Dwarf-Flowered Heartleaf Recommendation Team Meeting
12 June 2018

1. Given the current condition of the DFH, is the species in danger of extinction now? Use a scale of 0 (=definitely NOT in danger of extinction) to 100 (=definitely in danger of extinction) to indicate your determination. 85 not, 15 yes it is

   Please write your justification for said determination in a word document. Your justification will be used to facilitate discussion and, ultimately, to write the finding that will be published in the Federal Register.

[redacted]

2. Round 2: Given the current condition of DFH, is this species in danger of extinction now? Use a scale of 0 (=definitely NOT in danger of extinction) to 100 (=definitely in danger of extinction) to indicate your determination.

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3. What timeframe is scientifically and legally defensible as the "foreseeable future" for the DFH?

[redacted]

Write your justification in a word document. Please save often. [redacted]

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Significant Portion of the Range

7. Round 1: Are threats concentrated in any portion of the range of the DFH?

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(b)(5) DPP(b)(5) DPP

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e. No
f. Unsure

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10. Is this significant portion of the range in danger of extinction now?
    a. Yes
    b. No, however it is likely to be in danger of extinction in the foreseeable future (as defined above)
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Critical Habitat & 4(d) Rule

12. In terms of habitat, what do you think the DFH would have needed to reach a Not Warranted finding?

13. Because we've determined this species is threatened, we need to consider if there are any activities that should be exempt via a 4(d) rule. Discuss and capture your thoughts.

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    b. 10-20 years
    c. 20-30 years
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    f. 75-100 years
    g. Other (please specify)

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Tom McCoy – SCESFO State Supervisor

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Dwarf-flowered Heartleaf

(*Hexastylis naniflora*)

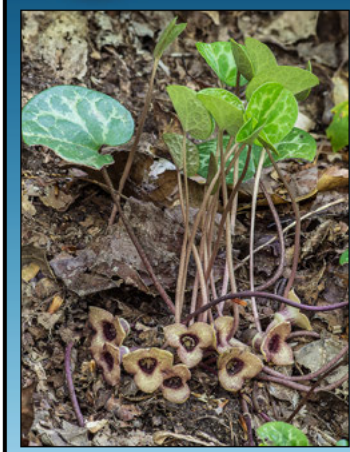


Photo credit: Jim Fowler

Species Status Assessment Overview

RD Briefing

October 10, 2018

We started the SSA process by sending Dear Interested Party letters to those that we thought would be interested or have information to share about the species.

We sent 78 emails and 6 letters. We received 3 responses.

We first engaged our experts during a kick-off call and presentation in January. This was followed by elicitation questions and review of the SSA during each phase of the writing process.

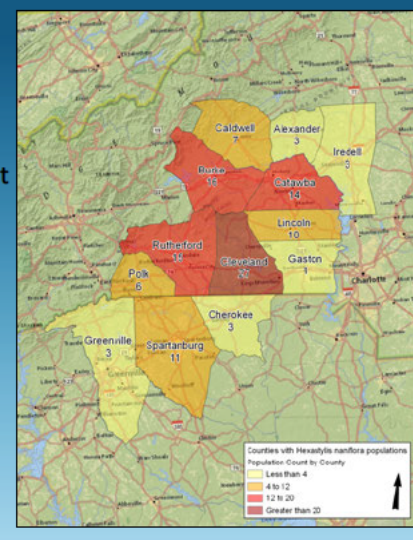
NCNHP was incredibly involved in the process and provided input that helped shape the SSA. SCHTP declined to participate on the expert team citing that they had not worked with the species in many years and weren't sure what additional information they could contribute to the process. They did provide us with heritage data and they were asked to participate in the peer review process.

We sent the SSA to seven potential peer reviewers on May 11. Peer review officially ended on June 4. To date we have received no comments.

<u>Other notes</u>
Have timeline
Who responded – David Brown (Corps related projects), Jennifer Robertson (quarry site and ski lake), and Gill Newberry (differences between HENA and HEHE)
Have elicitation questions

Listing & Recovery History

- Listed as threatened in 1989
  - 24 known populations in 8 counties
  - Approx. 5,000 individuals
  - Development was listed as the main threat
- Recovery Outline developed in 1989
- Recovery Plan never completed
- 5-Year Review (2011)
- Range-wide Status Report (2016)
- Species Status Assessment (2018)
  - 119 known populations in 13 counties
  - Approx. 300,000+ individuals



HENA was listed in 1989. At the time of listing, there were 24 known populations in 8 counties. This included approx. 5,000 individuals. Residential and industrial development was cited as the main threat. (Counties: SC – Chero, Green, Spart and NC – Clev, Cata, Burk, Ruth, Linc)

A recovery outline was developed in 1989. And, the outline indicated the draft plan would be completed by FY91. However, a Recovery Plan was never complete.

A 5-YR Review was finalized in 2011. A Range-wide Status Report was finalized in 2016.

The SSA was initiated in January of this year and there are now 119 populations in 13 counties totaling more than 300,000 individuals.

Cleveland County seems to be the strong-hold with 27 populations followed by the other counties shown in red – Rutherford, Burke, and Catawba.

<u>Other notes</u>

At the time of listing - Other threats cited in the listing rule include conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing.

A 5-YR Review was finalized in 2011 (initiated in 2005). Known populations jumped to 108 and the range expanded to 12 counties. (Counties added: NC – Alex, Cald, Ired, Polk)

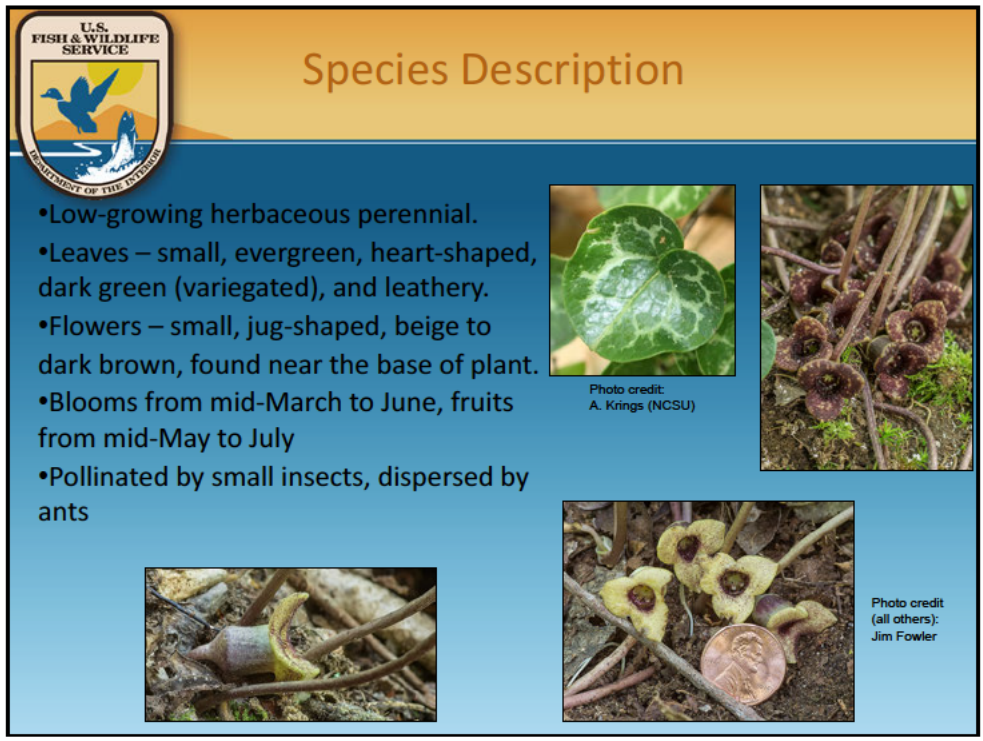
The 5-YR Review recommended working with partners to collect data capable of depicting status and trends in HENA at focal sites (over 1,000 individuals).

As a result, in 2012, the NCNHP initiated a status survey under a USFWS Flex Fund Grant to delineate and monitor some of the largest known populations previously identified by the USFWS to be important for recovery.

This effort produced a Range-wide Status Report, and a Comprehensive Review and Monitoring Report in 2016. The known populations increased to 113 populations and one additional county was added to the range. This included an estimate of approximately 300,000 individuals. (County added: NC – Gast)

The lack of Recovery Plan was what initially triggered this SSA; however, a significant amount of recovery has occurred. (There were attempts at Recovery Plans or Criteria by others – James Padgett, Gill Newberry, and NHP)

Fed government actions began when Section 12 of the ESA directed the secretary of the Smithsonian Institute to prepare a report of those plants considered to be TE or extinct. The report was presented to Congress in Jan of 1975. In July of 1975, the Service published a notice which formally accepted the report as a petition. By doing so, the FWS acknowledged the intention to review the status of those plant taxa named in the report. HENA was included. In June of 1976, the FWS published a proposed rule to determine that 1,700 vascular plants were endangered. HENA was included. The proposal was withdrawn in 1979 as a result of an amendment to the act. Another amendment in 1982 had all prior petitions treated as new. From 1983 to 1987, HENA was warranted but precluded by other listing actions. In 1988 there was a proposal to list HENA as threatened. Listed in 1989.



HENA is a low-growing, herbaceous plant in the Birthwort Family (Aristolochiaceae). Height of the plant rarely exceeds 15cm. The plant can have 1-40+ leaves. Leaves are heart-shaped, dark green with variegation, and leathery. They are 4-5 cm long and supported by a long, thin petiole.

Flowers are clustered at the base of the plant and often covered by leaf litter. They are small and jug shaped with no petals. Flowers have a wide range of coloring from beige to dark brown.

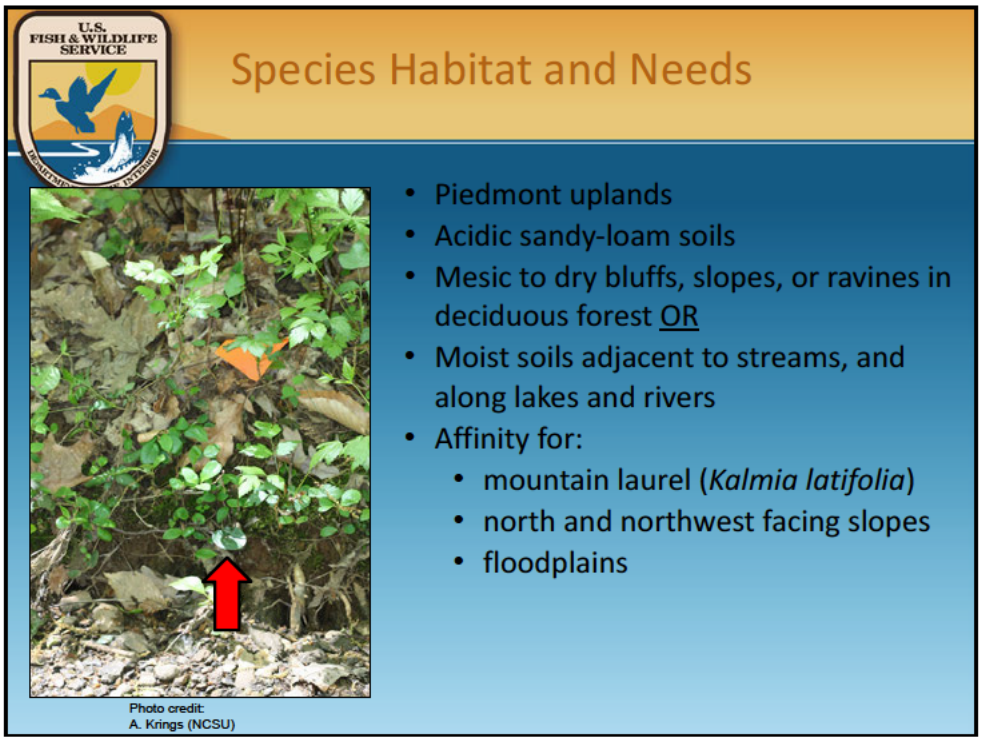
HENA is evergreen and blooms from Mid-March to June. The flower is pollinated by small insects. Fruits are produced from mid-May to July. Studies has shown that ants are one method of seed dispersal.

<u>Other notes</u>

Aristolochiaceae – Birthwort Family – 7 genera and 590 species of mostly tropical woody vines
Common in birthworts – 3-lobed calyx tube with 3 united sepals and no petals, perennial herbs and vines, typically broad leaves with red, purple, or brown flowers, fruit is a dry capsule that releases seeds when ripe
Another example is Dutchman's pipe (Aristolochia macrophylla)
3 united sepals form a 3-lobed calyx tube. The calyx tube opening is typically 5mm or less but can be up to 7mm. Collectively the sepals are called the calyx. The outermost whorl of parts that form a flower. Sepals typically function as protection for the flower in bud and support petals when in bloom.
Underground rhizome.

Fruits are a dry capsule that releases seeds when ripe.
Not a ton of research done on pollination or dispersal
Ant pollination study Gaddy 1986
Flies, wasps, and thripes – Otte 1977
50% of plant lineage is ant dispersed – Lengyel 2010
Jones 2014 – insects play a significant role but even without them, flowers managed to produce a partial seed set.

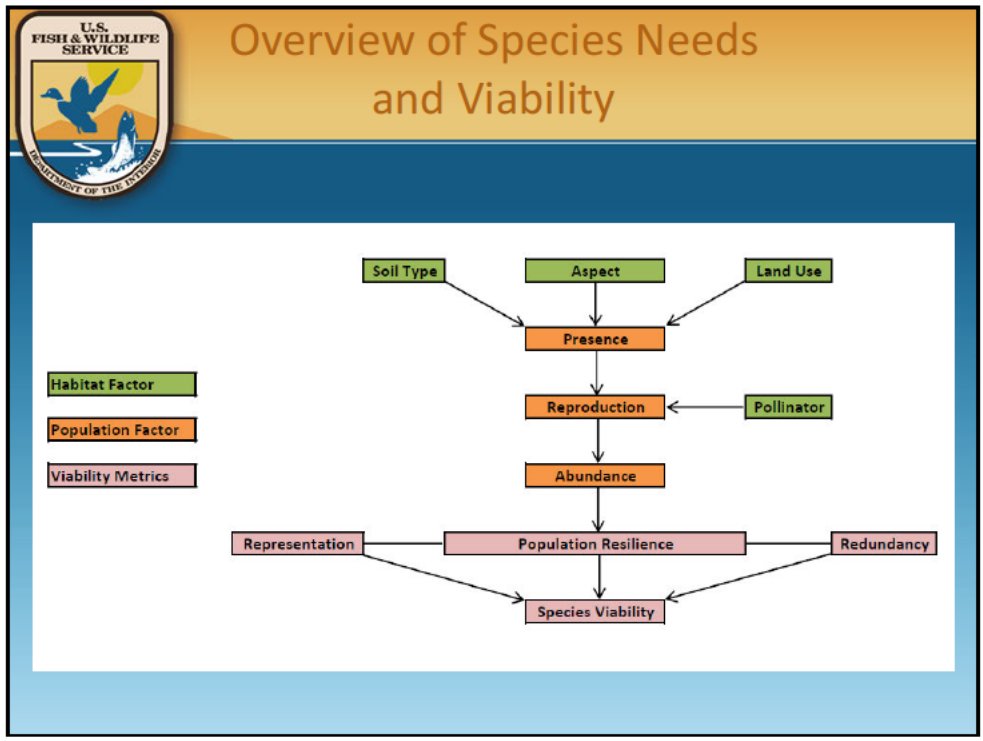
We are aware of one demographic study that took place from 1990-1991 in Spartanburg County, SC. The study found that there was a survival rate of approx. 96% over the two field seasons with highest mortality occurring in plants with <4 leaves and plants located highest on the slope. Percentage of flowering plants average 70% with the highest frequency of flowering occurring in the floodplain. Additionally, plants located in the floodplain were generally larger than plants located on adjacent slopes.



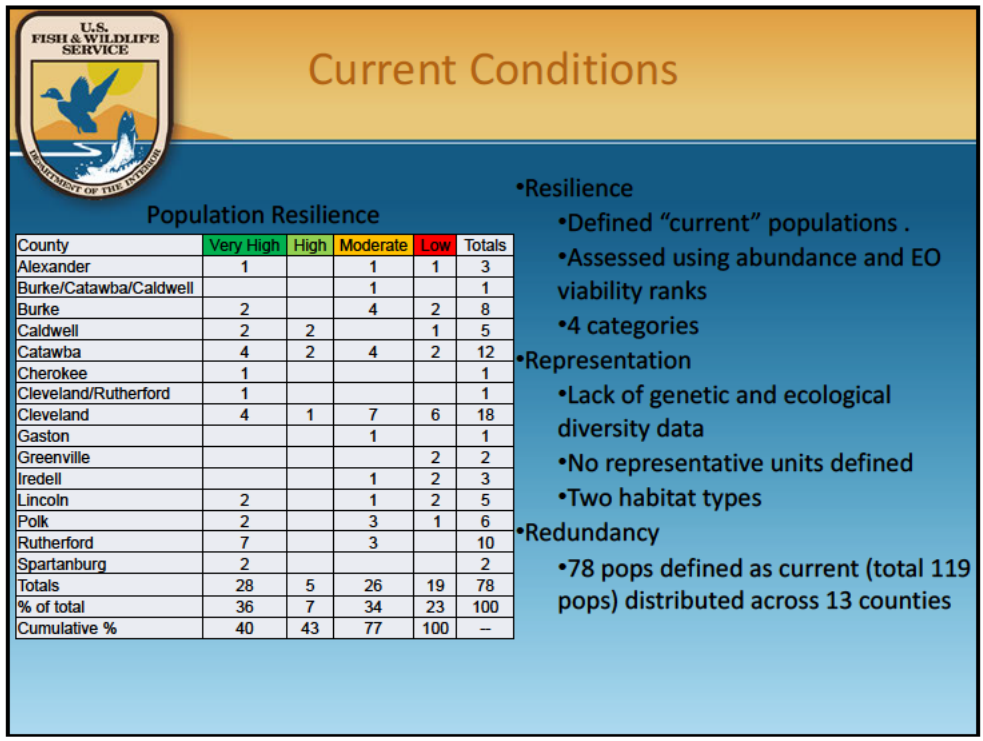
There are two types of habitat noted within Piedmont uplands with acidic soils – mesic to dry bluffs, slopes, and ravines AND moist soils adjacent to creeks, streamheads, and rivers. Literature indicates an association with mountain laurel, and an affinity for north facing slopes and floodplains.

Other notes

Mesic – a habitat containing a moderate amount of moisture.



This is a conceptual diagram showing how we get to a resilient population and what the species needs to be resilient. Abundance is the driving factor when we talk about resilience for HENA. If we step that back, abundance requires presence of individuals and reproduction with reproduction requiring the small insect pollinator. Presence is tied back to habitat factors – acidic sandy loam soils, north-northwest facing slopes, and forested land use.



County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burke/Catawba/Caldwell			1		1
Burke	2		4	2	8
Caldwell	2	2		1	5
Catawba	4	2	4	2	12
Cherokee	1				1
Cleveland/Rutherford	1				1
Cleveland	4	1	7	6	18
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	2		1	2	5
Polk	2		3	1	6
Rutherford	7		3		10
Spartanburg	2				2
Totals	28	5	26	19	78
% of total	36	7	34	23	100
Cumulative %	40	43	77	100	--

To assess current conditions, the first thing we did was to determine which populations would be included in our analysis. The element occurrence data from the Heritage programs includes a wide range of years since the species was last observed at a given location (1964-2017), data and reports suggest the species consists of 119 populations, but some of that data is outdated and some sites haven't been seen in many years. For the purposes of this SSA, we took a conservative approach and only used element occurrences that were observed since 2005. We picked 2005 because this was consistent with a natural break in the data that coincides with the initiation of the last 5-YR Review and it is consistent with the current populations that were used for the habitat model. So, based on our criteria, there are 78 populations that we define as current for purposes of the SSA. It is important to note that many of the populations that we excluded from our analysis likely still persist on the landscape.

Resilience

To determine overall resilience for populations we defined as current, we used known abundance and viability ranks from Heritage Program data as a starting point. The Heritage Program viability rankings are primarily based on abundance as well, but habitat condition (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are also considered. Using the Heritage program data, we developed four resilience ranks from low to very high. The table to the left shows a break down of the 78 populations by County and resilience rank. The bottom of that table shows % totals and cumulative %. 43% of populations are high or very high, and 77% of populations are moderate to very high.

Representation

We do not have the genetic and ecological diversity data to characterize representation for

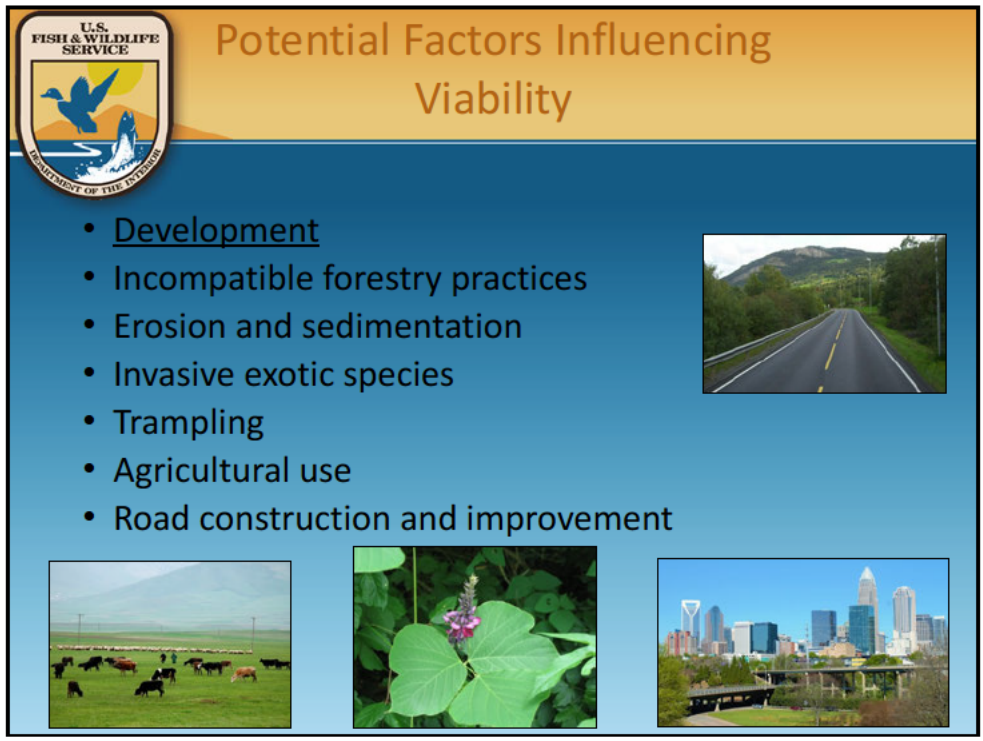
Hexastylis naniflora so we did not delineate representative units for the species. However, we do note that there are two habitat types across the range. One is the mesic to dry bluffs, slopes, and ravines and two is moist soils adjacent to creeks and streams.

Redundancy

Although Hexastylis naniflora is an upper Piedmont endemic, there are 78 populations defined as current distributed across 13 counties and two habitat types. This is a conservative estimate since the Heritage program data identifies 119 populations across the 13 counties observed from 1964 to 2017.

If asked:

Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.



There are several factors that influence the viability of HENA. Development was listed as the primary threat in the listing package and that is still the primary threat today. A large number of known populations occur near expanding urban areas and are threatened by residential, commercial, and industrial development. Most if not all of the threats listed could be linked back to development.

Other notes

Threat of development has either occurred or is reasonably foreseeable in approx. 37% of known population (NCNHP 2010)

Of those populations, all or portions of 50% had been adversely impacted by activities requiring ESA Section 7 consultation with the USFWS

Road and bridge improvement projects are the most recurrent source of habitat destruction

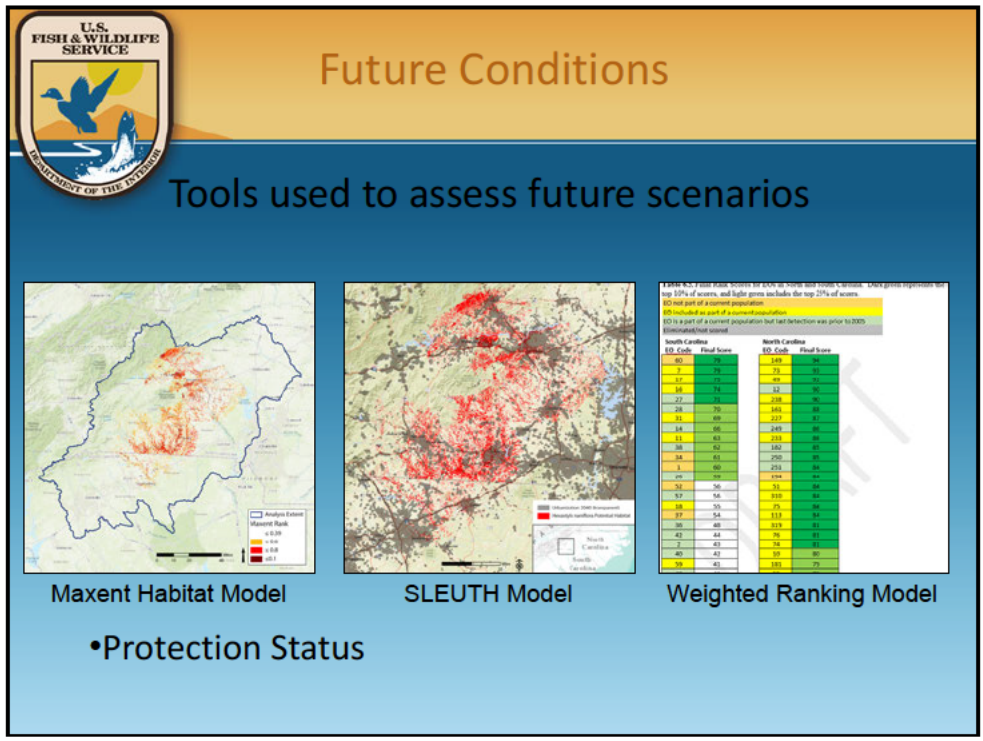
Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the NCDOT (NCNHP 2010)

Future Conditions

- Development of Future Scenarios
  - Primary threat = Development
  - Persistence of populations (pre-2005)
  - Assessment to 2040
- Three Scenarios
  - Status Quo
  - High Development
  - Targeted Conservation

In developing our future scenarios, we wanted to make sure we addressed development and urbanization since that is the largest threat to the species. Because populations are known to persist for many years, we wanted to also estimate the number of populations, not defined as current, that are still on the landscape. We chose an assessment timeframe to 2040 – this was chosen based on what we know about longevity of the species, expert input, precision of predictive models that show future development, and uncertainty about future conditions.

The three scenarios are: Status Quo, High Development, and Targeted Conservation. We believe that these three scenarios represent a range of possibilities that capture uncertainty about the future.

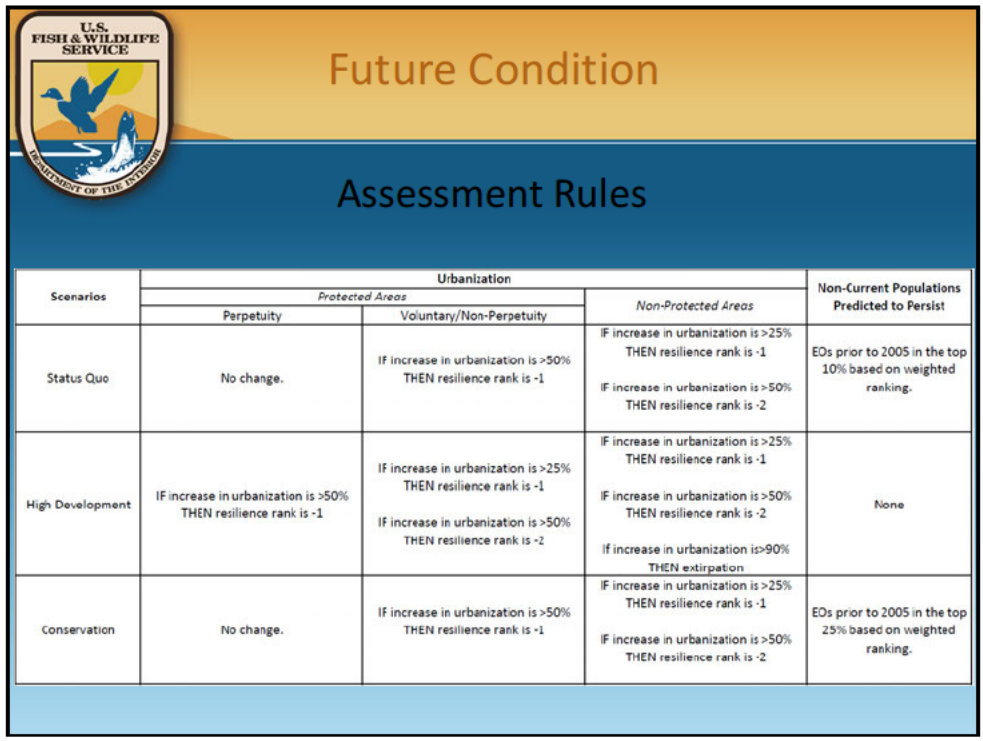


These are the tools we used to assess future conditions. The first is a Maxent habitat model. The model predicts habitat suitability based on habitat characteristics at known occurrences of Hexastylis naniflora. The output that you see is a heat map of potentially suitable habitat as defined by the model.

The SLEUTH model – which is the Slope, Land Cover, Exclusion, Urbanization, Transportation, and Hillshade model – was used to determine areas predicted to be developed by 2040. We looked at the % increase in projected development within our current populations and within areas delineated as potential habitat by the Maxent model. The output that you see in the middle is an overlay of the habitat model and the SLEUTH model. We used the % increase in projected development as a part of our assessment rules for assessing future scenarios.

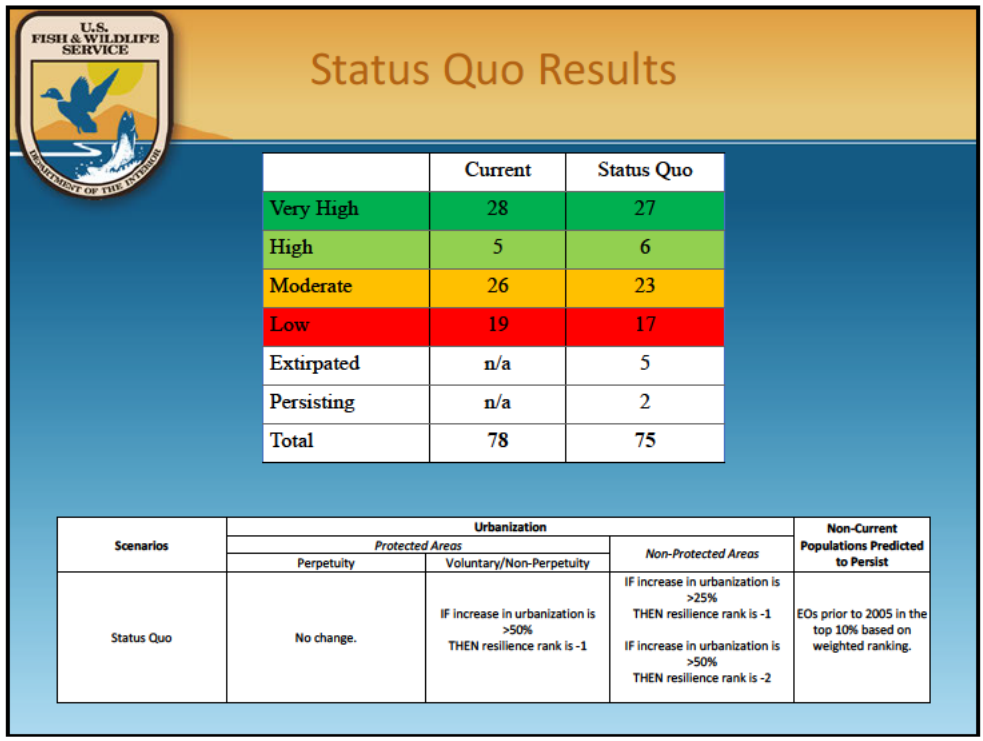
To determine what populations (pre-2005) are still likely to persist on the landscape, both model outputs were used in a weighted ranking model. Each population was given a score based on resilience category, habitat suitability, and % increase in development. The higher the score the more likely we thought the probability of persistence.

We also factored in protection status.



Scenarios	Urbanization			Non-Current Populations Predicted to Persist
	Protected Areas		*Non-Protected Areas*	
	Perpetuity	Voluntary/Non-Perpetuity		
Status Quo	No change.	IF increase in urbanization is >50% THEN resilience rank is -1	IF increase in urbanization is >25% THEN resilience rank is -1 IF increase in urbanization is >50% THEN resilience rank is -2	EOs prior to 2005 in the top 10% based on weighted ranking.
High Development	IF increase in urbanization is >50% THEN resilience rank is -1	IF increase in urbanization is >25% THEN resilience rank is -1 IF increase in urbanization is >50% THEN resilience rank is -2	IF increase in urbanization is >25% THEN resilience rank is -1 IF increase in urbanization is >50% THEN resilience rank is -2 If increase in urbanization is>90% THEN extirpation	None
Conservation	No change.	IF increase in urbanization is >50% THEN resilience rank is -1	IF increase in urbanization is >25% THEN resilience rank is -1 IF increase in urbanization is >50% THEN resilience rank is -2	EOs prior to 2005 in the top 25% based on weighted ranking.

Here are our assessment rules for each scenario. These are generally set up as IF-THEN statements. We assume that there will be a range of impacts from urbanization that are related to the % increase in urban development and we assume that a few populations will be persisting on the landscape depending on the scenario. So, if there is a certain % increase in urbanization/development, then resilience decreases by a certain amount.



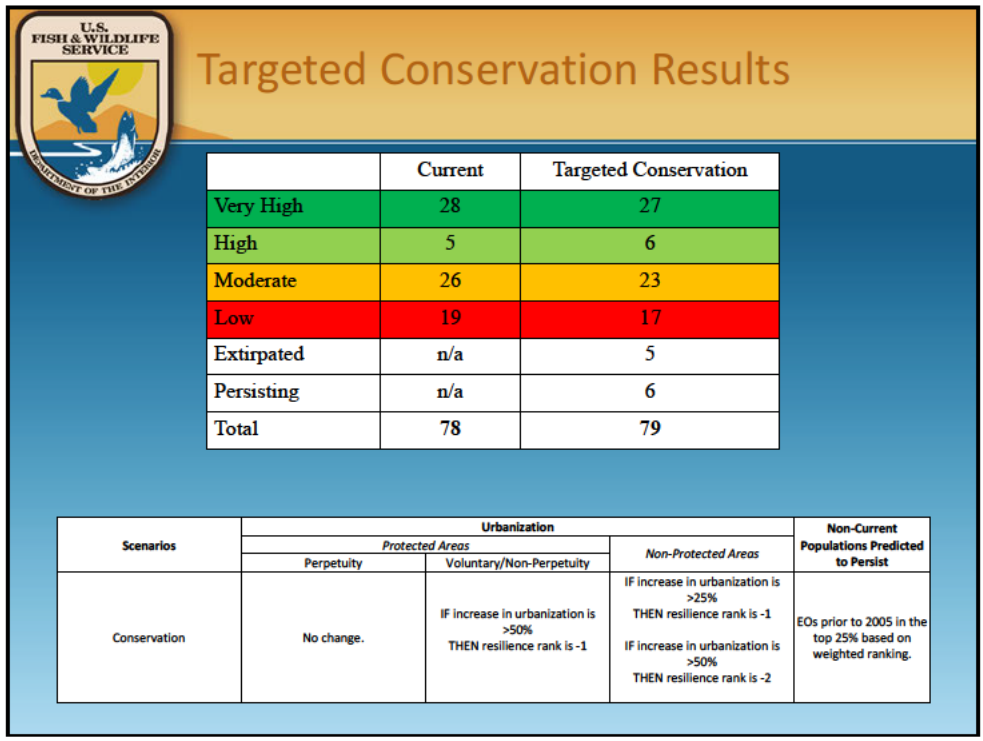
For the Status Quo scenario, we assumed there is no change in resilience for sites protected in perpetuity, we assumed a drop in resilience category if voluntarily protected sites and non-protected sites reached the thresholds in the table. And, we assumed that only those non-current populations that ranked in the top 10% of our ranking would be persisting on the landscape. The results are shown in the table. This scenario results in 5 extirpations and 2 persisting populations for a total of 75 populations in 2040.

High Development Results

	Current	High Development
Very High	28	27
High	5	4
Moderate	26	25
Low	19	16
Extirpated	n/a	6
Persisting	n/a	0
Total	78	72

Scenarios	Urbanization			Non-Current Populations Predicted to Persist
	Protected Areas		*Non-Protected Areas*	
	Perpetuity	Voluntary/Non-Perpetuity		
High Development	IF increase in urbanization is >50% THEN resilience rank is -1	IF increase in urbanization is >25% THEN resilience rank is -1 IF increase in urbanization is >50% THEN resilience rank is -2	IF increase in urbanization is >25% THEN resilience rank is -1 IF increase in urbanization is >50% THEN resilience rank is -2 If increase in urbanization is>90% THEN extirpation	None

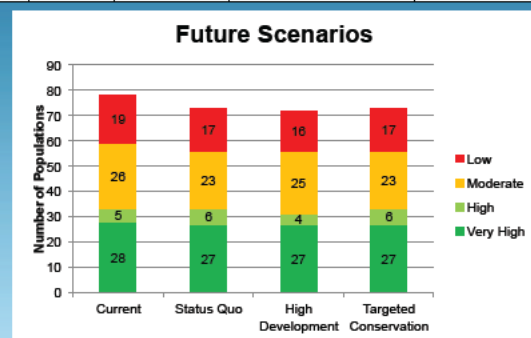
For the High Development scenario, we assumed a drop in resilience category if any sites reached the thresholds in the table. And, we assumed no non-current populations would persist on the landscape. This scenario results in 6 extirpations for a total of 72 populations in 2040.



For the Targeted Conservation scenario, we assumed the no change in resilience for sites protected in perpetuity, we assumed a drop in resilience category if voluntarily protected sites and non-protected sites reached the thresholds in the table. And, we assumed that only those non-current populations that ranked in the top 25% of our ranking would be persisting on the landscape. The results are shown in the table. This scenario results in 5 extirpations and 6 persisting populations for a total of 79 populations.

Viability Summary

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**



This is a table that shows all scenarios. The chart shows the data represented graphically.

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios and all scenarios have extirpations. However, the loss of resilience and extirpations is offset by several populations were found to persist in the Status Quo and Targeted Conservation scenarios. In all scenarios, the majority of the populations in 2040 are of at least moderate resilience.

Given the number of populations across each scenario, redundancy remains similar to current conditions.

Although we did not delineate representative units, we do not believe the scenarios predict declines in species representation because the populations in each scenario occur in both habitats known for the species.

Questions?

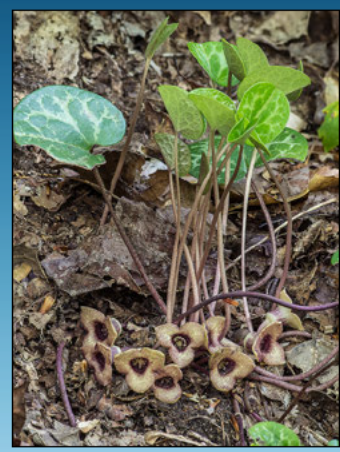


Photo credit: Jim Fowler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SERVICE
DEPARTMENT OF THE INTERIOR

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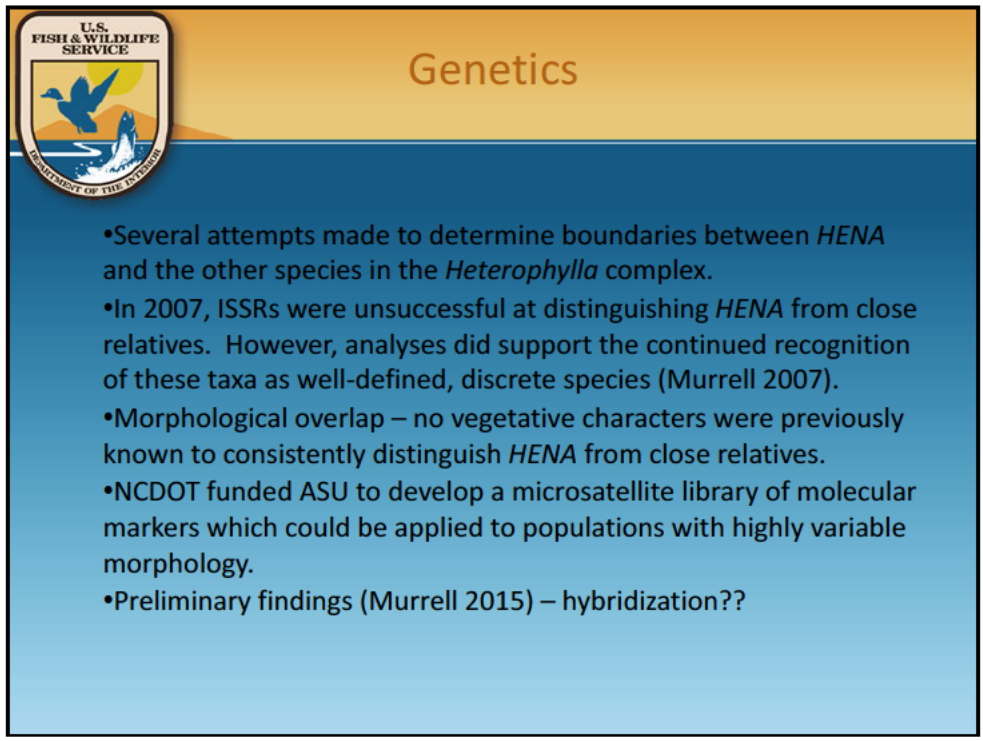


There have been several attempts made to determine the boundaries between HENA and other species in the Heterophylla complex. In 2007, Inter Simple Sequence Repeats were unsuccessful at distinguishing HENA from close relatives; however, the analyses did support the continued recognition of these taxa as well-defined, discrete species.

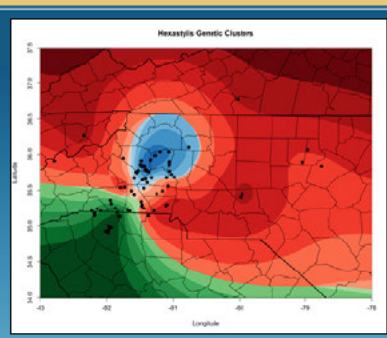
Field observations demonstrate that there are some populations of HENA with morphological characteristics that do not fit within the range of published values for key traits. These values overlap with values for HEHE and HEMI. Additionally, there were no vegetative characters known to consistently distinguish HENA from other close relatives. Given difficulties with field identification, particularly when not in flower, NCDOT funded ASU to develop a microsatellite library of molecular markers which could be applied to populations with highly variable characteristics.

Preliminary findings of the study suggest that populations in the southern range of HENA exhibit a more uniform genetic pattern, with some possible hybridization with HEMI. Populations in the northern part of the range appear to have hybridized with both HEHE and HEMI, although there are still some individuals with "pure" HENA genotypes in the northern range. The study made a point to say that the findings were preliminary and although they provide anecdotal evidence of hybridization – variation could be caused by forces other than hybridization.

<u>Other notes</u>
ISSR – track of repetitive DNA in which certain DNA sequence pattern are repeated multiple times
Other forces of hybridization – convergent morphological evolution, species in the process of

speciation and the study shows incomplete speciation, or other environmental factors that cause morphology to be at the extreme end of the ranges.
In evolutionary biology, convergent evolution is the process whereby organisms not closely related (not monophyletic), independently evolve similar traits as a result of having to adapt to similar environments or ecological niches.

Genetics



- Dr. Matt Estep of ASU disagrees with the analyses that lead to a conclusion of hybridization and no longer thinks hybridization is happening.
- A second look at data suggests a southern group of *Hexastylis* that is *naniflora* (green) and a northern group of *Hexastylis* that is yet to be described (blue).
- The genetic analysis to support the graphic is complete, a study of morphology is ongoing, no new species has been described, and no peer-reviewed publication is available.

- For purposes of the SSA, we assumed that all EO detections are *HENA*, and represent the best currently available scientific data.

During the elicitation process, Dr. Matt Estep of ASU indicated that he disagreed with the analyses that lead to a conclusion of hybridization. He took a second look at the data and thinks there is a southern group of Hexastylis that is naniflora (green) and a northern group of Hexastylis that is something else – not described (shown in blue). Red is other species – HEHE or HEMI.

So, the genetic analysis to support the map is complete and a study of the morphology is ongoing. However, a new species has not been described and there is no peer-reviewed publication to support the new analysis of data. With all of that in mind, for the purposes of the SSA, we assumed that all Eos identified as HENA are HENA and we assumed that Element Occurrence data represents the best currently available scientific data.

<u>Other notes</u>
Disagreement had to do with the way the samples were labeled and possibly the mis-identification of the samples.
EO – an area of land or water in which a species or natural community is or was present, for a species it often corresponds with the local population or a portion of a population.

Resilience Categories

- Very high—populations with **>1,000 individuals**; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with **500-1,000 individuals**; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with **100-500 individuals**; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with **<100 individuals**; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

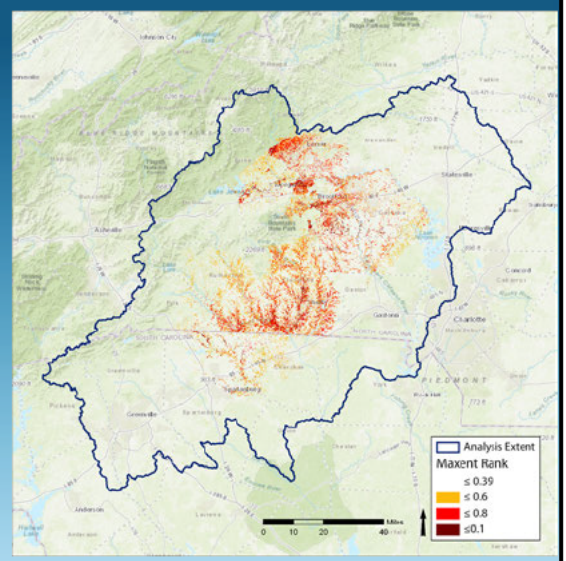
Associated Growth Trends

Rangewide monitoring report
At least 5 years of surveys

Trend	Survey	Site	2016 estimated number of plants (Rosettes)	2016 area occupied (Acres)
Increasing	NCNHP	Cliffside Steam Station (EO 276)	39,535	52
	NCNHP	Broad River: Floyds Creek, Long Branch (EO 177)	12,687	5 67
Stable	NCNHP	Island Creek Bluff/Love Lady Site (EO 029)	50,481	61 76
	NCNHP	Rhyne Preserve (EO 302)	19,873	22 43
	NCNHP	Mills Creek Forest and Seep (EO 023)	1,733	1 39
	NCNHP	New Hope Springhead Swamp (EO 125)	12,235	5 03
	NCNHP	Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop (EO099)	106,940	83 39
	NCNHP	Broad River: Cleghorn Creek, US 221 (EO 176)	6,750	7 24
	NCNHP	Cowpens National Battlefield (SC EO 016, 017, 018)	2,823	6 05
	NCNHP	Peters Creek Preserve (SC EO 011)	3,306	8 98
	NCNHP	Blalock Reservoir (SC EO 007, 031)	3,505	7 59
Decreasing	NCNHP	Second Broad River (Forest City Industrial Complex) (EO 154)	2,576	4 74
	NCNHP	South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)	123	0 09

Habitat Model

- 708 square miles of potential habitat
- Soil layer naming convention led to issues across state and watershed boundaries



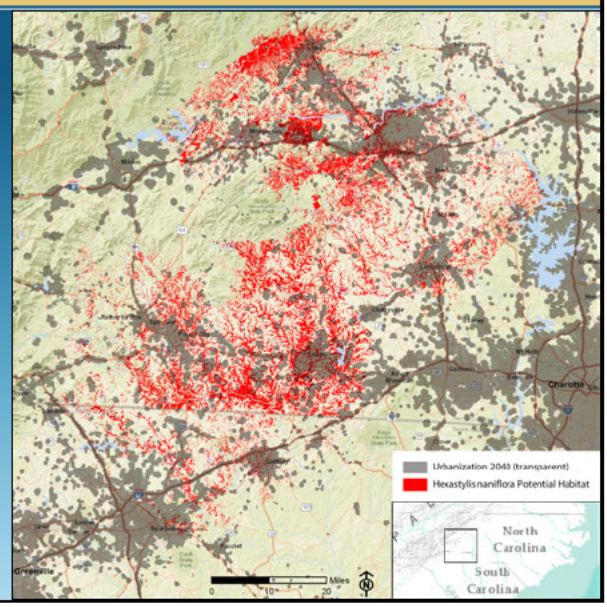
Habitat Suitability

•A minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence (excludes outliers). This led to only 6% of the area being excluded.

Maxent Score	Acres	Square Miles	Percent of Total
0.39 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

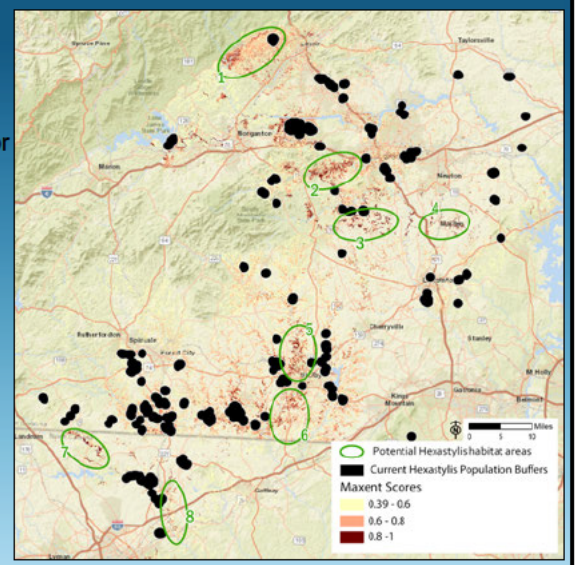
SLEUTH Model Results

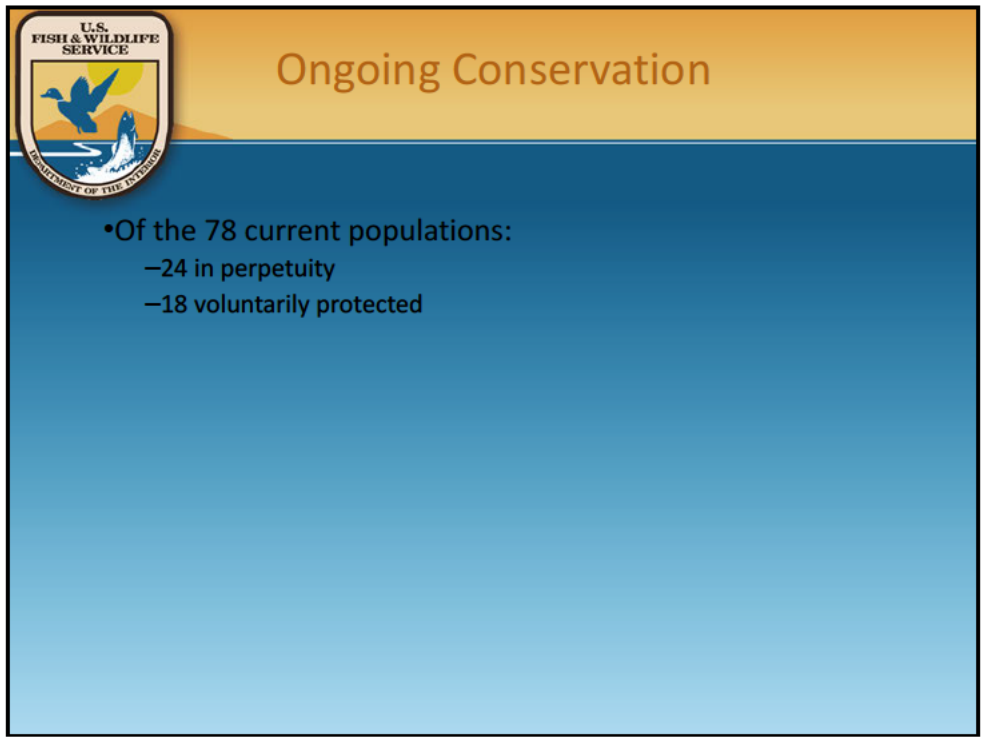
- 80% probability cutoff
- Focus on % increase in urbanization rather than total urbanization
- Scenarios will reflect different thresholds for species response to these increases
- SLEUTH + Habitat model + Protection Status helps to inform future viability and what areas are most likely to harbor additional populations



Future Conservation Opportunities

Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.





Protection status for the 78 populations identified as current was determined as a part of the SSA. Twenty-four populations, at least in part, are protected in perpetuity, 18 populations, at least in part, are voluntarily protected or protected but not in perpetuity, 34 populations are not protected, and two populations have an unknown status. Several populations are afforded permanent protection through fee title ownership by conservation partners. These sites include NCDOT mitigation sites at Murrays Mill and the Broad River Greenway. Other sites in permanent protection include the Catawba Lands Conservancy's Rhyne Preserve, the Cleveland County Landfill, Cowpens National Battlefield, and Peters Creek South Carolina State Heritage Preserve. NCNHP holds four voluntary Registry Agreements with private landowners for the purpose of protecting *Hexastylis naniflora*. These sites are the Parris Heartleaf Registered Heritage Area (RHA), the New Hope Springhead (Barefield) RHA, the Catawba County Wildlife Club RHA, and the Smith Cliff/Henry Fork RHA. Some populations are protected through conservation easements held by various partners. These include populations at the New Bethel Rare Plant Site, held by NCDOT. The Foothills Conservancy of NC holds a conservation easement at Peaked Top Rare Plant Site, and The Nature Conservancy holds a conservation easement at Jacob Fork West Corridor.

Elicitation Questions	Janet	Tom	Jack	Leo		Notes
Question 1						
Is the species in danger of extinciton now? Scale of 0-100	(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP					
Question 2 - NA						
Question 3						
Foreseeable future timeline?	(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP					
Question 4 - N/A						
Question 5						
Is species in danger of extinction in the FF? Scale of 0-100	(b)(5) DPP(b)(5) DPP(b)(5) DPP					
Question 6 - NA						
Question 7						
Are threats concentrated?	(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP					
Question 8-12 - NA						(b)(5) DPP(b)(5) DPP

2009
Hexastylis naniflora (Dwarf-flowered Heartleaf) Murray's Mill Inventory and Monitoring Report, Catawba County, North Carolina

Contact Person:
Dennis W. Herman
Environmental Program Consultant
North Carolina Department of Transportation
Natural Environment Unit
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919.431.6624
dwherman@ncdot.gov

November 11, 2010

Table of Contents

Species: *Hexastylis nanflora* (Dwarf-flowered heartleaf)

Site: Murrays's Mill Conservation Site (Catawba County)

NC NHP EO number(s): 184

Signed ROW occurrence? No

NCDOT Point of Contact (POC): Dennis Herman (Tim Bassette and Jared Gray)

Site management plan: Inventory and monitoring will occur every two years for a total of three monitoring sessions. A conservation plan similar to the Broad River Tract plan is in preparation.

Site protections: NCDOT purchased 24.74 acres on May 1, 1996 and an additional 8.61 acres (Bowman Tract) on March 13, 2006 as a permanent conservation site for the species.

Origin of species at this site: Native

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable/increasing

Species long-term trend at this site (averaged over multiple counts): Unknown

---

Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID: Formerly B-2119

USFWS log number:

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence):

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s): N/A

Description: N/A

Other actions undertaken by NCDOT and partners:

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence):
Monitoring and inventory activities every two years for a total of three monitoring sessions, i.e. 2009 (completed), 2011, and 2013.

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s): N/A

Description:

Discretionary actions undertaken by NCDOT and partners:

September 29-30, 2009 inventory and monitoring conducted.

Appendix A: *Hexastylis naniflora* (Dwarf-flowered heartleaf)

Appendix A.1: Murray's Mill Conservation Site (Catawba County)

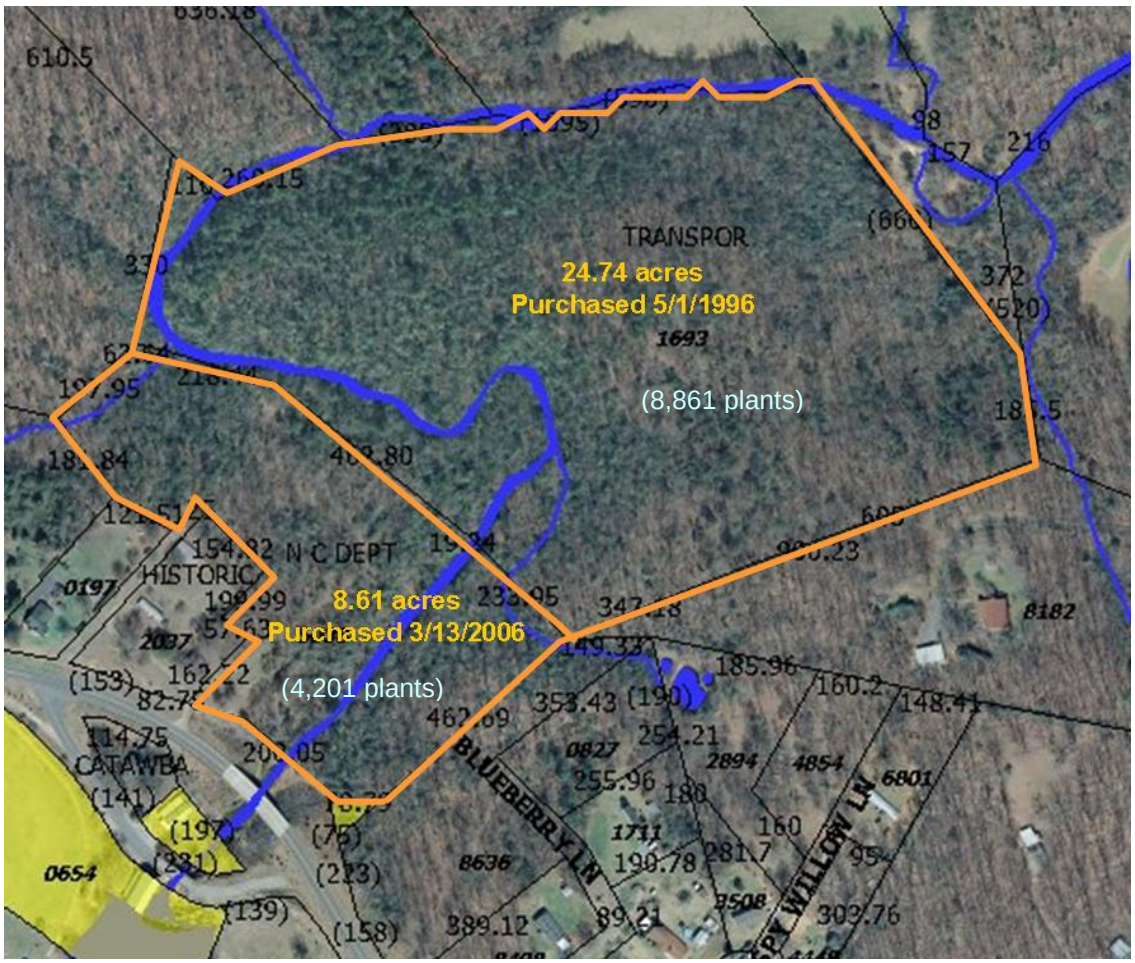


Figure 1: Murray's Mill Conservation Site, Catawba County, NC

Appendix A.1.2: Plant and Animal Species List for Murray's Mill Conservation Site

Plants

Acer rubrum	Red maple
Amelanchier arborea	Common serviceberry
Arundinaria gigantea	River cane
Asplenium platyneuron	Ebony spleenwort
Athyrium asplenioides	Southern lady fern
Betula nigra	River birch
Boehmeria cylindrica	False nettle
Botrychium virginianum	Rattlesnake fern
Campsis radicans	Trumpet creeper
Carpinus caroliniana	Ironwood
Carya glabra	Pignut hickory
Carya tomentosa	Mockernut hickory
Chimophila maculata	Spotted wintergreen
Cornus amomum	Swamp dogwood
Cornus florida	Flowering dogwood
Diospyros virginiana	Persimmon
Euonymus americanus	Strawberry bush
Fagus grandifolia	American beech
Galax urceolata	Galax
Goodyera pubescens	Rattlesnake plantain
Hexastylis naniflora	Dwarf-flowered heartleaf
Ilex opaca	American holly
Impatiens capensis	Spotted jewelweed
Juniperus virginiana	Eastern red cedar
Kalmia latifolia	Mountain laurel
Ligustrum sinense	Chinese privet
Liriodendron tulipifera	Tulip poplar
Lonicera japonica	Japanese honeysuckle
Microstegium vimineum	Japanese stiltgrass
Mitchella repens	Patridgeberry
Monotropa uniflora	Indian pipe
Morus rubra	Red mulberry
Nyssa sylvatica	Black gum
Osmunda cinnamomea	Cinnamon fern
Oxydendrum arborea	Sourwood
Parthenocissus quinquefolia	Virginia creeper
Pinus strobus	White pine
Pinus virginiana	Virginia pine
Platanus occidentalis	Sycamore
Polygonatum biflorum	Solomon's seal
Polygonum pensylvanicum	Pennsylvania smartweed
Polystichum acrostichoides	Christmas fern
Prunus serotina	Black cherry
Quercus alba	White oak

Quercus coccinea	Scarlet oak
Quercus falcata	Southern red oak
Quercus phellos	Willow oak
Quercus prinus	Chestnut oak
Quercus rubra	Northern red oak
Quercus stellata	Post oak
Rubus argutus	Sawtooth blackberry
Sassafras albidum	Sassafras
Smilax rotundifolia	Roundleaf greenbrier
Solidago altissima	Canada goldenrod
Thelypteris noveboracensis	New York fern
Tipularia discolor	Cranefly orchid
Toxicodendron radicans	Poison ivy
Vaccinium vacillans	Lowbush blueberry
Viburnum dentatum	Southern arrowwood
Vitis rotundifolia	Muscadine
Xanthoriza simplicissima	Yellowroot

Animals

Bufo woodhousei fowleri	Fowler's toad
Contopus virens	Eastern wood peewee
Corbicula fluminea	Asian clam
Diadophis punctatus edwardsi	Northern ringneck snake
Elliptio complanata	Eastern elliptio
Geothlyos trichas	Common yellowthroat
Guiraca caerulea	Blue grosbeak
Hylocichla mustelina	Wood thrush
Icterus spurious	Orchard oriole
Odocoileus virginianus	Virginia white-tailed deer
Pheucticus ludovicianus	Rose-breasted grosbeak
Piranga olivacea	Scarlet tanager
Piranga rubra	Summer tanager
Pyganodon cataracta	Eastern floater
Rana catesbeiana	Bullfrog
Rana sphenocephala	Southern leopard frog
Vespula maculifrons	Eastern yellowjacket
Vireo flavifrons	Yellow-throated vireo
Vireo solitarius	Blue-headed vireo

References

NCDOT. 2004-2010 Field observations.

