MARCELLUS SHALE COALITION™

RECOMMENDED PRACTICES:
Site Planning, Development and Restoration

MSC RP 2012-1 April 26, 2012

MARCELLUS
SHALE COALITION™

 • 24 Summit Park Drive • 2nd Fl. • Pittsburgh PA 15275 • 412.706.5160 • www.MarcellusCoalition.org

RECOMMENDED PRACTICES:
Site Planning, Development and Restoration

Preface
This document provides general guidance on recommended practices for the subject(s) addressed. It is offered as a reference aid and is designed to assist industry professionals in improving their effectiveness. It is not intended to establish or impose binding requirements. Nothing herein constitutes, is intended to constitute, or shall be deemed to constitute the setting or determination of legal standards of care in the performance of the subject activities. The foregoing disclaimers apply to this document notwithstanding any expressions or terms in the text that may conflict or appear to conflict with the foregoing.

Section 1 - Introduction

1.1 MSC Guiding Principles
We, the members of the Marcellus Shale Coalition, embrace and operate by the following guiding principles:

- We provide the safest possible workplace for our employees, our contractors, and in the communities in which we operate;
- We implement state-of-the-art environmental protection across our operations;
- We continuously improve our practices and seek transparency in our operations;
- We strive to attract and retain a talented and engaged local workforce;
- We are committed to being responsible members of the communities in which we work;
- We encourage spirited public dialogue and fact-based education about responsible shale gas development; and
- We conduct our business in a manner that will provide sustainable and broad-based economic and energy security benefits for all.

We recognize that to succeed in business, we must not only embrace these principles, we must live by them each and every day. This will be our legacy.

1.2 Purpose
These recommended practices address relevant considerations and guidelines for Site Planning, Restoration, and Development. These recommended practices support our guiding principles.

Section 2 - General

2.1 Why Site Development and Restoration Recommended Practices are Important:
In order to extract natural gas from the Marcellus Shale and deliver it to end-users, surface facilities and disturbances are necessary, including disturbances for the construction of well pads, access roads, water and gas pipelines, gas compression and processing facilities, and gas transmission lines. This infrastructure is vital to obtain the economic and energy security benefits from this abundant natural resource. However it is also desirable to producers and the public at large to minimize impacts from these activities; therefore, our members have committed to apply recommended practices in site development and restoration, all of which are intended to mimic pre-disturbance conditions or, in some cases, improve sites for desired end-uses.

Coalition members recognize that responsible development of the Marcellus Shale must acknowledge the needs and concerns of all relevant stakeholders. We are committed to ensuring that all parties engaged in the development of the clean-burning natural gas of the Marcellus Shale utilize procedures and technologies

2.2 What These Site Development and Restoration Practices Cover:
Recommended Practices address the full range of site development and restoration activities, from initial determination of needs for new facilities and associated land disturbances through site planning, surface owner discussions, permitting, clearing and grubbing, site and facility construction, interim restoration, and final restoration. These best practices do not address the industrial activities that occur within the confines of the well pad itself; other RPs have been developed for the pad site that address safety, site stabilization, secondary containment, runoff controls and other features of the pad site.

When possible upfront planning and coordination with the affected landowner(s) is desirable and beneficial to all parties. Without a clear understanding of the need for facilities over the long term (given that several viable unconventional resources overlay one another in many areas), as well as the need to consider viable land use options at the outset, beneficial restoration options may be missed. Regulatory agencies have emphasized site restoration practices that quickly and effectively stabilize sites against erosion and resulting sediment transport; however, many times the dense vegetation established for this single purpose inhibits native plant growth and, thus, natural succession from occurring. The planning stage is when long-term land use desires need to be identified and planned for. Once permits and plans are approved, the ability to change how a site is developed and restored is reduced. Likewise, once earthmoving has begun, additional post-disturbance restoration options are limited because site features of potential value for the long-term land use may have already been impacted.

Table 2-1 shows the major steps involved in Recommended Practices for site planning, development and restoration. These steps form a repeatable process that MSC upstream exploration and production (E&P) companies and midstream gathering and gas processing companies can follow in site planning and development. In this document, "restoration" means both interim restoration (following site construction and reflecting site conditions that will exist through the operational life of the well pad or pipeline) and final restoration (at the end of the operational life, following site closure and removal of facilities).

RECOMMENDED PRACTICES:
Site Planning, Development and Restoration

Table 2-1. Site Planning, Development and Restoration Process Recommended Practices

Major Steps in the Process	Critical Elements for Reducing Impacts, and for Improving Restoration and Final Reclamation Outcome
Operator Identifies Local Need for Site	- E&P company secures a production unit and determines ideal location(s) for well pad. - E&P or Midstream company determines local needs for gathering lines, compression, processing and transmission improvements.
Unconstrained Conceptual Site Plan Generation	- E&P or Midstream company lays out an unconstrained conceptual site plan free of potential landowner, regulatory or environmental constraints (What would be ideal, operationally?).
Conduct a Constraints Analysis	- E&P or Midstream company conducts fact-finding to identify constraints including zoning/siting constraints, landowner desires/preferences, environmental constraints, highway access constraints and the presence of other sensitive locations.
Refine Concept	- Upon analyzing the constraints to an ideal operational site layout, the E&P or Midstream company adjusts the conceptual site plan to account for known constraints.
Surface Owner Discussions	- The E&P or Midstream company shows refined concept plan to surface owner(s) and discusses how this concept would fit within their existing and planned future uses of the site.
Alter Site Concept as Needed; Identify Site Features to Retain or Protect	After adjusting the site plans to account for surface owner's desires, if possible the E&P or Midstream company clearly identifies features to be retained – including timber, stumps, slashings, mulch, topsoil, ponds or stock watering devices, access roads, etc. – and accounts for retention of these items in site planning.
Prepare Final Site Plan from Previous Concepts; Highlight Retained Features	From the information obtained above and site concepts as refined, prepare context-sensitive site plan while accounting for potential future O&G extraction from other formations – minimizing site disturbance using existing access or logging roads and trails or creating access roads that also meet landowner objectives.
Fully Implement E&S and Other Environmental Controls	Ensure that planned erosion and sedimentation ("E&S") stormwater management and other environmental controls are installed and maintained. Consider using permanent controls such as sedimentation basins, with potential future use, over temporary measures that may require multiple replacements over time.
Implement Partial Restoration During Operational Life	Developmental phases of well pads, as well as of gathering, processing and transmission facilities, often require larger footprints than operational phases. Evaluate future site needs (e.g., other formations to be tapped from pad); as appropriate, reclaim as much of the site as possible, minimizing soil compaction and new disturbances required to access other formations.
Final Restoration Conducive to Surface Owner's Plans and Objectives	Well pads may be in use for several decades, whereas surface disturbances for buried gathering or transmission lines can be fully reclaimed soon after installation. In recontouring site, minimize site compaction, lime and fertilize as necessary, seed with use-adapted mix, mulch appropriately, plant trees if appropriate, and control erosion and stormwater runoff. If oil and gas wells are to be permanently plugged, follow latest approved procedures and all applicable rules and regulations.
Site Monitoring, Maintenance and Repair	Although listed last in this process, site monitoring, maintenance and repair begins with initial site development and continues until the site is fully restored and the site is permanently closed. Critical elements include repair of access controls and gates, security fencing, ruts or washouts (often caused by uncontrolled ATV access), and revegetation of areas where initial efforts did not yield desired results.

