The logo for SWCA is positioned vertically on the left side of the page. It consists of the letters 'S', 'W', 'C', and 'A' stacked vertically in a large, light blue, serif font. The 'S' and 'W' are partially cut off by the left edge of the page.

Dwarf-flowered Heartleaf Report for the Kings Mountain Lithium Mine, Cleveland County, North Carolina

OCTOBER 2022

PREPARED FOR
Albemarle U.S., Inc.

PREPARED BY
SWCA Environmental Consultants

DWARF-FLOWERED HEARTLEAF REPORT FOR THE KINGS MOUNTAIN LITHIUM MINE, CLEVELAND COUNTY, NORTH CAROLINA

Prepared for

Albemarle U.S., Inc.
348 Holiday Inn Drive
Kings Mountain, North Carolina 28086
Attn: Trevor Chesal

Prepared by

SWCA Environmental Consultants
113 Edinburgh South Drive, Suite 120
Cary, North Carolina 27511
(919) 212-2200
www.swca.com

SWCA Project No. 70316

October 2022

CONTENTS

1	Introduction	1
1.1	Location.....	1
1.2	Project Area Description.....	1
2	Species Background	4
2.1	Description.....	4
2.2	Habitat	4
2.3	Range.....	4
2.4	Threats	4
2.5	Status	4
3	Methods	5
3.1	Desktop Analysis.....	5
3.2	Field Surveys	5
4	Results.....	6
4.1	Project Area Habitats	6
4.1.1	Forested Upland.....	6
4.1.2	Palustrine Forested Wetland	6
4.1.3	Palustrine Shrub-Scrub Wetland.....	6
4.1.4	Palustrine Emergent Wetland	7
4.1.5	Herbaceous Upland.....	7
4.2	Survey Results	7
5	Summary and Conclusions	10
6	Literature Cited.....	11

Appendices

Appendix A. Photographs

Tables

Table 1. Results of <i>Hexastylis</i> Habitat Survey within the Project Area.....	7
---	---

1 INTRODUCTION

On behalf of Albemarle Corporation (Albemarle), SWCA Environmental Consultants (SWCA) conducted dwarf-flowered heartleaf (*Hexastylis naniflora*) presence/absence surveys for the Kings Mountain Lithium Mining Project (Project) located in southeastern Cleveland County, North Carolina.

The dwarf-flowered heartleaf is a threatened species under the Endangered Species Act of 1973, as amended (ESA). A desktop review and field reconnaissance determined that approximately 100 acres of suitable dwarf-flowered heartleaf habitat are present in the Project area. No dwarf-flowered heartleaf populations were observed during presence/absence surveys conducted during the plant's flowering season in 2022.

1.1 Location

The Project is on private land owned or leased by Albemarle and consists of approximately 1,403 acres (Project area). The Project is located approximately 2 miles south of downtown Kings Mountain, North Carolina, and is located on the U.S. Geological Survey (USGS) Kings Mountain, North Carolina, 7.5-minute quadrangle (Figure 1). The Project area is divided by Interstate-85 (I-85), with the main parcel on the north side of the highway and two smaller parcels on the south side of the highway. The main parcel is bordered by South Battleground Avenue (Highway 216), Parkgrace Road, and Tin Mine Road to the west; Quarry Road to the north; and I-85 to the south and east.

1.2 Project Area Description

The main parcel is mostly developed/disturbed and includes Albemarle's lithium salts and compound processing facility and Albemarle's Global Technical Center. The west side includes an active drive-in theater, remnants of a textile plant, old school building, and recreational vehicle (RV) campground. Five utility rights-of-way (ROWs) cross the northern and central portions of the parcel. The parcel directly south of I-85 is mostly undeveloped. The Kings Mountain Gateway Trail goes around the northern and eastern boundaries of this parcel with trailheads off Galilee Church Road and Battleground Road. Additionally, three utility ROWs cross the parcel running northeast-southwest. The easternmost parcel, east of York Road, is undeveloped with only a few unpaved roads for access. Undeveloped land in the three parcels consists primarily of forest and wetland habitats.

The Project area is surrounded by residential, commercial, and industrial development to the north, west, and south (Figure 2). The Martin Marietta mine borders the Project area to the north. To the east is primarily undeveloped land associated with Crowders Mountain State Park.

