

**Aerial Photography Interpretation and Geographic Information System Analysis of the
Marsh Site
Erie County, PA**

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US Environmental Protection Agency
Washington, DC

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Background:

The United States Department of Justice (DOJ) asked me to provide expert aerial photography interpretation and Geographic Information Systems (GIS) analysis in connection with the property located in the Townships of McKean and Waterford, Erie County, Pennsylvania, immediately east of Sharp Road, north of Lane Road, south of Greenlee Road, and west of Elk Creek (the “Marsh Site”) (Figure 1). Specifically, I was asked to analyze and interpret aerial photographs of the Marsh Site taken over time to determine the existence and locations of wetlands, tributaries, and connections to downstream waters, and to describe any impacts or disturbances to the wetlands.

My analysis, as described below, is a desktop review of aerial photography, maps and relevant geo-spatial data covering the Marsh Site, supported by field work of United States Environmental Protection Agency (EPA) staff and others, and by my own personal observations on the Marsh Site on October 16 and 17, 2017.

I am an Environmental Scientist for the EPA. I have focused on the fields of aerial photography interpretation and Clean Water Act (CWA) regulation for over 20 years. A copy of my curriculum vitae is attached to this report, which identifies my expert testimony provided in the last four years. I am not being compensated for the opinions contained in this report other than my normal EPA annual salary.

Methods and Materials:

The techniques and methods used in this report combine aerial photography interpretation with GIS analysis to ground truth the findings.

Acquisition:

The first step in aerial photographic interpretation and GIS analysis is to locate aerial photographs and other relevant information pertaining to a site, including, but not limited to, current and historical aerial photography, digital and paper maps, GIS data, ground photographs and existing reports that describe the conditions on the site.

Aerial photography covering the time period 1939-2016 was acquired for the analysis of the Marsh Site. Aerial photography was obtained in digital format (or scanned to create a digital file) for analysis in a GIS. Also acquired for analysis were United States Geological Survey (USGS) maps and GIS data, United States Department of Agriculture (USDA) soil survey data (USDA Soil Survey Data), National Wetland Inventory (NWI) wetland data, and the results of field work by EPA on May 16, 1990, and EPA and Pennsylvania Department of Environmental Protection investigators on June 27, 2013. A complete listing of the aerial photography and other material reviewed that formed the basis for this report is located in the references section.

Analysis:

The analysis of the aerial photography and GIS data was performed using commercially available GIS software. The aerial photography was viewed under various magnifications allowing me to zoom in on the Marsh Site and examine the Marsh Site from a distance. This technique, combined with the variety of aerial photographic types (color, black and white and color infrared) and dates obtained, facilitates a thorough analysis of conditions and features appearing on the aerial photographs. The analysis of multiple dates of aerial photography and maps reveals the natural and man-made or influenced conditions at the time the photo was taken, or the map was made. The analysis of the multiple dates of aerial photographs and maps reveals consistent conditions and features over time, as well as changes to them.

Digital aerial photographs that were not already geo-referenced were geo-referenced using the GIS software. Geo-referencing is the process of fitting a digital aerial photograph to an already geo-referenced map or image through the use of visible control points present on both the geo-referenced map or image and the aerial photography being geo-referenced. Geo-referencing fits each of the aerial photographs to the coordinate system being used in the GIS software. Geo-referencing allows for accurate overlaying of the aerial photographs to other aerial photographs, base maps and geo-spatial data. Overlaying and comparing temporal aerial photographs, maps and other data provides information on current and historical conditions of a particular area, such as the historical presence of wetlands and their current extent. Site-specific conditions are compared with soils data, NWI data, USGS stream data and other relevant geo-spatial data covering the site. GIS analytic tools are used to measure area and length of features, to clip and combine data for further analysis, and to create maps for use in reports, displays and exhibits.

Wetlands are a landscape feature that can be identified from aerial photography based on their shape, size, texture, landscape position, vegetative cover, and evidence of water or high soil moisture. The combination of landscape position (depressions, low gradient drainage areas, flood plains, adjacency to lakes, estuaries, streams or other water features), with characteristic vegetation cover (emergent, shrub or forested vegetation) and indications of water (standing water, wetland drainage patterns, persistent ground moisture conditions and dark photographic tones) form an identifiable “signature” of a wetland area on aerial photography.

Drainage patterns such as tributaries, streams and other confined conveyances are observable in aerial photographs by their topographic expression, characteristic linear and curvilinear patterns, dark photographic tones and riparian vegetation. In some cases, water is visible.

Disturbances to wetlands generally have a distinct signature, and aerial photographic interpretation can be used to identify them, determine their spatial extent, and to help determine when they occurred. Disturbances to wetlands include, but are not limited to, mechanical land clearing, grading, plowing, and the presence of man-made structures (including construction of roads, houses, commercial buildings, dams, levees, dikes, and ditches). Each of these disturbances exhibit unique combinations of size, shape, photographic tone, texture and association that make them identifiable on aerial photographs.

Signatures seen on aerial photographs were compared to collateral information including USGS maps and digital stream data, NWI data, USDA Soil Survey Data, and on-site analysis performed by EPA regulators on May 16, 1990 and June 27, 2013. The information observed on-site (“ground truthed”) is used to support or refute feature and condition analysis observed from aerial photographic interpretation.

Digitizing and map production:

Features of interest such as wetland boundaries, stream courses, and areas of disturbance were identified and digitized using the tools found in the GIS software. Digitizing created line files (streams, ditches) and polygon files (wetland areas, disturbances) which were overlaid on the various dates of aerial photographs and other maps and with other geo-spatial data obtained for this analysis.

Thematic maps were created by overlaying the digitized features with the aerial photographs and other geo-spatial data in a map template which includes a scale bar, north arrow, a legend and title. These maps show wetland boundaries, drainage patterns, sample locations, areas of disturbance and other features relevant to this investigation.

Results:

Historical Land use:

Aerial photography is useful in understanding historical land use. With respect to the Marsh Site, I reviewed historical aerial photography records dating back to 1939. In 1939 two areas of the Marsh Site appeared to have been cultivated (identifiable as rectangular areas with smoothed textured angular features). The cultivation is confined to two linear fields along Lane and Sharp Roads. Figures 2 and 2a depict the cultivated areas without and with annotation respectively.

The potentially cultivated fields remained visible in the 1956 aerial photograph (Figure 3 and 3a) and again in the 1965 aerial photograph (Figure 4 and 4a), although the field on Sharp Road does not appear to have been cultivated recently as evidenced by mottled tones and texture, and the western and eastern ends of the field on Lane Road are becoming overgrown. By June 1977 the cultivation is not evident on either field (Figures 5 and 5a). Compare the darker rough textured signature of the formerly cultivated areas to the light toned smooth textured plowed field south of Lane Road on Figure 5 (the former cultivated fields are outlined in yellow on Figure 5a for reference). This clear distinction between smoothed textured angular cultivated areas (red arrows) and the darker toned natural areas (yellow arrows) is evident in the surrounding environs as well and along Elk Creek¹ and its tributaries (see yellow arrows on

¹ The lines seen on Figures 6 and Figure 12 are from the USGS NHD data. USGS designated the dark blue line seen on Figure 6 and Figure 12 as Elk Creek and considered Elk Creek on the Marsh Site as a perennial tributary to Elk Creek. This naming convention has no impact on my

Figure 6). It should be noted that Elk Creek was channelized and moved in the northeastern portion of the Marsh Site between 1965 and 1977 (see the light toned curvilinear feature on Figure 5).

No cultivation was visible on the aerial photography of the Marsh Site after the 1960s resulting in revegetation and reversion to wetland conditions over the majority of the site² (see Figures 7 and 7a and 8 and 8a which depict aerial photography taken in 1993 and 2005 respectively). This overgrown condition is particularly evident on Figures 8 and 8a by the widespread rough textures of tall herbaceous and shrubby vegetation and scattered trees. This wetland condition remained until the onset of the disturbances that are the subject of this investigation.

Wetlands Extent:

In preparing my analysis to determine if wetlands exist or existed on the Marsh Site, I reviewed the entire range of aerial photography at my disposal, as well as the aforementioned collateral information.

I reviewed the historical and recent aerial photography for signature of wetlands and wetland boundaries. I reviewed aerial photography from different time frames and seasons. Seasonal, leaf-off aerial photography help identify the ground surface and soil moisture conditions which can aide in wetland identification and mapping. I reviewed both historic and current aerial photographs, looking for consistent vegetation patterns and wetland signatures as well as changes to vegetation patterns and wetland signatures. I compared the patterns in the vegetation and wetland signatures with drainage patterns, topographic relief and the collateral information from the NWI, USDA Soil Survey Data, and the previous wetland determination by EPA and PADEP, as well as my own observations on or near the Marsh Site in 1990 and 2017.

Figure 9 depicts the NRCS Erie County very poorly drained soils mapping of the Marsh Site (soils other than very poorly drained are not shown for simplicity purposes). County soil surveys are created by a combination of field work (examining soil profiles with an auger or shovel) and mapping through aerial photography interpretation. Soil surveys are important tools for planning farming operations and site development activities. Soil surveys map the type and extent of locally formed soils and contain extensive descriptions of the soils. Soil surveys identify drainage characteristic of soils, including those soils that are poorly and very poorly drained. The identification of poorly or very poorly drained soils in an area is a good indicator that wetlands may be present.

Two soil types are mapped which cover the majority of the Marsh Site; Wick Silt Loam (Wc), is mapped along Elk Creek. Wick Silt Loam is a frequently flooded, very poorly drained

analysis or conclusions. Moreover, I saw a “Elk Creek” sign at the bridge on Sharp Road where the creek flowing through the Marsh Site passes under Sharp Road

² Based on the review of the entire aerial photographic record and collateral information described in the next section I conclude the wetlands mapped in 2009 existed over most of the site historically as well.

soil found on floodplains. Canandaigua Mucky Silt Loam (Cc) is mapped for the majority of the Marsh Site. Canandaigua Mucky Silt Loam is a frequently ponded, very poorly drained soil found on depressions and flats. According to the soils survey, neither soil is considered prime farmland soil. The small area of the Marsh Site along Sharp Road in Figure 8 is mapped by the NRCS as a somewhat poorly drained soil. Somewhat poorly drained soils can include poorly drained components and create wetland conditions. Finally, the small area of the Marsh Site along Lane Road in Figure 9 is mapped by the NRCS as a moderately well drained prime farmland soil. The NRCS soils mapping predate the disturbances that are the subject of this litigation.

Figure 10 shows the NWI wetland mapping of the Marsh Site. NWI identified and mapped two types of freshwater wetlands covering the entire Marsh Site, freshwater emergent (seasonal herbaceous) wetlands (shaded in light green on Figure 10) and forested/shrubby wetlands (shaded in darker green on Figure 10). The NWI mapped wetlands occur across the entire Marsh Site. With the transparency set at 50% for this figure, it can be clearly seen how Elk Creek bisects the NWI mapped wetlands. The NWI mapping also predates the disturbances on the Marsh Site that are the subject of this litigation.

The NWI maps wetlands over large geographic areas, and did so in Erie County as well. A review of Figure 12 indicates that the Marsh Site wetlands are part of a larger complex of wetlands that occur in the Elk Creek watershed.

Figures 9 and 10 show there is very good correlation between the very poorly drained soils and the NWI wetlands. When overlap between wet soils and NWI wetlands occurs, as seen on the Marsh Site, this provides strong collateral evidence of the presence of wetlands on site.

Figure 11 shows the Marsh Site in 1993 with the sample locations from the 1990 wetlands investigation of which I was a part³. The Marsh Site was undisturbed wetlands in 1990 and was used as reference conditions for our investigation. The EPA team documented wetland conditions on and adjacent to the Marsh Site and observed those conditions.

Synthesizing the above information over the Marsh Site and its environs, and incorporating my own observations in the site and using my experience as an aerial photo interpreter in analyzing wetland signatures on both pre-disturbance and post disturbance imagery, I created aerial photography interpreted mapped wetlands (“API Mapped Wetlands”) that existed prior to the disturbances that are at issue in this litigation.

³ In May 1990, I visited the Marsh Site to support my expert opinion provided in a different lawsuit (*United States v. Brace*, Civ. No. 90-229, W.D. Pa.) relating to the disturbance of different wetlands southeast of the Marsh Site. As part of my expert analysis in that earlier action, I visited the Marsh Site with a government team of experts to observe the (then) undisturbed wetlands at the Marsh Site in order to assist in my analysis and understanding of the nearby wetlands that were the subject of the 1990 lawsuit. During the 1990 site visit I participated in the sampling of hydrophytic vegetation, hydric soils and the observation of wetland hydrology that supported a finding of wetlands on Marsh Site in 1990.

Figures 13 and 14 show the Marsh Site in April 2009 with and without the API Mapped Wetland area annotated. The wetlands extent I mapped closely corresponds with both the NWI and wet soils mapping. It is my expert opinion that most of the Marsh Site was historically wetlands, with the exception of the small, somewhat better drained, area in the southwest corner of the Marsh Site along Lane Road.

From the review of the aerial photography acquired for this analysis (see reference section for complete list) which shows wetland signatures on the Marsh Site as early as 1939 and on each aerial photograph thereafter until the disturbances that are the subject of this litigation, and the aforementioned collateral information which mapped very poorly drained soils and wetlands on the Marsh Site, as well as field work which confirmed the presence of wetlands on the Marsh Site, I conclude that there were approximately 18.5 acres of wetlands on the Marsh Site prior to disturbance.

The Marsh Site wetlands are adjacent to, and directly abut, Elk Creek, a tributary to Lake Erie. The wetland extent covers much of the Marsh Site and extends to the bank of Elk Creek. Figure 16 shows how connected Elk Creek and the wetlands are; on that particular date it is hard to distinguish where the wetlands end and Elk Creek starts. I confirmed that the Marsh Site wetlands continue to abut Elk Creek when I visited the site on October 16 and 17, 2017. Elk Creek is mapped as a perennial or year round stream. Elk Creek flows approximately 27 meandering miles to Lake Erie (17 miles in a straight line from the Marsh Site to the confluence of Elk Run and Lake Erie). Figure 15 shows the Elk Creek flow path from the Marsh Site to Lake Erie.