Rossell, C.R. 2002. An Inventory of Significant Natural Areas of Catawba County, North Carolina. Natural Heritage Inventory , DENR NCNHP, pages 49-52.

Appendix A.2: Monitoring data

Murray's Mill Conservation Site was inventoried and monitored on September 29-30, 2010 by Tim Bassette, Anne Burroughs, Jared Gray, Matt Haney, Dennis Herman, Kathy Herring, and Steve Mitchell (NCDOT biologists). The property boundary corners of the Bowman Tract and original NCDOT properties were located and flagged. Fifteen to 50 feet wide transects were walked and individuals and rosettes of *H. naniflora* were counted.

Inventory Results

Bowman Tract:	4,201
NCDOT Original Site:	8,861
	13,062 Total *H. naniflora* plants

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: ***Hexastylis naniflora*** Common name: **Dwarf Flowered Heartleaf** **EO 184**

Survey date: **29-30 September 2009** 7.5' Quad Map: **Catawba**

County: **Catawba** Elevation: **850 - 940 feet**

Site location and directions: **Murray's Mill Conservation Site: east of Murray's Mill on Murray's Mill Rd. (SR 1003), along Balls Creek, approximately 2.4 miles SW Catawba. Coordinates on Balls Cr. just northeast of the new bridge:** [redacted] **(See Figure 1 attached)**

SPECIES INFORMATION

Number of individuals: **Transects from 15 to 50 feet wide were walked and individuals and rosettes of *H. naniflora* were counted. DOT original property purchased 5/1/96: 8,861 plants**
Bowman Tract purchased 3/13/06: 4,201 plants
13,062 total plants

Size of area in which population occurs: **33.35 acres**

Phenology: dormant
vegetative
bud
flower
fruit

Evidence of reproduction: **seedlings (many)**
clonal/vegetative?

Habitat (NC NHP natural community name and description; include quality, soils, geology, etc.): **Dry-Mesic Oak-Hickory Forest & Mesic Oak-Hickory Forest.**

Associated species: **See attached species list.**

Invasive species noted & degree of threat from invasive species: ***Ligustrum sinense, Lonicera japonica,* and *Microstegium vimineum*. The Chinese privet has become prevalent in the lower and moister areas, while the others do not appear to be a major problem.**

Area of suitable habitat (suitable for, but not necessarily occupied by the species): **There are many acres that the DFHL do not occupy over the whole 33+ acre tract that appear to be suitable. There may be a slight pH difference in the areas dominated by DFHL and the suitable areas where they are sparse or absent.**

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way?

Topographic position (examples: crest, mid slope, alluvial, etc): **DFHL found from creek bank to upper slopes.**

Micro-relief (examples: flat, concave, rippled, etc): **Flood plain to hilly with ravines.**

Moisture regime (examples: inundated, dry, seasonally wet, etc): **mesic to dry.**

Light (examples: open, woodland, closed canopy, etc): **Many acres that are open woods, but areas of dense mountain laurel and catbrier occur.**

Other information: **The property boundary corners were located with GPS and flagged for future inventories.**

Protection / management needs and opportunities: **Murray's Mill Conservation Site is being inventoried and monitored on a two year rotation for a total of three monitoring sessions that will end in 2013.**

Landowner(s), if known: **NCDOT**

Person making this report: **Dennis W. Herman** Search time: **14.0 hours**

Address: **NCDOT, NEU**

Phone:

Other observers: **Tim Bassette, Anne Burroughs, Jared Gray, Matt Haney, Kathy Herring, and Steve Mitchell (NEU Biological Survey Group)**

Specimens collected? **None** Collection #: Repository:

Miscellaneous Notes: **The DFHL population appears to be stable and increasing. The total plants counted were 4,000 more than counted in 2006 from both tracts.**

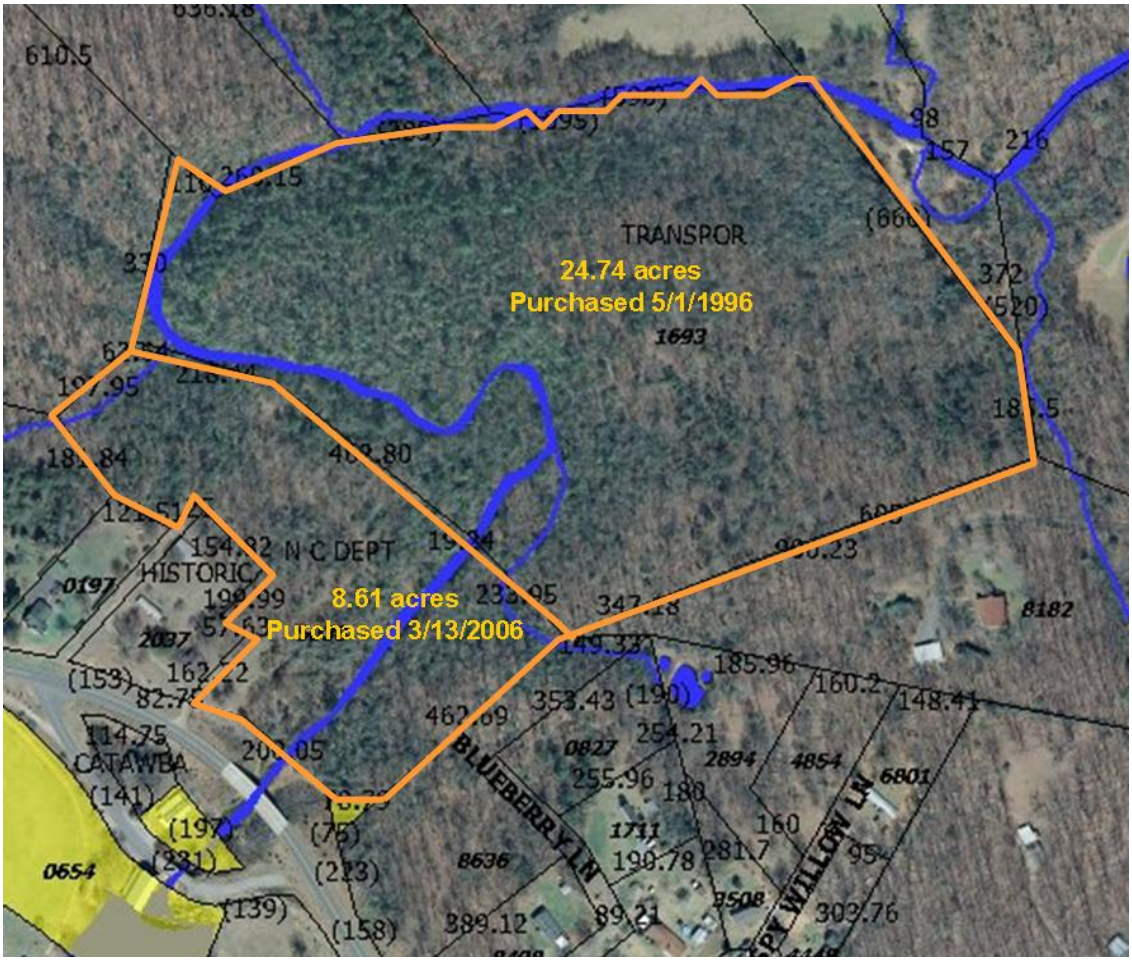


Figure 1: Murray's Mill Conservation Site, Catawba County, NC

Attachment 1: Murray's Mill Conservation Site Species List

Plants

Acer rubrum	Red maple
Amelanchier arborea	Common serviceberry
Arundinaria gigantea	River cane
Asplenium platyneuron	Ebony spleenwort
Athyrium asplenioides	Southern lady fern
Betula nigra	River birch
Boehmeria cylindrica	False nettle
Botrychium virginianum	Rattlesnake fern
Campsis radicans	Trumpet creeper
Carpinus caroliniana	Ironwood
Carya glabra	Pignut hickory
Carya tomentosa	Mockernut hickory
Chimophila maculata	Spotted wintergreen
Cornus amomum	Swamp dogwood
Cornus florida	Flowering dogwood
Diospyros virginiana	Persimmon
Euonymus americanus	Strawberry bush
Fagus grandifolia	American beech
Galax urceolata	Galax
Goodyera pubescens	Rattlesnake plantain
Hexastylis naniflora	Dwarf-flowered heartleaf
Ilex opaca	American holly
Impatiens capensis	Spotted jewelweed
Juniperus virginiana	Eastern red cedar
Kalmia latifolia	Mountain laurel
Ligustrum sinense	Chinese privet
Liriodendron tulipifera	Tulip poplar
Lonicera japonica	Japanese honeysuckle
Microstegium vimineum	Japanese stiltgrass
Mitchella repens	Patridgeberry
Monotropa uniflora	Indian pipe
Morus rubra	Red mulberry
Nyssa sylvatica	Black gum
Osmunda cinnamomea	Cinnamon fern
Oxydendrum arborea	Sourwood
Parthenocissus quinquefolia	Virginia creeper
Pinus strobus	White pine
Pinus virginiana	Virginia pine
Platanus occidentalis	Sycamore
Polygonatum biflorum	Solomon's seal
Polygonum pensylvanicum	Pennsylvania smartweed
Polystichum acrostichoides	Christmas fern
Prunus serotina	Black cherry
Quercus alba	White oak
Quercus coccinea	Scarlet oak
Quercus falcata	Southern red oak
Quercus phellos	Willow oak
Quercus prinus	Chestnut oak
Quercus rubra	Northern red oak
Quercus stellata	Post oak
Rubus argutus	Sawtooth blackberry

Sassafras albidum	Sassafras
Smilax rotundifolia	Roundleaf greenbrier
Solidago altissima	Canada goldenrod
Thelypteris noveboracensis	New York fern
Tipularia discolor	Cranefly orchid
Toxicodendron radicans	Poison ivy
Vaccinium vacillans	Lowbush blueberry
Viburnum dentatum	Southern arrowwood
Vitis rotundifolia	Muscadine
Xanthoriza simplicissima	Yellowroot

Animals

Bufo woodhousei fowleri	Fowler's toad
Contopus virens	Eastern wood peewee
Corbicula fluminea	Asian clam
Diadophis punctatus edwardsi	Northern ringneck snake
Elliptio complanata	Eastern elliptio
Geothlyos trichas	Common yellowthroat
Guiraca caerulea	Blue grosbeak
Hylocichla mustelina	Wood thrush
Icterus spurious	Orchard oriole
Odocoileus virginianus	Virginia white-tailed deer
Pheucticus ludovicianus	Rose-breasted grosbeak
Piranga olivacea	Scarlet tanager
Piranga rubra	Summer tanager
Pyganodon cataracta	Eastern floater
Rana catesbeiana	Bullfrog
Rana sphenocephala	Southern leopard frog
Vespula maculifrons	Eastern yellowjacket
Vireo flavifrons	Yellow-throated vireo
Vireo solitarius	Blue-headed vireo

References

NCDOT. 2004-2010 Field observations.

Rossell, C.R. 2002. An Inventory of Significant Natural Areas of Catawba County, North Carolina. Natural Heritage Inventory, DENR NCNHP, pages 49-52.

2011
Hexastylis naniflora (Dwarf-Flowered Heartleaf) Murray's Mill Inventory and Monitoring Report, Catawba County, North Carolina

Contact Person:
Dennis Herman
Environmental Program Consultant
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919.707.6127
dwherman@ncdot.gov

June 15, 2012

Species: *Hexastylis naniflora* (Dwarf-flowered heartleaf)

Site: Murray's Mill Conservation Area (Catawba County)

NC NHP EO number(s): 184

Signed ROW occurrence? No

NCDOT Point of Contact (POC): Tim Bassette (Dennis Herman and Jared Gray)

Site management plan: Inventory and monitoring will occur every two years for a total of three monitoring sessions. A draft Conservation Plan for dwarf-flowered heartleaf at Murray's Mill Conservation Area prepared by NCDOT has been submitted to Catawba County Historical Association for review.

Site protections: NCDOT purchased 25.07 acres (Tract 1) on May 1, 1996 and an additional 8.61 acre Bowman Tract (Tract 2) on March 13, 2006 as a permanent conservation site for the species. A copy of the draft Conservation Plan for Murray's Mill Conservation Area is included in Appendix B. Dennis Herman (919-707-6127) is the NCDOT point of contact from which to obtain a current copy of the draft conservation plan.

Origin of species at this site: Native

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable/increasing

Species long-term trend at this site (averaged over multiple counts): Stable/increasing

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Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID: TIP No. R-9999L (formerly B-2119).

USFWS log number: 4-2-95-102

On August 3, 1995 the U.S. Fish and Wildlife Service (Service) issued a Biological Opinion (BO) pertaining to projects B-2119, U-2307, and U-2528AA. The BO was issued in response to a request to initiate formal consultation for the referenced projects on July 20, 1995. Per the BO, NCDOT made the following environmental commitments (pgs. 5-6):

- The NCDOT will pursue purchasing land in fee title (or conservation easement) from willing sellers to establish a preserve of approximately 11.9 ha (29.4 acres) in the Murray's Mill area. *Status:* On May 1, 1996, the NCDOT purchased 25.07 acres (Tract 1) and an additional 8.61 acres on the adjacent Bowman Tract (Tract 2) on March 13, 2006.
- The preserve will be conveyed to another responsible entity (such as the Catawba County Historical Association of Catawba County) with an accompanying agreement or deed restriction that the existing plant population be protected in perpetuity.

Status: Currently NCDOT still holds the title to the site but is working toward the transfer of ownership and stewardship responsibilities to the Catawba County Historical Association. The NCDOT has developed a conservation plan which outlines the management of the Murray's Mill Site for the perpetual conservation of the *Hexastylis naniflora*.

- The NCDOT and FHWA have also agreed that if establishing a preserve in the Murray's Mill area is not feasible, they will pursue establishing a preserve of similar size and quality (with regards to plant population density and size) at another location in North Carolina, as agreed upon by the Service.
  Status: As of March 13, 2006 the NCDOT completed the purchase of the Murray's Mill tracts which met and exceeded the necessary 11.9 hectare (29.4 acres) commitment.
- If the entire 11.9 hectare area, as committed in the Assessment, is not protected through fee title or conservation easement, then Project U-2528AA will be dropped from the Programmatic Section 7 Consultation and will need to be addressed at a separate consultation at a future date.
  Status: As mentioned in the status of the commitment above, the NCDOT purchased more than the requisite 11.9 hectares.
- Some transplanting of *Hexastylis naniflora* individuals to protected sites, or possibly even the collecting of individuals for Center for Plant Conservation-approved of botanical gardens, may be carried out, but will be the sole responsibility of the Service. Any transplanting efforts will be conducted with prior coordination with NCDOT.
  Status: To-date, no transplanting or collecting of individual plants has been coordinated.
- The Service has agreed that if the above mentioned preserve is established, and Project U-2528AA is dropped (not constructed), the NCDOT may substitute another project involving *Hexastylis naniflora* contingent upon Service approval. The Service will evaluate such criteria as plant population size, habitat quality, landscape context (e.g. rural. urban), proposed impacts to the plant population, etc. in making a decision on substituting another NCDOT project.
  Status: The option for NCDOT to substitute another project is no longer viable because U-2528AA has been constructed.
- Assisting the Service in answering questions that arose during the recent 5-year status review for the species.
  Status: Every two years for no more than a six year period, the NCDOT will monitor all occurrences associated with 14 NCDOT projects where *Hexastylis naniflora* was found in the right-of-way, of which Murray's Mill is one. Environmental baseline data will be obtained and will include both quantitative and qualitative analyses. Specifics of the five year review assistance are detailed in the USFWS Biological Opinion letter to NCDOT dated November 13, 2009.

Status of terms and conditions from applicable NC Plant Conservation Program permits: No permit required or obtained by NCDOT.

NC PCP Permit ID number(s): N/A

Description: N/A

Discretionary actions undertaken by NCDOT and partners:

In addition to the environmental commitments made by NCDOT, the Service requested the following conservation recommendations be implemented by NCDOT as part of project plans (p. 7).

1. The agreement (or deed restriction) to protect plants on the preserve in perpetuity will include a provision that any management recommendations made by the service will be implemented if resources are available, and that access into the preserve will be granted for Service representatives and representatives from state resources agencies with prior notification to the owner.
2. The deed for the acquired site will identify that this area was purchased for conservation purposes.
3. The Service's Asheville Field Office will be notified at least one month in advance of the start of construction for all three projects to allow an opportunity to transplant specimens from project impacts area.

NCDOT currently has a draft Conservation Plan for the Murray's Mill Conservation Area. Within this document NCDOT has taken the following conservation measures:

1. Conservation Area Established:
    - NCDOT purchased a 25.07 acre tract (Tract 1) in Catawba County on May 1, 1996 and an 8.61 ac tract (Tract 2) on March 13, 2006. These two tracts are known as the "Murray's Mill Conservation Area".

2. Management to be conducted by the Catawba Co. Historical Association (CCHA):
    - Chinese privet, Japanese honeysuckle, multiflora rose were all found within the Conservation Area.
    - Signs, walking and all-terrain vehicle trails were found within the Conservation Area. Photos attached in Appendix A.3
    - Currently, based on the field observations gathered during the 2011 survey, these issues noted above do not present a detrimental effect on the *Hexastylis naniflora* habitat. The exotic, invasive species currently have a low degree of threat within the Conservation Area. No management actions are recommended to be acted upon at this time.

3. Monitoring
    - Several measures found in the current draft Conservation Plan for *Hexastylis naniflora* at Murray's Mill, including monitoring interval and data collection requirements, were subsequently modified in accordance with the conditions of the R-2824 Biological Opinion. The new monitoring interval requires monitoring every two years for no more than a six year period with surveys being conducted during the USFWS recommended *Hexastylis naniflora* optimal survey window. Following the baseline data collection, monitoring will include both a quantitative and qualitative analysis. A quantitative analysis will include *Hexastylis naniflora* plant enumerations via direct plant counts and/or sample plot estimates, delineating changes to *Hexastylis naniflora* plant boundaries using GPS and GIS technologies, computing changes to acreages of occurrence areas, computing *Hexastylis naniflora* plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas. The Biological Opinion notes that plant enumeration methodologies employed will remain consistent during the monitoring period (i.e. if direct counts rather than sampled with plot estimates, then the

direct count methodology will be employed throughout the remainder of the monitoring period. The qualitative analysis will include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching *Hexastylis naniflora* plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from drought or excessive precipitation, and land clearing and draining activities. As direct by the USFWS Biological Opinion the NCDOT will prepare a NC Natural Heritage Program - Endangered and Rare Plant Field Survey Form that incorporates both types of data. Currently at Murray's Mill, field monitoring was completed in 2009 by NCDOT biologists and 2011 by Mulkey biologists.

4. Reporting:
    - The "2009 *Hexastylis naniflora* Inventory Monitoring Report, Catawba County, North Carolina" was submitted on October 11, 2010. The "2011 *Hexastylis naniflora* Inventory Monitoring Report, Catawba County, North Carolina" will be submitted in 2012.

5. Adaptive Management
    - A draft Conservation Plan was submitted to Catawba County Historical Association for review in 2006. However, since preparation of the draft Conservation Plan, several of the measures provided including the monitoring interval and collection requirements, have been modified following additional Section 7 Consultations and USFWS-approved monitoring report guidelines. It is recommended by the NCDOT that the advisory committee modify the current draft Conservation Plan, as appropriate, for those measures that have changed over time.

6. Modification to land uses at Murray's Mill Conservation Area:
    - Generally speaking the land use of the site has not changed. Presently some trails are present throughout the site and appear to be intermittently used by all-terrain vehicles. Some of the trails leading from the historical mill area were installed by Boy Scout troops and are occasionally lined with rock; in a few places there are also interpretive signs along the trail. Additionally, a footbridge has been installed over Balls Creek connecting the trails. Although noticeable alterations to the natural landscape, these features do not appear to be a serious threat to the goals and objectives of the Conservation Plan.

7. Modification to Boundaries of Murray's Mill Conservation Area:
    - The Bowman Tract (Tract 2) was added to the Murray's Mill Conservation Area as of March 13, 2006 in order to contribute to the goals and objectives as stated in the Conservation Plan for Murray's Mill Conservation Area.

8. Term of the plan:
    - The stated term of the Conservation Plan has not changed at this time.

References

Catawba County GIS. Parcel data. Created by Catawba County, NC, using ArcMap. Purchased on November 29, 2011.

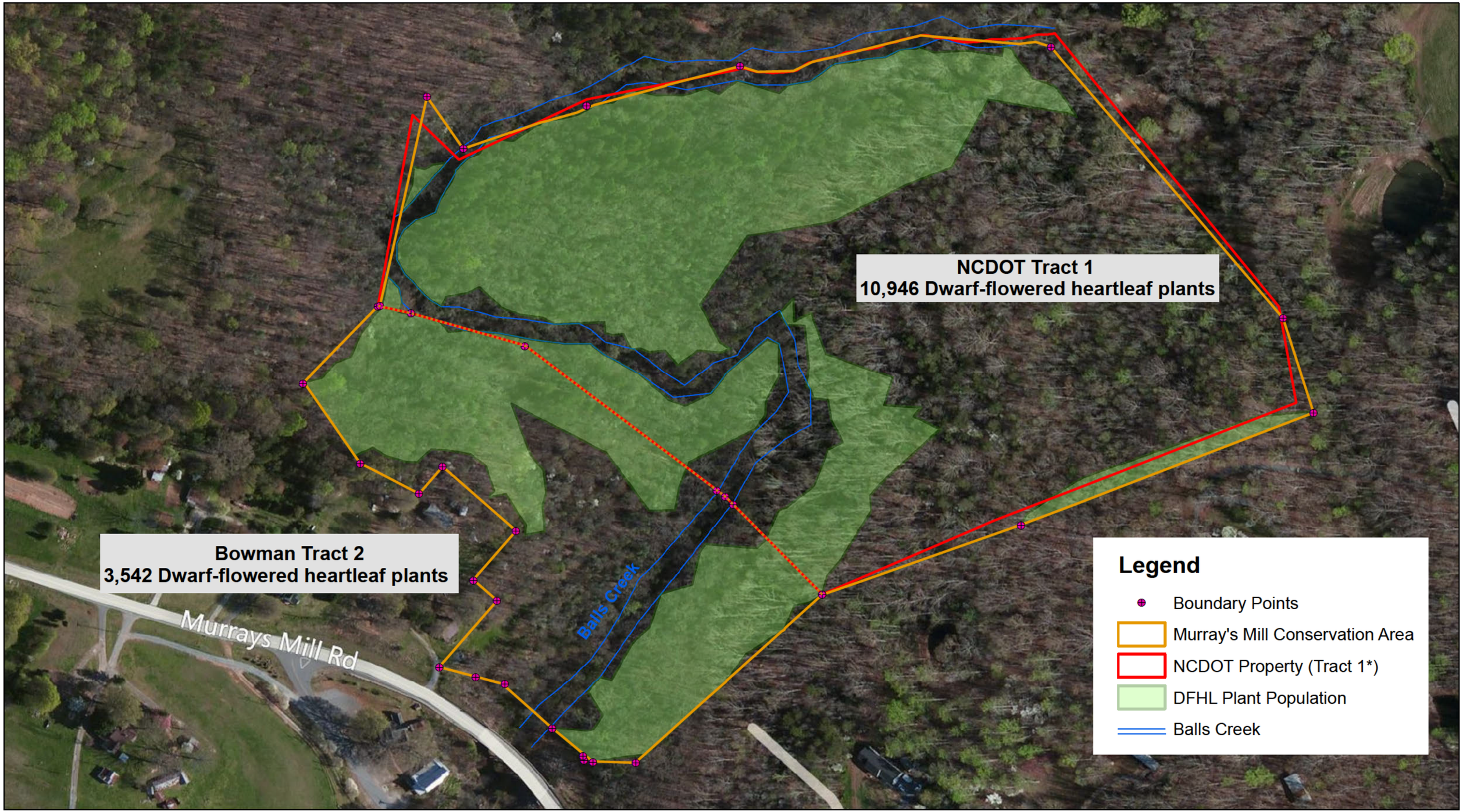
North Carolina Drought Management Advisory Council. Catawba County Drought Advisory Data. http://www.ncdrought.org/archive/index.php Accessed on June 14, 2012.

North Carolina Department of Transportation. Conservation Plan for Murray's Mill Conservation Area. Catawba County, North Carolina. DRAFT

North Carolina Department of Transportation. 1995. Dwarf Flowered Heartleaf. Programmatic Section 7 Consultation for T.I.P. Projects: B-2119, U-2307 & U-2528AA, Catawba County, North Carolina. 4pp.

United States Fish and Wildlife Service. 2009. *Proposed Upgrade of Lovelady Road, TIP No. R-2824*, *in Burke County, North Carolina, and Its Effects on the Federally Threatened Dwarf-Flowered Heartleaf.* Log Number 4-2-09-367.

United States Fish and Wildlife Service. 1995. *Biological Opinion of the US Fish and Wildlife Service Concerning the Effects of Construction of Three NC Department of Transportation Projects in Catawba County on the Federally Threatened Dwarf-Flowered Heartleaf.* Log Number 4-2-95-102.



Prepared by:

MULKEY ENGINEERS & CONSULTANTS

Prepared for:

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Appendix A. 1

MURRAY'S MILL CONSERVATION AREA

CATAWBA COUNTY, NC

This Exhibit is for planning purposes only and information shown hereon does not meet NC 47-30 Requirements and therefore is not for design, construction, or recording or transfer of title. The Exhibit was compiled from available information obtained from the sources listed below. Streams and Wetlands: All features located in the field were recorded using a mapping grade Trimble GeoXT or GeoXH GPS receiver with supposed sub-meter accuracy.

Sources:
*Catawba County Data: Catawba County GIS
Aerial Photography: ESRI Imagery Prime World 2D

1 inch = 200 feet

GRAPHIC SCALE

0 100 200 400 Feet

FIGURE

1

Appendix A.2: Monitoring data

Murray's Mill Conservation Area was monitored on December 5-6 and 12-13, 2011 by Brian Dustin, Wendee Smith, Mark Mickley, Tom Barrett, and Christopher Dustin (Mulkey biologists). The property boundary corners of the Bowman Tract (Tract 2) and original NCDOT property (Tract 1) were located and flagged. All flags were removed from the Bowman Tract (Tract 2). *Hexastylis naniflora* surveys were conducted via direct counts along ten to 50-foot wide transects. Whether single *H. naniflora* leaves or rosettes, in both cases it was counted as one plant. The number of plants identified on the Bowman (Tract 2) was 3,542, compared to the 2009 inventory of 4,201. Throughout the Bowman (Tract 2) and NCDOT (Tract 1) tracts several lightly used foot paths were seen and documented as shown in Appendix A.3. A variety of invasive species including, Chinese privet, Multiflora rose, and Japanese honeysuckle were observed.

For the 2011 surveys, a Catawba County GIS layer was used to identify the property boundary in combination with property irons found in the field. The outer limits of the *H. naniflora* population found within the Conservation Area are shown on Figure 1. There was a slight discrepancy between the Catawba County GIS parcel boundary and what was observed by Mulkey in the field. Property irons inventoried by Mulkey utilizing a Trimble XH GPS receiver with supposed sub-meter accuracy did not accurately correlate to property corners shown by Catawba County GIS on the north, south, east or northwest boundaries. Personal communication with Cathy Johnson of the Catawba County GIS Department revealed that the County's GIS boundary is derived from deed information manually drawn in the office which may introduce error, as opposed to locating the parcel corners in the field (February 14, 2012). The discrepancy is shown in Figure 1.

Table 1.

Murray's Mill Conservation Area *Hexastylis naniflora* Monitoring Results			
YEAR	**NCDOT (Tract 1)**	**Bowman (Track 2)**	**Totals**
2009	8,861	4,201	13,062
2011	10,946	3,542	14,488

As show in Table 1 above, there was a 10.9 percent increase to the number of *H. naniflora* plants within the Conservation Area from 2009 to 2011. The *H. naniflora* population shows a stable and increasing trend at the Conservation Area. Lower counts in Tract 2 could possibly be attributed to the surveys being conducted following the leaf fall, and therefore covering up individual *H. naniflora* plants. Leaf litter and time of year made it difficult to positively observe herbaceous and non-woody plants with the study area. This begs the question of how could Tract 1 stem counts show an increase from 2009 to 2011. One explanation, based strictly on visual observations, is that Tract 2 appeared to have a higher density of shrub and canopy species which may have yielded more leaf litter than Tract 1.

The variation in rainfall level and drought conditions when comparing 2009 and 2011 may have played a role in the number of *Hexastylis naniflora* stems counts. According to the NC Drought Management Advisory Council (http://www.ncdrought.org/archive/index.php), in 2009 Catawba County received a drought classification of "Abnormally Dry" during the months of January, May, and August for at least two or more weeks within the month. During February, March, and April the County was classified as being under a "Moderate Drought". All other months not specifically mentioned were documented has having normal rainfall levels. In 2011during the months of January through March, Catawba County was under a "Moderate Drought" advisory and was classified as "Abnormally Dry" from June through December. Only during the months of April and May was Catawba County at normal rainfall levels.

Prepared by: MULKEY ENGINEERS & CONSULTANTS	**Prepared For:** STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION	**MURRAY'S MILL CONSERVATION AREA** **CATAWBA COUNTY, NC**	This Exhibit is for planning purposes only and information shown hereon does not meet NC 47-30 Requirements and therefore is not for design, construction, or recording or transfer of title. The Exhibit was compiled from available information obtained from the sources listed below. Streams and Wetlands: All features located in the field were recorded using a mapping grade Trimble GeoXT or GeoXH GPS receiver with supposed sub-meter accuracy. Sources: Catawba County Data: Catawba County GIS USGS Topographic Map: ESRI USA Topo Maps	1 inch = 1,000 feet GRAPHIC SCALE 0 500 1,000 2,000 Feet	**FIGURE** **1**

North Carolina Natural Heritage Program Endangered And Rare Plant Field Survey Form
Return to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601.
www.ncnhp.org.

Species: *Hexastylis naniflora* Common name: Dwarf-flowered heartleaf
Survey date: December 5-6, 12-13, 2011 EO Number (if updating existing EO): 184
County: Catawba 7.5' Quad Map: Catawba
Coordinates (if known): Not processed per agreement with Plaintiff/Requester Not processed per agreement with Plaintiff/Requester Elevation: 840-900 AMSL

If coordinates given, indicate coordinate system and datum (State Plane 1927 or 1983, UTM, etc): NAD 83 State Plane NC FIPS 3200, Decimal degree

Site Name (if this is within previously identified site): Murray's Mill Conservation Area
Site location and directions: (attach copy of map with site marked or use back of form to draw a sketch of the site): Map Attached

Number of individuals: 14,488 Define individual (stem, clump, etc.): Individual and rosettes
Size of area in which population occurs: 15.4 acres
Estimate whether the entire population was surveyed, or only a portion: Entire population within the boundaries of Murray's Mill Conservation Area (Tracts 1 and 2). The population of these tracts was enumerated via direct counts using field transects.

Estimated Population Viability (circle one): (Excellent) Good Fair Poor Unknown Failed to find

Population Viability Comments:

Phenology (include % or # in each stage): (vegetative 100%) bud flower

Evidence of reproduction: fruit seedlings (clonal/vegetative)

Reproduction Comments: 2009 counts 13,062; 2011 counts 14,488

Habitat (NC NHP natural community name and description, if known; include quality, soils, geology, etc.): The community type was a Mesic Oak-Hickory Forest and the majority of the soils on the site are mapped as Madison gravelly sandy loam, 10-25 percent slopes, eroded, with Cecil clay loam 10-25 percent slopes, eroded and Congaree complex also present.

Associated species: See attached plant species list.

Invasive species noted & degree of threat from invasive species: The overall threat from invasive species is low on both Tract 1 and 2. The list of invasive species is included in the attached plant species list.

Area of apparently suitable habitat (suitable for, but not necessarily occupied by the species): There are a total of 19.8 ac of suitable habitat within the Murray's Mill Conservation Area. The area adjacent to the northwest bank of Balls Creek has approximately 4.4 acres of suitable habitat, however the species is not present.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way?

There are *H. naniflora* plants within the ROW on the southwest side of the current vehicular bridge (B-2119) over Balls Creek on SR 1003 that were not counted during the 2011 Murray's Mill Conservation inventory.

Topographic position (examples: crest, mid slope, alluvial, etc): The plants were found from within the banks of Balls Creek moving up to mid-slope.

Moisture regime (examples: inundated, dry, seasonally wet, etc): Well drained soils.

Light (examples: open, woodland, closed canopy, etc):
Mature canopy allowed for some filtered light. The understory varied from very open to dense mountain laurel thickets.

Other information: The plants were observed on north, northwest, and northeast facing slopes.

Protection / management needs and opportunities:
The population is protected in perpetuity as part of the Murray's Mill Conservation Area. NCDOT has prepared a draft Conservation Plan for the Murray's Mill Conservation Area which was submitted to the Catawba County Historical Association.

Landowner(s), if known: NCDOT

Person making this report, Address, & Phone: Brian Dustin, Mulkey Biologist 6750 Tryon Rd. Cary, NC 27518
The report was prepared on behalf of NCDOT – Biological Surveys Group (contact info: Dennis Herman 919-707-6127)

Other observers: Wendee Smith, Tom Barrett, Mark Mickley, and Christopher Dustin

Specimens collected (permits are required for federal or state listed species)? Collection #: No species were collected.

Repository:

2010
Hexastylis naniflora (Dwarf-Flowered Heartleaf) Extension of 15th Avenue, S.E. (Former TIP U-2307C, Element Occurrence No. 31) Inventory and Monitoring Report Catawba County, North Carolina

Contact Person:
Matt Haney
Environmental Senior Specialist
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919-707-6122
mmhaney@ncdot.gov

June 3, 2015

Table of Contents

Species: *Hexastylis naniflora* (Dwarf-Flowered Heartleaf)

Site: [Extension of 15th Avenue, S.E., Former TIP No. U-2307C] (Catawba County)

NC NHP EO number(s): Presumed to be 31

NCDOT Point of Contact (POC): Matt Haney, Jared Gray

Signed ROW occurrence? No

Site management plan: None

Site protections: No formal protection throughout all sites that comprise this occurrence. Small portions of sites NW, SW1 and SW2 are found as a roadside population in right-of-way.

Origin of species at this site: Native

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Decreasing. The North Carolina Department of Transportation (NCDOT) inventoried the populations on June 29, 1995 and estimated 10,700 plants. NCDOT inventoried the populations on December 20 and 21, 2011 and counted 1,202 plants. The 1995 enumeration was likely higher due to estimating instead of conducting a direct count.

Species long-term trend at this site (averaged over multiple counts): Decreasing. The NCDOT inventoried the populations on June 29, 1995 and estimated 10,700 plants. NCDOT inventoried the populations on December 20 and 21, 2011 and counted 1,202 plants. The 1995 enumeration was likely higher due to estimating instead of conducting a direct count. This data indicates a sixteen year span of a decreasing population.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

A. **NCDOT project ID**: U-2307C
USFWS log number: 4-2-95-102

On August 3, 1995 the U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (BO) pertaining to projects B-2119, U-2307, and U-2528AA. The BO was issued in response to a request to initiate formal consultation for the referenced projects on July 20, 1995. Per the BO, NCDOT made the following environmental commitments (pgs. 5-6):

- The NCDOT will pursue purchasing land in fee title (or conservation easement) from willing sellers to establish a preserve of approximately 11.9 ha (29.4 acres) in the Murray's Mill area.

Status: On May 1, 1996, the NCDOT purchased 25.07 acres (Tract 1) and an additional 8.61 acres on the adjacent Bowman Tract (Tract 2) on March 13, 2006.

- The preserve will be conveyed to another responsible entity (such as the Catawba County Historical Association of Catawba County) with an accompanying agreement or deed restriction that the existing plant population be protected in perpetuity.
  Status: Currently NCDOT still holds the title to the site but is working toward the transfer of ownership and stewardship responsibilities to the Catawba County Historical Association. The
  NCDOT has developed a conservation plan which outlines the management of the Murray's Mill Site for the perpetual conservation of the *Hexastylis naniflora*.
- The NCDOT and Federal Highway Administration have also agreed that if establishing a preserve in the Murray's Mill area is not feasible, they will pursue establishing a preserve of similar size and quality (with regards to plant population density and size) at another location in North Carolina, as agreed upon by the Service.
  Status: As of March 13, 2006 the NCDOT completed the purchase of the Murray's Mill tracts which met and exceeded the necessary 11.9 hectare (29.4 acres) commitment.
- If the entire 11.9 hectare area, as committed in the Assessment, is not protected through fee title or conservation easement, then Project U-2528AA will be dropped from the Programmatic Section 7 Consultation and will need to be addressed at a separate consultation at a future date.
  Status: As mentioned in the status of the commitment above, the NCDOT purchased more than the requisite 11.9 hectares.
- Some transplanting of *Hexastylis naniflora* individuals to protected sites, or possibly even the collecting of individuals for Center for Plant Conservation-approved of botanical gardens, may be carried out, but will be the sole responsibility of the USFWS. Any transplanting efforts will be conducted with prior coordination with NCDOT.
  Status: To-date, no transplanting or collecting of individual plants has been coordinated.
- The USFWS has agreed that if the above mentioned preserve is established, and Project U-2528AA is dropped (not constructed), the NCDOT may substitute another project involving *Hexastylis naniflora* contingent upon USFWS approval. The USFWS will evaluate such criteria as plant population size, habitat quality, landscape context (e.g. rural. urban), proposed impacts to the plant population, etc. in making a decision on substituting another NCDOT project.
  Status: The option for NCDOT to substitute another project is no longer viable because U-2528AA has been constructed.

B. **NCDOT project ID**: R-2824
USFWS log number: 4-2-09-367

Status of NCDOT commitments (per USFWS Biological Opinion (BO), USFWS letter of concurrence): From pages 31-34 of the Biological Assessment for TIP R-2824 Proposed Upgrade of Lovelady Road (dated May 2009), and Appendix B of the BO for the same project (dated November 13, 2009), NCDOT committed to assist USFWS with the five-year review process by providing information about several populations of DFHL that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure for R-2824.) The population of dwarf-flowered heartleaf (DFHL) associated with U-2307C is included in this group.

Because DFHL is located within the right-of-way of U-2307C, NCDOT will monitor this occurrence, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:
- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using Global Positioning System (GPS)/Geographic Information System (GIS), computing changes to acreages of occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program – Endangered and Rare Plant Field Survey Form that incorporates both types of data.
- Analyze population trends by comparing recent size estimates to data from previous years.

Status: This is the first of three post-construction monitoring reports for this Element Occurrence.

Status of terms and conditions from applicable NC Plant Conservation Program permits:

NC PCP Permit ID number(s): N/A
Description: N/A

Discretionary actions undertaken by NCDOT and partners:

In addition to the environmental commitments made by NCDOT, the Service requested the following conservation recommendations be implemented by NCDOT as part of project plans (p. 7).

1. The agreement (or deed restriction) to protect plants on the preserve in perpetuity will include a provision that any management recommendations made by the service will be implemented if resources are available, and that access into the preserve will be granted for USFWS representatives and representatives from state resources agencies with prior notification to the owner.
2. The deed for the acquired site will identify that this area was purchased for conservation purposes.
3. The USFWS Asheville Field Office will be notified at least one month in advance of the start of construction for all three projects to allow an opportunity to transplant specimens from project impacts area.

NCDOT currently has a draft Conservation Plan for the Murray's Mill Conservation Area. Within this document NCDOT has taken the following conservation measures:

1. Conservation Area Established:
   • NCDOT purchased a 25.07 acre tract (Tract 1) in Catawba County on May 1, 1996 and an 8.61 ac tract (Tract 2) on March 13, 2006. These two tracts are known as the "Murray's Mill Conservation Area".
2. Management to be conducted by the Catawba Co. Historical Association (CCHA):
   • Chinese privet, Japanese honeysuckle, multiflora rose were all found within the Conservation Area.
   • Signs, walking and all-terrain vehicle trails were found within the Conservation Area.
   • Currently, based on the field observations gathered during the 2011 survey, these issues noted above do not present a detrimental effect on the *Hexastylis naniflora* habitat. The exotic, invasive species currently have a low degree of threat within the Conservation Area. No management actions are recommended to be acted upon at this time.
3. Monitoring
   • Several measures found in the current draft Conservation Plan for *Hexastylis naniflora* at Murray's Mill, including monitoring interval and data collection requirements, were subsequently modified in accordance with the conditions of the R-2824 BO. The new monitoring interval requires monitoring every two years for no more than a six year period with surveys being conducted during the USFWS recommended *Hexastylis naniflora* optimal survey window. Following the baseline data collection, monitoring will include both a quantitative and qualitative analysis. A quantitative analysis will include *Hexastylis naniflora* plant enumerations via direct plant counts and/or sample plot estimates, delineating changes to *Hexastylis naniflora* plant boundaries using GPS and GIS technologies, computing changes to acreages of occurrence areas, computing *Hexastylis naniflora* plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas. The BO notes that plant enumeration methodologies employed will remain consistent during the monitoring period (i.e. if direct counts rather than sampled with plot estimates, then the direct count methodology will be employed throughout the remainder of the monitoring period. The qualitative analysis will include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching *Hexastylis naniflora* plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from drought or excessive precipitation, and land clearing and draining activities. As directed by the USFWS BO, the NCDOT will prepare a NC Natural Heritage Program - Endangered and Rare Plant Field Survey Form that incorporates both types of data. Currently at Murray's Mill, field monitoring was completed in 2009 by NCDOT biologists.
4. Reporting:
   • The "2009 *Hexastylis naniflora* Inventory Monitoring Report, Catawba County, North Carolina" was submitted on October 11, 2010.
5. Adaptive Management
   • A draft Conservation Plan was submitted to Catawba County Historical Association for review in 2006. However, since preparation of the draft Conservation Plan, several of the measures provided including the monitoring interval and collection requirements, have been modified following additional Section 7 Consultations and USFWS-approved monitoring report guidelines. It is recommended by the NCDOT that the advisory committee modify the current draft Conservation Plan, as appropriate, for those measures that have changed over time.
6. Modification to land uses at Murray's Mill Conservation Area:

• Generally speaking the land use of the site has not changed. Presently some trails are present throughout the site and appear to be intermittently used by all-terrain vehicles. Some of the trails leading from the historical mill area were installed by Boy Scout troops and are occasionally lined with rock; in a few places there are also interpretive signs along the trail. Additionally, a footbridge has been installed over Balls Creek connecting the trails. Although noticeable alterations to the natural landscape, these features do not appear to be a serious threat to the goals and objectives of the Conservation Plan.

7. Modification to Boundaries of Murray's Mill Conservation Area:
   • The Bowman Tract (Tract 2) was added to the Murray's Mill Conservation Area as of March 13, 2006 in order to contribute to the goals and objectives as stated in the Conservation Plan for Murray's Mill Conservation Area.
8. Term of the plan:
   • The stated term of the Conservation Plan has not changed at this time.

Appendix 1: Monitoring data

Two populations of dwarf-flowered heartleaf (DFHL) were discovered by NCDOT on the U-2307C project on May 4, 1995. These two populations comprised what was known as Element Occurrence (EO) No. 31 at that time. Figures 1 and 2 depict, in purple, the approximate location of this occurrence as it was originally known. The two populations were enumerated by NCDOT on June 29, 1995 through a formal sample plot estimate. Table 1 shows the size, density, total number of DFHL plants and number of DFHL plants anticipated to be adversely affected by the U-2307C project, within this original EO:

Table 1. Dwarf-flowered heartleaf- original EO No. 31 (1995, pre- U-2307C construction)

Population	Size (ac)	Plants/ac	Total number of plants	Anticipated number of plants impacted by U-2307C
U-2307-1	2.2	2104	4500	2300
U-2307-2	3	2064	6200	3100
Total	5.2	2058	10700	5400

On December 20 and 21, 2010, NCDOT biologists Tim Bassette, Jared Gray, Dennis Herman and Neil Medlin delineated and enumerated four populations of DFHL on the U-2307C project. The purpose of this survey was to re-survey the two populations of the original EO No. 31 to determine what remained after U-2307C construction, survey additional suitable DFHL habitat in and around the original study area of U-2307C that may also be a part of EO No. 31, and delineate and enumerate any new populations that are found. Four new populations, depicted in red on Figures 1 and 2, were found during this survey. A direct count method was used by walking transects throughout the populations. On April 27 and 28, 2011, NCDOT biologists Jared Gray, Tim Bassette, Anne Burroughs and Matt Haney verified the identification of DFHL plants that were found in December 2010. Table 2 shows the results of the 2010 survey.

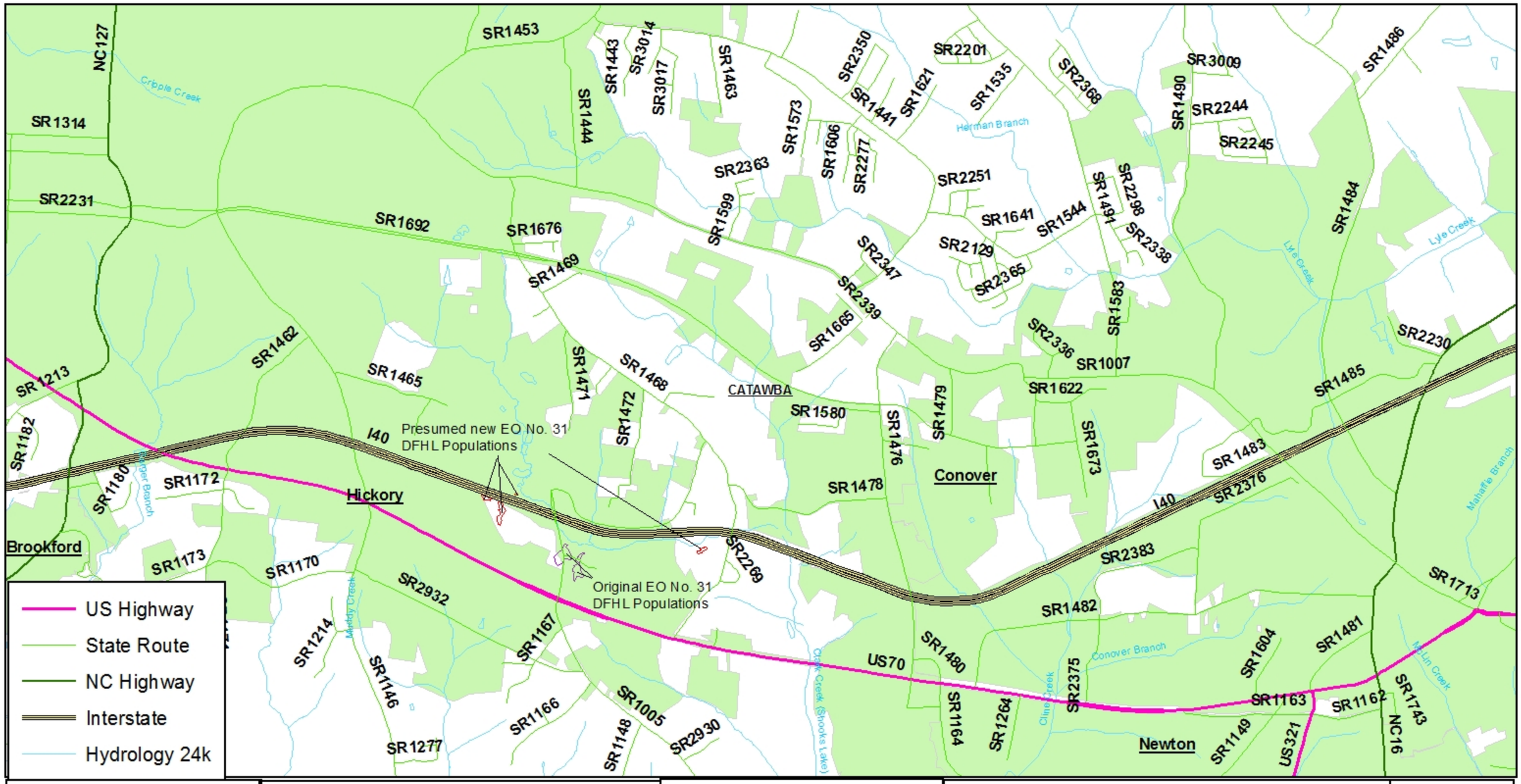
Table 2. Dwarf-flowered heartleaf- presumed new EO No. 31 (2010, post- U-2307C construction)

Population	Number of plants*	Acreage*	Density* (plants/ac)	Number of plants in right-of-way**	Acreage in right-of-way***
15th Avenue	423	0.56	755	0	0
SW1	522	1.54	339	57	0.17
NW	25	0.05	500	6	0.01
SW2	232	0.37	627	98	0.16
Total	1202	2.52	477	161	0.34

* As determined on December 20 and 21, 2010 field visits by NCDOT biologists.
** As determined on December 13, 2011 field visit by NCDOT biologists.
*** These numbers were calculated based on the plant density determined from the 2010 survey and the right-of-way plant enumeration completed in 2011. Also assumed is that the plants of 2010 are equally spaced throughout the population in 2011.

No DFHL plants were found in the U-2307-1 and U-2307-2 populations at the original EO 31 location (see Figure 2). The original EO 31 was adversely affected in its entirety by direct, indirect

and cumulative effects associated with U-2307C. The 15th Avenue, SW1, NW, and SW2 populations were first discovered during the 2010 survey. These four populations are now what is presumed to be the new EO 31. The area in which these three populations occur was not surveyed during the original field investigations conducted for U-2307C in 1995; possibly because the populations were just outside of the project corridor limits.



Prepared by NCDOT Jun 2015

Figure 1: Dwarf-Flowered Heartleaf Element Occurrence (EO) No. 31 (Vicinity Map)

Extension of 15th Avenue, S.E.
Catawba County, NC

Appendix 2

Fig 1

Prepared by NCDOT Jun 2015

Figure 2: Dwarf-Flowered Heartleaf Element Occurrence (EO) No. 31 (Aerial Imagery)

Extension of 15th Avenue, S.E.
Catawba County, NC

0 255 510 1,020 Feet

Appendix 2

Fig 2

Appendix 3

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* **Common name**: Dwarf-flowered heartleaf

Survey date: December 20, 2010

EO Number (if updating existing EO): Presumed to be 31

County: Catawba **7.5' Quad Map**: Hickory

Latitude/Longitude (if known): Not processed per agreement with Plaintiff/Requester **Elevation**: 900-920 feet above mean sea level

If latitude/longitude given, what coordinate system was used (State Plane 1927 or 1983, UTM, etc.): NAD83

Site Name (if this is within previously identified site): 15th Avenue Site.

Site location and directions: Take 40 West to Hickory. Take McDonald Parkway SE exit and turn left (south) on McDonald Parkway SE. Turn left on 15th Avenue. Turn left on 21st St. Go approximately 0.15 mi and the site is on the left (west) in a wooded area.

Number of individuals: Site contained 423 plants.

Define individual (stem, clump, etc.): Single stems to clumps with multiple stems.

Size of area in which population occurs: Area was 0.56 ac.

Estimate whether the entire population was surveyed, or only a portion: Entire population surveyed.

Estimated population viability: __Excellent _X__Good __Fair ___Poor ___Unknown ___Failed to find

Population viability comments: Population habitat is good.

Phenology (include % or # in each stage):
Vegetative: 100%.
Bud: Not applicable.
Flower: Not applicable.

Evidence of reproduction:
Fruit: Not applicable.
Seedlings: Not applicable.
Clonal/vegetative: Unknown because evidence of new plant emergence via rhizome was not field-investigated.

Reproductive comments: The survey was conducted outside of the species' flowering window.

Habitat (NC NHP natural community name and description; include quality, soils, geology, etc.): Mesic Mixed Hardwood Forest: Piedmont subtype (medium quality). Soils mapped as DaA, defined as Dan River loam, 0 to 2 percent slopes, frequently flooded and FdE2, defined as Fairview soils, 10 to 25 percent slopes, moderately eroded.

Associated species: *Kalmia latifolia*, *Fagus grandifolia*, *Cornus florida*, *Quercus rubra*, *Juniperus virginiana*, *Carpinus caroliniana*, *Carya tomentosa*, *Ilex opaca*, *Oxydendrum arboreum*, *Polystichum acrostichoides*, *Asplenium platyneuron*, *Quercus alba*, *Pinus virginiana*, *Tipularia discolor*, *Smilax* sp., *Euonymus americanus*, *Liquidambar styraciflua*, *Liriodendron tulipifera*, *Quercus coccinea*, *Acer rubrum*, *Quercus falcata*, *Nyssa sylvatica*, *Prunus serotina*, *Chimaphila maculata*, *Goodyera pubescens* and *Pinus strobus*.

Invasive species noted & degree of threat from invasive species: Low degree of threat from *Rosa multiflora*, *Ligustrum sinense*, and *Lonicera japonica*.

Area of suitable habitat (suitable for, but not necessarily occupied by the species): Approximately 15 ac. This includes wooded areas adjacent to the 15th Avenue Site.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? This population is not within NCDOT

right-of-way.

Topographic position (examples: crest, mid slope, alluvial, etc): Mid slope.

Moisture regime (examples: inundated, dry, seasonally wet, etc): Dry, well drained.

Light (examples: open, woodland, closed canopy, etc): 75% closed woodland canopy.

Other information: North and northeast facing slopes. Heavy leaf litter was observed on the ground.

Protection / management needs and opportunities: Currently unprotected, but there is an opportunity here to purchase a conservation easement.

Landowner(s), if known: Parcel ID No. 372105199587 owned by Sopps Investments LLC. Parcel ID No. 372106391595 owned by Carpenter Frances Whisnant. Landowner information obtained from Catawba County, NC Interactive Geographic Information System at http://arcgis.webgis net/nc/Catawba/ (accessed September 23, 2014).

Person making this report: Matt Haney
Address: NCDOT, Project Development & Environmental Analysis Unit, 1598 Mail Service Center, Raleigh, NC 27699-1598
Phone: 919-707-6122

Other observers: NCDOT biologists Tim Bassette, Jared Gray, Neil Medlin, and Dennis Herman.

Specimens collected? None. **Collection #**: Not applicable. **Repository**: Not applicable.

Appendix 3

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* **Common name**: Dwarf-flowered heartleaf

Survey date: December 20, 2010

EO Number (if updating existing EO): Presumed to be 31

County: Catawba **7.5' Quad Map**: Hickory

Latitude/Longitude (if known): Not processed per agreement with Plaintiff/Requester **Elevation**: 940-1020 feet above mean sea level

If latitude/longitude given, what coordinate system was used (State Plane 1927 or 1983, UTM, etc.): NAD83

Site Name (if this is within previously identified site): NW and SW1 sites.

Site location and directions: Take 40 West to Hickory. Take McDonald Parkway SE exit and turn left (south) on McDonald Parkway SE. Turn right (west) on US 70. Turn right on 19th St. Turn right on 13th Ave. Take 13th Ave. to the end and the SW1 site will be approximately 600 feet in the wooded area to the southeast.

The NW site is located to the north of I-40, where the on ramp from McDonald Parkway SE merges with I-40. The site is approximately 100 feet north of I-40.

Number of individuals: The SW1 site contained 522 plants. The NW site contained 25 plants.

Define individual (stem, clump, etc.): Single stems to clumps with multiple stems.

Size of area in which population occurs: Area of the SW1 site was 1.54 ac. Area of the NW site was 0.05 ac.

Estimate whether the entire population was surveyed, or only a portion: Entire population surveyed.

Estimated population viability: __Excellent _X__Good __Fair ___Poor ___Unknown ___Failed to find

Population viability comments: Population habitat is good.

Phenology (include % or # in each stage):
Vegetative: 100%.
Bud: Not applicable.
Flower: Not applicable.

Evidence of reproduction:
Fruit: Not applicable.
Seedlings: Not applicable.
Clonal/vegetative: Unknown because evidence of new plant emergence via rhizome was not field-investigated.

Reproductive comments: The survey was conducted outside of the species' flowering window.

Habitat (NC NHP natural community name and description; include quality, soils, geology, etc.): Mesic Mixed Hardwood Forest: Piedmont subtype (medium quality). Soils mapped as FcC, defined as Fairview gravelly fine sandy loam, 6 to 10 percent slopes and FdE2, defined as Fairview soils, 10 to 25 percent slopes, moderately eroded.

Associated species: *Platanus occidentalis, Quercus rubra, Quercus falcata, Quercus coccinea, Liriodendron tulipifera, Liquidambar styraciflua, Acer rubrum, Botrychium virginianum, Tipularia discolor, Asplenium platyneuron, Polystichum acrostichoides, Oxydendrum arboretum, Carya tomentosa, Prunus serotina, Pinus strobus, Pinus virginiana, Smilax* sp., *Cornus florida, Toxicodendron radicans, Nyssa sylvatica, Fagus grandifolia, Rubus* sp., *Quercus alba, Euonymus americanus, Quercus stellata, Vitis rotundifolia, Arundinaria gigantean, Juniperus virginiana, Lycopodium digitatum, Chimaphila maculata* and *Ilex opaca*.

Invasive species noted & degree of threat from invasive species: Moderately low risk from *Lonicera japonica* and *Ligustrum sinense*.

Area of suitable habitat (suitable for, but not necessarily occupied by the species): Approximately 10 ac for the SW1 site. This includes wooded areas adjacent to the SW1 site.
Approximately 20 ac for the NW site. This includes wooded areas adjacent to the NW site.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? A portion of these populations are in NCDOT right-of-way. Suitable habitat exists outside of NCDOT right-of-way.

Topographic position (examples: crest, mid slope, alluvial, etc): Along ephemeral drainage on valley floor, mid slope and crest.

Moisture regime (examples: inundated, dry, seasonally wet, etc): Dry, well-drained near ridge to seasonally wet and well-drained in valley.

Light (examples: open, woodland, closed canopy, etc): 75% closed woodland canopy.

