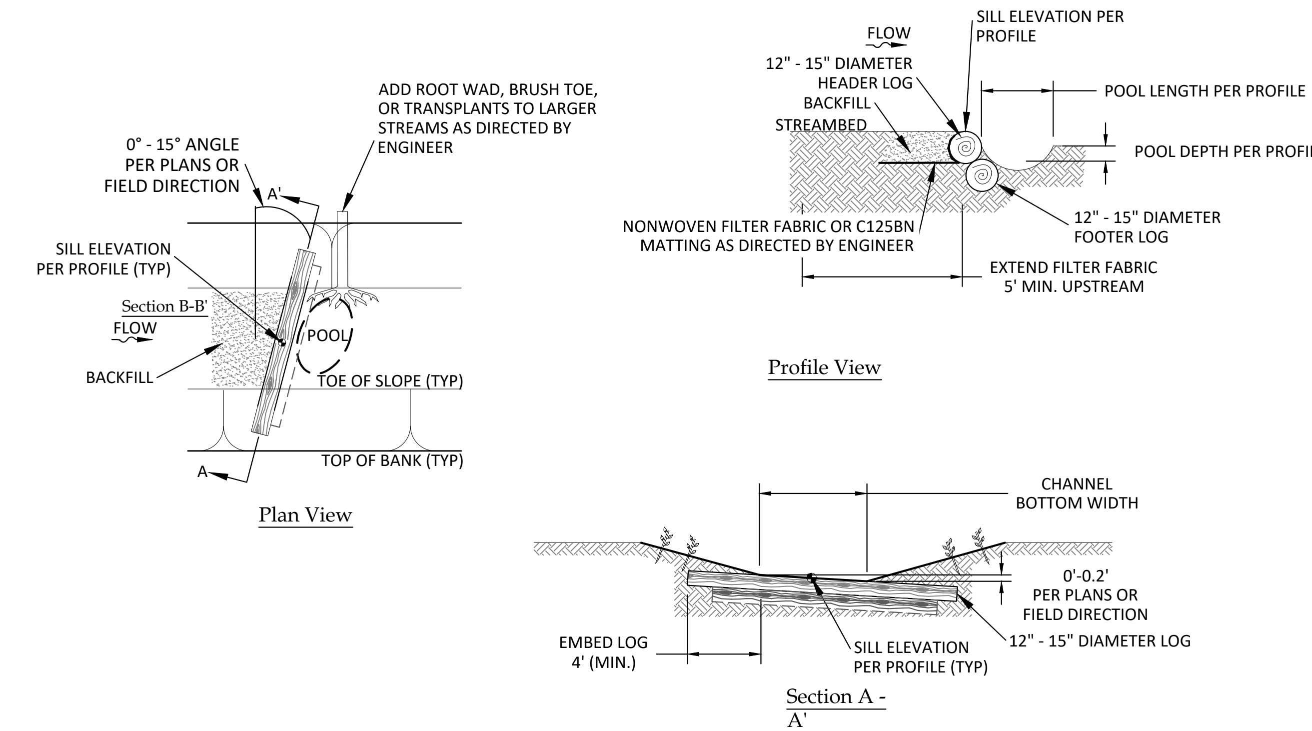
Drawn By: SJD, CK
Checked By: EGR

Sheet 6.2

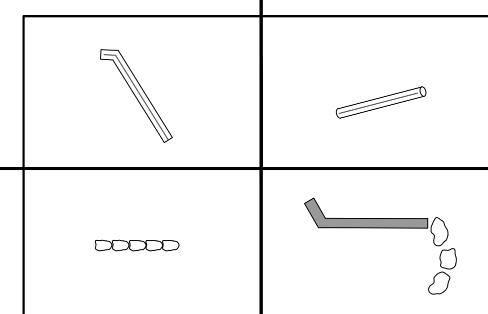


1 Log Vane
6.3 Not to Scale

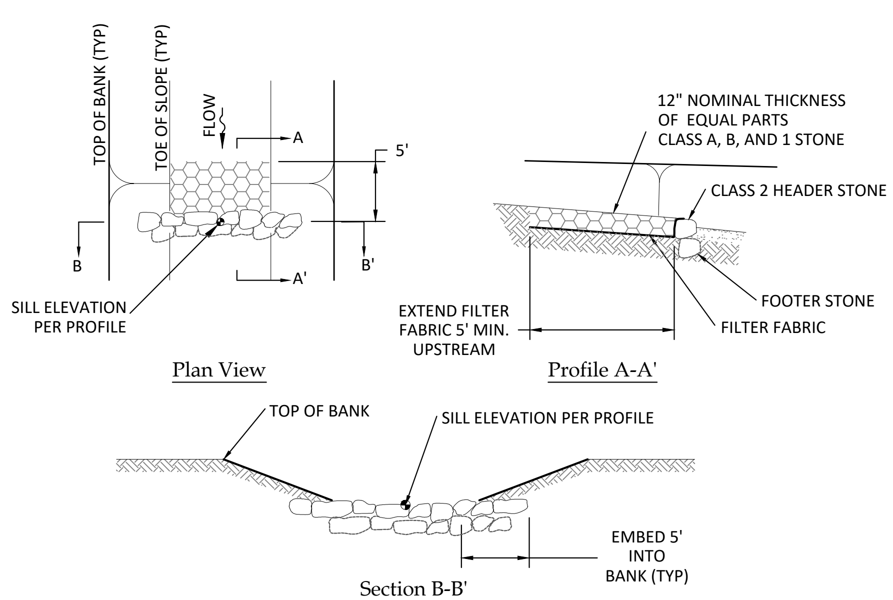
NOTE:
ON SMALLER STREAMS THE STABILIZATION BOULDER MAY BE REMOVED PER ENGINEER'S DISCRETION.



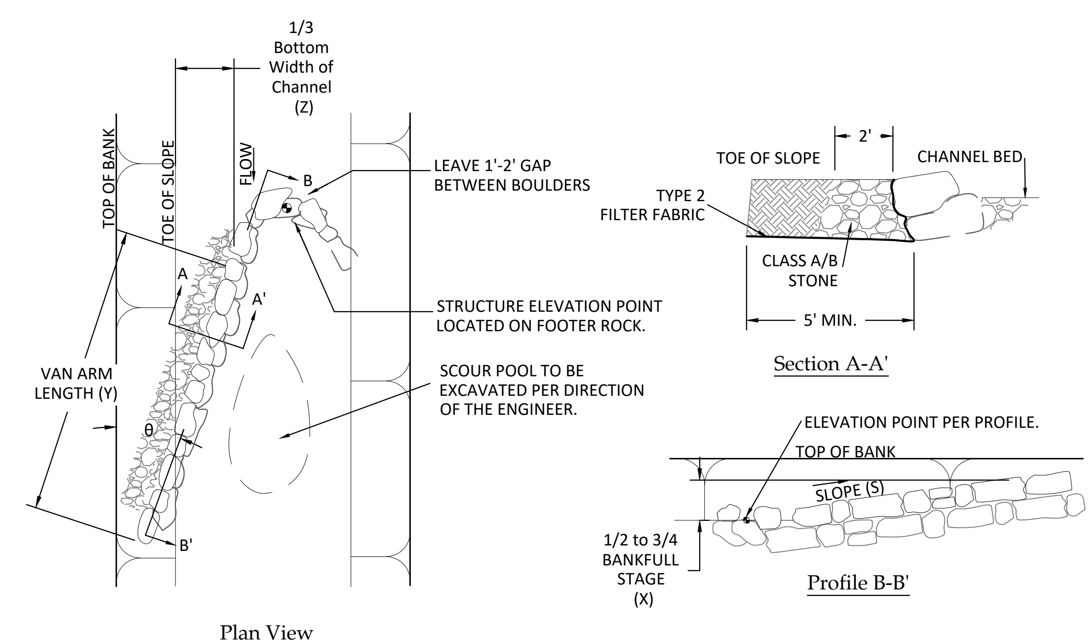
2 Log Sill
6.3 Not to Scale



NOTE:
FOOTER LOG TO BE ADDED IF DROP IS MORE THAN HEADER LOG DIAMETER.



3 Rock Sill
6.3 Not to Scale



4 Boulder J-Hook
6.3 Not to Scale

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Sheet 6.3

March 7, 2012

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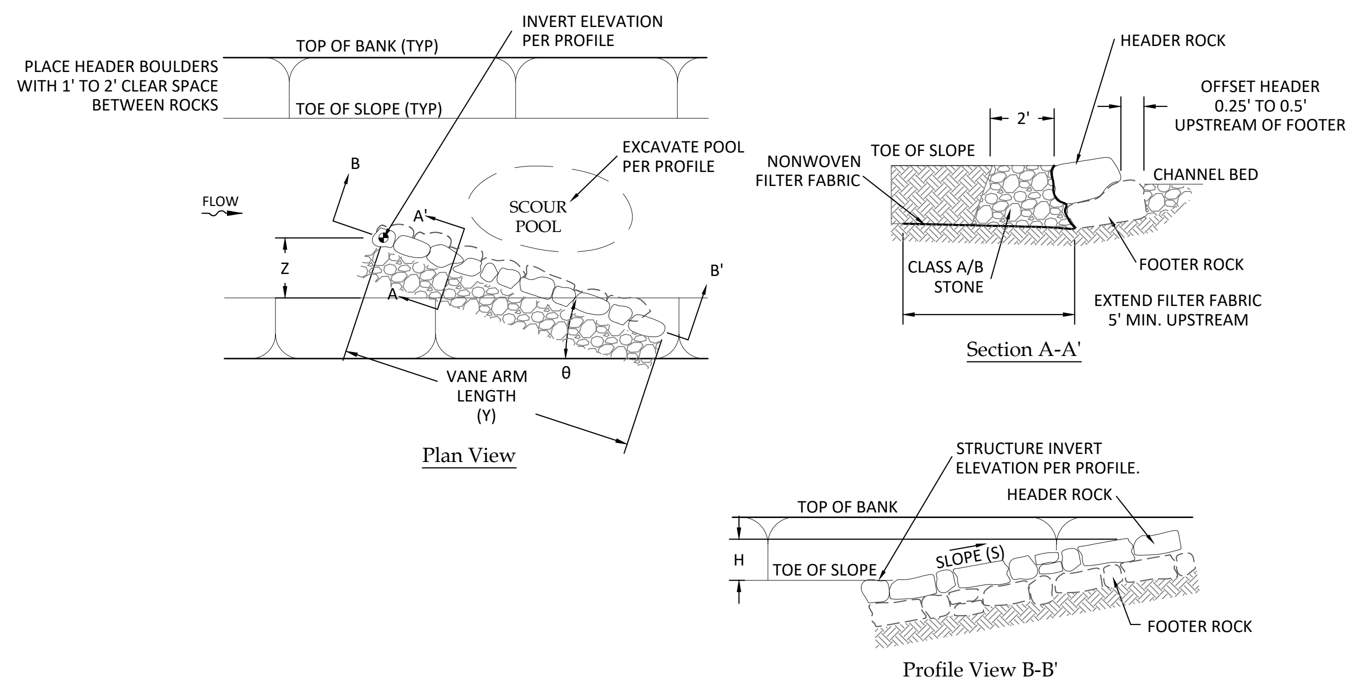
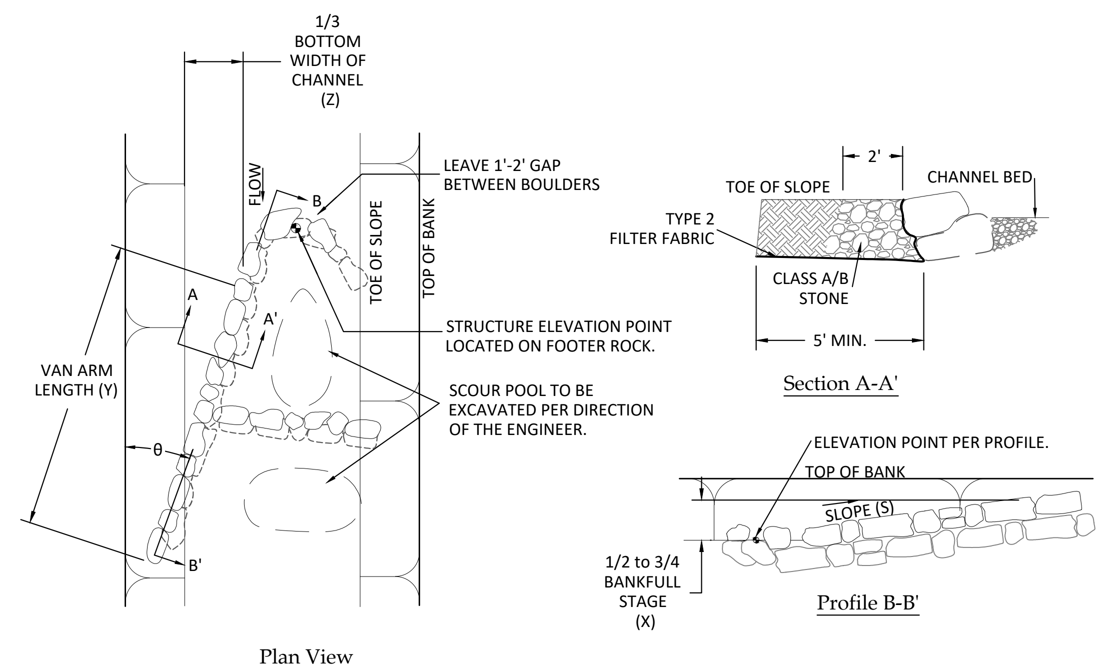
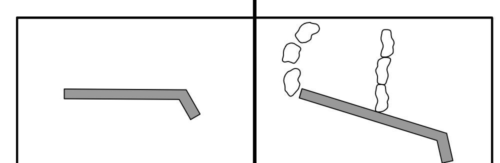
March 7, 2012