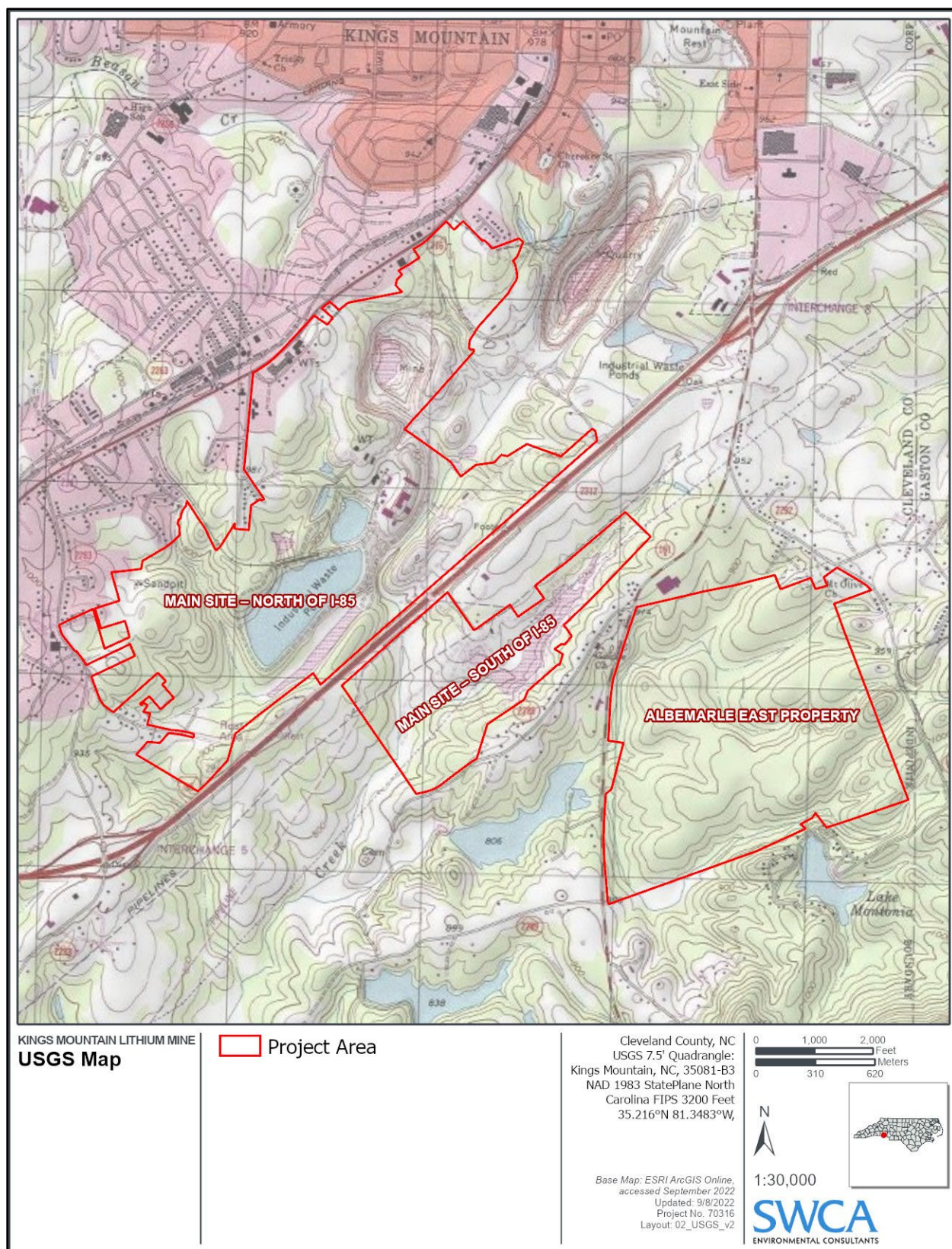


Figure 1. Project location.