Chronology of Impacts to Wetlands and Tributaries:

Figure 16 shows the Marsh Site in the fall of 2011 just before the subsequent disturbances occurred. Note the scattered large trees, shrubs and dense vegetative cover on the Marsh Site prior to disturbance.

Less than one year later, by September 2012, the entire site west of Elk Creek had been cleared of vegetation and graded as evidenced in the aerial photographs by the smooth textured, dark-toned signature (Figure 17), tile drains installed (visible in the aerial photographs as light-toned linear signatures), and ditches excavated (visible in the aerial photographs as dark-toned linear signatures). A back hoe is visible on the Marsh Site at the time the image was taken; the shadow it casts clearly identifying it (see inset in Figure 17). This activity graded and filled approximately 17.5 acres of wetlands.⁴ Figure 18 depicts the impacted wetlands with annotations. Figures 19 and 19a from Goggle Earth show the ditches discussed above and first seen on 2012. The yellow arrows point to segments of white drainage pipe laying in one of the ditches.

⁴ Note: the grading and filling extended northward beyond the annotated Marsh Site boundary along Elk Creek to the point where Elk Creek goes under Sharp Road (approximately an additional 0.6 acre of impact).

Observations on the Marsh Site

As mentioned previously, I visited the Marsh Site on October 16 and 17, 2017. During that time, I walked along of Elk Creek from Lane Road to Sharp Road and crisscrossed the disturbed wetland area observing wetland plants, hydrology and drainage features. The Marsh Site was heavily vegetated with herbaceous vegetation as well as patches of dense shrubs at the time of the visit. Figure 19 shows the locations of four drainage features I observed, a drainage tile inlet structure adjacent to Lane Road (Figure 20), the confluence of drainage tile where I mapped several ditches in 2012 and saw white drain tile pieces (Figure 21), a steel drain tile outlet to Elk Creek (Figure 22), and the outlet of the drainage tile network I saw on the 2012 imagery (Figure 23). The drainage features located in the field confirm the presence of the drainage features I mapped.

Conclusions:

From my analysis set forth above, I conclude that prior to the disturbances that are the subject of this investigation, approximately 18.5 acres of wetlands were present on the Marsh Site. These wetlands are adjacent to, and directly abut, Elk Creek, a direct tributary to Lake Erie and are part of system of wetlands in the Elk Creek valley.

While portions of the Marsh Site along Lane and Sharp Roads may have been cultivated prior to the 1960's, the majority of the site did not appear to be cultivated during that time frame. Moving forward from the 1960's, it appears that cultivation in those areas had ceased by 1977 and the Marsh Site became progressively more overgrown, and reverted to the 18.5 acres of wetland extent I identified prior to disturbance.

Sometime after October 2011 and before September 2012 the majority of the wetlands were cleared, graded and attempted to be drained, resulting in approximately 17.5 acres of impacts to wetlands on the Marsh Site.

(Blank Space is Intentional)

References & Documents Considered:**Aerial Photography**

<u>Date</u>	<u>Source</u>	<u>File Designation</u>
1939	USDA ⁵	Marsh1939.jpg
8-10-56	USGS ⁶	A550340020060.tif
4-29-65	USGS	1VAWV00050287.tif
6-4-77	USGS	1VECN00050250.tif
5-11-83	USGS	NC1NHAP820123016.tif
4-7-93	USGS	cambridge_springs_ne_pa.sid
5-4-02	USGS	N10NAPPW13001194.tif
4-15-05	USGS	68001340pan.tif
9-24-08	USGS	17tng790470.tif
		17tng775470.tif
April 09	PASDA ⁷	17tng775470.tif
		17tng790470.tif
2010	USGS	m_4108008_ne_17_1_20100530.tif
10-6-11	GoogleEarth	GE10-6-11.jpg
9-16-12	DG ⁸	91612_R1C1.tif
11-08-12	USGS	345667.tif
		342667.tif
2013	USGS	m_4108008_ne_17_1_20130605_20130802.jp2
4-13-15	DG	4_13_15_R1C1.tif
9-4-16	DG	9_4_2016_R1C1.tif

GIS Data

<u>Type</u>	<u>Source</u>
NHD ⁹	USGS
NWI ¹⁰	US FWS ¹¹
Soils	USDA
Elevation	PASDA
Watershed Boundary	USGS

Maps

<u>Name</u>	<u>Source</u>
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⁵ United States Department of Agriculture

⁶ United States Geological Survey

⁷ Pennsylvania Spatial Data Access

⁸ Digital Globe

⁹ National Hydrography Data

¹⁰ National Wetland Inventory

¹¹ United States Fish and Wildlife Service

Cambridge Springs NE	USGS
Parcel Map	Erie County
1990 Sample Locations and data sheets	EPA Region 3
Field data sheets	EPA Region 3

Documents

<u>Bates</u>	<u>Description</u>
EPA0000058	Photo of Marsh Site taken during 5/16/90 site visit by EPA
EPA0000060	Photo of Marsh Site taken during 5/16/90 site visit by EPA
EPA0000062	Photo of Marsh Site taken during 5/16/90 site visit by EPA
EPA0000220	1990 Field Investigation Report by EPA
EPA0000290	1990 Brace Site Photo Log by EPA
EPA0000439	Photos taken in 2012 and 2013 by PA Fish and Boat Commission
EPA0000465	2013 letter and attachment from Robert Brace to EPA
EPA0000502	June 27, 2013 EPA site inspection report
EPA0000516	June 27, 2013 EPA site inspection photos
EPA0000527	June 27, 2013 PADEP site inspection report
EPA0000545	August 29, 2013 letter from EPA and Corps to Braces
EPA0000560	Figure showing approximate location of Marsh Site
EPA0000002	Video of June 27, 2013 EPA site inspection