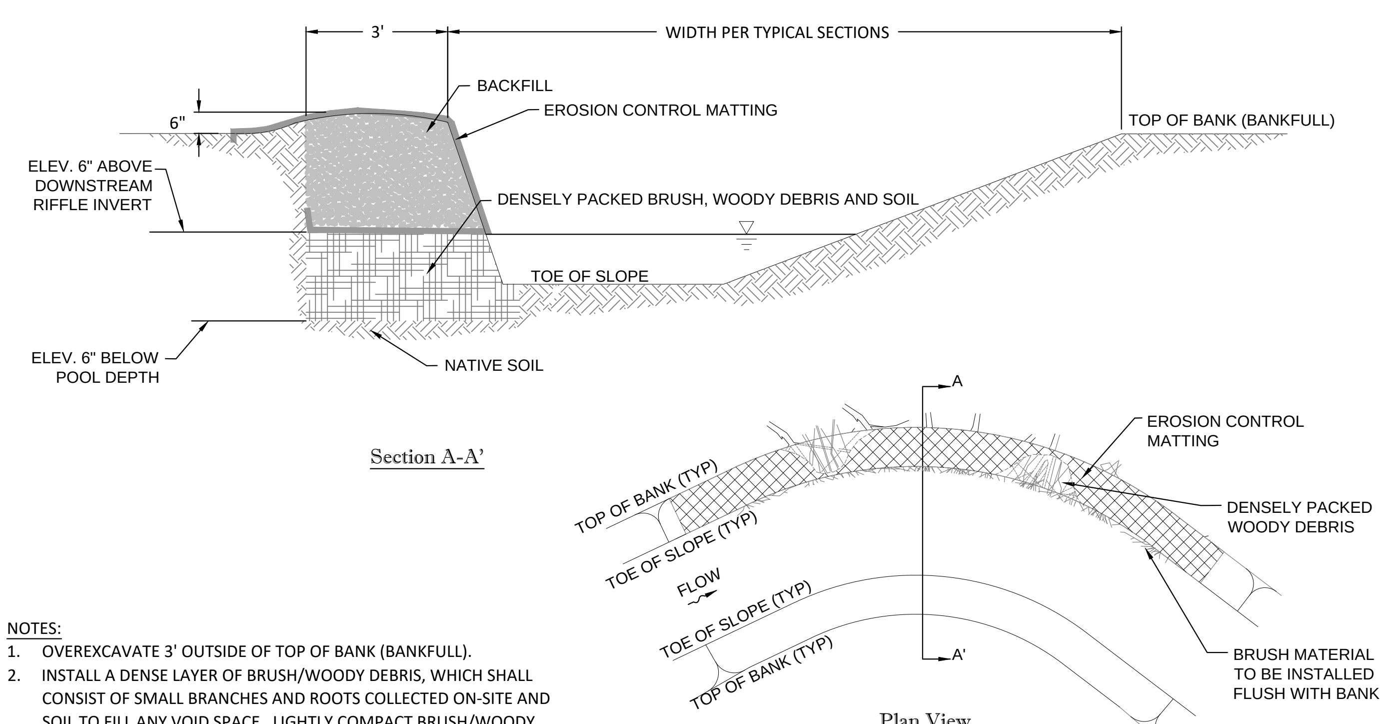


1
6.4 Rock Vane
Not to Scale





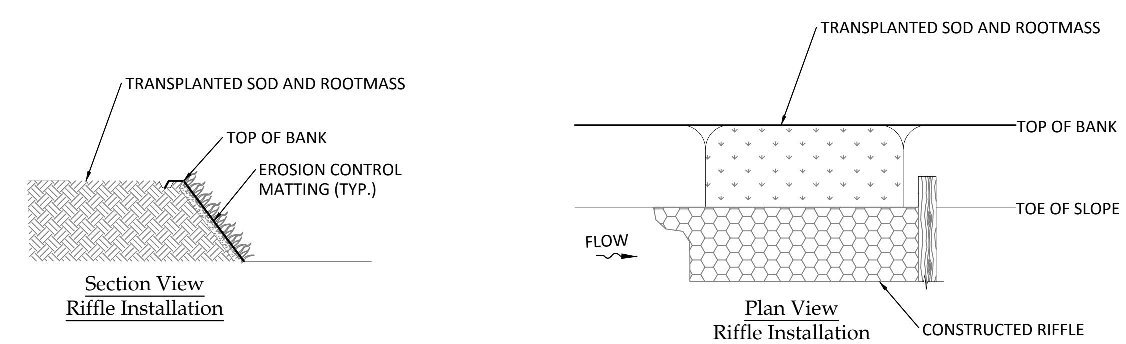
2
6.4 Boulder J-Hook with Sill
Not to Scale



NOTES:

1. OVEREXCAVATE 3' OUTSIDE OF TOP OF BANK (BANKFULL).
2. 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.
3. BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND IS INSTALLED POINTING SLIGHTLY UPSTREAM.
4. INSTALL MATTING OVER BRUSH/WOODY DEBRIS.
5. INSTALL EARTH BACKFILL OVER BRUSH/WOODY LAYER ACCORDING TO TYPICAL SECTION DIMENSIONS.
6. SEED, MULCH AND INSTALL EROSION CONTROL MATTING AND BANK STABILIZATION PER PLANS.

3
6.4 Brush Toe
Not to Scale



4
6.4 Transplanted Sod Mats
Not to Scale

NOTES:

1. PREPARE THE BANK WHERE THE SOD MAT WILL BE TRANSPLANTED BY RAKING & FERTILIZING.
2. EXCAVATE TRANSPLANT SOD MATS WITH A WIDE BUCKET AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE.
3. PLACE TRANSPLANT ON THE BANK TO BE STABILIZED.
4. SECURE WITH SOD STAPLES.
5. FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
6. ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
7. PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.
8. INSTALL EROSION CONTROL MATTING ABOVE TRANSPLANTED SOD MATS.

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6.4
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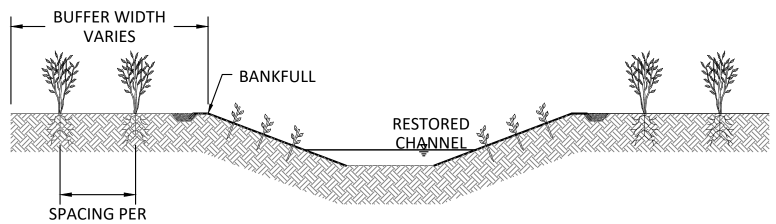
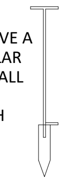


Section View

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.

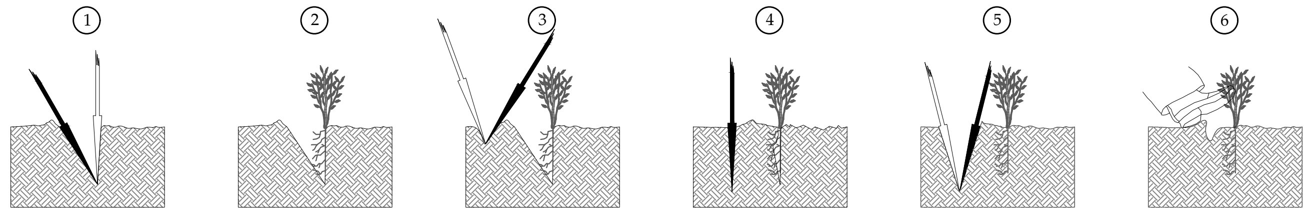


ROOTING PRUNING

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.

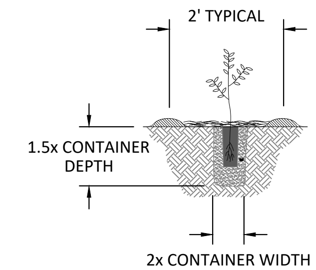
3. INSERT THE DIBBLE, OR SHOVEL, SEVERAL INCHES IN FRONT OF THE SEEDLING AND PUSH THE BLADE HALFWAY INTO THE SOIL. TWIST AND PUSH THE HANDLE FORWARD TO CLOSE THE TOP OF THE SLIT TO HOLD THE SEEDLING IN PLACE.

4. PUSH THE DIBBLE, OR SHOVEL, DOWN TO THE FULL DEPTH OF THE BLADE.

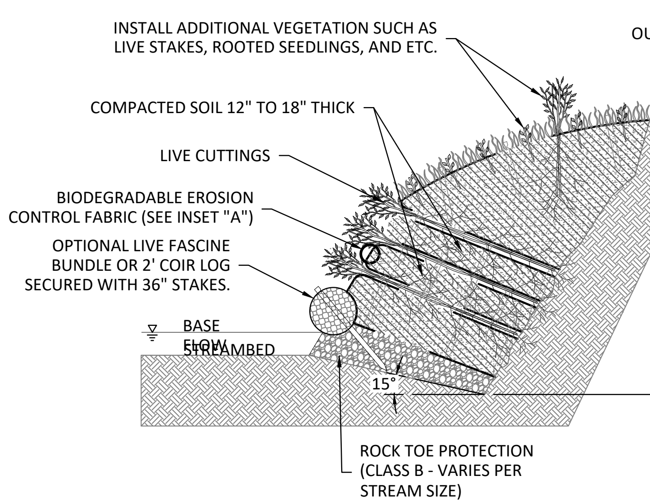
5. PULL BACK ON THE HANDLE TO CLOSE THE BOTTOM OF THE PLANTING HOLD. THEN PUSH FORWARD TO CLOSE THE TOP, ELIMINATING AIR POCKETS AROUND THE ROOT.

6. REMOVE THE DIBBLE, OR SHOVEL, AND CLOSE AND FIRM UP THE OPENING WITH YOUR HEEL. BE CAREFUL TO AVOID DAMAGING THE SEEDLING.

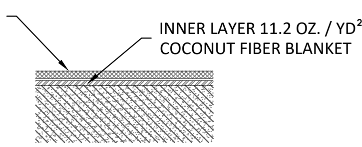
1/6.5 Bare Root Planting
Not to Scale



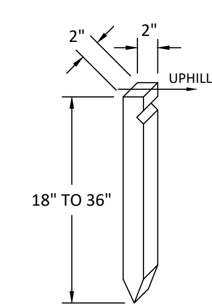
2/6.5 Containerized Planting
Not to Scale



Section View



Inset "A"
Matting and Blanket

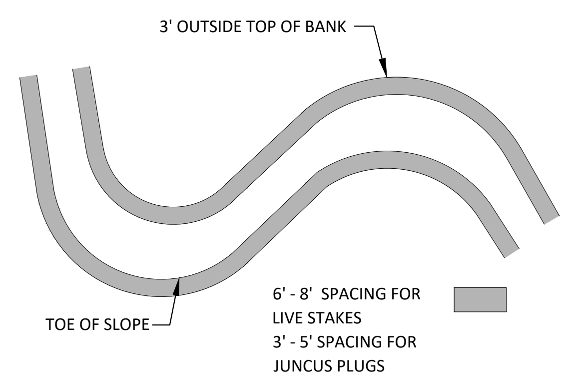


Typical Stakes

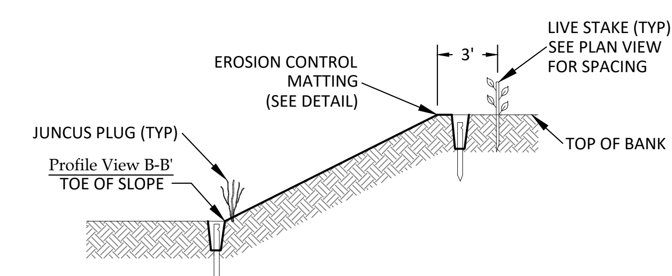
NOTE:

1. ROOTED/LEAFED CONDITION OF THE LIVING PLANT MATERIAL IS NOT REPRESENTATIVE OF THE TIME OF INSTALLATION.
2. BOTTOM OF FIRST COMPACTED EARTH LIFT TO BE PLACED 6" ABOVE NORMAL BASEFLOW.
3. NUMBER OF COMPACTED EARTH LIFTS TO VARY DEPENDING ON DESIGN TOP OF BANK HEIGHT.

