TETRA TECH

PITT-11-15-005

November 4, 2015

Project Number 112IC05958

Rebecca Bowen / Jason Ryndock / Frederick Sechler
PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street
Harrisburg, PA 17105

Subject: **Request for Effects Determination Concurrence**
PNDI File Number: 22275, Update 22275
Sunoco Pipeline, L.P. - Pennsylvania Pipeline Project Multiple Counties

Dear Ms. Bowen / Mr. Ryndock / Mr. Sechler:

Tetra Tech, Inc. (Tetra Tech) has been retained by Sunoco Pipeline, L.P. (SPLP) to conduct environmental field surveys and permitting services for the proposed Pennsylvania Pipeline Project (PPP) formerly part of the Mariner East 2 Pipeline Project (ME2). On behalf of SPLP, Tetra Tech is requesting effects determination concurrence from the Pennsylvania Department of Conservation and Natural Resources (PA DCNR).

On December 12, 2013 a Large Project Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Request including a large project form, project description, and preliminary project USGS topographic mapping was provided to the PA DCNR under the preliminary project name "Mariner East 2 Pipeline - Trans-Pennsylvania". The Mariner East 2 Project was described as traversing the state of Pennsylvania. The project was then split into two separate and independent projects; the PPP and the Ohio Pipeline Project (OPP) (Attachment 1). The initial PNDI response 22275 (Attachment 2) screened the original project route with a 1500 ft buffer on either side. The Updated PNDI response (Update 22275, Attachment 2) included all reroute areas outside of the initial project screening area including a large reroute south of Altoona.

The PPP involves the phased installation of approximately 561 miles of two parallel pipelines within a 306-mile, 50-foot-wide right-of-way (ROW) from Houston, Washington County, Pennsylvania to SPLP's Marcus Hook facility in Delaware County, Pennsylvania with the purpose of interconnecting with existing SPLP Mariner East pipelines. Initially, a 20-inch diameter pipeline would be installed within the ROW from Houston to Marcus Hook (306 miles) and a second, up to 20-inch diameter pipeline, would be installed in the same ROW. The second line is proposed to be installed from SPLP's Delmont Station, Westmoreland County, Pennsylvania to the Marcus Hook facility, paralleling the initial line for approximately 255 miles.

The botanical surveys for PPP included 23 AOCs (each AOC - consisting of at least one, and up to several, separate polygons) as directed by Mr. Jason Ryndock and Mr. Frederick Sechler of the PA DCNR, after their collaborative review of the Pennsylvania Natural Diversity Index (PNDI) database. The Botanical Survey Report (Attachment 3) summarizes the species biology and habitat preferences, methods, results, and conclusions of botanical surveys conducted from April 28, 2014 to September 16, 2015 to determine the presence or absence and extent of the SOSC listed on PNDI search receipt 22275 (Updated 22275) within the portions of the survey corridor that intersect with the assigned 23 AOCs of the Project. The surveys identified 63 SOSC populations of 12 distinct SOSC within the 23 AOCs that were traversed by the proposed Project route. A Serpentine Grassland Community of Concern (COC) was also identified within an AOC traversed by the Project.

The attached Conservation Plan (Attachment 4) provides SPLP's commitment to avoidance, minimization, and mitigation measures to prevent impacts to the listed SOSCs within the Project area. Proposed Project

Tetra Tech
661 Anderson Drive, Foster Plaza VII, Pittsburgh, PA 15220
Tel 412.921.7090 **Fax** 412.921.4040 www.tetratech.com

impacts were evaluated using both the current and proposed PA designations for the assigned state listed SOSC. Forty-seven populations of identified SOSC will not be impacted when evaluating using the current PA designations (PNHP 2015). When using the current PA status, two populations of PA Endangered (PE) SOSC, two populations of PA Threatened (PT) SOSC, and no populations of PA Rare (PR) SOSC are anticipated to be impacted. Forty-seven populations of identified SOSC will not be impacted when evaluating using the proposed PA designations. When using the proposed PA status, six populations of PE SOSC, no populations of PT SOSC, and eight populations of PR SOSC are anticipated to be impacted. Whether evaluating by current or proposed PA status the 2 state and federally listed Northeastern bulrush (*Scirpus ancistrochaetus*) populations identified during the 2014-2015 NE bulrush botanical survey will be avoided and will not be impacted by the Project. The Serpentine Grassland COC will not be impacted by the Project.

Significant effort was expended to utilize Best Management Practices (BMPs), such as temporary ROW "neck downs" or LOD reductions, HDD borings, and pipeline alignment rerouting, to avoid or minimize anticipated impacts to SOSC populations. Voluntary BMPs were utilized as often as practical to completely avoid or drastically reduce anticipated impacts to identified SOSC populations. Additional conservation measures such as topsoil segregation and replacement, "sod" excavation and replacement, and timber mat crossings will also be implemented to further avoid or minimize unavoidable anticipated impacts to specific SOSC populations. SPLP has utilized as many conservation measures as was practical to minimize total project impacts. Based on these avoidance, minimization, and mitigation measures, we do not anticipate significant impacts to any state-listed SOSC.

We hope this summary letter and the attached Botanical Survey Report assists you in completing an evaluation of the Project in relation to protected resources under PA DCNR-PNDI's purview. We appreciate your timely review of this report and are requesting a no impact determination for the proposed Project.

If you have any questions or require additional information regarding the survey, report, or reference population identification, feel free to contact Preston Smith (preston.smith@tetratech.com) at (412) 921-8167 or Korey McCluskey (korey.mccluskey@tetratech.com) at (412) 920-8338.

Sincerely,
Tetra Tech, Inc.

Preston Smith - Manager
Wetlands and Ecological Services Department

Korey McCluskey
Senior Wetland Scientist

Attachments:
- PPP Project Overview Map (Attachment 1)
- PA DCNR Response Letters (Attachment 2)
- Botanical Survey Report (Attachment 3)
- Conservation Plan (Attachment 4)

CC: Chris Embry, Sunoco Logistics;
Matt Gordon, Sunoco Logistics;
Monica Styles, Sunoco Logistics;
Brad Schaeffer, Tetra Tech;
Sandy Lare, Tetra Tech;
Robin Dingle, Tetra Tech;
File 112IC05958

ATTACHMENT 1

PPP Project Overview Map

Mariner East System

Sunoco Logistics

Mariner East Pipeline - Pennsylvania Pipeline Project

Sunoco Pipeline, L.P. (SPLP) proposes to construct and operate the Pennsylvania Pipeline Project (Project) that would expand existing pipeline systems to provide natural gas liquid (NGL) transportation of up to 350,000 barrels per day. The Project involves the phased installation of approximately 561 miles of two parallel pipelines within a 306-mile, 50-foot-wide right-of-way (ROW) from Houston, Washington County, Pennsylvania to SPLP's Marcus Hook facility in Delaware County, Pennsylvania with the purpose of interconnecting with existing SPLP Mariner East pipelines. Initially, a 20-inch diameter pipeline would be installed within the ROW from Houston to Marcus Hook (306 miles) and a second, up to 20-inch diameter pipeline, would be installed in the same ROW within 5 years. The second line is proposed to be installed from SPLP's Delmont Station, Westmoreland County, Pennsylvania to the Marcus Hook facility, paralleling the initial line for approximately 255 miles.

Buffalo District USACE

PADEP Northwest Regional Office

PADEP Northcentral Regional Office

PADEP Southwest Regional Office

Pittsburgh District USACE

PADEP Southcentral Regional Office

Baltimore District USACE

PADEP Southeast Regional Office

Philadelphia District USACE

Norfolk District USACE

Legend

- PPP1
- PPP2
- USACE Districts
- State Boundary
- County Boundary

PADEP Regions

- Northcentral
- Northeast
- Northwest
- Southcentral
- Southeast
- Southwest

Miles

0 10 20 30 40 50

N W E S

Source: World Street Map from ESRI Online. USACE Districts from USACE. State and County Boundaries from ESRI.

P:\GIS\Projects\T29725-Sunoco\MXD\Phase\PPP_Overview\12112014

ATTACHMENT 2

PA DCNR Response Letters

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

March 13, 2014 **PNDI Number: 22275**

Preston Smith
Tetra Tech
661 Andersen Drive
Pittsburgh, PA 15220
Email: preston.smith@tetratech.com

Re: UPDATE – PA Pipeline Project (Sunoco Mariner East 2 Pipeline)
Trans-Pennsylvania

Dear Mr. Smith,

Thank you for the submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Project Number 22275 for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

Potential Impact Anticipated

PNDI records indicate species or resources under DCNR's jurisdiction are located in the project vicinity. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern. **(NOTE: E10[r] of this update was deleted during review)**

Plant Species of Concern:

Scientific Name	Common Name	PA Current Status	PA Proposed Status	AOC (West and East)
Actaea podocarpa	Mountain Bugbane	Threatened	Rare	W1[r]
Amelanchier canadensis	Serviceberry	Not listed	Endangered	E19[r]
Amelanchier humilis	Low Serviceberry	Undetermined	Endangered	W3[r]
Amelanchier sanguinea	Roundleaf Serviceberry	Undetermined	Endangered	W3[r]
Andropogon gyrans	Elliott's Bluestem	Not listed	Rare	E15[r], E16[r]
Arabis patens	Spreading Rockcress	Not Listed	Threatened	W5[r]
Bartonia paniculata	Screw-stem	Not listed	Rare	E21[r]
Bouteloua curtipendula	Tall Gramma	Threatened	Threatened	E5[r]
Dicanthelium scoparium	Velvety Panic-grass	Endangered	Endangered	E18[r]
Desmodium nuttallii	Nuttall's Tick Trefoil	Unlisted	Threatened	E21[r]
Ellisia nyctelea	Ellisia	Threatened	Threatened	E12[r], E14[r]
Euthamia tenuifolia	Grass-leaved goldenrod	Threatened	Endangered	E19[r]
Gentiana saponaria	Soapwort Gentian	Undetermined	Endangered	E23[r]
Juncus torreyi	Torrey's Rush	Threatened	Rare	W4[r]
Leucothoe racemosa	Swamp Dog-Hobble	Undetermined	Threatened	E24[r]
Lycopodiella margueritae	Marguerite's Clubmoss	Not Listed	Endangered	W4[r]
Oenothera argillicola	Shale-barren Evening-primrose	Threatened	Threatened	W6[r]
Oxypolis rigidior	Stiff Cowbane	Undetermined	Threatened	E21[r]
Packera anonyma	Plain ragwort	Threatened	Threatened	E5[r]
Phemeranthus teretifolius	Round-leaved Fame-Flower	Threatened	Threatened	E4[r]
Poa autumnalis	Autumn Bluegrass	Endangered	Endangered	E3[r], E21[r], E23[r]
Poa paludigena	Bog Bluegrass	Threatened	Rare	E1[r]
Quercus phellos	Willow Oak	Endangered	Endangered	E25[r]
Rotala ramosior	Tooth-cup	Rare	Rare	E11[r]
Spiranthes vernalis	Spring Ladies'-Tresses	Endangered	Endangered	E22[r]

Thalictrum coriaceum	Thick-leaved Meadow-rue	Endangered	Threatened	W5[r]
Tipularia discolor	Cranefly Orchid	Rare	Rare	E17[r]
Trifolium virginicum	Kate's Mountain Clover	Endangered	Endangered	W6[r]
Trillium cernuum	Nodding Trillium	Not listed	Threatened	E1[r], E2[r], E4[r], E21[r]
Woodwardia areolata	Netted chain fern	Unlisted	Threatened	E2[r], E19[r]
Zizania aquatica	Indian Wild Rice	Rare	Rare	E6[r], E7[r], E8[r], E9[r], E11[r]

Communities of Concern:

Community	Global Rank	State Rank	AOC
Red-cedar Mixed Hardwood Rich Shale Woodland	GNR	S1S2	(W6[r])

Please see the following resource for more information on these plant communities:
http://www.naturalheritage.state.pa.us/fikebook.aspx

Survey Request
DCNR requests a survey for the following species:

- ***Actaea podocarpa* (Mountain Bugbane)** locally documented in rich moist woods within stream valleys; prefers rich moist wooded slopes and coves in the mountains; flowers in August
- ***Amelanchier canadensis* (Serviceberry):** locally documented on three roadside areas–prefers moist woods and swamps–flowers mid April – mid May, fruits June – early July
- ***Amelanchier humilis* (Low Serviceberry)** locally documented on a steep rocky shrubby hillside; prefers dry open high ground and bluffs; flowers April – mid May; fruits June – early July
- ***Amelanchier sanguinea* (Roundleaf Serviceberry)** locally documented on a steep rocky shrubby hillside; prefers open woods, rocky slopes, and barrens; flowers mid April – late May; fruits June – early July
- ***Andropogon gyrans* (Elliott's Beardgrass)** locally documented in an old field on a north facing slope and also in a grassy power line cut in E20–prefers dry or moist fields or open woods-flowers in September – October
- ***Arabis patens* (Spreading Rockcress)** locally documented on a rocky wooded limestone slope; prefers moist rocky woods; flowers April – July
- ***Bartonia paniculata* (Screw-stem)** locally documented in an opening on the uphill side of the maintenance road–prefers bogs and peaty lake margins-flowers from August-October
- ***Bouteloua curtipendula* (Tall Gramma)**–locally documented in a small prairie serpentine barren with scattered Juniperus virginiana–prefers serpentine barrens, dry calcareous openings, and other dry, rocky, or sandy sites–flowers August-September
- ***Desmodium nuttallii* (Nuttall's Tick-trefoil)** locally documented on a NE-facing slope in partial light with dry-mesic moisture in middle of pipeline; prefers open woods and edges; flowers July-September
- ***Dicanthelium scoparium* (Velvety Panic-grass)** locally documented on the crest, mid-slope and lower-slope of an open meadow–prefers moist meadows and swales–vernal terminal panicles May-early July, or late summer or early fall
- ***Ellisia nyctelea* (Ellisia):** locally documented in a sand bar with no woody vegetation; prefers damp, shady stream banks with rich alluvial soils and sometimes in disturbed ground
- ***Euthamia tenuifolia* (Grass-leaved Goldenrod)** locally documented in a powerline ROW with woods on both sides–prefers moist sandy or clayey fields-flowers in July–October
- ***Gentiana saponaria* (Soapwort Gentian)** locally documented on a flat slope in shaded light with moist to saturated moisture; prefers moist open woods, roadsides and swamps; flowers in September – October
- ***Juncus biflorus* (Grass-leaved Rush);** locally documented on open marshy ground in bottomland along river; prefers open woods, boggy fields, gravel pits, and ditches; fruits July to early November

- ***Juncus torreyi*** **(Torrey's Rush):** locally documented in abandoned sand mine pits and stone quarry wetlands; prefers muddy or sandy shores, strip mine areas, swales, and ditches; flowers and fruits early summer – fall
- ***Leucothoe racemosa*** **(Swamp Dog-hobble);** locally documented in a youngish poorly drained wet woods with sweet gum and a sparse understory; prefers wet woods and thickets
- ***Lycopodiella margueritae*** **(Marguerite's Clubmoss):** locally documented along stream edges associated with abandoned coal strip mines and damp sandy open ground within abandoned sand mines; prefers bogs and moist acidic soils; deciduous, sporulates July – October
- ***Oenothera argillicola*** **(Shale-barren Evening-primrose)** locally documented on a riverside shale barren; prefers shale barrens; flowers July – September
- ***Oxypolis rigidior*** (**Stiff Cowbane**) locally documented in a wedge of woods between road and a ROW with a small stream–prefers swamps, bogs, sedge meadows, sandy shores, and abandoned railroad beds–flowers from August – September
- ***Packera anonyma*** **(Plain Ragwort)** locally documented in a small attractive serpentine prairie; prefers dry fields, open woods, and serpentine barrens; flowers May–September
- ***Phemeranthus teretifolius*** **(Round-leaved Fame Flower)** locally documented in a small attractive serpentine prairie; prefers serpentine barrens; flowers late June-July and flowers are known to remain open only for a few hours
- ***Poa autumnalis*** (**Autumn Bluegrass**) locally documented floodplain woods, open at ground, with alluvial soils–prefers moist woods–flowers in late May-June
- ***Poa paludigena*** (**Bog Bluegrass**) locally documented in a scrub shrub/red maple sapling wetland–prefers boggy woods and swamps–flowers late May-June
- ***Quercus phellos*** **(Willow Oak)** locally documented in a coastal plain forest; prefers moist to wet woods within Coastal Plain forests in SE PA; survey during growing season before leaf fall
- ***Rotala ramosior*** **(Tooth-cup)** locally documented in a floodplain of Yellow Breeches Creek; prefers wet sandy shores and other swampy open grounds
- ***Spiranthes vernalis*** (**Spring Ladies'-tresses**): locally documented in a grassy opening in an old field remnant in young sweet gum-red maple woods–prefers moist, open sandy soils and serpentine barrens–flowers in May – August
- ***Symphyotrichum depauperatum*** **(Serpentine Aster)** locally documented in an open serpentine barren; prefers open areas of serpentine barrens; flowers August–October
- ***Thalictrum coriaceum*** **(Thick-leaved Meadow-rue)** locally documented on wooded slopes; prefers rich rocky woods, thickets, moist alluviums; flowers late May – June
- ***Trifolium virginicum*** **(Kate's Mountain Clover)** locally documented on a riverside shale barren; prefers shale barrens; flowers May – August
- ***Trillium cernuum*** **(Nodding Trillium)** locally documented on a moist, lower slope: prefers moist woods, also documented in a mesic hardwood forest in E19; flowers April-May
- ***Woodwardia areolata (*****Netted Chainfern)** locally documented in a small artificial pond in the woods with little herbaceous vegetation, in E19 the plant was found in the eastern edge of a seep; prefers moist or wet woods and acidic bogs; deciduous fern, sporulates July-September
- ***Zizania aquatica*** (**Indian Wild-rice**) locally documented in a 2 acre monoculture marsh in the wettest area of the marsh–prefers tidal and non-tidal marshes–flowers in late May – early September

- ✓ A survey for the above species should be conducted by a qualified botanist *at the appropriate time of year and then submitted to our office for review*. **Your botanist should carefully review the new DCNR Botanical Survey Protocols available at http://www.gis.dcnr.state.pa.us/hgis-er/Login.aspx. These protocols are recommended to ensure that the all necessary information is collected and that survey reports are prepared properly. It is the expectation of DCNR that these protocols will be followed when conducting surveys for species under our jurisdiction.**
- ✓ Your botanist should *fill out the field survey form while performing their survey:* http://www.gis.dcnr.state.pa.us/hgis-er/hgis/2012%20DCNR%20Field%20Survey%20Form.pdf. Contact our office prior to the survey for detailed information about the species, or for a list of qualified surveyors.
- ✓ Any target and non-target state-listed species found during the site visit should be reported to our office. Mitigation measures and monitoring may be requested if species or communities of special concern are found on or adjacent to site.
- ✓ If the land type(s) does not exist on site, a survey may not be necessary; please submit a habitat assessment report which describes the current land cover, habitat types, and species found on site.

IMPORTANT:
To assist with your botanical survey efforts, we are providing shapefiles of Areas of Concern (AOCs). These polygons are based on known locations or potential habitat of DCNR-regulated species or natural communities. Required surveys may be restricted to these AOCs. The survey may be further refined to suitable habitat within areas of anticipated disturbance. For example, if work is restricted to an existing open right-of-way, a survey for a forest-dwelling species would be unnecessary.

Plant communities and species that lack a currently listed or proposed conservation status are not required for survey. Surveys for these communities and species are voluntary. This applies to Red-cedar – Mixed Hardwood Rich Shale Woodland.

This response represents the most up-to-date review of the PNDI data files and is valid for two (2) years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review.

Should you have any questions or concerns, please contact Ecological Information Specialists, Jason Ryndock (717-705-2822; c-jryndock@pa.gov) or Frederick Sechler (717-705-2823; c-frsechle@pa.gov).

Sincerely,

Rebecca H. Bowen

Rebecca H. Bowen, Section Chief
Bureau of Forestry, Ecological Services Section
Pennsylvania Natural Heritage Program

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

March 13, 2014 **PNDI Number: 22275**

Preston Smith
Tetra Tech
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Email: preston.smith@tetratech.com

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- ***Dicanthelium scoparium* (Velvety Panic-grass)** locally documented on the crest, mid-slope and lower-slope of an open meadow–prefers moist meadows and swales–vernal terminal panicles May-early July, or late summer or early fall
- ***Ellisia nyctelea* (Ellisia):** locally documented in a sand bar with no woody vegetation; prefers damp, shady stream banks with rich alluvial soils and sometimes in disturbed ground
- ***Euthamia tenuifolia* (Grass-leaved Goldenrod)** locally documented in a powerline ROW with woods on both sides–prefers moist sandy or clayey fields-flowers in July–October
- ***Gentiana saponaria* (Soapwort Gentian)** locally documented on a flat slope in shaded light with moist to saturated moisture; prefers moist open woods, roadsides and swamps; flowers in September – October
- ***Juncus biflorus* (Grass-leaved Rush);** locally documented on open marshy ground in bottomland along river; prefers open woods, boggy fields, gravel pits, and ditches; fruits July to early November

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- ***Phemeranthus teretifolius*** **(Round-leaved Fame Flower)** locally documented in a small attractive serpentine prairie; prefers serpentine barrens; flowers late June-July and flowers are known to remain open only for a few hours
- ***Poa autumnalis*** (**Autumn Bluegrass**) locally documented floodplain woods, open at ground, with alluvial soils–prefers moist woods–flowers in late May-June
- ***Poa paludigena*** (**Bog Bluegrass**) locally documented in a scrub shrub/red maple sapling wetland–prefers boggy woods and swamps–flowers late May-June
- ***Quercus phellos*** **(Willow Oak)** locally documented in a coastal plain forest; prefers moist to wet woods within Coastal Plain forests in SE PA; survey during growing season before leaf fall
- ***Rotala ramosior*** **(Tooth-cup)** locally documented in a floodplain of Yellow Breeches Creek; prefers wet sandy shores and other swampy open grounds
- ***Spiranthes vernalis*** (**Spring Ladies'-tresses**): locally documented in a grassy opening in an old field remnant in young sweet gum-red maple woods–prefers moist, open sandy soils and serpentine barrens–flowers in May – August
- ***Symphyotrichum depauperatum*** **(Serpentine Aster)** locally documented in an open serpentine barren; prefers open areas of serpentine barrens; flowers August–October
- ***Thalictrum coriaceum*** **(Thick-leaved Meadow-rue)** locally documented on wooded slopes; prefers rich rocky woods, thickets, moist alluviums; flowers late May – June
- ***Trifolium virginicum*** **(Kate's Mountain Clover)** locally documented on a riverside shale barren; prefers shale barrens; flowers May – August
- ***Trillium cernuum*** **(Nodding Trillium)** locally documented on a moist, lower slope: prefers moist woods, also documented in a mesic hardwood forest in E19; flowers April-May
- ***Woodwardia areolata (*****Netted Chainfern)** locally documented in a small artificial pond in the woods with little herbaceous vegetation, in E19 the plant was found in the eastern edge of a seep; prefers moist or wet woods and acidic bogs; deciduous fern, sporulates July-September
- ***Zizania aquatica*** (**Indian Wild-rice**) locally documented in a 2 acre monoculture marsh in the wettest area of the marsh–prefers tidal and non-tidal marshes–flowers in late May – early September

- ✓ A survey for the above species should be conducted by a qualified botanist *at the appropriate time of year and then submitted to our office for review*. **Your botanist should carefully review the new DCNR Botanical Survey Protocols available at http://www.gis.dcnr.state.pa.us/hgis-er/Login.aspx. These protocols are recommended to ensure that the all necessary information is collected and that survey reports are prepared properly. It is the expectation of DCNR that these protocols will be followed when conducting surveys for species under our jurisdiction.**
- ✓ Your botanist should *fill out the field survey form while performing their survey:* http://www.gis.dcnr.state.pa.us/hgis-er/hgis/2012%20DCNR%20Field%20Survey%20Form.pdf. Contact our office prior to the survey for detailed information about the species, or for a list of qualified surveyors.
- ✓ Any target and non-target state-listed species found during the site visit should be reported to our office. Mitigation measures and monitoring may be requested if species or communities of special concern are found on or adjacent to site.
- ✓ If the land type(s) does not exist on site, a survey may not be necessary; please submit a habitat assessment report which describes the current land cover, habitat types, and species found on site.

IMPORTANT:
To assist with your botanical survey efforts, we are providing shapefiles of Areas of Concern (AOCs). These polygons are based on known locations or potential habitat of DCNR-regulated species or natural communities. Required surveys may be restricted to these AOCs. The survey may be further refined to suitable habitat within areas of anticipated disturbance. For example, if work is restricted to an existing open right-of-way, a survey for a forest-dwelling species would be unnecessary.

Plant communities and species that lack a currently listed or proposed conservation status are not required for survey. Surveys for these communities and species are voluntary. This applies to Red-cedar – Mixed Hardwood Rich Shale Woodland.

This response represents the most up-to-date review of the PNDI data files and is valid for two (2) years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review.

Should you have any questions or concerns, please contact Ecological Information Specialists, Jason Ryndock (717-705-2822; c-jryndock@pa.gov) or Frederick Sechler (717-705-2823; c-frsechle@pa.gov).

Sincerely,

Rebecca H. Bowen

Rebecca H. Bowen, Section Chief
Bureau of Forestry, Ecological Services Section
Pennsylvania Natural Heritage Program

ATTACHMENT 3

Botanical Survey Report

Note: Parts of the Botanical Survey Report have been modified to only reflect information associated with Area of Concern (AOC) W16 at Raystown Lake

Botanical Survey Report
PNDI No. 22275 (Update 22275)

Pennsylvania Pipeline Project

Allegheny, Berks, Blair, Cambria, Chester, Cumberland, Dauphin, Delaware, Huntingdon, Indiana, Juniata, Lancaster, Lebanon, Perry, Washington, Westmoreland, and York Counties, Pennsylvania

Prepared for:

Sunoco Logistics, L.P.

525 Friztown Road

Sinking Spring, PA 19608

Prepared by:

Tetra Tech, Inc.

661 Anderson Drive

Pittsburgh, Pennsylvania 15220

(412) 921-7090

Fax (412) 921-4040

Submitted to:

PA Department of Conservation of Natural Resources

Bureau of Forestry, Ecological Services Section

ATTN: Mr. Jason Ryndock or Mr. Frederick Sechler

400 Market Street

Harrisburg, Pennsylvania 17105

August 2015

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LIST OF ACRONYMS and ABBREVIATIONS

ACRONYM	MEANING
AOC	Area of Concern
AG	Agriculture
BTF	Broadleaf Terrestrial Forest
BTW	Broadleaf Terrestrial Woodland
CBTF	Coniferous - Broadleaf Terrestrial Forest
CBTW	Coniferous - Broadleaf Terrestrial Woodland
cm	Centimeter
CMNH	Carnegie Museum of Natural History
COC	Community of Concern
CTF	Coniferous Terrestrial Forest

dm	Decimeter
ECSI	Environmental Consultation Services Inc
FF	Fallow Field
ft	Foot or Feet
G1	Critically Imperiled
G2	Imperiled
G3	Vulnerable
G4	Apparently Secure
G5	Secure
in	Inch
HDD	Horizontal Directional Drill[ing]
LOD	Limit of Disturbance
m	Meter
MBTW	Mesic Broadleaf Terrestrial Woodland
MBTF	Mesic Broadleaf Terrestrial Forest
ME1	Mariner East Pipeline – Houston to Delmont
MSB	Mesic Broadleaf Woodland
MSF	Mesic Broadleaf Forest
NGLs	Natural Gas Liquids
NS	Not Surveyed
NRCS	Natural Resources Conservation Service
OPP	Ohio Pipeline Project
PA	Pennsylvania
PA DCNR	Pennsylvania Department of Conservation and Natural Resources
PE	Palustrine Emergent Wetland
PE	Pennsylvania Endangered
PF	Palustrine Forested Floodplain
PNDI	Pennsylvania Natural Diversity Index
PNHP	Pennsylvania Natural Heritage Program
PPP	Pennsylvania Pipeline Project
PR	Pennsylvania Rare
Project	Pennsylvania Pipeline Project
PS	Palustrine Scrub-Shrub Wetland
PSFP	Palustrine Successional Farm Pond
PT	Pennsylvania Threatened
RBTF	Riverine Broadleaf Terrestrial Forest
ROW	Right-of-Way
S1	Critically Imperiled
S2	Imperiled
S3	Vulnerable
SOSC	Species of Special Concern
SGL	Serpentine Grassland
SPLP	Sunoco Pipeline, L.P.
Tetra Tech	Tetra Tech Inc.
THO	Terrestrial Herbaceous Opening
TOM	Terrestrial Open Meadow
TS	Terrestrial Shrub Opening/Terrestrial Shrubland
URD	Urban-Residential-Developed
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

1.0 PROJECT INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) was contracted by Sunoco Pipeline, L.P. (SPLP) to perform botanical surveys for the Pennsylvania Pipeline Project (Project). Large project information including a large project form, project description, and preliminary project USGS topographic mapping was initially provided to the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) under the preliminary project name "Mariner East 2 Pipeline - Trans-Pennsylvania". The Mariner East 2 Project originally encompassed all of the project activities within the state of Pennsylvania (PA), excluding areas covered in the Mariner East Pipeline – Houston to Delmont (ME1) project. Mr. Jason Ryndock and Mr. Frederick Sechler of the PA DCNR utilized the initial large project information to define areas of concern (AOCs) where botanical surveys were required for the specific species of special concern (SOSC) and communities of concern (COC) listed in the Pennsylvania Natural Diversity Index (PNDI) search receipts 22275, dated January 30, 2014 and Update 22275, dated March 13, 2014. All PNDI search receipts are provided in Agency Coordination (Appendix A).

After the initial submission to the PA DCNR the Mariner East 2 Project activities and boundaries were broken up into two separate projects; the Pennsylvania Pipeline Project (Project) and the Ohio Pipeline Project (OPP). A separate botanical report, dated February 2015 was submitted for the OPP portion of Washington County, PA. The Pennsylvania Pipeline Project includes Allegheny, Berks, Blair, Cambria, Chester, Cumberland, Dauphin, Delaware, Huntingdon, Indiana, Juniata, Lancaster, Lebanon, Perry, Westmoreland, and York Counties. The Ohio Pipeline Project included the portions of Washington County west of the existing plant located in Houston, PA. The portion of Washington County to the east of the existing Houston, PA plant, all of Allegheny County, and the portion of Westmoreland County west of Delmont, PA were all previously surveyed during the botanical survey of the ME1 project under PNDI 22132 (Updated 22007). The Botanical Survey Report PNDI No. 22132 (Updated 22007) Mariner East Pipeline – Houston to Delmont is included in this Botanical Survey Report submittal package (Appendix B). PA DCNR clearance letters from the ME1 and OPP botanical surveys have been included in Appendix.

SPLP proposes to construct and operate the Project which would expand existing pipeline systems to provide natural gas liquid (NGL) transportation of up to 350,000 barrels per day. The Project involves the phased installation of approximately 561 miles of two parallel pipelines within a 306-mile, 50-foot-wide right-of-way (ROW) from Houston, Washington County, PA to SPLP's Marcus Hook facility in Delaware County, PA with the purpose of interconnecting with existing SPLP Mariner East pipelines (Figure 1, Appendix C). Initially, a 20-inch (in) diameter pipeline would be installed within the ROW from Houston to Marcus Hook (306 miles) and a second, up to 20-in diameter pipeline, would be installed in the same ROW within 5 years. The second line is proposed to be installed from SPLP's Delmont Station, Westmoreland County, Pennsylvania to the Marcus Hook facility, paralleling the initial line for approximately 255 miles. The following provides the details of the proposed pipeline facilities:

- Phase 1: Houston, PA to Marcus Hook, PA – This is an incremental expansion of the capacities of Sunoco Logistics to transport NGL's to the Marcus Hook facility. This Phase of the Project will include a 20 in diameter steel pipeline and pump stations. The route of the pipeline is either inside or adjacent to the existing Sunoco pipeline corridor and is approximately 306 miles long.

- Phase 2: Delmont, PA to Marcus Hook, PA – The second phase of the project will be completed should customer demand prove that additional transport capacity for ethane is required. The pipeline route for Phase 2 will include 255 miles of pipeline that will be inside the existing Sunoco corridor.

<u>Aboveground facilities in Pennsylvania</u>:

- Houston, PA has an existing facility which will connect to the pipeline. This Project will install meters on the outlets from existing storage, injection pumps, control valves, associated piping and accessory structures.

- Delmont, PA has an existing site and this Project will expand the pump station with added booster pumps, associated piping and accessory structures.

- Ebensburg, PA has an existing site and this Project will expand the pump station with added booster pumps, leak detection metering, associated piping and accessory structures.

- Middletown, PA has an existing pump station and this Project will expand the pump station with added booster pumps, associated piping and accessory structures.

- Beckersville, PA has an existing pump station and this Project will add to the pump station with leak detection metering, associated piping and accessory structures.

- Twin Oaks, PA is an existing site and this Project will install custody transfer meters and control valves.

- There are 50 Mainline Valve sets planned for this Project, which will be placed at as many existing valve sites as possible

Support Sites (Pipe / Contractor Yards and Access Roads)

SPLP is in the initial phases of project design and site selection and as such exact locations to be utilized for contractor and pipe yards have not been determined. The contractor and pipe yards will be used for equipment, pipe, and material storage, as well as temporary field offices and pipe preparation/field assembly areas during construction. Site selection and acquisition will continue throughout the planning and permitting stages of the Project. In most cases, contractors will be required to site pipe and contractor yards in previously developed areas that will require no new land disturbance.

Support Sites (Access Roads)

To the extent possible, SPLP will use existing public and private roads for temporary construction access to the mainline pipeline Right-of-Ways (ROWs) and aboveground facilities. SPLP is currently in the process of identifying potential temporary and permanent access roads and will provide detailed information relative to access road location, length, and land acreage requirements within all agency filings. SPLP will seek and obtain the necessary property rights and approvals from landowners and government agencies prior to the use or construction of such roads.

The AOCs provided by the PA DCNR generally represented a 1500-foot (ft) buffer around the pipeline route. Changes or "reroutes" made by SPLP to the proposed pipeline alignment that went outside the 1500-ft buffer were communicated to the PA DCNR by Tetra Tech Inc.

A large reroute, referred to as the "Twin Oaks-30 Mile Reroute", was a 30-mile reroute located in Chester and Delaware Counties. The PA DCNR was notified of the reroute and an updated PNDI search receipt (Update 22275, dated March 13, 2014) was generated which included numerous additional SOSC and associated AOCs not included on the original PNDI receipt. SPLP determined that the Twin Oaks-30 Mile Reroute was not feasible and reverted to the original proposed alignment contained in the initial submittal to the PA DCNR. None of the SOSC or associated AOCs for the Twin Oaks-30 Mile Reroute were included as part of this botanical survey.

Provided AOCs that existed completely outside the pipeline survey corridor (300-ft) were not included in the botanical survey. This includes areas initially provided by the PA DCNR that fell outside the survey corridor and areas where the pipeline was rerouted (but still within the 1500-ft PA DCNR buffer), resulting in the provided AOC existing outside the survey corridor. The PA DCNR determined during the April 16, 2015 meeting with Tetra Tech that two AOCs (ALT W2, ALT W4) were exempt from 2015 surveys. It was determined that no survey was necessary for grass-leaved rush (*Juncus biflorus*) in AOC ALT W2 due to a reroute in the pipeline alignment that bypassed AOC ALT W2 entirely. SPLP will cross AOC ALT W4

utilizing a horizontal directional drill (HDD) boring which will avoid impacts to any SOSC in the AOC. The directional bore underneath AOC ALT W4 will travel from outside of the original surveyed corridor to end up within areas that had been reviewed in the initial survey of the AOC.

AOCs previously surveyed as part of the ME1 project include AOC W2 through AOC W7. These areas were not surveyed as part of the Pennsylvania Pipeline Project. The results of the botanical survey for ME1 are included in the attached Botanical Survey Report PNDI No. 22132 (Updated 22007) Mariner East Pipeline – Houston to Delmont (Appendix B). A PA DCNR clearance letter was received for the ME1 project and is provided in Appendix A. AOC W1 was not located in the footprint of this project and was included in the Botanical Survey Report PNDI No. 22275 (Updated 22275) for the Ohio Pipeline Project submitted on February 27, 2015. A PA DCNR letter of no adverse effects was received for the OPP (Appendix A).

The Plant Species of Special Concern Table (Table 1, Appendix D) summarizes the SOSC listed on PNDI search receipts 22275, dated January 30, 2014 and Update 22275, dated March 13, 2014. The Communities of Concern Table (Table 2, Appendix D) summarizes the COC listed on the same three search reciepts. SOSC or COC not surveyed (NS) for are noted on Table 1 and Table 2 (Appendix D).

In addition to the surveys that were conducted in this report for the PA state listed SOSC listed on PNDI search receipts 22275, coordination with the United States Fish and Wildlife Service (US FWS) yeilded an additional required survey for the Northeastern bulrush (*Scirpus ancistrochaetus*). Though survey areas for these two surveys overlapped in areas, a separate report will be generated for the Northeastern bulrush survey. Thae bulrush report will be submitted to USFWS and all coordination regarding this federally listed species will be done with USFWS, but any identified populations of *S. ancistrochaetus* will be accounted for in both botanical reports.

This report summarizes the species biology and habitat preferences, methods, results, and conclusions of a botanical survey conducted throughout 2014 and 2015 growing seasons to determine the presence or absence and extent of the SOSC and COC listed on PNDI search receipt 22275 (Updated 22275) within the portions of the survey corridor that intersect with the assigned AOCs of the Project. Under Wild Plant Management Permit Numbers 14-624/15-624 (Appendix E), lead environmental scientist Korey McCluskey of Tetra Tech Inc. led a team that also included environmental scientists Codie Vileno (Permit Nos. 14-623/15-623), and Greg Stevens (Permit No. 15-676), Jason McGuirk (Permit No. 14-651), A.J Grech, and Deanna Quinn (Permit No. 14-650) of Tetra Tech Inc. Surveys were also conducted by Kevin Keat and David Bonomo (Permit No. 14-578) of Environmental Consultation Services Inc. (ECSI).

2.0 SPECIES BIOLOGY AND HABITAT PREFERENCE

2.1 MOUNTAIN BUGBANE ATTRIBUTES

Mountain bugbane (*Actaea podocarpa*) is a perennial herbaceous member of the Buttercup Family (Ranunculaceae) with stems 0.7 to 1.5 meters (m) tall (PNHP 2014a). It has palmately compound three-lobed leaves with large, toothed, ovate-obovate terminal leaflets approximately 6 to 16 centimeters (cm) wide (Rhoads and Block, 2007). The inflorescence is a slender raceme, approximately 10 to 60 cm long. The flowers are small, radially symmetric, with numerous distinctive white stamens. Mountain bugbane is distinguished from its congeners by its long flowering raceme; stalked, thin papery follicle fruit; five sepals, and the presence of three or more carpels. (PNHP 2014a; Rhoads and Block 2007).

Mountain bugbane is globally ranked as G4 (apparently secure), state ranked as S3 (vulnerable), and its Pennsylvania status is threatened (PT) with a proposed Pennsylvania status of rare (PR) (PNHP 2015). Mountain bugbane is found from Pennsylvania west to Illinois and south to Tennessee and Georgia (Natureserve 2015). In Pennsylvania, mountain bugbane is found primarily in the Appalachian Mountains in the southwest part of the state in moist, rich hardwood forests, often in mountain coves or north-facing slopes. In Pennsylvania, mountain bugbane flowers in August (PNHP 2014a; Rhoads and Block 2007).

2.2 LOW SERVICEBERRY ATTRIBUTES

Low serviceberry or low juneberry (*Amelanchier humilis*) is a woody perennial member of the Rose Family (Rosaceae) that grows to be between 0.3 and 8 m tall. It has densely tomentose leaves becoming glabrescent beneath. Leaflets are most commonly oval-oblong with serrate veins that fork and enter the teeth. Low serviceberry has an erect, densely tomentose raceme and produces densely tomentose flowers with petals that are 7-10 millimeters (mm) in length (Rhoads and Block 2007).

Low serviceberry is globally ranked as G5 (secure), state ranked in Pennsylvania as S1 (critically imperiled), has a tentatively undetermined (TU) current status, and a proposed status of PA endangered (PE) (PNHP 2015). Low serviceberry is distributed from Nebraska east to Pennsylvania, north to Canada, and south to West Virginia and Missouri (NatureServe 2015). In Pennsylvania, Low serviceberry is found scattered across the state (Rhoads and Block 2007, USDA 2015). This species reaches the southern limit of its range in southern Pennsylvania. Low serviceberry grows on dry, open sites with rocky, gravelly or sandy soil, often in calcareous regions. Low serviceberry typically flowers in PA from April to mid-May and fruits from June to early-July (Rhoads and Block 2007).

2.3 ROUNDLEAF SERVICEBERRY ATTRIBUTES

Roundleaf serviceberry (*Amelanchier sanguinea*) is a woody perennial member of the Rose Family (Rosaceae) that grows to be between 3 and 6 m tall. It has alternate, coarsely-toothed, oblong to subrotund leaflets with lateral veins extending into teeth (Rhoads and Block 2007). Roundleaf serviceberry has a long, drooping raceme with flowers that have five white petals approximately 11-15mm in length and group in small clusters, distinguishing it from its congeners (PNHP 2012b; Rhoads and Block 2007).

Roundleaf serviceberry is globally ranked as G5 (secure), state ranked as S1 (critically imperiled), and its Pennsylvania status is tentatively undetermined (PNHP 2015). Roundleaf serviceberry is distributed from Maine west throughout Canada, South to Kansas, and West to Georgia (Natureserve 2015). In Pennsylvania, roundleaf serviceberry is found scattered across the state growing on dry, rocky slopes, cliffs, and outcrops in scrubby woods and exposed locations (Rhoads and Block 2007). In Pennsylvania, roundleaf serviceberry flowers from late April to mid-May and fruits from June to early July (PNHP 2012b; Rhoads and Block 2007).

2.4 SHALE BARREN PUSSYTOES ATTRIBUTES

Shale barren pussytoes (*Antennaria virginica*) is a perennial herbaceous member of the Aster Family (*Asteraceae*) with cuneate to oblanceolate leaves with 1 to 3 veins on the basal leaves. It has short stolons and long, slender peduncles, that can be 6 to 20 cm in length. Shale barren pussytoes produces fruiting bodies that are 1.1 to 1.3 mm long with pappus bristles that can grow to be 4.5 mm long, the maximum length of the corolla (Rhoads and Block 2007).

Shale barren pussytoes is globally ranked as G4 (apparently secure), state ranked in Pennsylvania as S3 (vulnerable), and does not have a current Pennsylvania legal status, but is under review for future listing (PNHP 2015). It is distributed in Appalachia from Pennsylvania, West to Ohio, and South to Virginia (Natureserve 2015). Shale barren pussytoes is typically found in the southcentral region of Pennsylvania growing in open deciduous woods (eFloras 2015, Rhoads and Block 2007). Shale barren pussytoes flowers from late April to June (Rhoads and Block 2007).

2.5 SPREADING ROCKCRESS ATTRIBUTES

Spreading rockcress (*Arabis patens*) is a biennial herbaceous member of the Mustard Family (Brassicaceae). The stem, that can be branched or simple, grows from 3 to 6 decimeter (dm) in length with spreading hairs throughout. Basal leaves are ovate to oblanceolate and can grow up to 6 cm long. Cauline leaves are sessile and exhibit auriculate clasping bases. Spreading rockcress has an inflorescence of white flower petals, ascending or divergent fruiting pedicels that are 5-7 mm in length, and suberect or ascending fruits that are 2.5-4.5 cm in length. (Rhoads and Block 2007).

Spreading rockcress is globally ranked as G3 (vulnerable), state ranked as S3 (imperiled), and currently has no legal status in Pennsylvania, but is proposed PA threatened (PNHP 2015). Spreading rockcress reaches the northern limit of its boundary in central Pennsylvania and extends west to Indiana, south to Mississippi, and west to Georgia (Natureserve 2015). In Pennsylvania, spotted rockcress can be found in the southcentral and southeastern regions growing in moist, rocky woods. Spreading rockcress flowers from April to July (Rhoads and Block 2007).

2.6 WATER SEDGE ATTRIBUTES

Water sedge (*Carex aquatilis*) is a rhizomatous, perennial herbaceous member of the Sedge Family (Cyperaceae) and contains fibrous root stocks and tufted shoots, or rhizomatus with solitary or tufted shoots (Rhoads and Block 2007, Natureserve 2015). Water Sedge is a sod-forming sedge growing 14 to 100 cm tall, and leaf blades are 2.5 to 8 mm wide and located on the lower half of the stems. The inflorescence consists of 1 to 3 staminate spikes above 2 to 3 pistillate spikes, the pistillate scales are brown or purple brown (Tilley et al. 2011 and Rhoads and Block 2007).

