

United States Department of the Interior  
Bureau of Land Management  
Northeastern States Field Office  
LLES003410

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## Environmental Assessment

NEPA #: DOI-BLM-ES-030-2013-0027-EA

### Expressions of Interest 351 and 1006

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**Date:** September 2013

**Type of Action:** Oil and Gas

**Serial Number:** N/A

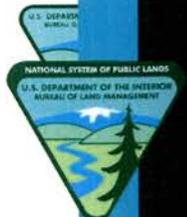
**Location:** Pennsylvania State Game Lands 219, Warren Township, Bradford County

**Project Acreage:** 5,194 acres

**Proponent Address:** Proprietary

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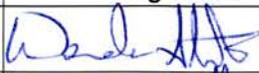
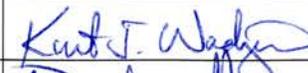
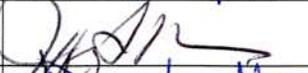
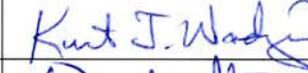
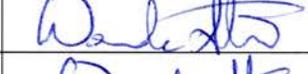
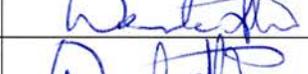
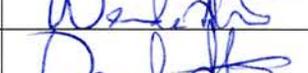
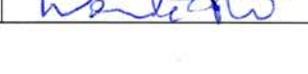
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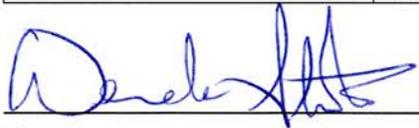


## MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

**Technical Review.**

Program	Reviewer	Signature	Date
Air Quality	Derek Strohl Natural Resources Specialist		9/17/13
Climate Change	Derek Strohl Natural Resources Specialist		9/17/13
Cultural/Paleontology	Jarrold Kellogg Archeologist	JKK	9/19/13
Environmental Justice	Kurt Wadzinski Planning & Environmental Coordinator		9/24/13
Fish and Wildlife	Derek Strohl Natural Resources Specialist		9/17/13
Geology/Mineral Resources/Energy Production	Jeffrey Nolder Geologist		9/19/2013
Hazardous Wastes	Derek Strohl Natural Resources Specialist		9/17/13
Invasive Species/Noxious Weeds	Derek Strohl Natural Resources Specialist		9/17/13
Native American Religious Concerns	Jarrold Kellogg Natural Resources Specialist	JKK	9/19/13
Recreation	Jarrold Kellogg Archeologist	JKK	9/19/13
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Special-Status Species	Derek Strohl Natural Resources Specialist		9/17/13
Vegetation	Derek Strohl Natural Resources Specialist		9/17/13
Visual Resources	Derek Strohl Natural Resources Specialist		9/17/13
Water Resources and Wetlands	Derek Strohl Natural Resources Specialist		9/17/13

  
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## **CHAPTER 1 – PURPOSE OF AND NEED FOR ACTION**

### **Purpose of the Proposed Action**

The purpose is to consider opportunities for private individuals or companies to explore for and develop Federal oil and gas resources through a competitive leasing process. A Federal oil and gas lease is a legal contract that grants exclusive rights to the lessee to develop Federally-owned oil and gas resources.

### **Need for the Proposed Action**

The tracts considered for lease in this analysis were nominated by Expressions of Interest (EOIs) from private industry. The oil and gas leasing program managed by the Bureau of Land Management (BLM) encourages private exploration and development of domestic oil and gas reserves and the reduction of U.S. dependence on foreign sources of energy and is essential to meeting the nation's future needs for energy. The BLM's oil and gas leasing programs are codified under the authority of the Mineral Leasing Act of 1920, as amended, the Mineral Leasing Act for Acquired Lands of 1947, as amended, the Federal Land Policy and Management Act (FLPMA) of 1976, and the Energy Policy Act of 2005.

On October 9, 2009, and April 6, 2010, the BLM Northeastern States Field Office (NSFO) received requests from the BLM Eastern States Office (ESO) for a National Environmental Policy Act (NEPA) analysis report on 5,194 acres of State Game Lands 219. This nomination is located on state-owned land.

### **Management Objectives of the Action**

Since the BLM does not manage the surface, the BLM's sole management objective is to make Federal minerals available for economically feasible development without causing undue, negative impacts to natural resources.

### **Conformance with BLM Land Use Plan(s)**

The BLM does not manage any surface acreage in Pennsylvania, and while the BLM has not developed a comprehensive land use plan for the Commonwealth of Pennsylvania, it is in the initial stages of developing a five-state Resource Management Plan (RMP) and associated Environmental Impact Statement (EIS) that includes Pennsylvania. In the interim, two Instruction Memoranda permit the BLM to consider leasing actions in areas for which the BLM has not conducted land use planning, provided the public has the opportunity for input into the process. BLM Instruction Memorandum No. ES-2006-13 states that, "When oil and gas leasing and non-energy solid mineral leasing are proposed in an area not covered by a Resource Management Plan (RMP) or other applicable LUP (Land Use Plan), an Environmental Assessment (EA) may be used as a basis for a decision on the proposal (43 CFR 1610.8(b)(1)), provided that there is an opportunity for the public to provide input during the process. At a minimum, there shall be some form of public notification that an EA is being initiated. This could take the form of a posting on the BLM-ES web site, a news release, or the posting of a legal notice in local media outlets." In addition, "there will be a mandatory 30-day public review and comment period on the EA and Finding of No Significant Impact before the Decision Record is signed."

BLM Instruction Memorandum No. WO-2010-117 states that, "State and field offices will provide for public participation as part of the review of parcels identified for potential leasing through the NEPA compliance documentation process. State and field offices will identify groups and individuals with an interest in local BLM oil and gas leasing, including surface owners of split estate lands where Federal minerals are being considered for leasing. Interested groups, individuals, and potentially affected split estate surface owners will be kept informed of field office leasing and NEPA activities through updated websites and email lists, and will be invited to comment during the NEPA compliance process."

Notice of initiation of this EA was posted to the Eastern States public website on the 2013 NSFO NEPA Log on September 11, 2013. Additionally, the ESO leasing process incorporates a mandatory 30-day public comment period on all completed EAs and unsigned Findings of No Significant Impact (FONSIs) for potential lease parcels on the ESO public website.

### **Relationship to Statutes, Regulations and Other Plans**

This EA was prepared in accordance with the NEPA of 1969 and in compliance with all applicable regulations and laws passed subsequently, including Council on Environmental Quality (CEQ) regulations (40 C.F.R., Parts 1500-1508), U.S. Department of the Interior (DOI) requirements (Department Manual 516, Environmental Quality), the National Historic Preservation Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, Executive Order 13007 (Indian Sacred Sites), guidelines listed in BLM's NEPA Handbook, H-1790-1 , and/or other Federal statutes and executive orders.

Any purchaser of a Federal oil and gas lease is required to comply with all applicable Federal, State, and local laws and regulations including obtaining all necessary permits required prior to the commencement of project activities.

### **Decision to Be Made**

The decision to be made is whether to offer the Federal oil and gas mineral estate for competitive leasing. The BLM's policy is to promote oil and gas development if such action meets the guidelines and regulations set forth by the NEPA of 1969 and other subsequent laws and policies passed by the U.S. Congress.

### **Scoping and Issues**

#### **Rationale for conducting external scoping**

The BLM elected to conduct external scoping for two reasons. First, the Decision Area includes a state-managed, public hunting area. The BLM recognizes that the state property managers have critical information regarding many surface natural resources that may be impacted by the proposed lease. Second, the Commonwealth of Pennsylvania owns a 25% interest in the minerals, and it is best for the BLM and the Commonwealth to coordinate their natural resource assessment in order to maintain consistency.

### **Process for conducting external scoping**

The BLM met on-site with the Pennsylvania Game Commission (PGC) staff on June 11, 2013, and continued its correspondence with the PGC through e-mail, telephone, and data-sharing through the period of time leading up to the drafting of this EA. The names of the participants are listed in **Chapter 5 - Persons, Organizations, and Agencies Consulted**.

### **Issues identified through internal and external scoping**

Following are the issues that were identified through internal and external scoping:

1. The state game area contains various intensive-management areas whose management goals are inconsistent with oil and gas surface development.
2. The state game area is used for hunting, which is intensive at various times throughout the year. The PCG will prohibit drilling activities during certain times of intensive hunting activity.
3. The state game area and surrounding region contain invasive species that may be spread by vehicle traffic and land clearing.

## **CHAPTER 2 – ALTERNATIVES, INCLUDING THE PROPOSED ACTION**

### **Introduction**

The BLM Northeastern States Field Office has received expressions of interest (EOIs) for the Federally-owned minerals underlying State Game Lands 219. Competitive leases would provide the lessee(s) exclusive rights to explore and develop Federal oil and gas minerals on the leases but would not authorize surface-disturbing activities or obligate the company to drill a well on a lease. Leases could be used to consolidate acreage to meet well spacing requirements, or a lease may be acquired for speculative value. The BLM would require applicants to adhere to lease stipulations, which have been formulated while conducting this EA and are made part of the proposed action.

### **Location**

The site, shown in Figure 1, is located on state-owned land in northeastern Pennsylvania. Federal minerals underlying State Game Lands #219 are located entirely within Warren Township, in the northeastern corner of Bradford County, along the state border with New York. The project area is about 15 miles east of Sayre, Pennsylvania and 15 miles southwest of Binghamton, New York. Access to the property is provided by a network of local and state roads west of State Highway 858 and southeast of State Route 1040.

### **Proposed Action**

#### **Well Drilling**

The nominated parcels, if approved, would be offered for competitive sale with stipulations and notices generated through this process and other consultations. Once awarded, the successful bidder would be required to submit an Application for Permit to Drill (APD) to the BLM before any ground disturbance would be authorized. In an APD, an applicant identifies a proposed drill site and provides the BLM with specific details on how and when the applicant proposes to drill the well within the constraints of the

lease document. Upon receipt of an APD, the BLM conducts an onsite inspection with the applicant and the surface-managing agency. NEPA and Endangered Species Act requirements must also be met at the APD stage and, in cases with potential to affect Federally-listed or State-listed species, a site-specific biological assessment is written, including the results of any required biological surveys. This would be submitted to the U.S. Fish and Wildlife Service (FWS) and the Pennsylvania Game Commission (PGC) for consultation. The lessee would be required, as a condition of approval, to comply with the recommendations of these consultations.

This EA will analyze impacts to natural resources based on the Reasonably Foreseeable Development Scenario (Appendix C), which predicts the development, over the next ten years, of 60 wells on 12 pads. Five of these pads already exist on nearby private lands, and three to four of these pads would likely be constructed on the State Game Lands. The total area of new ground disturbance is estimated to be 42 acres. *This scenario is provided strictly for the purpose of analysis and does not represent the BLM's decision or prediction as to a number of wells that may be permitted under the proposed lease.*

### Hydrocarbon Drilling Methods

Oil and gas (hydrocarbon) wells are built in two phases – drilling the borehole and completing the well. Wells may be drilled vertically if the end of the well, *bottom hole location*, is directly below the well pad, or directionally, if the well pad is not directly above the bottom hole location. For example, Federal minerals under a state park, where drilling is not permitted, can be accessed by directional drilling. The same method may be used to drill horizontally, with a wellbore extending for up to several thousand feet through the hydrocarbon-producing rock formation. In this case, the purpose of non-vertical drilling is not necessarily to provide access to the hydrocarbons but to increase the well's production.

Horizontal drilling using hydraulic fracturing methods is used for mineral extraction in Marcellus shale formations. Hydraulic fracturing (hydrofracture or "fracking") has been widely used in the oil and gas industry since the late 1940s. The process has allowed hydrocarbon production from tight sandstones, shales and some carbonates. Fracturing is not used in all well completions, but wells in shale reservoirs are typically completed using hydrofracture. The use of hydrofracture is dependent on the type of reservoir rock encountered in the subsurface.