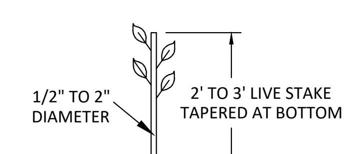
3/6.5 Vegetated Soil Lift
Not to Scale



Plan View



Section View



Live Stake Detail

NOTE:

1. LIVE STAKES TO BE PLANTED IN AREAS AS SHOWN ON PLANS AND DIRECTED BY THE ENGINEER.

3/6.5 Live Staking & Juncus Plugs
Not to Scale

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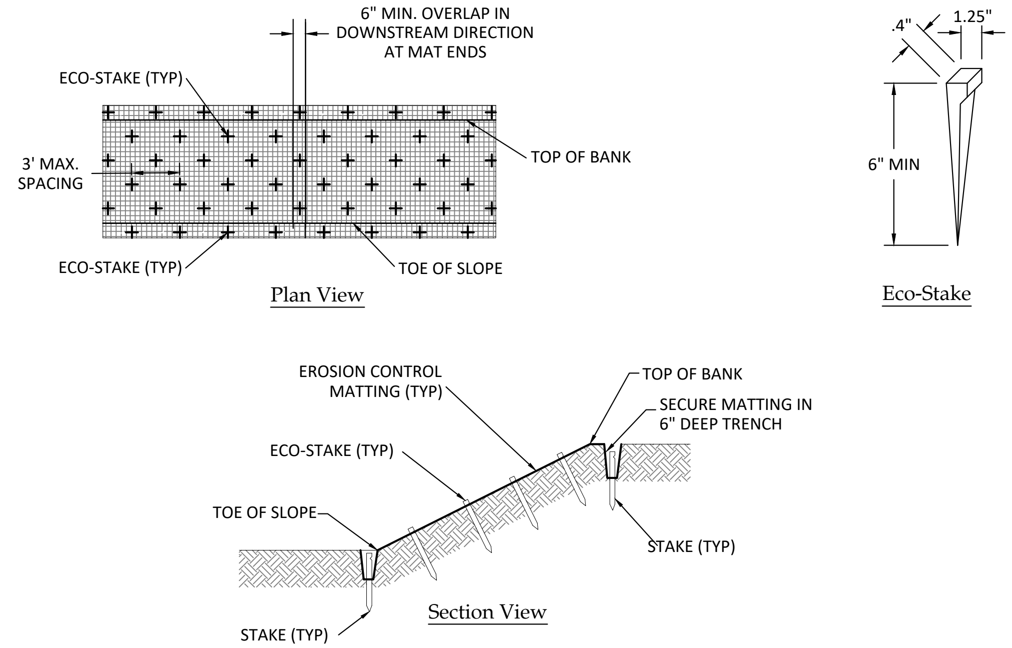
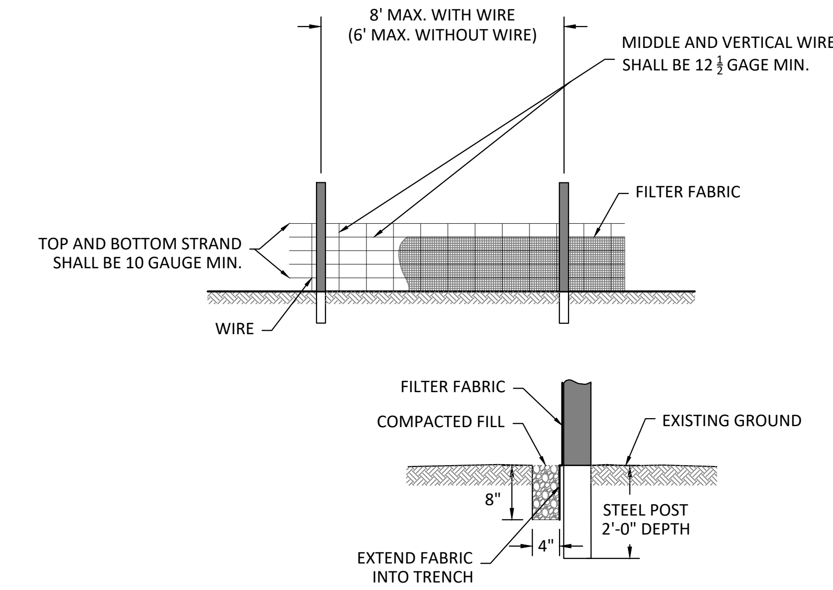
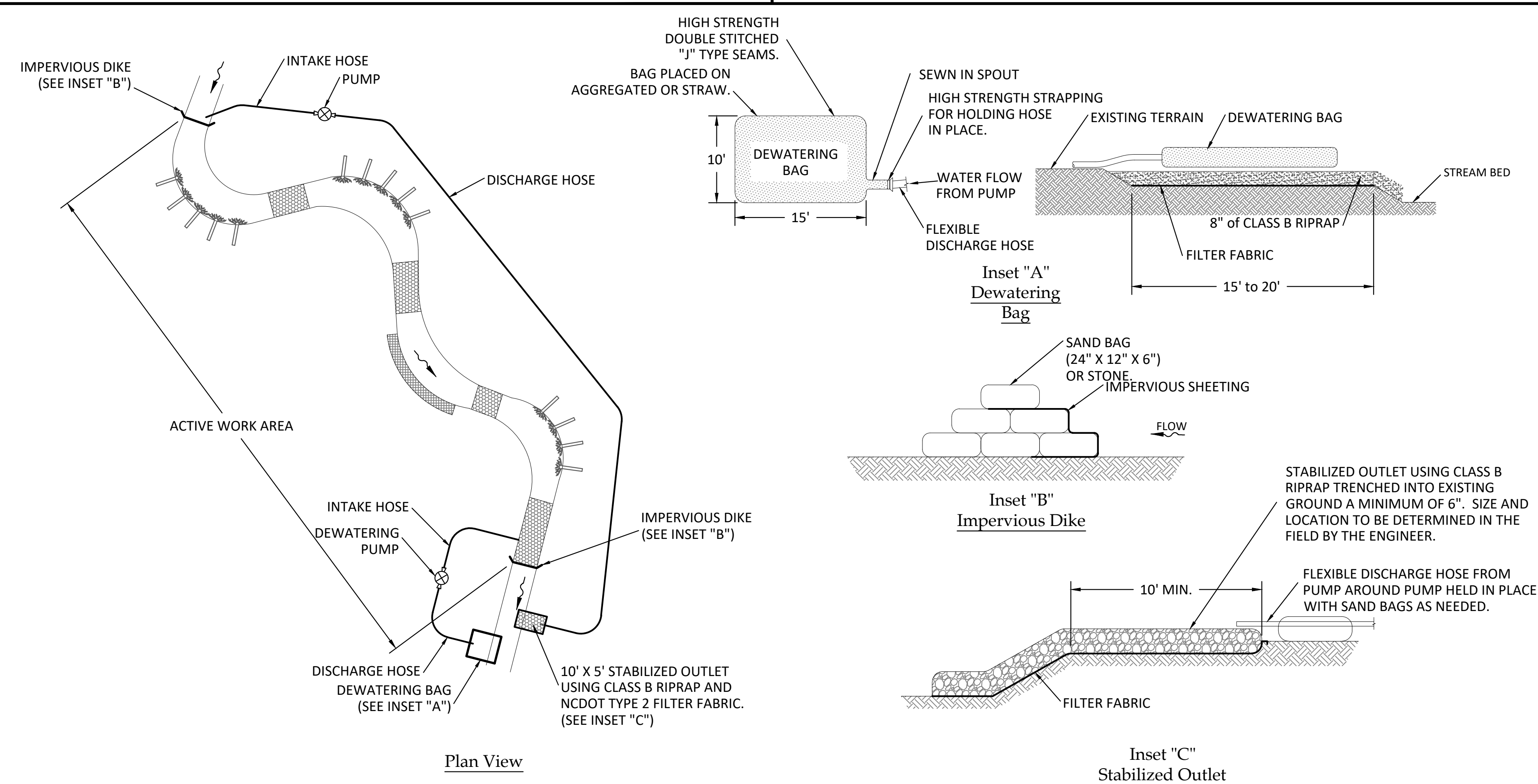


1 6.6 Erosion Control Matting
Not to Scale



2 6.6 Temporary Silt Fence
Not to Scale

NOTES:
1. USE WIRE A MINIUM OF 32" IN WIDTH AND WITH A MINIMUM OF 6 LINES OF WIRES WITH 12" STAY SPACING.
2. USE FILTER FABRIC A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE WIRES AS DIRECTED BY THE ENGINEER.
3. PROVIDE 5' STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE. ANGLE STEEL TYPE.



NOTE:
1. PROVIDE STABILIZED OUTLET TO STREAMBED.

3 6.6 Pump Around System
Not to Scale

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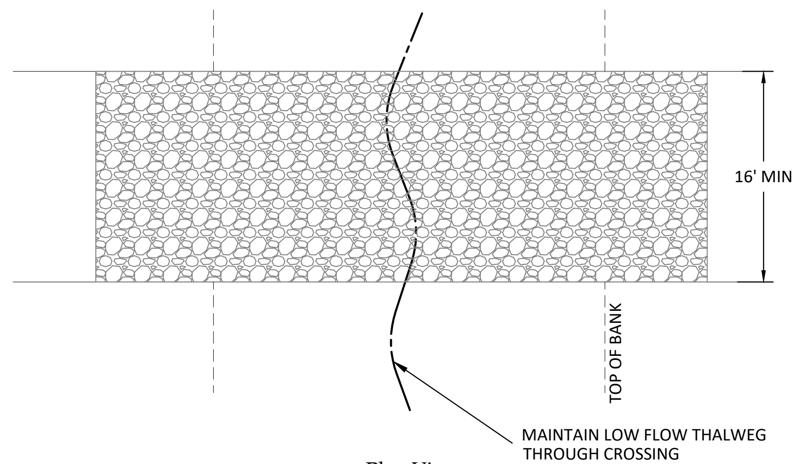
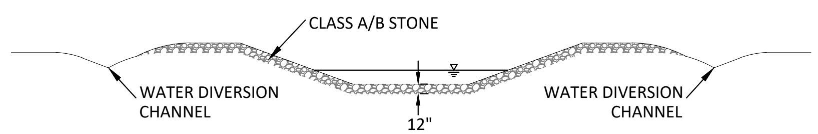


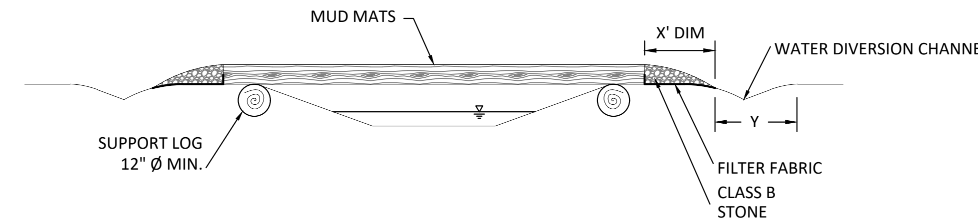
Plan View



Section View

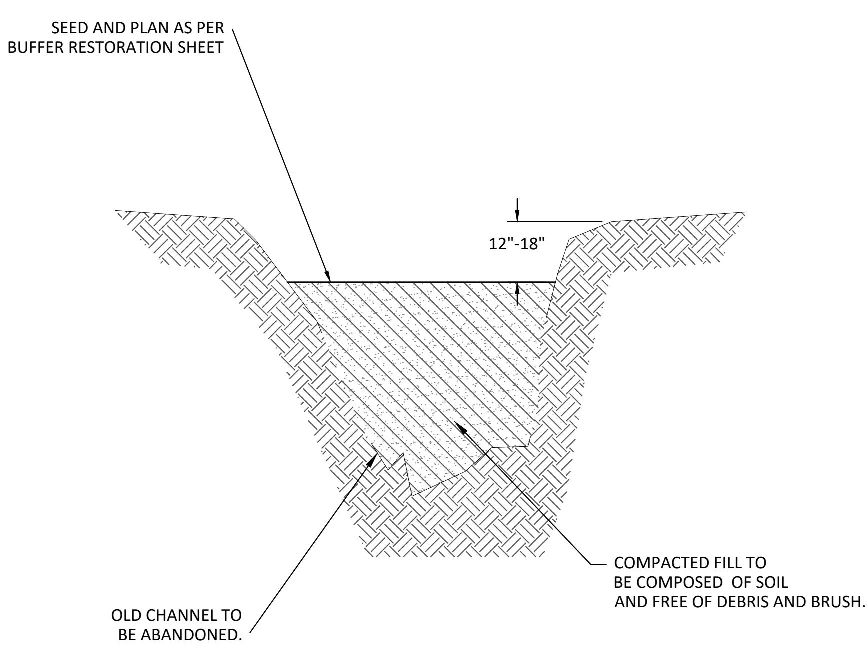
NOTES:
1. FORD CROSSING SHALL BE INSTALLED PERPENDICULAR TO CHANNEL BANKS.
2. MAINTAIN DIVERSION CHANNEL TO INSURE RUNOFF DOES NOT ENTER CHANNEL.
3. CONTRACTOR SHALL DETERMINE APPROPRIATE FORD DIMENSIONS.