Other information: Plants at SW1 on east and west facing slopes, but the general watershed flow of valley runs south at highest point to north at lowest downstream point. Plants at NW site on a generally northwest facing slope. Heavy leaf litter was observed on the ground.
Protection / management needs and opportunities: Currently unprotected, but there is an opportunity here to purchase a conservation easement.

Landowner(s), if known: Parcel ID No. 371216737099 owned by Martin Marietta Materials Inc. Parcel ID No. 371220705577 owned by Rudisill and Coulter Investment LLC. Landowner information obtained from Catawba County, NC Interactive Geographic Information System at http://arcgis.webgis.net/nc/Catawba/ (accessed September 24, 2014).

Person making this report: Matt Haney
Address: NCDOT, Project Development & Environmental Analysis Unit, 1598 Mail Service Center, Raleigh, NC 27699-1598
Phone: 919-707-6122

Other observers: NCDOT biologists Tim Bassette, Jared Gray, Neil Medlin, and Dennis Herman.

Specimens collected? None. **Collection #**: Not applicable. **Repository**: Not applicable.

Appendix 3

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* **Common name**: Dwarf-flowered heartleaf

Survey date: December 21, 2010

EO Number (if updating existing EO): Presumed to be 31

County: Catawba **7.5' Quad Map**: Hickory

Latitude/Longitude (if known): Not processed per agreement with Plaintiff/Requester **Elevation**: 960-980 feet above mean sea level

If latitude/longitude given, what coordinate system was used (State Plane 1927 or 1983, UTM, etc.): NAD83

Site Name (if this is within previously identified site): SW2 site.

Site location and directions: Take 40 West to Hickory. Take McDonald Parkway SE exit and turn left (south) on McDonald Parkway SE. Turn right (west) on US 70. Turn right on 19th St. Turn right on 13th Ave. Take 13th Ave. to the end and the site will be approximately 350 feet in the wooded area to the northeast.

Number of individuals: Site contained 232 plants.

Define individual (stem, clump, etc.): Single stems to clumps with multiple stems.

Size of area in which population occurs: Area was 0.37 ac.

Estimate whether the entire population was surveyed, or only a portion: Entire population surveyed.

Estimated population viability: __Excellent _X__Good __Fair ___Poor ___Unknown ___Failed to find

Population viability comments: Population habitat is good.

Phenology (include % or # in each stage):
Vegetative: 100%.
Bud: Not applicable.
Flower: Not applicable.

Evidence of reproduction:
Fruit: Not applicable.
Seedlings: Not applicable.
Clonal/vegetative: Unknown because evidence of new plant emergence via rhizome was not field-investigated.

Reproductive comments: The survey was conducted outside of the species' flowering window.

Habitat (NC NHP natural community name and description; include quality, soils, geology, etc.): Mesic Mixed Hardwood Forest: Piedmont subtype (medium quality). Soils mapped as FcC, defined as Fairview gravelly fine sandy loam, 6 to 10 percent slopes and FdE2, defined as Fairview soils, 10 to 25 percent slopes, moderately eroded.

Associated species: *Platanus occidentalis*, *Quercus rubra*, *Quercus falcata*, *Quercus coccinea*, *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Acer rubrum*, *Botrychium virginianum*, *Tipularia discolor*, *Asplenium platyneuron*, *Polystichum acrostichoides*, *Oxydendrum arboretum*, *Carya tomentosa*, *Prunus serotina*, *Pinus strobus*, *Pinus virginiana*, *Smilax* sp., *Cornus florida*, *Toxicodendron radicans*, *Nyssa sylvatica*, *Fagus grandifolia*, *Rubus* sp., *Quercus alba*, *Euonymus americanus*, *Quercus stellata*, *Vitis rotundifolia*, *Arundinaria gigantean*, *Juniperus virginiana*, *Lycopodium digitatum*, *Chimaphila maculata* and *Ilex opaca*.

Invasive species noted & degree of threat from invasive species: Medium threat from *Lonicera japonica*.

Area of suitable habitat (suitable for, but not necessarily occupied by the species): Approximately 10 ac. This includes wooded areas adjacent to the SW2 Site.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? A portion of this population is in NCDOT right-of-way. Suitable habitat exists outside of NCDOT right-of-way.

Topographic position (examples: crest, mid slope, alluvial, etc): Mid slope.

Moisture regime (examples: inundated, dry, seasonally wet, etc): Dry.

Light (examples: open, woodland, closed canopy, etc): 90% closed woodland canopy. A dense understory was observed.

Other information: North to north-northeast facing slope. Heavy leaf litter was observed on the ground. This site is not adjoining an intermittent or perennial stream.

Protection / management needs and opportunities: Currently unprotected, but there is an opportunity here to purchase a conservation easement.

Landowner(s), if known: Parcel ID No. 371219617232 owned by Carmax Auto Superstores Inc. Parcel ID No. 371220705577 owned by Rudisill and Coulter Investment LLC. Landowner information obtained from Catawba County, NC Interactive Geographic Information System at http://arcgis.webgis.net/nc/Catawba/ (accessed September 23, 2014).

Person making this report: Matt Haney
Address: NCDOT, Project Development & Environmental Analysis Unit, 1598 Mail Service Center, Raleigh, NC 27699-1598
Phone: 919-707-6122

Other observers: NCDOT biologists Tim Bassette, Jared Gray, Neil Medlin, and Dennis Herman.

Specimens collected? None. **Collection #**: Not applicable. **Repository**: Not applicable.

Transplant and Monitoring Report
for
Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)
at the
Tate Conservation Easement

Rutherford County, NC

North Carolina Department of Transportation
Raleigh, North Carolina

June 2015

Transplant and Monitoring Report
for
Dwarf-Flowered Heartleaf (*Hexastylis naniflora)*
at the
Tate Conservation Easement

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1.0 INTRODUCTION

The following Transplant and Monitoring Report (TMR) has been prepared as part of the conservation measures established in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)) and as recorded in the Biological Assessment (BA) for R-2233 (US 221 Widening).

The North Carolina Department of Transportation (NCDOT) has established an on-site conservation easement for the federally-protected dwarf-flowered heartleaf (DFHL; *Hexastylis naniflora*). This conservation easement consists of an approximately 8 acre site adjacent to R-2233 right-of-way (ROW) limits (Figure 1). This parcel will be referred to as the "Tate Conservation Easement" (TCE).

Additional project information is available in earlier environmental documentation including: Transplant and Monitoring Report for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement (2013), Transplant and Monitoring Report for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement (2011), Transplant and Monitoring Report for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement (2010), Conservation Management Plan for the Dwarf-Flowered Heartleaf (DFHL; *Hexastylis naniflora*) at the Tate Conservation Easement (2009), the Biological Assessment for the Proposed US 221 Widening and Bypass Around Rutherfordton, Rutherford County, NC (2008), the US Fish and Wildlife Service Biological Opinion (2009), the Final Natural Resources Technical Report – R-2233A (2003), the Final Natural Resources Technical Report – R-2233B (2004), the State Environmental Assessment – R-2233A (2005), and the State Finding of No Significant Impact – R-2233A (2006).

2.0 PHYSICAL AND BIOLOGICAL RESOURCES AT THE TATE CONSERVATION EASEMENT

The TCE lies in the southern outer piedmont physiographic region of North Carolina (Figure 2). Regional topography consists of gently sloping hills to moderately steep ridges and valleys. The property is situated on a north-facing slope with elevations ranging from 800 – 840 feet above sea level. Land use in the project vicinity is characterized as low-density residential, industrial, and agriculture with forested areas present as well.

2.1 Soils

The Rutherford County Soil Survey identifies two soil types within the TCE (Table 1).

Table 1. Soils in the Study Area.

Soil Series	Mapping Unit	Drainage Class
Pacolet-Bethlehem	PbC2	Well drained
Pacolet-Bethlehem	PbD2	Well drained

These are considered mineral soils with a loamy surface layer and clayey subsoil. The slightly acidic pH (4.5 – 6.5) was verified through soil analysis (data available from NCDOT).

2.2 Water Resources

Water resources in the TCE are part of the Broad River basin (U.S. Geological Survey [USGS] Hydrologic Unit 03050105). One stream, an unnamed tributary (UT) to Floyd's Creek, is located on the property. UT to Floyd's Creek (DWQ index # 9-37) is"Class C" water characterized by 3 – 5 foot wide stream with a water depth of 8 – 24 inches. The streambanks show areas of past erosion, with bank heights approaching 15 feet in some areas. The substrate is sand and gravel with moderate flow and high water clarity.

2.3 Biotic Resources

The primary terrestrial communities identified at the TCE are a dry-mesic oak hickory forest and mesic mixed forest that grade into a basic mesic forest. Dominant trees, saplings, and shrubs on the property are black oak (*Quercus velutina*), shortleaf pine (*Pinus echinata*), tulip poplar (*Liriodendron tulipifera*), sourwood (*Oxydendron arboretum*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), Northern red oak (*Quercus rubra*), ironwood (*Carpinus caroliniana*), mockernut hickory (*Carya tomentosa*), and dogwood (*Cornus florida*). The property has been maintained such that the understory is mostly clear of a dense shrub layer, but shrubs present include sweetshrub (*Calycanthus floridus*), farkleberry (*Vaccinium arboretum*), lowbush blueberry (*V. pallidum*), deerberry (*V. stamineum*), pinxter azalea (*Rhododendron periclymenoides*), and strawberry bush (*Euonymus americanus).* The herb layer is generally sparse, and is dominated by various herbs depending on relative soil moisture: downy rattlesnake plaintain (*Goodyera pubescens*), puttyroot (*Aplectrum hyemale*), pussytoes (*Antennaria plantaginifolia*), partridgeberry (*Mitchella repens*), spotted wintergreen (*Chimaphila maculata*), naked-flowered tick trefoil (*Hylodesmum nudiflorum*), Christmas fern (*Polystichum acrostichoides*), giant cane (*Arundinaria gigantea*), sedges (*Carex* spp.), and dwarf-flowered heartleaf (*Hexastylis naniflora*). Vines present are greenbrier (*Smilax rotundifolia*), grape (*Muscadina rotundifolia* var. *rotundifolia*), coral honeysuckle (*Lonicera sempervirens*), and poison ivy (*Toxicodendron radicans*).

2.4 Invasive Species

The presence of invasive plant species found on the property is low, and includes mainly Japanese honeysuckle (*Lonicera japonica*) and Chinese privet (*Ligustrum sinense*). Kudzu (*Pueraria lobata*) was noted for the first time in 2011, at the eastern edge of the parcel, near the base of the slope associated with the railroad tracks. It had not spread much by 2013. In 2015, it had grown dense in the maintained railroad corridor and was beginning to climb adjacent canopy trees.

Honeysuckle and privet are becoming quite dense near Jayne's road, within and adjacent to a small wetland area. Several Chinese privet and Japanese honeysuckle were observed, though none were dominant. Japanese stilt-grass was observed in

several areas, but also was not dominant. One sprig of English ivy (*Hedera helix* var. *helix*) was also noted near Jayne's Road at the northwestern edge of the TCE.

3.0 METHODOLOGY

Coordination with the Advisory Committee on methodology and contingences occurred prior to transplantation. For more information on the Advisory Committee see the Biological Assessment (2008) and Conservation Management Plan (2009). All work was performed under an NC Plant Conservation Program (NCPCP) Protected Plant Conservation Permit and Record (Rescue and Reintroduction Permit #155; Issued: 02 October 2009; Expiration: 30 September 2011).

The transplant effort occurred on 27 Jan 2010 and was performed by eight NCDOT biologists: Lance P. Fontaine, Heather Wallace, Mary Frazer, Dennis Herman, Steve Mitchell, Zachary McNeill, Tim Bassette, and Melissa Miller. Approximately 96 person-hours were expended on the transplant action.

To accomplish the relocation, DFHL within areas of the project right-of-way (ROW) that were anticipated to incur direct effects as per the BA were identified. Crews used hand-shovels to dig and extract each plant and the surrounding soil while keeping the root system intact. Invasive species (mainly Japanese honeysuckle) that were attached to the plants or soil were removed. Plants were placed into buckets and transported to the TCE as soon as was feasible (usually within 1 hour of removal). Throughout the relocation process, attempts were made to keep the plants shaded or covered with leaves and/or burlap cloth.

At the TCE, DFHL from each Natural Heritage Program (NHP) Element Occurrence (EO) were placed into individual circular plots. Plots containing donor DFHL were not mixed across EO's. The exact boundary and distribution of the resident DFHL at the site is patchy (though dense) and fluctuates over time. The resident DFHL boundary (EO #106) was based on 2008 data from NHP. It was observed that the resident DFHL appear to have spread beyond the 2008 boundary. Transplant plots were chosen by locating areas that were near but did not include resident DFHL. Plots were placed "lower on the hill" (at a slightly lower elevation) than resident DFHL to ensure placement within suitable DFHL habitat and within the TCE boundary. Plot locations are shown on Figure 3.

The location of each plot was recorded using GPS, while plot size, origin EO, and total number of plants in each plot were recorded. A metal stake with a metal label identifying the plot number was installed in the center of each circular plot.

Monitoring of the relocated DFHL, as well as resident DFHL, was conducted by NCDOT personnel on 14-15 April 2011 and 16-17 April 2013, and by NCDOT personnel and contract biologists on 22-23 April 2015.

4.0 DFHL STATUS AT THE TATE CONSERVATION EASEMENT

4.1 Relocated DFHL

The average planting density across plots of relocated DFHL was 4 plants/meter with an average plot radius of 3 meters. Twenty-three (23) circular plots were required to accommodate all donor plants. An additional seven (7) plots were established but not utilized. Tables 2 and 3 summarize the data collected for each plot of relocated DFHL. Table 2 provides information on the origin location (site number as listed in the BA) and NHP EO number for each of these, and the total number of plants removed from the original site and relocated to the TCE. Table 3 provides information on the status of the plants in each relocation plot at the TCE, including individual plot counts, densities, and percent survivorship.

Table 2. Summary Data for January 2010 DFHL Relocation Effort

Site Number*	Origin EO+	No. of Plants Relocated to TCE
1	106	93
2	174	35
3	114	14
4	173	0
5 (west of HWY 221)	113	7
5 (east of HWY 221)	175	114
6	76	9
7	172	4
TOTAL RELOCATED = 276		

* - As per the Biological Assessment.
+ - Element Occurrence

Table 3. DFHL Relocation and Monitoring Data

Plot ID	GPS Coordinates+	Origin EO *	No. Plants (2010)	No. Plants (2011)	No. Plants (2013)	No. Plants (2015)	Plot Radius (m)	Density #/m (2010)	Density #/m (2011)	Density #/m (2013)	Density #/m (2015)	% Survivorship (2011)	% Survivorship (2013)	% Survivorship (2015)
1	Not processed per agreement with Plaintiffs	106	27	39	44	59	7	4	6	6	8	144	163	219
2		106	12	12	14	13	3	4	4	5	4	100	117	108
3		106	12	12	8	12	3	4	4	3	4	100	67	100
4		106	12	17	13	16	3	4	6	4	5	142	108	133
5		106	12	13	6	12	3	4	4	2	4	108	50	100
6		106	12	12	5	16	3	4	4	2	5	100	42	133
7		106	6	5	4	2	3	2	2	1	1	83	67	33
8		174	12	10	6	10	3	4	3	2	3	83	50	83
9		174	11	11	5	10	3	4	4	2	3	100	45	91
10		174	12	11	8	10	3	4	4	3	3	92	67	83
11		-	-	-	-	-	-	-	-	-	-	-	-	-
12		175	12	13	6	13	3	4	4	2	4	108	50	108
13		114	14	14	13	21	3	5	5	4	7	100	93	150
14		-	-	-	-	-	-	-	-	-	-	-	-	-
15		172	9	11	4	13	3	3	4	1	4	122	44	144
16		175	12	9	3	13	3	4	3	1	4	75	25	108
17		175	12	9	4	11	3	4	3	1	4	75	33	92

Plot ID	GPS Coordinates+	Origin EO *	No. Plants (2010)	No. Plants (2011)	No. Plants (2013)	No. Plants (2015)	Plot Radius (m)	Density #/m (2010)	Density #/m (2011)	Density #/m (2013)	Density #/m (2015)	% Survivorship (2011)	% Survivorship (2013)	% Survivorship (2015)
18	Not processed per agreement with Plaintiff	175	12	12	3	13	3	4	4	1	4	100	25	108
19	Not processed per agreement with Plaintiff	175	15	11	5	12	3	5	4	2	4	73	33	80
20	Not processed per agreement with Plaintiff	175	12	16	2	19	3	4	5	1	6	133	17	158
21	Not processed per agreement with Plaintiff	175	10	12	10	20	3	3	4	3	7	120	100	200
22	Not processed per agreement with Plaintiff	113	7	5	3	8	3	2	2	1	3	71	43	114
23	Not processed per agreement with Plaintiff	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Not processed per agreement with Plaintiff	76	4	4	3	4	1.5	3	3	2	3	100	75	100
25	Not processed per agreement with Plaintiff	175	15	14	6	9	3	5	5	2	3	93	40	60
26	Not processed per agreement with Plaintiff	175	14	12	6	10	3	5	4	2	3	86	43	71
27	Not processed per agreement with Plaintiff	-	-	-	-		-	-	-	-	-	-	-	-
28	Not processed per agreement with Plaintiff	-	-	-	-		-	-	-	-	-	-	-	-
29	Not processed per agreement with Plaintiff	-	-	-	-		-	-	-	-	-	-	-	-
30	Not processed per agreement with Plaintiff	-	-	-	-		-	-	-	-	-	-	-	-
Summary Info for All Relocated Plants			**276**	**284**	**181**	**326**		**3.86**	**3.97**	**2.53**	**4.17**	**103**	**66**	**118**

+ - Decimal Degrees
* - Element Occurrence
" - " - Empty plot

4.2 Resident DFHL

NHP records for EO 106 indicate that prior surveys of the resident DFHL population at this site were performed in 2003 and 2005. These records qualitatively suggest that the DFHL at this location are a strong, growing, and highly viable population occurring in two sub-occurrences (A = along UT to Floyd's Creek and B = along US 221). Quantitative estimates of population size support this as the number of individuals counted between 2003 and 2005 increased greatly; in 2003, approximately 250 individual clumps were located, whereas in 2005, 649 were counted. Between these survey years it is noted that the plants appeared to be expanding between the two sub-occurrences. In 2005 eight plants were found in sub-occurrence B which was 0.02 acre in size. Also in 2005, 641 plants were counted in sub-occurrence A which covered 3.01 acres. Beginning in 2008, the two suboccurrences had expanded in size to the extent that their boundaries were indiscernable. Therefore, delineation, monitoring, and reporting includes both suboccurrences (represented as one occurrence) from that point forward.

4.3 Post-transplant – Resident and Relocated DFHL

Due to the apparent population expansion at this location and interest in this site as a conservation easement, NCDOT biologists performed a survey of the entire population on 22 April 2008. As of 12 May 2010, the NHP boundary for EO 106 was based on the April 2008 survey. At that time the two sub-occurrences were observed to have "connected" into one larger occurrence. NHP will track resident and transplanted DFHL at the TCE under separate EO numbers; EO 106 will continue to identify the resident DFHL at the TCE and EO 286 was created to track transplanted DFHL at the TCE. Tables 4 and 5 summarize NCDOT and NHP surveys at EO's 106 and 286.

Table 4. DFHL Population Data from Tate Conservation Easement (EO 106: Resident Plants)

Survey year	No. Plants	Area (Ac)	Density (#/ac)	Comments
2003	250	3.01	83	From NHP records: …in leaf and flower, seedlings and clonal / vegetative reproduction evident; flowers mostly disintegrated.
2005	649	3.01	212	From NHP records: …vegetative reproduction evident.
2008	2,326	4.34	536	High quality; few invasives
2011	3,088	4.45	693	Slight expansion in population boundary
2013	1,675	3.98	421	Slight reduction in population boundary; decrease in density
2015	4,547	4.70	1,016	High quality, few invasives, vegetative reproduction evident, boundary fluctuations included areas of expansion and reduction

Table 5. DFHL Population Data from Tate Conservation Easement (EO 286: Relocated Plants)

Survey year*	No. Plants	Area (m^2)	Density (#/m^2)	Comments
2010	276	755	0.37	At time of transplant, winter 2010
2011	284	755	0.38	Initial post-transplant survey in spring 2011; most plants in flower and/or producing new leaves
2013	181	755	0.24	Few plants in flower or producing new leaves.
2015	326	755	0.43	Numerous solitary-leaf (presumably year 1) plants observed, persistent clumps healthy.

* - Transplant occurred January 2010; Survey schedule is: one year post-transplant, then every two years through 2015.

As per the BA, BO, and Conservation Management Plan (CMP), NCDOT has performed additional surveys to monitor both resident (EO 106) and transplanted (EO 286) DFHL at the TCE. An initial post-transplant survey was conducted in the spring of 2011 in order to evaluate survivorship of transplanted individuals and to monitor quantity and status of the resident population. Subsequent surveys were conducted for both EO's at the TCE at two year intervals through 2015 (Tables 4 and 5). The data from these surveys will be disseminated as indicated in the BA, BO, and CMP.

4.4 2015 Monitoring Results Discussion

The total number of DFHL plants, area occupied, and overall density have all increased since the 2013 monitoring event. Plants appeared healthy and vigorous with approximately 45 percent bearing flowers. New growth was apparent on established individuals and a number of erect solitary leaves that had not yet unfurled were observed. Interestingly, the population seems to be expanding on the northeast side of UT Floyd's Creek, as more plants were found there in 2015 than in previous monitoring years. NCNHP Endangered and Rare Plant Field Survey Forms are provided for both EOs in Appendix A.

The western edge and northwestern extent of the TCE contained several invasive species, although none seemed to be threatening DFHL populations. At the northwestern edge of the TCE along SR 2287, some degradation of habitat was noted. This appeared to be associated with culvert replacement and storm flow scour. In addition, minor erosion was visible along the ephemeral channel in the valley that extends southwest-northeast from US 221 toward UT Floyd's Creek (where suboccurrence B was located). This erosion appears to be the result of increased stormwater flow associated with the widening of US 221.

Minor solid waste was observed north of and adjacent to the northwestern extent of the TCE. Debris appeared to be associated with an abandoned home in this area, and

included tires, trash, empty drums, playground equipment, and assorted metal debris. No trails, eroding slopes, or other evidence of human traffic was noted. Some stream bank erosion was observed at meander bends, including several severe areas, though no sedimentation or degradation of the stream bed was found.

4.5 Overall Observations and Discussion

It is unclear why the population appears to have fluctuated so significantly. Also unclear is why this naturally occurring population expanded so rapidly since 2003. A number of freshly emerged single-leaf plants were tallied as part of the 2015 inventory, one week later in the growing season than previous efforts. Had this inventory occurred one week sooner it is possible these individuals would not have been visible. However, this does not account for differences noted between 2011 and 2013.

As part of this effort, climatological data obtained from the North Carolina State Climate Office (NCSCO) was reviewed. The closest monitoring station is in Spindale, NC, but was installed in 2014 and had insufficient data. The next closest station, the Rutherford County Airport located 13 miles north-northwest, was used instead. An exception to this dataset is the period spanning October 2011 through May 2012, during which no data was collected. This range was supplemented with NCSCO data collected at their Bearwallow Mountain monitoring station, 35 miles west.

Monthly precipitation totals and average monthly temperatures were reviewed for the period between January 2007 and January 2015. Monthly Palmer Drought Severity Index (PDSI) data were also used, though only available through January 2014 (NCSCO, 2015).

These data were compared against biyearly DFHL counts to identify climate trends corresponding with observed changes in population. With the exception of several outliers (e.g. July 2013's over 13 inches of rainfall) precipitation patterns were fairly constant over the period of record. No connection between population variability and precipitation was noted. Drought measurements, outside the severe 2007-2009 regional drought, closely mirrored precipitation. Neither dataset appears to correlate with measured DFHL population performance. Temperature trends over this time period correlate somewhat with population fluctuations. The highest population counts were preceded by the coolest winters. Likewise, the lowest counts occurred after the warmest winters.

These temperature observations may provide an explanation for the variation in biyearly monitoring events. As documented in Adams et al. (2003), the authors studied the effects of cold treatments on the seeds of *Hexastylis heterophylla*. They found that radicle (root) dormancy from spring seeds was broken after a warm spell, but a post-radicle emergence cold treatment was necessary to break epicotyl (shoot) dormancy. In their study, seeds were subjected to 12 weeks of 5^{o} C (41^{o} F) constant temperature.

A warm winter may preclude dormancy in this species. The 2013 inventory was preceded by a mild winter where the lowest average temperature was above 41^{o} F and

persisted only one month. In comparison, there were two months below 39^{o} F prior to the 2015 inventory, and eight weeks below 37^{o}F preceding the 2011 inventory. These data are presented as Figure 4.

These data may explain the lack of new plants in 2013, but they do not account for the drop in previously established individuals. Other possible implications of mild winter temperatures include, but are not limited to: adverse responses from mutualistic pollinators and/or herbivorous predators, changes in size and duration of canopy openings or forest litter accumulation, and possibly others or a combination of two or more of these factors.

The population of DFHL at the TCE is today more vigorous and extensive than any inventory to date. The transplant effort (EO 286), with now 118 percent survivorship, has been a success. The native population (EO 106) is now at over 4,500 individuals (a 1,800 percent improvement over the 2003 inventory). Both EOs are mostly preserved within a permanent conservation easement.

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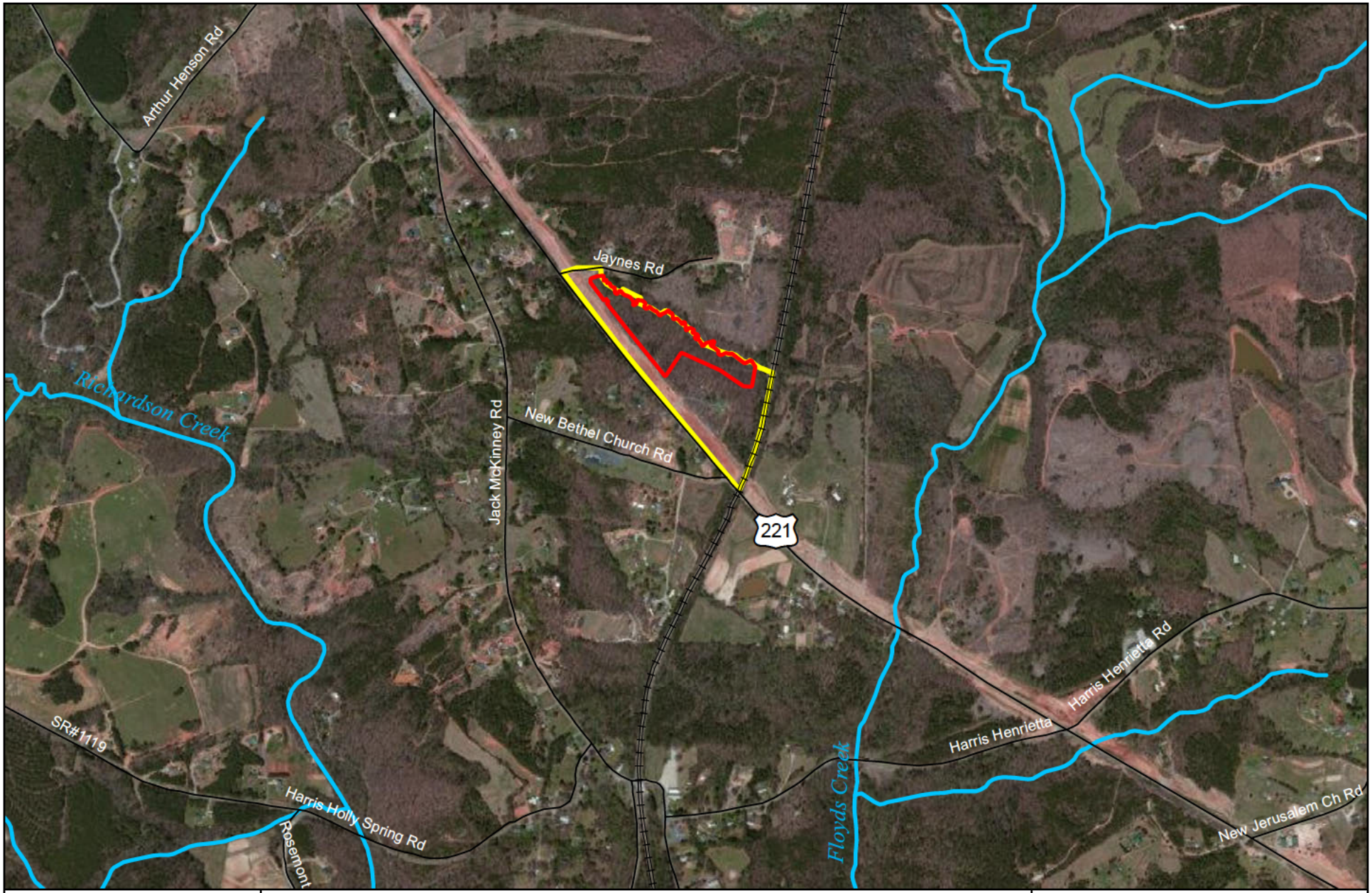

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Figure 1: Project Vicinity Map

Tate Conservation Easement for Dwarf-Flowered Heartleaf

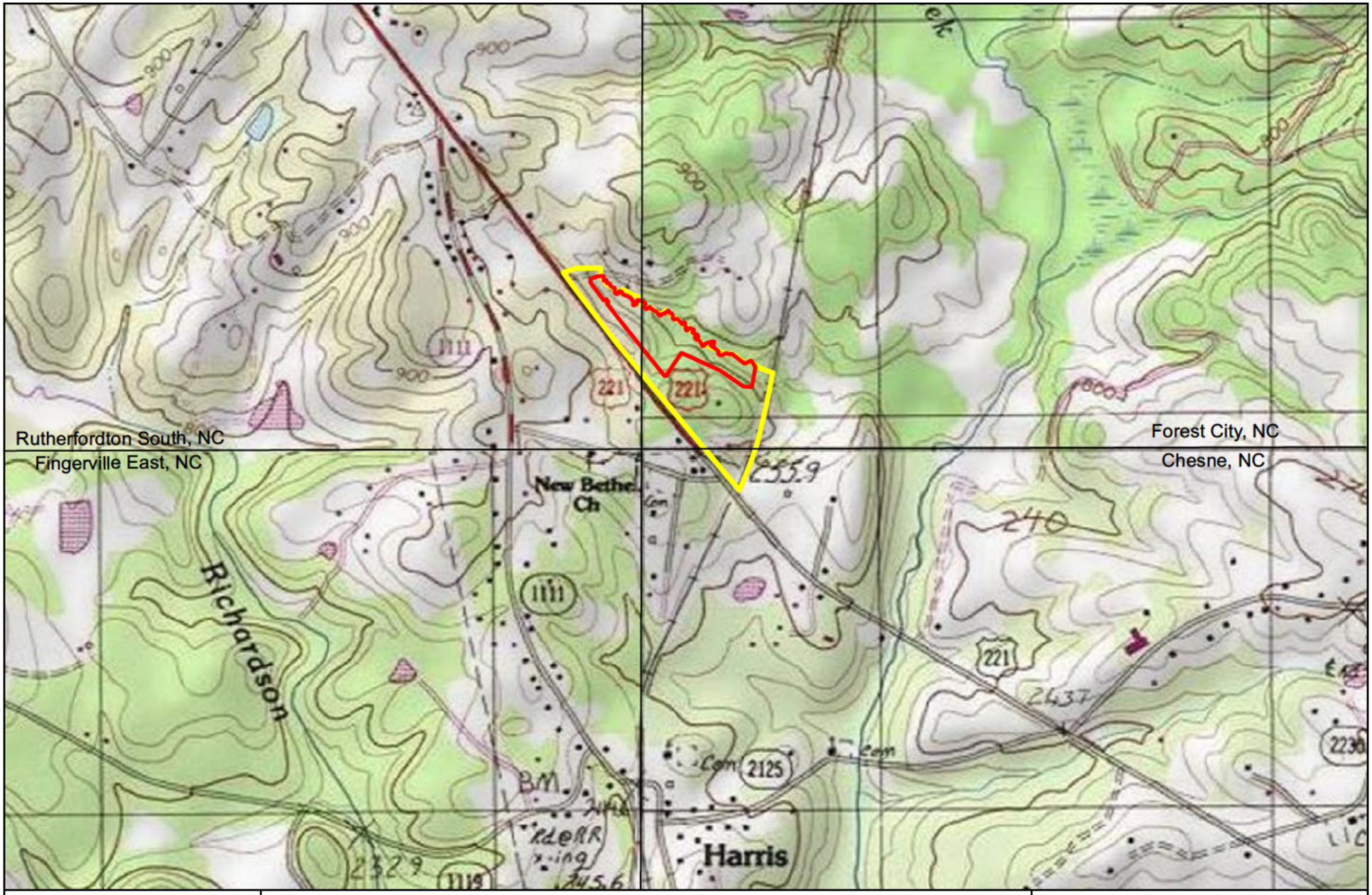

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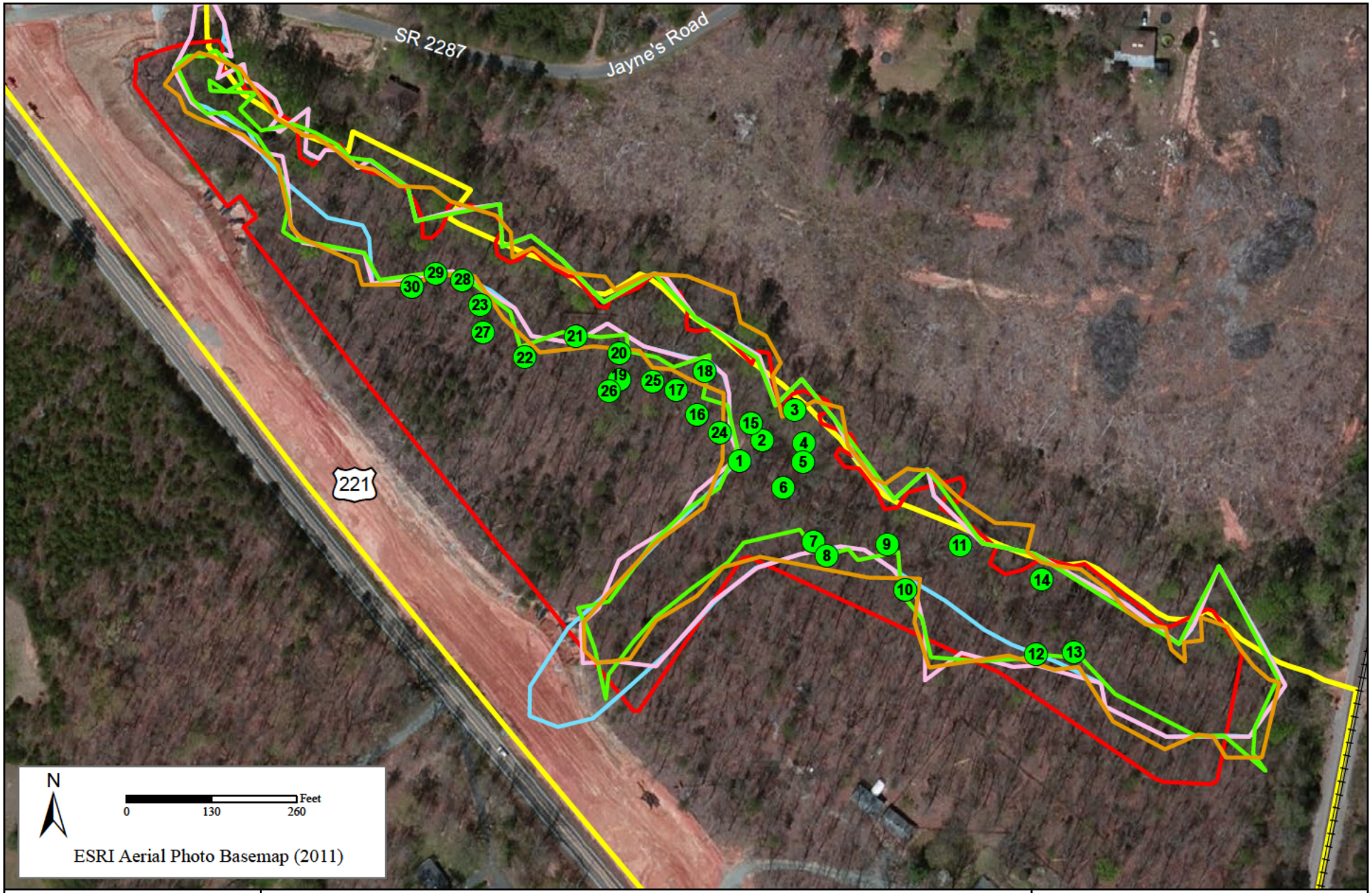
Figure 2: USGS Topographic Map

Tate Conservation Easement for Dwarf-Flowered Heartleaf



North Carolina Department of Transportation

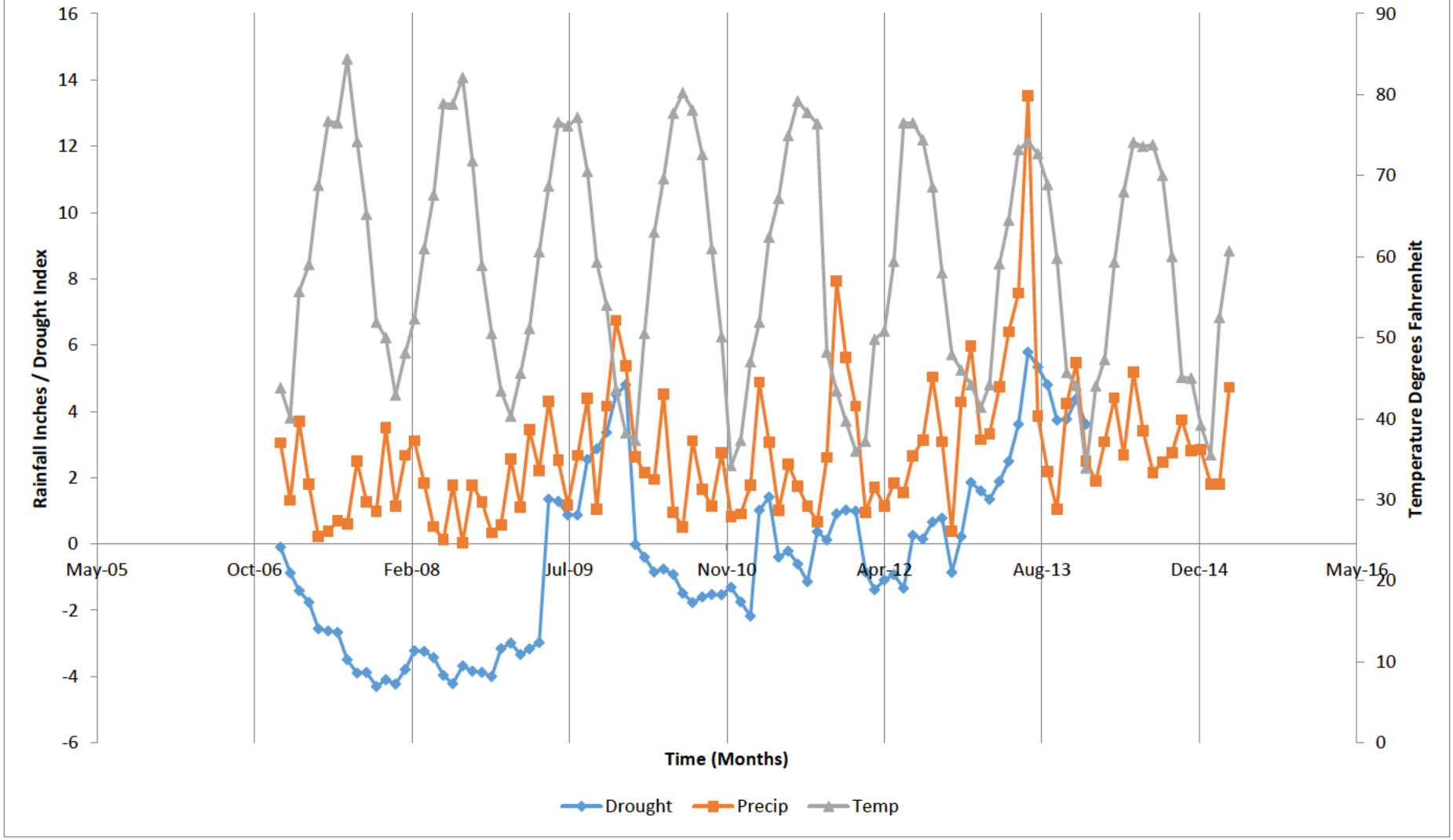
- # DFHL Relocation Plots 2010
- April 2015 DFHL Delineation
- April 2013 DFHL Delineation
- April 2011 DFHL Delineation
- April 2010 DFHL Delineation
- Tate Conservation Easement
- Tate Parcel
- Railroads

Figure 3: DFHL EO Boundaries

Tate Conservation Easement for Dwarf-Flowered Heartleaf

Figure 4. NC State Climate Office Precipitation, Temperature, and Drought: Monthly Averages

Jan. 2007 - Jan. 2015: Rutherford Couny Airport with Bearwallow Mountain (Oct. 2011 - May 2012)



Appendix A

North Carolina Natural Heritage Program Endangered and Rare Plant Field Survey Forms

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* Common name: Dwarf-flowered heartleaf

Survey date: 4/23/15 7.5' Quad Map: Rutherfordton South

County: Rutherford Elevation: 800-840'

Site location and directions: (**attach copy of map with site marked or use back of form to draw a sketch of the site**): **EO 106**

SPECIES INFORMATION

Number of individuals: 4,547 Define individual (**stem, clump, etc.**): clump

Size of area in which population occurs: 4.7 acres

Phenology: vegetative, flower Evidence of reproduction: seedlings, clonal/vegetative

Habitat (**NC NHP natural community name and description; include quality, soils, geology, etc.**): Pacolet soils; Dry-Mesic Oak-Hickory Forest; medium to high quality. The canopy is dominated Quercus alba, Q. stellata, Q. falcata, Q. coccinea, Carya cordiformis, C. tomentosa, Liriodendron tulipifera, Pinus echinata and P. virginica. The understory consists of Acer rubrum, Oxydendrum arboreum, Cornus florida, Ilex opaca, and Amelanchier arboreum. The shrub layer includes Vaccinium arboreum, V. pallidum, V. stamineum, Rhododendron periclymenoides, Calycanthus floridus, and Euonymus americanus. Woody vines included Muscadina rotundifolia var. rotundifolia, Mitchella repens, and Toxicodendron radicans. The herb layer is sparse to moderately dense and includes Hexastylis naniflora, Goodyera pubescens, Aplectrum hyemale, Antennaria plantaginifolia, Chimaphila maculata, Polystichum acrostichoides, and Hylodesmum nudiflorum.

Invasive species noted & degree of threat from invasive species: few Chinese privet (*Ligustrum sinense*), kudzu (*Pueraria montana* var. *lobate*), and multi-flora rose (*Rosa multiflora*) found near railroad tracks. Japanese stilt-grass (*Microstegeum vimineum*), Japanese honeysuckle (*Lonicera japonica*) and Chinese privet found in greater quantities than previous years near Jayne's Road. A single sprig of English Ivy (*Hedera helix* var *helix*) was also noted in this location.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? All plants present within right-of-way were relocated in 2010 so that they are situated within the conservation easement.

Topographic position (examples: crest, mid slope, alluvial, etc): north and northeast-facing slopes. Low, mid, and upper-slopes. Some plants also located within wetland area at western end of population and on south and south-west facing slopes across the creek.

Micro-relief (examples: flat, concave, rippled, etc): flat, concave, convex, drop-off

Moisture regime (examples: inundated, dry, seasonally wet, etc): moist to dry

Light (examples: open, woodland, closed canopy, etc): filtered through woodland canopy

Other information: Plants in this population have been monitored for several years. Plants from multiple other locations that would have been impacted the US 221 widening project were relocated to this property so they would be included in the conservation easement. Those plants are now considered EO 286. See NCDOT's "Transplant and Monitoring Report for Dwarf-flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement" for more information.

Protection / management needs and opportunities: Plants are included in a conservation easement established by NCDOT in 2010.

Landowner(s), if known: Carolyn T. Tate, 4411 US 221 South, Forest City, NC 28043

Person making this report: Heather Wallace Search time:
Address: NCDOT, PDEA, NEU Phone: 919-707-6149
Other observers: Tim Bassette (NCDOT), Phil May, Chris Hopper, and Rob Crowther (Carolina Ecosystems), Moni Bates (Alderman Environmental)

Specimens collected? no Collection #: Repository:
(**permits are required for federal or state listed species**)
Return form to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* Common name: Dwarf-flowered heartleaf

Survey date: 4/22/15 7.5' Quad Map: Rutherfordton South

County: Rutherford Elevation: 800-840'

Site location and directions: (**attach copy of map with site marked or use back of form to draw a sketch of the site**): **EO 286**

SPECIES INFORMATION

Number of individuals: 326 Define individual (**stem, clump, etc.**): clump

Size of area in which population occurs: 755 m^2

Phenology: vegetative, flower Evidence of reproduction: seedlings, clonal/vegetative

Habitat (**NC NHP natural community name and description; include quality, soils, geology, etc.**): Pacolet soils; Dry-Mesic Oak-Hickory Forest; medium to high quality. The canopy is dominated Quercus alba, Q. stellata, Q. falcata, Q. coccinea, Carya cordiformis, C. tomentosa, Liriodendron tulipifera, Pinus echinata and P. virginica. The understory consists of Acer rubrum, Oxydendrum arboreum, Cornus florida, Ilex opaca, and Amelanchier arboreum. The shrub layer includes Vaccinium arboreum, V. pallidum, V. stamineum, Rhododendron periclymenoides, Calycanthus floridus, and Euonymus americanus. Woody vines included Muscadina rotundifolia var. rotundifolia, Mitchella repens, and Toxicodendron radicans. The herb layer is sparse to moderately dense and includes Hexastylis naniflora, Goodyera pubescens, Aplectrum hyemale, Antennaria plantaginifolia, Chimaphila maculata, Polystichum acrostichoides, and Hylodesmum nudiflorum.

Invasive species noted & degree of threat from invasive species: none within transplant plots, but some located nearby EO 106

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? All plants are located within a permanent conservation easement

Topographic position (examples: crest, mid slope, alluvial, etc): north and northeast-facing slopes. Low, mid, and upper-slopes.
Micro-relief (examples: flat, concave, rippled, etc): flat, concave, convex, drop-off

Moisture regime (examples: inundated, dry, seasonally wet, etc): moist to dry

Light (examples: open, woodland, closed canopy, etc): filtered through woodland canopy

Other information: 276 plants from eight different EOs that would have been impacted the US 221 widening project were relocated to this property so they would be included in the conservation easement. 23 circular transplant plots were utilized for this purpose within the conservation easement. Those plants are now considered EO 286. See NCDOT's "Transplant and Monitoring Report for Dwarf-flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement" for more information.

Protection / management needs and opportunities: Plants are included in a conservation easement established by NCDOT in 2010.

Landowner(s), if known: Carolyn T. Tate, 4411 US 221 South, Forest City, NC 28043

Person making this report: Heather Wallace Search time:
Address: NCDOT, PDEA, NEU Phone: 919-707-6149
Other observers: Tim Bassette (NCDOT), Phil May, Chris Hopper, and Rob Crowther (Carolina Ecosystems), Moni Bates (Alderman Environmental)

Specimens collected? no Collection #: Repository:
(**permits are required for federal or state listed species**)
Return form to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601

Transplant and Monitoring Report for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement

Rutherford County, NC

North Carolina Department of Transportation
Raleigh, North Carolina

December 2011

List of Tables

1.0 INTRODUCTION

The following Transplant and Monitoring Report (TMR) has been prepared as part of the conservation measures established in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)) and as recorded in the Biological Assessment (BA) for this project.

The North Carolina Department of Transportation (NCDOT) has established an on-site conservation easement for the federally-protected Dwarf-Flowered Heartleaf (DFHL; *Hexastylis naniflora*). This conservation easement consists of an approximately 8 acre site adjacent to project ROW limits (Figure 1). As the current property owners are Mr. Robert and Mrs. Carolyn Tate, this parcel will be referred to as the "Tate Conservation Easement" (TCE).

Additional project information is available in earlier environmental documentation including: the Transplant and Monitoring Report for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement (2010), Conservation Management Plan for the Dwarf-Flowered Heartleaf (DFHL; *Hexastylis naniflora*) at the Tate Conservation Easement (2009), the Biological Assessment for the Proposed US 221 Widening and Bypass Around Rutherfordton, Rutherford County, NC (2008), the US Fish and Wildlife Service Biological Opinion (2009), the Final Natural Resources Technical Report – R-2233A (2003), the Final Natural Resources Technical Report – R-2233B (2004), the State Environmental Assessment – R-2233A (2005), and the State Finding of No Significant Impact – R-2233A (2006).

2.0 PHYSICAL AND BIOLOGICAL RESOURCES AT THE TATE CONSERVATION EASEMENT

The TCE lies in the southern outer piedmont physiographic region of North Carolina (Figure 2). Regional topography consists of gently sloping hills to moderately steep ridges and valleys. The property is situated on a north-facing slope with elevations ranging from 860 – 800 feet above sea level. Land use in the project vicinity is characterized as low-density residential, industrial, and agriculture with forested areas present as well.

2.1 Soils

The Rutherford County Soil Survey identifies two soil types within the TCE (Table 1).

Table 1. Soils in the study area.

Soil Series	Mapping Unit	Drainage Class
Pacolet-Bethlehem	PbC2	Well drained
Pacolet-Bethlehem	PbD2	Well drained

These are considered mineral soils with a loamy surface layer and a clayey subsoil. The slightly acidic pH (4.5 – 6.5) nature was verified through soil analysis (data available from NCDOT).

2.2 Water Resources

Water resources in the TCE are part of the Broad River basin (U.S. Geological Survey [USGS] Hydrologic Unit 03050105). One stream, an unnamed tributary (Ut) to Floyd's Creek, is located on the property (Table 2). Ut to Floyd's Creek (DWQ index # 9-37) is a "Class C" water and is characterized by 3 – 5 ft. wide with a water depth of 8 – 24 inches. The substrate is sand and gravel with moderate flow and high water clarity.

2.3 Biotic Resources

The primary terrestrial community identified at the TCE is a dry-mesic oak hickory forest and mesic mixed forest that grades into a basic mesic forest. Dominant trees, saplings, and shrubs on the property are black oak (*Quercus velutinaI*), shortleaf pine (*Pinus echinata*), tulip poplar (*Liriodendron tulipifera*), sourwood (*Oxydendron arboretum*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), Northern red oak (*Quercus rubra*), ironwood (*Carpinus caroliniana*), mockernut hickory (*Carya tomentosa*), and dogwood (*Cornus floridaI*). The property has been maintained such that the understory is mostly clear of a dense shrub layer, but shrubs present include sweetshrub (*Calycanthus floridus*), farkleberry (*Vaccinium arboretum*), lowbush blueberry (*V. pallidum*), deerberry (*V. stamineum*), pinxter azalea (*Rhododendron periclymenoides*), and strawberry bush (*Euonymus americanus).* The herb layer is generally sparse, and is dominated by various herbs depending on relative soil moisture: downy rattlesnake plaintain (*Goodyera pubescens*), puttyroot (*Aplectrum hyemale*), pussytoes (*Antennaria plantaginifolia*), partridgeberry (*Mitchella repens*), spotted wintergreen (*Chimaphila maculata*), downy rattlesnake plantain (*Goodyera pubescens*), naked-flowered tick trefoil (*Desmodium nudiflorum*), Christmas fern (*Polystichum acrostichoides*), giant cane (Arundinaria gigantea), sedges (*Carex* spp.), and dwarf-flowered heartleaf (*Hexastylis naniflora*). Vines present are greenbrier (*Smilax rotundifolia*), grape (*Vitis rotundifolia*), coral honeysuckle (*Lonicera sempervirens*), and poison ivy (*Toxicodendron radicans*). Few invasive plant species are found on the property including Japanese honeysuckle (*Lonicera japonica*) and Chinese privet (*Ligustrum sinense*).

3.0 METHODOLOGY

Coordination with the Advisory Committee on methodology and contingences occurred prior to transplantation. For more information on the Advisory Committee see the Biological Assessment (2008) and Conservation Management Plan (2009). All work was performed under an NC Plant Conservation Program (NCPCP) Protected Plant Conservation Permit and Record (Rescue and Reintroduction Permit #155; Issued: 02 October 2009; Expiration: 30 September 2011).

The transplant effort occurred on 27 Jan 2010 and was performed by eight NCDOT biologists. Lance P. Fontaine, Heather Renninger, Mary Frazer, Dennis Herman, Steve Mitchell, Zachary McNeill, Tim Bassette, and Melissa Miller. Approximately 96 person-hours were expended on the transplant action.

To accomplish the relocation, DFHL within areas of the project right-of-way (ROW) that were anticipated to incur direct effects as per the BA were identified. Crews used hand-shovels to dig and extract each plant and the surrounding soil while keeping the root system intact. Invasive species' (mainly Japanese honeysuckle) that may have been attached to the plants or soil were removed. Plants were placed into buckets and transported to the TCE as soon as was feasible (usually within 1 hour of removal). Throughout the relocation process, attempts were made to keep the plants shaded or covered with leaves and/or burlap cloth.

At the TCE, DFHL from each Natural Heritage Program (NHP) Element Occurrence (EO) were placed into individual circular plots. Plots containing donor DFHL were not mixed across EO's. The exact boundary and distribution of the resident DFHL at the site is patchy (though dense) and fluctuates over time. The resident DFHL boundary (EO #106) was based on 2008 data from NHP. It was observed that the resident DFHL appear to have spread beyond the 2008 boundary. Transplant plots were chosen by locating areas that were near but did not include resident DFHL. Plots were placed "lower on the hill" (at a slightly lower elevation) than resident DFHL to ensure placement within suitable DFHL habitat and within the TCE boundary.

The location of each plot was recorded using GPS, while plot size, origin EO, and total number of plants in each plot was recorded. A metal stake with a metal label identifying the plot number was installed in the center of each circular plot.

4.0 BASELINE DFHL STATUS AT THE TATE CONSERVATION EASEMENT

4.1 Relocated DFHL

The average planting density across plots of relocated DFHL was 4 plants/meter with an average plot size of 3 meters. Twenty-three (23) circular plots were required to accommodate all donor plants. An additional seven (7) plots were established but not utilized. Tables 2 and 3 summarize the data collected for each plot of relocated DFHL. Table 2 provides information on the origin location (site number as listed in the BA) and NHP EO number for each of these, and the total number of plants removed from the original site and relocated to the TCE. Table 3 provides information on the status of the plants in each relocation plot at the TCE.

Table 2. Summary data for January 2010 Dwarf-flowered Heartleaf relocation effort.

Site Number*	Origin EO+	No. of Plants Relocated to TCE
1	106	93
2	174	35
3	114	14
4	173	0
5 (west of HWY 221)	113	7
5 (east of HWY 221)	175	114
6	76	9
7	172	4
		TOTAL RELOCATED = 276

* - As per the Biological Assessment.
+ - Element Occurrence

Table 3. Dwarf-flowered Heartleaf relocation data.

Plot ID	GPS Coordinates+	Origin EO *	No. Plants (2010)	No. Plants (2011)	Plot Size (m)	Density (2010)	Density (2011)	% Survivorship
1	Not processed per agreement with Plaintiff/Requester	106	27	39	7	4	6	144
2	Not processed per agreement with Plaintiff/Requester	106	12	12	3	4	4	100
3	Not processed per agreement with Plaintiff/Requester	106	12	12	3	4	4	100
4	Not processed per agreement with Plaintiff/Requester	106	12	17	3	4	6	142
5	Not processed per agreement with Plaintiff/Requester	106	12	13	3	4	4	108
6	Not processed per agreement with Plaintiff/Requester	106	12	12	3	4	4	100
7	Not processed per agreement with Plaintiff/Requester	106	6	5	3	2	2	83
8	Not processed per agreement with Plaintiff/Requester	174	12	10	3	4	3	83
9	Not processed per agreement with Plaintiff/Requester	174	11	11	3	4	4	100
10	Not processed per agreement with Plaintiff/Requester	174	12	11	3	4	4	92
11	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-
12	Not processed per agreement with Plaintiff/Requester	175	12	13	3	4	4	108
13	Not processed per agreement with Plaintiff/Requester	114	14	14	3	5	5	100
14	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-
15	Not processed per agreement with Plaintiff/Requester	172	9	11	3	3	4	122
16	Not processed per agreement with Plaintiff/Requester	175	12	9	3	4	3	75
17	Not processed per agreement with Plaintiff/Requester	175	12	9	3	4	3	75
18	Not processed per agreement with Plaintiff/Requester	175	12	12	3	4	4	100
19	Not processed per agreement with Plaintiff/Requester	175	15	11	3	5	4	73
20	Not processed per agreement with Plaintiff/Requester	175	12	16	3	4	5	133
21	Not processed per agreement with Plaintiff/Requester	175	10	12	3	3	4	120
22	Not processed per agreement with Plaintiff/Requester	113	7	5	3	2	2	71
23	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-
24	Not processed per agreement with Plaintiff/Requester	76	4	4	1.5	3	3	100
25	Not processed per agreement with Plaintiff/Requester	175	15	14	3	5	5	93
26	Not processed per agreement with Plaintiff/Requester	175	14	12	3	5	4	86
27	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-
28	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-
29	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-
30	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-
Total			276	284		89	89	103

+ - Decimal Degrees
* - Element Occurrence
" - " - Empty plot

4.2 Resident DFHL

NHP records for EO 106 indicate that prior surveys of the resident DFHL population this site were performed in 2003 and 2005. These records qualitatively suggest that the DFHL at this location are a strong, growing, and highly viable population occurring in two sub-occurrences (A = along US 221 and B = along Ut to Floyd's Creek). Quantitative estimates of population size support this as the number of individuals counted between 2003 and 2005 increases greatly; in 2003, approximately 250 individual clumps were located, whereas in 2005, 641 were counted. Between these survey years it is noted that the plants appeared to be expanding between the two sub-occurrences. In 2005 eight plants were found in sub-occurrence B which was 0.02 acres in size. Also in 2005, 657 plants were counted in sub-occurrence A which covered 3.01 acres.

4.3 Post-transplant – Resident and Relocated DFHL

Due to the apparent population expansion at this location and growing interest in utilizing this site as a conservation easement, NCDOT biologists performed a survey of the entire population on 22 April 2008. As of 12 May 2010, the NCNHP boundary for EO 106 is based on the April 2008 survey. At this time the two sub-occurrences were observed to have "connected" into one larger occurrence. NHP will track resident and transplanted DFHL at the TCE under separate EO numbers; EO 106 will continue to identify the resident DFHL at the TCE and EO 286 was created to track transplanted DFHL at the TCE. Tables 4 and 5 summarize available data from NCDOT and NHP surveys at EO's 106 and 286.

Table 4. Dwarf-flowered heartleaf population data from Tate Conservation Easement (EO 106)

Survey year	No. Plants	Area (Ac)	Density (#/ac)	Comments
2003	250	3.01	83	From NHP records: …in leaf and flower, seedlings and clonal / vegetative reproduction evident; flowers mostly disintegrated.
2005	641	3.01	212	From NHP records: …vegetative reproduction evident.
2008	2326	4.34	536	High quality; few invasives
2011	3088	4.45	693	Slight expansion in population boundary
2013	-	-	-	
2015	-	-	-	
2017	-	-	-	

Table 5. Dwarf-flowered heartleaf population data from Tate Conservation Easement (EO 286)

Survey year*	No. Plants	Area (m^2)	Density (#/m^2)	Comments
2010	276	755	4	At time of transplant, winter 2010
2011	284	755	4	Initial post-transplant survey in spring 2011; most plants in flower and/or producing new leaves
2013	-	-	-	
2015	-	-	-	
2017	-	-	-	

* - Transplant occurred January 2010; Survey schedule is: one year post-transplant, then every two years thereafter for a period of six years.

As per the BA, BO, and Conservation Management Plan (CMP), NCDOT has committed to conducting additional surveys to monitor both resident (EO 106) and transplanted (EO 286) DFHL at the TCE. An initial post-transplant survey was conducted in the spring of 2011 in order to evaluate survivorship of transplanted individuals and to monitor quantity and status of the resident population. Subsequent surveys will be conducted for both EO's at the TCE at two year intervals for a period of six years (Table 4 and 5). The data from these surveys will be disseminated as indicated in the BA, BO, and CMP.

