

SURVEYS FOR RARE PLANTS
ALONG MVP'S PROPOSED
MOUNTAIN VALLEY PIPELINE PROJECT IN
CRAIG, FRANKLIN, GILES, MONTGOMERY, PITTSYLVANIA, AND
ROANOKE COUNTIES, VIRGINIA

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TABLE OF CONTENTS

	<u>Page</u>
1.0 PROJECT DESCRIPTION.....	1
2.0 REGULATORY SETTING.....	2
2.1 Endangered Species Act	2
2.2 Initial Project Review.....	3
2.3 Jefferson National Forest.....	6
2.4 Regional Occurrence of Listed Plants.....	6
2.4.1 Northeastern Bulrush	6
2.4.2 Shale Barren Rock Cress.....	7
2.4.3 Small Whorled Pogonia.....	7
2.4.4 Smooth Coneflower.....	7
2.4.5 Virginia Spiraea.....	7
2.4.6 Sweet Shrub	8
2.4.7 Pinnate-lobed Coneflower.....	8
2.5 Suitable Habitat is Present.....	8
2.6 Study Plan Approval and Qualified Surveyor	8
3.0 METHODS	9
3.1 Time of Survey.....	9
3.2 Desktop Review	9
3.3 In-field mapping	11
3.4 Field Surveys for Rare Plants	11
3.5 Community Types and Habitat Suitability.....	11
4.0 RESULTS	11
5.0 DISCUSSION AND CONCLUSION	12
5.1 Federally Listed Plant Species.....	12
5.2 State Listed Plant Species	12
5.3 JNF Forest Sensitive Species	13
5.4 Conclusion	13
6.0 LITERATURE CITED.....	13

LIST OF TABLES

<u>Table</u>	<u>Page</u>
Table 1. List of twelve potential plant species and two special plant communities potentially impacted by the Mountain Valley Pipeline Project in Virginia.	4
Table 2. Dates and area surveyed for seven endangered, threatened, rare, or USFS sensitive species.....	10

Appendices

Appendix A: Figures

Appendix B: Correspondence with United States Fish and Wildlife Service and State Agencies

Appendix C: List of Jefferson National Forest Sensitive Species

Appendix D: Life histories and Characteristics of Endangered, Threatened, and Rare Plants

Appendix E: Representative Project Photographs

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1.0 Project Description

Mountain Valley Pipeline, LLC (MVP), a joint venture of EQT Midstream Partners, LP, a subsidiary of NextEra Energy, Inc., WGL Holdings, Inc., Vega Energy Partners, Ltd., and RGC Midstream, LLC, plans to construct the Mountain Valley Pipeline (Project), an approximate 301-mile, 42-inch diameter natural gas pipeline, to provide timely, cost-effective access to the growing demand for natural gas for use by local distribution companies, industrial users and power generation in the Mid-Atlantic and southeastern markets, as well as potential markets in the Appalachian region. The Project will extend from the existing Equitrans L.P. transmission system near Mobley in Wetzel County, West Virginia, to Transcontinental Gas Pipe Line Company, LLC's Zone 5 compressor station 165 in Pittsylvania County, Virginia (Appendix A, Figures 1 and 2). In West Virginia, approximately 195.5 miles of the pipeline is expected to cross Braxton, Doddridge, Fayette, Greenbrier, Harrison, Lewis, Monroe, Nicholas, Summers, Webster, and Wetzel counties. In Virginia, approximately 105.5 miles of the pipeline is expected to cross Craig, Franklin, Giles, Montgomery, Pittsylvania, and Roanoke counties.

A previous proposed route and several alternate routes were originally proposed for the Project in Virginia and West Virginia. Alternative 110 (A110) begins in Monroe County, West Virginia and continues southeast into Craig, Montgomery, and Roanoke counties, Virginia. Alternative 110J (A110J) is a spur from A110 that traverses portions of Craig and Roanoke counties before connecting back with A110. Alternative 110R (A110R) is a spur from A110 in Craig and Montgomery counties, Virginia. Alternative 93 Preston North re-route (A93) and Alternative 87 Preston Southern re-route (A87) deviate from the original proposed route and occur in Montgomery County, Virginia. Alternative 35 occurs in Pittsylvania at the southern terminus of the route. These alternate routes are no longer under consideration for construction planning. Alternative 135 Spring Hollow re-route, Alternative 210 Cahas Mountain re-route, Alternative 200 - Blacksburg, and Alternative 145 were incorporated into the current proposed route.

The current route as proposed includes a permanent Right-of-way (ROW) of 50 feet. This encompasses a total of 1,184.56 acres in West Virginia and 639.44 acres in Virginia. The width of the construction ROW is 125 feet which will temporarily impact an additional 1,012.22 acres in West Virginia and 911.68 acres in Virginia. Construction of aboveground facilities (e.g., compressor stations) will total 18.07 acres in West Virginia and 2.40 acres in Virginia. Permanent access roads will impact 175.34 acres in West Virginia and 71.80 acres in Virginia. An additional 648.46 acres in West Virginia and 234.63 acres in Virginia will be impacted by temporary access roads. Ancillary sites are expected to impact 186.12 acres in West

Virginia and 42.19 acres in Virginia. Temporary additional work spaces will include 507.87 acres in West Virginia and 230.36 acres in Virginia.

The Project traverses four Physiographic Provinces. These include Appalachian Plateaus throughout most of West Virginia, Valley and Ridge on the border of West Virginia and Virginia, Blue Ridge in Virginia, and then the Project ends in the Piedmont in Central Virginia. These consist of many habitat types and plant communities and these features contribute to a high number of rare, threatened, and special concern species potentially occurring in the area.

2.0 Regulatory Setting

2.1 Endangered Species Act

The Federal Endangered Species Act (ESA) [16 U.S.C. 1531 et seq.] was codified into law in 1973. This law provides for the listing, conservation, and recovery of endangered and threatened species of plants and wildlife. Under the ESA, the U.S. Fish and Wildlife Service (USFWS) is mandated to monitor and protect listed species.

Section 9 of the ESA prohibits the take of listed species unless otherwise specifically authorized by regulation. Take is defined by the ESA as, “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect” [16 U.S.C. 1532(19)]. USFWS further defines harm to include significant habitat modification or degradation [50 CFR §17.3] to the point where it actually kills or injures an individual or significantly impairs essential behavioral patterns, including feeding, breeding, and sheltering. Harassment is an intentional or negligent act or omission that creates the likelihood of injury by annoying an individual to such an extent as to significantly disrupt formal behavior patterns, which include but are not limited to breeding, foraging, and sheltering. Harassment does not cover habitat disturbing activities.

Section 7(a)(2) of the ESA states that each federal agency shall insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in destruction or adverse modification of designated critical habitat. Federal actions include (1) expenditure of federal funds for roads, buildings, or other construction projects, and (2) approval of a permit or license, and the activities resulting from such permit or license. Compliance is required regardless of whether involvement is apparent, such as issuance of a federal permit, or less direct, such as federal oversight of a state-operated program. Actions of federal agencies that do not result in jeopardy or adverse modification, but that could result in a take, must also be addressed under Section 7. Take by a federal agency can be authorized through the Section 7 consultation process,

culminating in an Incidental Take Statement (ITS) by the USFWS. The take must be Incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

In 1982 amendments to the ESA, Congress established a provision in Section 10(a)(1)(B) that authorizes incidental take by nonfederal entities. To obtain an Incidental Take Permit (ITP), an applicant must submit a conservation plan specifying impacts that result in take and measures to minimize and mitigate those impacts.

Regardless of whether incidental take might be covered under Section 7 or Section 10, it is the obligation of the project proponent to avoid and minimize impacts to listed species. If, through this process, take is avoided, then an ITS or ITP is not required. The initial step in avoidance and minimization is to determine whether suitable habitat and listed species are present.

2.2 Initial Project Review

On 13 October 2014, MVP submitted letters introducing the Project to the USFWS Gloucester Field Office (USFWS GFO) and Virginia Department of Conservation and Recreation, Division of Natural Heritage (VDCR-DNH). Based on coordination with these agencies and review of spatial data provided by state natural heritage programs, six federally listed plants could potentially occur within two miles of the Project and include northeastern bulrush (*Scirpus ancistrochaetus*), running buffalo clover (*Trifolium stoloniferum*), shale barren rock cress (*Arabis serotina*), small whorled pogonia (*Isotria medeoloides*), smooth coneflower (*Echinacea laevigata*), and Virginia spiraea (*Spiraea virginiana*) (Table 1). Further analysis demonstrated running buffalo clover would not be affected in Virginia thus detailed searches for this species were limited to West Virginia.

The VDCR-DNH indicated eight (six plants and two significant plant communities) natural heritage resources of concern may occur within the proposed Project area. The six plant species include Addison's leatherflower (*Clematis addisonii*), Canby's mountain-lover (*Paxistima canbyi*), sweet-shrub (*Calycanthus floridus*), box huckleberry (*Gaylussacia brachycera*), common snowberry (*Symphoricarpos albus* var. *albus*), and piratebush (*Buckleya distichophylla*). The significant plant communities include the Ridge and Valley Dolomite Woodland and the Central Appalachian Xeric Shale Woodland (Chestnut Oak Mixed Herbs Type; Table 1). Review of spatial data provided by VDCR-DNH show the Project traverses a historic population of purple fringeless orchid (*Platanthera peramoena*) near Little Stony Creek just north of Pembroke in Giles County. It was last observed in 1937 and may possibly be extirpated but its current status is unknown. Agency coordination is provided in Appendix B.

The Project was redesigned and a second review indicated the modified alignment avoided habitat suitable for the following five species and significant plant

Table 1. List of twelve potential plant species and two special plant communities potentially impacted by the Mountain Valley Pipeline Project in Virginia.

Scientific Name	Common Name	Current Status ¹	Acceptable Survey Date	Preferred Habitat	Potential MVP Habitat
<i>Scirpus ancistrochaetus</i>	northeastern bulrush	E	July 1 – September 30	Open wetlands	71.8 acres of proposed and alternate route
<i>Arabis serotina</i>	shale barren rock cress	E	August 1 – September 30	Mid-Appalachian shale barrens	480.4 acres of proposed route, compressor station and access roads ²
<i>Isotria medeoloides</i>	small whorled pogonia	T	May 1 – September 30	Mature hardwood forests	747 acres of proposed route, compressor station and access roads ³
<i>Echinacea laevigata</i>	smooth coneflower	E	June 15 – October 31	Open forests, fields and edges	146.46 acres of proposed route, alternate route, and laydown yard
<i>Spiraea virginiana</i>	Virginia spiraea	T	July 1 – September 30	Banks of second and third order streams	black oak – black cherry – white ash – pin cherry sand barren savanna
<i>Calycanthus floridus</i>	sweet-shrub	VA-I, WV-V	March - September	Rich woods, ravine slopes, along small woodland streams	303.1 acres of proposed route
<i>Rudbeckia triloba</i> var. <i>beadlei</i>	pinnate lobed coneflower	VA-CI	July – October	Seepy dolomite and limestone cliffs	Giles County
<i>Clematis addisonii</i> ⁴	Addison's leatherflower	VA-CI	April - July	Open rocky glades and rich woodlands	Laydown yard
<i>Paxistima canbyi</i> ⁴	Canby's mountain-lover	I - Both	Year - round	Dolomite and limestone cliffs, outcrops, barrens and shale ledges	Laydown yard
<i>Gaylussacia brachycera</i> ⁴	box huckleberry	VA-CI, WV-V	Year - round	North-facing slopes over acidic shale bedrock	Alternate route
<i>Symphoricarpos albus</i> var. <i>albus</i> ⁴	common snowberry	VA-CI, WV-V	August - September	Dry to moist, well drained tickets, woods, and open slopes	Alternate route
<i>Buckleya distichophylla</i> ⁴	piratebush	VA-I	April - October	Open oak and hemlock forests on south facing slopes	Alternate route
Significant plant community ⁴	Ridge and Valley Dolomite Woodland		April - October	Woodlands occurring on subxeric to xeric, fertile habitats over carbonate formations of dolomite	Laydown yard

Scientific Name	Common Name	Current Status ¹	Acceptable Survey Date	Preferred Habitat	Potential MVP Habitat
Significant plant community ⁴	Central Appalachian Xeric Shale Woodland		April - October	Woodlands occurring on xeric, acidic shales at lower elevations	Alternate route

¹E = Federally Endangered, T = Federally Threatened, CI = Critically imperiled, I = Imperiled, V = Vulnerable

²Includes potential acreage for running buffalo clover (180.4 acres)

³Includes potential acreage for running buffalo clover (438.7 acres)

⁴Species eliminated from specific consideration due to reroute

communities: Addison's leatherflower, Canby's mountain lover, box huckleberry, common snowberry, and piratebush; Ridge and Valley Dolomite Woodland and the Central Appalachian Xeric Shale Woodland (Chestnut Oak Mixed Herbs Type). In addition it also avoids the general observance area where a historic population of snowy campion (*Silene nivea*) may occur. However, pinnate-lobed coneflower (*Rudbeckia triloba* L. var. *beadleii*; Table 1) was added by the VDCR-DNH on 10 June 2015.

In addition to the seven federally listed plant species in Table 1, the five excluded species, and two excluded special plant communities, all listed rare plant species were considered as potentially present within the Project area.

2.3 Jefferson National Forest

The proposed Project crosses portions of the Jefferson National Forest (JNF), managed by the U.S. Forest Service (USFS). The USFS requested MVP conduct field surveys for federally protected and USFS forest sensitive plant species on JNF lands crossed by the Project. These species will be fully addressed in a Biological Evaluation to be submitted to the USFS upon completion; however, a list of these species is included in Appendix C and the results of the surveys are included in Section 4.0 of this report.

2.4 Regional Occurrence of Listed Plants

The Project is within the ranges of the federally listed northeastern bulrush, shale barren rock cress, small whorled pogonia, smooth coneflower, and Virginia spiraea. It is also within the range of sweet shrub and pinnate-lobed coneflower, both listed as critically imperiled by the VDCR-DNH. Detailed life histories of each species are in Appendix D.

2.4.1 Northeastern Bulrush

Throughout its range, northeastern bulrush is found in open, tall herb-dominated wetlands. In the north, the species is most commonly found on the edge of shallow beaver ponds (Royte and Lortie 2000) where water levels vary depending on animal activity. One population occurs on an inland sand plain in Massachusetts, in a depression that periodically fills with groundwater. In the south, the taxon occurs often in sinkhole ponds that form in sandstone bedrock at intermediate elevations around 200 to 500 meters (656.1 to 1640.4 ft) (somewhat higher elevations in the Virginias). Plants at all sites occur around the margins of ponds in 8 to 40 centimeters (3.1 to 15.7 in) of standing water (in wet years). In Pennsylvania, the northeastern bulrush is found almost exclusively in vernal pools where the water level fluctuates seasonally. A study comparing Pennsylvania wetlands that supported northeastern bulrush wetlands with nearby ponds that did not, showed that ponds with northeastern bulrush were typically larger (> 400 square meters [>4305.5 sq ft]), freer of forest canopy cover, higher in exchangeable sodium (> 7 ppm), and higher in pH (Lentz and Dunson 1999). Northeastern bulrush is often found in ponds, wet

depressions, or shallow sinkholes within small (generally less than one acre) wetland complexes. These wetlands are characterized by seasonally variable water levels (USFWS 1993). The habitat of northeastern bulrush in Pennsylvania typically consists of small depressional palustrine wetlands (Lentz and Dunson 1999) which receive water primarily through precipitation (Lentz 1998).

2.4.2 Shale Barren Rock Cress

The shale barren rock cress is very habitat restricted, and is only known to occur at low densities among scattered mid-Appalachian shale barrens in West Virginia and Virginia (USFWS 2002, Catrow et al. 2009). It is endemic to the shale barrens of these areas. It is believed there may be fewer than 4,000 individuals in existence. Of known populations, most have fewer than fifty individuals. It has imperiled status in Virginia and West Virginia. It has been documented in six Virginia counties (Bath, Alleghany, Augusta, Highland, Page, and Rockbridge) and three West Virginia counties (Pendelton, Greenbrier, and Hardy) (Artz 1948, Bartgis and Wieboldt 1986, Bartgis 1987, USFWS 1989, USFS 2001).