Water sedge is globally ranked as G5 (secure), state ranked in Pennsylvania as S2 (imperiled), and has a current status of PA threatened (PNHP 2015). Water sedge is a circumboreal species and in North America, is distributed from Artic to as far as California, Arizona, New Mexico and Virginia (Tilley et al. 2011). In Pennsylvania, water sedge is found in the northwest, northcentral, and southeastern part of the state typically in calcareous fens, swamps, and marshy swales with limestone derived soils (Tilley et al. 2011 and Rhoads and Block 2007).

2.7 SHORT'S SEDGE ATTRIBUTES

Short's sedge (*Carex shortiana*) is a tufted perennial grass-like herb in the Sedge Family (*Cyperaceae*). Short's sedge can reach from 8 to 35 inches (20-90 cm) in height. This herb's tall flowering stems are light

green, hairless, and 3-sided, particularly near the base. The leaves grow from the base and alternately along the stems. The smooth, leaf blades are up to 12 in (30 cm) long and ⅓ in (1 cm) wide. The blades of Short's sedge are often indented along the central vein, which gives the leaf a channeled appearance. The flowers are held in densely packed, cylindrical spikes that become dark brown as they mature. The color change as the plant matures is a key feature for field identification of this sedge. Clusters of 3 to 6 spikes are produced at the top of each flowering stem. The lower spikes usually contain all female flowers, while the upper spikes have female flowers at the top and male flowers below (PNHP 2011c). Short's sedge has short-mucronate or acute pistillate scales, and squarrose, obovoid, glabrous but finely traverse corrugated, nerveless, and beakless perigynia. The achenes of Short's sedge are 3-sided (Rhoads and Block 2007).

Short's sedge is globally ranked as G5 (secure), state ranked as S3 (vulnerable), currently has no legal status in PA, but is proposed as PA rare (PNHP 2015). It is found from New York south to Virginia and west to Kansas and Oklahoma. In Pennsylvania, Short's sedge is typically found in the south-central to southwestern part of the state, in calcareous wet meadows and swamps or in rich woods (PNHP 2014c, NRCS 2009, Rhoads and Block 2007).

2.8 NUTTALL'S TICK-TREFOIL ATTRIBUTES

Nuttall's tick-trefoil (*Desmodium nuttalli*) is a perennial herbaceous member of the Pea Family (Fabaceae) with trifoliate leaves that are velvety-pubescent beneath (Rhoads and Block 2007, Natureserve 2015). Nuttall's tick-trefoil contains pink or purple flowers with 5 petals about 6 mm in length. The fruits contain 2-4 segments, with a convex upper margin and a rounded or obtusely angled lower margin (PNHP 2014e).

Nuttall's tick-trefoil is globally ranked as G5 (secure), state ranked in Pennsylvania as S2 (imperiled), and has a current status of PA Threatened (PNHP 2015). Nuttall's tick-trefoil can be found from New York south and southwest into Florida and Texas (Natureserve 2015). In Pennsylvania, Nuttall's tick-trefoil is found in the southeastern part of the state, in dry woods and edges. Flowering occurs between July and September (Rhoads and Block 2007).

2.9 LOG FERN ATTRIBUTES

Log fern (*Dryopteris celsa*) is a terrestrial, herbaceous member of the Wood Fern Family (Dryopteridaceae) with multiple hybrids (Rhoads and Block 2007, USDA 2015). The fronds are pinnate-pinnatifid, deciduous, between 6.5-12 dm long, widest above the base, and the scales are dark brown at the base, or are tan with a dark stripe (Rhoads and Block 2007). Log fern hybridizes with crested wood fern (*D. cristata*), Goldie's wood fern (*D. goldiana*), and marginal wood fern (*D. marginalis*) (Rhoads and Block 2007).

Log fern is globally ranked as G4 (apparently secure), state ranked in Pennsylvania as S1 (critically imperiled), and no current legal status exist in Pennsylvania (PNHP 2015). Log fern can be found from New York and Michigan south and southwest into Georgia, Alabama, Louisiana, and Texas (Natureserve 2015). In Pennsylvania, log fern is found in the southeastern part of the state, in seepage slopes, hummocks, and on logs in swamps (Rhoads and Block 2007).

2.10 ELLISIA ATTRIBUTES

Ellisia (*Ellisia nyctelea*), also known as waterpod or Aunt Lucy, is an annual, herbaceous member of the Waterleaf Family (Hydrophyllaceae) (PNHP 2014f). Ellisia grows to 1 to 4 dm in height and exhibits pinnately, coarsely toothed lobed leaves. The hairy leaves are oppositely arranged on the lower stem, alternately arranged on the upper stem, and grow to be about 10 cm in length (PNHP 2014f). The flowers are whitish-blue, have 5-petal-like lobes, are solitary and grow to be about 6.5 mm in length (PNHP 2014f and Rhoads and Block 2007).

Ellisia is globally ranked as G5 (secure), state ranked in Pennsylvania as S2 (imperiled), and has a current status of Pennsylvania Threatened (PNHP 2015). Ellisia can be found from Massachusetts west to Nevada, south to Texas, and north throughout most of Canada (Natureserve 2015). In Pennsylvania, it is found in the southeast region growing on damp, shady banks, and rich alluvial woods. Ellisia's flowering season occurs in May (Rhoads and Block 2007).

2.11 ANNUAL FIMBRY ATTRIBUTES

Annual fimbry (*Fimbristylis annua*) is an annual, herbaceous member of the Sedge Family (Cyperaceae). It grows in tufted clumps with wiry stems and can be up to 15 cm in length. The leaves are less than 3 mm wide, have flat, inrolled edges, and occur at the base of the plant (PNHP 2014g). Annual fimbry will have no more than 10 spikelets, distinguishing it from its congeners (PNHP 2014g, Rhoads and Block 2007). Its flowers are grouped in brown, egg-shaped spikelets (PNHP 2014g).

Annual fimbry is globally ranked as G5 (secure), state ranked in Pennsylvania as S2 (imperiled), and has a current status of Pennsylvania Threatened (PNHP 2015). Annual fimbry can be found from Pennsylvania west to Arizona, and south to Texas and Florida (Natureserve 2015). In Pennsylvania, it is at the northern end of its range and is only found in the southeast region growing in moist depressions on serpentine barrens. Annual fimbry has both a flowering and fruiting season of July to October (USDA 2015, Rhoads and Block 2007).

2.12 TORREY'S RUSH ATTRIBUTES

Torrey's rush (*Juncus torreyi*) is a perennial herbaceous member of the Rush Family (Juncaceae), that is also classified as part of the subgenus *Septati*, members of which have terete and septate leaves. Torrey's rush grows to a height of between 0.4 and 1 m with large, spherical flower heads clustered in a terminal inflorescence. This is a rhizomatous plant, and tubers sometimes develop at intervals along the rhizomes. Torrey's rush is most similar to its congener, knotted rush (*J. nodosus*), which also has spherical flower heads and tuberous rhizomes. Knotted rush is a smaller plant than Torrey's rush; it grows to between 1.5 and 4 dm tall and has shorter sepals than those of Torrey's rush (Rhoads and Block 2007, Thompson & Paris, 2004).

Torrey's rush is globally ranked as G5 (secure), state ranked in Pennsylvania as S3 (vulnerable), and has a current status of PA threatened and a proposed status of PA rare (PNHP 2015). The distribution of Torrey's rush includes most of North America, and it is more common in the western part of the continent than it is in the east (Thompson & Paris, 2004). In Pennsylvania, it has been found scattered throughout the state "on muddy or sandy shores, strip mine areas, swales, or ditches", and it flowers from July to September (Rhoads and Block 2007).

2.13 MARGUERITE'S CLUB MOSS ATTRIBUTES

Marguerite's club moss (*Lycopodiella margueritae*) is a perennial herbaceous member of the Clubmoss Family (Lycopodiaceae) that exhibits marginally-toothed leaves and erect fertile shoots (Rhoads and Block 2007). Its spreading, ascending leaves are 6 to 13 mm in length with 3 to 4 teeth and the strobili are 2 to 4 mm thicker than the lower portion of the fertile shoots (Rhoads and Block 2007, WIDNR 2014).

Marguerite's club moss is globally ranked as G1/G2 (critically imperiled/imperiled), state ranked in Pennsylvania as S1 (critically imperiled), and is not currently ranked in Pennsylvania but is under review for future listing and proposed as potentially endangered (PNHP 2015). It is only found in Michigan, Ohio, Pennsylvania, Virginia, and Wisconsin (Natureserve 2015). In Pennsylvania, no county data is available for this species as it is extremely rare (USDA 2015).

2.14 SHALE-BARREN EVENING-PRIMROSE ATTRIBUTES

Shale-barren evening-primrose (*Oenothera argillicola*) is a biennial herbaceous member of the Evening-Primrose Family (Onagraceae) that grows to be about 1.5 m in height (PNHP 2014h). It exhibits stems that are glabrous and somewhat hairy in the inflorescence and dark green, glossy, sometimes hairy leaves (PHNP 2014h, Rhoads and Block 2007). Sepals are yellow-green and flushed with red. Shale-barren evening primrose exhibits yellow flowers that have 4 petals that are 2 to 4 cm in length. The capsules are also 2 to 4 cm in length (Rhoads and Block 2007).

Shale-barren evening-primrose is globally ranked as G3/G4 (vulnerable/apparently secure), state ranked in Pennsylvania as S2 (imperiled), and has a state status of Pennsylvania threatened (PNHP 2015). Shale-barren evening-primrose is only found in Maryland, Pennsylvania, Virginia, and West Virginia. In Pennsylvania, it is found in the southcentral region growing in shale barrens (Natureserve 2015, Rhoads and Block 2007). Shale-barren evening-primrose flowers from July to September (Rhoads and Block 2007)

2.15 EASTERN PRICKLY PEAR-CACTUS ATTRIBUTES

Eastern prickly pear-cactus (*Opuntia humifusa*) is a perennial herbaceous member of the Cactus Family (Cactaceae) that grows forming mats or clumps (PNHP 2014i). It exhibits stems that are fleshy and flat and grow to be 10 cm in length and 6 cm in width. Its flowers are bright yellow and grow to be about 8 cm wide. Eastern prickly pear-cactus will produce a fleshy, vase-shaped, red or purple fruit that grow between the margins of the pads of the cactus (PNHP 2014i).

Eastern prickly pear-cactus is globally ranked as G5 (secure), state ranked in Pennsylvania as S3 (Vulnerable), and has a state status of Pennsylvania rare (PNHP 2015). It is distributed from Massachusetts north to Ontario, west to Utah, south to New Mexico, and east to Florida (Natureserve 2015). In Pennsylvania, it is found in the south and east regions growing on dry, shaley cliffs and barrens. Eastern prickly pear-cactus flowers in July (Rhoads and Block 2007).

2.16 PLAIN RAGWORT ATTRIBUTES

Plain ragwort (*Packera anonyma*) is a perennial herbaceous member of the Aster Family (Asteraceae) that produces many aster-like flowers and grows to be between 3 and 8 dm in height (PNHP 2014j). It exhibits basal serrated leaves that are oblanceolate to elliptically shaped and taper at the petiole. The leaves are cauline, sessile, and deeply pinnatifid (Rhoads and Block 2007). It produces yellow, flat-topped flowers with 20 to 100 flower heads per individual (PNHP 2014j, Rhoads and Block 2007).

Plain ragwort is globally ranked as G5 (secure), state ranked in Pennsylvania as S3 (Vulnerable), and has a state status of Pennsylvania rare (PNHP 2015). It is distributed from New Jersey, west to Indiana, south to Mississippi, and east to Florida (Natureserve 2015). In Pennsylvania, it is found in the southcentral region growing in dry fields, open woods, and serpentine barrens. Plain ragwort flowers from May to September (Rhoads and Block 2007).

2.17 BEARDTONGUE ATTRIBUTES

Beardtongue (*Penstemon canescens*) is a perennial herbaceous member of the Plantain Family (Plantaginaceae) that grows in clusters, exhibits a sterile, hairy stamen, and can be 40 to 80 cm in height (PNHP 2014k, Rhoads and Block 2007). It exhibits opposite, hairy leaves that are toothed on the margin with upper pairs having distinct stocks (PNHP 2014k). Beardtongue produces a flower that exhibits a pale-violet to purple colored corolla with a white inside (Rhoads and Block 2007). Additionally, the flower has a two-lipped entrance which allows for pollination from insects (PNHP 2014k).

Beardtongue is globally ranked as G5 (secure), state ranked in Pennsylvania as S3 (vulnerable), and has a no current legal Pennsylvania status (PNHP 2015). It is distributed from Quebec, south to Florida, and west to Louisiana (Natureserve 2015). In Pennsylvania, beardtongue is found in the southcentral and southeastern regions growing on dry, rocky, wooded slopes (Rhoads and Block 2007). Beardtongue flowers from May to September (PNHP 2014k).

2.18 ROUND-LEAVED FAME-FLOWER ATTRIBUTES

Round-leaved fame-flower (*Phemeranthus teretifolius*) is a perennial herbaceous member of the Purslane Family (Portulacaceae) that grows to be 2 dm in height. It exhibits alternate, densely clustered, fleshy leaves that gives the stem a tufted appearance (PNHP 2014l, Rhoads and Block 2007). The leaves grow to be 6 cm in length and exhibit a round cross section (PNHP 2014l). The inflorescence is a long penduncled cyme exhibiting pink flowers that remain open for a few hours in sunlight (Rhoads and Block 2007). The flowers grow in small clusters at the ends of long, slender stalks and exhibit 5 petals. Round-leaved fame-flower's fruit is a many-seeded, minutely roughened capsule (PNHP 2014l, Rhoads and Block 2007).

Round-leaved fame-flower is globally ranked as G4 (apparently secure), state ranked in Pennsylvania as S2 (imperiled), and has a current status of Pennsylvania threatened (PNHP 2015). It is distributed from Pennsylvania, south to Georgia and Alabama, and west to Tennessee (Natureserve 2015). In Pennsylvania, Round-leaved fame-flower is found in the southeastern region growing on dry, rocky, wooded slopes (Rhoads and Block 2007). Southern Pennsylvania is the northernmost extent of this species' range (Natureserve 2015). Round-leaved fame-flower has a flowering season from late June to July (Rhoads and Block 2007).

2.19 PURPLE FRINGELESS ORCHID ATTRIBUTES

Purple fringeless orchid (*Platanthera peramoena*) is a perennial herbaceous member of the Orchid Family (Orchidaceae) that grows to between 30 and 100 cm tall. In the *Platanthera* genus, each plant sends up a single stem which, during flowering, is topped by a single, showy, tall inflorescence bearing many flowers. Some members of this genus have only basal leaves; the purple fringeless orchid has 2-5 long, narrow leaves scattered along the stem and becoming progressively reduced into bracts upwards along the stem. Lower leaves may be up to 25 cm long. Purple fringeless flowers are purple and bilaterally symmetrical; the upper petals are fused into a hood, and the lower petals are deeply divided into three lobes. Other members of the genus have white, greenish, or yellow-orange flowers, and some have entire, rather than lobed, lower petals. The purple fringeless orchid is distinguished from its closest relatives in lacking a distinctive fringe on the margins of the lower petal lobes. These lobes are, however, slightly ragged along the edges. (FNA 1993; PNHP 2011a; Rhoads and Block 2007).

The purple fringeless orchid is globally ranked as G5 (secure), state ranked as S2 (imperiled), and its PA legal status is tentatively undetermined, but it is proposed PA threatened (PNHP 2015). Purple fringeless occurs from PA south to Georgia and west to Missouri and Arkansas (FNA 1993; PNHP 2011a). In Pennsylvania, this orchid flowers during July and August, and it is found in open, wet places, in meadows and wet woods, as well as in ditches and alongside roads, mostly in the southwestern portion of the state (PNHP 2011a; Rhoads and Block 2007).

2.20 RACEMED MILKWORT ATTRIBUTES

Racemed milkwort (*Polygala polygama*) is a biennial wildflower in the Milkwort Family (Polygalaceae) (USDA 2011). Grows 1-2.5dm in height with one or more leafy light green erect stems protruding from a taproot (Hilty 2015a, Rhoads and Block 2007). Alternate narrow oblong leaves line the stems with a smooth, glabrous surface that are singly veined (New England Wild Flower Society 2015a). Each stem

ends with a spike-like raceme of flowers, purple in color and 2-10cm in length (Hilty 2015a, Rhoads and Block 2007). Only a few flowers bloom at a time starting in June or July and only lasting a few weeks, with the rest looking bud-like and inconspicuous (Hilty 2015a, Rhoads and Block 2007).

Racemed milkwort is globally ranked as G5 (secure), state ranked as S1/S2 (critically imperiled/imperiled), and it has a current status of PA tentatively undetermined (PNHP 2015, NatureServe 2015). It has a range from Canada southeast to Florida and west to Minnesota south to Texas (USDA 2011, New England Wild Flower Society 2015a). It has been historically documented in the southcentral counties in Pennsylvania (USDA 2011).

2.21 MISSOURI GOOSEBERRY ATTRIBUTES

Missouri Gooseberry (*Ribes missouriense*) is a native woody shrub in the Gooseberry Family (Grossulariaceae) (USDA 2011). Known to reach 2m in height with hairy, thorned stems that have larger stout spines at the nodes (Native Plant Database 2015). Young branches are often green, while older mature branches are grey-brown and often peeling near the base (Hilty 2015b). The larger spikes are reddish in color, can be found in groups of 1-3 per node, and will be 2-3cm long, while the smaller thorns are brown and grow uniformly along the stem (Hilty 2015b, New England Wild Flower Society 2015b). Leaves grow alternately in bunches matching the spikes, and will be approximately 5cm long, palmately lobed with smaller lobes/teeth along the leaf margins. Upper leaf surfaces are usually hairless while the underside is hairless to pubescent. Flowers appear between late April and May and are greenish-white in color. Each fertilized flower is replaced by a round 1-2cm berry, green in color during growth turning reddish-purple upon maturity (Hilty 2015b, Rhoads and Block 2007). Berries are described as being juicy and containing many minute seeds (Hilty 2015b).

Missouri Gooseberry is globally ranked as G5 (globally secure), state ranked as S1 (critically imperiled), and it has a current status of PA endangered (PNHP 2015, NatureServe 2015). It is native to many midwestern states reaching as far south as Oklahoma and north to the Canadian border, and ranging east to New England where it is considered “Introduced” (New England Wild Flower Society 2015b). It is scattered through southcentral Pennsylvania and known habitats can include mesic to dry open woodlands and borders, small meadows in wooded areas, abandoned fields and partially shaded fence rows (Hilty 2015b, Rhoads and Block 2007).

2.22 TOOTHCUP ATTRIBUTES

Toothcup (*Rotala ramosior*) is a small annual herb in the Loosestrife Family (Lythraceae) (PNHP 2014m, USDA 2011, NatureServe 2015). Known to reach 30cm in height with smooth stems, toothcup has oppositely arranged stalk-less leaves about 2.5cm long, elliptic in shape, untoothed, and rounded at the tip (PNHP 2014m). Light pink to white 4-petal flowers appear between July and September and fall early (PNHP 2014m, Rhoads and Block 2007). Fruits appear as many-seeded capsules 3-5cm long that turn red as the growing season ends (PNHP 2014m).

Toothcup is globally ranked as G5 (globally secure), state ranked as S3 (vulnerable), and it has a current status of PA Rare (PNHP 2015, NatureServe 2015). It has a very wide and scattered range across North America, and has been historically documented in many southern counties in Pennsylvania, particularly along the Susquehanna River (PNHP 2014m). It is most often found in damp, open places such as exposed shorelines, stream margins, streambed outcrops, and sandy or swampy open ground (PNHP 2014m, Rhoads and Block 2007).

2.23 STALKED WILD-PETUNIA ATTRIBUTES

Stalked wild-petunia (*Ruellia pedunculata*) is a perennial herb in the Acanthus Family (Acanthaceae) (Gleason 1968, USDA 2011). Stems reach 3-7 dm tall with simple, or more commonly several divergent

branches, equally pubescent on all four sides with minute recurved hairs. The leaves of the stalked wild-petunia are lanceolate to ovate-lanceolate, with acute or obtuse gradually narrowing to the cuneate base with its principal leaves measuring roughly 5-10 cm. Peduncles are axillary from a few of the median nodes and are roughly 2-10 cm. long, bearing at their summit a pair of foliaceous bracts and 1 to 3 short-pediceled flowers. The calyx-lobes of the *R. peduculata* are very narrowly linear (Gleason 1968). The corolla of this species measures 3-5 cm, long and the tube is equal or is slightly longer than the throat. Flowers appear between June through the end of July or early August, typically alone or in small clusters at the leaf axils, and are typically light purple in color (Gleason 1968). Fruit consists of pubescent capsules with many seeds (Gleason 1968).

Stalked wild-petunia is globally ranked as G5 (secure), state ranked as S1 (critically imperiled), and it currently has no legal status in PA with a proposed PA status of tentatively undetermined (PNHP 2015, NatureServe 2015). It has a range from southern Illinois and Missouri south to Louisiana and west to Texas; also in the Appalachian region. It is typically found on dry or rocky upland wooded slopes (Gleason 1968).

2.24 LIMESTONE PETUNIA ATTRIBUTES

Limestone petunia (*Ruellia strepens*) is a perennial herb in the Acanthus Family (Acanthaceae) (PNHP 2014n, USDA 2011). Known to reach 1m in height with hairy lined stems and oval to lance-shaped oppositely arranged leaves. Leaves can reach 15cm in length and be 6cm wide. Flowers appear between late June and the end of July, typically alone or in small clusters at the leaf axils, and are blue or purple in color (Rhoads and Block 2007). Flower petals are 3-5cm long with a tube-like base and 5 spreading lobes. Fruit consists of a hairless capsule with many seeds (Rhoads and Block 2007).

Limestone petunia is globally ranked as G4/G5 (apparently secure / secure), state ranked as S2 (imperiled), and it has a current status of PA threatened (PNHP 2015, NatureServe 2015). It has a range from New Jersey west into Nebraska, south into Texas and the Gulf Coast states. It has been historically documented in counties along the southern tier of Pennsylvania, found on rich wooded slopes, floodplains, stream banks, bluffs, and roadsides on limestone/calcareous substrates (Rhoads and Block 2007).

2.25 SLENDER GOLDENROD ATTRIBUTES

Slender goldenrod (*Solidago erecta*) is an upright, perennial herb in the Aster Family (Asteraceae) (PNHP 2011b, USDA 2011). It grows up to 5 ft tall, with smooth stems near the base that get hairy near the flower (PNHP 2011b). Elliptical leaves between 5-20mm wide that are thick with a firm texture, grow alternately and reduce in number the as they approach the flower, which forms as a cluster that is spike-like. Flower heads are about 6mm wide with a central disk and 5-9 rays yellow in color (PNHP 2011b). Flowers are seen from August through October (PNHP 2011b, USDA 2011).

Slender goldenrod is globally ranked as G5 (secure), state ranked as S1 (critically imperiled), and it has a current status of PA rare (PNHP 2015, NatureServe 2015). It is found from Connecticut south to Georgia, west to Indiana through Mississippi. In Pennsylvania, slender goldenrod can be found growing on dry, acidic, shaley river and road banks (PNHP 2011b).

2.26 SHINING LADIES' TRESSES ATTRIBUTES

Shining ladies' tresses (*Spiranthes lucida*) is a perennial herbaceous member of the Orchid Family (Orchidaceae) that grows to between 10 and 25 cm tall. Plants of this genus have one stem per plant, and during flowering, are topped by a spike-like, usually spiraling inflorescence of whitish flowers. *Spiranthes* species have alternate, mostly basal leaves, and also sometimes a few scattered along the stem. In shining ladies' tresses, the basal leaves are oblong/lanceolate and shiny green. The spiraling inflorescence has three or four compact, vertical ranks of tubular white flowers. Shining ladies' tresses is distinct from its closest relatives in having a bright yellow spot on the lower lip of each flower; other *Spiranthes* species

have white, pale yellow, or green spots. It is also distinguished from other congeners in its relatively smaller stature (MDC NAP 2004; Rhoads and Block 2007).

Shining ladies' tresses is globally ranked as G5 (secure), state ranked as S3 (vulnerable), and it is not currently listed in Pennsylvania, but it is proposed PA threatened (PNHP 2015). Shining ladies' tresses occurs from Quebec and New Brunswick south to North Carolina and Georgia and west to Missouri and Indiana (NatureServe 2011). In Pennsylvania, it is found in moist meadows, often on calcareous soils, mostly in the south and west portions of the state, and it flowers from May to July (Rhoads and Block 2007).

2.27 SERPENTINE ASTER ATTRIBUTES

Serpentine aster (*Symphyotrichum depauperatum*) is a perennial herb in the Aster Family (Asteraceae) (PNHP 2014o). It grows in clumps with smooth, wiry, flowering stems that reach 4dm in height (PNHP 2014o). Oblong basal leaves are about 4cm in length while alternate narrow leaves line the stem (PNHP 2014o). Flowering stems produce many yellow-white daisy-like flower heads with 7-16 petals in branching clusters (PNHP 2014o, Rhoads and Block 2007).

Serpentine aster is globally ranked as G2 (imperiled), state ranked as S2 (imperiled), and it has a current status of PA Threatened (PNHP 2015). It is endemic to Pennsylvania and Maryland's eastern serpentine barrens (PNHP 2014o). Lancaster, Chester, and Delaware counties in Pennsylvania are considered the "stronghold" of the species (PNHP 2014o). Flowers can be seen from August through October (PNHP 2014o).

2.28 THICK-LEAVED MEADOW-RUE ATTRIBUTES

Thick-leaved meadow-rue (*Thalictrum coriaceum*) is a dioecious, perennial herb in the Buttercup Family (Ranunculaceae). It grows up to 1m tall, and it has a low woody base (PNHP 2011c, Rhoads and Block 2007). Flowers do not grow petals but are white to purple colored sepals (PNHP 2011c). Leaves are compound with as many as 4 kidney shaped or round leaves, lobed or toothed along the outer margins (PNHP 2011c). Roots are bright yellow in color (PNHP 2011c, Rhoads and Block 2007).

Thick-leaved meadow-rue is globally ranked as G4 (apparently secure), state ranked as S2 (vulnerable), and it has a current status of PA endangered (PNHP 2015). It is found from Pennsylvania south to Tennessee and Georgia (PNHP 2011c, USDA 2011). In Pennsylvania, thick-leaved meadow-rue grows in pristine forest habitat with rocky open wooded areas with rich piedmont terrain or moist mountain soils PNHP 2011c. It often flowers between late May and June in its Pennsylvania ranges (Rhoads and Block 2007).

2.29 KATE'S MOUNTAIN CLOVER ATTRIBUTES

Kate's mountain clover (*Trifolium virginicum*) is a perennial herb that grows from a stout taproot in the Pea Family (Fabaceae) (Rhoads and Block 2007, NatureServe 2015). It is a small plant, typically between 1-2 dm in height, with prostrate, pubescent stems, linear to oblanceolate shaped leaflets, flowers appear yellowish-white, and produce legumes with 1-6 seeds (NatureServe 2015, Rhoads and Block 2007).

Kate's mountain clover is globally ranked as G3 (vulnerable), state ranked as S1 (critically imperiled), and it has a current status of PA endangered (PNHP 2015, NatureServe 2015). It is found along one portion of the ridge and valley province in Virginia, West Virginia, Maryland, and southern Pennsylvania (USDA 2011). In Pennsylvania, Kate's mountain clover is primarily from outcrops of Devonian, Ordovician, and Silurian shales, and rarely from limestone (NatureServe 2015). Known to flower from May through August (Rhoads and Block 2007).

2.30 NETTED CHAIN FERN ATTRIBUTES

Netted chain fern (*Woodwardia areolata*) is a perennial forb/herb in the Chain Fern Family (Blechnaceae). It is an average size plant, growing between 5-8 dm tall, often forming small colonies (PNHP 2011d, Rhoads and Block 2007). It has a typical flattened, fern-like appearance, green in color with 7 to 12 deeply lobed leaflets with conspicuous leaf veins arranged in a net or chain-like appearance Fertile leaves are darker colored, narrow, and unflattened with spore structures located on the underside (PNHP 2014aa). Often mistaken for the Sensitive Fern (Onoclea sensibilis), take note of the Netted Chain Fern's alternately arranged lobes and the noticeable difference between fertile fronds (PNHP 2011d, Rhoads and Block 2007, USDA 2015).

Netted chain fern is globally ranked as G5 (secure), state ranked as S2 (imperiled), and it has a current status of PA rare (PNHP 2015). It is found from along the Atlantic coastal plain from Nova Scotia south and west into Texas and Florida. (PNHP 2011d). In Pennsylvania, netted chain fern is found in scattered counties especially in the Delaware River drainage, often growing in swamps, seepages, wet woods, boggy wetlands, and along margins of streams (PNHP 2011d).

3.0 METHODS

Prior to field surveys of the assigned Areas of Concern (AOCs), floras and herbarium specimens from the Carnegie Museum of Natural History (CMNH), and reference websites (see References) were consulted for information on characteristic morphological traits, flowering time, habitat preferences, and associated plant species. If a known reference population of the SOSC was accessible prior to field surveys it was visited to verify whether distinguishing morphological characteristics were present. USGS topographic mapping (Figure 1 and Figures 2-Index-1 to 2-Index-19, Appendix C) and aerial photography mapping of the study area were reviewed to evaluate areas of potential SOSC habitat (Figures 2-1 to 2-72, Appendix C) and target areas within each AOC to focus the field surveys on.

Field surveys were conducted in accordance with DCNR's *Protocols for Conducting Surveys for Plant Species of Special Concern, Part 2 of 4*, Conducting the Botanical Survey (PNHP 2011g). The limits of the study area were based on an approximately 300-foot wide survey corridor that encompassed the pipeline's limit of disturbance (LOD), a 100-foot wide survey corridor encompassing access roads, and the LOD of ancillary facilities (Figures 2-1 to 2-72, Appendix C). AOCs that fell completely outside the survey corridor were not included in the botanical survey. This includes areas initially provided by the PA DCNR that fell outside the survey corridor and areas where the pipeline was rerouted, resulting in the provided AOC existing entirely outside the survey corridor.

The PA DCNR determined during the April 16, 2015 meeting with Tetra Tech that two AOCs (ALT W2 and ALT W4) were exempt from survey. It was determined that no survey was necessary for grass-leaved rush (*Juncus biflorus*) in AOC ALT W2 due to a reroute in the pipeline alignment that bypassed AOC ALT W2 entirely. SPLP will cross AOC ALT W4 utilizing a horizontal directional bore (HDD) which will avoid impacts to any SOSC in the AOC. The directional bore underneath AOC ALT W4 will travel from outside of the original surveyed corridor to end up within areas that had been reviewed in the initial survey of the AOC.

AOCs previously surveyed as part of the ME1 project include AOC W2 through AOC W7. These areas were not surveyed as part of this Project. The results of the botanical survey for ME1 are included in the attached Botanical Survey Report PNDI No. 22132 (Updated 22007) Mariner East Pipeline – Houston to Delmont (Appendix B). AOC W1 is included in the Botanical Survey Report PNDI No. 22275 (Updated 22275) Ohio Pipeline Project submitted on February 27, 2015.

Habitat and hydrologic requirements for the SOSC were determined prior to conducting the survey. Field investigations of the AOCs occurred within the survey corridor crossings of AOCs. Botanical surveys were conducted over the 2014 and 2015 growing seasons. The timing of these surveys coincided with the recommended survey periods for the AOC specific SOSC listed on the PNDI response letter and listed in Table 1 of Appendix D. The multiple rounds of field surveys ensured that all SOSC listed in the search receipt that were within the defined survey corridor were surveyed for during the recommended survey period. In addition, characteristic photographs of the listed target SOSC are included in the Representative Photographs of SOSC (Appendix F).

Surveys for individual plants were done by two or three individuals walking in a systematic back-and-forth meander through the survey corridor within the assigned AOC. Less accessible areas (e.g. steep slopes or cliffs and extremely dense thicket communities) were surveyed in a random manner, slightly different than the methods mentioned above, but still ensuring coverage of the entire study corridor. Vegetation was reviewed within the entire length and width of the survey corridor, associated access roads, and ancillary facility LODs that lay within each of the assigned AOCs. The study area was divided into habitat types based on species composition and association, aspect and slope, soil and geology conditions, probable land use history, disturbance, and other factors present. Habitat classification and nomenclature was based on the Terrestrial & Palustrine Plant Communities of Pennsylvania 2nd Ed. (Zimmerman et al., 2012)

Habitat types encountered in the Project study area:

1) AG/FF Agriculture/ Fallow Field
2) BTF Broadleaf Terrestrial Forest
3) BTW Broadleaf Terrestrial Woodland
4) CBTF Coniferous - Broadleaf Terrestrial Forest
5) CBTW Coniferous – Broadleaf Terrestrial Woodland
6) CTF Coniferous Terrestrial Forest
7) MBTF Mesic Broadleaf Terrestrial Forest
8) MBTW Mesic Broadleaf Terrestrial Woodland
9) MSB Mesic Broadleaf Woodland
10) MSF Mesic Broadleaf Forest
11) PE Palustrine Emergent Wetland
12) PF Palustrine Forested Floodplain
13) PS Palustrine Scrub-Shrub Wetland
14) PSFP Palustrine Successional Farm Pond
15) RBTF Riverine Broadleaf Terrestrial Forest
16) RBTW Riverine Broadleaf Terrestrial Woodland
17) SGL Serpentine Grassland
18) THO Terrestrial Herbaceous Opening
19) TOM Terrestrial Open Meadow
20) TS Terrestrial Shrub Opening/Terrestrial Shrubland
21) URD Urban-Residential-Developed

Within each individual habitat of each assigned AOC, a Botanical Field Survey Form was filled out containing a species list, moisture level, canopy coverage, aspect and slope, relative age, disturbance and other relevant habitat information, and is included in Appendix G. Dominant species in each individual habitat were asterisked or given an estimated percent cover, while non-dominant plants were not. Representative photographs of each habitat type were taken from various locations along the Project and are included in the Representative Habitat Photographs (Appendix H).

All individual recorded habitats where located within areas of the survey corridor, associated access roads, and ancillary facility LODs that lay within each of the assigned AOCs. Each of the assigned AOCs was evaluated for the presence or absence, extent, and potential habitat suitability for the SOSC listed in each of the assigned AOCs listed in the Plant Species of Special Concern Table (Table 1, Appendix D). While survey efforts were focused on the SOSC listed in the PNDI search receipt, the potential presence of all other species on the PNHP SOSC list (PNHP 2015) was assessed within each AOC evaluated.

4.0 HABITAT DESCRIPTIONS AND RESULTS

Field investigations for the Project were conducted during the 2014 and 2015 growing seasons, beginning in April, 2014 and concluding in August, 2015. Botanical surveys were completed in an effort to determine the presence/absence, extent, and habitat suitability potential present for the PNDI 22275 (Updated 22275) listed SOSC within the botanical survey corridor crossings of 23 individual AOCs. Weather conditions during the growing seasons of 2014 and 2015 varied greatly. Climatic and hydrologic conditions were typical during the majority of the 2014 and 2015 field surveys with the exception of the spring of 2014 and the early summer of 2015, which were both unseasonably wet.

As noted in the Introduction (Section 1.0), prior to field investigations the determination was made by the PA DCNR that portions of the project area intersects with 23 AOCs that could contain the AOC specific target SOSCs or potentially suitable habitat for those SOSC. The prevalence of invasive species and human activities across the Project have reduced the potential for suitable habitat within many of the assigned AOCs. Other disturbances include agriculture, grazing, logging, construction, residential, commercial, and industrial development, periodic herbicide treatment, and mowing. These anthropogenic impacts extend throughout significant portions of the Project and severely limit the potential for sustained habitat suitability for the listed target SOSC.

Botanical Field Survey Forms (Appendix G) and Representative Habitat Photographs (Appendix H) that detail the existing vegetation, soil characteristics, and topography were prepared to help categorize individual recorded habitats within the assigned AOCs into generalized habitat types, as to assist in assigning preference to those communities that met suitable habitat requirements for the AOC specific target SOSC. Comprehensive vegetation lists of plant species occurring within each AOC are provided in Appendix I. Soils located within the study area are presented in the Soils Table (Table 3, Appendix D). A summary of the listed SOSC, assigned AOCs, individual recorded habitat areas, general habitat types, potential habitat suitability, and presence/absence within those recorded habitat areas is clarified in the Habitat Suitability and Presence Table (Table 4, Appendix D). Generalized habitat types identified within the Project survey corridor and listed in the Methods (Section 3.0) portion of this report are described below.

4.1 HABITAT DESCRIPTIONS

Habitat types across the Project study area were observed to have great variability in species composition and associations. Specific associations within each of these generalized habitat types are described in detail in the general habitat description sections of the botanical field survey forms included for each of the individually recorded habitat areas (Appendix G).

4.1.1 AGRICULTURE/FALLOW FIELD

Agriculture/Fallow Field AG/FF habitat type occurs rarely within the project area. The habitat type is characterized by planted crops and managed fields dominated by planted pasture grasses. Soils conditions within these habitats are generally dry. Common vegetation within the habitat consists of corn (*Zea mays*), orchard grass (*Dactylis glomerata*), common Timothy (*Phleum pratense*), Indian-hemp (*Apocynum cannabinum*), common yarrow (*Achillea millefolium*), Queen Anne's lace (*Daucus carota*). No tree or shrubs are generally present within this habitat type.

Botanical Field Survey Forms were recorded at each of the 2 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as AG/FF can be found in Table 4 (Appendix D).

4.1.2 BROADLEAF TERRESTRIAL FOREST

The Broadleaf Terrestrial Forest (BTF) habitat type occurs commonly throughout the project area. Soils conditions within these habitats range from dry to mesic. Various tree species observed include oaks (*Quercus* spp.), hickories (*Carya* spp.), black cherry (*Prunus serotina*), tuliptree (*Liriodendron tulipifera*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), sweet birch (*Betula lenta*), yellow birch (*Betula allegheniensis*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), basswood (*Tilia americana*), black-gum (*Nyssa sylvatica*). Conifers are also common in the BTF habitat, but make up a negligible percentage of the tree canopy. Typical conifers that may be found in the BTF habitat include pitch pine (*Pinus rigida*), Virginia pine (*Pinus virginiana*), eastern white pine (*Pinus strobus*), and hemlock (*Tsuga canadensis*). Shrubs include mountain laurel (*Kalmia latifolia*), blueberries (*Vaccinium* spp.), flowering dogwood (*Cornus florida*), witch-hazel (*Hamamelis virginiana*), spice bush (*Lindera benzoin*), and hop-hornbeam (*Ostrya virginiana*). The herbaceous stratum is highly variable across the evaluated study area. Representative species include wood ferns (*Dryopteris* spp.), New York fern (*Thelypteris noveboracensis*), rattle-snake fern (*Botrychium virginianum*), may-apple (*Podophyllum peltatum*), wild leek (*Allium tricoccum*), violets (*Viol*a spp.), false Solomon's-seal (Smilacina racemosa), and Pennsylvania sedge (*Carex pennsylvanica*).

Botanical Field Survey Forms were recorded at each of the 26 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as BTF can be found in Table 4 (Appendix D).

4.1.3 BROADLEAF TERRESTRIAL WOODLAND

The Broadleaf Terrestrial Woodland (BTW) habitat type occurs commonly throughout the project area, usually in association with BTF. Soils conditions within these habitats are commonly dry and/or acidic. Various tree species observed include Chestnut oak (*Quercus montana*), Yellow oak (*Quercus muhlenbergii*), black-oak (*Quercus velutina*), sweet birch (*Betula lenta*), and black-gum (*Nyssa sylvatica*). Conifers are also occur in the BTW habitat, but make up a smaller percentage of the tree canopy. Common conifers found in the BTW habitat include pitch pine (*Pinus rigida*) and eastern white pine (*Pinus strobus*). Common shrubs in the habitat include viburnums (*Viburnum* spp.), blueberries (*Vaccinium* spp.), mountain laurel (*Kalmia latifolia*), witch-hazel (*Hamamelis virginiana*), and hackberry (*Celtis occidentalis*). Common herbs include wood ferns (*Dryopteris* spp.), Pennsylvania sedge (*Carex pennsylvanica*), wild sarsaparilla (*Aralia nudicaulis*), and Virginia creeper (*Parthenocissus quinquefolia*). Bryophytes and lichens occur in some communities.

Botanical Field Survey Forms were recorded at each of the 25 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as BTW can be found in Table 4.

4.1.4 CONIFEROUS - BROADLEAF TERRESTRIAL FOREST

Soils conditions within the Coniferous – Broadleaf Terrestrial Forest (CBTF) habitats are generally dry and sandy. Some communities may exhibit a rocky forest floor with exposed bedrock. Common trees observed in the habitat consist of eastern white pine (*Pinus strobus*), Virginia pine (*Pinus virginiana*), red pine (*Prunus resinosa*), and eastern hemlock (*Tsuga canadensis*). Hardwood associates include chestnut oak (*Quercus montana*), red oak (*Quercus rubra*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), sweet birch (*Betula lenta*), and white ash (*Fraxinus Americana*). Shrubs consist of witch-hazel (*Hamamelis virginiana*), spice bush (Lindera benzoin), mountain laurel (*Kalma latifolia*), blueberries (*Vaccinium* spp.), and maple-leaved viburnum (*Viburnum acerifolium*). Herbs consist of may-apple (*Podophyllum peltatum*), wood ferns (*Dryopteris* spp.), Christmas fern (*Polystichum acrostichoides*), Pennsylvania sedge (*Carex pennsylvanica*), and common-wood sorrel (*Oxalis acetosella*).

Botanical Field Survey Forms were recorded at each of the 8 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as CBTF can be found in Table 4 (Appendix D).

4.1.5 CONIFEROUS - BROADLEAF TERRESTRIAL WOODLAND

The Coniferous – Broadleaf Terrestrial Woodland (CBTW) habitat type is rare within the project area, often occurring in association with BTF and/or BTW habitat types. Soils conditions within the habitat are commonly dry and acidic. Some communities exhibit calcareous shale outcrops with "shale barren" characteristics. CBTW closely resembles the species composition in CBTF. Common trees consist of red pine (*Prunus resinosa*), Virginia pine (*Pinus virginiana*), red-cedar (*Juniperus virginiana*), eastern white pine (*Pinus strobus*), chestnut oak (*Quercus montana*), red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*). Common shrubs consist of blueberries (*Vaccinium* spp.), shadbush (*Amelanchier arborea*), and mountain laurel (*Kalma latifolia*). Herbs consist of Canada may-apple (*Podophyllum peltatum*), wood ferns (*Dryopteris* spp.), Christmas fern (*Polystichum acrostichoides*), Pennsylvania sedge (*Carex pennsylvanica*), and common-wood sorrel (*Oxalis acetosella*).

Botanical Field Survey Forms were recorded at each of the 3 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as CBTW can be found in Table 4.

4.1.6 CONIFEROUS TERRESTRIAL FOREST

Within Coniferous Terrestrial Forest (CTF) habitats conifers generally exceed 75% of the canopy cover within the habitat area. Soils conditions within the habitat are commonly dry and sandy. Typical conifers include Eastern hemlock (*Tsuga canadensis*), pitch pine (*Pinus rigida*), and Virginia pine (*Pinus virginiana*). Associate species include a variety of northern hardwoods and oaks. Typical representatives include sugar maple (*Acer saccharum*), red maple (*Acer rubrum*) red oak (*Quercus rubra*), and witch-hazel (*Hamamelis virginiana*). Typical herbs found within the habitat include Christman fern (*Polystichum acrostichoides*) and wood ferns (*Dryopteris* spp.).

Botanical Field Survey Forms were recorded at each of the 4 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as CTF can be found in Table 4 (Appendix D).

4.1.7 MESIC BROADLEAF TERRESTRIAL WOODLAND & MESIC BROADLEAF WOODLAND

Mesic Broadleaf Terrestrial Woodlands (MBTW) and Mesic Broadleaf Woodlands (MSB) are rich community types that typically occur on rich, deep soils. Soils conditions are generally mesic to wet. Tree species typically include American beech (*Fagus grandifolia*), box elder (*Acer negundo*), red maple (*Acer rubrum*), and tuliptree (*Liriotendron tulipifera*). Common shrubs consist of spice bush (*Lindera benzoin*), witch-hazel (*Hamamelis virginiana*), and common privet (*Ligustrum vulgare*). Typical herbs consist of wood ferns (*Dryopteris* spp.), garlic mustard (*Alliaria petiolata*), bedstraw (*Gallium* spp.), and may-apple (*Podophyllum peltatum*).

A Botanical Field Survey Form was recorded at the 3 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as MBTF and MSF can be found in Table 4 (Appendix D).