In the hydraulic fracturing process, water, sand and small amounts of chemical additives are pumped down the wellbore. Holes in the production tubing direct the mixture to the reservoir rock under high pressure, breaking the rock. The water-induced fractures allow the oil and gas to flow into the wellbore. Additives may be added depending upon the type of reservoir rock and fluids encountered at depth. The subsurface pressure forces the hydrocarbons, reservoir fluids and used fracture fluids to the surface. The hydrocarbons naturally separate from the other fluids. The used fracture and reservoir fluids are stored in large tanks for disposal by state-approved methods. In areas where large quantities of water are needed to fracture the rocks, the fluids may be recycled and used in other completion operations.

### **Vertical Drilling**

Preparation for the drilling process includes construction of a road, drilling pad, and reserve pit. Constructed access roads normally have a running surface width of approximately 16-20 feet, the length depending upon the well site location in relation to existing roads or highways.

Drilling operations continue around the clock. Wells in this area are generally drilled within 30 days. An excavation reserve pit is usually constructed about five to ten feet deep and is lined with bentonite clay to retain drilling fluids, circulated mud, and cuttings. Plastic or butyl (or equivalent) liners that meet applicable thickness and quality standards are required for holding pit fluids. Where pits cannot be placed, steel tanks are used to collect return material.

Once drilling is completed, excess fluids are pumped out of the pit and disposed of in a state-authorized disposal site and the cuttings buried. Wells would be drilled by rotary drilling using mud as the circulating medium. Mud pumps would be used to force mud down the drill pipe and up through the annulus, circulating the rock cuttings out the wellbore. Most conventional wells require less than 500,000 gallons of water for completion. Water could be pumped to the site from a local pond, stream, or lake through a pipe laid on the surface, if permitted. Water could also be brought to the site in tankers. Some processing equipment or temporary storage may be necessary on site. It is unlikely that vertical drilling will be proposed on SGL 219.

### **Horizontal Drilling**

Wells drilled horizontally with multiple-stage hydrofracture operations require somewhat larger well pads and reserve pits than conventional vertical or directional wells and would accommodate five or more horizontal wells. The larger pads are required to store the larger amounts of equipment and supplies used in drilling horizontal wells.

Horizontal wells also require far more water for completion than conventional wells. Conventional wells are drilled to and slightly below the depth of the target formation(s), but a horizontal well is drilled to and then into the target formation, with the length of the horizontal portion of the well, known as a lateral, often exceeding the vertical depth of the well. In Pennsylvania, lateral lengths exceeding one mile are common, and the number of fracture stages used to complete a horizontal well are far greater than the number used for a conventional well. Marcellus and Utica shale wells typically consume between three and six million gallons of water for completion.

In some areas, surface water may be used for drilling and completion, depending on state requirements. Water users must apply for approval by the Susquehanna River Basin Commission for use of any surface water sources. When a hydrocarbon well is completed, the produced water, including both the hydrofracture fluids and formation fluids, must be collected in tanks for State-approved disposal.

### **No-Action Alternative**

Under the No-Action Alternative, the request to offer the proposed tract for oil and gas lease would be denied.

## CHAPTER 3 – DESCRIPTION OF THE AFFECTED ENVIRONMENT

### Introduction

The Decision Area includes a 7,500-foot buffer around the EOI, since unconventional wells drilled in the vicinity could have laterals about that long, and the buffer excludes the adjacent area in New York, where a moratorium on horizontal drilling is in effect. In the event that the moratorium were lifted in New York, some development may occur in New York to tap the Federal minerals, but the BLM would expect to see roughly the same number of wells proposed for accessing the Federal minerals under the state game lands. The total area for the Decision Area is 20,500 acres (Figure 1). The state-owned portion of the Decision Area is managed by the Pennsylvania Game Commission (PGC) for wildlife conservation and recreational use, primarily hunting. The state game lands consist of woodlands, wetlands, and croplands that are planted with crops to attract game. The non-state-owned lands in the Decision Area include privately-owned woodlands and farmlands.

The Decision Area is within the Eastern Temperate Forests level-I ecoregion, Mixed Wood Plains level-II ecoregion, and the Northern Allegheny Plateau level-III ecoregion. The Decision Area is in the Owego-Wappasening 8-digit hydrologic unit (watershed), which drains to the Susquehanna River via the Wappasening and Apalachin Creeks.

### Air Quality

Bradford County meets the National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and lead (Pb). These are the primary pollutants that the U.S. Environmental Protection Agency (EPA) tracks nationwide.

### Climate Change

The primary indicators of interest regarding climate change are emissions of greenhouse gases (GHG), primarily water vapor, carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and a few other gases of lesser importance. These gases tend to trap heat from the sun in the Earth's atmosphere, leading to global warming. The various GHGs trap different amounts of heat and persist in the atmosphere for different amounts of time. Therefore, the various GHGs have different levels of potency in causing global warming per unit volume in the atmosphere. These potencies are normalized with respect to the potency of CO<sub>2</sub> and expressed in terms of CO<sub>2</sub>e (carbon dioxide equivalent). For example, one metric ton of methane, which is 21 times as potent as carbon dioxide, represents 21 metric tons of CO<sub>2</sub>e. Carbon dioxide and CH<sub>4</sub> are the most abundant GHGs in terms of CO<sub>2</sub>e.

Because these gases circulate freely throughout Earth's atmosphere, the appropriate Analysis Area for this resource is the entire globe. The largest component of global anthropogenic greenhouse gas emissions is carbon dioxide. Global anthropogenic carbon emissions reached about 7,000,000,000 metric tons per year in 2000 and about 9,000,000,000 metric tons per year in 2008 (Boden, et al, 2010). Oil and gas production is a major contributor of greenhouse gases. In 2006, natural gas production accounted for eight percent of global methane emissions, and oil production accounted for 0.5% of

global methane emissions (URS Corporation, 2010). The impact of the proposed action on climate change will be discussed further in Chapter 4.

## **Cultural Resources/Paleontology**

A cultural resource is a location of human activity, occupation, or use identifiable through field inventory, historical documentation, or oral evidence. Cultural resources include both historic and prehistoric archaeological sites, structures, places of architectural significance, locations with important public and scientific uses, and may include traditional cultural properties, which are definite locations of traditional and or cultural importance to specific social and or cultural groups. The cultural resources that are evaluated in this section may fall under one of the following resource types: prehistoric archaeological resource, ethnographic resource, and historic-period archaeological and built environment resources. Cultural resources may be, but are not necessarily eligible, for the National Register of Historic Places (NRHP).

### **Prehistory**

Prehistoric resources are associated with human occupation and use prior to sustained European contact. These resources may include but are not limited to villages, subsurface deposits (middens), structures, artifacts, rock art, trails, and tool manufacturing sites.

Nomadic Paleo-Indians are believed to have first inhabited eastern Pennsylvania approximately 12,000 years ago. During this time the climate may have been conducive enough to supply an ample supply of food including mammoth, mastodon, and caribou (Kinsey, 1985). Several Paleo-Indian sites scattered throughout the region, including the Trojan site in Bradford County (Minderhout, 2013). As time progressed, the region became part of the Middle Atlantic Culture Province of the Eastern Woodlands (Kinsey, 1985). With the beginning of the Early Archaic Period around 10,000 B.P. (before present), the archaeological record begins to show a decline in habitation for the northeastern Pennsylvania area. There is some argument as to if this actually occurred; at this early stage in prehistory, projectile points are often used as the main indicator of culture change, and there is some disagreement over the date ranges for certain types of points (Funk, 1966; Justice, 1987). In addition to Paleo-Indian sites, several Early Archaic sites have also been found in and around northeastern Pennsylvania (Funk, 1978).

During the Late Archaic Period (3000 to 2000 Before Common Era (BCE)), regional cultural traditions had appeared. Several of these had an effect on eastern Pennsylvania, including the Lamoka of western New York, the Laurentian of eastern New York, and even more distant groups such as the Old Copper Culture of the Illinois and Wisconsin area and the Panhandle Tradition of northern Ohio and western Pennsylvania (Tuck, 1978). With the beginning of the Early Woodland Stage around 1000 BCE, local economies had stabilized with help from long distance trade to the Midwest, Southwest, and the Southeast. The first evidence of “high” placed burials on knolls and ridges located away from settlements also appeared during this time. The Susquehanna Valley to the west became a focal point of Native American use and settlement that continued into the historic era.

The area around SGL-219 occupies a border area of cultures with the Lake Forest Tradition to the north and the Narrow Point tradition to the south (Tuck, 1978). The former is noted as a transitional culture between the Archaic and climax Woodland cultures of Ohio, while the latter was marked by small

stemmed and Squibnocket Triangle points and the reliance of quartz for tool manufacture (Starbuck, 2006). This was followed by the Susquehannock Tradition, which, as the name implies, became concentrated along the Susquehannock River. This new tradition became known for the use of heavy, broad stemmed points, soapstone bowls, and for displacing other cultures. The Susquehannock tradition also became one of the early users of pottery, making it a part of the transition into the Early Woodland era (Tuck, 1978).

With the beginning of the Late Woodland Era around 700 CE (Common Era), there is more refined pottery, larger settlements, and the spread of farming with corn, beans, and squash now being important staples (Snow, 1978). The Iroquoian speakers, who became arguably the most influential and known group in the region, appeared as a distinct group in Ohio, Pennsylvania, and New York (Funk, 1983). At contact, several Iroquoian tribes had influence in modern day Bradford County including the Onondaga, Oneida, Cayuga, and Seneca. One group of Iroquoian speakers, the Susquehannock, split off from the west and by the mid-1500s had settled at several sites in Bradford County (Kinsey, 1985). The Susquehannock lived a semi-sedentary life, with seasonal hunting and gathering being the main source of food. However, it may be argued that Bradford County is in, or very near, the beginning of a transitional area between the Iroquois, Susquehannock, and Delaware. At contact, the Delaware, who spoke a mixture of Munsee and Umami dialects, occupied portions of eastern Pennsylvania, New Jersey, and southwestern New York (Goddard, 1978).

### Historic Era

European exploration of eastern North America began in earnest during the mid-1500s, with settlements being formed in the early 1600s. Contact with Europeans had a number of effects on Native Americans, including new diseases that decimated Native communities. Desire for European goods also led to a healthy trade between Native Americans and the new arrivals, contributing to resource decimation in certain areas and conflict among Tribes for control over these dwindling resources; this became exacerbated by differing alliances between tribes and the French and English. Such conflict led to the Beaver Wars that occurred intermittently during the 1600s and early 1700s. These wars took place between the Iroquois and their English allies against numerous other tribes, supported by the French (Purvis, 1999). Fighting and disease led to the displacement and intermingling of many Tribes, resulting in what is known as the Refugee Complex (Kinsey, 1985).

The Iroquois came out of the Beaver Wars and Refugee Complex relatively intact, thanks in part to the creation of the Iroquois League. Later named the Iroquois Confederacy, it is believed to have been founded during the mid-1600s, the Confederacy consisted of the Mohawk, Onondaga, Cayuga, Oneida, Tuscarora, and Seneca tribes. The purpose of the League was to unite all Iroquoian speakers under a non-centralized form of government to consolidate territory and protect themselves against European encroachment. Occupying a strategic position in the interior, the Iroquois Confederacy, for a time, was able to control access to the region and consequently the fur trade. Based primarily in New York, the Confederacy had member communities at Tioga Point to the east and Oquaga, New York, to the northeast of SGL-219 (Tooker, 1978).

In 1681, William Penn established the colony of Pennsylvania. Initially created for Quakers, all European settlers were allowed religious freedom, an ideal extended to the Native Americans. However, Penn

had to purchase or otherwise obtain much of the land for the new colony from various Tribes, particularly the Delaware. Between 1682 and 1684, Penn negotiated several treaties with both the Delaware and Iroquois tribes to obtain land. While Penn hoped for the inclusion of Tribes into the new colony, the colonial government became the supreme law of the land. Coupled with an influx of European settlers led to the eventual displacement of both the Iroquois and Delaware (Spady, 2004). This became one in a series of events that eventually led to the decline of the Iroquois Confederacy as an influential party among the Europeans. The prestige of the Confederacy was seriously damaged after the French and Indian War of 1754-1760. Not only did Confederacy members support different sides in the conflict, the expulsion of the French meant that British colonists no longer had to rely on the Crown for protection, one of the reasons which led to their decision to separate from the mother country. After the Revolutionary War, the now independent United States began to encroach on Iroquoian territory, forcing them to disperse. By the mid-1800s, all Iroquoian tribes in the United States had been placed on reservations in New York state (Tooker, 1978).