4.4 2011 Monitoring Results

The general trend for EO 106 has been an increase in number of plants and overall size of population each year since 2003. During the 2011 monitoring period, plants looked healthy and most were in flower. A slight increase in the population boundary was noted in two locations. Density of these plants increased between 2008 and 2011.

Transplant (EO 286) efforts appear to have been very successful, with survivorship from 2010 to 2011 of greater than 100 percent. Individual plots that showed greater than 100 percent survivorship were typically located within the population boundary of EO 106. It is assumed that native plants have either expanded into the transplant plots since January 2010 or did not have leaves at the time of the establishment of the transplant plots. The lowest survivorship in any individual plot was 71 percent, or a loss of two plants. Overall density of the transplant plots remained the same at 4 plants per square meter. Transplants looked healthy and vigorous. Most plants were producing new leaves and flowers.

All DFHL at TCE will be monitored again in 2013 using the same methodology used in 2011.

5.0 References

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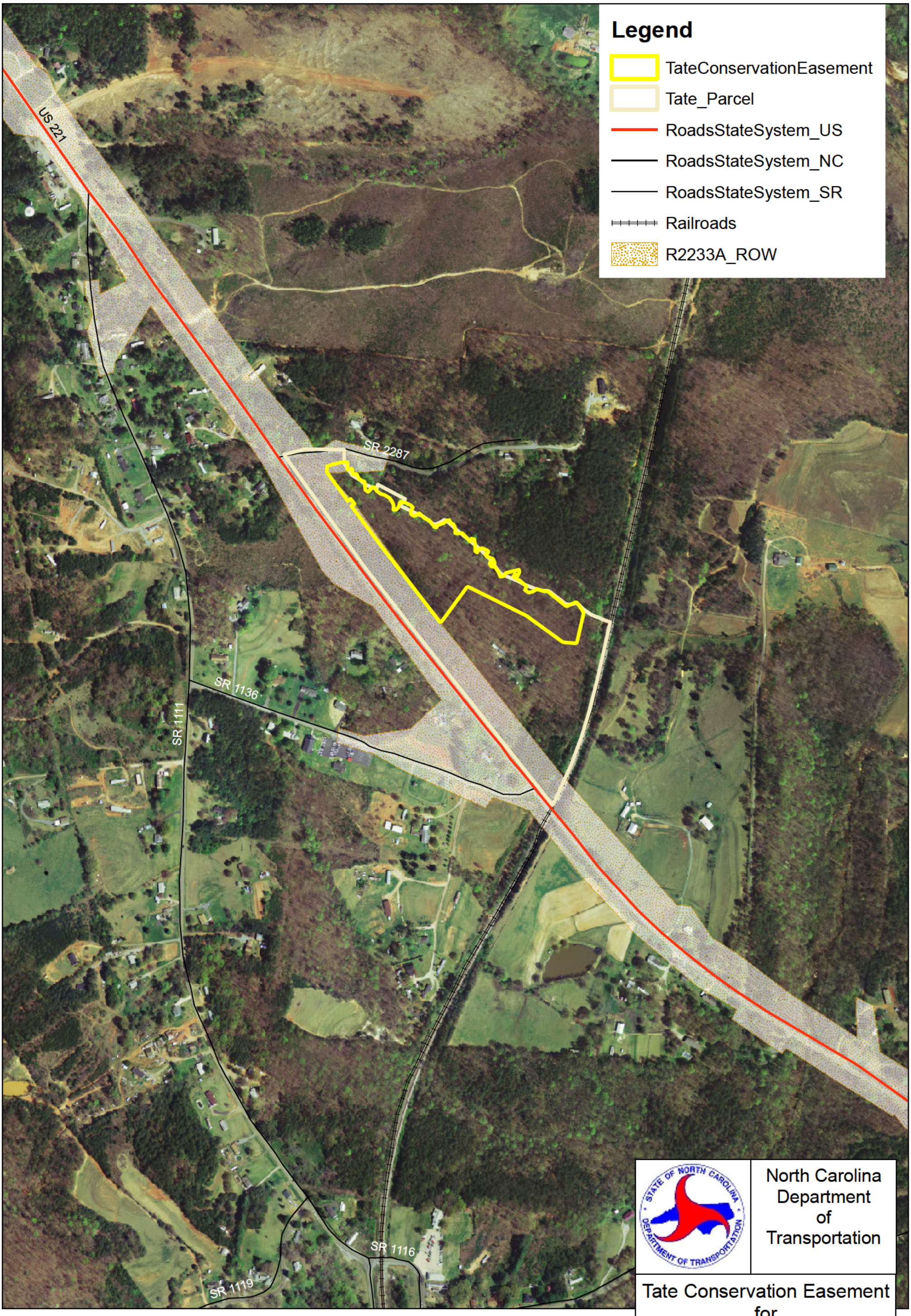

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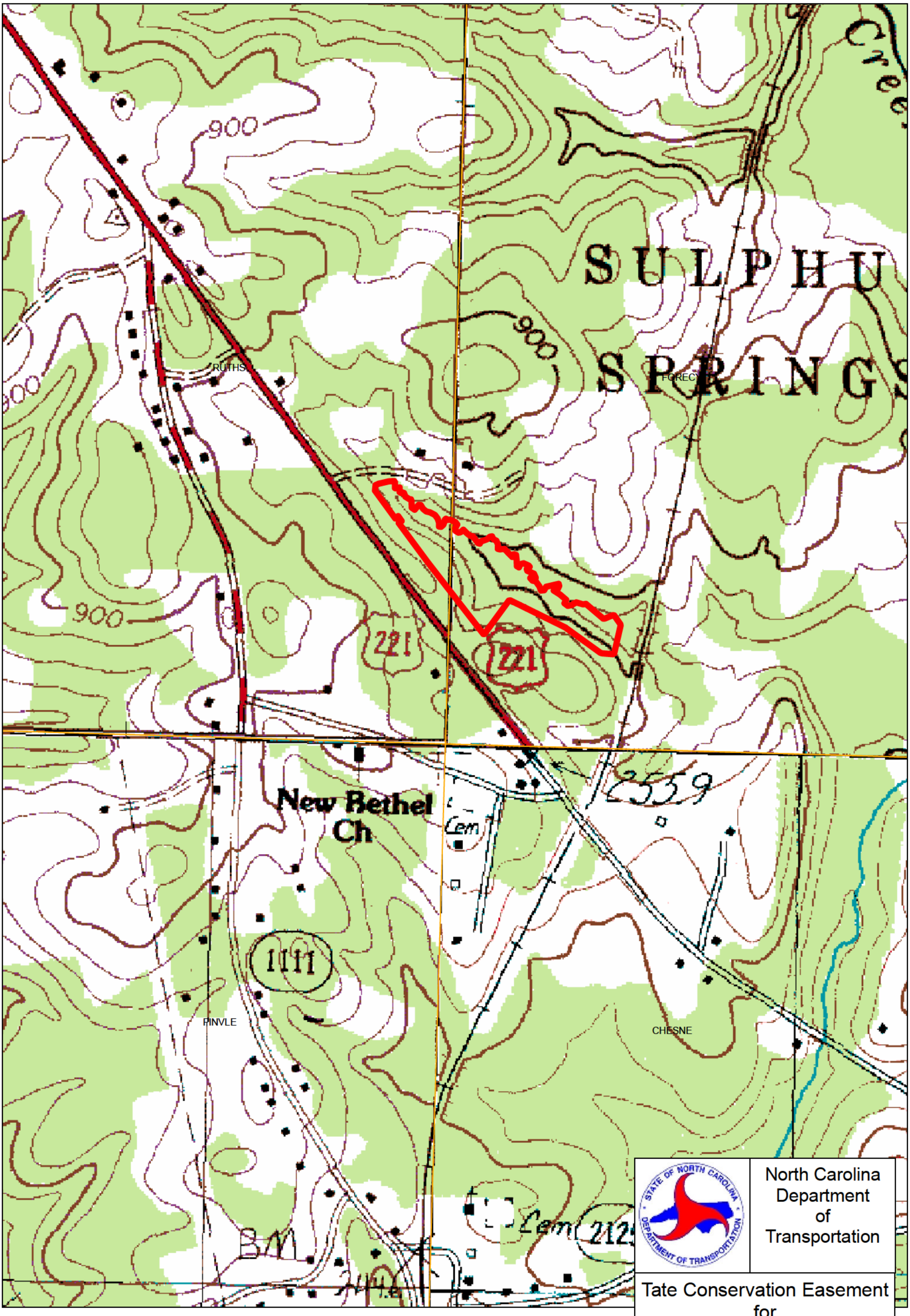
0 450 900 1,800 Feet

North Carolina Department of Transportation

Tate Conservation Easement for Dwarf-flowered Heartleaf

Project Vicinity Map

Figure 1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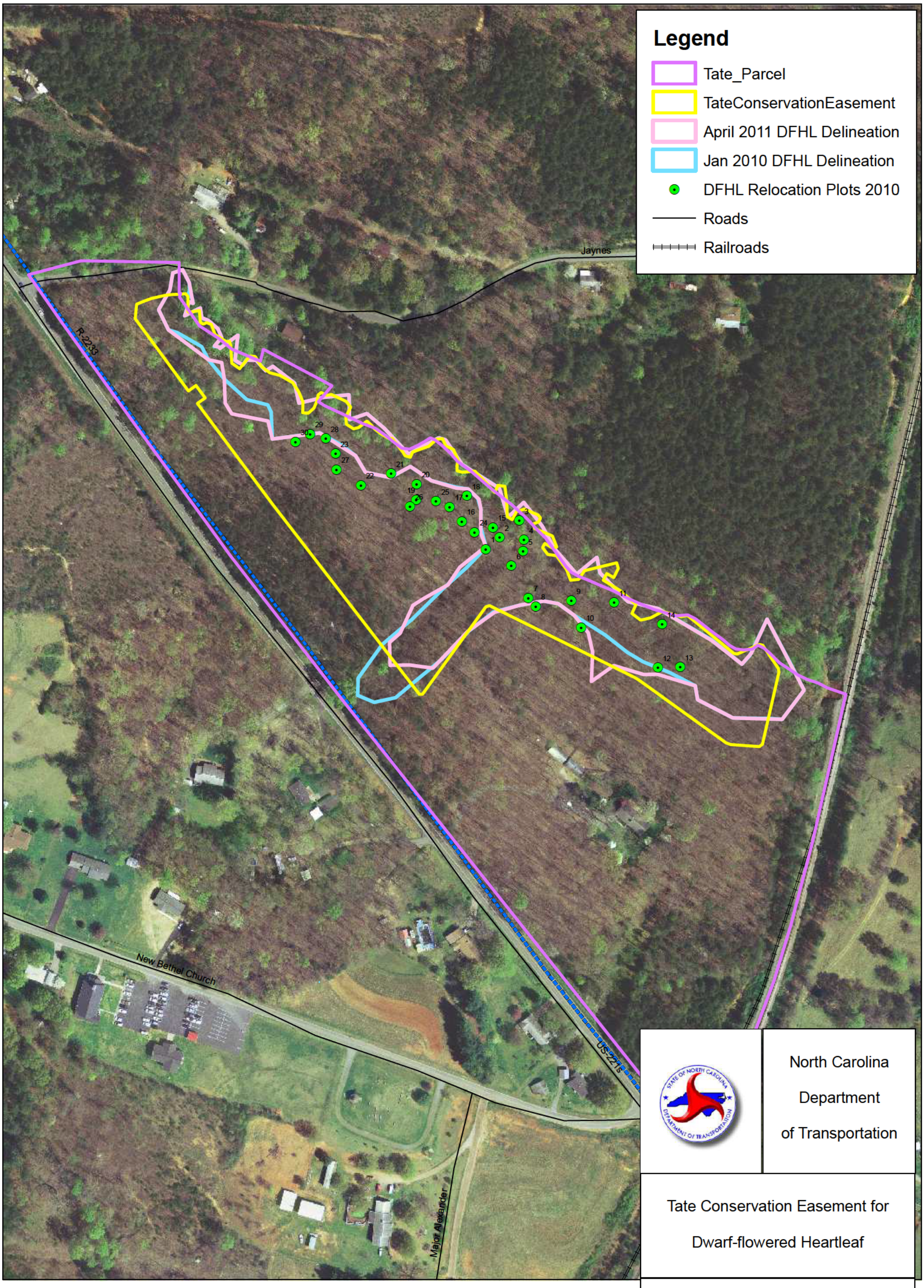
North Carolina
Department
of
Transportation
Tate Conservation Easement
for
Dwarf-flowered Heartleaf
Topographic map

Figure 2



North Carolina Department of Transportation

Tate Conservation Easement for Dwarf-flowered Heartleaf

Tate Conservation Easement Map

Figure 3

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* | Common name: Dwarf-flowered heartleaf

Survey date: 4/15/11 | 7.5' Quad Map: Rutherfordton South

County: Rutherford | Elevation: 810-840'

Site location and directions: (**attach copy of map with site marked or use back of form to draw a sketch of the site**): **EO 106**

SPECIES INFORMATION

Number of individuals: 3,088 | Define individual (**stem, clump, etc.**): clump

Size of area in which population occurs: 4.45 acres

Phenology: vegetative, flower | Evidence of reproduction: seedlings, clonal/vegetative

Habitat (**NC NHP natural community name and description; include quality, soils, geology, etc.**): Pacolet soils; Dry-Mesic Oak-Hickory Forest; medium to high quality. The canopy is dominated Quercus alba, Q. stellata, Q. falcata, Q. coccinea, Carya cordiformis, C. alba, Liriodendron tulipifera, Pinus echinata and P. virginica. The understory consists of Acer rubrum, Oxydendrum arboreum, Cornus florida, Ilex opaca, and Amelanchier arboreum. The shrub layer includes Vaccinium arboreum, V. pallidum, V. stamineum, Rhododendron periclymenoides, Calycanthus floridus, and Euonymus americanus. Woody vines included Vitis rotundifolia, and Toxicodendron radicans. The herb layer is sparse to moderately dense and includes Hexastylis naniflora, Goodyera pubescens, Aplectrum hyemale, Antennaria plantaginifolia, Mitchella repens, Chimaphila maculata, Goodyera pubescens, Polystichum acrostichoides, and Desmodium nudiflorum.

Invasive species noted & degree of threat from invasive species: few Chinese privet (*Ligustrum sinense*), and one kudzu (*Pueraria montana* var. *lobata*) found near railroad tracks. Japanese honeysuckle (*Lonicera japonica*) found in moderate quantities near Jayne's Road.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? All plants located within right-of-way were relocated in 2010 so that they are situated within the conservation easement.

Topographic position (examples: crest, mid slope, alluvial, etc): north and northeast-facing slopes. Low, mid, and upper-slopes. Some plants also located within wetland area at western end of population.

Micro-relief (examples: flat, concave, rippled, etc): flat, concave, convex, drop-off

Moisture regime (examples: inundated, dry, seasonally wet, etc): moist to dry

Light (examples: open, woodland, closed canopy, etc): filtered through woodland canopy

Other information: Plants in this population have been monitored for several years. The acreage and number of plants in this population has increased each time. Plants from multiple other locations that would have been impacted the US 221 widening project were relocated to this property so they would be included in the conservation easement. Those plants are now considered EO 286. See NCDOT's "Transplant and Monitoring Report for Dwarf-flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement" for more information.

Protection / management needs and opportunities: Plants are included in a conservation easement established by NCDOT in 2010.

Landowner(s), if known: Robert Tate, 4411 US 221 South, Forest City, NC 28043

Person making this report: Heather Wallace Renninger | Search time:
Address: NCDOT, PDEA, NEU | Phone: 919-707-6149
Other observers: Neil Medlin, Tim Bassette, Matt Haney (all NCDOT)

Specimens collected? no | Collection #: | Repository:
(**permits are required for federal or state listed species**)
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Habitat (**NC NHP natural community name and description; include quality, soils, geology, etc.**): Pacolet soils; Dry-Mesic Oak-Hickory Forest; medium to high quality. The canopy is dominated Quercus alba, Q. stellata, Q. falcata, Q. coccinea, Carya cordiformis, C. alba, Liriodendron tulipifera, Pinus echinata and P. virginica. The understory consists of Acer rubrum, Oxydendrum arboreum, Cornus florida, Ilex opaca, and Amelanchier arboreum. The shrub layer includes Vaccinium arboreum, V. pallidum, V. stamineum, Rhododendron periclymenoides, Calycanthus floridus, and Euonymus americanus. Woody vines included Vitis rotundifolia, and Toxicodendron radicans. The herb layer is sparse to moderately dense and includes Hexastylis naniflora, Goodyera pubescens, Aplectrum hyemale, Antennaria plantaginifolia, Mitchella repens, Chimaphila maculata, Goodyera pubescens, Polystichum acrostichoides, and Desmodium nudiflorum.

Invasive species noted & degree of threat from invasive species: none within transplant plots, but some located nearby EO 106

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way?

Topographic position (examples: crest, mid slope, alluvial, etc): north and northeast-facing slopes. Low, mid, and upper-slopes.
Micro-relief (examples: flat, concave, rippled, etc): flat, concave, convex, drop-off

Moisture regime (examples: inundated, dry, seasonally wet, etc): moist to dry

Light (examples: open, woodland, closed canopy, etc): filtered through woodland canopy

Other information: 276 plants from eight different EOs that would have been impacted the US 221 widening project were relocated to this property so they would be included in the conservation easement. 23 circular transplant plots were utilized for this purpose within the conservation easement. Those plants are now considered EO 286. See NCDOT's "Transplant and Monitoring Report for Dwarf-flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement" for more information.

Protection / management needs and opportunities: Plants are included in a conservation easement established by NCDOT in 2010.

Landowner(s), if known: Robert Tate, 4411 US 221 South, Forest City, NC 28043

Person making this report: Heather Wallace Renninger | Search time:
Address: NCDOT, PDEA, NEU | Phone: 919-707-6149
Other observers: Neil Medlin, Tim Bassette, Matt Haney (all NCDOT)

Specimens collected? no | Collection #: | Repository:
(**permits are required for federal or state listed species**)
Return form to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601

Transplant and Monitoring Report
for
Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)
at the
Tate Conservation Easement

Rutherford County, NC

North Carolina Department of Transportation
Raleigh, North Carolina

February 2015

Transplant and Monitoring Report
for
Dwarf-Flowered Heartleaf (*Hexastylis naniflora)*
at the
Tate Conservation Easement

TABLE OF CONTENTS

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1.0 INTRODUCTION

The following Transplant and Monitoring Report (TMR) has been prepared as part of the conservation measures established in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)) and as recorded in the Biological Assessment (BA) for this project.

The North Carolina Department of Transportation (NCDOT) has established an on-site conservation easement for the federally-protected Dwarf-Flowered Heartleaf (DFHL; *Hexastylis naniflora*). This conservation easement consists of an approximately 8 acre site adjacent to project ROW limits (Figure 1). As the current property owners are Mr. Robert and Mrs. Carolyn Tate, this parcel will be referred to as the "Tate Conservation Easement" (TCE).

Additional project information is available in earlier environmental documentation including: Transplant and Monitoring Report for dwarf-flowered heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement (2011), Transplant and Monitoring Report for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement (2010), Conservation Management Plan for the Dwarf-Flowered Heartleaf (DFHL; *Hexastylis naniflora*) at the Tate Conservation Easement (2009), the Biological Assessment for the Proposed US 221 Widening and Bypass Around Rutherfordton, Rutherford County, NC (2008), the US Fish and Wildlife Service Biological Opinion (2009), the Final Natural Resources Technical Report – R-2233A (2003), the Final Natural Resources Technical Report – R-2233B (2004), the State Environmental Assessment – R-2233A (2005), and the State Finding of No Significant Impact – R-2233A (2006).

2.0 PHYSICAL AND BIOLOGICAL RESOURCES AT THE TATE CONSERVATION EASEMENT

The TCE lies in the southern outer piedmont physiographic region of North Carolina (Figure 2). Regional topography consists of gently sloping hills to moderately steep ridges and valleys. The property is situated on a north-facing slope with elevations ranging from 860 – 800 feet above sea level. Land use in the project vicinity is characterized as low-density residential, industrial, and agriculture with forested areas present as well.

2.1 Soils

The Rutherford County Soil Survey identifies two soil types within the TCE (Table 1).

Table 1. Soils in the Study Area.

Soil Series	Mapping Unit	Drainage Class
Pacolet-Bethlehem	PbC2	Well drained
Pacolet-Bethlehem	PbD2	Well drained

These are considered mineral soils with a loamy surface layer and a clayey subsoil. The slightly acidic pH (4.5 – 6.5) nature was verified through soil analysis (data available from NCDOT).

2.2 Water Resources

Water resources in the TCE are part of the Broad River basin (U.S. Geological Survey [USGS] Hydrologic Unit 03050105). One stream, an unnamed tributary (Ut) to Floyd's Creek, is located on the property. Ut to Floyd's Creek (DWQ index # 9-37) is"Class C" water characterized by 3 – 5 feet wide stream with a water depth of 8 – 24 inches. The streambanks show areas of past erosion, with bank heights approaching 15 feet in some areas. The substrate is sand and gravel with moderate flow and high water clarity.

2.3 Biotic Resources

The primary terrestrial community identified at the TCE is a dry-mesic oak hickory forest and mesic mixed forest that grades into a basic mesic forest. Dominant trees, saplings, and shrubs on the property are black oak (*Quercus velutinal*), shortleaf pine (*Pinus echinata*), tulip poplar (*Liriodendron tulipifera*), sourwood (*Oxydendron arboretum*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), Northern red oak (*Quercus rubra*), ironwood (*Carpinus caroliniana*), mockernut hickory (*Carya tomentosa*), and dogwood (*Cornus floridaI*). The property has been maintained such that the understory is mostly clear of a dense shrub layer, but shrubs present include sweetshrub (*Calycanthus floridus*), farkleberry (*Vaccinium arboretum*), lowbush blueberry (*V. pallidum*), deerberry (*V. stamineum*), pinxter azalea (*Rhododendron periclymenoides*), and strawberry bush (*Euonymus americanus).* The herb layer is generally sparse, and is dominated by various herbs depending on relative soil moisture: downy rattlesnake plaintain (*Goodyera pubescens*), puttyroot (*Aplectrum hyemale*), pussytoes (*Antennaria plantaginifolia*), partridgeberry (*Mitchella repens*), spotted wintergreen (*Chimaphila maculata*), naked-flowered tick trefoil (*Desmodium nudiflorum*), Christmas fern (*Polystichum acrostichoides*), giant cane (Arundinaria gigantea), sedges (*Carex* spp.), and dwarf-flowered heartleaf (*Hexastylis naniflora*). Vines present are greenbrier (*Smilax rotundifolia*), grape (*Vitis rotundifolia*), coral honeysuckle (*Lonicera* sempervirens), and poison ivy (*Toxicodendron radicans*).

2.4 Invasive Species

The presence of invasive plant species found on the property is low, and includes mainly Japanese honeysuckle (*Lonicera japonica*) and Chinese privet (*Ligustrum sinense*). Kudzu (*Pueraria lobata*) was noted for the first time in 2011, at the eastern edge of the parcel, near the base of the slope associated with the railroad tracks. It had not spread much by 2013. Honeysuckle and privet are becoming quite dense near Jayne's road, within and adjacent to a small wetland area. However, these invasives are not dense enough to affect the viability of the dwarf-flowered heartleaf in this area. No invasive species were noted in the interior of the parcel.

3.0 METHODOLOGY

Coordination with the Advisory Committee on methodology and contingences occurred prior to transplantation. For more information on the Advisory Committee see the Biological Assessment (2008) and Conservation Management Plan (2009). All work was performed under an NC Plant Conservation Program (NCPCP) Protected Plant Conservation Permit and Record (Rescue and Reintroduction Permit #155; Issued: 02 October 2009; Expiration: 30 September 2011).

The transplant effort occurred on 27 Jan 2010 and was performed by eight NCDOT biologists: Lance P. Fontaine, Heather Wallace, Mary Frazer, Dennis Herman, Steve Mitchell, Zachary McNeill, Tim Bassette, and Melissa Miller. Approximately 96 person-hours were expended on the transplant action.

To accomplish the relocation, DFHL within areas of the project right-of-way (ROW) that were anticipated to incur direct effects as per the BA were identified. Crews used hand-shovels to dig and extract each plant and the surrounding soil while keeping the root system intact. Invasive species' (mainly Japanese honeysuckle) that may have been attached to the plants or soil were removed. Plants were placed into buckets and transported to the TCE as soon as was feasible (usually within 1 hour of removal). Throughout the relocation process, attempts were made to keep the plants shaded or covered with leaves and/or burlap cloth.

At the TCE, DFHL from each Natural Heritage Program (NHP) Element Occurrence (EO) were placed into individual circular plots. Plots containing donor DFHL were not mixed across EO's. The exact boundary and distribution of the resident DFHL at the site is patchy (though dense) and fluctuates over time. The resident DFHL boundary (EO #106) was based on 2008 data from NHP. It was observed that the resident DFHL appear to have spread beyond the 2008 boundary. Transplant plots were chosen by locating areas that were near but did not include resident DFHL. Plots were placed "lower on the hill" (at a slightly lower elevation) than resident DFHL to ensure placement within suitable DFHL habitat and within the TCE boundary. Plot locations are shown on Figure 3.

The location of each plot was recorded using GPS, while plot size, origin EO, and total number of plants in each plot was recorded. A metal stake with a metal label identifying the plot number was installed in the center of each circular plot.

Monitoring of the relocated DFHL, as well as resident DFHL, was conducted by NCDOT personnel on April 14-15, 2011 and April 16-17, 2013.

4.0 DFHL STATUS AT THE TATE CONSERVATION EASEMENT

4.1 Relocated DFHL

The average planting density across plots of relocated DFHL was 4 plants/meter with an average plot size of 3 meters. Twenty-three (23) circular plots were required to

accommodate all donor plants. An additional seven (7) plots were established but not utilized. Tables 2 and 3 summarize the data collected for each plot of relocated DFHL. Table 2 provides information on the origin location (site number as listed in the BA) and NHP EO number for each of these, and the total number of plants removed from the original site and relocated to the TCE. Table 3 provides information on the status of the plants in each relocation plot at the TCE, including individual plot counts, densities, and percent survivorship.

Table 2. Summary Data for January 2010 DFHL Relocation Effort

Site Number*	Origin EO+	No. of Plants Relocated to TCE
1	106	93
2	174	35
3	114	14
4	173	0
5 (west of HWY 221)	113	7
5 (east of HWY 221)	175	114
6	76	9
7	172	4
	TOTAL RELOCATED =	**276**

* - As per the Biological Assessment.
+ - Element Occurrence

Table 3. DFHL Relocation and Monitoring Data

Plot ID	GPS Coordinates[+]	Origin EO *	No. Plants (2010)	No. Plants (2011)	No. Plants (2013)	Plot Size (m)	Density (2010)	Density (2011)	Density (2013)	% Survivorship (2011)	% Survivorship (2013)
1	Not processed per agreement with Plaintiff/Requester	106	27	39	44	7	4	6	6	144	163
2	Not processed per agreement with Plaintiff/Requester	106	12	12	14	3	4	4	5	100	117
3	Not processed per agreement with Plaintiff/Requester	106	12	12	8	3	4	4	3	100	67
4	Not processed per agreement with Plaintiff/Requester	106	12	17	13	3	4	6	4	142	108
5	Not processed per agreement with Plaintiff/Requester	106	12	13	6	3	4	4	2	108	50
6	Not processed per agreement with Plaintiff/Requester	106	12	12	5	3	4	4	2	100	42
7	Not processed per agreement with Plaintiff/Requester	106	6	5	4	3	2	2	1	83	67
8	Not processed per agreement with Plaintiff/Requester	174	12	10	6	3	4	3	2	83	50
9	Not processed per agreement with Plaintiff/Requester	174	11	11	5	3	4	4	2	100	45
10	Not processed per agreement with Plaintiff/Requester	174	12	11	8	3	4	4	3	92	67
11	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-	-	-	-
12	Not processed per agreement with Plaintiff/Requester	175	12	13	6	3	4	4	2	108	50
13	Not processed per agreement with Plaintiff/Requester	114	14	14	13	3	5	5	4	100	93
14	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-	-	-	-
15	Not processed per agreement with Plaintiff/Requester	172	9	11	4	3	3	4	1	122	44
16	Not processed per agreement with Plaintiff/Requester	175	12	9	3	3	4	3	1	75	25
17	Not processed per agreement with Plaintiff/Requester	175	12	9	4	3	4	3	1	75	33
18	Not processed per agreement with Plaintiff/Requester	175	12	12	3	3	4	4	1	100	25
19	Not processed per agreement with Plaintiff/Requester	175	15	11	5	3	5	4	2	73	33
20	Not processed per agreement with Plaintiff/Requester	175	12	16	2	3	4	5	1	133	17
21	Not processed per agreement with Plaintiff/Requester	175	10	12	10	3	3	4	3	120	100
22	Not processed per agreement with Plaintiff/Requester	113	7	5	3	3	2	2	1	71	43
23	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-	-	-	-
24	Not processed per agreement with Plaintiff/Requester	76	4	4	3	1.5	3	3	2	100	75
25	Not processed per agreement with Plaintiff/Requester	175	15	14	6	3	5	5	2	93	40
26	Not processed per agreement with Plaintiff/Requester	175	14	12	6	3	5	4	2	86	43

Plot ID	GPS Coordinates+	Origin EO *	No. Plants (2010)	No. Plants (2011)	No. Plants (2013)	Plot Size (m)	Density (2010)	Density (2011)	Density (2013)	% Survivorship (2011)	% Survivorship (2013)
27	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-	-	-	-
28	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-	-	-	-
29	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-	-	-	-
30	Not processed per agreement with Plaintiff/Requester	-	-	-	-	-	-	-	-	-	-
Summary Info for All Relocated Plants			**276**	**284**	**181**		**3.86**	**3.97**	**2.53**	**103**	**66**

+ - Decimal Degrees
* - Element Occurrence
" - " - Empty plot

4.2 Resident DFHL

NHP records for EO 106 indicate that prior surveys of the resident DFHL population this site were performed in 2003 and 2005. These records qualitatively suggest that the DFHL at this location are a strong, growing, and highly viable population occurring in two sub-occurrences (A = along UT to Floyd's Creek and B = along US 221). Quantitative estimates of population size support this as the number of individuals counted between 2003 and 2005 increases greatly; in 2003, approximately 250 individual clumps were located, whereas in 2005, 641 were counted. Between these survey years it is noted that the plants appeared to be expanding between the two sub-occurrences. In 2005 eight plants were found in sub-occurrence B which was 0.02 acres in size. Also in 2005, 657 plants were counted in sub-occurrence A which covered 3.01 acres. The resident population boundary is shown on Figure 3.

4.3 Post-transplant – Resident and Relocated DFHL

Due to the apparent population expansion at this location and growing interest in utilizing this site as a conservation easement, NCDOT biologists performed a survey of the entire population on April 22, 2008. As of May 12, 2010, the NCNHP boundary for EO 106 is based on the April 2008 survey. At this time the two sub-occurrences were observed to have "connected" into one larger occurrence. NHP will track resident and transplanted DFHL at the TCE under separate EO numbers; EO 106 will continue to identify the resident DFHL at the TCE and EO 286 was created to track transplanted DFHL at the TCE. Tables 4 and 5 summarize available data from NCDOT and NHP surveys at EO's 106 and 286.

Table 4. DFHL Population Data from Tate Conservation Easement (EO 106: Resident Plants)

Survey year	No. Plants	Area (Ac)	Density (#/ac)	Comments
2003	250	3.01	83	From NHP records: …in leaf and flower, seedlings and clonal / vegetative reproduction evident; flowers mostly disintegrated.
2005	641	3.01	212	From NHP records: …vegetative reproduction evident.
2008	2,326	4.34	536	High quality; few invasives
2011	3,088	4.45	693	Slight expansion in population boundary
2013	1,675	3.98	421	Slight reduction in population boundary; decrease in density
2015	-	-	-	
2017	-	-	-	

Table 5. DFHL Population Data from Tate Conservation Easement (EO 286: Relocated Plants)

Survey year*	No. Plants	Area (m^2)	Density (#/m^2)	Comments
2010	276	755	3.86	At time of transplant, winter 2010
2011	284	755	3.87	Initial post-transplant survey in spring 2011; most plants in flower and/or producing new leaves
2013	181	755	2.53	Few plants in flower or producing new leaves.
2015	-	-	-	
2017	-	-	-	

* - Transplant occurred January 2010; Survey schedule is: one year post-transplant, then every two years thereafter for a period of six years.

As per the BA, BO, and Conservation Management Plan (CMP), NCDOT has committed to conducting additional surveys to monitor both resident (EO 106) and transplanted (EO 286) DFHL at the TCE. An initial post-transplant survey was conducted in the spring of 2011 in order to evaluate survivorship of transplanted individuals and to monitor quantity and status of the resident population. Subsequent surveys will be conducted for both EO's at the TCE at two year intervals for a period of six years (Table 4 and 5). The data from these surveys will be disseminated as indicated in the BA, BO, and CMP.

4.4 2013 Monitoring Results Discussion

The overall number of plants, population size, and density of plants in the native population (EO 106) has declined as compared to previous monitoring years. The increase in the density of exotic invasive vegetation at the western edge of the TCE may account for a very small portion of this decline. In addition, the valley that bisects the TCE also showed a decline in overall number of plants and plant density. However, there is no apparent reason for the decline in this area.

Likewise, EO 106 showed a decrease in number of plants, overall size of population, and population density each year since 2011. Survivorship also dramatically decreased since time of transplant, and now stands at 66%. Treefalls in a few of the transplant plots, which covered or destroyed some transplants, can account for some of this decline. No invasive species were noted in any of the transplant plots.

The number, density, and size of the DFHL populations on the TCE are in decline as compared to results from the 2011 monitoring season. Most plants were not in flower and were not exhibiting much new growth. In general, the plants looked stressed. An increase in density of invasive exotic species may contribute to the decline in some specific areas (westernmost and easternmost edges of the population). However, there doesn't seem to be an obvious reason for the overall decline due to physical changes in the landscape.

The Palmer Historical Drought Indices, available through the National Weather Service website (http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/psi/201101-201411), shows monthly precipitation amounts as compared to historic averages. 2010 and 2011 were normal to slightly dry years, while 2012 and January through April of 2013 were normal to moderately moist years. Perhaps these differences in rainfall amounts account for the decline in the number of plants during the respective monitoring years.

All DFHL at TCE will be monitored again in 2015 using the same methodology used in 2011 and 2013. 2015 will be the final year of monitoring for this population.

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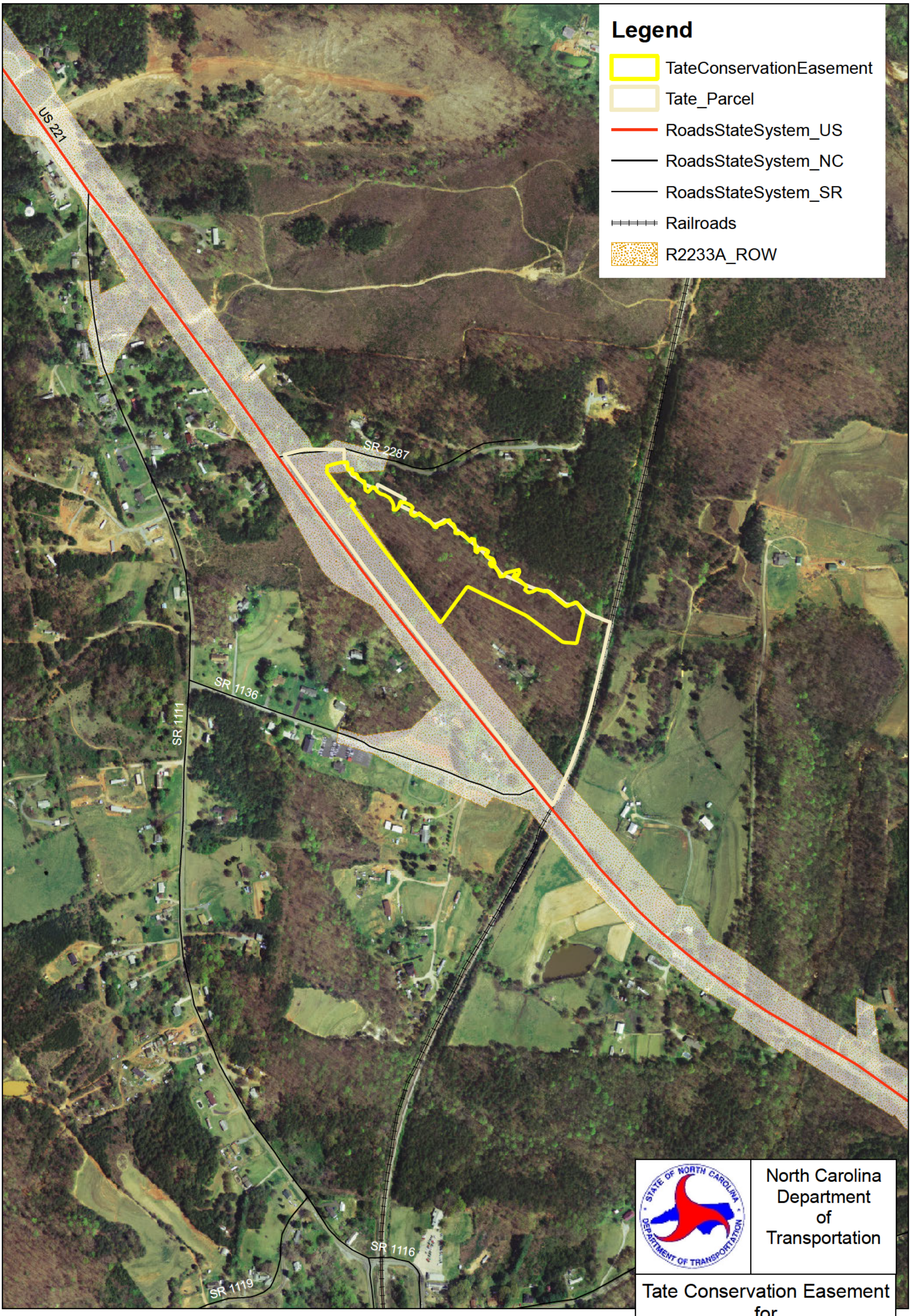


Rutherford_2004_SID

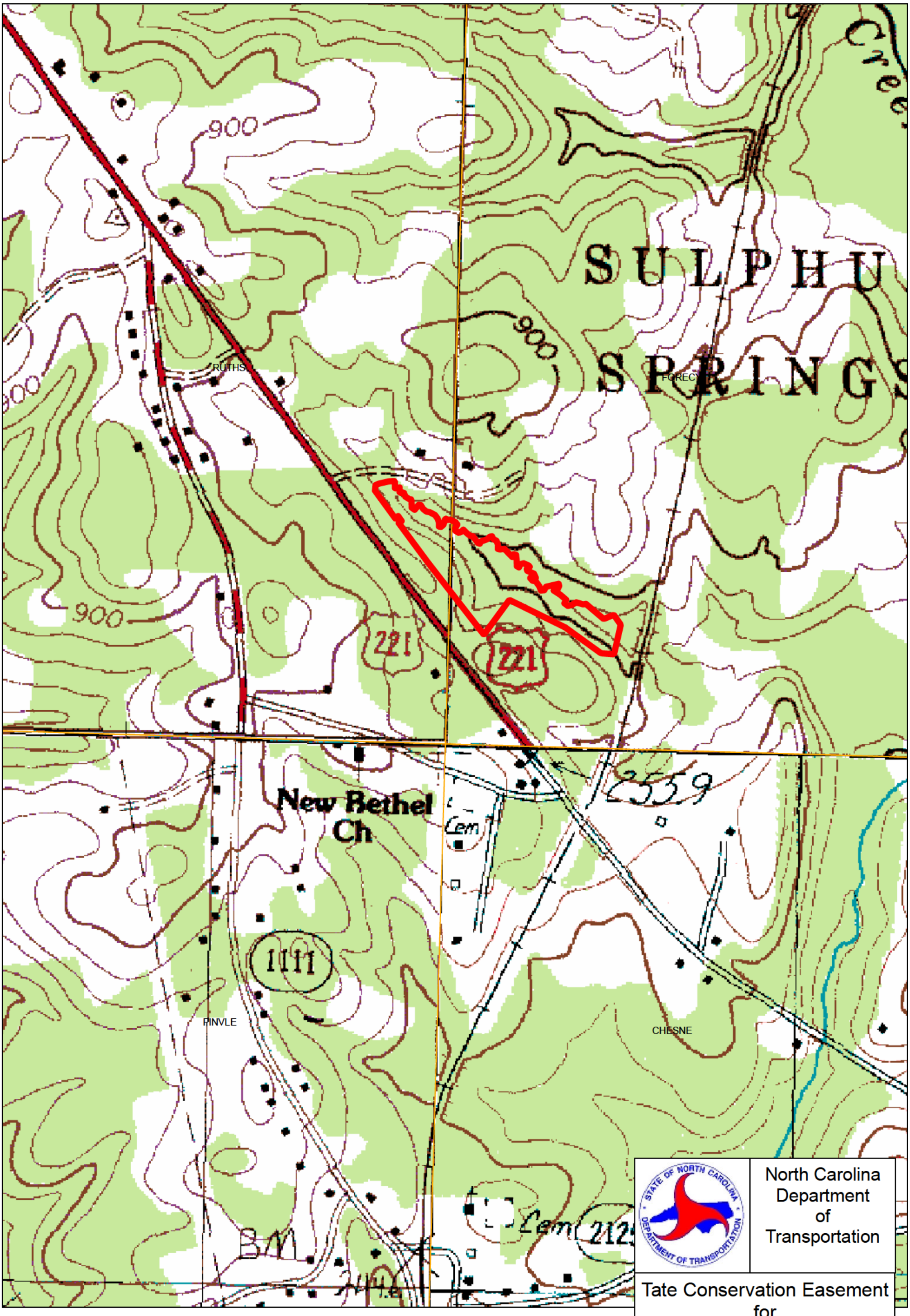
0 450 900 1,800 Feet

North Carolina Department of Transportation

Tate Conservation Easement for Dwarf-flowered Heartleaf

Project Vicinity Map

Figure 1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SULPHU
SPRING
RUTHS
FORECY
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900
221
221
2559
New Bethel
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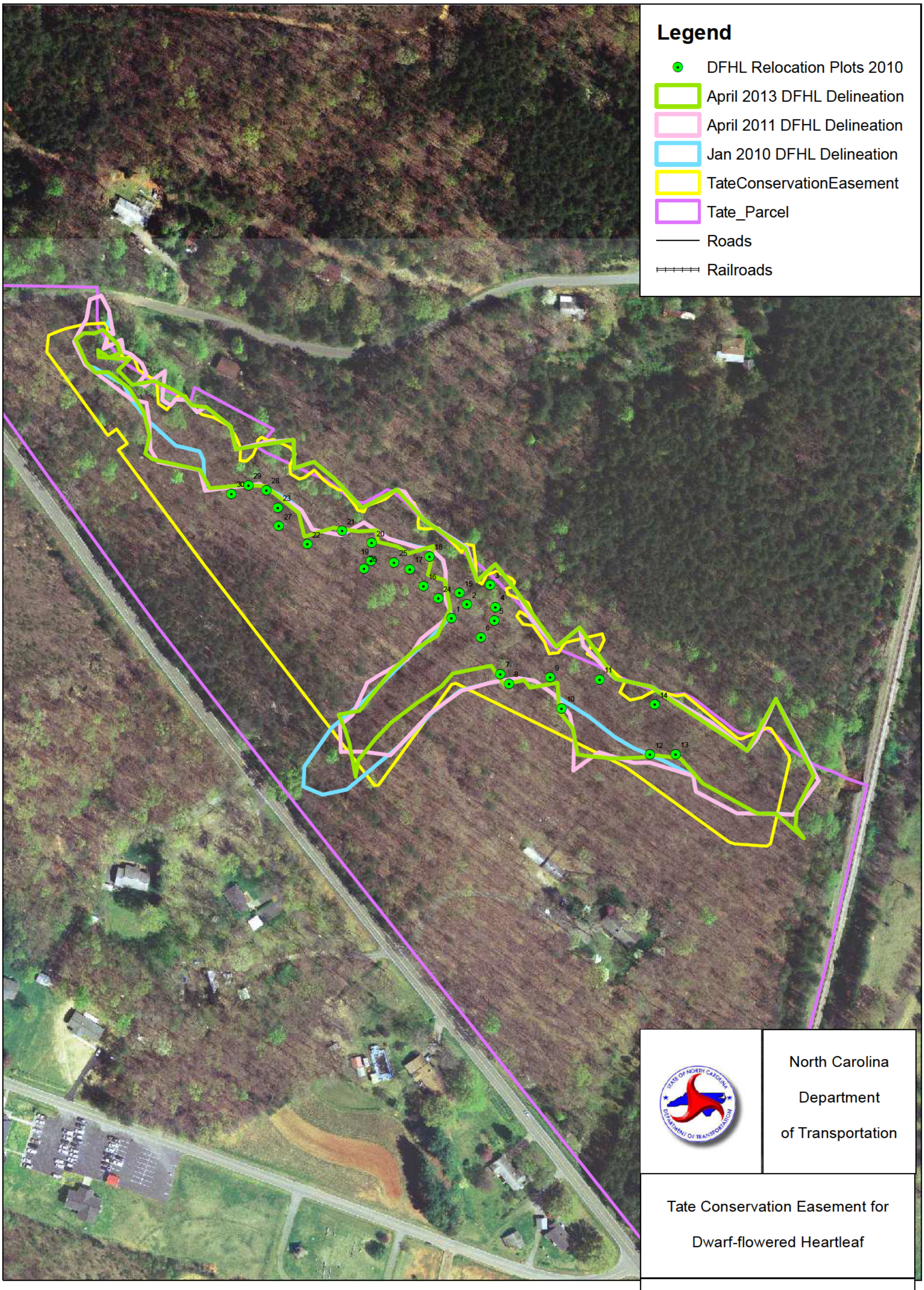
Cem
1111
PINVLE
CHESNE
BM
Cem 212
USGS 24K quads referenced: ruths, finvle, forecy, chesne.
Miles
0 0.05 0.1 0.2
North Carolina
Department
of
Transportation
Tate Conservation Easement
for
Dwarf-flowered Heartleaf
Topographic map

Figure 2


Legend
DFHL Relocation Plots 2010
April 2013 DFHL Delineation
April 2011 DFHL Delineation
Jan 2010 DFHL Delineation
TateConservationEasement
Tate_Parcel
Roads
Railroads
1
2
3
4
5
6
7
8
9
10
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Feet
North Carolina
Department
of Transportation
Tate Conservation Easement for
Dwarf-flowered Heartleaf
Tate Conservation Easement Map

Figure 3

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* Common name: Dwarf-flowered heartleaf

Survey date: 4/16/13 7.5' Quad Map: Rutherfordton South

County: Rutherford Elevation: 810-840'

Site location and directions: (**attach copy of map with site marked or use back of form to draw a sketch of the site**): **EO 106**

SPECIES INFORMATION

Number of individuals: 1,675 Define individual (**stem, clump, etc.**): clump

Size of area in which population occurs: 3.98 acres

Phenology: vegetative, flower Evidence of reproduction: seedlings, clonal/vegetative

Habitat (**NC NHP natural community name and description; include quality, soils, geology, etc.**): Pacolet soils; Dry-Mesic Oak-Hickory Forest; medium to high quality. The canopy is dominated Quercus alba, Q. stellata, Q. falcata, Q. coccinea, Carya cordiformis, C. alba, Liriodendron tulipifera, Pinus echinata and P. virginica. The understory consists of Acer rubrum, Oxydendrum arboreum, Cornus florida, Ilex opaca, and Amelanchier arboreum. The shrub layer includes Vaccinium arboreum, V. pallidum, V. stamineum, Rhododendron periclymenoides, Calycanthus floridus, and Euonymus americanus. Woody vines included Vitis rotundifolia, and Toxicodendron radicans. The herb layer is sparse to moderately dense and includes Hexastylis naniflora, Goodyera pubescens, Aplectrum hyemale, Antennaria plantaginifolia, Mitchella repens, Chimaphila maculata, Goodyera pubescens, Polystichum acrostichoides, and Desmodium nudiflorum.

Invasive species noted & degree of threat from invasive species: few Chinese privet (*Ligustrum sinense*), and one kudzu (*Pueraria montana* var. *lobata*) found near railroad tracks. Japanese honeysuckle (*Lonicera japonica*) and Chinese privet found in greater quantities than previous years near Jayne's Road.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? All plants present within right-of-way were relocated in 2010 so that they are situated within the conservation easement.

Topographic position (examples: crest, mid slope, alluvial, etc): north and northeast-facing slopes. Low, mid, and upper-slopes. Some plants also located within wetland area at western end of population.

Micro-relief (examples: flat, concave, rippled, etc): flat, concave, convex, drop-off

Moisture regime (examples: inundated, dry, seasonally wet, etc): moist to dry

Light (examples: open, woodland, closed canopy, etc): filtered through woodland canopy

Other information: Plants in this population have been monitored for several years. Plants from multiple other locations that would have been impacted the US 221 widening project were relocated to this property so they would be included in the conservation easement. Those plants are now considered EO 286. See NCDOT's "Transplant and Monitoring Report for Dwarf-flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement" for more information.

Protection / management needs and opportunities: Plants are included in a conservation easement established by NCDOT in 2010.

Landowner(s), if known: Robert Tate, 4411 US 221 South, Forest City, NC 28043

Person making this report: Heather Wallace Search time:
Address: NCDOT, PDEA, NEU Phone: 919-707-6149
Other observers: Neil Medlin, Tim Bassette, Matt Haney (all NCDOT)

Specimens collected? no Collection #: Repository:
(**permits are required for federal or state listed species**)
Return form to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* Common name: Dwarf-flowered heartleaf

Survey date: 4/16/13 7.5' Quad Map: Rutherfordton South

County: Rutherford Elevation: 810-840'

Site location and directions: (**attach copy of map with site marked or use back of form to draw a sketch of the site**): **EO 286**

SPECIES INFORMATION

Number of individuals: 181 Define individual (**stem, clump, etc.**): clump

Size of area in which population occurs: 755 m^2

Phenology: vegetative, flower Evidence of reproduction: seedlings, clonal/vegetative

Habitat (**NC NHP natural community name and description; include quality, soils, geology, etc.**): Pacolet soils; Dry-Mesic Oak-Hickory Forest; medium to high quality. The canopy is dominated Quercus alba, Q. stellata, Q. falcata, Q. coccinea, Carya cordiformis, C. alba, Liriodendron tulipifera, Pinus echinata and P. virginica. The understory consists of Acer rubrum, Oxydendrum arboreum, Cornus florida, Ilex opaca, and Amelanchier arboreum. The shrub layer includes Vaccinium arboreum, V. pallidum, V. stamineum, Rhododendron periclymenoides, Calycanthus floridus, and Euonymus americanus. Woody vines included Vitis rotundifolia, and Toxicodendron radicans. The herb layer is sparse to moderately dense and includes Hexastylis naniflora, Goodyera pubescens, Aplectrum hyemale, Antennaria plantaginifolia, Mitchella repens, Chimaphila maculata, Goodyera pubescens, Polystichum acrostichoides, and Desmodium nudiflorum.

Invasive species noted & degree of threat from invasive species: none within transplant plots, but some located nearby EO 106

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way?

Topographic position (examples: crest, mid slope, alluvial, etc): north and northeast-facing slopes. Low, mid, and upper-slopes.
Micro-relief (examples: flat, concave, rippled, etc): flat, concave, convex, drop-off

Moisture regime (examples: inundated, dry, seasonally wet, etc): moist to dry

Light (examples: open, woodland, closed canopy, etc): filtered through woodland canopy

Other information: 276 plants from eight different EOs that would have been impacted the US 221 widening project were relocated to this property so they would be included in the conservation easement. 23 circular transplant plots were utilized for this purpose within the conservation easement. Those plants are now considered EO 286. See NCDOT's "Transplant and Monitoring Report for Dwarf-flowered Heartleaf (*Hexastylis naniflora*) at the Tate Conservation Easement" for more information.

Protection / management needs and opportunities: Plants are included in a conservation easement established by NCDOT in 2010.

Landowner(s), if known: Robert Tate, 4411 US 221 South, Forest City, NC 28043

Person making this report: Heather Wallace Search time:
Address: NCDOT, PDEA, NEU Phone: 919-707-6149
Other observers: Neil Medlin, Tim Bassette, Matt Haney (all NCDOT)

Specimens collected? no Collection #: Repository:
(**permits are required for federal or state listed species**)
Return form to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601

Species: *Hexastylis naniflora* (Dwarf-flowered heartleaf)

Site: [Gunpowder Creek] (Caldwell County)

NC NHP EO number(s): 77

NCDOT Point of Contact (POC): Heather Wallace, Tim Bassette

Signed ROW occurrence? no

Site management plan: n/a

Site protections:
Three Subpopulations of DFHL are located at this site. Subpopulation A is located in the southwest quadrant, Subpopulation B in the Northwest quadrant, and Subpopulation C in the northeast quadrant. Subpopulations A and B were discovered in 2000, and Subpopulation C was not discovered until 2005. At present, Subpopulation B is located entirely within NCDOT right-of-way, while the other subpopulations are located partially in a right-of-way area, and the remainder lies on adjacent private property. DOT is monitoring the entire population, which constitutes all of NC NHP EO 77.

A Biological Assessment was completed for The Replacement of Bridge No. 90 on SR 1718 (Deal Mill Road) over Gunpowder Creek (TIP B-3126) in 2003, and a subsequent Biological Opinion was issued later that year. After Subpopulation C was discovered, the Biological Assessment was amended in 2006, and an amended Biological Opinion followed later that year. Project construction began in 2006. *There are some discrepancies in plant counts listed in various documents. The information provided here is presented to the best of our knowledge after reviewing all available information.*

Per the Amended Biological Opinion, NCDOT agreed to protect 90 plants within Subpopulation C by acquiring additional right-of-way. No other plants were agreed to be protected. However, additional right-of-way was acquired on the west side of Deal Mill Road for a stream mitigation project. In so doing, additional plants were thereby protected. After conducting monitoring in 2011, it was determined that 33 plants from Subpopulation B and 103 plants from Subpopulation A are also under protection. In addition, 197 plants in Subpopulation C now exist within the expanded right-of-way, and therefore are also under protection.

An additional conservation measure included in the 2006 amended Biological Opinion states that NCDOT/FHWA agreed to fund a temporary staff position for two months to assist the USFWS Recovery Coordinator with the 5-year status review for *H. naniflora*. This condition became unnecessary due to the additional plants that were protected in the expanded right-of-way areas.

Despite impacts to the subpopulations due to road construction, there are more plants in each of the subpopulations now than were counted when they were originally discovered. Table 1 shows the subpopulation trends since discovery.

***There is information within the Element Occurrence file at NCNHP that alludes to this population being a mixture of *H. naniflora* and *H. heterophylla*. Since there is no documentation on file at NCDOT to

corroborate this assessment, NCDOT biologists will visit the site in spring of 2012 to determine the species present within each subpopulation.

Origin of species at this site: native

Status of species at this site: extant

Species short-term trend at this site (relative to last count): increasing

Species long-term trend at this site (averaged over multiple counts): increasing

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Status of NCDOT commitments pledged during ESA Section 7 consultations:
NCDOT project ID: B-3126
USFWS log number: 4-2-03-415

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence):
From pages 31-34 of the Biological Assessment for TIP R-2824 (Proposed Upgrade of Lovelady Road (dated May 2009), and Appendix B of the Biological Opinion for the same project (dated November 13, 2009), NCDOT committed to assist USFWS with the five-year review process by providing information about several populations of DFHL that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure for R-2824.) The population of DFHL associated with B-3126 is included in this group.

Because DFHL is located within the right-of-way of B-3126, NCDOT will monitor this occurrence, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:

- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using GPS/GIS, computing changes to acreages of occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program – Endangered and Rare Plant Field Survey Form that incorporates both types of data.
- Analyze population trends by comparing recent size estimates to data from previous years.

NCDOT biologists counted plants in each subpopulation several times prior to construction. However, methods for enumerating plants were inconsistent. Beginning with the first monitoring phase in 2011, methods will be consistent to allow for better ability to track population trends.

Baseline data was collected by NCDOT biologists in 2000, 2003, 2005, and 2006, prior to project construction. On November 3, 2011 NCDOT biologists visited the site and conducted annual monitoring. All tasks listed above were completed and results will be included in the spreadsheet to be submitted to USFWS by January 1, 2011. To be consistent with the baseline data collection, plants were enumerated via direct count. Plant counts are documented in Table 1. The subpopulation boundaries have changed dramatically since the subpopulations were delineated in 2006. Habitat quality has changed slightly due to clearing of the right-of-way adjacent to the roadway, but dominant species have remained the same. Plants that lie within the ROW appear to be healthy. No other changes to habitat quality were observed. A NC NHP form was completed. Population trends at this site reveal that the number of plants and the density of the population have increased since pre-construction.

Table 1 and Figure 1 (attached) provide additional information on these subpopulations.

Status of terms and conditions from applicable NC Plant Conservation Program permits:
N/A. No plants collected from this site by NCDOT.

Discretionary actions undertaken by NCDOT and partners:
N/A

Table 1. Gunpowder Creek *Hexastylis naniflora* Subpopulation Trends

Sub-population	2000 Total Count	2003 Total Count	2005 Total Count	2006 Count Inside ROW, impacted by construction*	2006 Not Impacted By Construction	2006 Total Count	2011 Count Inside ROW**	2011 Count Outside ROW	2011 Total Count	Relative number since discovery
A	30	80	150	44	106	150	107	320	427	+397
B	30	50	67	67	0	67	33	0	33	+3
C	n/a	n/a	163	73	90	163	197	74	271	+108
Total	60	130	380	184	302	380	337	394	731	+508

* Number of plants impacted by construction activities

** Number of plants protected within established ROW following construction

Gunpowder Creek Hexastylis naniflora On-Site Preservation Areas, Caldwell County, NC

0 150 300 600 Feet

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* Common name: Dwarf-flowered heartleaf

Survey date: 11/3/11 7.5' Quad Map: Granite Falls

County: Caldwell Elevation: 1170'-1180'

Site location and directions: (**attach copy of map with site marked or use back of form to draw a sketch of the site**): EO 77. See attached mapping for location of each subpopulation.

SPECIES INFORMATION

Define individual (**stem, clump, etc.**): clump

Number of individuals: Subpop A: 427,
Subpop B: 33, Subpop C: 271

Size of area in which population occurs: A: 0.78 ac. B: 0.03 ac. C: 0.59 ac.

Phenology: vegetative Evidence of reproduction: seedlings
clonal/vegetative

Habitat (**NC NHP natural community name and description; include quality, soils, geology, etc.**): Pacolet and Cewacla soils; Dry-Mesic Oak-Hickory Forest; medium quality. Forest cover types are fairly similar amongst the three subpopulations. The canopy is dominated by Quercus alba, Q. rubra, Carya glabra, Acer rubrum, Prunus serotina, Liriodendron tulipifera, and Pinus strobus. The understory consists of Carpinus caroliniana, Oxydendrum arboretum, Acer rubrum, Cornus florida, Ilex opaca. The shrub layer includes Kalmia latifolia, Leucothoe axillaris var. editorium, and Euonymus americanus. Woody vines included Bignonia capreolata, Vitis rotundifolia, and Toxicodendron radicans. The herb layer is sparse to moderately dense and includes Hexastylis naniflora, Goodyera pubescens, Aplectrum hyemale, Mitchella repens, Chimaphila maculata, Polystichum acrostichoides, Tiarella sp., and Desmodium nudiflorum.

Invasive species noted & degree of threat from invasive species: Lonicera japonica is prevalent in subpop A. Some Ligustrum sinense is present in subpopulation A.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? Any suitable habitat that exists outside the ROW is already occupied by HENA.

Topographic position (examples: crest, mid slope, alluvial, etc): Subpop A on north and northwest-facing slopes, Subpops B and C on .northwest and west-facing slopes. Low, mid, and upper-slopes.
Micro-relief (examples: flat, concave, rippled, etc): flat, concave, convex, drop-off

Moisture regime (examples: inundated, dry, seasonally wet, etc): dry

Light (examples: open, woodland, closed canopy, etc): filtered through woodland canopy

Other information: All three subpopulations were impacted by construction of the replacement bridge over Gunpowder Creek and the associated realignment of Deal Mill Road. However, it appears as though most of them have expanded in size since these impacts occurred. Information regarding population trends will be reported in annual monitoring reports submitted to USFWS and NHP.

Protection / management needs and opportunities: Plants are included in a conservation easement established by NCDOT in 2006.

