

Appendix H: Proposed Refinements Water Resources Technical Report

Durham-Orange Light Rail Transit Project



October 2018

Table of Contents

1. Introduction	1
1.1 Description of the Proposed Refinements	1
2. Legal and Regulatory Framework	1
2.1 Agency Jurisdiction and Coordination	2
3. Methodology and Qualifications.....	2
4. Affected Environment.....	2
4.1 Streams.....	2
4.2 Wetlands	3
5. Environmental Consequences.....	4
5.1 Impact Calculation Methodology	8
5.2 Streams.....	9
5.3 Wetlands	9
6. Mitigation.....	10

List of Tables

Table 5-1: Summary of Change in Estimated Stream Impacts between Previous Design and Proposed Refinements	4
Table 5-2: Summary of Change in Estimated Wetland Impacts between Previous Design and Proposed Refinements	6
Table 5-3: Summary of Change in Estimated Pond Impacts between Previous Design and Proposed Refinements	7
Table 5-4: Summary of Change in Estimated Riparian Buffer Impacts between Previous Design and Proposed Refinements	7
Table 5-5: Summary of Change in Estimated Floodway and Floodplain Impacts between Previous Design and Proposed Refinements.....	7

List of Attachments

- Attachment H.1: Preliminary Jurisdictional Determination - Package Addendum No. 7
- Attachment H.2: Qualifications of Contributors
- Attachment H.3: Water Resource Impact Map Updates

List of Acronyms and Abbreviations

Acronym/Abbreviation	Definition
DEIS	Draft Environmental Impact Statement
D-O LRT	Durham-Orange Light Rail Transit
DWR	Division of Water Resources
EA	Environmental Assessment
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
JD	Jurisdictional Determination
LF	linear feet
NCCU	North Carolina Central University
NEPA	National Environmental Policy Act
ROD	Record of Decision
ROMF	Rail Operations and Maintenance Facility
RPW	Relatively Permanent Water
US	United States
USACE	United States Army Corps of Engineers

1. Introduction

The previous National Environmental Policy Act (NEPA) documentation for the Durham-Orange Light Rail Transit (D-O LRT) Project, including the Draft Environmental Impact Statement (DEIS) (2015), Final Environmental Impact Statement/Record of Decision (FEIS/ROD) (2016), Supplemental Environmental Assessment (EA) for the North Carolina Central University (NCCU) Station Refinement, and Amended ROD (2016), evaluated the effects of the light rail project based on a preliminary engineering design referred to herein as the Previous Design. Since the Amended ROD was issued, the engineering design has advanced, resulting in proposals to refine or modify certain physical and operational aspects of the proposed action. These Proposed Refinements to the Previous Design would modify the limits of disturbance of the D-O LRT Project and require additional evaluations of effects. This report supplements all prior NEPA documentation of water resources within the D-O LRT Project corridor and incorporates the prior NEPA documentation by reference.

1.1 Description of the Proposed Refinements

The Proposed Refinements are based on:

- Advancements in design since the Amended ROD;
- Responses to public comments and stakeholder feedback on the previous NEPA documentation and the Amended ROD;
- Recommendations from the Transit Oriented Development grant study to optimize platform locations for future development; and
- Recommendations from the updated Durham County and Orange County transit plans.

The major refinements discussed in this Supplemental EA include:

- Modification to the station platform lengths;
- Adjustments to the location and configuration of the station platforms, as well as corresponding refinements to the track alignments;
- Modifications to the planned park-and-ride lots;
- Inclusion of bicycle and pedestrian facilities throughout the project;
- Changes in the locations and number of Traction Power Substations;
- Reconfiguration of the Rail Operations and Maintenance Facility (ROMF) and rail yard;
- Using single-track configuration for the segment that includes the New Hope Creek and Sandy Creek bridge crossings;
- Revision to the alignment to pass underneath the intersection of University Drive and Shannon Road, rather than cross through the intersection at grade;
- Elevation of the alignment on Erwin Road;
- Inclusion of drainage, grading, and site preparation throughout the project; and
- Addition of a new station at Blackwell/Mangum Streets and a pedestrian/bicycle signature civic space that would span Pettigrew Street, the light rail tracks, NCCR tracks, and Ramseur Street approximately mid-block between Blackwell Street and Mangum Street.

2. Legal and Regulatory Framework

The groundwater, surface waters and wetlands, and floodplains and floodways legal and regulatory framework identified in Appendix K22 of the DEIS remains relevant to the water resources potentially affected by the Proposed Refinements.

2.1 Agency Jurisdiction and Coordination

The agency jurisdiction and coordination discussion in Appendix K22 of the DEIS describes the past agency coordination on water resources impacts and mitigation for the D-O LRT Project. Appendix K22 of the DEIS includes the United States Army Corps of Engineers (USACE) Jurisdictional Determination (JD). The USACE updated the JD in October 2016 for the NCCU Station Refinement, and additional field investigations commenced in mid-2017. The field efforts resulted in several updates to the jurisdictional mapping, which are documented in the request for an update to the approved JD provided at **attachment H.1**.

Agency coordination is ongoing in anticipation of the D-O LRT Project's scheduled construction in 2020. A February 20, 2018, agency meeting was held to provide the USACE, Environmental Protection Agency (EPA), and North Carolina Division of Water Resources (DWR) an opportunity to get reacquainted with the project and begin Section 404/401 permitting coordination. Regular coordination meetings will be held leading up to an anticipated fall 2018 Section 404/401 permit application.

3. Methodology and Qualifications

To evaluate the effects of the Proposed Refinements on water resources, field reviews were conducted in selected areas that were outside the JD boundary of the Previous Design and other areas needing further field investigation.

The qualifications of the environmental scientists contributing to the field work and documentation are detailed at **attachment H.2**. Methodologies for locating wetlands and streams are outlined in the DEIS Appendix K22 Section 3 and Appendix K13 Section 2.7. Field reviews were conducted along the proposed D-O LRT Project on the following dates: September 22, 2017; and February 1, 2, and 9, 2018. Field investigators reviewed the following locations, which are in the Proposed Refinements footprint:

- Additional bicycle/pedestrian facilities throughout the corridor
- Leigh Village Station refinement
- Gateway Station alignment refinement
- East side of United States (US) 15-501 Business

Environmental staff investigated the areas of the Proposed Refinements to evaluate the effects of the project changes on water resources.

4. Affected Environment

In addition to the water resources described in the previous NEPA documentation, field reviews resulted in the identification of two stream extensions and one wetland extension. The stream extensions are for Stream LC and Stream V. The wetland extension is for Wetland S. These water resources were identified in the DEIS JD study area. The extensions of these water resources are identified and mapped in the request for an update to the Approved JD provided in **attachment H.1**. Field verification visits will be arranged with the USACE and DWR to determine jurisdictional features and buffer determinations in the fall/winter of 2018/2019.

4.1 Streams

In summer 2016, GoTriangle identified three streams in the project area that were not included in the NEPA documentation for the Previous Design: Stream ZZ, Stream LC (west of US 15-501 Business), and Stream AS. These streams are described as follows.

Stream ZZ is a seasonal Relatively Permanent Water (RPW) with intermittent flow and is located south of Celeste Circle and north of NC 54. Stream ZZ begins at a pipe culvert and flows west and out of the study area.

Stream LC is a seasonal RPW with intermittent flow and is located east of the Duke Lemur Center, west of US 15/501 and south of Cameron Boulevard. Stream LC begins off site to the west and flows east to a stormwater pipe culvert under US 15/501.

Stream AS begins at a pipe culvert under Research Drive and flows west and into another pipe culvert south of Erwin Road. This feature was originally thought to be jurisdictional, but after field verification with the USACE found to be entirely stormwater driven (ephemeral) and non-jurisdictional. Stream AS was therefore removed from the Request for Jurisdictional Determination.

Delineated streams found within the areas of the Proposed Refinements during the September 2017, February 2018, and July 2018 field reviews are described below.

Stream V: The study area for the Proposed Refinements includes additional lengths of Stream V that were outside of the Previous Design study area. The extended length of Stream V in the affected environment is 900 linear feet east of George King Road. This length of Stream V is a seasonal RPW with intermittent flow.

Stream N: The study area for the Proposed Refinements includes additional lengths of Stream N that were inside the Previous Design study area. The extended length of Stream N in the affected environment is 30 linear feet within the boundary of the ROMF. This length of Stream N is a seasonal RPW with intermittent flow.

Stream NN: The study area for the Proposed Refinements includes additional lengths of Stream NN that were inside the Previous Design study area. The extended length of Stream NN in the affected environment is 328 linear feet within the boundary of the ROMF. This length of Stream NN is a seasonal RPW with perennial flow.

Stream LC: The study area for the Proposed Refinements includes additional lengths of Stream LC that were outside of the Previous Design study area. The extended length of Stream LC is 150 linear feet located east of US 15-501 Business, beginning at the outfall of the pipe culvert and continuing east of the project. The extended length of Stream LC is a seasonal RPW with intermittent flow.

4.2 Wetlands

In summer 2016, GoTriangle identified **Wetland GC**, which was not included in the NEPA documentation for the Previous Design. Wetland GC is a palustrine emergent wetland that is located south of NC 54 on the grounds of the UNC Finley Golf Course. This emergent wetland is located adjacent to a fairway and a water hazard. This wetland area has not been maintained and has been preserved by the golf course as a natural area. One delineated wetland, **Wetland S**, was found within and adjacent to the areas of the Proposed Refinement during the September 2017 and February 2018 field reviews. The study area for the Proposed Refinements includes an additional area of Wetland S of 0.057 acre. Wetland S, a forested wetland, was previously reported in the DEIS Appendix K21, and the footprint of Wetland S has been expanded based on the September 2017 field reviews.

5. Environmental Consequences

This section provides a comparison of the water resources impacts of the Previous Design to the Proposed Refinements. The difference between the impacts disclosed for the Previous Design and Proposed Refinements is noted in the tables.

In this section:

- **Table 5-1** summarizes the change in estimated stream impacts between the Previous Design and Proposed Refinements. Two additional, extended stream features are anticipated to be impacted by the project: Stream V and Stream LC.
- **Table 5-2** summarizes the change in estimated wetland impacts between the Previous Design and Proposed Refinements. One extended wetland, Wetland S, is anticipated to be impacted by the project.
- **Table 5-3** summarizes the change in pond impacts between the Previous Design and Proposed Refinements.
- **Table 5-4** summarizes the change in estimated riparian buffer impacts between the Previous Design and Proposed Refinements.
- **Table 5-5** summarizes the change in estimated floodway and floodplain impacts between the Previous Design and Proposed Refinements.

New features are noted in the tables with bold text and items in italics indicate a change in impacts between the Previous Design and Proposed Refinements. In the water resource impact figures located in **attachment H.3**, this change is noted with a green dot.

Table 5-1: Summary of Change in Estimated Stream Impacts between Previous Design and Proposed Refinements

Jurisdictional Feature	Stream Type	Previous Design LF (acre)	D-O LRT Project with Proposed Refinements LF (acre)	Change Resulting from the Proposed Refinements LF (acre)
<i>Stream WW (Chapel Branch)</i>	<i>Perennial</i>	85 (0.024)	100 (0.024)	15 (0.00)
<i>Stream TT</i>	<i>Perennial</i>	258 (0.068)	208 (0.055)	-50 (-0.013)
<i>Stream SS</i>	<i>Intermittent</i>	352 (0.032)	341 (0.031)	-11 (-0.001)
<i>Stream RR</i>	<i>Perennial</i>	28 (0.004)	61 (0.009)	33 (0.005)
<i>Stream QQ</i>	<i>Perennial</i>	0 (0)	32 (0.004)	32 (0.004)
Stream LLL	Intermittent	90 (0.004)	90 (0.004)	0 (0)
Stream KKK	Intermittent	23 (0.002)	23 (0.002)	0 (0)
<i>Stream EE</i>	<i>Perennial</i>	0 (0)	12 (0.006)	12 (0.006)
<i>Stream V</i>	<i>Intermittent</i>	322 (0.042)	617 (0.057)	295 (0.015)
<i>Stream ZZ</i>	<i>Perennial</i>	0 (0)	38 (0.003)	38 (0.003)
<i>Stream PP</i>	<i>Intermittent</i>	47 (0.005)	51 (0.005)	4 (0)
Stream N	Intermittent	*566 (0.058)	*596 (0.058)	30 (0.00)
Stream NN	Perennial	*186 (0.018)	*514 (0.048)	328 (0.03)
<i>Stream MM</i>	<i>Perennial</i>	138 (0.029)	107 (0.022)	-31 (-0.007)

Table 5-1 (cont'd): Summary of Change in Estimated Stream Impacts between Previous Design and Proposed Refinements

Jurisdictional Feature	Stream Type	Previous Design LF (acre)	D-O LRT Project with Proposed Refinements LF (acre)	Change Resulting from the Proposed Refinements LF (acre)
<i>Stream LL</i>	<i>Perennial</i>	74 (0.023)	88 (0.028)	15 (0.005)
<i>Stream R</i>	<i>Intermittent</i>	766 (0.06)	716 (0.056)	-49 (-0.003)
<i>Stream H</i>	<i>Intermittent</i>	157 (0.017)	40 (0.004)	-117 (-0.013)
<i>Stream G</i>	<i>Intermittent</i>	53 (0.004)	74 (0.006)	21 (0.002)
<i>Stream F</i>	<i>Perennial</i>	0 (0)	68 (0.02)	68 (0.02)
<i>Stream E</i>	<i>Intermittent</i>	15 (0.001)	39 (0.003)	24 (0.002)
<i>Stream D</i>	<i>Intermittent</i>	42 (0.004)	35 (0.003)	-7 (-0.001)
<i>Stream B</i>	<i>Perennial</i>	53 (0.004)	9 (0.001)	-44 (-0.003)
<i>Stream A</i>	<i>Perennial</i>	51 (0.011)	190 (0.041)	139 (0.03)
<i>Stream GG</i>	<i>Intermittent</i>	0 (0)	67 (0.006)	67 (0.006)
<i>Stream GG</i>	<i>Intermittent</i>	0 (0)	7 (<0.001)	7 (<0.001)
<i>Stream HH</i>	<i>Perennial</i>	0 (0)	49 (0.005)	49 (0.005)
<i>Stream J (Sandy Creek)</i>	<i>Perennial</i>	0 (0)	60 (0.012)	60 (0.012)
Stream LC	<i>Perennial</i>	0 (0)	150 (0.009)	150 (0.009)
<i>Stream J (Sandy Creek)</i>	<i>Perennial</i>	0 (0)	8 (<0.001)	8 (<0.001)
<i>Stream II</i>	<i>Intermittent</i>	0 (0)	13 (0.001)	13 (0.001)
<i>Stream J (Sandy Creek)</i>	<i>Perennial</i>	2 (0.001)	60 (0.031)	58 (0.031)
<i>Stream J (Sandy Creek)</i>	<i>Perennial</i>	0 (0)	40 (0.023)	40 (0.023)
<i>Stream JJ</i>	<i>Perennial</i>	32 (0.008)	26 (0.007)	-6 (-0.001)
<i>Stream KK</i>	<i>Perennial</i>	73 (0.019)	93 (0.017)	20 (-0.002)
Totals:		*3,413 (0.438)	4,626 (0.595)	1,213 (0.157)

Notes: The Previous Design impacts are based on the Basis for Engineering Design (Appendix L of the DEIS) for the D-O LRT Project and the JD dated October 2016 (Appendix G of the DEIS). The Proposed Refinements for water resource impacts are based on slope stake limits of design as of February 26, 2018. JDs are based on the last October 2016 resubmittal. Extensions of Stream V, Stream N, Stream NN and Stream LC have not been verified with the USACE yet.

All impacts are anticipated to be permanent. All types of impacts are not defined at this stage of the design.

*Impacts from the light rail alignment and the ROMF are combined and represent impacts on the east and west side of I-40. The D-O LRT Project alignment in the DEIS had stream impacts on the east side of I-40. DEIS total stream impact calculations show a total of 3,413 LF (0.438) which includes 566 (0.058), and 186 (0.018) for Streams N and NN, respectively, which includes impacts on the east side of I-40.

Negative values in the "Change Resulting from the Proposed Refinements" column indicate a reduction in impact.

Items in italics indicate changes in impacts between the Previous Design and Proposed Refinements.

Items in bold indicate Proposed Refinements impacts to a new feature and added features not affected by the Previous Design.

Table 5-2: Summary of Change in Estimated Wetland Impacts between Previous Design and Proposed Refinements

Jurisdictional Feature	Wetland Type	Previous Design (acre)	D-O LRT Project with Proposed Refinements (acre)	Change Resulting from the Proposed Refinements (acre)
<i>Wetland YY</i>	<i>Emergent</i>	<i>0.031</i>	<i>0.029</i>	<i>-0.002</i>
<i>Wetland GG</i>	<i>Forested</i>	<i>0.093</i>	<i>0.080</i>	<i>-0.013</i>
<i>Wetland Y</i>	<i>Forested</i>	<i>0.009</i>	<i>0.018</i>	<i>0.009</i>
<i>Wetland NNN</i>	<i>Emergent</i>	<i>0.325</i>	<i>0.304</i>	<i>-0.021</i>
<i>Wetland S</i>	<i>Forested</i>	<i>*0.10</i>	<i>0.157</i>	<i>0.057</i>
Wetland T	Scrub/shrub	0.077	0.077	0
Wetland R	<i>Forested</i>	<i>0</i>	<i>0.009</i>	<i>0.009</i>
<i>Wetland W</i>	<i>Forested</i>	<i>0.001</i>	<i>0.002</i>	<i>0.001</i>
<i>Wetland V</i>	<i>Forested</i>	<i>0.007</i>	<i>0.003</i>	<i>-0.004</i>
<i>Wetland E</i>	<i>Forested</i>	<i>0.003</i>	<i>0.004</i>	<i>0.001</i>
Wetland FF	<i>Forested</i>	<i>0</i>	<i>0.004</i>	<i>0.004</i>
Wetland A	<i>Forested</i>	<i>0</i>	<i>0.001</i>	<i>0.001</i>
<i>Wetland A</i>	<i>Forested</i>	<i>0.011</i>	<i>0.002</i>	<i>-0.009</i>
<i>Wetland TTT</i>	<i>Forested</i>	<i>0</i>	<i>0.005</i>	<i>0.005</i>
<i>Wetland XXX</i>	<i>Emergent</i>	<i>0.001</i>	<i>0</i>	<i>-0.001</i>
Totals:		*0.558	0.697	0.139

Note: The Previous Design impacts are based on the Basis for Engineering Design (Appendix L of the DEIS) for the D-O LRT Project and the JD dated October 2016 (Appendix G of the DEIS). The Proposed Refinements for water resource impacts are based on slope stake limits of design as of February 26, 2018. JDs are based on the last October 2016 resubmittal. The expansion of Wetland S is currently unverified with USACE.

*Wetland S was reported as an impact in DEIS Appendix K21 but not in DEIS Appendix K22.

Negative values in the "Change Resulting from the Proposed Refinements" column indicate a reduction in impact.

Items in italics indicate changes in impacts between the Previous Design and Proposed Refinements.

Items in bold indicate Proposed Refinements impacts to a feature not affected by the Previous Design, but reported in DEIS Appendix K22.

Table 5-3: Summary of Change in Estimated Pond Impacts between Previous Design and Proposed Refinements

Jurisdictional Feature	Type of Impact Area	Previous Design (acre)	D-O LRT Project with Proposed Refinements (acre)	Change Resulting from the Proposed Refinements (acre)
Pond C	Open Water	0.005	<0.001	-0.005
Totals:		0.005	<0.001	-0.005

Note: Negative values in the "Change Resulting from the Proposed Refinements" column indicate a reduction in impact.

Table 5-4: Summary of Change in Estimated Riparian Buffer Impacts between Previous Design and Proposed Refinements

Type of Impact Area	Previous Design (acre)	D-O LRT Project with Proposed Refinements (acre)	Change Resulting from the Proposed Refinements (acre)
Zone One	4.97	5.91	+0.94
Zone Two	4.10	4.42	+0.32

Note: Unverified stream buffer Zones One and Two for Stream V and Stream LC are included in Proposed Refinements totals, and are reflected in the "Change Resulting from the Proposed Refinements" column. These totals are subject to change after streams and buffers are verified by USACE/DWR during permitting.

Table 5-5: Summary of Change in Estimated Floodway and Floodplain Impacts between Previous Design and Proposed Refinements

Stream Name	Type of Impact Area	Previous Design (acre)	D-O LRT Project with Proposed Refinements (acre)	Change Resulting from the Proposed Refinements (acre)
<i>YY (Meeting of the Waters)</i>	<i>100-Year Floodplain</i>	<i>0.007</i>	<i>0.196</i>	<i>0.189</i>
<i>WW (Chapel Branch)</i>	<i>100-Year Floodplain</i>	<i>0.36</i>	<i>0.428</i>	<i>0.068</i>
<i>TT</i>	<i>500-Year Floodplain</i>	<i>0.079</i>	<i>0.099</i>	<i>0.020</i>
<i>Y (Little Creek)</i>	<i>100-Year Floodplain</i>	<i>0.603</i>	<i>1.418</i>	<i>0.815</i>
<i>T (New Hope Creek)</i>	<i>Floodway</i>	<i>0.013</i>	<i>0.012</i>	<i>-0.001</i>
<i>T (New Hope Creek)</i>	<i>100-Year Floodplain</i>	<i>0.015</i>	<i>0.056</i>	<i>0.041</i>
<i>T (New Hope Creek)</i>	<i>500-Year Floodplain</i>	<i>0.001</i>	<i>0.010</i>	<i>0.009</i>
<i>J (Sandy Creek)</i>	<i>Floodway</i>	<i>0.008</i>	<i>0.011</i>	<i>0.003</i>

**Table 5-5 (cont'd): Summary of Change in Estimated Floodway and Floodplain Impacts
between Previous Design and Proposed Refinements**

Stream Name	Type of Impact Area	Previous Design (acre)	D-O LRT Project (acre) with Proposed Refinements	Change Resulting from the Proposed Refinements (acre)
<i>J (Sandy Creek)</i>	<i>100-Year Floodplain</i>	<i>0.009</i>	<i>0.005</i>	<i>-0.004</i>
<i>J (Sandy Creek)</i>	<i>500-Year Floodplain</i>	<i>0.005</i>	<i>0.001</i>	<i>-0.004</i>
F	Floodway	0.186	0.186	0.000
<i>F</i>	<i>100-Year Floodplain</i>	<i>0.116</i>	<i>0.094</i>	<i>-0.022</i>
<i>F</i>	<i>500-Year Floodplain</i>	<i>0.044</i>	<i>0.027</i>	<i>-0.017</i>
<i>J (Sandy Creek)</i>	<i>Floodway</i>	<i>0.006</i>	<i>0.128</i>	<i>0.122</i>
<i>J (Sandy Creek)</i>	<i>100-Year Floodplain</i>	<i>0.008</i>	<i>0.300</i>	<i>0.292</i>
<i>J (Sandy Creek)</i>	<i>500-Year Floodplain</i>	<i>0.001</i>	<i>0.084</i>	<i>0.083</i>
<i>J (Sandy Creek)</i>	<i>Floodway</i>	<i>0.667</i>	<i>0.263</i>	<i>-0.404</i>
<i>J (Sandy Creek)</i>	<i>100-Year Floodplain</i>	<i>5.302</i>	<i>1.232</i>	<i>-4.069</i>
<i>J (Sandy Creek)</i>	<i>500-Year Floodplain</i>	<i>0.248</i>	<i>0.392</i>	<i>0.144</i>
Totals:	100-Year Floodplain	6.420	3.729	-2.691
	500-Year Floodplain	0.378	0.612	0.234
	Floodway	0.880	0.601	-0.279

Note: The Previous Design impacts are based on the Basis for Engineering Design (Appendix L of the DEIS) for the D-O LRT Project and the JD dated October 2016 (Appendix G of the DEIS). The Proposed Refinements for water resource impacts are based on slope stake limits of limits as design as of February 26, 2018.

All impacts are anticipated to be permanent. All types of impacts are not defined at this stage of the design.

Negative values in the “Change Resulting from the Proposed Refinements” column indicate a reduction in impact.

Items in italics indicate changes in impacts between the Previous Design and Proposed Refinements.

5.1 Impact Calculation Methodology

The Previous Design’s water resource impacts were calculated based on preliminary cut and fill limits as detailed in Appendix K22, Section 5.2 of the DEIS. The Previous Design’s water resource impacts are tabulated in Appendix K22, Tables 4 through 8, of the DEIS, and the extent of impacts are mapped in the DEIS Appendix A, Figures 2A through 2M. Water resources impact calculations for the Proposed Refinements were estimated based on the roadway cut and fill limits, track cut and fill limits, and estimated civil site work from the current D-O LRT Project design as of mid-February 2018. In areas where the alignment crosses major streams on an aerial structure, the plans for Proposed Refinements (see **appendix A** of the Supplemental EA for the Proposed Refinements, Basis for Engineering Design) were used to determine the impact of the bridge structure on water resource features.

The following is assumed in the calculations for water resource features impacted from aerial structures, as shown on plans for the Proposed Refinements (see **appendix A** of the Supplemental EA for the Proposed Refinements, Basis for Engineering Design):

- 24-foot x 24-foot sub-interior bent footings are represented by 47-foot x 47-foot footprint areas at the Meeting of the Waters aerial crossing;

- 10-foot x 34-foot sub-interior bent footings are represented by 32.5-foot x 46.5-foot footprint areas at the Meeting of the Waters aerial crossing;
- 5.4-foot-diameter drilled piers are represented as 8.5-foot-diameter footprint areas at the Meeting of the Waters aerial crossing;
- 10-foot x 26.5-foot sub-interior bent footings are represented by 32-foot x 49-foot footprint areas at the Little Creek aerial crossing;
- 1.4-foot-diameter driven piles are represented by 2.5-foot-diameter footprints at the New Hope Creek aerial crossing;
- 8-foot x 29.5-foot sub-interior bent footings are represented by 31.5-foot x 43.5-foot areas at the Sandy Creek aerial crossing (ST 8);
- 4-foot x 31-foot sub-end bent cap areas are represented by end bents areas across all aerial crossings; and
- Hexagonal sub-interior bent footings (200 square feet) are represented by 1,485-square-foot areas at the Sandy Creek aerial crossing (ST 8A).

5.2 Streams

Stream V was previously reported in the DEIS Appendix K22 and approximately 322 linear feet (0.042 acre) of Stream V would be affected by the at-grade crossing of the light rail in the Previous Design. In 2018, additional stream channel was delineated and extended Stream V south and downstream. Currently, approximately 617 linear feet of Stream V is located in the Proposed Refinements and would be affected by the light rail alignment in the Leigh Village Station area and the Leigh Village Station road network.

Stream N was previously reported in the DEIS Appendix K22 and approximately 566 linear feet (0.058 acre) of Stream N would be affected by the ROMF in the Previous Design. In July 2018, additional stream channel was delineated and extended Stream N upstream west to an access road pipe. This new extended length is located behind the existing cell tower. Currently, approximately 596 linear feet of Stream N is located in the Proposed Refinements and would be affected by the light rail alignment and ROMF.

Stream NN was previously reported in the DEIS Appendix K22 and approximately 186 linear feet (0.018 acre) of Stream NN would be affected by the ROMF in the Previous Design. In July 2018, additional stream channel was delineated and extended Stream NN throughout the residential property connecting the previous two delineated stream channel parts. Currently, approximately 514 linear feet of Stream NN is located in the Proposed Refinements and would be affected by the light rail alignment and ROMF.

Stream LC was previously reported and located only on the west side of US 15-501 Business where there were no impacts from the Previous Design. Effects to Stream LC have been extended downstream, east side of US 15-501 Business, and approximately 150 linear feet (0.009 acre) of Stream LC would be affected by the Proposed Refinements.

5.3 Wetlands

Wetland S was previously reported in DEIS Appendix K21. Approximately 0.10 acre of Wetland S would be affected by the Previous Design. An additional area of 0.057 acre was delineated within the area of the Proposed Refinements, creating a new total affected area of approximately 0.157 acre.

6. Mitigation

Water resource commitments would avoid and minimize impacts to aquatic resources, compensatory mitigation measures would be developed with agencies (USACE and DWR), and necessary permits would be obtained. For a detailed list of commitments, please refer to the mitigation section identified in Appendix K22 of the DEIS and Section 4.8 of the Amended ROD.

Attachments

This page intentionally left blank.

**Attachment H.1: Preliminary Jurisdictional Determination
Package Addendum No. 7**

This page intentionally left blank.



May 30, 2018

Mr. Ross Sullivan
U.S. Army Corps of Engineers
Raleigh Regulatory Field Office
3331 Heritage Trade Drive, Suite 105
Wake Forest, NC 27587

**SUBJECT: Request for Jurisdictional Determination-Addendum #7
Durham-Orange Light Rail Transit Project
Durham and Orange Counties, North Carolina
USACE Action ID SAW-2012-00957**

Dear Mr. Sullivan,

HDR Engineering, Inc. of the Carolinas (HDR) is providing environmental and engineering support to GoTriangle for the proposed Durham to Orange Light Rail Transit (D-O LRT) project. GoTriangle has previously requested and received written verification from the U.S. Army Corps of Engineers (USACE) of the location and extent of jurisdictional waters of the U.S. located within the project's preferred alignment corridor. The USACE issued the original Notification of Jurisdictional Determination for the D-O LRT project on May 12, 2014 (USACE Action ID SAW-2012-00957). Additional study area and mapping modifications were made in 2015 and 2016, as noted in the most recent Notification of Jurisdictional Determination, dated October 12, 2016.

Based on current project design refinements, additional areas have been added to the study area and are being provided to you in this letter and the attached figures. On behalf of GoTriangle, HDR is requesting an update to the Approved Jurisdictional Determination for the D-O LRT project, to include the additional jurisdictional waters identified within the expanded study area. A complete set of revised figures depicting the expanded study area is attached for your use.

Background and Methodology

On September 22, 2017, February 1 and 2, 2018, HDR biologists surveyed the additional areas for wetlands and jurisdictional waters of the U.S. regulated under Section 404/401 of the Clean Water Act (CWA). The survey was conducted according to the methodologies and guidance described in the U.S. Army Corps of Engineers (USACE) 1987 Wetland Delineation Manual, USACE Post-Rapanos guidance, 2012 USACE Eastern Mountain and Piedmont Regional Supplement (Version 2.0), and the North Carolina Division of Water Resources (NCDWR) Methodology for Identification of Intermittent and Perennial Streams and Their Origins (Version 4.11). Jurisdictional waters of the U.S. were delineated (flagged in the field) and mapped using a Trimble Geo7X GPS unit capable of

hdrinc.com



sub-meter accuracy. GPS points were post-processed utilizing Trimble GPS Pathfinder Office software.

Findings of Field Review

The additional areas identified as potential jurisdictional waters of the U.S. within the expanded study corridor are described briefly below. On-site reconnaissance conducted in September 2017 and February 2018 determined the expansion of one wetland totaling approximately 0.07 acres of the verified wetland boundaries (9/19/2016), and additional segments of three previously-verified streams.

Streams

Stream JJJ is an unnamed Relatively Permanent Water (RPW) with intermittent flow that is located west and south of Downing Creek Parkway and NC 54 in the D-O LRT Project corridor. The stream flows from a pond through a maintained grassy area and flows into a Downing Creek Parkway road culvert and then dissipates aboveground at the downstream end of the culvert. Approximately 450 feet downstream from the underground point of this stream segment, Stream JJJ becomes surficial and jurisdictional. An additional stream segment of approximately 76 linear feet has been added to Stream JJJ as compared to what was included in the previous JD packages.

Stream V is an unnamed seasonal RPW with intermittent flow located east of George King Road. An additional stream segment of approximately 900 linear feet begins at a braided stream area as a weak intermittent channel and flows southwest through the project corridor. The upstream portion above the braided stream channel was previously included in the JD packages as an intermittent stream.

Stream LC is a seasonal RPW with intermittent flow. An additional 150 linear feet of Stream LC is located east of US 15-501 beginning at the outfall of the pipe culvert and continuing east off the project. Another intermittent section is located east of the Duke Lemur Center, west of US 15/501 and south of Cameron Boulevard and was previously delineated as described in the *unpublished* Water Resources Technical Report Addendum #1.

Wetlands

Wetland S is a forested wetland that was previously reported in the DEIS Appendix K21, but has now been expanded. Approximately 0.157 acre of Wetland S would be affected by the Proposed Project Refinement, an increase from 0.10 impacts from the Previous Design. This area is a bottomland hardwood wetland that has three small ephemeral channels, and overland flow contributing to the hydrology of the area. Wetland S is located downstream of two ponds and connects to Stream R.



Closing

We respectfully request an updated verification and Jurisdictional Determination from the USACE regarding the jurisdictional status of the waters occurring within the recently expanded D-O LRT project study area. Please contact Jessica Tisdale at (919) 232-6654 or jessica.tisdale@hdrinc.com should you have any questions or concerns regarding this request.

Sincerely,
HDR Engineering, Inc. of the Carolinas



Jessica Tisdale
Environmental Scientist

Attachments:

- Revised D-O-LRT Project Water Resources Figures (May 2018)
- Stream Quality Assessment Worksheets
- NCDWR Stream Identification Forms
- Wetland Determination Data Form

Jurisdictional Determination Request



**US Army Corps
of Engineers**
Wilmington District

Jurisdictional Determination Request, Preliminary JD Request form, and waters upload sheet requested by Ross Sullivan in June of 2018 in support of original USACE submittal package

This form is intended for use by anyone requesting a jurisdictional determination (JD) from the U.S. Army Corps of Engineers, Wilmington District (Corps). Please include all supporting information, as described within each category, with your request. You may submit your request via mail, electronic mail, or facsimile. Requests should be sent to the appropriate project manager of the county in which the property is located. A current list of project managers by assigned counties can be found on-line at:

<http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram/Contact/CountyLocator.aspx>

by calling 910-251-4633, or by contacting any of the field offices listed below. Once your request is received you will be contacted by a Corps project manager.

**ASHEVILLE & CHARLOTTE REGULATORY
FIELD OFFICES**

US Army Corps of Engineers
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006
General Number: (828) 271-7980
Fax Number: (828) 281-8120

WASHINGTON REGULATORY FIELD OFFICE

US Army Corps of Engineers
2407 West Fifth Street
Washington, North Carolina 27889
General Number: (910) 251-4610
Fax Number: (252) 975-1399

RALEIGH REGULATORY FIELD OFFICE

US Army Corps of Engineers
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587
General Number: (919) 554-4884
Fax Number: (919) 562-0421

WILMINGTON REGULATORY FIELD OFFICE

US Army Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403
General Number: 910-251-4633
Fax Number: (910) 251-4025

INSTRUCTIONS:

All requestors must complete Parts A, B, C, D, E, F and G.

NOTE TO CONSULTANTS AND AGENCIES: If you are requesting a JD on behalf of a paying client or your agency, please note the specific submittal requirements in **Part H**.

NOTE ON PART D – PROPERTY OWNER AUTHORIZATION: Please be aware that all JD requests must include the current property owner authorization for the Corps to proceed with the determination, which may include inspection of the property when necessary. This form must be signed by the current property owner(s) or the owner(s) authorized agent to be considered a complete request.

NOTE ON PART D - NCDOT REQUESTS: Property owner authorization/notification for JD requests associated with North Carolina Department of Transportation (NCDOT) projects will be conducted according to the current NCDOT/USACE protocols.

NOTE TO USDA PROGRAM PARTICIPANTS: A Corps approved or preliminary JD may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should also request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

Jurisdictional Determination Request

A. PARCEL INFORMATION

Street Address: Durham-Orange Light Rail Transit Project
 City, State: _____
 County: _____
 Parcel Index Number(s) (PIN): _____

B. REQUESTOR INFORMATION

Name: Jessica Tisdale
 Mailing Address: 555 Fayetteville Street, Suite 400
Raleigh, NC 27601-3030
 Telephone Number: (919) 232-6654
 Electronic Mail Address: Jessica.Tisdale@hdrinc.com

Select one:

- I am the current property owner.
- I am an Authorized Agent or Environmental Consultant¹
- Interested Buyer or Under Contract to Purchase
- Other, please explain. _____

C. PROPERTY OWNER INFORMATION²

Name: _____
 Mailing Address: _____
 Telephone Number: _____
 Electronic Mail Address: _____

¹ Must provide completed Agent Authorization Form/Letter.
² Documentation of ownership also needs to be provided with request (copy of Deed, County GIS/Parcel/Tax Record).

Jurisdictional Determination Request

D. PROPERTY ACCESS CERTIFICATION^{3,4}

By signing below, I authorize representatives of the Wilmington District, U.S. Army Corps of Engineers (Corps) to enter upon the property herein described for the purpose of conducting on-site investigations, if necessary, and issuing a jurisdictional determination pursuant to Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899. I, the undersigned, am either a duly authorized owner of record of the property identified herein, or acting as the duly authorized agent of the owner of record of the property.

