

FINAL RARE PLANT SURVEY REPORT

For

**Proposed UniStar Nuclear Project Area
Calvert Cliffs Nuclear Power Plant Site
Calvert County, Maryland**



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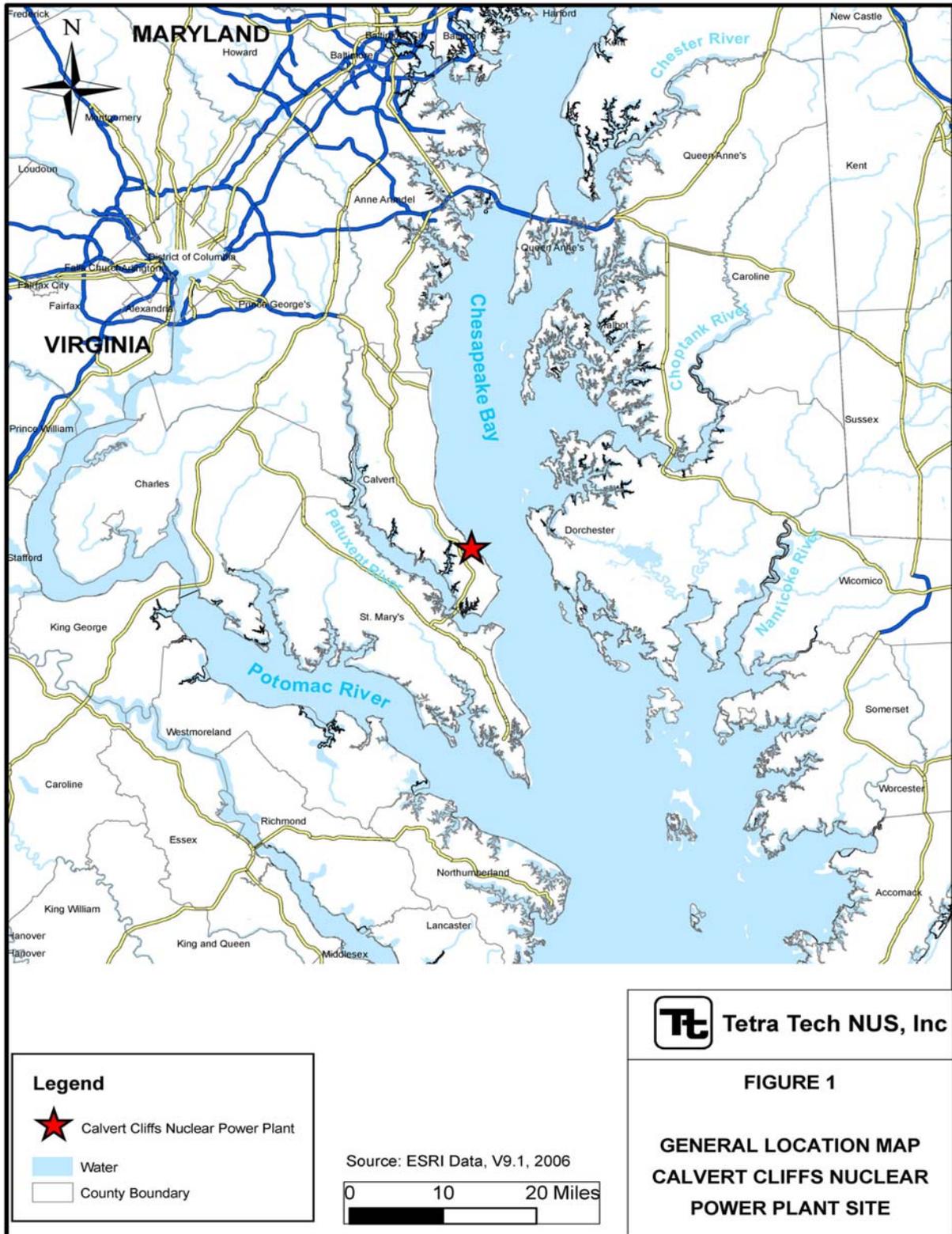
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INTRODUCTION