4.1.8 MESIC BROADLEAF TERRESTRIAL FOREST (MBTF) & MESIC BROADLEAF FOREST

Mesic Broadleaf Terrestrial Forest (MBTF) and Mesic Broadleaf Forest (MSF) are rich habitat types that typically occur on rich, deep soils. Soils conditions are generally mesic to wet. Tree species typically include slippery elm (Ulmus rubra), black walnut (*Juglans nigra*), silver maple (*Acer saccharinum*), Acer box elder (*Acer negundo*), red maple (*Acer rubrum*), and tuliptree (*Liriotendron tulipifera*). Common shrubs consist of spice bush (*Lindera benzoin*) and silky dogwood (*Cornus amomum*). Typical herbs consist of Jewel weed (*Impatiens capensis*), clearweed (*Pilea pumila*), white avens (*Geum canadense*), and garlic mustard (*Alliaria petiolata*).

Botanical Field Survey Forms were recorded at each of the 5 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as MBTW and MSB can be found in Table 4 (Appendix D).

4.1.9 PALUSTRINE EMERGENT WETLAND

The Palustrine Emergent Wetland (PE) habitat type occurs sporadically throughout the project area, usually in association with the palustrine forested wetland (PF) and/or palustrine scrub-shrub wetland (PS) habitat types. PE is an herb dominated habitat that occurs on temporarily saturated to permanently flooded soils. Herbaceous vegetation typically consists of sedges (*Carex* spp.), soft rush (*Juncus effusus*), path rush (*Juncus tenuis*), rice-cut grass (*Leersia oryzoides*), smartweeds (*Persicaria* spp.), reed canary grass (*Phalaris arundinacea*), Jewel weed (*Impatiens* spp.), bulrushes (*Scirpus* spp.), and sensitive fern (*Onoclea sensibilis*). Tree and shrub cover is typically sparse within the habitat type. Representative species include slippery elm (*Ulmus rubra*), red maple (*Acer rubrum*), muscle wood (*Carpinus caroliniana*), American sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), black walnut (*Junglans nigras*), spice bush (*Lindera benzoin*), and dogswoods (*Cornus* spp.).

Botanical Field Survey Forms were recorded at each of the 10 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as PE can be found in Table 4 (Appendix D).

4.1.10 PALUSTRINE FORESTED FLOODPLAIN

The Palustrine Forested Wetalnd (PF) habitat type occurs sporadically throughout the project area, usually in association with the PE and/or PS habitat types. PF is a tree dominated habitat that occurs on temporarily saturated to permanently flooded soils. Common trees within the habitat consist of slippery elm (*Ulmus rubra*), black willow (*Salix nigra*), red maple (*Acer rubrum*), muscle wood (*Carpinus caroliniana*), American sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), ash (*Fraxinus* spp.), Eastern cottonwood (*Populus deltoids*), and black walnut (*Juglans nigra*). Shrubs may make up a significant part of the habitat. Typical shrubs consist of spice bush (*Lindera benzoin*), dogwoods (*Cornus* spp.), and American elder (*Sambucus nigra*). Herbaceous cover may be sparse to dense. Common herbs include sedges (*Carex* spp.), soft rush (*Juncus effusus*), path rush (*Juncus tenuis*), rice-cut grass (*Leersia oryzoides*), smartweeds (*Persicaria* spp.), reed canary grass (*Phalaris arundinacea*), Jewel weed (*Impatiens* spp.), bulrushes (*Scirpus* spp.), and sensitive fern (*Onoclea sensibilis*).

Botanical Field Survey Forms were recorded at each of the 9 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as PF can be found in Table 4 (Appendix D).

4.1.11 PALUSTRINE SCRUB-SHRUB WETLAND

The Palustrine Scrub-Shrub Wetland (PS) habitat type is rare within the project area and usually occurs in association with the PE and/or PF habitat types. PS is a shrub and immature tree dominated habitat that occurs on temporarily saturated to permanently flooded soils. This habitat is commonly associated with PE or PF habitats. Typical shrub species include spice bush (*Lindera benzoin*), dogwoods (*Cornus* spp.), and American elder (*Sambucus nigra*). Immature trees include slippery elm (*Ulmus rubra*), black willow (*Salix nigra*), red maple (*Acer rubrum*), muscle wood (*Carpinus caroliniana*), American sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), ash (*Fraxinus* spp.), Eastern cottonwood (*Populus deltoids*), and black walnut (*Juglans nigra*). Mature trees may be present, but do not make up a significant part of the habitat. Herbaceous cover may be sparse to dense. Common herbs include sedges (*Carex* spp.), soft rush (*Juncus effusus*), path rush (*Juncus tenuis*), rice-cut grass (*Leersia oryzoides*), smartweeds (*Persicaria* spp.), reed canary grass (*Phalaris arundinacea*), Jewel weed (*Impatiens* spp.), bulrushes (*Scirpus* spp.), and sensitive fern (*Onoclea sensibilis*).

Botanical Field Survey Forms were recorded at each of the 2 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as PS can be found in Table 4 (Appendix D).

4.1.12 PALUSTRINE SUCCESSIONAL FARM POND

The Palustrine Successional Farm Pond (PSFP) habitat is rare within the project area and only occurs once. Soil conditions within the habitat are wet to inundated. The habitat consists of a PE habitat type fringing an impounded farm pond. Typical herbaceous vegetation includes rice-cut grass (*Leersia oryzoides*), duck-potato (*Sagittaria latifolia*), arrow-leaved tear thumb (*Persicaria sagittata*), spike-rush (*Eleocharis obtuse*), Canada rush (*Juncus canadensis*), and bulrush (*Scirpus atrovirens*). No trees are present in the habitat, shrubs are sparse and include buttonbush (*Cephalanthus occidentalis*).

A Botanical Field Survey Form was recorded at the habitat area that are represented by this habitat category. A list of the recorded habitat areas that were categorized as PSFP can be found in Table 4 (Appendix D).

4.1.13 RIVERINE BROADLEAF TERRESTRIAL FOREST

The Riverine Broadleaf Terrestrial Forest (RBTF) habitat occurs sporadically throughout the project area adjacent to large streams and rivers. Soil conditions within the habitat are commonly mesic to wet and often sandy. Some areas may be seasonally saturated or ponded. Typical trees found in this habitat include American sycamore (*Platanus occidentalis*), bitter-nut hickory (*Carya cordiformis*), box elder (*Acer negundo*), black locust (*Robinia pseudoacacia*), sweet birch (*Betula lenta*), elm (*Ulmus* spp.), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), black willow (*Salix nigra*), and tuliptree (*Liriodendron tulipifera*). Shrubs include spice bush (*Lindera benzoin*), witch hazel (*Hamamelis virginiana*), dog wood (*Cornus* spp.), honeysuckle (*Lonicera* spp.). The herbaceous stratum is highly variable across the evaluated study area. Representative species include ramblers rose (*Rosa multiflora),* Japanese knotweed (*Polygonum cuspidatum*), river bank rye (*Elymus riparius*), Virginia bluebells (*Mertensia virginica*), buttercup (*Ranunculus spp.),* mother-of-the-evening (*Hesperis matronalis*), poison ivy (*Taraxicum officinale*), Virginia creeper (*Parthenocissus quinquefolia*), and Japanese stilt grass (*Microstegium vimineum*).

Botanical Field Survey Forms were recorded at each of the 6 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as RBTF can be found in Table 4 (Appendix D).

4.1.14 RIVERINE BROADLEAF TERRESTRIAL WOODLAND (RBTW)

The Riverine Broadleaf Terrestrial Woodland (RBTW) habitat type is rare and occurs only once in the project area. Soil conditions within the habitat are mesic to wet. Common tree species include sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), and black cherry (*Prunus serontina*). Shrubs include gray dogwood (*Cornus racemosa*), Flowering dogwood (*Cornus florida*), honeysuckle (*Lonicera* spp.), and black elder (*Sambucus nigra*). Herbs include garlic mustard (*Alliaria petiolata*), jewel weed (*Impatiens* spp.), early meadow rue (*Thalictrum dioicum*), buttercup (*Ranunculus* spp.), goldenrod (*Solidago* spp.), violets (*Viola* spp.), and rough bedstraw (*Galium asprellum*).

A Botanical Field Survey Form was recorded at the habitat area that are represented by this habitat category. A list of the recorded habitat areas that were categorized as RBTW can be found in Table 4 (Appendix D).

4.1.15 SERPENTINE GRASSLAND

The Serpentine Grassland (SGL) habitat is listed as a Community of Concern (COC) on the PNDI search receipt. The habitat is rare within the project area, with only a single instance of the habitat having been identified. The SGL habitat type is part of the "Serpentine barren complex". It is restricted to areas underlain by serpentinite bedrock. The dense, prairie-like graminoid cover is usually dominated by warm-season grasses (Zimmerman et al. 2012). Common vegetation identified included panic grass (*Panicum* sp.), little bluestem (*Schizachyrium scoparium*), sandrush (*Bulbostylis capillaris*), slender knotweed (*Polygonum tenue*), and common ragweed (*Ambrosia artemisiifolia*).

A Botanical Field Survey Form was recorded at the habitat area that are represented by this habitat category. A list of the recorded habitat areas that were categorized as SGL can be found in Table 4 (Appendix D).

4.1.16 TERRESTRIAL HERBACEOUS OPENING

The Terrestrial Herbaceous Opening (THO) habitat type is an herb dominated habitat that occurs commonly throughout the project area. The THO habitat type is usually associated with maintained ROWs and other non-residential/non-agricultural maintained herb communities. Soils conditions within the habitat are dry to mesic and commonly disturbed. Common herbaceous vegetation with the habitat includes garden birds-foot-trefoil (*Lotus corniculatus*), crown vetch (*Securigera varia*), clover (*Trifolium* spp.), great plantain (*Plantago major*), common yarrow (*Achillea millefolium*), Japanese stilt grass (*Microstegium vimineum*), cinquefoil (*Potentilla* spp.), goldenrod (*Solidago* spp.), and various grasses (Poaceae). Various small shrubs and saplings are also common in the habitat. Representative species include American beech (*Fagus grandifolia*), autumn olive (*Elaeagnus umbellata*), black locust (*Robinia pseudoacacia*), pitch pine (*Pinus rigida*), white pine (*Pinus strobus*), and red maple (*Acer rubrum*).

Botanical Field Survey Forms were recorded at each of the 21 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as THO can be found in Table 4 (Appendix D).

4.1.17 TERRESTRIAL OPEN MEADOW

The Terrestrial Open Meadow (TOM) habitat type is an herb dominated habitat that occurs sporadically throughout the project area. TOM habitat exhibits meadow type characteristics, with little or no disturbance evident. Soils conditions within the habitat are commonly dry to mesic. Common species include black-eyed-susan (*Rudbeckia hirta*), common milkweed (*Asclepias syriaca*), horse nettle (*Solanum carolinense*),

sunflower (*Helianthus* spp.), aster (*Symphyotrichum* spp.), Indian-hemp (*Apocynum cannabinum*), and various grasses (Poaceae).

Botanical Field Survey Forms were recorded at each of the 3 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as TOM can be found in Table 4 (Appendix D).

4.1.18 TERRESTRIAL SHRUB OPENING/TERRESTRIAL SHRUBLAND

The Terrestrial Shrub Opening/Terrestrial Shrubland (TS) habitat type occurs sporadically throughout the project area. TS is a shrub and immature tree dominated habitat that occurs on dry to mesic soils. Various shrub species observed include flowering dogwood (*Cornus florida*), redbud (*Cercis canadensis*), hawthorn (*Crataegus* spp.), Russian olive (*Elaeagnus angustifolia*), honeysuckle (*Lonicera* spp.), shrubby oak (*Quercus ilicifolia*), and viburnums (*Virburnum* spp.). Immature trees include black walnut (*Juglans nigra*), box elder (*Acer negundo*), pitch pine (*Pinus rigida*), white oak (*Quercus alba*), white pine (*Pinus strobus*), and red maple (*Acer rubrum*). Mature trees may be present, but do not make up a significant part of the habitat. Common herbs include cinquefoil (*Potentilla* spp.), whorled loosestrife (*Lysmachia quadrifolia*), common ragweed (*Ambrosia artemisifolia*), Virginia creeper (*Parthenocissus quinquefolia*), Northern dewberry (*Rubus flagellaris*), common black berry (*Rubus allegheniensis*), and goldenrod (*Solidago* spp.).

Botanical Field Survey Forms were recorded at each of the 6 habitat areas that are represented by this habitat category. A list of the recorded habitat areas that were categorized as TS can be found in Table 4 (Appendix D).

4.1.19 URBAN-RESIDENTIAL-DEVELOPED

Urban-Residential-Developed (URD) property consists of urban, residential, and developed areas. These areas are greatly influenced by anthropogenic disturbances and may completely lack vegetative communities or are generally made up of actively maintained vegetation and planted grasses. No botanical field survey forms were completed for this habitat type due to a lack of habitat suitability for any of the target species. A list of the recorded habitat areas that were categorized as URD can be found in Table 4 (Appendix D).F

4.2 AREAS OF CONCERN

4.2.1 AOC W8

A survey for thick-leaved meadow-rue (*Thalictrum coriaceum*) within AOC W8, located in Indiana County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygons. AOC W8 is located on private land and also within Pine Ridge Park. Area of Concern W8 is comprised of multiple habitat types including: BTW, MSB, MSF, THO, RBTF, and BTF. W8 was generally dominated by broadleaf terrestrial woodlands, broadleaf terrestrial forests, and terrestrial herbaceous openings [ROW]. Habitats are illustrated on the aerial habitat maps for AOC W8 (Figures 2-1 to 2-5, Appendix C). No potential habitat suitability for *T. coriaceum* exists within habitat areas A, D, E, F, H, or I. Habitat B is considered poor potential habitat. Moderate potential habitat suitability is present within habitats C and G. No *T. coriaceum* or any other SOSC was identified within AOC W8 during the 2014 field investigations (Table 4 and Table 5, Appendix D). The lack of substantial habitat suitability for the thick-leaved meadow-rue within AOC W8 is likely due to the prevalence of invasive species and moderate to high disturbances within the proposed LOD. Where potential habitat exists there are less invasives and a lower level of anthropologic disturbances.

4.2.2 AOC W9

A survey for purple-fringeless orchid (*Platanthera peramoena*) and shinning ladies'-tresses (*Spiranthes lucida*) within AOC W9, located in Indiana County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygons. As noted in the search receipt comments from the PA DCNR, potential low wooded stream side wet ROW habitat is known to exist with stream connectivity to known populations of these target species. AOC W9 is located on private land. Area of Concern W9 is comprised of multiple habitat types including: PE, PS, BTF, RBTF, THO, and URD. AOC W9 was generally dominated by multiple small palustrine emergent wetlands, broadleaf terrestrial forests, and terrestrial herbaceous openings [ROW]. Habitats are illustrated on the aerial habitat maps for AOC W9 (Figures 2-6 to 2-8, Appendix C). No potential habitat suitability for *P. peramoena* or *S. lucida* exists within habitat areas B, C, E, and F. Moderate potential habitat suitability is present within habitats A and D. No *P. peramoena* or *S. lucida* or any other SOSC was identified within AOC W9 during the 2014 field investigations (Table 4 and Table 5, Appendix D). The lack of more substantial habitat suitability for the AOC specific target SOSC within AOC W9 is likely due to the prevalence of invasive species and moderate to high disturbances within the proposed LOD. Where potential habitat exists there were more suitable general habitat characteristics, less invasives, and a lower level of anthropologic disturbances.

4.2.3 AOC W10

A survey for mountain bugbane (*Actaea podocarpa*) within AOC W10, located in Indiana and Cambria Counties, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygon. Potential wooded slope habitat for *A. podocarpa* within the project buffer was noted in the search receipt comments from the PA DCNR. AOC W10 is located on private land, State Gameland, and Gallitzen State Forest land. Area of Concern W10 is comprised of multiple habitat types including: THO, BTW, BTF, CBTF, RBTF, and PE. W10 was generally dominated by terrestrial herbaceous openings [ROW], broadleaf terrestrial woodlands, and broadleaf terrestrial forests. Habitats are illustrated on the aerial habitat maps for AOC W10 (Figures 2-8 to 2-19, Appendix C). No potential habitat suitability for *A. podocarpa* exists within habitat areas A1, A2, B1, B3, C1, C2, C4, D1, D2, E1, F, and G. Habitat B2 and E2 is considered poor potential habitat. Moderate potential habitat suitability is present within habitat C3. No *A. podocarpa* was identified within AOC W10 during the 2014 or subsequent 2015 field investigations (Table 4). While conducting additional botanical surveys for the federally listed Northeastern bulrush (*S. ancistrochaetus*) one population of PA state listed SOSC bushy bluestem (*Andropogon glomeratus*) was observed, identified, delineated, and photographed. A voucher was collected and submitted to the CMNH herbarium. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix G) and within Table 4 and in the Identified Species of Special Concern Table (Table 5, Appendix D). The lack of substantial habitat suitability for the mountain bugbane within AOC W10 is likely due to the prevalence of canopy coverage, fragmentation of habitats by ROWs, moderate disturbances within the proposed LOD. Where potential habitat exists there are less invasives and a lower level of anthropologic disturbances.

4.2.4 AOC ALT W1

A survey for mountain bugbane (*Actaea podocarpa*) within AOC ALT W1, located in Cambria and Blair Counties, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygon. Potential wooded slope habitat for *A. podocarpa* within the project buffer was noted in the search receipt comments from the PA DCNR. AOC ALT W1 is located on private land, State Gameland, and Gallitzen State Forest land. Area of Concern ALT W1 is comprised of multiple habitat types including: THO, THO/TS, BTW, PE, BTF, CBTW. ALT W1 was generally dominated by broadleaf terrestrial woodlands, broadleaf terrestrial forests, and terrestrial herbaceous openings [ROW]. Habitats are illustrated on the aerial habitat maps for AOC ALT W1 (Figures 2-20 to 2-31, Appendix C). No potential habitat suitability for

A. podocarpa exists within any of the recorded habitat areas. No *A. podocarpa* was identified within AOC ALT W1 during the 2014 or subsequent 2015 field investigations (Table 4). While conducting additional botanical surveys for the federally listed Northeastern bulrush (*S. ancistrochaetus*) one population of state and federally listed Northeastern bulrush was identified. Additionally, during the same survey 5 populations of PA state listed SOSC bushy bluestem (*Andropogon glomeratus*) were observed, identified, delineated, and photographed. A voucher of each was collected and submitted to the CMNH herbarium. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix G) and within Table 4 and in the Identified Species of Special Concern Table (Table 5, Appendix D). The lack of potential habitat suitability for the mountain bugbane within AOC ALT W1 is likely due to the lack of general suitable habitat characteristics within the AOC, lack of suitable moisture levels, fragmentation of potential habitat by ROWs, and moderate disturbances within the proposed LOD.

4.2.5 AOC ALT W3

A survey for low serviceberry (*Amelanchier humilis*) and roundleaf serviceberry (*Amelanchier sanguinea*) within AOC ALT W3, located in Blair County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygons. As noted in the search receipt comments from the PA DCNR, potential rock outcrop habitat with connectivity to documented populations of these target species may exist within this AOC. AOC ALT W3 is located on entirely on privately owned land. Area of Concern ALT W3 is comprised of four distinct habitat types including: BTW, BTF, THO, and TS. This AOC was generally dominated by broadleaf terrestrial woodland and terrestrial herbaceous openings [ROW]. Habitats are illustrated on the aerial habitat maps for AOC ALT W3 (Figures 2-32 to 2-33, Appendix C). No potential habitat suitability for *A. humilis* or *A. sanguinea* exists within recorded habitat areas D, F, or H of AOC ALT W3. Recorded habitat area B provided poor potential habitat suitability for the two target SOSC. Moderate potential habitat suitability is present within habitat G. No *A. humilis* or *A. sanguinea* or any other SOSC was identified within AOC ALT W3 during the 2014 or subsequent 2015 field investigations (Table 4 and Table 5, Appendix D). The lack of more substantial habitat suitability for the AOC specific target SOSC within AOC ALT W3 is likely due to the moderate to high disturbances associated with private land owner development and management within the proposed LOD. Where potential habitat exists there were more suitable general habitat characteristics, less invasives, and a lower level of anthropologic disturbances.

4.2.6 AOC ALT W4

A survey for Torrey's rush (*Juncus torreyi*) and Marguerite's clubmoss (*Lycopodiella margueritae*) within AOC ALT W4, located in Blair County, Pennsylvania was assigned due to potential habitat suitability within palustrine emergent wetlands present in the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, potential wetland habitat with some wetland areas containing acidic conditions may provide suitable potential habitat for these AOC specific target species. AOC ALT W4 is located entirely on privately owned land. As discussed in the Methods (Section 3.0) SPLP will now be crossing AOC ALT W4 utilizing a horizontal directional bore (HDD) which will avoid impacts to any potential SOSC in the un-surveyed potion of this AOC. The directional bore underneath AOC ALT W4 will travel from outside of the original surveyed corridor and end up within areas that had been reviewed in the 2014 evaluated survey corridor through the AOC. The 2014 surveyed corridor through AOC ALT W4 is comprised of five distinct habitat types including: PE, TOM, TS, PF, and MBTW. This AOC was generally dominated by palustrine emergent wetlands, terrestrial shrub floodplain and openings, and mesic broadleaf terrestrial woodland. Habitats are illustrated on the aerial habitat maps for AOC ALT W4 (Figure 2-34, Appendix C). No potential habitat suitability for *L. margueritae* exists within any of the recorded habitat areas except habitat area F, which contains moderate potential habitat suitability for Marguerite's clubmoss. Habitat areas A and E provide poor habitat suitability for Torrey's rush. No potential habitat suitability for *J. torreyi* exists elsewhere within AOC ALT W4. No *J. torreyi* or *L. margueritae* or any other SOSC was identified within AOC ALT W4 during the 2014 field investigations (Table 4 and Table 5, Appendix D). The lack of more substantial habitat suitability for the AOC specific target SOSC within AOC ALT W4 is likely

due to the prevalence of invasive species and moderate to high disturbances within the proposed LOD. Where potential habitat exists there were more suitable general habitat characteristics, less invasives, and a lower level of anthropologic disturbances.

4.2.7 AOC W13

A survey for Torrey's rush (*Juncus torreyi*) and Marguerite's clubmoss (*Lycopodiella margueritae*) within AOC W13, located in Blair County, Pennsylvania was assigned due to potential habitat suitability within palustrine emergent wetlands present in the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, potential wetland habitat with some wetland areas containing acidic conditions may provide suitable potential habitat for these AOC specific target species. AOC W13 is located entirely on privately owned land. AOC W13 is comprised of two distinct habitat types including: PE and PSFP. This AOC was dominated by palustrine emergent wetlands and a palustrine successional farm pond. Habitats are illustrated on the aerial habitat maps for AOC W13 (Figure 2-35, Appendix C). No potential habitat suitability for *L. margueritae* exists within either of the recorded habitat areas. Good potential habitat suitability for *J. torreyi* exists within both recorded habitats within AOC W13. No *J. torreyi* or *L. margueritae* or any other SOSC was identified within AOC W13 during the 2014 field investigations (Table 4 and Table 5, Appendix D). The lack of more substantial habitat suitability for the AOC specific target SOSC within AOC W13 is likely due to the high level and frequency of disturbances within the proposed LOD. Where potential habitat exists there were more suitable general habitat characteristics.

4.2.8 AOC W14

A survey for shale barren pussytoes (*Antennaria virginica*) within AOC W14, located in Blair County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, the potential dry open woodland habitat with a Virginia pine (*Pinus virginiana*) canopy and acidic shale soils may provide potentially suitable habitat for *A. virginica* within the assigned AOC. AOC W14 is located entirely on privately owned land. Area of Concern W14 is comprised of eight distinct habitat types including: CBTF, BTF, CTF, THO, CBTW, and BTW. W14 was generally dominated by broadleaf terrestrial woodlands, coniferous - broadleaf terrestrial woodland, and coniferous terrestrial forest. Good or moderate potential habitat suitability for *A. virginica* existed within all of the recorded habitat areas except habitats H and I. 20 populations of *A. virginica* were observed, identified, delineated, and photographed. . A voucher was collected and submitted to the CMNH herbarium. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix D) and within Tables 4 and 5 (Appendix I). Habitats and identified SOSC populations are illustrated on the aerial habitat maps for AOC W14 (Figures 2-36 to 2-38, Appendix C). No other SOSC were identified within AOC W14 during the 2014 field investigation. The lack of habitat suitability for the shale barren pussytoes within recorded habitat areas H and I was directly correlated to the density of invasives and high level of disturbance present within these habitat areas.

4.2.9 AOC W15 & ALT W5

A survey for thick-leaved meadow-rue (*Thalictrum coriaceum*) and spreading rockcress (*Arabis patens*) within AOC W15 and AOC ALT W5, located in Blair County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygons. A locally documented population of *T. coriaceum* was located within Project buffer and potentially suitable stony woodland habitat may exist within the Project buffer. AOC W15 and AOC ALT W5 were combined due to their proximity to one another, similarity in target SOSC request, and similar potential habitat throughout each AOC. Tetra Tech assumed that the habitat that exists between these two AOC polygons [through which an access road travels] would need to be surveyed for the same two listed target SOSC. AOC W15 and AOC ALT W5 are located on

private land and State Gamelands. Areas of Concern W15 and ALT W5 are comprised of five distinct habitat types including: BTW, BTF, CBTF, RBTW, and THO. AOC W15 and AOC ALT W5 were generally dominated by broadleaf terrestrial woodlands and broadleaf terrestrial forests. Habitats are illustrated on the aerial habitat maps for AOC W8 (Figures 2-39 to 2-49, Appendix C). No potential habitat suitability for *T. coriaceum* exists within habitat areas A, B, C, D, H, J, K, or L. Habitat E is considered moderate potential habitat for *A. patens*. Poor potential habitat suitability for *A. patens* is present within habitats E, F, and I. No potential habitat suitability for *A. patens* exists within habitat areas A, C, D, H, I, J, or L. Habitat G is considered good potential habitat for *T. coriaceum*. Poor potential habitat suitability for *T. coriaceum* is present within habitats B, D, F, and K. No *T. coriaceum*, *A. patens*, or any other SOSC was identified within AOC W15 and AOC ALT W5 during the 2014 and subsequent 2015 field investigations (Table 4 and Table 5, Appendix D). The lack of substantial habitat suitability for the thick-leaved meadow-rue and spreading rockcress within AOC W15 and AOC ALT W5 is likely due to a general lack in suitable habitat characteristics and the moderate disturbances within the AOCs. Where potential habitat exists there are more suitable SOSC specific habitat characteristics and a lower level of anthropologic disturbances.

4.2.10 AOC W16 & ALT W6

A survey for shale-barren evening primrose (*Oenothera argillicola*) and Kate's mountain clover (*Trifolium virginicum*) within AOC W16 and AOC ALT W6, located in Huntingdon County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygons. As noted in the search receipt comments from the PA DCNR, potential steep shale derived soils may provide habitat for these two AOC specific target species. AOC W16 and AOC ALT W6 were combined due to their proximity to one another, similarity in target SOSC request, and similar potential habitat throughout each AOC. Tetra Tech assumed that the habitat that exists between these two AOC polygons [through which an access road travels] would need to be surveyed for the same two listed target SOSC. AOC W16 and AOC ALT W6 are located on private land and within the Raystown Lake Recreation Area. Areas of Concern W16 and ALT W6 are comprised of ten distinct habitat types including: THO, PF, BTF, MSB, AG/FF, BTW, CBTF, PE, TS, BTF, and TOM. AOC W16 and AOC ALT W6 were generally dominated by broadleaf terrestrial forest, coniferous - broadleaf terrestrial forests, and terrestrial herbaceous openings [ROW]. Habitats are illustrated on the aerial habitat maps for AOC W16 and AOC ALT W6 (Figures 2-50 to 2-59, Appendix C). No potential habitat suitability for *O. argillicola* or *T. virginicum* exists within habitat areas A1, A2, A6, B, C1, C2, D1, D2, E, F, G, H, I, J, K, L, M, N, or P. Habitats A3, A4, A5, and O were considered poor potential habitat for *O. argillicola* and *T. virginicum*. No *O. argillicola*, *T. virginicum*, or any other SOSC was identified within AOC W16 and AOC ALT W6 during the 2014 and subsequent 2015 field investigations (Table 4 and Table 5, Appendix D). The lack of substantial habitat suitability for the shale-barren evening primrose and Kate's mountain clover within AOC W16 and AOC ALT W6 is likely due to a general lack in suitable habitat characteristics and the moderate disturbances associated with ROW maintenance in these AOCs. Where potential habitat exists there are more suitable SOSC specific habitats characteristics like open, shale derived soil slopes and a lower level of anthropologic disturbances.

4.2.11 AOC E1

A survey for Short's sedge (*Carex shortiana*) within AOC E1, located in Juniata County, Pennsylvania was assigned due to potential habitat suitability and three known documented populations within the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, three documented occurrences of *C. shortiana* are documented within this polygon and potential habitat exists elsewhere within the assigned AOC. AOC E1 is located entirely on privately owned land. Area of Concern E1 is comprised of three distinct habitat types including: BTF, PF, and THO. The coverage of the three recorded habitat areas were split evenly across AOC E1. Good potential habitat suitability for *C. shortiana* existed within all of the recorded habitat areas. Five populations of *C. shortiana* were observed, identified, delineated, and photographed. A voucher was collected and submitted to the CMNH herbarium. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix D) and within Tables 4 and 5 (Appendix I). Habitats and identified SOSC

populations are illustrated on the aerial habitat maps for AOC E1 (Figure 2-60, Appendix C). No other SOSC were identified within AOC E1 during the 2014 field investigations.

4.2.12 AOC E2

A survey for racemed milkwort (*Polygala polygama*) within AOC E2, located in Perry County, Pennsylvania was assigned due to potential habitat and a known documented population within the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, a documented occurrence lies on a pipeline ROW in the Tuscarora State Forest lands within the assigned AOC. AOC E2 is located entirely within the Tuscarora State Forest land and specifically within a documented botanical plant sanctuary for the *P. polygama*. Area of Concern E2 is comprised of three distinct habitat types including: BTW, CBTW, and THO. E2 was generally dominated by broadleaf terrestrial woodlands and a shaley terrestrial herbaceous opening [ROW]. Good potential habitat suitability for *P. polygama* existed within the terrestrial herbaceous opening [ROW] recorded habitat area that runs through the botanical plant sanctuary. Five populations of *P. polygama* were observed, identified, delineated, and photographed. A voucher was collected in 2014 and submitted to the CMNH herbarium. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix D) and within Tables 4 and 5 (Appendix I). Habitats and identified SOSC populations are illustrated on the aerial habitat maps for AOC E2 (Figure 2-61, Appendix C). No other SOSC were identified within AOC E2 during the 2014 field investigation.

4.2.13 AOC E3

A survey for Missouri gooseberry (*Ribes missouriensis*), beardtongue (*Penstemon canescens*), and limestone petunia (*Ruellia strepens*) within AOC E3, located in Cumberland County, Pennsylvania was assigned due to a known occurrence of one of the SOSC present south of the proposed alignment and potential habitat suitability for the SOSC within the PA DCNR defined AOC polygon. AOC E3 is located entirely on privately owned land. Area of Concern E3 is comprised of four distinct habitat types including: BTW, BTF, THO/TS, and URD. E3 was generally dominated by broadleaf terrestrial woodlands and urban-residential-developed habitat types. Good habitat suitability for *R. missouriensis* existed within recorded habitat areas A and B. Poor potential habitat suitability for *P. canescens* was present within habitat B. There was no potentially suitable habitat for *R. strepens* within AOC E3. Six populations of *R. missouriensis* were observed, identified, delineated, and photographed. A voucher was collected in 2014 and submitted to the CMNH herbarium. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix G) and within Tables 4 and 5 (Appendix D). Habitats and identified SOSC populations are illustrated on the aerial habitat maps for AOC E3 (Figure 2-62, Appendix C). No other SOSC were identified within AOC E3 during the 2014 field investigations. The lack of habitat suitability for the beardtongue and limestone petunia within E3 is likely due to the prevalence of invasive species and moderate to high disturbances associated with property owner landuse in the areas surrounding the URD habitat type. Where potential habitat exists there were more suitable general habitat characteristics, less invasives, and a lower level of anthropologic disturbances.

4.2.14 AOC E4

A survey for Missouri gooseberry (*Ribes missouriensis*), beardtongue (*Penstemon canescens*), limestone petunia (*Ruellia strepens*), and stalked wild-petunia (*Ruellia pedunculata*) within AOC E4, located in Cumberland County, Pennsylvania was assigned due to a known occurrence of one of the SOSC present south of the proposed alignment and potential habitat suitability for the SOSC within the PA DCNR defined AOC polygon. AOC E4 is located entirely on privately owned land. Area of Concern E4 is comprised of three distinct habitat types including: BTW, THO/TS, and AG/FF. E4 was generally dominated by broadleaf terrestrial woodlands. Good habitat suitability for *R. missouriensis* existed within recorded habitat area A.

There was no potentially suitable habitat for *P. canescens*, *R. strepens,* or *R. pedunculata* within AOC E4. One population of *R. missouriensis* was observed, identified, delineated, and photographed. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix G) and within Tables 4 and 5 (Appendix D). Habitats and identified SOSC populations are illustrated on the aerial habitat maps for AOC E4 (Figure 2-63, Appendix C). No other SOSC were identified within AOC E4 during the 2014 field investigations. The lack of habitat suitability for the beardtongue and petunias within E4 is likely due to the moderate to high disturbances associated with property owner landuse in the areas surrounding the AG/FF habitat type. Where potential habitat exists there were more suitable habitat characteristics, less invasives, and a lower level of anthropologic disturbances.

4.2.15 AOC E6

A survey for Eastern prickly-pear cactus (*Opuntia humifusa*) and slender goldenrod (*Solidago erecta*) within AOC E6, located in Cumberland County, Pennsylvania was assigned due to known potential habitat and a documented population within the PA DCNR defined AOC polygon. AOC E6 is located entirely on privately owned land. Area of Concern E6 is comprised of three distinct habitat types including: BTW, TS, and THO. E6 was generally dominated by broadleaf terrestrial woodland and terrestrial herbaceous openings. Good or moderate potential habitat suitability for *O. humifusa* and *S. erecta* existed within recorded habitat areas A and B. Four populations of *O. humifusa* were observed, identified, delineated, and photographed. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix D) and within Tables 4 and 5 (Appendix I). Habitats and identified SOSC populations are illustrated on the aerial habitat maps for AOC E6 (Figure 2-64, Appendix C). No other SOSC were identified within AOC E6 during the field investigation.

4.2.16 AOC E8

A survey for Eastern prickly-pear cactus (*Opuntia humifusa*) and limestone petunia (*Ruellia strepens*) within AOC E8, located in Cumberland County, Pennsylvania was assigned due to potential habitat and soil suitability within the PA DCNR defined AOC polygon. AOC E8 is located entirely on private land. Area of Concern E8 is comprised of three habitat types including: TS, BTW, and THO. E8 was generally dominated by broadleaf terrestrial woodlands. Habitats are illustrated on the aerial habitat maps for AOC E8 (Figure 2-65, Appendix C). Poor potential habitat suitability for *O. humifusa* exists within habitat areas A and B. Habitat C contains no potential habitat for the eastern prickly-pear cactus. No potential suitable habitat for *R. strepens* is present within AOC E8. No *O. humifusa*, *R. strepens*, or any other SOSC was identified within AOC E8 during the 2014 field investigation (Table 4 and Table 5, Appendix D). The lack of substantial habitat suitability for the Eastern prickly-pear cactus and limestone petunia within AOC E8 is likely due to the prevalence of canopy coverage, fragmentation of habitats by ROWs and residential development, and moderate disturbance within the proposed LOD. Where potential habitat exists there are less invasives and a lower level of anthropologic disturbances.

4.2.17 AOC E11

A survey for tooth-cup (*Rotala ramosior*) within AOC E11, located in Cumberland County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, potential suitable habitat for *R. ramosior* if there are any open wet swampy areas within this mostly forested swamp. AOC E11 is located entirely on private land. Area of Concern E11 is comprised of two habitat types including: PE and PF. E11 was generally dominated by palustrine wetlands. Habitats are illustrated on the aerial habitat map for E11 (Figure 2-66, Appendix C). Moderate and poor potential habitat suitability for *R. ramosior* exists within AOC E11. No *R. ramosior* or any other SOSC was identified within AOC E11 during the 2014 field investigation (Table 4 and Table 5, Appendix D). Potential habitat for the tooth-cup is present, but the SOSC wasn't identified within AOC E11,

likely due to the prevalence of canopy coverage, fragmentation of habitats by ROWs and residential development disturbance within the proposed LOD.

4.2.18 AOC E12

A survey for ellisia (*Ellisia nyctelea*) within AOC E12, located in York County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, a narrow patch of potential marginal habitat for *E. nyctelea* may be present within AOC E12. AOC E12 is located entirely on private railroad land. Area of Concern E12 is comprised of two habitat types including: RBTF and PF. E12 was generally dominated by palustrine forested floodplain. Habitats are illustrated on the aerial habitat map for E12 (Figure 2-67, Appendix C). Poor potential habitat suitability for *E. nyctelea* exists within recorded habitat area A. No potential habitat existed for this SOSC within habitat area B due to the hich scouring and lack of herbaceous vegetation within this habitat. No *E. nyctelea* or any other SOSC was identified within AOC E12 during the 2014 field investigation (Table 4 and Table 5, Appendix D). Potential habitat for Ellisia is present, but the SOSC wasn't identified within AOC E12, likely due to the prevalence of canopy coverage, frequency of scouring events from the Susquehanna River, and railway disturbances within the proposed LOD.

4.2.19 AOC E13

A survey for ellisia (*Ellisia nyctelea*) within AOC E13, located in Dauphin County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, a possible ravine rich enough to sustain *E. nyctelea* may be present within AOC E13. AOC E13 is located entirely on private land. Area of Concern E13 is comprised of four habitat types including: MBTW, MBTF, PF, and RBTF. E13 was equally divided between the four separate habitat types. Habitats are illustrated on the aerial habitat map for E13 (Figure 2-68, Appendix C). Moderate and poor potential habitat suitability for *E. nyctelea* exist within habitats A, B, and C of AOC E13. No *E. nyctelea* or any other SOSC was identified within AOC E11 during the 2014 field investigation (Table 4 and Table 5, Appendix D).

4.2.20 AOC E14

A survey for water sedge (*Carex aquatilis*) within AOC E14, located in Berks County, Pennsylvania was assigned due to a documented population of the SOSC and potential habitat suitability within the PA DCNR defined AOC polygon. As noted in the search receipt comments from the PA DCNR, an open sedge fen with a documented occurrence of *C. aquatilis* is located within the limit of disturbance polygon. AOC E14 is located entirely on private land. Area of Concern E14 is comprised of four habitat types including: TOM, BTW, PF/PS/PE, and PF. E14 was generally dominated by a palustrine wetland complex. Habitats are illustrated on the aerial habitat map for E14 (Figure 2-69, Appendix C). No potential habitat suitability is present within recorded habitat areas A and B. Poor potential habitat suitability for water sedge exists within the disturbed wetland complex present within AOC E14. Good habitat suitability for *C. aquatilis* is present within fen palustrine forested wetland habitat D. No *C. aquatilis* was identified within AOC E14 during the 2015 field investigation, but a similarly looking species *Carex stricta* was found in numerous clumps within habitat D (Table 4 and Table 5, Appendix D). *C. stricta* could have easily been mistaken in the past with *C. aquatilis*. A voucher sample of the *C. stricta* was submitted to the CMNH herbarium for identification confirmation. The sedge was confirmed to be *C. stricta*.

4.2.21 AOC E15

A survey for log fern (*Dryopteris celsa*) and netted chain fern (*Woodwardia areolata*) within AOC E15, located in Berks County, Pennsylvania was assigned due to potential habitat suitability within the PA DCNR defined AOC polygon. Potential habitat for these two fern species may exist in the moist woods within the Project buffer. AOC E15 is located on municipal owned land. Area of Concern E15 is comprised of two distinct habitat types including: BTF and THO. AOC E15 is generally dominated by broadleaf terrestrial forest. Habitats are illustrated on the aerial habitat maps for AOC E15 (Figure 2-70, Appendix C). No potential habitat suitability for *D. celsa* or *W. areolata* exists within habitat A. Habitat B is considered poor potential habitat for the two SOSC. No *D. celsa*, *W. areolata*, or any other SOSC was identified within AOC E15 during the 2014 field investigation (Table 4 and Table 5, Appendix D). The lack of potential habitat suitability for the log fern and netted chain fern within AOC E15 is likely due to a general lack in suitable habitat characteristics and the moderate disturbances within the AOC. Where potential habitat exists there are more suitable SOSC specific habitat characteristics and a lower level of anthropologic disturbances.

4.2.22 AOC E17

A survey for Nuttall's tick trefoil (*Desmodium nuttallii*) within AOC E17, located in Blair County, Pennsylvania was assigned due to a documented occurrence of *D. nuttallii* present of within the PA DCNR defined AOC polygon. AOC E17 is located entirely on PA turnpike property. Area of Concern E17 is comprised of two distinct habitat types including: BTF and THO. Good habitat suitability for *D. nuttallii* exists within habitat area A. Two populations of *D. nuttallii* were observed, identified, delineated, and photographed. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix D) and within Tables 4 and 5 (Appendix I). Habitats and identified SOSC populations are illustrated on the aerial habitat maps for AOC E17 (Figure 2-71, Appendix C). No other SOSC were identified within AOC E17 during the 2014 field investigation.

4.2.23 AOC E19

A survey for round-leaved fame-flower (*Phemeranthus teretifolius*), plain ragwort (*Packera anonyma*), annual fimbry (Fimbristylis annua), serpentine aster (Symphyotrichum depauperatum) within AOC E19, located in Chester County, Pennsylvania was assigned due to documented occurences of the AOC Specific target SOSC the potential habitat suitability for those SOSC within the PA DCNR defined AOC polygon. The search receipt comments from the PA DCNR state that documented occurrences of these species were present in this AOC, but the site [AOC] looks like it's been developed; small remnants of habitat possible; also, potential serpentine grassland habitat may be present. Area of Concern E19 is comprised of two distinct habitat types including: BTF and SGL. E19 was generally dominated by broadleaf terrestrial woodlands, but recorded habitat A represents a serpentine grassland habitat. The COC of interest within AOC E19 was identified, documented, and photographed. Good potential habitat suitability for all four AOC specific SOSC exists within the serpentine grassland habitat A. No potential suitable habitat exists within the broadleaf terrestrial woodland habitat. Three populations of *P. anonyma* and two populations of *P. teretifolius* were observed, identified, delineated, and photographed. Vouchers were collected in 2014 and submitted to the CMNH herbarium. Detailed information on population locations, numbers, habitat characteristics, and more is provided on the botanical field survey forms (Appendix G) and within Tables 4 and 5 (Appendix D). Habitats and identified SOSC populations are illustrated on the aerial habitat maps for AOC E19 (Figure 2-72, Appendix C). No other SOSC were identified within AOC E19 during the 2014 field investigations.

5.0 CONCLUSIONS

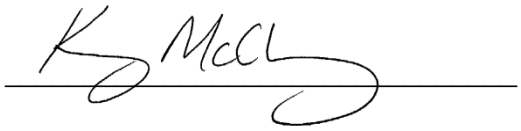
Field surveys were conducted during the 2014 and 2015 growing seasons within each of the assigned AOCs that the proposed pipeline Project traverses. Surveys were conducted during the appropriate time of year for the AOC specific target SOSC listed in the PA DCNR response letter. Although potential habitat for the target species was observed within the botanical survey corridor (Appendix I, Table 4), the prevalence of invasive species and human activities have reduced the potential for suitable habitat in which many of these species occur. Other disturbances include agriculture, grazing, logging, construction, residential development, periodic herbicide treatment, and mowing. These anthropogenic impacts extend throughout significant portions of the project and have severely limited the potential for target SOSCs and their associated habitats.

Sixty-three separate occurrences of PA state listed SOSCs were identified in 11 different AOCs. Eight of the 63 occurrences were identified outside of the 23 investigated AOCs (Table 5). Of the 63 populations of state listed target species identified during the botanical survey of the Project, one population of the federally listed Northeastern bulrush (*S. ancistrochaetus*) was observed. The Northeastern bulrush population was located within AOC ALT W1 during the USFWS requested Northeastern bulrush survey. The federally listed occurrence is located within a wetland that is anticipated to be HDD bored. All SOSC population information including SOSC identified, numbers of populations and individuals per population, AOCs of occurrences, population coordinate locations, and information regarding whether a voucher specimen was taken and submitted to a PA DCNR recognized herbarium is provided in Table 5. One Community of Concern (COC) was identified during the botanical survey within AOC E19. The serpentine grassland vegetative community with multiple SOSCs identified within it was observed outside of the anticipated LOD. Details concerning this habitat can be found in the serpentine grassland habitat description and in the AOC E19 descriptions.

Voluntary best management practices will be utilized when possible to minimize impacts to these SOSC populations unless further conservation measures are required by the PA DCNR.

6.0 SIGNATURES AND CONTACT INFORMATION

I hereby certify that the results contained within this survey report are accurate and that I am authorized under PA DCNR Wild Plant Management Permit Number 15-624 to conduct this botanical survey.