Section 3 - Health, Safety and the Environment

3.1 Health and Safety Practices Pertinent to Site Development and Restoration

The MSC places primary emphasis on worker safety. This is reflected in the MSC's first Guiding Principle: "We provide the safest possible workplace for our employees, our contractors, and in the communities where we operate." Site development involves a number of operations that must be conducted with extreme care to avoid injuries. Early on, the primary safety hazards arise when clearing lands with chainsaws and large mechanical tree and brush removal equipment, including tree shears, tree fellers and stump grinders. If timber is harvested for wood or pulp, the handling of large logs, including the loading operations prior to hauling timber off site, present additional hazards. Site grading with heavy equipment also presents safety hazards that must be understood and mitigated. On pipeline projects, trenching operations (with potential cave-ins and entrapment) can present hazards to workers that must be mitigated, as well. In the final stages of restoration, when soil amendments and seed are being applied, manufacturer's recommendations and Material Safety Data Sheets (MSDS) precautions must be followed to avoid unhealthful human exposures via contact, ingestion or respiration of soil amendments, seed and surface stabilizing agents/emulsions.

Recognizing the vital importance of providing a workplace that is free from recognized hazards is critical, and as part of maintaining a workforce skilled in the use of appropriate personal protective equipment, MSC member companies adopt stringent health and safety programs that meet or exceed the regulatory requirements of the federal government's Occupational Safety and Health Administration (OSHA) and other regulatory bodies. Therefore, all operations that are performed during the site development and restoration processes are to be accomplished in strict conformance with internal company health and safety policies, OSHA standards for both General Industry (29 CFR 1910) and Construction (29 CFR 1926), and manufacturers' operational recommendations for any equipment used. Beyond these regulations, OSHA publishes a number of Fact Sheets and Quickcards that are particularly relevant to site development and restoration operations, including tree trimming, personal protective equipment (PPE), heat and cold stress, heavy equipment vehicle and driving safety, trench excavations, working outdoors, and the presence of rodents, snakes and insects, among many others. All of these OSHA publications can be downloaded at: http://www.osha.gov/pls/publications/publication.html.

Section 4 - Site Planning, Development and Restoration Process

4.1 General

The following subsections repeat the major steps and elements listed in Table 2-1. As appropriate, additional guidance beyond these brief summary statements is provided. Users of this Recommended Practices document are encouraged to use Table 2-1 as their general process map, and to refer, as needed, to the following section and supporting appendices for more detailed information.

4.2 Step 1 - Operator Identifies Local Need for Site

Critical Elements from Table 2-1

- E&P company identifies proposed drilling area and determines ideal location(s) for well pad.
- E&P or Midstream company determines local needs for gathering lines, compression, processing and transmission improvements.

Additional Discussion

Identification of the need for additional facilities at a location – such as a new well pad, impoundment, access road, gathering line, processing and metering facility, or transmission line – is critical for the site planning, development and restoration process. These operational decisions are based on current facilities that perform similar functions, along with a finding that such facilities are not sufficient to extract and market natural gas in a safe, environmentally sound and cost-effective manner. At this earliest stage in the process, operators should be considering minimization of land disturbances by drilling additional wells off of existing pads, drilling multiple formations from a single pad (e.g., Upper Devonian, Marcellus and Utica formations), utilizing existing water impoundments and existing roadways (if feasible). New facilities outside of existing right of ways (ROWs) should only be proposed if existing facilities cannot support the near- and long-term operational needs.

4.2.1

Use of existing roadways is encouraged wherever possible. This can include taking advantage of abandoned skid trails from prior logging activities, improvement of existing roads and trails on both public and private lands, or combining water and gas pipeline routes and roadways in a single easement corridor. Operators also are encouraged to coordinate with one another to identify opportunities to minimize surface impacts by sharing road and pipeline corridors wherever possible.

4.2.2

Use of multi-well pads is encouraged to allow for the greatest amount of natural gas recovery from the smallest possible surface footprint. A typical multi-well pad may have anywhere from two to twelve horizontal wells (or more per formation being tapped) located on an area of about five acres during drilling activities. After wells are drilled and completed, usually only an acre or two is needed for the wellheads and their associated equipment; the remainder of the well pad can be restored to its pre-drill contours and condition. Given that multiple shale deposits are stacked vertically in much of the Appalachian Basin, companies should determine if well pads and delivery systems can be modified to serve each of these deposits, greatly minimizing construction and land disturbance activities by using sites and facilities to serve multiple gas and oil formations. Likewise, use of longer laterals is an effective means to minimize surface disturbances.

4.3 Step 2 - Unconstrained Conceptual Site Plan Generation

Critical Elements from Table 2-1

- E&P or midstream company lays out an unconstrained conceptual site plan free of potential landowner, regulatory or environmental constraints.

Additional Discussion

Once an operator knows that existing local facilities are insufficient to meet the operational needs for extracting and delivering natural gas, the decision to construct new facilities is made. Operators should initially plan these facilities in an unconstrained or "perfect world" manner without regard to the numerous constraints that will be fully considered as the planning process proceeds. Developing an unconstrained conceptual site plan allows the operator to determine how sites would be configured and facilities would be constructed under ideal developmental conditions. Such an unconstrained concept should show the best site layout from an operational efficiency, safety and cost perspective, with full recognition that this ideal configuration is simply a starting concept that will need to be modified to account for numerous real-world constraints as the process proceeds. Consider the unconstrained conceptual site plan the operational "wish list," which will be carefully modified over time during subsequent steps in the process.