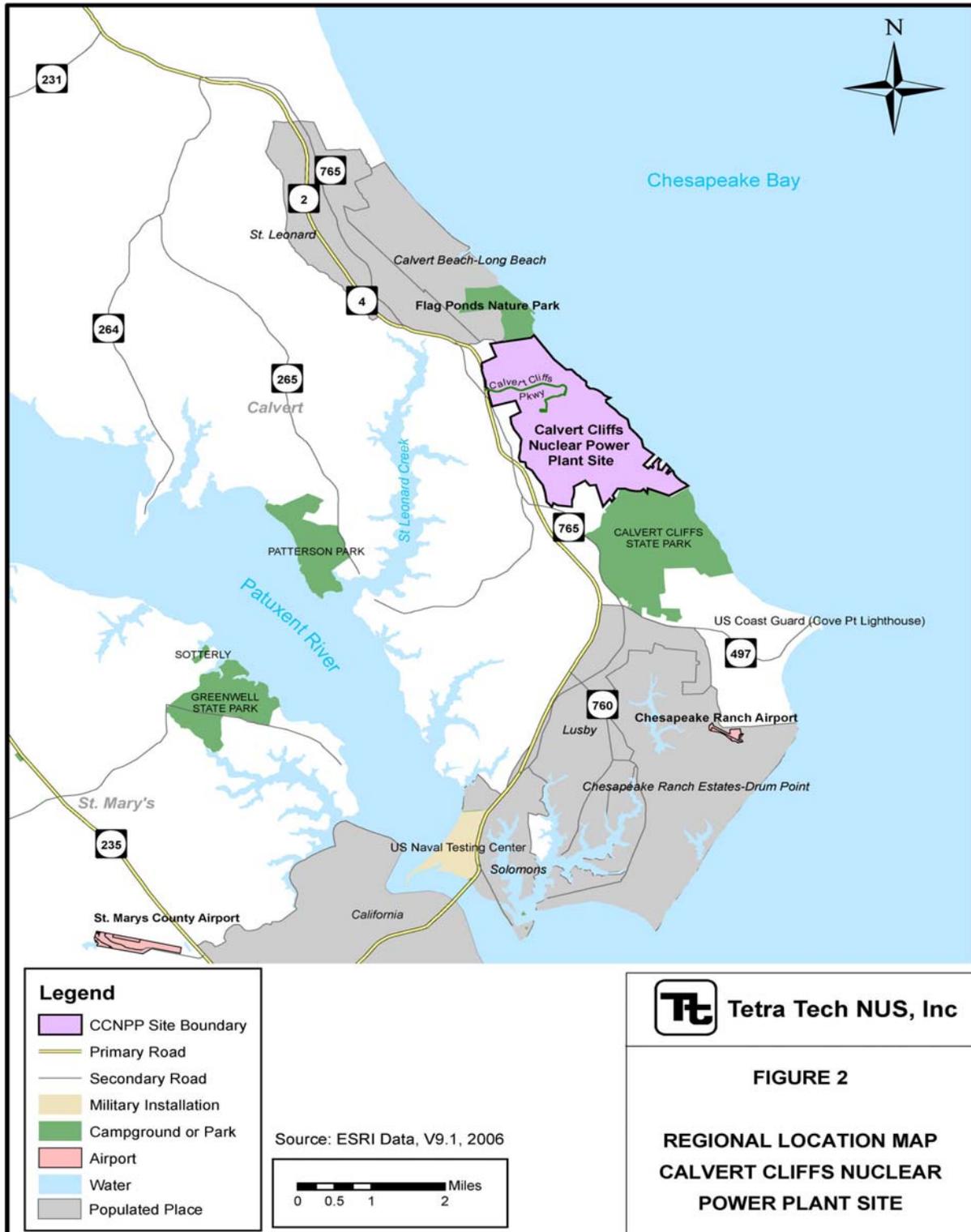
This Rare Plant Report addresses a tract of land on the Calvert Cliffs Nuclear Power Plant (CCNPP) Site in Calvert County, Maryland, where UniStar Nuclear Development, LLC (UniStar) is considering construction of a new nuclear power plant unit. Development of the new plant would require approval by the U.S. Nuclear Regulatory Commission (NRC) of a combined (construction and operating) license application (COLA), including an environmental report (ER), which documents the safety and environmental impact analyses for the facility. Plant development would also require approval by the Maryland Public Service Commission (PSC) of an application for a Certificate of Public Convenience and Necessity (CPCN), which similarly documents environmental impacts. This report provides background data on rare plants intended to support these environmental impact assessments.

The CCNPP Site consists of 2,057 acres (832 hectares) on the western shore of the Chesapeake Bay in Calvert County (Figures 1 and 2). The two existing CCNPP units (Units 1 and 2) are located in the east-central part of the CCNPP Site. The remainder of the CCNPP Site not associated with the existing power plant facilities is predominantly forest with some cleared land. The Chesapeake Bay shoreline (eastern perimeter) consists mostly of steep cliffs with little beach area. South of the existing units is a former recreational area known as Camp Conoy. Camp Conoy is accessed using a single-lane paved roadway (Camp Conoy Road) that runs north from the southern perimeter of the CCNPP Site. Camp Conoy facilities include various cabins, outbuildings, swimming pool, softball field, tennis courts, and a fishing pond formerly used by Constellation employees and their families.

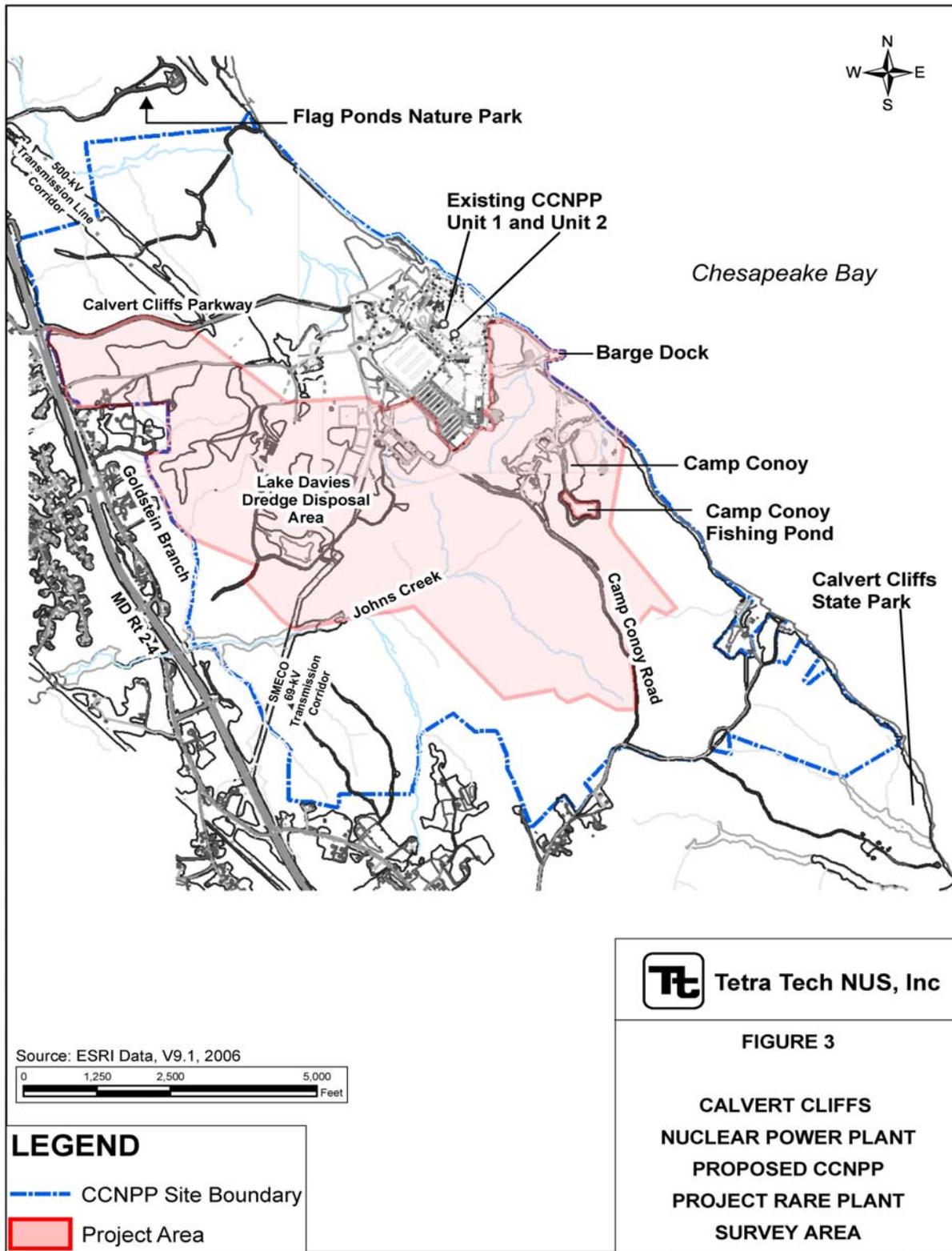
Under current plans, the new generating unit and associated construction and operation-phase facilities would be located within an area of the CCNPP Site south and west of the existing CCNPP Units 1 and 2, termed for convenience in this report the "Project Area" (Figure 3). Elevations in the Project Area range from sea level to nearly 150 feet (46 meters) (USGS 1987). Topography is rolling, dissected by a dendritic pattern of stream valleys. Slopes on the sides of the stream valleys frequently exceed 15 to 25 percent. Slopes elsewhere are gentle. Most lands east of Camp Conoy Road drain east, directly into the Chesapeake Bay. Most lands west of Camp Conoy Road drain into a system of headwaters that coalesce to form the west-flowing Johns Creek. John's Creek flows roughly west and exits the western perimeter of the Project Area and then the western perimeter of the CCNPP Site. It then flows west to St. Leonard Creek, a tidal tributary of the Patuxent River. Lands in the northern part of the Project Area drain to Goldstein Branch, a tributary of Johns Creek (USGS, 1987). Tidal water on the CCNPP Site is limited to the Chesapeake Bay shoreline; all streams in the Project Area, and elsewhere on the CCNPP Site, are non-tidal (MDNR, 2005 and onsite observations in 2006).