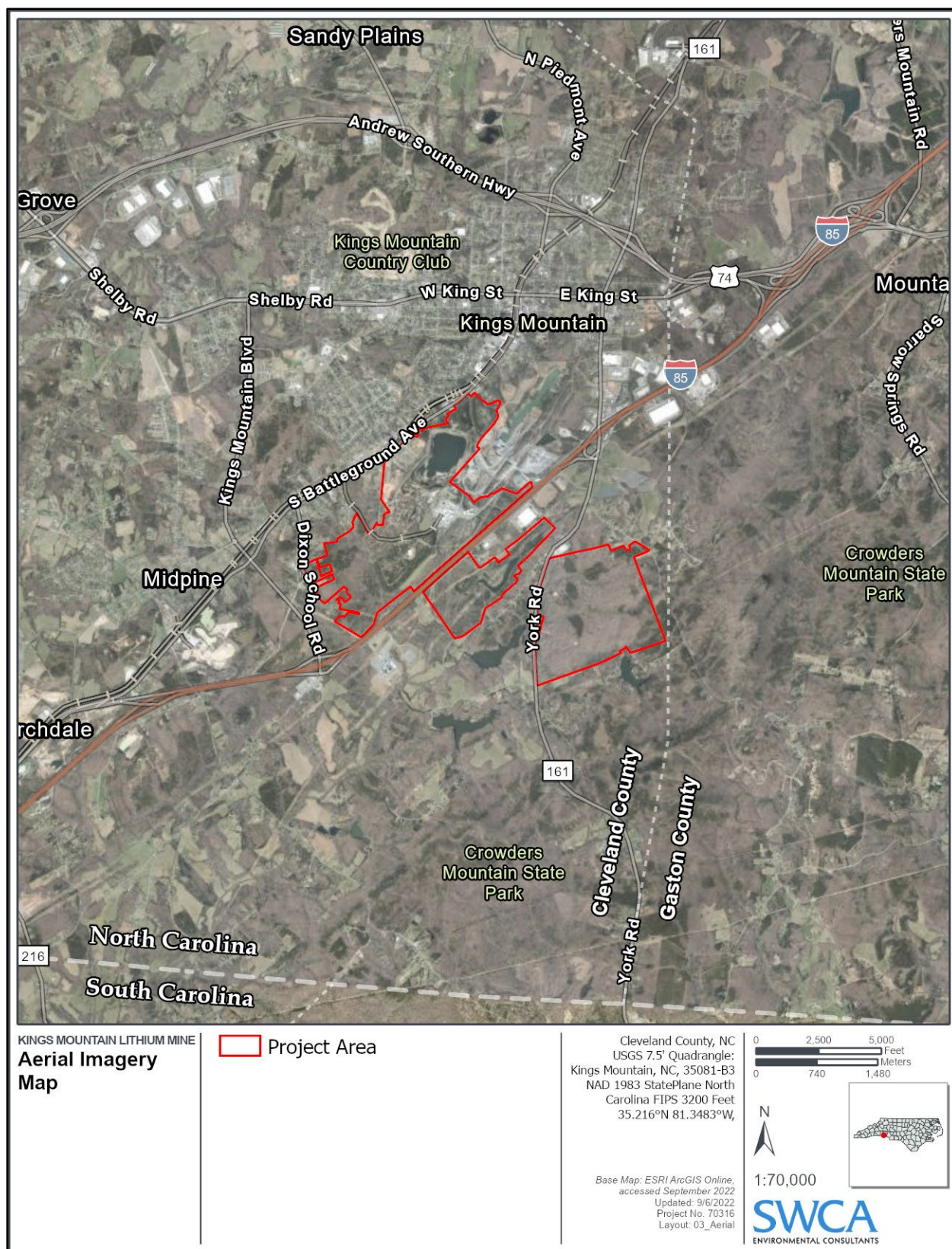


Figure 2. Aerial imagery of the Project area.

2 SPECIES BACKGROUND

2.1 Description

Dwarf-flower heartleaf is a clump-forming perennial woodland herb growing from rhizomes (University of Texas 2016). Leaves are rounded, glossy, variegated and approximately 2 inches wide. The dwarf-flowered heartleaf is not identifiable by its leaves and is best differentiated from other *Hexastylis* species by having the smallest flowers in the *Hexastylis* genus. Flowers are jug-shaped and grow close to the ground or buried in leaf litter. Dwarf-flowered heartleaf flowers typically have calyx tube openings less than 5 mm wide and/or a calyx tube less than 8 mm wide (Gaddy 1987; Krings et al. 2021). The calyx is the part of the flower that surrounds the growing bud, often found at the base of the bloom. The flowering period is March 1 through May 31.

2.2 Habitat

The dwarf-flowered heartleaf is generally found in acidic soils along moderate to dry bluffs, slopes, or ravines in deciduous forests or within moist soils adjacent to creeks, stream heads, or along lakes and rivers (North Carolina Parks 2020; U.S. Fish and Wildlife Service [USFWS] 2021). This plant is typically associated with mountain laurel (*Kalmia latifolia*) or American pawpaw (*Asimina triloba*) (Krings et al. 2021).