4.4 Conduct a Constraints Analysis

Critical Elements from Table 2-1

- E&P or Midstream company conducts fact-finding to identify constraints including zoning/siting constraints, landowner desires/preferences, environmental constraints, highway access constraints and the presence of other sensitive locations.

Additional Discussion

At this stage, the operator and/or its contractors and consultants need to carefully review the development site and its access routes to assess the development constraints that exist. Such constraints can be numerous, and most have a geographic component to them. For instance, these constraints may affect only certain portions of sites, routes or access corridors. Examples include:

- Buffer zones, such as floodplains, watercourses, public water supplies;
- Jurisdictional wetlands;
- Habitats of threatened or endangered species;
- Cultural resources;
- Sensitive resources, such as schools, churches and hospitals;
- Zoning districts where activities are permitted or require conditional-use approvals;
- Existing underground utilities, underground mines and related facilities (existing or permitted), landfills, or other potentially contaminated sites subject to federal statutes such as the Comprehensive Environmental Response, the Compensation and Liability Act (CERCLA), or the Resources Conservation and Recovery Act (RCRA);
- Surface and subsurface property ownership;
- Parks, gamelands, state or national forests, or other public lands/facilities;
- Railroads, airports and airfields;

Many companies use GIS mapping layers to display these constraints and plan effective mitigation measures.

Whenever feasible, E&P operators and midstream companies should explore opportunities to partner with other companies engaging or preparing to engage in similar operations in a given area. Such joint infrastructure development can reduce environmental impacts while simultaneously reducing the partners' respective capital investments.

RECOMMENDED PRACTICES:
Site Planning, Development and Restoration

4.5 Apply Constraints Information to Refine Concept
Critical Elements from Table 2-1

- Upon analyzing the constraints to an ideal operational site layout, the E&P or Midstream Company adjusts the conceptual site plan to account for known constraints.

Additional Discussion
Although there are few "fatal flaws" that completely prevent drilling or pipeline activities from occurring, there are many features or constraints that warrant avoidance, if possible. For instance, the avoidance of development on ecologically sensitive areas is often the most prudent course of action. Operators must follow the regulatory requirements and site-development restrictions of numerous state and federal agencies when planning locations for well pads, roads, pipelines, water withdrawal points and other facilities. These agencies have processes for identifying plant and animal species of special concern, as well as their natural habitats. If known locations of such sensitive areas can be avoided, avoidance is recommended. If avoidance is not an option, mitigation planning, in conjunction with the appropriate regulatory bodies, is needed. The Coalition further encourages operators to seek input from other parties, such as sportsmen's organizations and hunting and fishing clubs, to learn about unique local conditions that could affect fish, game and plant species. Operators should consider opportunities to adjust their site planning to be responsive to local conditions and seasonal issues related to breeding and spawning seasons of fish, game and wildlife in general.

As operators evaluate the characteristics of each locale, the unconstrained conceptual site plan should be adjusted and refined accordingly. For instance, operators may wish to move the pad site or alter the access points. Likewise, pipelines may be rerouted to account for identified local constraints. The plans may also be modified with prominent notes to identify avoidance or mitigation measures the operator will incorporate. For instance, potential roost trees for Indiana Bats cannot be disturbed when these migratory bats are in the area, but could be removed when the bats are in their hibernacula. If these bats could be present in an area, the plans should be modified to reflect dates when potential roost tree disturbance is acceptable, and periods when disturbance is prohibited.

Plan refinement should reflect the accepted environmental impact reduction sequence: avoidance, minimization, mitigation and compensation (in that order). For examples of compensation alternatives, please see also sections 4.6 and 4.8.1.

4.6 Surface Owner Discussions
Critical Elements from Table 2-1

- The E&P or Midstream company shows refined concept plan to surface owner(s) and discusses how this concept would fit within their existing and planned future uses of the site.

Additional Discussion
Operators are encouraged to coordinate closely with surface owners – whether they be private individuals, businesses or governmental agencies – on all aspects of site location and design. Surface owners often have unique knowledge of their lands, and can provide valuable insights on a variety of local conditions and concerns; on everything from planned agricultural processes to seasonal variations in surface runoff conditions to future planned uses of a given tract. Operators are encouraged to consider the following aspects of coordination and communication with surface owners:

4.6.1 - Legal Requirements:
Many leases, whether granted by private individuals or government agencies, contain very specific requirements, obligations and restrictions that must be recognized by the operator. These can include delineations of areas where specific types of surface facilities can or cannot be located, specifications related to planting, harvesting or hunting seasons that limit or prohibit activities during certain times, and the requiring of express written consent from the landowner for the location of facilities, among others. Operators are advised to strictly adhere to all contractual requirements and obligations in any lease, right of way or other instrument that affects proposed development locations, times or activities. It is a recommended practice that any agreement reached between the land owner and operator after a lease has been signed should be captured in a legal document such as a surface use agreement or amendment to such document.

4.6.2 - Communications:
Operators are strongly encouraged to proactively engage surface owners in the site planning, development and restoration process to ensure clear and mutual understanding of the activities, time periods and physical layout of proposed facilities. Operators should strive whenever possible to accommodate the reasonable requests of surface owners on such issues as adjustment of locations or restrictions on activities during certain times. Likewise, operators should be willing to modify plans (see 4.7) to account for reasonable requests for such items as access road retention, pond retention, wildlife habitat improvements, vegetative screening, site drainage improvements and swales, and the creation of habitat features like brush piles, vernal ponds, and nesting or cover areas.

Operators should be willing to meet at proposed locations with surface owners, and to provide surface owners with reasonably detailed conceptual maps and schedules of planned activities and facilities. Operators should be receptive to landowner input, and provide timely updates to landowners about changes under consideration. Operators should compensate surface owners at reasonable, prevailing market rates for damages to timber, crops, fences, etc., and do so in a timely fashion. Operators should provide their best estimates to surface owners of the time periods involved for all aspects of the operator's activities, from staking to site clearing, site construction, drilling, completion, pipelining, and restoration/remediation operations.

4.7 Alter Site Concept as Needed, Identify Site Features to Retain or Protect
Critical Elements from Table 2-1

- After adjusting the site plans to account for surface owner's desires if possible, the E&P or Midstream company clearly identifies features to be retained – including timber, stumps, slashings, mulch, topsoil, ponds or stock watering devices, access roads, etc. – and accounts for retention of these items in site planning.