Jessica Tisdale

Print Name

Capacity: Owner Authorized Agent⁵

08/22/2018

Date

jessica.tisdale@hdrinc.com

Digitally signed by Jessica Tisdale
DN: cn=jessica.tisdale@hdrinc.com,
c=US, email=jessica.tisdale@hdrinc.com

Signature

E. REASON FOR JD REQUEST: (Check as many as applicable)

- I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all aquatic resources.
- I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all jurisdictional aquatic resources under Corps authority.
- I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps, and the JD would be used to avoid and minimize impacts to jurisdictional aquatic resources and as an initial step in a future permitting process.
- I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps; this request is accompanied by my permit application and the JD is to be used in the permitting process.
- I intend to construct/develop a project or perform activities in a navigable water of the U.S. which is included on the district Section 10 list and/or is subject to the ebb and flow of the tide.
- A Corps JD is required in order obtain my local/state authorization.
- I intend to contest jurisdiction over a particular aquatic resource and request the Corps confirm that jurisdiction does/does not exist over the aquatic resource on the parcel.
- I believe that the site may be comprised entirely of dry land.
- Other: _____

³ For NCDOT requests following the current NCDOT/USACE protocols, skip to Part E.

⁴ If there are multiple parcels owned by different parties, please provide the following for each additional parcel on a continuation sheet

⁵ Must provide agent authorization form/letter signed by owner(s).

Jurisdictional Determination Request

F. JURISDICTIONAL DETERMINATION (JD) TYPE (Select One)

- I am requesting that the Corps provide a preliminary JD for the property identified herein.

A Preliminary Jurisdictional Determination (PJD) provides an indication that there may be “waters of the United States” or “navigable waters of the United States” on a property. PJDs are sufficient as the basis for permit decisions. For the purposes of permitting, all waters and wetlands on the property will be treated as if they are jurisdictional “waters of the United States”. PJDs cannot be appealed (33 C.F.R. 331.2); however, a PJD is “preliminary” in the sense that an approved JD can be requested at any time. PJDs do not expire.

- I am requesting that the Corps provide an approved JD for the property identified herein.

An Approved Jurisdictional Determination (AJD) is a determination that jurisdictional “waters of the United States” or “navigable waters of the United States” are either present or absent on a site. An approved JD identifies the limits of waters on a site determined to be jurisdictional under the Clean Water Act and/or Rivers and Harbors Act. Approved JDs are sufficient as the basis for permit decisions. AJDs are appealable (33 C.F.R. 331.2). The results of the AJD will be posted on the Corps website. A landowner, permit applicant, or other “affected party” (33 C.F.R. 331.2) who receives an AJD may rely upon the AJD for five years (subject to certain limited exceptions explained in Regulatory Guidance Letter 05-02).

- I am unclear as to which JD I would like to request and require additional information to inform my decision.

G. ALL REQUESTS

- Map of Property or Project Area. This Map must clearly depict the boundaries of the review area.

- Size of Property or Review Area _____ acres.

- The property boundary (or review area boundary) is clearly physically marked on the site.

Jurisdictional Determination Request

H. REQUESTS FROM CONSULTANTS

Project Coordinates (Decimal Degrees): Latitude: _____
Longitude: -78.9996

- A legible delineation map depicting the aquatic resources and the property/review area. Delineation maps must be no larger than 11x17 and should contain the following: (Corps signature of submitted survey plats will occur after the submitted delineation map has been reviewed and approved).⁶
- North Arrow
 - Graphical Scale
 - Boundary of Review Area
 - Date
 - Location of data points for each Wetland Determination Data Form or tributary assessment reach.

For Approved Jurisdictional Determinations:

- Jurisdictional wetland features should be labeled as Wetland Waters of the US, 404 wetlands, etc. Please include the acreage of these features.
- Jurisdictional non-wetland features (i.e. tidal/navigable waters, tributaries, impoundments) should be labeled as Non-Wetland Waters of the US, stream, tributary, open water, relatively permanent water, pond, etc. Please include the acreage or linear length of each of these features as appropriate.
- Isolated waters, waters that lack a significant nexus to navigable waters, or non-jurisdictional upland features should be identified as Non-Jurisdictional. Please include a justification in the label regarding why the feature is non-jurisdictional (i.e. "Isolated", "No Significant Nexus", or "Upland Feature"). Please include the acreage or linear length of these features as appropriate.

For Preliminary Jurisdictional Determinations:

- Wetland and non-wetland features should not be identified as Jurisdictional, 404, Waters of the United States, or anything that implies jurisdiction. These features can be identified as Potential Waters of the United States, Potential Non-wetland Waters of the United States, wetland, stream, open water, etc. Please include the acreage and linear length of these features as appropriate.

Completed Wetland Determination Data Forms for appropriate region (at least one wetland and one upland form needs to be completed for each wetland type)

⁶ Please refer to the guidance document titled "Survey Standards for Jurisdictional Determinations" to ensure that the supplied map meets the necessary mapping standards. <http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Jurisdiction/>

Jurisdictional Determination Request

- Completed appropriate Jurisdictional Determination form
 - P.JDs, please complete a Preliminary Jurisdictional Determination Form⁷ and include the Aquatic Resource Table
 - A.JDs, please complete an Approved Jurisdictional Determination Form⁸
- Vicinity Map
- Aerial Photograph
- USGS Topographic Map
- Soil Survey Map
- Other Maps, as appropriate (e.g. National Wetland Inventory Map, Proposed Site Plan, previous delineation maps, LIDAR maps, FEMA floodplain maps)
- Landscape Photos (if taken)
- NCSAM and/or NCWAM Assessment Forms and Rating Sheets
- NC Division of Water Resources Stream Identification Forms
- Other Assessment Forms

⁷ www.saw.usace.army.mil/Portals/59/docs/regulatory/reqdocs/JD/RGL_08-02_App_A_Prelim_JD_Form_fillable.pdf

⁸ Please see <http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Jurisdiction/>

Principal Purpose: The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the project area subject to federal jurisdiction under the regulatory authorities referenced above.

Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in the approved jurisdictional determination (AJD), which will be made available to the public on the District's website and on the Headquarters USACE website.

Disclosure: Submission of requested information is voluntary; however, if information is not provided, the request for an AJD cannot be evaluated nor can an AJD be issued.

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD:

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Jessica Tisdale

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:

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

State: **NC** County/parish/borough: **Durham/Orange** City: **Durham/Chapel Hill**

Center coordinates of site (lat/long in degree decimal format):

Lat.: **35.9512** Long.: **-78.9996**

Universal Transverse Mercator:

Name of nearest waterbody:

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

Office (Desk) Determination. Date: **08/22/2018**

Field Determination. Date(s):

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 resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (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 PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
Map: Water Resources Mapbook (29 pages)
- Data sheets prepared/submitted by or on behalf of the PJD requestor.
 - Office concurs with data sheets/delineation report.
 - Office does not concur with data sheets/delineation report. Rationale: _____
- Data sheets prepared by the Corps: _____
- Corps navigable waters' study: _____
- U.S. Geological Survey Hydrologic Atlas: _____
 - USGS NHD data.
 - USGS 8 and 12 digit HUC maps.
- U.S. Geological Survey map(s). Cite scale & quad name: _____
- Natural Resources Conservation Service Soil Survey. Citation: _____
- National wetlands inventory map(s). Cite name: _____
- State/local wetland inventory map(s): _____
- FEMA/FIRM maps: _____
- 100-year Floodplain Elevation is: _____ (National Geodetic Vertical Datum of 1929)
- Photographs: Aerial (Name & Date): _____
or Other (Name & Date): _____
- Previous determination(s). File no. and date of response letter: Action ID: 2012000957
- Other information (please specify): _____

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

Signature and date of
Regulatory staff member
completing PJD

Digitally signed by Jessica Lisdale
DN: cn=jessica.lisdale@ndrc.com, o=NDRC
Date: 2018.08.22 12:18:32 -0400

Signature and date of
person requesting PJD
(REQUIRED, unless obtaining
the signature is impracticable)¹

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



AGENT AUTHORIZATION FORM

I, Design and Engineering Manager, Dave Charters, representing GoTriangle, hereby certify that I have authorized Jessica Tisdale, representing HDR Engineering, to act on my behalf and take all actions necessary to the processing and issuance of the Preliminary Jurisdictional Determination associated with the Durham-Orange Light Rail Transit Project located in Durham and Orange Counties, North Carolina.

We hereby certify that the information submitted in this application is true and accurate to the best of our knowledge.


Dave Charters, GoTriangle

Jessica Tisdale, HDR

Applicant's Name

Agent's Name





Applicant's Signature

Agent's Signature

8/22/2018

8/21/2018

Date

Date

hdrinc.com

555 Fayetteville St., Suite 400, Raleigh NC 27601
T 919 232 6654



Waters_Name	State	Coordinat	Meas_Ty	Amount	Units	Waters_Ty	Latitude	Longitude
Stream YY (Meeting of the Waters)	NORTH CAROLINA	R3UB	Linear	50 FOOT	RPW	35.89906100	-79.03578600	
Stream WW (Chapel Branch) - EEP Site # 77 (SCO ID 050645701)	NORTH CAROLINA	R3UB	Linear	100 FOOT	RPW	35.90553000	-79.02994100	
Stream TT (UT to Chapel Branch)	NORTH CAROLINA	R3UB	Linear	205 FOOT	RPW	35.90563200	-79.02512200	
Stream SS (UT to Chapel Branch)	NORTH CAROLINA	R4SB	Linear	341 FOOT	RPW	35.90464400	-79.01915900	
Stream RR (UT to Chapel Branch)	NORTH CAROLINA	R3UB	Linear	81 FOOT	RPW	35.90482600	-79.01811200	
Stream QQ (UT to Chapel Branch)	NORTH CAROLINA	R3UB	Linear	32 FOOT	RPW	35.90360700	-79.01361200	
Stream LLL (UT to Chapel Branch)	NORTH CAROLINA	R4SB	Linear	90 FOOT	RPW	35.90375800	-79.01366700	
Stream KKK (UT to Chapel Branch)	NORTH CAROLINA	R4SB	Linear	23 FOOT	RPW	35.90170900	-79.00862000	
Stream JJJ (UT to Little Creek)	NORTH CAROLINA	R4SB	Linear	FOOT	RPW	35.90238900	-79.99799000	
Stream Y (Little Creek)	NORTH CAROLINA	R3UB	Linear	50 FOOT	RPW	35.90860000	-79.99570000	
Stream EE (UT to Little Creek)	NORTH CAROLINA	R3UB	Linear	12 FOOT	RPW	35.90472500	-79.99745000	
Stream V (UT to Little Creek)	NORTH CAROLINA	R4SB	Linear	617 FOOT	RPW	35.91540300	-79.98675600	
Stream ZZ (UT to Little Creek)	NORTH CAROLINA	R3UB	Linear	36 FOOT	RPW	35.91118900	-79.98761200	
Stream PP (UT to New Hope Creek)	NORTH CAROLINA	R4SB	Linear	51 FOOT	RPW	35.92293300	-79.98635700	
Stream N (UT to New Hope Creek)	NORTH CAROLINA	R4SB	Linear	596 FOOT	RPW	35.92056100	-79.98826300	
Stream NN (UT to New Hope Creek)	NORTH CAROLINA	R3UB	Linear	514 FOOT	RPW	35.92877600	-79.98915100	
Stream MM (UT to New Hope Creek)	NORTH CAROLINA	R3UB	Linear	107 FOOT	RPW	35.93614000	-79.99057600	
Stream LL (UT to New Hope Creek)	NORTH CAROLINA	R3UB	Linear	88 FOOT	RPW	35.93909600	-79.99203900	
Stream R (UT to New Hope Creek)	NORTH CAROLINA	R4SB	Linear	716 FOOT	RPW	35.94725300	-79.99746600	
Stream T (New Hope Creek)	NORTH CAROLINA	R3UB	Linear	50 FOOT	RPW	35.95894400	-79.99131000	
Stream S (UT to New Hope Creek)	NORTH CAROLINA	R3UB	Linear	50 FOOT	RPW	35.95997400	-79.97908400	
Stream I (Sandy Creek) 1	NORTH CAROLINA	R3UB	Linear	30 FOOT	RPW	35.95805600	-79.97035700	
Stream I (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	30 FOOT	RPW	35.96015300	-79.97085900	
Stream H (UT to Sandy Creek)	NORTH CAROLINA	R4SB	Linear	40 FOOT	RPW	35.95909000	-79.96589000	
Stream G (UT to Sandy Creek)	NORTH CAROLINA	R4SB	Linear	74 FOOT	RPW	35.96017800	-79.96272600	
Stream F (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	69 FOOT	RPW	35.96128500	-79.96105400	
Stream E (UT to Sandy Creek)	NORTH CAROLINA	R4SB	Linear	39 FOOT	RPW	35.97198700	-79.95703500	
Stream D (UT to Sandy Creek)	NORTH CAROLINA	R4SB	Linear	35 FOOT	RPW	35.97195100	-79.95864200	
Stream B (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	9 FOOT	RPW	35.97628500	-79.95903500	
Stream A (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	190 FOOT	RPW	35.97630100	-79.95828600	
Stream GG (UT to Sandy Creek) 1	NORTH CAROLINA	R4SB	Linear	74 FOOT	RPW	35.98272500	-79.95639600	
Stream HH (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	49 FOOT	RPW	35.98349100	-79.95664800	
Stream J (Sandy Creek) 2	NORTH CAROLINA	R3UB	Linear	60 FOOT	RPW	35.98390200	-79.95687500	
Stream LC (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	150 FOOT	RPW	35.98410100	-79.95759200	
Stream J (Sandy Creek) 3	NORTH CAROLINA	R3UB	Linear	9 FOOT	RPW	35.98644100	-79.95603600	
Stream II (UT to Sandy Creek)	NORTH CAROLINA	R4SB	Linear	13 FOOT	RPW	35.98695600	-79.95455900	
Stream J (Sandy Creek) 4	NORTH CAROLINA	R3UB	Linear	80 FOOT	RPW	35.99811900	-79.95436500	
Stream J (Sandy Creek) 5	NORTH CAROLINA	R3UB	Linear	40 FOOT	RPW	35.99770000	-79.95458900	
Stream JJ (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	26 FOOT	RPW	35.99859000	-79.95228400	
Stream KK (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	93 FOOT	RPW	36.00202300	-79.95161400	
Stream WWW (UT to Sandy Creek)	NORTH CAROLINA	R3UB	Linear	120 FOOT	RPW	36.00268400	-79.95172800	
Wetland YY	NORTH CAROLINA	PFO	Area	0.029 ACRE	RPWWD	35.90419500	-79.01654600	
Wetland GG	NORTH CAROLINA	PFO	Area	0.08 ACRE	RPWWD	35.90501900	-79.01805300	
Wetland FF	NORTH CAROLINA	PEM	Area	0.004 ACRE	RPWWD	35.90476700	-79.99768900	
Wetland Y	NORTH CAROLINA	PFO	Area	0.018 ACRE	RPWWD	35.91478700	-79.99516600	
Wetland NNN	NORTH CAROLINA	PEM	Area	0.304 ACRE	RPWWD	35.92610800	-79.98891300	
Wetland S	NORTH CAROLINA	PFO	Area	0.157 ACRE	RPWWD	35.94672100	-79.99944800	
Wetland T	NORTH CAROLINA	PSS	Area	0.077 ACRE	RPWWD	35.94703400	-79.99854400	
Wetland R	NORTH CAROLINA	PFO	Area	0.009 ACRE	RPWWD	35.95049000	-79.99671400	
Wetland W	NORTH CAROLINA	PFO	Area	0.002 ACRE	RPWWD	35.95945900	-79.99212700	
Wetland V	NORTH CAROLINA	PFO	Area	0.003 ACRE	RPWWD	35.95950500	-79.99016300	
Wetland E	NORTH CAROLINA	PFO	Area	0.004 ACRE	RPWWD	35.96053500	-79.97244000	
Wetland A	NORTH CAROLINA	PFO	Area	0.003 ACRE	RPWWD	35.97628900	-79.95801400	
Wetland TTT	NORTH CAROLINA	PFO	Area	0.005 ACRE	RPWWD	35.98202700	-79.95679900	
Pond C	NORTH CAROLINA	PUB	Area	0.001 ACRE	RPW	35.90471000	-79.01922400	



**Water Resources
FIGURE 1A**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle

0 250 500 Feet

Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland



**Water Resources
FIGURE 1B**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

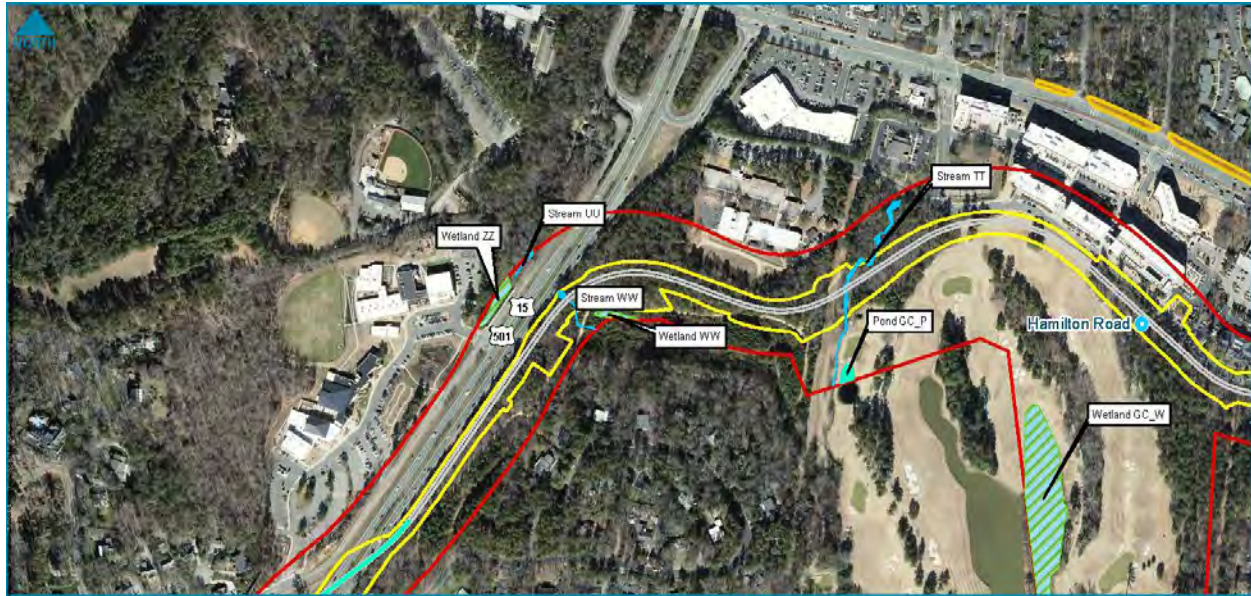
GO Triangle

0 250 500 Feet

Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland



**Water Resources
FIGURE 1C
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS

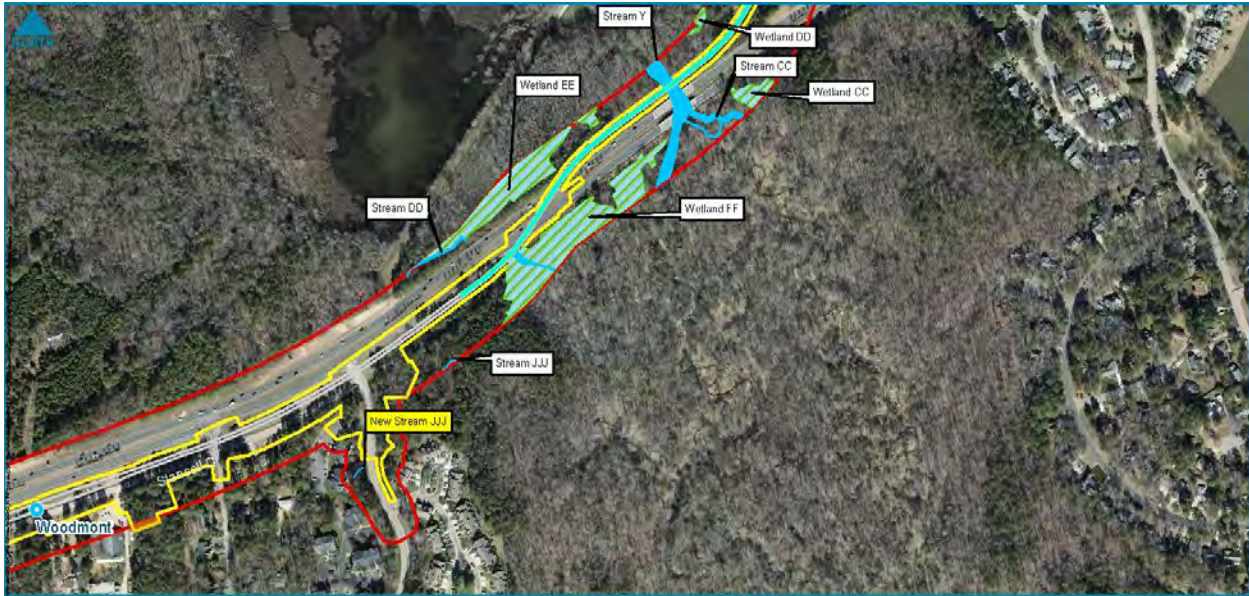
- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland

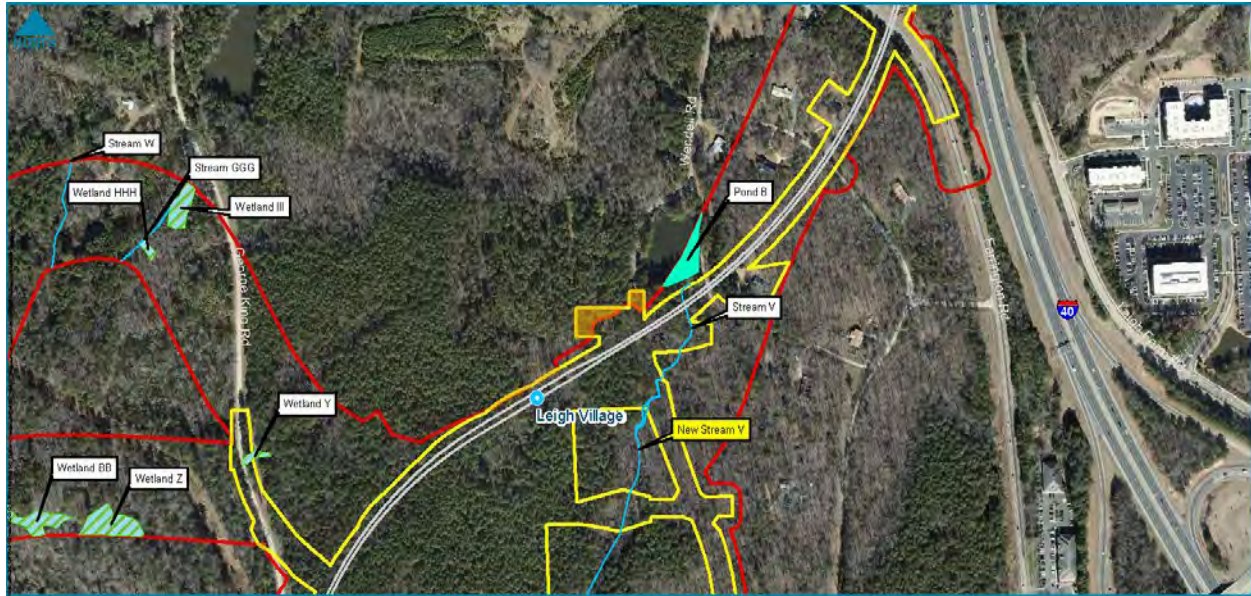


**Water Resources
FIGURE 1D
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland





**Water Resources
FIGURE 1G**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet

Chapel Hill Durham

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland



**Water Resources
FIGURE 1H**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet

Chapel Hill Durham

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland



**Water Resources
FIGURE 1I**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

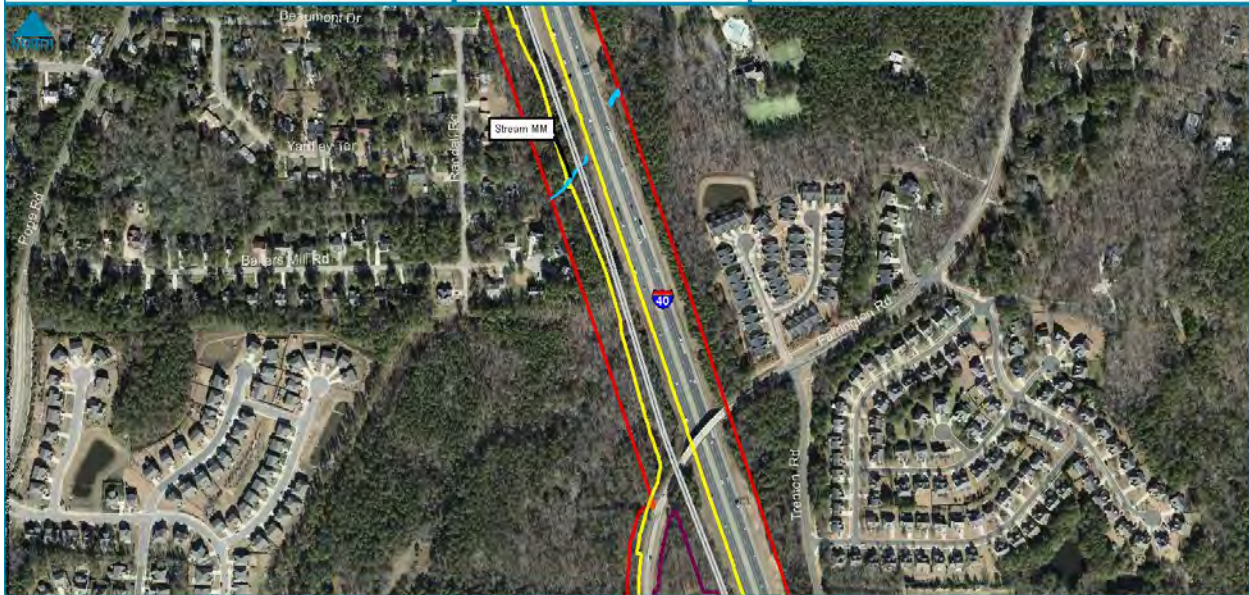
GO **Triangle**

0 250 500 Feet

Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland



**Water Resources
FIGURE 1J**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

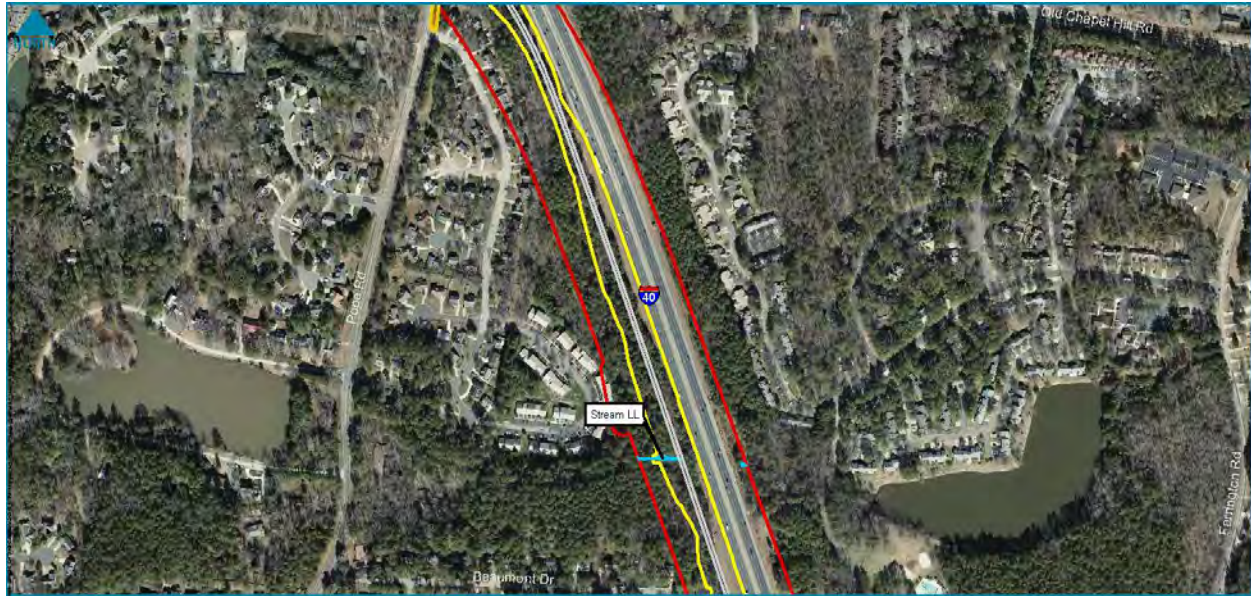
GO **Triangle**

0 250 500 Feet

Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland



Water Resources
FIGURE 1K
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland



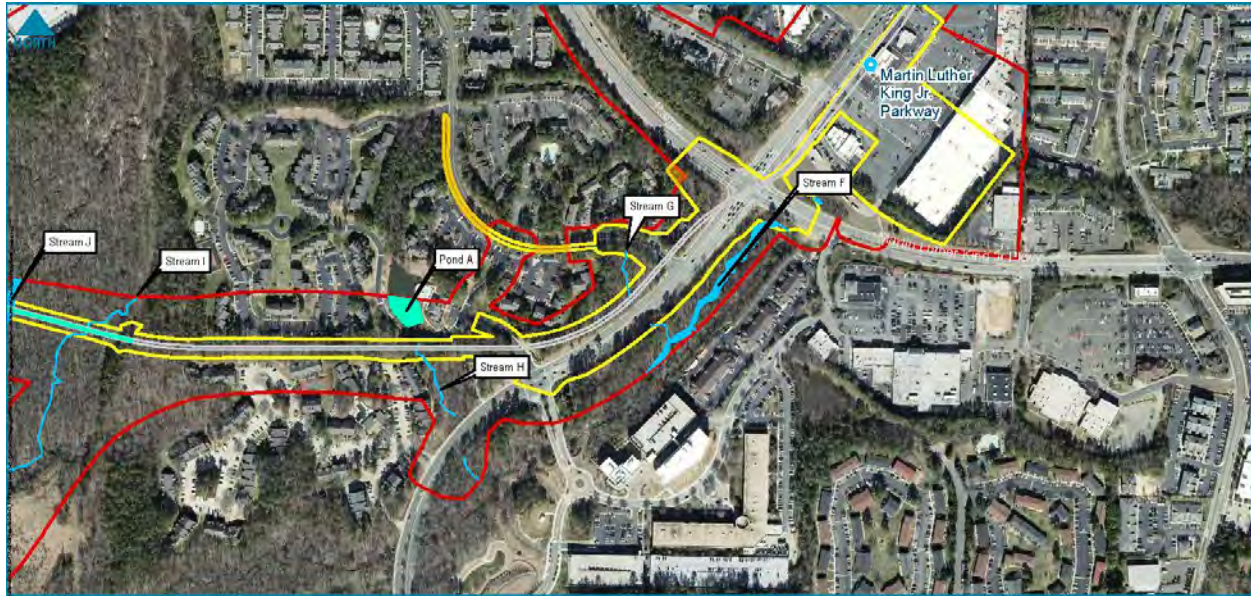
Water Resources
FIGURE 1L
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland





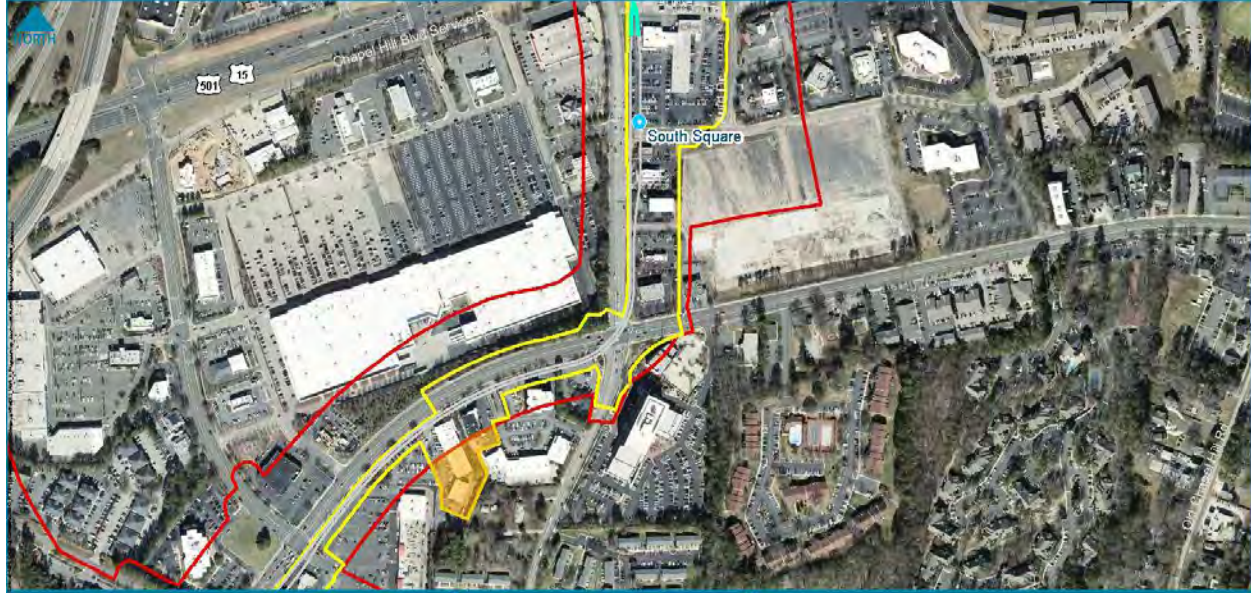
**Water Resources
FIGURE 10**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet



- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland



**Water Resources
FIGURE 1P**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet



- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland

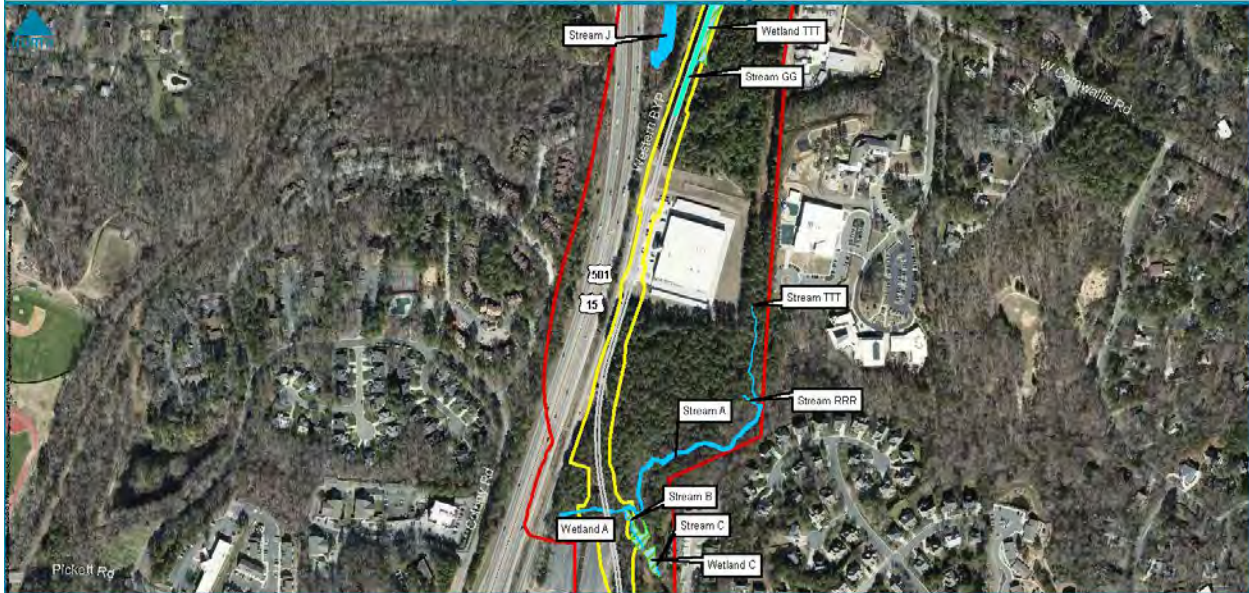


**Water Resources
FIGURE 1Q**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle

0 250 500 Feet

Sources: ESRI, USGS, CGIA, NCDOT, and URS

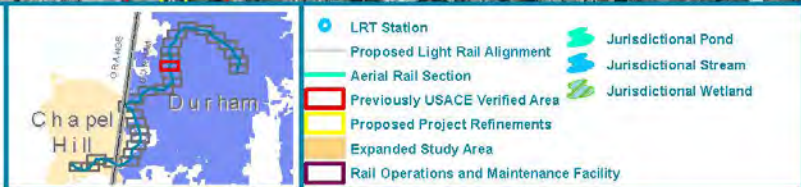


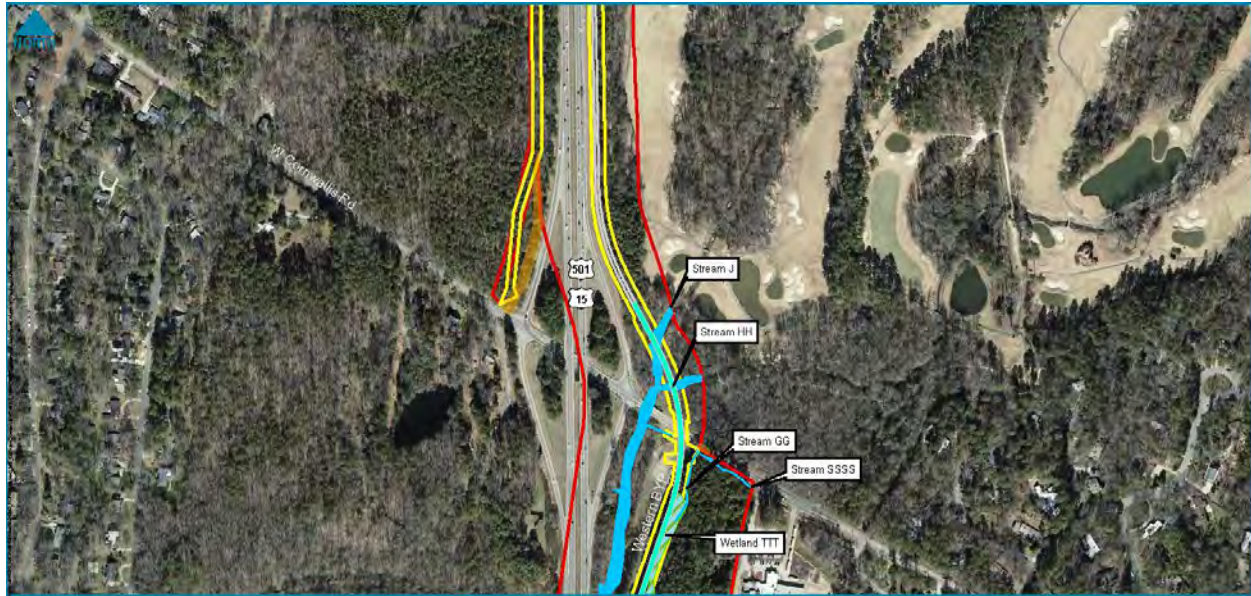
**Water Resources
FIGURE 1R**
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle

0 250 500 Feet

Sources: ESRI, USGS, CGIA, NCDOT, and URS





**Water Resources
FIGURE 1S
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland

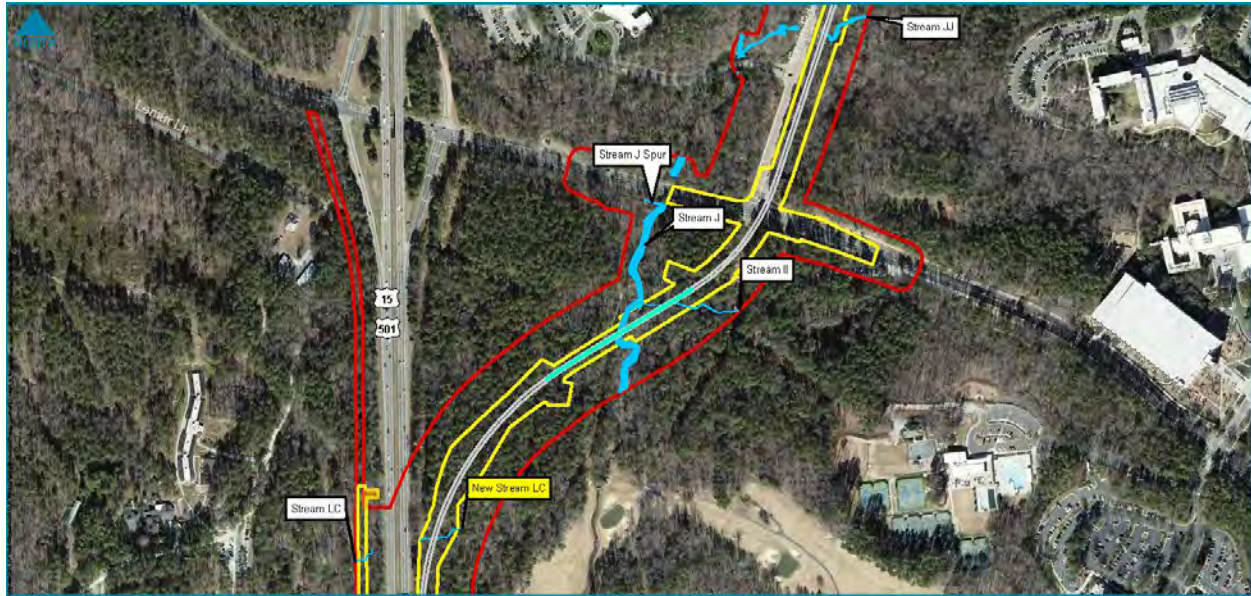


**Water Resources
FIGURE 1T
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland

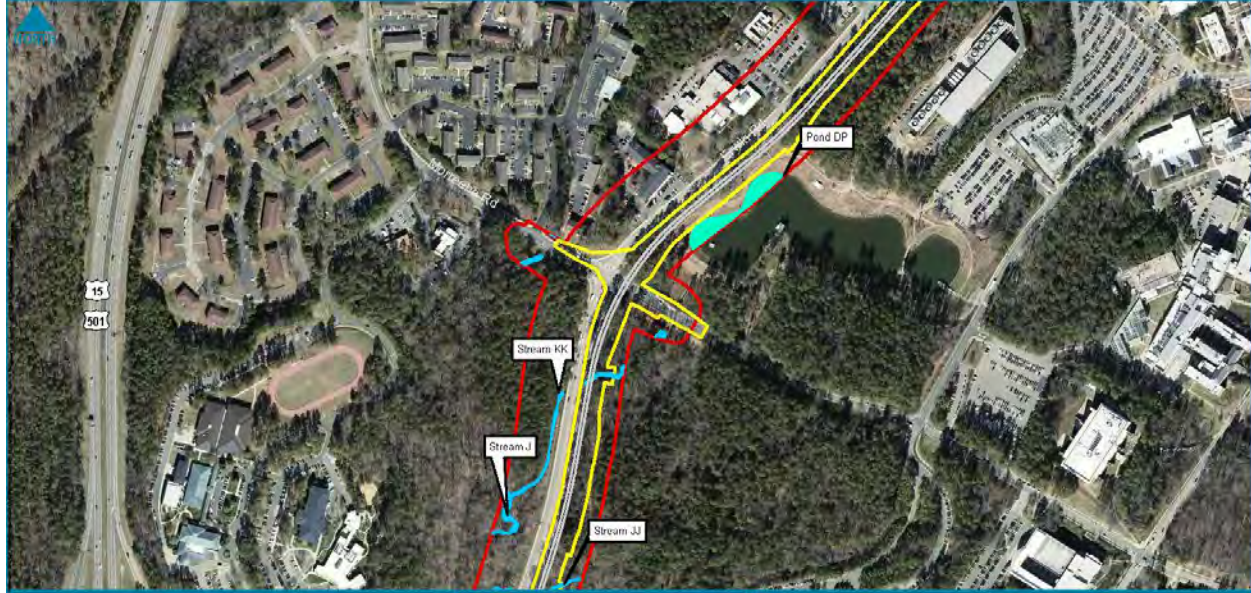


**Water Resources
FIGURE 1U
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland

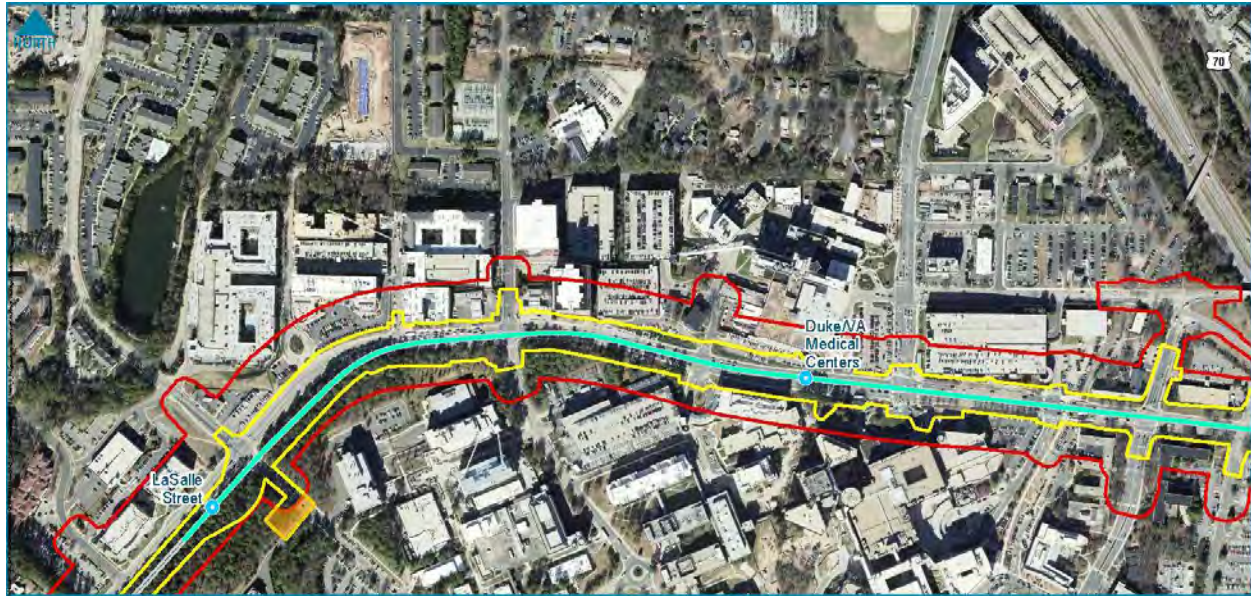


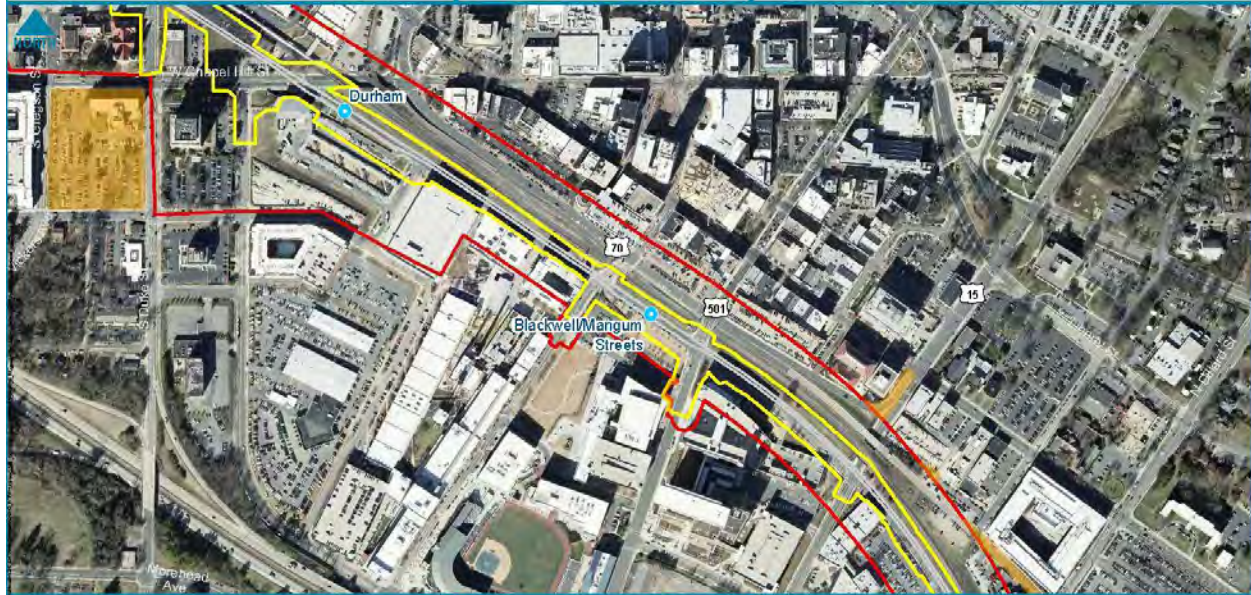
**Water Resources
FIGURE 1V
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

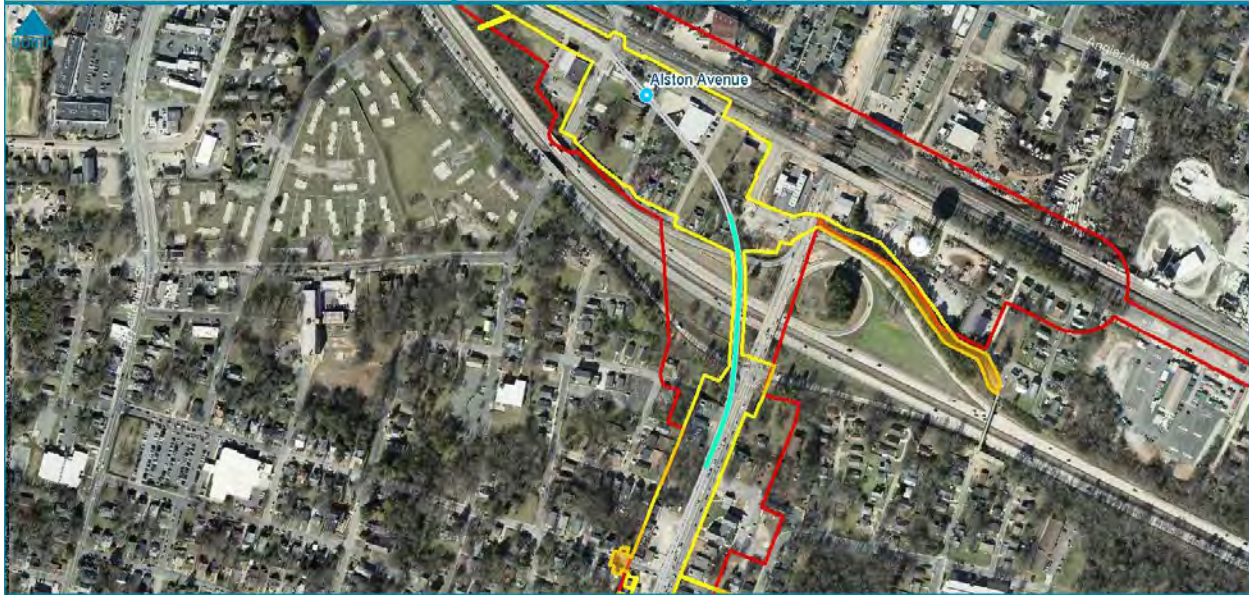
GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

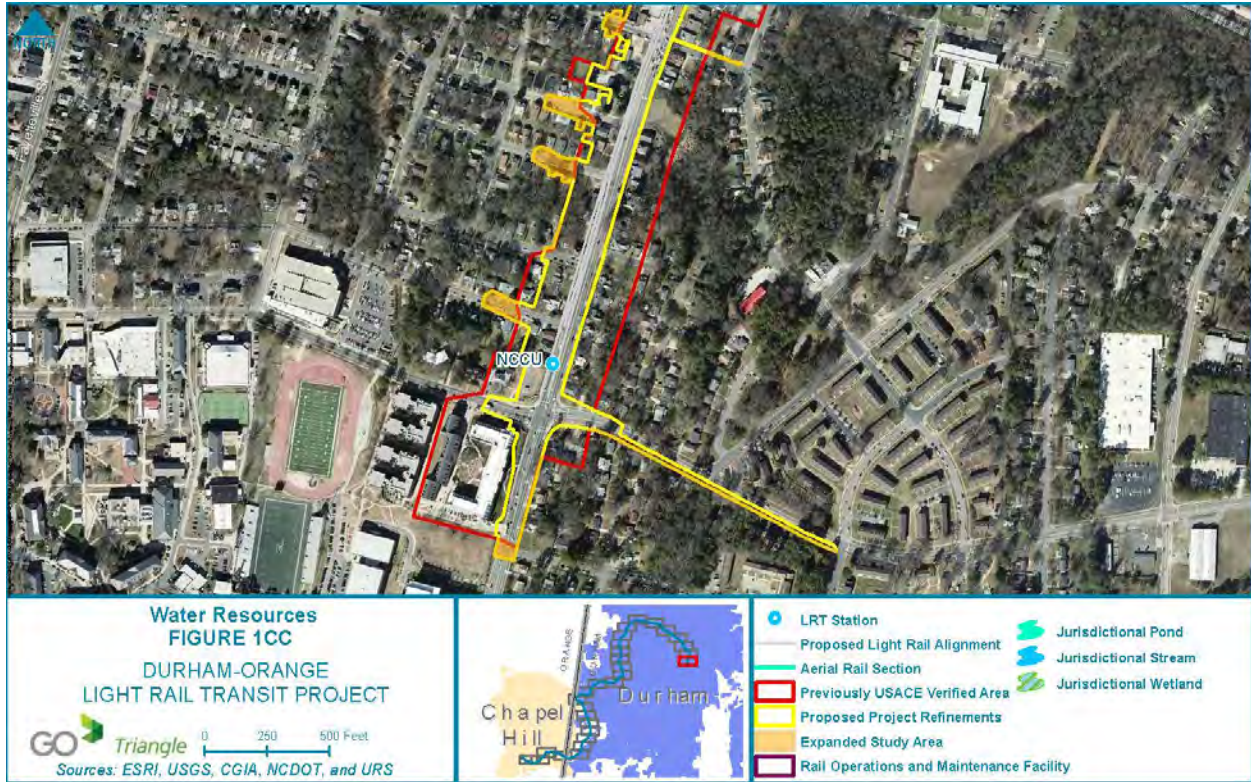
0 250 500 Feet

- LRT Station
- Proposed Light Rail Alignment
- Aerial Rail Section
- Previously USACE Verified Area
- Proposed Project Refinements
- Expanded Study Area
- Rail Operations and Maintenance Facility
- Jurisdictional Pond
- Jurisdictional Stream
- Jurisdictional Wetland









NC DWQ Stream Identification Form Version 4.11

Date: 2/9/18	Project/Site: DOLRT	Latitude: -78.999849
Evaluator: J. Tisdale, E. Alia	County: Durham	Longitude: 35.902362
Total Points: <small>Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*</small> 26	Stream Determination (circle one) Ephemeral <u>Intermittent</u> Perennial	Other <small>e.g. Quad Name:</small> Chapel Hill

A. Geomorphology (Subtotal = 14)

	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)	

^aartificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)

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 = 5)

18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macroinvertebrates (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: Segment of stream connected by two double 30" hole pipes under Downing Creek Parkway. Stream located in housing complex. Stream dissipates (flows underground) into low area on eastside of Downing Creek and picks back up further downstream.

Sketch:

Stream ID: Downing Creek Parkway

USACE AID# SAW-2012-00957 DWQ # _____ Site # JJJ (indicate on attached map)



STREAM QUALITY ASSESSMENT WORKSHEET



JJJ

Provide the following information for the stream reach under assessment:

1. Applicant's name: Go Triangle
2. Evaluator's name: J. Tisdale, E. Alia
3. Date of evaluation: 2/9/18
4. Time of evaluation: 10am
5. Name of stream: JJJ
6. River basin: Cape Fear
7. Approximate drainage area: < 100 acres
8. Stream order: 2nd (based on soil survey)
9. Length of reach evaluated: 150'
10. County: Durham
11. Site coordinates (if known): prefer in decimal degrees.
Latitude (ex. 34.872312): 35.902362 Longitude (ex. -77.556611): -78.999849
12. Subdivision name (if any): Downing Creek
- Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other _____
13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):
Downing Creek Parkway
14. Proposed channel work (if any): NA
15. Recent weather conditions: Sunny, 50's, clear
16. Site conditions at time of visit: Sunny, 50's
17. Identify any special waterway classifications known: Section 10 Tidal Waters Essential Fisheries Habitat
 Trout Waters Outstanding Resource Waters Nutrient Sensitive Waters Water Supply Watershed (I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES NO If yes, estimate the water surface area: _____
19. Does channel appear on USGS quad map? YES NO
20. Does channel appear on USDA Soil Survey? YES NO
21. Estimated watershed land use: % Residential % Commercial % Industrial % Agricultural
 % Forested % Cleared / Logged % Other (_____)
22. Bankfull width: 2-4'
23. Bank height (from bed to top of bank): 1'
24. Channel slope down center of stream: Flat (0 to 2%) Gentle (2 to 4%) Moderate (4 to 10%) Steep (>10%)
25. Channel sinuosity: Straight Occasional bends Frequent meander Very sinuous Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 47 Comments: _____

Evaluator's Signature [Signature] Date 2/9/18

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET

#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
		Coastal	Piedmont	Mountain	
PHYSICAL	1 Presence of flow / persistent pools in stream (no flow or saturation = 0; strong flow = max points)	0-5	0-4	0-5	3
	2 Evidence of past human alteration (extensive alteration = 0; no alteration = max points)	0-6	0-5	0-5	3
	3 Riparian zone (no buffer = 0; contiguous, wide buffer = max points)	0-6	0-4	0-5	2
	4 Evidence of nutrient or chemical discharges (extensive discharges = 0; no discharges = max points)	0-5	0-4	0-4	2
	5 Groundwater discharge (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0-3	0-4	0-4	1
	6 Presence of adjacent floodplain (no floodplain = 0; extensive floodplain = max points)	0-4	0-4	0-2	2
	7 Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0-5	0-4	0-2	3
	8 Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0-6	0-4	0-2	0
	9 Channel sinuosity (extensive channelization = 0; natural meander = max points)	0-5	0-4	0-3	1
	10 Sediment input (extensive deposition = 0; little or no sediment = max points)	0-5	0-4	0-4	2
	11 Size & diversity of channel bed substrate (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0-4	0-5	2
STABILITY	12 Evidence of channel incision or widening (deeply incised = 0; stable bed & banks = max points)	0-5	0-4	0-5	3
	13 Presence of major bank failures (severe erosion = 0; no erosion, stable banks = max points)	0-5	0-5	0-5	3
	14 Root depth and density on banks (no visible roots = 0; dense roots throughout = max points)	0-3	0-4	0-5	1
	15 Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0-5	0-4	0-5	4
HABITAT	16 Presence of riffle-pool/ripple-pool complexes (no riffles/ripples or pools = 0; well-developed = max points)	0-3	0-5	0-6	2
	17 Habitat complexity (little or no habitat = 0; frequent, varied habitats = max points)	0-6	0-6	0-6	3
	18 Canopy coverage over streambed (no shading vegetation = 0; continuous canopy = max points)	0-5	0-5	0-5	4
	19 Substrate embeddedness (deeply embedded = 0; loose structure = max)	NA*	0-4	0-4	2
BIOLOGY	20 Presence of stream invertebrates (see page 4) (no evidence = 0; common, numerous types = max points)	0-4	0-5	0-5	1
	21 Presence of amphibians (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	1
	22 Presence of fish (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	1
	23 Evidence of wildlife use (no evidence = 0; abundant evidence = max points)	0-6	0-5	0-5	1
Total Points Possible		100	100	100	
TOTAL SCORE (also enter on first page)					47

* These characteristics are not assessed in coastal streams.

NC DWQ Stream Identification Form Version 4.11

Stream V

Date: <i>2/9/18</i>	Project/Site: <i>DOLRT</i>	Latitude: <i>35.9136</i>
Evaluator: <i>Jessica Tisdale</i>	County: <i>Durham</i>	Longitude: <i>-78.9904</i>
Total Points: <i>Stream is at least intermittent if ≥ 19 or perennial if ≥ 30</i> <i>25.5</i>	Stream Determination (circle one) Ephemeral () Intermittent (<input checked="" type="radio"/>) Perennial ()	Other e.g. Quad Name:

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)	

^aartificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = *7*)

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 = *3.5*)

18. Fibrous roots in streambed	3	2	(1)	0
19. Rooted upland plants in streambed	3	2	(1)	0
20. Macroinvertebrates (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			

^aperennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

USACE AID# SAW-2012-00957 DWQ # _____ Site # V (indicate on attached map)



STREAM QUALITY ASSESSMENT WORKSHEET



Provide the following information for the stream reach under assessment:

1. Applicant's name: Go Triangle
2. Evaluator's name: Jessica Tisdale
3. Date of evaluation: 2/9/18
4. Time of evaluation: 1:00 pm
5. Name of stream: V
6. River basin: Cape Fear
7. Approximate drainage area: ~ 75 acres
8. Stream order: 2nd order (based on Soil Survey)
9. Length of reach evaluated: 900'
10. County: Purham
11. Site coordinates (if known): prefer in decimal degrees.
Latitude (ex. 34.872312): 35.9136 Longitude (ex. -77.556611): -78.9904
12. Subdivision name (if any): Chapel Run area
- Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other _____
13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):
close by new development Chapel Run, George King Run Road.
14. Proposed channel work (if any): NA
15. Recent weather conditions: Sunny, 50', clear.
16. Site conditions at time of visit: Sunny, 50'
17. Identify any special waterway classifications known: ___ Section 10 ___ Tidal Waters ___ Essential Fisheries Habitat
___ Trout Waters ___ Outstanding Resource Waters ___ Nutrient Sensitive Waters ___ Water Supply Watershed ___ (I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES NO If yes, estimate the water surface area: 1.5 acres.
19. Does channel appear on USGS quad map? YES NO
20. Does channel appear on USDA Soil Survey? YES NO
21. Estimated watershed land use: 30 % Residential ___ % Commercial ___ % Industrial ___ % Agricultural
60 % Forested 10 % Cleared / Logged ___ % Other (_____)
22. Bankfull width: 1' - 4'
23. Bank height (from bed to top of bank): 6" - 1'
24. Channel slope down center of stream: ___ Flat (0 to 2%) Gentle (2 to 4%) ___ Moderate (4 to 10%) ___ Steep (>10%)
25. Channel sinuosity: ___ Straight ___ Occasional bends Frequent meander ___ Very sinuous ___ Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 57 Comments: _____

Evaluator's Signature Jessica Tisdale Date 2/9/18

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change - version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	Presence of flow / persistent pools in stream (no flow or saturation = 0; strong flow = max points)	0-5	0-4	0-5	2
	2	Evidence of past human alteration (extensive alteration = 0; no alteration = max points)	0-6	0-5	0-5	4
	3	Riparian zone (no buffer = 0; contiguous, wide buffer = max points)	0-6	0-4	0-5	4
	4	Evidence of nutrient or chemical discharges (extensive discharges = 0; no discharges = max points)	0-5	0-4	0-4	4
	5	Groundwater discharge (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0-3	0-4	0-4	1
	6	Presence of adjacent floodplain (no floodplain = 0; extensive floodplain = max points)	0-4	0-4	0-2	3
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0-5	0-4	0-2	2
	8	Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0-6	0-4	0-2	0
	9	Channel sinuosity (extensive channelization = 0; natural meander = max points)	0-5	0-4	0-3	3
	10	Sediment input (extensive deposition = 0; little or no sediment = max points)	0-5	0-4	0-4	4
	11	Size & diversity of channel bed substrate (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0-4	0-5	2
STABILITY	12	Evidence of channel incision or widening (deeply incised = 0; stable bed & banks = max points)	0-5	0-4	0-5	2
	13	Presence of major bank failures (severe erosion = 0; no erosion, stable banks = max points)	0-5	0-5	0-5	4
	14	Root depth and density on banks (no visible roots = 0; dense roots throughout = max points)	0-3	0-4	0-5	2
	15	Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0-5	0-4	0-5	4
HABITAT	16	Presence of riffle-pool/ripple-pool complexes (no riffles/ripples or pools = 0; well-developed = max points)	0-3	0-5	0-6	1
	17	Habitat complexity (little or no habitat = 0; frequent, varied habitats = max points)	0-6	0-6	0-6	2
	18	Canopy coverage over streambed (no shading vegetation = 0; continuous canopy = max points)	0-5	0-5	0-5	5
	19	Substrate embeddedness (deeply embedded = 0; loose structure = max)	NA*	0-4	0-4	2
BIOLOGY	20	Presence of stream invertebrates (see page 4) (no evidence = 0; common, numerous types = max points)	0-4	0-5	0-5	1
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	1
	22	Presence of fish (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	1
	23	Evidence of wildlife use (no evidence = 0; abundant evidence = max points)	0-6	0-5	0-5	5
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						57

* These characteristics are not assessed in coastal streams.

NC DWQ Stream Identification Form Version 4.11

Stream LC

Date: 2/9/18	Project/Site: D-O LRT	Latitude: 35.9941
Evaluator: Jessica Tisdale	County: Durham	Longitude: -78.9576
Total Points: <small>Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*</small>	Stream Determination (circle one) Ephemeral () Intermittent (X) Perennial ()	Other <small>e.g. Quad Name:</small>

A. Geomorphology (Subtotal = 9.5)

	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	1	1	2	3
7. Recent alluvial deposits	1	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	

*artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)

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	1	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	0	2	1	0
20. Macroinvertebrates (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: UT flows into Sandy Creek, AL Birehler trail crosses it off the property, begins at 15-S01 pipe. Section above 15-S01 is also intermittent

Sketch:

USACE AID# SAW-2012-00957 DWQ # _____ Site # LC (indicate on attached map)



STREAM QUALITY ASSESSMENT WORKSHEET



Provide the following information for the stream reach under assessment:

1. Applicant's name: GoTriangle
2. Evaluator's name: Jessica Tisdal
3. Date of evaluation: 2/9/18
4. Time of evaluation: 3:00 pm
5. Name of stream: LC (LT to Sandy Creek)
6. River basin: Cape Fear
7. Approximate drainage area: 20 acres
8. Stream order: 1st order
9. Length of reach evaluated: 150'
10. County: Durham
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any): NA
- Latitude (ex. 34.872312): 35.9941
- Longitude (ex. -77.556611): -78.9576
- Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other _____
13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):
Located between bypass 15-501 and Duke University Golf course
14. Proposed channel work (if any): NA
15. Recent weather conditions: Sunny, 80's, clear
16. Site conditions at time of visit: Sunny, 50's
17. Identify any special waterway classifications known: Section 10 Tidal Waters Essential Fisheries Habitat
 Trout Waters Outstanding Resource Waters Nutrient Sensitive Waters Water Supply Watershed (I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES NO If yes, estimate the water surface area: _____
19. Does channel appear on USGS quad map? YES NO
20. Does channel appear on USDA Soil Survey? YES NO
21. Estimated watershed land use: 30% Residential Commercial Industrial Agricultural
70% Forested Cleared / Logged Other (_____)
22. Bankfull width: 2-4'
23. Bank height (from bed to top of bank): 1-2'
24. Channel slope down center of stream: Flat (0 to 2%) Gentle (2 to 4%) Moderate (4 to 10%) Steep (>10%)
25. Channel sinuosity: Straight Occasional bends Frequent meander Very sinuous Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 47 Comments: _____

Evaluator's Signature: Jessica Tisdal Date: 2/9/18
 This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET

#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
		Coastal	Piedmont	Mountain	
PHYSICAL	1 Presence of flow / persistent pools in stream (no flow or saturation = 0; strong flow = max points)	0-5	0-4	0-5	1
	2 Evidence of past human alteration (extensive alteration = 0; no alteration = max points)	0-6	0-5	0-5	2
	3 Riparian zone (no buffer = 0; contiguous, wide buffer = max points)	0-6	0-4	0-5	4
	4 Evidence of nutrient or chemical discharges (extensive discharges = 0; no discharges = max points)	0-5	0-4	0-4	3
	5 Groundwater discharge (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0-3	0-4	0-4	0
	6 Presence of adjacent floodplain (no floodplain = 0; extensive floodplain = max points)	0-4	0-4	0-2	0
	7 Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0-5	0-4	0-2	2
	8 Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0-6	0-4	0-2	0
	9 Channel sinuosity (extensive channelization = 0; natural meander = max points)	0-5	0-4	0-3	1
	10 Sediment input (extensive deposition = 0; little or no sediment = max points)	0-5	0-4	0-4	2
	11 Size & diversity of channel bed substrate (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0-4	0-5	3
STABILITY	12 Evidence of channel incision or widening (deeply incised = 0; stable bed & banks = max points)	0-5	0-4	0-5	2
	13 Presence of major bank failures (severe erosion = 0; no erosion, stable banks = max points)	0-5	0-5	0-5	2
	14 Root depth and density on banks (no visible roots = 0; dense roots throughout = max points)	0-3	0-4	0-5	2
	15 Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0-5	0-4	0-5	4
HABITAT	16 Presence of riffle-pool/ripple-pool complexes (no riffles/ripples or pools = 0; well-developed = max points)	0-3	0-5	0-6	2
	17 Habitat complexity (little or no habitat = 0; frequent, varied habitats = max points)	0-6	0-6	0-6	4
	18 Canopy coverage over streambed (no shading vegetation = 0; continuous canopy = max points)	0-5	0-5	0-5	5
	19 Substrate embeddedness (deeply embedded = 0; loose structure = max)	NA*	0-4	0-4	3
BIOLOGY	20 Presence of stream invertebrates (see page 4) (no evidence = 0; common, numerous types = max points)	0-4	0-5	0-5	1
	21 Presence of amphibians (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	1
	22 Presence of fish (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	1
	23 Evidence of wildlife use (no evidence = 0; abundant evidence = max points)	0-6	0-5	0-5	2
Total Points Possible		100	100	100	
TOTAL SCORE (also enter on first page)					47

* These characteristics are not assessed in coastal streams.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: DOLRT City/County: Durham Sampling Date: 9/22/17
 Applicant/Owner: GoT State: NC Sampling Point: WS DP WET
 Investigator(s): J. Tisdale, J. Jamison Section, Township, Range: _____
 Landform (hillside, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 1%
 Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 35.9467195432517 Long: -78.9996210928656 Datum: NAD83
 Soil Map Unit Name: WsC - White Store sandy loam, 6 to 10 percent slopes NWI classification: PFO
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 <u>X</u>	No _____	Is the Sampled Area within a Wetland?	Yes <u>X</u>	No _____
Hydric Soil Present?	Yes <u>X</u>	No _____			
Wetland Hydrology Present?	Yes <u>X</u>	No _____			
Remarks:					

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u>		<u>Secondary Indicators (minimum of two required)</u>	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> True Aquatic Plants (B14)	<input checked="" type="checkbox"/> Surface Soil Cracks (B6)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input checked="" type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input checked="" type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Moss Trim Lines (B16)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Dry-Season Water Table (C2)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Crayfish Burrows (C8)	
<input type="checkbox"/> Algal Mat or Crust (B4)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Water-Stained Leaves (B9)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Aquatic Fauna (B13)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	
Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes <u>X</u> No _____	
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:			
Remarks: No water			

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

 Sampling Point: WS DP WET

Tree Stratum (Plot size: <u>30' r</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Carya glabra</u>	20	Yes	FACU	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>8</u> (A) Total Number of Dominant Species Across All Strata: <u>13</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>61.5%</u> (A/B)
2. <u>Quercus phellos</u>	20	Yes	FAC	
3. <u>Quercus alba</u>	20	Yes	FACU	
4. <u>Liquidambar styraciflua</u>	20	Yes	FAC	
5. <u>Quercus nigra</u>	20	Yes	FAC	
6. <u>Ulmus americana</u>	20	Yes	FACW	
7. _____				
120 =Total Cover				Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>60</u> x 2 = <u>120</u> FAC species <u>130</u> x 3 = <u>390</u> FACU species <u>115</u> x 4 = <u>460</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>305</u> (A) <u>970</u> (B) Prevalence Index = B/A = <u>3.18</u>
50% of total cover: <u>60</u>		20% of total cover: <u>24</u>		
Sapling/Shrub Stratum (Plot size: <u>30' r</u>)				
1. <u>Carya glabra</u>	20	Yes	FACU	Hydrophytic Vegetation Indicators: <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Fraxinus pennsylvanica</u>	20	Yes	FACW	
3. <u>Cornus amomum</u>	10	No	FACW	
4. <u>Viburnum prunifolium</u>	10	No	FACU	
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
60 =Total Cover				
50% of total cover: <u>30</u>		20% of total cover: <u>12</u>		
Herb Stratum (Plot size: <u>15' r</u>)				
1. <u>Parthenocissus quinquefolia</u>	20	Yes	FACU	Definitions of Four Vegetation Strata: Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody Vine – All woody vines greater than 3.28 ft in height.
2. <u>Toxicodendron radicans</u>	20	Yes	FAC	
3. <u>Lonicera japonica</u>	15	Yes	FACU	
4. <u>Ligustrum sinense</u>	10	No	FACU	
5. <u>Fraxinus pennsylvanica</u>	10	No	FACW	
6. <u>Campsis radicans</u>	10	No	FAC	
7. <u>Microstegium vimineum</u>	10	No	FAC	
8. _____				
9. _____				
10. _____				
11. _____				
95 =Total Cover				
50% of total cover: <u>48</u>		20% of total cover: <u>19</u>		
Woody Vine Stratum (Plot size: <u>15' r</u>)				
1. <u>Toxicodendron radicans</u>	20	Yes	FAC	Hydrophytic Vegetation Present? Yes <u>X</u> No _____
2. <u>Smilax rotundifolia</u>	10	Yes	FAC	
3. _____				
4. _____				
5. _____				
30 =Total Cover				
50% of total cover: <u>15</u>		20% of total cover: <u>6</u>		
Remarks: (Include photo numbers here or on a separate sheet.)				