1/6.7 Temporary Ford Crossing
Not to Scale



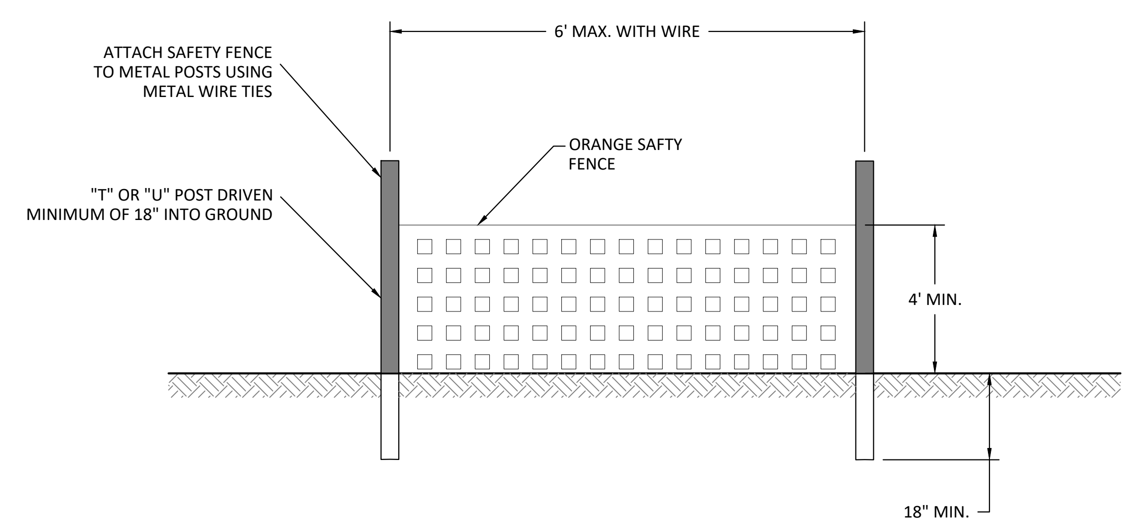
2/6.7 Temporary Stream Crossing - Mud Mat
Not to Scale

NOTE:
1. CONSTRUCT STREAM CROSSING WHEN FLOW IS AT NORMAL BASEFLOW.
2. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM.
3. INSTALL STREAM CROSSING PERPENDICULAR TO THE FLOW.
4. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
5. STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUD MAT.
6. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.



3/6.7 Ephemeral Pool
Not to Scale

MATERIAL SPECIFICATIONS		
PHYSICAL PROPERTY	TESTS	REQUIREMENTS
MATERIAL	N/A	POLYETHYLENE
RECOMENDED COLOR	N/A	"INTERNATIONAL ORANGE"
TENSILE YIELD	ASTM D638	AVE. 2000 LBS. PER 4' WIDE
ULTIMATE TENSILE STRENGTH	ASTM D638	AVE. 2900 LBS. PER 4' WIDE
ELONGATION AT BREAK (%)	ASTM D638	GREATER THAN 1000%
CHEMICAL RESISTANCE	N/A	INERT TO MOST CHEMICALS AND ACIDS



4/6.7 Safety Fence
Not to Scale

WILDLANDS ENGINEERING
1430 S. Mint Street, Ste 104
Charlotte, NC 28203
Tel: 704.332.7754
Fax: 704.332.3306
Firm License No. F-0831

PRELIMINARY DO NOT USE FOR CONSTRUCTION

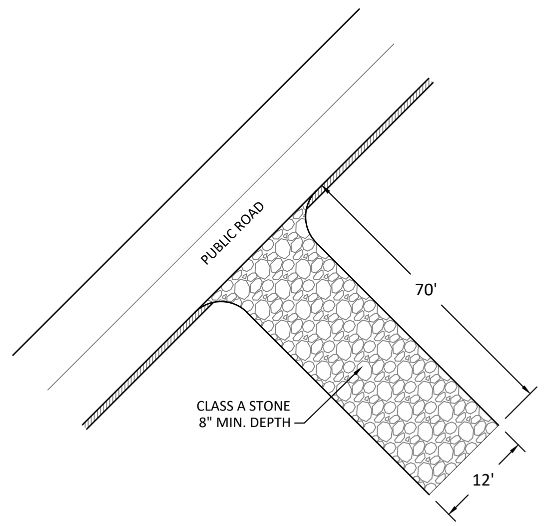
Lone Hickory Mitigation Site
Yadkin County, North Carolina

Details

Revisions:

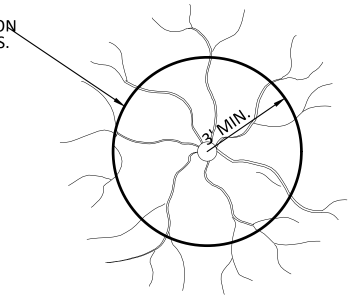
Date: December 8, 2017
Job Number: 005-02163
Project Engineer: EPN, ASE
Drawn By: SJD, JCK
Checked By: EGR

Sheet 6.7

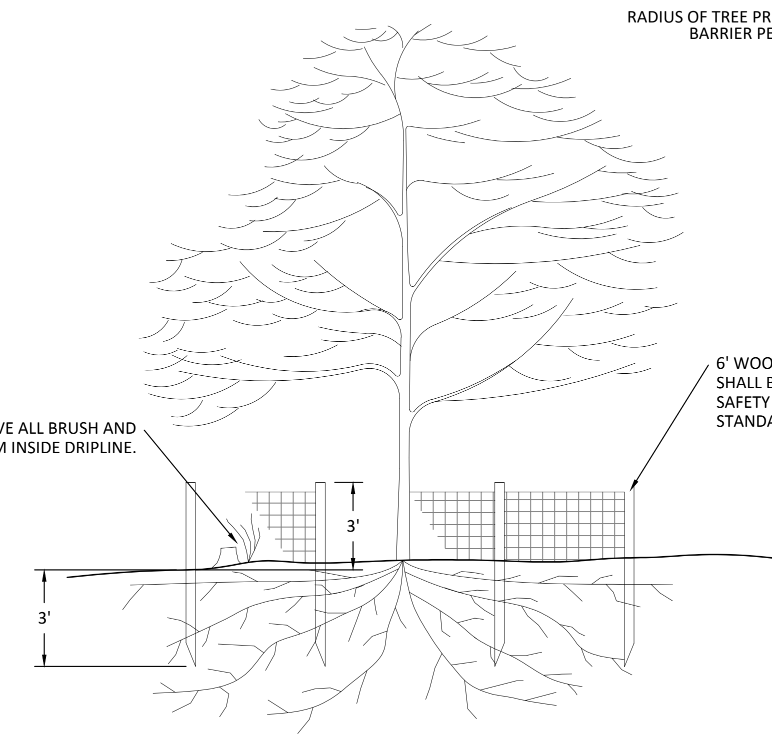


NOTES:
1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
5. LOCATE CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
6. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOP DRESSING WITH STONE WILL BE NECESSARY.
7. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED IMMEDIATELY.
8. USE CLASS A STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.
9. PLACE FILTER FABRIC BENEATH STONE.

1 / 6.8 Construction Entrance
Not to Scale



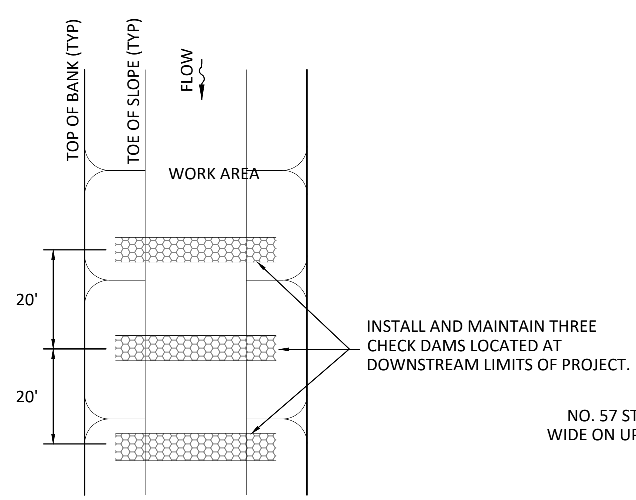
Plan View



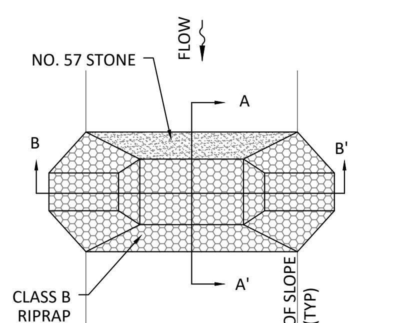
Section View

NOTES:
1. ALL TREE PROTECTION BARRIERS SHALL BE REMOVED PRIOR TO CONTRACTOR DEMOBILIZATION.
2. SEE PLANS FOR LOCATION OF ALL TREE PROTECTION BARRIERS.

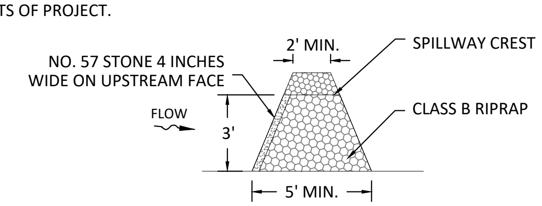
2 / 6.8 Tree Protection
Not to Scale



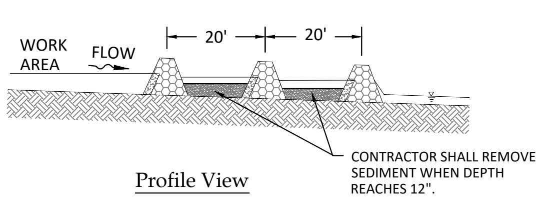
Plan View



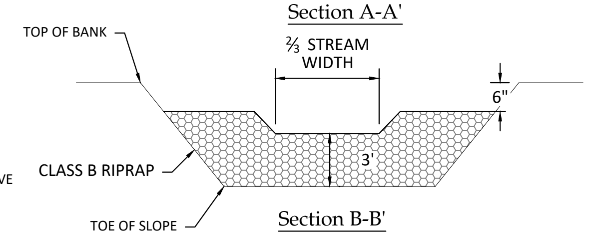
Plan View



Section A-A'



Profile View



Section B-B'

3 / 6.8 Temporary Rock Sediment Dam
Not to Scale

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Tel: 704.332.7754
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PRELIMINARY DO NOT USE FOR CONSTRUCTION

Lone Hickory Mitigation Site
Yadkin County, North Carolina

Details

Revisions:

Date: December 8, 2017
Job Number: 005-02163
Project Engineer: EPN, ASE
Drawn By: SJD, CK
Checked By: EGR

Sheet 6.8

APPENDIX 7
INVASIVE SPECIES PLAN

Appendix 7 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 – *Lone Hickory Mitigation Site*

Invasive Species	Recommended Removal Technique
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 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

Invasive Species	Recommended Removal Technique
	(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.
Porcelain berry (*Ampelopsis glandulosa var. brevipedunculata*)	The most effective chemical control of *A. brevipedunculata* has been achieved using triclopyr formulations toward the end of the growing season when plants are transporting nutrients to their roots. Apply a 2 percent solution of triclopyr plus a 0.5 percent non-ionic surfactant to the foliage. Or cut the plants first, allow time for re-growth, and then apply the herbicide mixture. *A. brevipedunculata* can also be killed with a mixture of 25 percent triclopyr and 75 percent mineral oil applied to the basal parts of the stem to a height of 2 to 3 feet from the ground. This method should be used judiciously since it takes a lot of chemical and can result in overspray. It has been used successfully in situations where no other technique is feasible, such as cliff faces or other exposed sites.
Japanese Hops (*Humulus japonicus*)	Pre-emergent herbicide containing sulfometuron methyl (Oust XP) applied in early spring causes minimal damage to established perennial vegetation. Mechanical control by cutting or mowing as close to the ground as possible beginning in late spring and recurring frequently until fall dieback is recommended. Post emergent herbicide treatment two times a year (mid and late summer) to prevent the fall seed set is recommended. Glyphosate provides good post-emergent chemical control. Hop seeds in the soil last up to three years. Repeat treatments for two to three years should be expected, or longer in areas subject to flooding that may receive influx of seeds from upstream infestations. Cultural control methods which favor fast-growing tall tree species to create dense shade in spring and summer and canopy closure will discourage infestations, as Japanese hop prefers direct sunlight and does not tolerate heavy shade. Establishing an early thick groundcover of hairy vetch, wheat, barley or rye can reduce hop germination and seedling survival. (National Park Service, Plant Conservation Alliance, Alien Plants Working Group, 2009)
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. • 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