k:\gproject\calvertcliffs\maps\Figure 1 Gen Loc Map A.mxd



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GENERAL VEGETATION DESCRIPTION

An accompanying flora survey report describes and maps the types of vegetation (plant community types) on the CCNPP Site (Tetra Tech NUS, 2007a). The following information is summarized from that report. According to the report, the vegetation can be broadly differentiated into the following plant community types (See Tetra Tech NUS, 2007a for a map of the plant community types):

Lawns and Developed Areas. Lawns and developed areas occur in the east-central part of the CCNPP Site (around the two existing reactor units) and in Camp Conoy. Camp Conoy includes several athletic fields and other lawn areas surrounding recreational facilities. Other than scattered trees and shrubs planted as ornamental landscaping, the lawns consist only of a groundcover stratum. Most of the lawns consist of cool season grasses (grasses that typically seed during spring and fall) such as tall fescue (*Festuca arundinacea*), bluegrass (*Poa pratensis*), large crabgrass (*Digitaria sanguinalis*), and Bermuda grass (*Cynodon dactylon*). Common broadleaf weeds typical of lawns are also present, such as white clover (*Trifolium repens*), broadleaf plantain (*Plantago major*), dandelion (*Taraxicum officinale*), and yellow hawkweed (*Hieracium pretense*).

Old Field. Two main areas of old field vegetation occur on the CCNPP Site. The largest is located on the dredge spoils in the central part of the site. The dredge spoils are covered by a dense stand of the invasive exotic grass phragmites (*Phragmites australis*). Phragmites is a perennial grass that can grow to more than 10 feet (3 meters) tall and typically infests brackish and fresh tidal and non-tidal marshes. It does not typically occur in well-drained old fields but is common on well-drained dredge spoil piles in coastal areas. Its presence on the dredge spoil piles is likely a result of propagules (seeds and rhizome fragments) contained in the dredge spoils. Other plants typical of old fields, such as common blackberry (*Rubus allegheniensis*) and tall fescue (*Festuca arundinacea*), are also present but are not as prevalent as phragmites.

The other old field vegetation is located in scattered forest clearings around the perimeter of the dredge spoils and in other developed areas, on previously farmed land, on transmission corridors, and along roadsides. Many such areas were disturbed during the initial construction of the existing reactors and various support facilities, and vegetation in many of these areas is maintained (e.g., by occasional mowing). Vegetation in these areas is dominated by tall fescue, sericea lespendeza (*Lespedeza cuneata*), common blackberry, Canada goldenrod (*Solidago canadensis*), and asters (*Aster* sp.).

Mixed Deciduous Forest. Most forested uplands on the CCNPP Site support deciduous forest dominated by tulip poplar (*Liriodendron tulifera*); chestnut oak (*Quercus prinus*); white oak (*Quercus alba*); red oaks such as black oak (*Quercus velutina*), southern red oak (*Quercus falcata*), and scarlet oak

(*Quercus coccinia*); American beech (*Fagus grandifolia*); and Virginia pine (*Pinus virginiana*). Other canopy trees include hickories such as pignut hickory (*Carya glabra*) and bitternut hickory (*Carya cordiformis*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), swamp chestnut oak (*Quercus michauxii*), and black gum (*Nyssa sylvatica*). The forest understory consists of dense patches of mountain laurel (*Kalmia latifolia*), pawpaw (*Asimina trilobata*), and American holly (*Ilex opaca*), with scattered but frequent saplings of canopy species. Ground cover is sparse except where recently fallen trees have left gaps in the tree canopy. Scattered patches of the following species are present in the groundcover: partridgeberry (*Mitchella repens*), Christmas fern (*Polystichum acrostichoides*), common violet (*Viola papilionacea*), and large whorled pogonia (*Isotria verticillata*).