Bradford County was established in 1812 with the seat at Towanda (Bradford County, n.d.). It has historically been an agricultural county and remains so today, with other industries being hunting and tourism. Bradford County contains approximately 300 recorded archaeological sites, with at least 260 having a prehistoric component, and 50 containing a historic component. At least 240 are in a riverine setting in or along a floodplain or terrace, a high percentage being along the Susquehanna River, with the remainder in upland areas (Pennsylvania Archaeology, 2012). This is consistent with the fact that prehistoric sites in the Northeast are normally located on hills or rises with good drainage in close proximity to water sources (Funk, 1978). Bradford County contains twelve properties and districts listed in the National Register of Historic Places, all of which are historic bridges or other structures. No Eligible Sites are located within the decision area. A search of the Pennsylvania Bureau for Historic Preservation (BHP) cultural resources geographic information system on September 3, 2013, revealed no recorded cultural resources in the decision area (Pennsylvania Historical & Museum Commission, 2013).

The BLM would consider potential cultural resources with each APD that is submitted under any lease(s) that would be approved pursuant to this EOI. While no further analysis is warranted for this EOI, any future APD would require archaeological surveys and further consultation with the Pennsylvania State Historic Preservation Office (PASHPO).

### **Paleontology**

The sedimentary rocks exposed in the area consist of Devonian sandstones, siltstones and shale. Rocks of the Lock Haven formation, the most common rocks exposed in the area, are fossiliferous in places, containing a marine invertebrate fauna consisting of brachiopods, crinoids ("sea lilies") and pelecypods. Vertebrate and fish fossils have been reported from Bradford County, but none are known to occur in the study area.

Fossil locations are known as localities; under Federal and BLM auspices, the only localities protected by law are generally those that contain vertebrate fossils. As fossil localities are considered part of the surface estate, regulations of the State of Pennsylvania would apply to any sites discovered. No further analysis is warranted at this time.

## Environmental Justice

Executive Order 12898 (1994) formally requires Federal agencies to incorporate environmental justice as part of their missions. Specifically, it directs agencies to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority or low-income populations.

Lands within the Decision Area are located in a rural area and are primarily used for hunting, fishing, and trapping. The proposed action will not create disproportionately high and adverse human health or environmental effects on minority populations and low-income populations, including tribal populations. No further analysis is warranted for Environmental Justice factors on this project.

## Fish and Wildlife

The Decision Area supports various game and non-game mammals, herptiles, birds, and other wildlife taxa. As many as ten species that are designated *species of greatest conservation need* in Pennsylvania use the state game lands (Speelman, 2013). The state game lands contain about 15 acres of talus slopes, bedrock outcrops, and boulders that provide unique wildlife habitat (Speelman, 2013). Most of the Decision Area is covered in second-growth, upland timber, pine plantations, and open croplands, as detailed in **Vegetation**, below. Whitetail deer are abundant in the Decision Area, and the Pennsylvania Game Commission has erected several deer exclosures for the purpose of allowing trees to regenerate in the absence of deer herbivory (Figure 2).

## Geology/Mineral Resources/Energy Production

The Decision Area is situated within the east-central portion of the central Appalachian Basin, an arcuate sedimentary basin elongated from western New England southwest to Ohio, West Virginia and northeastern Kentucky. The sediments reach depths over 15,000 feet in Berks County, southeastern Pennsylvania. Beneath the sedimentary section are crystalline basement rocks of the metamorphic Grenville Province. The sediments range in age from Cambrian, exposed in the southern part of the state, to Permian in the southwest. Bedrock underlying much of SGL 219 consists of the Devonian Lock Haven and Catskill Formations, made up of sandstone, siltstone, claystone, shale, and thin conglomerates.

Structure in the area consists of bedrock dipping southerly toward the basin axis. Superimposed on this is an east-trending syncline with an axis that passes just south of the property. The deep structure is still not well understood, but some models indicate deep transverse faulting in the region (Wickstrom et al, 2006). One fault in this network appears just west of the property. The recent focus on natural gas exploration in the region has added a great deal of drillhole and seismic data, which will allow more detailed analysis of the deep geologic structure.

Before 2005, the only significant mineral development in Bradford County consisted of scattered sand and gravel operations and dimension sandstone (“bluestone”) quarries. Coalbed methane and an Oriskany natural gas pool, the Stagecoach Field, had been the only hydrocarbons produced in the county, and exploration activity was low. The Marcellus Shale had long been known to contain natural gas, but the volumes from vertical shale wells were not sufficient to justify infrastructure investment.

In 2005, Range Resources drilled and completed the first horizontal Marcellus well in Washington County, southwestern Pennsylvania. The well was kicked off a vertical Marcellus well, the Renz #1, which had been completed at about 300 thousand cubic feet of gas per day (Mcf/d). The first horizontal leg (lateral) of the well, modeled after completions in the Barnett Shale in the Fort Worth basin, Texas, tested at 4000 Mcf/d. The announcement of the results created a leasing boom in the state which continues to the present.

The rate of new well starts in the Marcellus shale has slowed. Many of the wells already drilled await pipeline connections, and the current wellhead price of *dry* gas – nearly pure methane with no natural gas liquids (NGL) – is low and predicted to remain below \$5.00/Mcf until the economy adjusts its energy source profile to expand the use of natural gas in power generation and vehicle fuels. Efforts are also underway to increase exports of liquid natural gas (LNG).

### **Hazardous Wastes**

The Decision Area contains no commercial or captive hazardous waste sites. One land recycling cleanup location, labeled the Reagan Hill Road Release, is located near the west end of the State Game Lands and has the client listed as Talisman Energy USA, Inc. The site is listed as *inactive*.

### **Invasive Species/Noxious Weeds**

Many invasive species are present in and around the Decision Area and throughout Pennsylvania. A list of invasive plant species that have been identified as problems in Pennsylvania can be found at <http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm>. Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), and Oriental bittersweet (*Celastrus orbiculatus*) are the species that pose the greatest concern to the managers of the state game lands. These species are present in disturbed areas and are readily propagated along roads and other openings. Emerald ash borer (*Agrilus planipennis*), an insect that has destroyed millions of ash trees throughout the Midwest, has been identified in three of the five adjacent Pennsylvania counties. There is a small population of feral swine in the state game lands and, most likely, the adjacent private lands.

### **Native American Religious Concerns**

The BLM sent letters on September 6, 2013, to nine Federally Recognized Indian Tribes that have a known connection to the Decision Area, asking whether they can identify any concerns that would need special consideration with respect to the proposed action. The BLM has not yet received any responses from the Tribes. The BLM's responsibility is limited to the area of surface disturbance if or when a proposal for development is submitted. The BLM would consider potential Native American religious concerns with each APD that is submitted under any lease(s) that would be approved pursuant to this EOI. No further analysis is warranted at this time.

### **Recreation**

The State Game Lands 219 area is set aside for hunting, with game animals including deer and dove. There is a single developed trail, 1.5 miles in length, between Montrose Turnpike to Dewing Road. SGL-

219 has 49 designated parking areas for access. Dirt roads throughout the decision area may be used for off-highway vehicle use, and such activities may increase during hunting season.

Some forms of recreation likely occur on the private property parcels which are scattered throughout the decision area. While BLM has no data on these lands, it can be assumed that they host a wide variety of recreation including off-highway vehicle use, hunting, and hiking.

## Socioeconomics

Bradford County is located in the northern part of Pennsylvania, bordered on the west by Tioga and Lycoming Counties, to the north by the state of New York, by Susquehanna and Wyoming Counties to the east, and Sullivan County to the south. Bradford County is 1,147.40 square miles, with a population density of approximately 55 persons per square mile. Its estimated population in 2012 was 62,792, a 0.3% increase from the 2010 census. The county seat is located in the borough of Towanda, in the central part of the county. The project area encompasses approximately 5,200 acres and a 7,500-foot buffer around State Game Lands 219, a total of 20,500 acres.

The distribution of population in Bradford County is 96.3% White, 1.3% Hispanic or Latino, 1.1% Two or More Races, 0.6% African American, 0.6% Asian, and 0.3% Native American or Alaska Native. 77.7% of Bradford County residents are 18 years of age or older, with 18.5% aged 65 years or older; the State of Pennsylvania has a population 18 years of age and older of 78.5%, with 16% aged 65 or older.

In 2011, there were 30,009 housing units in the county with a homeownership rate from 2007-2011 of 75.2%, which is about 5% higher than the state as a whole. The median value of these owner-occupied homes was \$108,600 for the period 2007-2011, much lower than that of the state.

For the period 2007-2011, median household income was \$42,433 for Bradford County, over \$9,200 lower than for the state. Approximately 13.6% of persons lived below the poverty level, one percent higher than the 12.6% statewide that live below the poverty level. In 2011, 38.2% of Bradford County households received some form of Social Security payment, 22.6% of households received retirement income, and 10.3% of households received benefits from the Supplemental Nutrition Assistance Program (SNAP); the totals for social security income and retirement income are much higher than the national averages for these respective categories, while SNAP payments are virtually the same as national averages (U.S. Department of Commerce, 2012a). 85.5% of the county population 25 years of age and over graduated from high school, about two percent lower than the state. 16.5% of county residents 25 years of age and older have a bachelor's degree compared to 26.7% for Pennsylvania as a whole. About 3% of residents speak a foreign language in the home; in total, about 10% of Pennsylvania residents speak a foreign language in the home (U.S. Department of Commerce, 2013b).

The seasonal unemployment rate for Bradford County was 6.8% in May 2013, a 0.8% increase from the 6% rate in May 2012 but 0.8% lower than Pennsylvania's seasonally adjusted unemployment rate of 7.6% for May 2013 (U.S. Department of Labor, 2013).

In 2011, the health care and social assistance sector employed the most people (employment totals include wage and salary jobs and proprietors) in Bradford County (5,280) followed by manufacturing

(4,530); retail trade (3,957); and government (3,452). The mining sector gained the most wage and salary jobs and proprietors in the county between 2001 and 2011 (+1,606, an increase of 431.7% during the period), followed by transportation and warehousing (+476); construction (+456); and health care and social assistance (+421). Manufacturing (-2,195) and the farming (-575) sectors lost the most wage and salary jobs and proprietors during this period (U.S. Department of Commerce, 2012a).

According to the Department of Commerce (2013), from 1998 to 2011, mining employment in Bradford County grew from 51 jobs in 1998 to 627 jobs in 2011, a 1,129.4% increase. Mining dependent employment also grew during this period from four to 48 jobs, a 1,100% increase. Most of these jobs directly involve oil and gas extraction, which is about 3% of the county's employment. In total, mining jobs account for about 5.5% of the county's employment. Average annual wages in 2012 for mining jobs in Bradford County were \$82,675 (U.S. Department of Labor, 2012).

Demographically, Bradford County is less affluent, less educated, much more homogenous and older than most counties in the state of Pennsylvania. The main factor that may be influencing this demographic profile is the number of retirees living in the county based on the preponderance of Social Security and retirement incomes.

## Soils

The Decision Area is in the glaciated portion of Pennsylvania, and many of the soil types are rocky and characterized by steep slopes. The dominant soil types range from very poor to fair for agricultural production and from slight to moderate for mixed hardwood forest production. 664 acres (five percent) of the Decision Area is classified as *prime farmlands*, and 9,700 acres (68 percent) is classified as *farmlands of statewide importance*. Most of the areas not classified as important farmlands are steep slopes, very rocky soils, or wetlands (See **Water Resources and Wetlands**).

## Special-Status Species

The U.S. Fish and Wildlife Service, Pennsylvania Field Office encourages project proponents to conduct automated project reviews using the Pennsylvania Natural Heritage Program's online *Environmental Review Tool* (Pennsylvania Natural Heritage Program, 2013). The BLM conducted a review of the project on August 6, 2013, using the Decision Area as the project boundary. The review returned one species of concern: soft-leaved sedge (*Carex disperma*) – a state-special-concern plant species that lives in cool, wooded wetlands. This species is known to occur in Corbin Creek Wetlands, a complex in the southeastern portion of the Decision Area, just outside of the state game lands. The state-endangered yellow-bellied flycatcher (*Empidonax flaviventris*) has also been reported in Corbin Creek Wetlands. The yellow-bellied flycatcher is listed by the U.S. Fish and Wildlife Service as a Migratory Bird of Conservation Concern, and Corbin Creek is listed as an important site in the Pennsylvania Natural Heritage Inventory (Pennsylvania Department of Conservation and Natural Resources, 2013).