2.4.3 Small Whorled Pogonia

The small whorled pogonia is found in mature or secondary hardwood or mixed stands composed of beech (*Fagus* spp.), birch (*Betula* spp.), maple (*Acer* spp.), oak (*Quercus* spp.), hickory (*Carya* spp.), and pine (*Pinus strobus*) that have an open understory. However, it has been found that vegetative cover does not necessarily limit this species as it has been found in up to sixty percent cover (Mehrhoff 1980). In fact, one indicator community used to find this species is paper birch (*Betula papyrifera*) on steep slopes with dense fern understory. Its range is from Ontario to Maine down the eastern U.S. coast to Georgia and possibly as far west as Missouri, although it is thought to be extirpated there.

2.4.4 Smooth Coneflower

Smooth coneflower is listed as federally endangered. It occurs preferentially in open areas over amphibolite, dolomite, or limestone. In Virginia, smooth coneflower occurs preferentially in dolomite woodlands or glades that are generally open and xeric. It has also been found in open woods, cedar barrens, roadsides, clearcuts, utility line ROWs, and dry limestone bluffs; it is believed that periodic disturbance, common to these habitats, is needed to maintain high light conditions and low herbaceous competition required for the species to thrive (USFWS 1995).

2.4.5 Virginia Spiraea

Virginia spiraea occurs along scoured banks of second and third order streams, or on meander scrolls, point bars, natural levees, and other braided features of lower reaches. Virginia spiraea is somewhat different in that its life history requirements are strongly tied to high gradient streams on larger creeks and rivers. In Virginia, Virginia spiraea plants are along flood scour zones in crevices of sandstone cobbles, boulders, and massive rock outcrop, and quartzite/feldspar boulders. It occurs in soils

that are sandy, silty, or clay. The elevation range is 1000-2400 ft. In West Virginia, it occurs among large boulders, flatrock, and flood debris along scoured stream-sides. Soils are silt and sand and elevation for populations ranges from 1000-1800 ft.

2.4.6 Sweet Shrub

Sweet shrub occurs in Pennsylvania, West Virginia, and Kentucky south to Georgia. It also occurs in northwest Florida, Alabama, and southwest Mississippi and west to Mississippi and Tennessee, but this natural distribution is unclear due to centuries of cultivation (Kartesz 1994, Weakley 2011). Two varieties have been recognized with one having pubescent twigs, petioles, and leaves while the other is nearly hairless; however they have broadly overlapping distributions and the distinguishing characteristics are variable and thus they are currently recognized as not taxonomically distinct. It is a southeastern regional endemic and usually not abundant where found.

2.4.7 Pinnate-lobed Coneflower

Pinnate-lobed coneflower or Chauncey's coneflower is a short, thin-stemmed member of the aster family that prefers limestone and seepy dolomite cliffs, occurring in the crevices of the rock faces or in thin soils on the ledges. This species occurs in Kentucky, North Carolina, Tennessee, and Virginia. Scattered populations may also occur in Illinois (Mohlenbrock 2014). This includes Giles and Montgomery counties, Virginia (Kartesz 1994). This variety is currently only recognized in Virginia as its taxonomic status is uncertain (Weakley 2015).

2.5 Suitable Habitat is Present

A desktop habitat analysis was completed for the Project. Potentially suitable habitat for the aforementioned species was identified and used to determine the specific survey areas (Appendix A, Figure 2).

2.6 Study Plan Approval and Qualified Surveyor

A study plan outlining methods for plant surveys was submitted to the USFWS GFO and VDCR-DNH on 3 June 2015. After minor revisions, concurrence was provided by the VDCR-DNH on 10 June 2015 and the USFWS GFO on 17 June 2015. A JNF specific study plan was submitted to USFS on 3 June 2015. This study plan was based on a project review conducted by Mr. Fred Huber, USFS botanist.

Field surveys were completed by Mr. Lawrence Brewer. Mr. Brewer is a USFWS Certified Plant Surveyor for smooth coneflower, small whorled pogonia and Virginia spiraea in the state of Virginia, and an approved surveyor for northeastern bulrush (Pennsylvania) and running buffalo clover (Ohio). Mr. Brewer is an experienced and trained plant taxonomist and has conducted a wide variety of plant and natural community surveys over the last 25 years.

3.0 Methods

3.1 Time of Survey

Initially, rare plants were surveyed across ten deployments between 22 May and 31 August 2015. Based on a route realignment (Rev4.0.0), two additional survey efforts were completed in September and October. These twelve deployments occurred on the following dates for the following species: 22 May to 3 June (JNF forest sensitive species); 13 June (sweet shrub); 20 June (JNF forest sensitive species), 26 June to 1 July (JNF forest sensitive species), 3 to 4 August (JNF forest sensitive species), 5 to 12 August (northeastern bulrush, shale barren rock cress, small whorled pogonia, Virginia spiraea), 24 to 25 August (smooth coneflower), 29 to 30 August (pinnate-lobed coneflower), 29 September to 1 October (pinnate-lobed coneflower in Giles County, Virginia), and 21 to 23 September (sweet shrub in Pittsylvania and Franklin counties). During the survey periods, conditions were appropriate for the discovery of the seven endangered, threatened, or rare plants in Table 1 for the previous route and the proposed route as they were either in flower or fruiting. Due to route realignment, new areas were surveyed for the target species (Table 2). Much of this new area for the proposed route is along access roads, approximately 41.53 miles and was addressed by these additional surveys (Table 2; surveys in late September). All seven target species also potentially occur along this new ROW, approximately 37.16 miles (Table 2). Thus, these areas were resurveyed so that the appropriate time periods and plant conditions for proper identification could be followed. Only smooth coneflower was not resurveyed for along the proposed route due to land access. Based on desktop analyses appropriate habitat for smooth coneflower may exist along the proposed route. Once land access is granted these areas will be surveyed for smooth coneflower to confirm or refute the analysis.

Changes in Project routes resulted in removal of five species and two plant communities from survey consideration as analyses showed these to not be viable in the proposed changed route. As such, all species and potentially suitable habitat (or the lack thereof) could be identified. The twelve species listed use several major habitat types, such as wetlands and woodlands, with several additional habitat subtypes, but again only seven of these species were viable in the proposed route (Rev4.0.0).

3.2 Desktop Review

A desktop habitat analysis using National Landcover Database (NLCD 2011), publicly available aerial photographs, USGS, elevation and aspect layers is completed prior to initiating field surveys. This analysis helps identify likely habitat for potential species (e.g., open woodlands and edges for smooth coneflower or open wetlands for northeastern bulrush) and helps guide field survey efforts (Appendix A, Figure 2).

Table 2. Dates and area surveyed for seven endangered, threatened, rare, or USFS sensitive species.

Target Species	Survey Dates (2015)	Sampling Completed Rev3V2.5/Rev 4	Access Road Rev 3V2.5 (mi)	ROW Rev3V2.5 (mi)	Access Road Rev4.0.0 (mi)	ROW Rev 4.0.0 (mi)
northeastern bulrush	5-12 Aug	Yes/Yes	0	0.84	0	0.78
shale barren rock cress	5-12 Aug, 24 Sep – 1 Oct	Yes/Yes	1.55 ²	5.78 ³	2.06 ⁵	5.56 ⁷
small whorled pogonia	5-12 Aug, 24 Sep – 1 Oct	Yes/Yes	1.62 ^{1,2}	12.65 ³	2.27 ^{4, 5}	13.01 ⁸
smooth coneflower	24-25 Aug	Yes/No	0	2.52	2.39	2.69
Virginia spiraea	5-12 Aug	Yes/Yes	0	0.14	0.07	0.28
sweet shrub	13 June, 21-23 Sep	Yes/Yes	2.56	8.34	2.74	9.48
pinnate-lobed coneflower	29-30 Aug, 29 Sep – 1 Oct	Yes/Yes	2.69	0	2.90	5.43

¹ 1.05 miles overlap between buffalo running clover and small whorled pogonia

² 0.57 mile overlap between shale barren rock cress and small whorled pogonia

³ 4.83 miles overlap between shale barren rock cress and small whorled pogonia

⁴ 0.98 mile overlap between small whorled pogonia and running buffalo clover due to shared habitat preferences

⁵ 1.21 miles overlap between small whorled pogonia and shale barren rock cress due to shared habitat preferences

⁶ 0.13 mile overlap with small whorled pogonia due to shared habitat preferences

⁷ 4.45 miles overlap with small whorled pogonia due to shared habitat preferences

⁸ 0.13 mile overlap with running buffalo clover and 4.45 miles overlap with shale barren rock cress due to shared habitat preferences

3.3 In-field mapping

Map layers are loaded on a GPS-enabled tablet computer allowing biologists to selectively interact (i.e., turn layers on and off or zoom in or out) with maps while in the field. Using this same tablet computer, biologists create a real-time map layer that identifies the location of resources as they are identified, and also allows biologists to link these map layers to other data including habitat patches, disturbance conditions, and location and identification of rare species. In all cases, the mapped location is linked to text descriptions and representative photographs of the item being mapped. Representative photographs are in Appendix E and photo locations are shown in Appendix A, Figure 2.

3.4 Field Surveys for Rare Plants

Field surveys are completed using a meander search technique across the 45.7-meter (150 ft) wide ROW. Meander surveys were completed along each prospective survey area along the ROW. In areas where habitat conditions are highly suitable for any of the rare species more intensive searches are employed. Any rare plants encountered within the survey area are recorded and mapped using the interactive mapping tool.

3.5 Community Types and Habitat Suitability

Habitat suitability for the seven focal plant species is determined using aerial photographs, correspondence with state and federal agencies (see Appendix B), and in-field assessment of appropriate habitat. Aerial photographs and recent imagery are used to determine basic habitat types such as upland, bottomland, and old field habitats. These data are used in conjunction with field searches to verify habitat types and suitability for each target species. Correspondence with USFWS GFO and VDCR-DNH proved very helpful in determining historic locations for each of the focal species and thus were used to determine search locations for the focal plants species. For example, USFWS-GFO provided coordinates of areas likely to support focal species and where surveys should be focused. VDCR-DNH also reduced the number of specific areas for occurrence of state plant species of concern. Survey areas for these species were determined based on potentially suitable habitat identified during the desktop habitat analysis within the agency requested counties.

4.0 Results

None of the target federal or state listed species were detected, but two other species of concern were identified: American barberry (*Berberis canadensis*) and rock skullcap (*Scutellaria saxatilis*). Four patches of American barberry were identified (Alternative 110; Appendix A, Figure 3). The first patch was small with 3 individuals

contained within approximately two square meters [REDACTED]. The second patch was slightly larger with nine individuals represented [REDACTED]. The third patch contained 13 individuals [REDACTED] with the fourth and largest patch containing 23 individuals [REDACTED]. All four patches were on a dry mesic slope of Northern hardwood in Craig County, Virginia (Appendix A, Figure 3). A fifth patch of American barberry containing six stems in approximately 2 square meters was located on 25 August 2015 on an existing ROW in Montgomery County, Virginia ([REDACTED]). One smooth rock skullcap location was recorded [REDACTED]; Appendix A, Figure 3).

Additionally, a historic population of purple fringeless orchid (*Platanthera peramoena*) is believed to occur along Little Stony Creek just north of Pembroke in Giles County (last observed in 1937). This historic population may require further investigation to ensure the Project avoids impacting this species; however, it was not observed during the 2015 survey efforts which were extensive in Giles County. This species has no legal status but is considered extremely rare by VCDR-DNH.

5.0 Discussion and Conclusion

Surveys for federal and state listed plant species were completed on 22 May to 1 October 2015. During requisite conditions and within species-specific survey windows, twelve separate survey deployments were completed.

5.1 Federally Listed Plant Species

Surveys were completed for five federally listed plant species: northeastern bulrush, shale barren rock cress, small whorled pogonia, smooth coneflower, and Virginia spiraea. These species were not identified during surveys on previous route alignments, the proposed route, or associated access roads though several areas require smooth coneflower surveys. Surveys for smooth coneflower along the proposed route are anticipated in 2016 as land access permissions could not be obtained for the 2015 surveys. Surveys for this species were conducted along the previous route and the associated access roads. It was not identified during those efforts.

5.2 State Listed Plant Species

Surveys were completed for two species classified as natural heritage resources of concern by the VCDR-DNH: sweet shrub and pinnate-lobed coneflower. They were not identified during survey efforts on the previous or proposed route alignments, or associated access roads.

American barberry and rock skullcap were identified during survey efforts. At this time, neither species has legal status in Virginia, but are under review by the VDCR-DNH for future listing or a “tentatively unknown” designation. This status applies to plants thought to be declining, but are poorly known due to a lack of data.

A historic population of purple fringeless orchid may also need further investigation within the appropriate survey window, but none were observed during searches for the focal plant species, suggesting the populations are no longer extant.

5.3 JNF Forest Sensitive Species

Surveys for forest sensitive plant species (as classified by the USFS) were completed over three separate survey deployments in order to survey for various species during their peak survey windows. Four locations of American barberry (Craig County, Virginia) and one location of rock skullcap (Giles County, Virginia) were identified on JNF lands. The results of JNF surveys will be provided in a Biological Evaluation submitted to the USFS.

5.4 Conclusion

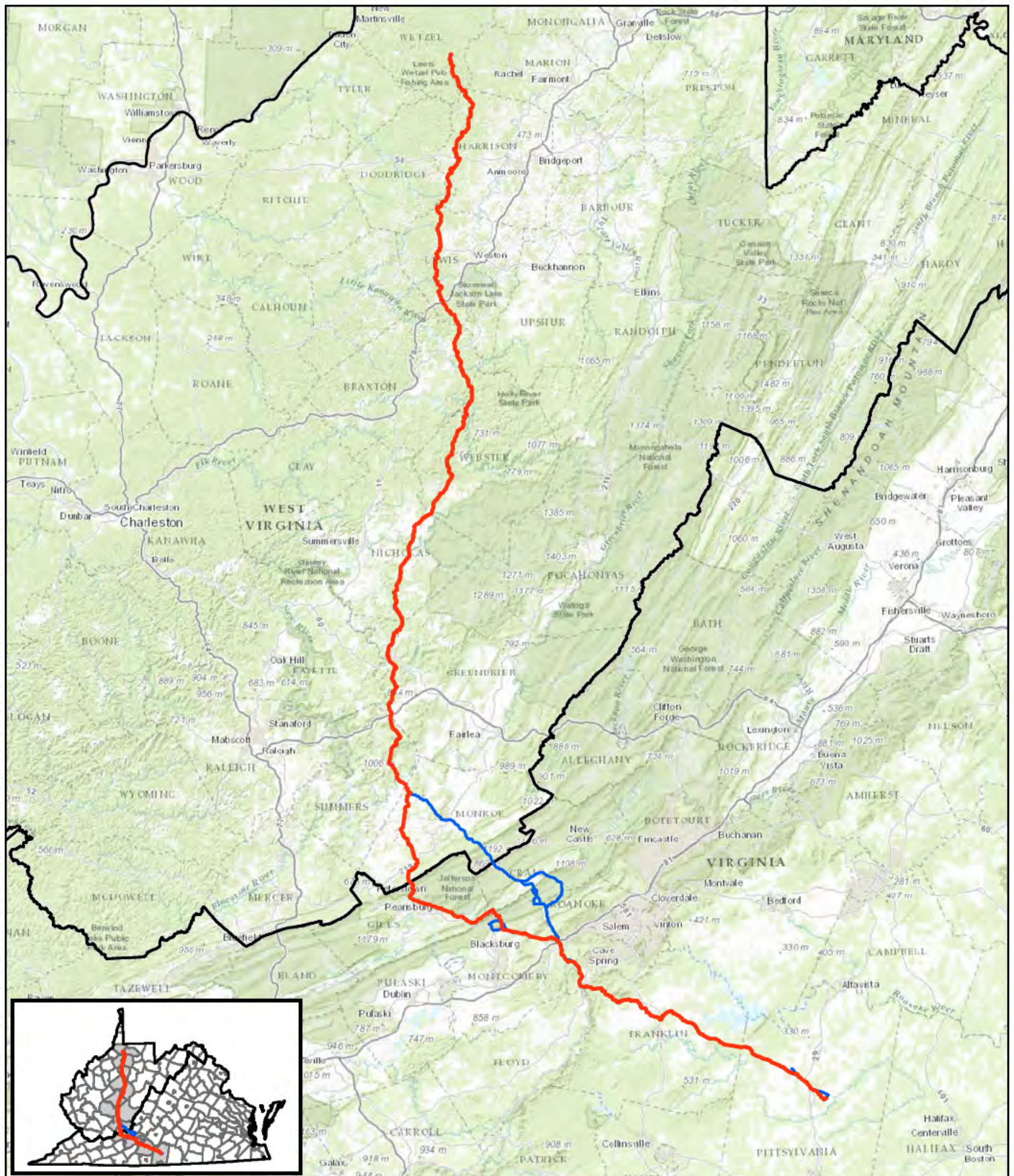
Lack of findings of these target plant species suggests no impacts to these species or populations will occur along the proposed alignment; however, an additional survey, anticipated in 2016, for smooth coneflower is outstanding. An addendum to this report will be submitted once smooth coneflower surveys are completed.