2.3 Range

The dwarf-flowered heartleaf is only known to occur in the southwestern Piedmont of North Carolina and adjacent areas of South Carolina (North Carolina Natural Heritage Program [NCNHP] 2003). The current reported range is Cherokee, Greenville, and Spartanburg Counties, South Carolina; and Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties, North Carolina (NatureServe 2022). Several known populations are in protected areas of Cleveland County, including Knob Creek Natural Area, West Shelby Mesic Slope, Broad River/Sandy Run Natural Areas, Hicks Hill Bluffs and Forests, First Broad Hop-hornbeam Natural Area Beaverdam Creek Natural Area, and the Rutherford County portion of Rollins/South Mountains Natural Area, which extends into Cleveland County (NCNHP 2003). This species has not been found during surveys of Crowder Mountain State Park (NCNHP 2003, Tompkins and Luckenbaugh 2018), which is the closest natural area to the Project and there are no records within 1 mile of the Project area (NCNHP 2022a).

2.4 Threats

The greatest threats are from commercial and residential development, and road improvement and construction (NatureServe 2022). Other threats include incompatible forestry practices, off-road vehicles, and invasive plants. Many occurrences are appropriately protected and managed by the States of North Carolina and South Carolina, and many of these populations are found on protected conservation land.

2.5 Status

Dwarf-flowered heartleaf was federally listed as threatened in 1989 and currently remains listed as threatened under the ESA. However, on April 21, 2021, the USFWS proposed delisting the species due to an increase in known, stable populations, some of which have more than 1,000 individuals (86 Federal Register 21994). According to the proposed delisting, data indicate that the threats to the species have

been eliminated or reduced to the point that the species no longer meets the definition of a threatened species. Until the species is formally delisted, all ESA laws and regulations still apply. The dwarf-flowered heartleaf is also state listed as threatened in North Carolina by the Plant Conservation Program (PCP) in the NC Department of Agriculture. The PCP's mission is to develop regulations, programs, and partnerships to help protect imperiled species in North Carolina.

3 METHODS

3.1 Desktop Analysis

A preliminary desktop analysis was completed for the Project prior to field surveys by using a combination of existing information obtained from available public sources, including reports, published literature, online databases, and geographic information system (GIS) data. The following publicly available data sources were used to complete a desktop analysis:

- Google Earth aerial imagery
- USGS National Land Cover Database (USGS 2019a)
- Natural Resources Conservation Service (NRCS) Web Soil Survey maps (NRCS 2022)
- USGS National Hydrology Dataset (USGS 2019b)
- USFWS National Wetlands Inventory maps (USFWS 2022a)
- NCNHP data and planning tools (NCNHP 2021, 2022a, 2022b)

These sources were used to characterize the resources in the Project area and surrounding area.

3.2 Field Surveys

A general field reconnaissance was conducted within the Project area in February and March 2022 to find potentially suitable habitat for the dwarf-flowered heartleaf. Additionally, in May 2022, prior to on-site surveys, biologists visited an off-site area with a known dwarf-flowered heartleaf population approximately 17 miles west of the Project area along a greenway to observe the flowers and known suitable habitat.

SWCA conducted presence/absence surveys within previously identified suitable habitat in the Project area during the flowering period (March 1–May 31). During on-site surveys, two SWCA biologists walked meandering transects throughout potential habitat within the Project area search for dwarf-flowered heartleaf plants. When plants within the genus *Hexastylis* were encountered, biologists observed the flowers, if present, and measured the calyx tube and the calyx tube opening to determine if these characteristics were consistent with the dwarf-flowered heartleaf. Representative photos of *Hexastylis* plants and flowers observed were taken for each survey area (Appendix A). This method was approved by the USFWS (personal communication, email from Rebeka Reid, USFWS, to Simon King, SWCA, on April 20, 2022). SWCA coordinated with the USFWS, NCNHP, and University of North Carolina Herbarium and utilized the recommended species' keys to determine *Hexastylis* species in the field (Gaddy 1987; Krings et al. 2021).

4 RESULTS

4.1 Project Area Habitats

The landscape has been significantly altered in the main parcel and the parcel south of I-85 due to historic mining. Land cover maps (USGS 2019a) indicate the Project area consists primarily of deciduous forest, mixed forest, and evergreen forest with smaller portions of pasture/herbaceous, medium to high intensity development, open water (e.g., ponds, lakes, mining pits), and wetland habitats. Field surveys confirmed that most of these land-cover types are fairly accurate. Outside of developed areas and open water, habitat in the Project area falls into five major communities: forested upland, forested wetland, emergent wetland, shrub-scrub wetland, herbaceous and edge uplands.