The Decision Area is within the known historic range of the endangered Indiana bat (*Myotis sodalis*) (U.S. Fish and Wildlife Service, 2013), but the Pennsylvania Game Commission reports, as of 2010, that the nearest summertime live-captures of Indiana bats in Pennsylvania were in Berks and McKean Counties, both more than 80 miles from the Decision Area (Pennsylvania Game Commission, 2010). The

nearest known hibernacula are in Luzerne County, Pennsylvania, at least 35 miles away, and in Onondaga County, New York, about 50 miles to the north. However, mist net surveys from 2011 indicate presence of eastern long-eared bats (*Myotis septentrionalis*), a Pennsylvania mammal species of concern (Speelman, 2013). Both of these bat species use upland woods and riparian corridors, which are found throughout the Decision Area. A stipulation prohibiting summertime tree cutting will be implemented for the protection of the eastern long-eared bat, and the BLM will require operators to gather additional information on the habitat for the purpose of consulting with the Fish and Wildlife Service regarding the Indiana bat.

## Vegetation

The state game lands area is mostly forested, with just over 300 acres in sharecropping agreements and a few other small openings planted as wildlife food plots. About half of the adjacent private lands within the Decision Area are forested, and the remnant consists mostly of pastures and croplands. The most common forest type in the state game lands is northern hardwood forests in the 40-80 year age class. The state game lands include several other forest types and a significant component of forest in the 81-125 year age class. The state game lands also contain many areas with undesirable vegetation communities, including American beech, black birch, striped maple, hay-scented fern, and the exotic, invasive species described in **Invasive Species/Noxious Weeds**. The state game lands contain 165 acres of deer exclosures, which have been erected to allow regenerating forest to mature in the absence of deer herbivory.

## Visual Resources

Most of the Decision Area is hilly, forested, and rural, with a significant proportion in agricultural use. Several oil and gas well pads have been constructed in the Decision Area. A 30-foot wide, high-tension power line runs through the Decision Area, including 4,000 feet of length within the state game lands, and residential electric lines run along the roads. A 50-foot pipeline right-of-way runs through the Decision Area, including over 4,000 feet of the length within the state game lands.

## Water Resources and Wetlands

The Decision Area contains 74 miles of streams, most of which are first- or second-order streams, including Corbin Creek, Dewey Creek, Prince Hollow Run, and Wappesening Creek. About two miles of Prince Hollow Run has impaired aquatic habitat due to nutrient overloading from animal feedlots. Most of the creeks in the Decision Area are small with steep banks and have minimal floodplains. The National Wetlands Inventory shows 206 acres of wetlands within the Decision Area. All of these are smaller than 13 acres, and about half of them are smaller than two acres. Almost all of these wetlands are associated with creeks.

The Decision Area likely contains approximately 100 drinking water wells, based on a review of data available online through the Pennsylvania Groundwater Information System (Pennsylvania Department of Conservation and Natural Resources, 2013b).

## CHAPTER 4 – ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

### Introduction

This chapter assesses potential consequences associated with direct, indirect, and cumulative effects of the Proposed Action. The No-Action Alternative, which would be to withhold the Federal minerals from leasing, would have no impacts on resources.

#### **General Direct Impacts on All Resources:**

The action of leasing the nominated parcels would, in and of itself, have no direct impact on resources. Any potential effects on resources from the sale of leases would occur during lease exploration and development activities. At the time of this review, it is unknown whether a particular lease parcel would be sold and a lease issued.

#### **General Indirect Impacts on All Resources:**

Oil and gas exploration and development activities such as construction, drilling, production, infrastructure installation, vehicle traffic and reclamation are indirect impacts of leasing and production of federal minerals on the nominated parcels in the Proposed Action. It is unknown when, where, how, or if future surface disturbing activities associated with oil and gas exploration and development such as well sites, roads, facilities, and associated infrastructure would be proposed. It is not certain if any wells would be drilled and/or completed, the types of technologies and equipment that would be used, and the types of infrastructure needed, for production of oil and gas. Thus, the types, magnitude and duration of potential impacts cannot be precisely quantified at this time, and would vary according to many factors. The potential impacts from exploration and development activities would be analyzed after receipt of an APD or sundry notice.

#### **General Cumulative Impacts on All Resources:**

Cumulative impacts are those impacts resulting from the incremental impact of an action when added to other past, present, and reasonably foreseeable actions regardless of what agency or person undertakes such other actions (40 CFR 1508.7). The ability to assess the potential cumulative impacts at the leasing stage for this project is limited for many resources due to the lack of site-specific information for potential future activities. Upon receipt of an APD for any of the lease parcels addressed in this document, more site-specific planning would be conducted in which the ability to assess contributions to cumulative impacts in a more detailed manner would be greater due to the availability of more refined site-specific information about proposed activities.

### Air Quality

A Memorandum of Understanding (MOU) dated June 23, 2011, between the Department of the Interior, Department of Agriculture, and the U.S. Environmental Protection Agency directs that air quality modeling be conducted for actions that meet certain emissions or geographic criteria:

- Creation of a substantial increase in emissions,
- Material contribution to potential adverse cumulative air quality impacts,
- Class I or sensitive Class II Areas

- Non-attainment or maintenance area
- Area expected to exceed NAAQS or Prevention of Significant Deterioration (PSD) increment

The Decision Area includes no Class I or sensitive Class II areas. Due to the small number of wells projected to follow a lease on the proposed tracts in relation to the current volume of hydrocarbon development in the area, the BLM expects that the Proposed Action will not meet the emissions criteria listed above.

Air quality impacts typical of oil and gas development include diesel engine emissions, dust, and volatile organic compounds (Pennsylvania Department of Environmental Protection, Bureau of Air Quality, 2011). Diesel emissions result from the use of diesel engines for trucking and driving engines for various construction operations. Dust is produced by truck traffic and earth-moving operations. Volatile organic compounds (VOCs) are found in diesel emissions and in hydrocarbons that are being produced by the wells. Fugitive hydrocarbons leak from connections between pipes and tanks and have been found to contain the constituents of natural gas, including methane, ethane, propane, butane, benzene, toluene, ethylbenzene, and xylene. Methyl mercaptan is present in some shale gas formations and crude oil and has a strong, foul odor that is detectable by the human nose at very low concentrations.

Diesel truck traffic, a major source of the VOCs and dust produced by oil and gas operations, would be greatly reduced if water is supplied by on-site wells or delivered through a pipeline instead of by truck. The distance to be travelled on unimproved roads would have a direct impact on the amount of dust produced, and warm, dry, or windy weather would also facilitate dustier conditions on and around roadways. This impact would persist through the period of well construction.

## Climate Change

Many aspects of oil and gas production emit greenhouse gases (GHG). The primary aspects include the following:

- Fossil fuel combustion for construction and operation of oil and gas facilities – vehicles driving to and from production sites, engines that drive drill rigs, etc. These produce CO<sub>2</sub> in quantities that vary depending on the age, types, and conditions of the equipment as well as the targeted formation, locations of wells with respect to processing facilities and pipelines, and other site-specific factors.
- Fugitive methane – methane that escapes from wells (both gas and oil), oil storage, and various types of processing equipment. This is a major source of global methane emissions. These emissions have been estimated for various aspects of the energy sector, and starting in 2011, producers are required under 40 CFR 98, to estimate and report their methane emissions to the EPA (U.S. Environmental Protection Agency, 2012).
- Combustion of produced oil and gas – it is expected that drilling will produce marketable quantities of oil and/or gas. Most of these products will be used for energy, and the combustion of the oil and/or gas would release CO<sub>2</sub> into the atmosphere. Fossil fuel combustion is the largest source of global CO<sub>2</sub>.

In recent years, many states and other organizations have initiated GHG inventories, tallying GHG emissions by economic sector. Links to statewide GHG emissions inventories can be found at <http://www.epa.gov/statelocalclimate/state/state-examples/ghg-inventory.html>. Guidelines for estimating project-specific GHG emissions are available (URS Corporation, 2010), but some necessary data, such as quantities of oil produced and number of wells, are not available for such an estimate for the proposed action. The uncertainties regarding numbers of wells and other factors make it very impractical to attempt to project amounts of GHG that the proposed action would emit. At the APD stage, more site-specific information on GHG impacts and mitigation measures would be described in greater detail.

Many oil and gas operators are already participating in Natural Gas STAR, a voluntary EPA program that identifies sources of fugitive methane sources and seeks to minimize fugitive methane through careful tuning of existing equipment and technology upgrades. The BLM would encourage operators to participate in this voluntary program.

### **Fish and Wildlife**

The proposed action would likely result in the conversion of approximately 40 acres of habitat to hardened, cleared surface. If pads and new corridors are placed in forest interior areas, then those clearings will result in forest fragmentation, which changes the quality of the forest habitat by giving forests a higher ratio of edge to interior. Forest edge habitat supports many opportunistic wildlife species, such as raccoons and brown-headed cowbirds, and are less suitable for highly conservative wildlife species that require large blocks of unbroken forest. The BLM will work with the PGC and the applicant for permits to drill to identify potential drilling locations that minimize clearing and forest fragmentation. The BLM will protect the unique rocky habitats on the state game lands through a stipulation.

### **Geology/Mineral Resources/Energy Production**

The proposed action is expected to allow for the dry gas in the Marcellus shale to be fully developed.

### **Hazardous Wastes**

Drilling introduces various chemicals into the environment that become waste products after use. These include drilling and completion fluids, which may contain heavy metals, hydrochloric acid, hydrocarbons, and brine. These materials are typically stored temporarily on-site. Pennsylvania Code, Chapter 78, Subchapter C., §78.60 describes the conditions under which produced fluids may be spread on the ground, including nearly neutral pH and other water quality standards, vegetated dispersal area, and minimum distances from water supplies and bodies of water. These wastes are exempt from the Federal definition of hazardous waste and are referred to as *special wastes* by the EPA. Environmental impacts to the Decision Area may occur under several circumstances. Chemicals may be spilled or leaked from a temporary storage facility or container used for transportation. Chemicals may contaminate groundwater resources in the event of improper design, construction, or use of an injection well intended for disposal of wastes.

## Invasive Species/Noxious Weeds

Construction of roads, well pads, pipelines, and other structures associated with oil and gas development can be expected to spread invasive species and/or noxious weeds in two general ways. First, increased vehicle traffic may carry seeds, plant parts, or other live organisms that may become established within the Decision Area. This could introduce new species from outside the Decision Area or from one part of the Decision Area to another. The risk of such propagation may be estimated in terms of the area disturbed, calculated in Chapter 2 at five acres per productive well; the volume of vehicle traffic; and the presence of invasive species in locations along the routes that traffic uses on the way to and within the Decision Area. However, many of these species are able to propagate into undisturbed areas, and large areas of otherwise intact habitat could be infested by plant parts that are introduced into the Decision Area on equipment and vehicles. Therefore, it is possible that far more than the directly-disturbed area of land could be infested in non-native, invasive plant species as a result of the disturbance.

The second way that oil and gas development may result in the propagation of invasive species is by creating open corridors and forest edges that are highly susceptible to invasion by edge-loving species. Where the forest canopy is broken, invasive species that thrive in sunny conditions may thrive.

Best management practices (BMPs) are available that are designed to prevent the spread of invasive species in forests due to forestry practices and right-of-way clearing (Wisconsin Council on Forestry, 2009 and 2010). Several of the BMPs are directly applicable to the proposed lease, since it would incorporate rights-of-way and vegetation management on dedicated forest land. The BLM would incorporate appropriate BMPs as conditions of approval into permits to drill in order to prevent the introduction and spread of invasive species into affected areas.

The state at one time established a quarantine on ash wood, affecting adjacent Lycoming and Tioga Counties, but the quarantine has been lifted. The state game lands managers are considering implementing a preventive ash treatment to minimize the spread of emerald ash borer.

## Recreation

Well construction, operation, and, eventually, abandonment will create noise and change views in ways that will make the area less attractive to people who desire solitude and natural surroundings. Also, the noise from construction will drive away game animals.