Korey McCluskey

Environmental Scientist IV – Department Technical Lead

Korey.McCluskey@tetratech.com

412-920-8614

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APPENDIX A
Agency Coordination

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

January 30, 2014 **PNDI Number: 22275**

Preston Smith
Tetra Tech
661 Andersen Drive
Pittsburgh, PA 15220
Email: preston.smith@tetratech.com

Re: Sunoco Mariner East 2 Pipeline
Trans-Pennsylvania

Dear Mr. Smith,

Thank you for the submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Project Number 22024 for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only. **The proposed project will affect State Forest Lands within the Gallitzin State Forest District**. Further coordination with the Bureau of Forestry is required (see "Projects on State Forest Lands").

Potential Impact Anticipated

PNDI records indicate species or resources under DCNR's jurisdiction are located in the project vicinity. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern.

Plant Species of Concern:

Scientific Name	Common Name	PA Current Status	PA Proposed Status	AOC (West and East)
Actaea podocarpa	Mountain Bugbane	Threatened	Rare	W10, W11
Amelanchier humilis	Low Serviceberry	Undetermined	Endangered	W12
Amelanchier sanguinea	Roundleaf Serviceberry	Undetermined	Endangered	W12
Antennaria virginica	Shale Barren Pussytoes	Not Listed	Rare	W14
Arabis patens	Spreading Rockcress	Not Listed	Threatened	W15
Asplenium pinnatifidum	Lobed Spleenwort	Not Listed	Rare	W6
Astragalus canadensis	Canadian Milkvetch	Not Listed	Undetermined	(W6)
Baptisia australis	Blue False-indigo	Not Listed	Threatened	W3
Carex aquatilis	Water Sedge	Threatened	Threatened	E14
Carex shortiana	Short's Sedge	Not Listed	Rare	W1, E1
Delphinium exaltatum	Tall Larkspur	Endangered	Endangered	W6
Desmodium nuttallii	Nuttall's Tick Trefoil	Unlisted	Threatened	E17
Dryopteris celsa	Log Fern	Unlisted	Endangered	E15
Ellisia nyctelea	Ellisia	Threatened	Threatened	E12, E13
Erythronium albidum	White Trout-lily	Not Listed	Undetermined	(W3), (W6)
Fimbristylis annua	Annual Fimbry	Threatened	Threatened	E18, E19, E21
Gentiana saponaria	Soapwort Gentian	Undetermined	Endangered	E20, E22
Iodanthus pinnatifidus	Purple Rocket	Endangered	Endangered	W3, W4, W6
Juncus biflorus	Grass-leaved Rush	Undetermined	Threatened	E20, E22
Juncus torreyi	Torrey's Rush	Threatened	Rare	W6, W11, W13
Leucothoe racemosa	Swamp Dog-Hobble	Undetermined	Threatened	E20, E22
Lycopodiella margueritae	Marguerite's Clubmoss	Not Listed	Endangered	W11, W13
Oenothera argillicola	Shale-barren Evening-primrose	Threatened	Threatened	W16
Opuntia humifusa	Eastern Prickly Pear-Cactus	Rare	Rare	E5, E6, E7, E8

Packera anonyma	Plain ragwort	Threatened	Threatened	E18, E19, E21
Passiflora lutea	Yellow Passion-flower	Endangered	Threatened	W6
Penstemon canescens	Beardtongue	Not listed	Undetermined	(E3), (E4)
Phemeranthus teretifolius	Round-leaved Fame-Flower	Threatened	Threatened	E18, E19, E21
Platanthera peramoena	Purple-fringeless Orchid	Undetermined	Threatened	W9
Polygama polygala	Racemed Milkwort	Undetermined	Endangered	E2
Quercus phellos	Willow Oak	Endangered	Endangered	E20, E22
Ribes missouriensis	Missouri Gooseberry	Endangered	Endangered	E3
Rotala ramosior	Tooth-cup	Rare	Rare	E9, E10, E11
Ruellia pedunculata	Stalked wild-petunia	Not listed	Undetermined	(E4)
Ruellia strepens	Limestone Petunia	Threatened	Threatened	E3, E4, E8
Smallanthus uvedalius	Hairy Leafcup	Not Listed	Rare	W6
Solidago erecta	Slender Goldenrod	Endangered	Endangered	E6
Spiranthes lucida	Shining Ladies'-tresses	Not Listed	Threatened	W9
Symphyotrichum depauperatum	Serpentine Aster	Threatened	Threatened	E18, E19, E21
Thalictrum coriaceum	Thick-leaved Meadow-rue	Endangered	Threatened	W8, W15
Trifolium virginicum	Kate's Mountain Clover	Endangered	Endangered	W16
Trillium nivale	Snow Trillium	Rare	Rare	W2, W5, W6, W7
Woodwardia areolata	Netted chain fern	Unlisted	Threatened	E15

Communities of Concern:

Community	Global Rank	State Rank	AOC
Red-cedar Mixed Hardwood Rich Shale Woodland	GNR	S1S2	(W16)
Serpentine Grassland	GNR	S1	(E18), (E19), (E21)
Yellow Oak – Redbud Woodland	GNR	S2	(W6)

Please see the following resource for more information on these plant communities:
http://www.naturalheritage.state.pa.us/fikebook.aspx

Survey Request
DCNR requests a survey for the following species:

- ***Actaea podocarpa* (Mountain Bugbane):** locally documented in rich moist woods within stream valleys; prefers rich moist wooded slopes and coves in the mountains; flowers in August
- ***Amelanchier humilis* (Low Serviceberry):** locally documented on a steep rocky shrubby hillside; prefers dry open high ground and bluffs; flowers April – mid May; fruits June – early July
- ***Amelanchier sanguinea* (Roundleaf Serviceberry):** locally documented on a steep rocky shrubby hillside; prefers open woods, rocky slopes, and barrens; flowers mid April – late May; fruits June – early July
- ***Antennaria virginica* (Shale Barren Pussytoes):** locally documented on a dry open shale bank; prefers dry woods and openings; flowers late April – June
- ***Arabis patens* (Spreading Rockcress):** locally documented on a rocky wooded limestone slope; prefers moist rocky woods; flowers April – July
- ***Asplenium pinnatifidum* (Lobed Spleenwort):** locally documented on a vertical slope; prefers crevices of dry lightly shaded cliffs of noncalcareous rocks; evergreen
- ***Astragalus canadensis* (Canadian Milkvetch):** locally documented on a steep limey outcrop; prefers rocky roadside banks, limestone ledges, and shale barrens; flowers late June – early August
- ***Baptisia australis* (Blue False-indigo):** locally documented on a deciduous forest slope; prefers open woods, stream banks, and sandy floodplains; flowers May – June
- ***Carex aquatilis* (Water Sedge):** locally documented in an open seep; prefers marshy swales in more calcareous areas
- ***Carex shortiana* (Short's Sedge):** locally documented in a sedge-graminoid wet meadow; prefers calcareous wet meadows, swamps, and rich woods; fruits May – late July

- ***Delphinium exaltatum* (Tall Larkspur):** locally documented dry calcareous forest slopes; prefers rich shaded woods and rocky limestone bluffs; flowers July – August
- ***Desmodium nuttallii* (Nuttall's tick-trefoil)**; locally documented on a NE-facing slope in partial light with dry-mesic moisture in middle of pipeline; prefers open woods and edges; flowers July-September
- ***Dryopteris celsa* (Log Fern):** locally documented in a wet thicket along brook on steep rocky slope; prefers seepage slopes, hummocks, and logs in swamps; survey summer-fall
- ***Ellisia nyctelea* (Ellisia):** locally documented on a xeric flat lower slope with open partial light; prefers damp, shady stream banks with rich alluvial soils and sometimes in disturbed ground
- ***Erythronium albidum* (White Trout-lily):** locally documented on wooded slopes and in riparian forest; prefers moist woods and rich slopes, especially on limestone; flowers April – May
- ***Fimbristylis annua* (Annual Fimbry);** locally documented in a moist swale area along ridge; prefers moist depressions on serpentine barrens; flowers and fruits from July–October
- ***Gentiana saponaria* (Soapwort Gentian)**; locally documented on a flat slope in shaded light with moist to saturated moisture; prefers moist open woods, roadsides and swamps; flowers in September - October
- ***Iodanthus pinnatifidus* (Purple Rocket):** locally documented on rich wooded slopes; prefers moist alluvial woods and wooded slopes; flowers May – June
- ***Juncus biflorus* (Grass-leaved Rush);** locally documented in an open, flat crest in moist mesic shrub meadow along pipeline; prefers open woods, boggy fields, gravel pits, and ditches; fruits July to early November
- ***Juncus torreyi* (Torrey's Rush):** locally documented in abandoned sand mine pits and stone quarry wetlands; prefers muddy or sandy shores, strip mine areas, swales, and ditches; flowers and fruits early summer – fall
- ***Leucothoe racemosa* (Swamp Dog-hobble);** locally documented in a youngish poorly drained wet woods with sweet gum and a sparse understory; prefers wet woods and thickets
- ***Lycopodiella margueritae* (Marguerite's Clubmoss):** locally documented along stream edges associated with abandoned coal strip mines and damp sandy open ground within abandoned sand mines; prefers bogs and moist acidic soils; deciduous, sporulates July – October
- ***Oenothera argillicola* (Shale-barren Evening-primrose):** locally documented on a riverside shale barren; prefers shale barrens; flowers July – September
- ***Packera anonyma* (Plain Ragwort);** locally documented on a ridge in a serpentine barren; prefers dry fields, open woods, and serpentine barrens; flowers May–September
- ***Passiflora lutea* (Yellow Passion-flower):** locally documented along the edge of a mixed hardwood forest; prefers most stream bank thickets; flowers in July
- ***Penstemon canescens* (Beard-tongue);** locally documented in a Virginia Pine-mixed hardwood shale woodland opening on steep forested WSW facing slopes; prefers dry, rocky, wooded slopes; flowers May-July, fruits July – August.
- ***Phemeranthus teretifolius* (Round-leaved Fame Flower);** locally documented in 20 acres of prairie, outcrop, and damp sandy community; prefers serpentine barrens; flowers late June-July and flowers are known to remain open only for a few hours
- ***Platanthera peramoena* (Purple-fringeless Orchid):** locally documented on swampy woodland ground; prefers moist meadows, low wet woods, and ditches; flowers July – August

- ***Polygala polygama* (Racemed Milkwort):** locally documented between two pipeline rights-of-way; prefers abandoned fields and wooded bogs; flowers June-July
- ***Quercus phellos* (Willow Oak)**; locally documented in a coastal plain forest; prefers moist to wet woods within Coastal Plain forests in SE PA; survey during growing season before leaf fall
- ***Ribes missouriensis* (Missouri Gooseberry);** locally documented on a west-facing xeric shale slope; prefers wooded slopes; flowers late April-May
- ***Rotala ramosior* (Tooth-cup);** locally documented in a floodplain of Yellow Breeches Creek; prefers wet sandy shores and other swampy open grounds
- ***Ruellia pedunculata* (Stalked Wild-petunia)**; locally documented on a xeric SE-facing slope in open to partial light; prefers dry rocky woods, ravines, lowlands, glades, and slopes; flowers June-August
- ***Ruellia strepens* (Limestone petunia);** locally documented in a Virginia Pine-mixed hardwood shale woodland opening on steep forested WSW facing slopes; prefers rich wooded slopes, bluffs, and roadsides on limestone
- ***Smallanthus uvedalius* (Hairy Leafcup):** locally documented in early successional woodland; prefers ravines, thickets, and river or stream banks; flowers July – September
- ***Solidago erecta* (Slender Goldenrod);** locally documented on a SW facing slope in partial light in xeric soil; prefers dry, acidic shaley banks; flowers late August–October
- ***Spiranthes lucida* (Shining Ladies'-tresses):** locally documented within an upland wetland; prefers moist banks, lake shores, and wet meadows, usually on calcareous soils; flowers May – July
- ***Symphyotrichum depauperatum* (Serpentine Aster)**; locally documented in an open serpentine barren; prefers open areas of serpentine barrens; flowers August–October
- ***Thalictrum coriaceum* (Thick-leaved Meadow-rue):** locally documented on wooded slopes; prefers rich rocky woods, thickets, moist alluviums; flowers late May – June
- ***Trifolium virginicum* (Kate's Mountain Clover):** locally documented on a riverside shale barren; prefers shale barrens; flowers May – August
- ***Trillium cernuum* (Nodding Trillium);** locally documented on a moist, lower slope: prefers moist woods; flowers April-May
- ***Trillium nivale* (Snow Trillium):** locally documented on wooded stream valley slopes, often with limestone float; prefers moist woods; flowers late March – April
- ***Woodwardia areolata (*Netted Chainfern*)***; locally documented in a small forested pond at headwaters of stream in seepy deciduous woods; prefers moist or wet woods and acidic bogs; deciduous fern, sporulates July-September

- ✓ A survey for the above species should be conducted by a qualified botanist *at the appropriate time of year and then submitted to our office for review*. **Your botanist should carefully review the new DCNR Botanical Survey Protocols available at http://www.gis.dcnr.state.pa.us/hgis-er/Login.aspx. These protocols are recommended to ensure that the all necessary information is collected and that survey reports are prepared properly. It is the expectation of DCNR that these protocols will be followed when conducting surveys for species under our jurisdiction.**
- ✓ Your botanist should *fill out the field survey form while performing their survey:* http://www.gis.dcnr.state.pa.us/hgis-er/hgis/2012%20DCNR%20Field%20Survey%20Form.pdf. Contact our office prior to the survey for detailed information about the species, or for a list of qualified surveyors.
- ✓ Any target and non-target state-listed species found during the site visit should be reported to our office. Mitigation measures and monitoring may be requested if species or communities of special concern are found on or adjacent to site.

- ✓ If the land type(s) does not exist on site, a survey may not be necessary; please submit a habitat assessment report which describes the current land cover, habitat types, and species found on site.

IMPORTANT:
To assist with your botanical survey efforts, we are providing shapefiles of Areas of Concern (AOCs). These polygons are based on known locations or potential habitat of DCNR-regulated species or natural communities. Required surveys may be restricted to these AOCs. The survey may be further refined to suitable habitat within areas of anticipated disturbance. For example, if work is restricted to an existing open right-of-way, a survey for a forest-dwelling species would be unnecessary.

Plant communities and species that lack a currently listed or proposed conservation status are not required for survey. Surveys for these communities and species are voluntary. This applies to Red-cedar – Mixed Hardwood Rich Shale Woodland, Serpentine Grassland, and Yellow Oak – Redbud Woodland, as well as *Astragalus canadensis*, *Erythronium albidum*, *Penstemon canescens*, and *Ruellia pedunculata*.

PROJECTS ON STATE FOREST LANDS:
A portion of this project takes place on the Gallitzin State Forest (District 6). The DCNR Bureau of Forestry's *State Forest Resource Management Plan* sets forth guidelines for ecologically-sound management of State Forest Lands and resources including protection of wetlands, wildlife, native wild plants and invasive species management. As such, the DCNR Bureau of Forestry may request additional surveys in association with this project. **This letter applies to PNDI impacts only and does not authorize the initiation of any work on State Forest Lands. Further coordination with the Bureau of Forestry is required.** If you have not already done so, please contact Terence Stemmler, District Forester for Gallitzin State Forest, at (814) 472-1862 for additional information.

This response represents the most up-to-date review of the PNDI data files and is valid for two (2) years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review.

Should you have any questions or concerns, please contact Ecological Information Specialists, Jason Ryndock (717-705-2822; c-jryndock@pa.gov) or Frederick Sechler (717-705-2823; c-frsechle@pa.gov).

Sincerely,

Rebecca H. Bowen

Rebecca H. Bowen, Section Chief
Bureau of Forestry, Ecological Services Section
Pennsylvania Natural Heritage Program

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

March 13, 2014 **PNDI Number: 22275**

Preston Smith
Tetra Tech
661 Andersen Drive
Pittsburgh, PA 15220
Email: preston.smith@tetratech.com

Re: UPDATE – PA Pipeline Project (Sunoco Mariner East 2 Pipeline)
Trans-Pennsylvania

Dear Mr. Smith,

Thank you for the submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Project Number 22275 for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

Potential Impact Anticipated

PNDI records indicate species or resources under DCNR's jurisdiction are located in the project vicinity. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern. **(NOTE: E10[r] of this update was deleted during review)**

Plant Species of Concern:

Scientific Name	Common Name	PA Current Status	PA Proposed Status	AOC (West and East)
Actaea podocarpa	Mountain Bugbane	Threatened	Rare	W1[r]
Amelanchier canadensis	Serviceberry	Not listed	Endangered	E19[r]
Amelanchier humilis	Low Serviceberry	Undetermined	Endangered	W3[r]
Amelanchier sanguinea	Roundleaf Serviceberry	Undetermined	Endangered	W3[r]
Andropogon gyrans	Elliott's Bluestem	Not listed	Rare	E15[r], E16[r]
Arabis patens	Spreading Rockcress	Not Listed	Threatened	W5[r]
Bartonia paniculata	Screw-stem	Not listed	Rare	E21[r]
Bouteloua curtipendula	Tall Gramma	Threatened	Threatened	E5[r]
Dicanthelium scoparium	Velvety Panic-grass	Endangered	Endangered	E18[r]
Desmodium nuttallii	Nuttall's Tick Trefoil	Unlisted	Threatened	E21[r]
Ellisia nyctelea	Ellisia	Threatened	Threatened	E12[r], E14[r]
Euthamia tenuifolia	Grass-leaved goldenrod	Threatened	Endangered	E19[r]
Gentiana saponaria	Soapwort Gentian	Undetermined	Endangered	E23[r]
Juncus torreyi	Torrey's Rush	Threatened	Rare	W4[r]
Leucothoe racemosa	Swamp Dog-Hobble	Undetermined	Threatened	E24[r]
Lycopodiella margueritae	Marguerite's Clubmoss	Not Listed	Endangered	W4[r]
Oenothera argillicola	Shale-barren Evening-primrose	Threatened	Threatened	W6[r]
Oxypolis rigidior	Stiff Cowbane	Undetermined	Threatened	E21[r]
Packera anonyma	Plain ragwort	Threatened	Threatened	E5[r]
Phemeranthus teretifolius	Round-leaved Fame-Flower	Threatened	Threatened	E4[r]
Poa autumnalis	Autumn Bluegrass	Endangered	Endangered	E3[r], E21[r], E23[r]
Poa paludigena	Bog Bluegrass	Threatened	Rare	E1[r]
Quercus phellos	Willow Oak	Endangered	Endangered	E25[r]
Rotala ramosior	Tooth-cup	Rare	Rare	E11[r]
Spiranthes vernalis	Spring Ladies'-Tresses	Endangered	Endangered	E22[r]

Thalictrum coriaceum	Thick-leaved Meadow-rue	Endangered	Threatened	W5[r]
Tipularia discolor	Cranefly Orchid	Rare	Rare	E17[r]
Trifolium virginicum	Kate's Mountain Clover	Endangered	Endangered	W6[r]
Trillium cernuum	Nodding Trillium	Not listed	Threatened	E1[r], E2[r], E4[r], E21[r]
Woodwardia areolata	Netted chain fern	Unlisted	Threatened	E2[r], E19[r]
Zizania aquatica	Indian Wild Rice	Rare	Rare	E6[r], E7[r], E8[r], E9[r], E11[r]

Communities of Concern:

Community	Global Rank	State Rank	AOC
Red-cedar Mixed Hardwood Rich Shale Woodland	GNR	S1S2	(W6[r])

Please see the following resource for more information on these plant communities:
http://www.naturalheritage.state.pa.us/fikebook.aspx

Survey Request
DCNR requests a survey for the following species:

- ***Actaea podocarpa* (Mountain Bugbane)** locally documented in rich moist woods within stream valleys; prefers rich moist wooded slopes and coves in the mountains; flowers in August
- ***Amelanchier canadensis* (Serviceberry):** locally documented on three roadside areas–prefers moist woods and swamps–flowers mid April – mid May, fruits June – early July
- ***Amelanchier humilis* (Low Serviceberry)** locally documented on a steep rocky shrubby hillside; prefers dry open high ground and bluffs; flowers April – mid May; fruits June – early July
- ***Amelanchier sanguinea* (Roundleaf Serviceberry)** locally documented on a steep rocky shrubby hillside; prefers open woods, rocky slopes, and barrens; flowers mid April – late May; fruits June – early July
- ***Andropogon gyrans* (Elliott's Beardgrass)** locally documented in an old field on a north facing slope and also in a grassy power line cut in E20–prefers dry or moist fields or open woods-flowers in September – October
- ***Arabis patens* (Spreading Rockcress)** locally documented on a rocky wooded limestone slope; prefers moist rocky woods; flowers April – July
- ***Bartonia paniculata* (Screw-stem)** locally documented in an opening on the uphill side of the maintenance road–prefers bogs and peaty lake margins-flowers from August-October
- ***Bouteloua curtipendula* (Tall Gramma)**–locally documented in a small prairie serpentine barren with scattered Juniperus virginiana–prefers serpentine barrens, dry calcareous openings, and other dry, rocky, or sandy sites–flowers August-September
- ***Desmodium nuttallii* (Nuttall's Tick-trefoil)** locally documented on a NE-facing slope in partial light with dry-mesic moisture in middle of pipeline; prefers open woods and edges; flowers July-September
- ***Dicanthelium scoparium* (Velvety Panic-grass)** locally documented on the crest, mid-slope and lower-slope of an open meadow–prefers moist meadows and swales–vernal terminal panicles May-early July, or late summer or early fall
- ***Ellisia nyctelea* (Ellisia):** locally documented in a sand bar with no woody vegetation; prefers damp, shady stream banks with rich alluvial soils and sometimes in disturbed ground
- ***Euthamia tenuifolia* (Grass-leaved Goldenrod)** locally documented in a powerline ROW with woods on both sides–prefers moist sandy or clayey fields-flowers in July–October
- ***Gentiana saponaria* (Soapwort Gentian)** locally documented on a flat slope in shaded light with moist to saturated moisture; prefers moist open woods, roadsides and swamps; flowers in September – October
- ***Juncus biflorus* (Grass-leaved Rush);** locally documented on open marshy ground in bottomland along river; prefers open woods, boggy fields, gravel pits, and ditches; fruits July to early November

- ***Juncus torreyi*** **(Torrey's Rush):** locally documented in abandoned sand mine pits and stone quarry wetlands; prefers muddy or sandy shores, strip mine areas, swales, and ditches; flowers and fruits early summer – fall
- ***Leucothoe racemosa*** **(Swamp Dog-hobble);** locally documented in a youngish poorly drained wet woods with sweet gum and a sparse understory; prefers wet woods and thickets
- ***Lycopodiella margueritae*** **(Marguerite's Clubmoss):** locally documented along stream edges associated with abandoned coal strip mines and damp sandy open ground within abandoned sand mines; prefers bogs and moist acidic soils; deciduous, sporulates July – October
- ***Oenothera argillicola*** **(Shale-barren Evening-primrose)** locally documented on a riverside shale barren; prefers shale barrens; flowers July – September
- ***Oxypolis rigidior*** (**Stiff Cowbane**) locally documented in a wedge of woods between road and a ROW with a small stream–prefers swamps, bogs, sedge meadows, sandy shores, and abandoned railroad beds–flowers from August – September
- ***Packera anonyma*** **(Plain Ragwort)** locally documented in a small attractive serpentine prairie; prefers dry fields, open woods, and serpentine barrens; flowers May–September
- ***Phemeranthus teretifolius*** **(Round-leaved Fame Flower)** locally documented in a small attractive serpentine prairie; prefers serpentine barrens; flowers late June-July and flowers are known to remain open only for a few hours
- ***Poa autumnalis*** (**Autumn Bluegrass**) locally documented floodplain woods, open at ground, with alluvial soils–prefers moist woods–flowers in late May-June
- ***Poa paludigena*** (**Bog Bluegrass**) locally documented in a scrub shrub/red maple sapling wetland–prefers boggy woods and swamps–flowers late May-June
- ***Quercus phellos*** **(Willow Oak)** locally documented in a coastal plain forest; prefers moist to wet woods within Coastal Plain forests in SE PA; survey during growing season before leaf fall
- ***Rotala ramosior*** **(Tooth-cup)** locally documented in a floodplain of Yellow Breeches Creek; prefers wet sandy shores and other swampy open grounds
- ***Spiranthes vernalis*** (**Spring Ladies'-tresses**): locally documented in a grassy opening in an old field remnant in young sweet gum-red maple woods–prefers moist, open sandy soils and serpentine barrens–flowers in May – August
- ***Symphyotrichum depauperatum*** **(Serpentine Aster)** locally documented in an open serpentine barren; prefers open areas of serpentine barrens; flowers August–October
- ***Thalictrum coriaceum*** **(Thick-leaved Meadow-rue)** locally documented on wooded slopes; prefers rich rocky woods, thickets, moist alluviums; flowers late May – June
- ***Trifolium virginicum*** **(Kate's Mountain Clover)** locally documented on a riverside shale barren; prefers shale barrens; flowers May – August
- ***Trillium cernuum*** **(Nodding Trillium)** locally documented on a moist, lower slope: prefers moist woods, also documented in a mesic hardwood forest in E19; flowers April-May
- ***Woodwardia areolata (*****Netted Chainfern)** locally documented in a small artificial pond in the woods with little herbaceous vegetation, in E19 the plant was found in the eastern edge of a seep; prefers moist or wet woods and acidic bogs; deciduous fern, sporulates July-September
- ***Zizania aquatica*** (**Indian Wild-rice**) locally documented in a 2 acre monoculture marsh in the wettest area of the marsh–prefers tidal and non-tidal marshes–flowers in late May – early September

- ✓ A survey for the above species should be conducted by a qualified botanist *at the appropriate time of year and then submitted to our office for review*. **Your botanist should carefully review the new DCNR Botanical Survey Protocols available at http://www.gis.dcnr.state.pa.us/hgis-er/Login.aspx. These protocols are recommended to ensure that the all necessary information is collected and that survey reports are prepared properly. It is the expectation of DCNR that these protocols will be followed when conducting surveys for species under our jurisdiction.**
- ✓ Your botanist should *fill out the field survey form while performing their survey:* http://www.gis.dcnr.state.pa.us/hgis-er/hgis/2012%20DCNR%20Field%20Survey%20Form.pdf. Contact our office prior to the survey for detailed information about the species, or for a list of qualified surveyors.
- ✓ Any target and non-target state-listed species found during the site visit should be reported to our office. Mitigation measures and monitoring may be requested if species or communities of special concern are found on or adjacent to site.
- ✓ If the land type(s) does not exist on site, a survey may not be necessary; please submit a habitat assessment report which describes the current land cover, habitat types, and species found on site.

IMPORTANT:
To assist with your botanical survey efforts, we are providing shapefiles of Areas of Concern (AOCs). These polygons are based on known locations or potential habitat of DCNR-regulated species or natural communities. Required surveys may be restricted to these AOCs. The survey may be further refined to suitable habitat within areas of anticipated disturbance. For example, if work is restricted to an existing open right-of-way, a survey for a forest-dwelling species would be unnecessary.

Plant communities and species that lack a currently listed or proposed conservation status are not required for survey. Surveys for these communities and species are voluntary. This applies to Red-cedar – Mixed Hardwood Rich Shale Woodland.

This response represents the most up-to-date review of the PNDI data files and is valid for two (2) years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review.

Should you have any questions or concerns, please contact Ecological Information Specialists, Jason Ryndock (717-705-2822; c-jryndock@pa.gov) or Frederick Sechler (717-705-2823; c-frsechle@pa.gov).

Sincerely,

Rebecca H. Bowen

Rebecca H. Bowen, Section Chief
Bureau of Forestry, Ecological Services Section
Pennsylvania Natural Heritage Program

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

March 13, 2014 **PNDI Number: 22275**

Preston Smith
Tetra Tech
661 Andersen Drive
Pittsburgh, PA 15220
Email: preston.smith@tetratech.com

Re: UPDATE – PA Pipeline Project (Sunoco Mariner East 2 Pipeline)
Trans-Pennsylvania

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Potential Impact Anticipated

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Plant communities and species that lack a currently listed or proposed conservation status are not required for survey. Surveys for these communities and species are voluntary. This applies to Red-cedar – Mixed Hardwood Rich Shale Woodland.

This response represents the most up-to-date review of the PNDI data files and is valid for two (2) years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review.

Should you have any questions or concerns, please contact Ecological Information Specialists, Jason Ryndock (717-705-2822; c-jryndock@pa.gov) or Frederick Sechler (717-705-2823; c-frsechle@pa.gov).

Sincerely,

Rebecca H. Bowen

Rebecca H. Bowen, Section Chief
Bureau of Forestry, Ecological Services Section
Pennsylvania Natural Heritage Program

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

March 26, 2015 **PNDI Number: 22424**

Preston Smith
Tetra Tech, Inc.
661 Andersen Drive, Foster Plaza No. 7
Pittsburgh, PA 15220
Email: preston.smith@tetratech.com (hard copy will not follow)

Re: Sunoco Pipeline, L.P. - Ohio Pipeline Project (previously part of the Mariner East 2 Pipeline Project)
Washington County, PA

Dear Mr. Smith,

Thank you for the submission of your field survey for Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Large Project Number 22424 for review (previously part of the Mariner East 2 Pipeline Project, PNDI 22275). PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

No Impact Anticipated as per Survey (with Avoidance Measure)

PNDI records indicate species or resources under DCNR's jurisdiction are located in the vicinity of the project. DCNR requested a botanical survey for *Carex shortiana* (Short's sedge) on January 30, 2014. A survey was conducted by Tetra Tech on May 21 and October 10, 2014. Two populations of Short's sedge were documented within the proposed pipeline corridor.

Sunoco Pipeline has agreed to alter the limit-of-disturbance, moving the proposed route slightly south of the Short's sedge populations in an effort to avoid direct impacts. With the addition of this avoidance measure, DCNR has determined that no impact is likely.

This response represents the most up-to-date review of the PNDI data files and is valid for two (2) years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review.

Should you have any questions or concerns, please contact Jason Ryndock, Ecological Information Specialist, by phone (717-705-2822) or via email (c-jryndock@pa.gov).

Sincerely,

Rebecca H. Bowen

Rebecca H. Bowen, Section Chief
Bureau of Forestry, Ecological Services Section
Pennsylvania Natural Heritage Program

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

July 22, 2013 **PNDI Large Project Number: 22132**

Sandy Lare
Tetra Tech, Inc.
285 Ellicott Street
Buffalo, NY 14203
Email: sandy.lare@tetratech.com (hard copy not to follow)

Re: Sunoco Logistics L.P. SXL
Mariner East Project
Multiple Townships, Allegheny, Washington, and Westmoreland Counties, PA

Dear Ms. Lare,

Thank you for the submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Large Project Number **22132** for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

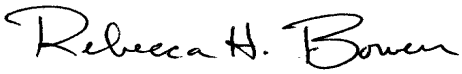
No Impact Anticipated per botanical survey

PNDI records indicate species or resources under DCNR's jurisdiction are located in the vicinity of the project. A botanical survey was requested for *Trillium nivale* (snow trillium), *Baptisia australis* (blue false indigo), *Iodanthus pinnatifidus* (purple rocket), *Trillium* x 1 (a trillium), *Juncus torreyi* (Torrey's rush), *Passiflora lutea* (Passiflora lutea), and *Smallanthus uvedalius* (leaf-cup). A voluntary observation survey was requested for *Erythronium albidum* (white trout-lily), which has an undetermined and unlisted status in Pennsylvania. Botanical surveys were conducted by Tetra Tech, Inc. from April 16, 2013 to July 8, 2013 at the project site. None of the target plant species of concern or any other listed PA plant species of concern were found during the botanical surveys. However, a population of *E. albidum* was found within habitat area 36, and voluntary best management practices will be utilized when possible to minimize impacts to this population. In addition, a suspected individual of *Cardamine maxima* (large toothwort) was found early in the growing season, but was later identified as *Cardamine diphylla* (toothwort). Therefore, based on the information you submitted concerning the nature of the project, the immediate location, and the botanical survey, DCNR has determined that no impact is likely. No further coordination with our agency is needed for this project.

This response represents the most up-to-date review of the PNDI data files and is valid for **two years** only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. For PNDI project updates, please see the PNHP website at www.naturalheritage.state.pa.us for guidance. As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review. Should you have any questions or concerns, please don't hesitate to contact me at 717.705.2819 or c-frsechle@pa.gov.

Sincerely,

Frederick C. Sechler, Jr, Ecological Information Specialist
Pennsylvania Natural Heritage Program
Bureau of Forestry, Ecological Services Section



Rebecca H. Bowen, Section Chief
Pennsylvania Natural Heritage Program
Bureau of Forestry, Ecological Services Section

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY

March 5, 2013 **PNDI Number: 22132 (Update 22007)**

Sandy Lare
Tetratech, Inc.
Fax 716-849-9420

Re: Sunoco Logistics L.P. SXL
Mariner East Project
Allegheny, Washington and Westmoreland Counties, PA

Dear Ms. Lare,

Thank you for the submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Number **22132** for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

Potential Impact Anticipated

PNDI records indicate species or resources under DCNR's jurisdiction are located in the project vicinity. Based on a detailed PNDI review, DCNR determined potential impacts to the following threatened or endangered species or species of special concern. Please note our new survey protocols are available at http://www.gis.dcnr.state.pa.us/hgis-er/Login.aspx .

Survey Request
DCNR requests a survey for the ***attached species list***:

- A survey for the attached species should be conducted by a qualified botanist *at the appropriate time of year and then submitted to our office for review.* **Your botanist should carefully review the new DCNR Botanical Survey Protocols available at http://www.gis.dcnr.state.pa.us/hgis-er/Login.aspx. These protocols are recommended to ensure that the all necessary information is collected and that survey reports are prepared properly. It is the expectation of DCNR that these protocols will be followed when conducting surveys for species under our jurisdiction.**
- Your botanist should *fill out the field survey form while performing their survey*: http://www.gis.dcnr.state.pa.us/hgis-er/hgis/Internet%20Field%20Survey%20Form_2007.pdf. Contact our office prior to the survey for detailed information about the species, or for a list of qualified surveyors.
- Any target and non-target state-listed species found during the site visit should be reported to our office. Mitigation measures and monitoring may be requested if species or communities of special concern are found on or adjacent to site.
- If the land type(s) does not exist onsite a survey may not be necessary; please submit a habitat assessment report which describes the current land cover, habitat types and species found onsite.

Conservation Measure—Voluntary Action

The following species is currently Tenatively Undetermined in PA and therefore, is not a target species for a survey. However, because of its ecological significance, please note if this species is identified during the required survey and avoid potential impacts to this species.

- *Erythronium albidum*—moist woods and rich slopes, especially on limestone; flowers April-May

This response represents the most up-to-date review of the PNDI data files and is valid for two years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. For PNDI project updates, please see the PNHP website at www.naturalheritage.state.pa.us for guidance. As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review. Should you have any questions or concerns, please don't hesitate to contact me at 717.705.2823 or c-arohrbau@pa.gov.

Sincerely,

Andrew Rohrbaugh, Environmental Review Manager
Bureau of Forestry, Ecological Services Section
Pennsylvania Natural Heritage Program

Rebecca H. Bowen, Section Chief
Bureau of Forestry, Ecological Services Section
Pennsylvania Natural Heritage Program

PNDI 22132
Species of Special Concern near Sunoco Logistics Mariner East Project Phase 1

Sheets 3, 6
Please conduct a survey for the following species during an appropriate time of year:

Scientific Name	Common Name	PA Status	Proposed PA Status	Wetland Indicator	Habitat	Survey Period
Trillium nivale	Snow Trillium	Rare	Rare	n/a	moist woods	flowers late March -April

Please note if the following species of concern are observed during the required survey:

Scientific Name	Common Name	PA Status	Proposed PA Status	Wetland Indicator	Habitat	Survey Period
Erythronium albidum	White Trout-lily	None	Tentatively Undetermined	FACU	moist woods and rich slopes, especially on limestone	flowers April - May

PNDI 22132
Species of Special Concern near Sunoco Logistics Mariner East Project Phase 1

Sheet 5
Please conduct a survey for the following species during an appropriate time of year:

Scientific Name	Common Name	PA Status	Proposed PA Status	Wetland Indicator	Habitat	Survey Period
Baptisia australis	Blue False-indigo	None	Threatened	n/a	open woods, stream banks and sandy floodplains	flowers May-June
Iodanthus pinnatifidus	Purple Rocket	Endangered	Endangered	FACW	moist alluvial woods and wooded slopes	flowers May-June
Trillium nivale	Snow Trillium	Rare	Rare	n/a	moist woods	flowers late March -April
Trillium x 1			Threatened		moist woods	flowers late March -April

Please note if the following species of concern are observed during the required survey:

Scientific Name	Common Name	PA Status	Proposed PA Status	Wetland Indicator	Habitat	Survey Period
Erythronium albidum	White Trout-lily	None	Tentatively Undetermined	FACU	moist woods and rich slopes, especially on limestone	flowers April - May

PNDI 22132
Species of Special Concern near Sunoco Logistics Mariner East Project Phase 1

Sheets 7, 8
Please conduct a survey for the following species during an appropriate time of year:

Scientific Name	Common Name	PA Status	Proposed PA Status	Wetland Indicator	Habitat	Survey Period
Delphinium exaltatum	Tall Larkspur	Endangered	Endangered	n/a	rich shaded woods and on rocky limestone bluffs	flowers July - August
Iodanthus pinnatifidus	Purple Rocket	Endangered	Endangered	FACW	moist alluvial woods and wooded slopes	flowers May-June
Juncus torreyi	Torrey's Rush	Threatened	Rare	FACW	muddy or sandy shores, strip mine areas, swales or ditches	flowers/fruits Summer
Passiflora lutea	Passion-flower	Endangered	Threatened	n/a	moist stream bank thickets	flowers July
Smallanthus uvedalius	Leaf-cup	None	Rare	n/a	ravines, thickets and river or stream banks	flowers July-September
Trillium nivale	Snow Trillium	Rare	Rare	n/a	moist woods	flowers late March-April

Please note if the following species of concern are observed during the required survey:

Scientific Name	Common Name	PA Status	Proposed PA Status	Wetland Indicator	Habitat	Survey Period
Erythronium albidum	White Trout-lily	None	Tentatively Undetermined	FACU	moist woods and rich slopes, especially on limestone	flowers April - May

APPENDIX B
Mariner East 1 – Houston to Delmont
Botanical Report Submittal - 2013

Note: Appendix B the Mariner East 1 Botanical Report does not cover AOC W16 and is omitted from this document; however it is available upon request.

APPENDIX C
Figures

Figure 1	**USGS Project Location Map**
Figures 2-Index-1 to 2-Index-19	**USGS Project Index Maps**
Figures 2-1 to 2-72	**Aerial Habitat Maps [Arranged by AOC]**

Note: Appendix C has been modified to only include AOC W16 maps at Raystown Lake

Legend

- Access Road
- Alignment Centerline
- PA State Boundary

Sheet Identifier

N

Miles
0 10 20

Kilometers
0 16.095 32.19

FIGURE 1
USGS PROJECT LOCATION MAP

PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
COUNTY,

TETRA TECH

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2011 ESRI and its data suppliers).
2) Quadrangles being displayed:

P:\GIS\SUNOCO\MARINER EAST 2\MXD\PENNPIPELINE_BOTANICALHABITAT_USGS_PLM.MXD 09/14/15 JN

Legend

▨ Area of Concern

🟨 Access Road

🟥 Alignment Centerline

🟧 ATWS/Limit of Disturbance

⬛ Block Valve Site Layout

🟦 Botanical Survey Corridor

Sheet Identifier

N

0 1,000 2,000 Feet

0 304.8 609.6 Meters

FIGURE 2-INDEX-8
USGS PROJECT INDEX MAP

PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2011 ESRI and its data suppliers).
2) Quadrangles being displayed:
Cassville, Entriken, Huntingdon, Williamsburg

Legend

- Broadleaf Terrestrial Forest
- Broadleaf Terrestrial Woodland
- Coniferous-Broadleaf Terrestrial Forest
- Palustrine Emergent Wetland
- Terrestrial Herbaceous Opening
- Terrestrial Open Meadow
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

N

Feet
0 100 200

Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-50
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2011 ESRI and its data suppliers).

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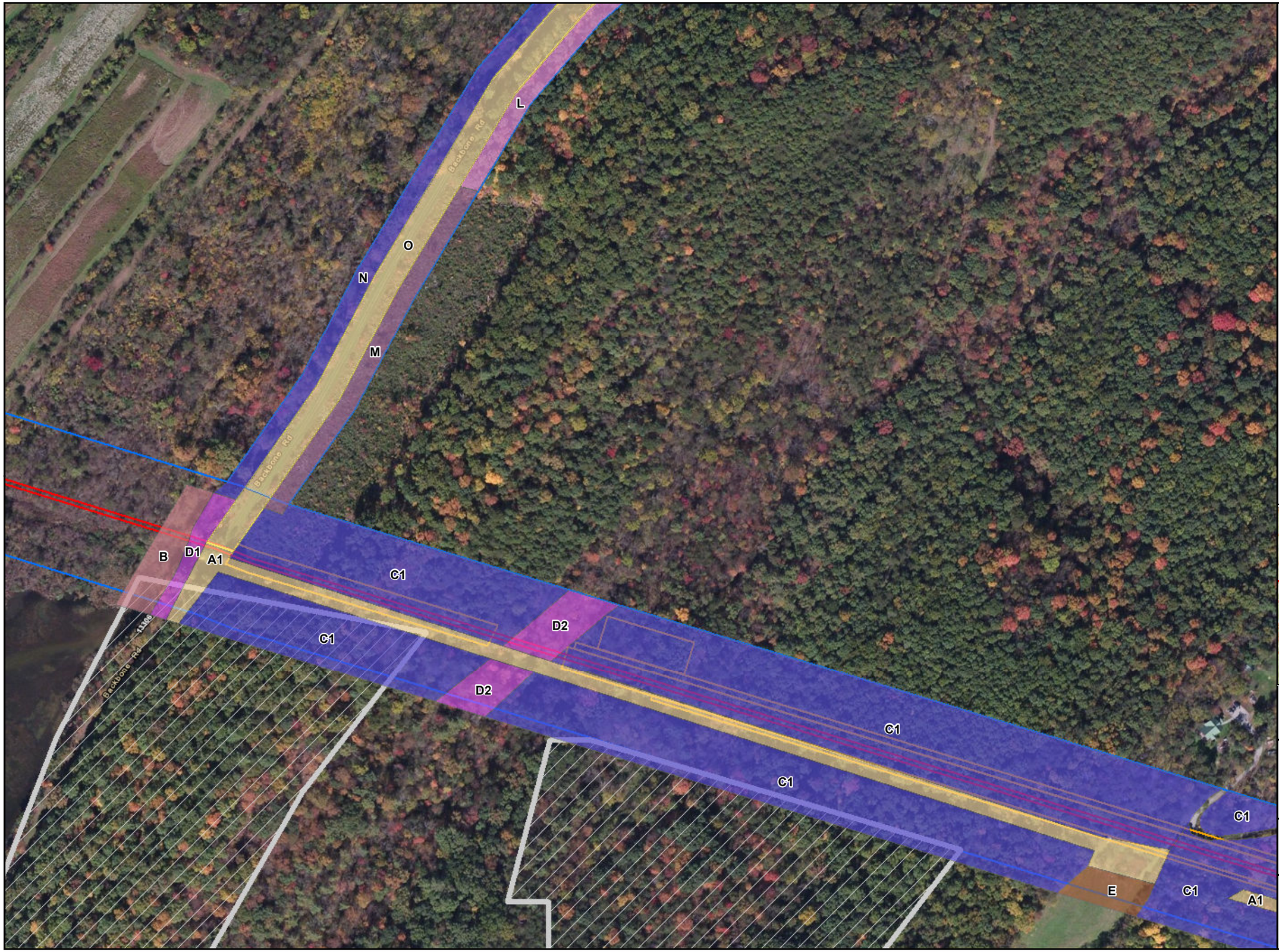

Legend

- Agriculture or Fallow Field
- Broadleaf Terrestrial Forest
- Coniferous-Broadleaf Terrestrial Forest
- Mesic Broadleaf Woodland
- Palustrine Forested Wetland
- Terrestrial Herbaceous Opening
- Terrestrial Shrubland
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

N

Feet
0 100 200

Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-51
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2011 ESRI and its data suppliers).