Mixed Deciduous Regeneration Forest. Several areas of relatively level highlands that formerly supported mixed deciduous forest (described above) have been subjected to timber harvest activities within the past 10-30 years. These areas presently support dense thickets of deciduous trees and Virginia pines. The deciduous trees consist of tulip poplar, oaks, sweet gum, and red maple. Virginia pine is generally more frequent in the regenerating forest than in adjoining areas of mature mixed deciduous forest. The regenerating forest lacks a distinct understory, but does contain scattered mountain laurel and American holly. Little groundcover is present other than along fire roads or in other small openings.

Well-Drained Bottomland Deciduous Forest. Areas of well-drained soils in lowlands adjoining Johns Creek, Goldstein Branch, their headwaters, and other streams support bottomland deciduous forest dominated by tulip poplar, American beech, sweet gum, black gum, and red maple. This vegetation represents an ecotone (transition) between the mixed deciduous forest on the adjoining upland slopes and the bottomland hardwood forest in wetter areas closer to the stream channel. The understory is generally sparse, although some mountain laurel and American holly are present. While groundcover is sparse in many areas of well-drained bottomland deciduous forest, expansive dense patches of New York Fern (*Thelypteris noveboracensis*) occur, even in areas of dense canopy cover.

Poorly Drained Bottomland Deciduous Forest. Areas of poorly-drained, seasonally saturated soils in lowlands adjoining Johns Creek, Goldstein Branch, their headwaters, and other streams support bottomland hardwood forest dominated by red maple, sweet gum, and black gum. The shrub layer is generally sparse. The groundcover is dense throughout, dominated by ferns such as New York Fern, sensitive fern (*Onoclea sensibilis*), and royal fern (*Osmunda regalis*); sedges and rushes such as tussock sedge (*Carex stricta*), eastern bur-reed (*Sporangium americanum*), and soft rush (*Juncus effusus*); and forbs such as lizard tail (*Saururus cernuus*) and skunk cabbage (*Symplocarpus foetida*).

Herbaceous Marsh Vegetation. Herbaceous marsh vegetation occurs throughout much of the broad bottomland areas adjoining Johns Creek as well as in localized gaps in the forest cover in the narrower bottomlands adjoining the headwaters of Johns Creek, Goldstein Branch, and other streams. This vegetation is dominated in many places by phragmites. Other areas of herbaceous marsh vegetation are dominated by sedges, rushes, and bulrushes; lizard tail, which forms localized dense patches; and various other wetland forbs such as dotted smartweed (*Polygonum punctatum*), Pennsylvania smartweed (*Polygonum pennsylvanicum*), jewelweed (*Impatiens capensis*), and halberd-leaved tearthumb (*Polygonum arifolium*). These areas include a marshy fringe surrounding the shore of Camp Conoy Fishing Pond, two smaller impoundments on the stream carrying the outflow from Camp Conoy Fishing Pond to the Chesapeake Bay, a constructed wetland (Wetland Mitigation Area) in an old field area west of the existing facilities, and a marshy fringe surrounding a stormwater detention pond immediately west of the CCNPP Barge Dock on the Chesapeake Bay.

Successional Forest Vegetation. Scattered areas on the CCNPP Site support forest cover dominated by fast-growing hardwoods such as black locust (*Robinia pseudoacacia*), black cherry (*Prunus serotina*), sweet gum, big-tooth aspen (*Populus grandidentata*) and pines such as Virginia pine and loblolly pine (*Pinus taeda*). All are native, fast-growing trees that rapidly form patches of forest cover in old fields, waste areas, roadsides, and fence rows in eastern and central Maryland (Brown and Brown, 1972). Other native tree species with scattered seedlings and saplings in old field vegetation include black cherry (*Prunus serotina*), eastern redcedar (*Juniperus virginiana*), and sweet gum (*Liquidambar styraciflua*). Non-native tree species present as scattered seedlings and saplings in successional forest vegetation on the Project Site include tree of heaven (*Ailanthus altissima*) and paulownia (*Paulownia tomentosa*). Although both tree species are listed as invasive exotic plants by the State of Maryland (MDNR, 1997), neither has formed dense patches on the Project Site.

RARE PLANT SURVEY METHODOLOGY

In June 2006, UniStar requested an Environmental Review from the Maryland Department of Natural Resources (MDNR) Natural Heritage Program (NHP) for federally listed and state-listed rare, threatened, and endangered species and critical habitats on the CCNPP Site. The Environmental Review letter response, dated July 31, 2006 (MDNR 2006), noted only one plant, the spurred butterfly-pea (*Centrosema virginianum*), for which a record exists for an occurrence in an open area along a fire road in the western part of the CCNPP site, south of Johns Creek. Although the NHP did not provide a map of the recorded location, the verbal description of the location in the letter indicates that it is south and west of Johns Creek, in the southwestern part of the CCNPP Site and southwest of the Project Area.

Because the state had not previously conducted field surveys for rare plants on the CCNPP Site, UniStar directed Tetra Tech to inspect the Project Area for the possible presence of each threatened, endangered, or rare plant species recognized by the NHP for Calvert County. That list, which was last updated by the NHP in May 2004 (MDNR, 2004), is provided in Table 1. Table 1 provides information from *Gray's Manual of Botany* (Fernald, 1970) on the favored habitats and normal flowering seasons for each species on the state list for Calvert County.

J. Peyton Doub, PWS, CEP, of Tetra Tech performed three field visits to the Project Area specifically to look for the possible presence of the Table 1 plant species in the Project Area. The Project Area, which corresponds to the area where a wetland delineation was conducted to support the ER (Tetra Tech NUS, 2007b), was broadly defined early in the project planning process to include all land areas on the CCNPP Site that could potentially be subject to ground disturbance by construction of the proposed reactor units and permanent or temporary appurtenant facilities once the design was finalized. The first visit was on July 31 and August 1, 2006 and focused on looking for plants shown in Table 1 as easiest to identify in summer (summer-flowering herbaceous plants, based on information from Fernald, 1970). The second visit was on October 12 and 13, 2006 and focused on looking for plants shown in Table 1 as easiest to identify in fall (fall-flowering herbaceous plants, based on information from Fernald, 1970). The third visit was on April 18, 2007 and focused on looking for plants shown in Table 1 as easiest to identify in spring (spring-flowering herbaceous plants, based on information from Fernald, 1970). None of the plants in Table 1 are easiest to identify in winter.