Noise that is generated by construction or operation is naturally damped as it travels through an environment, and the nature of the environment through which it travels, such as open air, buildings, or woods, determines the rate at which noise is damped. Finally, the time during which the woods are disturbed with noise affects the value of the impact, since hunters and wildlife are present and/or active at some times of the year more than at others.

Construction equipment generates between 70 and 115 decibels (dB) (Bureau of Land Management, 1998) and a forest may damp noise by five to 20 dB per 100 feet. Hunters or game animals are unlikely to tolerate noise above 40 dB. Using these figures, the affected radius with respect to hunting around construction operation would range from 150 feet to 1500 feet (0.28 mile). The damping effect of the woods would be at its highest during summer, when leaves aid in damping the sound, or in winter under

thick snow cover. The areas to be affected by these minimum and maximum radii are, respectively, 1.6 acres and 160 acres per point source of the described construction noises.

These noises are expected to continue non-stop for 30 days for each well that is constructed. Under normal circumstances, noise created at the height of a hunting season would impact the hunting in the affected area. It may also force animals to move to other nearby areas making them easier for hunters to target and improving hunting success. If the noise were created outside of a hunting season, the animals may reacclimate to the site and behave naturally by the time hunting begins, and hunters may not even be aware of the disturbance if they do not see the well(s). However, no drilling will be allowed by the Pennsylvania State Game Commission during the height of hunting season, allowing for hunting to continue, although it is most likely that drilling locations will remain off-limits during the season. It is also possible that if drilling does force animals out of the area, they may not return quickly, reducing the amount of game in SGL-219 during hunting season.

### **Cumulative Effects to Recreation**

The majority of land within SGL-219 can be drilled, allowing for noise to be spread throughout the parcel(s) while drilling is occurring. Noise may also temporarily force animals out of the immediate vicinity. Drilling and the subsequent wells will result in a visual effect through the life of the well pad. These factors will cause a reduction in recreation values, particular for people looking for solitude and to watch or hunt wildlife. Additionally, drilling locations will be off-limits to the public while drilling activities are ongoing and most likely during any break in such actions; the well pads will also reduce the amount of land available to the public for hiking or other activities during the duration of oil or gas production.

### **Socioeconomics**

Local economic effects of leasing federal minerals for oil and gas exploration, development, and production are influenced by the number of acres leased and estimated levels of production. Federal oil and gas leases generate a one-time lease bonus bid as well as annual rents. The minimum competitive lease bid is \$2.00 per acre. If parcels do not receive the minimum bid they may be leased later as noncompetitive leases that don't generate bonus bids. Lease rental is \$1.50 per acre per year for the first five years and \$2.00 per acre per year thereafter. Typically, oil and gas leases expire after 10 years unless held by production. During the lease period annual lease rents continue until one or more wells are drilled that result in production and associated royalties.

For the state of Pennsylvania in 2010, average wellhead prices were \$69.80 per barrel (bbl.) for crude oil (wellhead price for natural gas is unknown at this time). Statewide average output per producing well was 143 bbls. of crude oil and 9,707 Million cubic Feet (McF) of natural gas from 11,018 producing crude oil wells and 55,215 producing natural gas wells, respectively. In 2010, the state of Pennsylvania ranked sixth in crude oil production and third in natural gas production in the United States. Bradford County is the top oil and gas producing county in Pennsylvania, providing 17.09% of all production in the state and 0.32% of all production in the United States (Independent Petroleum Association of America, 2012).

Federal revenues from oil and gas production disbursed to the state of Pennsylvania in Fiscal Year 2012 totaled \$67,081 (U.S. Department of Interior, 2013a). From this amount, revenues are disbursed to

each local county of production. In 2012, Bradford County did not receive any payments directly related to oil and gas production on federal lands within the county as there were no producing federally leased wells at this time (U.S. Department of Interior, 2013b). The federal government owns 75% of the mineral rights to the proposed lease tracts, and the state of Pennsylvania owns the remaining 25%, which have been leased independently. Should the federal government offer the lands for lease, 25% of the federal revenues (bonus bids, rentals and royalty) from the 75% federal ownership would be returned to the state for distribution to local governments. These revenues help fund traditional county functions such as enforcing laws, administering justice, collecting and disbursing tax funds, providing for orderly elections, maintaining roads and highways, providing fire protection, and/or keeping records. Other county functions that may be funded include administering primary and secondary education and operating clinics/hospitals, county libraries, county airports, local landfills, and county health systems.

The RFDS (Appendix D) for the proposed action indicates the potential for drilling as many as sixty wells on these parcels. If the maximum amount of wells are drilled and are productive, the project would be expected to generate moderate revenues in the form of royalty payments, bonus bids, and rent monies to the state and county; wages and salaries to employees, maintenance staff, and contractors who are employed in drilling wells; and sales to area hotels, restaurants, and other businesses that serve drillers for the duration of drilling; and similar construction-related benefits later as wells are abandoned and sites restored.

State Game Lands 219 is managed for game conservation, hunting and other recreational pursuits which could be affected by increased oil and gas related activities. Potential impacts to recreation resource values can be found in the **Recreation** section above. Exploration, drilling or production could create an inconvenience to people living adjacent to leases due to increased traffic and traffic delays, road maintenance, and light, noise and visual impacts. This could be especially noticeable in rural areas where oil and gas development has not occurred previously. The amount of inconvenience could depend on the activity affected, traffic patterns within the area, noise and light levels, length of time and season these activities occur, etc. In addition, competition for housing could potentially occur in the area. Stipulations regarding drilling activities will be put into place to minimize negative economic and social impacts to local residents, hunters, and other recreationists that use these lands.

## Soils

The BLM anticipates that operators will seek to locate well pads on ridge tops, which would be the preferred type of landform for minimizing erosion and avoiding wetlands and waterways. In the event that access roads, well pads, or other structures are proposed on steep slopes, the BLM would incorporate the use of best management practices, such as those recommended for oil and gas activity on state forest lands (Pennsylvania Department of Conservation and Natural Resources, 2011).

## Special-Status Species

In order to avoid impacts to the state-listed species that use Corbin Creek Wetlands, the BLM will require applicants to submit for BLM approval a habitat protection plan if they seek permission to disturb land within the supporting landscape for the Corbin Creek Wetlands, as depicted by the

Pennsylvania Natural Heritage Program's interactive map (Pennsylvania Department of Conservation and Natural Resources, 2013).

The Proposed Action may affect Indiana bats, since almost all projects that involve removing trees have the potential to affect this species. The BLM will mitigate this risk by stipulating that applicants for permits to drill delineate all suitable Indiana bat habitat within the area proposed for development. The BLM will use that habitat delineation to determine, through formal or informal consultation with the U.S. Fish and Wildlife Service, whether the proposed wells and construction are likely to affect the Indiana bat and whether additional conservation measures must be implemented in order to avoid and minimize impacts to the species. The BLM sent a letter to the U.S. Fish and Wildlife Service on September 3, 2013 (Appendix C), requesting its concurrence that the BLM's protective measures would result in the project being not likely to impact Indiana bat and is awaiting the Service's reply.

### **Vegetation and Visual Resources**

Impacts for vegetation and visual resources are combined because the primary visual quality of the Decision Area is defined by the vegetation or the industrial activities that replace the vegetation. Since surface occupancy will be prohibited in wetlands, any drilling that takes place will be in uplands. While construction is anticipated to affect up to 42 acres, the BLM anticipates that much of this area will utilize existing openings. These areas would be cleared and maintained for various durations and restored after their uses as roads, staging areas, or well pads, and then restored as described in Chapter 2. Wells pads in forested areas will be visible only a short distance into the adjacent forest. Since most of the openings in the Decision Area are on the order of 10 to 40 acres in size, and since the Decision Area is hilly, most well pads constructed in the Decision Area would be visible throughout an area of less than 40 acres.

### **Water Resources and Wetlands**

A lease stipulation (see Appendix B) will establish protective buffers around wetlands and waterways. This will prevent direct filling of wetlands and mitigate the risk of spills contaminating surface waters. Because wells could potentially be directionally drilled from outside the EOI, prohibiting surface occupancy in wetlands would not necessarily prevent accessing the minerals under the wetlands. The BLM will closely analyze areas proposed for drilling in APDs, since regional wetland inventories often do not capture small wetlands.

Water use in the Susquehanna River Basin is regulated by the Susquehanna River Basin Commission. Water users are required to submit an application for their use to the Commission for surface water withdrawals over 100,000 gallons per day or consumptive water use – use of water that is consumed and not returned to the basin – of more than 20,000 gallons per day. Hydrofracturing a well typically takes several million gallons of water. Some of the water that is used in hydrofracture remains in the producing formation, and some of that water returns to the surface, where it can be disposed of or treated and reused. Water that returns to the surface, known as *produced water* or *frack water*, is disposed of in state-approved facilities or treated and reused in another hydrofracture operation.

Hydrofracture takes place in formations thousands of feet below the lowest potable water, making contamination of potable water supplies unlikely (Abdalla, 2012). Fluids have been found not to migrate

such long distances through single fractures, but it is feasible that multiple fractures may permit migration over longer distances (Mooney, 2011). Likewise, natural fissures in the bedrock may allow fluids to travel toward potable water supplies. Fractures may also connect to existing wells, allowing contaminants to travel through the wells' annular spaces to fresh water aquifers. These spaces are sealed with cement, and failure of these cement seals is considered to be an important vulnerability in well construction and permitting (Mooney, 2011, and Jackson et al, 2013).

Well development may result in elevated levels of hydrocarbons, including methane, ethane, and propane, in drinking water wells near the gas wells (Jackson et al, 2013). There is anecdotal evidence of fracking chemicals contaminating drinking water wells (Lustgarten, 2011), and there are studies demonstrating that horizontal drilling in shale gas formations does not contaminate them (Boyer, 2012). The U.S. EPA is planning to conduct a study of the issue (USEPA, 2011), and the BLM will continue to consider ongoing scientific evidence as it becomes available throughout the APD process.

These risks will be mitigated by the BLM's cementing requirements, which are found in Onshore Order No. 2 (Bureau of Land Management, 1988). The BLM requires that casing and cementing programs protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Surface impacts can be limited with properly constructed wells, including adequate casing and cementing design and equipment testing.

## CHAPTER 5 – PERSONS, GROUPS, AND AGENCIES CONSULTED

### Consultation and Coordination

#### List of Persons, Agencies and Organizations Consulted

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Kerry Speelman, Oil/Gas and Mineral Development Section, Pennsylvania Game Commission	Natural resources data from State Game Lands 219	Established areas and resources to be protected through stipulations
Pennsylvania Bureau of Historic Preservation State Historic Preservation Office Harrisburg, Pennsylvania	Antiquities Act, Section 106	Consultation initiated by letter; no response to date.
Lora Zimmerman, USFWS, Pennsylvania Field Office, South College, Pennsylvania	Endangered Species Act, Section 7	Consultation Letter sent September 3, 2013; no response to date.
Chief William Jacobs Cayuga Nation of New York Seneca Falls, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
President Kerry Holton The Delaware Nation Anadarko, Oklahoma	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Chief Paula Pechonick The Delaware Tribe of Indians Bartlesville, Oklahoma	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Nation Representative Raymond Halbritter Verona, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Faithkeeper Tony Gonyea Onondaga Nation Nedrow, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Chief Randy Hart St. Regis Mohawk Tribe Akwasasne, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
President Barry E. Snyder Seneca Nation of New York Irving, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Chief Leo Henry Tuscarora Nation Lewiston, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Chief Roger Hill Tonawanda Seneca Nation Basom, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.