Figures

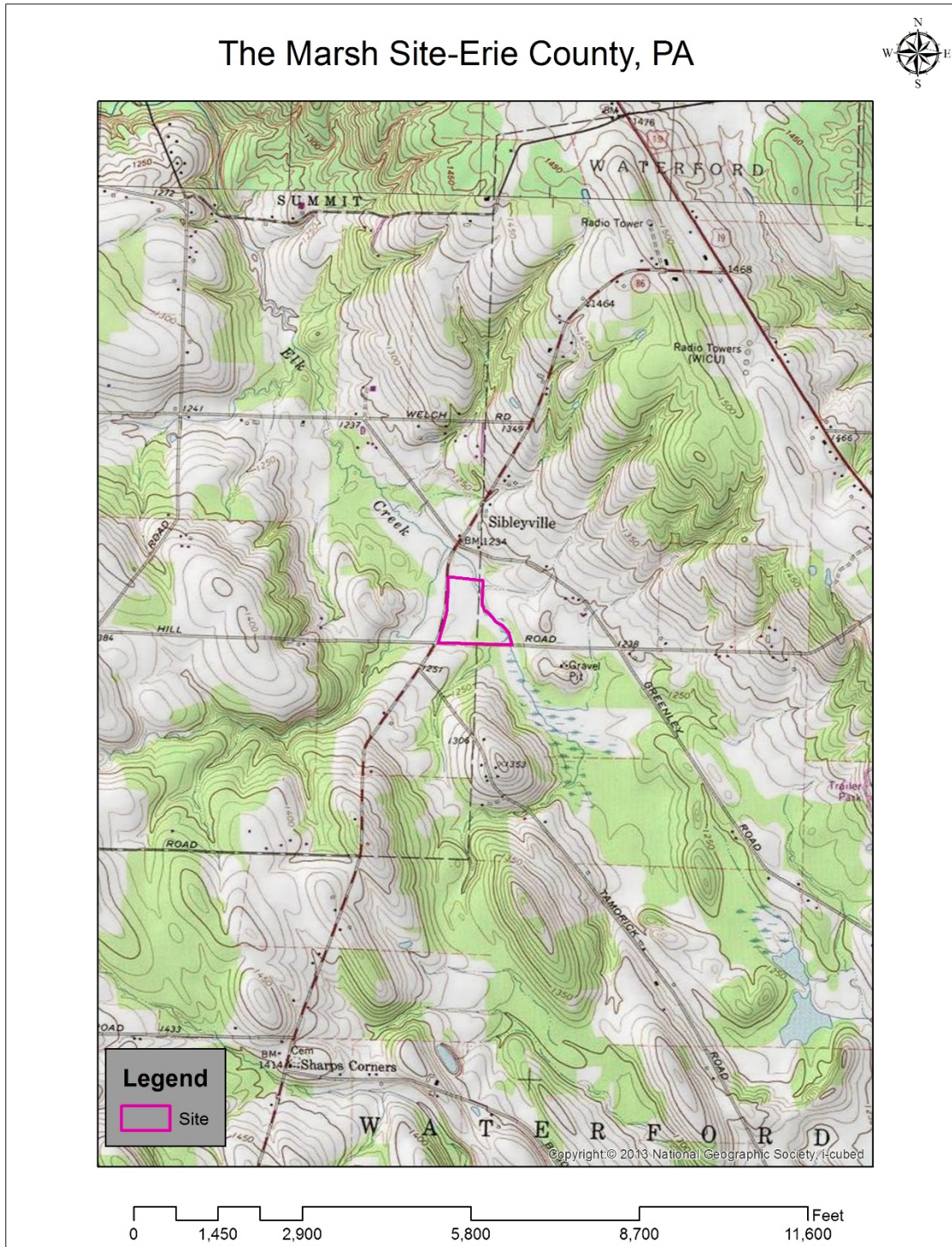


Figure 1

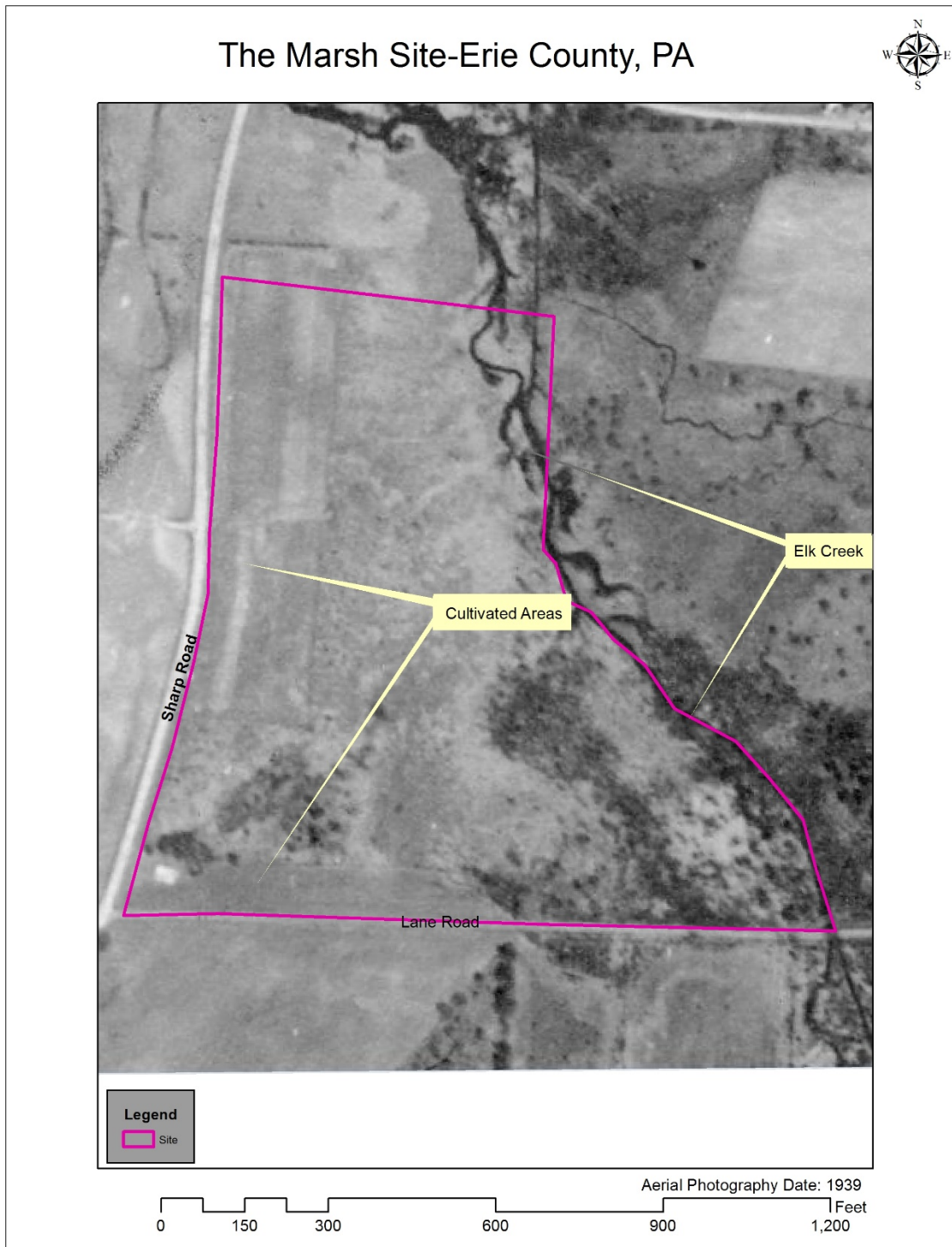


Figure 2

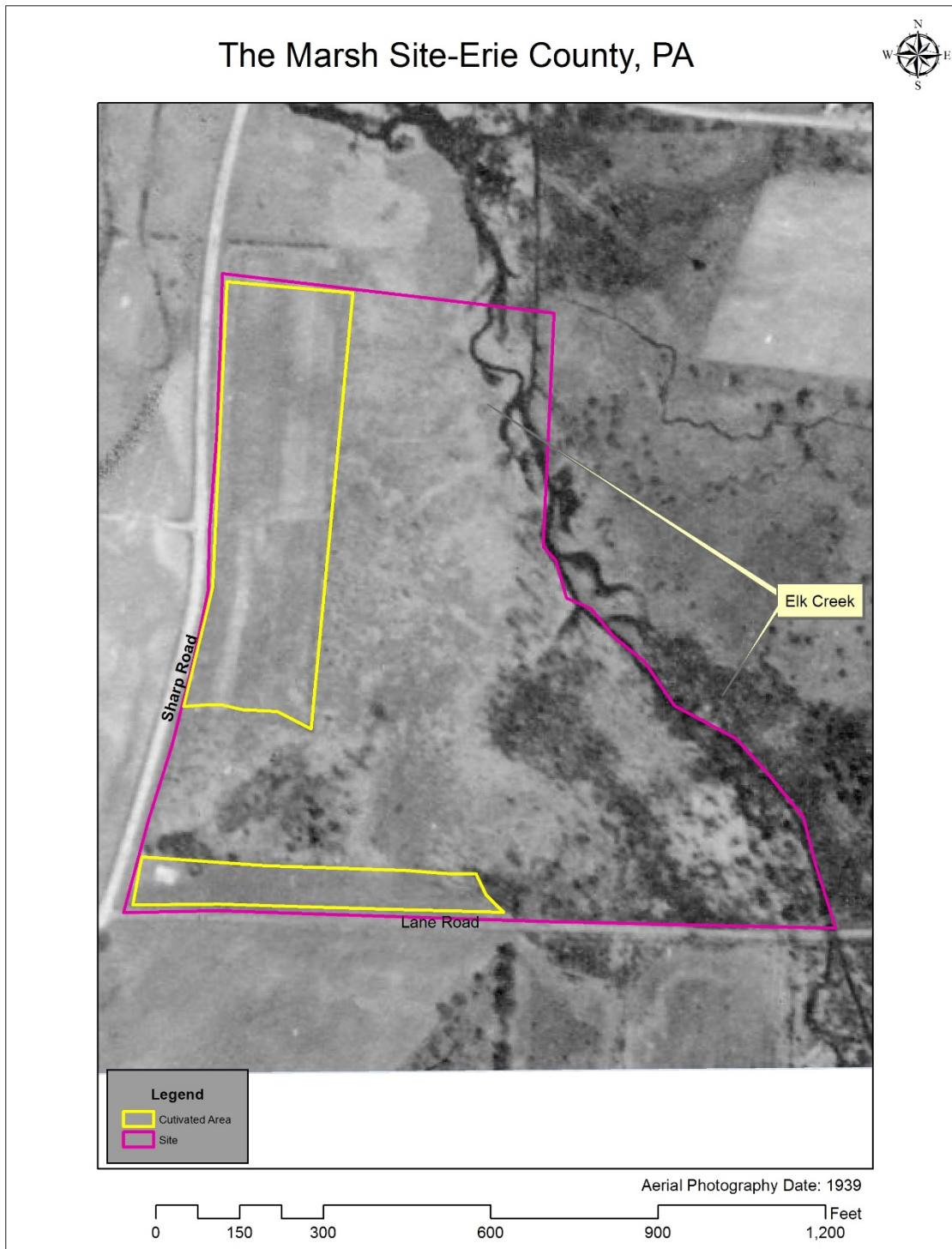


Figure 2a

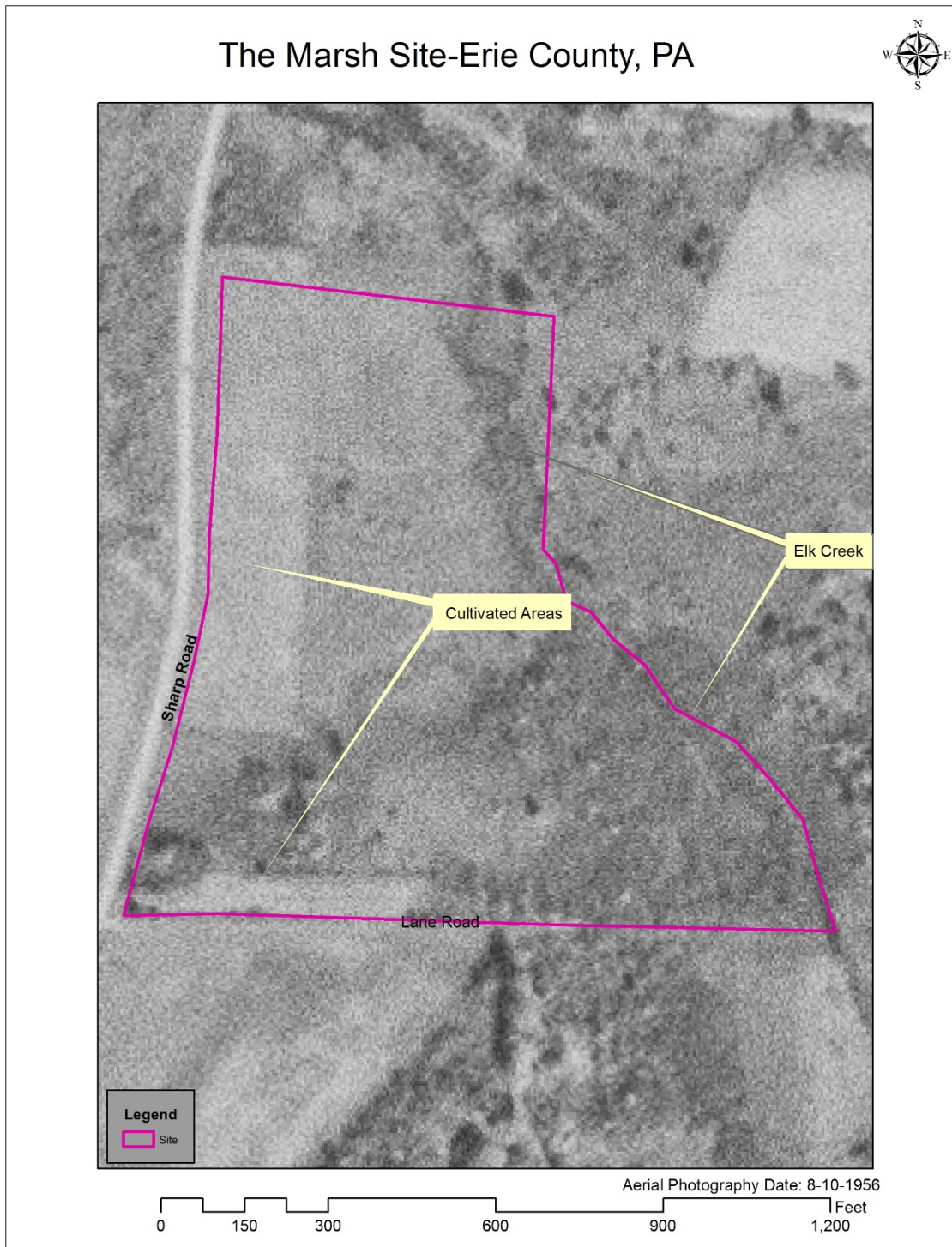


Figure 3