Landowner(s), if known: NCOT ROW (partial)

Person making this report: Heather Wallace Search time:
Address: NCDOT, PDEA, NEU Phone: 919-707-6149
Other observers: Neil Medlin, Tim Bassette, Jared Gray, Steve Mitchell, Matt Haney (all NCDOT)

Specimens collected? no Collection #: Repository:
(**permits are required for federal or state listed species**)
Return form to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601

2013
Hexastylis naniflora (Dwarf-flowered Heartleaf) Murray's Mill Inventory and Monitoring Report, Catawba County, North Carolina

Contact Person:
Tim Bassette
Environmental Program Consultant
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919.707.6104
tpbassette@ncdot.gov

January 16, 2015

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Site: Murray's Mill Conservation Area (Catawba County)

NC NHP EO number(s): 184

Signed ROW occurrence? No

NCDOT Point of Contact (POC): Tim Bassette

Site management plan: Inventory and monitoring will occur every two years for a total of three monitoring sessions. A draft Conservation Plan for Dwarf-flowered Heartleaf at Murray's Mill Conservation Area prepared by NCDOT has been submitted to Catawba County Historical Association for review.

Site protections: NCDOT purchased 25.07 acres (Tract 1) on May 1, 1996 and an additional 8.61 acre Bowman Tract (Tract 2) on March 13, 2006 as a permanent conservation site for the species as shown in Figure 1. Dennis Herman (919-707-6127) is the NCDOT point of contact from which to obtain a current copy of the draft conservation plan.

Origin of species at this site: Native

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Decreasing

Species long-term trend at this site (averaged over multiple counts): Stable/Decreasing

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Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID: TIP No. R-9999L (formerly B-2119).

USFWS log number: 4-2-95-102

On August 3, 1995 the U.S. Fish and Wildlife Service (Service) issued a Biological Opinion (BO) pertaining to projects B-2119, U-2307, and U-2528AA. The BO was issued in response to a request to initiate formal consultation for the referenced projects on July 20, 1995. Per the BO, NCDOT made the following environmental commitments (pgs. 5-6):

- The NCDOT will pursue purchasing land in fee title (or conservation easement) from willing sellers to establish a preserve of approximately 11.9 hectare (29.4 acres) in the Murray's Mill area.
  Status: On May 1, 1996, the NCDOT purchased 25.07 acres (Tract 1) and an additional 8.61 acres on the adjacent Bowman Tract (Tract 2) on March 13, 2006.
- The preserve will be conveyed to another responsible entity (such as the Catawba County Historical Association) with an accompanying agreement or deed restriction that the existing plant population be protected in perpetuity.

Status: Currently NCDOT still holds the title to the site but is working toward the transfer of ownership and stewardship responsibilities to the Catawba County Historical Association. The NCDOT has developed a conservation plan which outlines the management of the Murray's Mill Site for the perpetual conservation of the *Hexastylis naniflora*.

- The NCDOT and FHWA have also agreed that if establishing a preserve in the Murray's Mill area is not feasible, they will pursue establishing a preserve of similar size and quality (with regards to plant population density and size) at another location in North Carolina, as agreed upon by the Service.
  Status: As of March 13, 2006 the NCDOT completed the purchase of the Murray's Mill tracts which met and exceeded the necessary 11.9 hectare (29.4 acres) commitment.
- If the entire 11.9 hectare area, as committed in the Assessment, is not protected through fee title or conservation easement, then Project U-2528AA will be dropped from the Programmatic Section 7 Consultation and will need to be addressed at a separate consultation at a future date.
  Status: As mentioned in the status of the commitment above, the NCDOT purchased more than the requisite 11.9 hectares.
- Some transplanting of *Hexastylis naniflora* individuals to protected sites, or possibly even the collecting of individuals for Center for Plant Conservation-approved of botanical gardens, may be carried out, but will be the sole responsibility of the Service. Any transplanting efforts will be conducted with prior coordination with NCDOT.
  Status: To-date, no transplanting or collecting of individual plants has been coordinated.
- The Service has agreed that if the above mentioned preserve is established, and Project U-2528AA is dropped (not constructed), the NCDOT may substitute another project involving *Hexastylis naniflora* contingent upon Service approval. The Service will evaluate such criteria as plant population size, habitat quality, landscape context (e.g. rural. urban), proposed impacts to the plant population, etc. in making a decision on substituting another NCDOT project.
  Status: The option for NCDOT to substitute another project is no longer viable because U-2528AA has been constructed.
- Assisting the Service in answering questions that arose during the recent 5-year status review for the species.
  Status: Every two years for no more than a six year period, the NCDOT will monitor all occurrences associated with 14 NCDOT projects where *Hexastylis naniflora* was found in the right-of-way, of which Murray's Mill is one. Environmental baseline data will be obtained and will include both quantitative and qualitative analyses. Specifics of the five year review assistance are detailed in the USFWS Biological Opinion letter to NCDOT dated November 13, 2009.

Status of terms and conditions from applicable NC Plant Conservation Program permits: No permit required or obtained by NCDOT.

NC PCP Permit ID number(s): N/A

Description: N/A

Discretionary actions undertaken by NCDOT and partners:

In addition to the environmental commitments made by NCDOT, the Service requested the following conservation recommendations be implemented by NCDOT as part of project plans (p. 7).

1. The agreement (or deed restriction) will include a provision that any management recommendations we make will be implemented, if resources are available, and that access into the preserve will be granted for our representatives and representatives from State resource agencies with prior notification to the owner. *Status*: Management recommendation in the form of a draft conservation plan for the Murray's Mill Conservation Area has been approved by the USFWS, NCNHP and NCDOT but not the Catawba County Historical Association.
2. The deed for the acquired site will identify that this area was purchased for conservation purposes. *Status*: It is not NCDOT policy to place deed restrictions on properties purchased fee simple. To ensure this property remains protected in perpetuity all sites purchased or maintained by NCDOT for threatened and endangered species mitigation are placed on the existing Natural Environment Section's (NES) Mitigation GeoDatabase. This geo-referenced database includes the location and boundaries of NCDOT fee simple owned mitigation sites as well as all mitigation sites that are held in Conservation Easement. This database is provided to and accessible to the public as a record of mitigation sites and their attributes, including permit conditions and prohibited activities. Information including new mitigation sites or changes in status to sites is updated at a minimum quarterly or more often as updates are needed. (http://www.arcgis.com/home/item.html?id=d560dfeb1ea443b299ca7fc68b2506b4.
3. The Service's Asheville Field Office will be notified at least one month in advance of the start of construction for all three projects to allow an opportunity to transplant specimens from project impact areas.
   Status: None of the *H. naniflora* specimens found along the former B-2119 project have ever been, or are anticipated to be, transplanted to another area.

-No other discretionary activities (i.e. rescue, relocation, augmentation or management) other than what is listed above have been or are anticipated to be undertaken by NCDOT and its partners.

The transfer of ownership of the Murray's Mill Conservation Area to the Catawba County Historical Association or some other organization or state agency is planned for the near future. NCDOT submitted a draft Conservation Plan for the Murray's Mill Conservation Area in 2006. Within this document NCDOT has taken the following conservation measures:

1. Conservation Area Established:
   - NCDOT purchased a 25.07 acre tract (Tract 1) in Catawba County on May 1, 1996 and an 8.61 ac tract (Tract 2) on March 13, 2006. These two tracts are known as the "Murray's Mill Conservation Area".

2. Management to be conducted by the Catawba County Historical Association (CCHA), assuming the transfer of ownership is to them:
   - Autumn-olive, Chinese Privet, Japanese Honeysuckle, Mimosa, Multiflora Rose were all found within the Conservation Area.
   - Signs, walking and all-terrain vehicle trails were found within the Conservation Area. Photos attached in Appendix A.2

- Currently, based on the field observations gathered during the 2013 survey, these issues noted above do not present a detrimental effect on the *Hexastylis naniflora* habitat. The exotic, invasive species currently have a low degree of threat within the Conservation Area. No management actions are recommended to be acted upon at this time.

3. Monitoring
    - Several measures found in the current draft Conservation Plan for *Hexastylis naniflora* at Murray's Mill, including monitoring interval and data collection requirements, were subsequently modified in accordance with the conditions of the R-2824 Biological Opinion. The new monitoring interval requires monitoring every two years for no more than a six year period with surveys being conducted during the USFWS recommended *Hexastylis naniflora* optimal survey window. Following the baseline data collection, monitoring will include both a quantitative and qualitative analysis. A quantitative analysis will include *Hexastylis naniflora* plant enumerations via direct plant counts and/or sample plot estimates, delineating changes to *Hexastylis naniflora* plant boundaries using GPS and GIS technologies, computing changes to acreages of occurrence areas, computing *Hexastylis naniflora* plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas. The Biological Opinion notes that plant enumeration methodologies employed will remain consistent during the monitoring period (i.e. if direct counts rather than sampled with plot estimates, then the direct count methodology will be employed throughout the remainder of the monitoring period). The qualitative analysis will include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching *Hexastylis naniflora* plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from drought or excessive precipitation, and land clearing and draining activities. As direct by the USFWS Biological Opinion the NCDOT will prepare a NC Natural Heritage Program - Endangered and Rare Plant Field Survey Form that incorporates both types of data. Currently at Murray's Mill, field monitoring was completed in 2009 by NCDOT biologists and 2011 and 2013 by Mulkey biologists.

4. Reporting:
    - The "2009 *Hexastylis naniflora* Inventory Monitoring Report, Catawba County, North Carolina" was submitted on October 11, 2010. The "2011 *Hexastylis naniflora* Inventory Monitoring Report, Catawba County, North Carolina" was submitted in 2012. The "2013 *Hexastylis naniflora* Monitoring Report, Catawba County, North Carolina" will be submitted in 2014. Monitoring information and data for 2013 surveys can be found in Appendix A.1.

5. Adaptive Management
    - A draft Conservation Plan was submitted to Catawba County Historical Association for review in 2006. However, since preparation of the draft Conservation Plan, several of the measures provided including the monitoring interval and collection requirements, have been modified following additional Section 7 Consultations and USFWS-approved monitoring report guidelines. It is recommended by the NCDOT that the advisory committee modify the current draft Conservation Plan, as appropriate, for those measures that have changed over time.

6. Modification to land uses at Murray's Mill Conservation Area:
    - Generally speaking the land use of the site has not changed. Presently some trails are present throughout the site and appear to be intermittently used by all-terrain vehicles. Some of the trails leading from the historical mill area were installed by Boy Scout troops and are occasionally lined with rock; in a few places there are also interpretive signs along the trail. Additionally, a footbridge has been installed over Balls Creek connecting the trails. Although noticeable alterations to the natural landscape, these features do not appear to be a serious threat to the goals and objectives of the Conservation Plan.

7. Modification to Boundaries of Murray's Mill Conservation Area:
    - The Bowman Tract (Tract 2) was added to the Murray's Mill Conservation Area as of March 13, 2006 in order to contribute to the goals and objectives as stated in the Conservation Plan for Murray's Mill Conservation Area.

8. Term of the plan:
    - The stated term of the Conservation Plan has not changed at this time.

References

Catawba County GIS. Parcel data. Created by Catawba County, NC, using ArcMap. Purchased on November 29, 2011.

North Carolina Drought Management Advisory Council. Catawba County Drought Advisory Data. http://www.ncdrought.org/archive/index.php Accessed on June 14, 2012.

North Carolina Department of Transportation. Conservation Plan for Murray's Mill Conservation Area. Catawba County, North Carolina. DRAFT

North Carolina Department of Transportation. 1995. Dwarf-flowered Heartleaf. Programmatic Section 7 Consultation for T.I.P. Projects: B-2119, U-2307 & U-2528AA, Catawba County, North Carolina. 4pp.

United States Fish and Wildlife Service. 2009. *Proposed Upgrade of Lovelady Road, TIP No. R-2824, in Burke County, North Carolina, and Its Effects on the Federally Threatened Dwarf-flowered Heartleaf.* Log Number 4-2-09-367.

United States Fish and Wildlife Service. 1995. *Biological Opinion of the US Fish and Wildlife Service Concerning the Effects of Construction of Three NC Department of Transportation Projects in Catawba County on the Federally Threatened Dwarf-flowered Heartleaf.* Log Number 4-2-95-102.

Appendix A.1: Monitoring data

Murray's Mill Conservation Area was monitored on October 28-30, 2013 by Mulkey biologists Brian Dustin, Mark Mickley, Tom Barrett, Christopher Dustin, Sam Beavans and Logan Williams as well as NCDOT biologists Dennis Herman and Tim Bassette. For the 2013 and the 2011 surveys, a Catawba County GIS layer was used to identify the property boundary in combination with property irons found in the field. The location of the Murray's Mill Conservation Area is shown in Figure 1. The outer limits of the *Hexastylis naniflora* population found within the Conservation Area are shown on Figure 2. A slight discrepancy between the Catawba County GIS parcel boundary and the actual boundary markers was observed by Mulkey in the field (Figures 1 and 2).

Hexastylis naniflora surveys were conducted via direct counts along ten to 50-foot wide transects. During the surveys, *H. naniflora* plants identified with single leaves or rosettes were counted as one plant in both cases. The number of plants identified on the NCDOT Tract (Tract 1) was 9,031 and 2,289 on the Bowman Tract (Tract 2) as shown in Figure 2. Table 1 compares the previous year's counts. Throughout the Bowman (Tract 2) and NCDOT (Tract 1) several lightly used foot paths were seen and documented in Appendix A.2. A variety of invasive species, including Chinese Privet, Multiflora Rose, Mimosa, Autumn-olive and Japanese Honeysuckle were observed. A list of plant species is found in the Associated Species section of the NCNHP data sheet in Appendix A.3

Table 1. Murray's Mill Conservation Area Monitoring Results for *Hexastylis naniflora*

***Hexastylis naniflora* Plant Counts**				
YEAR	**Date Surveyed**	**NCDOT (Tract 1)**	**Bowman (Tract 2)**	**Totals**
2009	29-30 September	8,861	4,201	13,062
2011	5-6, 12-13 December	10,946	3,542	14,488
2013	28-30 October	9,031	2,829	11,860

There are approximately 17.31 acres (Tract 1 = 10.71 acres; Tract 2 = 6.60 acres) of suitable habitat present within the Murray's Mill Conservation Area for *H. naniflora*. A large area of suitable habitat (1.90 acres) is located on Tract 2 along the hillslope, just northwest of Balls Creek as you enter the Conservation Area from the highway bridge. However, no *H. naniflora* plants have been identified in this area during any of the surveys. Currently, *H. naniflora* occupies 13.89 acres (15.41 acres in 2011) of the total suitable habitat area, which is 1.52 acres less than the previous survey in 2011 (Table 2).

Table 2. Murray's Mill Conservation Area Suitable and Occupied Habitat

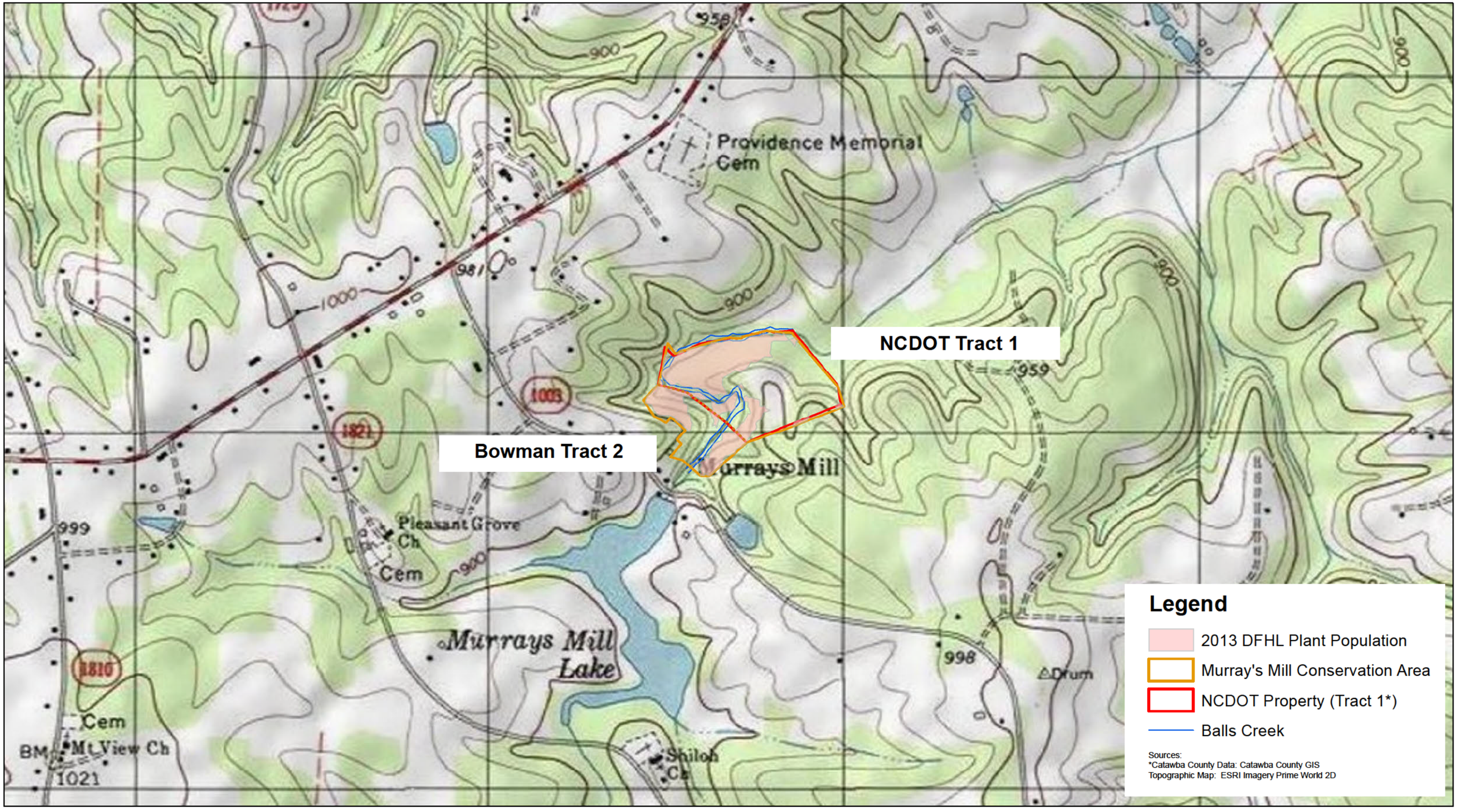
Murray's Mill Conservation Area	**MMCA (33.68 acres)**	**Tract 1 (25.07 acres)**	**Tract 2 (8.61 acres)**
2011 Suitable Habitat (acres)	19.80	12.24	7.56
2011 DFHL Occupied Area (acres)	15.41	10.71	4.70
2011 Suitable habitat, but no plants observed	**4.39**	**1.53**	**2.86**
2013 Suitable Habitat (acres)	17.31	10.71	6.60
2013 DFHL Occupied Area (acres)	13.89	9.75	4.14
2013 Suitable habitat, but no plants observed	**3.42**	**0.96**	**2.46**
2011 Suitable Habitat (acres)	19.80	12.24	7.56
2013 Suitable Habitat (acres)	17.31	10.71	6.60
Difference	**2.49**	**1.53**	**0.96**

Table 2. Continued

Murray's Mill Conservation Area	MMCA (33.68 acres)	Tract 1 (25.07 acres)	Tract 2 (8.61 acres)
2011 DFHL Occupied Area (acres)	15.41	10.71	4.70
2013 DFHL Occupied Area (acres)	13.89	9.75	4.14
Difference	**1.52**	**0.96**	**0.56**
2011 Suitable habitat, but no plants observed	4.39	1.53	2.86
2013 Suitable habitat, but no plants observed	3.42	0.96	2.46
Difference	**0.97**	**0.57**	**0.40**

There was an 18 percent decrease in the number of *H. naniflora* plants within the Conservation Area from 2011 to 2013 (Table 1). However, the 2013 *H. naniflora* population on Tract 1 still has more plants when compared to the 2009 monitoring period. The *H. naniflora* population on Tract 2 shows a decreasing trend in the number of plants on the tract during each of the last three monitoring seasons. This decreasing trend could be due to a variety of factors including foot traffic, rainfall, and natural fluctuations of the plant's physiology. One specific area (Figure 3. P1) along the banks of Balls Creek in the southeastern portion of Tract 2 showed a decrease in plants from 2011 to 2013. This area may have suffered from major rain events that caused flooding and scouring along the stream banks, which ultimately may have damaged or killed *H. naniflora* plants. The surveys for the plants were conducted outside of the normal spring blooming period during all three inventories in 2009, 2011, and 2013 (Table 1). Since these counts were conducted during the Fall and mid-Winter, the leaf fall during each count may have influenced the ability to observe the plants. Although plant numbers show a decreasing trend, a large number of single leaf plants were observed, which could indicate successful clonal reproduction at the site.

Figure 3 shows five major areas where *H. naniflora* plant boundaries changed from 2011 to 2013 and there was a decrease in plants. These five major areas show where the majority of acreage loss for the *H. naniflora* population occurs; however, it is not necessarily where the largest decrease in plant numbers occurred. Area 1 has largest amount of acreage loss at approximately 1.25 acres. With the exception of Area 1 these five areas contained single plants that formed the outer vertices of the plant boundary with significant distance and space between the main body of *H. naniflora* plants. As a result, when some of these outer edge plants were not identified in 2013, the plant boundary shrunk considerably resulting in the changes shown in Figure 3. Additionally, the reduction in the plant boundary at Area 4 could also be attributed to foot traffic from a nearby residential home, whereby plants may have been trampled. The largest decrease in plant numbers occurred within in the polygon along the east side of Balls Creek (P1) and the large polygon on Tract 1 south of Balls Creek (P2) (Figure 3).



Prepared by:

MULKEY
ENGINEERS & CONSULTANTS

Prepared for:

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Appendix A. 1

MURRAY'S MILL CONSERVATION AREA
CATAWBA COUNTY, NC

This Exhibit is for planning purposes only and information shown hereon does not meet NC 47-30 Requirements and therefore is not for design, construction, or recording or transfer of title. The Exhibit was compiled from available information obtained from the sources listed below. Streams and Wetlands: All features located in the field were recorded using a mapping grade Trimble GeoXT or GeoXH GPS receiver with supposed sub-meter accuracy.

N

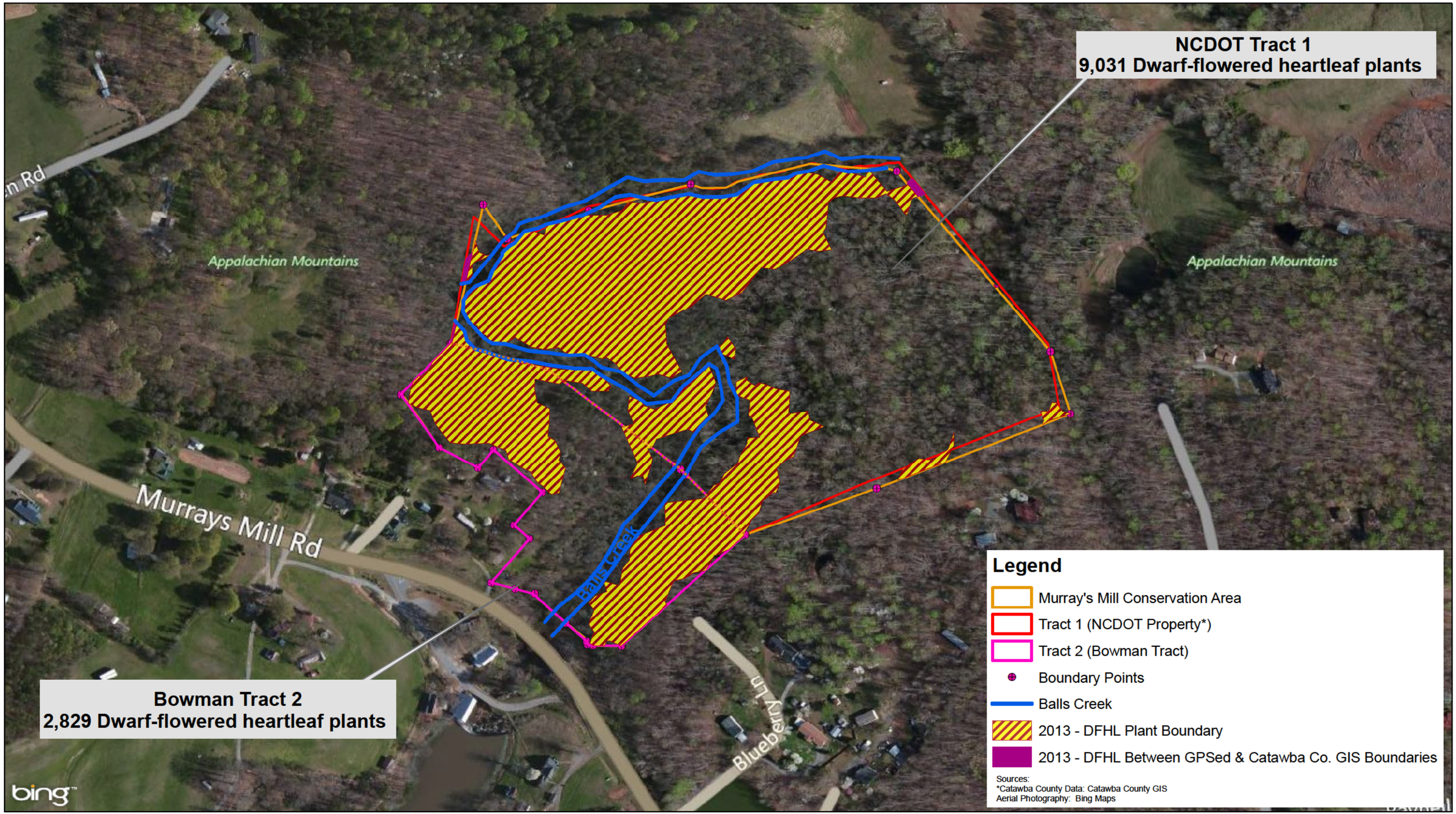
1 inch = 1,000 feet

GRAPHIC SCALE

0 500 1,000 2,000 Feet

FIGURE

1



Prepared by: MULKEY ENGINEERS & CONSULTANTS

Prepared for: STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

MURRAY'S MILL CONSERVATION AREA
CATAWBA COUNTY, NC

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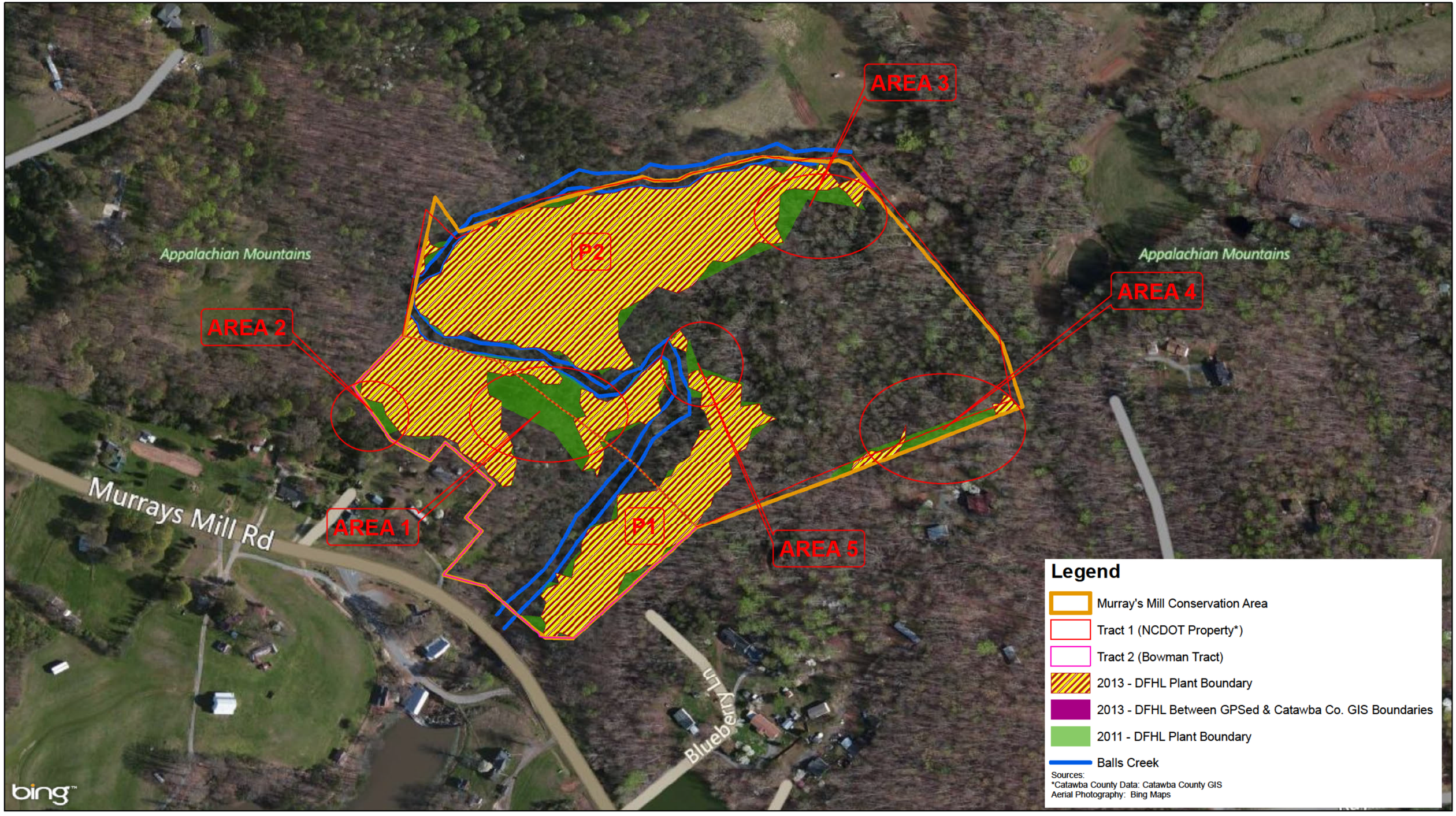
1 inch = 300 feet

GRAPHIC SCALE

0 150 300 600 Feet

FIGURE 2



Prepared by: MULKEY ENGINEERS & CONSULTANTS

Prepared for: STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

MURRAY'S MILL CONSERVATION AREA

CATAWBA COUNTY, NC

This Exhibit is for planning purposes only and information shown hereon does not meet NC 47-30 Requirements and therefore is not for design, construction, or recording or transfer of title. The Exhibit was compiled from available information obtained from the sources listed below. Streams and Wetlands: All features located in the field were recorded using a mapping grade Trimble GeoXT or GeoXH GPS receiver with supposed sub-meter accuracy.

1 inch = 300 feet

GRAPHIC SCALE

0 150 300 600 Feet

FIGURE

3

Appendix A.2 - Photo Log

NCDOT Tract 1

Four wheeler trail

Bowman Tract 2

Bridge over Balls Creek

Signage along trail

Trail Crossing

Signage along trail

Trail under Bridge

Trail with sign

North Carolina Natural Heritage Program Endangered and Rare Plant Field Survey Form

Species: ***Hexastylis naniflora*** Common name: **Dwarf-flowered Heartleaf**

Survey date: **October 28-30, 2013** EO Number (if updating existing EO): **184**

County: **Catawba** 7.5' Quad Map: **Catawba**

Coordinates (if known): Not processed per agreement with Plaintiff/Requester Not processed per agreement with Plaintiff/Requester Elevation: **840-920 AMSL**

If coordinates given, indicate coordinate system and datum (State Plane 1927 or 1983, UTM, etc): **NAD 83 State Plane NC FIPS 3200, Decimal degree**

Site Name (if this is within previously identified site): **Murray's Mill Conservation Area – The conservation area is made up of two tracts. Tract 1 is the original NCDOT Tract and Tract 2 is the Bowman Tract**

Site location and directions: (attach copy of map with site marked or use back of form to draw a sketch of the site): **See Figures 1, 2, and 3 of Appendix A.1 of the 2013 *Hexastylis naniflora* (Dwarf-flowered Heartleaf) Murry's Mill Inventory and Monitoring Report**

Number of individuals: **11,860 (Tract 1 = 9,031; Tract 2 = 2,829)**

Define individual (stem, clump, etc.): **Single stems to rosettes**

Size of area in which population occurs: **13.89 acres (Tract 1 = 9.75 acres; Tract 2 = 4.14 acres) The size of area in which the DFHL occurred in 2013 was less than the 2011 inventory (15.41 acres). This decrease in *H. naniflora* plants from year 2011 to 2013 could be due to a variety of factors including foot traffic, rainfall, and natural fluctuations of the plant's physiology. More specifically the decrease in plants from 2011 to 2013 along the southeast banks of Balls Creek of Tract 2 (P1, Figure 3), as you enter from Murray's Mill Road, could be related to major rain events that caused flooding and scouring along the stream banks, and therefore, damaged or killed *H. naniflora* plants. Another area that had a noticeable decrease in *H. naniflora* plants was on the southeastern boundary of Tract 1 (Area 4, Figure 3). This decrease could be associated with the close proximity to a residential home and foot traffic in the area which could have trampled plants. Three other areas that have had a reduction in plants between 2011 and 2013 include the relatively large area south and west of Balls Creek (Area 1, Figure 3) that straddles the boundary between the two tracts, the area immediately east of Balls Creek near the center of Tract 1 (Area 5, Figure 3), and the area just south of Balls Creek near the northern most point of Tract 1 (Area 3, Figure 3. Another theoretical explanation of the decrease in specimens of *H. naniflora* throughout both tracts may perhaps be the plant's variable vegetative characteristics, where the plants only flourish when weather conditions are favorable within the site.**

Estimate whether the entire population was surveyed, or only a portion**: Entire population within the boundaries of Murray's Mill Conservation Area (Tracts 1 and 2). The population of these tracts**

was enumerated via direct counts using field transects.

Estimated Population Viability (circle one): Excellent (Good) Fair Poor Unknown Failed to find

Population Viability Comments:

Phenology (include % or # in each stage): (vegetative 100%) bud flower

Evidence of reproduction: fruit seedlings (clonal/vegetative)

Reproduction Comments: **2009 counts = 13,062; 2011 counts = 14,488; 2013 counts = 11,860 The reproductive trend appears to be decreasing/stable, although the plant counts have declined between the 2011 and 2013 surveys the overall health of the plants present seem to be stable. A number of single leaf plants were identified during surveys, which could indicate that clonal reproduction is occurring at the site. See Appendix A.1 of the 2013 Monitoring Report for a discussion regarding the possible reasons for this decreasing trend.**

Habitat (NC NHP natural community name and description, if known; include quality, soils, geology, etc.): **The community type is a Dry Mesic Oak-Hickory Forest and the soils where the species is present are mapped as Madison-Bethlehem complex, 10-25 percent slopes, eroded, and Congaree loam 0 to 2 percent slope, frequently flooded.**

Associated species: ***Acer rubrum, Alnus serrulata, Amelanchier arborea, Asplenium platyneuron, Betula nigra, Botrychium virginianum, Campsis radicans, Carpinus caroliniana, Carya glabra, Carya tomentosa, Catalpa speciosa, Celtis laevigata, Cercis canadensis, Chasmathium laxum, Chimophila maculata, Chionanthus virginiana, Cornus amomum, Cornus florida, Corylus americana, Crataegus* sp.*, Diospyros virginiana, Elephantopus tomentosus, Euonymus americanus, Eupatorium capillifolium, Fagus grandifolia, Fraxinus americana, Galax urceolata, Goodyera pubescens, Hamamelis virginiana, Ilex decidua, Ilex opaca, Juglans nigra, Juniperus virginiana, Kalmia latifolia, Liquidambar stryaciflua, Liriodendron tulipifera, Lycopodium digitatum, Mitchella repens, Nyssa sylvatica, Oxydendrum arboreum, Osmunda cinnamomea, Parthenocissus quinquefolia, Phytolacca americana, Pinus echinata, Pinus strobus, Pinus virginiana, Polystichum acrostichoides, Populus deltoides, Prunus serotina, Quercus alba, Quercus falcata, Quercus phellos, Quercus prinus, Quercus rubra, Quercus stellata, Quercus velutina, Quercus virginiana, Rhododendron periclymenoides, Rubus argutus, Sassafras albidum, Smilax glauca, Smilax rotundifolia, Symplocos tinctoria, Thelypteris noveboracensis, Tipularia discolor, Toxicodendron radicans, Vaccinium arboreum, Vaccinium stamineum, Vaccinium vacillans, Viburnum nudum, Vitis rotundifolia, Xanthorhiza simplicissima***

Invasive species noted & degree of threat from invasive species: **The overall threat from invasive species is low on both Tract 1 and 2. The following invasive species were found throughout Murray's Mill Conservation Area:** ***Elaeagnus umbellata*****,** ***Ligustrum sinense*****,** ***Lonicera japonica*****,** ***Albizia julibrissin*****,** ***Rosa multiflora*****.**

Area of apparently suitable habitat (suitable for, but not necessarily occupied by the species): **There are approximately 17.31 acres (Tract 1 = 10.71 acres; Tract 2 = 6.60 acres) of suitable habitat within the MMCA, including 1.90 acres on the slope above Balls Creek in Tract 2 as you enter the area from the Murray's Mill Road Bridge where** ***H. naniflora*** **has never been observed. An**

estimated 19.80 acres of suitable habitat was reported in 2011; a difference of 2.49 acres. Dwarf-flowered Heartleaf occupies 13.89 acres (15.41 acres in 2011) of the suitable habitat.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way?
There are *H. naniflora* plants in suitable habitat outside the Conservation Area's ROW, but within the ROW on the southwest side of the current vehicular bridge (B-2119) over Balls Creek on SR 1003. These plants were not counted during the 2013 Murray's Mill Conservation Area's inventory.

Topographic position (examples: crest, mid slope, alluvial, etc): **The plants were found from within the banks of Balls Creek moving up to mid-slope.**

Moisture regime (examples: inundated, dry, seasonally wet, etc): **Mesic, well-drained soils.**

Light (examples: open, woodland, closed canopy, etc):
Mature canopy allowed for some filtered light. The understory varied from very open to dense mountain laurel thickets.

Other information: **The plants were observed on north, northwest, and northeast facing slopes**.

Protection / management needs and opportunities:
The population is protected in perpetuity as part of the Murray's Mill Conservation Area. NCDOT prepared a draft Conservation Plan for the Murray's Mill Conservation Area and submitted it to the Catawba County Historical Association (CCHA). The CCHA never commented or listed future plans for the conservation area.

Landowner(s), if known: **NCDOT**

Person making this report, Address, & Phone: **Brian Dustin, Mulkey Biologist, 6750 Tryon Rd., Cary, NC 27518**

The report was prepared on behalf of NCDOT – Biological Surveys Group (contact info: Dennis Herman, 919-707-6127)

Other observers: **Tom Barrett, Mark Mickley, Christopher Dustin, Sam Beavans, Logan Williams, Tim Bassette and Dennis Herman**

Specimens collected (permits are required for federal or state listed species)? Collection #: **No**

Repository:

Species: *Hexastylis naniflora* (Dwarf-flowered heartleaf)

Site: [Gunpowder Creek] (Caldwell County)

NC NHP EO number(s): 77

NCDOT Point of Contact (POC): Heather Wallace, Tim Bassette

Signed ROW occurrence? no

Site management plan: n/a

Site protections:
Three Subpopulations of DFHL are located at this site. Subpopulation A is located in the southwest quadrant, Subpopulation B in the Northwest quadrant, and Subpopulation C in the northeast quadrant. Subpopulations A and B were discovered in 2000, and Subpopulation C was not discovered until 2005. At present, Subpopulation B is located entirely within NCDOT right-of-way, while the other subpopulations are located partially in a right-of-way area, and the remainder lies on adjacent private property. DOT is monitoring the entire population, which constitutes all of NC NHP EO 77.

A Biological Assessment was completed for The Replacement of Bridge No. 90 on SR 1718 (Deal Mill Road) over Gunpowder Creek (TIP B-3126) in 2003, and a subsequent Biological Opinion was issued later that year. After Subpopulation C was discovered, the Biological Assessment was amended in 2006, and an amended Biological Opinion followed later that year. Project construction began in 2006. *There are some discrepancies in plant counts listed in various documents. The information provided here is presented to the best of our knowledge after reviewing all available information.*

Per the Amended Biological Opinion, NCDOT agreed to protect 90 plants within Subpopulation C by acquiring additional right-of-way. No other plants were agreed to be protected. However, additional right-of-way was acquired on the west side of Deal Mill Road for a stream mitigation project. In so doing, additional plants were thereby protected. (After conducting monitoring in 2013, it was determined that 37 plants from Subpopulation B and 52 plants from Subpopulation A are also under protection. In addition, 201 plants in Subpopulation C now exist within the expanded right-of-way, and therefore are also under protection.)

An additional conservation measure included in the 2006 amended Biological Opinion states that NCDOT/FHWA agreed to fund a temporary staff position for two months to assist the USFWS Recovery Coordinator with the 5-year status review for *H. naniflora*. This condition became unnecessary due to the additional plants that were protected in the expanded right-of-way areas.

Despite impacts to the subpopulations due to road construction, there are more plants in each of the subpopulations now than were counted when they were originally discovered. Table 1 shows the subpopulation trends since discovery.

***There is information within the Element Occurrence file at NCNHP that alludes to this population being a mixture of *H. naniflora* and *H. heterophylla,* or perhaps a hybrid of the two. Since there is no

documentation on file at NCDOT to corroborate this assessment, NCDOT has contracted with Appalachian State University to determine the species present at this site, among others, through the use of genetic and morphological analysis.

During the 2013 monitoring event, *Hexastylis arifolia* was identified as a component of the herb layer within the bounds of this population. These plants were not included in the count totals for this monitoring event.

Origin of species at this site: native

Status of species at this site: extant

Species short-term trend at this site (relative to last count): decreasing

Species long-term trend at this site (averaged over multiple counts): increasing

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Status of NCDOT commitments pledged during ESA Section 7 consultations:
NCDOT project ID: B-3126
USFWS log number: 4-2-03-415

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence):
From pages 31-34 of the Biological Assessment for TIP R-2824 (Proposed Upgrade of Lovelady Road (dated May 2009), and Appendix B of the Biological Opinion for the same project (dated November 13, 2009), NCDOT committed to assist USFWS with the five-year review process by providing information about several populations of DFHL that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure for R-2824.) The population of DFHL associated with B-3126 is included in this group.

Because DFHL is located within the right-of-way of B-3126, NCDOT will monitor this occurrence, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:

- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using GPS/GIS, computing changes to acreages of occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program – Endangered and Rare Plant Field Survey Form that incorporates both types of data.

- Analyze population trends by comparing recent size estimates to data from previous years.

NCDOT biologists counted plants in each subpopulation several times prior to construction. However, methods for enumerating plants were inconsistent. Beginning with the first monitoring phase in 2011, methods will be consistent to allow for better ability to track population trends.

Baseline data was collected by NCDOT biologists in 2000, 2003, 2005, and 2006, prior to project construction. Counts were also conducted by NCDOT biologist in November 2011, following completion of project construction. On May 15, 2013 RK&K biologists visited the site and conducted annual monitoring. All tasks listed above were completed and results will be included in the spreadsheet to be submitted to USFWS by January 1, 2014. To be consistent with the baseline data collection, plants were enumerated via direct count. Plant counts are documented in Table 1. The subpopulation boundaries have changed dramatically since the subpopulations were delineated in 2006. Habitat quality has changed slightly due to clearing of the right-of-way adjacent to the roadway, but dominant species have remained the same. Plants that lie within the ROW appear to be healthy. No other changes to habitat quality were observed. A NC NHP form was completed. Population trends at this site reveal that the number of plants and the density of the population have increased since pre-construction.

Table 1 and Figure 1 (attached) provide additional information on these subpopulations.

Status of terms and conditions from applicable NC Plant Conservation Program permits:
N/A. No plants collected from this site by NCDOT.

Discretionary actions undertaken by NCDOT and partners:
N/A

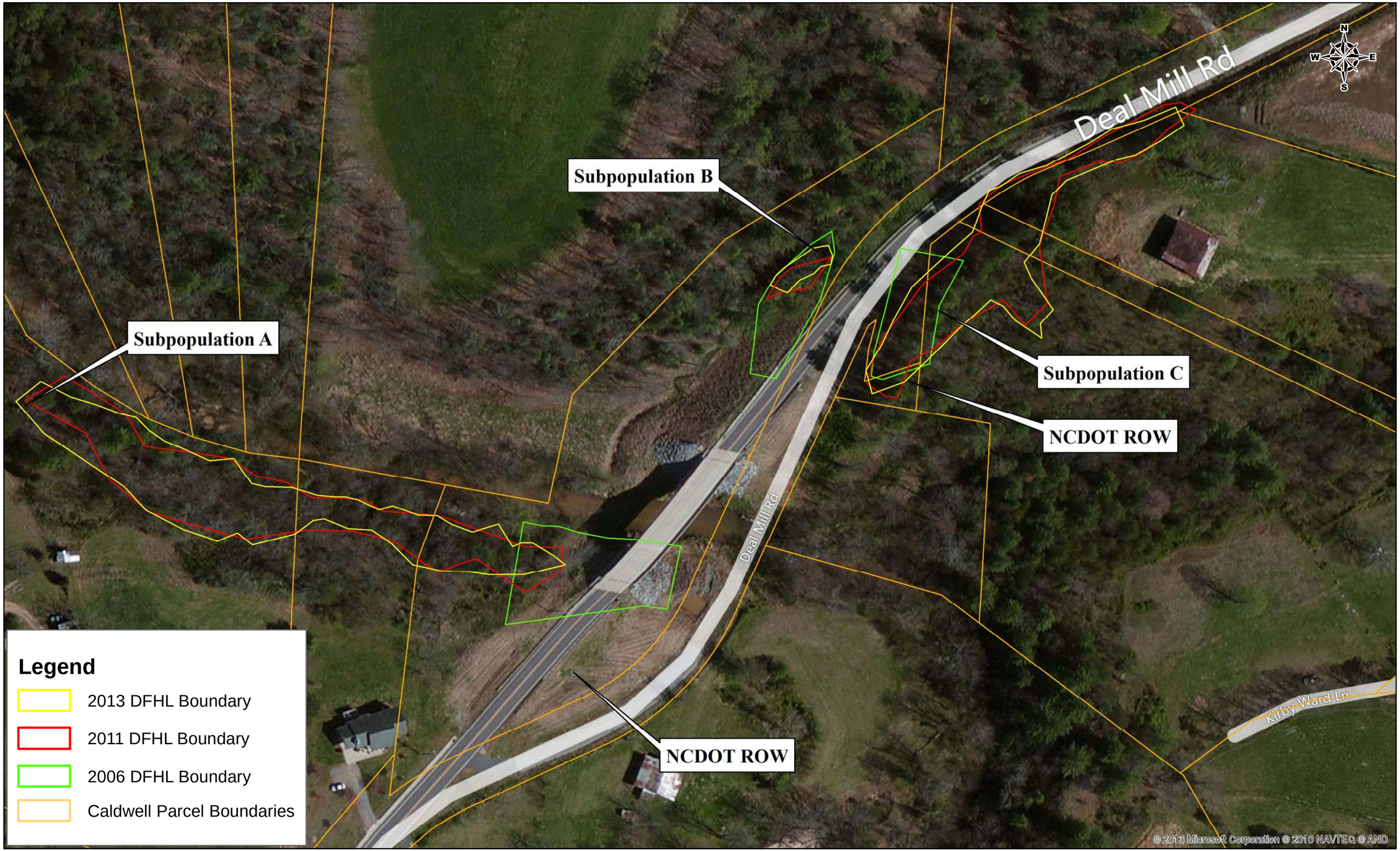
Table 1. Gunpowder Creek *Hexastylis naniflora* Subpopulation Trends

Sub-population	2000 Total Count	2003 Total Count	2005 Total Count	2006 Count Inside ROW, impacted by construction*	2006 Not Impacted By Construction	2006 Total Count	2011 Count Inside ROW**	2011 Count Outside ROW	2011 Total Count	Relative number since discovery
A	30	80	150	44	106	150	107	320	427	+397
B	30	50	67	67	0	67	33	0	33	+3
C	n/a	n/a	163	73	90	163	197	74	271	+108
Total	60	130	380	184	302	380	337	394	731	+508

Sub-population	2013 Count Inside ROW**	2013 Count Outside ROW	2013 Total Count	Relative number since discovery
A	52	290	342	+312
B	37	0	37	+7
C	201	37	238	+75
Total	290	327	617	+394

* Number of plants impacted by construction activities

** Number of plants protected within established ROW following construction



Gunpowder Creek Hexastylis naniflora On-Site Preservation Areas, Caldwell County, NC

0 50 100 200 300 Feet

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* Common name: Dwarf-flowered heartleaf

Survey date: 05/15/13 7.5' Quad Map: Granite Falls

County: Caldwell Elevation: 1170'-1180'

Site location and directions: (**attach copy of map with site marked or use back of form to draw a sketch of the site**): EO 77. See attached mapping for location of each subpopulation.

SPECIES INFORMATION

Define individual (**stem, clump, etc.**): clump

Number of individuals: Subpop A: 342,
Subpop B: 37, Subpop C: 238

Size of area in which population occurs: A: 0.78 ac. B: 0.03 ac. C: 0.59 ac.

Phenology: vegetative Evidence of reproduction: seedlings
clonal/vegetative

Habitat (**NC NHP natural community name and description; include quality, soils, geology, etc.**): Pacolet and Cewacla soils; Dry-Mesic Oak-Hickory Forest; medium quality. Forest cover types are fairly similar amongst the three subpopulations. The canopy is dominated by Quercus alba, Q. rubra, Carya glabra, Acer rubrum, Prunus serotina, Liriodendron tulipifera, and Pinus strobus. The understory consists of Carpinus caroliniana, Oxydendrum arboretum, Acer rubrum, Cornus florida, Ilex opaca. The shrub layer includes Kalmia latifolia, Leucothoe axillaris var. editorium, and Euonymus americanus. Woody vines included Bignonia capreolata, Vitis rotundifolia, and Toxicodendron radicans. The herb layer is sparse to moderately dense and includes Hexastylis naniflora, Goodyera pubescens, Aplectrum hyemale, Mitchella repens, Chimaphila maculata, Polystichum acrostichoides, Tiarella sp., and Desmodium nudiflorum.

Invasive species noted & degree of threat from invasive species: Lonicera japonica is prevalent in subpop A. Some Ligustrum sinense is present in subpopulation A.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? Any suitable habitat that exists outside the ROW is already occupied by HENA.

Topographic position (examples: crest, mid slope, alluvial, etc): Subpop A on north and northwest-facing slopes, Subpops B and C on .northwest and west-facing slopes. Low, mid, and upper-slopes.
Micro-relief (examples: flat, concave, rippled, etc): flat, concave, convex, drop-off

Moisture regime (examples: inundated, dry, seasonally wet, etc): dry

Light (examples: open, woodland, closed canopy, etc): filtered through woodland canopy

Other information: All three subpopulations were impacted by construction of the replacement bridge over Gunpowder Creek and the associated realignment of Deal Mill Road. However, it appears as though most of them have expanded in size since these impacts occurred. Information regarding population trends will be reported in annual monitoring reports submitted to USFWS and NHP.

Protection / management needs and opportunities: Plants are included in a conservation easement established by NCDOT in 2006.

Landowner(s), if known: NCOT ROW (partial)

Person making this report: Pete Stafford Search time: May 15, 2013 8 am to 6 pm
Address: 900 Ridgefield Drive Suite 350 Raleigh NC 27609 Phone: 919-878-9560
Other observers: Allen Tutt (RK&K)

Specimens collected? no Collection #: Repository:
(**permits are required for federal or state listed species**)
Return form to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601

2010
Dwarf-flowered Heartleaf, *Hexastylis naniflora,* Inventory and Monitoring Report

Contact Person:
Dennis W. Herman
Environmental Program Consultant
North Carolina Department of Transportation
Natural Environment Unit
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919.431.6624
dwherman@ncdot.gov

December 31, 2010

Table of Contents

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Site: EO 157 (Cleveland County)

NC NHP EO number(s): 157

Signed ROW occurrence? No

NCDOT Point of Contact (POC): Dennis Herman (Tim Bassette)

Site management plan: The site boundary is well outside of the ROW. NCDOT is not responsible for the future monitoring of this EO.

Site protections: Future road paving plans will have no effect on the DFHL population at this site.

Origin of species at this site: Native.

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable. HDR (2005) estimated the population at 1,394 plants based on 10 individual 1/100 acre study plots. The population was visited on 1 December 2010 and **330 plants** were counted. This count is probably higher due to the heavy leaf cover observed during the inventory.

Species long-term trend at this site (averaged over multiple counts): This population should remain stable unless the land use changes drastically because of the current landowner.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID:

USFWS log number:

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): The NCDOT is not responsible for the continued monitoring of this population because it is outside of the current ROW.

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s):

Description: N/A

Other actions undertaken by NCDOT and partners:

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): Per agreement with USFWS.

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s): N/A

Description:

Discretionary actions undertaken by NCDOT and partners:

December 1, 2010 inventory and monitoring conducted.

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Site: EO 158 (Catawba County)

NC NHP EO number(s): 158

Signed ROW occurrence? No

NCDOT Point of Contact (POC): Dennis Herman (Tim Bassette)

Site management plan: NCDOT is responsible for monitoring this population per our agreement with USFWS as stated in the Lovelady Road BO. Much of this population, which includes the east and west side of SR 1115, is outside of the ROW.

Site protections: Future road improvement plans may effect portions of the DFHL population adjacent to the existing road.

Origin of species at this site: Native.

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable. HDR (2005) did a direct count of this population and counted 325 plants on the east side of SR 1115 and 9 plants on the west side for 334 total plants. Bassette (2003) counted 357 plants on the east side of the road and 189 on the west side for a total 546 plants. We inventoried the population on December 1, 2010 and counted **312** plants on the east side of the road and **223** on the west side for a total of **535** plants. This recent count is probably higher due to the heavy leaf cover observed during the inventory.

Species long-term trend at this site (averaged over multiple counts): This population should remain stable unless the land use changes drastically because of the current landowner, or future road improvement projects.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID:

USFWS log number:

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): This was the first inventory of this population under the NCDOT's commitment per the Lovelady BO. The next scheduled inventory will take place in **2012?**

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s):

Description: N/A

Other actions undertaken by NCDOT and partners:

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): USFWS BO.

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s): N/A

Description:

Discretionary actions undertaken by NCDOT and partners:

December 1, 2010 inventory and monitoring conducted.

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Site: EO 162 (Catawba County)

NC NHP EO number(s): 162

Signed ROW occurrence? No

NCDOT Point of Contact (POC): Dennis Herman (Tim Bassette)

Site management plan: NCDOT is responsible for monitoring this population per our agreement with USFWS as stated in the Lovelady Road BO.

Site protections: Future road improvement plans may effect the DFHL plants along the ditch adjacent to the existing road.

Origin of species at this site: Native.

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable. HDR (2005) did a direct count of this population and counted 25 plants on the south side of SR 1473 (8th Avenue). We inventoried the population on December 20, 2010 and counted **23** plants. This recent count is probably higher due to the heavy leaf cover observed during the inventory.

Species long-term trend at this site (averaged over multiple counts): This population should remain stable unless there is a future road improvement project.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID:

USFWS log number:

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): This was the first inventory of this population under the NCDOT's commitment per the Lovelady BO. The next scheduled inventory will take place in **2012?**

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s):

Description: N/A

Other actions undertaken by NCDOT and partners:

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): USFWS BO.

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s): N/A

Description:

Discretionary actions undertaken by NCDOT and partners:

December 20, 2010 inventory and monitoring conducted.

Appendix A: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

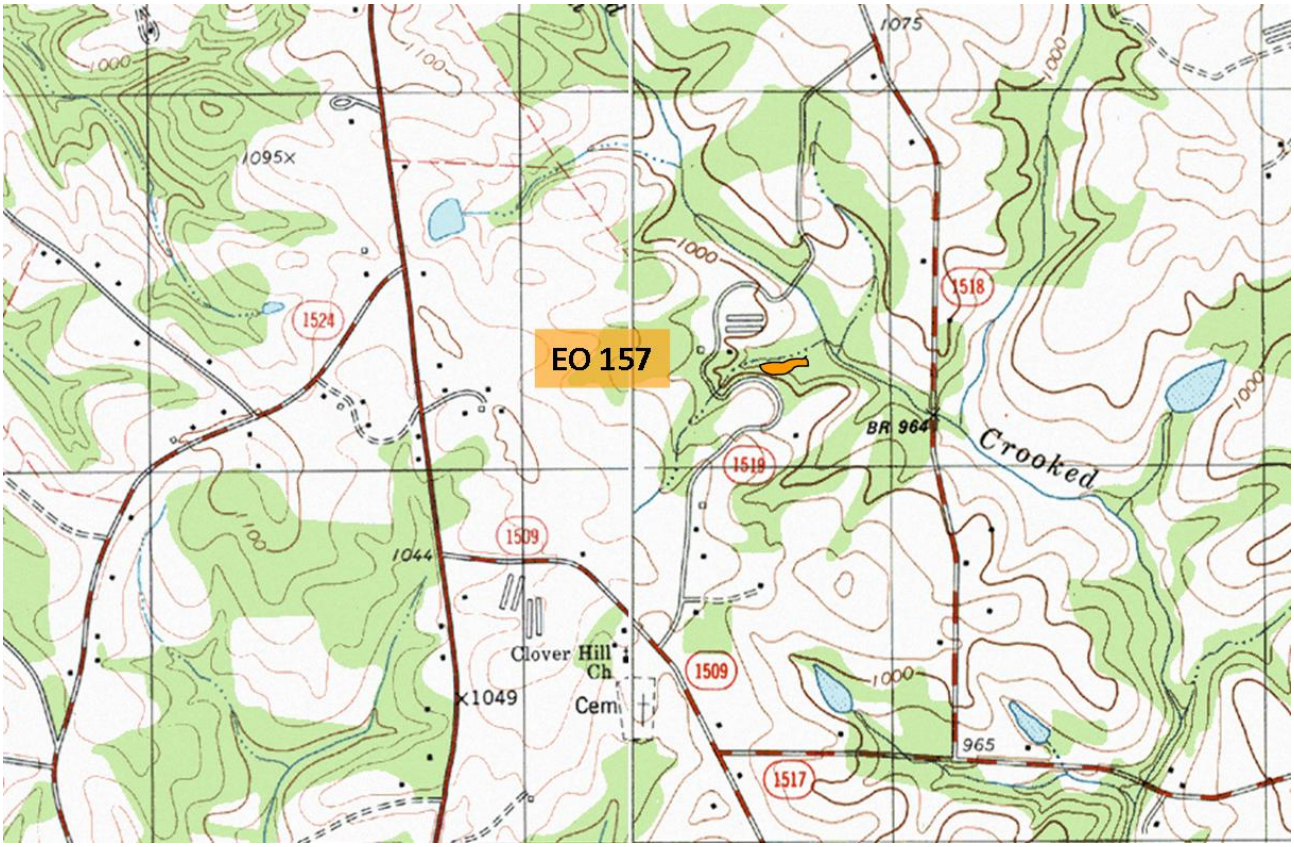
Appendix A.1: Monitoring data

Appendix A.2: EO 157 (Cleveland County)

EO 157 was inventoried and monitored on December 1, 2010 by Tim Bassette, Steve Mitchell, Jared Gray, Matt Haney, and Dennis Herman (NCDOT biologists). The DFHL were counted on the east side of SR 1519 (Grady McNeilly Road). **330** total *H. naniflora* plants were direct-counted on the slope above the stream.

This population is outside of the current ROW. HDR (2005) estimated the population at 1,394 plants based on 10 individual 1/100 acre study plots. We did a direct count during our visit and found many plants that were obscured by the heavy leaf cover we observed. This population appears to be stable and safe from any future road improvement (paving) projects.