Potentially suitable habitat for the dwarf-flowered heartleaf was observed within the Project area during field reconnaissance activities in February and March 2022. These areas largely consisted of forested slopes adjacent to stream sides, often including areas with mountain laurel and north-facing slopes underlain by floodplain, sandy loam, or fine sandy loam soils. Approximately 100 acres of potentially suitable habitat for the dwarf-flowered heartleaf was identified and surveyed in the Project area. Most of the suitable habitat (87%) is on the Albemarle East Property parcel.

4.1.1 Forested Upland

The forested upland community is the dominant habitat present in the Project area. Approximately 1,000 acres of forested uplands (i.e., deciduous, mixed, and evergreen forest) are present in the Project area. Dominant trees include American sweetgum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), tulip tree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*), white oak (*Quercus alba*), red oak (*Quercus* spp.), mockernut hickory (*Carya tomentosa*), and chestnut oak (*Quercus montana*). Understory species commonly observed in the forested areas are flowering dogwood (*Cornus florida*), greenbrier (*Smilax* spp.), blackberry (*Rubus* spp.), spicebush (*Lindera benzoin*), and various successional hardwoods (oaks, hickories, sweetgum, maples). Potentially suitable habitat includes portions of the forested upland habitat.

4.1.2 Palustrine Forested Wetland

The forested wetland community consist of a prevalence of hydrophytic woody species over 20 feet tall. The tree strata are dominated by red maple, American sycamore (*Platanus occidentalis*), water oak (*Quercus nigra*), sugarberry (*Celtis laevigata*), American elm (*Ulmus americana*), and American sweetgum. Based on wetland delineations, approximately 43 acres of forested wetlands are present in the Project area (SWCA 2022). Potentially suitable habitat includes portions of the forested wetland habitat.

4.1.3 Palustrine Shrub-Scrub Wetland

The shrub-scrub wetland community consists of a prevalence of hydrophytic woody vegetation less than 20 feet tall. The shrub-scrub strata are dominated by brookside alder (*Alnus serrulata*), American sycamore, black willow (*Salix nigra*), Chinese privet (*Ligustrum sinense*), and red maple. Based on wetland delineations, approximately 10 acres of shrub-scrub wetlands are present in the Project area (SWCA 2022). Potentially suitable habitat does not include shrub-scrub wetland habitat.

4.1.4 Palustrine Emergent Wetland

The emergent wetland community consists of a prevalence of hydrophytic non-woody vegetation less than 3 feet in height. Dominant herbaceous species include giant cane (*Arundinaria gigantea*), bushy bluestem (*Andropogon glomeratus*), lamp rush (*Juncus effusus*), cottongrass bulrush (*Scirpus cyperinus*), lesser poverty rush (*Juncus tenuis*), fowl blue grass (*Poa palustris*), shallow sedge (*Carex lurida*), and goldenrod species (*Solidago* sp.). Based on wetland delineations, approximately 6 acres of emergent wetlands are present in the Project area (SWCA 2022). Potentially suitable habitat does not include emergent wetland habitat.

4.1.5 Herbaceous Upland

The herbaceous upland and edge communities consist of non-wetland areas dominated by non-woody vegetation. Dominant herbaceous species include broom-sedge (*Andropogon virginicus*), wild garlic/onion (*Allium* spp.), Kentucky blue grass (*Poa pratensis*), goldenrod, clovers (*Trifolium* spp.), hemp dogbane (*Apocynum cannabinum*), Japanese honeysuckle (*Lonicera japonica*), American burnweed (*Erechtites hieraciifolia*), wild strawberry (*Fragaria virginiana*), and southern crab grass (*Digitaria ciliaris*). Herbaceous uplands are found primarily within the maintained utilities ROWs. Approximately 100 acres of herbaceous uplands are present in the Project area. Potentially suitable habitat does not include herbaceous uplands.

4.2 Survey Results

SWCA biologists conducted presence/absence surveys within potentially suitable habitat on May 2–5, 23, and 24, 2022. The 11 survey areas covered 99.56 acres of potentially suitable habitat (Figure 3).

The threatened dwarf-flowered heartleaf (*Hexastylis naniflora*) was not identified within any of the survey areas. Several populations of the little heartleaf (*Hexastylis minor*), a common *Hexastylis* species, were observed during the surveys (Table 1). There were survey areas where some *Hexastylis* plants lacked flowers and therefore prevented identification to species level. However, other flowers that were observed in these areas had calyx tube openings larger than 5 mm and/or a calyx tube larger than 8 mm wide, which are not characteristics consistent with *Hexastylis naniflora* (Gaddy 1987; Krings et al. 2021). SWCA biologists determined that none of the observed flowering *Hexastylis* species were *Hexastylis naniflora*. Photographs of suitable habitat and *Hexastylis* plants and flowers observed are provided in Appendix A.