6.0 Literature Cited

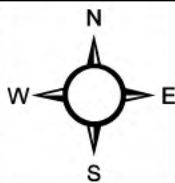
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APPENDIX A FIGURES



— Proposed Route 4.0.0 Alignment — Alternate Route



Appendix A, Figure 1. Location of the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Project No.
593

20 0 20 40
Kilometers

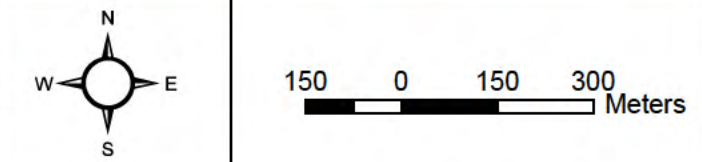
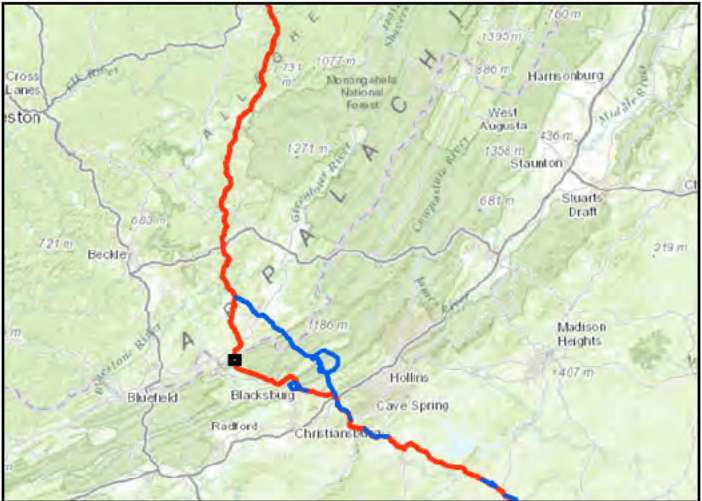


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Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

Map 1 of 15

- Milepost
- ▲ Photo Location
- Proposed Route 4.0.0 Alignment
- Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Additional Rare Plant Survey Area for Route 4.0.0
- Route REV 4.0.0 - 150-foot Buffer
- Rare Plant Survey Segment Area
- Northeastern Bulrush



Base Map: ESRI ArcGIS Web service - "World_Imagery"
accessed - 11/3/2015

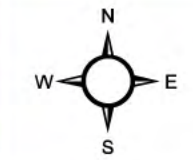
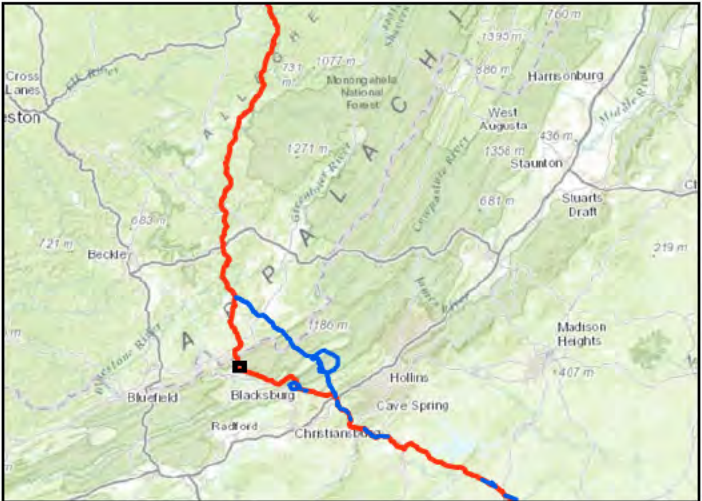


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Project No. 593

Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

- Milepost
- ▲ Photo Location
- Proposed Route 4.0.0 Alignment
- - - Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Additional Rare Plant Survey Area for Route 4.0.0
- Route REV 4.0.0 - 150-foot Buffer



150 0 150 300 Meters

Base Map: ESRI ArcGIS Web service - "World_Imagery"
accessed - 11/3/2015

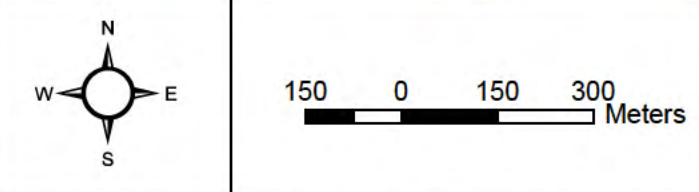
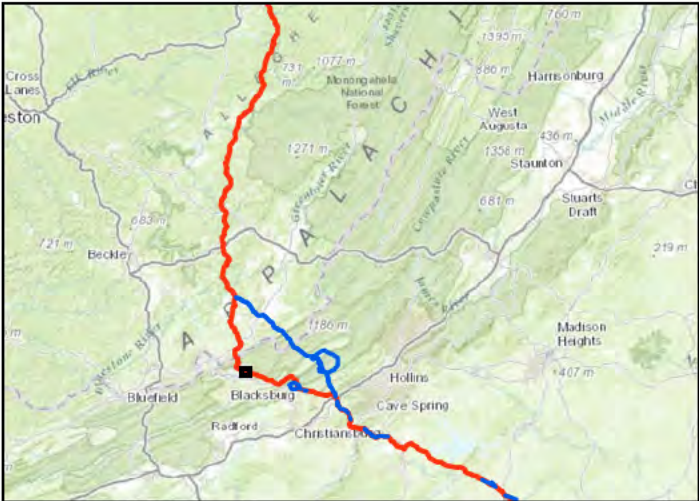


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Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

- Milepost
- ▲ Photo Location
- Proposed Route 4.0.0 Alignment
- ▬ Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Additional Rare Plant Survey Area for Route 4.0.0
- ▭ Route REV 4.0.0 - 150-foot Buffer



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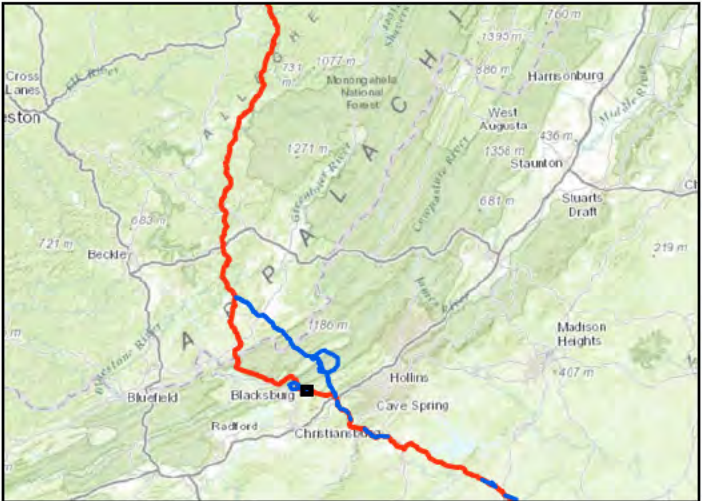


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Project No. 593

Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

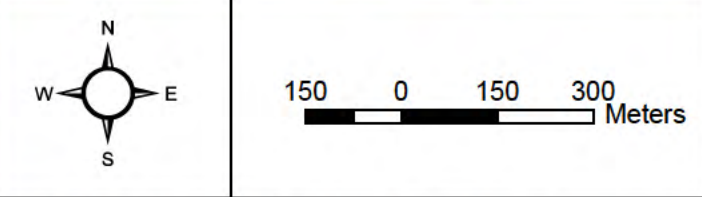
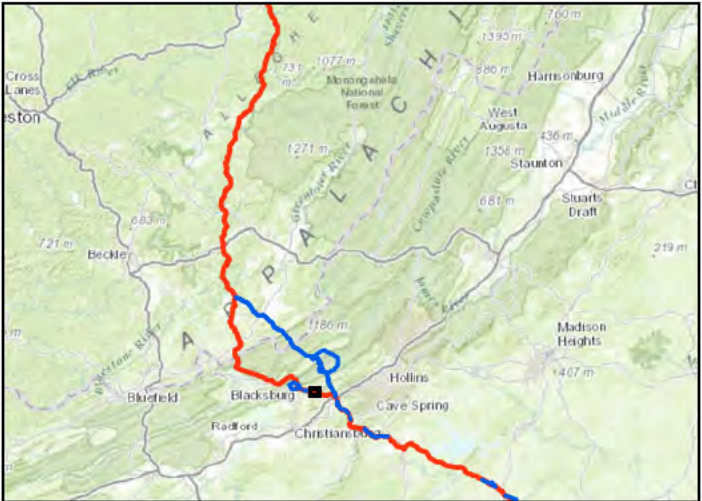
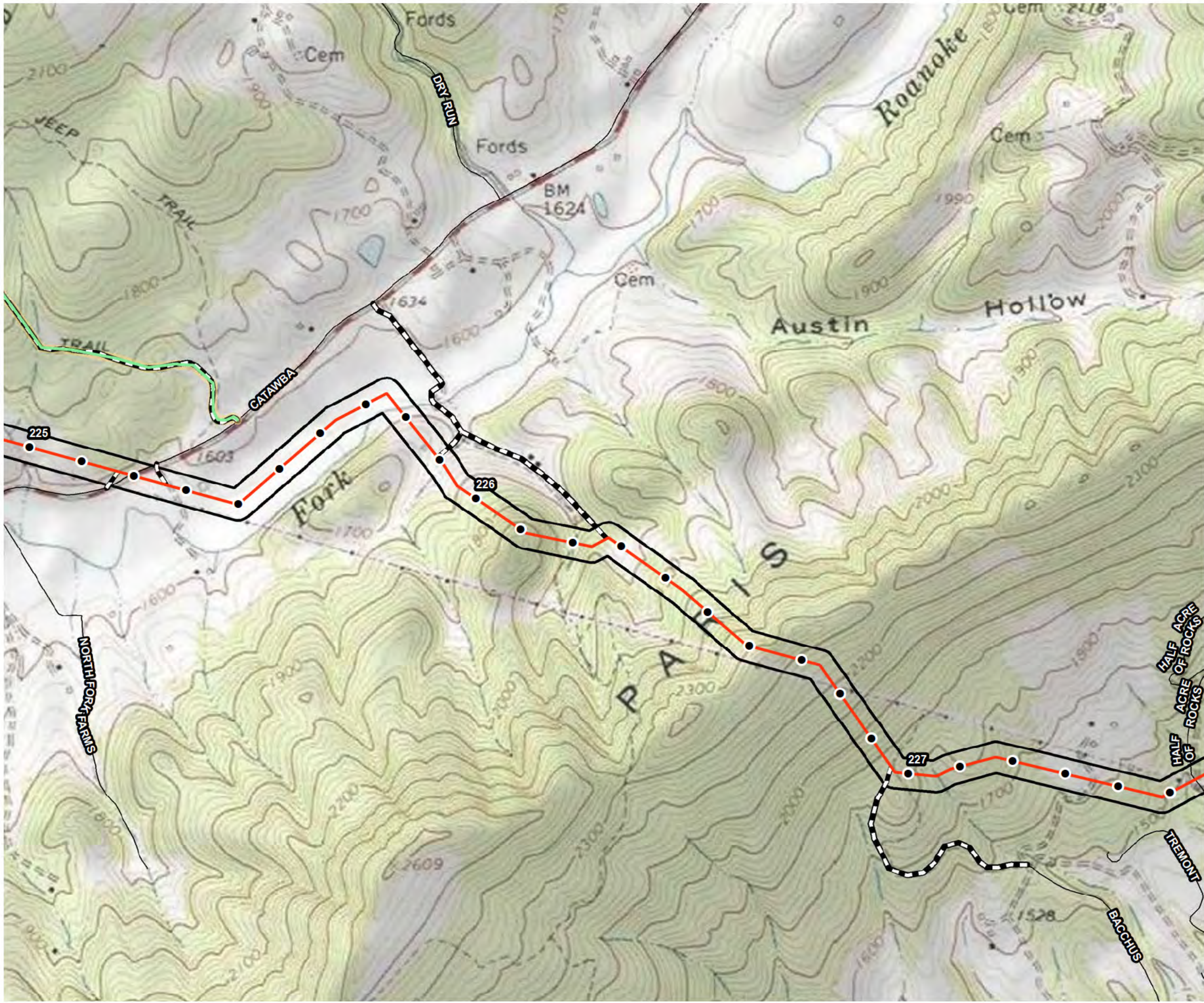
Map 4 of 15

- Milepost
- Proposed Route 4.0.0 Alignment
- ▬ Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Additional Rare Plant Survey Area for Route 4.0.0
- ▭ Route REV 4.0.0 - 150-foot Buffer
- Alternate Route
- Rare Plant Survey Segment Area
- Smooth Coneflower



Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

- Milepost
- Proposed Route 4.0.0 Alignment
- - - Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Route REV 4.0.0 - 150-foot Buffer
- Rare Plant Survey Segment Area
- Smooth Coneflower