Invasive Species	Recommended Removal Technique
	dormant or apply a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix) directed at the infestation.
Mimosa (*Albizia julibrissin)*	Trees: Make stem injections using Arsenal AC* or when safety to surrounding vegetation is desired, Garlon 3A or Milestone in dilutions as specified on the herbicide label (anytime except March and April). For felled trees, apply the herbicides to stump tops immediately after cutting. 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). Saplings: Apply a basal spray to young bark using 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, kerosene, or diesel fuel (where permitted). Resprouts and seedlings: Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: From June to August, either Escort XP at 1 ounce per acre (0.2 ounces per 3-gallon mix) plus a glyphosate herbicide as a 2-percent solution addition (8 ounces per 3-gallon mix) or Milestone VM Plus at 6 to 9 pints per acre (1.5 to 3 pints per 3-gallon mix and 10 gallons per acre). From July to September, Transline* † or Milestone as a 0.25-percent solution plus Garlon 3A as a 4-percent solution (1 ounce plus 5 ounces per 3-gallon mix).
Princess Tree (*Paulownia tomentosa*)	<u>Foliar Spray Method</u>: This method should be considered for large thickets of paulownia seedlings where risk to non-target species is minimal. Air temperature should be above 65Â°F to ensure absorption of herbicides. Glyphosate: Apply a 2% solution of glyphosate and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species. Glyphosate is a non-selective systemic herbicide that may kill non-target partially-sprayed plants. Triclopyr: Apply a 2% solution of triclopyr and water plus a 0.5% non-ionic sur-factant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species. Triclopyr is a selective herbicide for broadleaf species. In areas where desirable grasses are growing under or around paulownia, triclopyr can be used without non-target damage. <u>Cut Stump Method</u>: This control method should be considered when treating individual trees or where the presence of desirable species precludes foliar application. Stump treatments can be used if the ground is not frozen. Glyphosate: Horizontally cut stems at or near ground level. Immediately apply a 25% solution of glyphosate and water to the cut stump making sure to cover the outer 50% of the stump. Triclopyr: Horizontally cut stems at or near ground level. Immediately apply a 50% solution of triclopyr and water to the cut stump making sure to cover the outer 20% of the stump. https://www.se-eppc.org/manual/princess.html

APPENDIX 8
MAINTENANCE PLAN

Appendix 8 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 – *Lone Hickory 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 9) 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 9
CREDITING INFORMATION

Appendix 9 - Credit Release Schedule

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 – *Lone Hickory Mitigation Site*

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met (additional 10% released at second bankfull event in a separate year)	10%	50% (60%)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (70%)
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%)
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	10%	90% (100%)

Table B: Credit Release Schedule – Wetland Credits – *Lone Hickory Mitigation Site*

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70%

5	Fifth year monitoring report demonstrates performance standards are being met; Provided that all performance standards are met, the IRT may allow the DMS to discontinue hydrologic monitoring after the fifth year, but vegetation monitoring must continue for an additional two years after the fifth year for a total of seven years.	10%	80%
6	Sixth year monitoring report demonstrates performance standards are being met	10%	90%
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval	10%	100%

1.1 Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by DMS without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan.
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; per the DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

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. For stream projects a reserve of 10% of a site's total stream credits shall be released after two 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 two bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. 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.

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MEETING NOTES

MEETING:	Post-Contract IRT Site Walk **LONE HICKORY Mitigation Site** Yadkin 03040101; Yadkin County, NC DEQ Contract No. 6897 DMS Project No. 97135 Wildlands Project No. 005-02163
DATE:	Tuesday, July 19, 2016 @ 2:00 PM – 5:00 PM
LOCATION:	Lone Hickory Road Yadkinville, NC

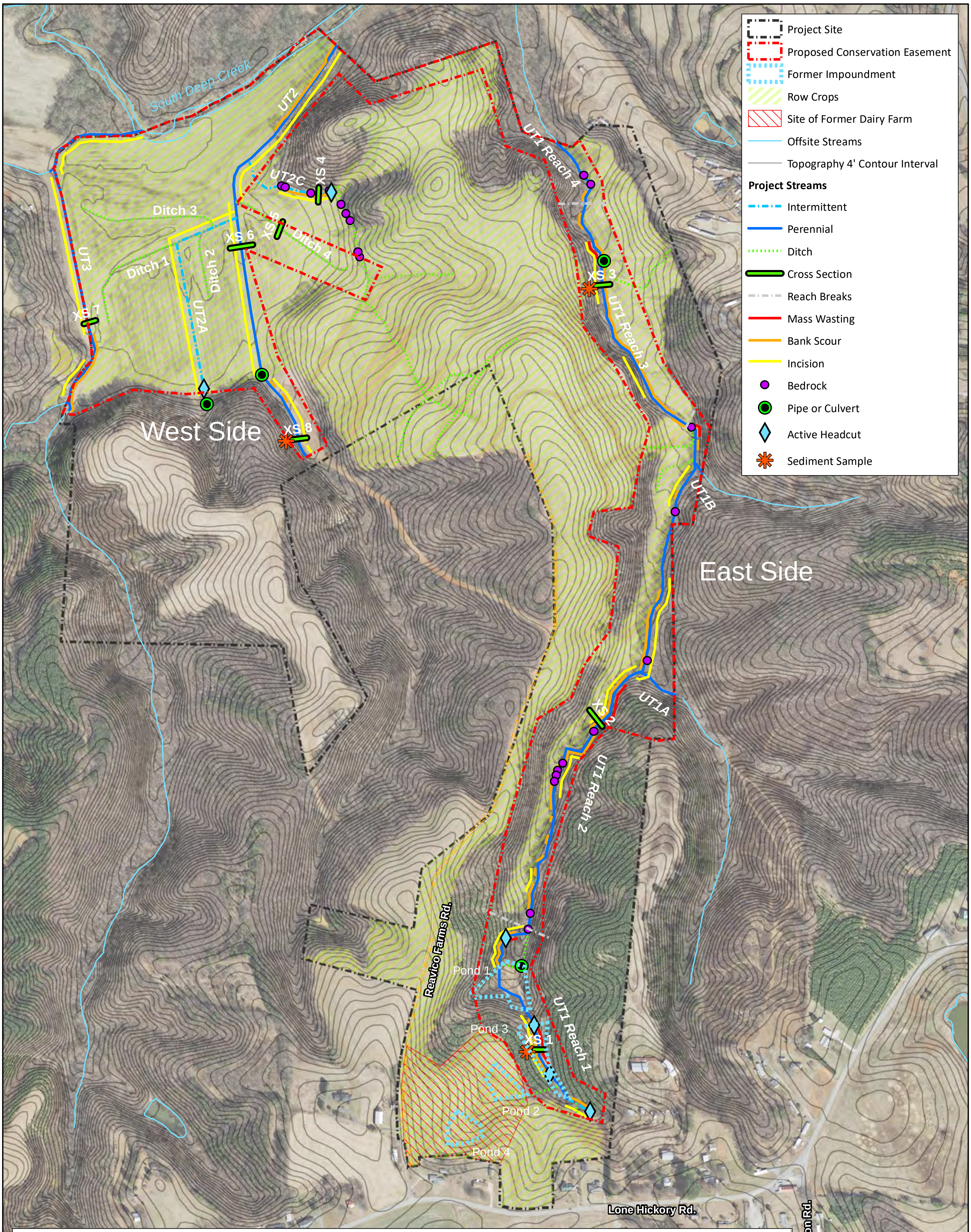
Attendees
Todd Tugwell, USACE
Paul Wiesner, DMS Project Manager
Matthew Reid, DMS
Shawn Wilkerson, Wildlands Engineering
John Hutton, Wildlands Engineering
Emily Reinicker, Wildlands Engineering Project Manager

Materials
- Wildlands Engineering Technical Proposal dated 1/21/2016 in response to DMS RFP 16-006706

Meeting Notes
1. Overview of project from entrance at Reavico Farms Road off Lone Hickory Road.
2. Discussed proposed BMPs in west floodplain of UT1 Reach 1. For overall site, discussed consideration of sediment load and BMP selection. Several locations likely need detention pond BMP with more sediment storage capacity than step pool stormwater conveyance (SPSC). Wildlands will select BMP types per specific location based on sediment or water quality treatment concerns. No direct credit has been requested for BMPs.
3. East Side of site includes UT1 and series of 3 dams/ former dairy ponds in headwaters.
4. Looked at upstream extent of UT1 at jurisdictional stream call. Todd will need JD evaluation submitted through Asheville office for verification of all stream and wetland calls on site.
5. Discussion around intermittent channels, IRT prefers that these do not comprise a significant portion of mitigation site credits. Wildlands will include flow gages in monitoring plan to document intermittent stream channel status.
6. Viewed series of 3 dairy ponds that have filled with unconsolidated sediments and formed wetland habitat over the past several decades. Viewed dam breach and 8’-10’ vertical headcut. The breaching dams and active headcuts will eventually lead to loss of these wetland areas. Wildlands proposes to re-

grade valley and re-establish stream and floodplain on the valley floor. Todd requested delineation of these current wetland areas. Discussion around making up for loss of wetland habitat elsewhere on site. Wildlands will need to address this concern in the Mitigation Plan.

7. Discussed potentially using excavated pond soils to re-create valley hillside adjacent to UT1 Reach 3. Allowance for vernal pools or oxbows may be a good way to remediate excess nutrients in former dairy pond sediments.
8. Three site reaches for preservation include UT1A, UT1B, and UT1 Reach 4. UT1A and UT1B will need to be extended to tie into UT1 Reach 2 which will be restored in the lower west floodplain that is currently planted in corn. Todd noted that UT1A and UT1B will need to be raised for a short distance at the downstream extent to tie into the Priority 1 restoration reach.
9. Walked down UT1 Reach 3 to Reach 4. Transition from restoration on Reach 3 to preservation on Reach 4 was difficult to locate. Wildlands will need to document need for restoration versus preservation in the Mitigation Plan. Transition zone with enhancement/ spot stabilization may be appropriate.
10. Overall on UT1 Reaches 2 and 3, Todd noted that stability issues are consistently on the left (west) bank and floodplain side adjacent to corn field. Hillslope toe erosion observed at intermittent locations throughout reaches on right side. Todd agreed that stream needs to be pulled offline and restored in the left floodplain.
11. Group hiked over hill and ridge line separating East Side of site from West Side. Viewed UT2 and UT3 channels on West Side.
12. Discussion around importance of analysis of sediment supply and slope transition as channels flow from steeper hill slopes into flat floodplain of South Deep Creek. Todd asked whether streams should splay out into a wetland complex in the flat floodplain area. Wildlands to look at BMP potential at top end of channels. Todd expressed concern regarding whether the streams with small drainage areas will maintain as a flowing channel or fill in with sediment. IRT will need to see functioning channels at the end of the monitoring period to award stream credits. Wildlands to address this discussion in Mitigation Plan in existing conditions assessment, design discussion, and monitoring plan.
13. Todd expressed concern over proposed stream restoration alignments, where and how these come together. During the design phase of the project, Wildlands needs to investigate the potential to bring the project streams on the West Side of the site together sooner rather than running parallel for a considerable distance. The mitigation plan will need to discuss and justify the project stream alignments, orientation and trajectory. Wildlands to address this discussion in Mitigation Plan in existing conditions assessment and design discussion.
14. Discussion on potential wetland restoration area in vicinity of UT2/ UT3/ UT3A. DMS asked for optional WMU submittal but has not contracted at this time. Todd advised that if WMUs will be developed, then install wetland wells as soon as possible to document pre-project conditions. No soils were examined during this site walk and no further discussion of WMU potential.



Streams Proposed for Modification							
Reach	Bank Scour	Incision	Mass Wasting	Row Crops	Former Inline Impoundments	Ditching/ Straightening	Total Length
UT1	62%	50%	12%	78%	21%	0%	5,952
UT2	27%	96%	0%	79%	0%	79%	2,401
UT2A	0%	100%	0%	97%	0%	100%	1,142
UT2C	51%	51%	0%	100%	0%	100%	510
UT3	24%	94%	0%	100%	0%	100%	1,842
Total	42%	71%	6%	84%	10%	46%	11,847

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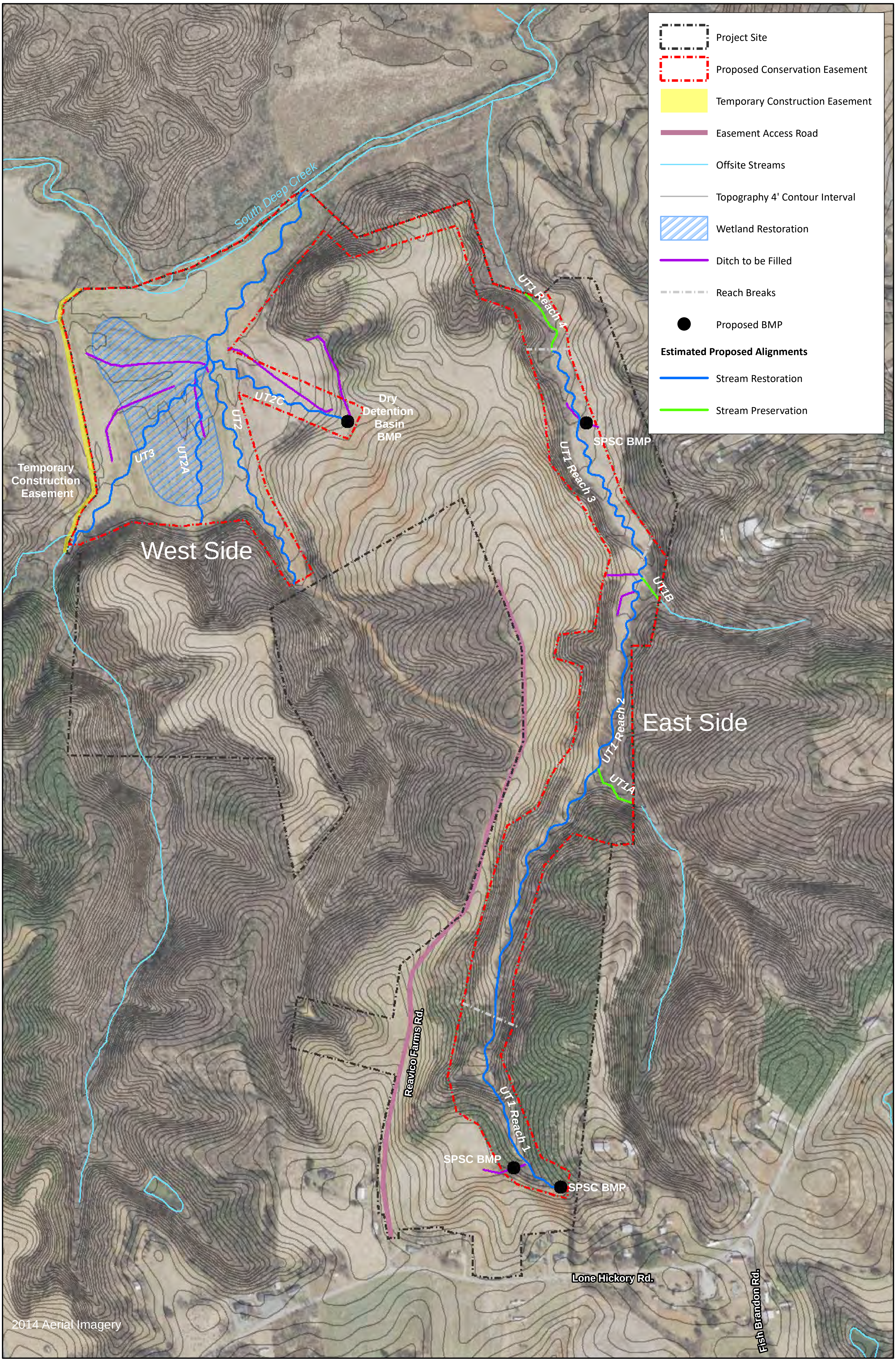
0 500 1,000 1,500 Feet