The inspection process consisted of walking representative meander routes through habitats where the plants included in Table 1 could potentially occur. Descriptive information on the subject plant species from Fernald, 1970 was used as the basis for confirming observations of possible occurrences of species in Table 1. Table 2 describes each area walked, and Figure 4 shows the approximate locations. Because most of the plants listed in Table 1 are most likely to occur in wetland, bottomland, or rich forest habitats, the inspection routes focused on lands in and close to wetlands. However, representative areas of appropriate upland habitats were also walked to inspect for those plants in Table 1 that favor uplands.

Mr. Doub was also onsite on multiple occasions at irregular intervals between early May 2006 and mid-October 2006 to conduct other natural resource investigations, including a wetland delineation, flora survey, and fauna survey. Plants on Table 1 that were incidentally observed were noted. The flora survey report (Tetra Tech NUS, 2007a) includes a comprehensive list of all plant species observed on the CCNPP Site. The flora survey included inspection of vegetation for plants with floral characteristics as described in Fernald, 1970 for the species in Table 1.

Table 1
List of Rare, Threatened, or Endangered Plant Species for Calvert County, Maryland
Maryland Natural Heritage Program, May 2004

Scientific Name	Common Name	Form	Federal Status ^a	State Status ^a	Typical Habitat (According to Fernald, 1970)	Areas of Most Probable Occurrence on Project Area ^b (Based on Fernald, 1970)	Best ID Season
<i>Aeschynomene virginica</i>	Sensitive Joint-Vetch	Forb	T	E	Fresh to brackish tidal shores	None	Fall
<i>Agalinis obtusifolia</i>	Blunt-Leaved Gerardia	Forb	-	E	Pinelands, thickets, and openings	None	Summer
<i>Agalinis setacea</i>	Thread-Leaved Gerardia	Forb	-	E	Dry sandy woods and openings	None	Summer
<i>Ammannia latifolia</i>	Keohne's Ammannia	Forb	-	R	Swamps and tidal marshes	HMV and PD BDF along streams	Summer
<i>Angelica atropurpurea</i>	Great Angelica	Forb	-	X	Rich thickets, bottomlands, and swamps	WD and PD BDF along streams	Summer
<i>Antennaria solitaria</i>	Single-Headed Pussytoes	Forb	-	T	Rich woods and clearings	MDF and WD BDF	Spring
<i>Apocynum sibiricum</i>	Clasping-Leaved Dogbane	Forb	-	X	Rocky or gravelly soils, often along streams	None	Summer
<i>Aristida curtissii</i>	Curtis's Three-Awn	Grass	-	R	Dry sterile soil	None	Fall
<i>Aristida lanosa</i>	Wooly Three-Awn	Grass	-	E	Dry sterile soil	None	Fall
<i>Aster concolor</i>	Silvery Aster	Forb	-	E	Dry sandy open woods and barrens	None	Fall
<i>Aster radula</i>	Rough-Leaved Aster	Forb	-	E	Low woods, swamps, and bogs	WD and PD BDF along streams	Fall
<i>Azolla caroliniana</i>	Mosquito Fern	Fern	-	R	Quiet waters	Camp Canoy Fishing Pond and down-gradient ponds	Growing Season
<i>Berberis canadensis</i>	American Barberry	Shrub	-	X	Dry woodlands and bluffs	Primarily along cliffs at eastern edge of Project Site	Anytime
<i>Bidens mitis</i>	Small-Fruited Beggar-Ticks	Forb	-	E	Brackish to fresh swamps	None	Growing season
<i>Carex hyalinolepis</i>	Shoreline Sedge	Sedge	-	R	Calcareous or brackish swamps, swales, or shores	None	Summer

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<i>Carex lacustris</i>	Lake-Bank Sedge	Sedge	-	T	Calcareous or neutral swamps and shallows	None	Summer
<i>Carex projecta</i>	Necklace Sedge	Sedge	-	R	Swales, thickets, and damp woods	WD and PD BDF	Summer
<i>Centrosema virginianum</i>	Spurred Butterfly-Pea	Forb	-	R	Sandy woods and fields	MDF	Summer
<i>Chelone oblique</i>	Red Turtlehead	Forb	-	T	Cypress swamps and wet woods	No cypress on Project Site. PD BDF may be suitable.	Fall
<i>Chenopodium standleyanum</i>	Standley's Goosefoot	Forb	-	E	Waste places, cultivated land, and roadsides	Phragmites-free old field areas and roadsides	Summer
<i>Desmodium lineatum</i>	Linear-Leaved Tick-Trefoil	Forb	-	E	Sandy pinelands	None	Fall
<i>Desmodium ochroleucum</i>	Cream-Flowered Tick-Trefoil	Forb	-	E	Sandy to loamy woods	MDF	Fall
<i>Desmodium pauciflorum</i>	Few-Flowered Tick-Trefoil	Forb	-	E	Rich woods and wooded banks	WD and PD BDF	Summer
<i>Desmodium rigidum</i>	Rigid Tick-Trefoil	Forb	-	E	Dry sandy woods	None	Fall
<i>Digitaria villosa</i>	Shaggy Crabgrass	Grass	-	X	Sandy soil	None	Fall
<i>Diplazium pycnocarpum</i>	Glade Fern	Fern	-	T	Rich, calcareous, wooded slopes, ravines, and bottoms	MDF on slopes and WD and PD BDF	Fall
<i>Eleocharus rostellata</i>	Beaked Spikerush	Rush	-	R	Saline, brackish, or limy marshes	None	Fall
<i>Elephantopus tomentosus</i>	Tobaccoweed	Forb	-	E	Woodlands	MDF and WD BDF	Fall
<i>Fimbristylus puberula</i>	Hairy Fimbristylis	Rush	-	R	Brackish or saline sands, dune hollows, and flats	None	Fall
<i>Fuirina pumila</i>	Smooth Fuirina	Sedge	-	R	Bogs and wet peaty or sandy shores	PD BDF and HMV	Fall