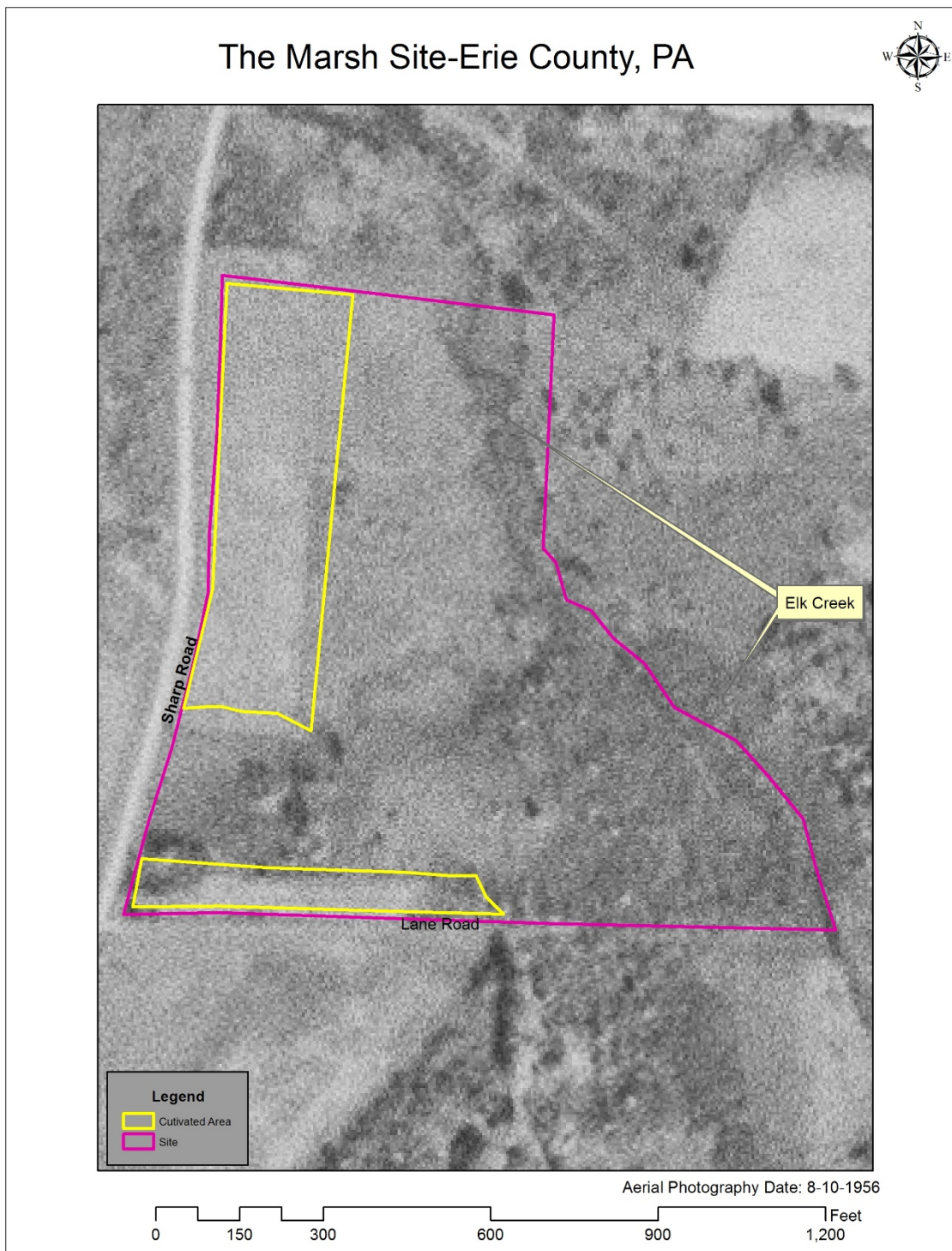


Figure 3a

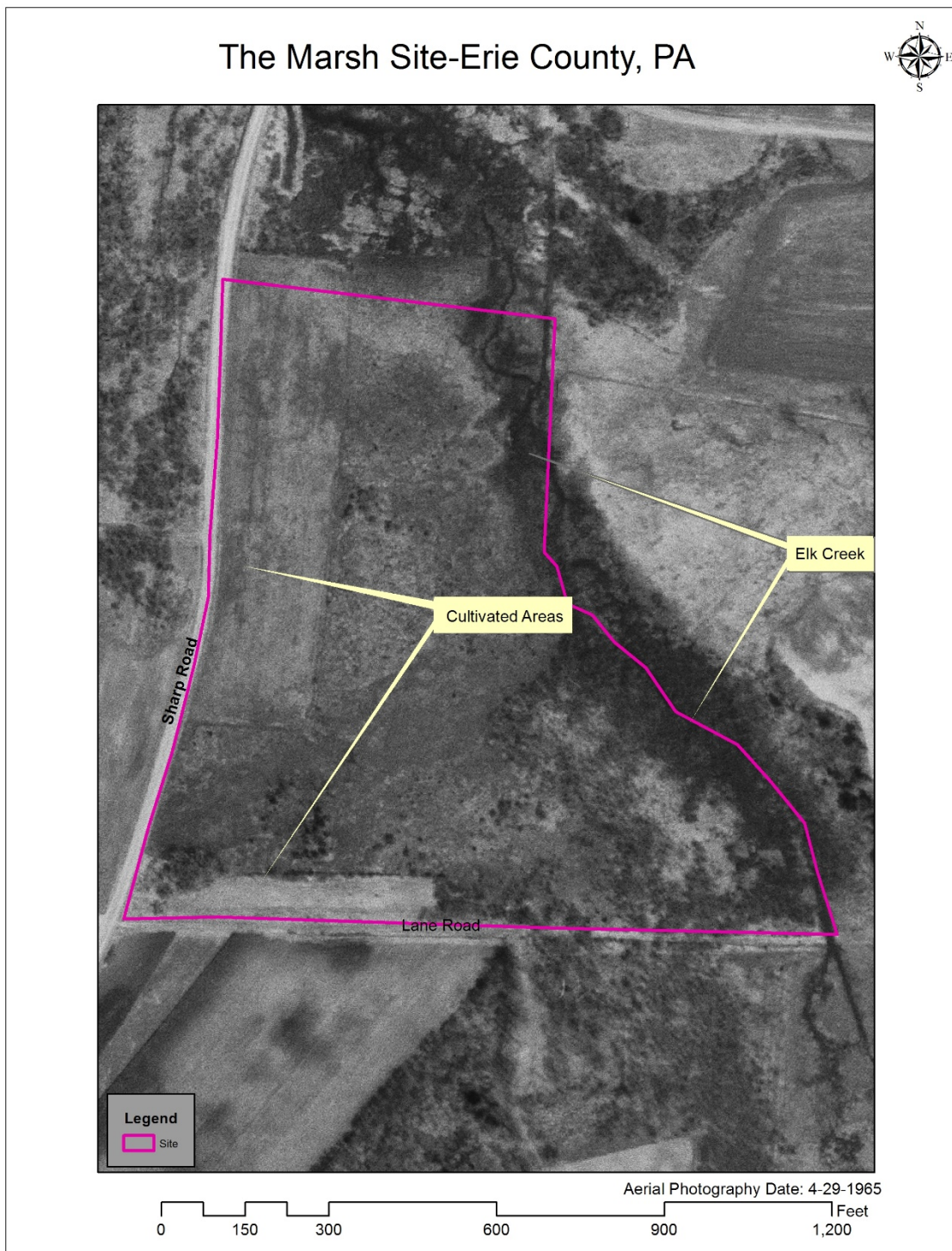


Figure 4



Figure 4a



Figure 5



Figure 5a

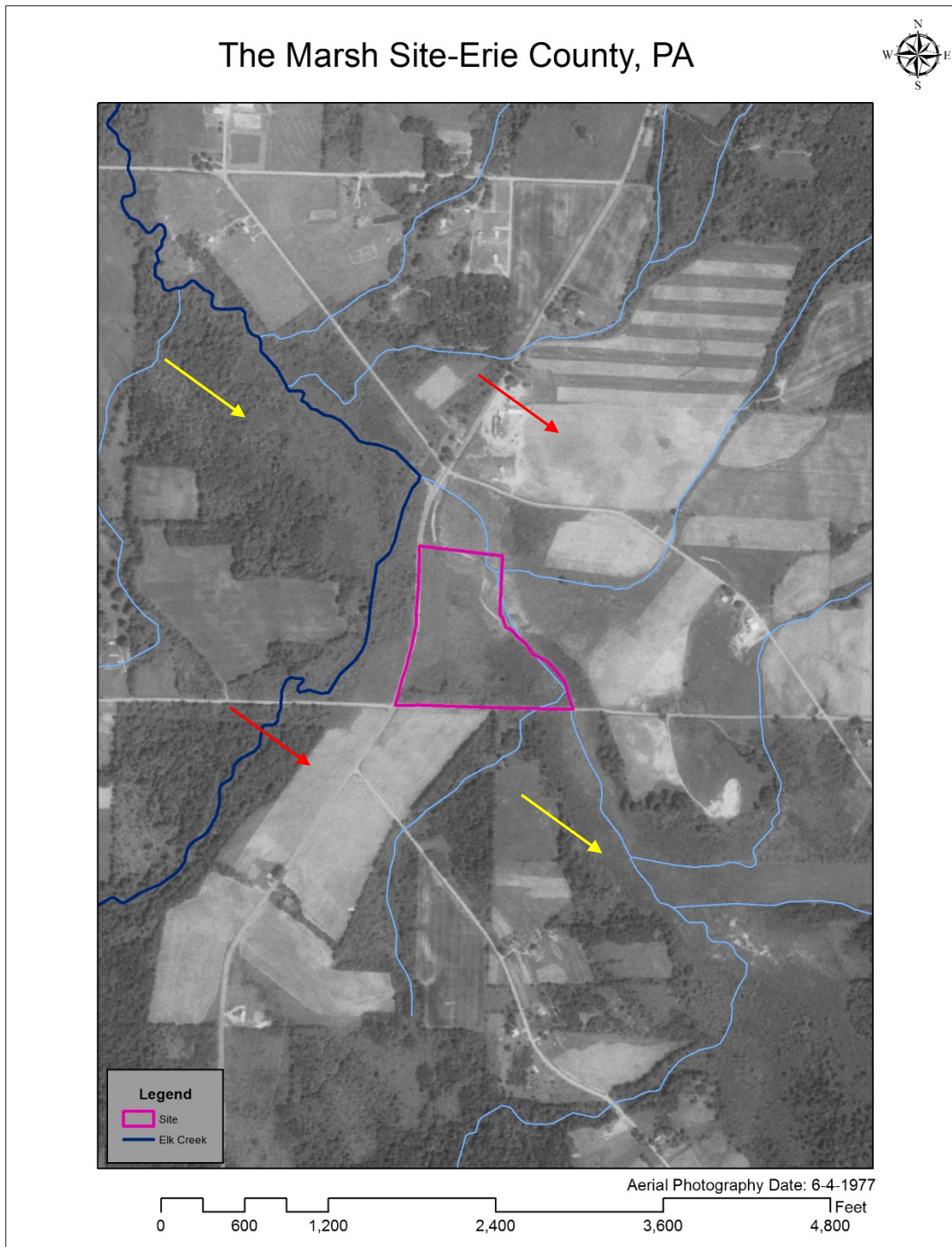


Figure 6

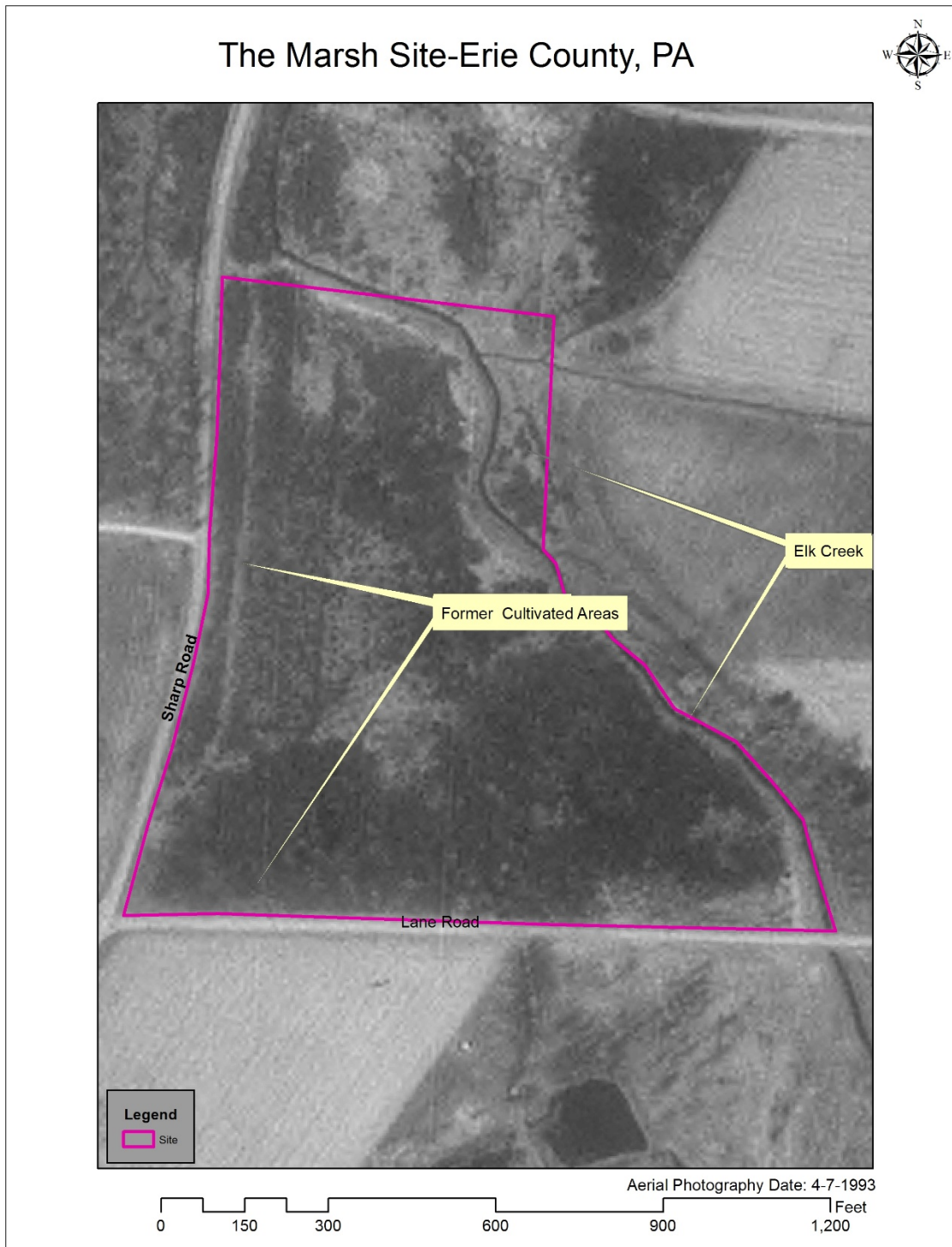