## List of Preparers

### BLM Preparers

Name	Title	Responsible for the Following Section(s) of this Document
Derek Strohl	Natural Resources Specialist	Air Quality, Climate Change, Prime and Unique Farmlands, Fish and Wildlife, Floodplains, Hazardous Wastes, Invasive Species/Noxious Weeds, Soils, Threatened, Endangered, or Candidate Animal Species/Migratory Birds, Vegetation, Visual Resources, Water Resources/Quality (Drinking/Surface/Ground),

		Wetland/Riparian Zones, Wild and Scenic Rivers, and Wilderness
Jarrold X Kellogg	Archeologist	Cultural Resources, Paleontological Resources, Native American Religious Concerns, Recreation
Kurt Wadzinski	Planning and Environmental Coordinator	Environmental Justice, Socioeconomics
Jeff Nolder	Geologist	Geology/Mineral Resources/Energy Production

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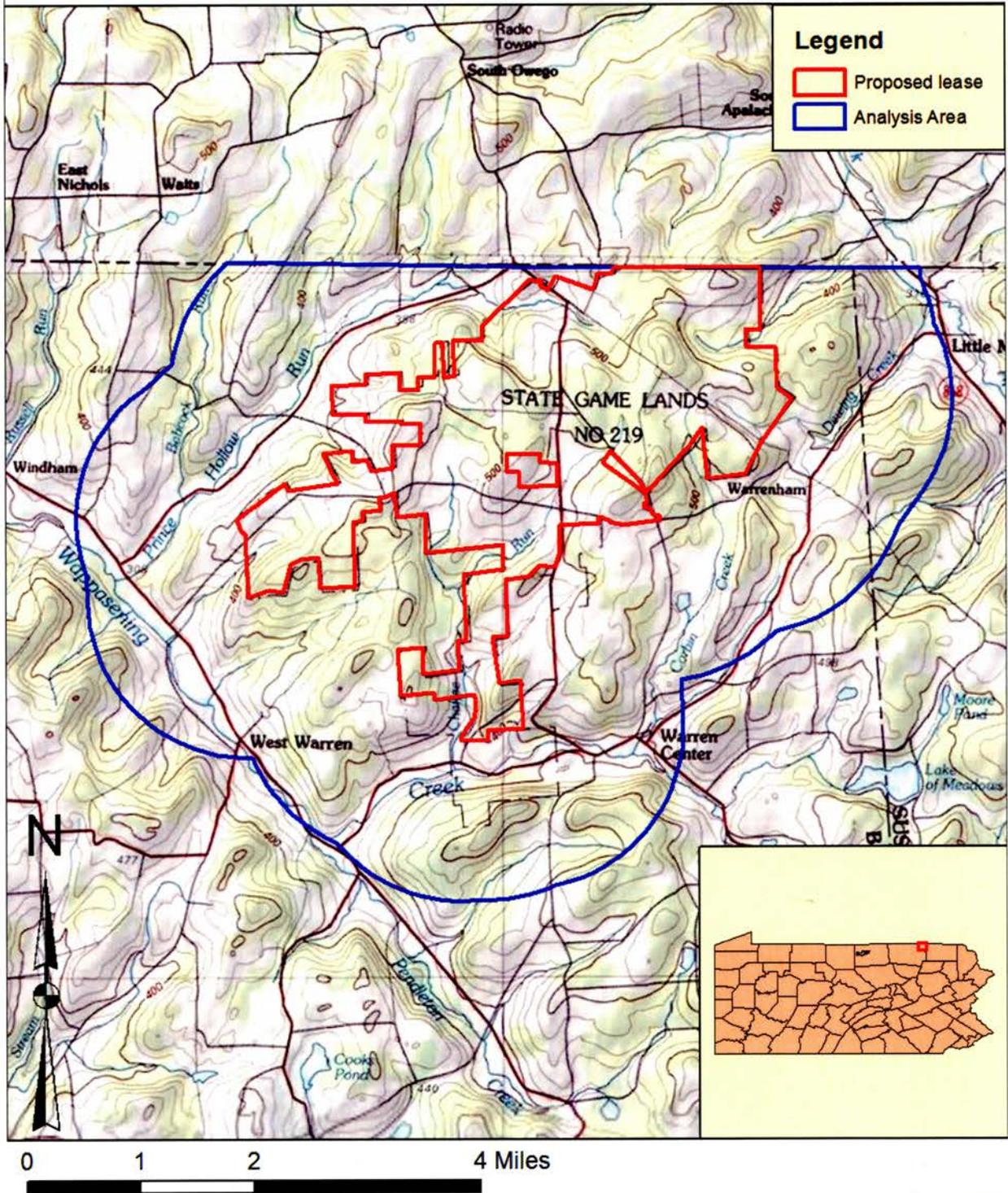
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## **CHAPTER 7 - APPENDICES**

### **APPENDIX A – FIGURES**

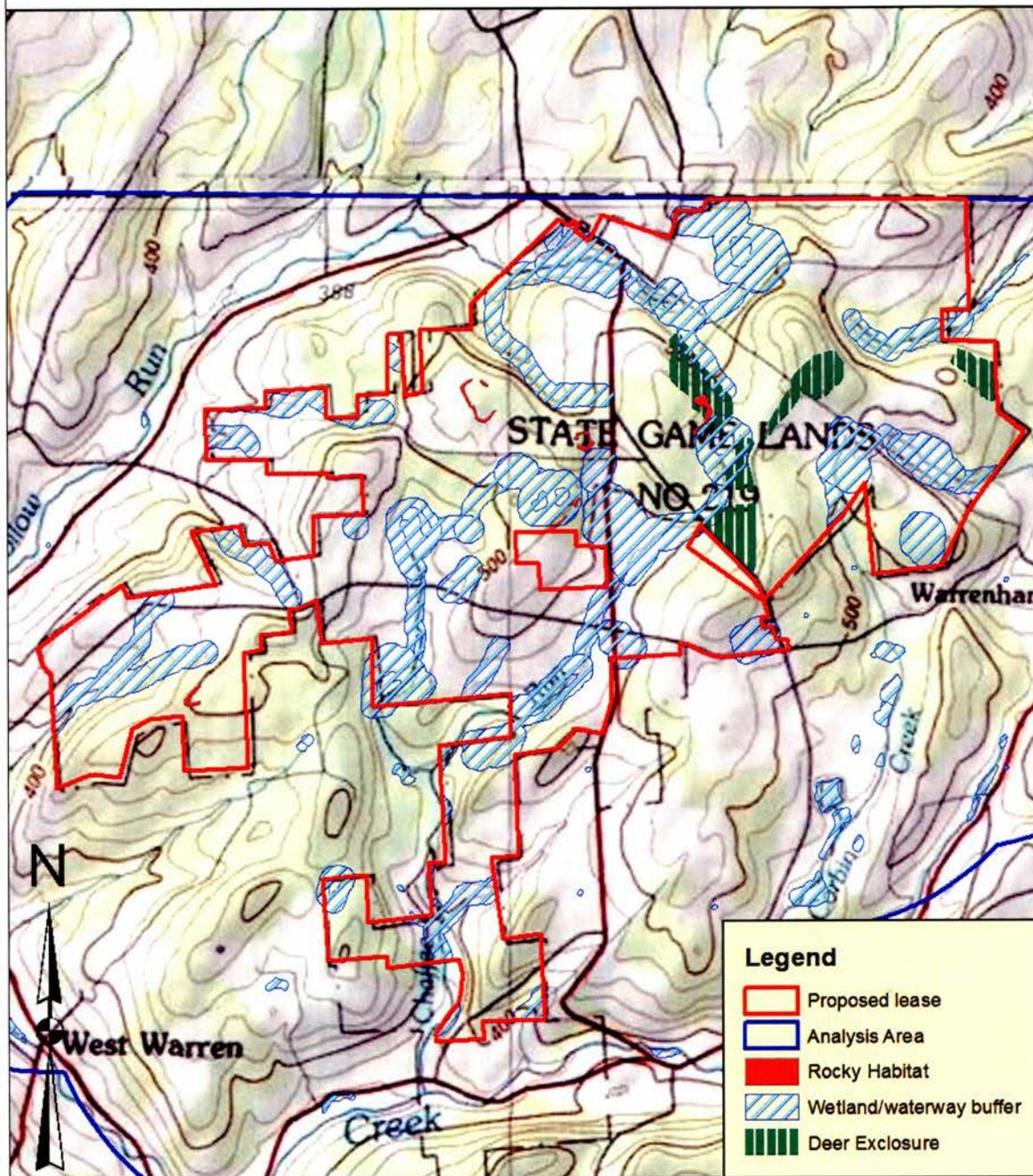
Figure 1. Proposed lease and Decision Area.



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.



Figure 2. Stipulated avoidance areas.



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## APPENDIX B – STIPULATIONS AND NOTICES

### LEASE NOTICES

1. The area that may be developed contains many wetlands, including many small seeps and other wetlands that do not have saturated soils year-round. Disturbance in or discharge into wetlands must comply with the Clean Water Act, notably Sections 401 (Water Quality Certification) and 404 (wetland filling. Applicants for drilling permits will be required to conduct a wetland survey of areas to be disturbed.
2. Applicants for drilling permits will be required to conduct a cultural resources Phase I survey. Cultural resources surveys may also be required prior to the start of subsequent well operations if additional ground disturbance is planned or expected. Mitigation measures or movement of planned ground disturbance may be necessary to avoid adverse effects to cultural resources. The need and requirements for mitigation or alterations will be based on consultation between the lessee, Bureau of Land Management, the Pennsylvania Bureau for Historic Preservation, and the Advisory Council on Historic Preservation.
3. Applicants for drilling permits may be required to submit a Discovery Plan for accidental archaeological discoveries that occur during ground-disturbing activities. This may include consultation between the Bureau of Land Management, Pennsylvania Bureau for Historic Preservation, and the Advisory Council on Historic Properties.
4. The lands overlying the lease and the surrounding lands that may be used to access the lease contain suitable habitat for various species listed by the U.S. Fish and Wildlife Service or the Commonwealth of Pennsylvania as endangered, threatened, or special-concern, including the Indiana bat (*Myotis sodalis*). The BLM will comply with the Endangered Species Act when reviewing and approving Applications for Permit to Drill, and this compliance may entail applying best management practices and modifications to project location and/or timing as conditions of approval in order to avoid and minimize impacts to endangered species.

**No Surface Occupancy Stipulation**

Surface occupancy on the entire lease is subject to the following:

No surface occupancy will be permitted within 300 feet of a wetland or waterway. This stipulation affects approximately 1,500 acres.

Purpose: Protect surface water quality.

Exception: The BLM may grant exceptions, pending use of appropriate best management practices for protecting water quality, for use of existing roadways and utility rights-of-way. Exceptions must be made in writing by the BLM and the Pennsylvania Game Commission.

Waiver/modification: No waivers or modifications will be made to this stipulation.

**No Surface Occupancy Stipulation**

No surface occupancy will be permitted in the deer exclosures. This stipulation affects 165 acres.

Purpose: Protect regenerating forest.

Exception/Waiver/modification: No exceptions, waivers, or modifications will be made to this stipulation.

**No Surface Occupancy Stipulation**

Surface occupancy on the entire lease is subject to the following:

No surface occupancy will be permitted on areas of rocky habitat identified in advance by the PGC or in the process of reviewing an APD. This stipulation affects approximately 15 acres of the proposed lease.

Purpose: Protect unique wildlife habitat.

Exception/Waiver/modification: No exceptions, waivers, or modifications will be made to this stipulation.

### **Controlled Surface Use Stipulation**

Surface occupancy on the entire lease is subject to the following:

Operator shall delineate, within area to be disturbed, infestations of non-native, invasive plant species, including, but not limited to, Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), and Oriental bittersweet (*Celastrus orbiculatus*). Operator shall prepare an invasive species control plan, subject to approval by the BLM and the Pennsylvania Game Commission. The action items in the control plan will be conditions of approval of the Application for Permit to Drill. Guides to the use of recommended best management practices for controlling the spread of invasive plant species are found in *Guidelines for Administering Oil and Gas Activity on State Forest Lands*, available from the Bureau of Forestry, Department of Conservation and Natural Resources. Many of the same practices that are employed for preventing soil erosion also function to prevent the spread of invasive species.

Purpose: Protecting native vegetation communities and timber resources.

Exception/modification/waiver: No exceptions, modifications, or waivers will be made to this stipulation.

### **Controlled Surface Use Stipulation**

Surface occupancy on the entire lease is subject to the following:

No trees may be cut during the active foraging and roosting season of the eastern long-eared bat, a Pennsylvania mammal of concern, which is April through October. All tree cutting must take place between November 1 and March 31.

Purpose: Avoiding and minimizing impacts to eastern long-eared bat.

Exception/waiver: No exceptions, waivers, or modifications will be made to this stipulation.