Table 1. Results of *Hexastylis* Habitat Survey within the Project Area

Survey Area	Acres	General Location	Observations
1	10.11	35.213194, -81.364526 Main Site - North of I-85	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .
2	2.02	35.207391, -81.360492 Main Site - North of I-85	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .
3	0.45	35.208524, -81.345121 Main Site - South of I-85	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .
4	0.63	35.209293, -81.34418 Main Site - South of I-85	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .

Dwarf-flowered Heartleaf Report for the Kings Mountain Lithium Mine, Cleveland County, North Carolina
October 2022

5	2.15	35.210508, -81.339115 Albemarle East Property	<i>Hexastylis</i> species were observed but lacked flowers. Plants were unable to be identified to a species level, but unlikely to be <i>Hexastylis naniflora</i> based on nearby flowering samples.
6	22.94	35.210316, -81.330704 Albemarle East Property	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .
7	6.02	35.212204, -81.333768 Albemarle East Property	No <i>Hexastylis</i> species were observed.
8	21.84	35.206441, -81.330927 Albemarle East Property	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .
9	21.29	35.20203, -81.330603 Albemarle East Property	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .
10	7.15	35.201926, -81.340355 Albemarle East Property	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .
11	4.96	35.205843, -81.33984 Albemarle East Property	No <i>Hexastylis naniflora</i> observed. All other <i>Hexastylis</i> plants observed had calyx tube openings >5 mm and/or a calyx tube >8 mm wide and were likely <i>Hexastylis minor</i> .