N

Figure 2 Site Map and Channel Stability Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC



0 500 1,000 1,500 Feet

N

Figure 6 Concept Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

WILDLANDS
ENGINEERING

MEETING NOTES

MEETING: Post-Contract IRT Site Walk for Wetland Soils Evaluation
LONE HICKORY Mitigation Site
Yadkin 03040101; Yadkin County, NC
DEQ Contract No. 6897
DMS Project No. 97135
Wildlands Project No. 005-02163

Attendees

Todd Tugwell, USACE
Paul Wiesner, DMS Project Manager
Mac Haupt, NC Department of Environmental Quality
Kevin Martin, Soil & Environmental Consultants
Shawn Wilkerson, Wildlands Engineering
John Hutton, Wildlands Engineering
Eric Neuhaus, Wildlands Engineering

Materials

- Wildlands Engineering Technical Proposal dated 1/21/2016 in response to DMS RFP 16-006706
- Detailed Hydric Soil Investigation dated 1/17/2017 prepared by Soil & Environmental Consultants

Meeting Summary

On Wednesday, January 25, 2017, the attendees listed above walked the Lone Hickory Mitigation Site to evaluate the site's potential for wetland restoration based on the presence on hydric soil indicators. Prior to the meeting, licensed soil scientist Kevin Martin prepared a detailed hydric soils investigation of the site. Based on the meeting, it was determined that the information within the report including depth to hydric indicators F19 (Piedmont Flood Plain Soils) and F3 (Depleted Matrix), potential for wetland restoration, and overall presence of hydric soils was confirmed. For further clarification, three zones of potential wetland areas were created and added to Figure 1. The zones included Potential Wetland Restoration Zone R, Potential Wetland Restoration Zone R2, and Potential Wetland Creation. These zones were based on depth to hydric soil indicators, evaluations of previous topographic manipulations, and the estimated amount of required overburden removal. Generally, in Zones R and R2, overburden removal for Potential Wetland Restoration will be limited to 12 inches. In isolated areas, the removal of spoil piles or high berms may require additional overburden removal within these zones. Wetland mitigation crediting for Wetland Restoration Zones R and R2 is expected to be approved at a ratio of 1:1 for areas of re-establishment and 1.5:1 for areas of rehabilitation based on the jurisdictional delineation. Crediting for Wetland Creation is anticipated to be approved at 3:1. It is not anticipated that the Wetland Creation zone will be needed to provide the 8 wetland mitigation units within Wildlands' contract with the NC Division of Mitigation Services. Wildlands will design stream morphology to produce a frequent flooding regime to provide a wetland saturation period between 8 to 12% which will be determined based on further evaluation of hydrologic data and outlined within the mitigation plan. If there are questions or comments related to the meeting or this memorandum, please advise.

Sincerely,

Eric Neuhaus, PE
Water Resources Engineer

Emily G. Reinicker, PE, CFM
Project Manager

Enclosure: Updated Detailed Hydric Soil Investigation provided by Soil & Environmental Consultants, PA

S&
EC
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DETAILED HYDRIC SOIL INVESTIGATION

Lone Hickory Rd. Project Site
South Deep Creek, WSIII
Yadkin – Pee Dee River Basin (03040101)
Yadkin County, North Carolina

Prepared for:
Mr. John Hutton
Wildlands
312 West Millbrook Road, Suite 225
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PROFESSIONAL WETLAND SCIENTIST

January 17th, 2017
Revised January 26th, 2017

INTRODUCTION

Soil & Environmental Consultants, PA (S&EC, PA) was retained to perform an evaluation to assess the presence and extent of hydric soils onsite. There are ditched streams that generally bisect the site (four unnamed tributaries of South Deep Creek). All of the area evaluated is currently utilized for row crops.

METHODOLOGY

On November 21st and 22nd, 2016 Kevin Martin (LSS, PWS) of S&EC, PA performed a soil evaluation at the site. Hand auger borings were advanced on the property at locations approximately shown on the attached Surveyed Soil Boring Grid Map (FIGURE 1). Each soil boring was evaluated to assess the presence or absence of hydric soil indicators. Depth below existing land surface to hydric soil indicators F3 & F19, if present, are shown attached (TABLE 1) for each boring performed. FIGURE 1 indicates the depth below land surface to the first hydric soil indicator encountered where more than one was present. While the F8 Hydric soil indicator (Redox Depressions) was observed in a significant portion of the site, it was not used to identify potential wetland restoration areas because it is believed that the depressions where it was observed are artificial in nature. These depressions are believed to have been created by agricultural practices such as ditching, side casting of spoil material, plowing, etc. and therefore do not represent "natural pre European settlement" conditions. 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 7.0, 2010).*

BACKGROUND

Ninety-five soil borings were performed within the study area (FIGURE 1). Soil characteristics were evaluated and the depths to hydric soil indicators documented if present.

Hydric soil indicator F3 (Depleted matrix) was found at various depths within the soil profile exhibited a low chroma soil matrix color and contained redoximorphic features (mainly redox concentrations present as pore linings although some contained Fe masses).
Hydric soil indicator F3 (Depleted Matrix) is defined as:
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. 5 cm (2 inches) if the 5 cm is entirely within the upper 15 cm (6 inches) of the soil, or
b. 15 cm (6 inches), starting within 25 cm (10 inches) of the soil surface.

Hydric soil indicator F19 (Piedmont Floodplain soils) was found at various depths within the soil profile exhibited a matrix chroma less than 4 and contained redoximorphic features (mainly redox concentrations present as pore linings although some contained Fe masses).
Hydric Soil Indicator F19 (Piedmont Flood Plain Soils) is defined as:
On active flood plains, a mineral layer at least 15 cm (6 inches) thick, starting within 25 cm (10 inches) of 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.

RESULTS

There is obvious human alteration throughout the study area. The study area is in a floodplain used as an active agricultural field. The agricultural field has been manipulated by past typical farming practices (ditching, side casting of spoil material, plowing, etc.). The soil borings were noted as being one of four types on FIGURE 1:

(1) Hydric F3 & F19: (Borings 67, 68, 87, 88, 89 &99). These soil borings contained hydric soil indicators F3 and F19 at ≤10". Performing hydraulic site modifications (i.e. stream relocation, removing subsurface drainage (if any), raising of the restored stream bed, etc.) with soil removal as determined to be appropriate would make these areas suitable for Wetland Restoration.

(2) Hydric F19: – (Borings 17, 23, 27, 34, 38, 47, 54, 55, 66, 69, 75,76,78,79,83,84,86, 90, 93, & 98). These soil borings contained hydric soil indicator F19 at ≤10". Performing hydraulic site modifications (i.e. stream relocation, removing subsurface drainage (if any), raising of the restored stream bed, etc.) as determined to be appropriate would make these areas suitable for Wetland Restoration.

(3) Buried Hydric: (all borings except those listed in (1), (2) and (4)).These borings exhibited hydric soil indicators F3 and/or F19 but at depths such that they would not currently classify as a hydric soil. The depth to the buried hydric soil indicator is shown on Table 1 and Figure 1. The soil surface material did not exhibit adequate soil characteristics to be classified as hydric using any current hydric soil indicator (excluding F8). Performing hydraulic site modifications (i.e. stream relocation, removing subsurface drainage (if any), raising of the restored stream bed, etc.) with soil removal as determined to be appropriate would make these areas suitable for Wetland Restoration or Creation as noted in Figure 1. Based on a 1/25/17 site meeting with Todd Tugwell of the USACE, Mac Haupt of NCDWR and others, it was agreed areas where the depth to hydric soil indicator F3 or F19 was >10" but ≤18" below existing land surface would be considered as having potential for wetland restoration, while areas where the depth to hydric soil indicator F3 or F19 was >18" but ≤22" below existing land surface have potential for wetland creation. See CONCLUSIONS section below for more details.

(4) Non-Hydric: These soil boings did not exhibit soil characteristics indicative of a hydric soil or buried hydric soil (Borings 4, 6, 8, 9, 19, & 108). All borings except 108 appeared to be in areas that would have been historically a levee adjacent to South Deep creek or one of its tributaries. Boring 108 appeared to be a residual upland soil at the toe slope of a hill that had been graded to construct a farm road. These areas are not suitable for Wetland Restoration nor creation.

CONCLUSIONS

The land surface of the borings that are currently hydric are generally lower in elevation than those where the hydric indicators are deeper in the profile and that depth correlates to the proximity of ditches where the land surface has been artificially elevated by (1) construction of the ditches (2) cleaning out of the ditches over many years and/or (3) the common agricultural practice of "plowing in the same direction every year" which moves soil from the center of the field toward the edge exacerbating the elevation increase next to the ditches.

Based on a 1/25/17 site meeting with Todd Tugwell of the USACE, Mac Haupt of NCDWR and others, it was agreed:
(1) Areas where the depth to hydric soil indicator F3 or F19 was ≤10" below existing land surface would be considered as having potential for wetland restoration (these areas are outlined in red on the attached Figure 1 and labeled R). See attached B87 Soil Sampling point for an example profile description.
(2) Areas where the depth to hydric soil indicator F3 or F19 was >10" but ≤18" below existing land surface would be considered as having potential for wetland restoration, these areas are labeled R2. See attached B65 Soil Sampling point for an example profile description
(3) Areas where the depth to hydric soil indicator F3 or F19 was >18" but ≤22" below existing land surface have potential for wetland creation, these areas are labeled C. See attached B42 Soil Sampling point for an example profile description.
(4) Areas where the depth to hydric soil indicator F3 or F19 was >22" below existing land surface are not suitable for wetland creation or restoration.