Additional Discussion
Operators are reminded that proper preservation and redistribution of the native topsoil can make the restoration process a much more efficient task for the operator. By using the native topsoil, the existing seed bank may be redistributed across the site, facilitating the eventual reestablishment of native foliage and plant life. Additionally, preserving topsoil will save the operator the time and cost of trucking in suitable materials from an outside source.

Some required temporary site features, such as diversion and collection channels, as well as sedimentation basins, could be planned to fulfill landowner needs – for instance, designing the riser of a sedimentation basin to eventually serve as either a stormwater retention basin (with small outlet orifices cut at the base of the riser to slowly release stormwater) or a permanent pond once the drainage siphon is removed and a trash rack is installed (assuming an appropriate emergency spillway is designed and adequate freeboard is planned for). Of course, if eventual conversion to a permanent pond is desired, the pond should have natural clays compacted as an impervious layer, and the diversion channels must be able to be redirected to divert clean runoff to the pond.

Given the quality of the access roads needed to construct well pads or pipelines, repurposing these roads for eventual use by the landowner should be carefully considered. Such access roads could support a future subdivision plan, open up access to remote areas of the property, or provide access for future logging operations. Access roads also may serve as firebreaks or emergency access corridors.

4.8 Prepare Final Site Plan from Previous Concepts Highlight Retained Features

Critical Elements from Table 2-1

- From the information obtained above and site concepts as refined, prepare context-sensitive site plan while accounting for potential future O&G extraction from other formations – minimizing site disturbance using existing access or logging roads and trails or creating access roads that also meet landowner objectives.

Additional Discussion

Among the most critical natural resources to be fully accounted for in the final site plan are wetlands. Wetlands are protected under the Clean Water Act, and through regulations enforced by the Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers, and state agencies, which are granted regulatory authority pursuant to state program general permits. Other site features and desired outcomes also must be accommodated in the final site plan, as this is the primary mechanism to convert operator, agency and landowner goals and objectives into an actionable plan for construction and restoration activities. Some of the more important elements to be addressed in the final site plan are discussed below.

4.8.1 - Wetland Considerations:

As mentioned earlier, proper wetland identification is vital to the overall success of a particular location. Missing a wetland can create costly setbacks, site redesign, or, under the worst-case scenario, permit revocation due to encroachment. Properly permitted minor wetland encroachments can create the opportunity for habitat creation or improvement for all types of wetland species. Wetlands may be enhanced by replacing impacted areas at an approved ratio of > 1:1, thereby expanding the size of existing wetlands. Wetland mitigation can provide the opportunity for the removal of invasive species (e.g., Common Reed [*Phragmites australis*], Purple Loosestrife [*Lythrum salicaria*] and Water Chestnut [*Trapa natans*]), and may also provide the opportunity to diversify the native hydrophyte population by creating microtopography within newly constructed wetland areas, which can in turn sustain plant life tolerant to varying soil saturation conditions. Likewise, wetland mitigation provides the opportunity to bolster migratory waterfowl habitats through the planting of diet-enhancing native grasses and forbs and the creation of nesting sites.

With all of these considerations in mind, final plans must portray explicitly the preservation, stockpiling and reapplication of impacted wetland soils. These soils provide for the necessary seed bank, organic compounds and parent material for a successful wetland reestablishment. For very small wetland impacts, there are opportunities to contribute to wetland replacement funds that have been set up to reduce the financial burden of the replacement/mitigation of wetlands associated with both public and private projects.

4.8.2 - Other Environmental and Landowner Considerations:

Throughout the site-planning process, operators will have obtained information on sensitive resources that may require mitigation efforts, site features that landowners want to have established or retained after site development (such as stabilized access roads, drainage diversion or collection channels, sedimentation basins that can be converted to ponds or stormwater retention basins, brush piles, and site security or access control features such as fencing and gates), and other special considerations related to site development or restoration. The final site plans should be fully reflective of all such features to be avoided, retained, maintained, created or restored so that the methodical planning process outlined in this document is translated into site plans that formally portray these considerations.

Site plans should clearly indicate the portions of the site that are needed only during the construction and development phase, and the portions of the site necessary for long-term operations. This distinction will permit operators to identify portions of the site that can be restored when development is complete, as well as areas that will be required for long-term operations until the useful service life is reached. On well pad sites, the area around the wellheads, processing and metering equipment, and brine collection tanks, plus a stabilized access roadway for service trucks and brine collection, will be needed throughout the life of each well that taps one or more formations, per the drilling program. Ideally, operators will want to restore portions of the site that are not needed during the operational phase.

Likewise, site plans will need to identify clearly the erosion and sedimentation controls and stormwater controls that will be put in place during the construction, operational and restoration phases. Plans should detail measures intended to ensure that post-construction runoff does not exceed pre-construction values specified by the relevant regulatory bodies. Important considerations here are engineering controls, grading and the establishment of vegetative cover that meets site objectives. It should be recognized that well sites and pipeline ROWs present some great opportunities to enhance or establish habitats that particular landowners would like to see as part of their overall land-use plans. For instance, landowners wanting to improve agriculture capabilities may ask for certain drainage controls, impoundments/livestock watering features or access corridors to inaccessible portions of farmland. As another example, landowners interested in timber harvesting may want access roads to remain in place post-development to facilitate future timber harvests.

Should landowners want to cultivate a particular species of plant or establish suitable habitats for certain insect or wildlife species, they should be able to work with the operator to help them achieve such goals. For instance, the Pennsylvania Game Commission incorporates into its oil and gas leases plans for reseeding with legumes such as Ladino Clover, White Dutch Cover and Birdsfoot Trefoil. There are, in fact, many agencies, organizations and institutions with species-specific recommendations for operators to follow in preparing the site for seeding or seedling establishment, seed mixes, soil amendment recommendations, and mulching or mechanical stabilization to aid in germination and minimize soil erosion until vegetation is well established. Some examples are listed below, with more detailed information provided in the appendices.