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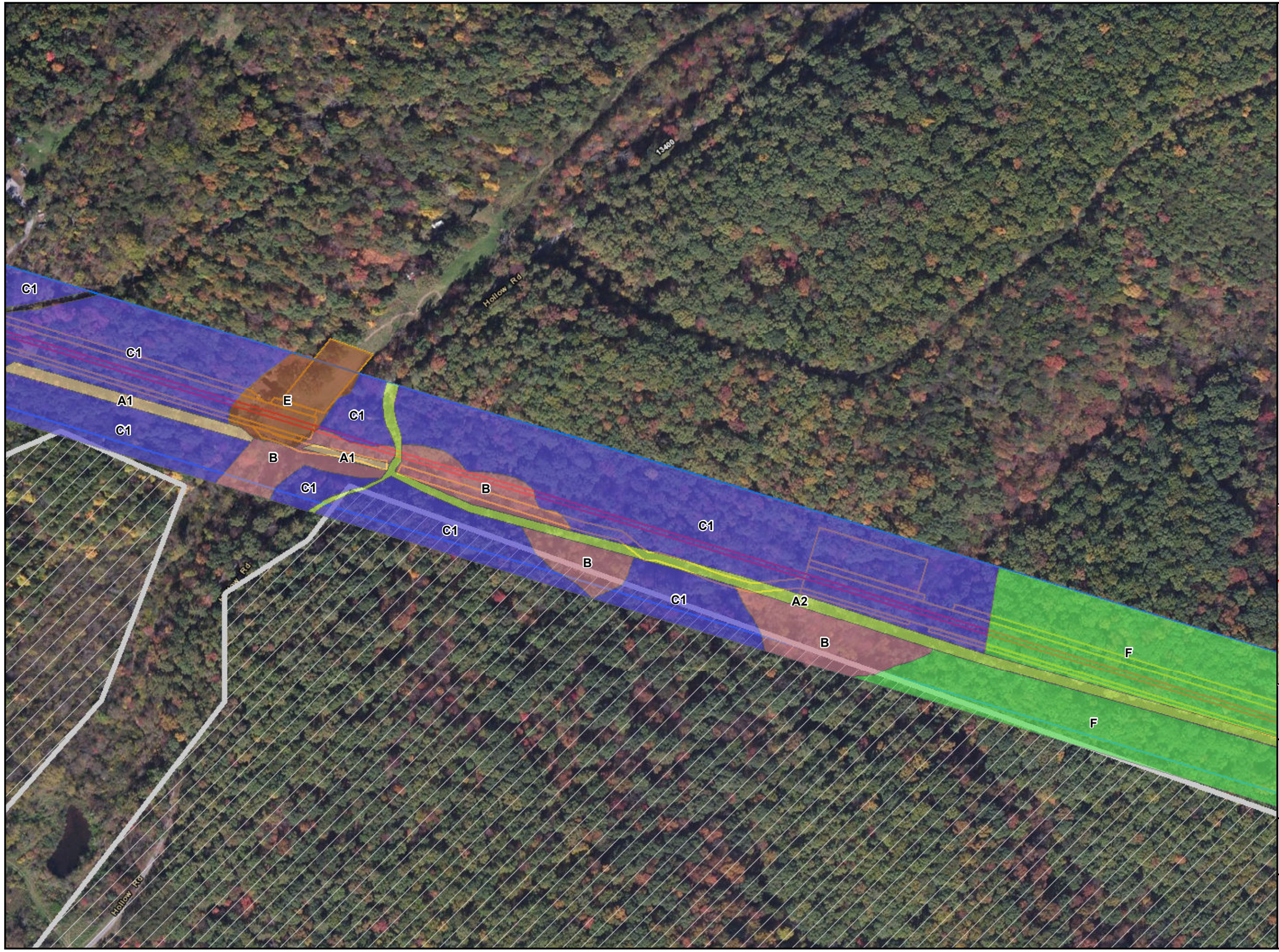

Legend

- Agriculture or Fallow Field
- Broadleaf Terrestrial Forest
- Broadleaf Terrestrial Woodland
- Palustrine Forested Wetland
- Terrestrial Herbaceous Opening
- Terrestrial Herbaceous Shrub Opening
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

N

Feet
0 100 200

Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-52
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2011 ESRI and its data suppliers).

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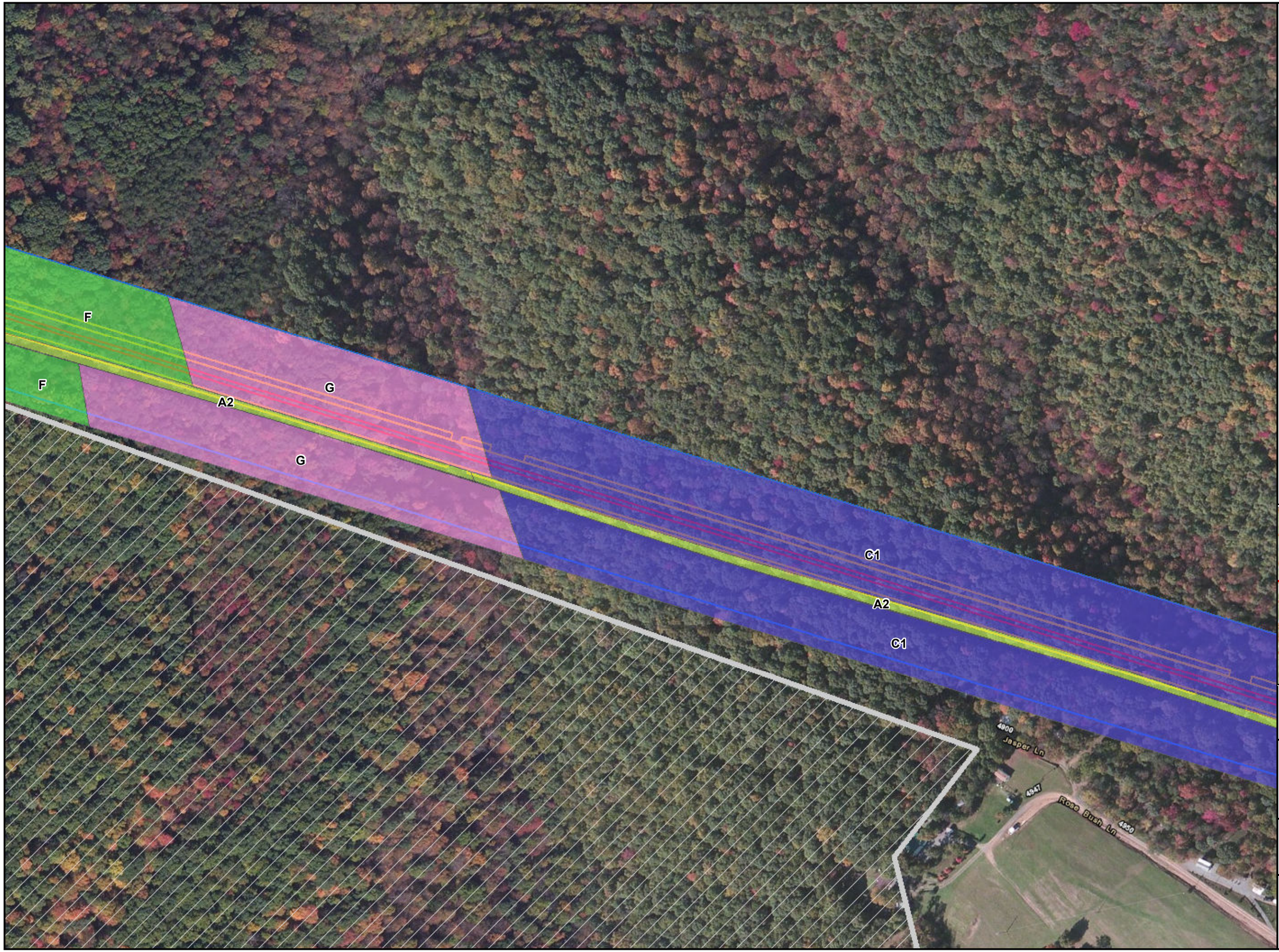

Legend

- Broadleaf Terrestrial Forest
- Broadleaf Terrestrial Woodland
- Coniferous-Broadleaf Terrestrial Forest
- Terrestrial Herbaceous Shrub Opening
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

N

Feet
0 100 200
Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-53
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

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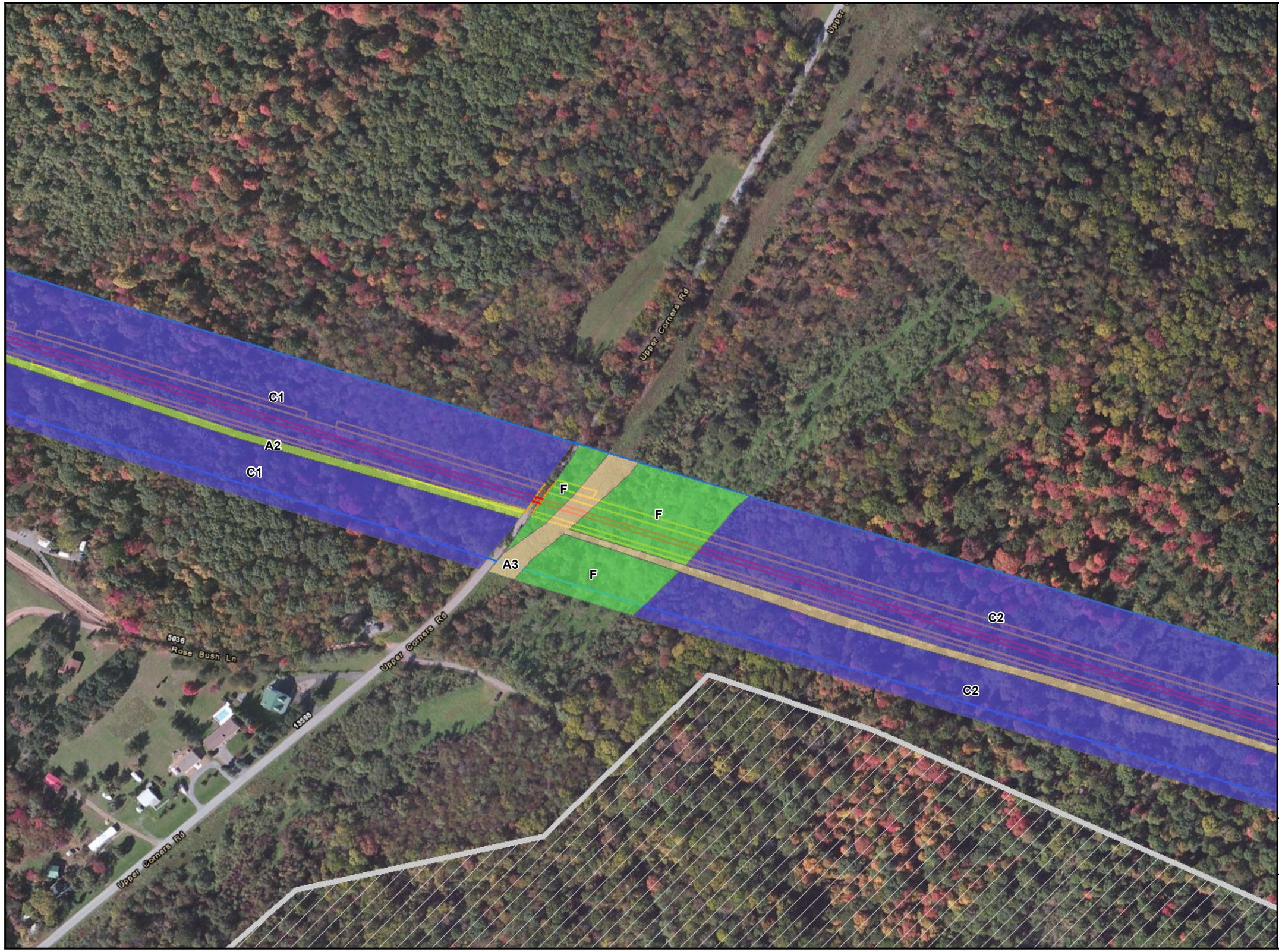


Legend

- Broadleaf Terrestrial Forest
- Broadleaf Terrestrial Woodland
- Terrestrial Herbaceous Opening
- Terrestrial Herbaceous Shrub Opening
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

Feet
0 100 200
Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-54
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

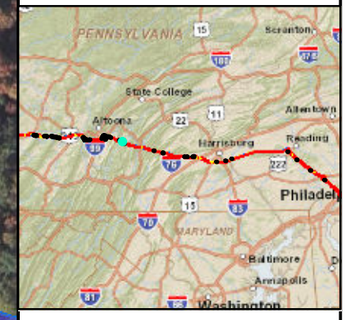
Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2011 ESRI and its data suppliers).

PGH P:\GIS\SUNOCO\MARINER EAST 2\MXD\PENNPIPELINE_BOTANICAL\HABITAT.MXD 08/17/15 JN

Legend

- Broadleaf Terrestrial Forest
- Terrestrial Herbaceous Opening
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier



N

Feet
0 100 200

Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-55
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
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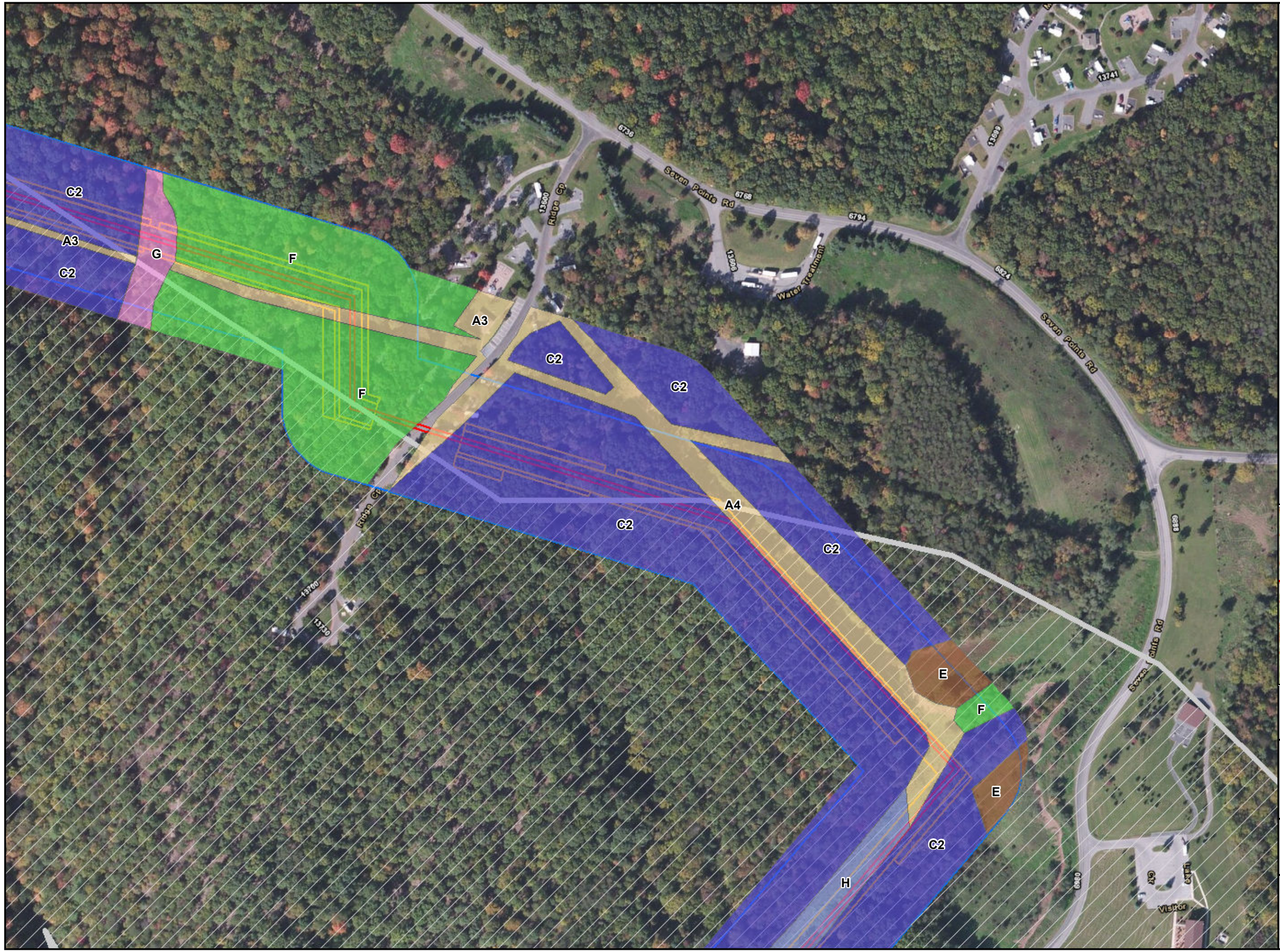

Legend

- Agriculture or Fallow Field
- Broadleaf Terrestrial Forest
- Broadleaf Terrestrial Woodland
- Coniferous-Broadleaf Terrestrial Forest
- Palustrine Emergent Wetland
- Terrestrial Herbaceous Opening
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

N

Feet
0 100 200

Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-56
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2011 ESRI and its data suppliers).

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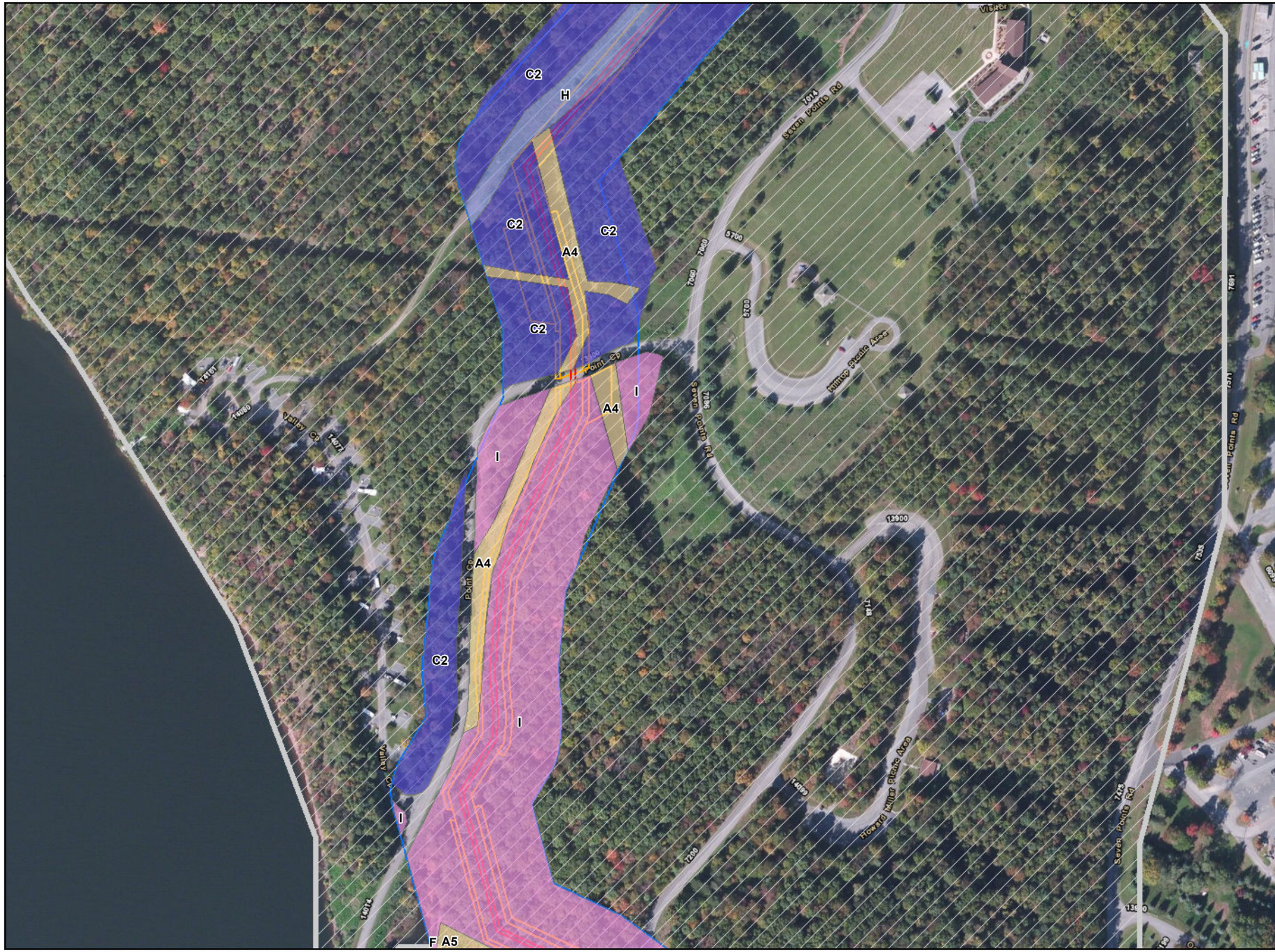

Legend

- Broadleaf Terrestrial Forest
- Broadleaf Terrestrial Woodland
- Coniferous-Broadleaf Terrestrial Forest
- Palustrine Emergent Wetland
- Terrestrial Herbaceous Opening
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

N

Feet
0 100 200

Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-57
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
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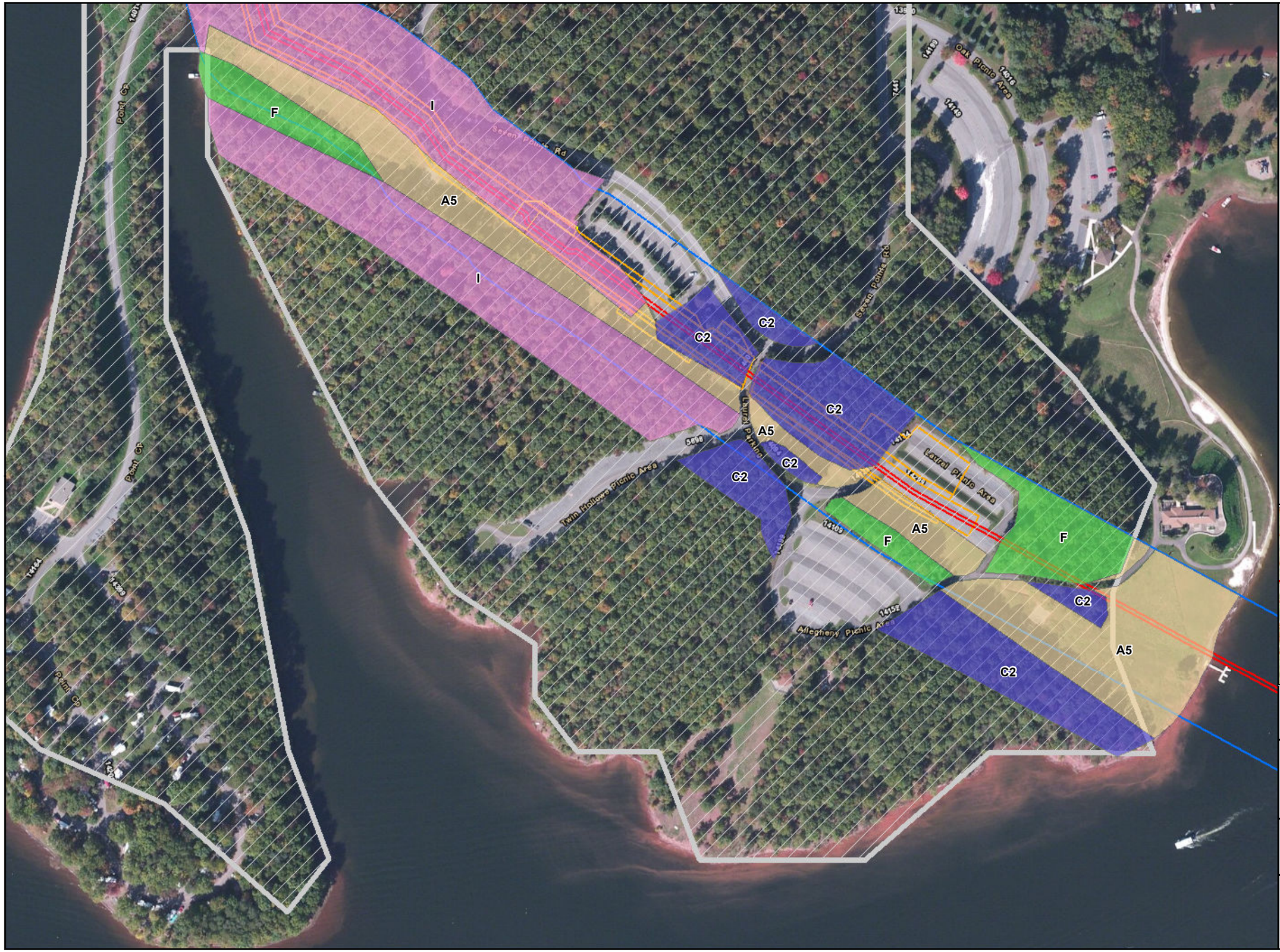

Legend

- Broadleaf Terrestrial Forest
- Broadleaf Terrestrial Woodland
- Coniferous-Broadleaf Terrestrial Forest
- Terrestrial Herbaceous Opening
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

N

Feet
0 100 200

Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-58
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
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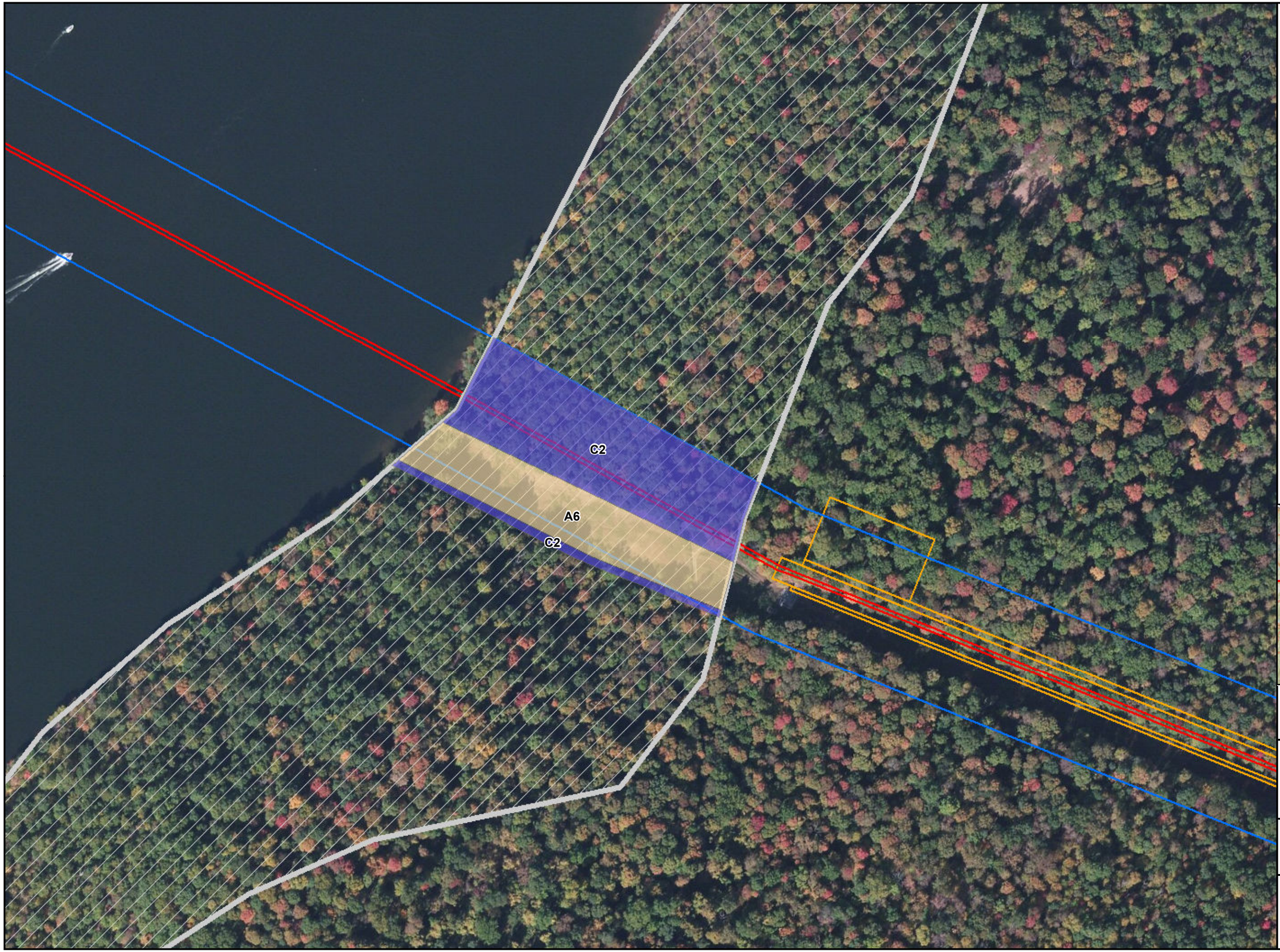

Legend

- Broadleaf Terrestrial Forest
- Terrestrial Herbaceous Opening
- Area of Concern
- Access Road
- Alignment Centerline
- ATWS/Limit of Disturbance
- Block Valve Site Layout
- Botanical Survey Corridor

Sheet Identifier

N

Feet
0 100 200

Meters
0 30.48 60.96

AOC W16/ALT W6
FIGURE 2-59
AERIAL HABITAT MAP
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
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APPENDIX D
Tables

Note: Appendix D tables have been modified to only include information from AOC W16

Table 1.
Plant Species of Special Concern:

Scientific Name	Common Name	PA Current Status	PA Proposed Status	AOC (West and East)	Survey Conducted?
Actaea podocarpa	Mountain Bugbane	Threatened	Rare	W10, W11, ALT W1	Yes
Amelanchier humilis	Low Serviceberry	Undetermined	Endangered	W12, ALT W3	Yes
Amelanchier sanguinea	Roundleaf Serviceberry	Undetermined	Endangered	W12, ALT W3	Yes
Antennaria virginica	Shale Barren Pussytoes	Not Listed	Rare	W14	Yes
Arabis patens	Spreading Rockcress	Not Listed	Threatened	W15, ALT W5	Yes
Asplenium pinnatifidum	Lobed Spleenwort	Not Listed	Rare	W6	NS – ME1
Astragalus canadensis	Canadian Milkvetch	Not Listed	Undetermined	W6	NS – ME1
Baptisia australis	Blue False-indigo	Not Listed	Threatened	W3	NS – ME1
Carex aquatilis	Water Sedge	Threatened	Threatened	E14	Yes
Carex shortiana	Short's Sedge	Not Listed	Rare	W1, E1	W1 included in OPP Report
Delphinium exaltatum	Tall Larkspur	Endangered	Endangered	W6	NS – ME1
Desmodium nuttallii	Nuttall's Tick Trefoil	Unlisted	Threatened	E17	Yes
Dryopteris celsa	Log Fern	Unlisted	Endangered	E15	Yes
Ellisia nyctelea	Ellisia	Threatened	Threatened	E12, E13	Yes
Erythronium albidum	White Trout-lily	Not Listed	Undetermined	W3, W6	NS – ME1
Fimbristylis annua	Annual Fimbry	Threatened	Threatened	E18, E19, E21	E18, E21 Outside Study corridor
Gentiana saponaria	Soapwort Gentian	Undetermined	Endangered	E20	NS – Outside Corridor
Iodanthus pinnatifidus	Purple Rocket	Endangered	Endangered	W3, W4, W6	NS – ME1
Juncus biflorus	Grass-leaved Rush	Undetermined	Threatened	ALT W2, E20	NS – Outside Corridor
Juncus torreyi	Torrey's Rush	Threatened	Rare	W6, W11, W13, ALT W4	Survey of W13 & ALT W4
Leucothoe racemosa	Swamp Dog-Hobble	Undetermined	Threatened	E20	NS – Outside Corridor
Lycopodiella margueritae	Marguerite's Clubmoss	Not Listed	Endangered	W11, W13, ALT W4	Surveys of W13 & ALT W4
Oenothera argillicola	Shale-barren Evening-Primrose	Threatened	Threatened	W16, ALT W6	Yes
Opuntia humifusa	Eastern Prickly Pear-Cactus	Rare	Rare	E5, E6, E7, E8	Surveys of E6 & E8
Packera anonyma	Plain ragwort	Threatened	Threatened	E18, E19, E21	E18, E21 Outside Study corridor
Passiflora lutea	Yellow Passion-flower	Endangered	Threatened	W6	NS – ME1
Phemeranthus teretifolius	Round-leaved Fame-Flower	Threatned	Threatned	E18. E19, E21	E18, E21 Outside Study corridor
Penstemon canescens	Beardtongue	Not listed	Undetermined	E3, E4	Yes

Table 1.
Plant Species of Special Concern:

Scientific Name	Common Name	PA Current Status	PA Proposed Status	AOC (West and East)	Survey Conducted?
Platanthera peramoena	Purple-fringeless Orchid	Undetermined	Threatened	W9	Yes
Polygama polygala	Racemed Milkwort	Undetermined	Endangered	E2	Yes
Quercus phellos	Willow Oak	Endangered	Endangered	E20, E22	NS – Outside Corridor
Ribes missouriensis	Missouri Gooseberry	Endangered	Endangered	E3	Yes
Rotala ramosior	Tooth-cup	Rare	Rare	E9, E10, E11	Yes
Ruellia pedunculata	Stalked wild-petunia	Not listed	Undetermined	(E4)	Yes - Voluntary Survey
Ruellia strepens	Limestone Petunia	Threatened	Threatened	E3, E4, E8	Yes
Smallanthus uvedalius	Hairy Leafcup	Not Listed	Rare	W6	NS – ME1
Solidago erecta	Slender Goldenrod	Endangered	Endangered	E6	Yes
Spiranthes lucida	Shining Ladies'-tresses	Not Listed	Threatened	W9	Yes
Symphyotrichum depauperatum	Serpentine Aster	Threatened	Threatened	E18, E19, E21	E18, E21 Outside Study corridor
Thalictrum coriaceum	Thick-leaved Meadow-rue	Endangered	Threatened	W8, W15, ALT W5	Yes
Trifolium virginicum	Kate's Mountain Clover	Endangered	Endangered	W16, ALT W6	Yes
Trillium cernuum	Nodding Trillium	Not Listed	Threatened	E16	NS – Outside Corridor
Trillium nivale	Snow Trillium	Rare	Rare	W2, W5, W6, W7	NS – ME1
Woodwardia areolata	Netted chain fern	Unlisted	Threatened	E15	Yes

Table 2.
Communities of Concern:

Community	Global Rank	State Rank	AOC	Survey Conducted?
Red-cedar Mixed Hardwood Rich Shale Woodland	GNR	S1S2	(W16, ALT W6)	Yes - Voluntary Survey
Serpentine Grassland	GNR	S1	(E18, E19, W7)	Yes - Voluntary Survey
Yellow Oak – Redbud Woodland	GNR	S2	(W6)	NS – ME1 - Voluntary Survey

Table 3.
Soils within the Surveyed Areas of Concern

AOC	Soil Symbol	Mapped Soil Unit	Soil Classification
Cumberland			
E08	Mf	Middlebury soils	Coarse-loamy, mixed, superactive, mesic Fluvaquentic Eutrudepts
E08	BeC	Berks shaly silt loam, 8 to 15 percent slopes	Fine-loamy, mixed, mesic Aquic Hapludults
E06	WeB	Weikert very channery silt loam, 3 to 8 percent slopes	Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs
E08	BpB	Blairton silt loam, 3 to 8 percent slopes	Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs
E06	BeC	Berks shaly silt loam, 8 to 15 percent slopes	Fine-loamy, mixed, mesic Aquic Hapludults
E08	WeD	Weikert very channery silt loam, 15 to 25 percent slopes	Fine-loamy, mixed, mesic Aquic Hapludults
E07	WeD	Weikert very channery silt loam, 15 to 25 percent slopes	Fine-loamy, mixed, mesic Aquic Hapludults
E06	BeB	Berks channery silt loam, 3 to 8 percent slopes	Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs
E04	BeB	Berks channery silt loam, 3 to 8 percent slopes	Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs
E03	WeD	Weikert very channery silt loam, 15 to 25 percent slopes	Fine-loamy, mixed, mesic Aquic Hapludults
E03	WeC	Weikert very channery silt loam, 8 to 15 percent slopes	Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs
E03	WeD	Weikert very channery silt loam, 15 to 25 percent slopes	Fine-loamy, mixed, mesic Aquic Hapludults
Dauphin			
E13	Lt	Lindside silt loam	Fine-silty, mixed, active, mesic Fluvaquentic Eutrudepts
E13	LrD2	Lewisberry gravelly sandy loam, 15 to 25 percent slopes, moderately eroded	Coarse-loamy, mixed, semiactive, mesic Ultic Hapludalfs
E13	W	Water	
Huntingdon			
W16	KlC	Klinesville shaly silt loam, 8 to 15 percent slopes	Loamy-skeletal, mixed, active, mesic Lithic Dystrudepts
W16	BMF	Berks-Weikert association, steep	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts

Table 3.
Soils within the Surveyed Areas of Concern

AOC	Soil Symbol	Mapped Soil Unit	Soil Classification
Huntingdon			
W16	BkC	Berks channery silt loam, 8 to 15 percent slopes	Loamy-skeletal, mixed, active, mesic Lithic Dystrudepts
W16	CaD	Calvin shaly silt loam, 15 to 25 percent slopes	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	CaD	Calvin shaly silt loam, 15 to 25 percent slopes	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	AbB	Albrights silt loam, 3 to 8 percent slopes	Fine-loamy, mixed, semiactive, mesic Aquic Fragiudalfs
W16	CaC	Calvin shaly silt loam, 8 to 15 percent slopes	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	MkD	Meckesville very stony silt loam, 8 to 25 percent slopes	Fine-loamy, mixed, active, mesic Typic Fragiudults
W16	CaD	Calvin shaly silt loam, 15 to 25 percent slopes	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	CaB	Calvin shaly silt loam, 3 to 8 percent slopes	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	ErB	Ernest silt loam, 3 to 8 percent slopes	Fine-loamy, mixed, superactive, mesic Aquic Fragiudults
W16	BMF	Berks-Weikert association, steep	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	BMF	Berks-Weikert association, steep	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	BMF	Berks-Weikert association, steep	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	BkC	Berks channery silt loam, 8 to 15 percent slopes	Loamy-skeletal, mixed, active, mesic Lithic Dystrudepts
W16	CaD	Calvin shaly silt loam, 15 to 25 percent slopes	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	CaC	Calvin shaly silt loam, 8 to 15 percent slopes	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	BMF	Berks-Weikert association, steep	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	AbB	Albrights silt loam, 3 to 8 percent slopes	Fine-loamy, mixed, semiactive, mesic Aquic Fragiudalfs
W16	BMF	Berks-Weikert association, steep	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	KlD	Klinesville shaly silt loam, 15 to 25 percent slopes	Loamy-skeletal, mixed, active, mesic Lithic Dystrudepts
W16	BMF	Berks-Weikert association, steep	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	CaC	Calvin shaly silt loam, 8 to 15 percent slopes	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
W16	W	Water	
Indiana			
W09	BkB	Brinkerton silt loam, 3 to 8 percent slopes	Fine-loamy, mixed, superactive, mesic Aquic Fragiudults
W09	SxF	Shelocta-Gilpin channery silt loams, 25 to 75 percent slopes, very stony	Fine-loamy, mixed, active, mesic Typic Hapludults

Table 4.

Habitat Suitability and Presence/Absence

Area of Concern (AOC)	PA DCNR AOC Notes	Habitat Area	Habitat Type	Northing	Easting	Suitable Habitat Present[1] / Plants Present
						Antennaria virginica
AOC W14	Potential dry woodland habitat, acidic shale soils.	G	Broadleaf Terrestrial Woodland (BTW)	40.44197	-78.30812	Moderate / Yes
		H	Broadleaf Terrestrial Woodland (BTW)	40.44045	-78.30706	None / No
		I	Broadleaf Terrestrial Forest (BTF)	40.43764	-78.30147	None / No

Area of Concern (AOC)	PA DCNR AOC Notes	Habitat Area	Habitat Type	Northing	Easting	Suitable Habitat Present[1] / Plants Present	
						Arabis patens	*Thalictrum coriaceum*
AOC W15 & ALT W5	*T. coriaceum* population located within project buffer; potential stony woodland habitat.	A	Broadleaf Terrestrial Woodland (BTW)	40.43332	-78.29377	None / No	None / No
		B	Broadleaf Terrestrial Forest (BTF)	40.43197	-78.28925	Poor / No	None / No
		C	Coniferous - Broadleaf Terrestrial Forest (CBTF)	40.43100	-78.28598	None / No	None / No
		D	Broadleaf Terrestrial Forest (BTF)	40.43275	-78.28076	Poor / No	None / No
		E	Broadleaf Terrestrial Forest (BTF)	40.43462	-78.27389	Moderate / No	Poor / No
		F	Broadleaf Terrestrial Woodland (BTW)	40.43364	-78.26860	Poor / No	Poor / No
		G	Riverine Broadleaf Terrestrial Woodland (RBTW)	40.43298	-78.26640	None / No	Good / No
		H	Terrestrial Herbaceous Opening (THO)	40.42974	-78.25163	None / No	None / No
		I	Broadleaf Terrestrial Forest (BTF)	40.42813	-78.24357	None / No	Poor / No
		J	Broadleaf Terrestrial Woodland (BTW)	40.42631	-78.23554	None / No	None / No
		K	Broadleaf Terrestrial Forest (BTF)	40.42418	-78.29616	Poor / No	None / No
		L	Terrestrial Herbaceous Opening (THO)	40.41662	-78.30242	None / No	None / No

Area of Concern (AOC)	PA DCNR AOC Notes	Habitat Area	Habitat Type	Northing	Easting	Suitable Habitat Present[1] / Plants Present	
						Oenothera argillicol	*Trifolium virginicum*
AOC W16 & ALT W6	Potential steep shaly habitat; **Red-cedar Mixed Hardwood Rich Forest* - survey voluntary.	A1	Terrestrial Herbaceous Opening (THO)	40.39579466620	-78.12882306560	None / No	None / No
		A2	Terrestrial Herbaceous-Shrub Opening (THO/TS)	40.39286	-78.11622	None / No	None / No
		A3	Terrestrial Herbaceous Opening (THO)	40.38515	-78.08220	Poor / No	Poor / No
		A4	Terrestrial Herbaceous Opening (THO)	40.38387	-78.07949	Poor / No	Poor / No
		A5	Terrestrial Herbaceous Opening (THO)	40.37220	-78.07320	Poor / No	Poor / No
		A6	Terrestrial Herbaceous Opening (THO)	40.36863	-78.06462	None / No	None / No
		B	Palustrine Forested Wetland (PF)	40.39402	-78.12171	None / No	None / No
		C1	Broadleaf Terrestrial Forest (BTF)	40.39387	-78.12158	None / No	None / No
		C2	Broadleaf Terrestrial Forest (BTF)	40.37318	-78.07600	None / No	None / No
		D1	Mesic Broadleaf Woodland (MSB)	40.39666	-78.13235	None / No	None / No
		D2	Mesic Broadleaf Woodland (MSB)	40.39583	-78.13002	None / No	None / No
		E	Agriculture or Fallow Field (AG/FF)	40.39461	-78.12505	None / No	None / No
		F	Broadleaf Terrestrial Woodland (BTW)	40.37285	-78.07487	None / No	None / No
		G	Coniferous - Broadleaf Terrestrial Forest (CBTF)	40.38550	-78.08406	None / No	None / No
		H	Palustrine Emergent Wetland (PE)	40.38131	-78.07898	None / No	None / No
		I	Coniferous - Broadleaf Terrestrial Forest (CBTF)	40.37662	-78.08061	None / No	None / No
		J	Palustrine Emergent Wetland (PE)	40.38099	-78.07941	None / No	None / No
		K	Broadleaf Terrestrial Woodland (BTW)	40.40104	-78.12738	None / No	None / No
		L	Coniferous - Broadleaf Terrestrial Forest (CBTF)	40.39994	-78.12897	None / No	None / No
		M	Terrestrial Shrub Opening (TS)	40.39788	-78.13093	None / No	None / No
		N	Broadleaf Terrestrial Forest (BTF)	40.39861	-78.13076	None / No	None / No
		O	Terrestrial Herbaceous Opening (THO)	40.39924	-78.12981	Poor / No	Poor / No
		P	Terrestrial Open Meadow (TOM)	40.38295	-78.07777	None / No	None / No
		*No (Red-cedar - Mixed Hardwood Rich Shale Woodland) Communities were observed within the evaluated survey area of AOC W16 & ALT W6.					

Table 4.