Appendix A.2.1: Figure 1. EO 157 Map



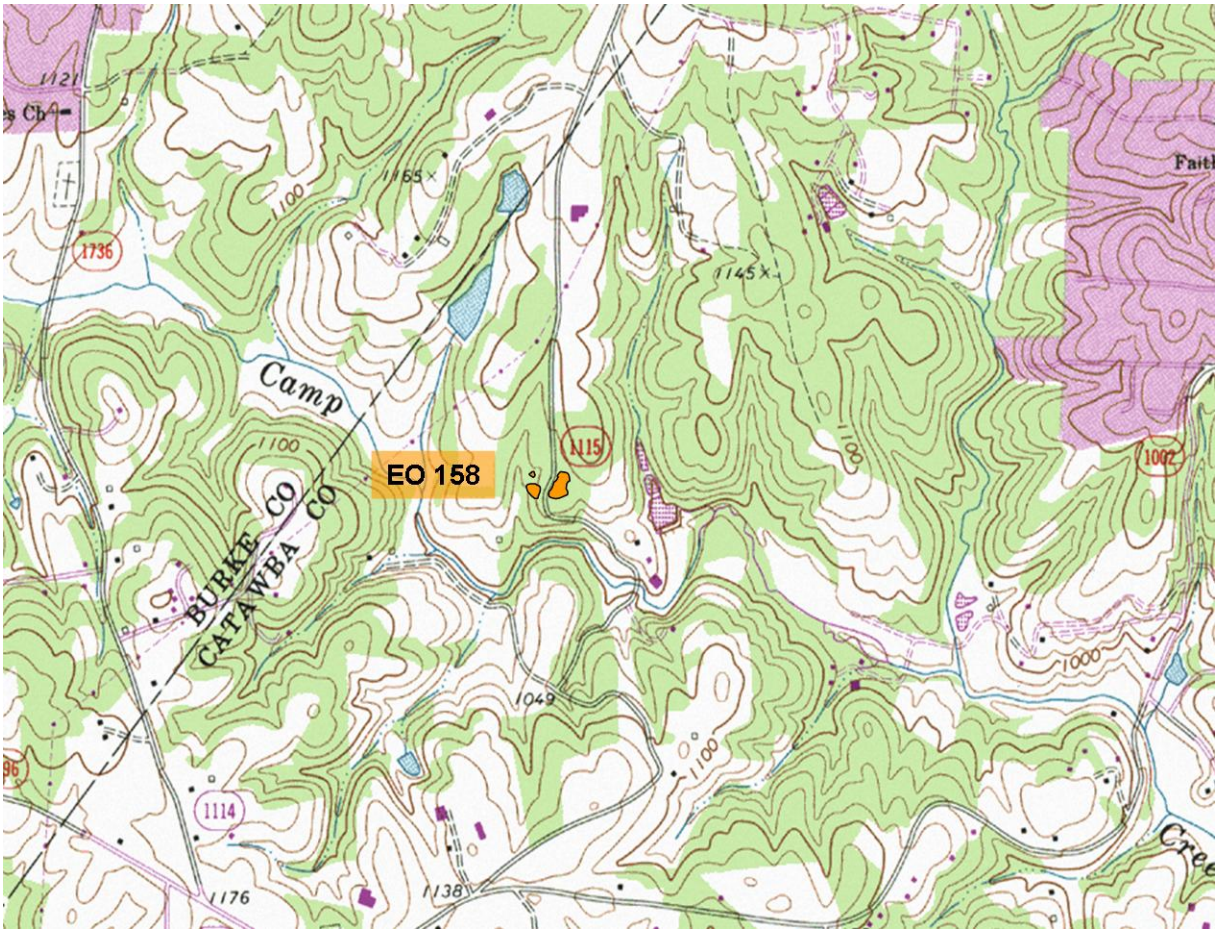
Appendix A.3: EO 158 (Catawba County)

EO 158 was inventoried and monitored on December 1, 2010 by Tim Bassette, Steve Mitchell, Jared Gray, Matt Haney, and Dennis Herman (NCDOT biologists). This EO occurs on the east and west sides of SR 1115 (Camp Creek Road). **312** *H. naniflora* plants were direct-counted on the east side of SR 1115 and **223** plants were counted on the west side. The plants on the west side of the road were separated by an unimproved driveway (1387 Camp Creek Rd. address), a small area was counted (**12** plants) on the north side of the drive and a larger area on the south side (**211** plants). The total population is estimated at 535 plants, but the heavy leaf cover probably obscured others.

HDR (2005) counted a total **334** plants (direct count); **325** on the east side of SR 1115 and **9** on the west side. They calculated the plant density at 1,392 plants per acre. Bassette (2003) estimated the population at **546** plants in 2001; **357** on the east side of SR 1115 and **189** on the west side. The current count is very close to the total Bassette estimated in 2001.

The population appears to be stable, and many small plants were observed. Most of the population is outside the current ROW, but will be monitored and inventoried by NCDOT per the USFWS agreement. The plants along the east side road embankment may be threatened by future road improvement projects and several have been sprayed by the power company that maintains the nearby poles.

Appendix A.3.1 Figure 2. EO 158 Map



Appendix A.3.2: Plant Species List for DFHL EO 158 (Catawba County)

Plants

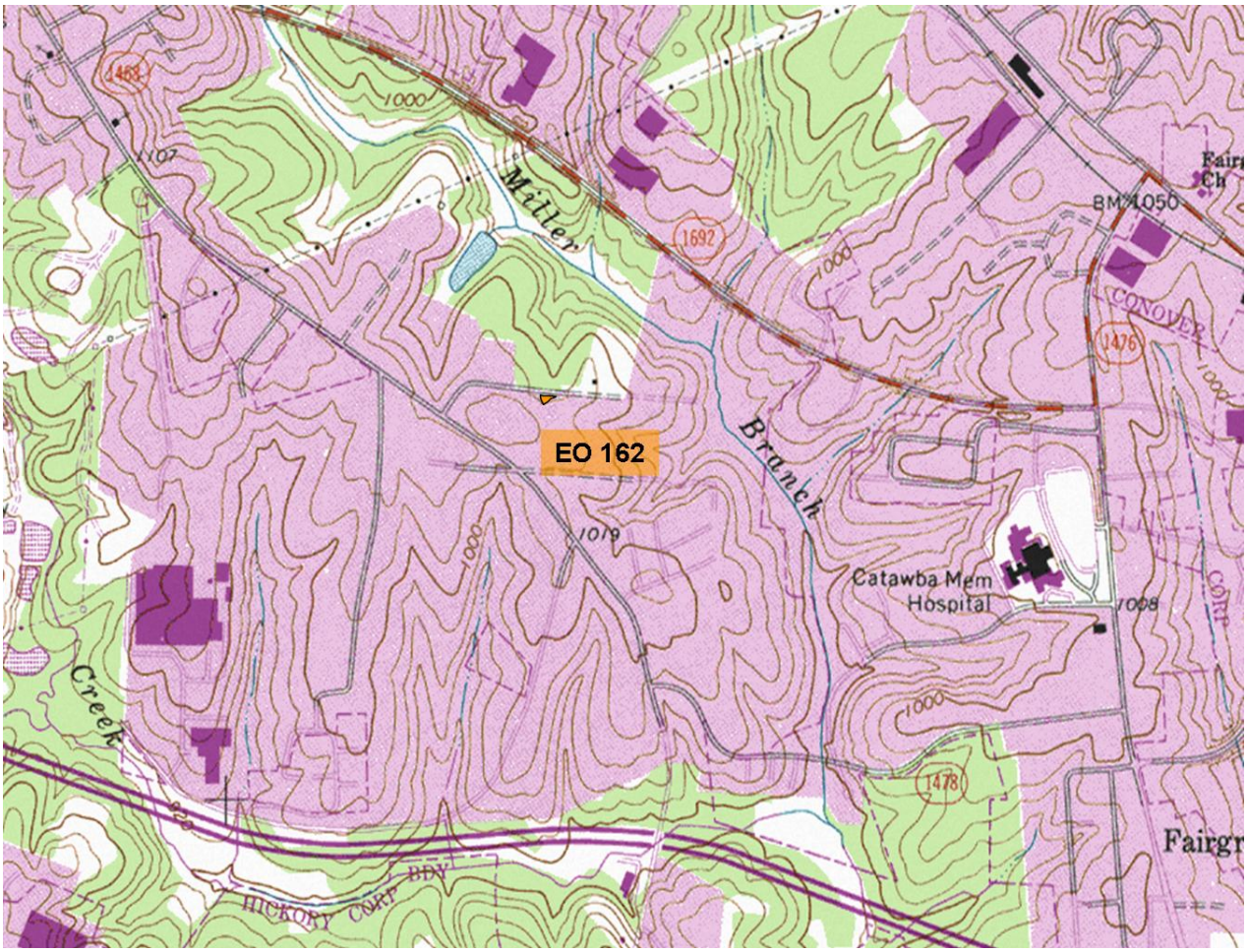
Acer rubrum	Red maple
Asplenium platyneuron	Ebony spleenwort
Athyrium asplenioides	Southern lady fern
Carpinus caroliniana	Ironwood
Chimophila maculata	Spotted wintergreen
Cornus florida	Flowering dogwood
Euonymus americanus	Strawberry bush
Fagus grandifolia	American beech
Hexastylis naniflora	Dwarf-flowered heartleaf
Ilex opaca	American holly
Juniperus virginiana	Eastern red cedar
Kalmia latifolia	Mountain laurel
Ligustrum sinense	Chinese privet
Lonicera japonica	Japanese honeysuckle
Oxydendrum arborea	Sourwood
Pinus strobus	White pine
Pinus taeda	Loblolly pine
Pinus virginiana	Virginia pine
Polystichum acrostichoides	Christmas fern
Prunus serotina	Black cherry
Quercus alba	White oak
Quercus rubra	Northern red oak
Rubus sp.	Blackberry
Smilax rotundifolia	Roundleaf greenbrier
Tipularia discolor	Cranefly orchid
Toxicodendron radicans	Poison ivy
Vaccinium sp.	Blueberry
Vitis sp.	Wild grape

Appendix A.4: EO 162 (Catawba County)

This population is located on a north facing slope on the south side of SR 1473 (8th Avenue) in Hickory, Catawba Co. near Miller Branch.

EO 162 was inventoried and monitored on December 20, 2010 by Tim Bassette, Jared Gray, Neil Medlin, and Dennis Herman (NCDOT biologists). This EO occurs on the south side of SR 1473 (8th Avenue). **23** *H. naniflora* plants were direct-counted in the 0.04 ac plot. The last count performed at this site was 25 plants, but the heavy leaf cover probably obscured others.

Appendix A.4.1: Figure 3. EO 162 Map



Appendix A.4.2: Plant Species List for DFHL EO 162 (Catawba County)

Plants

Acer rubrum	Red maple
Carya tomentosa	Mockernut hickory
Chimophila maculata	Spotted wintergreen
Cornus florida	Flowering dogwood
Euonymus americanus	Strawberry bush
Fagus grandifolia	American beech
Hexastylis naniflora	Dwarf-flowered heartleaf
Ilex opaca	American holly
Juniperus virginiana	Eastern red cedar
Lonicera japonica	Japanese honeysuckle
Microstegium vimineum	Japanese stiltgrass
Oxydendrum arborea	Sourwood
Pinus strobus	White pine
Pinus virginiana	Virginia pine
Polystichum acrostichoides	Christmas fern
Pueraria lobata	Kudzu
Quercus alba	White oak
Quercus Montana	Chestnut oak
Quercus rubra	Northern red oak
Rubus sp.	Blackberry
Smilax sp.	Greenbrier
Tipularia discolor	Cranefly orchid
Toxicodendron radicans	Poison ivy
Vaccinium vacillans	Low sweet blueberry

Table of Contents

Species: *Hexastylis naniflora* (Dwarf-flowered heartleaf)

Site: [Buffalo Shoals Creek/Eufola Road] (Iredell County)

NC NHP EO number(s): 275

NCDOT Point of Contact (POC): Heather Renninger, Tim Bassette

Signed ROW occurrence? no

Site management plan: n/a

Site protections:
Previously, seven plants were going to be directly impacted by the cut slope in the southwest quadrant. However, the design plans were modified to avoid the plants by tightening the cut slopes in that area to 1.5:1. No formal consultation was necessary, as no adverse effects from construction of this project were expected. A very small portion of this population (approximately 30 plants) lies within NCDOT right-of-way. This DFHL population is located partially in a signed right-of-way area, and the remainder lies on adjacent private property. DOT is monitoring the entire population, which constitutes all of NC NHP EO 275.

Origin of species at this site: native

Status of species at this site: extant

Species short-term trend at this site (relative to last count): stable, increasing slightly

Species long-term trend at this site (averaged over multiple counts): stable, increasing slightly

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Status of NCDOT commitments pledged during ESA Section 7 consultations:
NCDOT project ID: B-2146
USFWS log number: 4-2-09-367

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence):
From pages 31-34 of the Biological Assessment for TIP R-2724 (Proposed Upgrade of Lovelady Road (dated May 2009), and Appendix B of the Biological Opinion for the same project (dated November 13, 2009), NCDOT committed to assist USFWS with the five-year review process by providing information about several populations of DFHL that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure for R-2824.) The population of DFHL associated with B-2146 is included in this group.

Because DFHL is located within the right-of-way of B-2148, NCDOT will monitor this occurrence, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:

- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using GPS/GIS, computing changes to acreages of occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program – Endangered and Rare Plant Field Survey Form that incorporates both types of data.
- Analyze population trends by comparing recent size estimates to data from previous years.

Baseline data was collected by NCDOT biologists on July 11, 2007, prior to project construction. On November 9, 2010 NCDOT biologists visited the site and conducted annual monitoring. All tasks listed above were completed and results will be included in the spreadsheet to be submitted to USFWS by January 1, 2010. To be consistent with the baseline data collection, plants were enumerated via direct count. Two hundred thirty plants (230) were counted in this population. The population boundary has not changed since the baseline count was conducted in 2007, so no GPS delineation was necessary. Habitat quality has changed slightly due to clearing of the right-of-way adjacent to the roadway. Clearing was kept to a minimum, and stumps were left in place. Plants that lie within the ROW appear to be healthy. No other changes to habitat quality were observed. A NC NHP form was completed. Population trends at this site reveal that the number of plants and the density of the population has increased since 2007.

Status of terms and conditions from applicable NC Plant Conservation Program permits:

N/A. No plants collected from this site.

Discretionary actions undertaken by NCDOT and partners:

N/A

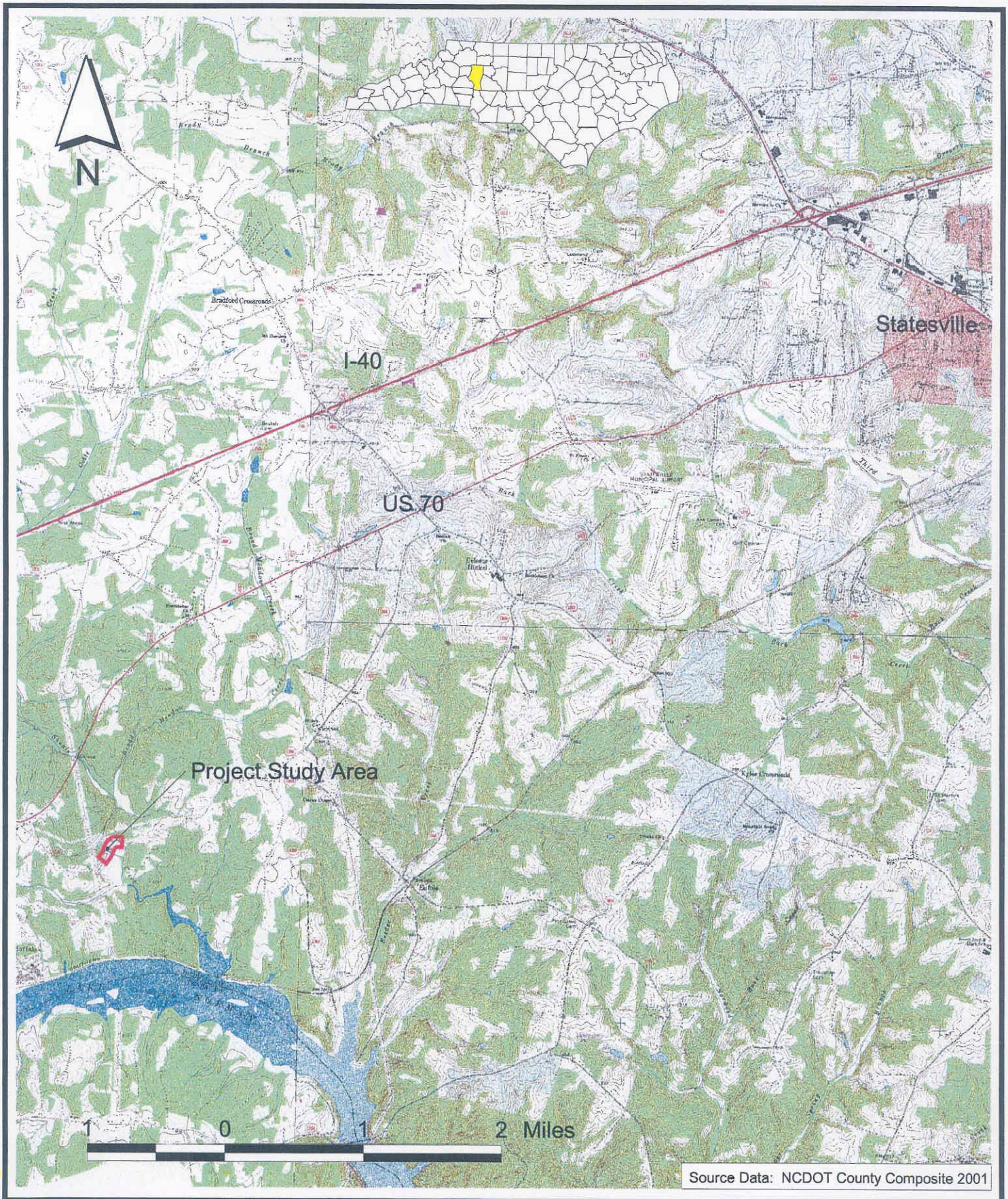
Appendices

Recommend one appendix per species, subdivided into sections as needed to present information from different sites/projects. Monitoring data (in Excel spreadsheets) should be provided here, as should any maps necessary to understand the narratives presented in the body of the report. If the narratives reference site-specific locations of monitoring or management actions, maps should be provided OR referenced from the BA/BO. If the BA/BO did not contain appropriate figures, they should be included here.

(Follow same sort order presented in main body of report. Identify the content and provide file names of documents included separately (e.g., in another format (PDF, Excel, etc.).)

Appendix A: *Hexastylis naniflora* (Dwarf-flowered heartleaf)

Appendix A.1 Monitoring data (all sites) – reference one or more excel files, as appropriate



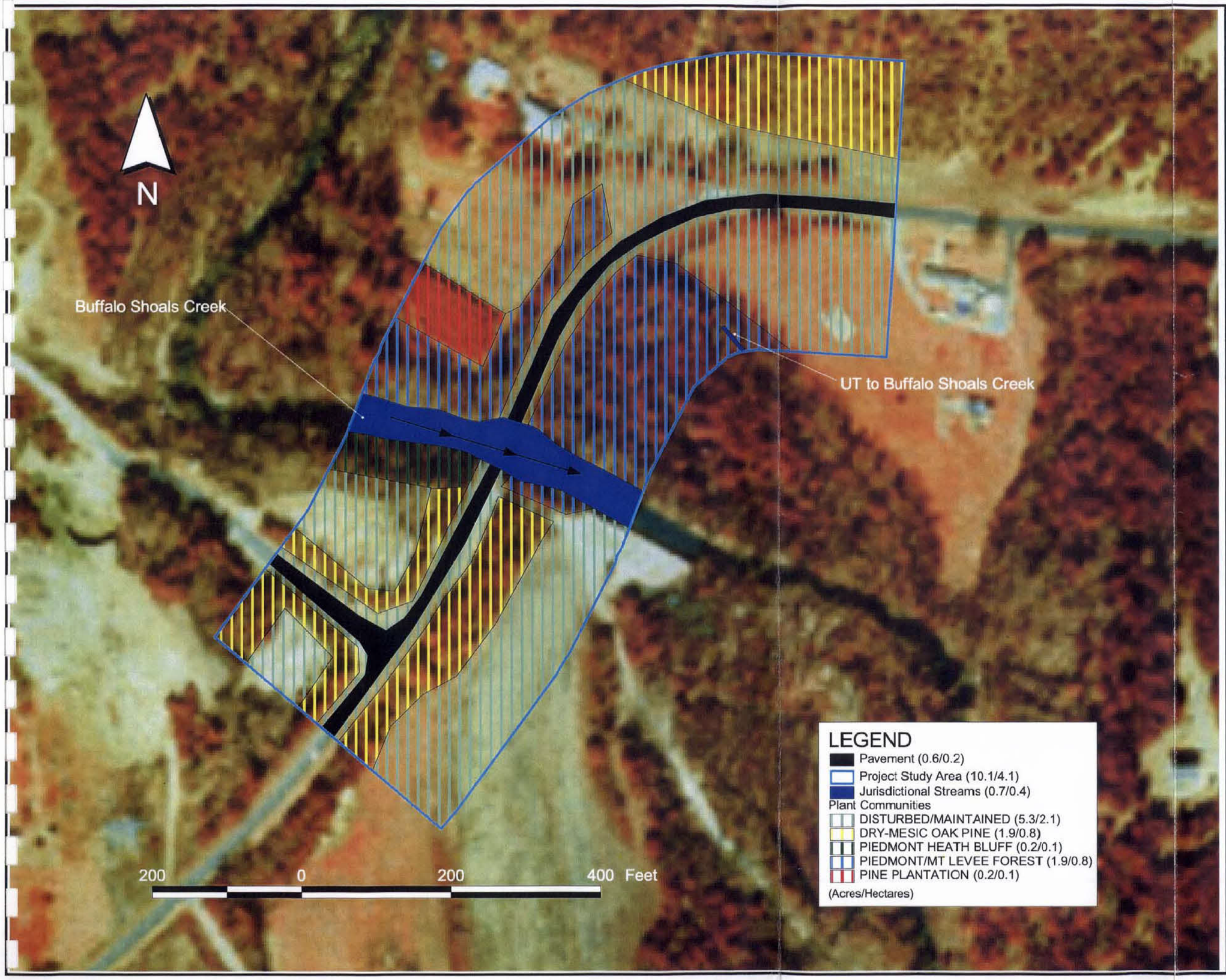
EcoScience Corporation
1101 Haynes Street, Suite 101
Raleigh, North Carolina 27604
919-828-3433 Fax: 919-828-3518
ecosciencenc.com

Project Location

Replacement of Bridge No. 86
SR 1333 over Buffalo Shoals Creek
B-2146
Iredell County, North Carolina

Dwn by:	KCW
Scale:	1:60,000
Date:	April 2003
Project:	03-138

Figure 1



EcoScience Corporation
1101 Haynes Street, Suite 101
Raleigh, North Carolina 27604
Ph: 919 828 3433
Fax: 919 828 3518

Client:

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Project:

Replacement of Bridge No. 86
SR 1333 over Buffalo Shoals Creek
Iredell County, North Carolina
(B-2146)
(State Project No. 8.2822801)
(Federal Aid No. BRZ-1333[5])

Title:

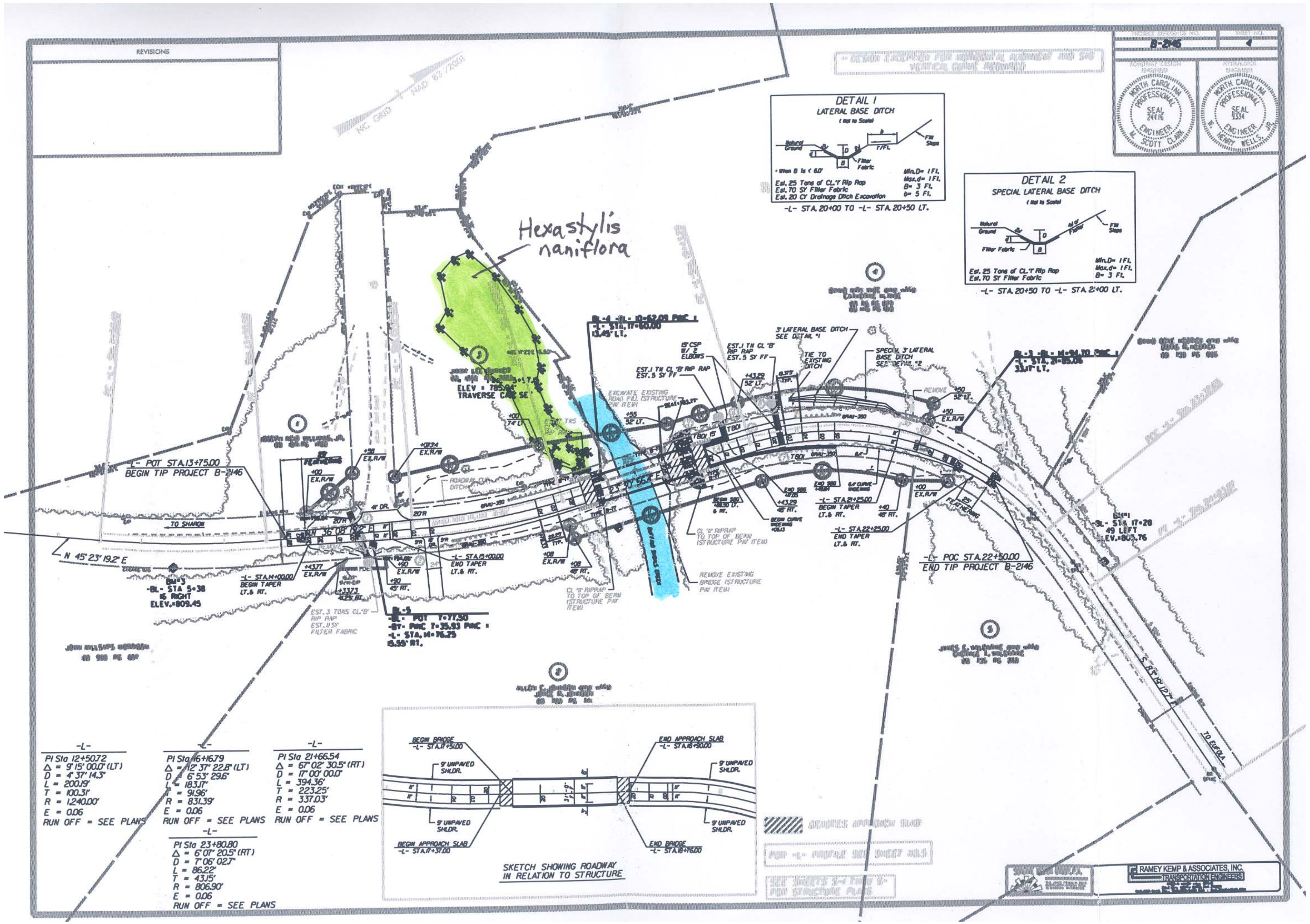
Project Study Area,
Plant Communities,
and Jurisdictional Areas

Dwn By: KCW	Date: March 2003
Ckd By: APS	Scale: 1:1500

ESC Project No: 03-138

FIGURE

2



REVISIONS
B-2146
Hexastylis naniflora
DETAIL 1
LATERAL BASE DITCH
-L- STA. 20+00 TO -L- STA. 20+50 LT.
DETAIL 2
SPECIAL LATERAL BASE DITCH
-L- STA. 20+50 TO -L- STA. 21+00 LT.
-L- POT STA.13+75.00
BEGIN TIP PROJECT B-2146
-L- POC STA.22+50.00
END TIP PROJECT B-2146
N 45°23'19.2" E
TO SHARON
TO EUFOLA
-L-
PI Sta 12+50.72
Δ = 9°15'00.0" (LT)
D = 4°37'14.3"
L = 200.19'
T = 100.31'
R = 1,240.00'
E = 0.06
RUN OFF = SEE PLANS
-L-
PI Sta 16+16.79
Δ = 12°37'22.8" (LT)
D = 6°53'29.6"
L = 183.17'
T = 91.96'
R = 831.39'
E = 0.06
RUN OFF = SEE PLANS
-L-
PI Sta 21+66.54
Δ = 67°02'30.5" (RT)
D = 17°00'00.0"
L = 394.36'
T = 223.25'
R = 337.03'
E = 0.06
RUN OFF = SEE PLANS
-L-
PI Sta 23+80.80
Δ = 6°07'20.5" (RT)
D = 7°06'02.7"
L = 86.22'
T = 43.15'
R = 806.90'
E = 0.06
RUN OFF = SEE PLANS
SKETCH SHOWING ROADWAY IN RELATION TO STRUCTURE
RAMEY KEMP & ASSOCIATES, INC.
TRANSPORTATION ENGINEERS

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexasylis naniflora* Common name: Dwarf-flowered Heartleaf Survey date: 11/9/10

EO Number: 275 County: Iredell 7.5' Quad Map: Catawba

Lat./Long: Not processed per agreement with Plaintiff/Requester Elevation: 780-840' above msl

Site Name: Eufola Road

Site location and directions: (**attach copy of map with site marked or use back of form to draw a sketch of the site**):
Southwest quadrant of bridge Number 86 on SR 1333 (Eufola Rd.) over Buffalo Shoals Creek. Site located approximately 0.7 mile southwest of Statesville, and approximately 1.0 mile east-southeast of the intersection of SR 1333 and US Route 70.

SPECIES INFORMATION

Number of individuals: 230

Define individual (stem, clump, etc.): one plant varies from a single stem to several stems arising from its root system.

Size of area in which population occurs: 0.35 ac

Estimate whether the entire population was surveyed or only a portion: entire population

Estimated Population Viability: excellent
Comments: plants look healthy and do not seem to be affected by adjacent clearing associated with bridge replacement activities

Phenology:		Evidence of reproduction:	
	dormant		**seedlings 100%**
	Vegetative 100%		clonal/vegetative
	bud		
	flower		
	fruit		

Reproduction comments:

Habitat (NC NHP natural community name and description; include quality, soils, geology, etc.): majority of site occurs in a Piedmont/Coastal Plain Heath Bluff (high quality); some of the site occurs in a Mesic Mixed Hardwood Forest (Piedmont subtype) (high quality). Soils on most of the site are mapped as LuF (Louisburg and Louisa soils, 25-55% slopes); very southern and eastern fringes are mapped as CsE2 (Cecil soils, 15-25% slopes, eroded).

Associated species: *Fagus grandifolia, Quercus alba, Quercus rubra, Quercus falcate, Liquidambar styraciflua, Acer rubrum, Oxydendrum arboretum, Carpinus caroliniana, Cornus florida, Hammamelis virginiana, Kalmia latifolia, Halesia Carolina, Leucothoe fontanesiana, Viburnum acerifolium,* Smilax spp., Vaccinium vacillans, Vitis rotundifolia, Hexastylis arifolia, Polystichum acrostichoides, Tipularia discolor, Asplenium platyneuron.

Invasive species noted & degree of threat from invasive species: low threat overall. Small amounts of Japanese honeysuckle (*Lonicera japonica*) growing along periphery of population. Small amount of Japanese grass (*Microstegium vimineum*), sericea lespedeza (*Lespedeza cuneata*), and mimosa (*Albizia julibrissin*) observed within the NCDOT right-of-way but outside the limits of the *H. naniflora* population.

Area of suitable habitat (suitable for, but not necessarily occupied by the species): More than 1 acre on the southwest quadrant, and more than 0.1 acre in the southeast quadrant.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? Yes, see above.

Topographic position (examples: crest, mid slope, alluvial, etc):top of stream bank to near crest, with majority of plants occurring on midslope.

Micro-relief (examples: flat, concave, rippled, etc): flat to concave

Moisture regime (examples: inundated, dry, seasonally wet, etc): moist, well-drained, mesic

Light (examples: open, woodland, closed canopy, etc): 50% closed woodland canopy; with a prevalence of understory trees and shrubs.

Other information:

Protection / management needs and opportunities: NCDOT is monitoring this population as part of a commitment to USFWS

Landowner(s), if known: Jimmy Lee Shaver

Person making this report: Heather Renninger (NCDOT Biological Surveys, Natural Environment Unit)

Address: 1598 Mail Service Center, Raleigh, NC 27699-1598

Phone: 919-431-6743

Other observers: Melissa Miller, Dennis Herman, Mike Sanderson (all NCDOT)

Specimens collected? no Collection #: Repository:

(**permits are required for federal or state listed species**)

Return form to: N.C. Natural Heritage Program, 1601 MSC, Raleigh, NC 27699-1601

2011

Hexastylis naniflora (Dwarf-Flowered Heartleaf)

Replacement of Bridge No. 84 on SR 1108 over Little Gunpowder Creek (Former TIP B-2937, Element Occurrence No. 44) Inventory and Monitoring Report

Caldwell County, North Carolina

Contact Person:
Matt Haney
Environmental Senior Specialist
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919-707-6122
mmhaney@ncdot.gov

June 8, 2015

Table of Contents

Species: *Hexastylis naniflora* (Dwarf-Flowered Heartleaf)

Site: [Little Gunpowder Creek, Former TIP No. B-2937] (Caldwell County)

NC NHP EO number(s): 44

NCDOT Point of Contact (POC): Matt Haney, Jared Gray

Signed ROW occurrence? No

Site management plan: None

Site protections: The North Carolina Department of Transportation (NCDOT) purchased a combined 2.68 acres on May 10 and 24, 2000 as perpetual conservation easements for the species. These two easements are the Wallace and Church Conservation Easements.

Origin of species at this site: Native and transplants

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable/decreasing (based on using different survey methodologies)

Species long-term trend at this site (averaged over multiple counts): Stable/decreasing (based on using different survey methodologies)

Status of NCDOT commitments pledged during ESA Section 7 consultations:

A. **NCDOT project ID**: TIP No. B-2937
USFWS log number: 4-2-98-147

On August 19, 1999 the U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (BO) pertaining to project B-2937. The BO was issued in response to a request to initiate formal consultation for the referenced project on May 19, 1999.

The USFWS requested the following conservation recommendations be implemented by NCDOT as part of its BO (pgs. 5 and 7).

> 4. (Direct Effects): The NCDOT will purchase 2.68 acres of dwarf-flowered heartleaf (DFHL) habitat (including an estimated 1,522 plants) adjacent to the project area and protect the area with perpetual conservation easements.
> *Status: NCDOT purchased the conservation easements on May 10 and 24, 2000.*
> 4. (Conservation Recommendations): Notify the North Carolina Plant Conservation Program (NCPCP) that 324 plants will be lost to the proposed construction. Allow a qualified botanist from their organization to transplant, if desired, any of the plants that would be lost to a different area (outside the acquisition area) for protection.

Status: In November 2000, representatives from Appalachian State University (ASU), the North Carolina Department of Agriculture (NCDOA), and the NCDOT transplanted 175 H. naniflora *individuals from the bridge construction site onto the adjacent conservation easements established by the NCDOT.*

5. (Conservation Recommendations): Monitor the DFHL population inside the acquisition area annually for 5 years to determine its stability and detect any construction effects (positive or negative) that could occur which have not been anticipated (increased light, hydrology changes, etc.).

Status: The population inside the acquisition area was not monitored annually for 5 years upon completion of the bridge replacement project B-2937. The site was revisited in May 2005 by personnel from the North Carolina Natural Heritage Program (NHP) and HDR Engineering, Inc. of the Carolinas (on behalf of NCDOT), and no construction effects were observed during this visit. This area is currently being monitored under the guidelines outlined in the BO of TIP No. R-2824.

6. (Conservation Recommendations): Develop a management plan for the DFHL on the newly acquired parcel. The plan, which would require our approval, should address the long-term conservation of the population.

Status: No management plan has been developed for this parcel.

B. **NCDOT project ID**: TIP No. R-2824
USFWS log number: 4-2-09-367

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): From pages 31-34 of the Biological Assessment for TIP R-2824 Proposed Upgrade of Lovelady Road (dated May 2009), and Appendix B of the BO for the same project (dated November 13, 2009), NCDOT committed to assist USFWS with the five-year review process by providing information about several populations of DFHL that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure for R-2824.) The population of DFHL associated with B-2937 is included in this group.

Because DFHL is held in conservation easements at this site, NCDOT will monitor this occurrence, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:

- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using Global Positioning System (GPS)/Geographic Information System (GIS), computing changes to acreages of Occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program – Endangered and Rare Plant Field Survey Form that incorporates both types of data.

- Analyze population trends by comparing recent size estimates to data from previous years.

Status of terms and conditions from applicable NCPCP permits:

NC PCP Permit ID number(s): None depicted on the permit.
Description: Rescue 15 plants and cuttings on December 7, 2000 at Little Gunpowder Creek, Caldwell County for research at ASU. The permit is dated December 7, 2000.

Discretionary actions undertaken by NCDOT and partners:
None

Appendix 1: Monitoring data

In November 2000, 175 native individuals were relocated by representatives from ASU, NCDOA, and NCDOT from the proposed right of way of Bridge No. 84 over Little Gunpowder Creek on SR 1108 (TIP No. B-2937) to Site 1 within the adjacent conservation easements of 2.68 combined acres (see Figure 2). James Padgett (former graduate student at ASU) found that 68% of the transplanted individuals survived as of April 2002, despite drought conditions.

On May 2, 2011, NCDOT biologists Neil Medlin, Mary Frazer, Anne Burroughs and Jared Gray surveyed EO 44 as it was known at that time, east of US 321. The EO was surveyed by walking transects and conducting a direct count. NCDOT biologists observed a few pin-flags from some of the plots used during the 2000 transplant. However, the biologists did not know the location of all of the plots and there were not enough pin-flags visible to determine how many transplants were within those plots that were located. Therefore, the surviving transplants were not differentiated from the natives in Site 1 during the 2011 survey; they were accounted for together. The number of DFHL plants, acreage of habitat occupied by the species and plant density are depicted in Table 1 for both sites of EO 44. The total occurrence includes both native and transplanted specimens of DFHL.

The following table shows the results of the 2011 survey:

Table 1. Dwarf-Flowered Heartleaf Sites within EO 44

Site	Number of plants	Area (ac)	Density (plants/ac)
1	1112*	1.68*	662*
2	123**	0.37**	332**
Total	1235*	2.05*	602*

* Native and transplanted DFHL

** Native DFHL only

The number of DFHL specimens located solely within the limits of the conservation easements also was not determined in the field. The exact location of the combined conservation easement limits were not known by the biologists until after the field survey was completed. As depicted in Figure 2, only a portion of Sites 1 and 2 lie within the combined conservation easement limits. Therefore, the number of DFHL specimens protected with the conservation easements can only be estimated from the 2011 survey. Table 2 shows the difference between the number of plants and area of EO 44 and the portion of EO 44 protected within the conservation easements.

Table 2. Portion of EO 44 Protected within the Conservation Easements

Occurrence	Number of plants	Area (ac)	Density (plants/ac)
EO 44	1235	2.05	602
EO 44 protected within conservation easements	1054*	1.75	602

*This number was calculated assuming that the density is the same for EO 44 and the portion of EO 44 protected within the conservation easements. It is also assumed that DFHL plants are spatially distributed in an equal manner throughout the occurrence.

The USFWS anticipated in its BO that 1,522 DFHL plants (1999 estimate based on species density) would be protected in the conservation easements. The estimated number of plants protected in the conservation easements, based on plant counts in 2011, is 1,054. Some of the discrepancy in the plant numbers can be attributed to using different sampling methods (estimate was used in 1999 and direct counts were done in 2011). One factor that can attribute to plant fatalities is drought. Caldwell County experienced abnormally dry to moderate drought conditions from January 2011 to May 2011, which includes the three months leading up to the 2011 survey (http://droughtmonitor.unl.edu/MapsAndData/MapArchive.aspx, accessed September 3, 2014). Furthermore, an estimated 324 DFHL plants were lost due to construction of the bridge replacement project.

It is important to note that portions of Site 2 and the Wallace Conservation Easement lie within the existing right-of-way of US 321 (see Figure 2). US 321 is also proposed to be widened in the near future (TIP No. U-4700). Efforts must be taken in the planning phases of TIP No. U-4700 to avoid adverse effects to Site 2 and the conservation easement. Table 3 shows the area of occupied DFHL and the estimated number of DFHL plants for the portion of EO 44 within existing NCDOT right-of-way and where the conservation easement and existing NCDOT right-of-way overlap.

Table 3. Portion of EO 44 within existing NCDOT right-of-way/Wallace Conservation Easement

Occurrence	Estimated number of plants	Area (ac)	Density (plants/ac)
Portion of EO 44 within existing NCDOT right-of-way	54*	0.09	602
Portion of EO 44 where the Wallace Conservation Easement and existing NCDOT right-of-way overlap	18*	0.03	602

*This number was calculated assuming that the density of the areas evaluated are the same as that of EO 44. It is also assumed that DFHL plants are spatially distributed in an equal manner throughout the occurrence.

APPENDIX 2 (Figures)

Figure 1- Dwarf-Flowered Heartleaf Element Occurrence No. 44 (Vicinity Map)

Figure 2- Dwarf-Flowered Heartleaf Element Occurrence No. 44 (Aerial Imagery)

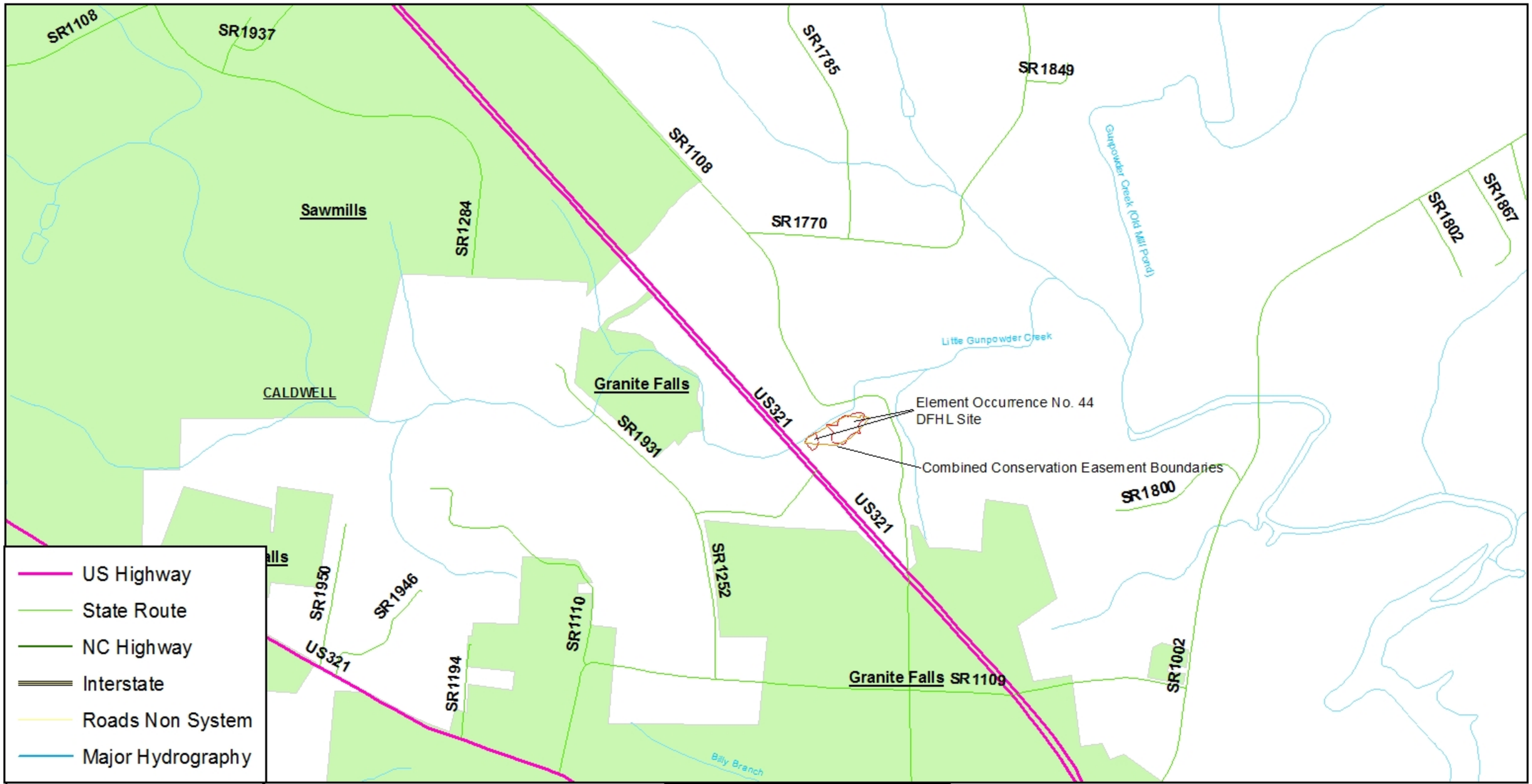

SR1108
SR1937
SR1108
SR1785
SR1849
Gunpowder Creek (Old Mill Pond)
SR1802
SR1867
Sawmills
SR1284
SR1770
Little Gunpowder Creek
CALDWELL
Granite Falls
US321
SR1931
Element Occurrence No. 44
DFHL Site
Combined Conservation Easement Boundaries
SR1800
US321
SR1252
SR1950
SR1946
SR1110
US321
SR1194
Granite Falls SR1109
SR1002
Billy Branch
US Highway
State Route
NC Highway
Interstate
Roads Non System
Major Hydrography
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
Prepared by NCDOT Jun 2015
Figure 1: Dwarf-Flowered Heartleaf Element Occurrence (EO) No. 44 (Vicinity Map)
SR 1108 over Little Gunpowder Creek
Caldwell County, NC
N
0 0.0750.15 0.3 Miles
Fig 1

Figure 2: Dwarf-Flowered Heartleaf Element Occurrence No. 44 (Aerial Imagery)

SR 1108 over Little Gunpowder Creek
Caldwell County, NC

0 137.5 275 Feet

Prepared by NCDOT Jun 2015

Fig 2

APPENDIX 3 (Conservation Easement Deeds)

APPENDIX 4

North Carolina Natural Heritage Program Endangered and Rare Plant Field Survey Form

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* **Common name**: Dwarf-flowered heartleaf

Survey date: May 2, 2011

EO Number (if updating existing EO): EO 44

County: Caldwell **7.5' Quad Map**: Granite Falls

Latitude/Longitude (if known): Not processed per agreement with Plaintiff/Requester **Elevation**: 1050-1100 feet above mean sea level

If latitude/longitude given, what coordinate system was used (State Plane 1927 or 1983, UTM, etc.): NAD83

Site Name (if this is within previously identified site): Sites 1 and 2

Site location and directions: Take US 321 North towards Granite Falls. Turn right on SR 1108. Go approximately 0.4 mile and the site will be in the southeast quadrant of the Little Gunpowder Creek bridge crossing over SR 1108.

Number of individuals: Total occurrence contained 1235 plants, native and transplanted.

Define individual (stem, clump, etc.): Information not collected during survey.

Size of area in which population occurs: Site 1 was 1.68 ac and Site 2 was 0.37 ac, for a combined total of 2.05 ac.

Estimate whether the entire population was surveyed, or only a portion: Entire population was surveyed.

Estimated population viability: __Excellent ___Good __Fair ___Poor _x__Unknown ___Failed to find

Population viability comments: Population viability information was not collected during the survey.

Phenology (include % or # in each stage):
Vegetative: 100%
Bud: Not applicable
Flower: Information not collected during survey.

Evidence of reproduction:
Fruit: Information not collected during survey.
Seedlings: Information not collected during survey.
Clonal/vegetative: Information not collected during survey.

Reproductive comments:

Habitat (NC NHP natural community name and description; include quality, soils, geology, etc.): Information for the NCNHP natural community name and description was not collected during the survey. Soils mapped as CnA, defined as Codorus loam, 0 to 2 percent slopes, frequently flooded; WoD, defined as Woolwine-Fairview complex, 15 to 25 percent slopes; and WoC, defined as Woolwine-Fairview complex, 8 to 15 percent slopes.

Associated species: Information not collected during survey.

Invasive species noted & degree of threat from invasive species: Information not collected during survey.

Area of suitable habitat (suitable for, but not necessarily occupied by the species): Approximately 3 ac along Little Gunpowder Creek between US 321 and SR 1108.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? Yes

Topographic position (examples: crest, mid slope, alluvial, etc): Alluvial and mid slope.

Moisture regime (examples: inundated, dry, seasonally wet, etc): Information not collected during survey.

Light (examples: open, woodland, closed canopy, etc): Information not collected during survey.

Other information: Slope aspect-north and northwest facing. Survey methodology consisted of direct counts of single plants within visual range along straight-line transects across the entire occurrence.

Protection / management needs and opportunities: A portion of Sites 1 and 2 are protected in two conservation easements, Wallace and Church. A portion of Site 2 and the Wallace Conservation Easement are located within the existing right-of-way of US 321. The portion of Sites 1 and 2 not currently protected by these two easements has the potential to be protected in the future through either the acquisition of additional road right-of-way along US 321 or the acquisition of another conservation easement.

Landowner(s), if known: Parcel Nos. 28195 and 28197 owned by Bruce A. and Elizabeth T. Wallace. Parcel 27281 owned by Annie Church. Landowner information obtained from Caldwell County, NC Interactive Geographic Information System at http://arcgis.webgis.net/nc/Caldwell/ (accessed July 31, 2014).

Person making this report: Matt Haney
Address: NCDOT, Project Development & Environmental Analysis Unit, 1598 Mail Service Center, Raleigh, NC 27699-1598
Phone: 919-707-6122

Other observers: NCDOT biologists Neil Medlin, Mary Frazer, Anne Burroughs, and Jared Gray.

Specimens collected? None **Collection #**: Not applicable **Repository**: Not applicable

2011

Hexastylis naniflora (Dwarf-Flowered Heartleaf)

Replacement of Bridge No. 148 on SR 1547 over Micol Creek (Former TIP B-3621, Element Occurrence No. 159) Inventory and Monitoring Report

Burke County, North Carolina

Contact Person:
Matt Haney
Environmental Senior Specialist
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919-707-6122
mmhaney@ncdot.gov

March 17, 2015

Table of Contents

Species: *Hexastylis naniflora* (Dwarf-Flowered Heartleaf)

Site: [SR 1547 over Micol Creek, Former TIP No. B-3621] (Burke County)

NC NHP EO number(s): 159

NCDOT Point of Contact (POC): Matt Haney, Tim Bassette

Signed ROW occurrence? No

Site management plan: None

Site protections: Unprotected roadside population. A portion of this occurrence is found within North Carolina Department of Transportation (NCDOT) right-of-way.

Origin of species at this site: Native

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Decreasing, with a caveat. HDR Engineering, Inc. of the Carolinas (HDR) inventoried the population in November 2004 and estimated 5,650 plants. NCDOT inventoried the population on November 2, 2011 and counted 2,182 plants. The 2005 enumeration was likely higher due to estimating instead of conducting a direct count.

Species long-term trend at this site (averaged over multiple counts): Decreasing, with a caveat. HDR (2005) estimated 5,650 total plants. NCDOT (2011) counted 2,182 total plants. The 2005 enumeration was likely higher due to estimating instead of conducting a direct count. This data indicates a six year span of a generally decreasing population.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

A. **NCDOT project ID:** B-3621
USFWS log number: 4-2-06-210

On February 15, 2007 the U.S. Fish and Wildlife Service (USFWS) issued a concurrence letter pertaining to project B-3621. A concurrence request was sent to USFWS on December 1, 2006.

B. **NCDOT project ID**: R-2824
USFWS log number: 4-2-09-367

Status of NCDOT commitments (per USFWS Biological Opinion (BO), USFWS letter of concurrence): From pages 31-34 of the Biological Assessment for TIP R-2824 Proposed Upgrade of Lovelady Road (dated May 2009), and Appendix B of the BO for the same project (dated November 13, 2009), NCDOT committed to assist USFWS with the five-year review process by providing information about several populations of DFHL that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure

for R-2824.) The population of dwarf-flowered heartleaf (DFHL) associated with B-3621 is included in this group.

Because DFHL is located within the right-of-way of B-3621, NCDOT will monitor this occurrence, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:
- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using Global Positioning System (GPS)/Geographic Information System (GIS), computing changes to acreages of occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program – Endangered and Rare Plant Field Survey Form that incorporates both types of data.
- Analyze population trends by comparing recent size estimates to data from previous years.

Status: This is the first of three post-construction monitoring reports for this Element Occurrence.

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s): N/A
Description: N/A

Discretionary actions undertaken by NCDOT and partners:

None

Appendix 1: Monitoring data

In November 2004, HDR conducted an initial inventory count of EO 159. Due to the size and steep slope of this site, 1/100 acre sample plots were conducted instead of a direct count. Based on 15 sample plots, it was estimated that 5650 DFHL plants occur in this study area, or approximately 2580 DFHL plants per acre.

On November 2, 2011, NCDOT biologists Neil Medlin, Tim Bassette, Matt Haney, Steve Mitchell, Heather Wallace and Jared Gray surveyed all of EO 159. The EO was surveyed by walking transects and conducting a direct count. Survey results indicate that three separate populations are found within the occurrence. Figure 1 depicts the overall location of the occurrence. Figure 2 shows the three separate populations that make up the occurrence. Table 1 shows the results of the 2011 survey:

Table 1. Populations of DFHL within EO No. 159

Population	Number of plants	Area (ac)	Density (plants/ac)
N	655	0.79	829
SW	253	0.15	1687
SE	1274	1.13	1127
Total	2182	2.07	1054

A portion of the SW population is located within NCDOT right-of-way of SR 1547. The number of DFHL specimens located within the entire SW population was not differentiated in the field from the number of DFHL specimens of the same population located solely within NCDOT right-of-way. The exact location of NCDOT right-of-way was not known by the biologists until after the field survey was completed. Therefore, the number of DFHL specimens located within NCDOT right-of-way can only be estimated from the 2011 survey. Table 2 shows the difference between the number of plants and area of the SW population and the portion of the SW population located within NCDOT right-of-way.

Table 2. The SW population of EO No. 159 within NCDOT right-of-way

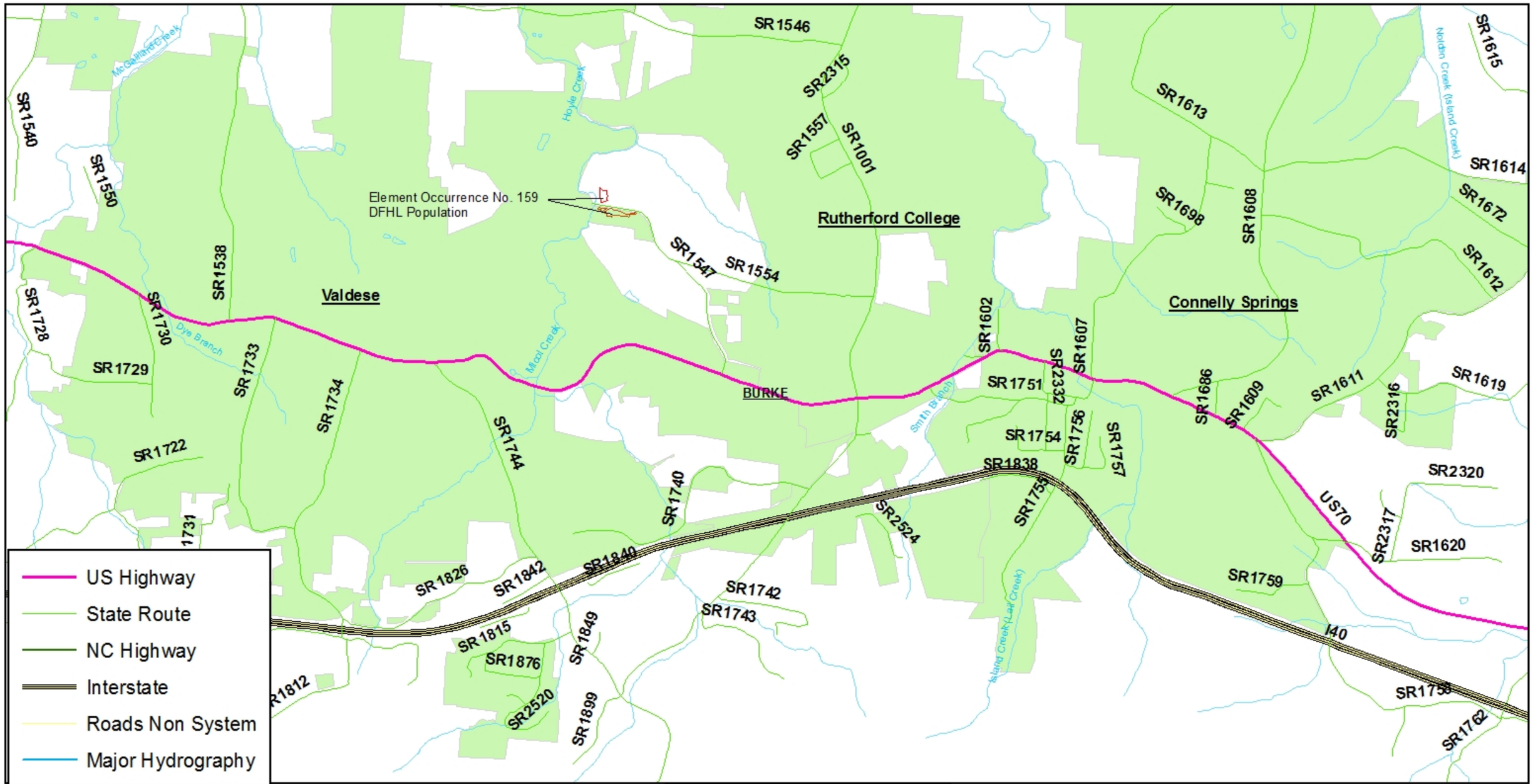
Population	Number of plants	Area (ac)	Density (plants/ac)
SW	253	0.15	1687
SW within NCDOT right-of-way	67*	0.04	1687

*This number was calculated assuming that the density is the same for the SW population and the portion of the SW population within NCDOT right-of-way. It is also assumed that DFHL plants are spatially distributed in an equal manner throughout the occurrence.

APPENDIX 2 (Figures)

Figure 1- Dwarf-Flowered Heartleaf Element Occurrence No. 159 (Vicinity Map)

Figure 2- Dwarf-Flowered Heartleaf Element Occurrence No. 159 (Aerial Imagery)



Prepared by NCDOT Mar 2015

Figure 1: Dwarf-Flowered Heartleaf Element Occurrence (EO) No. 159 (Vicinity Map)

SR 1547 over Micol Creek
Burke County, NC

0 0.15 0.3 0.6 Miles

Fig 1

Micol Creek

Population N

BURKE

SR1547

Population SW

Population SE

Micol Creek

US Highway
State Route
NC Highway
Interstate
Roads Non System
Major Hydrography

NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board

Prepared by NCDOT Mar 2015

Figure 2: Dwarf-Flowered Heartleaf Element Occurrence No. 159 (Aerial Imagery)

SR 1547 over Micol Creek
Burke County, NC

0 40 80 160 Feet

Fig 2

APPENDIX 3

North Carolina Natural Heritage Program Endangered and Rare Plant Field Survey Form

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* **Common name**: Dwarf-flowered heartleaf

Survey date: November 2, 2011

EO Number (if updating existing EO): 159

County: Burke **7.5' Quad Map**:

Latitude/Longitude (if known): Not processed per agreement with Plaintiff/Requester **Elevation**: 1080-1170 feet above mean sea level

If latitude/longitude given, what coordinate system was used (State Plane 1927 or 1983, UTM, etc.): NAD83

Site Name (if this is within previously identified site): Populations N, SW, and SE comprise entire occurrence.

Site location and directions: Take 70 West towards Valdese. Turn right on SR 1547 (Gardiol St. NE). Go approximately ¾ mile and the site will be in the northeast and southeast quadrants of the Micol Creek bridge crossing over SR 1547.

Number of individuals: Site contained 2182 plants.

Define individual (stem, clump, etc.): Single stems to multiple stems.

Size of area in which population occurs: Area was 2.07 ac.

Estimate whether the entire population was surveyed, or only a portion: Entire population surveyed.

Estimated population viability: __Excellent _X__Good __Fair ___Poor ___Unknown ___Failed to find

Population viability comments: Population habitat is good.

Phenology (include % or # in each stage):
Vegetative: 100%.
Bud: Not applicable.
Flower: Not applicable.

Evidence of reproduction:
Fruit: Not applicable.
Seedlings: Not applicable.
Clonal/vegetative: Unknown because evidence of new plant emergence via rhizome was not field-investigated.

Reproductive comments: The survey was conducted outside of the species' flowering window.

Habitat (NC NHP natural community name and description; include quality, soils, geology, etc.): Habitat composed of a medium quality Dry-Mesic Oak-Hickory Forest (Piedmont Subtype). Soils mapped as MoE, defined as Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony; CvA, defined as Colvard sandy loam, 0 to 3 percent slopes, occasionally flooded; WoD2, defined as Woolwine-Fairview complex, 15 to 25 percent slopes, moderately eroded; and MeD, defined as Meadowfield-Fairview complex, 15 to 25 percent slopes.