RECOMMENDED PRACTICES:
Site Planning, Development and Restoration

Appendix A–Forestry Restoration Practices:
Some landowners will want their land returned to forest to provide both a habitat for wildlife and the potential for harvestable timber. Because well pad sites are typically formed by means of cut-and-fill using heavy construction equipment, they can suffer from excessive soil compaction and similar problems associated with heavy equipment usage. The Appalachian Regional Reforestation Initiative has developed a number of advisories that describe the Forestry Reclamation Approach ("FRA"). According to their Reclamation Advisory Number 6;

"The FRA is a method for reclaiming coal-mined land to forest under SMCRA (see Burger and others, 2005). The FRA differs from past reclamation practices that used agricultural grasses and legumes such as K-31 tall fescue and red clover to create dense vegetative cover. Thick, vigorous agricultural grasses and legumes are necessary for post-mining land uses such as hayland/pasture, but grasses and legumes are used only as needed for erosion control when reclaiming lands for forestry. For forestry, native herbaceous and woody ground cover is preferred because it seldom hinders tree survival and growth. The FRA has five steps: 1). create a suitable rooting medium for good tree growth that is no less than four feet deep and comprised of topsoil, weathered sandstone and/or the best available material; 2). loosely grade the topsoil or topsoil substitute established in step one to create a non-compacted growth medium.; 3). use ground covers that are compatible with growing trees; 4). plant two types of trees--early successional species for wildlife and soil stability, and commercially valuable crop trees; and 5). use proper tree planting techniques."

Appendix B–Re-establishing American Chestnuts:
The American chestnut tree once flourished over 200 million acres of eastern U.S. woodlands, from Maine to Florida, and from the Piedmont west to the Ohio Valley. An estimated 4 billion American chestnut trees, fully one-fourth of the hardwood tree population, grew within this range. Unfortunately, the American chestnut population succumbed to a lethal fungus infestation, known as the chestnut blight, during the early 1900s, which decimated the species. Today, efforts to restore this valuable tree are being led by The American Chestnut Foundation (TACF), which conducts a variety of research and breeding projects designed to create and grow blight-resistant trees.

Appendix C–Restoring Forest Openings for Wild Turkey and other Wildlife Species:
National Wild Turkey Federation (NWTF) has been instrumental in reintroducing wild turkeys to all suitable habitat throughout the U.S. Like many species, the wild turkey thrives where small openings in forested areas add diversity to the habitat and create herbaceous cover that attracts insects that are a vital food source for the rapid growth of poults. These openings can be planted with species that provide both soft and hard mast for turkeys and numerous other species. Given that the NWTF recognizes the value of openings created by well pads, access roads and pipeline corridors, they have developed recommendations for preparing these openings for herbaceous and woody species. These recommendations are presented in Appendix C.

The NWTF also operates the Energy for Wildlife program that helps the utility industry manage millions of miles of rights-of-way and other properties that could potentially provide ideal habitat for a number of wildlife species. Under this program, the NWTF works with participating utility and energy companies to provide technical assistance with vegetation and wildlife management issues and securing public access for sport hunting. Operators wanting to know more about this partnership opportunity with the NWTF can go to http://www.nwtf.org/conservation/energy_for_wildlife.html .

Appendix D–Federal and State Regulatory and Conservation Agencies:
Within each state there are agencies charged with managing wildlife and public lands that often provide guidance to other landowners looking to minimize wildlife and habitat impacts during active operations and improve habitats through site-restoration activities. Likewise, there are conservation districts within each state that provide expert counsel in erosion and sedimentation control, site stabilization and revegetation. Contact information for a number of these agencies in areas of active shale gas development is listed in Appendix D.

Appendix E – Site Restoration Recommendations by Governmental Agencies and Universities:
There are numerous websites that house good information on site restoration techniques, plant materials selection, seeding, soil amendments, noxious weeds, and other relevant topics. Some useful links are found in this Appendix. Aside from those previously listed, such organizations include: Ducks Unlimited; The Ruffed Grouse Society; Rocky Mountain Elk Foundation; Pheasants Forever; the Quality Deer Management Association; and many others with species-specific interests.

Appendix F–Additional Site-Restoration References

4.9 Fully Implement E&S and Other Environmental Controls
Critical Elements from Table 2-1

- Ensure that planned E&S, stormwater management and other environmental controls are installed and maintained. Consider using permanent controls such as sedimentation basins, with potential future use, over temporary measures which may require multiple replacements over time.

Additional Discussion
Surface disturbances for well pads, access roads, central impoundments and gas or water pipelines require erosion and sedimentation-control plans and stormwater runoff controls, and, in many cases, permits. As such, the operator needs to ensure that its plans are approved and implemented, and that controls are inspected following storm events and regularly monitored, maintained and repaired, as necessary.

There will be transitions during site development and operation that will require changes in the E&S controls, as well as the addition of some temporary controls as permanent vegetation is established. Sites are in a state of flux until all wells on a pad are drilled on or all construction on access roads or pipelines is completed. Plans should be written so that installation of E&S features can be phased in as each portion of the site is constructed. Although not desirable, it may be necessary at times to temporarily vegetate and mulch areas that have been disturbed, possibly using quick growing annual grasses, even though this is not the desired seed for permanent restoration.

State environmental regulatory bodies and conservation districts often have E&S and post-construction stormwater-management best practices; in some cases, conformance with BMPs is a requirement. Should an operator need to deviate from the agency-approved BMPs, they should seek concurrence well in advance, as approval of alternative methods may be a lengthy process. When site plans are being developed, the operator should consider introducing mechanisms to alternate from the implementation of one BMP to another, or, in some cases, to deviate from the accepted installation guidance of a particular BMP. Such pre-planning

may allow an operator to better adapt to site conditions under the guidance of a registered consultant or internal engineering department. Operators should consider drafting an amendable list of interchangeable BMP features and/or installation techniques.

E&S controls can be enhanced significantly by the preservation of native vegetation. Natural vegetative filter strips can cut the cost of constructing a location by reducing the need for man-made materials, and by providing a natural jump-start to the site-stabilization process. Additionally, the preservation of the native vegetation can enhance visual resource management.

Regulatory bodies often impose requirements for frequent inspections of interim stabilization if sites are inactive for even a short period of times (e.g., four days in Pennsylvania). Such requirements may be counterproductive, forcing operators to undertake some disturbance activities to avoid triggering interim stabilization measures. If an operator expects interruptions to the construction cycle and has installed adequate erosion controls, the operator should seek a waiver of site-stabilization requirements from the relevant regulator.

Because BMP maintenance is often impossible to perform during wet conditions without the destruction of established features, operators should be mindful of the need for site-specific considerations. An operator should be able to avoid a potential notice of violation (NOV) for maintenance issues by having the current situation addressed with a specific maintenance plan that identifies issues and sets a reasonable timeframe for completing the maintenance once site conditions improve. Operators should consider retaining the services of an on-call BMP maintenance contractor capable of efficiently performing minor location maintenance in the event of storms or other unforeseeable events.