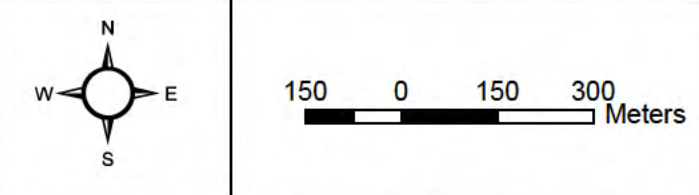
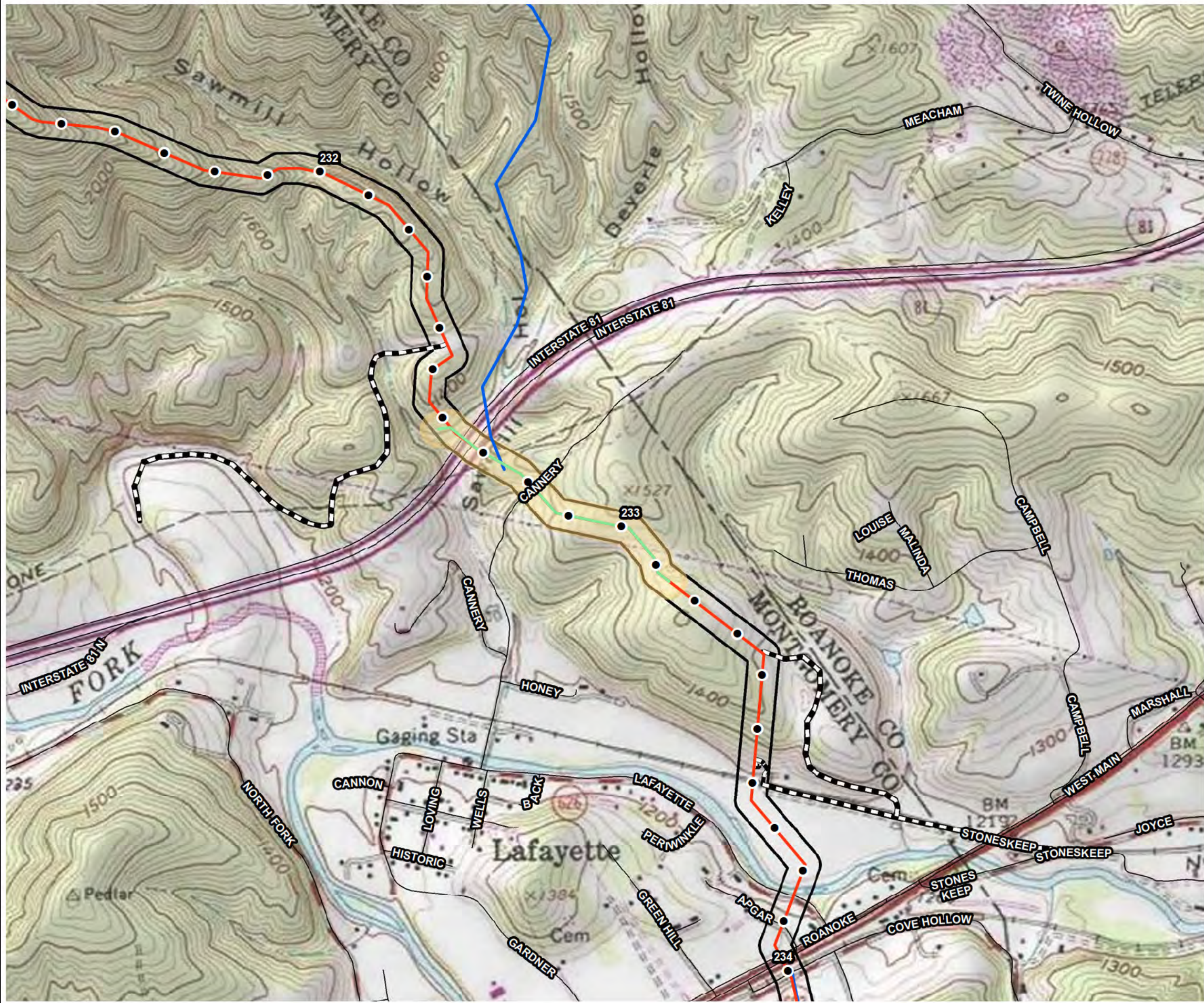
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Project No. 593

Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

- Milepost
- Proposed Route 4.0.0 Alignment
- - - Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Route REV 4.0.0 - 150-foot Buffer
- Alternate Route
- Rare Plant Survey Segment Area
- Smooth Coneflower



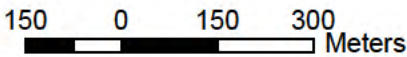
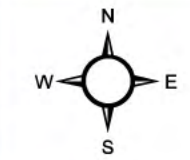
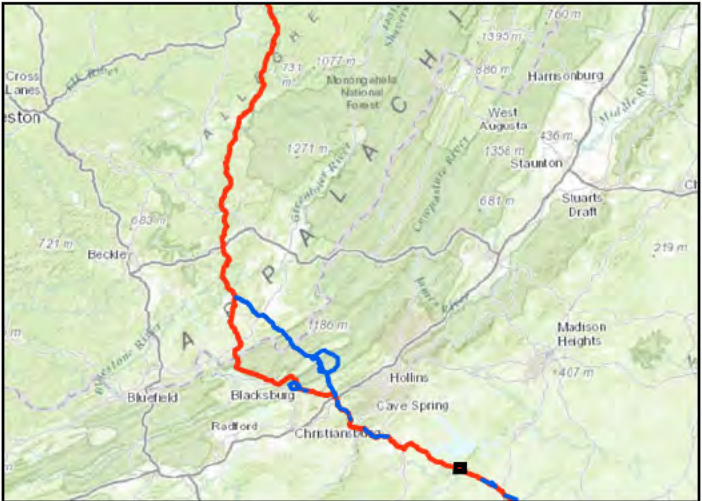
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Project No. 593

Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

- Milepost
- Proposed Route 4.0.0 Alignment
- Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Additional Rare Plant Survey Area for Route 4.0.0
- Route REV 4.0.0 - 150-foot Buffer
- Rare Plant Survey Segment Area
- Sweet-shrub



Base Map: ESRI ArcGIS Web service - "World_Imagery"
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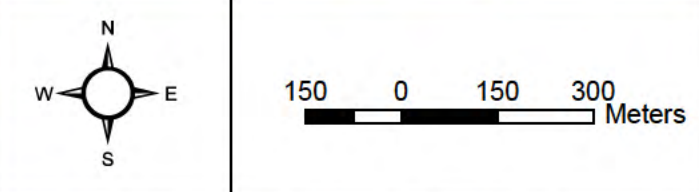
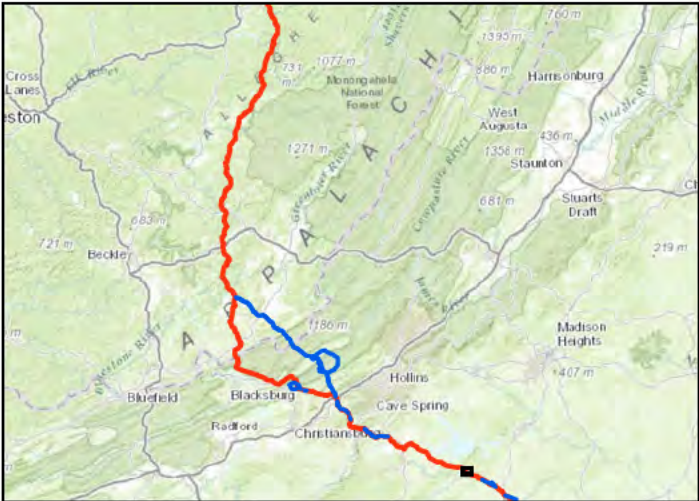
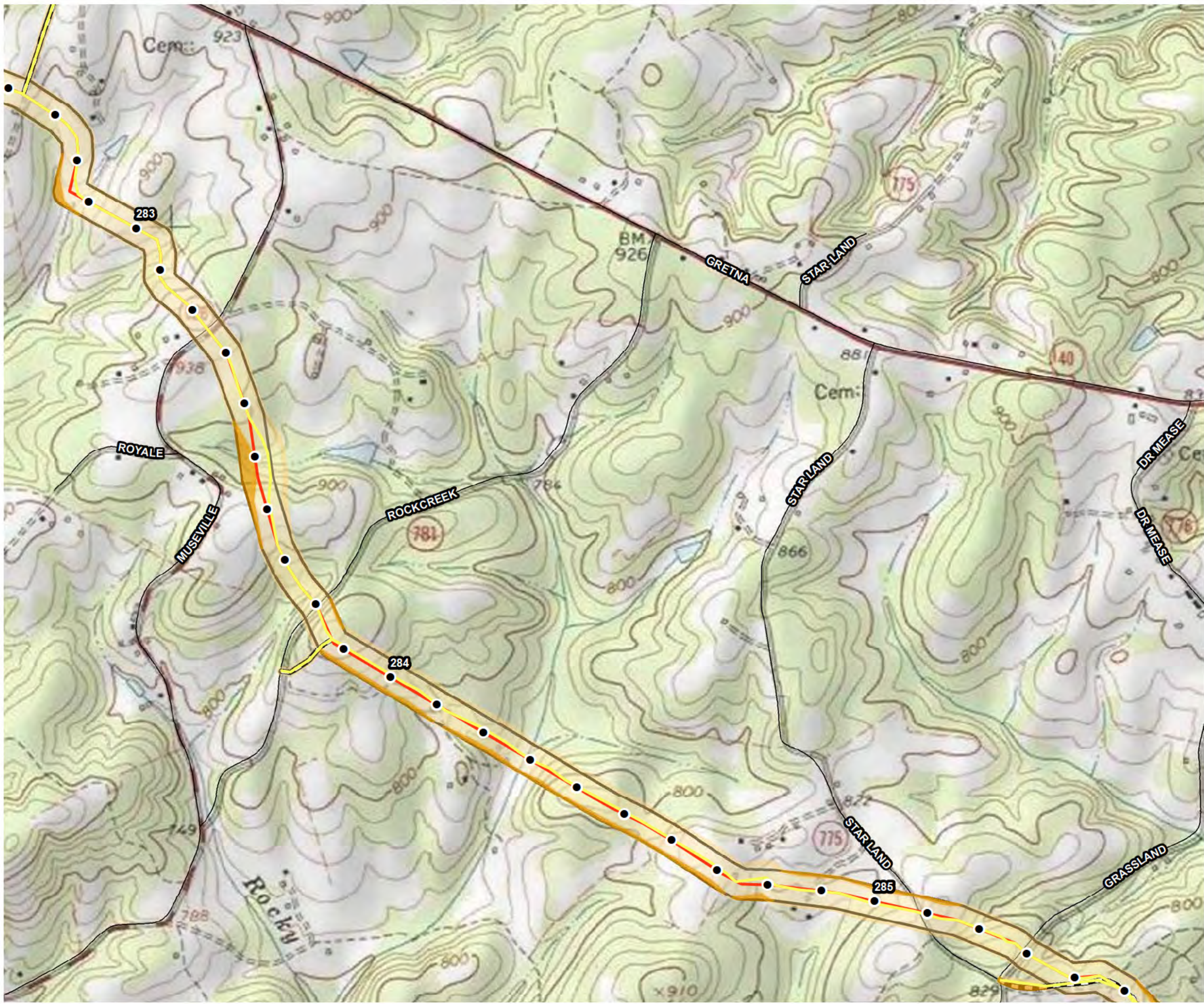


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Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

- Milepost
- Proposed Route 4.0.0 Alignment
- ▬ Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Additional Rare Plant Survey Area for Route 4.0.0
- ▭ Route REV 4.0.0 - 150-foot Buffer
- Rare Plant Survey Segment Area
- Sweet-shrub



Base Map: ESRI ArcGIS Web service - "World_Imagery"
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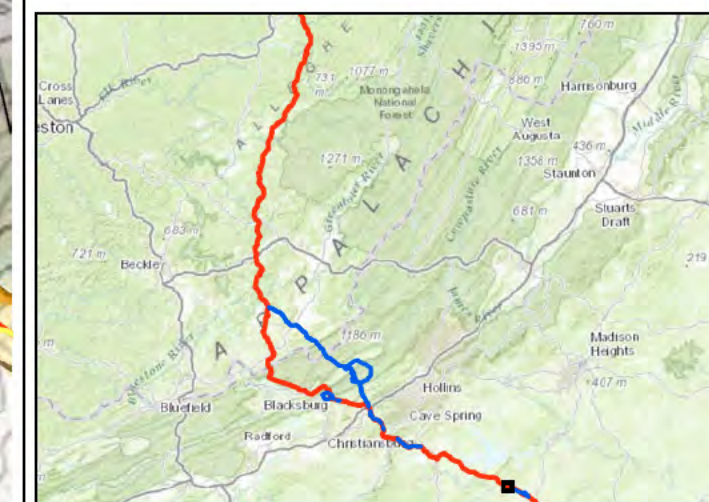
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Project No. 593



Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

Map 9 of 15

- Milepost
- Proposed Route 4.0.0 Alignment
- Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Additional Rare Plant Survey Area for Route 4.0.0
- Route REV 4.0.0 - 150-foot Buffer
- Rare Plant Survey Segment Area
- Sweet-shrub



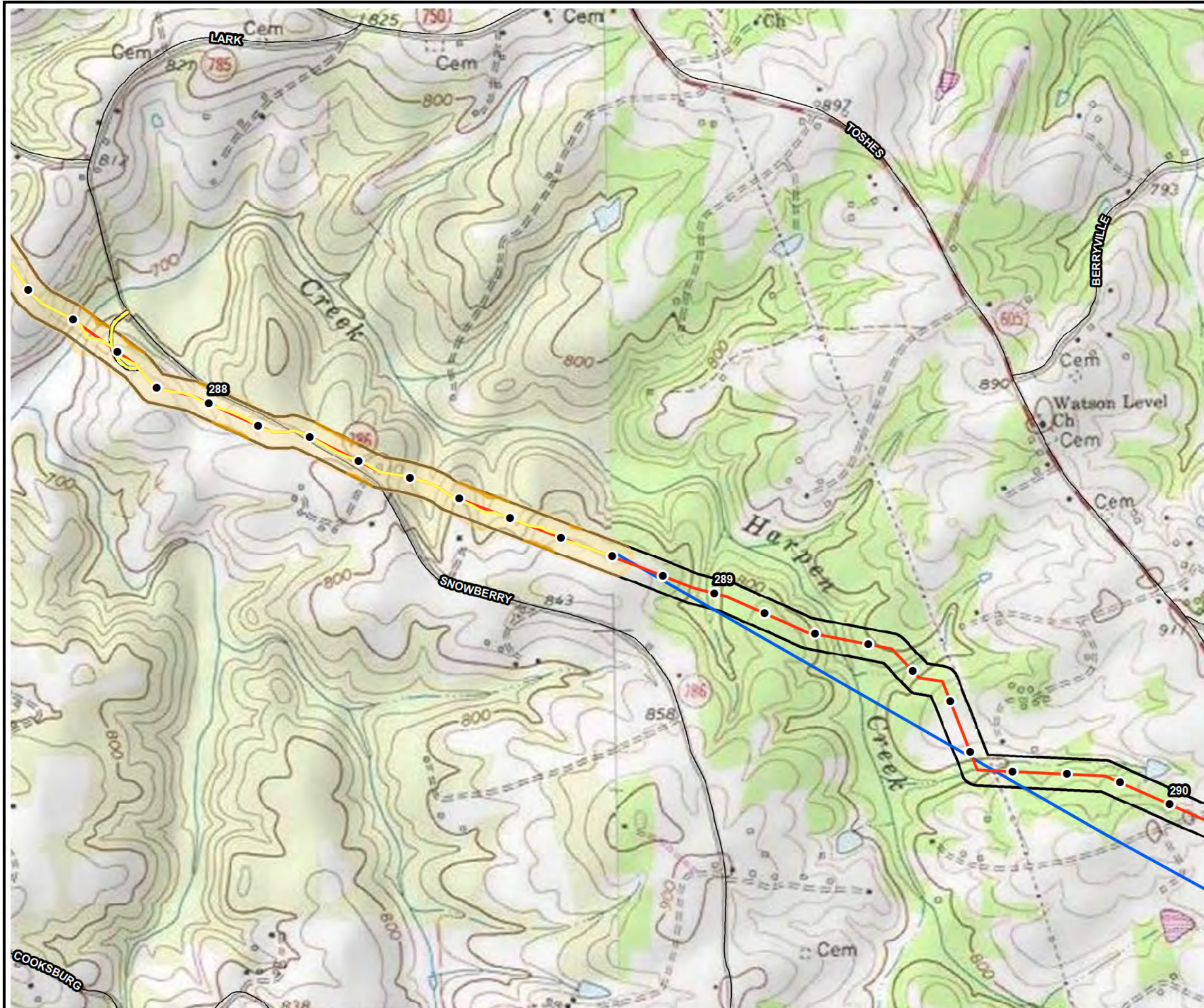
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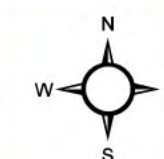
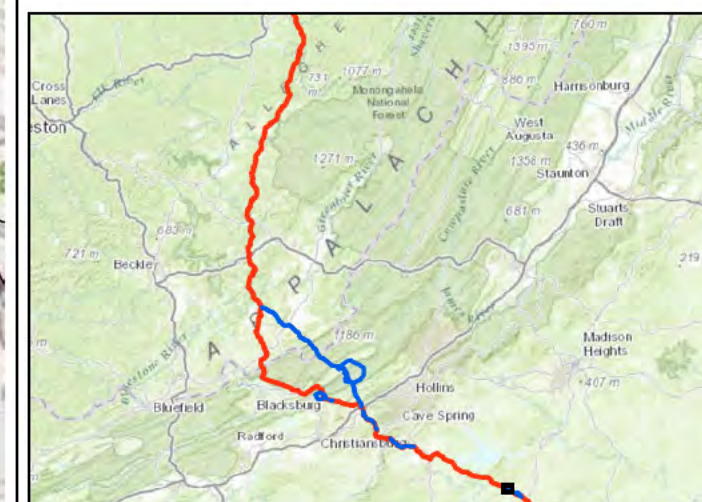
Project No. 593



Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

Map 10 of 15

- Milepost
- Proposed Route 4.0.0 Alignment
- Proposed Route 4.0.0 Access Road
- Rare Plant Survey Area for Route Rev3v2-5
- Additional Rare Plant Survey Area for Route 4.0.0
- Route REV 4.0.0 - 150-foot Buffer
- Alternate Route
- Rare Plant Survey Segment Area
- Sweet-shrub



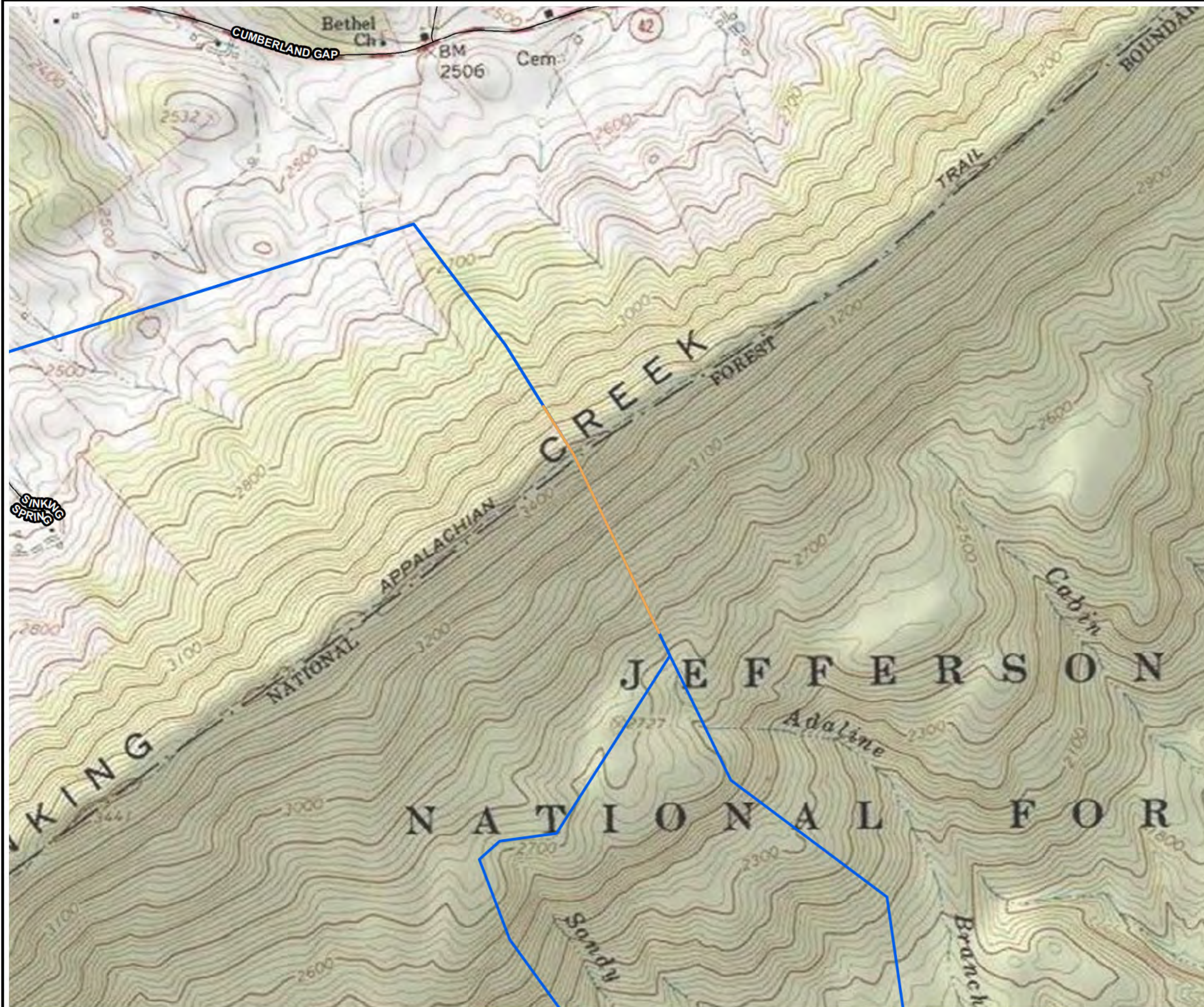
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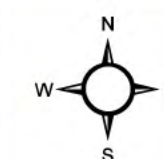
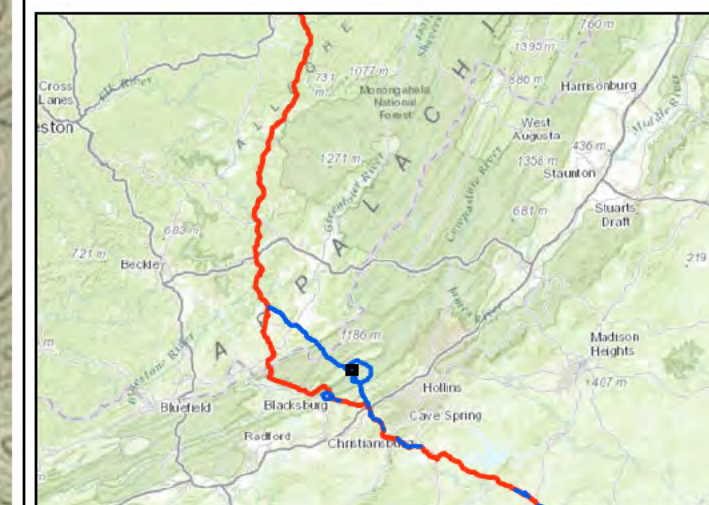
Project No. 593



Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

Map 11 of 15

- Alternate Route
- Rare Plant Survey Segment Area
- Northeastern Bulrush



150 0 150 300 Meters

Base Map: ESRI ArcGIS Web service - "World_Imagery"
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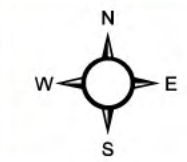
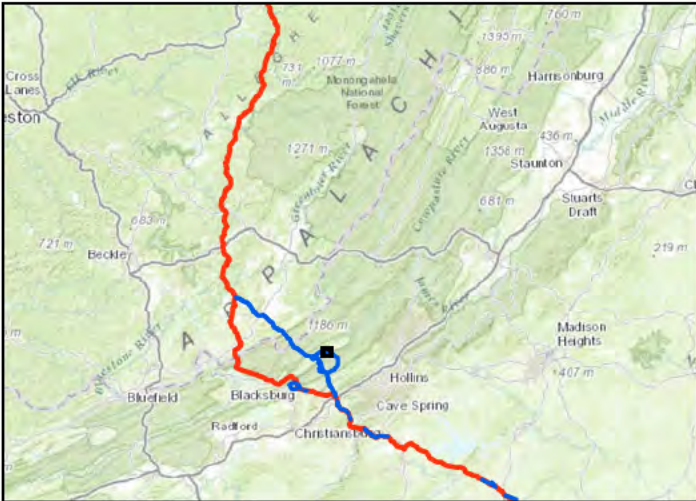
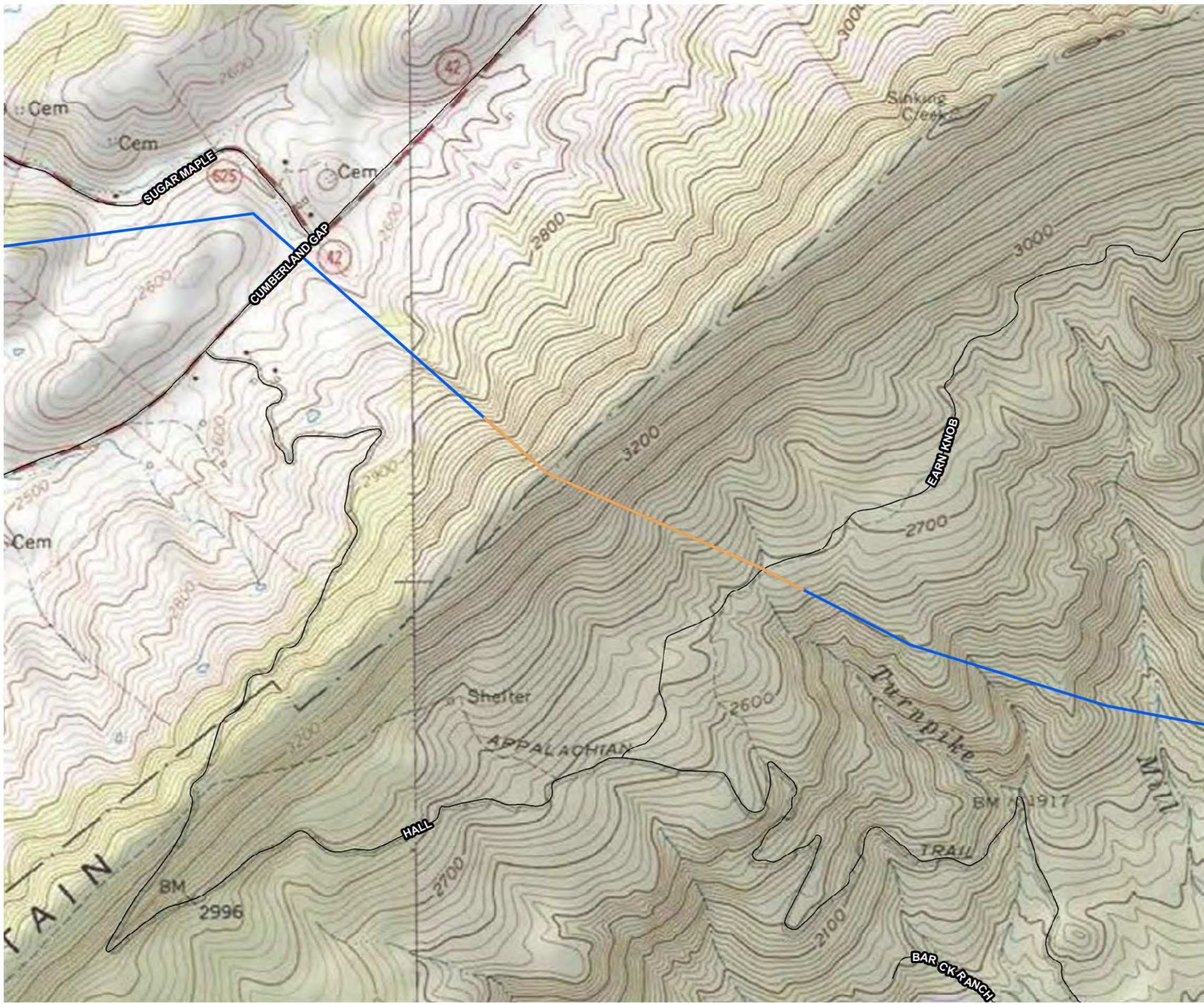


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Project No. 593

Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

- Alternate Route
- Rare Plant Survey Segment Area
- Northeastern Bulrush



150 0 150 300 Meters

Base Map: ESRI ArcGIS Web service - "World_Imagery"
accessed - 11/3/2015



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& INNOVATIONS, INC.

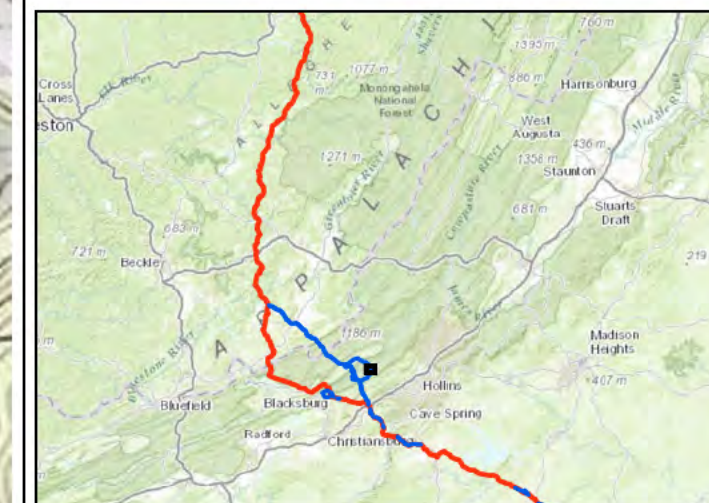
Project No. 593



Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

Map 13 of 15

- Alternate Route
- Rare Plant Survey Segment Area
- Cent. Appalach. Xeric Shale
- Piratebush



150 0 150 300 Meters

Base Map: ESRI ArcGIS Web service - "World_Imagery" accessed - 11/3/2015



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& INNOVATIONS, INC.

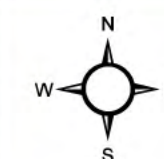
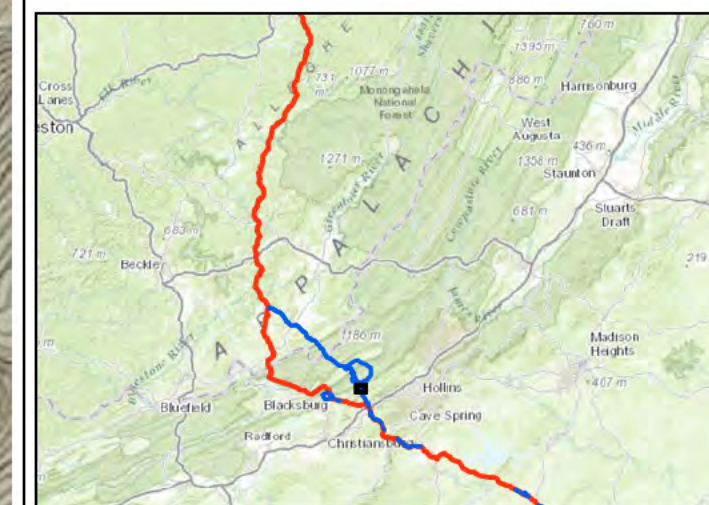
Project No. 593



Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

Map 14 of 15

- Alternate Route
- Rare Plant Survey Segment Area
- Smooth Coneflower



150 0 150 300 Meters

Base Map: ESRI ArcGIS Web service - "World_Imagery"
accessed - 11/3/2015

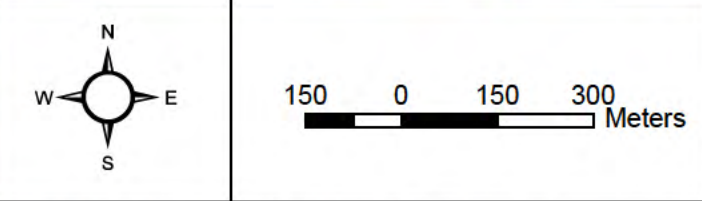
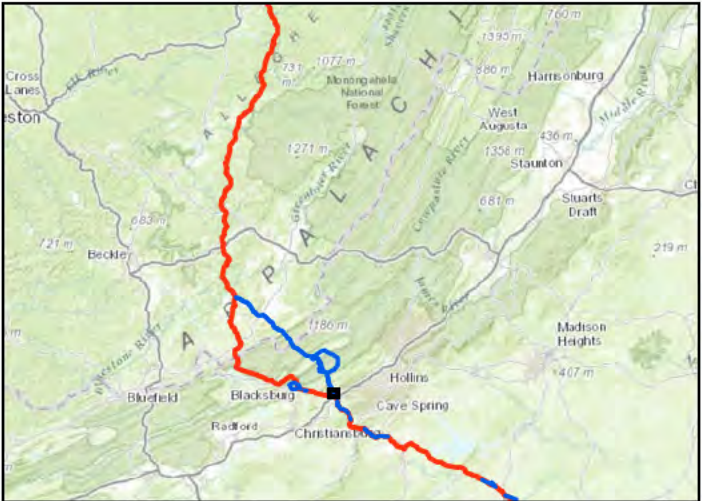


ENVIRONMENTAL SOLUTIONS
& INNOVATIONS, INC.