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<i>Gymnopogon brevifolius</i>	Broad-Leaved Beardgrass	Grass	-	E	Dry sandy or rocky openings and thin woods	None	Fall
<i>Lemna trisulca</i>	Star Duckweed	Aquatic	-	E	Ponds and springy places	Camp Conoy Fishing Pond and down-gradient ponds, beaver-flooded areas along Johns Creek (HMV)	Growing season
<i>Leptochloa fascicularis</i>	Long-Awned Diplachne	Grass	-	R	Sandy soils	None	Fall
<i>Limnobium spongia</i>	American Frogs-Bit	Forb	-	E	Salt marshes	None	Fall
<i>Lygodium palmatum</i>	Climbing Fern	Fern	-	T	Moist acid soil of thickets, marshes, and open woods	HMV and PD BDF	Fall
<i>Matelea carolinensis</i>	Anglepod	Forb	-	E	Rich thickets	MDF regeneration areas	Summer
<i>Melica mutica</i>	Narrow Melicgrass	Grass	-	T	Dry open woods and thickets	None	Summer
<i>Melothria pendula</i>	Creeping Cucumber	Forb	-	E	Rich or damp thickets	MDF and WD BDF	Summer
<i>Monotropis odorata</i>	Sweet Pinesap	Forb	-	E	Sandy, chiefly pine, woods	None	Spring
<i>Myosotis macrosperma</i>	Large-Seeded Forget-Me-Not	Forb	-	R	Loamy calcareous woods and bottomlands	None	Spring
<i>Myrica heterophylla</i>	Evergreen Bayberry	Shrub	-	E	Dry and moist thickets and woods	MDF and WD BDF	Anytime
<i>Orthilia secunda</i>	One-Sided Pyrola	Forb	-	X	Dry or moist woods	MDF and WD BDF	Summer
<i>Parnassia asarifolia</i>	Kidneyleaf Grass-of-Parnassus	Forb	-	E	Bogs, wet woods, and rocky banks	PD BDF and HMV along streams	Fall
<i>Platanthera flava</i>	Pale Green Orchid	Forb	-	R	Swamps, bottomlands, swales, and wet shores	WD and PD BDF and HMV along streams	Summer
<i>Pluchea camphorata</i>	Marsh Fleabane	Forb	-	E	Fresh to brackish marshes, shores, and ditches	None	Fall
<i>Polygonum densiflorum</i>	Dense-Flowered Knotweed	Forb	-	E	Wet swamps, thickets, and margins of shallow pools	PD BDF and HMV along streams	Fall

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<i>Polygonum setaceum</i>	Bristly Smartweed	Forb	-	R	Low woods, swamps, shores, and wet clearings	WD and PD BDF and H MV along streams	Fall
<i>Potamogeton foliosus</i>	Leafy Pondweed	Aquatic	-	E	Fresh, often calcareous, or brackish waters	None	Fall
<i>Potamogeton perfoliatus</i>	Clasping-Leaved Pondweed	Aquatic	-	R	Calcareous to brackish waters	None	Fall
<i>Potamogeton spirillus</i>	Spiral Pondweed	Aquatic	-	R	Quiet waters	Camp Canoy Fishing Pond and smaller downstream impoundments	Fall
<i>Quercus shumardii</i>	Shumard's Oak	Tree	-	T	Rich woods, bottoms, or calcareous slopes	WD BDF	Anytime
<i>Rhynchosia tomentosa</i>	Hairy Snoutbean	Forb	-	T	Dry sandy woods and clearings	MDF	Summer
<i>Sagittaria engelmanniana</i>	Englemann's Arrowhead	Forb	-	T	Wet sand and peat	H MV along streams	Fall
<i>Sagittaria longirostra</i>	Long-Beaked Arrowhead	Forb	-	R	By springs, rills, and ponds	PD BDF and H MV along streams, especially at upper ends	Fall
<i>Scutellaria galericulata</i>	Common Skullcap	Forb	-	R	Gravelly, sandy, or rocky shores, meadows, swamps	PD BDF and H MV along streams	Summer
<i>Sesuvium maritimum</i>	Sea-Purselane	Forb	-	E	Damp coastal sands	None	Fall
<i>Solidago speciosa</i>	Showy Goldenrod	Forb	-	T	Dry to moist thickets, open woods, and prairies	MDF, OFV	Fall
<i>Sporobolus clandestinus</i>	Rough Rushgrass	Grass	-	T	Dry sandy or rocky soil	None	Fall
<i>Sporobolus neglectus</i>	Small Rushgrass	Grass	-	X	Dry, sterile, often calcareous, soil	None	Fall
<i>Zizaniopsis milicea</i>	Southern Wildrice	Grass	-	E	Swamps and margins of streams, often tidal	None	Spring

Table 1
List of Rare, Threatened, or Endangered Plant Species for Calvert County, Maryland
Maryland Natural Heritage Program, May 2004

- a R: Rare
T: Threatened
E: Endangered
X: Extirpated

- b HMV: Herbaceous Marsh Vegetation
MDF: Mixed Deciduous Forest (including Mixed Deciduous Regeneration Forest)
OFV: Old Field Vegetation
PD BDF: Poorly Drained Bottomland Deciduous Forest
WD BDF: Well-Drained Bottomland Deciduous Forest