SOIL

 Sampling Point: WS DP WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (Inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-2	10yr 4/4	100					Loamy/Clayey	
2-9	10yr 5/6	100					Loamy/Clayey	
9-14	10yr 6/2	85	10yr 6/6	15	C	M	Loamy/Clayey	Prominent redox concentrations
¹ Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.					² Location: PL=Pore Lining, M=Matrix.			
Hydric Soil Indicators:						Indicators for Problematic Hydric Soils³		
<input type="checkbox"/> Histosol (A1)			<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)			<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)		
<input type="checkbox"/> Histic Epipedon (A2)			<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)			<input type="checkbox"/> Coast Prairie Redox (A16)		
<input type="checkbox"/> Black Histic (A3)			<input type="checkbox"/> Loamy Mucky Mineral (F1) (MLRA 136)			<input type="checkbox"/> (MLRA 147, 148)		
<input type="checkbox"/> Hydrogen Sulfide (A4)			<input type="checkbox"/> Loamy Gleyed Matrix (F2)			<input type="checkbox"/> Piedmont Floodplain Soils (F19)		
<input type="checkbox"/> Stratified Layers (A5)			<input type="checkbox"/> Depleted Matrix (F3)			<input type="checkbox"/> (MLRA 136, 147)		
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)			<input type="checkbox"/> Redox Dark Surface (F6)			<input type="checkbox"/> Red Parent Material (F21)		
<input type="checkbox"/> Depleted Below Dark Surface (A11)			<input checked="" type="checkbox"/> Depleted Dark Surface (F7)			<input type="checkbox"/> (outside MLRA 127, 147, 148)		
<input type="checkbox"/> Thick Dark Surface (A12)			<input type="checkbox"/> Redox Depressions (F8)			<input type="checkbox"/> Very Shallow Dark Surface (F22)		
<input type="checkbox"/> Sandy Mucky Mineral (S1)			<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N,			<input type="checkbox"/> Other (Explain in Remarks)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)			<input type="checkbox"/> MLRA 136)			³ Indicators of hydrophytic vegetation and		
<input type="checkbox"/> Sandy Redox (S5)			<input type="checkbox"/> Umbric Surface (F13) (MLRA 122, 136)			wetland hydrology must be present,		
<input type="checkbox"/> Stripped Matrix (S6)			<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)			unless disturbed or problematic.		
<input type="checkbox"/> Dark Surface (S7)			<input type="checkbox"/> Red Parent Material (F21) (MLRA 127, 147, 148)					
Restrictive Layer (if observed):								
Type: _____								
Depth (Inches): _____						Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		
Remarks: This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016. Soil dry, Wet for color.								

This page intentionally left blank.

Attachment H.2: Qualifications of Contributors

This page intentionally left blank.

Principal

Investigator: Jessica Tisdale
Education: M.S. Forestry, NC State University, 2008
B.S. Environmental Sciences, University of Maine, 2002
Experience: Environmental Scientist, HDR Engineering, 2008-Present
Ecological Monitor, Goldstein and Associates, 2006-2007
Forest Service/NCSU Research Technician, 2005-2008
Responsibilities: GPS/GIS, stream/wetland delineation, preparation, T/E species Assessment, QA/QC, natural resource investigation, protected species surveys, wetland delineation, surface water identification, document preparation.

Investigator: John Jamison, Professional Wetland Scientist (PWS)
Education: B.S. Natural Resources, NC State University, 1999
Experience: Project Manager/ Senior Environmental Scientist, HDR Engineering, 2004-Present
Environmental Scientist, AMEC (f/k/a Law Engineering)
Responsibilities: Oversight, quality control

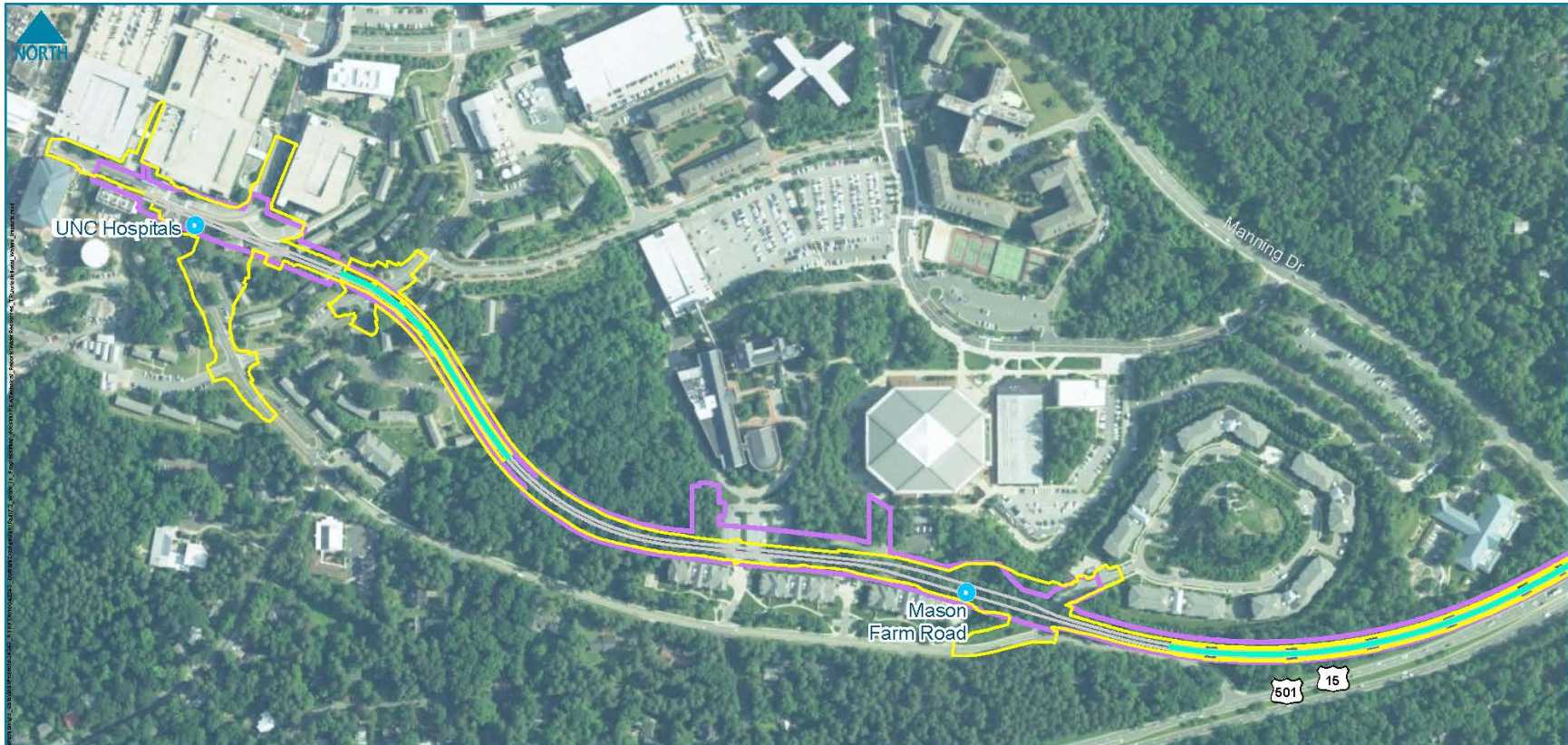
Investigator: Eanas Alia
Education: B.S. Environmental Technology and Management, NC State University, 2016
Experience: Environmental Scientist, HDR Engineering, 2017-Present
Program Coordinator, Doris Duke Conservation Scholars Program, 2016-2017
Responsibilities: GPS/GIS, document preparation, field support

Investigator: Josh Mace, Professional Wetland Delineator (PWD)
Education: M.N.R Fisheries, Utah State University, 2003
B.A. Environmental Sciences, University of Virginia, 2002
Experience: Project Manager/ Senior Environmental Scientist, HDR Engineering, 2008-Present
Environmental Engineer, VDOT 2006-2008
Researcher, University of Virginia 2004-2006
Responsibilities: Quality control

This page intentionally left blank.

Attachment H.3: Water Resource Impact Map Updates

This page intentionally left blank.

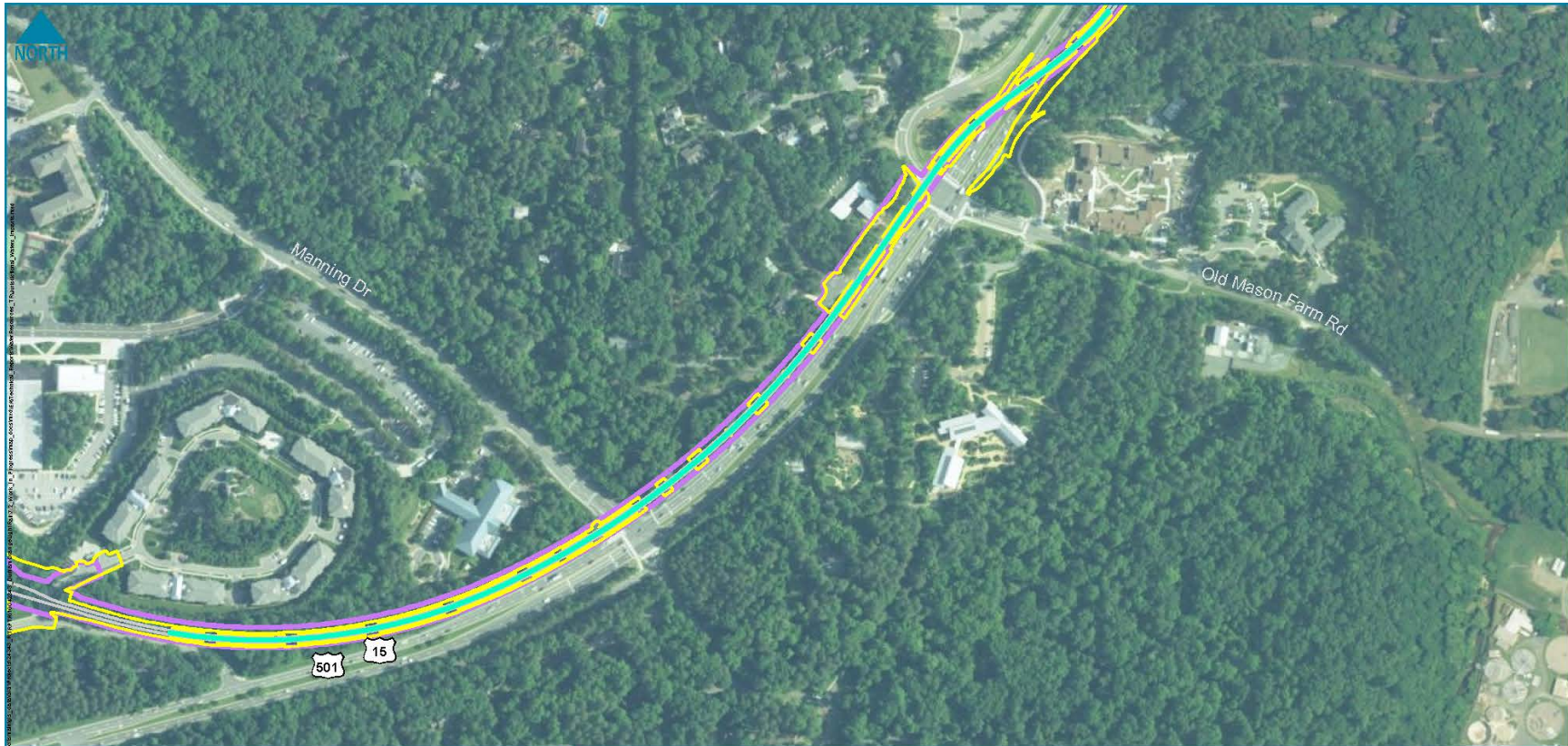


Jurisdictional Waters Impacts
FIGURE 1A
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)

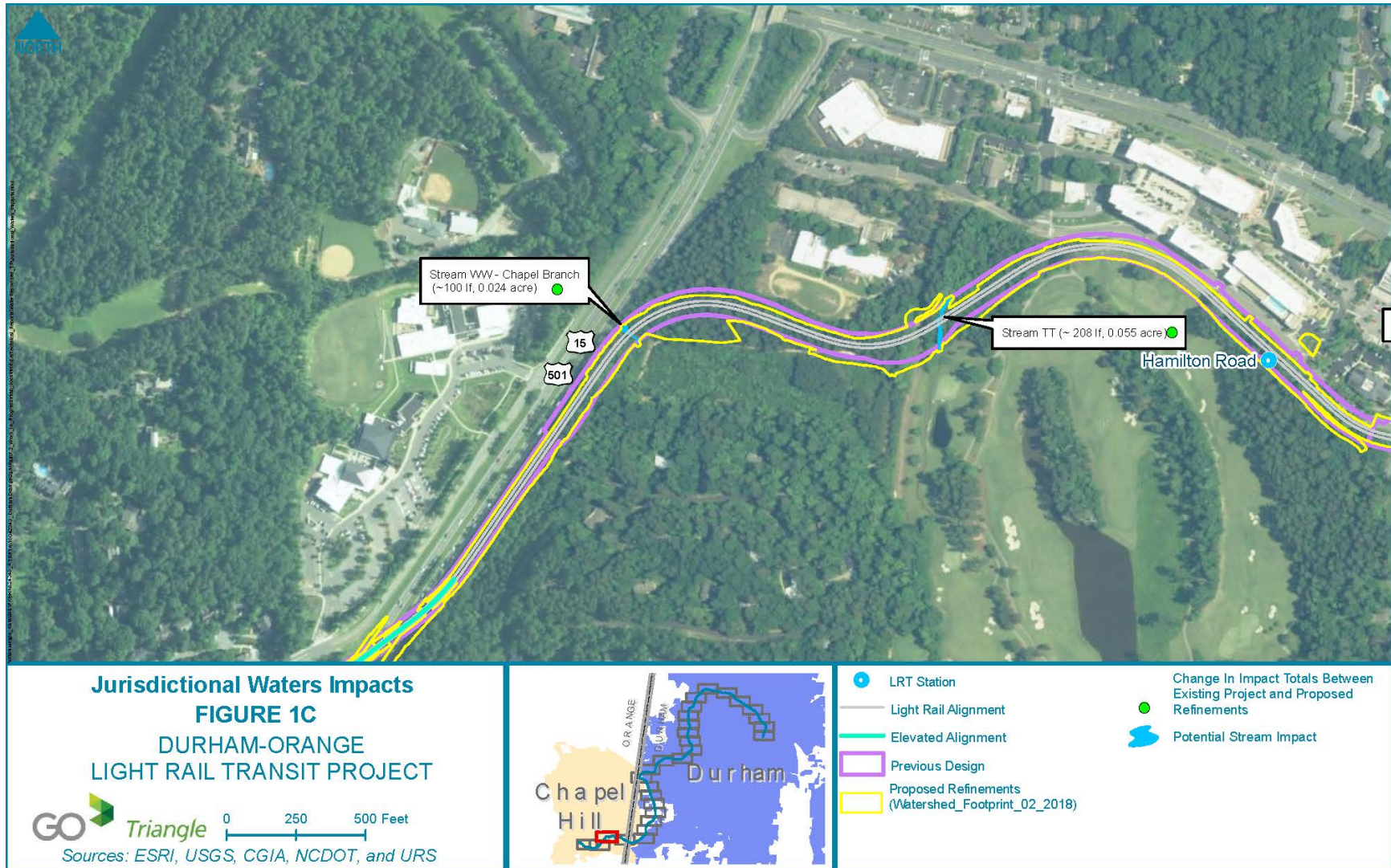


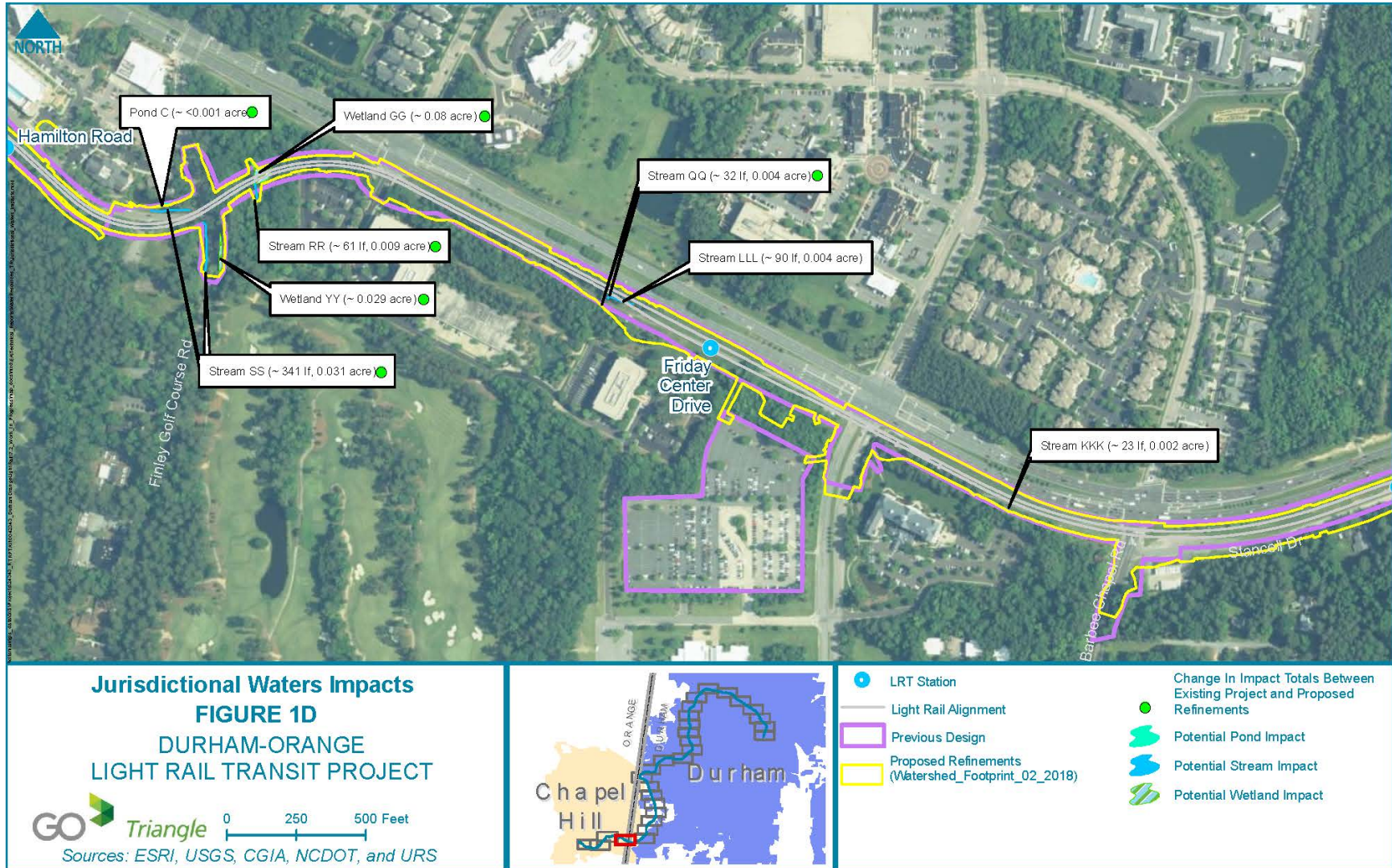
Jurisdictional Waters Impacts
FIGURE 1B
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

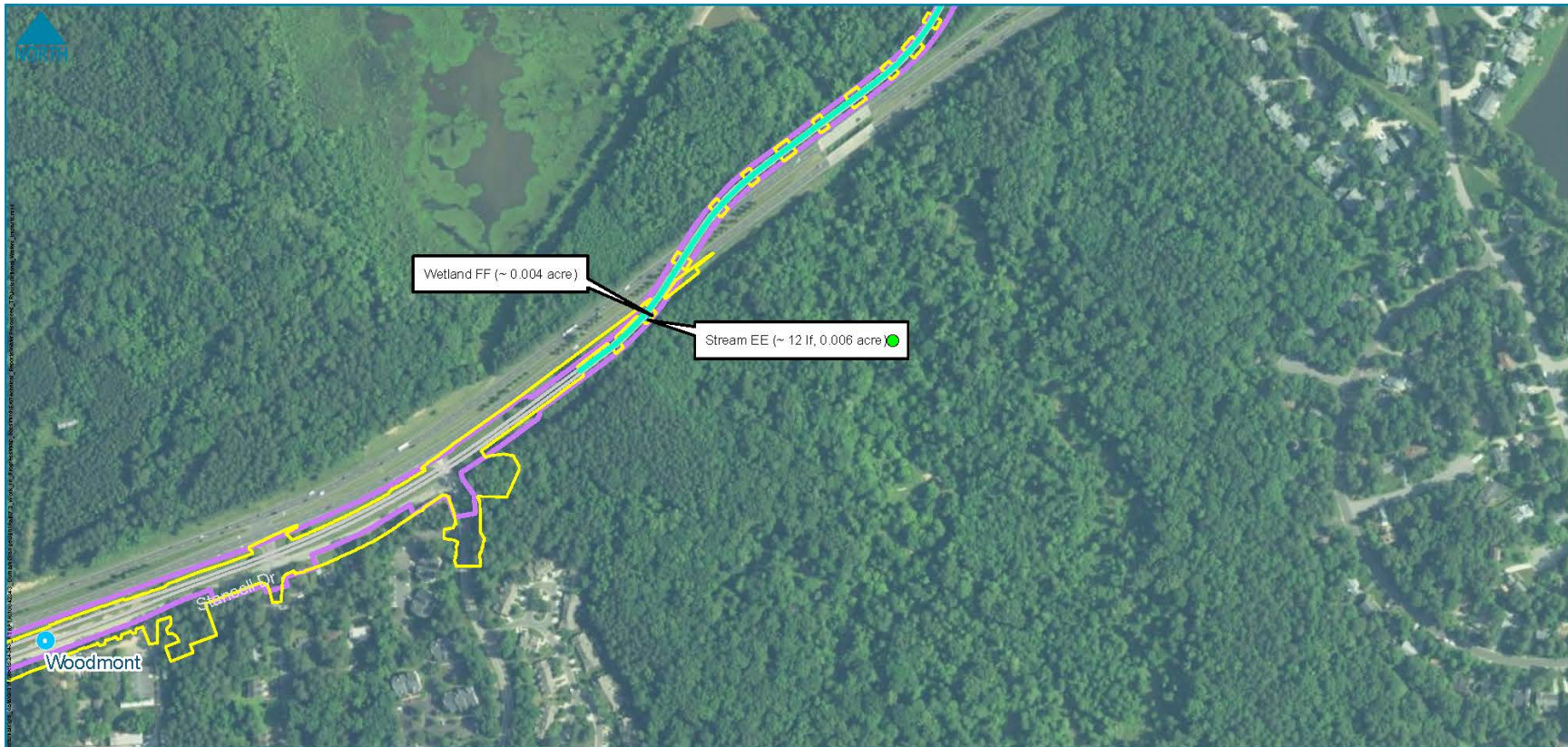
GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)





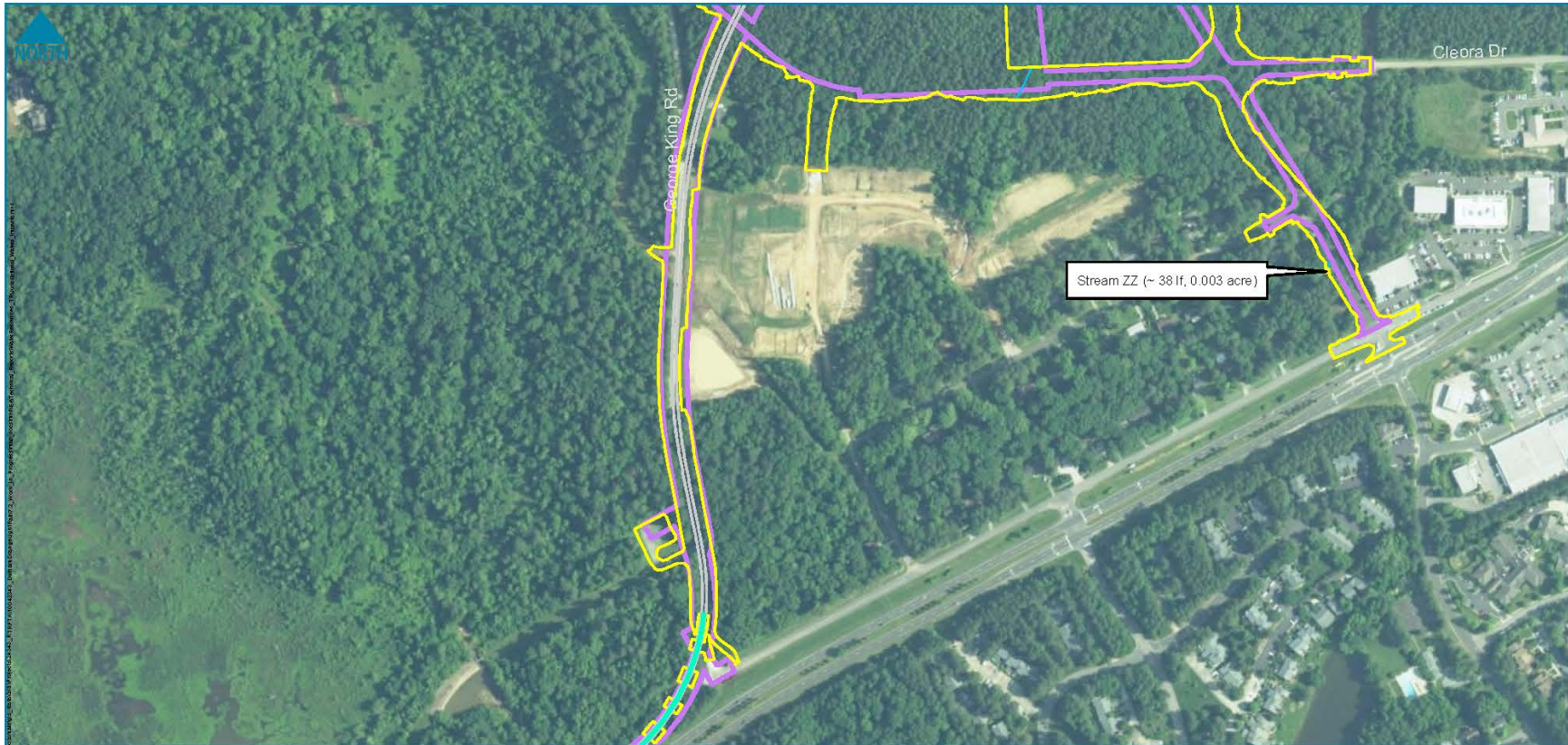


Jurisdictional Waters Impacts
FIGURE 1E
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Potential Stream Impact
- Potential Wetland Impact

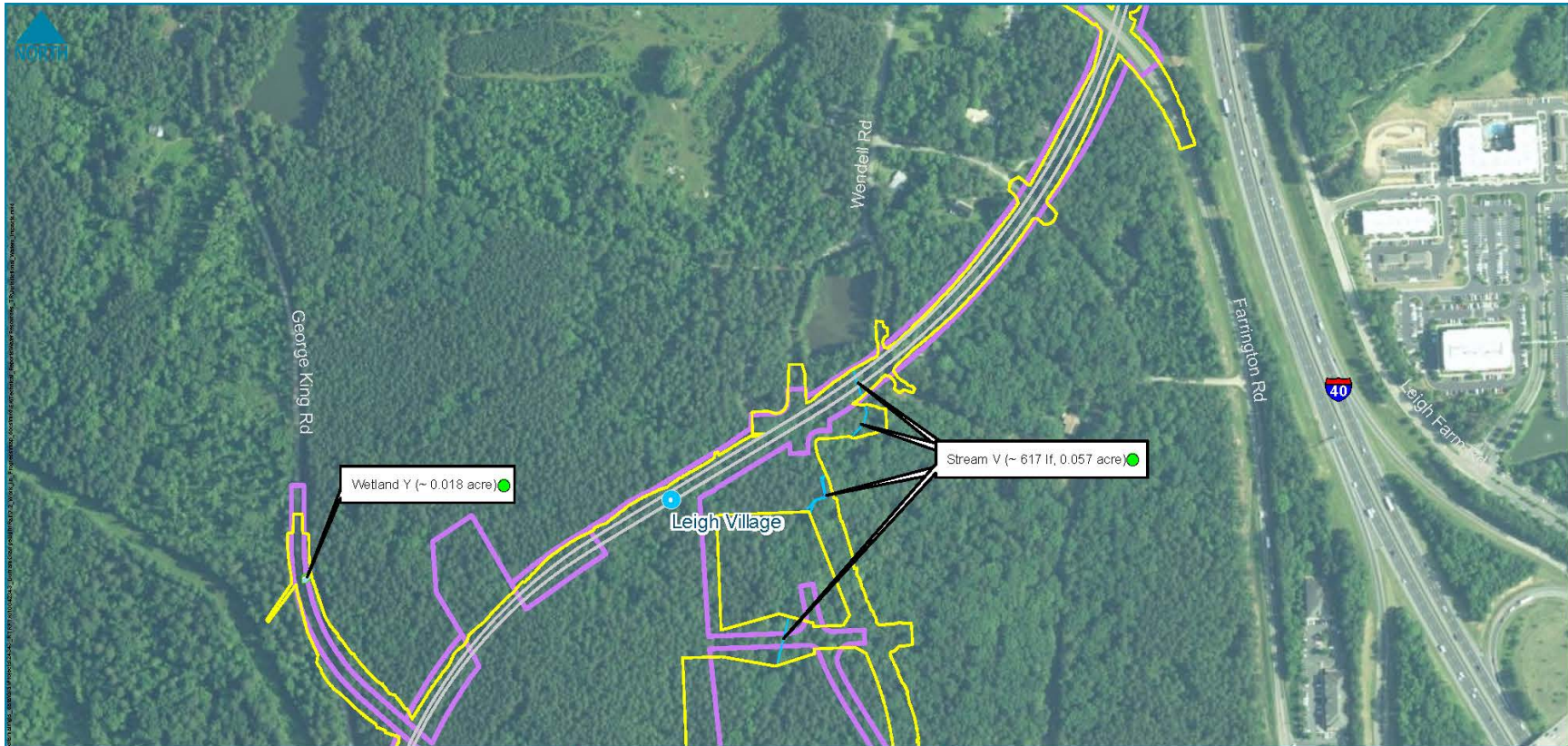


Jurisdictional Waters Impacts
FIGURE 1F
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- ☁ Potential Stream Impact



Jurisdictional Waters Impacts
FIGURE 1G
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Potential Stream Impact
- Potential Wetland Impact



Jurisdictional Waters Impacts
FIGURE 1H
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



-  Light Rail Alignment
-  Previous Design
-  Proposed Refinements (Watershed_Footprint_02_2018)
-  Potential Stream Impact





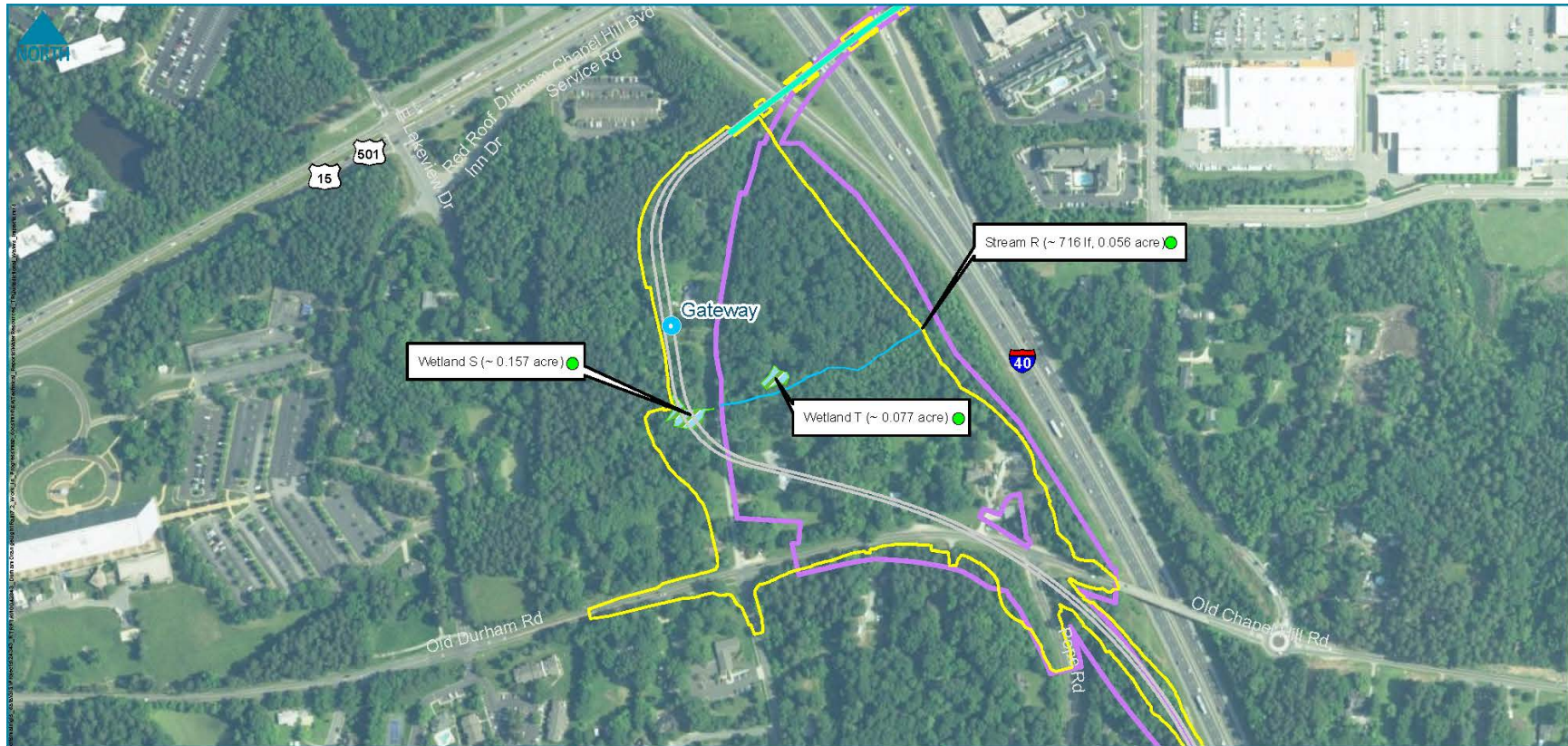


Jurisdictional Waters Impacts
FIGURE 1K
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Potential Stream Impact