Figure 7



Figure 7a

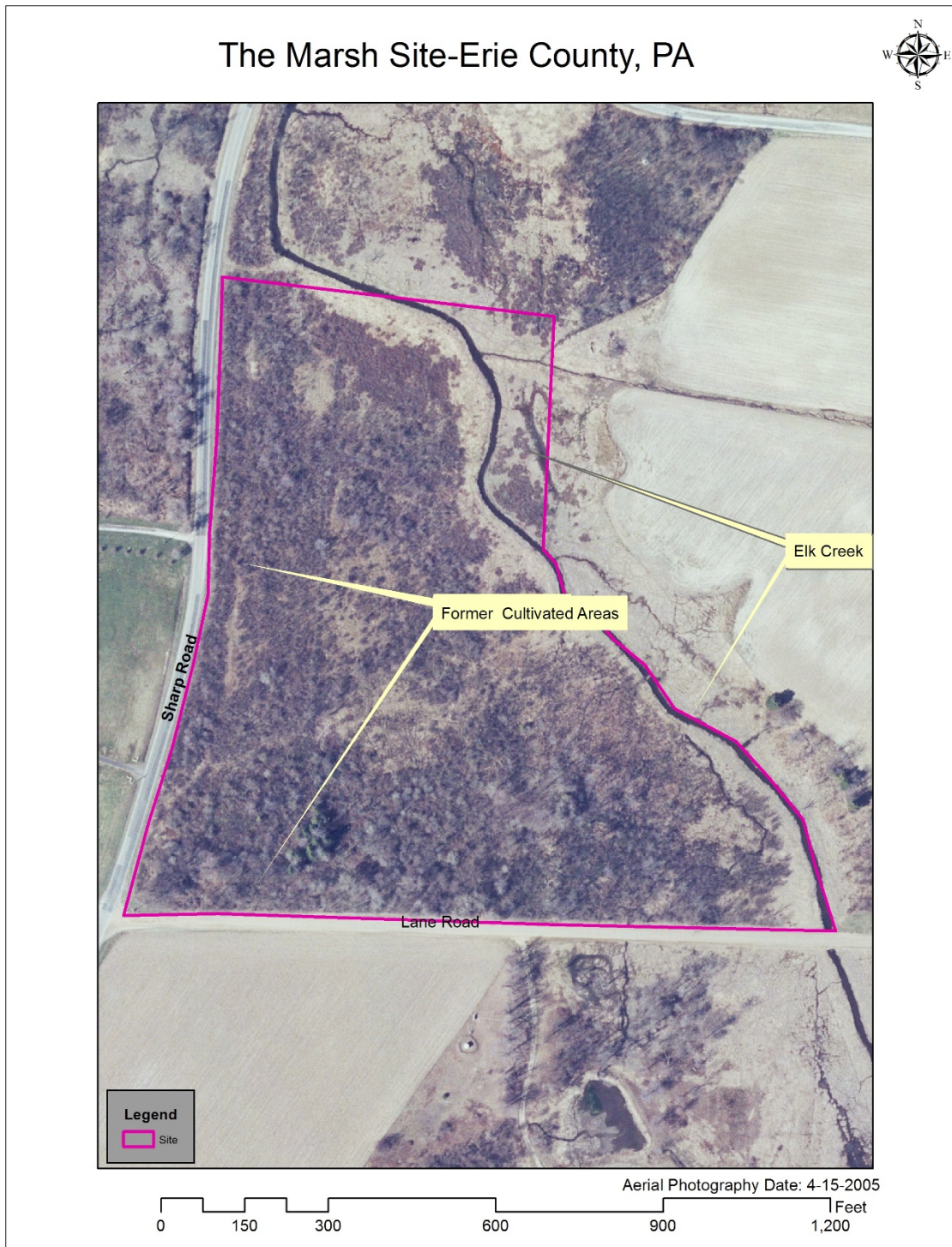


Figure 8

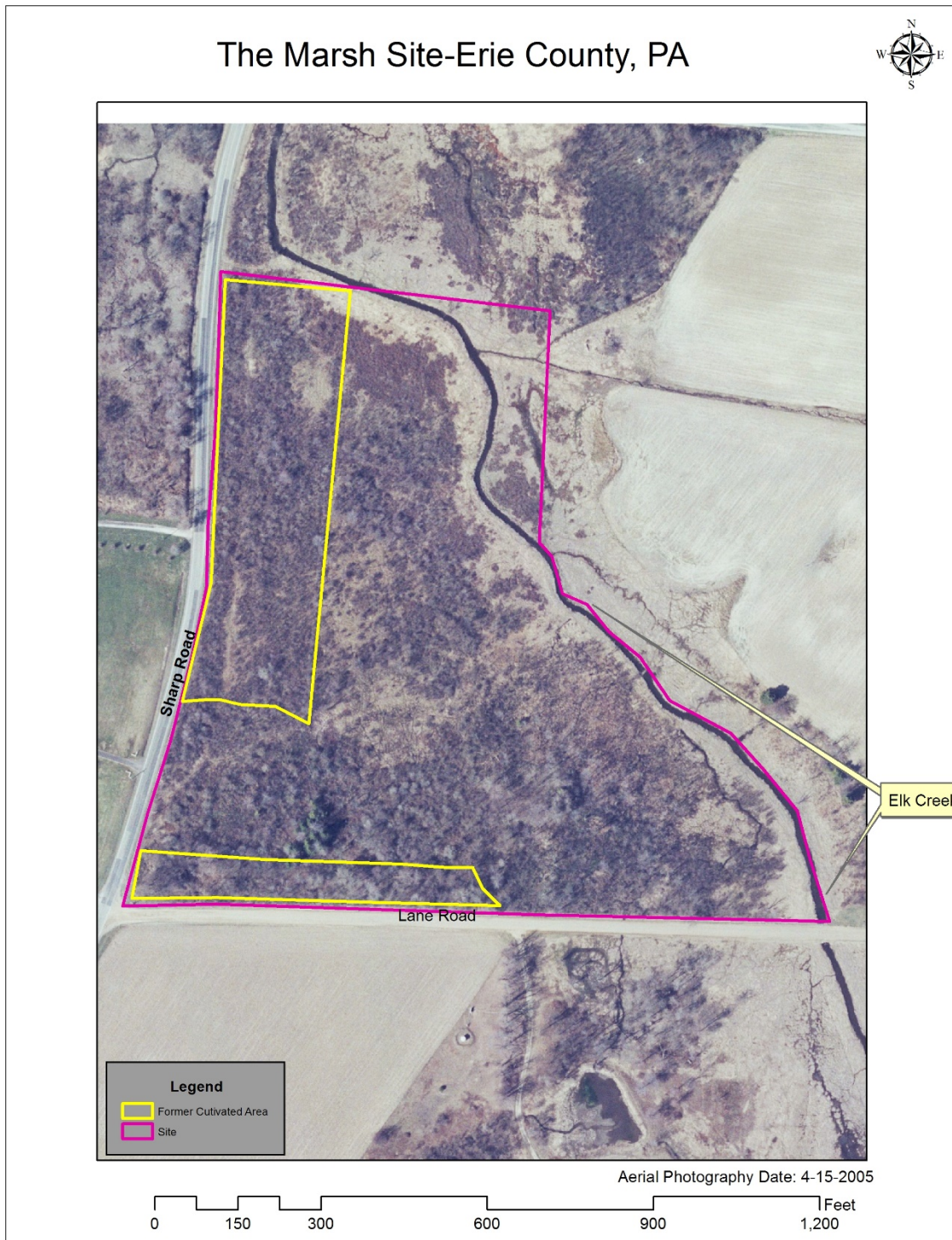


Figure 8a

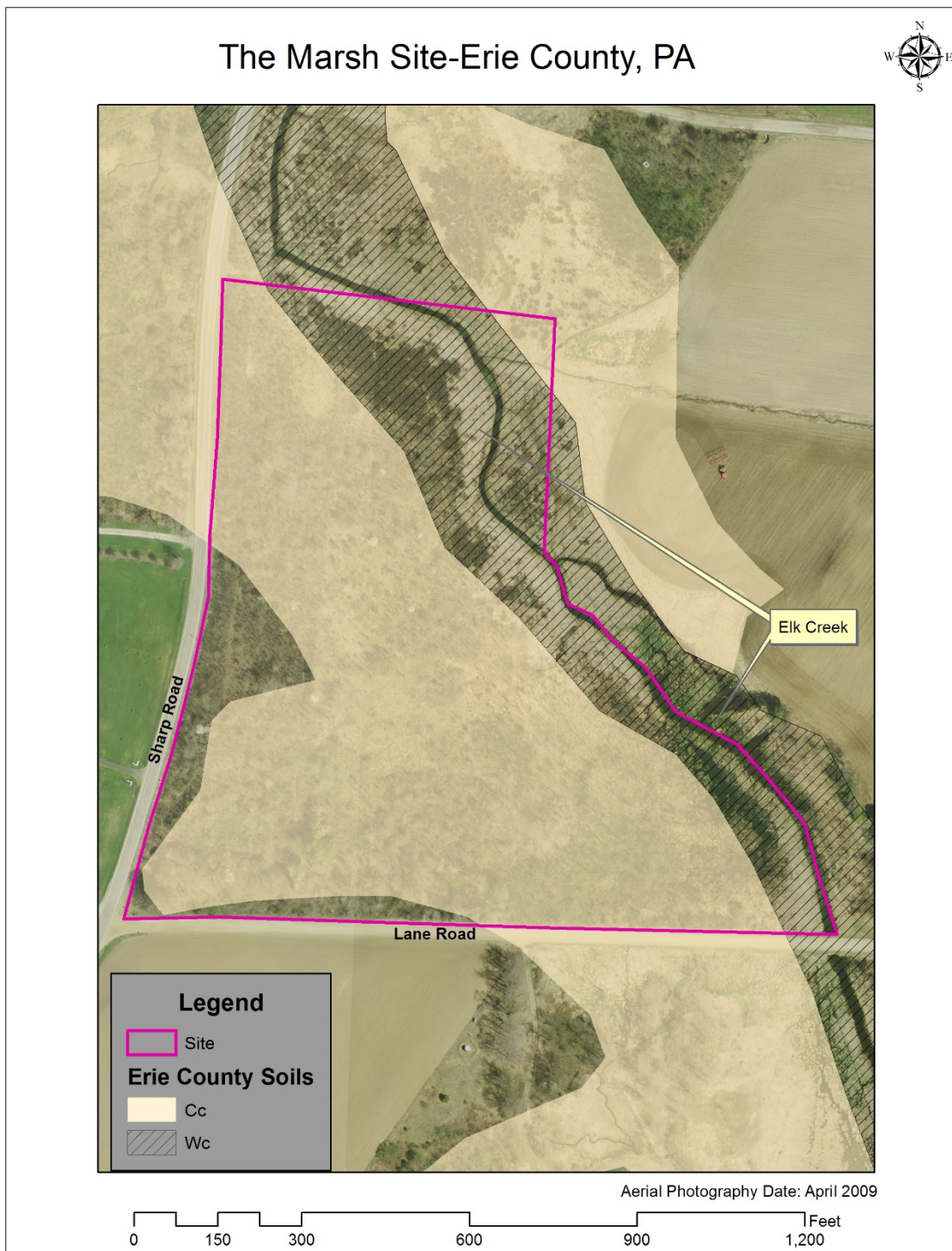


Figure 9

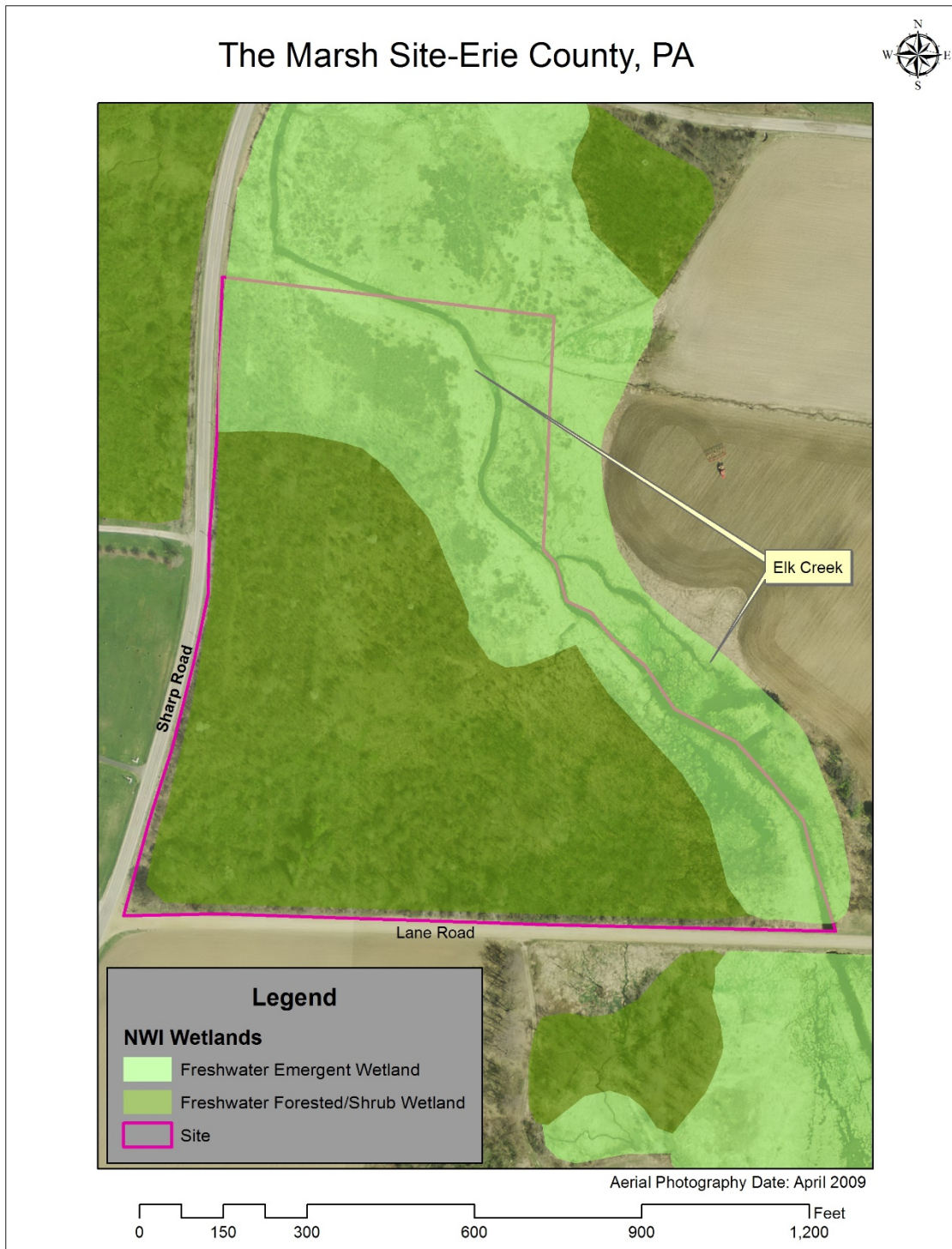