Associated species: *Fagus grandifolia, Viburnum acerifolium, Amelanchier arborea, Smilax glauca, Geranium* sp., *Viola* sp., *Galax aphylla, Smilax rotundifolia, Ilex opaca, Liquidambar styraciflua, Mitchella repens, Quercus alba, Polystichum acrostichoides, Botrychium* sp., *Asplenium platyneuron, Carya tomentosa, Acer rubrum, Rhododendron maximum, Kalmia latifolia, Pinus strobus, Cornus florida, Oxydendrum arboreum, Quercus prinus, Quercus coccinea, Toxicodendron radicans, Quercus rubra, Quercus falcata, Prunus serotina, Vaccinium vacillans, Pinus echinata, Vitis rotundifolia, Carpinus caroliniana, Platanus occidentalis, Rubus* sp., *Quercus phellos, Tsuga canadensis, Thelypteris noveboracensis, Acer saccharum, Dioscorea villosa,* and *Liriodendron tulipifera*.

Invasive species noted & degree of threat from invasive species: Moderate degree of threat from *Rosa multiflora, Ligustrum sinense, Albizia julibrissin,* and *Lonicera japonica*, especially along the road by the stream.

Area of suitable habitat (suitable for, but not necessarily occupied by the species): Approximately 10 ac. This includes wooded areas adjacent to EO 159, on the north side of SR 1547.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? Yes.

Topographic position (examples: crest, mid slope, alluvial, etc): Mid slope and top of streambank.

Moisture regime (examples: inundated, dry, seasonally wet, etc): Terrestrial, dry, well drained.

Light (examples: open, woodland, closed canopy, etc): Fifty percent closed mixed pine/hardwood canopy on north side of road. Seventy-five percent closed shrub/subcanopy on south side of road.

Other information: West facing slope on north side of road. North and northeast facing slopes on south side of road. Habitat on south side of road is a lot rockier. The survey was conducted using direct counts of single plants within visual range along straight-line transects across the entire occurrence.

Protection / management needs and opportunities: Currently unprotected, but there is an opportunity here to purchase a conservation easement.

Landowner(s), if known: Parcel No. 14310 owned by Paul Lucinda Stiff. Parcel 12956 owned by Richard F. and Elizabeth A. Murphy. Landowner information obtained from Burke County, NC Interactive Geographic Information System at http://arcgis.webgis.net/nc/Burke/ (accessed July 30, 2014).

Person making this report: Matt Haney
Address: NCDOT, Project Development & Environmental Analysis Unit, 1598 Mail Service Center, Raleigh, NC 27699-1598
Phone: 919-707-6122

Other observers: NCDOT biologists Tim Bassette, Steve Mitchell, Jared Gray, Neil Medlin, and Heather Wallace.

Specimens collected? None. **Collection #**: Not applicable. **Repository**: Not applicable.

2011
Hexastylis naniflora (Dwarf-flowered heartleaf)
Former U-2528AA (Current ID R-9999L)
Inventory and Monitoring Report
Catawba County, North Carolina

Contact Person:

Cheryl Gregory
Environmental Senior Specialist
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919-707-6142
clgregory1@ncdot.gov

Species: *Hexastylis naniflora* (Dwarf-flowered heartleaf)

Site: [Former U-2528AA] (Catawba County)

NC NHP EO number(s): 32, EO ID 14983

NCDOT Point of Contact (POC): Cheryl Gregory, Tim Bassette, Jared Gray

Signed ROW occurrence? No

Site management plan: N/A

Site protections:
A small portion of this occurrence (60 plants, March 3, 2011 survey) is situated within the existing NCDOT right-of-way of I-40. This portion of the occurrence, however, is a roadside population that is not under formal protection from a binding agreement. The remainder of the occurrence, which sits outside of the existing NCDOT right-of-way, is also not under any formal protection from a binding agreement.

Origin of species at this site: Native

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Declining

Species long-term trend at this site (averaged over multiple counts): Declining

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Status of NCDOT commitments pledged during ESA Section 7 consultations:

A. **NCDOT project ID**: R-9999L, Murrays Mill Conservation Area (formerly B-2119)
USFWS log number: 4-2-95-102

On August 3, 1995 the U.S. Fish and Wildlife Service (Service) issued a Biological Opinion (BO) pertaining to projects B-2119, U-2307, and U-2528AA. The BO was issued in response to a request to initiate formal consultation for the referenced projects on July 20, 1995. Per the BO, NCDOT made the following environmental commitments (pgs. 5-6):
• The NCDOT will pursue purchasing land in fee title (or conservation easement) from willing sellers to establish a preserve of approximately 11.9 ha (29.4 acres) in the Murray's Mill area.
Status: On May 1, 1996, the NCDOT purchased 25.07 acres (Tract 1) and an additional 8.61 acres on the adjacent Bowman Tract (Tract 2) on March 13, 2006.
• The preserve will be conveyed to another responsible entity (such as the Catawba County Historical Association of Catawba County) with an accompanying agreement or deed restriction that the existing plant population be protected in perpetuity.
Status: Currently NCDOT still holds the title to the site but is working toward the transfer of ownership and stewardship responsibilities to the Catawba County Historical Association. The NCDOT has developed a conservation plan which outlines the management of the Murray's Mill Site for the perpetual conservation of the *H. naniflora*.

• The NCDOT and FHWA have also agreed that if establishing a preserve in the Murray's Mill area is not feasible, they will pursue establishing a preserve of similar size and quality (with regards to plant population density and size) at another location in North Carolina, as agreed upon by the Service.
Status: As of March 13, 2006 the NCDOT completed the purchase of the Murray's Mill tracts which met and exceeded the necessary 11.9 hectare (29.4 acres) commitment.
• If the entire 11.9 hectare area, as committed in the Assessment, is not protected through fee title or conservation easement, then Project U-2528AA will be dropped from the Programmatic Section 7 Consultation and will need to be addressed at a separate consultation at a future date.
Status: As mentioned in the status of the commitment above, the NCDOT purchased more than the requisite 11.9 hectares.
• Some transplanting of *H. naniflora* individuals to protected sites, or possibly even the collecting of individuals for Center for Plant Conservation-approved of botanical gardens, may be carried out, but will be the sole responsibility of the Service. Any transplanting efforts will be conducted with prior coordination with NCDOT.
Status: To-date, no transplanting or collecting of individual plants has been coordinated.
• The Service has agreed that if the above mentioned preserve is established, and Project U- 2528AA is dropped (not constructed), the NCDOT may substitute another project involving *H. naniflora* contingent upon Service approval. The Service will evaluate such criteria as plant population size, habitat quality, landscape context (e.g. rural. urban), proposed impacts to the plant population, etc. in making a decision on substituting another NCDOT project.
Status: The option for NCDOT to substitute another project is no longer viable because U- 2528AA has been constructed.
• Assisting the Service in answering questions that arose during the recent 5-year status review for the species.
Status: Every two years for no more than a six year period, the NCDOT will monitor all occurrences associated with 14 NCDOT projects where *H. naniflora* was found in the right-of-way, of which Murray's Mill is one. Environmental baseline data will be obtained and will include both quantitative and qualitative analyses. Specifics of the five year review assistance are detailed in the R-2824 (Proposed Upgrade of Lovelady Road) USFWS Biological Opinion letter to NCDOT dated November 13, 2009.

B. NCDOT project ID: TIP No. R-2824 (Upgrade of Existing Lovelady Road (SR 1546) from Laurel Street (SR 1545) in Valdese to Malcolm Boulevard (SR 1001) in Rutherford College, Burke County, North Carolina.
USFWS log number: 4-2-09-367

From pages 31-34 of the Biological Assessment for TIP R-2824 (May 8, 2009), and Appendix B of the Biological Opinion for the same project (November 13, 2009), NCDOT committed to assist USFWS with the five-year review process by providing information about several populations of DFHL that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure for R-2824.) The population of DFHL associated with U-2528AA is included in this group.

Because DFHL is partially located within the right-of-way of U-2528AA, NCDOT will monitor EO No. 32 that is associated with U-2528AA, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:

- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using GPS/GIS, computing changes to acreages of occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program (NCNHP) – Endangered and Rare Plant Field Survey Form that incorporates both types of data.
- Analyze population trends by comparing recent size estimates to data from previous years.

Status: This monitoring report documents the first of three post-construction monitoring efforts associated with Element Occurrence No 32 along the former TIP U-2528AA.

Status of terms and conditions from applicable NC Plant Conservation Program permits:

No applicable permits from the NC Plant Conservation Program have been applied for or been issued for this project.

Discretionary actions undertaken by NCDOT and partners:

From page 2 of the former TIP U-2528AA Biological Opinion issued May 10, 2001; conservation recommendations included:

(1) The agreement (or deed restriction) will include a provision that any management recommendations we make will be implemented, if resources are available, and that access into the preserve will be granted for our representatives and representatives from State resource agencies with prior notification to the owner. *Status*: Management recommendation in the form of a draft conservation plan for the Murray's Mill Conservation Area has been approved by the USFWS, NCNHP and NCDOT but not the Catawba County Historical Association.

(2) The deed for the acquired site will identify that this area was purchased for conservation purposes. *Status*: It is not NCDOT policy to place deed restrictions on properties purchased fee simple. To ensure this property remains protected in perpetuity all sites purchased or maintained by NCDOT for threatened and endangered species mitigation are placed on the existing Natural Environment Section's (NES) Mitigation GeoDatabase. This geo-referenced database includes the location and boundaries of NCDOT fee simple owned mitigation sites as well as all mitigation sites that are held in Conservation Easement. This database is provided to and accessible to the public as a record of mitigation sites and their attributes, including permit conditions and prohibited activities. Information including new mitigation sites or changes in status to sites is updated at a minimum quarterly or more often as updates are needed. (http://www.arcgis.com/home/item.html?id=d560dfeb1ea443b299ca7fc68b2506b4.

(3) The Service's Asheville Field Office will be notified at least one month in advance of the start of construction for all three projects to allow an opportunity to transplant specimens from project impact areas.
Status: None of the *H. naniflora* specimens found along the former U-2528AA project have ever been, or are anticipated to be, transplanted to another area.

-No other discretionary activities (i.e. rescue, relocation, augmentation or management) other than what is listed above have been or are anticipated to be undertaken by NCDOT and its partners.

Appendix A. Monitoring Data & Discussion

Baseline data was collected by North Carolina Department of Transportation biologists Tim Savidge and Hal Bain on March 21, 1995 and June 28, 1995 (NCDOT 1995). This data was collected using 21x21 m^2 sample plots within each quadrant (quad) and consisted of estimates of the average number of plants per square meter and the number of plants occurring within each quad. The size of the population (ha) was also calculated for each area that contained *H. naniflora*. It should be noted that the *H. naniflora* population within the northeast quad was too small to use a 21 m^2 plot so a total of 30 square meter samples were taken along a transect line every meter.

A November 27, 2000 survey by NCDOT biologists Tim Savidge, Elizabeth Lusk and Trish Simon was initiated to accommodate a design changes that occurred in the project area. Design changes included the relocation of a service road along I-40 in the southeast quad. Also, the proposed project, as originally designed (a basic diamond configuration) would have impacted all four quads around the interchange. The exit ramp originally designed to be in the northeast quad was changed to a loop and nested inside the northwest ramp, thus eliminating the impacts in the entire northeast quad (250 plants). Because baseline data was already available from 1995, no further surveys were conducted in 2000 in the northeast and southeast quads. However, surveys in the two western quads of the interchange revealed additional plants there apparently not found during 1995 surveys (100 and 30 respectively). During this field visit, they also observed that the high quality habitat in the northwest quad (mature oak/hickory forest) had been harvested. Many of the *H. naniflora* plants were chlorotic, indicating stress due to the absence of a protective canopy. Also, they were located on east- and west- facing slopes, rather than the typical north-facing slopes.

North Carolina Natural Heritage Program field survey forms were completed during site visits (2005 & 2007) and include pertinent qualitative and quantitative information listed in the commitments. According to a 2005 NCNHP form, simply dated Spring-2005, the visit revealed that much of the surrounding habitat had been disturbed through logging operations and/or project impacts. While only one plant was found during field checks, 250 were thought to be preserved in the northeast quad. NCDOT did not disturb the northeast quad according to project plans but the property owner had since cleared the area for future development; the plants in that quad are now gone. The northwest quad was already stressed before construction started due to logging, these plants are now gone (NCNHP 2005).

Census counts were conducted by NCDOT biologists Tim Bassette, Anne Burroughs, Neil Medlin and Jared Gray on May 3, 2011. Figures 1 and 2 depict EO 32 as determined during the 2011 monitoring period. This survey was completed following project commitments established for R-2824 (Lovelady Rd). Methods for enumerating plants were inconsistent between years. In 2011, plants were enumerated via direct census count; however baseline surveys prior to 2011 were conducted using sample plots and estimating density using a subset of the population. Beginning with the first monitoring phase in 2011, methods remain consistent to allow for better ability to track population trends in the future. Plant survey results are documented in Table 1 for 1995, 2000 and 2011.

Table 1. *Hexastylis naniflora* (NHP EO Number 32) by quadrant of former TIP No. U-2528AA									
Quadrant of I-40 Interchange	**1995**			**2000**			**2011**		
	Size (acre)	**No. Plants**	**Density (plant/ac)**	**Size (acre)**	**No. Plants**	**Density (plant/ac)**	**Size (acre)**	**No. Plants**	**Density (plant/ac)**
Northeast	0.2	250	1,250	0.2	N/A*	N/A	0	0	N/A
Southeast	3.3	6200	1,878	3.3	6200	1,878	2.1	820 †	390
Northwest	No Info Available	None discovered ‡	N/A	No Info Available	100	N/A	0	0	N/A
Southwest	No Info Available	None discovered ‡	N/A	No Info Available	30	N/A	0	0	N/A
Totals		**6450**			**6330**			**820**	

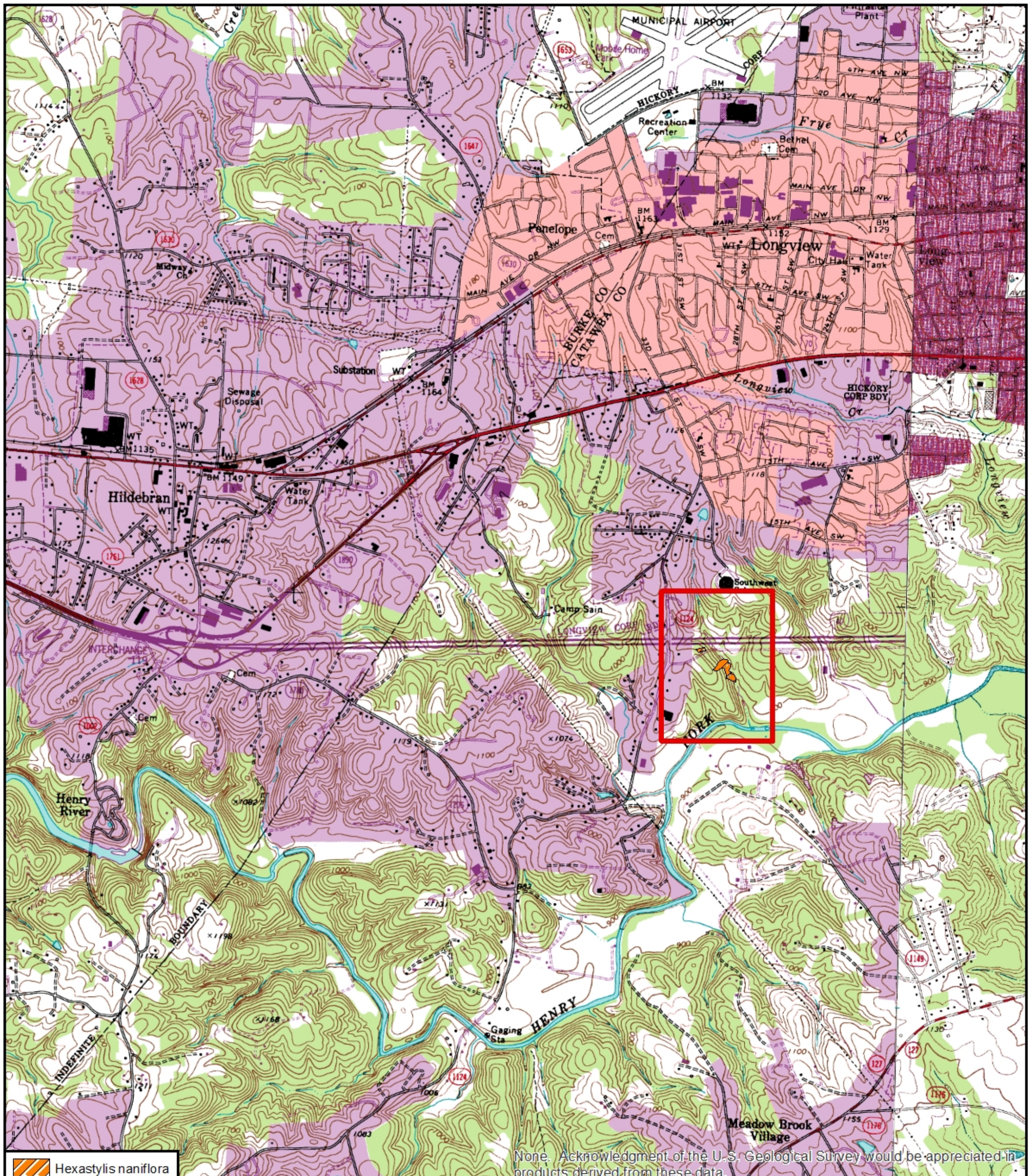
* The 2000 survey was initiated to accommodate a design change. The design in the northeast quad was changed in 2000 to a loop nested in the northwest ramp thus eliminating impacts to entire northeast quad (250 plants). Because baseline data was already available from 1995, no further surveys were conducted in 2000 in the northeast and southeast quads. However, surveys in the northwest and southwest quads revealed additional plants there. On March 22, 2007 & May 3, 2011 NCDOT biologists conducted surveys in the northeast quad. It was determined that *H. naniflora* no longer exists in that quad because of poor habitat which has been overtaken by the invasive *Pueraria lobata* (kudzu).

† The methods for enumerating plants were inconsistent between baseline estimates (1995 & 2000) and the 2011 census count. Beginning with the first monitoring phase in 2011, methods will remain consistent to allow for better ability to track population trends.

‡ The original 1995 survey revealed no plants in the northwest and southwest quads.

Although a true trend analysis cannot be performed due to the discrepancies in survey methods discussed above, casual observations at each quad reveal that the number of plants and the density of the populations have decreased or have been completely eradicated since pre-construction. Direct and indirect adverse effects from this project included disturbance from construction activities, effects of population fragmentation and a partial clear cut of the northwest quad severely degrading the population in that portion of the project area. Furthermore, it was noted in the U-2528AA Biological Opinions (August 3, 1995 & May 10, 2001) that the ensuing development resulting from project completion would likely eliminate a large portion if not all of the occurrence. Because of the establishment of the Murray's Mill Conservation Area, the United States Fish and Wildlife Service issued a Biological Opinion of Not Likely to Jeopardize the species, issued May 10, 2001, pages 4-5 of this Opinion states:

> *"…all populations at the proposed interchange eventually will be eliminated due to secondary development. To offset these impacts, H. naniflora at Murray's Mill Preserve will be protected in perpetuity. Plant numbers are estimated at over 20,000. Given the large number of plants protected by this preserve, USFWS believe the impacts from this project are still offset by the protection afforded to H. naniflora by the preserve."*

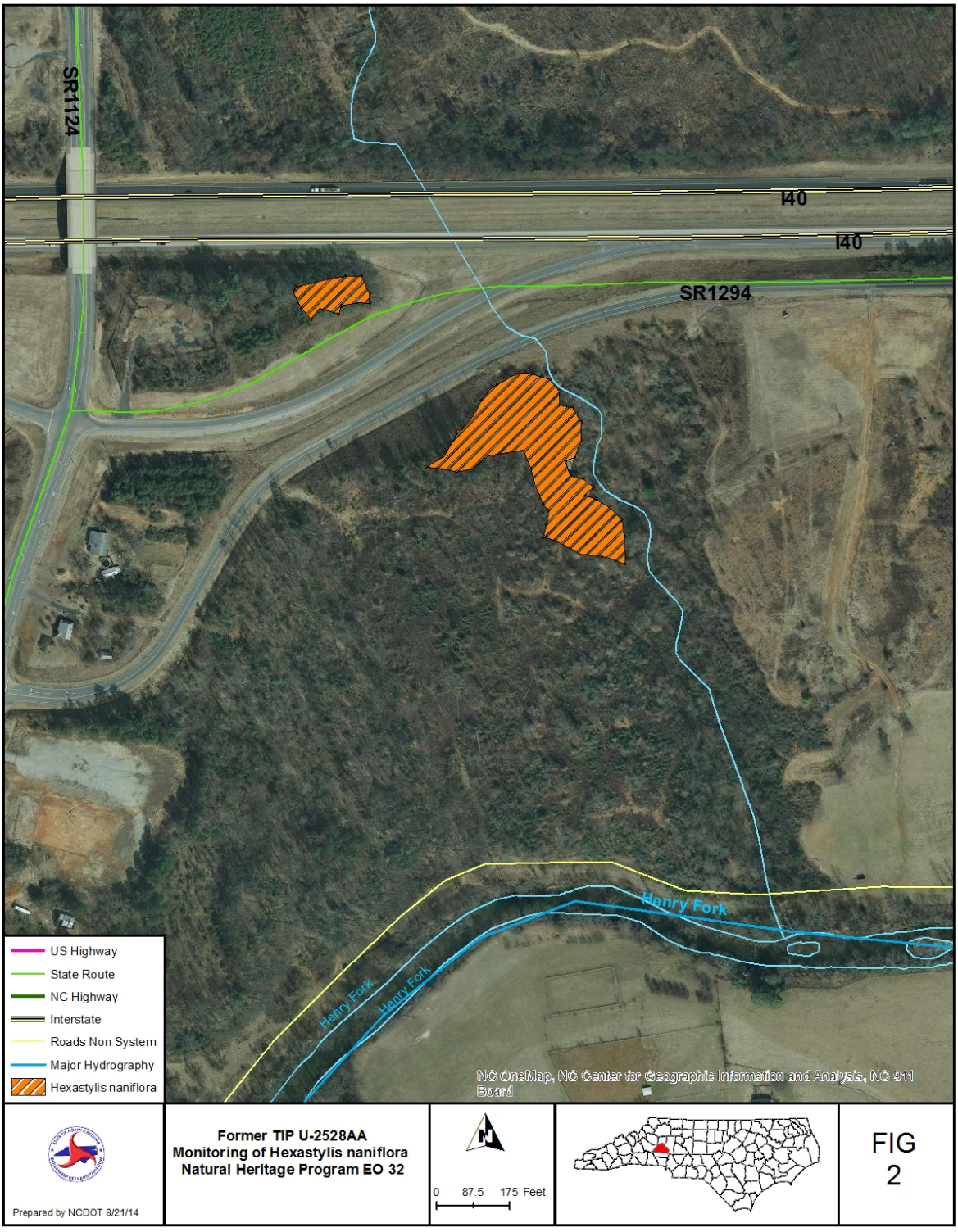

MUNICIPAL AIRPORT
HICKORY
Recreation Center
Frye
Bethel Cem
Penelope
Longview
City Hall
Water Tank
Substation
Sewage Disposal
Hildebran
Water Tank
BURKE CO
CATAWBA CO
HICKORY CORP BDY
Camp Sain
INTERCHANGE
Henry River
HENRY
Gaging Sta
BOUNDARY
INDEFINITE
Meadow Brook Village
Hexastylis naniflora
None. Acknowledgment of the U.S. Geological Survey would be appreciated in products derived from these data.

Prepared by NCDOT 8/21/14

Former TIP U-2528AA
Monitoring of Hexastylis naniflora
Natural Heritage Program EO 32

0 700 1,400 Feet

FIG 1


SR1124
I40
I40
SR1294
Henry Fork
Henry Fork
Henry Fork
US Highway
State Route
NC Highway
Interstate
Roads Non System
Major Hydrography
Hexastylis naniflora
NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board
Prepared by NCDOT 8/21/14
Former TIP U-2528AA
Monitoring of Hexastylis naniflora
Natural Heritage Program EO 32
0 87.5 175 Feet
FIG 2

References

North Carolina Department of Transportation. 2011 Conservation Plan for Murray's Mill Conservation Area. Catawba County, North Carolina. DRAFT

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North Carolina Department of Transportation. 2009. Biological Assessment for the Proposed Upgrade of Lovelady Road, TIP No.R-2824, in Burke County, North Carolina.

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United States Fish and Wildlife Service. 2001. Amendment to the *Biological Opinion of the US Fish and Wildlife Service Concerning the Effects of Construction of DOT Project TIP U-2528AA in Catawba County on the Federally Threatened Dwarf-Flowered Heartleaf.* Log Number 4-2-95- 102.

2014
Dwarf-flowered Heartleaf, *Hexastylis naniflora,* Inventory and Monitoring Report

Element Occurrence (EO) 275
Iredell County, NC

Contact Person:
Tim Bassette
Environmental Program Consultant
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

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919.707.6104
tpbassette@ncdot.gov

August 18, 2014

Table of Contents

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Site: EO 275 [Buffalo Shoals Creek/Eufola Road] (Iredell County)

NCNHP EO number(s): 275

NCDOT Point of Contact (POC): Tim Bassette

Signed ROW occurrence? No

Site management plan: No portion of the site is subject to a management plan.

Site protections: Previously, seven plants were going to be directly impacted by the cut slope in the southwest quadrant. However, the design plans were modified to avoid the plants by tightening the cut slopes in that area to 1.5:1. No formal consultation was necessary, as no adverse effects from construction of this project were expected. A very small portion of this population (approximately 20 plants) lies within North Carolina Department of Transportation (NCDOT) right-of-way (ROW), and the remainder lies on adjacent private property. North Carolina DOT is monitoring the entire population, which constitutes all of North Carolina Natural Heritage Program (NCNHP) EO 275.

Origin of species at this site: Native.

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable, increasing slightly. Carolina Ecosystems, Inc. inventoried the population on May 21, 2014 and counted 257 plants. North Carolina DOT inventoried the population on May 24, 2012 and counted 222 plants. The 2014 count was likely higher due to an increasing population.

Species long-term trend at this site (averaged over multiple counts): Stable, increasing slightly. In 2007, Bassette and others from both the NCDOT and NCNHP counted 192 total plants. In 2010, the NCDOT counted 230 total plants. In 2012 the NCDOT counted 222 total plants but noted that more may be present and obscured by leaf cover. In 2014, Carolina Ecosystems, Inc. counted 257 total plants. The 2014 count was likely higher due to an increasing population. This data indicates a seven year span of a generally increasing population.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID: R-2824
USFWS log number: 4-2-09-367

Status of NCDOT commitments (per USFWS biological opinion, USFWS letter of concurrence): From pages 31-34 of the Biological Assessment for TIP R-2824 Proposed Upgrade of Lovelady Road (dated May 2009), and Appendix B of the Biological Opinion for the same project (dated November 13, 2009), NCDOT committed to assist United States Fish and Wildlife Service (USFWS) with the five-year review process by providing information about several populations of Dwarf-flowered Heartleaf (DFHL) that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure for R-2824.) The population of DFHL associated with B-2146 is included in this group.

Because DFHL is located within the right-of-way of B-2146, NCDOT will monitor this occurrence, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:

- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using Global Positioning System (GPS)/Geographic Information Systems (GIS), computing changes to acreages of occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program – Endangered and Rare Plant Field Survey Form that incorporates both types of data.
- Analyze population trends by comparing recent size estimates to data from previous years.

Status: This is the third of three post-construction monitoring reports for this EO.

Status of terms and conditions from applicable NC Plant Conservation Program permits:

NC PCP Permit ID number(s): N/A
Description: N/A

Discretionary actions undertaken by NCDOT and partners:

No additional discretionary actions (*i.e.,* rescue, relocation, augmentation, management) have been undertaken by NCDOT and its partners.

Appendix A: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Appendix A.1: Monitoring Data

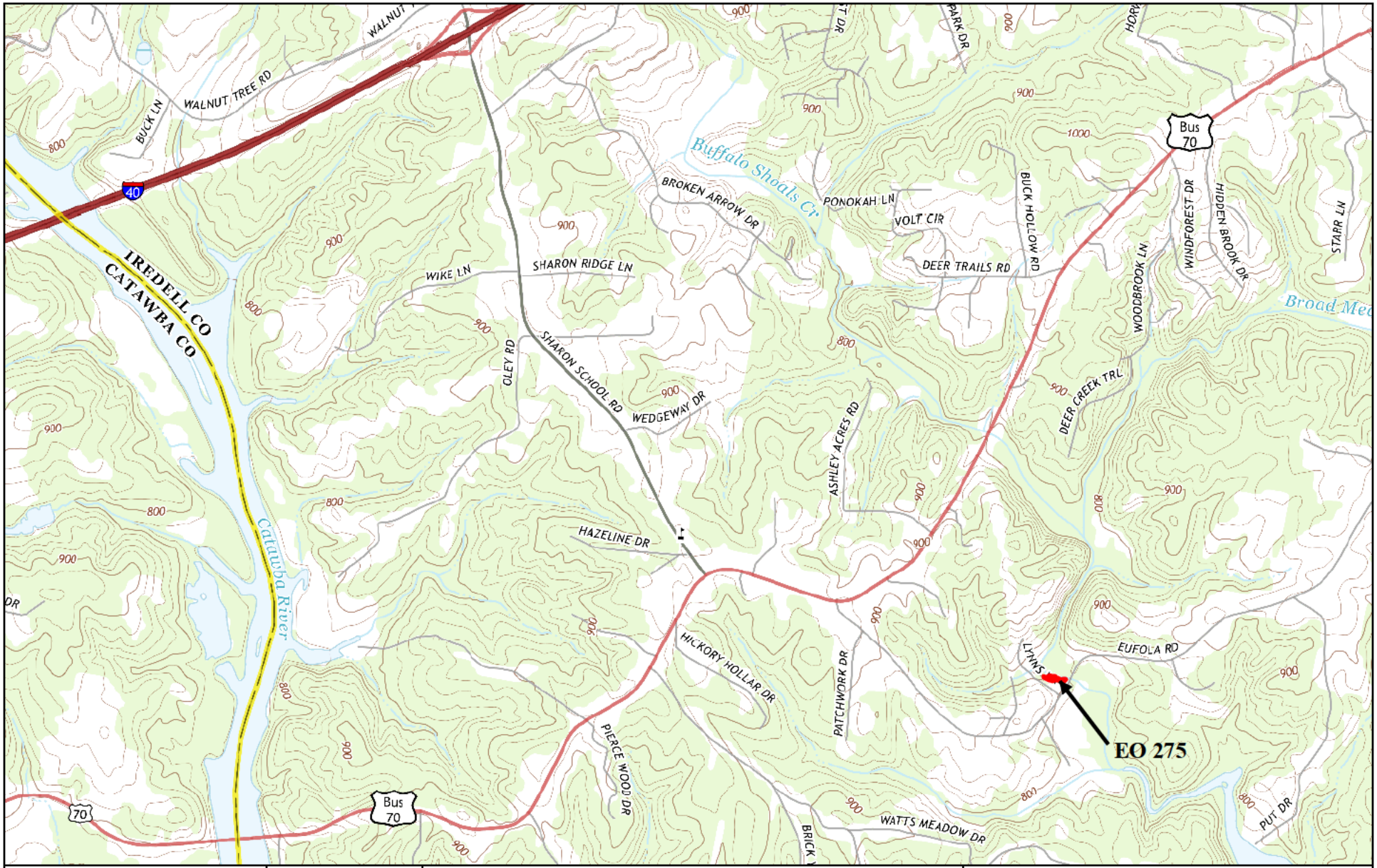
EO 275 Pre- and Post-Construction Inventories			
Survey Date	Count	Area (acres)	Density (plants/acre)
2007	192	0.35	549
2010	230	0.35	657
2012	222	0.35	634
2014	257	0.38	676

Current Results:
The above table summarizes the pre- and post-construction DFHL inventories for EO 275. The site was inventoried and monitored on May 21, 2014 by Phil May, Brian Smith, and Joe Sullivan (Carolina Ecosystems Inc. biologists). This EO occurs on the northwest side of SR 1333 (Eufola Road) (Figure 1, USGS Map). Each individual transect, approximately five meters wide, was traversed by three people and each plant encountered was inventoried using mechanical tally counters. Flagging was temporarily used to delineate between transects. The total plants counted for EO 275 on May 21, 2014 was 257 plants. Additionally new single-leaved plants were noted, but the early stage of development made the leaf morphology indistinguishable from *H. arifolia*.

Previous Results:
Bassette along with other NCDOT biologists, Heather (Wallace) Renninger and Lance Fontaine, as well as NCNHP biologist, James Padgett, collected baseline data on July 11, 2007 prior to project construction. The population was direct-counted at 192 plants in 2007. The site was also inventoried by direct count on November 9, 2010 by Heather (Wallace) Renninger, Melissa Miller, Dennis Herman, and Mike Sanderson (NCDOT biologists). The total population was direct-counted at 230 plants in 2010. The site was direct counted and monitored on May 24, 2012 by NCDOT biologists. The total population was direct-counted at 222 plants in 2012, but the heavy leaf cover may have obscured some plants during the count.

Trends and Discussion:
The direct-counted population increased between 2007 and 2010 by over 30 plants. The count remained relatively stable in 2012, but the count may have been low due to leaf cover. The population has increased between 2012 and 2014 by over 30 plants. Plant density has increased from 634 plants/acre in 2012 to 676 plants/acre in 2014 (See above table). In 2014, a portion of the occurrence (approximately 20 plants) was found to be within the approximate road ROW. In 2010 there were approximately 30 plants found within the approximate road ROW.

The population has increased between the direct-counted population from the pre-construction baseline survey of 2007 and the last post-construction survey of 2014. The population boundary has also been changed (Figure 2, Aerial Imagery Map), increasing from 0.35 acres to 0.38 acres primarily due to additional area on the west side containing approximately 20 plants. Plant density has increased from 549 plants/acre in 2007 to 676 plants/acre in 2014 (See above table). Habitat quality has not changed between the pre-construction baseline survey of 2007 and the last post-construction survey of 2014. The entire population, including plants that lie within the road ROW, appeared healthy during the 2014 monitoring visit.



Prepared By:

CAROLINA ECOSYSTEMS, INC.

3040 NC 42 West; Clayton NC, 27520
P (919)-606-9145 F:(919)-585-5570

August 2014

Prepared For:

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

N

0 1,000 2,000 Feet

DFHL Population

USGS 1:24000 Quadrangle Maps: Catawba (2013), Statesville West (2013), Stony Point (2013), and Troutman (2013)

Figure 1: USGS Map

Element Occurrence (EO) - 275
Dwarf-Flowered Heartleaf (DFHL)
Iredell County

Prepared By:

CAROLINA ECOSYSTEMS, INC.
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P (919)-606-9145 F:(919)-585-5570

August 2014

Prepared For:

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

N

0 25 50 Feet

DFHL Population

2010 NC Statewide Aerial Photographs

Figure 2: Aerial Imagery

Element Occurrence (EO) - 275
Dwarf-Flowered Heartleaf (DFHL)
Iredell County

Appendix A.3: EO 275 Photographs

Photograph 1: EO 275 Habitat

Photograph 2: EO 275 Dwarf-flowered Heartleaf

NORTH CAROLINA NATURAL HERITAGE PROGRAM
PLANT SURVEY FORM

Return form to: N.C. Natural Heritage Program; MSC 1601; Raleigh, NC 27699-1601;
or e-mail form to appropriate staff member (see "Contact Us" link at www.ncnhp.org)

Species: *Hexastylis naniflora* Common name: Dwarf-flowered Heartleaf **Survey date**: 5/21/2014

EO Number (if updating existing EO): 275 **County**: Iredell 7.5' Quad Map: Catawba

Coordinates (if known): Not processed per agreement with Plaintiff/Request Not processed per agreement with Plaintiff/Request Elevation: approximately 780-820'
If coordinates given, indicate coordinate system and datum (State Plane 1927 or 1983, UTM, etc): NAD 1983

Site Name (if this is within previously identified site):
Site location and directions: (attach copy of map with site marked or use back of form to draw a sketch of the site):
From I-40 Exit 144, head south on Old Mountain Rd, turn right onto Lewis Ferry Rd, then turn right onto Eufola Rd. The population is located in the southwest quadrant of Bridge Number 86 on SR 1333 (Eufola Rd.) over Buffalo Shoals Creek. The site is located approximately 0.7 mile southwest of Statesville, and approximately 1.0 mile east-southeast of the intersection of SR 1333 and US Route 70.

Number of individuals: 257 Define individual (stem, clump, etc.): Plants vary from a single stem to several stems (clump) arising from its root system.

Size of area in which population occurs: 0.38 acres

Estimate whether the entire population was surveyed, or only a portion: Entire population surveyed.

Estimated Population Viability (circle one): (Excellent) Good Fair Poor Unknown Failed to find
Population Viability Comments: Plants look healthy and do not seem to be affected by adjacent clearing associated with bridge replacement activities, or disturbance along the edge of the adjacent residence.

Phenology (include % or # in each stage): (100% vegetative) bud (30% flower)

Evidence of reproduction: fruit seedlings (clonal/vegetative)

Reproduction Comments:

Habitat (NC NHP natural community name and description, if known; include quality, soils, geology, etc.):

The majority of the site occurs in a Piedmont/Coastal Plain Heath Bluff (high quality); some of the site occurs in a Mesic Mixed Hardwood Forest (Piedmont subtype) (high quality). Soils on most of the site are mapped as PrF (Poindexter-Rowan complex, 25-45% slopes); very southern and eastern fringes are mapped as PrE (Poindexter-Rowan complex, 15-25% slopes). Note that soil unit designations have been updated by the NRCS since the last monitoring date.

Associated species: *Fagus grandifolia, Quercus alba, Quercus rubra, Quercus falcata, Liquidambar styraciflua, Acer rubrum, Carya tomentosa, Oxydendrum arboretum, Nyssa sylvatica, Carpinus caroliniana, Liriodendron tulipifera, Cornus florida, Hammamelis virginiana, Kalmia latifolia, Sassafras albidum, Leucothoe fontanesiana, Viburnum acerifolium, Euonymus americanus, Smilax* spp., *Vaccinium vacillans, Vitis rotundifolia, Lonicera sempervirens, Hexastylis arifolia, Polystichum acrostichoides, Polygonatum biflorum, Maianthemum racemosum, Parthenocissus quinquefolia, Toxicodendron radicans, Trillium* sp.

Invasive species noted & degree of threat from invasive species*:* Low threat overall. Small amounts of Japanese honeysuckle (*Lonicera japonica*) is growing along the periphery of the population. Small amounts of Japanese grass (*Microstegium vimineum*), sericea lespedeza (*Lespedeza cuneata*), and mimosa (*Albizia julibrissin*) were observed within the NCDOT right-of-way but outside the limits of the *H. naniflora* population.

Area of apparently suitable habitat (suitable for, but not necessarily occupied by the species): Relative to the bridge over Buffalo Shoals Creek, approximately 1 acre in the southwest quadrant, and 0.1 acre in the southeast quadrant. The southeast quadrant does not contain *H. naniflora*.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? Approximately 20 plants are located in NCDOT Right-of-Way. Suitable habitat exists outside of Right-of-Way, see above.

Topographic position (examples: crest, mid slope, alluvial, etc): Top of stream bank to near crest, with the majority of plants occurring on midslope.

Moisture regime (examples: inundated, dry, seasonally wet, etc): Moist, well-drained, mesic.

Light (examples: open, woodland, closed canopy, etc): 50% closed woodland canopy, with a prevalence of understory trees and shrubs.

Other information: Multiple (50+) small, single stem *Hexastylis* plants without flowers were noted on site, but were indistinguishable from *H. arifolia* due to indistinct leaf morphology at this early growth stage. Some of these may be *H. naniflora* but were not included in the count until they can be identified. The *Hexastylis* is located on a hillslope with a general north and north-northeast aspect.

Protection / management needs and opportunities: North Carolina DOT is monitoring this population as part of a commitment to USFWS. This population has the potential to be protected through an extension of the road's ROW or as part of a potential conservation easement.

Landowner(s), if known: Jimmy Lee Shaver, Parcel ID# 3792858085, Deed Book/Page 1070/0223 (Iredell County GIS http://iredell.connectgis.com/Map.aspx accessed by Carolina Ecosystems Inc. May 2014).

Person making this report, Address, & Phone:

Phil May, Carolina Ecosystems Inc.
3040 NC Hwy 42 W
Clayton, NC 27520
919-606-1065

This report is prepared for:
Tim Bassette, Environmental Program Consultant
Biological Surveys Group
Project Development and Environmental Analysis Unit
NCDOT Mail Service Center 1598
Raleigh, NC 27699-1598
Phone Number: 919-707-6104

Other observers:
Brian Smith, Carolina Ecosystems Inc.
Joseph Sullivan, Carolina Ecosystems Inc.

Specimens collected? No Collection #: N/A Repository: N/A
(**permits are required for federal or state listed species**)

Draw sketch below or attach map. See Figures 1 and 2.

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
1	3	3852	H	Beaverdam Creek/3 mi east of Travelers Rest				1964	2009	GREE			
1	5	7689	CD	Sagittaria Hydrology Site		150	200	1991	2008	GREE			Doug Rayner (Wofford College) - emailed 12/12/17
1	6	1160	CD	Junction of SSR173 and SSR 262		75	100	1991	2008	GREE			
1	8	4875	BD	UT Beaverdam Creek/S-903		150		1991	2008	GREE			
1	15	1713	AC	DNR Bunched Arrowhead Preserve		1		1991	2010	GREE	Y	DNR Bunched Arrowhead Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
1	52	730	AC	DNR Belvue Springs Heritage Preserve		?		1999	2008	GREE		"numerous clumps", DNR Belvue Springs HP. Is this the same as the Bunched Arrowhead Preserve?	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
2	10	7931	H?	UT Enoree River				1985	2010	GREE			
2	51	6287	BC	DNR Clear Creek Heritage Preserve		1		1999	2008	GREE	Y	DNR Clear Creek Heritage Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
3	22	1649	BD	UT Tyger River/south of S-75		50	100	1991	2008	SPAR		same as 9058	
3	23	9058	BD	UT Tyger River/south of S-75						SPAR		same as 1649 (duplicate plant count)	
4	2	7399	BD	1.5 mi south of Gowensville/SC14		150		1991	2008	GREE			
4	4	3101	CD	Fairview Farms		75		1991	2008	SPAR			
4	24	6179	CD	UT Motlow Creek		50	100	1991	2008	SPAR			
4	32	5677	BD	Page Creek at Landrum HS		155		1991	2008	SPAR			
4	33	4879	BD	NW of Junction SC11 and SC14		168		1991	2008	GREE			
4	36	1993	BD	Clear Branch Creek		303		1991	2008	SPAR			
4	38	3367	BD	UT Spivey Creek	+	1000		1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
4	39	8503	CD	1 mi SW of US176 and S-209 in Ingleside		66		1991	2008	SPAR			
4	40	8504	BD	UT Clear Branch Creek		221		1991	2008	SPAR			
4	41	1460	CD	SC 14 and High Farm Road		50	100	1991	2008	SPAR			
4	42	8856	BD	1/4 mi E of SC14 and South Pacolet River		189		1991	2008	GREE/SPAR			
4	49	1450	AB	UT Page Creek/Campbell Ave		750	800	2001	2008	SPAR	?	2001 "new Spartanburg Water Systems preserve"	Spartanburg Water System (who?)
4	50	1449	BD	Page Creek Sewer Line		400	550	2001	2008	SPAR	?	2001 "an easment is being sought"	Spartanburg Water System (who?)
4	54	2719	BD	Headwater UT Wolfe Creek		400		2001	2008	SPAR	?	"On City of Landrum Property"	
4	59	13002	BD	Beaver Dam Creek/MetCalf		250	500	2005	2011	SPAR			
5	30	6009	BD	Greene Creek		100		1994	2008	SPAR			
6	25	878	CD	Lake William Bowen		10	20	1991	2008	SPAR			
7	37	6749	CD	Bear Creek		56		1991	2008	SPAR			
8	35	108	BD	Alverson Grove Church		74		1991	2008	SPAR			
9	34	7788	BD	Arrowood Branch		13		1991	2008	SPAR			
10	31	1730	H?	Blalock Res Site P				1984	2009	SPAR		NCNHP includes EO 7 and 31 as Blalock sites, 5-YR Review includes EO 7 and 29. 2km rule groups EO 7 and 29 together with EO 31 separate (>2km) but close by.	Spartanburg Water System (who?)
11	7	7013	BD	Taylor Blalock Res		3505		2016	2008	SPAR		James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	Spartanburg Water System (who?) or Gaddy
11	29	6010	H?	Blalock Res Site C				1984	2009	SPAR			Spartanburg Water System (who?)
12	20	3552	BD	Camp Mary Elizabeth		150		1991	2008	SPAR	?	Girl Scouts of America	Fred Parrish
12	21	1984	BD	Beaverdam Creek/Claggett Raintree		700		1991	2008	SPAR	?	SC Nature Conservancy	Kristen Austin (TNC SC) emailed 12/12/17, or Fred Parrish
12	55	2486	CD	UT North Tyger River/Woodridge		50		2001	2008	SPAR			
13	9	7930	CD	Chinquapin Creek		?		1991	2008	SPAR		"two small colonies"	Fred Parrish
13	13	6456	BD	UT Cleveland Park Lake		50		1991	2008	SPAR	?	City of Spartanburg - Cleveland Park	Fred Parrish
13	19	3551	BC	USC-Upstate		25	50	1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
13	46	2369	CD	Shoally Creek		25		1998	2008	SPAR			
13	53	8981	BC	USC-Upstate		250	300	2000	2008	SPAR		Is this a part of other USC population?	Doug Rayner (Wofford College) - emailed 12/12/17
13	56	6523	BD	Lawsons Fork Creek on US221		200	250	2001	2008	SPAR			
14	11	6097	AB	DNR Peters Creek Heritage Preserve		3306		2016	2008	SPAR	Y	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	14	2791	AB	DNR Peters Creek Heritage Preserve		5000		1991	2008	SPAR	Y	DNR Peters Creek Heritage Preserve, Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	26	5183	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	27	4476	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	28	8667	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	47	6953	U	Cannon Campground Road and Kelly Road				1998	2008	SPAR			
14	48	2769	U	Kelly Road				1998	2008	SPAR			
14	57	4312	BD	Lincoln Memorial Cem/Cannon Campground Rd		450	600	1997	2012	SPAR			
15	16	916	BC	Cowpens NBF - Site 1		2823		2016	2008	CHER		US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	Park manager (who?) or NCNHP

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
15	17	5173	BC	Cowpens NBF - Site 3	+	130		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP
15	18	6825	BC	Cowpens NBF - Site 2		50		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP
16	1	235	BD	Cherokee Creek/SC 11		200		1991	2008	CHER			
16	44	3124	H?	SW side of SC 11 - 5.45 mi NW of I-85				1984	2009	CHER			
16	45	5554	U	Lenzer Circle				1989	2008	CHER			
16	60	13003	BD	Cherokee Creek/Bonner and Robin School Roads		1500		2004	2011	CHER			
17	43	7286	CD	McKee Drive		20		1991	2008	CHER			
18	12	1322	H?	Horse Creek				1986	2012	CHER			
				Boulder Creek Subdivision - Jordan Road		15	20	2006		GREE	Y	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17)	April Punsalan
				Gateway Elementary School						GREE		"number of clumps around trees near streams" (F. Hollemon 12/12/17)	

Populations	EO Number	EO Rank	Site Name	Total Estimated Plants	Resilience Category	Last Observed	County	Notes	RNR Notes
1	7; 29	BD	Taylor Blalock Res	>1000	Very High	2016	SPAR	James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	
2	11; 14; 26; 27; 28; 47; 48; 57	AB	DNR Peters Creek Heritage Preserve	>1000	Very High	2016	SPAR	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	
3	16; 17; 18	BC	Cowpens NBF - Site 1	>1000	Very High	2016	CHER	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	
4			Boulder Creek Subdivision - Jordan Road	<100	Low	2016	GREE	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17). Last seen in 2016 per F. Hollemon (02/06/18).	Not in EO data. Two locations [redacted] and [redacted] Coordinates located from paper maps.
5			Gateway Elementary School	<100	Low	2017	GREE	"number of clumps around trees near streams" (F. Hollemon 12/12/17). Last seen in 2017, not a full survey just noticed plants likely additional plants in wooded area. Plants located directly behind school per F. Hollemon (02/06/18)	Not in EO data. "Directly behind school" is approximately [redacted]

2012
Dwarf-flowered Heartleaf, *Hexastylis naniflora,* Inventory and Monitoring Report

Contact Person:
Tim Bassette
Environmental Program Consultant
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919.707.6104
tpbassette@ncdot.gov

April 15, 2013

Table of Contents

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Site: EO 158 (Catawba County)

NC NHP EO number(s): 158

NCDOT Point of Contact (POC): Tim Bassette

Signed ROW occurrence? No

Site management plan: No portion of the site is subject to a management plan.

Site protections: No signed right-of-way, conservation easement, or fee title acquisition. Approximately 15 plants (3%) are within the estimated right-of-way of SR 1115 (Camp Creek Road). Plants found within the right-of-way are not protected under any formal agreement. Future road improvement and/or maintenance may affect portions of the dwarf-flowered heartleaf (DFHL) population adjacent to the existing road.

Origin of species at this site: Native.

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable. Carolina Ecosystems Inc. inventoried the population on December 17, 2012 and counted 330 plants on the east side of SR 1115 (Camp Creek Road) and counted 226 plants on the west side for a total of **556** total plants. NCDOT inventoried the population on December 1, 2010 and counted 312 plants on the east side of the road and 223 on the west side for a total of **535** plants. The 2012 count was likely higher due to minimal leaf cover. The leaf cover was low as the area had experienced a complete clear-cut in the monitoring area. Many plants were exhibiting signs of stress during the 2012 monitoring visit.

Species long-term trend at this site (averaged over multiple counts): Stable. Bassette (2001) counted 546 total plants. NCDOT (2010) counted 535 total plants with the lower count attributed to heavy leaf cover. Carolina Ecosystems Inc. (2012) counted 556 total plants. The 2012 count was likely higher due to the area being recently clear-cut so leaf cover was minimal. Foliage on many plants exhibited stress (brown coloration) likely from the recent clear-cut. This data indicates a nine year span of a stable population. However, this clear-cut may result in a population decline in subsequent years.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID: **R-2824**

USFWS log number: 4-2-09-367

Appendix B, Conservation Measures; Section 6.2.2, 5-Year Review Assistance. Five additional NCDOT projects will be investigated to determine whether any DFHL plants occur within NCDOT right-of-way. If DFHL plants are found within the right-of-way, then NCDOT will monitor these occurrences, the results of which will also be incorporated into a data spreadsheet. These five occurrences include NCDOT Division 12 project (SR 1115 in Catawba County) [EO No. 158] and

NCDOT Division 12 project (SR 1473 in Catawba County) [EO No. 162]. Monitoring will occur every two years for no more than a six year period, and will include a quantitative and qualitative analysis that assesses population trends.

EO 158 has been monitored twice by either NCDOT or its contractors on December 1, 2010, and December 17, 2012. Monitoring results were last updated and submitted with the Plant Mitigation & Monitoring List (last update March 1, 2012) as well as Table 2 of the *Amended Biological Assessment, US 74 Shelby Bypass, Cleveland County, North Carolina* (NCDOT 2012).

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): This was the second inventory of this population under the NCDOT's commitment per the R-2824 BO. The next scheduled inventory will take place in **2014.**

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s): **N/A**
Description: N/A

Discretionary actions undertaken by NCDOT and partners:

No additional discretionary actions (*i.e.,* rescue, relocation, augmentation, management) have been undertaken by NCDOT and its partners.

Species: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Site: EO 162 (Catawba County)

NC NHP EO number(s): 162

NCDOT Point of Contact (POC): Tim Bassette

Signed ROW occurrence? No

Site management plan: No portion of the site is subject to a management plan.

Site protections: No signed right-of-way, conservation easement, or fee title acquisition. No plants are currently within estimated right-of-way. Future road improvement plans may affect the DFHL plants along the ditch adjacent to the existing road.

Origin of species at this site: Native.

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Stable. Carolina Ecosystems Inc. inventoried the population on December 17, 2012 and counted **21** plants on the south side of SR 1473 (8th Avenue). NCDOT inventoried the population on December 20, 2010 and counted **23** plants. Both of these counts may be low due to the heavy leaf cover observed during the inventories. The occupied habitat of DFHL identified during the 2012 monitoring period has been reduced by 50 percent from that which was identified during the December 20, 2010 monitoring survey (0.04 acres to 0.02 acres).

Species long-term trend at this site (averaged over multiple counts): Stable. This population appears to be stable or in slight decline based on historical accounts. The total count was 25 in 2005, 23 in 2010, and 21 in 2012. The numbers do indicate a potential declining trend, which may be influenced by heavy leaf cover in the latter two events.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

NCDOT project ID: **R-2824**

USFWS log number: **4-2-09-367**

Appendix B, Conservation Measures; Section 6.2.2, 5-Year Review Assistance. Five additional NCDOT projects will be investigated to determine whether any DFHL plants occur within NCDOT right-of-way. If DFHL plants are found within right-of-way, then NCDOT will monitor these occurrences, the results of which will also be incorporated into a data spreadsheet. These five occurrences include NCDOT Division 12 project (SR 1115 in Catawba County) [EO No. 158] and NCDOT Division 12 project (SR 1473 in Catawba County) [EO No. 162]. Monitoring will occur every two years for no more than a six year period, and will include a quantitative and qualitative analysis that assesses population trends.

EO 162 has been monitored twice by either NCDOT or its contractors on December 20, 2010, and December 17, 2012. Monitoring results were last updated and submitted with the Plant Mitigation & Monitoring List (last update March 1, 2012) as well as Table 2 of the *Amended Biological Assessment, US 74 Shelby Bypass, Cleveland County, North Carolina* (NCDOT 2012).

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): This was the second inventory of this population under the NCDOT's commitment per the R-2824 BO. The next scheduled inventory will take place in **2014.**

Status of terms and conditions from applicable NC Plant Conservation Program permits: N/A

NC PCP Permit ID number(s): **N/A**

Description: N/A

Discretionary actions undertaken by NCDOT and partners:

No additional discretionary actions (*i.e.*, rescue, relocation, augmentation, management) have been undertaken by NCDOT and its partners.

Appendix A: *Hexastylis naniflora* (Dwarf-flowered Heartleaf)

Appendix A.1: Monitoring Data

R-9999L
DFHL Inventory

FIELD DATA SUMMARY
12/17/2012

EO 158

Area 1 Transects - 3 people direct count
Cumulative totals (counters)
Pin flags delineating between transects

Transect	BS	JP	PM	
1	10	20	51	
2	46	59	84	
3	61	73	97	
4	81	94	110	
5	90	103	114	
6	91	103	114	
7	93	109	122	
8	95	111	123	
9	96	111	123	
Total	**96**	**111**	**123**	**330**

Area 2 Direct count - 2 people (independent count)

Personnel	BS	PM	
Count	9	9	
Total			**9**

Area 3 Transects - 3 people direct count
Cumulative totals (counters)
Pin flags delineating between transects

Transect	BS	JP	PM	
1	0	1	6	
2	7	12	31	
3	28	25	48	
4	58	53	69	
5	74	67	74	
6	75	68	74	
Total	**75**	**68**	**74**	**217**

TOTAL COUNT ALL AREAS: **556**

EO 162

Area 1 Direct count - 3 people (independent count)

Personnel	BS	JP	PM	
Count	21	20	21	
Total				**21**

TOTAL COUNT: **21**

Appendix A.2: EO 158 (Catawba County)

EO 158 was inventoried and monitored on December 17, 2012 by Phil May, Brian Smith, and James Pflaum (Carolina Ecosystems Inc. biologists). This EO occurs on the east and west sides of SR 1115 (Camp Creek Road). There are three distinct polygons that contain plants: one on the east side of SR 1115 (Area 1, 0.27 acres) and two on the west side of SR 1115 (Area 2, 0.01 acres and Area 3, 0.17 acres). Areas 2 and 3 are separated by a gravel driveway (1387 Camp Creek Road) (Figure 1). Each individual transect, approximately five meters wide, was traversed by three people and each plant encountered was counted. The total plant counts per area were: Area 1, **330** plants: Area 2, **9** plants: Area 3, **217** plants (Appendix A.1). The total plants counted for EO 158 in December 2012 was **556** plants.

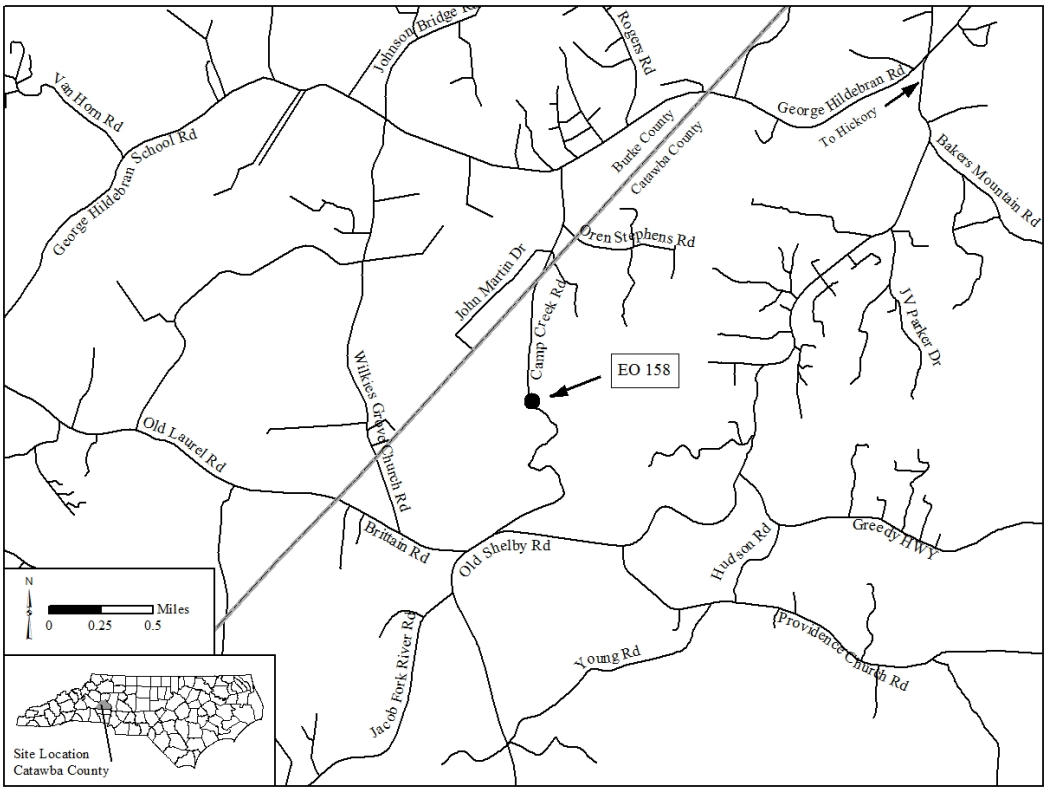
EO 158 was inventoried and monitored on December 1, 2010 by Tim Bassette, Steve Mitchell, Jared Gray, Matt Haney, and Dennis Herman (NCDOT biologists). **312** *H. naniflora* plants were direct-counted on the east side of SR 1115 and **223** plants were direct-counted on the west side. The plants on the west side of the road were separated by an unimproved driveway (1387 Camp Creek Rd. address), a small area was counted (**12** plants) on the north side of the drive and a larger area on the south side (**211** plants). The total population is estimated at **535** plants, but the heavy leaf cover may have obscured others.