Habitat Suitability and Presence/Absence

Area of Concern (AOC)	PA DCNR AOC Notes	Habitat Area	Habitat Type	Northing	Easting	Suitable Habitat Present[1] / Plants Present	
						Dryopteris celsa	*Woodwardia areolata*
AOC E15	Potential habitat for these two fern species - moist woods.	A	Terrestrial Herbaceous Opening (THO)	40.19992	-75.91138	None / No	None / No
		B	Broadleaf Terrestrial Forest (BTF)	40.19983	-75.91176	Poor / No	Poor / No

Area of Concern (AOC)	PA DCNR AOC Notes	Habitat Area	Habitat Type	Northing	Easting	Suitable Habitat Present[1] / Plants Present
						Desmodium nuttallii
AOC E17	Documented occurrence of *Desmodium nuttallii* .	A	Terrestrial Herbaceous Opening (THO)	40.09634	-75.74393	Good / Yes
		B	Broadleaf Terrestrial Forest (BTF)	40.09627	-75.74344	None / No

Area of Concern (AOC)	PA DCNR AOC Notes	Habitat Area	Habitat Type	Northing	Easting	Suitable Habitat Present[1] / Plants Present			
						Phemeranthus teretifolius	*Packera anonyma*	*Fimbristylis annua*	*Symphyotrichum depauperatum*
AOC E19	Originally there were documented occurences of these species, but site looks like its been developed [at least most of it] - small remnants possible. Also, survey for Serpentine Grassland Community of Concern.	A	Serpentine Grassland (SGL) *(Community of Concern)	39.99828	-75.57202	Good / Yes	Good / Yes	Good / No	Good / No
		B	Broadleaf Terrestrial Forest (BTF)	39.99865	-75.57213	None / No	None / No	None / No	None / No
		*Serpentine Grassland Community of Concern (COC) was observed within the evaluated survey area of AOC E19.							

[1] **Suitable Habitat Present:** None – No potential habitat present; Good – Some good potential habitat present; Moderate – some moderate potential habitat present; Poor – some poor potential habitat present; Possible – Possibly some potential habitat present

Information Regardng Communities of Concern
Identified SOSC/COC
Poor Suitability
Moderate Suitability
Good Suitability

APPENDIX E
PA DCNR Wild Plant Management Permits

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DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

8100-FM-FROO33 Rev. 2/11

WILD PLANT MANAGEMENT PERMIT

Date: 11 April 2014 **Permit No.** 14-624

THIS PERMIT IS ISSUED TO:

Korey McCluskey for collection of Pennsylvania Endangered and Threatened plant species for submission as voucher specimens while conducting botanical studies and research in Pennsylvania.

THE PERMITTEE MUST CARRY THIS PERMIT DURING THE REMOVAL, COLLECTION, OR TRANSPLANTING OF PA ENDANGERED AND PA THREATENED PLANT SPECIES AND WILL PRESENT THIS PERMIT FOR INSPECTION UPON REQUEST. THE PERMITTEE MUST ALSO COMPLY WITH CHAPTER 45, SECTION 47 AND 48 RELATING TO REPORT INFORMATION.

PERMIT CONDITIONS:

Vouchers are to be deposited in an accredited institution. Notify land managers before conducting permitted activities. Permittee shall report results to the Bureau of Forestry, Ecological Services. Land owner permission must be acquired before conducting work.

Chris K Tenastorp

DCNR, BUREAU OF FORESTRY, WILD PLANT PROGRAM MANAGER

THIS PERMIT WILL EXPIRE **APRIL 11, 2015**

NONTRANSFERRABLE

THIS PERMIT MAY BE REVOKED FOR GOOD CAUSE.

PA Bureau of Forestry, Ecological Services Section
P.O. Box 8552, Harrisburg, PA 17105-8552 717-787-3444 (fax) 717-772-0271
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DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

8100-FM-FROO33 Rev. 2/11

WILD PLANT MANAGEMENT PERMIT

Date: 20 February 2015 **Permit No.** 15-624

THIS PERMIT IS ISSUED TO:

Korey McCluskey for collection of Pennsylvania Endangered and Threatened plant species for submission as voucher specimens while conducting botanical studies and research in Pennsylvania.

THE PERMITTEE MUST CARRY THIS PERMIT DURING THE REMOVAL, COLLECTION, OR TRANSPLANTING OF PA ENDANGERED AND PA THREATENED PLANT SPECIES AND WILL PRESENT THIS PERMIT FOR INSPECTION UPON REQUEST. THE PERMITTEE MUST ALSO COMPLY WITH CHAPTER 45, SECTION 47 AND 48 RELATING TO REPORT INFORMATION.

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Chris K Tenastorp

DCNR, BUREAU OF FORESTRY, WILD PLANT PROGRAM MANAGER

THIS PERMIT WILL EXPIRE **FEBRUARY 20, 2016**

NONTRANSFERRABLE

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WILD PLANT MANAGEMENT PERMIT

Date: 11 March 2014 **Permit No.** 14-623

THIS PERMIT IS ISSUED TO:

Codie Vileno for collection of Pennsylvania Endangered and Threatened plant species for submission as voucher specimens while conducting botanical studies and research in Pennsylvania.

THE PERMITTEE MUST CARRY THIS PERMIT DURING THE REMOVAL, COLLECTION, OR TRANSPLANTING OF PA ENDANGERED AND PA THREATENED PLANT SPECIES AND WILL PRESENT THIS PERMIT FOR INSPECTION UPON REQUEST. THE PERMITTEE MUST ALSO COMPLY WITH CHAPTER 45, SECTION 47 AND 48 RELATING TO REPORT INFORMATION.

PERMIT CONDITIONS:

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Chris A Ernstson

DCNR, BUREAU OF FORESTRY, WILD PLANT PROGRAM MANAGER

THIS PERMIT WILL EXPIRE **MARCH 11, 2015**

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WILD PLANT MANAGEMENT PERMIT

Date: 4 March 2015 **Permit No.** 15-623

THIS PERMIT IS ISSUED TO:

Codie Vileno for collection of Pennsylvania Endangered and Threatened plant species for submission as voucher specimens while conducting botanical studies and research in Pennsylvania.

THE PERMITTEE MUST CARRY THIS PERMIT DURING THE REMOVAL, COLLECTION, OR TRANSPLANTING OF PA ENDANGERED AND PA THREATENED PLANT SPECIES AND WILL PRESENT THIS PERMIT FOR INSPECTION UPON REQUEST. THE PERMITTEE MUST ALSO COMPLY WITH CHAPTER 45, SECTION 47 AND 48 RELATING TO REPORT INFORMATION.

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Chris K Firestone

DCNR, BUREAU OF FORESTRY, WILD PLANT PROGRAM MANAGER

THIS PERMIT WILL EXPIRE **MARCH 4, 2016**

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WILD PLANT MANAGEMENT PERMIT

Date: 28 February 2014 **Permit No.** 14-578

THIS PERMIT IS ISSUED TO:

David J. Bonomo for collection of Pennsylvania Endangered and Threatened plant species for submission as voucher specimens while conducting botanical studies and research in Pennsylvania.

THE PERMITTEE MUST CARRY THIS PERMIT DURING THE REMOVAL, COLLECTION, OR TRANSPLANTING OF PA ENDANGERED AND PA THREATENED PLANT SPECIES AND WILL PRESENT THIS PERMIT FOR INSPECTION UPON REQUEST. THE PERMITTEE MUST ALSO COMPLY WITH CHAPTER 45, SECTION 47 AND 48 RELATING TO REPORT INFORMATION.

PERMIT CONDITIONS:

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Chris K Firestone

DCNR, BUREAU OF FORESTRY, WILD PLANT PROGRAM MANAGER

THIS PERMIT WILL EXPIRE **FEBRUARY 28, 2015**

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THIS PERMIT MAY BE REVOKED FOR GOOD CAUSE.

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WILD PLANT MANAGEMENT PERMIT

Date: 28 February 2014 **Permit No.** 14-651

THIS PERMIT IS ISSUED TO:

Jason McGuirk for collection of Pennsylvania Endangered and Threatened plant species for submission as voucher specimens while conducting botanical studies and research in Pennsylvania.

THE PERMITTEE MUST CARRY THIS PERMIT DURING THE REMOVAL, COLLECTION, OR TRANSPLANTING OF PA ENDANGERED AND PA THREATENED PLANT SPECIES AND WILL PRESENT THIS PERMIT FOR INSPECTION UPON REQUEST. THE PERMITTEE MUST ALSO COMPLY WITH CHAPTER 45, SECTION 47 AND 48 RELATING TO REPORT INFORMATION.

PERMIT CONDITIONS:

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Chris K Firestone

DCNR, BUREAU OF FORESTRY, WILD PLANT PROGRAM MANAGER

THIS PERMIT WILL EXPIRE **FEBRUARY 28, 2015**

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WILD PLANT MANAGEMENT PERMIT

Date: 4 March 2015 **Permit No.** 15-676

THIS PERMIT IS ISSUED TO:

Greg Stevens for collection of Pennsylvania Endangered and Threatened plant species for submission as voucher specimens while conducting botanical studies and research in Pennsylvania.

THE PERMITTEE MUST CARRY THIS PERMIT DURING THE REMOVAL, COLLECTION, OR TRANSPLANTING OF PA ENDANGERED AND PA THREATENED PLANT SPECIES AND WILL PRESENT THIS PERMIT FOR INSPECTION UPON REQUEST. THE PERMITTEE MUST ALSO COMPLY WITH CHAPTER 45, SECTION 47 AND 48 RELATING TO REPORT INFORMATION.

PERMIT CONDITIONS:

Vouchers are to be deposited in an accredited institution. Notify land managers before conducting permitted activities. Permittee shall report results to the Bureau of Forestry, Ecological Services. Land owner permission must be acquired before conducting work.

Chris K Tenaston

DCNR, BUREAU OF FORESTRY, WILD PLANT PROGRAM MANAGER

THIS PERMIT WILL EXPIRE **MARCH 4, 2016**

NONTRANSFERRABLE

THIS PERMIT MAY BE REVOKED FOR GOOD CAUSE.

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WILD PLANT MANAGEMENT PERMIT

Date: 4 March 2015 **Permit No.** 15-674

THIS PERMIT IS ISSUED TO:

Adam Mengel for collection of Pennsylvania Endangered and Threatened plant species for submission as voucher specimens while conducting botanical studies and research in Pennsylvania.

THE PERMITTEE MUST CARRY THIS PERMIT DURING THE REMOVAL, COLLECTION, OR TRANSPLANTING OF PA ENDANGERED AND PA THREATENED PLANT SPECIES AND WILL PRESENT THIS PERMIT FOR INSPECTION UPON REQUEST. THE PERMITTEE MUST ALSO COMPLY WITH CHAPTER 45, SECTION 47 AND 48 RELATING TO REPORT INFORMATION.

PERMIT CONDITIONS:

Vouchers are to be deposited in an accredited institution. Notify land managers before conducting permitted activities. Permittee shall report results to the Bureau of Forestry, Ecological Services. Land owner permission must be acquired before conducting work.

Chris K Firestone

DCNR, BUREAU OF FORESTRY, WILD PLANT PROGRAM MANAGER

THIS PERMIT WILL EXPIRE **MARCH 4, 2016**

NONTRANSFERRABLE

THIS PERMIT MAY BE REVOKED FOR GOOD CAUSE.

PA Bureau of Forestry, Ecological Services Section
P.O. Box 8552, Harrisburg, PA 17105-8552 717-787-3444 (fax) 717-772-0271

APPENDIX F
Representative Photographs of Species of Special Concern

Note: Appendix F has been modified to only include Species of Special Concern at AOC W16

Oenothera argillicola – Shale-barren Evening primrose

Oenothera argillicola – Shale-barren Evening primrose

Trifolium virginicum – Kate's Mountain Clover

Trifolium virginicum – Kate's Mountain Clover

APPENDIX G
Botanical Field Survey Forms

Note: Appendix G has been modified to only include survey forms for AOC W16 at Raystown Lake

AOC W 167
AOC Alt W6
HAB. A,
(THO)

Version 4.2012

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

DCNR requests a Botanical Field Survey Form be submitted for each occurrence/population of a PA Plant Species of Special Concern (SOSC) found during a survey. Please attempt to complete as many fields as possible. Please direct any questions to DCNR Bureau of Forestry, Ecological Services Section at (717)-787-3444.

Species Name: AOC Alt W6 - Oenothera Argillicola - Trifolium virgidicum AOC Alt W6 * No SOSC Identified within HAB. A	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bonomo K. Keat	**Survey Date(s):** 7-16-14, 8-4-14 to 8-7-14	**Time Spent:** 4 hrs.
Site Name: AOC Alt W6 - Habitat A	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS maps attached. * Specific: Follow Backbone Road to existing pipeline ROW. Habitat A continues along ROW for approximately 4.5 miles to the East-SE.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial Herbaceous Opening Dry to moist, herbaceous opening & generally found along ROW, trails (4x4), and open fields. Microstegium vimineum and Coronilla varia dominate sections of Habitat A.		
Estimate of Area of Potential Habitat: None.		
Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Dry, Dark - medium Brown, silt loam and shale silt loam		
Relative age/Successional stage: Early	**Aspect:** East / West	**Elevation (provide units):** 800 - 1320 ft.

Moisture:	Light:	Topo Position:	Slope:
☐ Inundated (hydric)	☑ Open	☑ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☑ Upper Slope	☑ 0-10%
☐ Moist (mesic)	☐ Filtered	☑ Mid-slope	☑ 10-35%
☑ Dry (mesic)	☐ Shaded	☑ Lower Slope	☐ 35+%
☑ Dry (xeric)		☐ Bottom	☐ Vertical

AOC W16+
AOC Alt W6
HAB A1
(THO)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
	Rosa multiflora	Geum canadense Microstegium vimineum Trifolium repens Asclepias syriaca

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
		Impatiens capensis Coronilla varia Achillea millefolium Viola sp. Erigeron annuus

Invasive Species Present at Site (est. % Cover): *Microstegium vimineum
* Rosa multiflora

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16 +
AOC Alt W6
HAB. A_2
(THO/TS)

Version 4.2012

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Species Name: AOC Alt W6
- Oenothera Argillicola
- Trifolium virginicum

No SOSC Identified within HAB A_2

PNDI # (If applicable): 22275

EO ID # (If applicable):

☐ ~~New Occurrence~~ ☐ ~~Update~~

Surveyor(s): D. Benenno, K. Kent.

Survey Date(s): 8-14-14

Time Spent: 3.0 hrs

Site Name: AOC Alt W6 - Habitat A_2

~~GPS Coordinates of Occurrence (include datum):~~

Directions to Site: See USGS Maps
* Specific: Habitat A_2 occurs east of Hollow Road along existing pipeline ROW.

Site Owner:

~~Landowner aware of Species of Special Concern?~~ ☐ YES ☐ NO

Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005

~~Landowner consent for data submission to PA Heritage Program?~~ ☐ YES ☐ NO

~~Landowner consent for voucher collection?~~ ☐ YES ☐ NO

General SOSC Habitat Description: Terrestrial - Herbaceous/Shrub Opening
Dry, open habitat of existing pipeline ROW. Vegetation is dominantly herbaceous with woodland species of Quercus ilicifolia, Robinia pseudoacacia and oak saplings.

Estimate of Area of Potential Habitat: None

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):
Dry, Medium Brown, shaly silt loam

Relative age/Successional stage: Early

Aspect: NW

Elevation (provide units): 900-1100

Moisture:	Light:	Topo Position:	Slope:
☐ Inundated (hydric)	☑ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☑ Upper Slope	☐ 0-10%
☐ Moist (mesic)	☐ Filtered	☐ Mid-slope	☑ 10-35%
☐ Dry (mesic)	☐ Shaded	☐ Lower Slope	☐ 35+%
☑ Dry (xeric)		☐ Bottom	☐ Vertical

AOC W16+
AOC Alt W6
HAB. A2
(THOITS)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
	Ramets[1]		Genets[2]			
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy: NA	Sub-Canopy/Shrub:	Herbaceous:
	Robinia pseudoacacia Quercus alba Quercus ilicifolia	Potentilla recta Lysimachia quadrifolia Lespedeza hirta

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
	Pinus rigida Pinus strobus Acer rubrum	Ambrosia artemisiifolia Hieracium venosum Lobelia inflata Achillea millefolium Pycnanthemum tenuifolium

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16 +
AOC Alt W6
HAB. A_3
(THO)

Version 4.2012

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Species Name: AOC Alt W6 - Oenothera Argillicola - Trifolium virginicum No SOSC Identified within HAB A_3	**PNDI # (If applicable):** 22275 **EO ID # (If applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Benamo K. Kratt.	**Survey Date(s):** 8-5-14	**Time Spent:** 3.0 hrs
Site Name: AOC Alt W6 - Habitat A_3	**GPS Coordinates of Occurrence (Include datum):**	
Directions to Site: See USGS maps attached * Habitat A_3 occurs to the southeast of Upper Corner Road within the existing ROW.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial - Herbaceous Opening Dry, open habitat of existing pipeline ROW. Vegetation is dominantly herbaceous with few woodland saplings along the edge habitat.			
Estimate of Area of Potential Habitat: Poor habitat suitability for both target species.			
Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Dry, Medium Brown, shaly silt loam			
Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):** 1100 - 1300	
Moisture: ☐ Inundated (hydric) ☐ Saturated (wet-mesic) ☐ Moist (mesic) ☐ Dry (mesic) ☑ Dry (xeric)	**Light:** ☑ Open ☐ Partial ☐ Filtered ☐ Shaded	**Topo Position:** ☐ Crest ☑ Upper Slope ☐ Mid-slope ☐ Lower Slope ☐ Bottom	**Slope:** ☐ Flat ☑ 0-10% ☑ 10-35% ☐ 35+% ☐ Vertical

AOC W-16 +
AOC Alt W6
HAB. A_3
(THO)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
	Ramets[1]		Genets[2]			
☐ In leaf	☐	1-10	☐	☐ 1 yd^2	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd^2	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd^2	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd^2	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd^2 – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	____	EST #	____	____ Est Area		

ID Confidence: ☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
		Chenopodium vulgare Teucrium canadense Rubus flagellaris Rubus occidentalis

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
	Robinia pseudoacacia	Hypericum punctatum Linaria vulgaris Euthamia graminifolia Dracocephalum canadense Asclepias syriaca

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W-16 +
AOC Alt W6
HAB. A4
(THO)

Version 4.2012

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: AOC Alt W6 - Oenothera Argillicola - Trifolium virginicum No SOSC Identified within HAB	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bowman K. Kratt.	**Survey Date(s):** 8-16-14	**Time Spent:** 2.5 hrs
Site Name: AOC Alt W6	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS maps attached.		
Site Owner: –	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial - Herbaceous Opening
Dry, open, shale barren habitat of existing pipeline Row. Vegetation is dominantly herbaceous with saplings of Robinia pseudoacacia and Pinus virginiana.

Estimate of Area of Potential Habitat: Poor potential habitat suitability for both target species.

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):
Dry, medium-light brown, shaly-silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Early	West	800-900 ft

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☒ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☒ Upper Slope	☐ 0-10%
☐ Moist (mesic)	☐ Filtered	☐ Mid-slope	☒ 10-35%
☐ Dry (mesic)	☐ Shaded	☐ Lower Slope	☐ 35+%
☒ Dry (xeric)		☐ Bottom	☐ Vertical

AOC W16f
AOC Alt W4
HAB. A4
(THO)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd^2	___ Annuals	☐ Very feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd^2	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd^2	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd^2	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd^2 – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	______	EST #	______	______ Est Area		

ID Confidence: ☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____ Known or _____ Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
	Robinia pseudoacacia Pinus virginiana	Chamaecrista fasciculata Centaurea stoebe Lespedeza hirta

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
		Dichanthelium clandestinum Potentilla sp. Phytolacca americana Oenothera biennis

Invasive Species Present at Site (est. % Cover): Centaurea stoebe

****Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.***

AOC W16 t
AOC Alt W6
HAB. A5
(THO)

Version 4.2012

Botanical Field Survey Form – PA Plant Species of Special Concern

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Species Name: AOC Alt W6 - Cooperia Argillicola - Tripolium virginicum No SOSC Identified within HAB A5	**PNDI # (If applicable):** 22275 **EO ID # (If applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bowman K. Krat.	**Survey Date(s):** 8-6-14	**Time Spent:** 0.75 hrs
Site Name: AOC Alt W6 - Habitat A5	**GPS Coordinates of Occurrence (Include datum):**	
Directions to Site: See USGS maps attached. * Habitat A5 occurs within the Seven Points Recreation Area @ Raystown Lake. Approx. 200ft from Lake within ROW.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial - Herbaceous opening. Dry, open habitat of existing pipeline ROW. Vegetation is dominantly herbaceous with saplings of Robinia pseudoacacia.			
Estimate of Area of Potential Habitat: Poor habitat suitability is present for both SOSC.			
Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Dry, Medium Brown - Shaly silt loam			
Relative age/Successional stage: Early	**Aspect:** SE		**Elevation (provide units):** 800 - 860
Moisture: ☐ Inundated (hydric) ☐ Saturated (wet-mesic) ☐ Moist (mesic) ☐ Dry (mesic) ☑ Dry (xeric)	**Light:** ☑ Open ☐ Partial ☐ Filtered ☐ Shaded	**Topo Position:** ☐ Crest ☐ Upper Slope ☐ Mid-slope ☑ Lower Slope ☐ Bottom	**Slope:** ☐ Flat ☑ 0-10% ☐ 10-35% ☐ 35+% ☐ Vertical

AOC W16+
AOC Alt W6
HAB. A5
(THO)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
	Ramets[1]		Genets[2]			
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence: ☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy: NA	Sub-Canopy/Shrub:	Herbaceous:
	Robinia pseudoacacia	Coronilla varia Linaria vulgaris Rubus flagellaris

Other Species Present: Phytolacca americana

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
		Achillea millefolium Plantago lanceolata Hypericum punctatum Verbascum verbatum Asclepis tuberosa

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16+
AOC Alt W6
HAB. A_6
(THO)

Version 4.2012

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Species Name: AOC Alt W6 - Oenothera Argillicola - Tripolium virginicum No SOSC Identified within HAB A_6	**PNDI # (If applicable):** 22275 **EO ID # (If applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Benamo K. Kratt.	**Survey Date(s):** 8-7-14	**Time Spent:** 2.0 hrs
Site Name: AOC Alt W6 - Habitat A_6	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS Maps. * Habitat A_6 occurs along the eastern slopes overlooking Raystown Lake.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial - Herbaceous

Dry, open habitat along existing pipeline ROW. Dominantly herbaceous species with Robinia pseudoacacia and Rosa multiflora in the shrub layer.

Estimate of Area of Potential Habitat: None

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):

Dry, Dark-medium Brown, Shaly silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Early	N-W	900-1100 ft

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☑ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☐ 0-10%
☐ Moist (mesic)	☐ Filtered	☑ Mid-slope	☑ 10-35%
☑ Dry (mesic)	☐ Shaded	☐ Lower Slope	☐ 35+%
☐ Dry (xeric)		☐ Bottom	☐ Vertical

AOC W16+
AOC Alt W6
HAB. A6
(THO)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
	Ramets[1]		Genets[2]			
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence: ☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):		
Canopy:	**Sub-Canopy/Shrub:**	**Herbaceous:**
	Robinia pseudoacacia Rosa multiflora Rubus allegheniensis	Dioscorea polystachya Microstegium vimineum Persicaria virginiana
Other Species Present:		
Canopy:	**Sub-Canopy/Shrub:**	**Herbaceous:**
		Impatiens capensis Clinopodium vulgare Dianthalium clandestinum
Invasive Species Present at Site (est. % Cover):	Microstegium vimineum Rosa multiflora	

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.*

AOC W16+
AOC Alt W6
HAB. B (PF)

Version 4.2012

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: AOC Alt W6 Oenothera argillicola Trifolium virginicum * No SOSC Identified within Habitat B	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bowomo K. Keat	**Survey Date(s):** 7-16-14	**Time Spent:** ~45 min
Site Name: AOC Alt W6 - Habitat B	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS maps attached. * Specific: From Backbone Road, Habitat B is located west along existing pipeline ROW. Also located East/west of Hollow Road		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Palustrine Forested Wetland
Moist to wet, late successional forest located along James Creek at base of slope. Canopy is dominantly Green Ash, Red Maple and Sugar Maple with a dense understory of Hawthorne sp., Spicebush, etc.

Estimate of Area of Potential Habitat: None

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):
Moist - saturated, Dark Brown, silt-clay loams

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Late	W-SW	800 ft.

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☑ Flat
☑ Saturated (wet-mesic)	☑ Partial	☐ Upper Slope	☐ 0-10%
☐ Moist (mesic)	☑ Filtered	☐ Mid-slope	☐ 10-35%
☐ Dry (mesic)	☐ Shaded	☐ Lower Slope	☐ 35+%
☐ Dry (xeric)		☑ Bottom	☐ Vertical

AOC W16 +
AOC Alt W6
HAB. 3 (PF)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Fraxinus pennsylvanicum Acer rubrum Acer saccharum	Lindera benzoin Sambucus canadensis Crataegus sp.	Impatiens capensis Microstegium vimineum Boehmeria cylindrica

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
	Fraxinus pennsylvanicum	Circaea quadrisculata Arisaema triphyllum

Invasive Species Present at Site (est. % Cover): *Microstegium vimineum

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.*

AOC W16+
AOC Alt W6
HAB. C1
(BTF)

Version 4.2012

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

DCNR requests a Botanical Field Survey Form be submitted for each occurrence/population of a PA Plant Species of Special Concern (SOSC) found during a survey. Please attempt to complete as many fields as possible. Please direct any questions to DCNR Bureau of Forestry, Ecological Services Section at (717)-787-3444.

Species Name: AOC Alt W6 Oenothera argillicola Trifolium virginicum * No SOSC Identified within Habitat C	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Benemo K. Kent.	**Survey Date(s):** 7-16-14 8-4-14 to 8-7-14	**Time Spent:** 3.0 hrs
Site Name: AOC Alt W6 - Habitat C	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS maps attached. * Habitat C_1 occurs along the existing pipeline extending from Backbone Road to Upper Corners Rd.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial Broadleaf Forest Dry, late successional hard wood woodland dominated by Quercus montana, Q. rubra, Q. alba, and Carya alba.			
Estimate of Area of Potential Habitat: None			
Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Dry, Medium Brown, Silt loams and Shaly silt loams			
Relative age/Successional stage: Late Successional	**Aspect:** NW/SE		**Elevation (provide units):** 900 - 1300 Ft.
Moisture: ☐ Inundated (hydric) ☐ Saturated (wet-mesic) ☐ Moist (mesic) ☑ Dry (mesic) ☑ Dry (xeric)	**Light:** ☐ Open ☐ Partial ☑ Filtered ☑ Shaded	**Topo Position:** ☐ Crest ☑ Upper Slope ☐ Mid-slope ☐ Lower Slope ☐ Bottom	**Slope:** ☐ Flat ☐ 0-10% ☑ 10-35% ☐ 35+% ☐ Vertical

AOC W16+
AOC Alt W6
HAB. C_1
(BTF)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
	Ramets[1]		Genets[2]			
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	____	EST #	____	____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

____Known or ____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Quercus montana Quercus rubra Quercus alba Carya alba	Cornus racemosa Viburnum prunifolium Vaccinium angustifolium	Polystichum acrostichoides Dennstaedtia punctilobula Dryopteris marginalis

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Pinus serotina	Berberis thunbergii Hamamelis virginiana Carya alba	Dioscorea villosa Goodyera pubescens Mitchella repens Rubus flagellaris Toxicodendron radicans

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16 +
AOC Alt W6
HAB C2
Version 4.2012 (BTF)

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

DCNR requests a Botanical Field Survey Form be submitted for each occurrence/population of a PA Plant Species of Special Concern (SOSC) found during a survey. Please attempt to complete as many fields as possible. Please direct any questions to DCNR Bureau of Forestry, Ecological Services Section at (717)-787-3444.

Species Name: AOC Alt W6 Oenothera argillicola Trifolium virginicum * New SOSC Tal-trifoal with Hab. C2	**PNDI # (If applicable):** 22275 **EO ID # (If applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bramo K. Keat.	**Survey Date(s):** 7-16-14	**Time Spent:** 0.5 hrs
Site Name: AOC Alt W1 - HAB C2	**GPS Coordinates of Occurrence (include datum):**	

Directions to Site: See USGS maps attached...
* Habitat C data point covers habitat from Upper Corners Rd to the Western edge of Raystown Lake.

Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO

General SOSC Habitat Description: Terrestrial Broadleaf Forest
Dry, late successional hardwood forest dominated by Quercus alba and Quercus rubra. Timbering is apparent throughout. Dense growth of shrub layer dominated by Vaccinium angustifolium

Estimate of Area of Potential Habitat: None

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):
Dry, medium Brown, Silt loam and shaly silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Late Successional	NW	

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☑ Upper Slope	☑ 0-10%
☐ Moist (mesic)	☑ Filtered	☐ Mid-slope	☑ 10-35%
☑ Dry (mesic)	☐ Shaded	☐ Lower Slope	☐ 35+%
☑ Dry (xeric)		☐ Bottom	☐ Vertical

AOC W16+
AOC Alt W6
HAB. C_2
(BTF)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
☐ In leaf	Ramets[1]		Genets[2]	☐ 1 yd^2	___ Annuals	☐ Very Feeble
☐ In bud	☐	1-10	☐	☐ 1-5 yd^2	___ % Seedlings	☐ Feeble
☐ In flower	☐	11-50	☐	☐ 5-10 yd^2	___ % Immature	☐ Normal
☐ Immature fruit	☐	51-100	☐	☐ 10-100 yd^2	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	101-1000	☐	☐ 100 yd^2 – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	1001-10K	☐	☐ 1+ acres	___ % Senescent	
	☐	10K+	☐			
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Quercus alba	Acer pensylvanicum	
Quercus rubra	Carpinus virginiana	
	Hamamelis virginiana	

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
	Acer saccharum	
	Pinus strobus	
	Vaccinium angustifolium	

Invasive Species Present at Site (est. % Cover):

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.*

AOC W16+
AOC alt W6

HAB D
Version 4.2012
(MSB)

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: AOC Alt W6 Oenothera argillicola Trifolium virginicum * No SOSC Identified within Habitat D.	**PNDI # (if applicable):** 22273 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bowers K. Krat	**Survey Date(s):** 7-16-14	**Time Spent:** 1.0 hrs
Site Name: AOC Alt W6 - Habitat D	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS. maps attached * specific: From Backbone Road, Habitat D, is located to the west along existing pipeline Row.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Mesic Broadleaf Woodland
Moist, late successional hardwood woodland dominated by Carya ovata, Quercus rubra, Acer saccharum and Pinus rigida. A dense understory dominated with Lindera benzoin and Crataegus sp.

Estimate of Area of Potential Habitat: None

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):
moist, Dark Brown, silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Late	West	800 ft.

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☑ 0-10%
☑ Moist (mesic)	☐ Filtered	☐ Mid-slope	☐ 10-35%
☐ Dry (mesic)	☑ Shaded	☐ Lower Slope	☐ 35+%
☐ Dry (xeric)		☑ Bottom	☐ Vertical

AOC W16+
AOC Alt W6
HAB D,
(MSB)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
☐ In leaf	Ramets[1]		Genets[2]	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	1-10	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	11-50	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	51-100	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	101-1000	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	1001-10K	☐	☐ 1+ acres	___ % Senescent	
	☐	10K+	☐			
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Carya ovata	Viburnum prunifolium	Anthoxanthum odoratum
Acer saccharum	Carpinus caroliniana	Maianthemum racemosum
Quercus rubra	Lindera benzoin	Potentilla recta

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Pinus rigida	Crataegus sp.	Geranium carolinianum
	Rosa multiflora	Vine's
	Acer saccharum	Toxicodendron radicans

Invasive Species Present at Site (est. % Cover): Rosa multiflora

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.*

AOC W16+
AOC Alt W6
HAB. D_2

Version 4.2012

(MSB)

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: AOC Alt W6 Oenothera Argillicola Trifolium virginicum * No SOSC Identified with HAB D_2	**PNDI # (If applicable):** 22275 **EO ID # (If applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bozzuto K. Keat	**Survey Date(s):** 7-16	**Time Spent:** 0.25 hrs
Site Name: AOC Alt W6 - Habitat D_2	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS Maps * Specific: Follow existing ROW to the east from Backbone Road for approximately 0.20 miles. Habitat D_2 is a base of slope		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information:	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Mesic Broadleaf Woodland

Moist, Late successional woodland surrounding Palustrine habitat and perennial stream. Acer saccharum dominates the canopy with Carya sp. and Crataegus sp. in the understory.

Estimate of Area of Potential Habitat: None

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):

Moist, Dark Brown, silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Late	NW/SE	800 ft

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☑ 0-10%
☑ Moist (mesic)	☑ Filtered	☐ Mid-slope	☐ 10-35%
☐ Dry (mesic)	☐ Shaded	☐ Lower Slope	☐ 35+%
☐ Dry (xeric)		☑ Bottom	☐ Vertical

AOC W16+
AOC Alt W6
HAB. D_2
(MSB)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
	Ramets[1]		Genets[2]			
☐ In leaf	☐	1-10	☐	☐ 1 yd^2	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd^2	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd^2	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd^2	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd^2 – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	____	EST #	____	____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: Individual reproduced vegetatively (a clone)
[2]Genet: Individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Acer saccharum	Crataegus sp.	Verbesina alternifolia
Pinus rigida	Carya sp.	Parthenocissus quinquefolia
	Acer saccharum	Podophyllum peltatum

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
	Rosa multiflora	Circaea quadriscolata
		Galium aparine
		Impatiens capensis
		Vine:
		Toxicodendron radicans

Invasive Species Present at Site (est. % Cover): *Rosa multiflora

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.*

AOC Alt W6
Hab. E
Version 4.2012
(FF/AG)

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: AOC Alt W6 Oenothera argillicola Trifolium virginicum * No SOSC Identified within Habitat E	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bosomo K. Kratt	**Survey Date(s):** 8-6-14	**Time Spent:** 0.5 hours
Site Name: AOC Alt W6 - Habitat E	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS maps attached		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0049.0000 to PA-HU-0026.0000	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Fallow Field Dry, open field dominated by Zea mays, Phleum pratense, Dactylis glomerata, and Coronilla varia.			
Estimate of Area of Potential Habitat: None			
Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Dry, Dark-medium Brown, silt loam			
Relative age/Successional stage: Early	**Aspect:** SW	**Elevation (provide units):** 960-980 ft.	
Moisture: ☐ Inundated (hydric) ☐ Saturated (wet-mesic) ☐ Moist (mesic) ☑ Dry (mesic) ☐ Dry (xeric)	**Light:** ☑ Open ☐ Partial ☐ Filtered ☐ Shaded	**Topo Position:** ☐ Crest ☑ Upper Slope ☐ Mid-slope ☐ Lower Slope ☐ Bottom	**Slope:** ☐ Flat ☑ 0-10% ☐ 10-35% ☐ 35+% ☐ Vertical

AOC W16+
AOC A14. W6
HAB.E
(FF/AG)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	____	EST #	____	____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]**Ramet: Individual reproduced vegetatively (a clone)**
[2]**Genet: Individual generated by sexual reproduction (a seedling)**

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
		Zea mays Phleum pratense Dactylis glomerata Coronilla varia

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
		Solanum carolinense Setaria pumila Ambrosia artemisifolia Potentilla recta Panicum virgatum

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16+
AOC Alt W6
HAB. F
Version 4.2012 (BTW)

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: AOC Alt W6 Oenothera argillicola Trifolium virginicum * No SOSC Identified within Habitat F	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bonomo K. Keat	**Survey Date(s):** 8-4-14	**Time Spent:** 2.5 hrs.
Site Name: AOC Alt W6 - Habitat F	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS maps attached * Specific: Follow existing pipeline row from Upper Corners Road for Approximately 0.75 miles to the NW. Habitat F is also found to the southeast at approximately 200 ft.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial Broadleaf Woodland Dry, mid-successional woodland dominated with Acer saccharum, Carya tomentosa, Robinia pseudoacacia, and few Pinus resinosa. Sub-canopy consists of saplings of the canopy species.			
Estimate of Area of Potential Habitat:			
Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Dry, Dark to Medium Brown, silt loam			
Relative age/Successional stage: Mid-successional	**Aspect:** W - NW		**Elevation (provide units):** 900 - 1080 ft.
Moisture: ☐ Inundated (hydric) ☐ Saturated (wet-mesic) ☐ Moist (mesic) ☑ Dry (mesic) ☐ Dry (xeric)	**Light:** ☐ Open ☐ Partial ☑ Filtered ☐ Shaded	**Topo Position:** ☐ Crest ☑ Upper Slope ☐ Mid-slope ☐ Lower Slope ☐ Bottom	**Slope:** ☐ Flat ☐ 0-10% ☑ 10-35% ☐ 35+% ☐ Vertical

AOC W16+
AOC Alt W6
HAB. F
(BTW)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]	Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐ 1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐ 11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐ 51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐ 101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐ 1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐ 10K+	☐	☐ 1+ acres	___ % Senescent	
	_____ EST #	_____	_____ Est Area		

ID Confidence: ☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Acer saccharum Robinia pseudoacacia Carya tomentosa	Ostrya virginiana Carya tomentosa Fraxinus americana	Parthenocissus quinquefolia Mitchella repens Goodyera pubescens

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Pinus resinosa	Pinus strobus Crataegus sp.	Lysimachia quadrifolia Smilax rotund. folia

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16+
AOC Alt W6
HAB. G
Version 4.2012 (CBTF)

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: AOC Alt W6 - Oenothera argillicola - Trifolium virginicum * No SOSC Identified with Habitat G	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Bowne K. Kratt.	**Survey Date(s):** 8-4-14 to 8-7-14	**Time Spent:** 1.5 hrs.
Site Name: AOC Alt W6 - Habitat G	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS maps attached * Specific: Follow existing pipeline Row to the NW from Ridge Road Campground for approx. 800 ft.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial Mixed Forest - Hemlock Ravine Dry-moist, late successional, mixed forest composed of a Tsuga canadensis and Betula lenta canopy along steep slopes of a stream valley.

Estimate of Area of Potential Habitat: None

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):
Dry-moist, Dark Brown, silt loam, Exposed Bedrock

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Late	NW / SE	860 - 900 ft.

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☐ 0-10%
☑ Moist (mesic)	☐ Filtered	☐ Mid-slope	☑ 10-35%
☑ Dry (mesic)	☑ Shaded	☑ Lower Slope	☐ 35+%
☐ Dry (xeric)		☑ Bottom	☐ Vertical

AOC W16+
AOC Alt W6
HAB. 6
(CBTF)

SOSC Occurrence Information (describe below)

Phenology:	# Plants:			Population Area:	Age Structure:	Vigor:
	Ramets[1]		Genets[2]			
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Tsuga canadensis Betula lenta	Acer saccharum Quercus rubra Betula lenta	Polystichum acrostichoides Dennstaedtia punctilobula Maianthemum racemosum Viola sp.

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
	Quercus ilicifolia Viburnum lentago	Potentilla sp.

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16 +
AOC Alt W6
HAB. H. (PE)

Version 4.2012

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Species Name: AOC Alt W6 - Oenothera Argillicola - Trifolium virginicum * No SOSC Identified within Habitat H	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Boromo K. Keat	**Survey Date(s):** 8-4-14 to 8-7-14	**Time Spent:** 0.75 hrs
Site Name: AOC Alt W6 - Habitat H	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See USGS maps attached * Specific: From Seven Point Road, Habitat H is located to the west along existing ONE ROW.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Palustrine Emergent wetland Moist, early successional, emergent wetland located within existing ROW (ONE). Dominant species include Impatiens capensis, Acorus americanus, Pilea pumila, and Onoclea sensibilis.			
Estimate of Area of Potential Habitat: None			
Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Saturated - Moist, Dark Brown, clay - silt loam			
Relative age/Successional stage: Early	**Aspect:** SE		**Elevation (provide units):** 880 - 980 ft.
Moisture: ☐ Inundated (hydric) ☑ Saturated (wet-mesic) ☐ Moist (mesic) ☐ Dry (mesic) ☐ Dry (xeric)	**Light:** ☑ Open ☐ Partial ☐ Filtered ☐ Shaded	**Topo Position:** ☐ Crest ☐ Upper Slope ☐ Mid-slope ☑ Lower Slope ☑ Bottom	**Slope:** ☐ Flat ☑ 0-10% ☐ 10-35% ☐ 35+% ☐ Vertical

AOC W16 +
AOC Alt W6
HAB. H (PE)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]	Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐ 1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐ 11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐ 51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐ 101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐ 1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐ 10K+	☐	☐ 1+ acres	___ % Senescent	
	_____ EST #	_____	_____ Est Area		

ID Confidence: ☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
		Acorus americanus Impatiens capensis Pilea pumila

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
		Onoclea sensibilis Eutrannia graminifolia Veronia noveboracensis

Invasive Species Present at Site (est. % Cover):

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.*

AOC W16 +
AOC Alt W6
HAB. I
Version 4.2012
(CBTF)

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: AOC Alt W6 - Oenothera argillicola - Trifolium virginicum # No SOSC Identified within Habitat I	**PNDI # (If applicable):** 22275 **EO ID # (If applicable):**	☐ New Occurrence ☐ Update
Surveyor(s): D. Benamo K. Keat	**Survey Date(s):** 8-4-14 to 8-7-14	**Time Spent:** 2.5 hrs
Site Name: AOC Alt W6 - Habitat I	**GPS Coordinates of Occurrence (Include datum):**	
Directions to Site: See USGS maps attached. * Specific: Habitat I is found to the west of Seven Points Road within the Raystown Lake Recreation Area.		
Site Owner:	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0019.0000 to PA-HU-0026.0005	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO **Landowner consent for voucher collection?** ☐ YES ☐ NO	

General SOSC Habitat Description: Terrestrial Mixed Forest

Dry, shaded forest of Pinus strobus, Pinus virginiana, Quercus montana, Quercus rubra, and Q. alba. Thin understory of Vaccinium angustifolium.

Estimate of Area of Potential Habitat: None

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):

Dry, Dark-medium brown, silt loam – shaly silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Late	West - Southwest	960 - 990

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☑ Upper Slope	☑ 0-10%
☐ Moist (mesic)	☐ Filtered	☐ Mid-slope	☐ 10-35%
☑ Dry (mesic)	☑ Shaded	☐ Lower Slope	☐ 35+%
☐ Dry (xeric)		☐ Bottom	☐ Vertical

AOC W16 +
AOC Alt W6
HAB. I
(CBTF)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☐ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☐ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☐ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Pinus strobus Pinus virginiana Quercus montana	Pinus strobus Q. rubra Q. alba	Dryopteris marginalis Polystichum acrostichoides

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Quercus alba Quercus rubra	Quercus montana Vaccinium angustifolium	

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC: W16+ Alt W6 Habitat: J (PE)

Version 4.2012

BOTANICAL FIELD SURVEY FORM – PA PLANT SPECIES OF SPECIAL CONCERN

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Species Name: Trifolium virginicum Oenothera argillicola	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):** -	☐ New Occurrence ☐ Update
Surveyor(s): Korey MacIuskey, Codie Vileno	**Survey Date(s):** 8-4-15	**Time Spent:** 30 min
Site Name: AOC Alt W6+ W16	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See attached USGS Project location maps + Aerial Habitat Detail Maps for AOC W16+ AOC alt W6		
Site Owner: –	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: • PA-HU-0020, 0008-TAR	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO	
	Landowner consent for voucher collection? ☐ YES ☐ NO	

General SOSC Habitat Description: (PE) Palustrine Emergent Wetland · Moist to Saturated, Slightly disturbed, Partial Light, Palustrine emergent wetland.

Estimate of Area of Potential Habitat: none

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Moist to Saturated, Slightly disturbed, Partial light, Palustrine emergent wetland

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Early	W (gentle)	

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☑ Open	☐ Crest	☐ Flat
☑ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☑ 0-10%
☑ Moist (mesic)	☐ Filtered	☐ Mid-slope	☐ 10-35%
☐ Dry (mesic)	☐ Shaded	☑ Lower Slope	☐ 35+%
☐ Dry (xeric)		☑ Bottom	☐ Vertical

AOC: W16 + Habitat: J
ALT W6 (PE)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☑ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☑ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☑ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]**Ramet: individual reproduced vegetatively (a clone)**
[2]**Genet: individual generated by sexual reproduction (a seedling)**

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Acer rubrum	Acer rubrum	Leersia virginiana
Fraxinus pennylvanicum	Sambucus nigra	Impatiens capensis
		Onoclea sensibilis

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Quercus alba	Ulmus americana	Symphyotricum novae-angliae
Quercus bicolor	Crataegus sp	Carex sp
Quercus imbricaria	Lindera benzoin	Persicaria virginiana
		Persicaria sagittata
		Bidens frondosa
		Cicuta maculata

Invasive Species Present at Site (est. % Cover):	
Rosa multiflora	Alliaria petiolata
Microstegium vimineum	Symphyotrichum prenanthoides

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.**

AOC: W16 Habitat: K (BTW)
Alt W6

Version 4.2012

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Species Name: AOC W16 + ALT W6 Trifolium virginicum Oenothera argillicola	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):** -	☐ New Occurrence ☐ Update
Surveyor(s): Korey McCluskey, Cedric Vilens	**Survey Date(s):** 8/4/15	**Time Spent:** 1.5 hr
Site Name: AOC W16 AOC alt W6	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See attached USGS Project location maps + Arial Habitat Detail Maps for AOC W16 + AOC Alt W6		
Site Owner: –	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: • PA-HU-0020.0008-TAR	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO	
	Landowner consent for voucher collection? ☐ YES ☐ NO	

General SOSC Habitat Description: Broadleaf Terrestrial Woodland (BTW) Dry to Moist (mesic), Partial to filtered light, early successional.