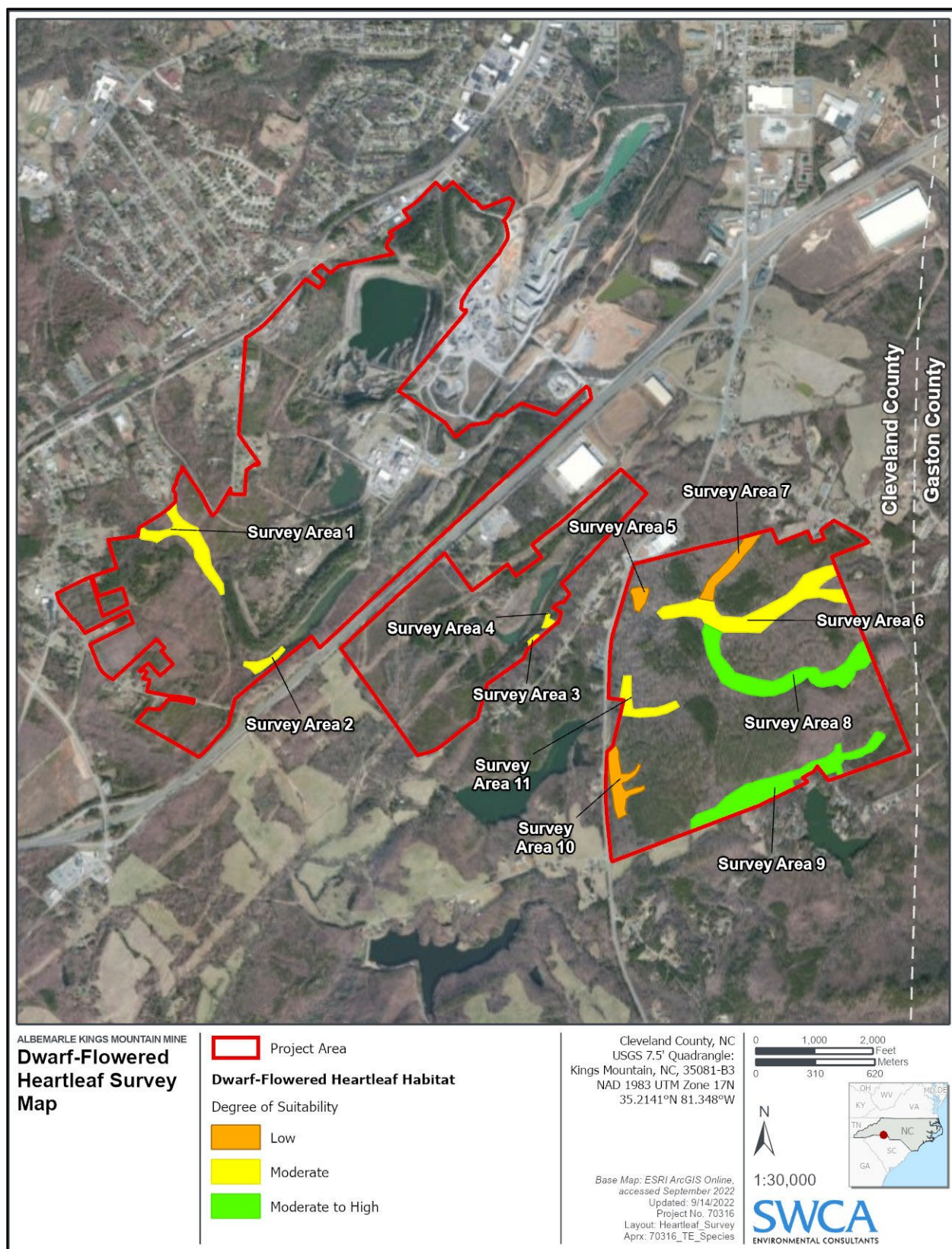


Figure 3. Dwarf-flowered heartleaf survey map.

5 SUMMARY AND CONCLUSIONS

Approximately 100 acres of suitable dwarf-flowered heartleaf habitat are present and were surveyed in the Project area. No dwarf-flowered heartleaf populations were observed during presence/absence surveys conducted during the plant's flowering season in 2022. If this species is subsequently identified, any occupied habitat should be avoided until after consultation with the USFWS. According to the USFWS, surveys are valid for 2 years and would be required again starting May 2024 if the species is still listed at that time (USFWS 2022b).

If the species is removed from the federal list, dwarf-flowered heartleaf may remain a state-listed species. However, state-listed plants receive little protection on private land. State-listed plants are protected from collection, selling, and poaching on private property, but the incidental disturbance of protected plants during development operations is not illegal.

6 LITERATURE CITED

- Gaddy, L.L. 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). *Castanea* 52(3):186–196. Available at: <http://www.jstor.org/stable/4033526>. Accessed April 2022.
- Google Earth Pro Version 7.3.4.8573. 2022. Project area imagery. Available at: <https://www.google.com/earth/versions/>.
- Krings, A., S. Goyette, D. Suiter., and M. Samuels. 2021. Rare plants of North Carolina. Available at: <https://projects.ncsu.edu/cals/plantbiology/ncsc/rare/>. Accessed April 2022.
- National Resources Conservation Service (NRCS). 2022. United States Department of Agriculture. Web Soil Survey. Available at <http://websoilsurvey.nrcs.usda.gov/>. Accessed August 2022.
- NatureServe. 2022. NatureServe Explorer species data. Available at: <https://explorer.natureserve.org/>. Accessed August 2022.
- North Carolina Natural Heritage Program (NCNHP). 2003. An Inventory of the Significant Natural Areas of Cleveland County, North Carolina. Prepared by N. C. Natural Heritage Program Office and Foothills Conservancy of North Carolina. April.
- _____. 2021. List of Rare Plant Species of North Carolina. Available at: <https://www.ncnhp.org/publications/nhp-publications/rare-plant-list>. Accessed May 2022.
- _____. 2022a. Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Within a One-mile Radius of the Project Area, Albemarle Main Boundary, Project No. 00070316-000-RDU. February 9, 2022
- _____. 2022b. Species/Community Search. Cleveland County. Available at: <https://www.ncnhp.org/data/speciescommunity-search>. Accessed August 2022.
- North Carolina Parks. 2020. Vascular Plants of North Carolina. Available at <https://auth1.dpr.ncparks.gov/flora/index.php>. Accessed August 2022.
- SWCA Environmental Consultants (SWCA). 2022. Wetland and Waterbody Delineation Report for the Albemarle Kings Mountain Lithium Mining Project, Cleveland County, North Carolina. April.
- Tompkins, R.D. and C. M. Luckenbaugh. 2018. Vascular Flora of Crowders Mountain State Park. *Castanea* 83(2): 236-248. July.
- University of Texas. 2016. Lady Bird Johnson Wildflower Center Plant Database. Available at <https://www.wildflower.org/plants/>. Accessed September 2022.
- U.S. Fish and Wildlife Service (USFWS). 2021. Proposed delisting of the dwarf-flowered heartleaf. Available at: <https://www.fws.gov/story/2021-04/proposed-delisting-dwarf-flowered-heartleaf>. Accessed September 2022.
- _____. 2022a. National Wetland Inventory (NWI) Surface Waters and Wetlands. Available at: <https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/>. Accessed February 2022.