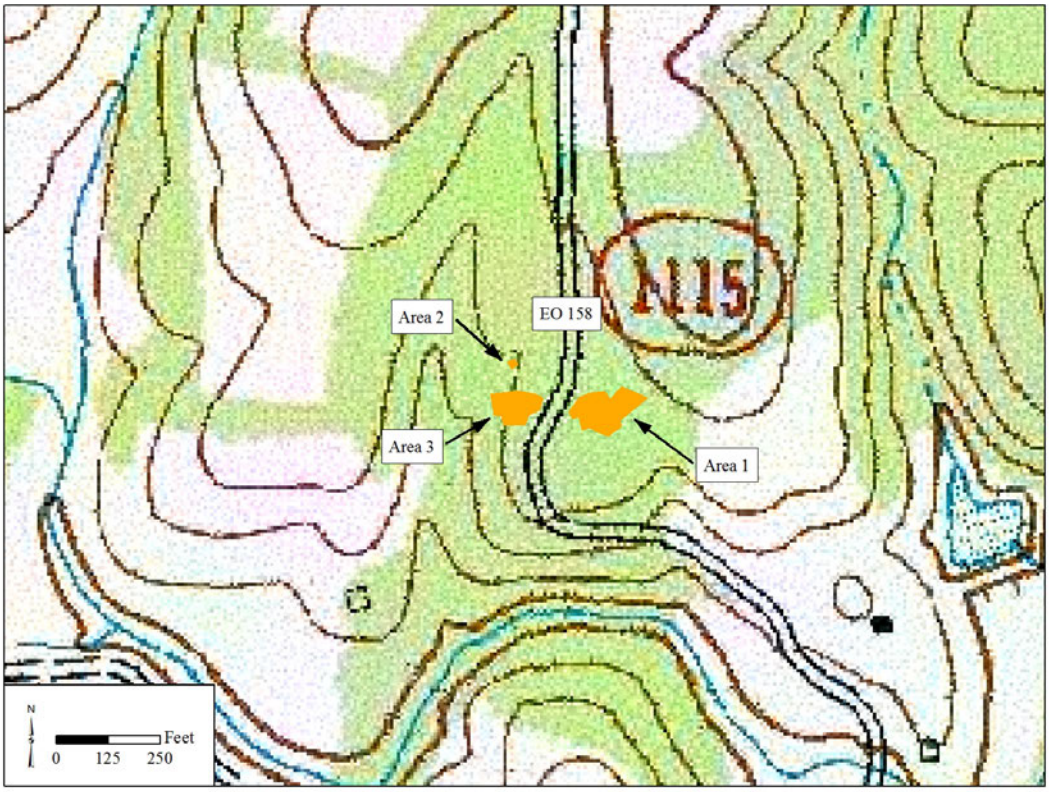
HDR (2005) counted a total **334** plants (direct count); **325** on the east side of SR 1115 and **9** on the west side. They calculated the plant density at 1,392 plants per acre.

Bassette (2003) direct-counted the population at **546** plants in 2001; **357** on the east side of SR 1115 and **189** on the west side. The current count is very close to the total Bassette direct-counted on May 7, 2001.

The population appears to have been stable as the direct-counted population from 2001 is similar to the count in 2012. A portion of the occurrence (15 plants) is found within the approximate right-of-way, and the entire population will be monitored and inventoried by NCDOT per the USFWS agreement. This population may decline in the future as the property has been clear-cut within the last year (2012). Many plants were brown in color, possibly stressed by the significant habitat change.

Appendix A.2.1 Figures 1 and 2. EO 158 Map





Appendix A.2.2: EO 158 Photographs

Photograph 1: EO 158 Habitat (Area 3)

Photograph 2: EO 158 Dwarf-flowered Heartleaf

Appendix A.2.3: EO 158 Natural Heritage Program Plant Survey Form

NORTH CAROLINA NATURAL HERITAGE PROGRAM
PLANT SURVEY FORM

Return form to: N.C. Natural Heritage Program; MSC 1601; Raleigh, NC 27699-1601;
or e-mail form to appropriate staff member (see "Contact Us" link at www.ncnhp.org)

Species: *Hexastylis naniflora* Common name: Dwarf-flowered Heartleaf **Survey date**: 12/17/2012

EO Number (if updating existing EO): 158 **County**: Catawba 7.5' Quad Map: Banoak

Coordinates (if known): Not processed per agreement with Plaintiff/Requester Not processed per agreement with Plaintiff/Requester Not processed per agreement with Plaintiff/Requester Elevation: approximately 1060'
If coordinates given, indicate coordinate system and datum (State Plane 1927 or 1983, UTM, etc): NAD 1983

Site Name (if this is within previously identified site):
Site location and directions: (attach copy of map with site marked or use back of form to draw a sketch of the site):
From I-40 exit 121 follow Old Shelby Road south, turn right onto George Hildebrand Road, then left onto Camp Creek Road. Site is located adjacent to the address 1387 Camp Creek Road (Figure 1).

Number of individuals: 556* Define individual (stem, clump, etc.): Rosette/clump

Size of area in which population occurs: 0.45 acres

Estimate whether the entire population was surveyed, or only a portion: Entire population surveyed
*Approximately 15 of the 556 plants counted are within the estimated road right-of-way

Estimated Population Viability (circle one): Excellent Good Fair (Poor) Unknown Failed to find
Population Viability Comments: Area was clear-cut within the last year (2012) and many plants appeared stressed (brown coloration) likely due to significant habitat change.

Phenology (include % or # in each stage): **556 vegetative** bud flower

Evidence of reproduction: fruit seedlings clonal/vegetative

Reproduction Comments: Out of season

Habitat (NC NHP natural community name and description, if known; include quality, soils, geology, etc.):

Area has been clear-cut. Habitat can be considered early successional and poor quality, regenerating possibly towards a Mesic Mixed Hardwood Forest (Piedmont Subtype). Soils in the area are mapped as Poplar Forest gravelly sandy loam 6 to 10 percent slopes and Woolwine-Fairview complex 10 to 25 percent slopes (Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for [Catawba, North Carolina]. Available online at http://soildatamart.nrcs.usda.gov. Accessed [May/2012]).

Associated species: *Ilex opaca, Smilax* sp.*, Acer rubrum, Liriodendron tulipifera, Vitis rotundifolia, Quercus alba, Oxydendrum arboreum, Lespedeza cuneata, Juniperus virginiana.* Due to the recent clear-cut, all tree species were saplings/scrub.

Invasive species noted & degree of threat from invasive species: *Lespedeza cuneata,* high degree of threat due to clear-cut.

Area of apparently suitable habitat (suitable for, but not necessarily occupied by the species): Habitat is considered extremely poor but suitable due to the existence of dwarf-flowered heartleaf. Area of suitable habitat is approximately 0.48 acres where the plants currently exist.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? Yes

Topographic position (examples: crest, mid slope, alluvial, etc): Crest/mid slope

Moisture regime (examples: inundated, dry, seasonally wet, etc): Dry

Light (examples: open, woodland, closed canopy, etc): Open/Clear-cut

Other information: Area was clear-cut. It was difficult to see plants under clear-cut debris in some areas and some plants were brown in color further hindering survey. Plants are located on moderate southwest facing slopes.

Protection / management needs and opportunities: This occurrence could be protected with a conservation easement.

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Landowner(s), if known: Smith, Carole Jean, Parcel ID# 266902899005, Deed Book/Page 2069/0350 (Catawba County GIS http://www.gis.catawba.nc.us/ accessed by Carolina Ecosystems Inc. April 2013).

Person making this report, Address, & Phone:

Phil May, Carolina Ecosystems Inc.
3040 NC Hwy 42 W
Clayton, NC 27520
919-606-1065

This report is prepared for:
Tim Bassette, Environmental Program Consultant
Biological Surveys Group
Project Development and Environmental Analysis Unit
NCDOT Mail Service Center 1598
Raleigh, NC 27699-1598
Phone Number: 919-707-6104

Other observers:
Brian Smith, Carolina Ecosystems Inc.
James Pflaum, Carolina Ecosystems Inc.

Specimens collected? No Collection #: N/A Repository: N/A
(**permits are required for federal or state listed species**)

Draw sketch below or attach map. See Figure 1.

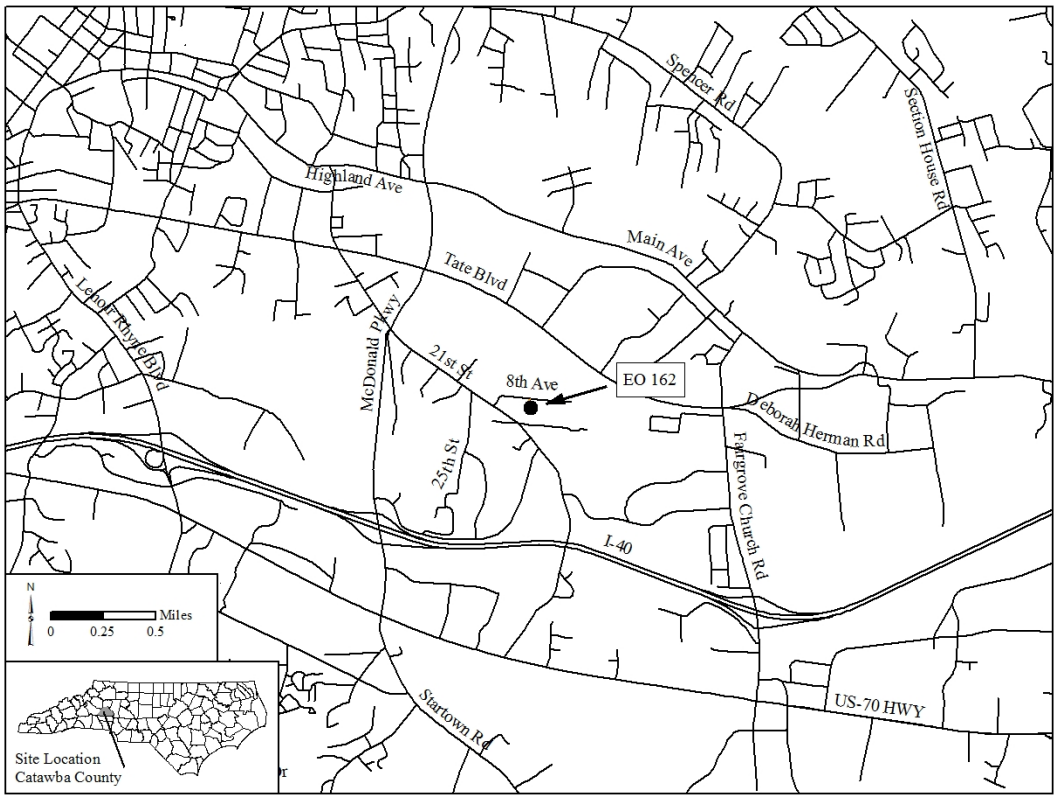
Appendix A.3: EO 162 (Catawba County)

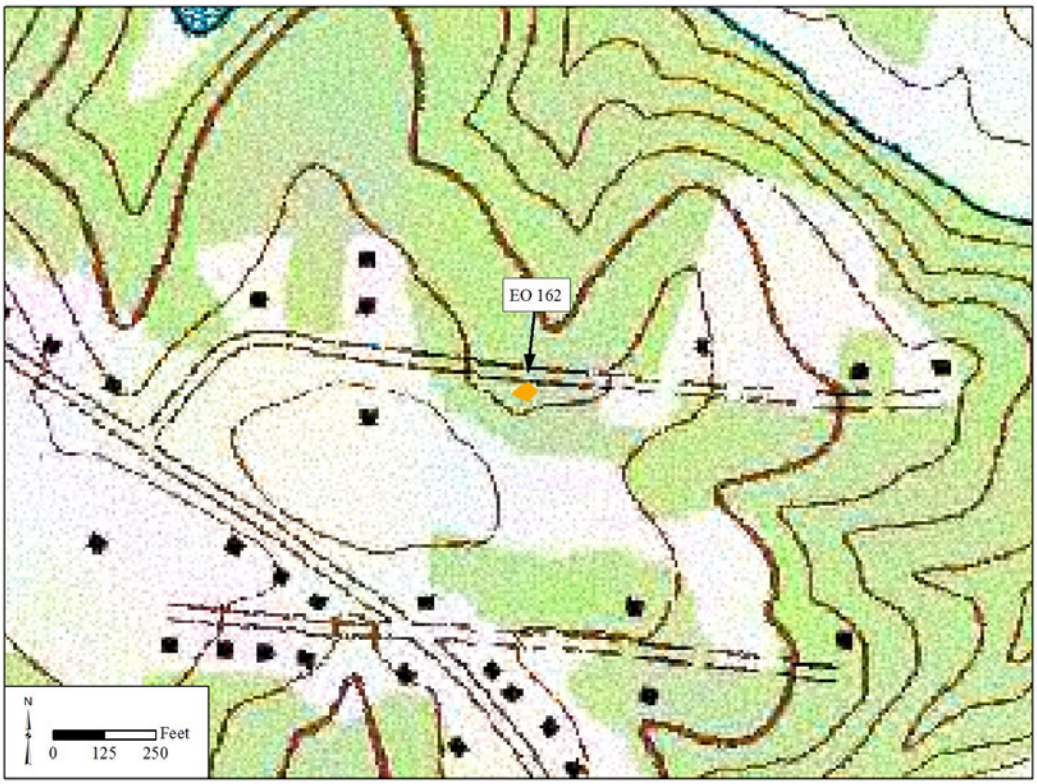
EO 162 was inventoried and monitored on December 17, 2012 by Phil May, Brian Smith, and James Pflaum (Carolina Ecosystems Inc. biologists). This population is located on a north facing slope on the south side of SR 1473 (8th Avenue) in Catawba County, east of Hickory, near Miller Branch. There is one distinct polygon that contains plants, approximately 0.02 acres in size (Figure 2). Multiple direct counts of this area were performed. Total count for EO 162 on December 17, 2012 was **21** plants. Heavy leaf cover may have obscured some plants.

EO 162 was inventoried and monitored on December 20, 2010 by Tim Bassette, Jared Gray, Neil Medlin, and Dennis Herman (NCDOT biologists). There were **23** *Hexastylis naniflora* plants direct-counted in the 0.04 ac plot. HDR direct-counted **25** plants at this site in 2005, but the heavy leaf cover may have obscured others.

The population appears to be stable or in slight decline. However, kudzu growing within the clear-cut north of the site and in the ditch adjacent to the site may significantly alter the habitat if it encroaches from the road. The population is outside the current right-of-way, but will be monitored and inventoried by NCDOT per the USFWS agreement because in the past limits of the occurrence have occurred in part within the road's approximate right-of-way.

Appendix A.3.1: Figures 3 and 4. EO 162 Maps





Appendix A.3.2: EO 162 Photographs

Photograph 1: EO 162 Habitat

Photograph 2: EO 162 Dwarf-flowered Heartleaf

Appendix A.3.3: EO 162 Natural Heritage Program Plant Survey Form

NORTH CAROLINA NATURAL HERITAGE PROGRAM
PLANT SURVEY FORM

Return form to: N.C. Natural Heritage Program; MSC 1601; Raleigh, NC 27699-1601;
or e-mail form to appropriate staff member (see "Contact Us" link at www.ncnhp.org)

Species: *Hexastylis naniflora* Common name: Dwarf-flowered Heartleaf **Survey date**: 12/17/2012

EO Number (if updating existing EO): 162 **County**: Catawba 7.5' Quad Map: Hickory

Coordinates (if known): Not processed per agreement with Plaintiff/Requester Not processed per agreement with Plaintiff/Requester Not processed per agreement with Plaintiff/Requester Elevation: approximately 1024'
If coordinates given, indicate coordinate system and datum (State Plane 1927 or 1983, UTM, etc): NAD 1983

Site Name (if this is within previously identified site):
Site location and directions: (attach copy of map with site marked or use back of form to draw a sketch of the site):
From I-40 exit 126 head north on McDonald Parkway, turn right onto 21st Drive Southeast, then left onto 8th Avenue. Population is on the south side of the road.

Number of individuals: 21 Define individual (stem, clump, etc.): Rosette/clump

Size of area in which population occurs: 0.02 acres

Estimate whether the entire population was surveyed, or only a portion: Entire population surveyed

Estimated Population Viability (circle one): Excellent Good (Fair) Poor Unknown Failed to find
Population Viability Comments: Kudzu beginning to encroach from roadside clear-cut on the opposite side of the road.

Phenology (include % or # in each stage): **21 vegetative** bud flower

Evidence of reproduction: fruit seedlings clonal/vegetative

Reproduction Comments: Out of season

Habitat (NC NHP natural community name and description, if known; include quality, soils, geology, etc.):

Mesic Mixed Hardwood Forest (Piedmont Subtype). Soils in the area are mapped as Clifford sandy loam, 10 to 15 percent slopes (Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for [Catawba, North Carolina]. Available online at http://soildatamart.nrcs.usda.gov. Accessed [May/2012]).). Habitat is of good quality due to the presence of a significant canopy and shrub layer.

Associated species: *Quercus alba, Quercus montana, Quercus rubra, Smilax* sp.*, Ilex opaca, Acer rubrum, Tipularia discolor, Chimaphila maculata, Pinus strobus, Juniperus virginiana, Fagus grandifolia, Carya tomentosa, Euonymus americanus, Pueraria lobata, Cornus florida*

Invasive species noted & degree of threat from invasive species*:* Kudzu is present south of the site (outside the boundaries of

the occurrence) and is a potentially high threat due to this plant's ability to rapidly change habitat types.

Area of apparently suitable habitat (suitable for, but not necessarily occupied by the species): Approximately 1.3 acres

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? N/A

Topographic position (examples: crest, mid slope, alluvial, etc): Mid slope

Moisture regime (examples: inundated, dry, seasonally wet, etc): Dry

Light (examples: open, woodland, closed canopy, etc): Woodland, but open to north

Other information: Difficult to see plants under leaf debris. Plants are located on a shallow north facing slope.

Protection / management needs and opportunities: Control/remove kudzu

.

Landowner(s), if known: Benco Steel Inc., Parcel ID# 372214237622, Deed Book/Page 2006/0044 (Catawba County GIS http://www.gis.catawba.nc.us/ accessed by Carolina Ecosystems Inc. April 2013).

Person making this report, Address, & Phone:

Phil May, Carolina Ecosystems Inc.
3040 NC Hwy 42 W
Clayton, NC 27520
919-606-1065

This report is prepared for:
Tim Bassette, Environmental Program Consultant
Biological Surveys Group
Project Development and Environmental Analysis Unit
NCDOT Mail Service Center 1598
Raleigh, NC 27699-1598
Phone Number: 919-707-6104

Other observers:
Brian Smith, Carolina Ecosystems Inc.
James Pflaum, Carolina Ecosystems Inc.

Specimens collected? No Collection #: N/A Repository: N/A
(**permits are required for federal or state listed species**)

Draw sketch below or attach map. See Figure 1.

2013

Hexastylis naniflora (Dwarf-Flowered Heartleaf)
Portion of Element Occurrence No. 191: Site 7
Inventory and Monitoring Report
US 74 Shelby Bypass (TIP R-2707)
Cleveland County, North Carolina

Contact Person:
Matt Haney
Environmental Senior Specialist
North Carolina Department of Transportation
Natural Environment Section
Biological Surveys Group

1598 Mail Service Center
Raleigh, NC 27699
919-707-6122
mmhaney@ncdot.gov

September 4, 2015

Table of Contents

Species: *Hexastylis naniflora* (Dwarf-Flowered Heartleaf) [DFHL]

Site: [Portion of Element Occurrence (EO) No. 191: Site 7] (Cleveland County)

NC NHP EO number(s): Part of 191

NCDOT Point of Contact (POC): Matt Haney, Tim Bassette

Signed ROW occurrence? No

Site management plan: None

Site protections: The North Carolina Department of Transportation (NCDOT) purchased 19 acres of right-of-way for the US 74 Shelby Bypass on or about October 28, 2013. The right-of-way, Parcel No. 62597, was obtained from parent Parcel No. 51544. Of the 19 acres, about 6.4 acres are to preserve in perpetuity DFHL specimens at Site 7. The acreage purchased includes both the portion of occupied DFHL in part of EO No. 191 designated as Site 7 as well as a protective buffer extending outward from the protected site.

Origin of species at this site: Native

Status of species at this site: Extant

Species short-term trend at this site (relative to last count): Increasing, relative to NCDOT's last complete enumeration conducted on October 27, 2000.

Species long-term trend at this site (averaged over multiple counts): Increasing, relative to NCDOT's last complete enumeration conducted on October 27, 2000.

Status of NCDOT commitments pledged during ESA Section 7 consultations:

A. **NCDOT project ID**: TIP No. R-2707
USFWS log number: 4-2-95-031

On November 9, 2012 the U.S. Fish and Wildlife Service (USFWS) issued an Amendment to the Biological Opinion (BO) pertaining to project R-2707. The BO was issued in response to a request to reinitiate formal consultation for the referenced project on October 17, 2012.

The USFWS requested the following conservation recommendations be implemented by NCDOT as part of its BO (pg. 3).

> 3. On-site protection- The portions of DFHL Sites 7, 10, 11, 15, 16, 20, 22, 24, 25, 28, 31, 32, and 49 not lost from project construction will be protected in perpetuity. A protective buffer of up to 400 feet out from the limits of preserved occupied DFHL habitat will be placed around these plant sites and also preserved in perpetuity. Final buffer widths will vary for each site. Design Plan Sheet Nos. 16-26 of 26 in the amended Biological

Assessment (BA) depict the area of occupied DFHL habitat to be protected and the approximate limits of the protective buffers. Final site configurations, including buffer limits, will be mapped and submitted to the Service when ROW acquisitions are complete.
Status: NCDOT purchased 6.4 acres around Site 7 on or about October 28, 2013 as additional ROW. The Notice of Condemnation and Consent Judgment document this transaction (see Appendices 3 and 4).
5. On-site monitoring- For on-site conservation sites entered into a secured protective ownership, either through ROW extension via settlement/condemnation or through a conservation easement with a landowner, the NCDOT will quantitatively and qualitatively monitor occupied DFHL habitat preserved in perpetuity. Monitoring efforts will begin with the acquisition of pre-construction/easement acquisition environmental baseline data. The preserved sites will then be monitored post-construction/easement acquisition once every 2 years over a 6-year period to ensure the protection, and detect trends in numbers, of DFHL plants that may or may not be due to project construction. Monitoring reports detailing the monitoring results and any appropriate management activities undertaken will be submitted to the Service at the end of each monitoring period.
Status: This report details the pre-construction monitoring period because the survey took place before construction of the US 74 Shelby Bypass began in the immediate area.

B. **NCDOT project ID**: TIP No. R-2824
USFWS log number: 4-2-09-367

Status of NCDOT commitments (per USFWS BO, USFWS letter of concurrence): From pages 31-34 of the Biological Assessment for TIP R-2824 Proposed Upgrade of Lovelady Road (dated May 2009), and Appendix B of the BO for the same project (dated November 13, 2009), NCDOT committed to assist USFWS with the five-year review process by providing information about several populations of DFHL that are either held in conservation easements or occur within NCDOT right-of-way. (This assistance serves as a conservation measure for R-2824.) The portion of EO No. 191 that corresponds with Site 7 of R-2707 is included in this group.

Because DFHL is located within a conservation easement, NCDOT will monitor this occurrence, the results of which will be incorporated into the data spreadsheet, submitted to USFWS annually on January 1. Information generated by the following activities will be included in the spreadsheet.

Every two years for no more than six years, NCDOT will:
- Enumerate plants via direct count and/or sample plot estimates.
- Delineate changes to the population boundary using Global Positioning System (GPS)/Geographic Information System (GIS), computing changes to acreages of occurrence areas, computing DFHL plant densities for each occurrence, and estimating changes to acreages of suitable habitat areas.
- Perform a qualitative analysis to include estimating the population viability, phenology, and evidence of reproduction; identifying associate species; identifying invasive, exotic species and documenting their degree of threat; and assessing the topographic position, moisture regime, amount of sunlight reaching DFHL plants, as well as other natural and human threats to the species, including but not limited to stream bank erosion, all-terrain vehicles, effects from historical herbicide applications and the lack of such applications in the future, effects from drought or excessive precipitation, and land clearing and draining activities.
- Prepare a North Carolina Natural Heritage Program – Endangered and Rare Plant Field Survey Form that incorporates both types of data.
- Analyze population trends by comparing recent size estimates to data from previous years.

Status: This is the first of four monitoring reports for this site.

Status of terms and conditions from applicable NCPCP permits:

NC PCP Permit ID number(s): N/A
Description: N/A

Discretionary actions undertaken by NCDOT and partners:

None

Appendix 1: Monitoring Data

On June 3, 2013, NCDOT biologists Jenny Morris, Jared Gray, Matt Haney, Tim Bassette, and Mike Sanderson surveyed the portion of DFHL EO No. 191 designated by NCDOT as Site 7 of the US 74 Shelby Bypass (TIP No. R-2707). The 2013 survey acts as an environmental baseline for monitoring purposes because it occurred before construction of the Bypass began at the site. A DFHL plant enumeration was completed as part of this survey by a direct count of plant specimens along walked straight-line transects. The same site was previously surveyed in its entirety during 1999-2000 by NCDOT and Environmental Services, Inc. acting on behalf of NCDOT. This survey determined the location and extent of DFHL occurring within the corridor limits of the Preferred Alternative of the Bypass as proposed at the time. As part of the 1999-2000 corridor survey, NCDOT biologists Jared Gray, Tim Bassette, Jill Holmes, and Matt Haney enumerated the DFHL plants in Site 7 on October 27, 2000. This plant enumeration was also completed by a direct count of plant specimens along straight-line transects. The number of DFHL plants, acreage of habitat occupied by the species, and plant density for Site 7 are depicted in Table 1 for both the 1999-2000 and 2013 surveys, while Figures 1 and 2 of Appendix 2 show the location of the site as it was delineated during the 2013 survey.

Table 1. Portion of DFHL EO No. 191: Site 7

Date	Number of plants	Area (ac)	Density (plants/ac)
1999-2000*	148	0.4	370
June 3, 2013	283	0.35	809

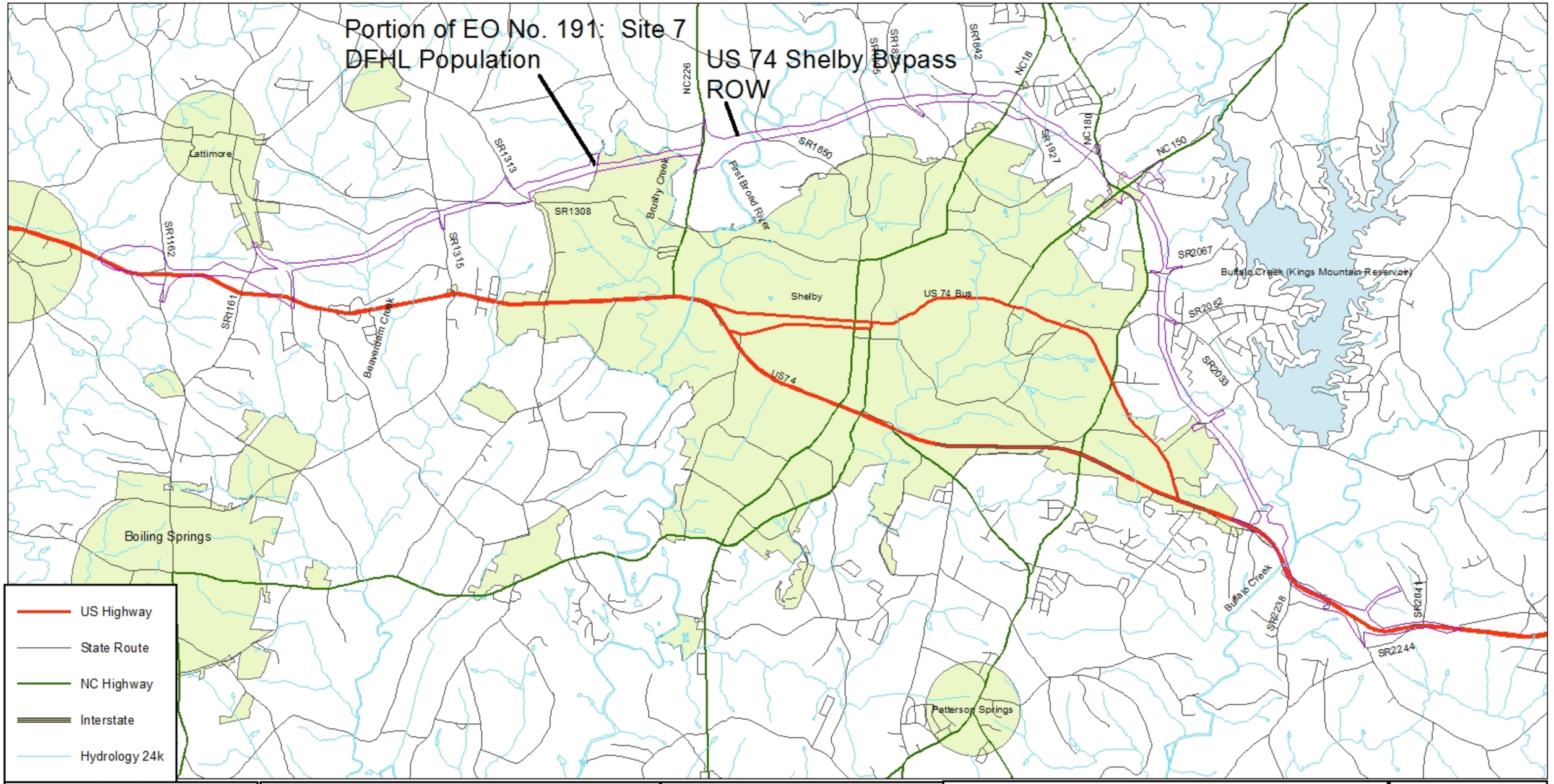
*Corridor survey for the Preferred Alterative of the US 74 Shelby Bypass. This survey was the last complete survey done prior to the implementation of pre- and post-construction monitoring efforts under Conservation Measures tied to the Bypass.

Much of Site 7 was clear-cut and logged just prior to the October 27, 2000 plant enumeration. The Mesic Mixed Hardwood Forest (Piedmont Subtype) and Dry-Mesic Oak-Hickory Forest community types that naturally exist at the site have since regenerated from the clear-cutting activities. Natural habitat regeneration primarily explains why the number of DFHL plants found at the site in 2013 has increased by over 91 percent as compared to the number of plants found in 2000. However, some of the vines, shrubs, and understory species have regenerated into extraordinarily dense vegetative layers along a large swath of the site, potentially crowding out some DFHL plants. Furthermore, a medium-high degree of threat also exists in portions of the site from the prevalence of invasive, exotic plant species such as Chinese privet, Japanese honeysuckle, and multiflora rose. Consequently, future management needs and opportunities at the site might include eliminating existing invasive plant species and potentially opening up some of the vegetative layers in order to reduce the risk of other plants outcompeting DFHL.

APPENDIX 2 (Figures)

Figure 1- Portion of Dwarf-flowered Heartleaf Element Occurrence No. 191: Site 7 (Vicinity Map)

Figure 2- Portion of Dwarf-flowered Heartleaf Element Occurrence No. 191: Site 7 (Aerial Imagery)



STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Prepared by NCDOT Aug 2015

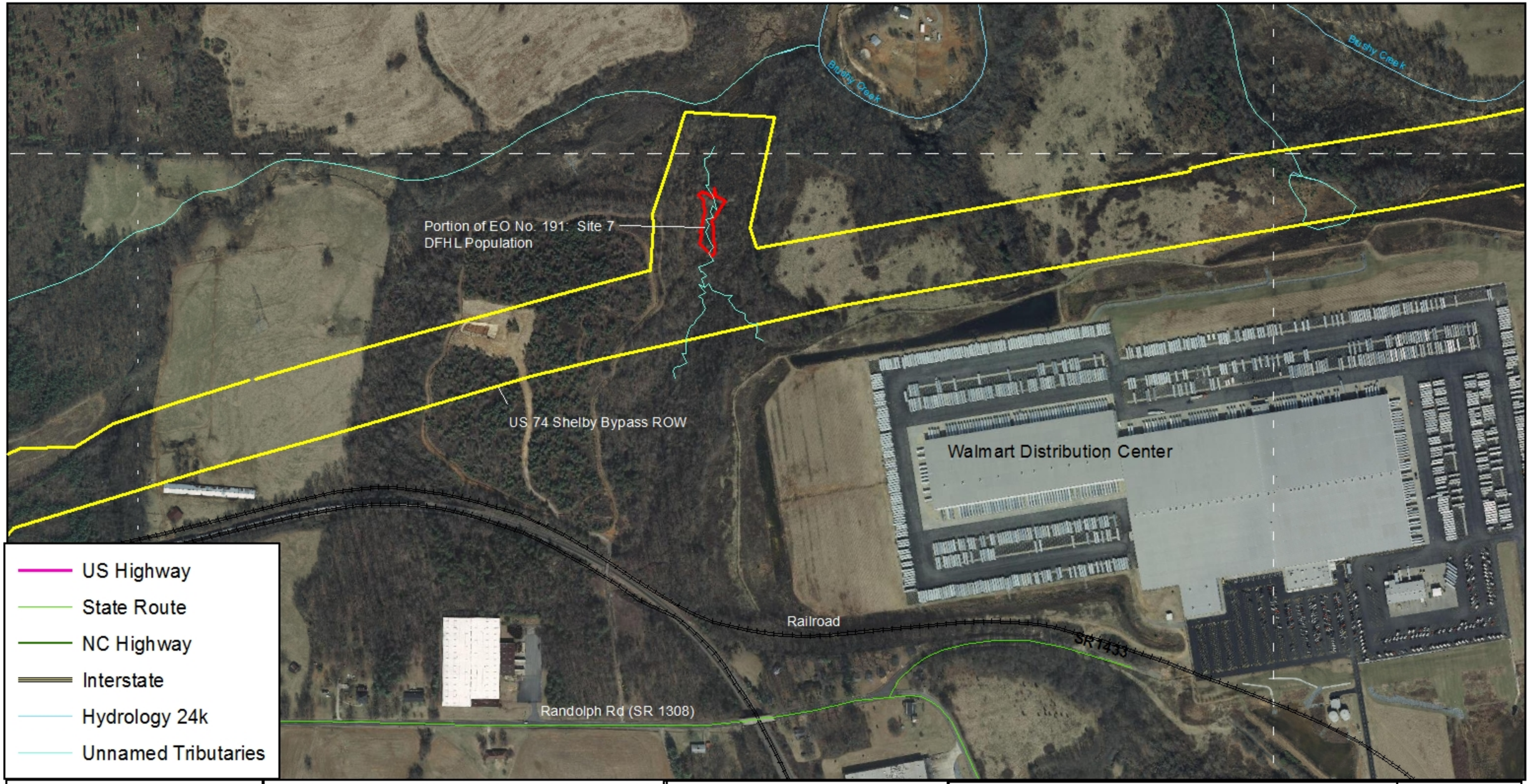
Figure 1: Portion of Dwarf-Flowered Heartleaf Element Occurrence No. 191: Site 7 (Vicinity Map)

US 74 Shelby Bypass
TIP No. R-2707
Cleveland County, NC

N

0 0.425 0.85 1.7 Miles

Fig 1



Prepared by NCDOT Aug 2015

Figure 2: Portion of Dwarf-Flowered Heartleaf Element Occurrence No. 191: Site 7 (Aerial Imagery)

US 74 Shelby Bypass
TIP No. R-2707
Cleveland County, NC

0 185 370 740 Feet

Fig 2

APPENDIX 3

Notice of Condemnation

178417

2013-010878 B: 1667 P: 1305
10/28/2013 04:34:28 PM Total Pages: 2 Fees: 26.00
Bonnie E. Reece, Register of Deeds, Cleveland County, NC

2 RECORDING FEE $ 26 00

*(E) NC Department of Transportation
Attorney General's Office
1505 Mail Service Center
Raleigh, NC 27690-9974
Attn: Jessie Thompson

Prepared By/Return To: Richard G. Sowerby, Assistant Attorney General
N.C. Department of Transportation, Attorney General's Office
1505 Mail Service Center, Raleigh, N.C. 27699-1505

NORTH CAROLINA
CLEVELAND COUNTY

DEPARTMENT OF TRANSPORTATION,
Plaintiff,
v.

SHELBY DEVELOPMENT PARTNERS, LLC; and TD BANK,
Defendants.

MEMORANDUM OF ACTION
(G.S. 136-104)

Take Notice:

1. That on or about the 28th day of October, 2013, the Department of Transportation, under the provisions of Article 9, Chapter 136 of the General Statutes, instituted the above-captioned civil action in the Superior Court of Cleveland County by the filing of a Complaint and Declaration of Taking and by the issuance of summons; that pursuant to G.S. 136-104, the interest and area specified in said Complaint and Declaration of Taking vested in the Department of Transportation on said date.

2. That the above-named defendants are the persons who the Department is informed and believes may have or claim to have an interest in said lands.

Project No.: 34497.2.8
Parcel No.: 022
I.D. No.: R-2707B

A.G. FILE NO. TR-11-01642

3. That the property which is the subject of this action is described as follows:

Those certain lands lying and being in Number Six Township, Cleveland County, North Carolina and being more particularly described as follows:

> Being that tract of land described in a deed dated March 6, 2008 to Shelby Development Partners, LLC, and recorded March 12, 2008 in Book 1546, Page 2390, Cleveland County Registry. The property description contained in said deed is hereby incorporated by reference.

Being also that tract of land represented by Tax Parcel Identification No. 51544 (Map/Block/Lot No. 6-90-1-16R) as is shown in the Cleveland County Tax Office.

4. That the estate or interest acquired in or across said lands taken are described in Exhibit "B" of said Complaint and Declaration of Taking.

This the 25th day of October, 2013.

ROY COOPER
Attorney General

E. Burke Haywood
Special Deputy Attorney General

Project No.: 34497.2.8
Parcel No.: 022
I.D. No.: R-2707B

A.G. FILE NO. TR-11-01642

APPENDIX 4

Consent Judgment

182280

10

RECORDING FEE $ 26.00

2014-001932 B: 1674 P: 0045
03/11/2014 11:52:13 AM Total Pages: 10 Fees: 26.00
Bonnie E. Reece, Register of Deeds, Cleveland County, NC

* SCHWEPPE LAW FIRM

(ABOVE THIS LINE FOR REGISTER OF DEEDS USE ONLY)

Prepared by/Return to: Thomas O. Lawton III, Assistant Attorney General
N.C. Department of Justice,
42 N. French Broad Avenue, Asheville, N.C. 28801

STATE OF NORTH CAROLINA

COUNTY OF CLEVELAND

IN THE GENERAL COURT OF JUSTICE
SUPERIOR COURT DIVISION
2013-CVS-1843

DEPARTMENT OF TRANSPORTATION,
Plaintiff,

v.

SHELBY DEVELOPMENT PARTNERS, LLC; and TD BANK,
Defendants.

CONSENT JUDGMENT
(CNDM - CJ)

THIS CAUSE coming on to be heard and being heard before the undersigned Judge of the Superior Court and it appearing to the Court and the Court finding as fact:

That this action was duly instituted on the 29th day of October, 2013, by the issuance of Summons, filing of a Complaint and Declaration of Taking and Notice of Deposit, and by the deposit of **ONE HUNDRED NINETY-TWO THOUSAND DOLLARS ($192,000.00)** as estimated just compensation; that Summons was duly served on the defendants, together with a copy of the Complaint and Declaration of Taking and Notice of Deposit;

That the defendants have not yet filed an answer to the Complaint and the time for filing an answer or otherwise responding to the Complaint has not expired; that the defendants by the execution of this consent judgment waive service of process; waive any claims for insufficiency of service of

process; waive the right to file answer or to otherwise plead in response to the Complaint and submit themselves to the jurisdiction of the court;

That the defendants are the only parties who have or claim to have an interest in the property described in the Complaint and Declaration of Taking, and the title to the property is not in dispute; that as of the date of the institution of this action, the property described in the Complaint and Declaration of Taking was subject only to such liens and encumbrances as were set forth in Exhibit "A" of the Complaint and Declaration of Taking;

That all parties who are necessary to the determination of this action are properly before the Court; and that the defendants are under no legal disability;

That defendants and the plaintiff have reached an agreement whereby the plaintiff has agreed to pay and the defendants have agreed to accept the additional sum of **EIGHTY-EIGHT THOUSAND DOLLARS ($88,000.00),** as complete and final settlement of all claims in this action and as just compensation pursuant to Article 9, Chapter 136, of the North Carolina General Statutes for the appropriation of the interests and areas as set forth in the Complaint and Declaration of Taking and as hereinafter more particularly described; which excludes interest and all costs, any claim for which the defendants hereby expressly waive; for any and all damages caused by the acquisition for the construction of Department of Transportation Project ID # R-2707B (WBS# 34497.2.8) Cleveland County; and for the past and future use thereof by the Department of Transportation, its successors and assigns, for all purposes for which the said Department of Transportation is authorized by law to subject the same.

Further, as a part of this agreement, the defendant Shelby Development Partners, LLC, shall execute and deliver to the plaintiff Department of Transportation a warranty deed for portions of the remainder tract of land contemporaneously with the Entry of this Consent Judgment, and that said defendant Shelby Development Partners, LLC, hereby covenants that it is seized of the subject property in fee simple, that title to the same is marketable and free and clear of encumbrances; that of the total compensation being paid herein, **ELEVEN THOUSAND SIX HUNDRED THIRTY-TWO DOLLARS ($11,632.00)** is allocated as payment for this portion of the remainder tract.

NOW, THEREFORE, IT IS ORDERED, ADJUDGED, AND DECREED:

1. That the Department of Transportation, the plaintiff herein, was entitled to acquire and did acquire, free and clear of all encumbrances, on the 29th day of October, 2013, by the filing of a Complaint and Declaration of Taking and Notice of Deposit, together with the deposit of **ONE HUNDRED NINETY-TWO THOUSAND DOLLARS ($192,000.00)**, those certain interests or estates and areas, hereinafter more particularly described, in, over, upon, and across the property of the defendants; and that said property of the defendants is described as follows:

> Being all of that tract of land more particularly described in that certain MEMORANDUM OF ACTION captioned "DEPARTMENT OF TRANSPORTATION, Plaintiff, v. SHELBY DEVELOPMENT PARTNERS, LLC, and TD BANK, Defendants," recorded in the Office of the Register of Deeds for Cleveland County in Book 1667 Page 1305, reference to which MEMORANDUM OF ACTION is made for a more particular description of said property of the defendants.

2. That the interests or estates acquired in, over, upon, and across the hereinabove described property of the defendants are described as follows:

INTERESTS OR ESTATES TAKEN:

> Fee simple title to right of way, and a slope easement for providing lateral support to the highway, or land adjacent thereto, which area will revert to the owners at such time as said owners lower or raise the elevation of the land adjacent to said highway to the extent that such lateral support is no longer needed and, in addition, a temporary construction easement to continue until the completion of the project, at which time said temporary construction easement area will terminate.

CONTROL-OF-ACCESS:

> Access is controlled by the Department of Transportation as is indicated by control-of-access (C/A) lines on the plans referred to below, and there will be no access to, from, or across the areas within the control-of-access (C/A) lines to the main traffic lanes, ramps, or approaches from the property abutting said highway right of way.

3. That the areas acquired in, over, upon, and across the hereinabove described property, to include survey lines and station numbers, are delineated on that set of plans for Department of Transportation Project ID# R-2707B (WBS#34497.2.8) on file in the Right of Way Branch of the Department of Transportation, Transportation Building, in Raleigh, North Carolina, and also on a copy of said project plans which are or will be recorded, as required by law, in the Office of the Register of Deeds of Cleveland County, to which plans reference is hereby made for greater certainty of the areas and interests herein conveyed, and said areas and interests are described by metes and bounds as follows:

AREAS TAKEN:

NEW RIGHT OF WAY:

Beginning at a point located 160 feet Southerly of and normal to Survey Station 288+20 Survey line L. Running thence in a Westerly direction along and with the Southern Control Access Right of Way limits of the Project, in a concentric manner to Survey line L, to its point of intersection with the Western Property line of the undersigned, said point being located 160 feet Southerly of and normal to Survey line L. Running thence North 09°51'22" East 345 feet plus or minus to its point of intersection with the Northern Right of Way limits of the Project, said point being located 160° Northerly of and normal to Survey line L. Running thence in a Easterly direction, along and with the Northern Control Access Right of way limits of the project, in a concentric manner to Survey Line L to a point located 160° Northerly of and normal to Survey Station 291+35 Survey Line L. Running thence in a Northerly direction in a straight line along the Western Right of Way limits of the Project to a Northern Property corner, said property corner being marked by an existing iron pin with a burnt chimney cap. Running thence North 16°11'38" East along a Western Property line of the undersigned to a point located 826.81 feet Northerly of and normal to Survey Line L. Running thence in a Southeasterly direction in a straight line along the Northern Right of Way limits of the Project to its point of intersection with a Eastern property line of the undersigned, said point of intersection being the eastern R/W limits of the project also said point being located 715.46 feet

Northerly of and normal to Survey Line L. Running thence South 09°06'52" West along and with the Eastern property line and the Eastern Right of Way limits of the project 328.83 feet to a point being located 407.78 feet Northerly of and normal to Survey Line L. Running thence South 13°57'23" West along and with the Eastern Property line and the Eastern Right of way limits of the Project 174.31 feet to a point located 250.77 feet Northerly of and normal to Survey Line L. Running thence South 01°30'30" East along and with the eastern property line and the eastern R/W limits of the project 75.12 feet to a point located 176.28 feet Northerly of and normal to Survey Line L. Running thence South 05°28'25" West along and with the Eastern Property line and the Eastern Right of Way limits of the Project to its point of intersection with the Northern Control of access Right of Way limits of the Project, said point being located 160 feet Northerly of and normal to Survey line L. Running thence South 05°28'25" West 124 feet plus or minus to a corner. Running thence South 23°29'18" East 52.97 feet to a corner. Running thence South 03°04'06" East 58.74 feet to a corner. Running thence South 37°53'53" West 125.38 feet to a corner. Running thence South 15°25'04" West 10 feet plus or minus to its point of intersection with the Southern Controlled Access Right of Way limits of the Project. Said point being located 160 feet Southerly of and normal to Survey Line L. Running thence in a Westerly direction, along and with the Southern Control of Access Right of way limits of the Project, in a concentric manner to Survey line L to the point of beginning.

TEMPORARY CONSTRUCTION EASEMENT:

Point of beginning being S 34°39'39.6" W, 240.361 feet from -L- Sta 290+00; thence to a point on a bearing of S 75°46'25.9" W, 313.790 feet; thence to a point on a bearing of N 80°37'3.0" E, 195.298 feet; thence to a point on a bearing of N 74°49'25.6" E, 51.609 feet; thence to a point on a bearing of N 62°44'56.5" E, 69.372 feet; returning to the point and place of beginning. Having an area of 2961.721 square feet being 0.068 acres

SLOPE EASEMENT:

It is understood and agreed that the Department of Transportation shall have the right to construct and maintain the cut and/or fill slopes in the above-described areas until such time as the property owners alter the adjacent lands in such a manner that the cut and/or fill slopes are no longer needed for the lateral support of the roadway. Any additional construction areas lying beyond the cut and/or fill slopes and extending beyond the right of way and beyond any permanent easement areas will terminate upon completion of the project.

CONTROL-OF-ACCESS:

Access is controlled by the Department of Transportation as is indicated by control-of-access (C/A) lines on the plans referred to above, and there will be no access to, from, or across the areas within the control-of-access (C/A) lines to the main traffic lanes, ramps, or approaches from the property abutting said highway right of way.

4. That the Department of Transportation, the plaintiff herein, pay into Court the additional sum of **EIGHTY-EIGHT THOUSAND DOLLARS ($88,000.00),** and that said sum, together with the original deposit made by the plaintiff in this action, unless heretofore disbursed by order of the Court, be disbursed to defendants, as their interests may appear.

5. That as part of this agreement, defendant Shelby Development Partners, LLC, shall, contemporaneously with the entry of this Consent Judgment, execute and deliver to the Plaintiff Department of Transportation a warranty deed for the portions of the remainder tract of land described below, and that said defendant hereby covenants that it is seized of the subject property in fee simple, that title to the same is marketable and free and clear of encumbrances; that of the total compensation being paid herein, **ELEVEN THOUSAND SIX HUNDRED THIRTY-TWO DOLLARS ($11,632.00**) is allocated as payment for the remainder tract.

The portions of the remainder to be conveyed to the Plaintiff Department of Transportation are described by metes and bounds as follows:

Remainder portion number 1:

Beginning at a point located 160 FT. Northerly of and normal to Survey Station 291+35 Survey Line L. Running thence in a Southwesterly direction, in a concentric manor to survey Line L., along the Control access limits of the project to its point of intersection with a Western Property line of the undersigned, said point being located 160 FT. Northerly of and normal to Survey line L. Running thence N. 09°50'57" E. approx. 720 FT. to a Northwestern Property corner. Running thence S. 83°17'56" E. approx. 1130 FT. to a pipe. Running thence in a Southerly direction in a straight line, along the Western Right of Way limits of the Project to the POB. Said description describes approx. 12.84 AC more or less.

Remainder portion number 2:

Beginning at a point located 826.81 FT. Northerly of and normal to survey line L. Running thence N 16°11'38" E 1000 +/- FT to a # 5 Rebar Stake. Running thence N 16°11'38" E 47.71 FT to the center of Brushy Creek. Running thence N 81°46'10" E 68.37 FT to a point in the middle of Brushy Creek. Running thence S 58°34'36" E 95.51 FT to a point in the middle of Brushy Creek. Running thence S 67°45'13" E 111.40 FT to a point in the middle of Brushy Creek. Running thence S 45°19'47" E 66.14 FT to a point in the middle of Brushy Creek. Running thence S 26°48'22" E 74.02 FT to a point in the middle of Brushy Creek. Running thence S 30°47'35" E 100.34 FT to a point in the middle of Brushy Creek. Running thence S 31°10'36" E 92.50 FT to a point in the middle of Brushy Creek. Running thence S 10°49'48" E 45.32 FT to a point in the middle of Brushy Creek. Running thence S 00°29'46" W 54.62 FT to a point in the middle of Brushy Creek. Running thence S 28°15'28" W 108.45 FT to a point in the middle of Brushy Creek. Running thence S 29°33'48" W 289.77 FT to a point in the middle of Brushy Creek. Running thence S 29°33'48" W 92.82 FT to a point in the middle of Brushy Creek. Running thence S 36°00'08" W 155.19 FT to a point in the middle of Brushy Creek. Running thence in a southerly direction along and with the northern R/W limits of the project in a straight line to the POB. Said description describes approx. 13.25 AC more or less.

6. That the sum of **TWO HUNDRED EIGHTY THOUSAND DOLLARS ($280,000.00),** said sum being the total amount of the original deposit plus said additional amount, is just compensation pursuant to Article 9, Chapter 136, of the North Carolina General Statutes for the taking of the hereinabove described interests and areas by the Department of Transportation; excluding all claims for interest and costs, which the defendants hereby expressly waive; for any and all damages caused by the acquisition for the construction of Department of Transportation Project ID# R-2707B (WBS #34497.2.8), Cleveland County; and for the past and future use thereof by the Department of Transportation, its successors and assigns, for all purposes for which the said Department of Transportation is authorized by law to subject the same.

7. That a copy of this Judgment be certified by the Clerk of Superior Court of this County to the Register of Deeds, who shall record the same among the land records of said County.

This the 10th day of March, 2014.

JUDGE OF SUPERIOR COURT

SIGNATURES CONTINUE ON FOLLOWING PAGE

APPROVED AND CONSENTED TO:

ROY COOPER
Attorney General

David P. Brenskelle
Special Deputy Attorney General

Thomas O. Lawton III
Assistant Attorney General

Shelby Development Partners, LLC,

By: _____

Title: MEMBER MANAGER

Ronald K. Payne
Attorney for Defendant Shelby Development Partners, LLC

TD Bank

By: _____

Title: VP

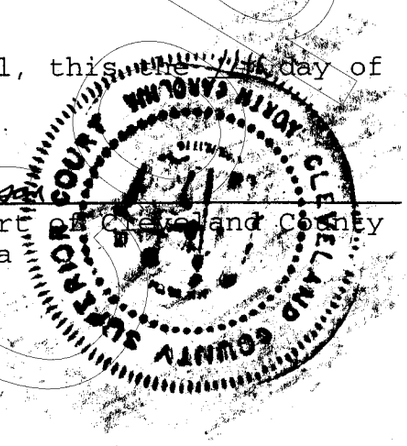
Lance P. Martin, WARD AND SMITH, PA
Attorney for Defendant TD Bank

STATE OF NORTH CAROLINA
COUNTY OF CLEVELAND

I, Mitzi M. Johnson, Clerk of the Superior Court of Cleveland County, North Carolina, do hereby certify that the foregoing is a true, accurate and correct copy of the Judgment entered in this case entitled, "DEPARTMENT OF TRANSPORTATION, Plaintiff, v. SHELBY DEVELOPMENT PARTNERS, LLC, and TD BANK, Defendants," as taken from and compared to the original on file in my office.

Witness my hand and the official seal, this the 11th day of March, 2014.

Mitzi M. Johnson
Clerk of Superior Court of Cleveland County
Shelby, North Carolina



APPENDIX 5

North Carolina Natural Heritage Program Endangered and Rare Plant Field Survey Form

NORTH CAROLINA NATURAL HERITAGE PROGRAM
ENDANGERED AND RARE PLANT FIELD SURVEY FORM

Species: *Hexastylis naniflora* **Common name**: Dwarf-flowered heartleaf

Survey date: June 3, 2013

EO Number (if updating existing EO): Part of EO 191

County: Cleveland **7.5' Quad Map**: Shelby

Latitude/Longitude (if known): Not processed per agreement with Plaintiff/Requester **Elevation**: 740-780 feet above mean sea level

If latitude/longitude given, what coordinate system was used (State Plane 1927 or 1983, UTM, etc.): NAD83

Site Name (if this is within previously identified site): Site 7

Site location and directions: Enter the dirt road on the north side of Randolph Road (SR 1308), just east of 2212 Randolph Road. Follow the dirt road over the railroad tracks, taking the right fork that continues northward, paralleling the small valley to your right (east side). From the fork, walk about 1,000 feet until reaching the centerline of the proposed Bypass. Turn right (east) and walk downslope toward the perennial stream. Once reaching the stream, head north (downstream) for about 200 feet until reaching the site, which sits along both the west and east sides of an unnamed tributary to Brushy Creek. A large portion of the site occurs on the stream floodplain, where the floodplain gradually slopes down along a generally north facing slope. The portion of the site west of the stream occurs on generally east, northeast, and northwest facing slopes. The attached Figures 1 and 2 depict the location of the site.

Number of individuals: The number of plants totaled 283 within the entire site prior to project construction. Of this total, the portion of the site west of the stream contains 193 plants, while the remaining 90 plants are found on the part of the site east of the stream.

Define individual (stem, clump, etc.): Mostly single and double stems with a few small rosettes.

Size of area in which population occurs: Entire population is 0.35 ac.

Estimate whether the entire population was surveyed, or only a portion: Entire population surveyed before the commencement of project construction. Actual survey, starting from the time the truck arrived near the site and including the time it took to hike from the vehicles to the site and back to the vehicles, took about 16.25 person-hours. The boundaries of the occupied *Hexastylis naniflor*a habitat were re-delineated in the field using Global Positioning System (GPS). *Hexastylis naniflora* plants within the site were enumerated by a plant-by-plant direct count via straight-line walking transects.

Estimated population viability: __Excellent ___Good __←X_ Fair ___Poor ___Unknown ___Failed to find

Population viability comments: Population habitat is "Fair," but trending towards "Good." The portion of the population along the entire eastern side of the stream as well as the very southwestern corner of the population contains a fairly dense understory comprised of shrubs, vines, and small trees. The remaining part of the population west of the stream generally contains moderately open woodlands. Occupied habitat found along both sides of the stream are more open and "mature" with a somewhat less dense understory as compared to what was observed during the site surveys of 2006 and 2010. Without conserving and appropriately managing this site, the entire population is anticipated to be lost from adverse indirect effects (drainage impacts + biological pollution) associated with the construction of the US 74 Shelby Bypass.

Phenology (include % or # in each stage):
Vegetative: 100%.
Bud: Not applicable.
Flower: Not applicable for the 2013 survey period.

Evidence of reproduction:
Fruit: Not applicable for the 2013 survey period.
Seedlings: Not applicable.
Clonal/vegetative: Unknown because evidence of the 2013 season's new plant emergence via rhizome was not field-investigated during the survey periods.

Reproductive comments: The 2013 survey period was conducted outside of the species' flowering window.

Habitat (NC NHP natural community name and description; include quality, soils, geology, etc.): Disturbed area (former logged cutover area) on the eastern and very western portions of site grading to a relatively undisturbed area on the remaining western portions of the site. Habitat composed of a medium quality Dry-Mesic Oak-Hickory Forest grading to a low to medium quality Mesic Mixed Hardwood Forest (Piedmont Subtype). Soils mapped as PtD, defined as Pacolet-Saw complex with 15-25% slopes, stony.

Associated species: *Aronia arbutifolia*, *Athyrium asplenioides*, *Asplenium platyneuron*, *Acer rubrum*, *Acer negundo*, *Arundinaria gigantea*, *Arisaema triphyllum*, *Amelanchier arborea*, *Arundinaria gigantea*, *Asimina triloba*, *Aristolochia tomentosa*, *Boehmeria cylindrica*, *Carex* sp., *Cimicifuga racemosa*, *Chimaphila maculata*, *Chionanthus virginicus*, *Cornus florida*, *Crataegus* sp., *Carya tomentosa*, *Carya ovata*, *Dennstaedtia punctilobula*, *Dioscorea villosa*, *Fagus grandifolia*, *Hamamelis virginiana*, *Ilex opaca*, *Impatiens capensis*, *Smilax bona-nox*, *Smilax glauca*, *Smilax rotundifolia*, *Sassafras albidum*, *Monotropa uniflora*, *Nyssa sylvatica*, *Onoclea sensibilis*, *Oxydendrum arboreum*, *Rubus argutus*, *Rhododendron periclymenoides*, *Parthenocissus quinquefolia*, *Polystichum acrostichoides*, *Viola* sp., *Quercus alba*, *Quercus rubra*, *Quercus muehlenbergii*, *Quercus phellos*, *Quercus nigra*, *Pinus taeda*, *Prunus serotina*, *Platanus occidentalis*, *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Vaccinium arboreum*, *Vitis rotundifolia*, *Xanthorhiza simplicissima*, *Smilacina racemosa*, *Sanguinaria canadensis*, *Sambucus canadensis*, and *Toxicodendron radicans*.

Invasive species noted & degree of threat from invasive species: Medium-high degree of threat from *Lonicera japonica*, *Ligustrum sinense*, *Lespedeza cuneata*, *Microstegium vimineum*, *Elaeagnus umbellata*, and *Rosa multiflora*.

Area of suitable habitat (suitable for, but not necessarily occupied by the species): Approximately 8 ac within the Preferred Alternative corridor of TIP No. R-2707 (US 74 Shelby Bypass). Note that this acreage was determined prior to the commencement of road construction activities.

If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way? The entire population, including a protective wooded buffer surrounding the occupied habitat, is within existing NCDOT right-of-way. Suitable habitat does exist outside of the actual population.

Topographic position (examples: crest, mid slope, alluvial, etc): Stream bank, stream floodplain, and mid slope.

Moisture regime (examples: inundated, dry, seasonally wet, etc): Dry and dry-mesic, well drained.

Light (examples: open, woodland, closed canopy, etc): Closed woodland canopy and fairly dense understory layer along the eastern and very southwestern portions of the site, with a semi-closed woodland canopy along the remaining western portions of the site.

Other information: None.

Protection / management needs and opportunities: As part of its conservation measures to offset the loss of *Hexastylis naniflora* plants in occupied habitat along TIP No. R-2707 (US 74 Shelby Bypass), the NC Department of Transportation acquired right-of-way to preserve in perpetuity *H. naniflora* specimens at Site 7 that will remain intact after incurring adverse direct and/or indirect (drainage) effects associated with construction of the Bypass project. This right-of-way that is protected in perpetuity also contains a protective buffer around the limits of the preserved occupied habitat of *H. naniflora* in order to minimize the potential adverse effects that may otherwise harm the protected site in the future.

Management needs and opportunities include eliminating existing exotic, invasive plant species in and around the site and managing the growth and spread of such species in the future. The vine, shrub, and understory vegetative layers may need to be opened up to reduce the risk that other plant species will outcompete with *Hexastylis naniflora* plants.

Landowner(s), if known: The NCDOT obtained Parcel No. 62597, from parent Parcel No. 51544, on or about October 28, 2013. Landowner information obtained from Cleveland County, NC Geographic Information System at http://arcgis.webgis.net/nc/Cleveland/ (accessed August 12, 2015) and personal communication with David Angel, NCDOT Division 12 Right-of-Way Office's Division Agent, on February 16, 2015.

Person making this report: Tim Bassette
Address: NCDOT, Project Development & Environmental Analysis Unit, 1598 Mail Service Center, Raleigh, NC 27699-1598
Phone: 919-707-6104

Other observers: NCDOT biologists Jared Gray, Jennifer Morris, Mike Sanderson, and Matt Haney.

Specimens collected? None. **Collection #**: Not applicable. **Repository**: Not applicable.