TABLE 1 - DEPTH BELOW CURRENT LAND SURFACE TO HYDRIC SOIL INDICATOR

Boring #	Depth to F19 inches	Depth to F3 inches
1	skip	skip
2	skip	skip
3	12	24
4	NA	36
5	skip	skip
6	NA	>48
7	skip	skip
8	NA	>42
9	30	>44
10	NA	34
11	skip	
12	18	29
13	18	35
14	6	40
15	18	40
16	12	33
17	2	18
18	NA	12
19	NA	36
20	skip	
21	12	23
22	16	25
23	2	32
24	14	32
25	NA	21
26	14	27
27	2	22
28	15	32
29	NA	26
30	18	25
31	skip	
32	skip	
33	skip	
34	10	16
35	skip	
36	20	26
37	NA	19
38	8	28
39	skip	
40	18	30
41	NA	24
42	22	34
43	16	33
44	15	20

45		skip					
46		skip					
47		6		32			
48		16		22			
49		17		23			
50		NA		33			
51		16		18			
52		17		19			
53		skip					
54		4		28			
55		2		14			
56		14		22			
57		NA		22			
58		skip					
59		25		34			
60		24		28			
61		NA		24			
62		24		38			
63		NA		16			
64		24		32			
65		14		26			
66		2		22			
67		2		10			
68		4		9			
69		4		18			
70		14		18			
71		17		24			
72		NA		17			
73		24		36			
74		NA		16			
75		4		16			
76		6		20			
77		16		22			
78		10		15			
79		8		22			
80		16		20			
81		skip					
82		13		18			
83		2		22			
84		6		30			
85		NA		14			
86		2		15			
87		2		6			
88		6		10			
89		4		10			
90		6		14			
91		14		18			

92		14		24			
93		8		24			
94		18		24			
95		24		30			
96		12		21			
97		14		19			
98		2		12			
99		2		10			
100		NA		22			
101		24		32			
102		NA		12			
103		12		18			
104		14		18			
105		NA		12			
106		NA		22			
107		skip					
108		NA		30			
109		skip					
A		12		26			
B		12		18			
C		17		21			
D		NA		14			

SOIL

Sampling Point: B42

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-22	10YR 4/4	80	7.5YR 4/6	20			cl	
22-34	10YR 4/3	60	7.5YR 4/6	40	C	M	cl	F19 hydric soil indicator met
34-39+	10YR 5/1	60	10YR 3/6	40	C	M	c	F2 hydric soil indicator met

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

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☐ No ☑

Remarks:

SOIL

Sampling Point: B65

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 4/4	100					cl-scl	
14-22	10YR 4/3	70%	10YR 4/6	30%	C	M	cl	F19 hydric soil indicator met
22-36+	10YR 5/2	65%	10YR 3/6	40%	C	M	sl	F2 hydric soil indicator met

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

Hydric Soil Indicators:

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- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☐ No ☑

Remarks:

SOIL

Sampling Point: B87

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/3	100					cl-scl	
2-6	10YR 5/2	65	7.5YR 4/6	35	C	M	cl	F2 hydric soil indicator met
6-36+	2.5Y 5/1	60	7.5YR 4/6	40	C	M	c	

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

Hydric Soil Indicators:

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- ☐ Loamy Gleyed Matrix (F2)
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- ☐ Depleted Dark Surface (F7)
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- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
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- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
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Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

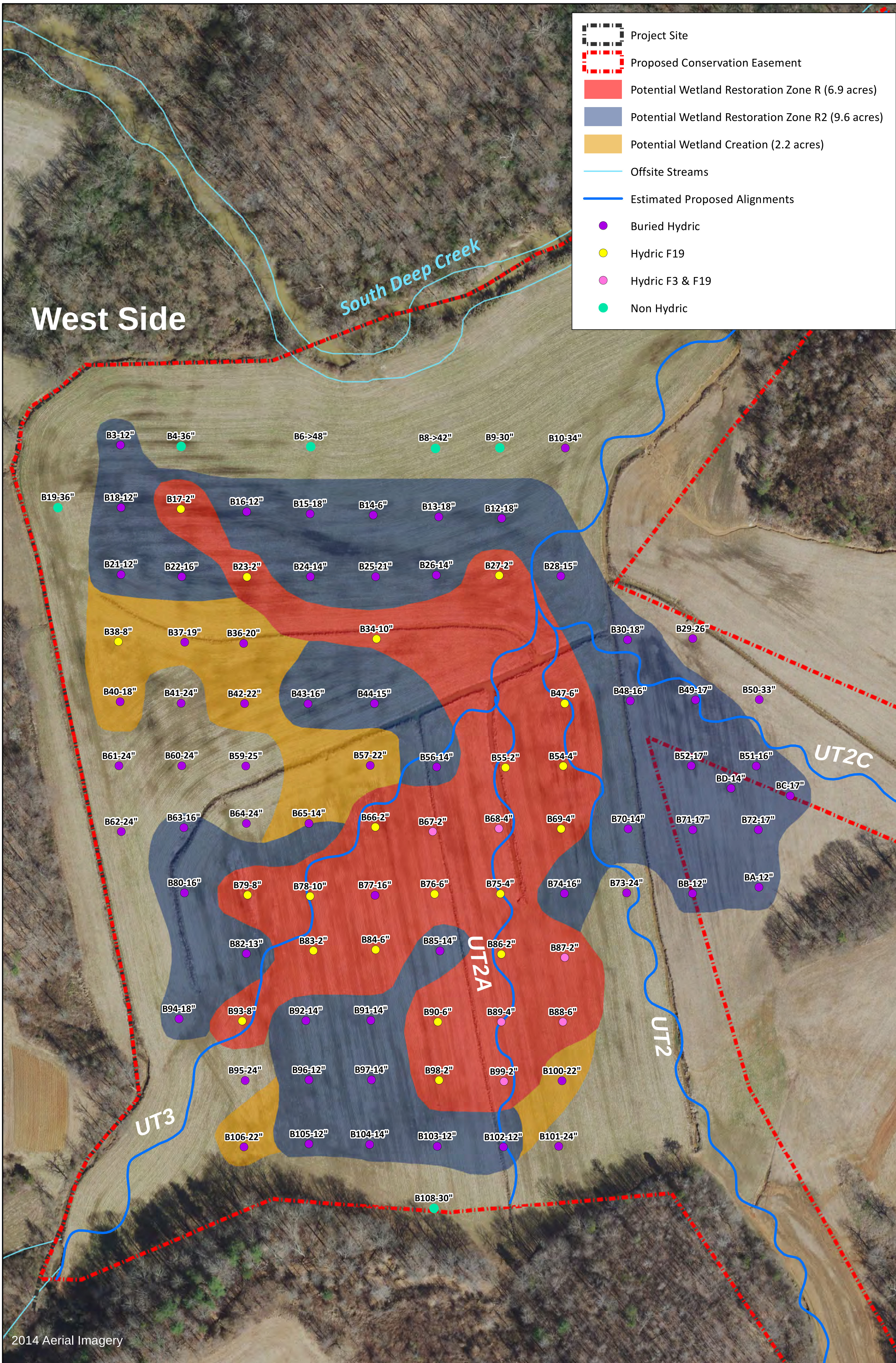
Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☑ No ☐

Remarks:



WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 1 - Surveyed Soil Boring Grid Map
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

Lone Hickory Mitigation Site
Master Credit Table

Stream Name	Reach	Management Activity	Credit Ratio		Start Sta	End Sta	Design Length (LF)	*1 Start Sta*	*1 End Sta*	*2 Start Sta*	*2 End Sta*	*3 Start Sta*	*3 End Sta*	Length impacted by crossings (LF)	Net Length (LF)	SMUs	Negative Buffer Width Adjustments	Positive Buffer Width Adjustments	Total Buffer Width Adjustments	Adjusted SMUs
UT1	Reach 1	R	1		101+39	111+05	966							0	**966**	966	0	137	137	**1,103**
UT1	Reach 2A	R	1		111+05	128+51	1,746							0	**1,746**	1,746	0	339	339	**2,085**
UT1	Reach 2B	R	1		128+51	142+19	1,368							0	**1,368**	1,368	0	188	188	**1,556**
UT1	Reach 3	R	1		142+19	158+60	1,641							0	**1,641**	1,641	0	313	313	**1,954**
UT1	Reach 4	P	10		158+60	165+19	659							0	**659**	66	0	0	0	**66**
UT1A		P	10		180+00	182+82	282							0	**282**	28	0	0	0	**28**
UT1B		P	10		190+00	191+24	124							0	**124**	12	0	0	0	**12**
UT2	Reach 1	R	1		200+00	206+23	623							0	**623**	623	0	108	108	**731**
UT2	Reach 2	R	1		206+23	217+03	1,080							0	**1,080**	1,080	0	122	122	**1,202**
UT2A		R	1		400+34	406+89	655							0	**655**	655	0	44	44	**699**
UT2B		R	1		500+00	507+84	784							0	**784**	784	0	109	109	**893**
UT3	Reach 1	R	1		300+13	307+92	779							0	**779**	779	-72	71	-1	**778**
UT3	Reach 2	R	1		307+92	319+51	1,159							0	**1,159**	1,159	0	10	10	**1,169**
UT3	Reach 3	R	1		319+51	327+15	764							0	**764**	764	0	124	124	**888**
							12,630								**12,630**	**11,671**	**-72**	**1,565**	**1,493**	**13,164**
														Eph. length	**0**					
														P/I Length	**12,630**					
																			Potential Total Credits	**13,164**

UT1

Reach	Treatment	Total Length	Ratio	Total Credits	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Net Credits
Reach 1	R	966	1.0	966	0.0	136.9	136.9	136.9
Reach 2A	R	1,746	1.0	1746	0.0	339.1	339.1	339.1
Reach 2B	R	1,368	1.0	1368	0.0	188.5	188.5	188.5
Reach 3	R	1,641	1.0	1641	0.0	312.9	312.9	312.9
Reach 4	P	659	10.0	66	0.0	0.0	0.0	0.0

Reach	Total Length	Start Sta	End Sta	Credit Addition/Reduction	Left Bank (ft)	Right Bank (ft)	Credits Gained/Lost (at 1:1)	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Notes
Reach 1	966	101+39	101+83	0.0%		44	0.0	0.0	61.7	61.7	
		101+83	109+26	6.0%		743	44.6				
		109+26	109+66	8.0%		+40	3.2				
	966	109+66	111+05	10.0%		139	13.9				
Reach 2A	1746	111+05	119+05	10.0%		800	80.0	0.0	164.5	164.5	
		119+05	122+63	8.0%		358	28.6				
		122+63	123+77	10.0%		114	11.4				
		123+77	125+25	8.0%		148	11.8				
	1746	125+25	128+51	10.0%		326	32.6				
Reach 2B	1368	128+51	130+31	10.0%		180	18.0	0.0	51.7	51.7	
		130+31	130+85	8.0%		54	4.3				
		130+85	132+02	6.0%		117	7.0				
		132+02	133+32	3.5%		130	4.6				
		133+32	137+79	0.0%		447	0.0				
		137+79	138+52	3.5%		73	2.6				
		138+52	138+69	6.0%		17	1.0				
		138+69	139+93	8.0%		124	9.9				
		139+93	140+33	6.0%		40	2.4				
		140+33	140+87	3.5%		54	1.9				
	1368	140+87	142+19	0.0%		132	0.0				
Reach 3	1641	142+19	143+14	0.0%		95	0.0	0.0	148.8	148.8	
		143+14	143+55	3.5%		41	1.4				
		143+55	144+21	6.0%		66	4.0				
		144+21	144+44	8.0%		23	1.8				
	1641	144+44	158+60	10.0%		1416	141.6				
Reach 4	659	158+60	165+19	0.0%		659	0.0	0.0	0.0	0.0	
	659										
Reach 1	966	101+39	101+83	0.0%	44		0.0	0.0	75.2	75.2	
		101+83	102+39	3.5%	56		2.0				
		102+39	102+62	0.0%	23		0.0				
		102+62	103+50	3.5%	88		3.1				
		103+50	103+94	6.0%	44		2.6				
		103+94	105+63	8.0%	169		13.5				
		105+63	106+42	10.0%	79		7.9				
		106+42	106+50	8.0%	8		0.6				
	966	106+50	111+05	10.0%	455		45.5				
Reach 2A	1746	111+05	128+51	10.0%	1746		174.6	0.0	174.6	174.6	
	1746										
Reach 2B	1368	128+51	142+19	10.0%	1368		136.8	0.0	136.8	136.8	
	1368										
Reach 3	1641	142+19	158+60	10.0%	1641		164.1	0.0	164.1	164.1	
	1641										
Reach 4	659	158+60	165+19	0.0%	659		0.0	0.0	0.0	0.0	
	659										

UT1A								
Reach	**Treatment**	**Total Length**	**Ratio**	**Total Credits**	**Credits Lost (at 1:1)**	**Credits Gained (at 1:1)**	**Total Credits Gained/Lost (at 1:1)**	**Net Credits**
UT1A	P	282	10.0	28	0.0	0.0	0.0	0.0

Reach	Total Length	Start Sta	End Sta	Credit Addition/Reduction	Left Bank (ft)	Right Bank (ft)	Credits Gained/Lost (at 1:1)	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Notes
UT1A	282	180+00	182+82	0.0%	282		0.0	0.0	0.0	0.0	
	282										
UT1A	282	180+00	182+82	0.0%		282	0.0	0.0	0.0	0.0	
	282										

Lone Hickory Mitigation Site
East Side - UT1B
Detailed Credit Calculation

UT1B								
Reach	**Treatment**	**Total Length**	**Ratio**	**Total Credits**	**Credits Lost (at 1:1)**	**Credits Gained (at 1:1)**	**Total Credits Gained/Lost (at 1:1)**	**Net Credits**
UT1B	P	124	10.0	12	0.0	0.0	0.0	0.0

Reach	Total Length	Start Sta	End Sta	Credit Addition/Reduction	Left Bank (ft)	Right Bank (ft)	Credits Gained/Lost (at 1:1)	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Notes
UT1B	124	190+00	191+24	0.0%	124		0.0	0.0	0.0	0.0	
	124										
UT1B	124	190+00	191+24	0.0%		124	0.0	0.0	0.0	0.0	
	124										

UT2								
Reach	**Treatment**	**Total Length**	**Ratio**	**Total Credits**	**Credits Lost (at 1:1)**	**Credits Gained (at 1:1)**	**Total Credits Gained/Lost (at 1:1)**	**Net Credits**
Reach 1	R	623	1.0	623	0.0	108.0	108.0	108.0
Reach 2	R	1,080	1.0	1080	0.0	121.8	121.8	121.8