Estimate of Area of Potential Habitat: none

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):
Moist to Dry, Medium brown, Silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
early successional	W (gentle)	

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☒ Partial	☐ Upper Slope	☒ 0-10%
☒ Moist (mesic)	☒ Filtered	☒ Mid-slope	☐ 10-35%
☒ Dry (mesic)	☐ Shaded	☒ Lower Slope	☐ 35+%
☐ Dry (xeric)		☐ Bottom	☐ Vertical

AOC: W16+ Habitat: K
ALT W6
(BTW)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]	Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐ 1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐ 11-50	☐	☐ 1-5 yd²	___ % Seedlings	☑ Feeble
☐ In flower	☐ 51-100	☐	☐ 5-10 yd²	___ % Immature	☑ Normal
☐ Immature fruit	☐ 101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☑ Vigorous
☐ Mature fruit	☐ 1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐ 10K+	☐	☐ 1+ acres	___ % Senescent	
	_____ EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Quercus alba	Juglans nigra Lindera benzion	Amphicarpaea bracteata
Acer rubrum	Acer Rubrum	Parthenocissus quinquefolia
Juglans nigra	Ulmus americana	Urtica dioica
	Ostrya virginiana	

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Quercus imbricata	Quercus alba	Galium aparine
Fraxinus americana	Quercus nigra	Potentilla simplex
Quercus bicolor	Cornus florida	Eurybia divaricata
Acer saccharum	Ligustrum vulgare	Ageratina altissima
Pinus virginiana	Ribes americanum	Impatiens capensis
Carya ovata		

Invasive Species Present at Site (est. % Cover):
Rosa multiflora Lonicera tatarica Alliaria petiolata
Lonicera morrowii microstegium Viminium Celastrus orbiculatus

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16 Habitat K
AOC Alt W6 (BTF)

Herbaceous Cont.

Toxicodendron radicans
Symphyotrichum rugosum
Arisaema atrorubens
Geum canadense
Symphyotrichum pilosus
Rubus occidentalis
Anemones virginiana

AOC: W16 Habitat: L (CBTF)
Alt W6

Version 4.2012

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Species Name: AOC W16 + ALT W6 Trifolium virginicum Oenothera argillicola	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):** -	☐ New Occurrence ☐ Update
Surveyor(s): Korey Mccluskey, Codie Vilen	**Survey Date(s):** 8-4-15	**Time Spent:** 2 hr.
Site Name: Aoc W16 AOC Alt W6	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See attached USGS Project location maps + Arial Habitat Detail Maps for AOC W16 + AOC Alt W6		
Site Owner: –	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: • PA-HU-0020.0008-TAR	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO	
	Landowner consent for voucher collection? ☐ YES ☐ NO	

General SOSC Habitat Description: Dry mesic, shaded light, mid-late successional Coniferous - Broadleaf terrestrial forest.			
Estimate of Area of Potential Habitat: none			
Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.): Moist to Dry, Dark to Medium brown, Silt loam			
Relative age/Successional stage: mid-late successional	**Aspect:** W	**Elevation (provide units):** 825' to 850'	
Moisture: ☐ Inundated (hydric) ☐ Saturated (wet-mesic) ☑ Moist (mesic) ☑ Dry (mesic) ☐ Dry (xeric)	**Light:** ☐ Open ☐ Partial ☐ Filtered ☑ Shaded	**Topo Position:** ☐ Crest ☐ Upper Slope ☐ Mid-slope ☑ Lower Slope ☐ Bottom	**Slope:** ☐ Flat ☑ 0-10% ☐ 10-35% ☐ 35+% ☐ Vertical

AOC: W16+ Habitat: L
ALT W6

(CBTF)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☑ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☑ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☑ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Acer saccharum Quercus alba	Ostrya virginiana Acer saccharum Hamamelis virginiana Viburnum acerifolium	Ageratina altissima Parthenocisis quinquefolia Hepatica americana Acer saccharum Dioscorea villosa

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Fraxinus americana Quercus rubra Robinia pseudoacacia Prunus serotia Quercus imbricaria (Cont. of back)	Ulmus americana Lindera benzoin Cornus florida Aesculus altisima Fraxinus americana Quercus rubra	Geum canadensis Polystichum acrostichoides toxicodendron radicans Symphyotrichum divaricata Podophyllum peltatum

Invasive Species Present at Site (est. % Cover):
Rosa multiflora Alliaria petiolata
Lonicera tatarica

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

Hoc W16 +
Hoc Alt W6

Habitat L
(CBTF)

Canopy

Carya ovata
Juglans cinerea
Betula lenta
Carya cordiformis
Pinus strobus
Tsuga canadensis
Quercus nigra
Quercus muehlenbergii

Herbaceous

Smilacina racemosa
Dryopteris sp.
Fraxinus americana
ailanthus altissima
Ribes sp.
Goodyera pubescens
Galium triflorum
Persicaria virginiana
polygonatum biflorum
Smilax rotundifolium
Rubus occidentalis
michella repens
Acer pensylvanica
Persicaria virginianna
Agrimonia striata

AOC: W16 Habitat: M (TS)
Alt W6

Version 4.2012

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Species Name: AOC W16 + ALT W6 Trifolium virginicum Oenothera argillicola	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):** -	☐ New Occurrence ☐ Update
Surveyor(s): Korey McCluskey, Codie Vilena	**Survey Date(s):** 8-4-15	**Time Spent:** 1.5hr
Site Name: AOC W16 AOC alt W6	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See attached USGS Project location maps + Aerial Habitat Detail Maps for AOC W16 + AOC Alt W6		
Site Owner: -	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: PA-HU-0020.0008-TAR	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO	
	Landowner consent for voucher collection? ☐ YES ☐ NO	

General SOSC Habitat Description: Dry, maintained, shaded, late successional terrestrial shrubland / thicket;

Substrate is ideal but far too shaded + overgrown

Estimate of Area of Potential Habitat: none

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):

Dry, Light Brown, Silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
late successional	W	830'-820'

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☒ 0-10%
☐ Moist (mesic)	☐ Filtered	☐ Mid-slope	☐ 10-35%
☒ Dry (mesic)	☒ Shaded	☒ Lower Slope	☐ 35+%
☐ Dry (xeric)		☐ Bottom	☐ Vertical

AOC: W16 + Habitat: M(TS)
ALT W6

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☑ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☑ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☑ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence:
☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Sassafrass albidum	Quercus meuhlenbergii	Toxicodendrons radicans
Populus deltoides	Sassafrass albidum	Parthenocissus quinquefolia
Quercus alba	Hamamelis virginiana	
	Populus deltoides	

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Prunus serotina	Ailanthus altissima	Dryopteris sp.
Acer saccharum	Cornus racemosa	Geum canadensis
Acer rubrum Tsuga canadensis	Cornus florida	
Pinus strobus	Juglans nigra	
Quercus meuhlenbergii		

Invasive Species Present at Site (est. % Cover):

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

AOC W16
AOC Alt W6

Habitat M (TS)

Sub-canopy cont.

Acer saccharum
Acer rubrum
Ulmus americana

AOC: W16 Habitat: N (BTF)
Alt W6

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Species Name: AOC W16 + ALT W6 Trifolium virginicum Oenothera argillicola	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):** -	☐ New Occurrence ☐ Update
Surveyor(s): Kacy MacMuskey, Codie Vitko	**Survey Date(s):** 8/4/15	**Time Spent:** 2 hr.
Site Name: AOC W16 + AOC Alt W6	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See attached USGS Project location maps + Arial Habitat Detail Maps for AOC W16 + AOC Alt. W6		
Site Owner: -	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: •PA-Hu-0020.0008-TAR	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO	
	Landowner consent for voucher collection? ☐ YES ☐ NO	

General SOSC Habitat Description: Dry to moist (mesic) shaded, slightly disturbed, early-mid successional broad leaf terrestrial forest.

Estimate of Area of Potential Habitat: none

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):

Dry to Moist, Dark brown Silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
early-mid successional	W	

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☐ Open	☐ Crest	☐ Flat
☐ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☒ 0-10% 8-15%
☒ Moist (mesic)	☐ Filtered	☒ Mid-slope	☒ 10-35%
☒ Dry (mesic)	☒ Shaded	☒ Lower Slope	☐ 35+%
☐ Dry (xeric)		☐ Bottom	☐ Vertical

AOC: W16 + ALT W6 Habitat: N (BTF)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☑ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☑ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☑ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	____	EST #	____	____ Est Area		

ID Confidence:	ID Problems (explain):
☐ Positive ID ☐ Somewhat certain ☐ Uncertain	

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Quercus rubra Quercus alba Acer rubra Juglans nigra Acer saccharum	Hamamelis virginiana Lindera benzoin	Polygonatum biforum Eurybia divaricata Parthenocissus quinquefolia

Other Species Present:

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Carya ovata Liriodendron tulipifera Pinus virginiana Ulmus americana Sassafrass albidum Fraxinus americana Populus deltoides Quercus imbricaria	Quercus rubra Ulmus americana Acer rubrum Juglans nigra Cont. on back. Carya ovata Acer saccharum	Helianthus divaricatus Geranium maculatum toxicodendron radicans Fraxinus americana Viola sororlna

Invasive Species Present at Site (est. % Cover):
Berberis thunbergii Microstegium vimineum
Rosa multiflora
Lonicera tatarica

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.*

AOC W16
AOC Hit. W6

Habitat N

Sub-canopy

Ulmus rubra
Cornus racemosa
Ligustrum vulgara
Carpinus caroliniana
Crataegus sp.
Carya cordiformis
Quercus imbricata
Liriodendron tulipifera
Ailanthus altissima
Ostrya virginiana

Herbaceous

Carex sp.
Ribes sp.
Dioscorea villosa
Quercus rubra
Symphyotrichum pilosus
Galium aparine
Pinus virginiana
Smilax rotundifolia
Amphicarpa bracteata
Thalictrum dioica
Onoclea sensibilis
Urtica dioica
Rubus occidentalis
Sassafras albidum
Podophyllum peltatum
Geum canadense
Celastrus orbiculatus
Aremones virginiana

AOC: W16 + ALT W6 Habitat: O (THO)

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Species Name: AOC W16 + AOC ALT W6 • Trifolium virginicum • Oenothera argillicola	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):** -	☐ New Occurrence ☐ Update
Surveyor(s): Karey McCluskey, Codie Vileno	**Survey Date(s):** 8-4-15	**Time Spent:** 1.5 hrs
Site Name: AOC W16 + AOC ALT W6 - Hab-O	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See attached USGS Project location Maps + Aerial Habitat Detail Maps for AOC W16 + Alt W6.		
Site Owner: –	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: • PA-HU-0020,0008-TAR	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO	
	Landowner consent for voucher collection? ☐ YES ☐ NO	

General SOSC Habitat Description: Dry, moderately to Highly disturbed, Full Sunlight, maintained dirt access road, Terrestrial herbaceous opening.

Estimate of Area of Potential Habitat: Poor Habitat Suitability for both target species.

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):

Shaley, Dry, Disturbed, unconsolidated Fill/ Silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
early successional		Variable

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☑ Open	☐ Crest	☑ Flat
☐ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☑ 0-10%
☐ Moist (mesic)	☐ Filtered	☐ Mid-slope	☐ 10-35%
☐ Dry (mesic)	☐ Shaded	☑ Lower Slope	☐ 35+%
☑ Dry (xeric)		☑ Bottom	☐ Vertical

AOC: W16 → ALT W6 Habitat: O (THO)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd²	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd²	___ % Seedlings	☑ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd²	___ % Immature	☑ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd²	___ % 1st Year	☑ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd² – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	_____	EST #	_____	_____ Est Area		

ID Confidence: ☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy:	Sub-Canopy/Shrub:	Herbaceous:
Carya ovata Juglans nigra Acer saccharum Populus deltoides	Populus deltoides Hamamelis virginiana Ailanthus altissima Lonicera tatarica	Lotus corniculatus Securigera varia Plantago major Plantago lanceolata Trifolium repens, pretense, hybridum

Other Species Present:

Canopy: N/A	Sub-Canopy/Shrub:	Herbaceous:
	Acer Saccharum Acer negundo Rubus allegheniensis Cornus racemosa	Erigeron annuus Erigeron philadelphicus Achillea millefolium Daucus carota Oxalis corniculata Dactylis glomerata

*List cont. on back.

Invasive Species Present at Site (est. % Cover): Lonicera tatarica - 10%, Ailanthus altissima - 5%,

Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.

Acc: W16+ Habitat: O
Alt W6
(THO)

Herbs continued.

Phleum pratense
Festuca sp.
Physalis heterophylla
Eupatorium perfoliatum
Desmodium canescens
Viola sp.
Taraxacum officinale
Solidago canadensis
Apocynum cannabinum
Solidago rugosa
Dichanthelium clandestinum
Toxicodendron radicans
Rudbeckia hirta

AOC: W16 + ALT W6 Habitat: P (TOM)

Version 4.2012

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Species Name: AOC W16 + ALT W6 • Oenothera argillicola • Trifolium virginicum * No SOSC identified within AOC.	**PNDI # (if applicable):** 22275 **EO ID # (if applicable):** -	☐ New Occurrence ☐ Update
Surveyor(s): Korey McClurkey, Codie Vilero	**Survey Date(s):** 8-4-15	**Time Spent:** 1 hr
Site Name: AOC W16 + ALT W6 - Habitat P	**GPS Coordinates of Occurrence (include datum):**	
Directions to Site: See attached USGS Project Location Map, Aerial Habitat Detail Map		
Site Owner: –	**Landowner aware of Species of Special Concern?** ☐ YES ☐ NO	
Owner Contact Information: • PA-HU-0020.0008-TAR	**Landowner consent for data submission to PA Heritage Program?** ☐ YES ☐ NO	
	Landowner consent for voucher collection? ☐ YES ☐ NO	

General SOSC Habitat Description: Dry, Full sunlight, moderately disturbed, early successional terrestrial meadow. Grass + wildflowers + low shrubs.

Estimate of Area of Potential Habitat: None.

Soil conditions (Substrate and soil type, soil moisture, underlying geology, etc.):

Dry, Shaley, Light tan, Silt loam

Relative age/Successional stage:	**Aspect:**	**Elevation (provide units):**
Early successional	W (gentle)	830'

Moisture:	**Light:**	**Topo Position:**	**Slope:**
☐ Inundated (hydric)	☑ Open	☐ Crest	☑ Flat
☐ Saturated (wet-mesic)	☐ Partial	☐ Upper Slope	☑ 0-10%
☐ Moist (mesic)	☐ Filtered	☐ Mid-slope	☐ 10-35%
☐ Dry (mesic)	☐ Shaded	☑ Lower Slope	☐ 35+%
☑ Dry (xeric)		☐ Bottom	☐ Vertical

AOC: W16 + ALT W6 Habitat: P (TOM)

SOSC Occurrence Information (describe below)

Phenology:	# Plants: Ramets[1]		Genets[2]	Population Area:	Age Structure:	Vigor:
☐ In leaf	☐	1-10	☐	☐ 1 yd^2	___ Annuals	☐ Very Feeble
☐ In bud	☐	11-50	☐	☐ 1-5 yd^2	___ % Seedlings	☒ Feeble
☐ In flower	☐	51-100	☐	☐ 5-10 yd^2	___ % Immature	☒ Normal
☐ Immature fruit	☐	101-1000	☐	☐ 10-100 yd^2	___ % 1st Year	☒ Vigorous
☐ Mature fruit	☐	1001-10K	☐	☐ 100 yd^2 – 1 ac	___ % Mature	☐ Exceptional vigor
☐ Seed dispersing	☐	10K+	☐	☐ 1+ acres	___ % Senescent	
	______	EST #	______	_____ Est Area		

ID Confidence: ☐ Positive ID ☐ Somewhat certain ☐ Uncertain

ID Problems (explain):

_____Known or _____Inferred Land Use History:

Integrity/Fragmentation of Habitat:

Land Use/Disturbance Information:

Threats (on- or off-site):

Conservation or Management Recommendations:

Additional SOSC Comments:

[1]Ramet: individual reproduced vegetatively (a clone)
[2]Genet: individual generated by sexual reproduction (a seedling)

Associated Species :: Most Abundant/Dominant by Strata (est. % cover):

Canopy: N/A	Sub-Canopy/Shrub: N/A	Herbaceous:
		Solidago canadensis Phleum pratense Helianthus spp. Vernonia noveboracensis

Other Species Present:

Canopy: N/A	Sub-Canopy/Shrub: N/A	Herbaceous:
		Solanum carolinense Eleagnus umbellatum Pinus strobus Rudbeckia laciniata Asclepias syriaca

*List cont. on back...

Invasive Species Present at Site (est. % Cover):

***Please also submit site maps indicating species location, any photographs taken (to aid in confirming ID) and if a voucher specimen is collected, the label data, number, and repository.*

AOC: W16+ Habitat: P
ALT W6
(TOM)

Herbs cont.

Festuca arundinacea
Rosa multiflora
Agrostis sp.
Solidago rugosa
Euthamia graminifolia
Symphyotrichum pilosum
Achillea millefolium
Daucus carota
Lamium purpurea
Eupatoriadelphus fistulosus
Apocynum cannabinum

APPENDIX H
Representative Habitat Photographs

Agriculture/ Fallow Field - AG/FF

Broadleaf Terrestrial Forest - BTF

Broadleaf Terrestrial Woodland - BTW

Coniferous-Broadleaf Terrestrial Forest - CBTF

Coniferous-Broadleaf Terrestrial Woodland - CBTW

Coniferous Terrestrial Forest - CTF

Mesic Broadleaf Terrestrial Forest - MBTF

Mesic Broadleaf Terrestrial Woodland - MBTW

Mesic Broadleaf Woodland - MSB

Mesic Broadleaf Forest-MSF

Palustrine Emergent Wetland - PE

Palustrine Forested Wetland or Floodplain - PF

Palustrine Scrub-Shrub Wetland - PS

Palustrine Successional Farm Pond - PSFP

Riverine Broadleaf Terrestrial Forest - RBTF

Riverine Broadleaf Terrestrial Woodland - RBTW

Serpentine Grassland - SGL

Terrestrial Herbaceous Opening - THO

Terrestrial Shrub Opening - TS

Urban-Residential-Developed - URD

APPENDIX I
Comprehensive Vegetation Lists

Note: Appendix I has been modified to only include vegetation list from AOC W16

List of Vegetation Observed During the Botanical Survey of AOC W16 and Alt W6

Common Name	Latin Name
Striped Maple	*Acer pensylvanicum*
Red maple	*Acer rubrum*
Sugar Maple	*Acer saccharum*
Common yarrow	*Achillea millefolium*
Sweet flag	*Acorus americanus*
White Snakeroot	*Ageratina altissima*
Woodland Grooveburr	*Agrimonia striata*
Unidentified Bent	*Agrostis sp.*
Tree-of-Heaven	*Ailanthus altissima*
Garlic-Mustard	*Alliaria petiolata*
Common ragweed	*Ambrosia artemisifolia*
Hog peanut	*Amphicarpa bracteata*
American Hog-Peanut	*Amphicarpaea bracteata*
Tall Thimbleweed	*Anemone virginiana*
Thimbleweed	*Anenome virginiana*
Spreading Dogbane	*Apocynum androsaemifolium*
Indian-Hemp	*Apocynum cannabinum*
Jack-in-the-pulpit	*Arisaema triphyllum*
Common milkweed	*Asclepias syriaca*
Butterfly-weed	*Asclepias tuberosa*
Ebony spleenwort	*Asplenium platyneuron*
Japanese barberry	*Berberis thunbergii*
Black birch	*Betula lenta*
Devil's-Pitchfork	*Bidens frondosa*
False-nettle	*Boehmeria cylindrica*
Unidentified Sedge	*Carex sp.*
American Hornbeam	*Carpinus caroliniana*
Bitter-Nut Hickory	*Carya cordiformis*
Pignut Hickory	*Carya glabra*
Shag-bark hickory	*Carya ovata*
Unidentified Hickory	*Carya sp.*
Mockernut hickory	*Carya tomentosa*
Asian Bittersweet	*Celastrus orbiculatus*
Spotted knapweed	*Centaurea stroebe*
Sleepingplant	*Chamaecrista fasciculata*

Common Name	Latin Name
Lamb's-quarters	*Chenopodium album*
Spotted Water-Hemlock	*Cicuta maculata*
Broadleaf Enchanter's Nightshade	*Circaea canadensis*
Wild basil	*Clinopodium vulgare*
Silky Dogwood	*Cornus amomum*
Flowering Dogwood	*Cornus florida*
Gray dogwood	*Cornus racemosa*
Crown Vetch	*Coronilla varia*
Unidentified Hawthron	*Crataegus sp.*
Orchard grass	*Dactylis glomerata*
Hay-scented fern	*Dennstaedtia punctilobula*
Showy Tick-Trefoil	*Desmodium canadense*
Deertongue-grass	*Dichanthelium clandestinum*
Wild yam root	*Dioscorea villosa*
Marginal wood fern	*Dryopteris marginalis*
Unidentified Wood Fern	*Dryopteris sp.*
Autumn Olive	*Elaeagnus umbellata*
Trailing-arbutus	*Epigaea repens*
Daisy fleabane	*Erigeron annus*
Philadelphia Fleabane	*Erigeron philadelphicus*
Common Boneset	*Eupatorium perfoliatum*
Flowering spurge	*Euphorbia collorata*
White Wood Aster	*Eurybia divaricata*
Flat-Top Goldentop	*Euthamia graminifolia*
Trumpetweed	*Eutrochium fistulosum*
Spotted joe-pye-weed	*Eutrochium maculatum*
Unidentified Fescue	*Festuca sp.*
White Ash	*Fraxinus americana*
Red Ash	*Fraxinus pennsylvanica*
Cleavers	*Galium aparine*
Fragrant Bedstraw	*Galium triflorum*
Wild geranium	*Geranium carolinianum*
Spotted Crane's-Bill	*Geranium maculatum*
White avens	*Geum canadense*
Downy rattlesnake-plantain	*Goodyera pubescens*
Witch-hazel	*Hamamelis virginiana*
Woodland Sunflower	*Helianthus divaricatus*
Unidentified Sunflower	*Helianthus sp.*
Ox-eye	*Heliopis helianthoides*
Rattlesnake-weed	*Hieracium venosum*

Common Name	Latin Name
Pineweed	*Hypercium gentianoides*
St. Johnswort	*Hypercium punctatum*
Shrubby St. Johnswort	*Hypercium spathulatum*
Jewelweed	*Impatiens capensis*
White Walnut	*Juglans cinerea*
Black Walnut	*Juglans nigra*
Mountain laurel	*Kalmia latifolia*
Purple Deanettle	*Lamium purpureum*
White Grass	*Leersia virginica*
Hairy Lespedeza	*Lespedeza hirta*
Violet Lespedeza	*Lespedeza violacaea*
European Privet	*Ligustrum vulgare*
Butter-and-eggs	*Linaria vulgaris*
Spicebush	*Lindera benzoin*
Tuliptree	*Liriodendron tulipifera*
Indian tobacco	*Lobelia inflata*
Morrow's Honeysuckle	*Lonicera morrowii*
Twinsisters	*Lonicera tatarica*
Garden Bird's-Foot-Trefoil	*Lotus corniculatus*
Whorled loosestrife	*Lysmachia quadrifolia*
False Solomon's-seal	*Maianthemum racemosum*
Japanese Stilt Grass	*Microstegium vimineum*
Partridge-berry	*Mitchella repens*
Shale Barren Evening Prmirose	*Oenothera argillcola*
Evening-primrose	*Oenothera biennis*
Sensitive fern	*Onoclea sensibilis*
Eastern Hop-Hornbeam	*Ostrya virginiana*
Creeping Yellow Wood-Sorrel	*Oxalis corniculata*
Common yellow wood-sorrel	*Oxalis stricta*
Switchgrass	*Panicum virgatum*
Virginia-Creeper	*Parthenocissus quinquefolia*
Smartweed	*Persicaria pensylvanica*
Arrow-Leaf Tearthumb	*Persicaria sagittata*
Jumpseed	*Persicaria virginiana*
Common Timothy	*Phleum pratense*
Lopseed	*Phryma leptostachya*
Pokeweed	*Phytolacca americana*
Clearweed	*Pilea pumila*
Red Pine	*Pinus resinosa*
Pitch Pine	*Pinus rigida*

Common Name	Latin Name
Eastern White Pine	*Pinus strobus*
Virginia Pine	*Pinus virginiana*
English plantain	*Plantago lanceolata*
Great Plantain	*Plantago major*
Mayapple	*Podophyllum peltatum*
King Solomon's-Seal	*Polygonatum biflorum*
Christmas Fern	*Polystichum acrostichoides*
Eastern Cottonwood	*Populus deltoides*
Sulfur cinquefoil	*Potentilla recta*
Oldfield Cinquefoil	*Potentilla simplex*
Cinquefoil	*Potentilla sp.*
Black cherry	*Prunus serotina*
Hoary Mountainmint	*Pycnanthemum incanum*
Narrowleaf Mountainmint	*Pycnanthemum tenuifolium*
Northern white oak	*Quercus alba*
Swamp White Oak	*Quercus bicolor*
Bear oak	*Quercus ilicifolia*
Shingle Oak	*Quercus imbricaria*
Chestnut oak	*Quercus montana*
Chinkapin Oak	*Quercus muehlenbergii*
Water Oak	*Quercus nigra*
Northern red oak	*Quercus rubra*
Wild Black Currant	*Ribes americanum*
Unidentified Goosberry	*Ribes sp.*
Black locust	*Robinia pseudoacacia*
Multiflora Rose	*Rosa multiflora*
Common blackberry	*Rubus allegheniensis*
Northern dewberry	*Rubus flagellaris*
Black raspberry	*Rubus occidentalis*
Black-Eyed-Susan	*Rudbeckia hirta*
Bitter dock	*Rumex obtusifolius*
Black Willow	*Salix nigra*
American elder	*Sambucus canadensis*
Black Elder	*Sambucus nigra*
Sassafras	*Sassafras albidum*
Tall False Rye Grass	*Schedonorus arundinaceus*
Crownvetch	*Securigera caria*
Yellow foxtail	*Setaria pumila*
Catbrier	*Smilax rotundifolia*
Horse Nettle	*Solanum carolinense*

Common Name	Latin Name
Canada goldenrod	*Solidago canadense*
Canadian Goldenrod	*Solidago canadensis*
Smooth goldenrod	*Solidago gigantea*
Wrinkle-Leaf Goldenrod	*Solidago rugosa*
Unidentified Goldenrod	*Solidago sp.*
Sow thistle	*Sonchus arvensis*
Lawn American-Aster	*Symphyotrichum divaricatum*
New England American-Aster	*Symphyotrichum novae-angliae*
White Oldfield American-Aster	*Symphyotrichum pilosum*
Crooked-Stem American-Aster	*Symphyotrichum prenanthoides*
Small white aster	*Symphyotrichum racemosum*
American Germander	*Teucrium canadense*
Early Meadow-Rue	*Thalictrum dioicum*
Poison-ivy	*Toxicodendron radicans*
Alsike Clover	*Trifolium hybridum*
Red clover	*Trifolium pratense*
White clover	*Trifolium repens*
Kate's Mountain Clover	*Triifolium virginicum*
Eastern hemlock	*Tsuga canadensis*
American Elm	*Ulmus americana*
Stinging Nettle	*Urtica dioica*
Low sweet blueberry	*Vaccinium angustifolium*
Common mullien	*Verbascum verbatum*
Wingstem	*Verbesina alternifolia*
New York ironweed	*Veronia noveboracensis*
Thyme-leaved speedwell	*Veronica serpyllifolia*
Maple-leaved viburnum	*Vibunum acerifolium*
Nannyberry	*Viburnum lentago*
Black-haw	*Viburnum prunifolium*
Hooded Blue Violet	*Viola sororia*
Violet	*Viola sp.*
Summer grape	*Vitis aestivalis*
Corn	*Zea mays*

APPENDIX J
Photographs of Identified Species of Special Concern

Note: No Species of Special Concern Identified in AOC W16

APPENDIX K
Resumes

TETRA TECH

Korey M. McCluskey
Environmental Scientist IV – Technical Lead

EXPERIENCE SUMMARY

Mr. Korey McCluskey a wetland/environmental scientist - technical lead with 8+ years of experience in wetland delineation, stream evaluation, rare, threatened & endangered (SOSC) botanical surveying and assessment, and construction monitoring throughout Pennsylvania, Ohio, West Virginia, New Jersey and New York. Korey has performed hundreds of wetland delineations and stream evaluations as well as conducted numerous botanical surveys, habitat assessments, and related report generation. Korey is on the USFWS short list of qualified surveyors for the federally listed Running Buffalo Clover. He has provided environmental consultation to clients in the commercial Oil and Gas, residential development, and public utility sectors to ensure compliance with local, state, and federal environmental regulations and ordinances through the environmental permitting process, including minimization of impacts to aquatic and terrestrial resources. This permitting, documentation, and guidance includes the preparation of wetland delineation and stream evaluation reports, botanical reports, wetland creation, wetland monitoring, 404 and related state and local permits, assisting with environmental assessments, and preparation of other environmental reports. He also has experience performing bat hibernaculum and summer roost tree habitat surveys in Western Pennsylvania.

RELEVANT EXPERIENCE

FIELD (OIL/GAS)

Wetland/Environmental Scientist IV - Department Technical Lead; Sunoco Logistics; OPP and PPP Natural Gas Pipeline Projects, Multiple Counties across Ohio, West Virginia, and Pennsylvania; October 2013 to present. Responsibilities included aiding in wetland delineations and stream assessments for the proposed 450 miles of the Ohio Pipeline (OPP) and Pennsylvania Pipeline Projects (PPP).

Wetland/Environmental Scientist IV - Department Technical Lead; Sunoco Logistics; OPP and PPP Natural Gas Pipeline Projects, Rare, Threatened, and Engendered Species Surveys; 43 listed Species of Special Concern (SOSC); March 2014 to present. Pennsylvania. Segments 1, 2, and 3 Botanical Survey Lead, and crew leader. Responsibilities included organizing and conducting all field work operations for multiple botanical crews, conducted botanical surveys for the 350 miles of proposed pipeline installation for the Ohio Pipeline (OPP) and Pennsylvania Pipeline Projects (PPP). Additional work included proposing potential re-routes and avoidance recommendations on a potential environmental impact basis.

EDUCATION

B.A., Environmental Sciences, University of Pittsburgh, April. 2006

Geographical Information Systems (GIS) Certificate, University of Pittsburgh, April. 2006

REGISTRATIONS

Wild Plant Management Permit, PA, 2014, Permit # 15-624

USFWS Certified Qualified Surveyor for the Federally Listed Running Buffalo Clover

AREA OF EXPERTISE

Wetland Delineation and Stream Identification & RTE Botanical Surveys

TRAINING/CERTIFICATIONS

USFWS and WV DNR Sponsored Training for the Identification of the Federally Listed Running Buffalo Clover, Virginia Spirea, and Small Whorled Pogonia, May 2015.

2015 PA Plant Forum and Winter Woody ID workshop. Sponsored by the PA DCNR and Western Pennsylvania Conservancy, April 2015.

Creation and Restoration of Wetlands - The Olentangy River Wetland Research Park, The Ohio State University, July 2011.

Identification of Freshwater Wetland Sedges, Grasses, and Rushes - Pennsylvania Institute for Conservation Education, August 2010.

Ohio Rapid Assessment Method (ORAM) for Wetlands v. 5.0- Ohio Environmental Protection Agency, March. 2009.

ACOE-based 40-hour Wetland Delineation Certification - Richard Chinn Environmental Training, Inc., March. 2007.

OFFICE

Pittsburgh, PA

YEARS OF EXPERIENCE

8+

YEARS WITHIN FIRM

2+

CONTACT

Korey.McCluskey@TetraTech.com

Wetland/Environmental Scientist IV - Department Technical Lead; Dominion Transmission, Inc.; Lebanon West II - TL-400 FERC Pipeline Project; Tuscarawas, Licking, Muskingum, Harrison, Coshocton, Columbiana, and Carroll Counties, Ohio (OH) and in Beaver County, Pennsylvania (PA); June 2014 to present. Responsible for conducting wetland delineations and stream evaluations for the natural gas pipeline replacement segments of the TL-400 FERC Pipeline Project. Specific tasks included field surveys, report preparation, and completion of Ohio EPA specific wetland and stream assessments.

Wetland/Environmental Scientist IV - Department Technical Lead; Noble Energy, Inc.; Various Water Withdrawal Projects; Greene, Fayette, Washington Counties (PA), and Marshall County (WV); March 2014 to present. Responsible for conducting numerous wetland delineations and stream evaluations for proposed water withdrawal projects located in southwestern Pennsylvania and the panhandle of West Virginia. Also prepared wetland delineation and stream assessment reports for each project in support of permit submissions.

Wetland/Environmental Scientist IV - Department Technical Lead; Noble Energy, Inc.; Dunkard Fork Water Withdrawal Project; Greene County, PA; June 2014 to September 2014. Responsible for conducting botanical surveys and habitat assessments for 5 listed SOSC. Responsible for preparing a botanical survey and habitat assessment report in support of permit submissions.

Wetland/Environmental Scientist IV - Department Technical Lead; Noble Energy, Inc.; Wolfe Run Resevoir Water Withdrawal, Water Pipeline, and Access Road Project; Marshall County, WV; May 2014 to September 2014. Responsible for conducting a wetland delineation and stream evaluation for a proposed water withdrawal, water pipeline, and its associated access road. Also prepared a wetland delineation and stream assessment report in support of permit submissions.

Wetland/Environmental Scientist IV - Department Technical Lead; Rice Drilling D, LLC; Various Water Withdrawal Projects; Harrison and Belmont Counties (OH); March 2014 to present. Responsible for conducting numerous wetland delineations and stream evaluations for proposed water withdrawal projects located in eastern Ohio. Also prepared wetland delineation and stream assessment reports for each project in support of permit submissions.

Wetland/Environmental Scientist IV - Department Technical Lead; Rice Poseidon Midstream, LLC; North Fork Dunkard Fork Water Withdrawal Project; Greene County, PA; December 2014 to January 2015. Responsible for conducting a botanical habitat assessment for 2 listed SOSC. Responsible for preparing a botanical habitat assessment report in support of permit submissions.

Wetland/Environmental Scientist IV - Department Technical Lead; Rice Drilling B, LLC; Fink Pond Impoundment Project; Greene County, PA; October 2014. Responsible for conducting a wetland delineation and stream investigation, as well as a botanical survey for 2 listed SOSC. Responsible for preparing a wetland delineation and stream identification report and a botanical survey report in support of permit submissions.

Wetland/Environmental Scientist IV - Department Technical Lead; Rice Poseidon Midstream, LLC; Waterboy to Pollock Natural Gas Pipeline Project; Washington County, PA; July 2014 to January 2015. Responsible for conducting a wetland delineation and stream identification survey. Responsible for preparing a wetland delineation and stream identification report in support of permit submissions.

Wetland/Environmental Scientist IV; MarkWest Liberty Midstream and Resources, LLC; Boyscout Camp Wetland Restoration Project & Post-Restoration Monitoring; Harrison County, PA; November 2012 to present. Responsible for evaluating post-impact conditions at a recently disturbed wetland, assist in designing a

USACE approved wetland restoration plan. Plans included survey of current and proposed wetland habitats, elevations, and hydrologic inputs; planting/seeding plan and implementation instructions; and construction/earthwork calculations and implementation instructions. Also responsible for wetland restoration monitoring for the past two years.

Wetland/Environmental Scientist III; Sunoco Logistics; Mariner East [ME1] Pipeline Project Natural Gas Pipeline Projects, Rare, Threatened, and Engendered Species Surveys; 8 listed Species of Special Concern (SOSC); April 2013 to August 2013. Botanical Survey Lead, and crew leader. Responsibilities included organizing and conducting all field work operations for multiple botanical crews, conducted botanical surveys for the 20 miles of the 40 mile proposed pipeline installation Mariner East [ME1] Pipeline Project. Additional work included proposing potential avoidance recommendations based on a potential environmental impact basis.

Wetland/Environmental Scientist III; MarkWest Ohio Gathering Company, LLC; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Ohio. Responsible for performing and assisting with wetland delineations for various proposed natural gas pipeline projects in eastern Ohio. Specific tasks included field survey, report preparation, and completion of Ohio EPA specific wetland and stream assessments.

Wetland/Environmental Scientist III; Gulfport Energy Corporation; Wetland Delineations for Miscellaneous Natural Gas Well Pad Projects; Ohio. Responsible for performing and assisting with wetland delineations for various proposed natural well pads southeastern Ohio. Specific tasks included field survey, report preparation, and completion of Ohio EPA specific wetland and stream assessments.

Wetland/Environmental Scientist III; Williams/Laurel Mountain Midstream Operations, LLC; Brown to Davis Natural Gas Pipeline Project; Fayette County, PA; January 2013 to present. Conducted a wetland delineation and stream evaluation for the Brown to Davis natural gas pipeline project. Also prepared a wetland delineation and stream evaluation report in support of permit submissions.

Wetland Scientist; Joseph and Lori Baker; Baker Property Wetland Restoration Project; Derry Township, Westmoreland County, PA; March 2010 to June 2010. As onsite environmental consultant to Joseph and Lori Baker, responsible for wetland and stream encroachment survey and assessment and assisted with a wetland restoration design and planting/seeding design.

Wetland Scientist/Project Manager; Range Resources; Multiple Temporary and Permanent Water Pipelines; Washington County, Pennsylvania. 2010 to 2011. Mr. McCluskey was responsible for wetland delineations and stream evaluations on dozens of temporary and permanent water pipelines linking frac water impoundments in the Washington County area.

FIELD (ENERGY TRANSMISSION)

Wetland Scientist; Orange & Rockland Utilities, Inc., Counties of Bergen (NJ) and Rockland (NY); Transmission Line 702 – Proposed Shield Wire Replacement Project; November 2008 to February 2009. Responsible for wetland delineation and stream evaluation of a 500 foot wide, 10 mile long transmission line corridor.

FIELD (MINING)

Wetland Scientist; Rosebud Mining Company; Kiski Junction Railroad Allegheny River Spur Re-activation Project; Bethel and Gilpin Townships, Armstrong County, PA; 2007 to 2008. As onsite environmental consultant to Rosebud Mining Company, responsible for wetland delineation and assisted with the preparation of a

Joint Permit Application for USACE Individual Permit, as well as assisting with wetland mitigation site search and wetland mitigation design for railroad re-activation project.

Wetland Scientist; MEPCO, LLC.; Coresco Overland Coal Conveyor Project; Greene (PA) and Monogalia (WV) Counties. Responsible for wetland delineation and review and stream evaluation of a 10 mile overland coal conveyor. Rare, threatened, and endangered species (SOSC) survey and permitting services were provided.

CHRONOLOGICAL HISTORY

Wetland/Environmental Scientist IV - Department Technical Lead; Tetra Tech, Inc.; Pittsburgh, PA, June 2014 – Present.

Wetland/Environmental Scientist III; Tetra Tech, Inc.; Pittsburgh, PA, October 2012 – June 2014.

Wetland Specialist/Project Manager; Pennsylvania Soil & Rock, Inc.; Monroeville, PA, May 2010 – October 2012.

Wetland/Environmental Specialist; Pennsylvania Soil & Rock, Inc.; Monroeville, PA, March 2008 – May 2010.

Wetlands Technician/Field Technician; Pennsylvania Soil & Rock, Inc.; Monroeville, PA, November 2006 – March 2008.

Park Naturalist; Frick Environmental Center – City of Pittsburgh; Pittsburgh, PA, April 2006 – November 2006.

SCIENTIFIC/TECHNICAL PUBLICATIONS

- N/A

MEMBERSHIPS

- Society of Wetland Scientists (SWS)

AWARDS

- N/A

TETRA TECH

Jason McGuirk
Wetland/Environmental Scientist IV

EXPERIENCE SUMMARY

Mr. Jason McGuirk has six years of professional experience in wetland delineation, permitting, fisheries and wildlife, and stream assessments and classification in Pennsylvania, New York, Ohio, and Alaska. Mr. McGuirk has conducted hundreds of wetland delineations, stream evaluations as well as conducted and produced habitat assessments, and post monitoring impact statements and assessments on over 800 miles of proposed natural gas pipeline, and fifty plus proposed well pad sites. He has extensive knowledge in watercourse classification and assessment including the Rosgen method. In particular attention of his has been focused on fisheries habitat and macro-invertebrate work, with over fifty miles of stream classifications in Alaska. Mr. McGuirk's educational background is in Fisheries and Aquaculture with a minor focus in Marine Biology and Wildlife management.

RELEVANT EXPERIENCE

Environmental Scientist III; Sunoco Logistics; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects, Engendered Species Surveys; Reptilia (*Glyptemys muhlenbergii*), Plantae (*Ellisia nyctelea*); Pennsylvania. Segments 1, 2, and 3 wetlands field lead, and crew leader. Responsibilities include organizing and conducting all field work operations for multiple wetlands crews, wetland delineations and stream assessments for the proposed 450 mile Pennsylvania Pipeline Project. Additional work included proposing potential re-route on an environmental basis.

Environmental Scientist III; MarkWest Liberty Midstream & Resources, LLC; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Pennsylvania. Responsible for performing and assisting with wetland delineations for various proposed natural gas pipeline projects in southwestern Pennsylvania. Specific tasks included field survey, report preparation, and wetland functional assessments.

Environmental Scientist III; MarkWest Ohio Gathering Company, LLC; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Ohio. Responsible for performing and assisting with wetland delineations for various proposed natural gas pipeline projects in eastern Ohio. Specific tasks included field survey, report preparation, and completion of Ohio EPA specific wetland and stream assessments.

EDUCATION

B.T. Fisheries and Aquaculture, SUNY Cobleskill, 2011T

REGISTRATIONS

Wild Plant Management Permit, PA, 2014, Permit # 14-651

AREA OF EXPERTISE

Wetland Delineation and Stream Identification, Fisheries, and Botanical Surveys

TRAINING/CERTIFICATIONS

Winter Vegetation ID, Rutgers University, 2012

Amtrak Contractor Certification, 2014

Certified Wetland Assessment Delineator, NY, 2009

OFFICE

Pittsburgh, PA

YEARS OF EXPERIENCE

6+

YEARS WITH TETRA TECH

2+

Environmental Scientist III; Gulfport Energy Corporation; Wetland Delineations for Miscellaneous Natural Gas Well Pad Projects; Ohio. Responsible for performing and assisting with wetland delineations for various proposed natural well pads southeastern Ohio. Specific tasks included field survey, report preparation, PCN preparation, and completion of Ohio EPA specific wetland and stream assessments.

Environmental Scientist III; MarkWest Liberty Midstream & Resources, LLC; Wetland Delineation and Engendered Species Survey (*Ranunculus flabellaris and Alopecurus aequalis*) for Vanport to Butler Gas Pipeline; Butler County, Pennsylvania. Responsible for performing and assisting with wetland delineation and endangered species survey along pipeline right-of-way. Specific tasks included field survey and report preparation.

Environmental Scientist III; Antero Resources Appalachian Corp.; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Ritchie and Doddridge Counties, West Virginia. Responsible for performing and assisting with wetland delineations for various proposed natural gas well pads and access roads in northern West Virginia. Specific tasks included field survey and report preparation.

Wetland & Watercourse Biologist; Chesapeake Energy; Schoharie County, PA; November 2011 to October 2012. Responsible for conducting wetland delineations for proposed pipe line routes and reroutes. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland report for 30 miles of pipeline in Northeastern Pennsylvania.

Wetland & Watercourse Biologist; Southwest Energy L.P; Schoharie County, PA; November 2011 to October 2012. Responsible for conducting wetland delineations on proposed Well pad and compressor sites. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland report for 15 proposed well pad locations in Northeastern Pennsylvania.

Wetland & Watercourse Biologist; Southwest Energy L.P; Susquehanna County, PA; November 2011 to October 2012. Responsible for conducting wetland delineations on proposed Well pad and compressor sites. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland report for 20 proposed well pad locations in Northeastern Pennsylvania.

Wetland & Watercourse Biologist; Chesapeake Energy; Carroll, Jefferson County, OH; November 2011 to October 2012. Responsible for conducting wetland delineations for proposed pipe line routes and reroutes. Performed ORAM and QHEI Assessments, and preparation of wetland report for 30 miles of pipeline in Eastern Ohio.

Wetland & Watercourse Biologist; Shell Oil; Butler County, PA; November 2011 to October 2012. Responsible for conducting wetland delineations for proposed pipe line routes and reroutes. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland report for 40 miles of pipeline in Western Pennsylvania.

Wetland & Watercourse Biologist; Chesapeake Energy; Schoharie County, PA; November 2011 to October 2012. Responsible for conducting Indiana Bat habitat surveys on multiple proposed natural gas pipelines in Northeastern Pennsylvania.

Wetland & Watercourse Biologist; Chesapeake Energy; Schoharie County, PA; November 2011 to October 2012. Responsible for conducting post construction habitat monitoring and assessment of constructed natural gas pipelines in Northeastern Pennsylvania.