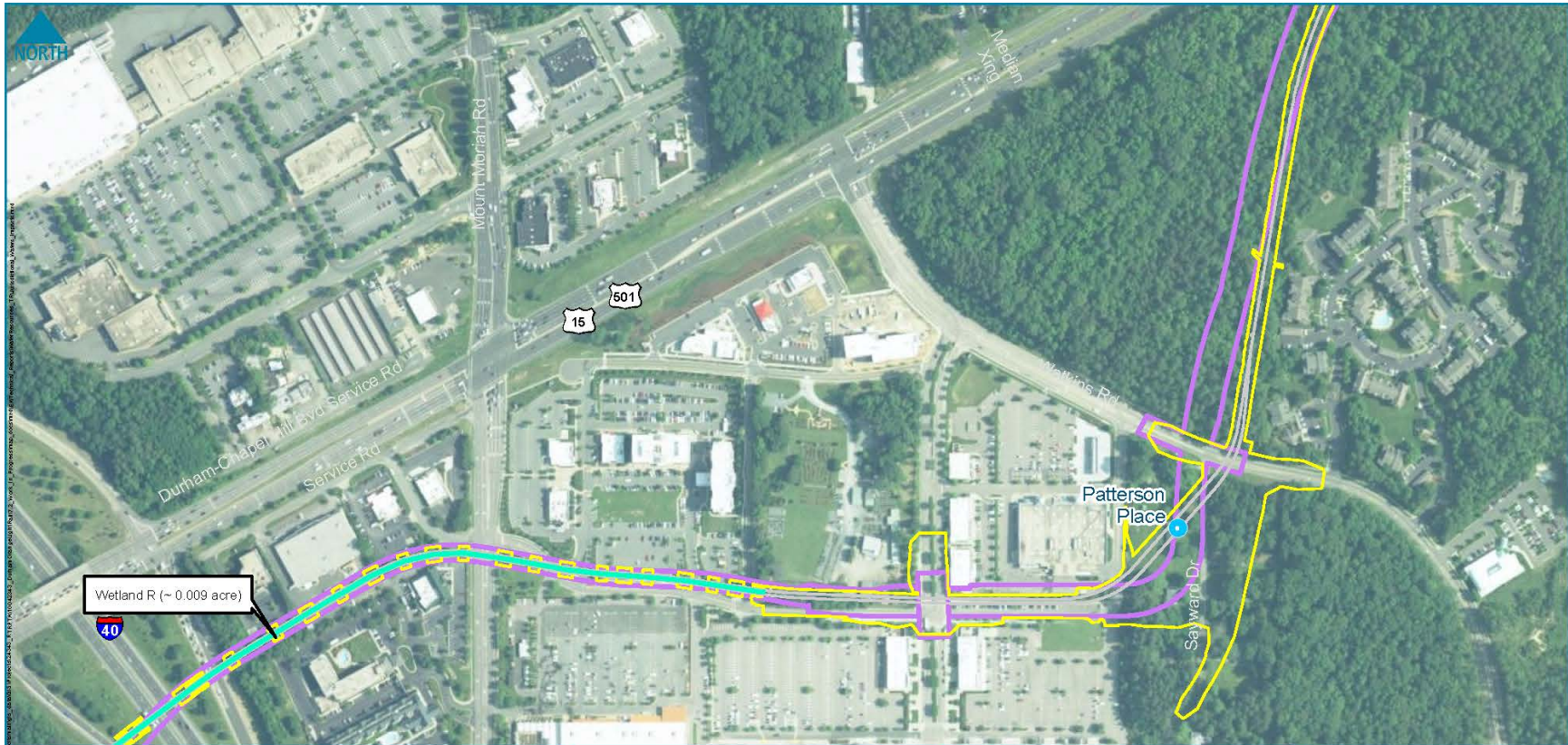


Jurisdictional Waters Impacts
FIGURE 1L
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



LRT Station	Change In Impact Totals Between Existing Project and Proposed Refinements
Light Rail Alignment	Potential Stream Impact
Elevated Alignment	Potential Wetland Impact
Previous Design	
Proposed Refinements (Watershed_Footprint_02_2018)	

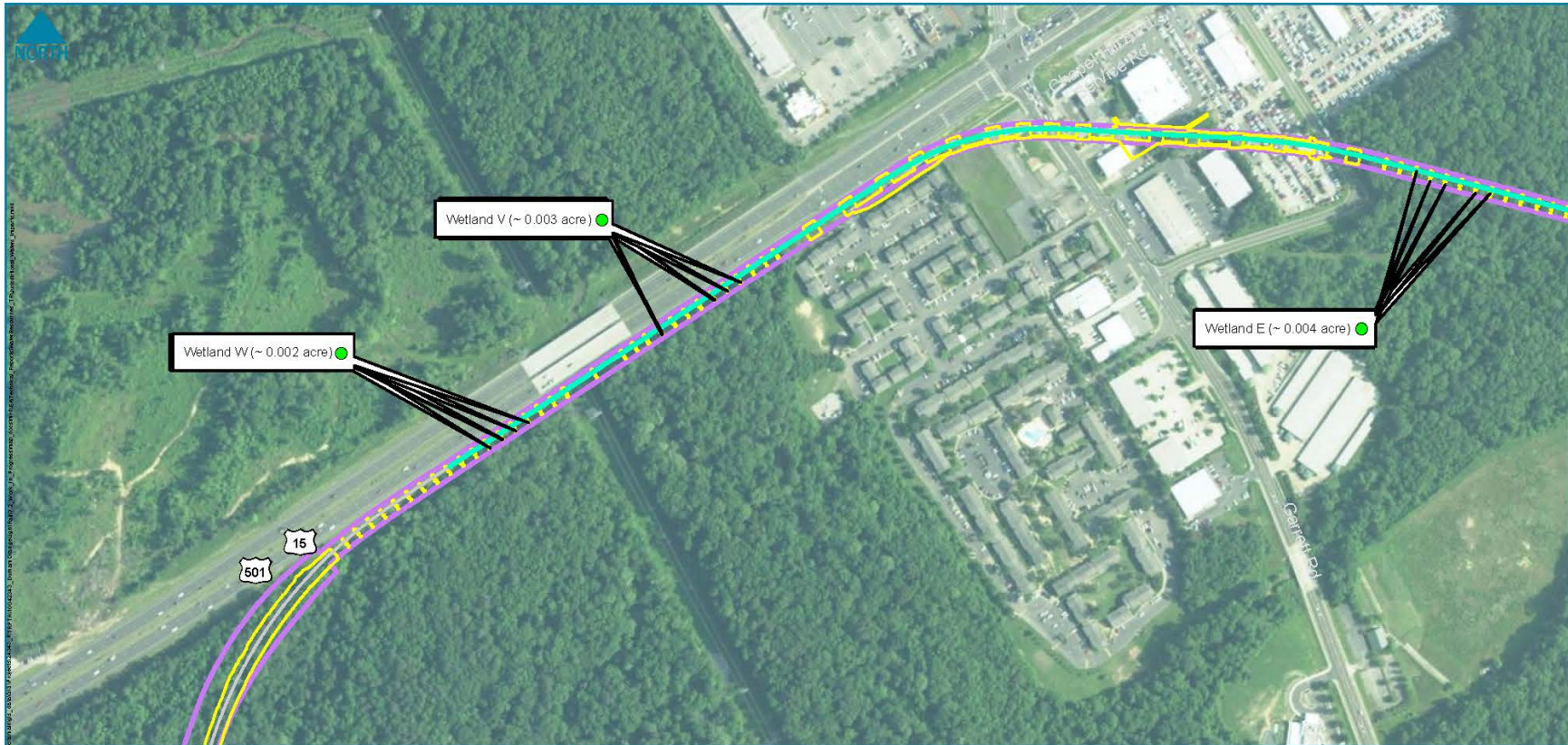


Jurisdictional Waters Impacts
FIGURE 1M
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- - - Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Potential Wetland Impact



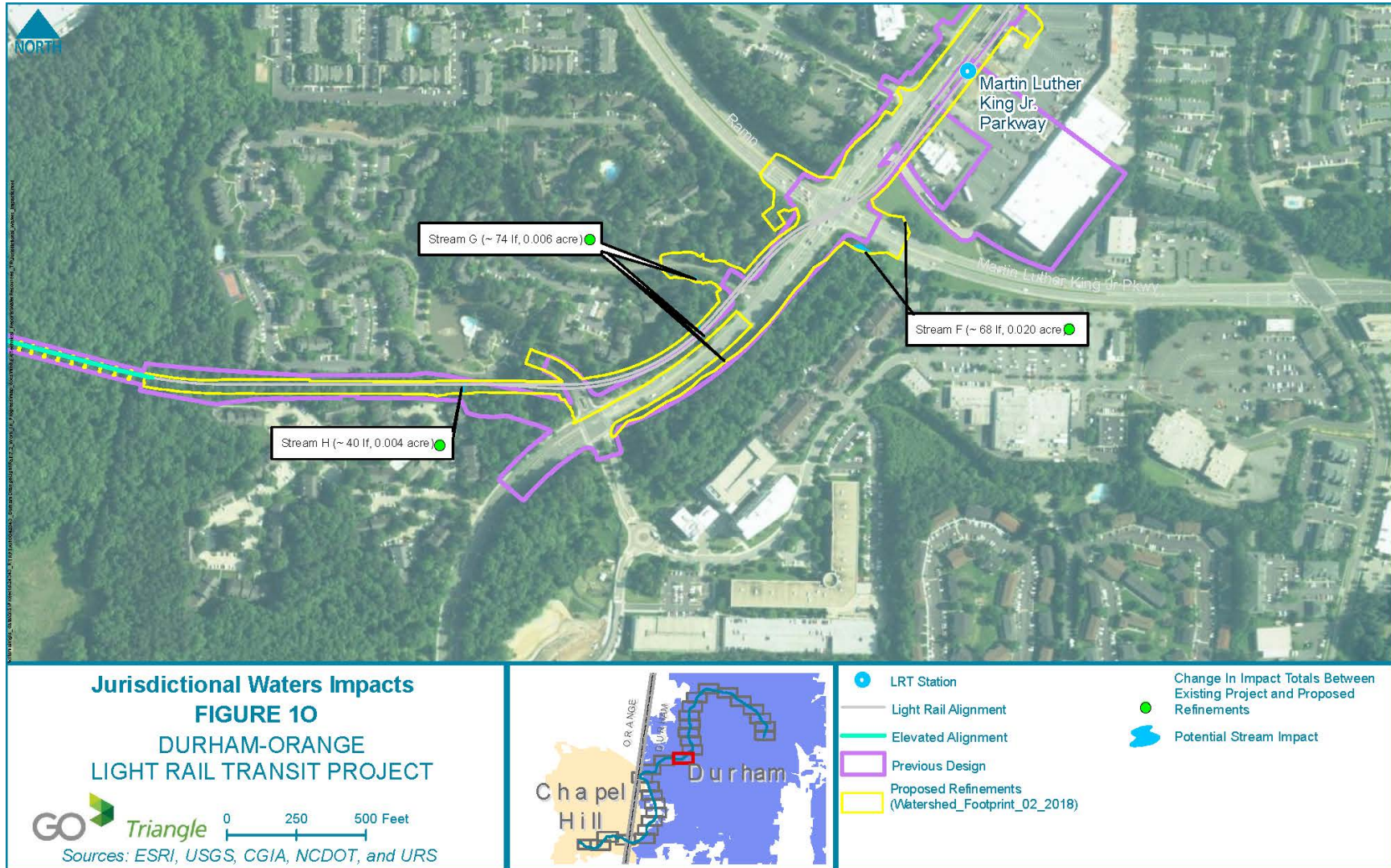
Jurisdictional Waters Impacts
FIGURE 1N
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet



- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change in Impact Totals Between Existing Project and Proposed Refinements
- ▨ Potential Wetland Impact



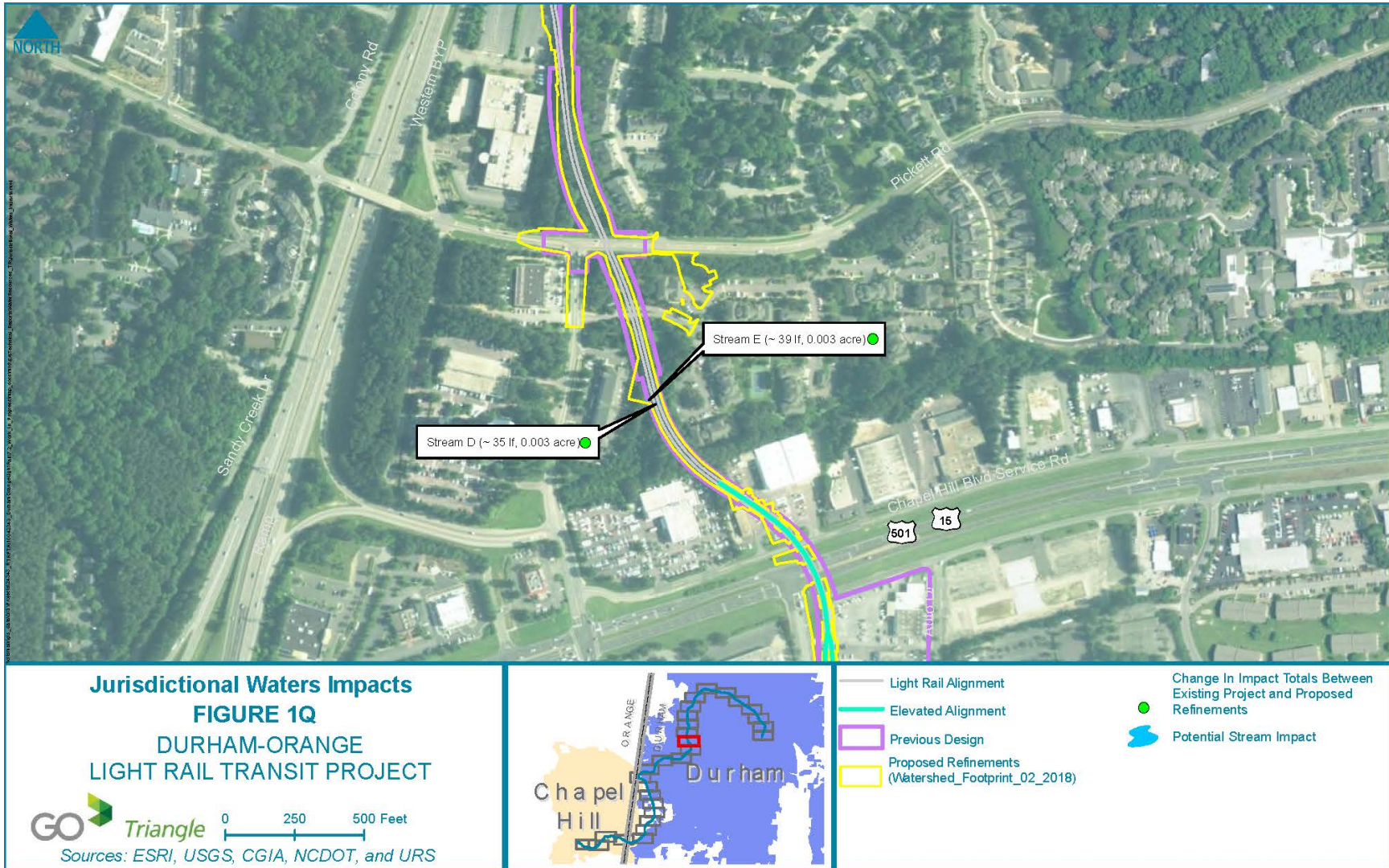


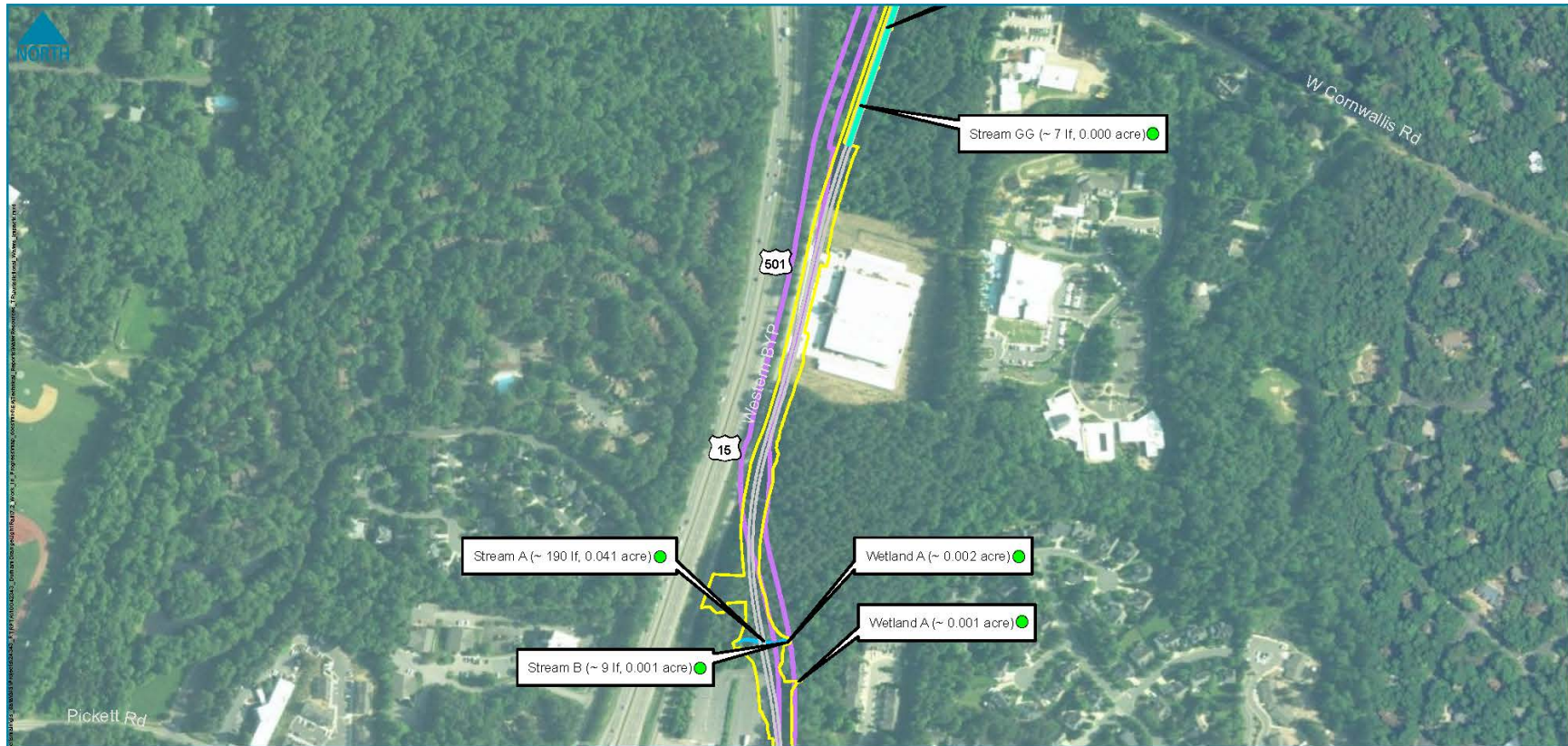
Jurisdictional Waters Impacts
FIGURE 1P
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Proposed Underpass
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)



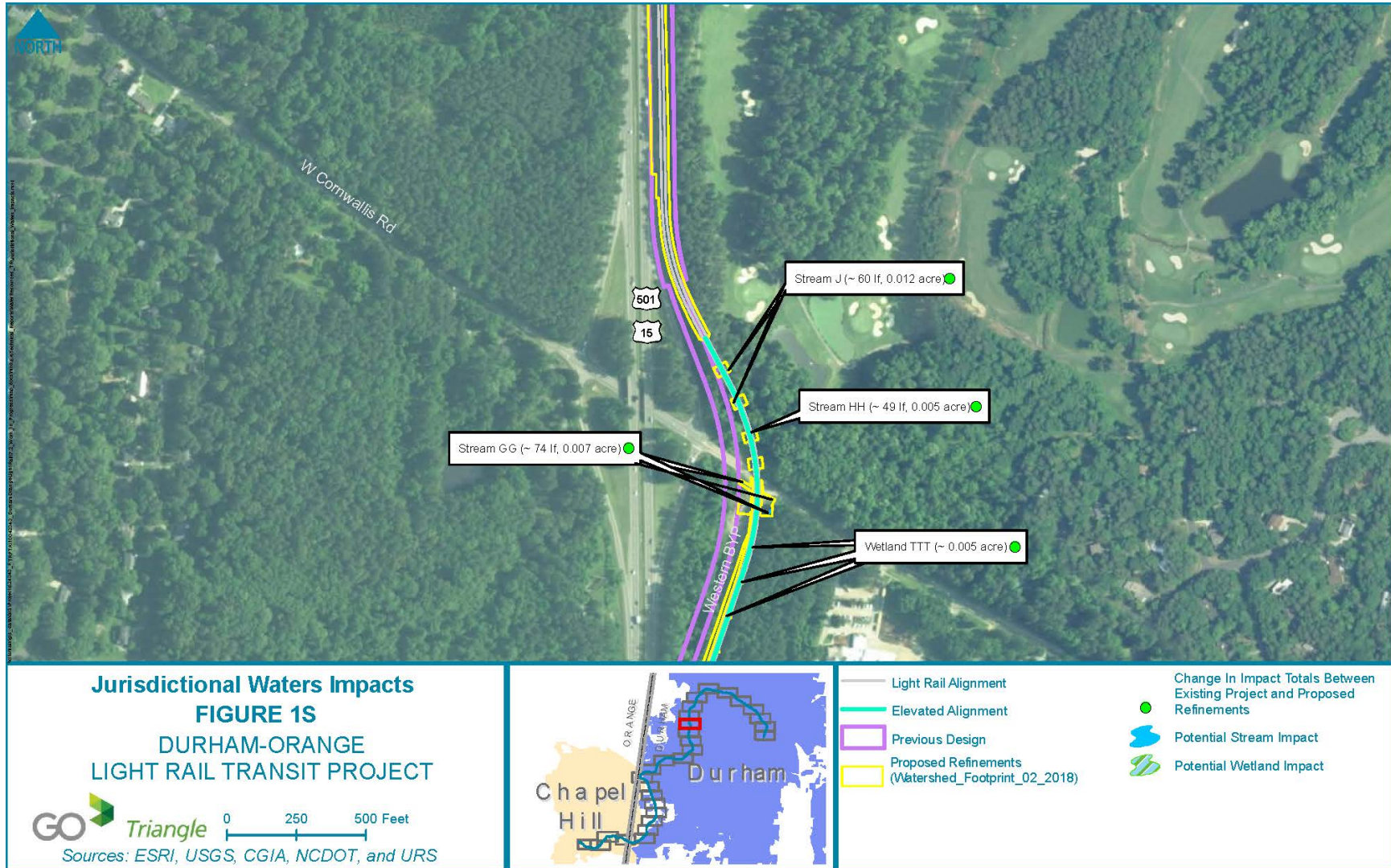


Jurisdictional Waters Impacts
FIGURE 1R
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Potential Stream Impact
- Potential Wetland Impact



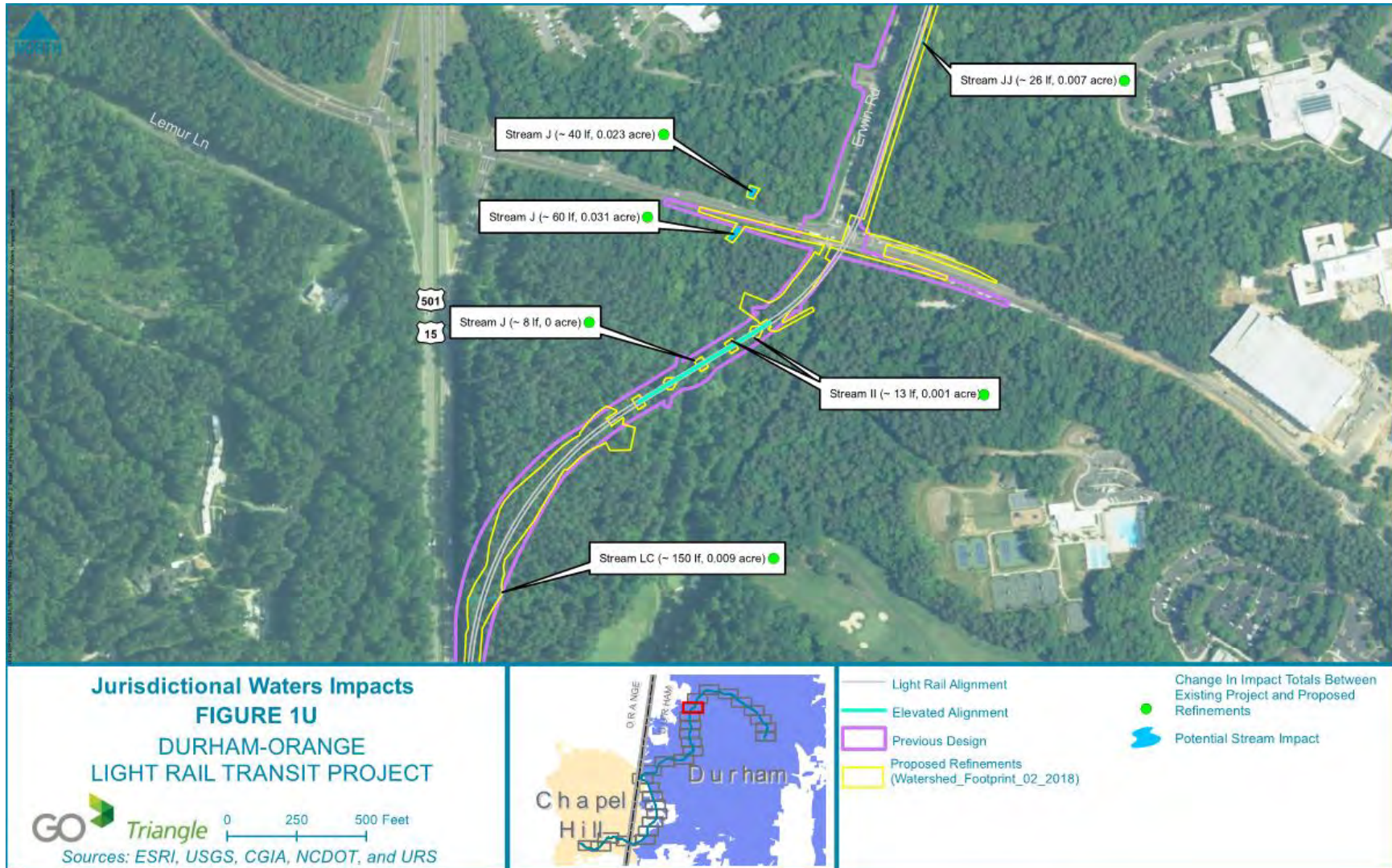


Jurisdictional Waters Impacts
FIGURE 1T
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO **Triangle** 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)



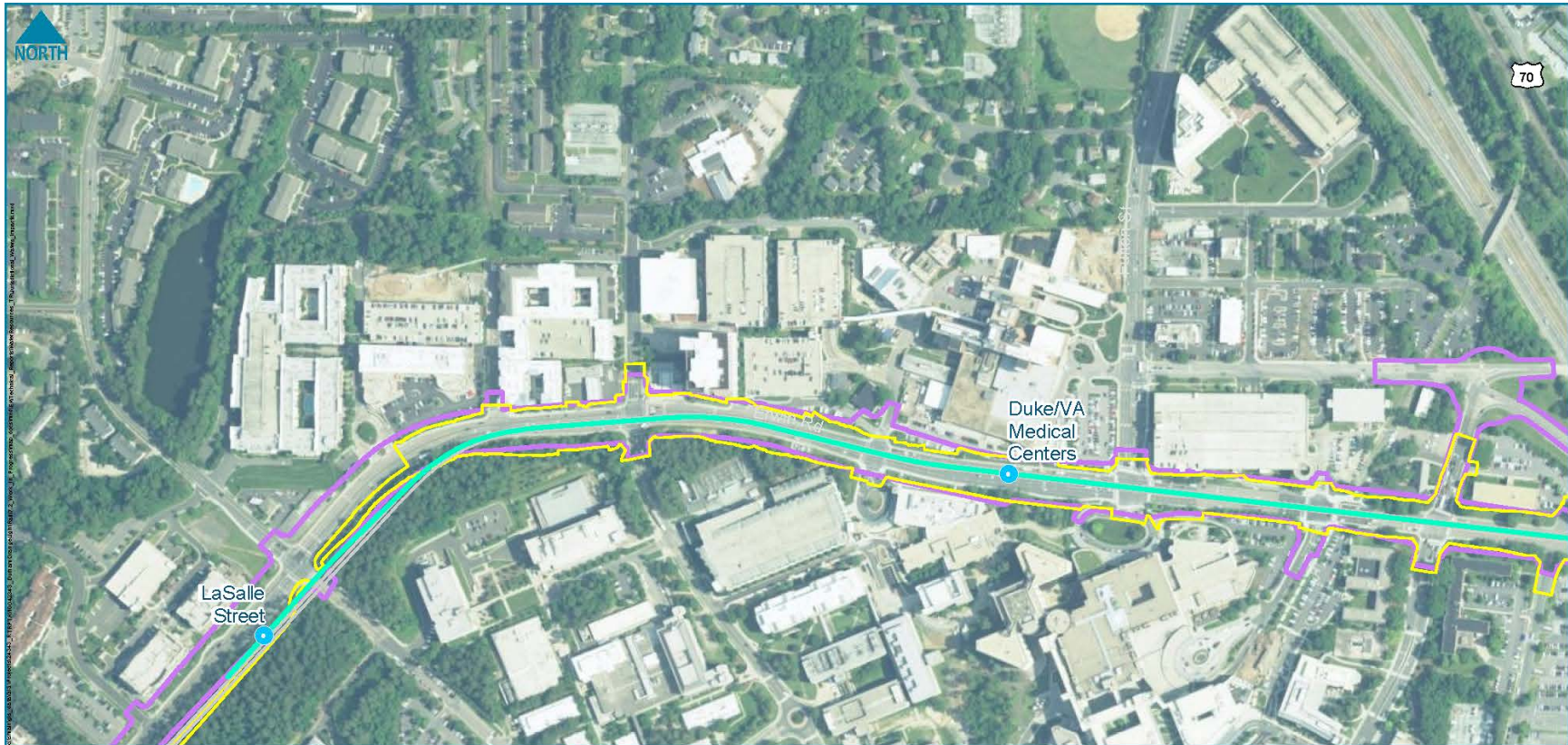


Jurisdictional Waters Impacts
FIGURE 1V
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Potential Stream Impact

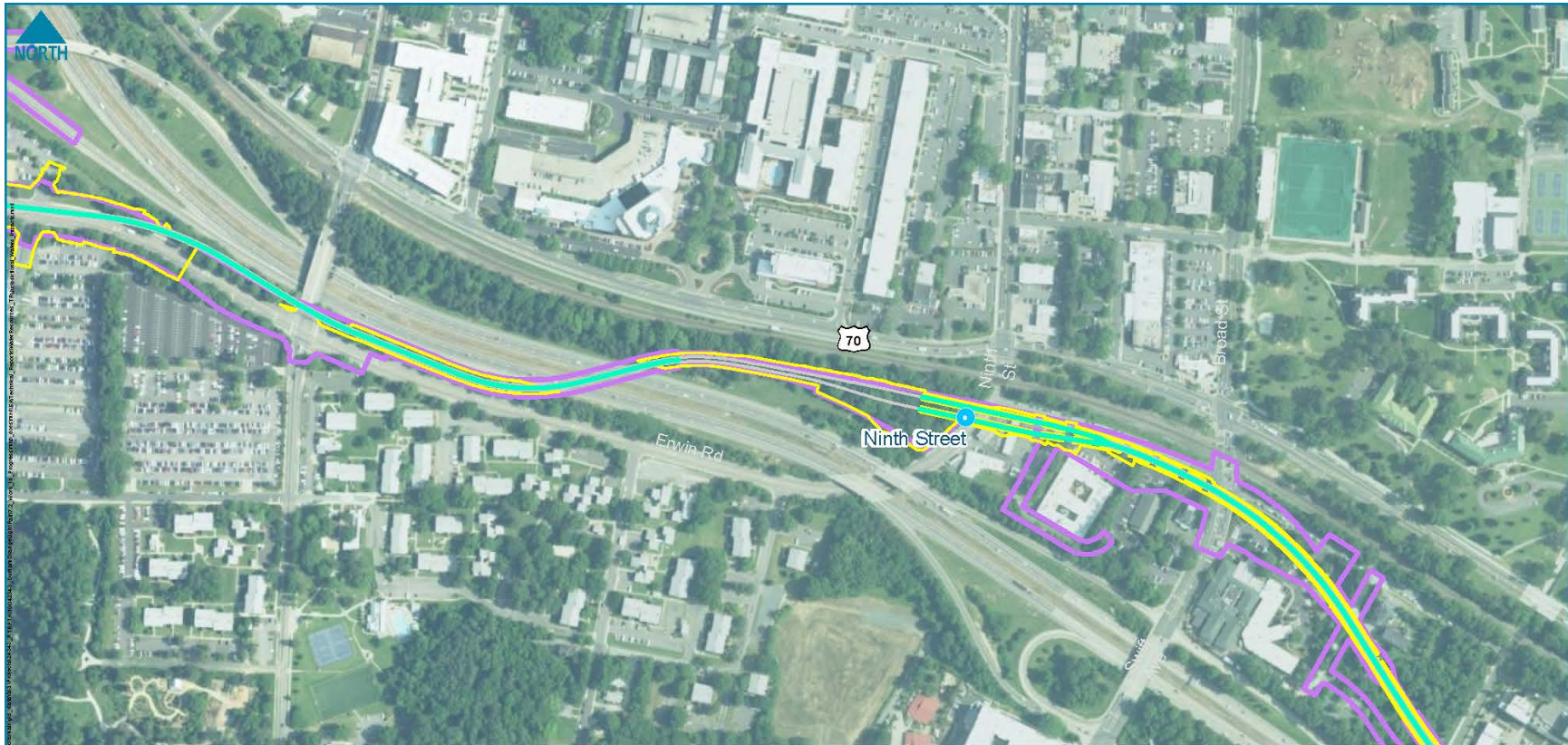


Jurisdictional Waters Impacts
FIGURE 1W
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)

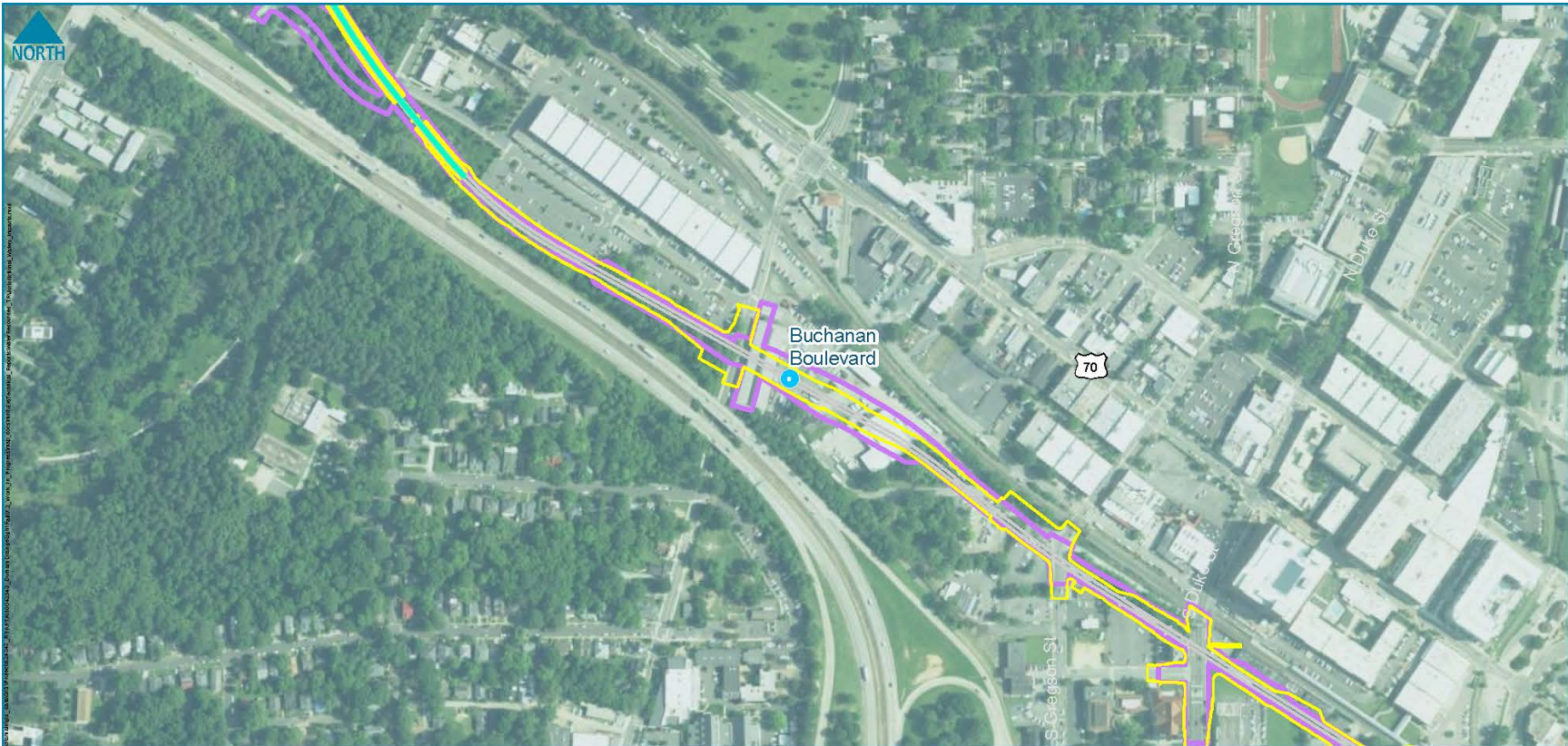


Jurisdictional Waters Impacts
FIGURE 1X
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)



Jurisdictional Waters Impacts
FIGURE 1Y
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)