Figure 10

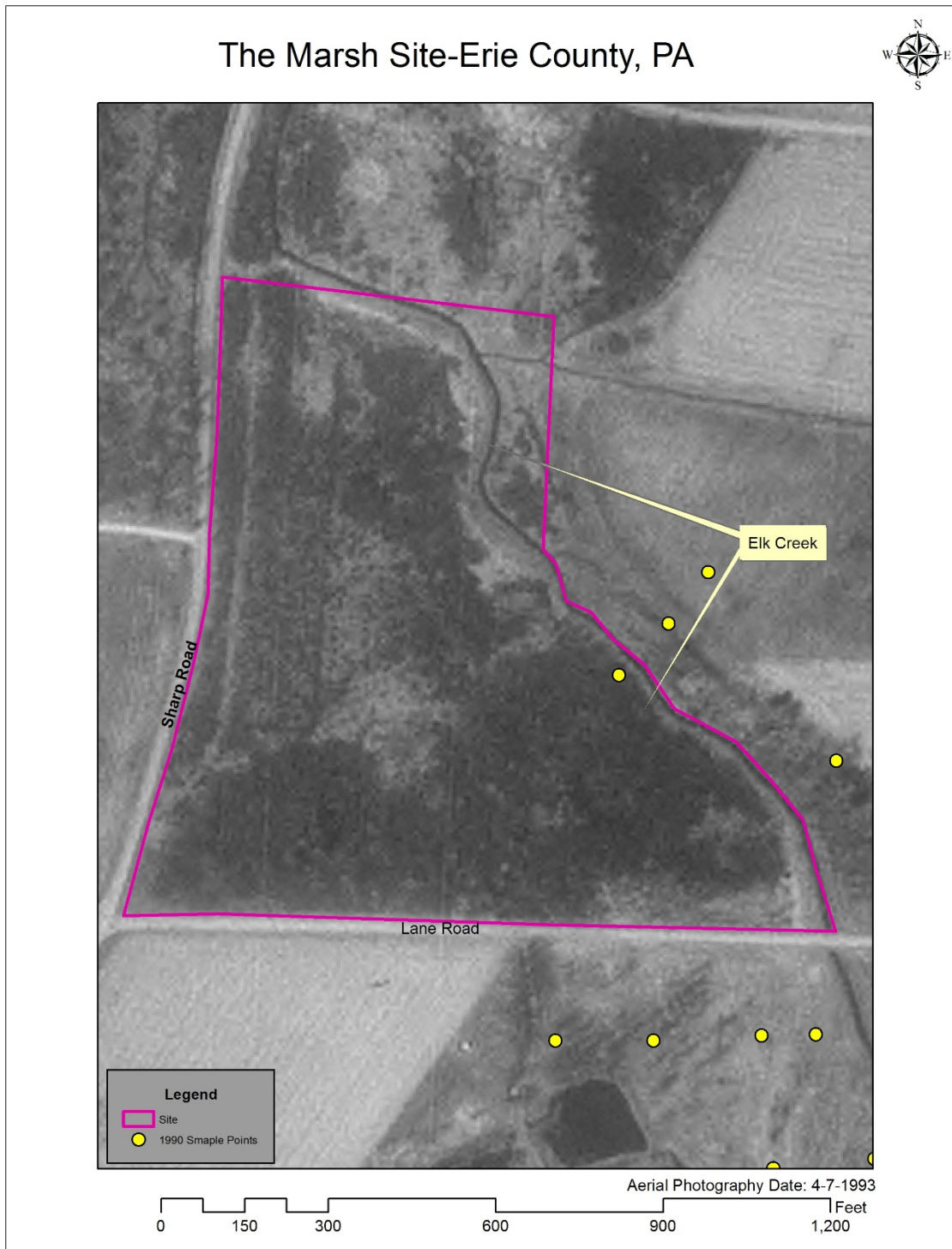


Figure 11

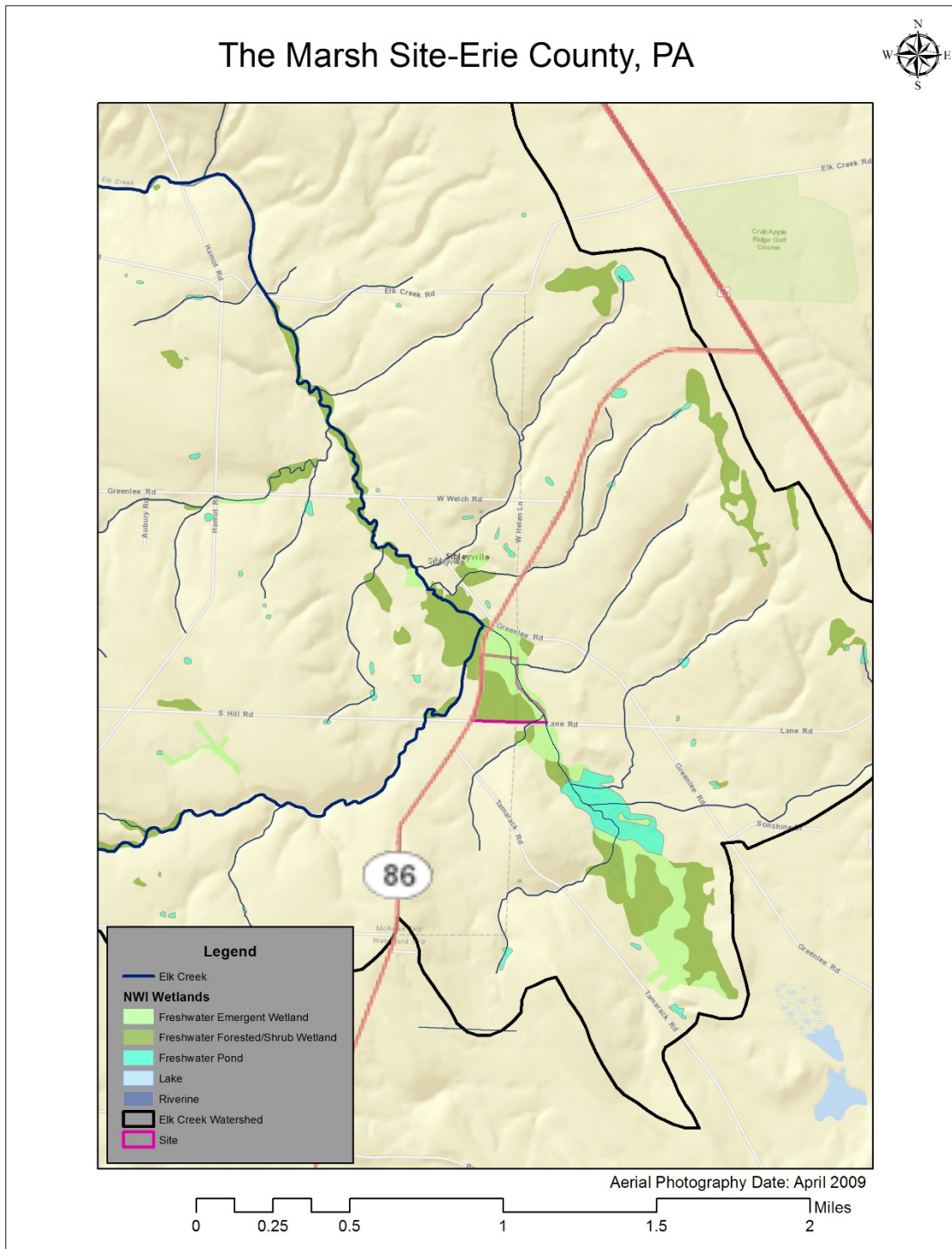


Figure 12

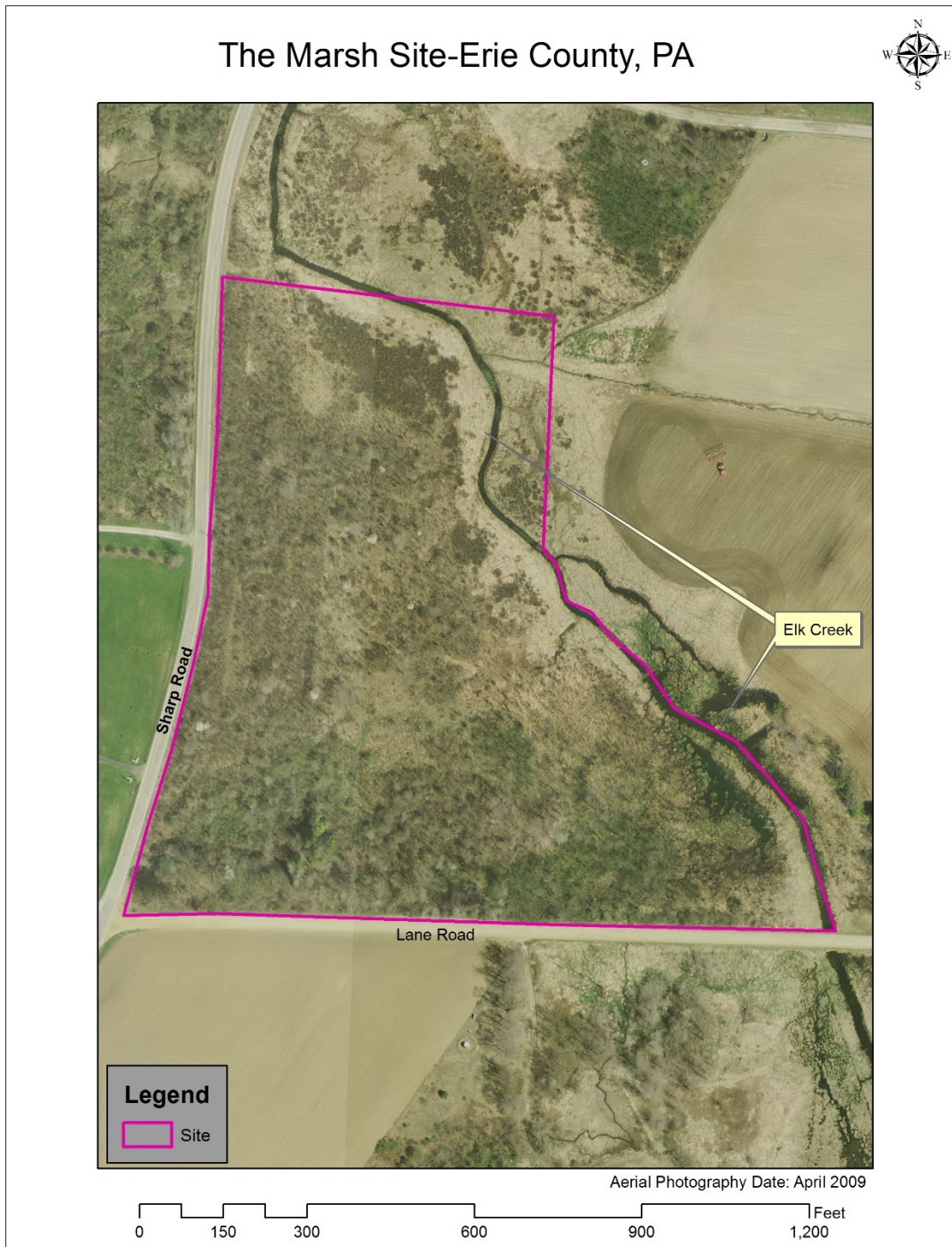
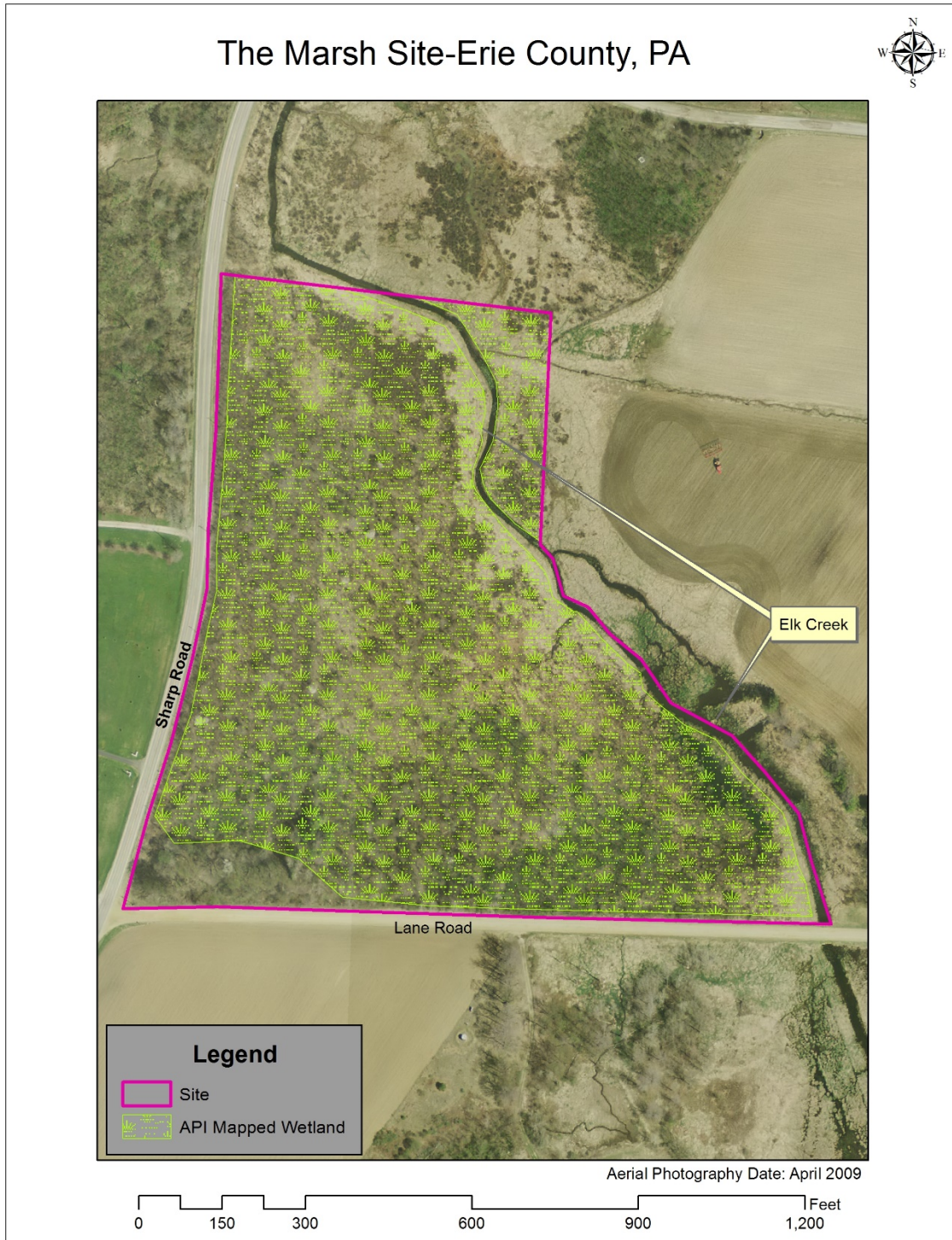