CHRONOLOGICAL HISTORY

Wetland Environmental Scientist IV; Tetra Tech, Inc.; Pittsburgh, PA, June 2014 - Present

Wetland Environmental Scientist III; Tetra Tech, Inc.; Pittsburgh, PA, February 2013 - June 2014

Wetland & Watercourse Biologist; Hanover Engineering & Associates; Towanda, PA, November 2011 - October 2012

Assistant Hatchery Manager; SUNY Cobleskill; Cobleskill, NY, September – May of 2009- 2011

Biological Fisheries Technician, US Forest Service; Thorne Bay, AK, May 2010 - August 2010

Fisheries Technician, Cook Inlet Aquaculture Association, Kenai, AK, May 2009 – August 2009

SCIENTIFIC/TECHNICAL PUBLICATIONS

- McGuirk, J, M, "Walleye (*Sander vitreus)* spawning movements and habitat utilization in Otsego Lake, NY, 2011

MEMBERSHIPS

- N/A

AWARDS

- David E. Moorehouse Award for Outstanding Junior in Fisheries and Aquaculture B.T.

TETRA TECH

Codie Vileno
Environmental Scientist IV

EXPERIENCE SUMMARY

Mr. Vileno has worked in the environmental field for over seven years. His experience includes conducting wetland delineations, habitat assessments, and endangered species surveys. He has additional experience performing and supervising Phase 1 archaeological surveys. Mr. Vileno's educational background includes graduate level studies in wetland ecology, stream ecology, hydrology, wetland/stream restoration methods, geology, and environmental impact assessments.

RELEVANT EXPERIENCE

Environmental Scientist III; Environmental and Restoration Services Contract for Site 73, Site 178, and Site 20. Army Corps of Engineers Louisville District. Savanna, Illinois; November 2014. Conducted wetland delineation and threatened and endangered species review in support of remedial activities. Responsible for field effort and report deliverables.

Environmental Scientist III; Sunoco Logistics; Wetland Delineation and Engendered Species Survey for Pennsylvania Pipeline Project; Pennsylvania, January 2014 to December 2014. Conducted wetland delineations and endangered species survey along pipeline right-of-way. Specific tasks included field survey and report preparation.

Environmental Scientist III; Sunoco Logistics; Wetland Delineation and Engendered Species Survey for Ohio Pipeline Project; Ohio, West Virginia, Pennsylvania, January 2014 to December 2014. Conducted wetland delineations and endangered species survey along pipeline right-of-way. Specific tasks included field survey, report preparation, and permitting activities.

Environmental Scientist III; Rice Energy; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Pennsylvania and Ohio. Conducts wetland delineations and permitting activities for various proposed natural gas pipeline projects in eastern Ohio. Specific tasks include field survey, report preparation, completion of Ohio EPA specific wetland/stream assessments, agency consultation, and compiling of PCN.

Environmental Scientist III; MarkWest Liberty Midstream & Resources, LLC; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Pennsylvania. Conducts wetland delineations for various proposed natural gas pipeline projects in southwestern Pennsylvania. Specific tasks included field survey, report preparation, and wetland functional assessments.

Environmental Scientist III; MarkWest Ohio Gathering Company, LLC; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Ohio. Conducts wetland delineations for various proposed natural gas pipeline projects in eastern Ohio. Specific tasks included field survey, report preparation, and completion of Ohio EPA specific wetland and stream assessments.

Environmental Scientist III; Gulfport Energy Corporation; Wetland Delineations for Miscellaneous Natural Gas Well Pad Projects; Ohio. Responsible for performing and assisting with wetland delineations for various proposed natural well pads southeastern Ohio. Specific tasks included field survey, report preparation, PCN preparation, and completion of Ohio EPA specific wetland and stream assessments.

EDUCATION

B.A., Anthropology, 2007, State University College at Buffalo

AREA OF EXPERTISE

Wetland Science

TRAINING/CERTIFICATIONS

38 Hour ACOE Wetland Delineation Training Program, November 2009

Ohio Rapid Assessment Method for Wetlands Training Course, May 2013

Identifying Grasses, Sedges, and Rushes, June 2014

Winter Woody Plant Identification, April 2015

Running Buffalo Clover, Virginia Spirea, and Small Whorled Pogonia Federal RTE Identification Workshop, May 2015

Engineering for Ecosystem Restoration Workshop, June 2010

American Red Cross Adult First Aid/CPR/AED, March 2015

16 Hour Wilderness First Aid, November 2012

40 hours EPA 165.5 HAZWOPER Health and Safety Worker 2012

OFFICE

Pittsburgh, PA

YEARS OF EXPERIENCE

7+

YEARS WITHIN FIRM

7+

CONTACT

Codie.Vileno@TetraTech.com

Environmental Scientist III; MarkWest Liberty Midstream & Resources, LLC; Wetland Delineation and Engendered Species Survey (Ranunculus flabellaris and Alopecurus aequalis) for Vanport to Butler Gas Pipeline; Butler County, Pennsylvania. Responsible for performing and assisting with wetland delineation and endangered species survey along pipeline right-of-way. Specific tasks included field survey and report preparation.

Environmental Scientist III; Antero Resources Appalachian Corp.; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Ritchie and Doddridge Counties, West Virginia. Responsible for performing and assisting with wetland delineations for various proposed natural gas well pads and access roads in northern West Virginia. Specific tasks included field survey and report preparation.

Environmental Scientist III; Stone Energy; Wetland Delineation for Mercer 1 Well Pad; Sisterville, Tyler County, West Virginia; September 2012. Performed wetland delineation for proposed natural gas well pad and associated access road. Specific tasks included field survey and report preparation.

Environmental Scientist III; Laurel Mountain Midstream Operating, LLC; Endangered Species Survey (Yellow Passionflower) for Miller to Headlee Pipeline Project; Greene and Cumberland Townships, Greene County, Pennsylvania; September 2012. Assisted with botanical survey for yellow passionflower along the proposed Miller to Headlee natural gas pipeline right-of-way and access roads. Tasks included pre-survey research, field survey, and report preparation.

Environmental Scientist III; Laurel Mountain Midstream Operating, LLC; Endangered Species Survey (Drooping Bluegrass) for Nickelville Pipeline Project; Nickelville, Venango County, Pennsylvania; July 2012. Assisted with botanical survey for drooping bluegrass along the proposed Nickelville natural gas pipeline right-of-way. Specific tasks included field survey and report preparation.

Environmental Scientist III; Laurel Mountain Midstream Operating, LLC; Endangered Species Survey (Tall Larkspur) for Dunlap Creek Pipeline Project; Luzerne and Redstone Townships, Fayette County, Pennsylvania; June 2012. Assisted with botanical survey for tall larkspur along the proposed Dunlap Creek natural gas pipeline right-of-way and access roads. Specific tasks included field survey and report preparation.

Environmental Scientist III; Laurel Mountain Midstream Operating, LLC; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Pennsylvania. Responsible for performing and assisting with wetland delineations for various proposed natural gas pipeline projects in southwestern Pennsylvania. Specific tasks included field survey and report preparation.

Environmental Scientist III; Enervest Operating, LLC; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Ohio. Responsible for performing and assisting with wetland delineations for various proposed natural gas pipeline projects in southeastern Ohio. Specific tasks included field survey, report preparation, and completion of Ohio EPA specific wetland and stream assessments.

Environmental Scientist III; NAVFAC Washington; Marine Corps Base Quantico Wetland Functional Analysis; Quantico, Virginia; April 2012. Assisted with wetland functional assessments in support of remedial activities.

Environmental Scientist III; NASA; Wallops Flight Facility Remedial Action Contract; Wallops Island, Virginia; March 2012. Assisted with wetland delineation and wetland functional assessments in support of remedial activities.

Environmental Scientist III; Burnett Oil Company, Inc.; New Salem, Pennsylvania; December 2011 to February 2012. Responsible for performing and assisting with wetland delineations for various proposed natural gas pipeline projects in southwestern Pennsylvania. Specific tasks included field survey and report preparation.

Scientist I; Army Corps of Engineers; South Park Lake Dredge Project; Buffalo, New York; October 2011. Supervised Phase 1 archaeological survey in preparation of dredging activities.

Scientist I; Dominion East Ohio; Monroe County Gas Pipeline Project; Indiana Bat Habitat Assessment and Wetland Delineation; Woodsfield, Ohio; July 2011 to September 2011. Assisted with Indiana Bat habitat assessment and wetland delineation along a proposed natural gas pipeline right-of-way. Specific tasks included field survey and completion of Ohio EPA specific wetland and stream assessments. Other responsibilities included Phase 1A archaeological assessment

Archaeological Technician; National Grid; Lockport to Mortimer; Rochester, New York; May 2011 to October 2011. Performed Phase 1 archaeological survey in support of transmission line replacement. Assisted with report preparation.

Scientist I; National Fuel Gas Company; Tioga Pipeline Expansion; Tioga County, Pennsylvania; June 2011 to September 2011. Assisted with wetland delineation along proposed natural gas pipeline right-of-way. Other responsibilities included performing a Phase 1A archaeological assessment and supervising a Phase 1 archaeological survey.

Archaeological Technician; National Fuel Gas Company; Allegheny National Forest Pipeline Project; Warren, Pennsylvania; September 2009 to October 2009. Performed Phase 1 archaeological survey along proposed natural gas pipeline right-of-way.

Archaeological Technician; Dominion East Ohio; Pipeline Replacement; Wooster, Ohio; June 2008 to July 2009. Performed Phase 1 archaeological survey along proposed natural gas pipeline right-of-way.

Archaeological Technician; Haley & Aldrich, Inc.; AES Sparrows Point LNG; Cecil County, Maryland; June 2008 to July 2008. Performed Phase 1 archaeological survey along proposed natural gas pipeline right-of-way.

Archaeological Technician; Horizon Wind Energy, LLC; Arkwright Wind Farm; Arkwright, New York; September 2008 to March 2009. Performed Phase 1 archaeological survey on proposed turbine pads and transmission lines.

Archaeological Technician; National Fuel Gas Supply Company.; Galbraith Storage Field Expansion Project; Allegheny National Forest, Marienville, Pennsylvania; August 2008 to October 2008. Performed Phase 1 archaeological survey along proposed natural gas pipeline right-of-way.

CHRONOLOGICAL HISTORY

Environmental Scientist IV; Tetra Tech, Inc.; Pittsburgh, Pennsylvania; 2011 – Present

Scientist I; Tetra Tech, Inc.; Buffalo, New York; June 2008 – November 2011

Research Assistant; State University of New York Research Foundation; Buffalo, New York; October 2009 – January 2010

On-Call Research Assistant; State University of New York Research Foundation; Buffalo, New York; May 2009 – August 2009

Report Writer; Test America Laboratories; Amherst, New York; November 2007 – June 2008

SCIENTIFIC/TECHNICAL PUBLICATIONS

N/A

MEMBERSHIPS

- Society of Wetland Scientists

ANDREW J. GRECH
WETLAND ENVIRONMENTAL SCIENTIST III
PITTSBURGH, PA

EDUCATION: **B.T. Wildlife Management, SUNY Cobleskill, 2011**

CERTIFICATIONS/ REGISTRATIONS: **Certified Wetland Assessment Delineator, NY, 2009**

TRAINING: **Sedges, Grasses, and Rushes ID, Rutgers University, 2012**
Wetland Hydrology, Rutgers University, 2012

EXPERIENCE SUMMARY:

Mr. Andrew Grech has five years of professional experience in wetland delineation, permitting, fisheries and wildlife, and stream assessments and classification in Pennsylvania, New York, and Ohio. Mr. Grech has conducted hundreds of wetland delineations, stream evaluations as well as conducted and produced habitat assessments, and post monitoring impact statements and assessments on over one hundred and fifty miles of proposed natural gas pipeline, and twenty proposed well pad sites. He has extensive knowledge in watercourse classification and assessment including the Rosgen method. Mr. Grech's educational background is in Wildlife Management with a minor focus in Fisheries & Aquaculture.

PROJECT EXPERIENCE:

Wetland & Watercourse Biologist; Chesapeake Energy; Bradford, Wyoming, & Susquehanna Counties, PA; March 2012 to March 2013. Responsible for conducting wetland delineations for proposed pipe line routes and reroutes. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland report for 40 miles of pipeline in Northeastern Pennsylvania.

Wetland & Watercourse Biologist; Chesapeake Energy; Carroll, Jefferson County, OH; June-November 2012. Responsible for conducting wetland delineations for proposed pipe line routes and reroutes. Performed ORAM and QHEI Assessments, and preparation of wetland report for 50 miles of pipeline in Eastern Ohio.

Wetland & Watercourse Biologist; Shell Oil; Mckean & Bradford Counties, PA; March 2012 to March 2013. Responsible for conducting wetland delineations for proposed pipe line routes and reroutes. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland report for 40 miles of pipeline in Northeast/central Pennsylvania.

Wetland & Watercourse Biologist; Chesapeake Energy; Bradford, Wyoming, & Susquehanna Counties, PA; November 2012 to March 2013. Responsible for conducting post construction habitat monitoring and assessment of constructed natural gas pipelines in Northeastern Pennsylvania.

Wetland & Watercourse Biologist; Southwest Energy; Wayne, Monroe, & Pike Counties, PA; November 2012 to March 2013. Responsible for conducting wetland delineations for proposed well pads. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland report for 15 proposed well pads in Northeastern Pennsylvania.

Wetland & Watercourse Biologist; Markwest Energy; Allegheny, Butler, & Washington Counties, PA; August 2013 to October 2013. Responsible for conducting wetland delineations for proposed pipe line routes and reroutes. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland report for 20 miles of pipeline in Southwest Pennsylvania.

Wetland & Watercourse Biologist; REX Energy; Butler County, PA; September 2013. Responsible for conducting wetland delineations for proposed water withdrawal sites along Connoquenessing Creek and Glade Run. Performed PA Rapid Assessments, stream evaluation, and preparation of wetland reports for 2 water withdrawal sites in Southwest Pennsylvania.

Environmental Mgmt. Systems:

- Angler Surveys and Census for the Ice Fishery of Otsego Lake, NYDEC September - December 2007
- Pond surveys (water quality, fish identification, mapping) for Schoharie County residents January – May 2008
- Sonic and radio tracking, research crew member on 24 hour tracking samples. Otsego Lake N.Y. Through SUNY Cobleskill from September – December 2008
- Reptile and Amphibian trapping survey. SUNY Cobleskill from March – May 2009
- Wetland delineation, Field work in various wetlands thoughout the Cobleskill N.Y. area from September- December 2009
- Electrofishing Survey, Member of boat electro fishing crew; scapper, fish ID, Gill net retrieval, and fish measuring for night as well as day sampling of Otsego Lake N.Y. Through Biological Field Station from January – May 2010
- Waterfowl habitat survey, Activity budget survey, Nest Predation survey, various research projects around Cobleskill N.Y. September - December 2010.

Sampling:

Fisheries Technician; SUNY Cobleskill; Cobleskill, NY; September 2008. Responsible for preforming a fisheries survey and rescue for the N.Y. State power authority, on Gilboa reservoir. Sampled and collected fishes to be transported to mitigation location.

Fisheries Technician; SUNY Cobleskill; Cobleskill, NY; on and off from September 2007-December 2010. Responsible for collecting state fisheries data on several N.Y. state watersheds. Field sampling including haul seines, electro-shocking, gill nets, fyke nets, Responsible for the use of MS-222 for anesthetizing fishes during the study.

Wildlife Technician; SUNY Cobleskill; Cobleskill, NY; June 2010. Conducted local herpetology surveys on both salamander and frog habitats locally in and around Cobleskill area. Used amphibian traps to capture live specimens and recorded population densities and species diversity indexes for each location. Specifically focusing on human impacts, and habitat alterations and the population and diversity impacts associated with the disturbance.

Other:

New York State DEC; Trap-netted birds of prey, Richmondville, NY
SUNY Cobleskill; Electro-fishing/sonic tagging Walleye, Otsego Lake, NY
Otsego Lake Biological Field Station; Trap-netting/hydro-acoustic survey of Alewife, Otsego Lake, NY
SUNY Cobleskill; Electro-fished lake at night for a "mark and re-capture study," Otsego Lake, NY
New York State DEC; Bat count surveys, Howe Caverns, Cobleskill, NY
Peabody Wildlife Management Area; Trapping/radio-telemetry of Bob-white Quail, Drakesboro, KY
Colorado Parks and Wildlife Commission; Trapped and collared Columbian Sharp-tailed Grouse, W. CO
Colorado Parks and Wildlife Commission; Performed radio-telemetry and observation counts of Bighorn Sheep, W. CO

CHRONOLOGICAL WORK HISTORY:

Wetland Environmental Scientist III; Tetra Tech, Inc.; Pittsburgh, PA, August 2013- Present

Environmental technician/Range Manager, XH Angus Ranch; Saratoga, WY March 2013- August 2013

Wetland & Watercourse Biologist; Hanover Engineering & Associates; Towanda, PA, March 2012 - March 2013

Environmental Technician, Mount Agamenticus, York, ME, May 2011-March 2012

Seasonal Park Ranger, US Army Corps of Engineers, Thomaston, CT, May- September 2009 & 2010

PROFESSIONAL AFFILIATIONS:

American Wildlife Society

TETRA TECH

GREGORY P. STEVENS
Environmental Scientist II – Technology Lead

EXPERIENCE SUMMARY

Mr. Stevens has over five years' experience as an environmental scientist with a background in resource management through remote sensing techniques and insitu. His experience includes conducting wetland delineations, waterway quality assessments, habitat assessments, and endangered species surveys. He has conducted wetland determinations for federal and private clients. He is an Environmental Systems Research Institute geomentor, as such he has traveled to various school districts and instructed staff and students about geospatial technologies and implemented curriculum.

RELEVANT EXPERIENCE

Wetland/Environmental Scientist II - Sunoco Logistics; OPP and PPP Natural Gas Pipeline Projects, Multiple Counties across Ohio, West Virginia, and Pennsylvania; April 2014 to present. Responsibilities included aiding in wetland delineations and stream assessments for the proposed 450 miles of the Ohio Pipeline (OPP) and Pennsylvania Pipeline Projects (PPP).

Wetland/Environmental Scientist II; Dominion Transmission, Inc.; Lebanon West II - TL-400 FERC Pipeline Project; Tuscarawas, Licking, Muskingum, Harrison, Coshocton, Columbiana, and Carroll Counties, Ohio (OH) and in Beaver County, Pennsylvania (PA); June 2014 to present. Responsible for conducting wetland delineations and stream evaluations for the natural gas pipeline replacement segments of the TL-400 FERC Pipeline Project. Specific tasks included field surveys, report preparation, and completion of Ohio EPA specific wetland and stream assessments.

Wetland/Environmental Scientist II; Noble Energy, Inc.; Various Water Withdrawal Projects; Greene, Fayette, Washington Counties (PA), and Marshall County (WV); April 2014 to present. Responsible for conducting numerous wetland delineations and stream evaluations for proposed water withdrawal projects located in southwestern Pennsylvania and the panhandle of West Virginia. Also prepared wetland delineation and stream assessment reports for each project in support of permit submissions.

Wetland/Environmental Scientist II; Rice Drilling D, LLC; Various Water Withdrawal Projects; Harrison and Belmont Counties (OH); April 2014 to present. Responsible for conducting numerous wetland delineations and stream evaluations for proposed water withdrawal projects located in eastern Ohio. Also prepared wetland delineation and stream assessment reports for each project in support of permit submissions.

Environmental Scientist II: Advanced Environmental Management Group: Plymouth, Michigan: July 2013 to April 2014. Conducted wetland redeterminations as a team leader for property owners under the direction of two federal agencies in Michigan. Utilized the Midwest, NENC regional supplements and the 1987 USACOE manual. Trained four field technicians in wetland science and wetland determination procedures.

EDUCATION

B.S. Environmental Studies,
Richard Stockton College of New Jersey, 1995

B.S.Certificate Energy Management,
Richard Stockton College of New Jersey, 1995

M.S. Geographic Information Systems,
Eastern Michigan University, 2012

M.S.Certificate in Hydrogeology
Eastern Michigan University, 2012

AREA OF EXPERTISE

Wetland Delineation and Stream Identification & Remote Sensing

TRAINING/CERTIFICATIONS

OSHA 1910.120 40-Hour HAZWOPER Training,
Nov 2013
ACOE-based 40-hour Wetland Delineation Certification
July 2013
American Red Cross CPR responder

OFFICE

Pittsburgh, PA

YEARS OF EXPERIENCE

5+

YEARS WITHIN FIRM

1

CONTACT

Greg.P.Stevens@tetratech.com

Environmental Scientist II: Advanced Environmental Management Group: Plymouth, Michigan: July 2013 to April 2014. Plotted soil sampling points for the Detroit District ACOE for the continued maintenance of dredging activities. Prepared field reports through the use of Bentley Microstation

Remote Sensing Technician: Photo Science: Ann Arbor, Michigan: September 2012 to June 2013. Mapped through satellite image interpretation land cover change using Landsat image pairs. Produced submission data for NOAA Coastal Change Analysis Program (CCAP). Required exchanges between Erdas for pixel adjustments then editing in ArcMap.

Geospatial Consultant: United States Fish and Wildlife Service Region 3: May 2009 to August 2012. Created a decision support database and produced maps that are implemented daily for the United States Fish and Wildlife region 3 office. Provided GIS tracking for species community assessments and invasive monitoring. Verified ecological communities and spread of invasive plants through field studies. Designed study transects along the Detroit coast and delineated the surrounding ecological communities, Department of Commerce grant #NA090AR4170172. Collected spectral signatures to develop a library that will aid in vegetation determination through hyperspectral analysis.

CHRONOLOGICAL HISTORY

Environmental Scientist II; Tetra Tech NUS, Inc.; Pittsburgh, Pennsylvania; April 2014 to Present.

Environmental Scientist II: Advanced Environmental Management Group: Plymouth, Michigan: July 2013 to April 2014.

Remote Sensing Technician: Photo Science: Ann Arbor, Michigan: September 2012 to June 2013.

Geospatial Consultant: United States Fish and Wildlife Service Region 3: May 2009 to August 2012

GIS Laboratory Supervisor; Eastern Michigan University; September 2006 to May 2012

SCIENTIFIC/TECHNICAL PUBLICATIONS

“Use of LiDAR in determining ecological community distribution” 2011

“Potential of Phragmites australis as a biofuel feed crop, determinations of yield and access through remote sensing” 2012

MEMBERSHIPS

Society of Wetland Scientists (SWS)

American Association of Photogrammetry and Remote Sensing (ASPRS)

Society of Ecological Restoration (SER)

TETRA TECH

Deanna N.Quinn
Wetland/Environmental Scientist II

EXPERIENCE SUMMARY

Ms. Quinn has two years' experience as an environmental scientist/ wildlife biologist with a background in wildlife and fisheries resource management. Her education background includes studies in chemistry, biology, statistics, botany, terrestrial ecology, natural resource management, conservation ecology, environmental policy and regulatory compliance, wetland ecosystems, wetland assessment and delineation, geographic information systems and other environmental related fields. Deanna has performed numerous wildlife and vegetation surveys, stream assessments habitat assessments and related report generation. As an Environmental Scientist, Deanna has had the opportunity of working fulltime on wetland delineations under Environmental Wetland Specialists, primarily for Marcellus shale projects. She also has experience performing bat hibernaculum habitat surveys in Western Pennsylvania as well as Phase 1 Bog Turtle surveys in Pennsylvania.

RELEVANT EXPERIENCE

Environmental Scientist II, Sunoco Logistics, Ohio-Pennsylvania Pipeline Project, Spanning from Delaware County, PA through Harrison County, Ohio, November 2013 to present. Ms. Quinn conducted site investigations, wetland delineations, stream assessments, performed Ohio Rapid Assessment Method, PHWH HHEI & QHEI, Phase 1 Bog Turtle surveys, macroinvertebrate surveys, and wetland report preparation for proposed 300 mile natural gas pipeline reaching from the Delaware River in PA to Scio, OH.

Environmental Scientist I; Gulfport Energy; Various Natural Gas Well Pad Sites; Belmont County, Ohio; August 2013 to present. Ms. Quinn conducted site investigations, wetland delineations, stream assessments, performed Ohio Rapid Assessment Method, PHWH HHEI & QHEI, and wetland report preparation for proposed well pad locations in Belmont County, Ohio.

EDUCATION

BT Wildlife Management, 2011, SUNY Cobleskill

AAS Animal Sciences & Ecology, 2009, SUNY Delhi

REGISTRATIONS

NA

TRAINING/CERTIFICATIONS

Certified Wetland Assessment Delineator, 2010, NY

OFFICE

Pittsburgh, PA

YEARS OF EXPERIENCE

3

YEARS WITH TETRA TECH

1 year 10months

Environmental Scientist I; MarkWest Liberty Midstream & Resources, LLC; Wetland Delineations for Miscellaneous Natural Gas Pipeline Projects; Pennsylvania; May 2013 to present. Responsible for performing and assisting with wetland delineations for various proposed natural gas pipeline projects in southwestern Pennsylvania. Specific tasks included field survey, report preparation, and wetland functional assessments.

CHRONOLOGICAL HISTORY

Environmental Analysis/Management: Environmental Scientist I-II, 2013-present, Pittsburgh, PA
Research: Husbandry Services Technician I, 2013, Pittsburgh, PA
Research Wildlife Biologist, 2010-2012, Cobleskill, NY
Research Avian Research Technician, 2011, Abaco, Bahamas
Research Predator Research Technician, 2010, Batavia, NY

SCIENTIFIC/TECHNICAL PUBLICATIONS

- N/A

MEMBERSHIPS

- The Wildlife Society, N/A

AWARDS

- N/A

TETRA TECH

Jennifer Bittner
Environmental Scientist I

EXPERIENCE SUMMARY

Jennifer Bittner has three years of experience in the environmental field. Her experience includes stream and wetland mitigation monitoring, rare plant species surveys, and report writing. She also has experience in the oil and gas industry inspecting and recommending corrective actions for post-construction pipeline right-of-ways and facilities for erosion and sedimentation issues.

RELEVANT EXPERIENCE

ENERGY

- **Wetland/Environmental Scientist I; Sunoco; Pennsylvania Pipeline Project; December 2014 – Present.** Assisted with report writing for wetland and stream delineations. Tasks included stream and wetland data entry and write-ups.
- **Wetland/Environmental Scientist I; Sunoco; Ohio Pipeline Project; December 2014 – Present.** Assisted with report writing for wetland and stream delineations. Tasks included stream and wetland data entry and write-ups.
- **Wetland/Environmental Scientist I; MarkWest Liberty Midstream & Resources, LLC; January 2014.** Assisted with report writing for wetland and stream delineations. Tasks included stream and wetland data entry.
- **Wetland/Environmental Scientist I; MarkWest Liberty Midstream & Resources, LLC; December 2014.** Assisted in wetland and stream delineations for proposed pipeline routes and reroutes. Tasks included mapping wetlands and streams.
- **Wetland/Environmental Scientist I; Rice Energy Inc.; December 2014.** Assisted with stream field survey. Tasks included mapping the stream high water table.
- **Compliance Monitor; Hunt, Gulliot & Associates, April 2014 - November 2014.** Inspected post-construction pipeline and facility right-of-ways for erosion and sedimentation issues for Williams Companies, Inc. Tasks included documenting issues and recommending corrective actions, coordinated with other compliance monitors on how to effectively inspect all assigned pipeline and facilities each week, and complete weekly E&S Inspection reports.
- **Staff Scientist; CONSOL Energy, Inc. May 2013 - December 2013.** Assisted with wetland and stream mitigation monitoring for longwall mining restoration projects. Tasks included conducting vegetation surveys, water sampling, soil surveys, and report writing.
- **Staff Scientist; CONSOL Energy, Inc. May 2013.** Assisted with rare plant surveys for power line project. Tasks included making plots and documenting the rare plant observed.
- **Staff Scientist CONSOL Energy, Inc. October 2012 – December 2012.** Assisted with stream mitigation surveys for longwall mining projects**.** Tasks included conducting vegetation surveys, water sampling, and report writing.

EDUCATION

M.S. Environmental Science and Management, Duquesne University

B.S. Marine Biology, Waynesburg University

AREA OF EXPERTISE

Environmental Science

OFFICE

Pittsburgh, PA

YEARS OF EXPERIENCE

3

YEARS WITHIN FIRM

1

CONTACT

Direct : 412.921.4010

Email :Jen.Bittner@tetraatech.com

SAMPLING

- **Water Quality Intern; Clearwater Marine Aquarium, May 2010 – August 2010.** Maintained water quality and appearance for all exhibits. Tasks included daily water testing, recordkeeping, backwashing pumps, and feeding fish, sharks, and stingrays

CHRONOLOGICAL HISTORY

- Wetland/Environmental Scientist I; Tetra Tech, Pittsburgh, PA; December 2014 – Present
- Compliance Monitor; Hunt, Guillot & Associates, LLC; Pittsburgh, PA; April 2014 – November 2014
- Staff Scientist; Civil & Environmental Consultants, Inc.; Pittsburgh, PA; October 2012 – April 2014
- Teaching Assistant; Duquesne University; Pittsburgh, PA; January 2012 – April 2012

Adam Mengel

Environmental Scientist/Wildlife Biologist I

EXPERIENCE SUMMARY

Mr. Mengel has two years of experience as an environmental scientist/ wildlife biologist with a background in ecology and conservation. His education background includes studies in chemistry, biology, mathematics, statistics, botany, terrestrial ecology, population ecology, herpetology, evolutionary biology, wetland ecosystems, wetland assessment and delineation, geographic information systems and other environmental related fields. Adam has performed numerous wildlife and vegetation surveys, stream assessments, and habitat assessments. As an Environmental Scientist, Adam has had the opportunity of working fulltime on wetland delineations under Environmental Wetland Specialists, primarily for Marcellus shale projects. He also has experience in performing both acoustic and mist net surveys for the Northern long-eared bat species in Pennsylvania and the Midwest. Additionally, he has experience in performing radio telemetry and summer roost counts.

RELEVANT EXPERIENCE

Crew Lead; Line 66 and Sandpiper Pipeline Project; Enbridge; WI, MN, ND; May – August 2014. Mr. Mengel led acoustic and radio telemetry surveys for the Northern long-eared bat in the Midwest. He also performed roost counts and mist net surveys. Daily interaction with land agents and data submissions.

Research Technician; Goleden-winged Warbler Habitat Conservation Plan; Delaware State Forest; May – July 2013. Mr. Mengel monitored Golden-winged Warbler nesting success and assisted in locating a state record of 51 nests for the threatened species.

EDUCATION

B.S. Biology: Environmental Science, 2012, Saint Francis University

TRAINING/CERTIFICATIONS

First aid, CPR, AED

OFFICE

Pittsburgh, PA

YEARS OF EXPERIENCE

2

YEARS WITH TETRA TECH

1

CHRONOLOGICAL HISTORY

Environmental Scientist/Wildlife Biologist I, Tetra Tech, Inc., December, 2014 – Present, Pittsburgh, PA

Research Technician, WEST, Inc., May – August, 2014, Bloomington, IN

Research Technician, Indiana University of Pennsylvania, May – July, 2014, Indiana, PA

SCIENTIFIC/TECHNICAL PUBLICATIONS

Loya, L.J., C. Clair, P.H. Harchack, and A.J. Mengel. 2014. "Odonate Diversity at an Acid Mine Drainage Remediation Site in Cambria, County, Pennsylvania." Argia. 26(3):14-17

MEMBERSHIPS

- The Wildlife Society

Environmental Consultation Services, Inc

DAVID J. BONOMO
Senior Environmental Scientist

Profile

- Environmental scientist with over ten years experience in environmental consulting and conducting ecological field studies in Northeastern US.
- Professional experience in environmental consulting managing projects and performing wetland delineation and stream assessments; preparing permit applications; performing biological site assessments including existing vegetation evaluations, habitat and species evaluations and searches for federal and state endangered, threatened, and rare plant and animal species; conducting wetland and stream mitigation design and monitoring; and designing and conducting research studies on wildlife in the Northeastern US.
- Provides technical support for the planning, permitting and construction of wind and solar energy facilities, transmission line corridors, as well as large commercial and residential projects.
- Advanced technical skills and training for water of the US evaluations in multiple regions, including *Northcentral and Northeast, Eastern Mountains and Piedmont, and Atlantic and Gulf Coastal Plain*.

PROFESSIONAL EXPERIENCE

Environmental Consultation Services, Inc. Pen Argyl, PA
Senior Environmental Scientist 2014 - Present

- Provide ecological services for large-scale gas pipeline and electrical transmission utility projects, residential and industrial construction projects, and private residential owners and small business.
- Conduct site reconnaissance, wetland and stream delineations; habitat assessments; threatened and endangered plant and animal surveys.
- Conduct habitat evaluations, ecological assessments, and threatened and endangered wildlife and plant species and rare community surveys. Perform habitat assessments and searches for PA Special Concern species, including the bog turtle (*Glyptemys muhlenbergii*).
- Provide site environmental surveys utilizing Trimble GPS. Prepare site mapping using Geographic Information Systems (GIS) and AutoCAD software.

Shoener Environmental, Inc. Dickson City, PA
Senior Environmental Scientist 2004 - 2014

- Provide direct project management of ecological services for high value and/or complex large-scale wind farm projects, linear state and local utility projects, Marcellus shale projects, residential and industrial construction projects, and private residential owners and small business.
- Prepare federal, state, and local permit applications, wetland mitigation designs, and erosion and sediment control plans to meet regulatory requirements for site development.
- Prepare and review ecological project plans and budgets.
- Conduct site reconnaissance, wetland and stream delineations; habitat assessments; threatened and endangered plant and animal surveys.
- Inspect wetland mitigation and construction sites for regulatory compliance of erosion and stormwater controls.
- Conduct habitat evaluation and technical services for the Ecological Services Division, including habitat evaluations, ecological assessments, and threatened and endangered wildlife and plant species and rare community surveys. Perform habitat assessments and searches for PA Special Concern species, including the small-footed bat (*Myotis leibii*), timber rattlesnake (*Crotalus horridus*), wood rat (*Neotoma magister*), and the Indiana Bat (*Myotis sodalis*).
- Provide field mapping of environmental survey data utilizing survey quality Trimble Global Positioning System (GPS). Prepare site mapping using Geographic Information Systems (GIS) and AutoCAD software.
- Manage field personnel for post-construction bat/bird mortality monitoring studies on wind energy facilities in Pennsylvania.

Ecoscientific Solutions, Inc Scranton, PA
Environmental Scientist 2004

- Lake and Pond Management and Water Quality technician.
- Conducted aquatic plant surveys; water quality analysis; and benthic surveys
- Certified pesticide applicator for the control of invasive aquatic vegetation.

COMPUTER SKILLS

AutoCAD (2010-2014), ARCView (10.1), Microsoft Office (Word, Excel, PowerPoint),

EDUCATION

Wilkes University Wilkes-Barre, PA
Bachelor of Science, Environmental Science 2004

- Lake and Stream Ecology, Field Botany, Water Quality Analysis, and Environmental Engineering
- Research assistant and water quality specialist for the study of freshwater bivalve populations in natural lakes of northeastern Pennsylvania.

Continuing Education

- A Consulting Botanist Workshop, Morris Arboretum, Philadelphia, PA, April 18, 2014
- Acoustical Bat Monitoring Workshop, Albany, New York, January 2013.
- Outdoor Emergency Care, National Ski Patrol, Poconos, Pa. Fall 2012.
- Acoustical Bat Monitoring Workshop. Bat Conservation and Management, Gettysburg, PA. Instructed by Joe Szewczak (Developer of SonoBat software), October, 2011.
- Advanced Bat Capture Techniques Workshop, Bat Conservation International and Bat Conservation Management, Patuxent Research Refuge, Laurel, MD. September 2010.
- Final Chapter 102 Training Session. Changes to the PA Chapter 102 Regulations (Erosion and Sediment Control and Stormwater Management) (effective November 19, 2010). PA DEP. Wilkes-Barre, PA. November 3, 2010.
- Annual Industry Training Workshop. PA DEP, Bureau of Oil & Gas Management. Williamsport, PA. May 11, 2010.
- Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual Northcentral and Northeast Region. PAPSS Training Conference. Laporte, Sullivan County, PA. April 27, 2010.
- Bat Capture Techniques Workshop, Bat Conservation and Management Workshop, Bat Conservation Management and Pennsylvania Game Commission (PGC), August 2007.
- Soil Science, Soil Morphology, and Field Applications, Wilkes University, June 2007.
- Hydric Soils, Rutgers University, June 2006.

PROFESSIONAL MEMBERSHIPS

- Society of Wetland Scientist (SWS)
- Pennsylvania Lake Management Society (PALMS)
- North American Society for Bat Research (NASBR)
- National Ski Patrol (NSP)

PROJECT PORTFOLIO

- Allegheny Ridge Wind Farm, Cambria and Blair Counties, PA (2007) - 132 MW/66 Turbines
- Highland Wind Farm, Cambria County, PA (2008) - 50MW/25 Turbines
- North Allegheny Wind, Blair County, PA (2008) – 20 MW/10 Turbines
- Sandy Ridge Wind Farm, Centre and Blair Counties, PA (2009)- 62.5 MW/25 Turbines
- Twin Ridges Wind Farm, Somerset County, PA (2011) – 136 MW/68 Turbines
- Mehoopany Wind Farm, Wyoming County, PA (2012)–180 MW/90 Turbines
- Penelec HTC Power Line – Cambria County, PA (2008), 17 lineal miles
- Valley View Business Park Phase 2, Lackawanna County, PA (2007), 810 Acres
- Harrisburg – Allentown Communication Line, Dauphin, Lebanon, Berks, and Lehigh Counties, PA (2012) – 90 lineal miles
- PA Pipeline - Natural Gas Pipeline, Western Pennsylvania to Marcus Hook Industrial Complex, Philadelphia

KEVIN S. KEAT, *PWS, Sr. Biologist*
Environmental Consultation Services, Inc.
1095 Mill Road, Pen Argyl, PA 18072
Phone: (484) 515-6806 Email: kevinkeat@ptd.net

YEARS OF EXPERIENCE: 23

EDUCATION: B.S. Earth and Environmental Science, Wilkes University, Wilkes-Barre, PA;1992

PROFESSIONAL REGISTRATIONS AND TRAINING

- Professional Wetland Scientist Certification – Society of Wetland Scientists Since 2013
- PA Fish & Boat Commission – Recognized Qualified Biologist, March 2006
- US Fish & Wildlife Service-Recognized Qualified Biologist, March 2006
- US Army Corps of Engineers – Recognized Qualified Wetlands Delineator, May 1998
- NY DEC - Recognized Qualified Biologist, May 2009
- NJ Fish & Wildlife Service – Recognized Qualified Biologist, March 2006
- MD Department of Natural Resources – Recognized Qualified Biologist, March 2006
- Rutgers University Certificate of Completion for Endangered and Threatened Species of Northern NJ, Survey Techniques and Habitat Assessment Regulatory Implications, 2005
- Rutgers University Certificate of Completion for Environmental and Ecological Risk Assessment; 2000
- Ohio State University, Certificate of Completion for Creation and Restoration of Wetlands for Mitigation of Wetland Loss; 1999
- Pennsylvania Department of Environmental Protection Certificate of Achievement in the Application of Pennsylvania Department of Environmental Protection Act 2 Regulations and Procedures in the Act 2 Technical Manual; 1999
- Plant Identification: Wetlands and Their Borders; 1999
- U.S. Army Corps of Engineers Wetlands Delineator Training; 1998
- USEPA Certification for Hazardous Materials Incident Response Operations (29 CFR1910.120); 1992

PROFESSIONAL AFFILIATIONS

Society of Wetlands Scientists

PA Fish & Boat Commission Timber Rattlesnake Site Assessment and Inventory Project, 2006-Present *Field Specialist for the Northeast Region of Pennsylvania*

KEY QUALIFICATIONS

Mr. Keat has worked continuously in Environmental Consulting from December 1992 to the present. He conducted environmental studies and obtained local, state and federal environmental approvals for multiple project sites throughout Pennsylvania, New Jersey and New York. Mr. Keat has performed studies for public and private projects including power transmission lines, gas pipelines, commercial and residential development, telecommunications facilities, transportation and port facilities. He has also conducted surveys for state resource protection agencies. Mr. Keat is proficient in construction monitoring, wetland delineation, biological

cause and effect stream surveys, wildlife habitat surveys and environmental impact assessments. He is experienced in surveys for endangered and threatened plant and animal species including bog turtles. He has performed phase 1, 2 and 3 surveys for bog turtles and conducted trapping surveys for the pine and corn snakes in southern New Jersey. He has conducted benthic macroinvertebrate surveys to assess stream quality. He has prepared baseline ecological evaluations to assess the effects of contamination on environmentally sensitive areas. He has prepared environmental screening and environmental assessment reports in accordance with state and federal requirements. He has performed Phase I environmental site assessments to screen for hazardous waste contamination and has performed soil and groundwater site characterizations and prepared and implemented site remediation plans.

Mr. Keat has 23 continuous years of environmental consulting experience which is extensive in conducting Wetlands Delineation, Flora/Fauna Threatened and Endangered Species Surveys, PA Chapter 105 Environmental Assessments, Ecological Assessments, Freshwater Macroinvertebrate Stream Surveys, Groundwater Monitoring, and Wetlands Mitigation/Restoration for the following:

Project Types:

Several Hundred Miles of Linear Projects*:*
Electric Power Transmission Lines, Oil and Gas Pipelines, State Highway and Railway Corridors - Wetlands Delineation, T&E Species Habitat Surveys, Construction Monitoring, Wetlands Mitigation

Oil and Gas Well Development Pads and Pump Stations:
Wetlands delineation, T&E Botanical Species Surveys

Large Land Tract Subdivisions*:* Residential, Commercial and Industrial Development – Wetlands Delineation, Mitigation/Restoration, T&E Species Surveys, PA Chapter 105 Environmental Assessments, Construction Monitoring

Soil and Groundwater Remediation Projects*:* Soil Excavation and Disposal, Groundwater Pump and Treat Technologies including Petroleum-Related Volatile Organic Compounds, Heavy Metals from Industrial Contaminants – Wetlands Delineation, Wetlands Hydrological Monitoring and Mitigation, T&E Species Surveys, Ecological Risk Assessment

Bridge Repair/Reconstruction Projects*:* Including Wetlands Delineation, T&E Species Surveys and Environmental Assessments as Per PA Chapter 105

Government Funded Local, County, State and Federal Agency Research Projects: For flora/fauna species presence/absence determinations, diversity assessments, population size and distribution in PA, NJ, MD and NY.

KEVIN S. KEAT, *PWS, Sr. Biologist*
Environmental Consultation Services, Inc.
1095 Mill Road, Pen Argyl, PA 18072
Phone: (484) 515-6806 Email: kevinkeat@ptd.net

Permitted Municipal Waste Landfill Disposal Facilities: Groundwater and Surface Water Monitoring, Methane Gas Monitoring, Wetlands Mitigation/Restoration, Quantitative Macroinvertebrate Stream Surveys

State and / or Federally Listed Threatened, Endangered or Concern Species Surveyed w/Random Visual Search Methods and / or Trapping:

Reptiles: Bog Turtle, Wood Turtle, Spotted Turtle, Timber Rattlesnake, Copperhead, Diamond Back Rattlesnake, Eastern Coral Snake, Pine Snake, Corn Snake

Amphibians: Mole Salamanders, Pine Barrens Treefrog

PA and NJ Botanical Surveys: Wild pea (*Lathyrus ochroleucus*) Eared-false foxglove (*Agalinis auriculata*), Northeastern bulrush (*Scirpus ancistrochaetus*), Swamp dog hobble bush (*Leucothoe racemosa*), Swamp pink (*Helonias bullata*), Knieskern's beaked rush (*Rhynchospora knieskernii)*, Twin flower *(Linnaea borealis)*, Spreading globeflower (*Trollius laxus*), Carex fava, Carex shortiana, Sand cherry (*Prunus pumila*), Prickly pear cactus (*Opuntia humifusa*), Racemed milkwort (*Polygala polygama*), Small whorled pogonia (*Isotria medeoloides*), Nuttall's ticktrefoil (*Desmodium nuttallii*), Quill fameflower (*Phemeranthus teretifolius*), Mountain bugbane (*Actaea podocarpa*), Wild gooseberry (*Ribes missouriense*), Shale barren Evening primrose (*Oenothera argillicola*), Serpentine aster (*Symphyotrichum depauperatum)*, Small's ragwort (*Packera anonyma*), Torrey's rush (*Juncus torreyi*), Netted chain fern (*Woodwardia areolata*)

Potential Hazardous Waste Site Assessments and Remediation:

ASTM E1527-1528 Phase 1 Environmental Site Assessments for Due Diligence

PA ACT 2 Site Characterization and Remediation for Soil and Groundwater including NPL/Superfund Sites

Underground Storage Tank Indemnification Fund (USTIF) Projects

NJ ISRA Site Characterization and Remediation Projects