4.10 Implement Partial Restoration During Operational Life

Critical Elements from Table 2-1

- Developmental phases of well pads, as well as of gathering, processing and transmission facilities, often require larger footprints than operational phases. Evaluate future site needs (e.g., other formations to be tapped from pad); as appropriate, reclaim as much of the site as possible, minimizing soil compaction and new disturbances required to access other formations.

Additional Discussion

Operators need to recognize that a significant portion of the initial well pad – the portion used to support well completion/stimulation activities – can be reclaimed through the operational life of the facility. Assuming a pad is five acres during the developmental phase, it may be possible to restore half or more of the site, recognizing that final restoration will not occur until the wells are no longer in operation. Allow adequate time to sufficiently evaluate the project and the well(s) performance prior to beginning reclamation efforts; the timing may also be dictated by regulatory requirements. While pipeline surface disturbances are largely reclaimed once the installation of the pipeline itself is complete, some surface facilities, such as metering stations and compression facilities, will remain in place throughout the operational life of the pipeline.

The precautions against excessive soil compaction and the establishment of vegetation that is not conducive to the long-term desired state, such as return to forest, are equally applicable to partial restoration and final restoration. Partial restoration represents an opportunity to incorporate site screening, and to integrate some runoff-minimization strategies and/or vernal ponds. Operators should recognize that plants, especially trees and shrubs, planted on the reduced footprint during partial restoration may reach a height of fifty feet or more when final restoration is undertaken. If such trees could topple onto well heads or gas-metering or other equipment, shorter or slower-growing plants should be used.

4.11 Final Restoration Conducive to Surface Owner's Plans and Objectives

Critical Elements from Table 2-1

- Well pads may be in use for several decades, whereas surface disturbances for buried gathering or transmission lines can be fully reclaimed soon after installation. In recontouring the site, the operator should minimize site compaction, lime and fertilize as necessary, seed with use-adapted mix, mulch appropriately, plant trees if appropriate, and control erosion and stormwater runoff. If oil and gas wells are to be permanently plugged, follow the latest approved procedures and all applicable rules and regulations.

Additional Discussion

Given the dynamic timeline between initial planning and final restoration, operators should re-evaluate their restoration plan in the year preceding the start of final-restoration activities, as landowner objectives, the landowners themselves, regulatory requirements restoration techniques, and a host other factors may have changed.

4.12 Site Monitoring, Maintenance and Repair

Critical Elements from Table 2-1

- Although listed last in this process, site monitoring, maintenance and repair begins with initial site development and continues until the site is fully restored and the site is permanently closed. Critical elements include repair of access controls and gates, security fencing, ruts or washouts (often caused by uncontrolled ATV access), and revegetation of areas where initial efforts did not yield desired results.

Additional Discussion

During early site development, there are many personnel on and around the drill pads, access roads and pipelines. As a result, there are many eyes on the site capable of detecting a host of unwanted conditions Likewise, regulatory authorities in each state require observation of erosion and sedimentation and stormwater controls following major storm events that can cause damage to recently installed E&S controls or leave significant silt deposits that require removal.

However, when sites move into long-term production or gas transmission phases, there are fewer eyes available for such monitoring. Well tenders responsible for pad sites should be instructed to remain on the lookout for field conditions that may require immediate maintenance and repair, and should not discontinue their monitoring of assigned sites just because a site has had no history of such issues. Vandals can breach site access controls and security measures at any time, and off-road vehicles can severely damage well pads, access roads and pipeline ROWs, vegetation and drainage controls. Producers are encouraged to have well tenders and pipeline maintenance personnel remain vigilant and report observed damages to appropriate company departments or supervisors/site managers in a timely manner. Likewise, operators should encourage landowners with surface facilities on their properties to alert company personnel if any damage is observed.

Appendix A
Forestry Restoration Practices

The Appalachian Regional Reforestation Initiative has published eight Forest Reclamation Advisories that, although developed for the mining industry, provide valuable insight for oil and gas operators wishing to establish forests when restoring disturbed sites. The following is a listing and description of these advisories, which also are available at http://arri.osmre.gov/Default.shtm.

RECOMMENDED PRACTICES:
Site Planning, Development and Restoration

Forest Reclamation Advisory No. 1 - The Appalachian Regional Reforestation Initiative. In this first advisory, the goals of ARRI and the function of these Forest Reclamation Advisories are explained. [December 2005]

Forest Reclamation Advisory No. 2 - The Forestry Reclamation Approach (FRA). The Forestry Reclamation Approach is the science-based technique for reclaiming coal-mined land to forest while complying with the existing state and federal mining laws. This advisory explains the five steps of the FRA. [December 2005]

Forest Reclamation Advisory No. 3 - Low Compaction Grading to Enhance Reforestation Success on Coal Surface Mines. This advisory describes final-grading techniques that can be used during reclamation to prepare coal-surface mines to support a forested, post-mining land use. [July 2007]

Forest Reclamation Advisory No. 4 - Loosening Compacted Soils on Mined Sites. Some areas of mine sites become compacted due to machinery operation, traffic and storage. This advisory describes practices for ripping compacted areas to loosen soils necessary to achieve successful reforestation. [July 2007]

Forest Reclamation Advisory No. 5 - Mine Reclamation Practices to Enhance Forest Development Through Natural Succession. Natural succession is the natural change in plant community composition over time. This advisory describes the ways in which reclamation methods can encourage rapid natural succession and accelerate the development of high-quality post-mining forests. [July 2007]

Forest Reclamation Advisory No. 6 - Tree Compatible Groundcovers for Reforestation and Erosion Control. This advisory describes methods for establishing ground-cover vegetation to control erosion without hindering the survival and growth of the trees planted. [July 2009]

Forest Reclamation Advisory No. 7 - Planting Hardwood Tree Seedlings on Reclaimed Mine Land in Appalachia. Proper care and planting of tree seedlings is essential to any reforestation effort, especially on the rough, rocky and steep terrain of reclaimed Appalachian coal mines. This Advisory describes proper tree-planting techniques in these areas. [February 2010]

Forest Reclamation Advisory No. 8 - Selecting Materials for Mine Soil Construction When Establishing Forests On Appalachian Mine Sites. The guidelines reviewed here can aid mine operators in ensuring that mine soils applied at a minimum thickness of four feet will restore land capability and support forest growth and diversity at pre-mining levels. [July 2011]