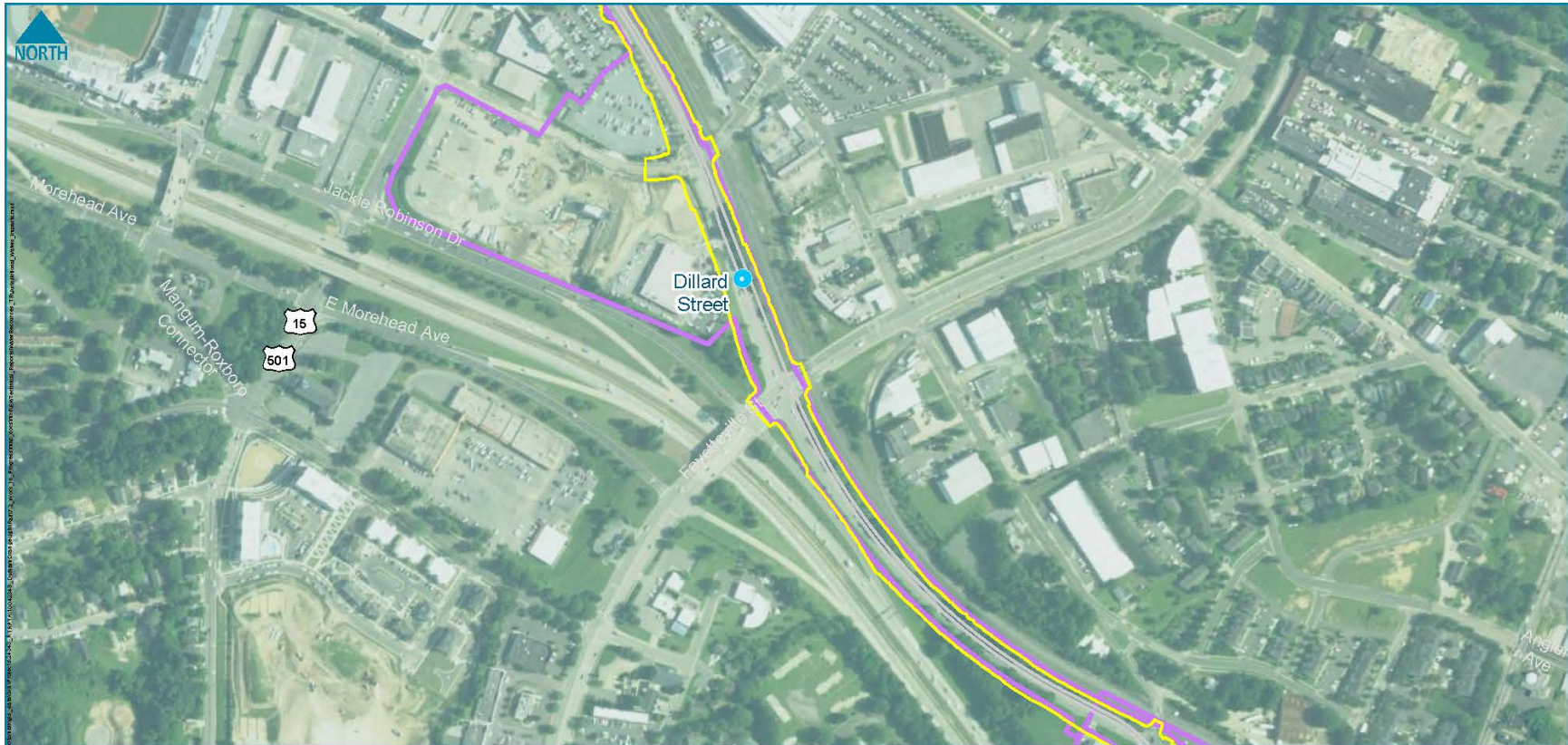
Jurisdictional Waters Impacts
FIGURE 1Z
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 250 500 Feet



- LRT Station
- Proposed LRT Station
- Light Rail Alignment
- ▭ Previous Design
- ▭ Proposed Refinements (Watershed_Footprint_02_2018)

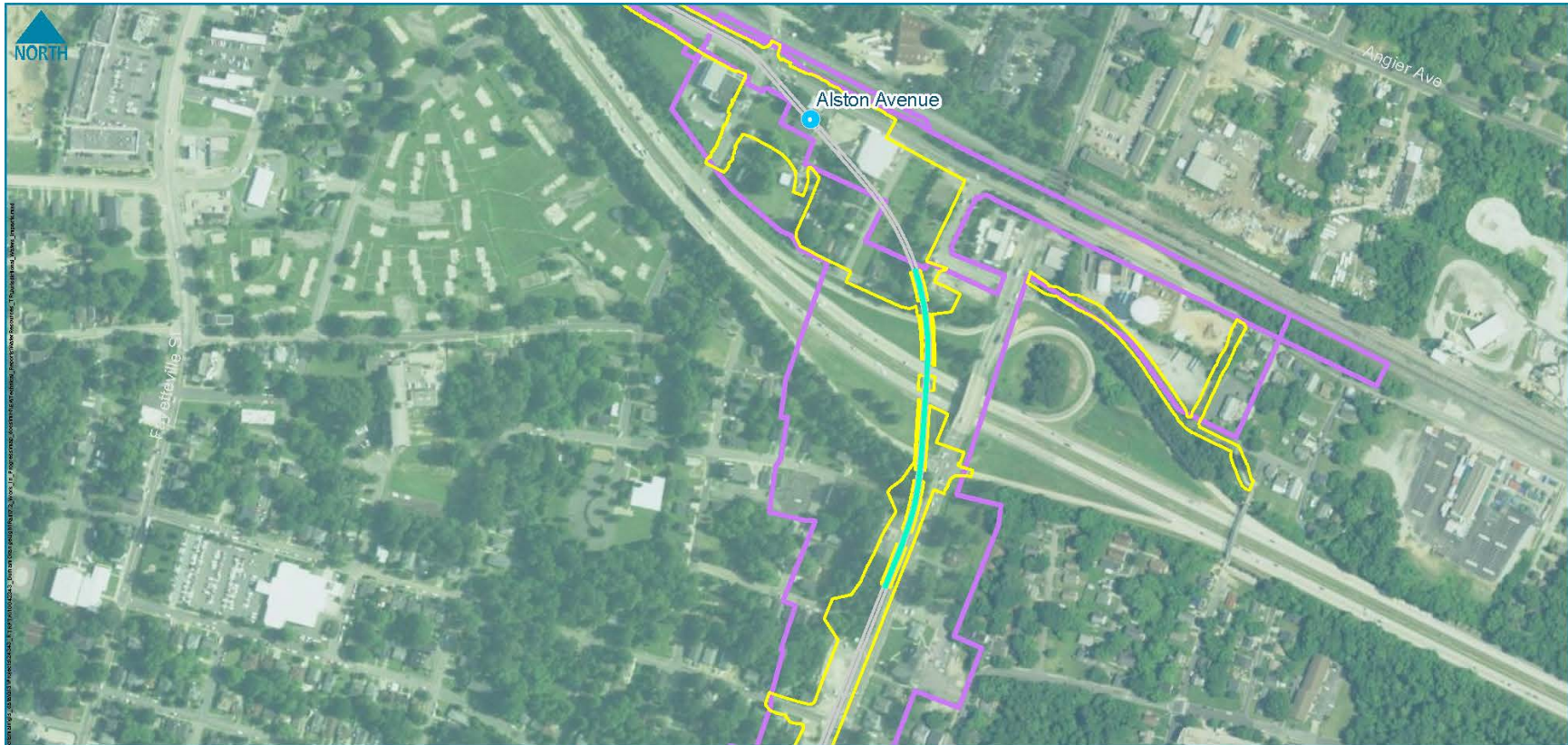


**Jurisdictional Waters Impacts
FIGURE 1AA
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle 0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)



Jurisdictional Waters Impacts
FIGURE 1BB
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)

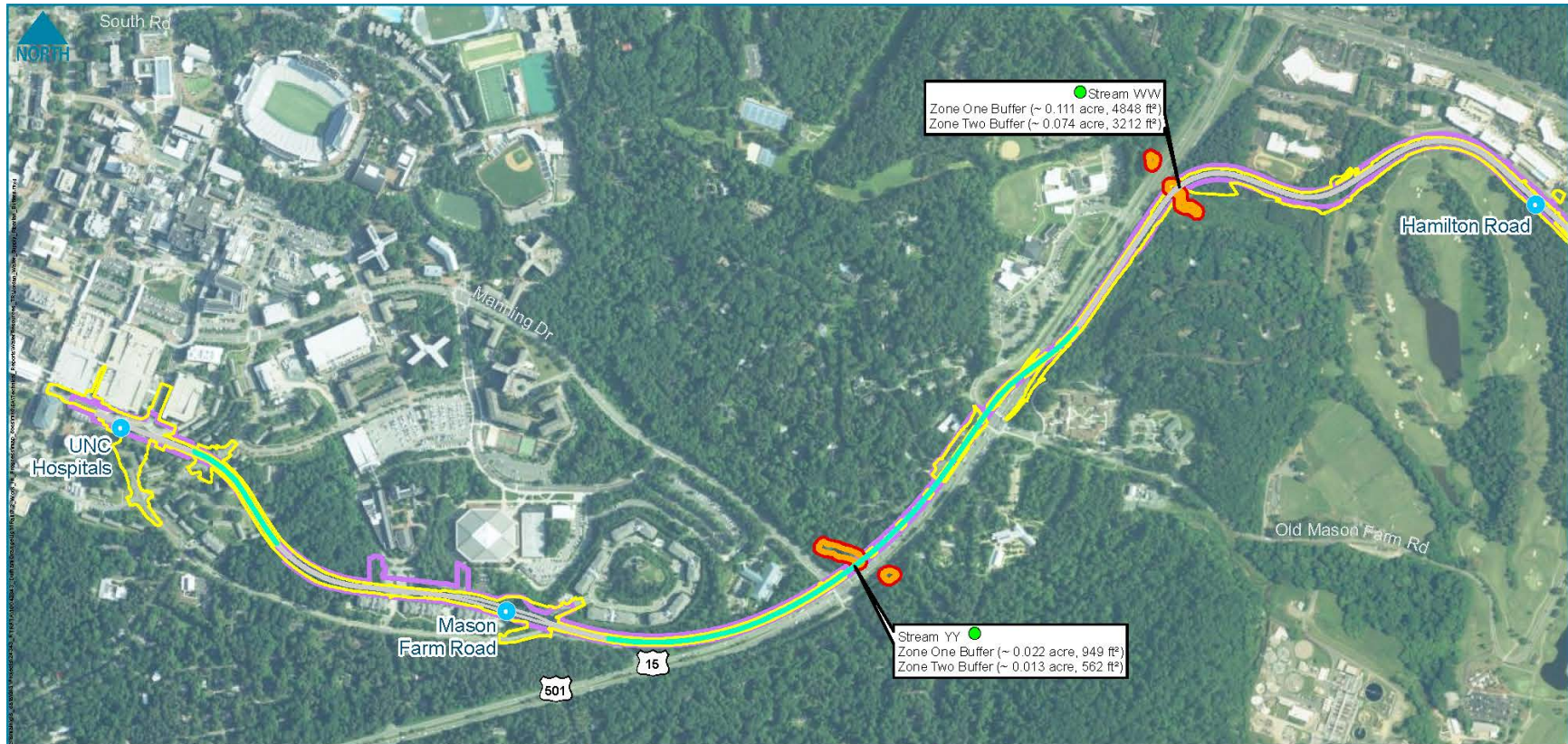


Jurisdictional Waters Impacts
FIGURE 1CC
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 250 500 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS

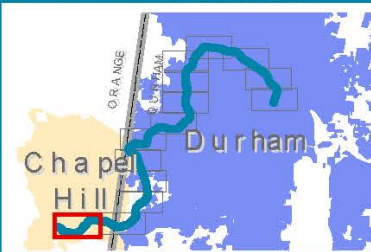


- LRT Station
- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)

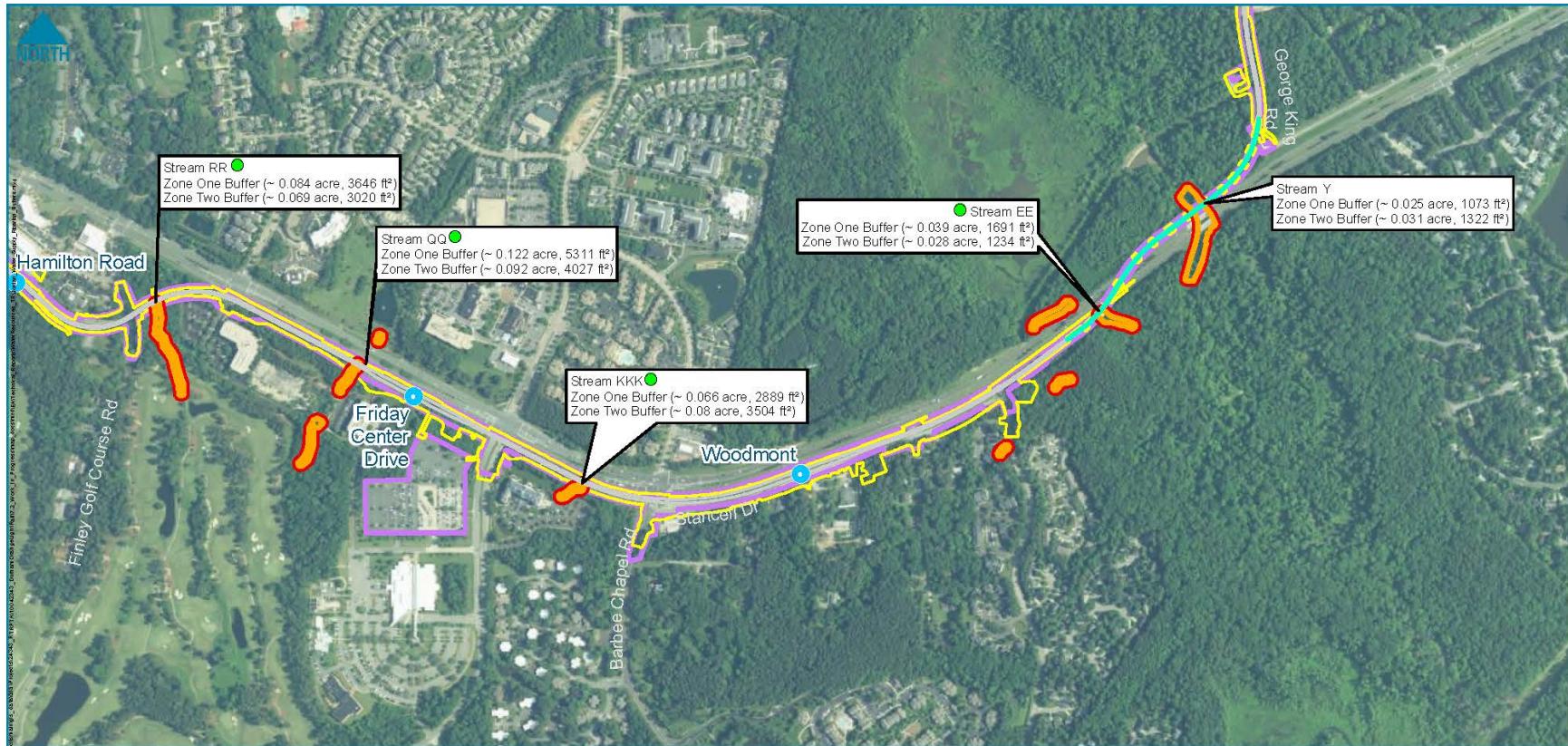


Jordan Water Supply Riparian Buffer Impacts
Figure 2A
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
 Sources: ESRI, USGS, CGIA, NCDOT, and URS



● LRT Station	● Change In Impact Totals Between Existing Project and Proposed Refinements
— Light Rail Alignment	● Jordan Lake Buffer Zone One
— Elevated Alignment	● Jordan Lake Buffer Zone Two
— Previous Design	
— Proposed Refinements (Watershed_Footprint_02_2018)	



Stream RR
Zone One Buffer (~ 0.084 acre, 3646 ft²)
Zone Two Buffer (~ 0.069 acre, 3020 ft²)

Stream QQ
Zone One Buffer (~ 0.122 acre, 5311 ft²)
Zone Two Buffer (~ 0.092 acre, 4027 ft²)

Stream KKK
Zone One Buffer (~ 0.066 acre, 2889 ft²)
Zone Two Buffer (~ 0.08 acre, 3504 ft²)

Stream EE
Zone One Buffer (~ 0.039 acre, 1691 ft²)
Zone Two Buffer (~ 0.026 acre, 1234 ft²)

Stream Y
Zone One Buffer (~ 0.025 acre, 1073 ft²)
Zone Two Buffer (~ 0.031 acre, 1322 ft²)

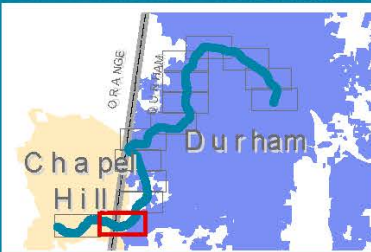
Jordan Water Supply Riparian Buffer Impacts

Figure 2B
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

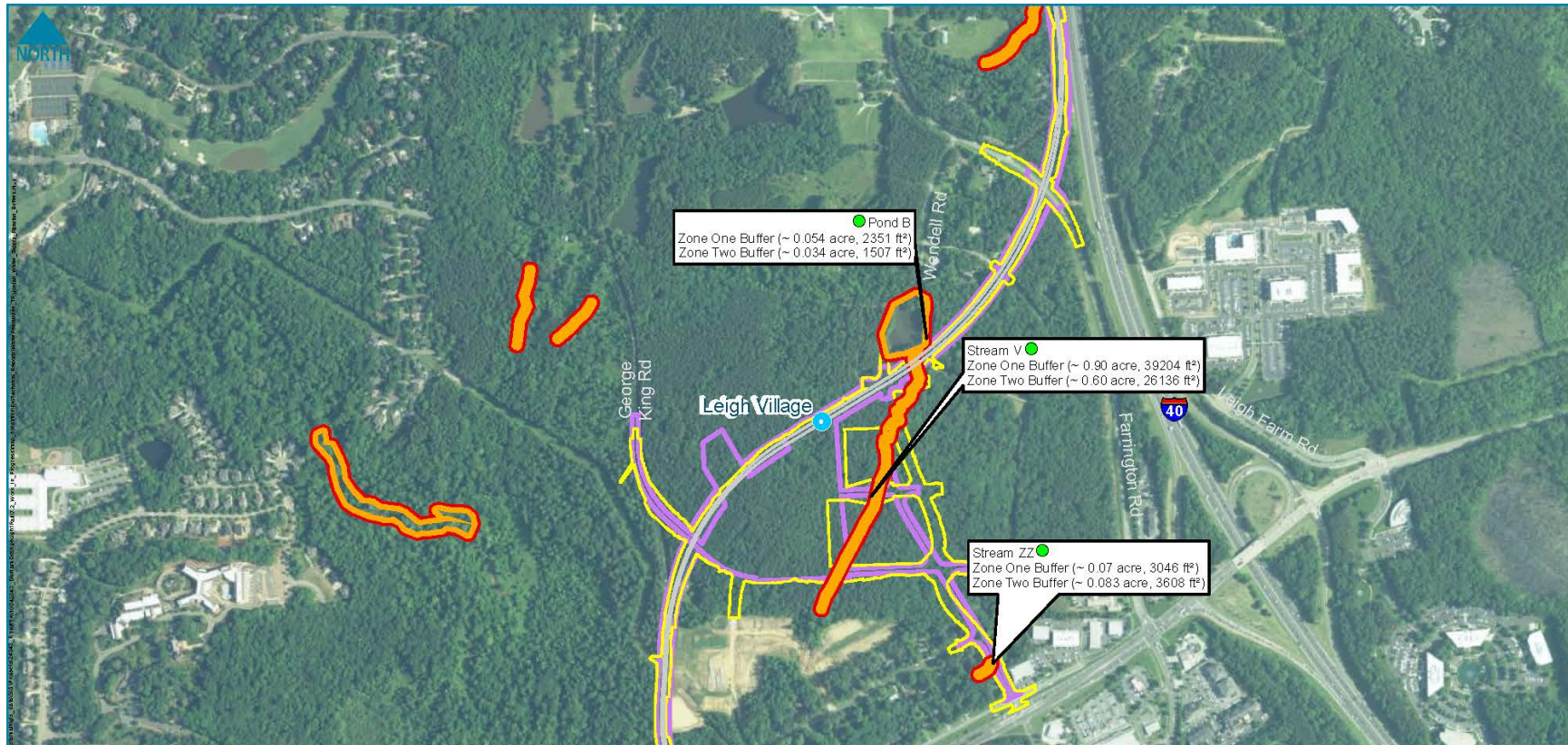


0 500 1,000 Feet

Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Jordan Lake Buffer Zone One
- Jordan Lake Buffer Zone Two

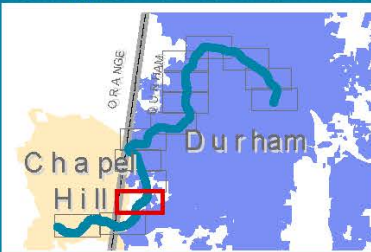


Jordan Water Supply Riparian Buffer Impacts

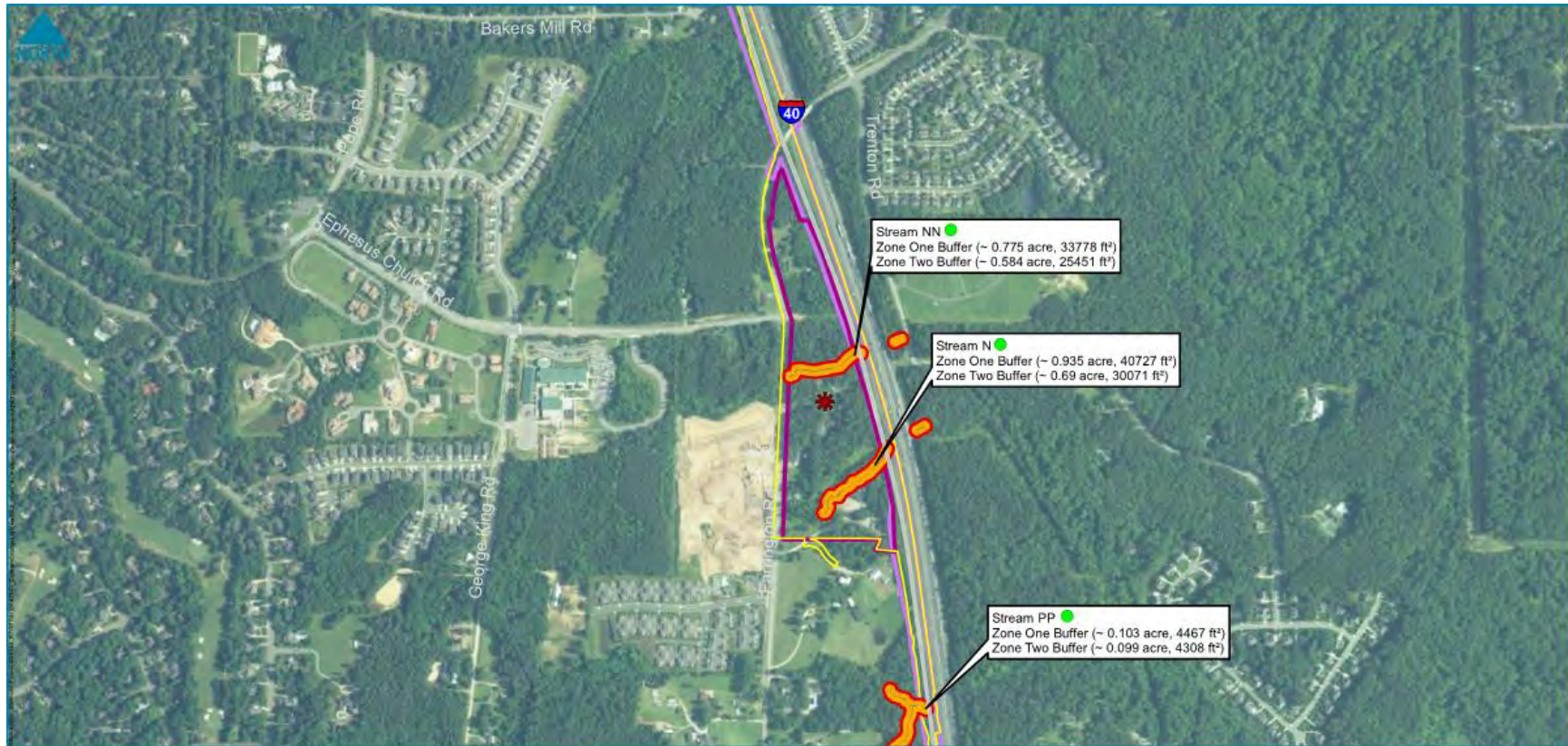
Figure 2C
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 500 1,000 Feet



- LRT Station
- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Jordan Lake Buffer Zone One
- Jordan Lake Buffer Zone Two

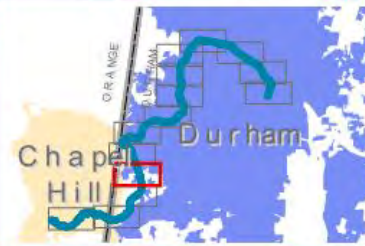


Jordan Water Supply Riparian Buffer Impacts

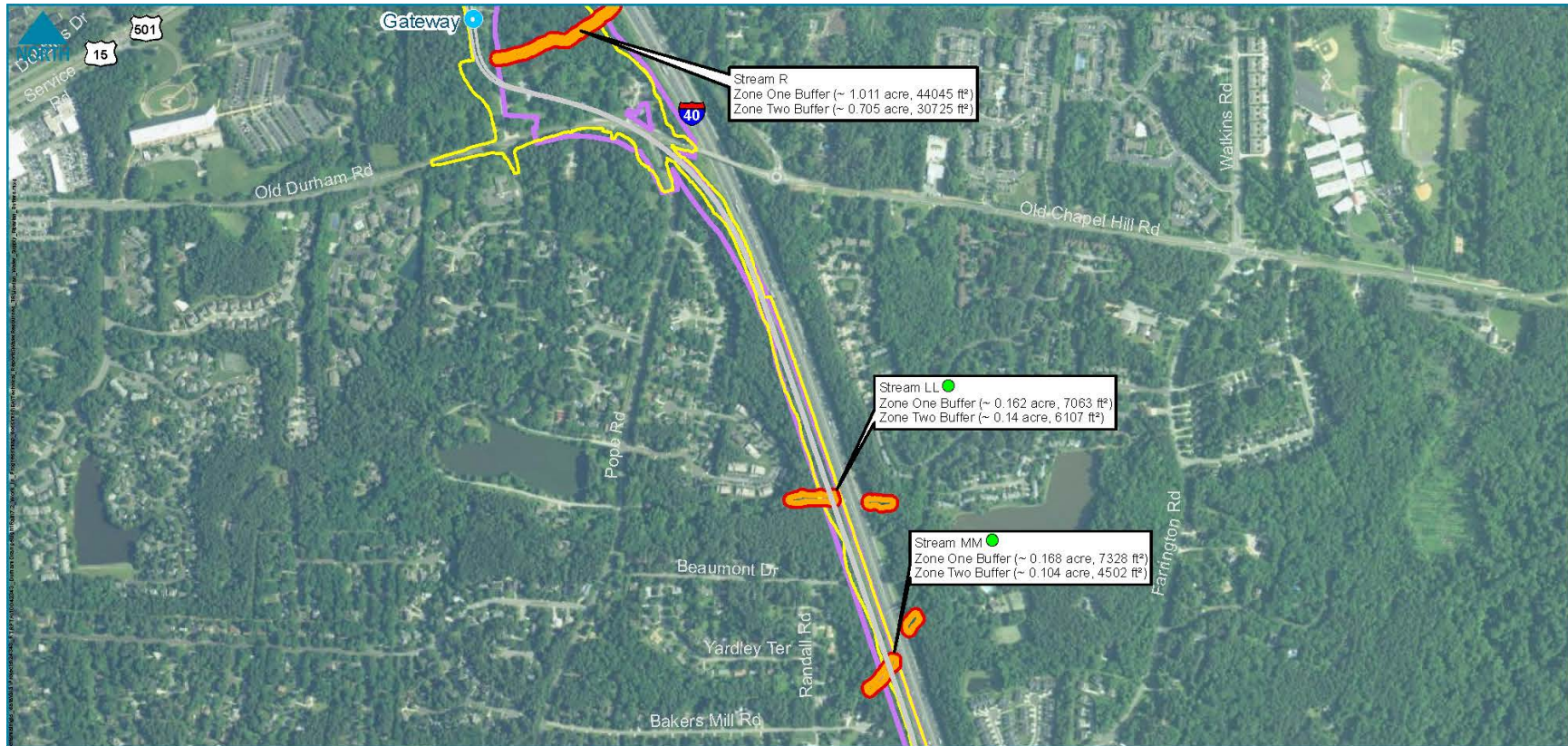
Figure 2D
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 500 1,000 Feet



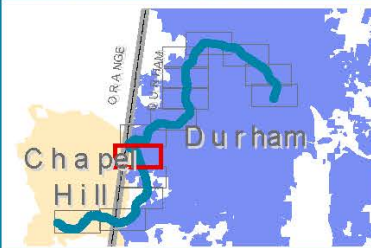
<ul style="list-style-type: none"> — Light Rail Alignment * Rail Operations and Maintenance Facility — Previous Design — Proposed Refinements (Watershed_Footprint_02_2018) 	<ul style="list-style-type: none"> ● Change In Impact Totals Between Existing Project and Proposed Refinements ■ Jordan Lake Buffer Zone One ■ Jordan Lake Buffer Zone Two
---	---

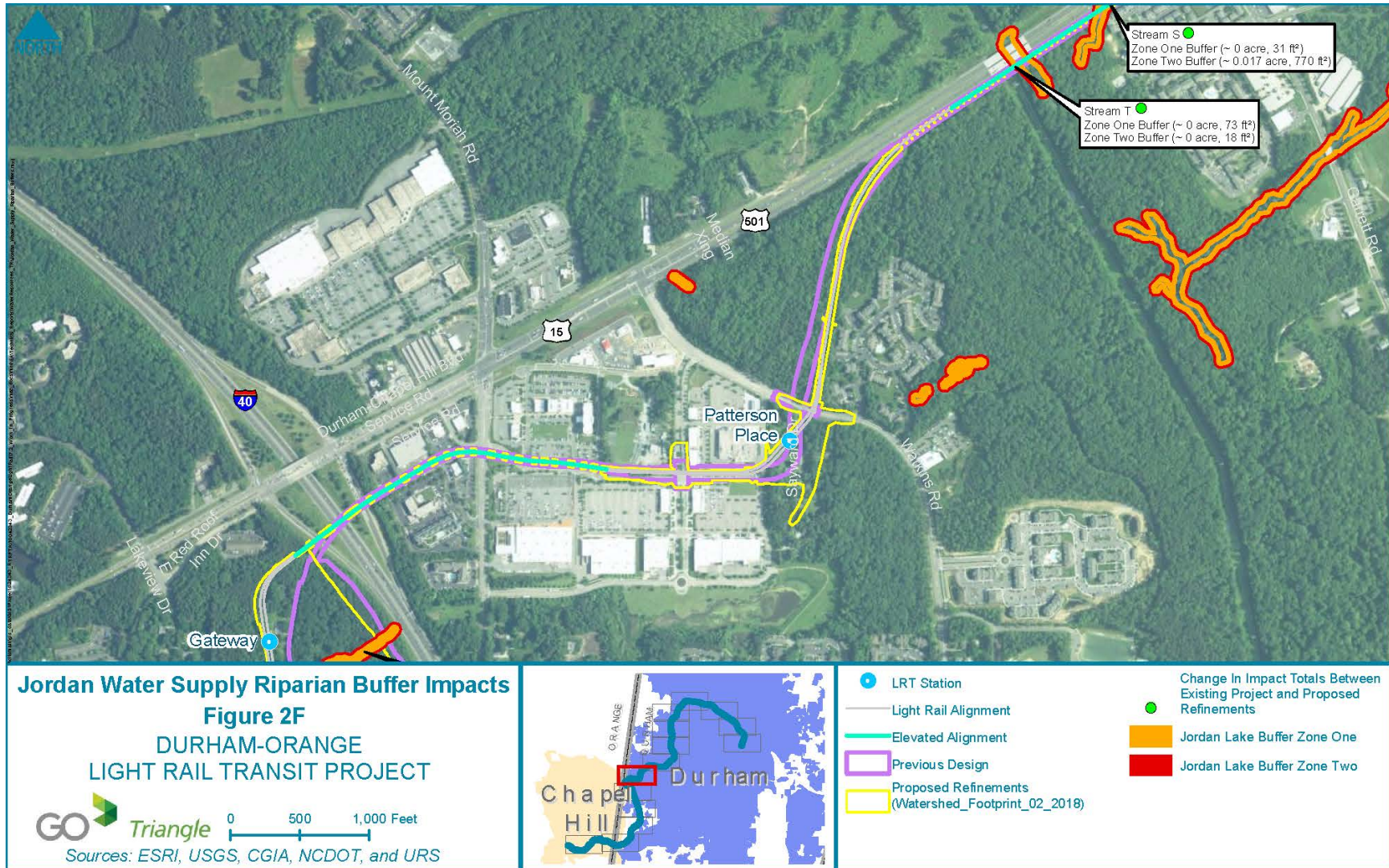


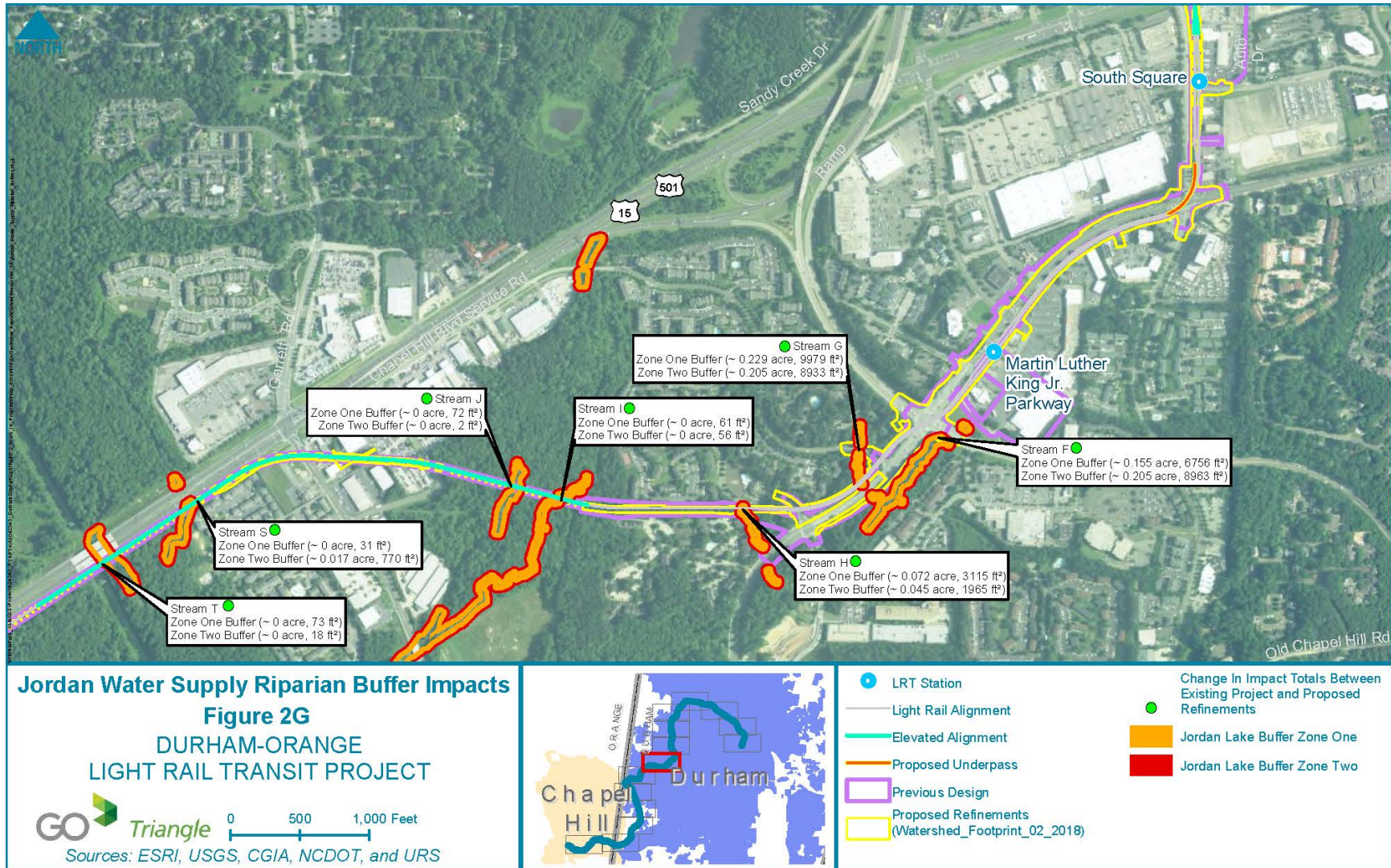
Jordan Water Supply Riparian Buffer Impacts