Reach	Total Length	Start Sta	End Sta	Credit Addition/Reduction	Left Bank (ft)	Right Bank (ft)	Credits Gained/Lost (at 1:1)	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Notes
Reach 1	623	200+00	200+83	0.0%	83		0.0	0.0	54.0	54.0	
		200+83	206+23	10.0%	540		54.0				
	623										
Reach 2	1080	206+23	212+32	10.0%	609		60.9	0.0	60.9	60.9	
		212+32	217+03	0.0%	471		0.0				
	1080										
Reach 1	623	200+00	200+83	0		83	0.0	0.0	54.0	54.0	
		200+83	206+23	10.0%		540	54.0				
	623										
Reach 2	1080	206+23	212+32	10.0%		609	60.9	0.0	60.9	60.9	
		212+32	217+03	0.0%		471	0.0				
	1080	212+32									

UT2A								
Reach	**Treatment**	**Total Length**	**Ratio**	**Total Credits**	**Credits Lost (at 1:1)**	**Credits Gained (at 1:1)**	**Total Credits Gained/Lost (at 1:1)**	**Net Credits**
UT2A	R	655	1.0	655	0.0	44.0	44.0	44.0

Reach	Total Length	Start Sta	End Sta	Credit Addition/Reduction	Left Bank (ft)	Right Bank (ft)	Credits Gained/Lost (at 1:1)	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Notes
UT2A	655	400+34	400+87	0.0%	53		0.0	0.0	17.9	17.9	
		400+87	402+38	10.0%	151		15.1				
		402+38	402+54	8.0%	16		1.3				
		402+54	402+68	6.0%	14		0.8				
		402+68	402+87	3.5%	19		0.7				
		402+87	406+89	0.0%	402		0.0				
	655										
UT2A	655	400+34	400+87	0.0%		53	0.0	0.0	26.1	26.1	
		400+87	403+48	10.0%		261	26.1				
		403+48	406+89	0.0%		341	0.0				
	655										

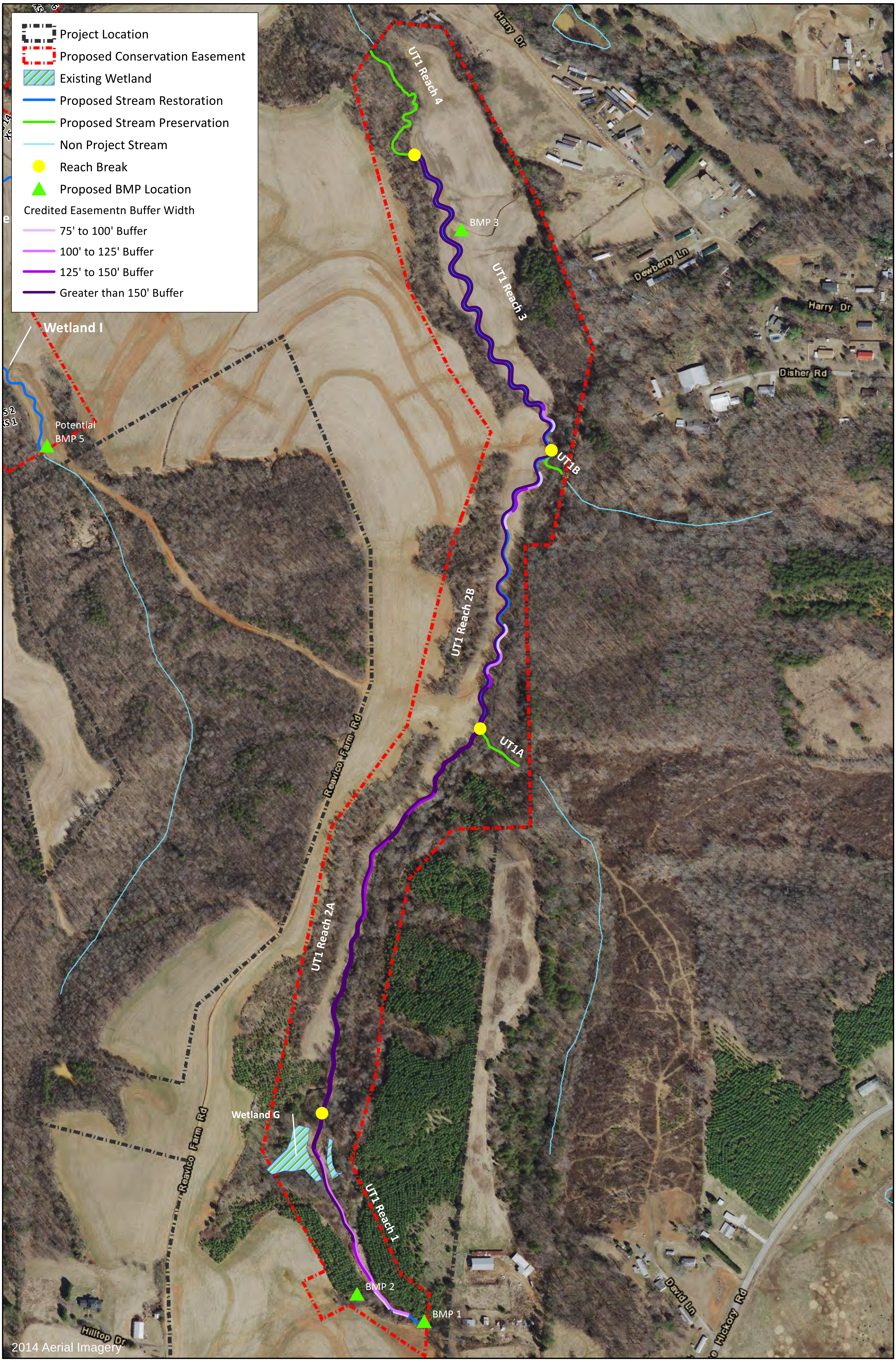
UT2B								
Reach	Treatment	Total Length	Ratio	Total Credits	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Net Credits
UT2B	R	784	1.0	784	0.0	109.1	109.1	109.1

Reach	Total Length	Start Sta	End Sta	Credit Addition/Reduction	Left Bank (ft)	Right Bank (ft)	Credits Gained/Lost (at 1:1)	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Notes
UT2B	784	500+00	500+14	0.0%	14		0.0	0.0	45.3	45.3	
		500+14	500+43	3.5%	29		1.0				
		500+43	500+67	6.0%	24		1.4				
		500+67	500+92	8.0%	25		2.0				
		500+92	504+65	10.0%	373		37.3				
		504+65	504+89	8.0%	24		1.9				
		504+89	505+06	6.0%	17		1.0				
		505+06	505+24	3.5%	18		0.6				
	784	505+24	507+84	0.0%	260		0.0				
UT2B	784	500+00	500+14	0.0%		14	0.0	0.0	63.8	63.8	
		500+14	506+22	10.0%		608	60.8				
		506+22	507+08	3.5%		86	3.0				
	784	507+08	507+84	0.0%		76	0.0				

UT3

Reach	Treatment	Total Length	Ratio	Total Credits	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Net Credits
Reach 1	R	779	1.0	779	-72.0	70.6	-1.4	-1.4
Reach 2	R	1,159	1.0	1159	0.0	10.0	10.0	10.0
Reach 3	R	764	1.0	764	0.0	123.6	123.6	123.6

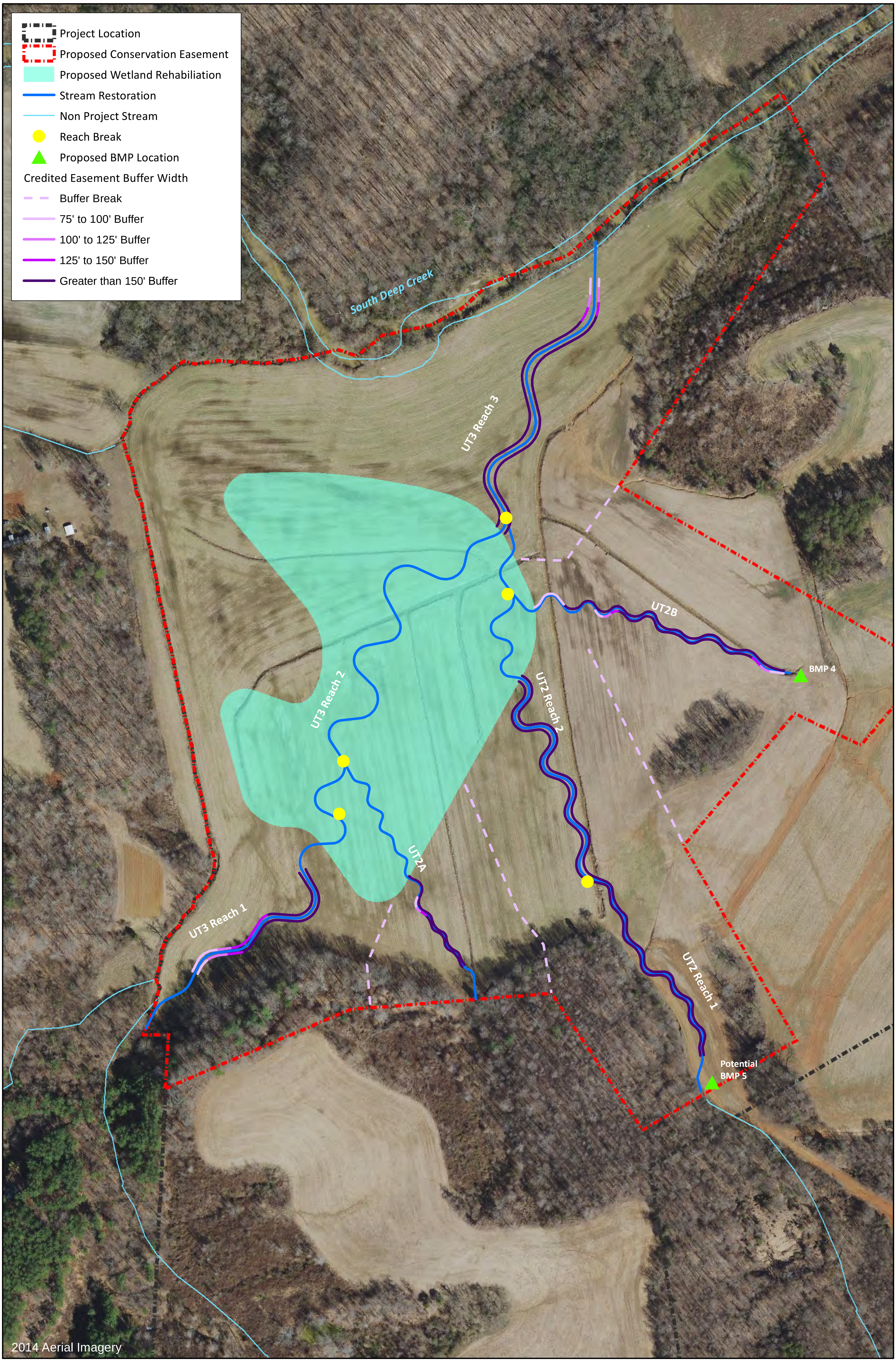
Reach	Total Length	Start Sta	End Sta	Credit Addition/Reduction	Left Bank (ft)	Right Bank (ft)	Credits Gained/Lost (at 1:1)	Credits Lost (at 1:1)	Credits Gained (at 1:1)	Total Credits Gained/Lost (at 1:1)	Notes
Reach 1	779	300+13	300+85	-50.0%	72		-36.0	-36.0	33.9	-2.1	
		300+85	301+74	0.0%	89		0.0				
		301+74	302+43	3.5%	69		2.4				
		302+43	302+75	6.0%	32		1.9				
		302+75	303+92	8.0%	117		9.4				
		303+92	305+94	10.0%	202		20.2				
	779	305+94	307+92	0.0%	198		0.0				
Reach 2	1159	307+92	319+01	0.0%	1109		0.0	0.0	5.0	5.0	
		319+01	319+51	10.0%	50		5.0				
	1159										
Reach 3	764	319+51	324+99	10.0%	548		54.8	0.0	61.2	61.2	
		324+99	325+43	8.0%	44		3.5				
		325+43	325+71	6.0%	28		1.7				
		325+71	326+05	3.5%	34		1.2				
	764	326+05	327+15	0.0%	110		0.0				
Reach 1	779	300+13	300+85	-50.0%		72	-36.0	-36.0	36.7	0.7	
		300+85	301+74	0.0%		89	0.0				
		301+74	302+13	3.5%		39	1.4				
		302+13	302+65	6.0%		52	3.1				
		302+65	302+99	8.0%		34	2.7				
		302+99	305+94	10.0%		295	29.5				
	779	305+94	307+92	0.0%		198	0.0				
Reach 2	1159	307+92	319+01	0.0%		1109	0.0	0.0	5.0	5.0	
	1159	319+01	319+51	10.0%		50	5.0				
Reach 3	764	319+51	325+26	10.0%		575	57.5	0.0	62.4	62.4	
		325+26	325+55	8.0%		29	2.3				
		325+55	325+88	6.0%		33	2.0				
		325+88	326+05	3.5%		17	0.6				
	764	326+05	327+15	0.0%		110	0.0				



0 250 500 Feet

Additional Credits from Stream Buffer Widths - East Side
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC



WILDLANDS ENGINEERING

Additional Credits from Stream Buffer Widths - West Side
Lone Hickory Mitigation Site
Yadkin River Basin (03040101)

Yadkin County, NC

APPENDIX 10
FINANCIAL ASSURANCE

Appendix 10 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.