Appendix B
Re-establishment of the American Chestnut

The American Chestnut Foundation is the lead organization attempting to re-establish the American chestnut to its native range (see http://www.acf.org/). The American chestnut tree once flourished over 200 million acres of eastern U.S. woodlands, from Maine to Florida, and from the Piedmont west to the Ohio Valley. An estimated 4 billion American chestnut trees, fully one-fourth of the hardwood tree population, grew within this range, and in Pennsylvania the density was even higher (40%-50% of the total timber population in some counties). The American chestnut was an essential component of the ecosystem, a late-flowering, reliable and productive tree that was not only a key source of lumber, but also the single-most important food source for a wide variety of wildlife from bears to birds. Rural communities once depended on the annual nut harvest as a cash crop to feed livestock. Unfortunately, the American chestnut population succumbed to a lethal fungus infestation, known as the chestnut blight, during the early 1900s, which decimated the species. Today, efforts to restore this valuable tree are being led by the American Chestnut Foundation ("TACF"), which conducts a variety of research and breeding projects designed to create and grow blight-resistant trees.

The Pennsylvania Chapter of the TACF has expressed a willingness to partner with the Marcellus Shale industry [Note – there are other TACF Chapters in other shale states that would likely be just as willing to partner with industry to restore American chestnuts] to help identify stands or individual examples of American chestnut trees that have demonstrated natural blight-resistance so that they can harvest reproductive materials from such trees. Those seed and pollen samples are used in the TACF's genetic breeding techniques, known as "backcrossing," to produce new breeding stock that will have enhanced resistance to blight.

The PA-TACF has training programs designed to teach people how to identify the American chestnut, and to provide location information on existing trees so that volunteers can both monitor the trees' health and growth, as well as harvest the necessary reproductive materials for the research and breeding programs. Gas industry personnel that are engaged in site reconnaissance, planning and design have a unique opportunity to contribute to the valuable efforts of the PA-TACF by becoming trained in species identification, and by providing tree location information to the PA-TACF. Additionally, operators may be able to further contribute to PA-TACF's efforts by volunteering sites that may be suitable for hybrid chestnut demonstration and education orchards.

Appendix C
Draft Recommendations for Reclaiming Marcellus Shale Well Sites. National Wild Turkey Federation

Small openings in an otherwise forested landscape have the potential to increase wildlife habitat diversity and quality in much of Pennsylvania. Older age class forest dominates much of the Commonwealth. This is particularly true on public lands. Three to ten acre well site openings typical of Marcellus Shale Natural Gas Play drilling operations provide an opportunity to improve wildlife habitat as operations to develop this resource occur. Often well sites are established on hillsides creating an uphill and downhill exposure or aspect on which to work. Our recommendations apply to both public and private lands.

If the land in question was forested prior to natural gas development the land should be re-contoured to approximate the original topography. This applies to sites that were previously in agricultural use or fallow fields as well. Previously farmed lands should be returned to agricultural use if desired by the landowner. These are suitable for haying operations and limited grain cropping. It is assumed that a number of best management practices are being employed on site to reduce or mitigate impact from clearing and drilling operations. Among the assumptions made regarding the drilling site are the following:

- Erosion and soil mitigation practices are in place.
- The original topsoil was stored and so that it may be re-spread across the well site after operations are completed.
- Soil tests to determine the proper amount of soil additives such as lime and fertilizer have been completed and are available for planning purposes.
- Continuous access to the well head site is required and this area should be planted with low-growing vegetation designed to accommodate daily maintenance.
- Re-vegetation plans should include forethought regarding potential re use of the site if additional hydro-fracturing is required to maintain natural gas production.
- The edges of the site, tank storage areas and impoundment areas of the cleared portion of the site may present opportunities for reclamation with higher-growing and more permanent vegetation types.
- The site is being managed to meet Pennsylvania Department of Environmental Protection permit requirements.
- The drilling operator is working to control invasive plant species on site, especially invasive shrub species such as autumn olive, bush honeysuckle and multi-flora rose.

Revegetation of Sites in a Forested Environment
Well Head and Surrounding Area

The immediate surrounding area of the well heads is best revegetated with a low-growing legume, cool season grass and forb mix such as white or red clovers, alfalfa, and trefoil. Mixes can contain timothy and/or orchard grass as well though the grasses tend to over-seed and overpower clover over time. Among the mixes recommended and marketed by the National Wild Turkey Federation are our Longevity Clover Mix, Alfalfa Attractant Mix, and Triple Threat Clover. These mixes are specifically designed for food plots, day-lighted roads, or log landings. We have had great success all over the eastern U.S. with these mixes. All three mixes are sown at a rate of 12 pounds per acre. These seed mixes will work very well on reclamation sites and will provide adequate ground cover to reduce erosion potential in addition to being highly attractive to wildlife. Specialty mixes that precisely match the Pennsylvania reclamation standard criteria may also be purchased from NWTF.

Operators may also create their own seed mix by purchasing clover seed from local dealers and creating a seed mix of white, red, alfalfa, trefoil, and crimson clovers, and applying the mix at a rate of 10-20 lbs per acre.

The site disturbed for establishing a wellhead and drilling produces a 3-10 acre opening in the forest. The edges of the drill site provide good locations for planting shrubs and trees that will attract wildlife if the entire area will not need to be kept open. Creating an 'edge' effect along the tree line adjacent to the opening will increase the wildlife benefits of the site. An area 30 to 50 feet wide at the edge of the clearing should be managed for vertical diversity thus softening the edge of the forest by planting smaller trees and shrubs, creating a transition from the vertical forest edge to the permanent field in the center of the well site. Vertical diversity can increase wildlife use by providing additional forage and cover. Softening the forest edge allows abundant sunlight to reach the center of the opening thereby enhancing growth of clover, grasses and forbs planting near the wellhead itself.

The area downhill from the site may sometimes be used as deposit areas for rock and wood debris as work progresses. This windrow or debris pile can provide habitat for small mammals, birds, amphibians, and reptiles. It is recommended that openings of 20-30 feet be left between debris piles to allow safe access to the well site opening by reducing the efficiency of predators hiding in the slash.

Planting of conifers in small groups adjacent to slash piles will provide winter thermal cover from wind and cold. The conifers should be planted in strips or patches adjacent to the windrow at least 30 feet in width and on a 6'x6' spacing.

Wild turkeys and deer use this thermal cover during winter storms, especially when the trees mature. Lesser snow depths under the trees allow smaller animals to shelter and feed more effectively when snow persists. Snowshoe hares use conifers for both hiding and feeding cover. Songbirds use conifers for nesting.