Project No. 593

Appendix A, Figure 2. Endangered Plant Surveys along the Proposed Mountain Valley Pipeline Project in Virginia.

- Milepost
- Proposed Route 4.0.0 Alignment
- ▬ Proposed Route 4.0.0 Access Road
- ▭ Route REV 4.0.0 - 150-foot Buffer
- Alternate Route
- Rare Plant Survey Segment Area
- Common Snowberry



Base Map: ESRI ArcGIS Web service - "World_Imagery"
accessed - 11/3/2015



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Project No. 593

Appendix A, Figure 3. Species of Concern
Identified Along the Proposed Mountain
Valley Pipeline Project in Virginia.

Map 1 of 3

-  American Barbary
-  Alternate Route





 150 0 150 300 Meters

Base Map: ESRI ArcGIS Web service - "World_Imagery"
accessed - 11/3/2015



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& INNOVATIONS, INC.

Project No. 593

Appendix A, Figure 3. Species of Concern Identified Along the Proposed Mountain Valley Pipeline Project in Virginia.

Map 2 of 3

- Skull cap
- Alternate Route
- Rare Plant Survey Segment/Area
- Northeastern Bulrush (1)



1500150300

Meters

Base Map: ESRI ArcGIS Web service - "World_Imagery"
accessed - 11/3/2015



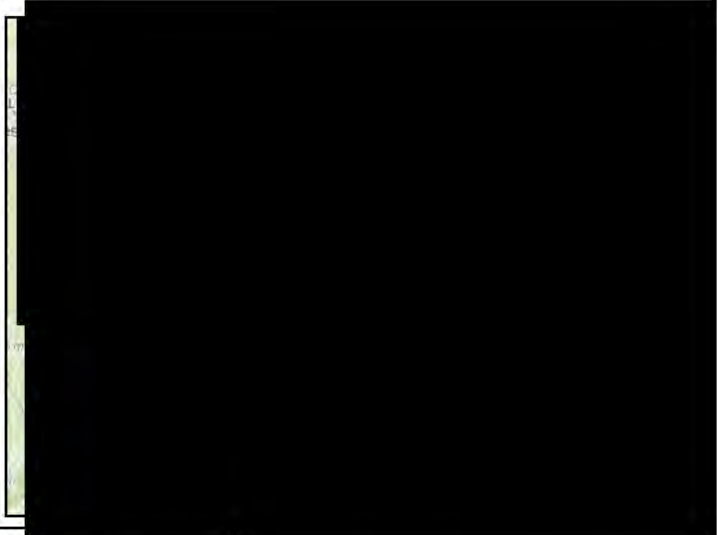
ENVIRONMENTAL SOLUTIONS
& INNOVATIONS, INC.

Project No. 593

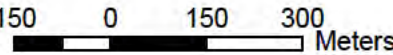
Appendix A, Figure 3. Species of Concern Identified Along the Proposed Mountain Valley Pipeline Project in Virginia.

Map 3 of 3

-  American Barbary
-  Milepost
-  Proposed Route 4.0.0 Alignment
-  Alternate Route
-  Proposed Route 4.0.0 Access Road
-  Rare Plant Survey Area for Route Rev3v2-5
-  Route REV 4.0.0 - 150-foot Buffer
- Rare Plant Survey Segment/Area
-  Smooth Coneflower (1)







Meters

Base Map: ESRI ArcGIS Web service - "World_Imagery"
accessed - 11/3/2015

APPENDIX B
CORRESPONDENCE WITH UNITED STATES FISH AND WILDLIFE SERVICE AND
STATE AGENCIES



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Virginia Field Office
6669 Short Lane
Gloucester, VA 23061



April 3, 2015

Ms. Valerie Clarkston
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, OH 45232

Re: Mountain Valley Pipeline, Virginia
Segments

Dear Ms. Clarkston:

The U.S. Fish and Wildlife Service (Service) has reviewed the project package for the referenced project. Mountain Valley Pipeline plans to construct a 42-inch diameter natural gas pipeline to allow producers and end-users a direct route to transport new gas supplies. The project will extend from the existing Equitrans transmission system near Mobley in Wetzel County, WV to Transcontinental Gas Pipeline Company's Zone 5 compressor station 165 in Pittsylvania County, VA. In Virginia, the pipeline is expected to cross Craig, Franklin, Giles, Montgomery, Pittsylvania, and Roanoke Counties. The following comments are provided under provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended, and Migratory Bird Treaty Act of 1940 (16 U.S.C. 703-712, 40 Stat. 755).

Our recommendations are based on the route alignment provided on March 6, 2015. Once the action area of the project is finalized, an additional review that includes all attendant facilities, staging areas, etc. will be necessary. Action area refers to all areas directly or indirectly affected by the proposed action and not only the immediate area involved in the action.

Migratory birds are a Federal trust resource and are protected under the Migratory Bird Treaty Act. The project package did not include information on proposed impacts to migratory birds and their habitats. The Service will provide additional comments upon receipt of a plan that identifies and addresses impacts to migratory birds.

We recommend a detailed habitat assessment be conducted for the federally listed and proposed species below within the specified areas of potential habitat. An approved surveyor can conduct these habitat assessments in the action area to identify suitable habitat and survey for the species

if suitable habitat is identified. Surveys are not needed if the approved surveyor determines that no suitable habitat is present.

A table of optimal survey times for plants can be found on our website at:

http://www.fws.gov/northeast/virginiafield/pdf/endspecies/MISC/20120125_VIRGINIA_survey_time_frame_for_plants.pdf.

A list of qualified surveyors can be found on our website at:

<http://www.fws.gov/northeast/virginiafield/endspecies/surveyors.html>. This list does not include all individuals qualified or authorized to survey for these species. If you select someone not on the pre-approved surveyor list, provide the proposed surveyor's qualifications and proposed survey design to this office for review and approval prior to initiating the survey. Send copies of all habitat assessments and/or survey results to this office.

- James spinymussel (*Pleurobema collina*): federally listed endangered. We have reviewed the study plan entitled, "Freshwater mussel (Unionidae) site assessments, surveys, and relocations for the proposed Mountain Valley Pipeline in Virginia." Because this species has been documented in Craig, Johns, Little Oregon, and Dicks Creeks in Virginia, presence/absence surveys are not necessary in these streams. Habitat assessments are necessary for other perennial streams in the Craig Creek watershed in Craig County. We recommend that alternative routes be developed that avoid this watershed due to its importance to the conservation and recovery of this species. Formal consultation pursuant to the Endangered Species Act between the Service and Federal Energy Regulatory Commission is likely if this route or other routes in this watershed are pursued. Any relocation of federally listed mussels must be authorized by the Service prior to relocation. This species also occurs in South Fork Potts Creek in West Virginia and coordination with Service's West Virginia Field Office is necessary (see contact information below).
- Roanoke logperch (*Percina rex*): federally listed endangered. Because this species has been documented in the Pigg, Roanoke, and North Fork Roanoke Rivers, presence/absence surveys are not necessary in these rivers. Habitat assessments are necessary for other perennial streams in the Roanoke River watershed in Montgomery, Roanoke, Franklin, and Pittsylvania Counties.
- Northeastern bulrush (*Scirpus ancistrochaetus*): federally listed endangered. Potential habitat occurs in Craig and Giles Counties between points -80.237, 37.416 and -80.246, 37.42; -80.284, 37.387 and -80.287, 37.392; and -80.688, 37.392 and -80.693, 37.402.
- Smooth coneflower (*Echinacea laevigata*): federally listed endangered. Potential habitat occurs in Roanoke and Montgomery Counties between points -80.364, 37.275 and -80.329, 37.268; 80.242, 37.319 and -80.243, 37.316; -80.21, 37.246 and -80.202, 37.242; and 80.198, 37.229 and 80.197, 37.227.

- Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*): federally listed endangered. Potential habitat occurs in Franklin and Montgomery Counties.
- Bats
 - Surveys for potential hibernacula including cave openings and cave-like structures (e.g., abandoned or active mines, railroad tunnels) should be conducted following the guidance on page B3 of the Northern Long-Eared Bat Interim Conference and Planning Guidance within the action area of the proposed pipeline route. This guidance is available at:
<http://www.fws.gov/Midwest/endangered/mammals/nlba/pdf/NLEBinterimGuidance6Jan2014.pdf>.
 - In areas where tree removal will occur, surveys should be conducted by an approved surveyor following the most recent version of the Range-wide Indiana Bat Summer Survey Guidelines (available at:
<http://www.fws.gov/northeast/virginiafield/endangered/about.html>) for the following species in the areas specified below within suitable habitat.
 - Indiana bat (*Myotis sodalis*): federally listed endangered. Potential habitat occurs in Giles, Montgomery, Roanoke, and Craig Counties.
 - Northern long-eared bat (*Myotis septentrionalis*) (NLEB): federally proposed endangered (effective May 2, 2015 this species will be federally listed threatened with an interim 4(d) rule). Potential habitat occurs in Franklin, Giles, Montgomery, Pittsylvania, Roanoke, and Craig Counties.
 - The proposed route intersects with Tawneys Cave in Giles County, a known hibernaculum for Indiana and Northern long-eared bats. We recommend a minimum 5 mile buffer from the known hibernaculum opening and any mapped passages.
 - Specific comments on the revised study plan dated March 6, 2015:
 - Page 4 – Per page B5 of the NLEB Interim Conference and Planning Guidance, revise the description as follows, “a field survey, where access can be obtained, of all land within one-half mile of the edge of the project footprint and documentation (i.e., literature search) of all known caves and abandoned mine portals within 3 miles of the outside edge of the project footprint should be conducted.”
 - Page 5 – Per page B6 of the NLEB Interim Conference and Planning Guidance, if you plan to conduct spring portal/cave surveys they must be conducted between April 1 and April 21 and prior to any tree clearing. A minimum of three nights of sampling per week for three weeks (i.e., 9

nights of sampling) is required at each suitable entrance as determined by the Phase 1 Habitat Assessment. Your study plan proposes two evenings of sampling. Fall portal/cave surveys can be conducted rather than spring surveys. Per page B5 of the NLEB Guidance, surveys must be conducted between September 1 and October 31 and prior to any tree clearing. A minimum of two nights of sampling is required at each suitable entrance as determined by the Phase 1 Habitat Assessment.

- Page 5 - Per page B6 of the NLEB Interim Conference and Planning Guidance, harp traps and/or mist nets should be monitored for captured bats on 10-minute intervals. Your study plan states “traps are checked at least once per hour or continuously if the catch rate is greater than 25 bats per hour.” Change your plan to reflect the NLEB Interim Guidance.
- Address and incorporate comments the Service provided on November 26, 2014 on the study plan dated November 3, 2014. Specifically comments: SH10, SH11, SH12, and SH13.

To assist us in analyzing effects to federally listed and proposed species from the proposed action, provide the following information to this office:

- For proposed stream crossings where federally listed species are present, provide us an analysis that outlines all alternatives considered for that crossing, how the determination was made that the selected alternative was the least environmentally damaging, an analysis of effects to the stream anticipated due to the pipeline approaches to each side of the stream, and the proposed schedule/timing of the crossing. If boring or drilling is proposed, provide a best professional opinion on the likelihood that drilling fluids will escape through the bedrock to the stream.

To avoid and minimize impacts to federally listed and proposed species, incorporate the following conservation measures into the proposed project:

- To address impacts to summer bat habitat (see Appendix D of the NLEB Interim Conference and Planning Guidance): leave dead or dying trees standing (if not a safety hazard), maintain or improve forest patches and forested connections (e.g., hedgerows, riparian corridors) between patches, clearly demarcate trees to be protected vs. cut to help ensure contractors do not accidentally remove more trees than anticipated, avoid/minimize tree clearing that fragments large forested areas or tree lined corridors (e.g., route linear features along the edge of a woodlot instead of through the middle).

We recommend that you contact Liz Stout (West Virginia Field Office) at 304-636-6586 or elizabeth_stout@fws.gov to coordinate the portions of the project in West Virginia.

Once the action area of the project is finalized, an additional review that includes all attendant facilities, staging areas, etc. will be necessary. If habitat assessments and/or surveys determine that suitable habitat for listed or proposed species are present, this office will work with you to ensure that the project avoids or minimizes adverse impact to listed species and their habitats.

If you have any questions, please contact Kim Smith at (804) 824-2410 or via email at kimberly_smith@fws.gov.

Sincerely,

Cindy Schulz
Field Supervisor
Virginia Ecological Services

cc: FERC, Washington, D.C. (Attn: Paul Friedman)
Service, Elkins, WV (Attn: Liz Stout)
VDCR-DNH, Richmond, VA (Attn: Rene Hypes)
VDGIF, Richmond, VA (Attn: Amy Ewing)

APPENDIX C
LIST OF JNF FOREST SENSITIVE SPECIES

Appendix D. List of JNF forest sensitive species surveyed for on the MVP proposed pipeline route.

Common Name	Scientific name
Non-vascular plants	
Nardia liverwort	Nardia lescurii
Plagiochila liverwort	Pagloichila sullivantii
hydrothyria lichen	Hydrotheria sp.
Vascular plants	
trailing white monkshood	Aconitum reclinatum
nodding onion	Allium cernuum
American barberry	Berberis canadensis
Bentley's coralroot	Carallorhiza bentleyi
Virginia white-haired leatherflower	Clematis albicoma
Schweinitz's sedge	Cyperus schweinitzii
tall larkspur	Delphinium exaltatum
glade spurge	Euphorbia purpurea
sweet-scented indian-plantain	Hasteola suaveolens
Blue Ridge St. John's-wort	Hypericum mitchellianum
long-stalked holly	Ilex collina
butternut	Juglans cinerea
turgid gayfeather	Liatris turgida
sweet pinesap	Monotropis odorata
sword-leaf phlox	Phlox buckleyi
bog bluegrass	Poa paludigena
tennessee pondweed	Potamogeton tennesseensis
Torrey's mountain-mint	Pycnanthemum torrei
rock skullcap	Scutellaria saxatilis
Carolina hemlock	Tsuga caroliniana
sand grape	Vitis rupestris

Focal plant species from USFWS and VDCR-DNH

shale barren rockcress

piratebush

Addison's leather flower

smooth coneflower

small whorled pogonia

Canby's mountain lover

pinnate-lobed coneflower

northeastern bulrush

Arabis serotina

Buckleya distichophylla

Clematis addisonii

Echinacea laevigata

Isotria medeoloides

Paxistima canbyi

Rudbeckia triloba var. *beadleii*

Scirpus ancistrochaetus

*

APPENDIX D
LIFE HISTORIES AND CHARACTERISTICS OF ENDANGERED, THREATENED, AND
RARE PLANTS

TABLE OF CONTENTS

	<u>Page</u>
1.0 LIFE HISTORIES	1
1.1 Northeastern bulrush (<i>Scirpus ancistrochaetus</i>)	1
1.1.1 Description	1
1.1.2 Status	1
1.1.3 Ecology	1
1.2 Running Buffalo Clover (<i>Trifolium stoloniferum</i>)	2
1.2.1 Description	2
1.2.2 Status	3
1.2.3 Ecology	3
1.3 Shale Barren Rock Cress (<i>Arabis serotina</i>)	4
1.3.1 Description	4
1.3.2 Status	5
1.3.3 Ecology	5
1.4 Small Whorled Pogonia (<i>Isotria medeoloides</i>)	5
1.4.1 Description	5
1.4.2 Status	5
1.4.3 Ecology	6
1.5 Smooth Coneflower (<i>Echinacea laevigata</i>)	6
1.5.1 Description	6
1.5.2 Status	6
1.5.3 Ecology	8
1.6 Virginia spiraea (<i>Spiraea virginiana</i>)	8
1.6.1 Description	8
1.6.2 Status	9
1.6.3 Ecology	9
1.7 Sweet shrub (<i>Calycanthus floridus</i>)	10
1.7.1 Description	10
1.7.2 Status	10
1.7.3 Ecology	10
1.8 Pinnate-lobed coneflower (<i>Rudbeckia triloba</i> L. var. <i>beadlei</i>)	11
1.8.1 Description	11
1.8.2 Status	11
1.8.3 Ecology	11
2.0 LITERATURE CITED	12

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1.0 Life Histories

1.1 Northeastern bulrush (*Scirpus ancistrochaetus*)

1.1.1 Description

The northeastern bulrush is a member of the sedge family (*Cyperaceae*) and is native to the northeastern United States. Northeastern bulrush, first described as a new species by A.E. Schuyler in 1962, is a leafy, perennial herb approximately 80 to 120 centimeters (47.2 in) in height (Schuyler 1962). The lowermost leaves are up to 8 millimeters (0.3 in) wide and 40-60 times as long as wide, while the uppermost leaves are 3 to 5 millimeters (0.1 to 0.2 in) wide and 30 to 50 times as long as wide (Schuyler 1962). Flowering culms (stems) are produced from short, woody, underground rhizomes. The umbellate inflorescence has distinctly arching rays, which bear clusters of brown spikelets (small, elongated flower clusters). Each of the minute flowers has six small (1.1 - 1.7 mm long), rigid perianth bristles, and each bristle is armed with thick walled, sharply pointed barbs projecting downward. Flowers have 0 to 3 stamens and a 3-parted style. The yellow brown achenes are 1.10 to 1.35 millimeters (0.04 to 0.05 in) long, obovate, and tough and thickened above the seed (Schuyler 1962). Flowering occurs mid-June to July, and fruit sets between July and September.