### Controlled Surface Use Stipulation

Surface occupancy on the entire lease is subject to the following:

Operator shall delineate and describe, within area to be disturbed, suitable roosting and foraging habitat for Indiana bat (*Myotis sodalis*). This description shall include the following:

- A list of the dominant tree and understory species,
- Age, size, and cover composition of each dominant tree and shrub species,
- Location, species, condition, and size of each suitable roost tree.

This delineation shall contain clear maps showing the boundaries of suitable habitat areas in relation to the area proposed for development, and the BLM prefers to receive electronic shapefiles depicting these boundaries. No surface disturbance will be permitted until the BLM has approved of this delineation and determined what measures will be taken to protect Indiana bat. These measures may include restrictions on tree cutting between March and October or prohibition on removing particular trees.

Purpose: Avoiding and minimizing impacts to endangered species.

Exception/waiver: No exceptions or waivers will be made to this stipulation.

Modification: The BLM may modify this stipulation to include a less detailed delineation if the U.S. Fish and Wildlife Service determines that Indiana bat is likely not present or present in very low density at the site to be developed.

**APPENDIX C – ENDANGERED SPECIES ACT CONSULTATION**



## United States Department of the Interior

**Bureau of Land Management-Eastern States  
Northeastern States Field Office  
626 E. Wisconsin Avenue, Suite 200  
Milwaukee, Wisconsin 53202-4617**



IN REPLY REFER TO:  
6842 (003420)  
DOI-BLM-ES-030-2013-0027-EA

August 29, 2013

**CERTIFIED MAIL 7012 2210 0001 2786 8371  
RETURN RECEIPT REQUESTED**

Lora Zimmerman, Project Leader/Supervisor  
U.S. Fish and Wildlife Service  
Pennsylvania Field Office  
315 S. Allen Street, Suite 322  
South College, Pennsylvania 16801

Dear Ms. Zimmerman:

The Bureau of Land Management (BLM), Northeastern States Field Office (NSFO) has received a request to lease federally-owned oil and gas in State Game Lands 219 (SGL-219) in Bradford County, Pennsylvania (see enclosed map). The BLM is developing an Environmental Assessment of projected oil and gas development on the proposed 5,200-acre lease area and a 1.5-mile buffer to account for likely horizontal drilling from locations outside of the lease, creating a total analysis area of 20,500 acres.

The NSFO has developed a reasonably foreseeable development scenario (RFDS), an estimate of likely development based on geology, current development trends, oil and gas markets, and state law, for the proposed lease. The RFDS projects a total of 60 wells being constructed on 12 pads. Five of those pads already exist on private lands, and the total area of new disturbance is projected to be up to 42 acres.

If the BLM approves the lease, the lessee would need to submit an application for permit to drill (APD) prior to conducting any ground disturbing activities such as the construction of access roads, drilling pads and wells, pipelines, equipment staging areas, and other associated structures. At that time, the BLM would conduct another review of the area proposed for construction and would consult as necessary with the Service.

Our review of the potentially affected area using the Pennsylvania Natural Heritage Inventory's online Environmental Review Tool revealed no concerns regarding Federally endangered, threatened, or candidate species. However, we are aware that the endangered Indiana bat (*Myotis sodalis*) is likely present in Bradford County, Pennsylvania. Due to this potential concern, we have drafted the attached lease notice and lease stipulation for your review. We

think that the use of these would result in the proposed action being ***not likely to impact Indiana bat***. We request your concurrence with our finding, and we ask that you inform us of any Indiana bat survey results within five miles of the Decision Area.

We ask that you reply by October 15<sup>th</sup>, 2013. If you have any questions, comments, or concerns about the BLM's procedures with respect to Federal trust species, please contact Derek Strohl, Natural Resources Specialist, at (414) 297-4416, or [dstrohl@blm.gov](mailto:dstrohl@blm.gov).

Sincerely,



Dean S. Gettinger  
Acting Field Manager

Enclosures

**Lease Notice:** The lands overlying the lease and the surrounding lands that may be used to access the lease contain suitable habitat for various species listed by the U.S. Fish and Wildlife Service or the Commonwealth of Pennsylvania as endangered, threatened, candidate, or special-concern, including the Indiana bat (*Myotis sodalis*). The BLM must comply with the Endangered Species Act when reviewing and approving Applications for Permit to Drill, and the BLM is not permitted to approve an APD without an incidental take permit if the proposed construction will likely adversely affect threatened or endangered species.

**Controlled Surface Use Stipulation:** Surface occupancy on the entire lease is subject to the following:

The applicant for a permit to drill shall delineate and describe, within area to be disturbed, suitable roosting and foraging habitat for Indiana bat (*Myotis sodalis*). This description shall include the following:

- A list of the dominant tree and understory species,
- Age, size, and cover composition of each dominant tree and shrub species,
- Location, species, condition, and size of each suitable roost tree.

This delineation shall contain clear maps showing the boundaries of suitable habitat areas in relation to the area proposed for development, and the BLM prefers to receive electronic shapefiles depicting these boundaries. No surface disturbance will be permitted until the BLM has approved this delineation and determined what measures must be taken to protect the Indiana bat. These measures may include seasonal restrictions on tree cutting or prohibition of removing particular trees.

**Purpose:** Avoiding and minimizing impacts to endangered species.

**Exception/waiver:** No exceptions or waivers will be made to this stipulation.

**Modification:** The BLM may modify this stipulation if the U.S. Fish and Wildlife Service determines that Indiana bat is likely not present or present in very low density at the site to be developed.

## APPENDIX D – REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

### I. Summary

The Reasonably Foreseeable Development Scenario (RFDS) for the 20,342 acre analysis area indicates that, if leases issue, approximately sixty horizontal wells could be drilled from 12 pads located on or adjacent to the federal leasehold. Five pads already constructed on private land could host wells capable of producing from the federal leasehold. Three to four pads could be located on the leased areas, while three to four more could be located on adjacent leased private land. The surface disturbance occurring on some combination of private and state lands as a result of well pad and road construction could total as much as 42 acres (6 acres per pad, 1.2 acres per well). The well success rate in this area is 100%, with production consisting of dry natural gas.

Most of the wells drilled as a result of the federal leasing would produce from both federal and private portions of the Marcellus Shale reservoir. The size of the drained area would depend on the length of the lateral portion of the hole and the depth of fractures induced in the formation. Long-term disturbance of 6 acres - the average size of a pad and access road - would occur if production is established. The initial production period of these wells is likely to exceed 15 years, and could be increased if wells are reworked or recompleted. This would not be done unless the anticipated increased production is significant. New wells may be drilled from existing pads as the Marcellus play matures, thus the pads may be occupied for much longer periods of time than the initial wells.

The federal government owns 75% of the mineral rights to these lands, and the State of Pennsylvania owns the remaining 25%, which has been leased independently. Should the federal government offer the lands for lease, 25% of the federal revenues (bonus bids, rentals and royalty) from the 75% federal ownership would be returned to the state for distribution to local governments.

The use of hydraulic fracture (“fracking”) technology in the completion of Marcellus Shale wells has led to controversy and increasing scrutiny by industry, federal and state authorities, academia and the general public. The process has been used in oil and gas well completions for at least sixty years without apparent damage to surface resources and uses, but was never used at the scale that makes commercial shale production viable. Issues related to the process include the large quantities of water required and the types of chemicals used in well completions, potential contamination of surface and groundwater resources, and the composition of, and methods used for handling and disposal of produced fluids and completion fluids returned to the surface.

Other issues associated with shale gas development include increased vehicle traffic, the size and weight of many of the vehicles and attendant damage to roads and related structures, air quality in the vicinity of production facilities, and the placement of pipelines, compressors and other production infrastructure. Some wildlife biologists are also considering the effects of habitat fragmentation, especially in areas where habitats support species of concern.

## II. Introduction

A "Reasonably Foreseeable Development Scenario" (RFDS) for State Game Lands #219 (SGL 219) is a projection of oil and gas exploration, development, production, and reclamation activity. The RFDS projects oil and gas activity in a defined area for a specified period of time, based on the best available information and data available. This RFDS was prepared in response to Expression of Interest (EOI) 351, submitted by private entities in an area that had not produced significant quantities of oil or gas before Marcellus development began in 2009. The RFDS provides a baseline for conducting the required National Environmental Policy Act (NEPA) analysis before leasing can take place. The analysis will address potential conflicts with other surface uses and resources.

The federal government owns 75% of the mineral estate over most of the property. The State of Pennsylvania owns the remaining 25% of the minerals and the surface, which is managed by the Pennsylvania Game Commission (PGC). The state also owns several tracts outright, with private parties owning a small parcel within the boundary. Any proposed oil and gas operations that include the leased federal mineral ownership (FMO) would require compliance with federal and state laws, regulations, and policies. In its role as surface management agency, the PGC has proposed an occupancy plan for SGL 219 that allows development of natural gas resources without interference with surface uses or damage to surface resources. The plan provides for access to 80-90% of the FMO. BLM intends to use this proposed plan as a basis for analysis, but the analysis may lead to changes in the final plan. The state and BLM will continue to cooperate in the NEPA analysis and the final plan.

Information regarding the wells and the drilling results used in this RFDS can be retrieved from the website created and maintained by the Pennsylvania Department of Environmental Protection, Office of Oil and Gas Management (OGM) ( Pennsylvania Department of Environmental Protection, 2013)

Proposed Action: The Bureau of Land Management (BLM), the agency responsible for federal mineral leasing, is proposing to offer federal oil and gas leases to comply with policy regarding requests from private individuals or companies to explore for and establish production from unleased minerals. Because the Marcellus Shale production is not subject to Pennsylvania's Oil and Gas Conservation Law (Act 1961-359, 58 P.S. §§ 401-419) at this time, leasing is also needed to prevent significant drainage of federal and state resources by production from adjacent private wells. The state has leased its 25% mineral ownership, but development cannot take place unless the federal government leases its minerals.

The lease sale would be conducted by competitive bidding with the highest bid per acre offered by prospective lessees determining the owner of the lease. The term of a Federal lease is ten years; if after that time the lessee has not established production on the lease, the lease expires. If a lease operator establishes production, the lease remains in effect until the lease no longer produces in paying quantities. The lease operator must make annual rental payments of \$1.50 per acre for the first five years of the lease term and \$2.00 per acre thereafter.

Federal royalty on the value of the production is set at 12.5%, although the State of Pennsylvania recently established a minimum royalty to be paid to all lessors of 15% on all new unconventional

production. In addition to the state's 25% mineral interest revenues, the federal government would return 25% of all federal revenues (bonus bids, rental and royalties) to the state for distribution to local governments.

Applications for Permit to Drill (APD) must be submitted to the BLM for site-specific analysis under NEPA before approval of proposed operations can take place. The APD is separate from the state's drilling permit requirements. Any well proposed that includes federally leased FMO would be analyzed under NEPA, regardless of surface location. Before any surface disturbance under a lease may begin, the lessee or lease operator must furnish proof of a performance bond. The bond ensures compliance with all lease terms, including proper drilling and production operations, plugging, abandonment, and reclamation. If a well is proposed to be drilled directionally into federal portions of SGL 219 from a location off the leased area, evidence of landowner permission for surface use would also be required.

### **III. Description of Geology**

Location and General Geology: Federal minerals underlying State Game Lands #219 are located entirely within Warren Township, in the northeastern corner of Bradford County, along the state border with New York. The project area is about 15 miles east of Sayre, Pennsylvania and 15 miles southwest of Binghamton, New York. Access to the property is provided by a network of local and state roads west of State Highway 858 and southeast of State Route 1040.

The property is located in the United States Geological Survey's Kanawha section of the Appalachian Plateaus physiographic province. The Pennsylvania Geological Survey has further subdivided that section, and the property is a part of the Glaciated Low Plateaus. The terrain consists of rounded hills separated by broad, widely-spaced stream valleys. Elevations range from just over 1200 to more than 1700 feet. The area is part of the North Branch (or Upper) Susquehanna River watershed, and is drained by tributaries of Wappasening Creek to the southwest and Apalachin Creek to the east.