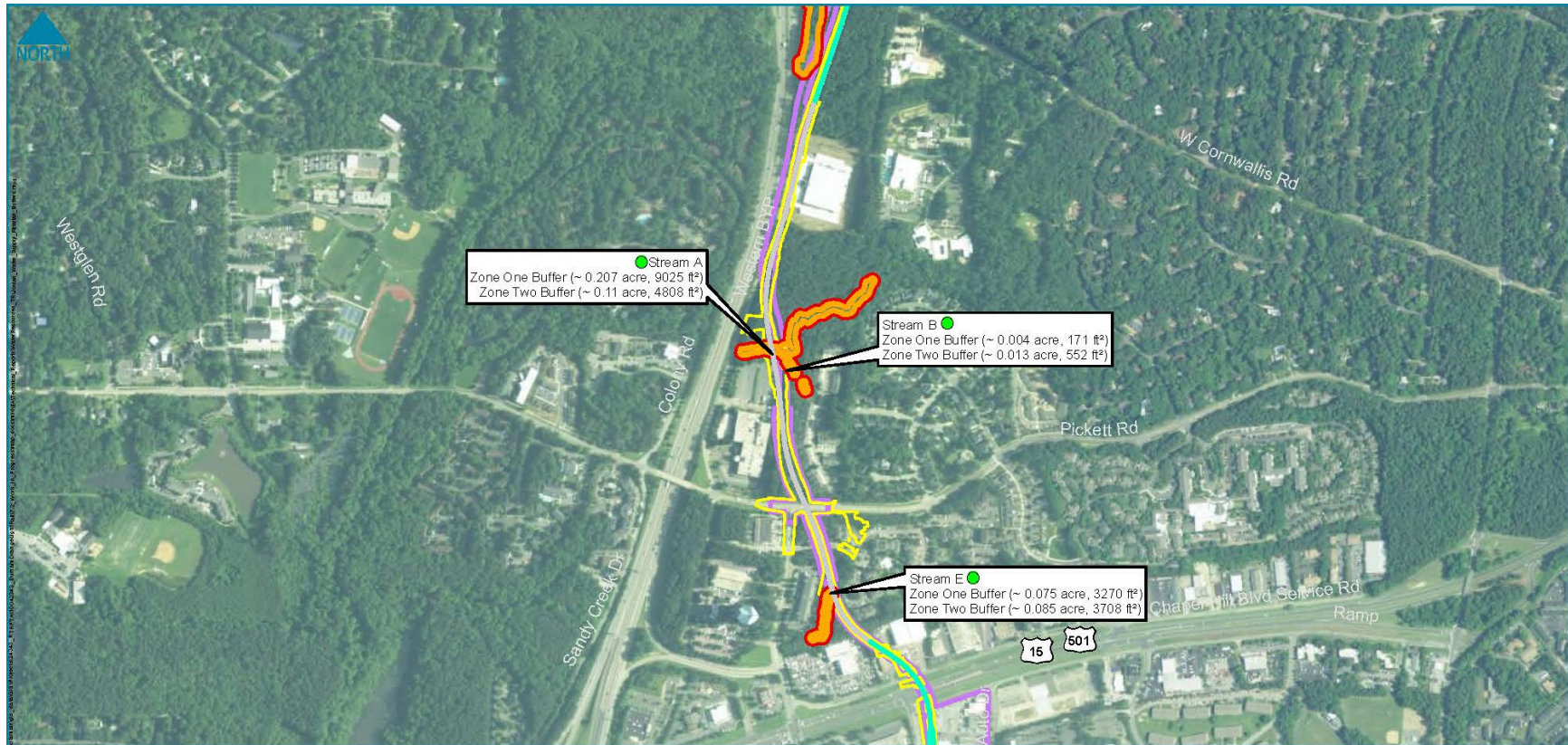
Figure 2E
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS







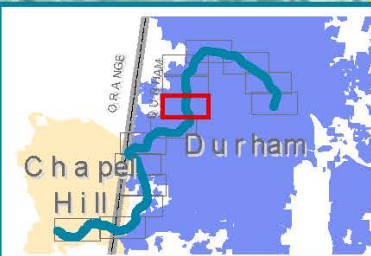


Jordan Water Supply Riparian Buffer Impacts

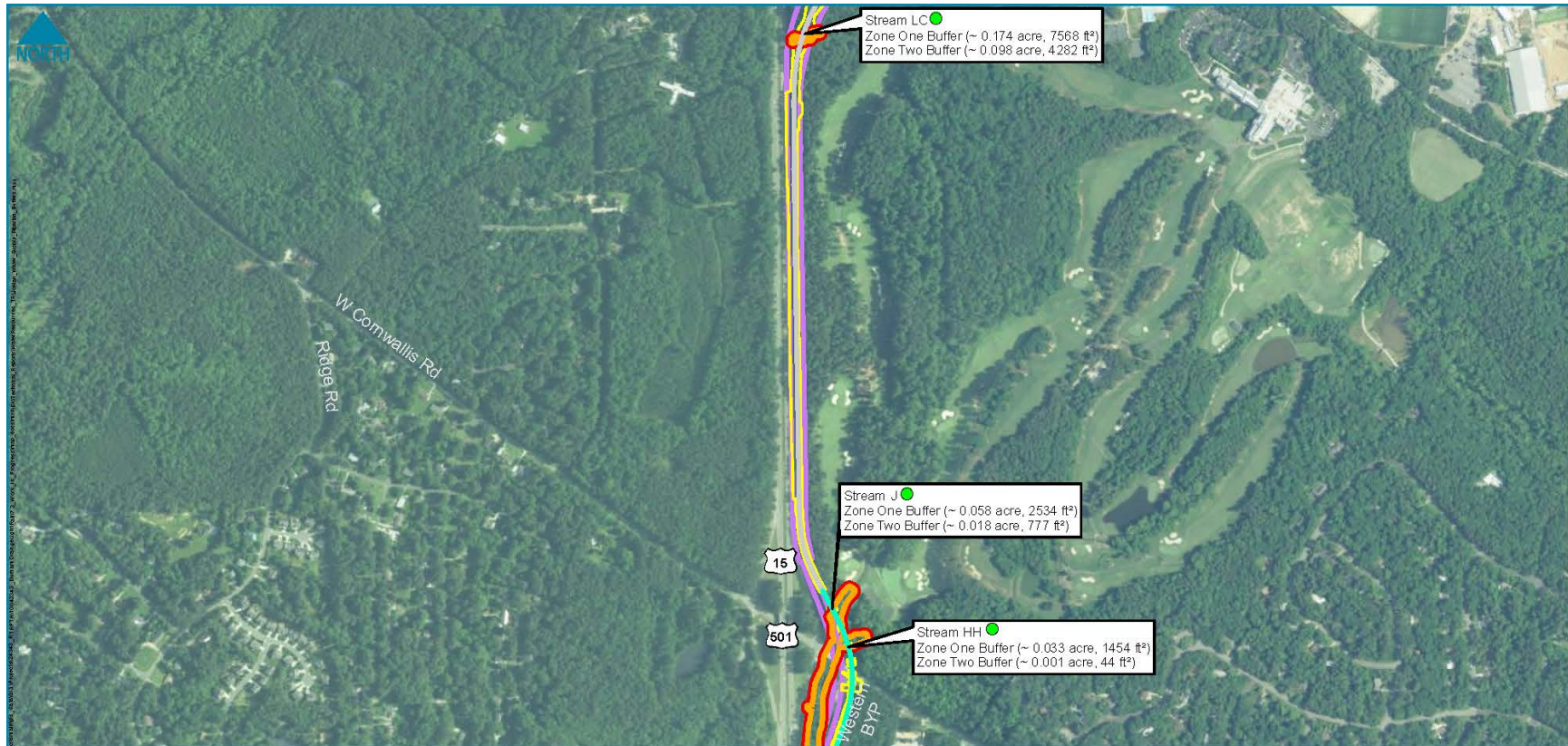
Figure 2H
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 500 1,000 Feet



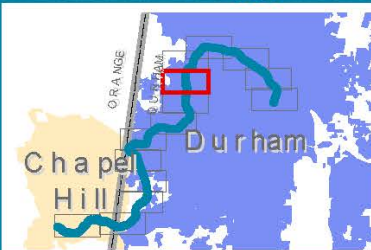
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Jordan Lake Buffer Zone One
- Jordan Lake Buffer Zone Two



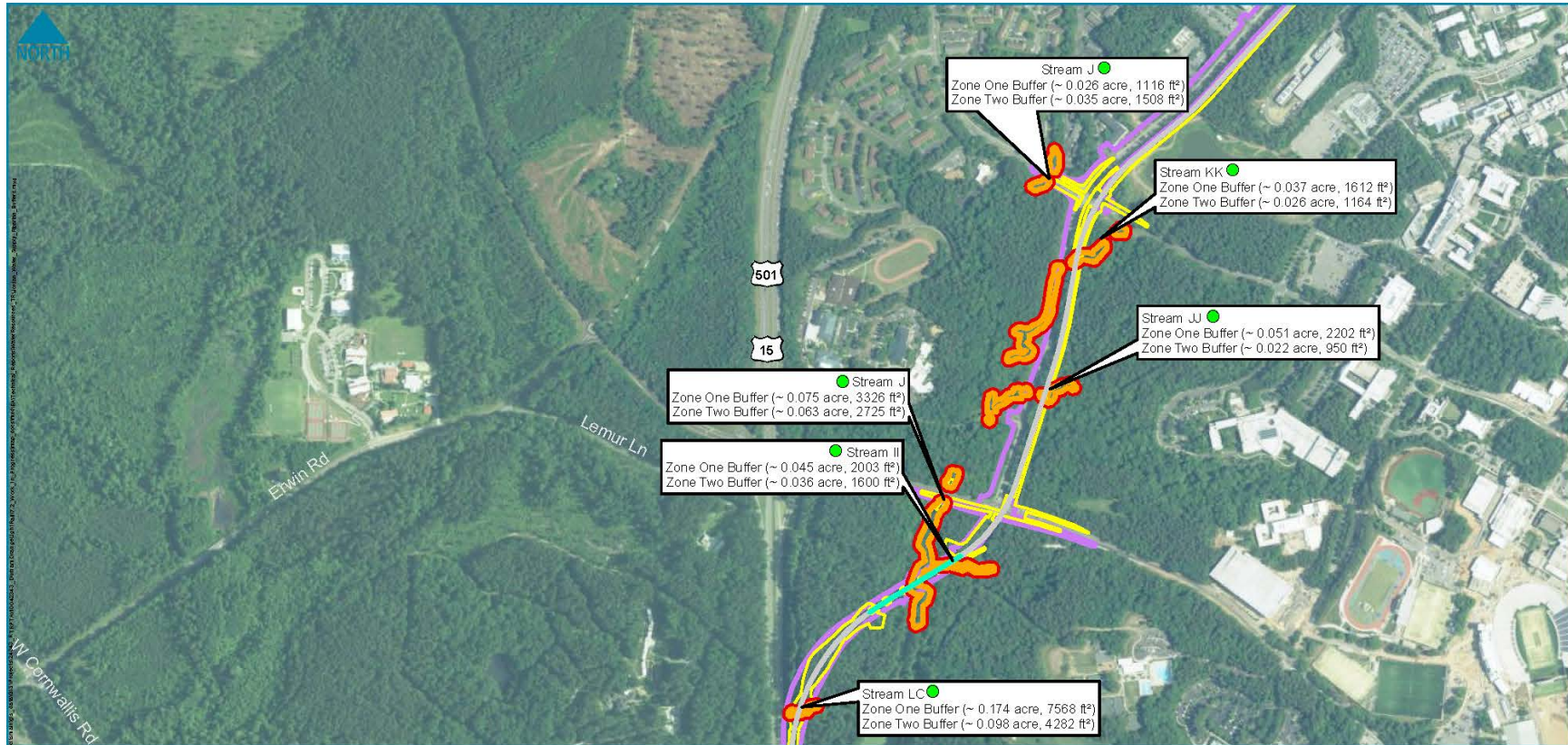
Jordan Water Supply Riparian Buffer Impacts

Figure 2I
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS



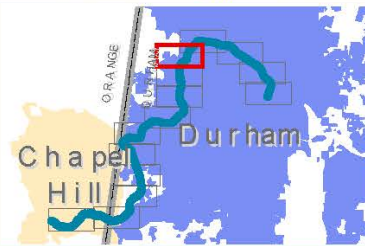
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Jordan Lake Buffer Zone One
- Jordan Lake Buffer Zone Two



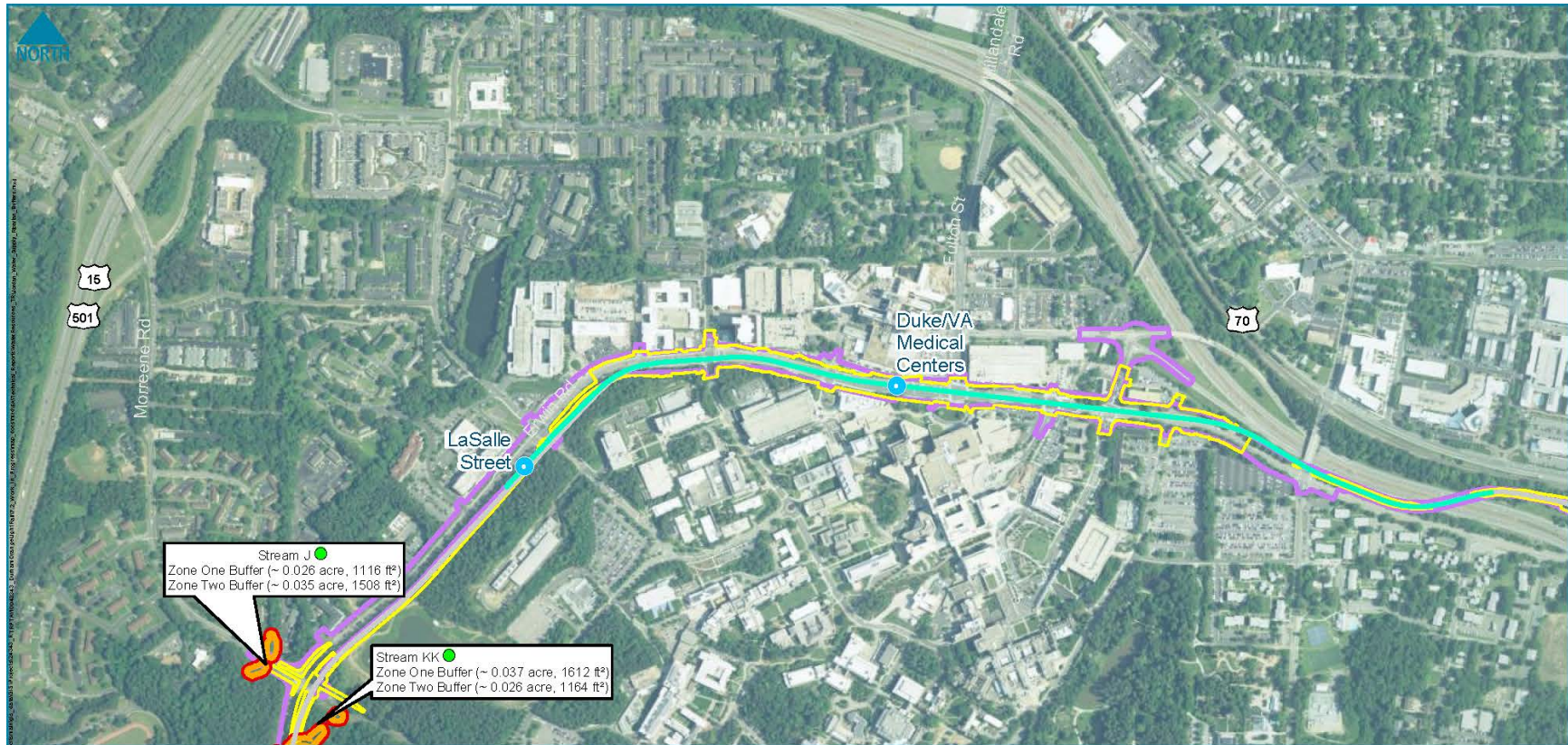
Jordan Water Supply Riparian Buffer Impacts

Figure 2J
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO **Triangle** 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Jordan Lake Buffer Zone One
- Jordan Lake Buffer Zone Two

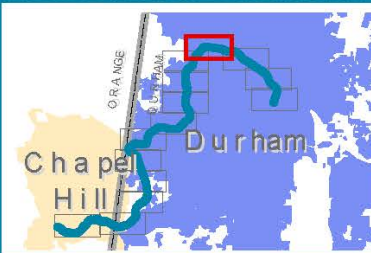


Stream J ●
Zone One Buffer (~ 0.028 acre, 1116 ft²)
Zone Two Buffer (~ 0.035 acre, 1508 ft²)

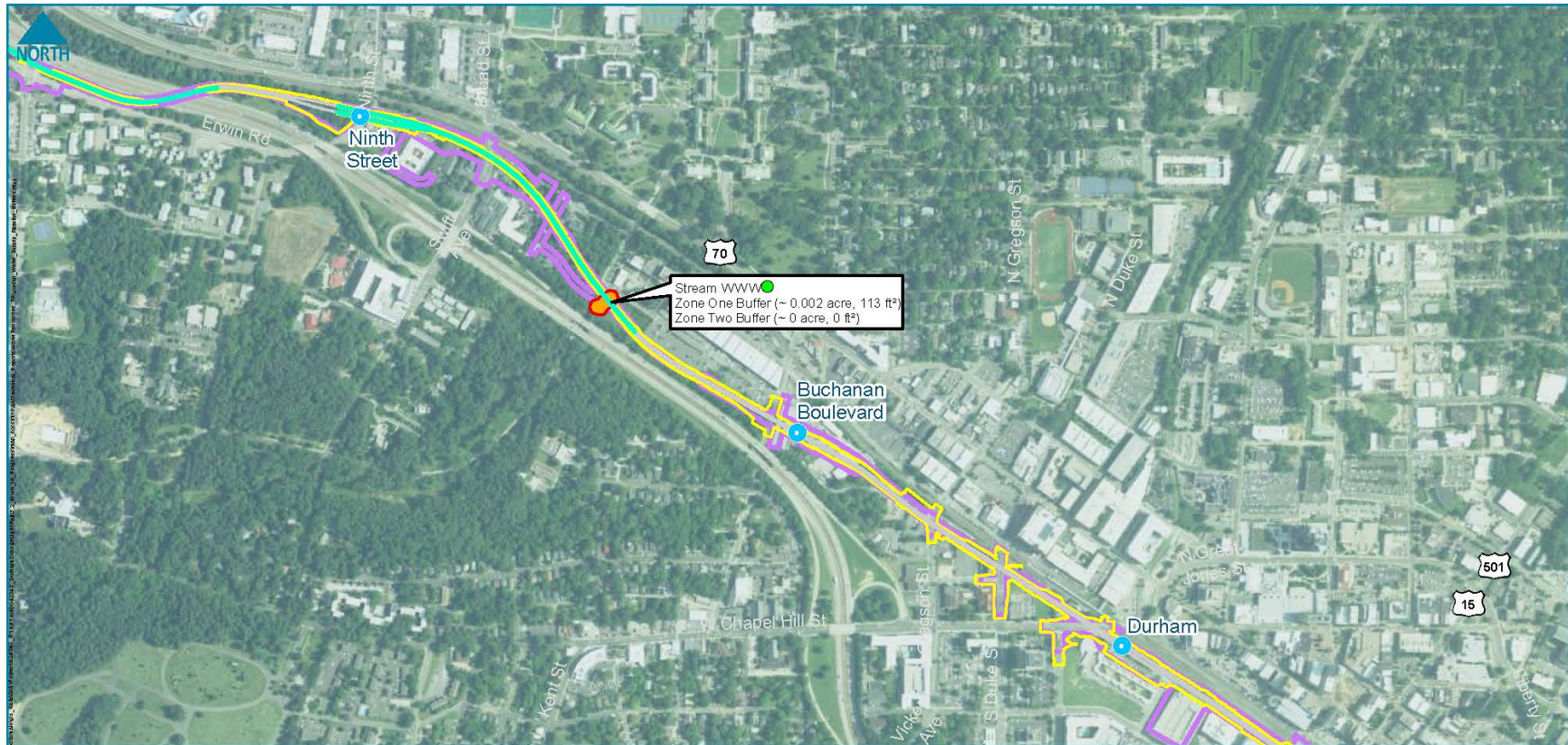
Stream KK ●
Zone One Buffer (~ 0.037 acre, 1612 ft²)
Zone Two Buffer (~ 0.026 acre, 1164 ft²)

Jordan Water Supply Riparian Buffer Impacts
Figure 2K
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- Jordan Lake Buffer Zone One
- Jordan Lake Buffer Zone Two

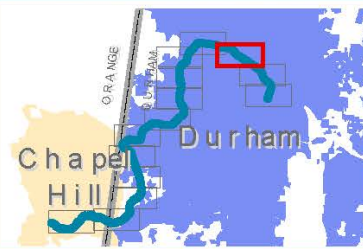


Jordan Water Supply Riparian Buffer Impacts

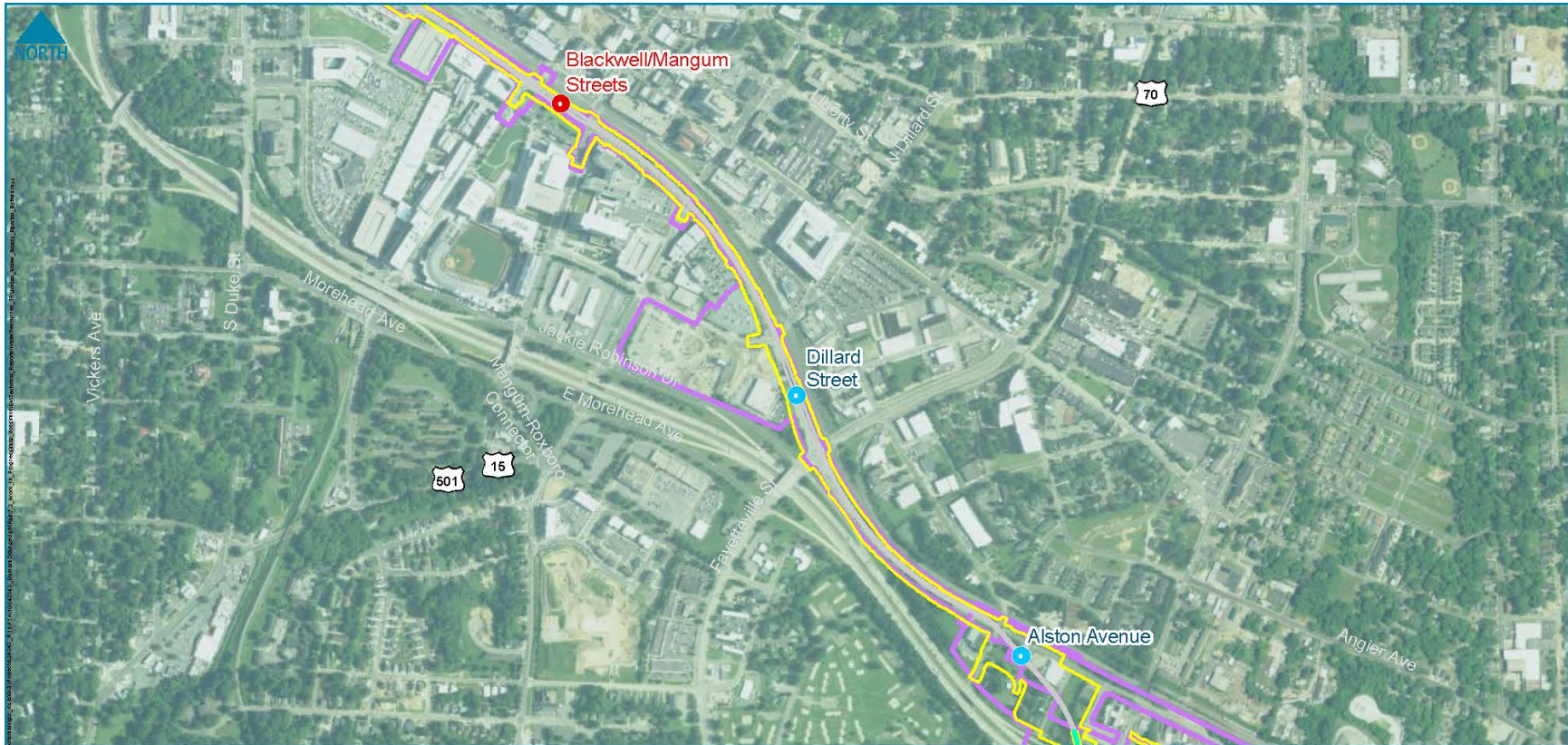
Figure 2L
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 500 1,000 Feet



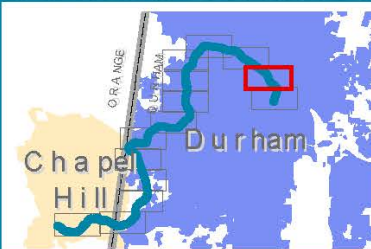
LRT Station	Change In Impact Totals Between Existing Project and Proposed Refinements
Light Rail Alignment	Jordan Lake Buffer Zone One
Elevated Alignment	Jordan Lake Buffer Zone Two
Previous Design	
Proposed Refinements (Watershed_Footprint_02_2018)	



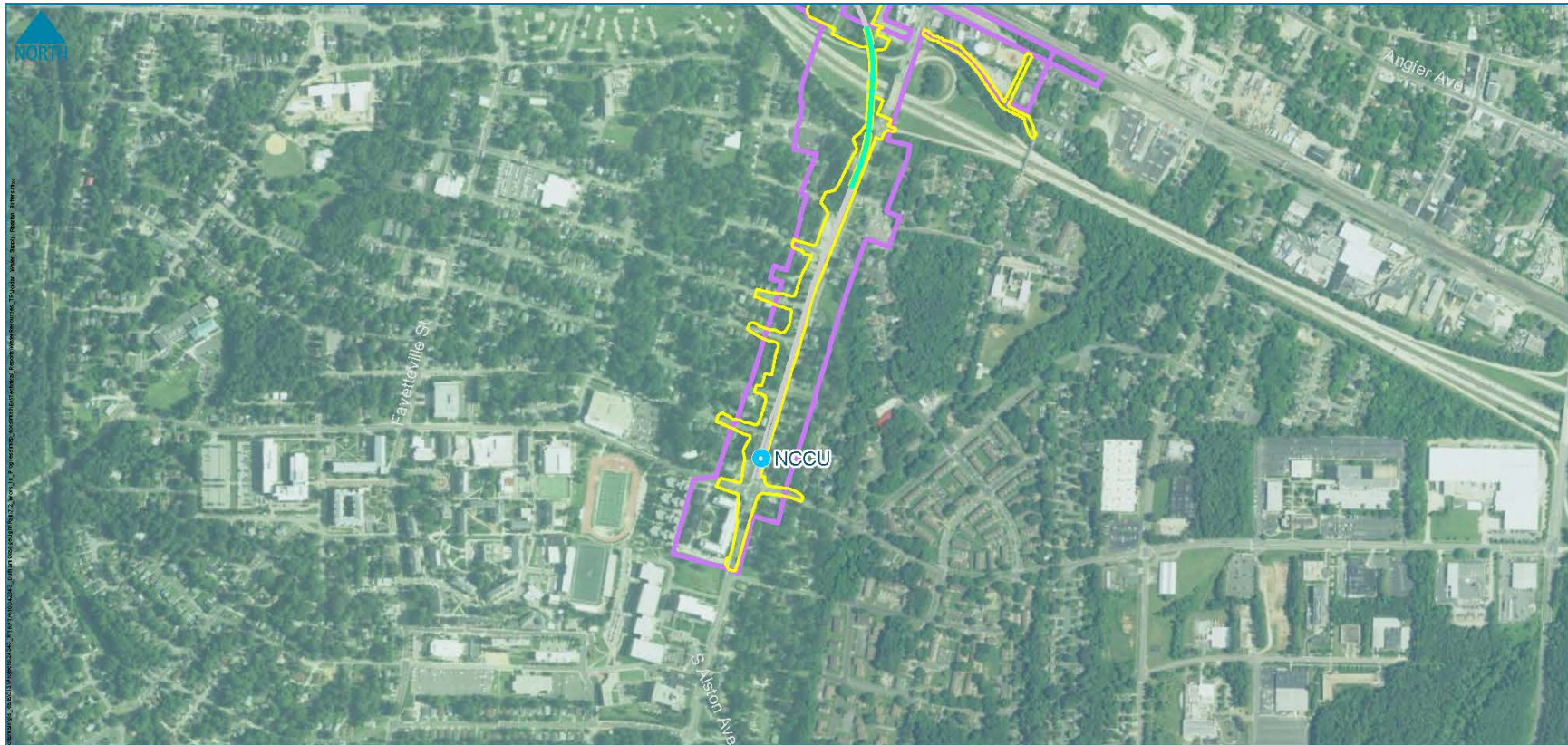
Jordan Water Supply Riparian Buffer Impacts
Figure 2M
 DURHAM-ORANGE
 LIGHT RAIL TRANSIT PROJECT

GO Triangle
 Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 500 1,000 Feet



- LRT Station
- Proposed LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)

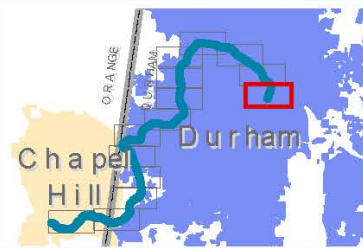


Jordan Water Supply Riparian Buffer Impacts

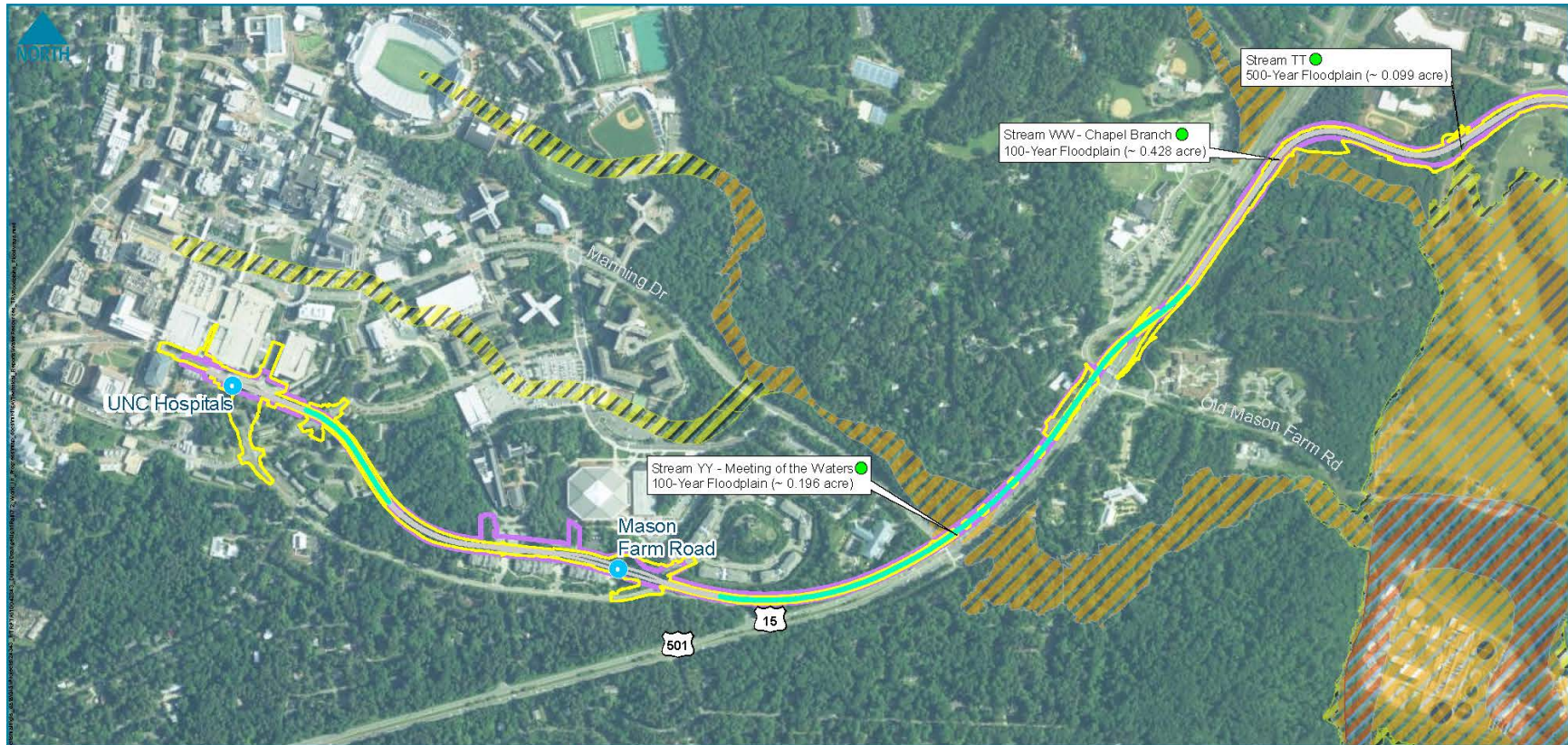
Figure 2N
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT



0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)