Figure 13



Figure

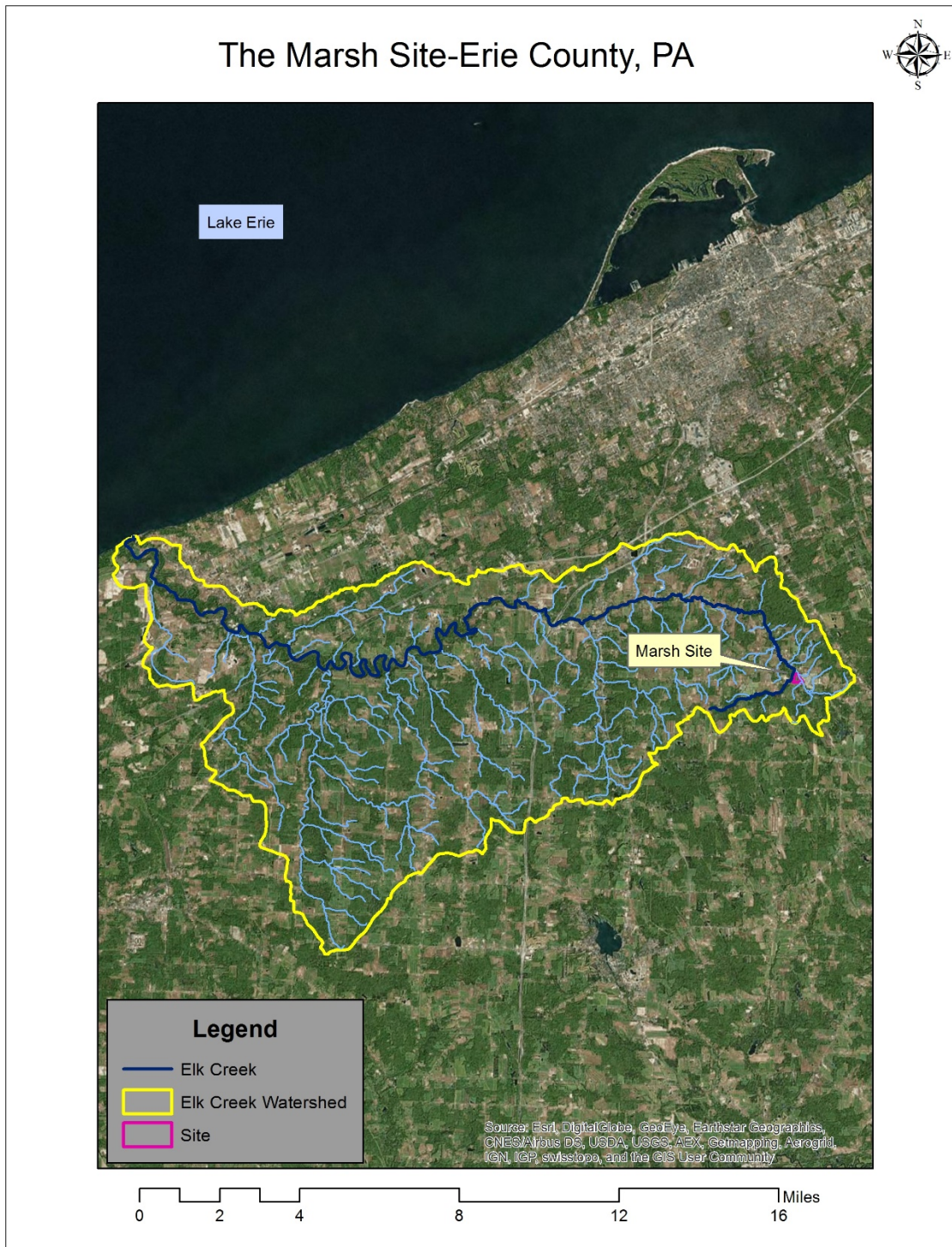


Figure 15



Figure 16

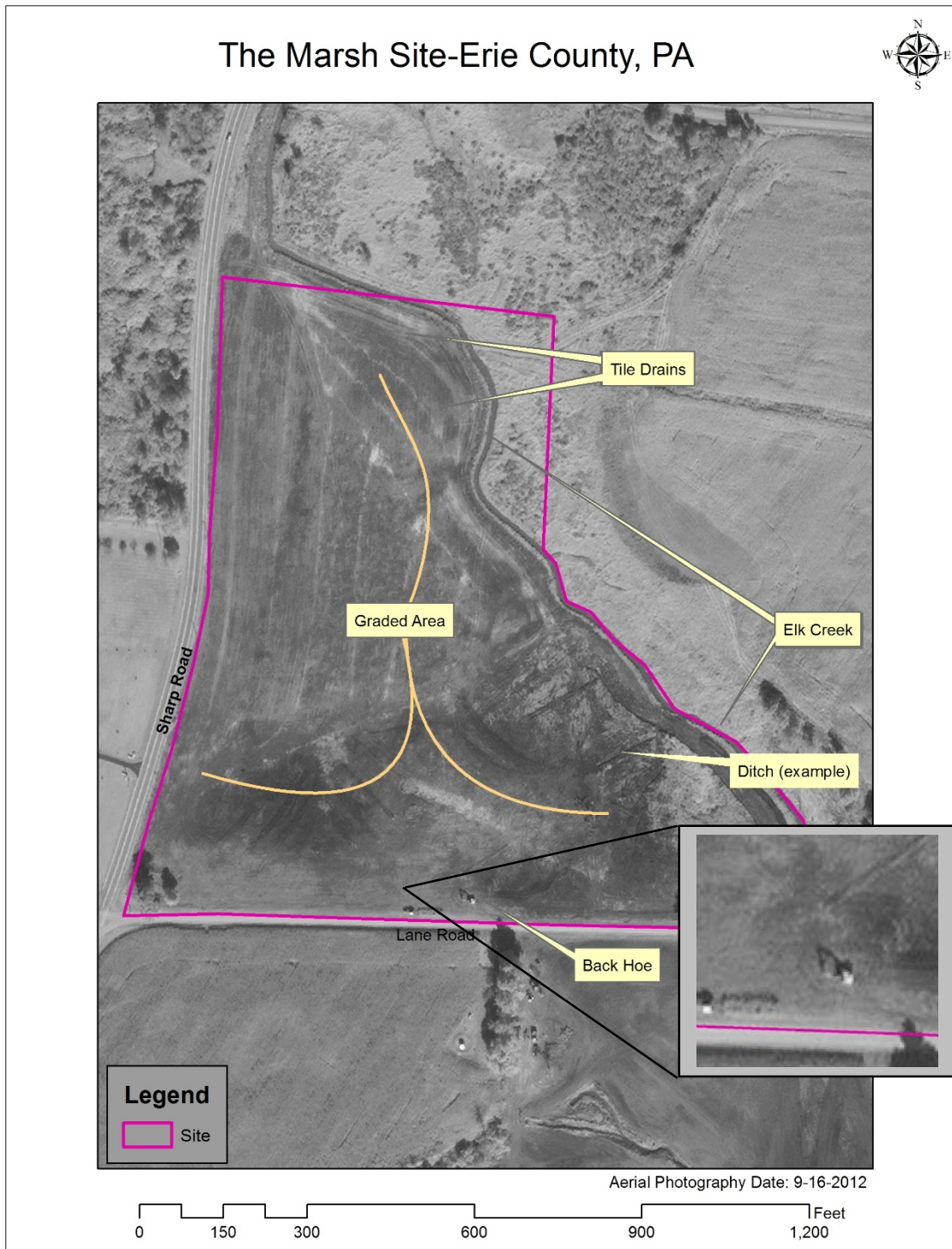


Figure 17

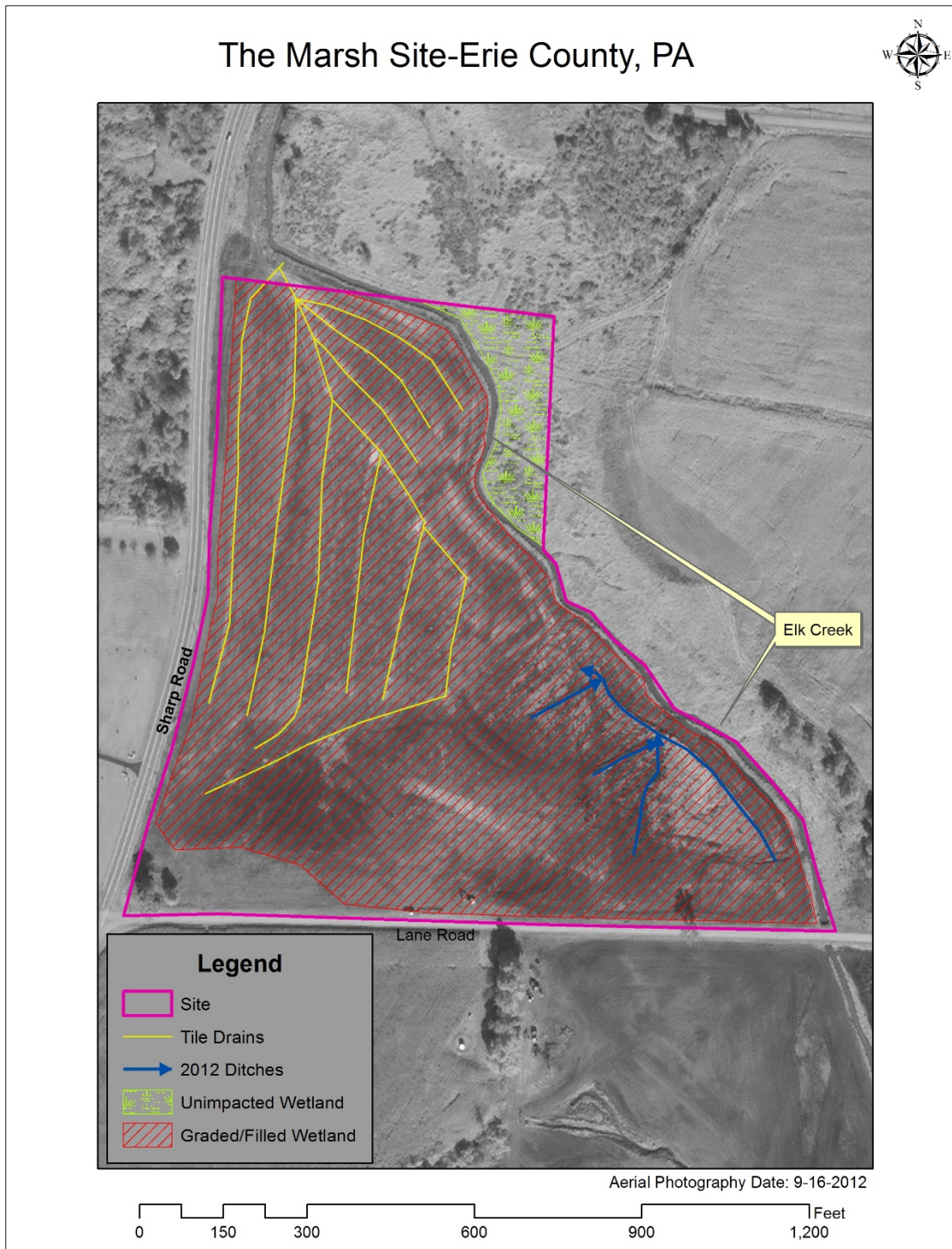


Figure 18



Figure

19

May 25, 2013



Figure 19a

April 14, 2016



Figure 20

Drain Tile Inlet Structure on Lane Road



Figure 21

Drain Tile Confluence



Figure 22

Steel Pipe Outlet



Figure 23

Drain Tile Outlet Location (Drain Tile Not Visible in Photo)

Appendix

Curriculum Vitae

Peter M. Stokely

Current Position

Clean Water Act (CWA) Section 404 Coordinator
Environmental Protection Agency
Office of Civil Enforcement
1220 Pennsylvania Ave, Washington, DC 20460

Responsibilities

- Support Environmental Protection Agency (EPA) Regions and the U.S. Department of Justice in Clean Water Act (CWA) case development through aerial photography interpretation, GIS support and knowledge of wetland science and policy.
- Perform as government expert in CWA litigation.
- Provide outreach and training in CWA enforcement methods including, aerial photography interpretation, GIS mapping, and analysis.
- Help develop and implement headquarters CWA enforcement policies, initiatives and guidance.
- Coordinate with the Regions on enforcement issues, initiatives, case development and program direction.

Accomplishments

- Recruited by the Office of Enforcement and Compliance Assurance (OECA) to help EPA's national CWA enforcement efforts after the Supreme Court ruling in *Rapanos v. United States*.
- Developed training materials and guidance for supporting CWA enforcement investigations after Rapanos which have been presented nationwide.
- Provided technical outreach of the effects of Rapanos on CWA enforcement to House of Representative and Senate staff.
- Recognized expert in aerial photography interpretation both regionally and nationally.
- Presenter at EPA/DOJ National Enforcement Conferences and EPA remote sensing symposiums.
- Invited faculty at the National Advocacy Center in Columbia, South Carolina (2007, 2008).
- Provided expert witness testimony in both criminal and civil litigation of numerous CWA enforcement cases across the nation (see Aerial Photo Interpretation and Expert Witness Testimony Provided).
- Provided aerial photography interpretation and GIS analysis in support of EPA review of proposed federal rule making as the result of the Supreme Court's decision in the *Solid Waste Agency of Northern Cook County (SWANCC) v US Army Corps of Engineers*.
- Participated in the planning and execution of numerous multi-disciplinary wetland field investigations to support CWA enforcement and permit cases.
- Provided aerial photo interpretation expertise and wetland policy guidance in support of the CERCLA program.
- Developed and instructed aerial photography courses that have been taught at various locations nationally.

Awards/Recognition
Medals

- Awarded EPA Region 5 Bronze Medal as part of the Rapanos Civil Litigation Team (June 2010).
- Awarded EPA Region 5 Bronze Medal as part of the Fabian Wetlands Enforcement Team (June 2009).
- Awarded EPA Region 2 Bronze Medal for exceptional service in *United States v. Manzo*, a successful CERCLA litigation that resulted in \$31 million cost recovery judgment for the Government (June 2008).
- Awarded EPA Office of Water Bronze Medal for Effective Co-administering the Rapanos Guidance to Ensure CWA Protection to our Nation's Aquatic Resources (July 2008).
- Awarded EPA Region 3 Bronze Medal for exemplary management and implementation of a high priority grants program designed to protect and enhance wetlands and aquatic resources in the Mid-Atlantic Region (April 2007).
- Awarded EPA Region 3 Bronze Metal for aquatic resource protection using Aerial Photography Interpretation and GIS Analysis (May 2006).
- Awarded EPA OECA Bronze Metal for outstanding team effort in the conviction of three individuals and two corporate defendants in the largest wetland's criminal enforcement case in United States history (July 2006).
- Awarded EPA Region 3 Bronze Metal for outstanding scientific analysis supporting continued regulation of the uppermost reaches of our Nation's Waters (April 2004).
- Awarded EPA Region 3 Bronze Metal for efforts leading to the successful prosecution of violations of the Clean Water Act (April 1996).
- Awarded EPA Region 3 Bronze Metal for efforts associated with the testing of the proposed 1991 revisions to the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (April 1992).

Special Recognition or Achievement Awards

- Awarded a Special Recognition Award by the U.S. Department of Justice for providing extraordinary assistance in the investigation and prosecution in the matter of *United States v. Robert J. Lucas Jr., et al.* Convictions February 25, 2005 (February 2007).
- EPA's Office of Compliance for playing a critical role in helping to make the NPDES Technical Inspector Workshops a success (December 2007).
- Superior Accomplishment Award for my role in developing EPA Region 3's comments on Advanced Notice for Proposed Rulemaking after the Supreme Court ruled in *SWANCC* (July 2003).
- Superior Accomplishment Award from EPA Region 8 for aerial photography interpretation and expert reports in the West Valley City, Utah CWA investigations (August 2003).

Letters or Certificates of Appreciation

- Buffalo District Corps of Engineers Certificate of Appreciation for co-instructing an aerial photography and GIS course (May 2013).
- U.S. Department of Justice Executive Office for United States Attorneys for participating as an instructor in the 2008 Environmental Crimes Seminar (June 2008).
- U.S. Department of Justice for being a panelist in the 1998 and 2001 EPA/DOJ National Enforcement Conferences.

- EPA National Enforcement Training Institute for instructing a course in aerial photography interpretation (May 1999).
- United States Attorney's Office for aerial photography interpretation support in *United States v. Mango, et al.* (January 1997).
- United States Attorney's Office for aerial photography interpretation support in *United States v. James J Wilson, et al.* (July 1996).
- Virginia Cooperative Extension Service (VEC) letter of appreciation for participation VEC Wetland Regulation Training Session (May 1995).
- Corps of Engineers Certificate of Appreciation for preparation and teaching Aerial Photography Interpretation courses (May 1993).
- Delaware Valley Science Fair for judging the 1993 fair (April 1993).
- United States Attorney's Office for aerial photography interpretation support in *United States v. William B. Ellen* (April 1992).
- Cabrini College in Philadelphia for guest teaching a wetlands course (March 1992).
- Society of American Foresters (SAF) letter of Appreciation for participation in SAF Wetland Training Session (July 1990).
- United States Attorney's Office for aerial photography interpretation support in *United States v. Paul V. Keibert et al.* (October 1987).
- EPA ORD Certificate of Appreciation for my efforts to improve the environment which have contributed to the search for a better life (November 1982).
- EPA ORD Nomination for Outstanding Support Services in the Southeast Ohio Risk Assessment Study (December 1981).

Education

Bachelor of Science from West Virginia University (1980) in *Forest Resource Management*, with a Supportive curriculum of remote sensing, computer science, geography, hydrology, surveying and mapping.

Continuing Education

Aerial Photo Interpretation Course. American Congress on Surveying and Mapping. Washington D.C., February 1981.

Technical Writing Workshop. Shipley Associates. Warrenton VA., November 1981 and March 1982.