- _____. 2022b. North Carolina's federally threatened, endangered, and at-risk plant species. Optimal survey windows and duration a survey is valid. Available at: <https://fws.gov/story/2022-03/north-carolinas-federally-threatened-endangered-and-risk-plant-species>. Accessed May 2022.
- U.S. Geological Survey (USGS). 2019a. National Land Cover Database (NLCD). Available at: <https://www.usgs.gov/data/national-land-cover-database-nlcd-2019-products>. Accessed March 2022.
- _____. 2019b. National Hydrography Dataset (NHD). Available at: <https://www.usgs.gov/national-hydrography>. Accessed March 2022.

APPENDIX A

Photographs



Photo 1. Representative habitat in Survey Area 1.



Photo 2. Representative *Hexastylis minor* flower in Survey Area 1.



Photo 3. Representative *Hexastylis* spp. leaves in Survey Area 1. Not identifiable to species due to lack of flowers.



Photo 4. Representative habitat in Survey Area 2.



Photo 5. Representative *Hexastylis minor* flowers and leaves in Survey Area 2.



Photo 6. Representative habitat in Survey Area 3.



Photo 7. Representative *Hexastylis minor* flower from Survey Area 3.



Photo 8. Representative habitat in Survey Area 4.



Photo 9. Representative *Hexastylis minor* in Survey Area 4.



Photo 10. Representative habitat in Survey Area 5.



Photo 11. Representative *Hexastylis* in Survey Area 5. Individuals could not be identified to species level due to lack of flowers.



Photo 12. Representative habitat in Survey Area 6.



Photo 13. Representative *Hexastylis minor* in Survey Area 6.

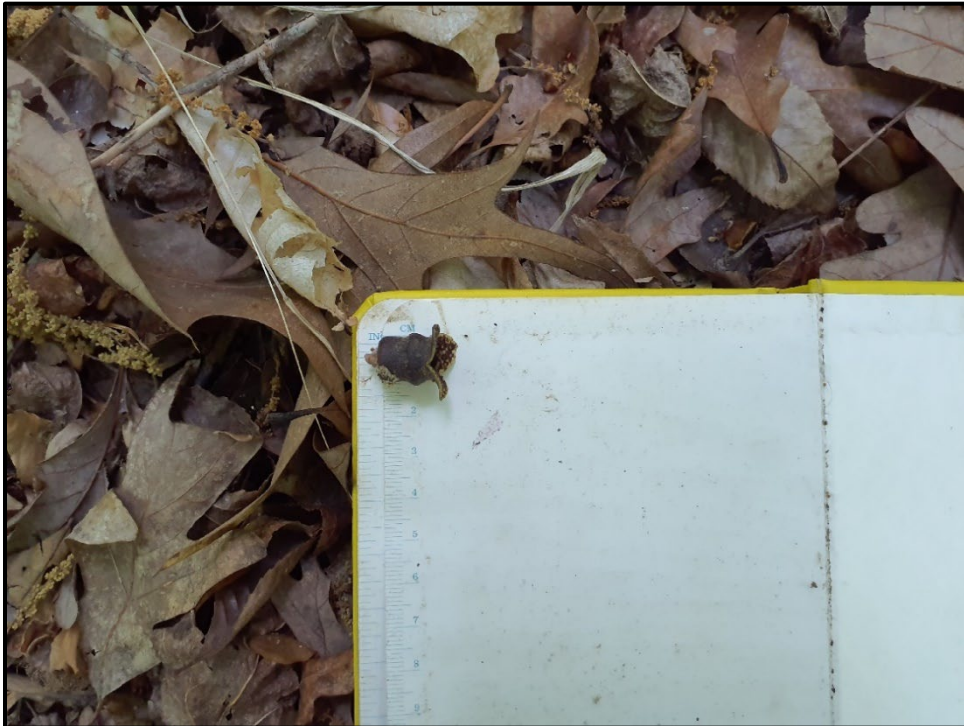


Photo 14. Representative *Hexastylis minor* flower in Survey Area 6.



Photo 15. Representative habitat in Survey Area 7.



Photo 16. Representative habitat in Survey Area 8.



Photo 17. Representative *Hexastylis minor* leaves and flower in Survey Area 8.



Photo 18. Representative habitat in Survey Area 9.



Photo 19. Representative *Hexastylis minor* leaf and flower in Survey Area 9.



Photo 20. Representative habitat in Survey Area 10.



Photo 21. Representative *Hexastylis minor* flower in Survey Area 10.



Photo 22. Representative *Hexastylis minor* leaves in Survey Area 10.



Photo 23. Representative habitat in Survey Area 11.



Photo 24. Representative *Hexastylis minor* flower in Survey Area 11.