**Table 2
Representative Areas Inspected for Rare Plants in
UniStar Project Area, Calvert County, Maryland**

Area (Figure 3)	Description	Summer (7/31-8/1) 2006	Fall (10/12-13) 2006	Spring (4/18) 2007
1	Marshy fringe and old field vegetation surrounding Camp Conoy Fishing Pond (Herbaceous Marsh Vegetation and Old Field Vegetation)	X	X	X
2	Stream, wetlands, and two small man-made impoundments flowing northeast from Camp Conoy Fishing Pond to the Chesapeake Bay (Herbaceous Marsh Vegetation, Poorly Drained Bottomland Deciduous Forest, and Mixed Deciduous Forest)	X	X	X
3	Stream, wetlands, and forested uplands immediately northwest of Camp Conoy (Poorly Drained Bottomland Deciduous Forest and Mixed Deciduous Forest)	X	X	X
4	Stream and adjacent wetlands originating near southwest corner of Camp Conoy and flowing west to Johns Creek (Poorly Drained Bottomland Deciduous Forest and Mixed Deciduous Forest)	X	X	X
5	Seepages, streams, and forested uplands on slopes west of Lake Conoy (Herbaceous Marsh Vegetation, Poorly Drained Bottomland Deciduous Forest, and Mixed Deciduous Forest)	X	X	
6	Seepage and adjoining uplands southwest of upper (eastern) reach of Johns Creek (Herbaceous Marsh Vegetation, Poorly Drained Bottomland Deciduous Forest, Well-Drained Bottomland Deciduous Forest, and Mixed Deciduous Forest)	X		
7	Wetlands down-gradient (southwest) of largest pond in Lake Davies Area (Herbaceous Marsh Vegetation and Poorly Drained Bottomland Deciduous Forest)		X	
8	Bottomlands along upper (eastern) reach of Johns Creek; also forested uplands on lower part of adjacent slopes (Herbaceous Marsh Vegetation, Poorly Drained Bottomland Deciduous Forest, Well-Drained Bottomland Deciduous Forest, and Mixed Deciduous Forest)	X		X
9	Seepages and forested uplands north of Johns Creek in south-central part of Project Site (Mixed Deciduous Forest and Poorly Drained Bottomland Deciduous Forest)		X	
10	Bottomlands along uppermost (northernmost) headwaters to Goldstein Branch near northwestern corner of Project Site; also forested uplands on lower part of adjacent slopes (Poorly Drained Bottomland Deciduous Forest and Mixed Deciduous Forest)	X		
11	Bottomlands and forested uplands on slope east of central reach of Goldstein Branch (Poorly Drained Bottomland Deciduous Forest and Mixed Deciduous Forest)		X	



Figure 4
Approximate Locations:
Search Areas Walked to Inspect for Rare Plants
Yellow Dotted Line is CCNPP Site Boundary
Red Dotted Line is Project Area Boundary
No Potentially Suitable Rare Plant Habitat in Northwest Corner of Project Area
(Not Shown)

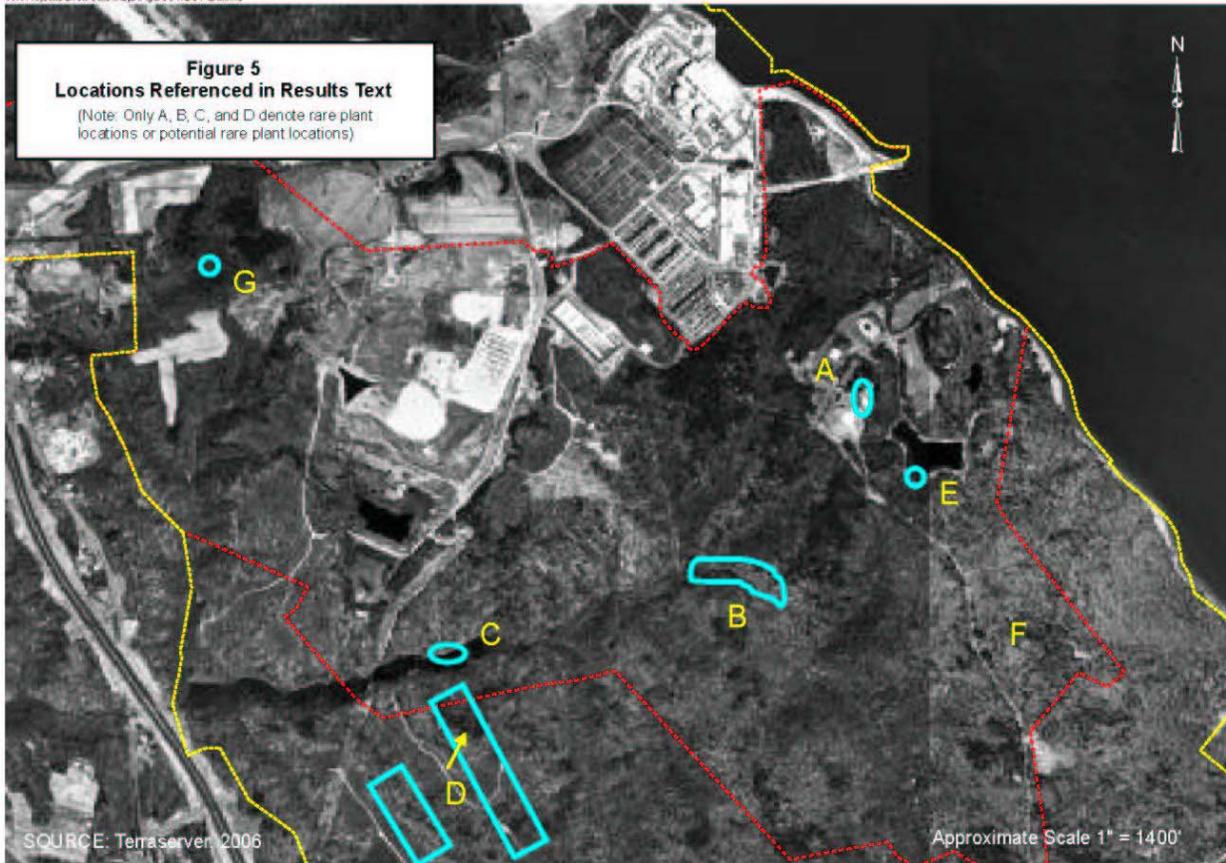
RESULTS

Only one plant on the list of Federal or state rare, threatened, or endangered plants maintained by the Maryland Natural Heritage Program for Calvert County (Table 1) was definitively observed within areas subject to construction based on plans as of April 2007. The plant is showy goldenrod (*Solidago speciosa*), which is designated as state threatened. Several large patches of showy goldenrod were observed in lawn, old field, and mixed deciduous forest in and around the edge of Camp Conoy (Cover Photo, Area A on Figure 5).