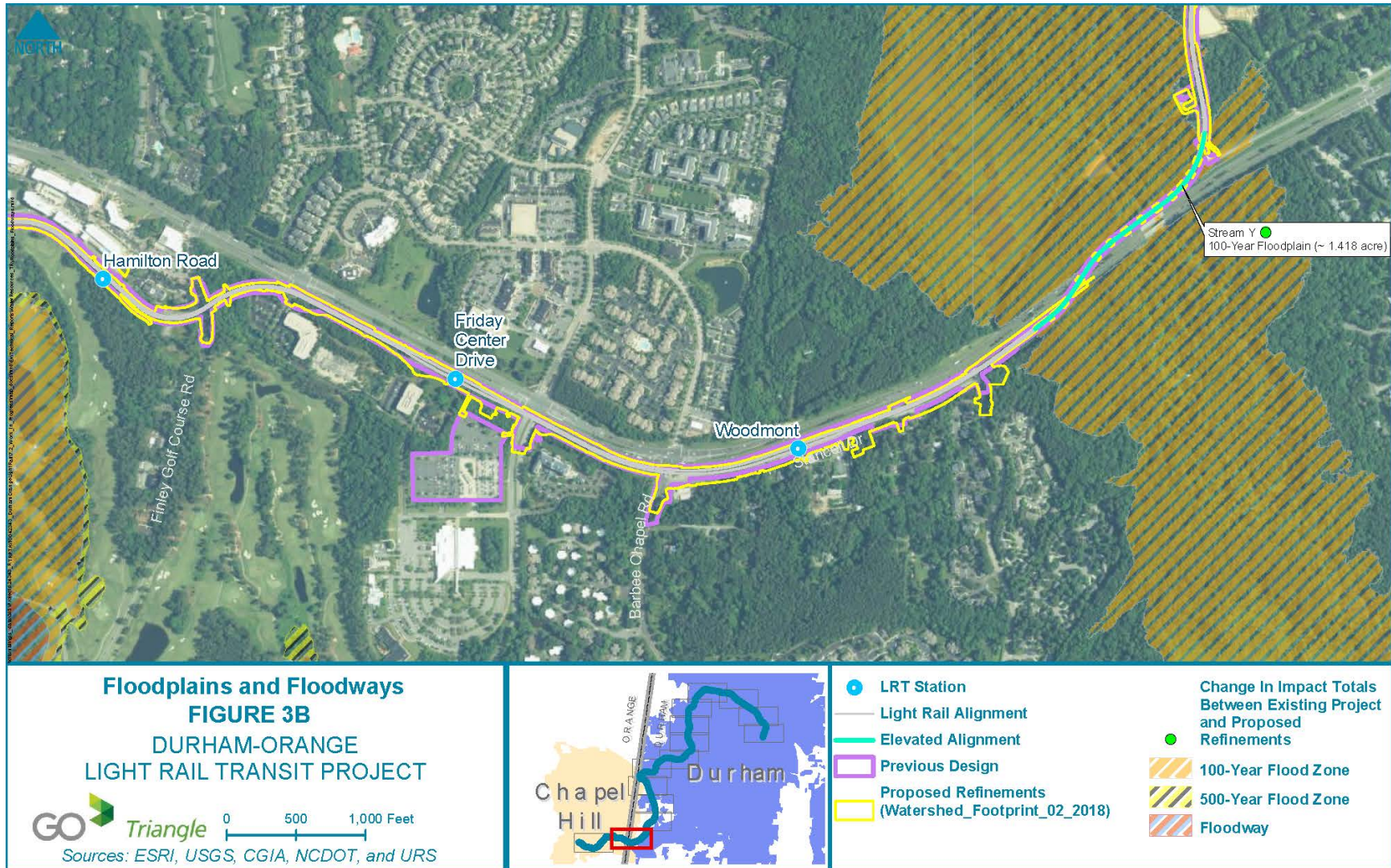


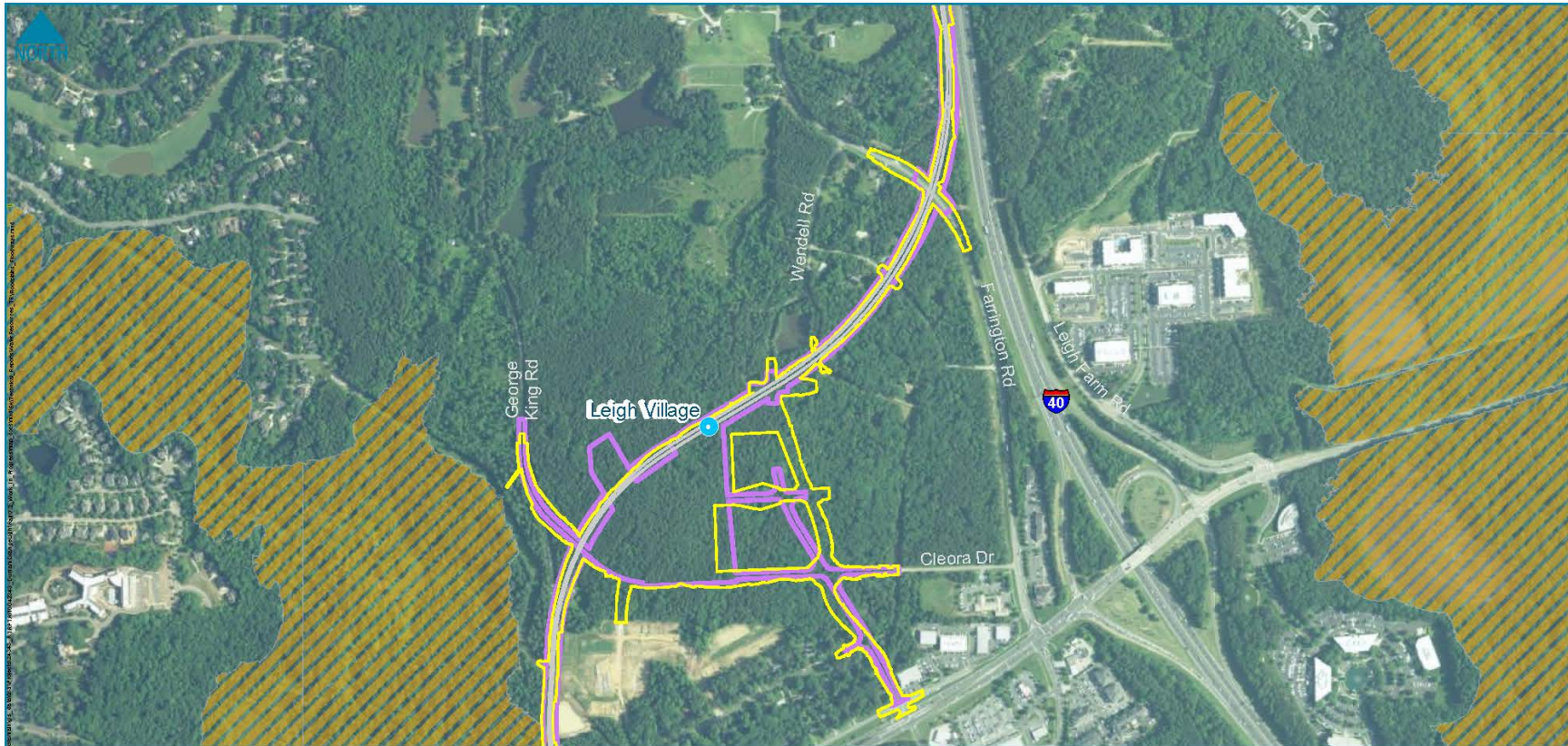
Floodplains and Floodways
FIGURE 3A
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO **Triangle** 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



● LRT Station	Change In Impact Totals Between Existing Project and Proposed Refinements
— Light Rail Alignment	● 100-Year Flood Zone
— Elevated Alignment	▨ 500-Year Flood Zone
— Previous Design	▨ Floodway
— Proposed Refinements (Watershed_Footprint_02_2018)	





Floodplains and Floodways
FIGURE 3C
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone
- 500-Year Flood Zone
- Floodway



**Floodplains and Floodways
FIGURE 3D
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Rail Operations and Maintenance Facility
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone

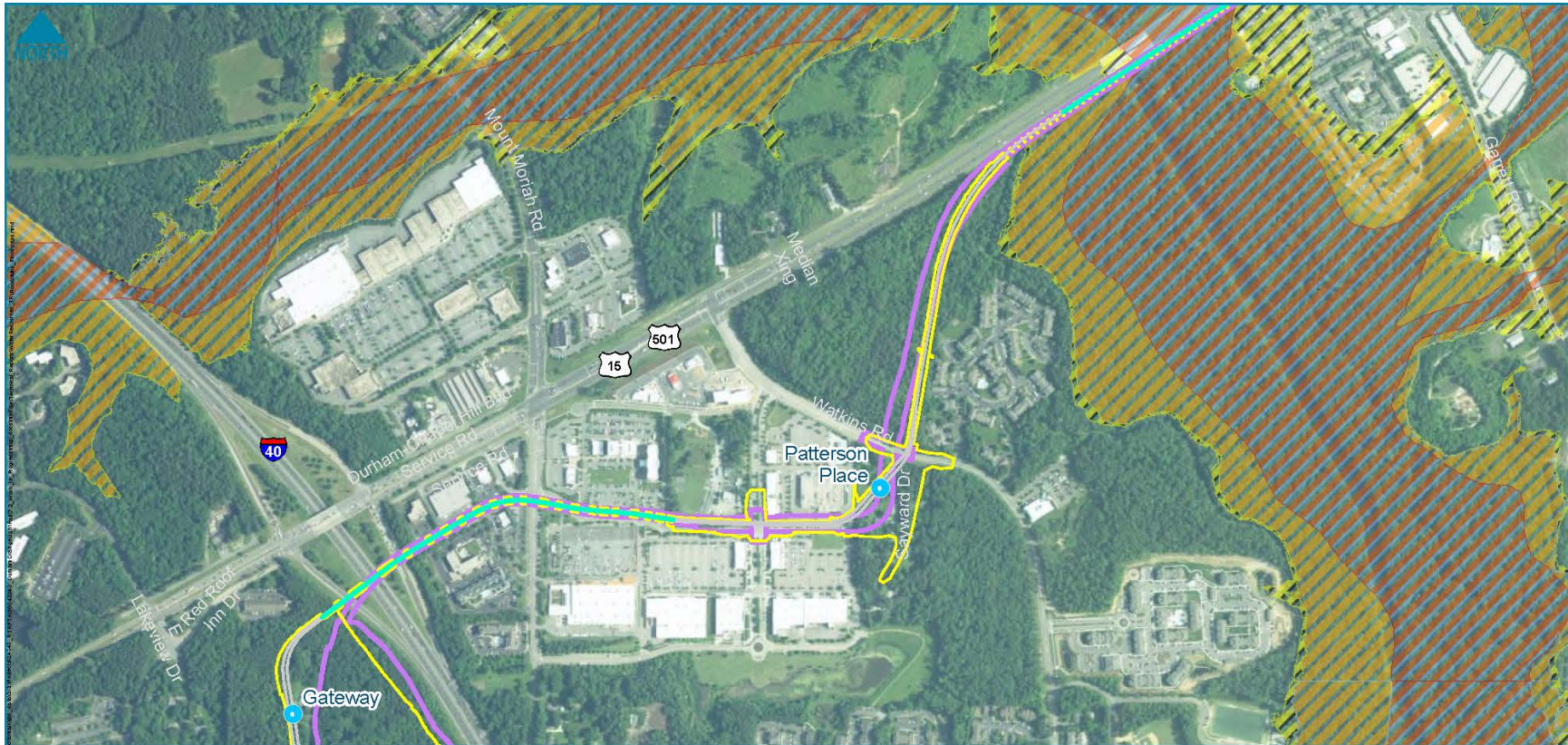


**Floodplains and Floodways
FIGURE 3E
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone
- 500-Year Flood Zone
- Floodway

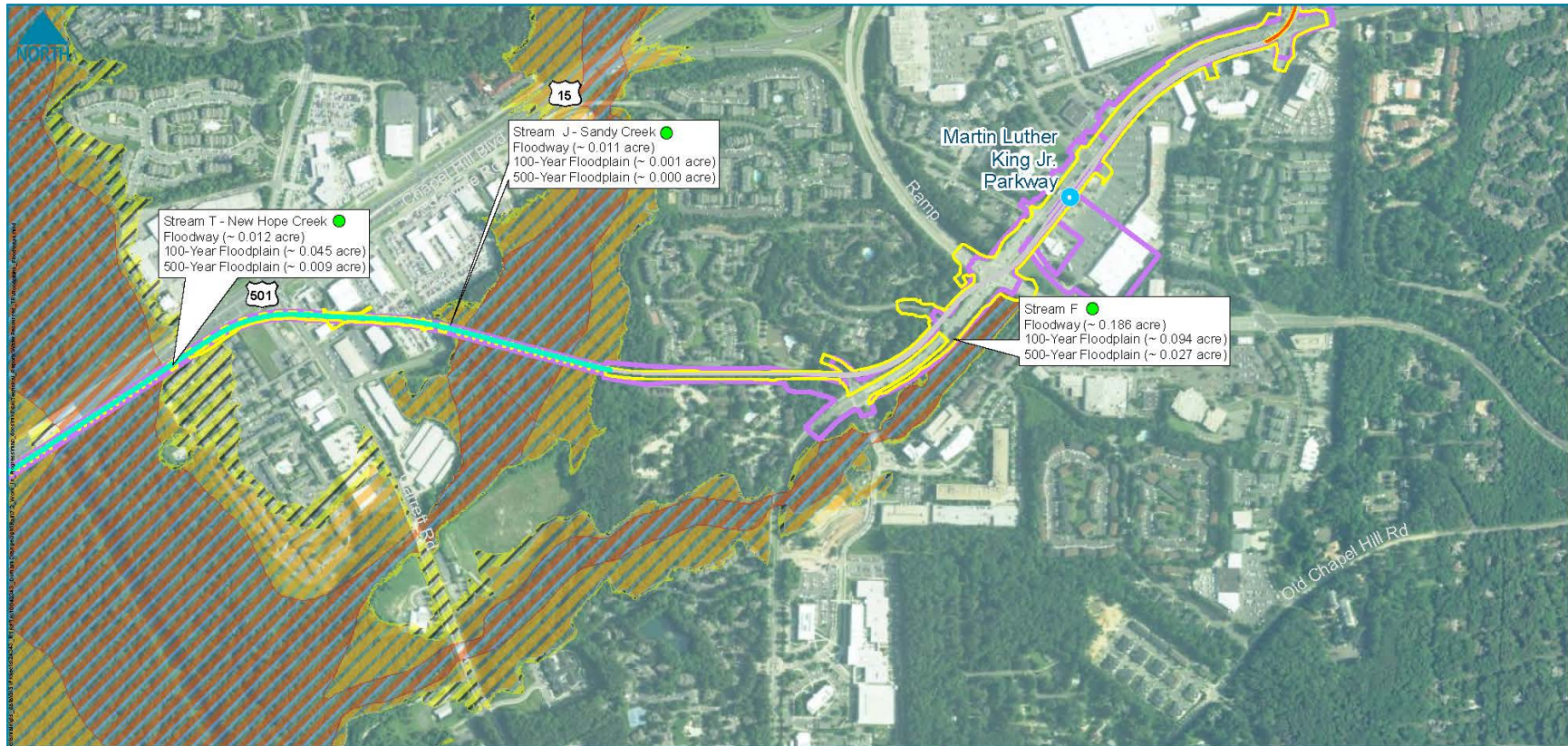


**Floodplains and Floodways
FIGURE 3F
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS

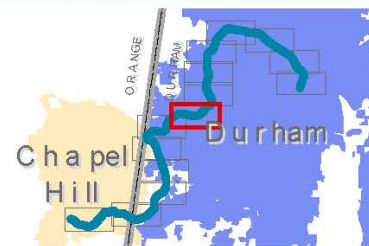


- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone
- 500-Year Flood Zone
- Floodway



Floodplains and Floodways
FIGURE 3G
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



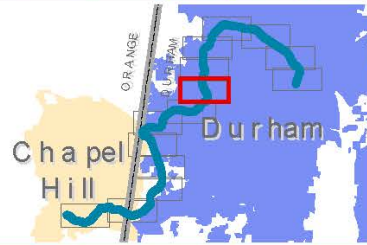
- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Proposed Underpass
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)

- Change In Impact Totals
Between Existing Project
and Proposed
Refinements**
- 100-Year Flood Zone
 - 500-Year Flood Zone
 - Floodway

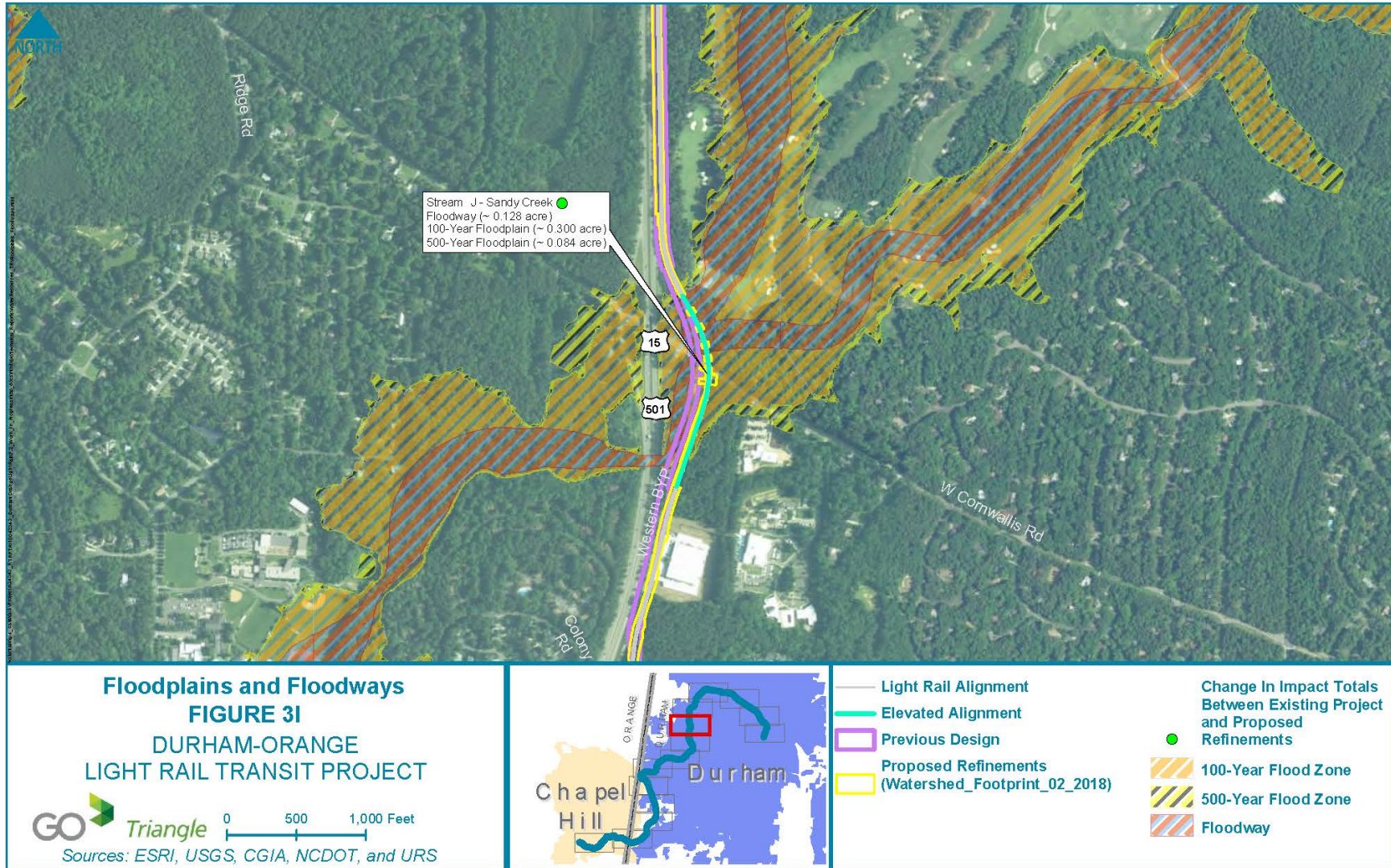


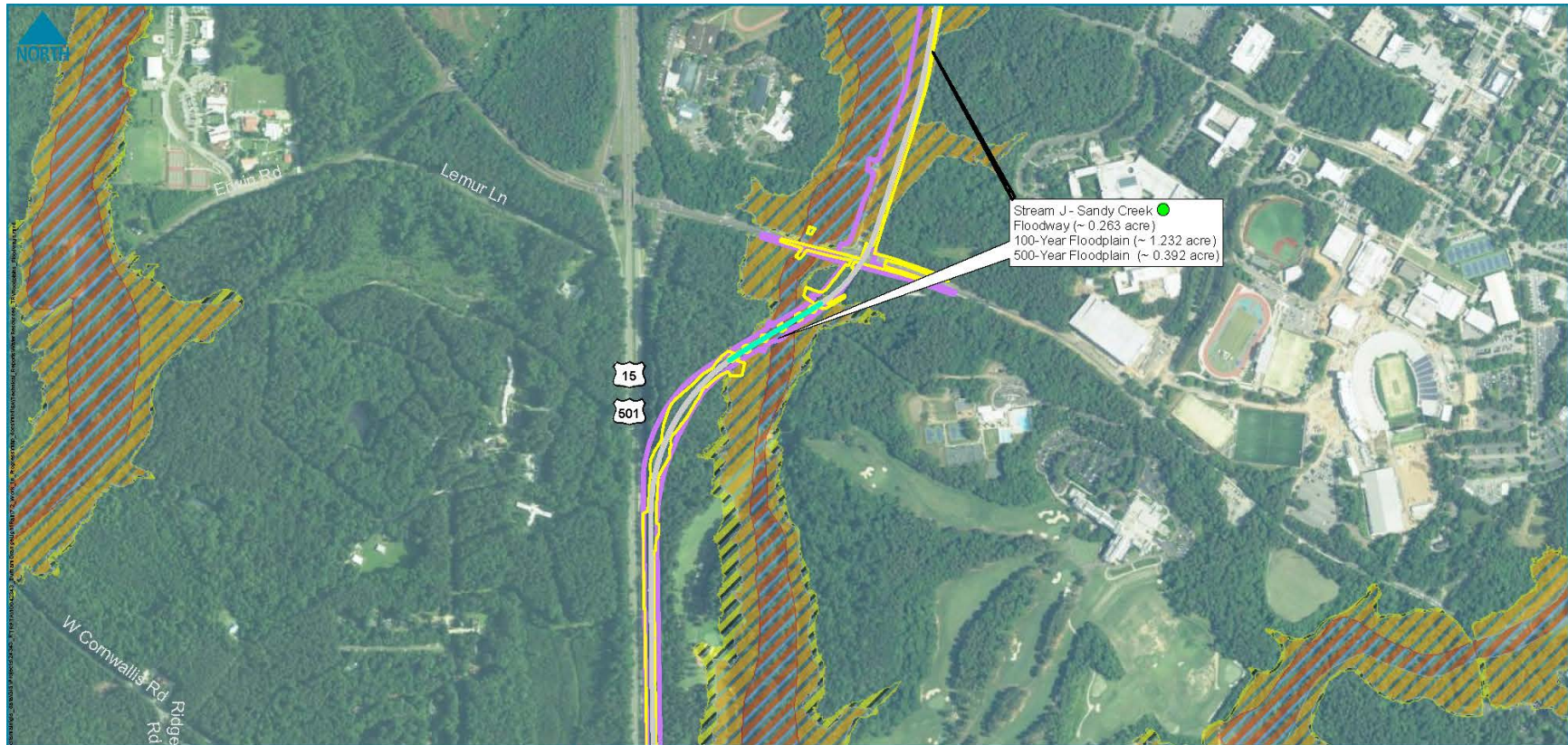
**Floodplains and Floodways
FIGURE 3H
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Proposed Underpass
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone
- 500-Year Flood Zone
- Floodway



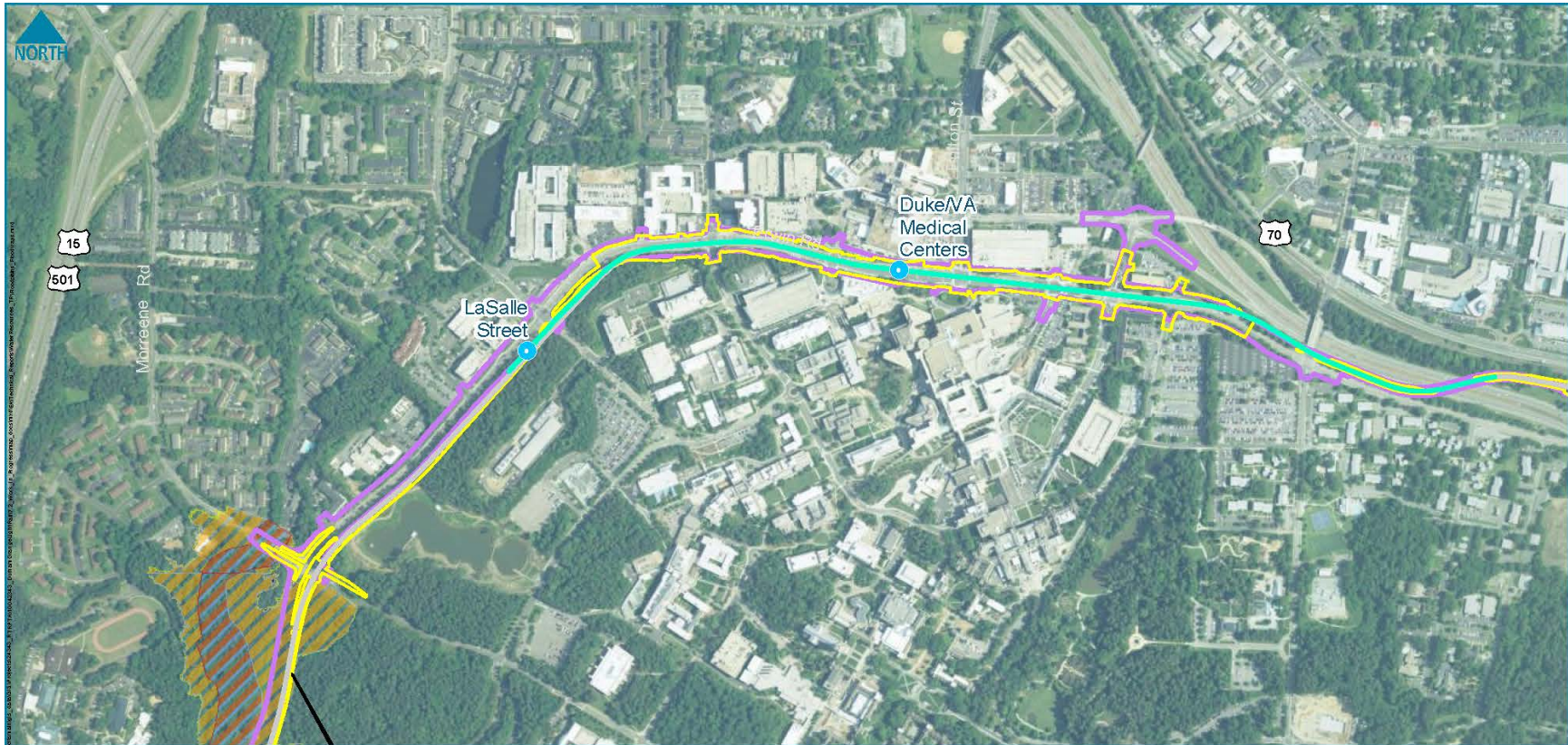


**Floodplains and Floodways
FIGURE 3J
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT**

GO Triangle 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- Change In Impact Totals Between Existing Project and Proposed Refinements
- ▨ 100-Year Flood Zone
- ▨ 500-Year Flood Zone
- ▨ Floodway

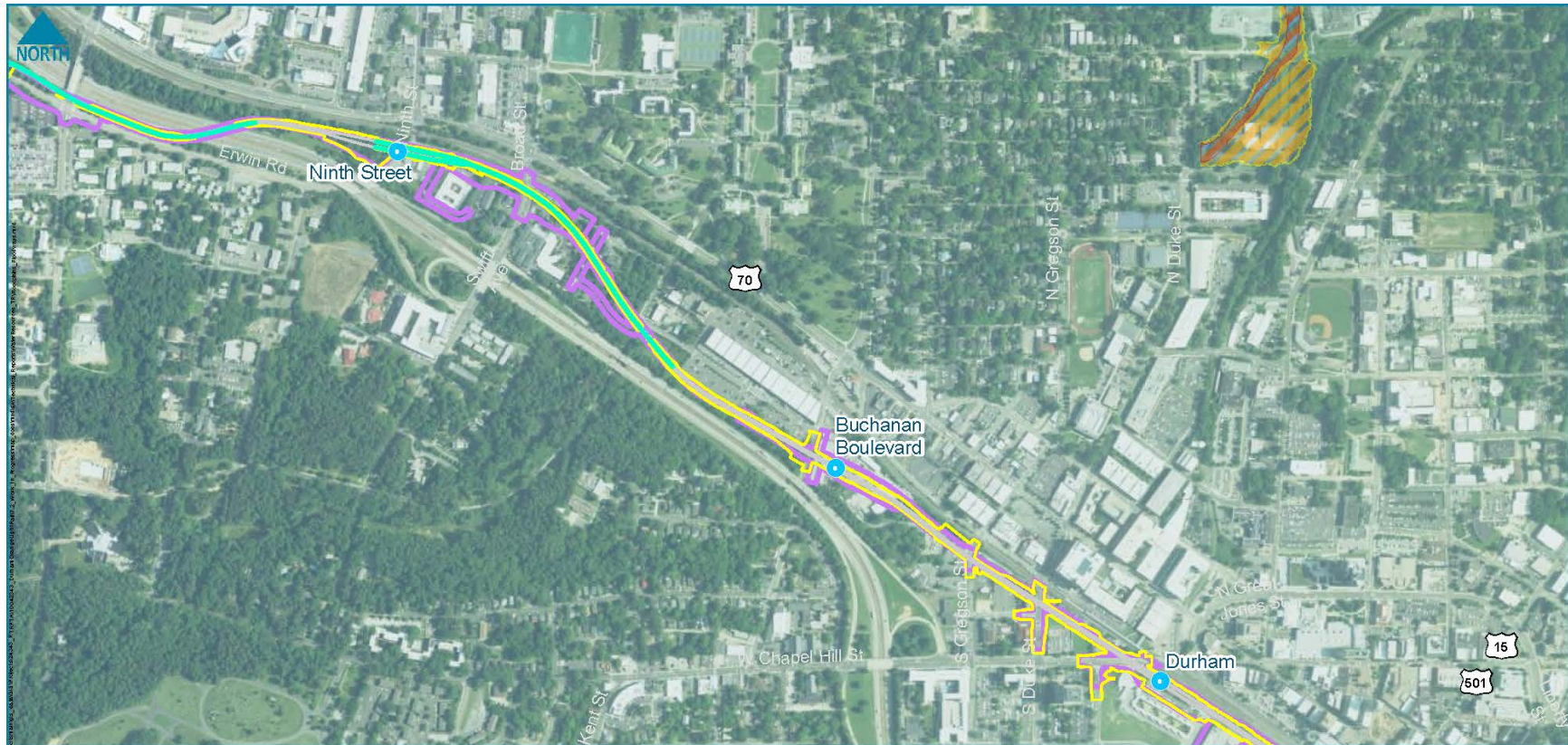


Floodplains and Floodways
FIGURE 3K
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone
- 500-Year Flood Zone
- Floodway

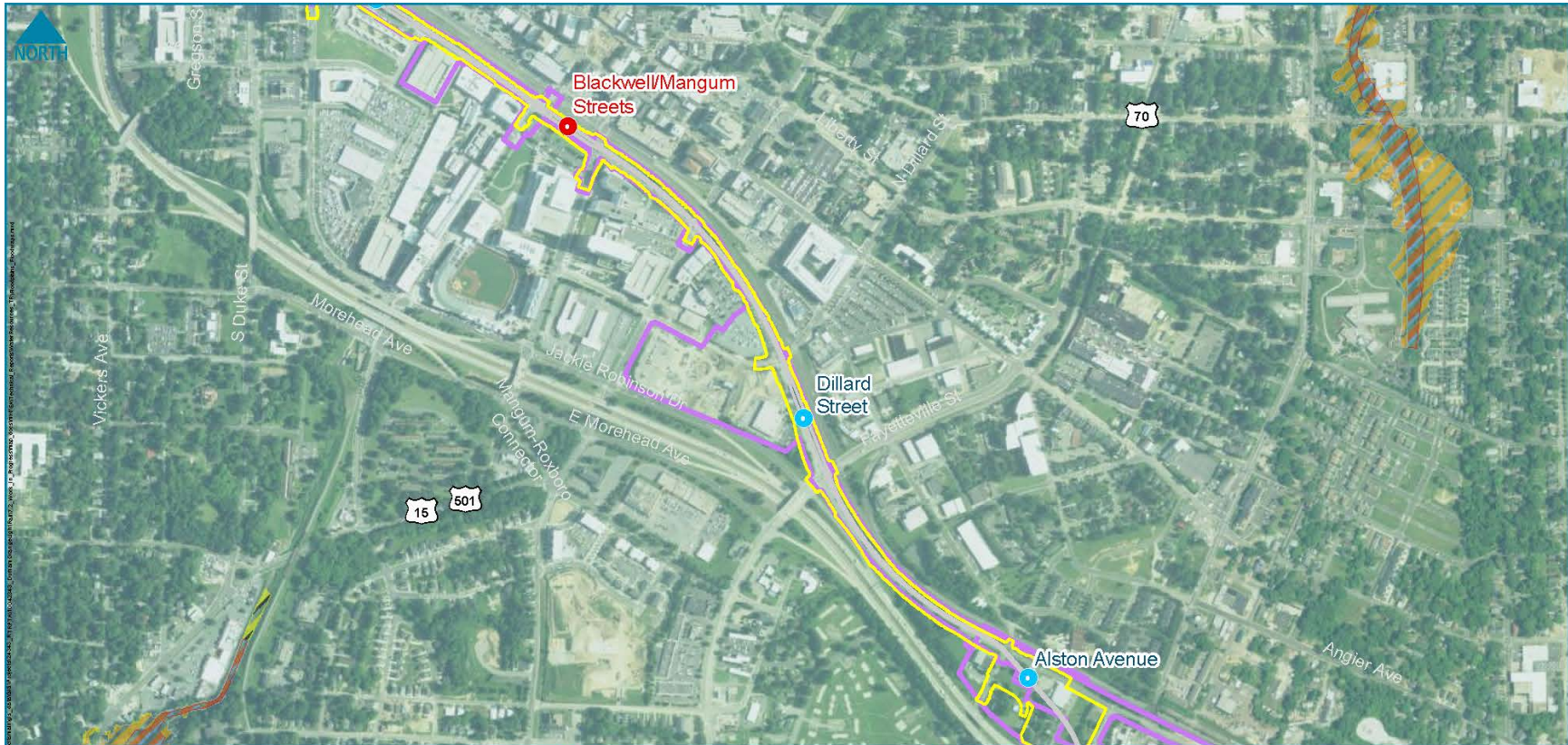


Floodplains and Floodways
FIGURE 3L
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle 0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



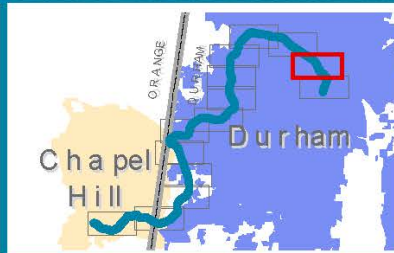
- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone
- 500-Year Flood Zone
- Floodway



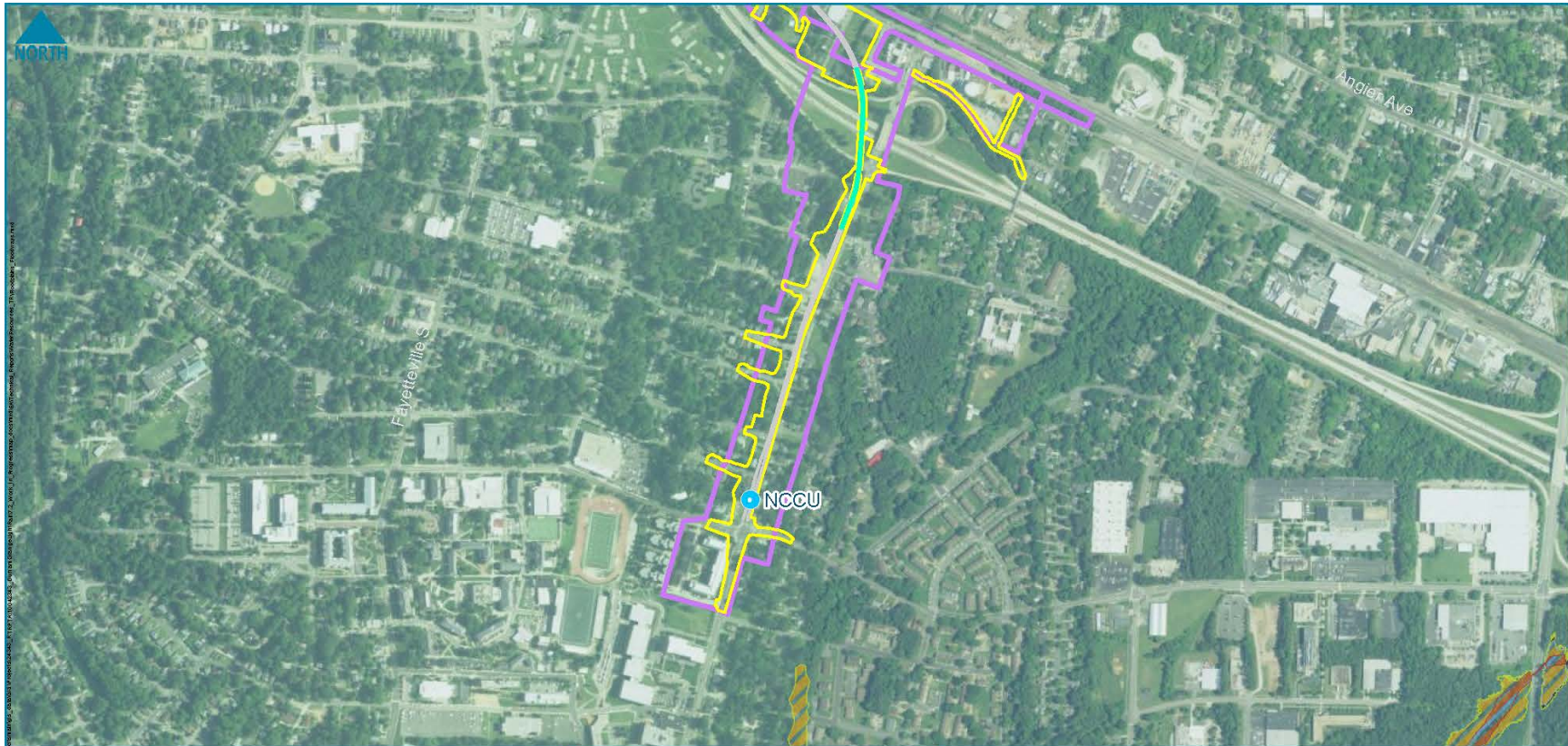
Floodplains and Floodways
FIGURE 3M
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
Sources: ESRI, USGS, CGIA, NCDOT, and URS

0 500 1,000 Feet



- LRT Station
- Proposed LRT Station
- Light Rail Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone
- 500-Year Flood Zone
- Floodway



Floodplains and Floodways
FIGURE 3N
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

GO Triangle
0 500 1,000 Feet
Sources: ESRI, USGS, CGIA, NCDOT, and URS



- LRT Station
- Light Rail Alignment
- Elevated Alignment
- Previous Design
- Proposed Refinements (Watershed_Footprint_02_2018)
- 100-Year Flood Zone
- 500-Year Flood Zone
- Floodway