Plants emerge from underground rhizomes in May (the new year's seedlings typically begin to germinate in March (USFWS 1993). Flowering occurs from mid-June to mid-July across the range of the species. Hybridization has been observed between northeastern bulrush and mosquito bulrush (*S. hattorianus*) in the wild; in fact, Schuyler (1962, 1967) suggested that the intermediate, co-occurring species, green bulrush (*S. atrovirens*), might have arisen evolutionarily from a backcross hybridization of these taxa.

1.1.2 Status

The northeastern bulrush was listed as federally endangered on 7 May 1991. A recovery plan was prepared and released on 5 August 1993 (USFWS 1993). The northeastern bulrush recovery plan has records of 33 known populations range wide. Twenty of these 33 populations occurred on private land and were identified as being subject to habitat loss, modification, and degradation caused by residential and agricultural development (USFWS 1993).

Federal Register Documents
55 FR 46963 46968; 08 November 1990:
Proposed Listing, Endangered
55 FR 46963 46968; 07 May 1991: Final
Listing, Endangered

1.1.3 Ecology

Northeastern bulrush is likely pollinated by wind. Seeds mature in late summer to fall, and have been observed germinating on the parent plant (Bartgis 1992). Plants

may also reproduce vegetatively by proliferating along rhizomes or by initiating new shoots off decumbent stems (Bartgis 1992). However, the relative contributions of sexual and asexual reproduction to population growth are not currently understood. The bristly seeds may be dispersed by animals or by water (Lentz and Dunson 1999). Herbivores that feed on northeastern bulrush are unknown, but mammals such as deer, beaver, and bear have been noted to disturb the soil around northeastern bulrush stands (Lentz and Dunson 1999).

Throughout its range, northeastern bulrush is found in open, tall herb-dominated wetlands. In the north, the species is most commonly found on the edge of shallow beaver ponds (Royte and Lortie 2000) where water levels vary depending on animal activity. One population occurs on an inland sand plain in Massachusetts, in a depression that periodically fills with groundwater. In the south, the taxon occurs often in sinkhole ponds that form in sandstone bedrock at intermediate elevations around 200 to 500 meters (656.1 to 1640.4 ft) (somewhat higher elevations in the Virginias). Plants at all sites occur around the margins of ponds in 8 to 40 centimeters (3.1 to 15.7 in) of standing water (in wet years). In Pennsylvania, the northeastern bulrush is found almost exclusively in vernal pools where the water level fluctuates seasonally. In a study comparing Pennsylvania wetlands that supported northeastern bulrush wetlands with nearby ponds that did not, showed that ponds with northeastern bulrush were typically larger (> 400 square meters [>4305.5 sq ft]), freer of forest canopy cover, higher in exchangeable sodium (> 7 ppm), and higher in pH (Lentz and Dunson 1999). Northeastern bulrush is often found in ponds, wet depressions, or shallow sinkholes within small (generally less than one acre) wetland complexes. These wetlands are characterized by seasonally variable water levels (USFWS 1993). The habitat of northeastern bulrush in Pennsylvania typically consists of small depressional palustrine wetlands (Lentz and Dunson 1999) which receive water primarily through precipitation (Lentz 1998).

Examination of field reports indicates that there is considerable variety in associated species. A few species, however, are common to several of the sites. These are three way sedge (*Dulichium arundinaceum*), woolgrass (*Scirpus cyperinus*), rattlesnake manna grass (*Glyceria canadensis*), and Virginia marsh St. Johnswort (*Triadenum virginicum*) (USFWS 1993).

1.2 Running Buffalo Clover (*Trifolium stoloniferum*)

1.2.1 Description

Running buffalo clover (*Trifolium stoloniferum*) is a stoloniferous, perennial herb. This species is characterized by and differentiated from white clover (*Trifolium repens* L.) by having erect peduncles (flowering stalks) that have two large trifoliate leaves at their summit (USFWS 2007). White clover lacks these leaves on the peduncle. Running buffalo clover's erect flowering stems are typically 7.6 to 15.2 centimeters (3 to 6 inches [in]) tall. The round flowering heads occur in mid-April to June with wilted flowering heads persisting for a short time thereafter. It reproduces by both seeds

and stolons.

1.2.2 Status

Running buffalo clover was listed as federally endangered on 5 June 1987. A recovery plan was prepared and released on 12 August 2005. As recently as 1983, this species was considered to possibly be extinct, as it had not been encountered in the field since 1937 in Preston County, West Virginia and 1940 in Webster County, West Virginia. Brooks (1983) considered the species endangered (with a few undiscovered populations) or extinct. In 1983, the U.S. Fish and Wildlife Service placed the species under review for listing, noting that the species was probably extinct.

Federal Register Documents

[51 FR 8217 8220](#); 10 March 1986:
Proposed Listing, Endangered
[52 FR 21478 21481](#); 05 June 1987:
Final Listing, Endangered
[70 FR 47222 47223](#); 12 August 2005:
Draft Recovery Plan
[72 FR 35253 35254](#); 27 June 2007:
Recovery Plan Revision 1

The plant was rediscovered in 1985 at two sites in West Virginia (Bartgis 1985) and federally listed as endangered in 1987. These finds spurred a continued search for the species, and additional populations have been found in West Virginia, Ohio, Indiana, and Kentucky. These sites vary in size from a few individuals covering a few square feet to hundreds of individuals over a quarter of an acre.

1.2.3 Ecology

Running buffalo clover is known to occur in relatively moist, fertile soils in calcareous regions. There does not appear to be any correlation between running buffalo clover and any particular soil type. It has been encountered in semi-shaded conditions along footpaths, logging trails, lawns of older homes and cemeteries, and grazed, semi-wooded terraces along stream corridors. In Ohio, it clearly inhabits open to semi-open, moist ground with grazing, trampling, or mowing and it is generally near streams or rivers. Running buffalo clover may be found in semi-shaded, moist openings and edge habitats maintained by some form of long-term disturbance. Disturbance must be moderate in intensity: minimal or excessive disturbance is detrimental. Disturbances that may be helpful when moderate (or detrimental when excessive) include grazing, trampling, and mowing. Moderate amounts of disturbance, at a level conducive for establishment and maintenance of healthy populations, are infrequently encountered.



A canopy closure of 50 to 80 percent has been noted at some sites in Kentucky. Modern-day woody associates at those sites include bitternut hickory (*Carya cordiformis*), tulip tree (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), boxelder (*Acer negundo*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), red bud (*Cercis canadensis*), spicebush (*Lindera benzoin*), and sassafras (*Sassafras*

albidum). Herbaceous components of the community include pale touch-me-not (*Impatiens pallida*), rich-weed, white grass (*Leersia virginica*), path rush (*Juncus tenuis*), white snakeroot (*Eupatorium rugosum*), honewort (*Cryptotaenia canadensis*), wild rye (*Elymus* sp.), and garlic mustard (*Alliaria officinalis*) (Campbell et al. 1989).

In Indiana, Homoya et al. (1989) described the habitat of two populations as of three types: (1) narrow, mesic floodplain forest, (2) steep, mesic upland forest, and (3) gravel wash of small, high-gradient, ephemeral streams. The sites have rich, silty clay loam soils. The sites are forested but lack an understory due to grazing. Moderately grazed areas had more plants than heavily grazed areas. Nearby, similar but un-grazed areas lacked running buffalo clover. Woody species included American sycamore (*Platanus occidentalis*), boxelder (*Acer negundo*), red elm (*Ulmus rubra*), Ohio buckeye (*Aesculus glabra*), pawpaw (*Asimina triloba*), and spicebush. Herbaceous associates include honewort, sedge (*Carex jamesii*), rich-weed (*Collinsonia canadensis*), wood-nettle (*Laportia canadensis*), white grass (*Leersia virginica*), Canada bluegrass (*Poa compressa*), wingstem (*Verbesina alternifolia*), white snakeroot, garlic mustard (*Alliaria petiolata*), Jacob's ladder (*Polemonium reptans*), mayapple (*Podophyllum peltatum*), and smartweeds (*Polygonum hydropiperoides*, *P. punctatum*, and *P. virginianum*).

Historically, the range of this species was across the central eastern United States. Brooks (1983) included eight states within the range: Arkansas, Illinois, Indiana, Kansas, Kentucky, Missouri, Ohio, and West Virginia. The earliest dated collection of the species was in 1830 near St. Louis, Missouri, with scattered collections throughout its range during the latter part of the 1800s and early 1900s. In Ohio, running buffalo clover is known from Hamilton, Warren, and Clermont counties, and most recently from Lawrence County.

1.3 Shale Barren Rock Cress (*Arabis serotina*)

1.3.1 Description

The shale barren rock cress is a biennial plant species within the mustard family. Young, non-reproductive individuals have leaves in a basal rosette that range in size from 1.6 to 3.5 centimeters in diameter. Potentially reproductive individuals are erect (41 to 97 centimeters) and are flowering plants that lack the basal rosette. The flowering stalks are highly branched with three to forty one branches measuring 20 to 40 centimeters wide with many flowers. The flowers are small and white with calyxes (2.0 to 3.3 millimeters long) that bear silique fruits ranging from 4.3 to 7.9 centimeters long (USFWS 1991). It flowers from mid-July to October. Because of flower size and structure small bees and flies are believed to be the principle pollinators.

A similar species (*Arabis laevigata* var. *burkii*) is often confused with shale barren rock cress as it is also found on shale barrens. However, it occupies a variety of habitats, flowers in April and May, has broader leaves that are auricled at the base, less branched inflorescences and larger flowers than shale barren rock cress

(Wieboldt 1987).

1.3.2 Status

The plant was listed as federally endangered on 8 August 1989 and only 34 extant and 1 historical populations were known at the time of listing (USFWS 1989). Threats include habitat loss, reproductive failure due to drought and lack of pollinators, herbivory by large mammals and insects, competition from exotic plants, and over collection by botanists. No published critical habitat exists for the shale barren rock cress.

1.3.3 Ecology

The shale barren rock cress is very habitat restricted, and is only known to occur at low densities among scattered mid-Appalachian shale barrens in West Virginia and Virginia (USFWS 2002, Catrow et al. 2009). It is endemic to the shale barrens of these areas. It is believed there may be fewer than 4000 individuals in existence. Of known populations, most have fewer than fifty individuals. It has imperiled status in Virginia and West Virginia. It has been documented in six Virginia counties (Bath, Alleghany, Augusta, Highland, Page, and Rockbridge) and three West Virginia counties (Pendelton, Greenbrier, and Hardy) (Artz 1948, Bartgis and Wieboldt 1986, Bartgis 1987, USFWS 1989, USFS 2001).

1.4 Small Whorled Pogonia (*Isotria medeoloides*)

1.4.1 Description

The small whorled pogonia is a member of the orchid family and is characterized by a single gray-green stem up to 30 centimeters tall and the whorl of five to six leaves at the top of the stem. The leaves are gray-green, oblong, and reach 4 to 8 centimeters in length. A single or pair of green-yellow flowers appears in May or June. Pollinators are unknown. Fruits are capsules which mature in the autumn.

Common whorled pogonia is a similar species and can be differentiated by its reddish stem, differently colored flowers and sepal characteristics. Small whorled pogonia also resembles young plants of Indian Cucumber-root (*Medeola virginiana*) and is distinguished from it because it has a hollow stout stem whereas Indian cucumber root has a solid more slender stem (USFWS 2008a).

1.4.2 Status

This plant was listed as endangered in 1982 because of a population size of only 466 individuals (USFWS 1982) and was subsequently reclassified as threatened in 1994 when 61 percent of the plant's viable sites were permanently protected (USFWS 1994). Most small whorled pogonia populations remain small and are not considered viable (USFWS 2008b). West Virginia lists it as critically imperiled and Virginia lists it as imperiled.

1.4.3 Ecology

The small whorled pogonia is found in mature or secondary hardwood or mixed stands comprised of beech (*Fagus* spp.), birch (*Betula* spp.), maple (*Acer* spp.), oak (*Quercus* spp.), hickory (*Carya* spp.), and pine (*Pinus strobus*) that have an open understory. However, it has been found that vegetative cover does not necessarily limit this species as it has been found in up to sixty percent cover (Mehrhoff 1980). In fact, one indicator community used to find this species is paper birch (*Betula papyrifera*) on steep slopes with dense fern understory. Witch hazel (*Hamamelis virginiana*) is almost always associated with it as a shrub species. Associated herbaceous cover includes Indian cucumber-root, club mosses (*Lycopodium* spp.), eastern teaberry (*Gaultheria procumbens*), trailing arbutus (*Epigaea repens*), striped prince's pine (*Chimaphila maculata*), partridgeberry (*Mitchella repens*), wintergreens (*Pyrola* spp.) and orchids such as moccasin flower (*Cypripedium acaule*), checkered rattlesnake plantain (*Goodyera tessellata*), downy rattlesnake plantain (*G. pubescens*), summer coralroot (*Corallorhiza maculata*), autumn coralroot (*C. odontorhiza*) and threebirds (*Triphora trianthophora*). Eight other orchids have been listed associated with a population in Ontario (Brownell 1981). In Virginia, green adder's-mouth orchid (*Malaxis unifolia*) and brown widelip orchid (*Liparis liliifolia*) have been listed as associated orchids (Grimes 1921). The species typically occurs in acidic soils (Mehrhoff 1989). Its range is from Ontario to Maine down the Eastern United States coast to Georgia and possible as far west as Missouri, although it is thought to be extirpated there.