Fundamentals of Remote Sensing for Terrain Analysis. George Washington University, January 1982.

Elements of Photogrammetry I and 2. George Mason University, May 1983.

Graduate Level Terrain Analysis. Robert Frost, U.S. Army Engineer Topographic Laboratories, 1983.

Classification of Wetland and Deepwater Habitats. U.S. Fish and Wildlife Service, Clearwater, Florida, October 1987.

ESRI ARC/Info GIS Training Course. U.S. EPA, Philadelphia, Pennsylvania, March 1988.

Jurisdictional Delineation of Wetlands. U.S. EPA. Hickory Corners Michigan, September 1988.

Cumulative Impact Assessment in South Eastern Wetland Ecosystems. U.S. EPA. Slidel, Louisiana, October 1988.

Hazardous Materials Incident Response Operations. U.S. EPA, Edison New Jersey, Oct 26-30, 1992.

Habitat Evaluation Procedures Workshop. U.S. Fish and Wildlife Service, National Ecology Research Center, Philadelphia, Pennsylvania, Nov. 1-6, 1992.

Practical Conflict Management. National Highway Institute, Hunt Valley Maryland, February 2-4, 1993.

Soils Classification Course. Delaware Valley College, Doylestown, Pennsylvania, June 28-30 1993.
Soil Science for Hazardous Materials, Cook College, New Brunswick, New Jersey, October 27-29, 1993.
National Environmental Policy Act Training Workshop. Shipley Associates, New York City, June 13-15, 1995.
Training Program for Major Investment Studies. National Transit Institute, Wilmington, Delaware, September 6-8, 1995.
The Hydrogeomorphic Approach to Assessment of Wetland Functions in the Mid-Atlantic. The Natural Resource Conservation Service in cooperation with EPA, COE, FWS and the National Wetland Science Training Cooperative, Annapolis, Maryland, September 18-22, 1995.
ISTEA: Opportunities for Innovative Transportation and Environmental Policymaking. U.S.EPA, Office of Policy, Planning, and Evaluation, Philadelphia Pa., Dec. 12, 1995.
Regulatory IV Interagency Wetland Identification Training. Stockton, New Jersey, September 30-October 4, 1996.
Applied Fluvial Geomorphology. Dave Rosgen; Wildland Hydrology Consultants, Charlottesville, Virginia, March 10-14, 1997.
Remote Sensing and Digital Image Processing. Doug Wheeler; United States Geological Survey, Reston, Virginia, January 22-March 5, 1998.
Automated Geospatial Watershed Management-GIS Based Hydrologic Monitoring. USDA Southwest Watershed Research Center/ EPA Office of Research and Development Reston, Virginia, September 17-18, 2002.

Professional Publications

Stokely, PM, 2013.
Using Aerial Photography, Geospatial Data, and GIS to Support the Enforcement of Environmental Statutes. American Bar Association, Natural Resources and Environment, Volume 28, Number 1, Summer 2013.

Brilis, GM; vanWaasbergen, RJ; Stokely, PM; Gerlach, CL, 2001.
Remote Sensing Tools Assist in Environmental Forensics: Part II-Digital Tools. Environmental Forensics, Volume 2, Number 3. Academic Press, Pages 223-230.

Stokely, PM, 1987.
The EPA's Remote Sensing Support of the Clean Water Act's Section 404 Enforcement Activities. Army Corps of Engineers, 1987.

Stokely, PM. and Bear, WL, 1984.
Incorporation of Hydrogeologic Data into the USEPA Environmental Photographic Interpretation Center Investigations into Hazardous Waste Sites. Conference Proceedings, Management of Uncontrolled Hazardous Waste Sites, Washington, D.C.

Previous Employment

Environmental Scientist/Work Assignment Manager, EPA Region 3, 12201 Sunrise Valley Drive, 555 National Center, Reston VA 20192. Job Description: Clean Water Act (CWA) and National Environmental Policy Act (NEPA) program duties, including CWA enforcement. Used established rules, current science, aerial photography interpretation and Geographic Information System (GIS) tools to support EPA programs (2/88-7/06).

Senior Level Imagery Analyst/Team Leader (Held Top Secret Clearance): The Bionetics Corporation, (contractor to EPA's Environmental Photographic Interpretation Center (EPA/EPIC)). P.O. Box 1575, V.H.F.S. Warrenton, VA 22186, (9/80 to 2/88).

Expert Witness Testimony Provided

1) U.S.A. v Paul V. Kebert, Kebert Construction Co., and the Kebert Family Partnership, Civil Action 86-86E, Crawford County, PA., November 1986, Federal Court Erie.

Issue: Wetlands filling for residential development.

Subject of testimony: Presence of wetlands prior to disturbance, chronology and extent of filling activity.

2) U.S.A. v Phillip R. and Paul S. Hobbs, Civil Action 90-41 Ware Neck, VA., January 1990, Federal Court Norfolk.

Issue: Wetlands filling for residential development although contested as normal silviculture.

Subject of testimony: Chronology of site disturbance, location of field samples, presence of natural and manmade drainage, connection to waters of the United States.

3) U.S.A. v William B. Ellen, Criminal No. S-90-0215, Dorchester County, MD, December 1990, Federal Court Baltimore.

Issue: Wetlands filling for hunting preserve, ponds, home and road construction.

Subject of testimony: Presence of wetlands prior to disturbance, chronology of events, description of wetlands at each count and opinion as to whether wetlands were filled, and acreage, impact of rainfall on wetland signatures.

4) U.S.A. v Robert Brace and Robert Brace Farms, Inc., Civil Action 90-229 Erie, Erie County, PA., November 1993, Federal Court Erie.

Issue: Wetland conversion for unknown purposes although contested for agricultural purposes.

Subject of testimony: Presence of wetlands prior to disturbance, chronology of events, presence of sidecast fill material and underground drainage tiles, acreage of impact, drainage direction, connection to waters of the United States.

5) U.S.A. Counter Claim Plaintiff v Harry H. Cupp and Mina H. Cupp, Civil Action 89-170-E, Randolph County, WVA., July 1994, Federal Court Elkins.

Issue: Forested wetland conversion for agricultural purposes.

Subject of testimony: Presence of wetlands prior to disturbance, drainage direction and connection to Waters of the United States, acreage of impact.

6) Bozievich Case, October 1994, EPA Administrative Hearing, Philadelphia.

Issue: Conversion of wetlands for farming related purposes, York County, PA.

Subject of testimony: Presence of wetlands prior to disturbance, connection to Waters of the United States, area of impact.

7) Britton Construction Co., BIC Investments, and William and Mary Hammond, Docket No. CWA-III-096, November 1996, EPA Administrative Hearing, Washington, D.C.

Issue: Filling of tidal wetlands for residential construction, Chincoteague VA.

Subject of testimony: Presence of wetlands prior to filling, connection to tidal waters.

8) U.S.A. v James J. Wilson, Interstate General Co., LP and St. Charles Associates, Criminal No. AW-95-0390, Charles County, MD. February 1996, Federal Court Greenbelt.

Issue: Non-tidal wetlands filling for residential and commercial development.

Subject of testimony: Presence of wetlands prior to disturbance, drainage direction and connection to Waters of the United States, presence of natural and manmade drainage features, stability and reliability of wetland signatures, chronology of disturbances, selection and location of reference points, impact of rainfall on wetland signatures, opinion as to whether wetlands were filled and acreage of fill.

9) Borden Ranch Partnership v US Army Corps of Engineers and US EPA, CIV-597 0858 GEB JFM , Sacramento and San Joaquin Counties, California. January 1998, Federal Court Sacramento.

Issue: Non-tidal wetlands filling for agricultural purposes (vineyard and orchard).

Subject of testimony: Documentation and enumeration of discharges as the result of deep-ripping.

10) U.S.A. v Sartori, CIV 98-14087 Moore, Lake Placid, Highlands County, Florida, Federal District Court, Southern District of Florida, Fort Pierce, FL. July 2000.

Issue: Conversion of non-tidal wetland for agricultural purposes (caladium production).

Subject of testimony: Documentation of the history of the conversions, mechanized land clearing, site drainage, connections to waters of the United States, presence of wetlands, documentation of hydrology visible on the aerial photography.

11) U.S.A. v Paul G. Phypers, et al. Civ. Case No. 00-141195-CIV-PAINE/LYNCH, S.D. FLA., Lake Placid, Highlands County , FL. Federal District Court, Southern District of Florida, Fort Pierce, FL. May 8, 2002.

Issue: conversion of non-tidal wetlands for agriculture purposes (caladium production).

Subject of testimony: Documentation of the history of the site 1970-1999, description of the site before and after conversion to agriculture (mechanized land clearing, ditching), site drainage, connections to waters of the United States.

12) U.S.A. vs. Dominick and Louis Manzo, Marlboro Township, Monmouth County, NJ: Civil Action No. 97-289 (MLC), Federal District Court, District of New Jersey, Trenton, NJ. June 11-12, 2002.

Issue: Division of liability under CERCLA regarding the release of contaminants into Burnt Fly Bog.

Subject of testimony: Documentation of the history of the site from the 1950's until the present including the description of the waste lagoon contents and condition, description of manmade disturbances to the lagoons and subsequent deposition of material into Burnt Fly Bog, description of surface water flow paths and erosion from the lagoons and the description of changes to the vegetative cover of the adjacent wetlands.

13) Smith Farms Hearing, EPA 404/402 Administrative Proceeding, Virginia Beach Circuit Court, Virginia, June 18, 2002 (Retried October 6-10, 2003).

Issue: Tulloch ditching in preparation for land development.

Subject of Testimony: the methods and conclusions contained in two expert reports (January and June 2002), the January 2002 report covered the presence of wetlands on site and the description and measurement of disturbances to wetlands (ditching, clearing of swaths) and total land disturbance for 402 purposes. The June 2002 report focused on the hydrological connection of the site to other waters and tidal waters.

14) Lewis Farms Hearing, EPA 404/402Administrative Proceeding, Virginia Beach Circuit Court, Virginia, January 14 and February 6, 2003.

Issue: Tulloch ditching in preparation for land development.

Subject of Testimony: the presence of wetlands on site and the description and measurement of disturbances to wetlands (ditching, clearing of swaths, access roads (where and when)) and total land disturbance for 402 purposes. Testimony also focused on the hydrological connection of the site to other waters and tidal waters.

15) Doug Blossom Hearing, EPA CWA Administrative Proceeding, Alaska State Court House, Kenia, Alaska, May 4, 2004.

Issue: Ditching and land clearing of wetlands for agriculture adjacent to Cook Inlet.

Subject of Testimony: testimony performed using live demonstration of ArcView GIS. Issues were the presence of wetlands, alteration of wetlands, evidence of silviculture activity, drainage connection to Cook Inlet, including flow across beach.

16) U.S.A. v Lucas, Criminal No: 1:04cr60GuRo, Federal District Court, Gulfport, MS. January 25, 2005.

Issue: Extent of wetlands, connections to the Gulf of Mexico, filling of wetlands for a trailer park.

Subject of Testimony: Method and results of aerial photography interpretation and GIS analysis showing the physical alterations and hydrological connection of the Lucas wetlands to local streams and bayous and ultimately to the Gulf of Mexico.

17) Smith Farms Hearing, Post Rapanos Remand Administrative Proceeding, Norfolk, VA, May 14, 2007.

Issue: CWA Jurisdiction after Supreme Court ruling in Rapanos.

Subject of Testimony: the results of the analysis of historical aerial photography and maps showing relatively permanent hydrologic connections. Analysis and discussion of comparable wetlands in the area, as well as testimony regarding the presence of wetlands on site and the hydrological connection of the site to other waters and tidal waters.

18) Lewis Farms Hearing, Post Rapanos Remand Administrative Proceeding, Norfolk, VA, May 25, 2007.

Issue: CWA Jurisdiction after Supreme Court ruling in Rapanos.

Subject of Testimony: the results of the analysis of historical aerial photography and maps showing relatively permanent hydrologic connections. Analysis and discussion of comparable wetlands in the area, as well as testimony regarding the presence of wetlands on site and the hydrological connection of the site to other waters and tidal waters.

19) Cody Bedford Evidentiary Hearing, Federal District Court, Norfolk, VA, October 22, 2008.

Issue: CWA Jurisdiction after Supreme Court ruling in Rapanos.

Subject of Testimony: testimony regarding the presence of wetlands on site and the hydrological connection of the site to other waters and tidal waters, and the chronology of filling in the wetlands.

20) U.S.A. v Johnson, Civil Action No. 99-12465-EFH, Federal District Court, Boston, MA, April 11-12, 2011.

Issue: CWA Jurisdiction after Supreme Court ruling in Rapanos.

Subject of Testimony: the results of the analysis of historical aerial photography and maps showing tributary connections, adjacent and abutting wetlands and flow paths to traditional navigable waters.

21) U.S.A. v Nicastro, June 2, 2011, Syracuse, NY-Grand Jury.

Issue: CWA Jurisdiction after Supreme Court ruling in Rapanos.

Subject of Testimony: the results of the analysis of historical aerial photography and maps showing wetlands and tributary connections and flow paths to traditional navigable waters.

22) U.S.A. v Richard Roberts, November 8, 2013, Federal District Court, Nashville, TN.

Issue: Establishing CWA Jurisdiction over a tributary to the Duck River in west-central Tennessee.

Subject of Testimony: the methods and results of historical aerial photography interpretation of the tributary of the Duck River known as Snake Creek.

23) Ron Foster, et al. v United States Environmental Protection Agency, Southern District of West Virginia.

Deposition: taken on November 4, 2015.

24) Ron Foster, et al. v United States Environmental Protection Agency, Trial testimony, August 16, 2017. Southern District of West Virginia.

Issue: Factors related to CWA Jurisdiction over a tributary to Neil Run and the Little Kanawha River in west central West Virginia.

Subject of Testimony: the methods and results of aerial photography interpretation of the tributary (known as RR4) to Neil Run. The historical presence of a channel and bed and bank features across "the hayfield".

25) U.S.A v Robert Brace, Federal District Court, Erie PA

Deposition: taken on October 10, 2017