Two other plant species listed in Table 1 were observed or potentially observed in other areas within the Project Area. One is Shumard's oak (*Quercus shumardii*), a state threatened species. Several specimens were observed in well-drained bottomland deciduous forest in the floodplain adjoining the southern of the two main headwaters to Johns Creek (Area B on Figure 5). Photos 1 and 2 depict a leaf and acorn from Shumard's oaks in Area B. No Shumard's oaks were observed more than 50 feet (15 meters) landward (roughly east) of the stream channel and adjoining wetlands (more than 50 feet [15 meters] east of the delineated wetland boundary segment marked using flag numbers WET I-25 to WET I-65).

The other species is spurred butterfly pea (*Centrosema virginianum*), a state rare species. A plant of similar morphology was observed on the northern edge of an emergent wetland (herbaceous marsh vegetation) adjoining Johns Creek in the central part of the CCNPP Site (Area C on Figure 5) in August 2006. The plant was in flower and displayed other characteristics expected for spurred butterfly pea, but the observation is noted as "possible" because the species is more typical of dry, open forest habitats than wetland habitats (Fernald, 1970). The MDNR NHP (MDNR 2006) stated that records of spurred butterfly pea occurred in an open area along a fire road south of Johns Creek in the southwestern part of the CCNPP Site (Area D on Figure 5). The ideal open upland forest habitat for this species does not occur on the Project Area. The upland forest plant communities consist of closed canopy cover with dense understory wherever the canopy is broken. Area C on Figure 5 is remote from areas currently anticipated to be disturbed by construction or operation of the proposed facilities. Therefore, no further effort was undertaken to confirm the status of this observation.

K:\0\Project\Calvert Cliffs\maps\Figure 5 Rare Plant.mxd



Several large patches of Carolina elephant's foot (*Elephantopus carolinianus*) were observed in multiple forested areas in the Project Area, including an area directly west of Lake Conoy (Area E on Figure 5), an area east of Camp Conoy Road (Area F on Figure 5), and on a slope south of a barn in the northwestern part of the CCNPP Site (Area G on Figure 5). This species has no federal or state protected status, but is highlighted in this report because it is morphologically similar to tobacco weed (*Elephantopus tomentosus*), which is listed as endangered by the State of Maryland (Table 1). However, the *Elephantopus* plants in the Project Area displayed cauline leaves (leaves growing from a stem) as well as basal leaves (leaves growing very close to the ground surface). Possessing cauline as well as basal leaves is indicative of Carolina elephant's foot. Tobacco weed typically displays only basal leaves (Fernald 1970).

POTENTIAL MITIGATION OPTIONS

This rare plant survey found that specimens of two rare plant species, showy goldenrod and Shumard's oak, occur in or close to areas known as of April 2007 to be potentially subject to disturbance by construction or operation of the proposed facilities. Potential mitigation options that are available for these specimens, if mitigation is found to be necessary, are summarized in this section.

Showy Goldenrod: Various approaches are available for mitigating construction impacts to the showy goldenrod population in and around Camp Conoy. First, seed may be hand collected from existing showy goldenrod on the site during the late fall preceding anticipated groundbreaking. The seed can be dried and sown in peat pots by a commercial nursery, and the seedlings can be transplanted to a mitigation planting site the following spring. Second, the rhizomes (underground roots) can be hand dug in the fall preceding groundbreaking and immediately relocated to the mitigation planting site. Both of these approaches would preserve and propagate the localized gene pool. The redundancy of the two approaches would reduce the probability that the effort would fail to successfully preserve the gene pool. It would not be necessary to collect all of the seed or dig all of the rhizomes; collecting seed and rhizomes from only a few (10 or more) locations in existing stands of showy goldenrod on the site should adequately preserve the localized gene pool. Once established, the transplanted seedlings and/or rhizomes should gradually spread over the mitigation area until coverage eventually meets or exceeds existing coverage disturbed by construction.

A last resort approach would be to buy and plant showy goldenrod seedlings grown by commercial sources. Although it may be necessary to order seedlings several months or a year in advance, showy goldenrod is sold by some nurseries specializing in native plants. The disadvantage of this approach is that the seedlings would not carry the local gene pool from the site. Maryland is at the edge of the natural range of showy goldenrod, which is more common in prairie settings in the Midwest. Hence, much of the commercial supply of showy goldenrod is derived from Midwestern stock for prairie restoration projects.

Shumard's Oak: The observed Shumard's oaks are potentially located near areas subject to construction disturbance. An option to minimize direct construction impact is to establish construction barriers with prominent field marking at the drip-line for each specimen prior to ground disturbance. The drip-line constitutes an approximately circular area surrounding a tree trunk and extending outward horizontally as far as foliage on the outermost limb. The *State Forest Conservation Technical Manual* (MDNR, 1997) outlines specifications for temporary fencing and signage to protect specimen trees and forest vegetation on construction sites. If disturbance can be avoided within the drip-line, no further mitigation should be necessary to protect the Shumard's oak population on the site.

The *State Forest Conservation Technical Manual* (MDNR, 1997) outlines procedures such as deep fertilization that can be taken to enhance the probability of tree survival if partial encroachment into the drip-line is unavoidable. The trees on the site are too large to transplant (their diameters at breast height are all greater than 15 inches [38 centimeters]), even with modern tree transplanting equipment capable of transplanting trees with diameters up to 8 inches (20 centimeters). Acorns from the trees could be collected prior to groundbreaking and custom-grown in a greenhouse to generate seedlings carrying localized genes.

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Photo 1
Shumard Oak Leaf along Upper Reach of Johns Creek



Photo 2
Shumard Oak Acorn along Upper Reach of Johns Creek