1.5 Smooth Coneflower (*Echinacea laevigata*)

1.5.1 Description

Smooth coneflower grows in a single stem, becoming 35 to 110 centimeters tall. It has broadly lanceolate to elliptic or broadly ovate leaves, which are 10 to 50 centimeters long and 3 to 6.5 centimeters wide with up to 26 centimeter long petioles or stalks (Chafin 2007). They are contracted to subcordate to the petiole, and are usually glabrous and more-or-less glaucous. The flower disk is 1.5 to 3.5 centimeters wide, and the 3 to 8 centimeter ray flowers that are reddish purple to occasionally pale pink, which droop away from the disk. The pollen is bright yellow. It is very similar to purple coneflower (*E. purpurea*), except for the hairier leaves and the sometimes multiple and slightly taller (to 18 centimeters) stems of purple coneflower. Smooth coneflower also occurs in drier sites than purple coneflower. Another similar related species is pale purple coneflower (*Echinacea pallida*). However, it has a more westerly distribution and has smaller basal leaves (up to 33 cm long and 4 centimeters wide) and white pollen (Chafin 2007).

Federal Register Documents

57 FR 46340 46344; 08 October 1992: Final Listing, Endangered
56 FR 64229 64234; 09 December 1991: Proposed Listing, Endangered

1.5.2 Status

Smooth coneflower is listed as federally endangered. It occurs preferentially in open areas over amphibolite, dolomite, or limestone. In Virginia, smooth coneflower

occurs preferentially in dolomite woodlands or glades that are generally open and xeric. It has also been found in open woods, cedar barrens, roadsides, clearcuts, utility line ROWs, and dry limestone bluffs; it is believed that periodic disturbance,

common to these habitats, is needed to maintain high light conditions and low herbaceous competition required for the species to thrive (USFWS 1995).

1.5.3 Ecology

This species flowers from May through July (Gleason and Cronquist 1991, USFWS 1995). Coneflowers have open conspicuous flowering heads and are animal pollinated with the principle pollinators being bees, flies and butterflies (Krombein et al. 1979). Congener species have been found to be pollen limited probably because they occur in aggregations, are self-incompatible, and use generalist pollinators which may contribute to decline in populations (Kunin 1993, Wagenius 2004). In addition, agriculture contributes to these declines as populations often occur in areas that cannot be plowed or in which it is not economically feasible (Wagenius 2004). Plowing destroys the large single taproot. The fruits are achenes which are mainly gravity dispersed but may also be dispersed by birds or small mammals (Chafin 2007).

Associated plants include oak trees (*Quercus* spp.), shortleaf pine (*Pinus echinata*) and forbs such as rattlesnake master (*Eryngium yuccifolium*) and sunflowers (*Helianthus* spp.). It grows and germinates in most soils but must have full sun and open habitat. Young plants do not compete well and can be easily dominated by other species. Historically, it probably occurred in prairies and savannas maintained by fire or animal grazing (Chafin 2007).

1.6 Virginia spiraea (*Spiraea virginiana*)

1.6.1 Description

Virginia spiraea is a clonal, often profusely branched shrub that grows 1 to 3 meters in height. Its leaves are oblong-lanceolate or oblanceolate, 3 to 6 centimeters by 10 to 18 millimeters, acute and mucronate, entire or with a few low teeth near the tip, and somewhat glaucous beneath. The inflorescence is a short, broad, terminal corymb, 5 to 22 centimeters wide, with glabrous or villous branches. The flowers are white and 5 to 6 millimeters wide, with 0.8 to 1.1 millimeter sepals. The fruits are small follicles, at 1.5 millimeters long. This species flowers in late May to late July (Gleason and Cronquist 1991, USFWS 1992).

Virginia spiraea can be differentiated from other spiraeas mainly by its creamy white flower color and leaves which have an acute apex (Weakley 2015). It most closely resembles shinyleaf meadowsweet (*Spiraea betulifolia* var. *corymbosa*) (Ogle 1991). VS is distinguished from shinyleaf meadowsweet by its leaves which are more than twice as long as wide (shinyleaf meadowsweet's leaves are less than twice as long as wide) and cuneate base (Weakley 2015). The introduced Japanese spiraea (*Spiraea japonica*) occurs in similar habitats but has pink flowers and leaves with long-acuminate tips (Patrick et al. 1995).

Federal Register Documents

55 FR 24241 24247; 15 June 1990: Final Listing, Threatened
54 FR 30577 30581; 21 July 1989: Proposed Listing, Threatened

1.6.2 Status

Virginia spiraea was listed as federally threatened in 1990 and is listed as critically imperiled in Virginia and West Virginia. The reasons for this include: it is considered endemic to the southern Appalachians (although it occurs from Pennsylvania where it is presumed extirpated to Ohio south to Alabama and Georgia), sexual reproduction is rare, very little population expansion is reported, majority of populations are poor quality and have low viability, and it is restricted to very specific habitats with only a few clumps. In addition less than thirty genotypes are thought to occur range wide and few mature seed and no seedlings have been sighted. Virginia is known to have 5 known occurrences and West Virginia has six (of sixty one known). There are approximately 31 populations in seven states, down from 39 populations in eight states (USFWS 1992).

1.6.3 Ecology

It occurs along scoured banks of second and third order streams, or on meander scrolls, point bars, natural levees, and other braided features of lower reaches. Virginia spiraea is somewhat different in that its life history requirements are strongly tied to high gradient streams on larger creeks and rivers. In Virginia, Virginia spiraea plants are along flood scour zones in crevices of sandstone cobbles, boulders, and massive rock outcrop, and quartzite/feldspar boulders. It occurs in soils that are sandy, silty, or clay. The elevation range is 1000-2400 ft. In West Virginia, it occurs among large boulders, flatrock, and flood debris along scoured stream-sides. Soils are silt and sand and elevation for populations ranges from 1000-1800 ft.

Associated plants in Virginia include trees, shrubs and forbs such as hazel alder (*Alnus serrulata*), American hogpeanut (*Amphicarpaea bracteata*), sweet birch (*Betula lenta*), river birch (*B. nigra*), trumpet creeper (*Campsis radicans*), American hornbeam (*Carpinus caroliniana*), common buttonbush (*Cephalanthus* sp.), silky dogwood (*Cornus amomum*), leatherwood (*Dirca* sp.), scouringrush horsetail (*Equisetum hyemale*), ash (*Fraxinus* sp.), common winterberry (*Ilex verticillata*), cardinalflower (*Lobelia cardinalis*), royal fern (*Osmunda regalis*), ninebark (*Physocarpus* sp.), American sycamore (*Platanus occidentalis*), dotted smartweed (*Polygonum punctatum*), Japanese meadowsweet (*Spiraea japonica*), steeplebush (*S. tomentosa*), eastern poison ivy (*Toxicodendron radicans*), bluejacket (*Tradescantia ohiensis*), hemlock (*Tsuga* sp.), wingstem (*Verbesina alternifolia*), and yellowroot (*Xanthorhiza simplicissima*). In West Virginia, associated plants are red maple (*Acer rubrum*), hazel alder (*Alnus serrulata*), river birch (*Betula nigra*), common buttonbush (*Cephalanthus occidentalis*), silky dogwood (*Cornus amomum*), leatherwood (*Dirca* sp.), common winterberry (*Ilex verticillata*), royal fern (*Osmunda regalis*), creeper (*Parthenocissus* sp.), ninebark (*Physocarpus* sp.), American sycamore (*Platanus occidentalis*), Japanese meadowsweet (*Spiraea japonica*), eastern poison ivy (*Toxicodendron radicans*), bluejacket (*Tradescantia ohiensis*), hemlock (*Tsuga* sp.), and yellowroot (*Xanthorhiza simplicissima*).

Many sites are threatened by changes in hydrology by impoundment and by impact from recreational use, hydroelectric facilities, and run-off debris (available at: http://www.centerforplantconservation.org/collection/CPC_ViewProfile.asp?CPCNum=4076, accessed 17 September 2015). Small populations may be threatened by severe flooding that results in wash-outs of the streambank. Exotic species, such as multiflora rose (*Rosa multiflora*) and Japanese honeysuckle (*Lonicera japonica*), that compete with Virginia spiraea, roadside maintenance, damage by mammals, all-terrain vehicle use and upslope timbering are also threats. One site in West Virginia is near a powerline right-of-way and may be threatened by herbicide overspray.

1.7 Sweet shrub (*Calycanthus floridus*)

1.7.1 Description

Sweet shrub is an aromatic shrub with dark green, opposite, shiny, leathery, elliptic to ovate leaves that have 3 to 10 millimeter petioles. The leaves are 5 to 15 centimeters long and 3 to 6 centimeters at their widest point. It grows up to 3.5 meters tall (usually 2-3 meters tall), is deciduous, and occurs in rich woods along ravine slopes and along small woodland streams (Gleason and Cronquist 1991).

It is very similar to Brock's sweet shrub (*C. brockianus*) which is endemic to mesic hardwood forests in Georgia but it differs from this shrub because it has reddish brown tepals (yellowish green in Brock's sweet shrub) and larger seeds (10 millimeters versus 6 millimeters) which have straight rather than curled hairs (Weakley 2015).

1.7.2 Status

Sweet shrub is not federally protected but it is listed as imperiled in Virginia and vulnerable in West Virginia. It is a southeastern regional endemic and usually not abundant where found.

1.7.3 Ecology

It occurs in Pennsylvania, West Virginia, and Kentucky south to Georgia. It also occurs in northwest Florida, Alabama, and southwest Mississippi and west to Mississippi and Tennessee, but this natural distribution is unclear due to centuries of cultivation (Kartesz 1994, Weakley 2015). Two varieties have been recognized with one having pubescent twigs, petioles, and leaves while the other is nearly hairless; however they have broadly overlapping distributions and the distinguishing characteristics are variable and thus they are currently recognized as not taxonomically distinct. It produces fragrant, 4-7 centimeter wide, red to maroon flowers April to May and August to September (Weakley 2015). Based on the color, fragrance and morphology it is most likely pollinated by moths, flies and hummingbirds. It produces urn-shaped, hanging fruits (2-6 centimeters long by 1-3 centimeters wide) in late fall (Gleason and Cronquist 1991).

1.8 Pinnate-lobed coneflower (*Rudbeckia triloba* L. var. *beadlei*)

1.8.1 Description

Pinnate-lobed coneflower or Chauncey's coneflower is a short, thin-stemmed member of the aster family that prefers limestone and seepy dolomite cliffs, occurring in the crevices of the rock faces or in thin soils on the ledges. This species occurs in Kentucky, North Carolina, Tennessee, and Virginia. Scattered populations may also occur in Illinois (Mohlenbrock 2014). This includes Giles and Montgomery counties, Virginia (Kartesz 1994). This variety is currently only recognized in Virginia as its taxonomic status is uncertain (Weakley 2015). It is 5-15 decimeters tall, with thin sharply toothed to semi-entire leaves. The basal leaves have long petioles and are mostly ovate while the cauline leaves have short petioles and are trilobed or pinnatifid. It flowers from July to October. The flowers have a central purple to brown disc (8 to 15 millimeters wide) that produces the pollen and nectar and includes the reproductive parts. This disc is surrounded by six to thirteen yellow ray flowers that are 1 to 2 centimeters long, typical of the brown-eyed Susan's (Gleason and Cronquist 1991).

1.8.2 Status

Pinnate-lobed coneflower is not federally protected but is considered critically imperiled in Virginia.

1.8.3 Ecology

Principal pollinators include bees, flies, and butterflies based upon open flower morphology. In particular, bees in the genus *Melissodes*, bumble bees, sweat bees and several groups of solitary bees may be important pollinators (Horth et al. 2014). Pinnate-lobed coneflower is considered an ideal native plant for pollinators and the North American Pollinator Protection Campaign encourages selection of this plant to encourage native pollinators especially in the central Appalachians including Virginia and West Virginia (Pollinator Partnership and NAPPC Not dated). It is very similar to other subspecies in the *triloba* group, differing from pinnate-leaf coneflower (*Rudbeckia triloba* var. *pinnatifida*) in distribution and having longer phyllaries and from common three lobed coneflower (*R. triloba* var. *triloba*) and Blue ridge three lobed coneflower (*R. triloba* var. *rupestris*) in the more lobed leaves (3-7 lobes on at least some part of the plant) and habitat preference (Weakley 2015). Plants strongly associated with pinnate-lobed coneflower include American sycamore, elderberry (*Sambucus canadensis*), wingstem, white vervain (*Verbena urticifolia*) and great blue lobelia (*Lobelia siphilitica*) (Homoya 1993).

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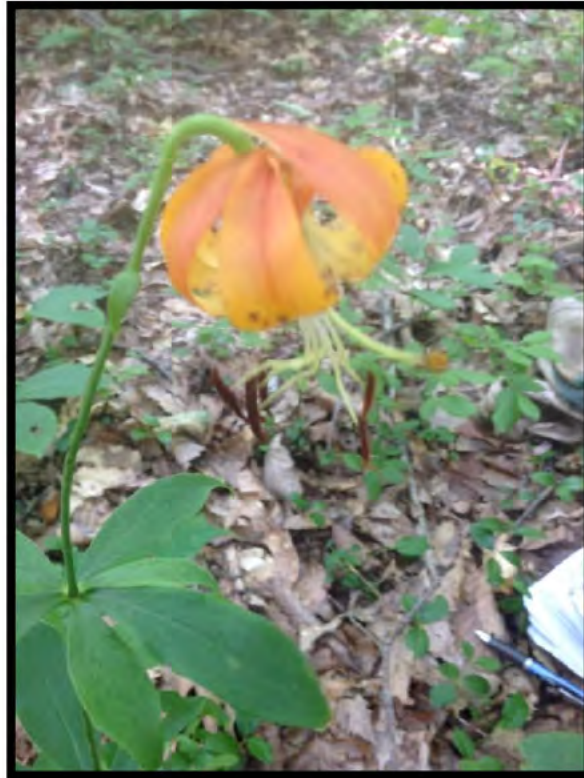
APPENDIX E
REPRESENTATIVE PROJECT PHOTOGRAPHS



VA-Photo 1



VA-Photo 3



VA-Photo 19



VA-Photo 9-3



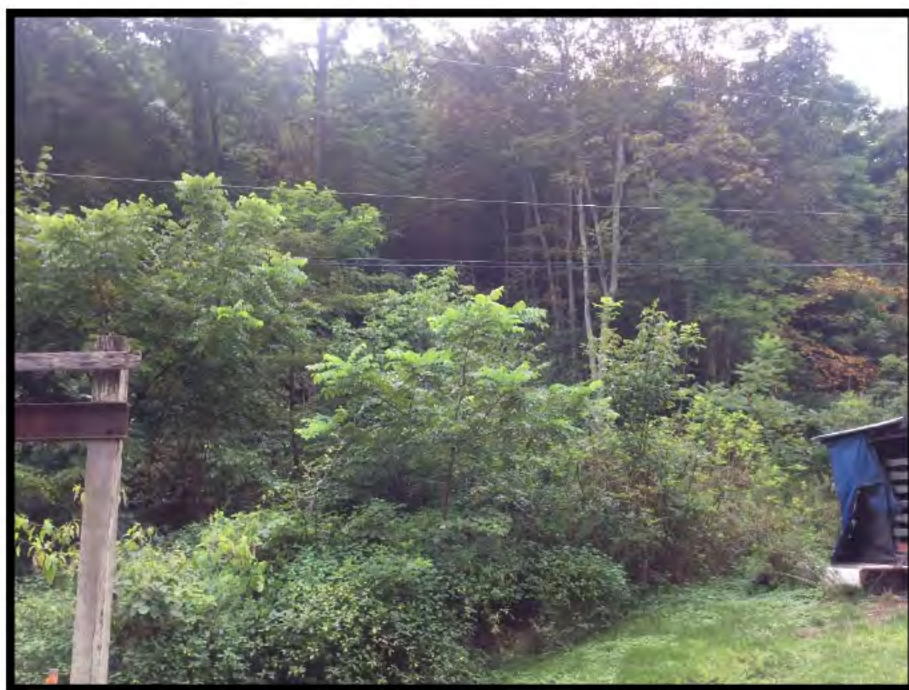
VA-Photo 94-2



VA-Photo 95-2



VA-Photo 191



VA-Photo 193



VA-Photo 196



VA-Photo 95-1



VA-Photo 130



VA-Photo 178