The region is situated within the east-central portion of the central Appalachian Basin, an arcuate sedimentary basin elongated from western New England southwest to Ohio, West Virginia and northeastern Kentucky. The sediments reach depths over 15,000 feet in Berks County, southeastern Pennsylvania. Beneath the sedimentary section are crystalline basement rocks of the metamorphic Grenville Province. The sediments range in age from Cambrian, exposed in the southern part of the state, to Permian in the southwest.

Under a veneer of glacial till that is thickest in the stream valleys, the bedrock underlying much of SGL 219 consists of the Devonian Lock Haven Formation, made up of fossiliferous marine sandstone, siltstone, claystone and thin conglomerates. Sandstone, siltstone and shale of the upper Devonian Catskill Formation overlie the Lock Haven, capping some hills in the area.

Structure in the area consists of bedrock dipping southerly toward the basin axis. Superimposed on this is an east-trending syncline with an axis that passes just south of the property. The deep structure is still not well understood, but some models indicate deep transverse faulting in the region (Wickstrom et al, 2006). One fault in this network appears just west of the property. The recent focus on natural gas

exploration in the region has added a great deal of drillhole and seismic data, which will allow more detailed analysis of the deep geologic structure.

Economic Geology: Before 2005, the only significant mineral development in Bradford County consisted of scattered sand and gravel operations and dimension sandstone (“bluestone”) quarries. Coalbed methane and an Oriskany natural gas pool, the Stagecoach Field, had been the only hydrocarbons produced in the county, and exploration activity was low. The Marcellus Shale had long been known to contain natural gas, but the volumes from vertical shale wells were not sufficient to justify infrastructure investment.

In 2005, Range Resources drilled and completed the first horizontal Marcellus well in Washington County, in southwestern Pennsylvania. The well was kicked off a vertical Marcellus well, the Renz #1, which had been completed at about 300 thousand cubic feet of gas per day (Mcf/d). The first horizontal leg (lateral) of the well, modeled after completions in the Barnett Shale in the Fort Worth basin, Texas, tested at 4000 Mcf/d. The announcement of the results created a leasing boom in the state which continues to the present.

Subsequent Marcellus drilling along the northern tier of eastern Pennsylvania counties also continues today, although the rate of new well starts has slowed. Many of the wells already drilled await pipeline connections, and the current wellhead price of “dry” gas, or nearly pure methane with no natural gas liquids (NGL) is low. Projections indicate that the price of gas will remain below \$5.00/Mcf until the economy adjusts its energy source profile to expand the use of natural gas in power generation and vehicle fuels. Efforts are also underway to increase exports of liquid natural gas (LNG).

Some companies in the Marcellus play are evaluating the conversion of not only their vehicles but their heavy equipment to use natural gas as fuel, and at least one company is exploring the use of natural gas instead of water in fracking operations.

#### **IV. Past and Present Oil and Gas Exploration Activity**

Geophysical Exploration: From the late 1940s through the early 1950s, geophysical exploration was conducted in portions of the area to detect folding associated with traps in the Oriskany sandstone. Improvements over the years led to the discovery of smaller Oriskany fields, including the Stagecoach Field about ten miles west of SGL 219. Other geophysical exploration activity targeted the deep Trenton-Black River play.

The onset of Marcellus Shale development has increased geophysical activity markedly in the region, along with volume and quality of data. Regional “shoots”, often done on a speculative basis for sale to prospective lessees, have been replaced in large part by concentrated 3-D seismic programs designed to detail areas around prospective drillsites, both to confirm target zones and to identify possible impediments to drilling and completion, such as faults. Both road-based “thumper” surveys and overland grids using explosives have been used. Results may be transmitted by satellite for immediate analysis by decision-makers.

Exploratory drilling: Before the first Marcellus Shale well was drilled in 2008, Warren Township had little history of exploratory drilling. The nearest recorded oil and gas exploration occurred to the west, in Litchfield Township near Sayre, and resulted in the extension of an Oriskany sandstone reservoir, the Stagecoach Field (now converted largely to gas storage). A few coalbed methane wells were drilled in the southwestern part of the county.

The initial Marcellus development involved a few vertical wells that were cored to determine basic formation data such as porosity, total organic content (TOC), fracture density, and other reservoir parameters important to production. Vertical wells were later converted to production, plugged and abandoned, or used as pilot holes for horizontal wells. With the exception of the northern border of the property, SGL 219 is surrounded by wells either producing or capable of production.

It is possible that other Devonian shale zones may be capable of commercial production. In other parts of the Marcellus play, the overlying Rhinestreet, Canisteo, and Burket shale members have been tested and found to be commercially viable. Although the deeper Utica shale is present at thicknesses over 500 feet, in this area it is overmature and contains no producible hydrocarbons.

#### **V. Past and Present Oil and Gas Development Activity**

There has been no recorded oil and gas development activity in Warren Township, and very little in Bradford County prior to 1992. Unrecorded (pre-regulatory) oil and gas activity in the area is uncertain, but the presence of unknown abandoned and/or orphan wells in the area is unlikely to be a significant issue in an area where so little recorded activity had occurred before the Marcellus play opened.

Permits for 71 Marcellus wells have been approved by the State of Pennsylvania for the township. Of the 26 wells drilled as a result, eight have recently begun production. The remaining wells are shut in pending pipeline connections. Portions of the laterals of 11 of these wells are within one mile of SGL 219, with one (Strope #5) in production. The laterals average about 5000 feet in length, and are separated from each other, or spaced, by about 1000 feet. Wells are oriented in a northwest-southeast direction to maximize fracture density in each well. Wells usually take 20-30 days to drill on a 24-7 basis, with another week to ten days for completion. After completion, wells are usually allowed to stabilize, or “rest”, for periods of three to six months. Wells are then tested, which can take up to a week. In some cases, operators will drill several wells on a single pad and complete them sequentially.

Each lateral is completed with multiple hydraulic fracture operations, or stages, spaced along the lateral to maximize exposure of the gas to the wellbore. A typical well will use 3 to 4 million gallons of water for drilling and completion; most of this water will come from surface sources. Up to 90% of the water used remains in the formation, with flowback either disposed by state-approved methods or recycled for further use in drilling and completion operations. Surface water withdrawal in this area is managed by the Susquehanna River Basin Commission. Fluids used in most Marcellus operations include water, sand, lubricant gels, hydrochloric acid, antimicrobial agents and scale inhibitors. This type of frac fluid is known as “slickwater”.

Multiple wells are typically drilled from a single pad; in the vicinity of SGL 219 as many as 5 wells per pad have been drilled. In other areas as many as eight wells per pad is common. Pads and access roads are constructed for long-term use, due to the long productive lives of shale wells and the possibility that wells will be recompleted or that new wells will be proposed. The initial disturbed area for a typical well pad is 7 to 8 acres. This may include an impoundment for fluids storage, which is used for multiple wells. After pad completion, areas will be reclaimed to state and landowner standards, leaving an operational area of up to 6 acres, including a 5-acre pad and about 1 acre for a half-mile, 16-20 foot access road.

Pipelines would be constructed to transport the gas to the local network, for eventual connection to main high-capacity, often interstate, market lines. A gathering line associated with each pad will be constructed in the access road to transport the gas from the wells on the pad to a main gathering line, which may be placed on public road rights-of-way, cross-country, or a combination of the two. This line will take the gas from the leased area to the local network. Pipeline construction requires a right-of-way width of at least 16 feet. It is unlikely that the length of pipeline required in the leased area will exceed two miles, thus the total new disturbance due to pipeline construction will not exceed 4 acres. Potential pipeline routes will be analyzed as they are proposed, but the PGC has approval authority for pipelines.

Although Marcellus development activity in the northeastern counties expanded rapidly in previous years, it has slowed recently due to several factors. Lower wellhead natural gas prices and production shut in pending infrastructure development, as mentioned above, are primary factors. Other factors include a shortage of gas storage, shortages of engineering and other skilled personnel, the high cost of wells (a single well can cost over \$5 million) and changes required in interstate natural gas transport, such as redirection of gas flow. Should SGL 219 be leased, development is unlikely to occur at a rapid pace.

## **VI. Oil and Gas Occurrence Potential**

Geologists have long known that the Marcellus Shale, as well as other highly organic Devonian shale zones, contained large volumes of natural gas. With the development of appropriate technology to extract the gas, northeastern Pennsylvania, including Warren Township, has been proven to form one of the core areas of the play. Eleven laterals capable of production pass within one mile of the property, and one has recently begun producing. The success rate for the Marcellus play in the area approaches 100%, and typical production volumes are high.

At this time the status of other shallow Devonian shales that overlie the Marcellus is unknown. The Utica Shale, which underlies the Marcellus by more than 5000 feet in this area, does not have production potential here due to overmaturity. No other potentially productive formations are believed to exist in the area.

## **VII. Oil and Gas Development Potential**

The Pennsylvania Game Commission has provided a draft occupancy plan for SGL 219 that avoids most conflicts with surface uses and resources. This proposal has been used as a basis for this RFDS, and will

be evaluated further during the analysis under NEPA. During this time, further consultation with PGC will occur.

Natural gas has been developed in the area since 2007. Infrastructure for natural gas development in the area is still being introduced, but is as yet insufficient to provide access to markets for all the wells that have been completed. Horizontal drilling techniques are used to develop wells, with multi-stage fracs used to complete wells. Up to eight wells may be drilled from a single well pad, which may be as large as 5 acres (6 acres with the access road). Pad sizes may be larger if other infrastructure components are to be sited there.

Public roads in the area may require improvement and intensive maintenance if Marcellus development occurs, due to the number of vehicles involved and the weight of some of the heavy equipment and supplies used. In the event that the PGC does not wish to have cross-country pipeline routes on SGL 219, public road rights-of-way are likely to be used for pipeline access, as well. Should the PGC model be approved, Hicky's Rocks Road and the Owego-Montrose Turnpike would provide direct access to facilities on private land. Construction of the main gathering line along public roads would create inconvenience for local residents and recreational users of SGL 219, but would result in no new surface disturbance.

An alternative to the road-based pipeline scenario would be the gathering lines and pipeline installation across undisturbed land. This would create more surface disturbance, and would require further analysis when the proposal is made. The most likely scenario, however, is a combination of road-based and cross-country construction, which would limit both road construction and new surface disturbance.

#### **VIII. RFD Baseline Scenario Assumptions and Discussion**

SGL 219 is managed for game conservation, hunting and other recreational pursuits. Although the PGC, responsible for managing the property, does not have consent authority (granted only to other federal agencies) to deny federal lessees access to the property, BLM will accept all suggested stipulations from PGC for analysis. There may be some negotiation required, but the management goals of PGC and BLM are similar, and both agencies wish to provide access to the mineral resources while protecting surface uses and resources.

PGC has issued a mineral development contract for development of its 25% mineral interest, as well as for those tracts in which their interest is 100%. This contract contains certain requirements:

*“Without written consent of the Pennsylvania Game Commission (PGC), three (3) wells pads will be permitted on the surface of the BLM lease area. Without written consent, no more than 45 acres of the surface land on the lease area will be disturbed which includes pipelines, well pads, access roads, and water handling facilities. The actual well pad locations, pipelines, road use and upgrades, and water handling facility locations must be agreed upon in writing by the PGC as the surface landowner and fractional oil and gas interest owners, and BLM as the fractional oil and gas interest owner. Without PGC's written consent, no compression or water treatment facilities will be permitted on SGL 219. Impoundments on the lease area shall*

*only contain freshwater. Drill cutting shall be disposed of properly off the lease area.”*

#### **IX. Surface Disturbance Due to Oil and Gas Activity on All Lands**

In the approximately 20,500 acre analysis area, 11 wells have been drilled from 8 surface locations. Using 8 acres as a reasonable average surface disturbance per pad and access road, a total of 64 acres has been disturbed as a result of oil and gas activity in the analysis area. The amount of surface disturbed as a result of pipeline construction is unknown.

Should a lease issue, an additional short-term disturbance of up to 32 acres could result in the leased area, depending on the number of pads on the lease. A long-term disturbed area of up to 24 acres could result if production is established. If a pipeline is constructed on undisturbed acreage, as much as an additional 4 acres of disturbance could occur. The areas disturbed on adjacent private lands would be nearly the same, for a total of 68 acres of short-term disturbance and long-term disturbance of 52 acres on all lands. Pipeline disturbance on private lands cannot be projected, because the routes of pipeline rights-of-way are negotiated between companies and private landowners.