Black spruce, blue spruce, Norway spruce, balsam fir, and white pine may be used to create a mix of conifer cover. Conifer cover created using one tree species are more susceptible to insect or disease agents. Spruces such as the Norway spruce make excellent winter cover and are easy to acquire from growers. However, some state forestry agencies and private landowners do not favor non-native species so Norway spruce may not be usable on some sites. Balsam fir is preferred as a browse item by white-tailed deer so it may not be suitable in areas with high deer densities. If planted in conjunction with other species it will be less susceptible to deer damage. Use 3-year or 4-year old seedlings for conifer planting regardless of species to obtain a quicker cover.

The area uphill or on the northern side of the site provides a prime opportunity to transition into a lower-growing shrub mix in the center of what was the impoundment area by planting mast-producing trees as a fall and winter food source. Among the species recommended for this are various oaks (red, white, chestnut, pin, black), various hickories (shagbark, pignut), black cherry and chestnut.

These well sites may provide an opportunity to reintroduce the American Chestnut cross hybrids, now available on a limited scale in Pennsylvania from the American Chestnut Foundation. The chestnut nuts will be spread across the adjacent forest environment by foraging wildlife over time and help to disperse this native but struggling tree species back into Pennsylvania forests.

Two or three rows of oaks or other species should be planted 30-50' apart along the entire upslope area. These trees must be planted in tubes or fenced, if seedlings are used to establish this planting. The largest seedling size available is recommended. Larger stock may only be available from a landscape nursery versus commercial nurseries. The need for tubing or fencing can be avoided if you obtain stock greater than 4.0 feet in height.

The center of the former impoundment, an area of Ð to 1 acre should be planted with either a legume or warm-season grass mix to keep it open for insect production. Legume mixes should be planted at the rate of at least 12 pounds per acre. If considering planting a warm-season grass mix in the center Ð to one-acre, a broadcast rate of 20#/acre should be used. Switchgrass, Indian grass, and big bluestem grasses grow well on the poor soils found in northern Pennsylvania. NWTF features a warm season grass and forb mix that contains regional phenotypes suitable for Pennsylvania. This mix is called the Northeast Uplands Mix. It consists of big bluestem, little bluestem, Indiangrass, switchgrass, eastern gamma grass, partridge pea, Illinois bundleflower, purple prairie clover, white prairie clover, lance-leaved coreopsis and black-eyed Susan. There is also a General Conservation Nesting and Brood Cover Mix that does not contact the switchgrass or eastern gamma grass.

Aspen and soft mast trees may be planted on the rest impoundment area at a high density (1,100 seedlings per acre) on a 6'x6' spacing. This will produce a large seedling base that could potentially survive deer browsing, and not require tubing or fencing.

Soft mast produced by dogwoods, viburnums, crabapples, hawthorn and others are heavily used by a variety of wildlife species in the fall and early winter. Native shrubs such as blackberries, raspberries, juneberry, hophornbeam, and witch hazel will eventually become established on the edges of the former impoundment opening. A diversity of species and vertical cover across the three to ten acres of former impoundment site is the desired outcome. This uneven structure with various heights and age classes is critical to wildlife species dependent on early-successional habitat. Recent research indicates this may be of particular importance to golden-winged warblers, a species declining in northern Pennsylvania. It is also important for a suite of species associated with disturbed or early successional habitat preferences including rufous-sided towhees, brown thrashers, northern catbirds, prairie warblers, blue-winged warblers, American woodcock and whip-poor-wills. Randomly placed conifers can also be planted on the impoundment site.

Shrubs and trees that can be planted can include the following native and non-invasive species:

- Flowering dogwood;
- Standard apple;
- Crabapple or hawthorn;
- Dogwood shrubs, particularly gray and silky dogwood – fruit is particularly nutritious;
- Viburnums such as northern wild raisin, black haw, highbush cranberry and arrowwood;
- Mountain ash trees.

RECOMMENDED PRACTICES:
Site Planning, Development and Restoration

Seedlings ideally should be three to four years old because older seedlings have much better survival and will produce fruit quickly. If planting small or bareroot seedlings consider using weed mats, tree tubes and stakes to protect the seedlings until they are 3 to 4 feet high.

Shrub and Tree Scientific Names for Ordering

Apples – Malus spp.
Aspen, trembling – Populus tremuloides
Balsam fir – Abies balsamea
Crabapples – Malus spp.
Dogwood – Cornus spp.
Dogwood, flowering- Cornus florida
Dogwood, gray – Cornus racemosa
Hawthorne – Crataegus spp.
Hophornbeam – Ostrya virginiana
Mountain ash – Sorbus americana
Northern red oak – Quercus rubra
White oak – Quercus alba
Black oak – Quercus velutina
Chestnut oak – Quersuc prinus
Pin Oak – Quercus pulustris
Black cherry – Prunus serotina
Spruce, black – Picea mariana
Viburnum, northern wild raisin – Viburnum cassinoides
Viburnum, black haw – Viburnum prunifolium
Viburnum, nannyberry – Viburnum lentago
Viburnum, arrowwood – Viburnum dentatum
Vibirnum, highbush cranberry – Viburnum trilobum
White pine – Pinus strobus

Seed and Seedling Sources

Clover and Warm Season Grass Mixes; seedlings and shrubs
National Wild Turkey Federation
Project HELP
PO Box 530
Edgefield, SC 29824-0530
803-637-7510

Appendix D
State and Federal Regulatory and Conservation Agencies

OHIO AGENCIES:

Primary Regulatory Authority

Ohio Dept. of Natural Resources
Mineral Resources Management
2045 Morse Road
Building H-3
Columbus, OH 43229-6633
614-265-6633

Conservation Organizations

Ohio Dept. of Natural Resources
Division of Forestry
2045 Morse Road
Building H-1
Columbus, OH 43229-6633
877-247-8763

Link for Logging BMPs
http://ohiodnr.com/Portals/18/landowner/pdf/bmplogging.pdf

Ohio Dept. of Natural Resources
Division of Soil and Water Resources
2045 Morse Road
Building B-3
Columbus, OH 43229-6633
877-265-6610

Soil & Water Conservation Districts (Directory from Ohio Federation of Soil & Water Conservation /Districts), 88 in total, see
http://www.dnr.state.oh.us/Portals/12/swcds/Roster_04_04_2011.pdf

PENNSYLVANIA AGENCIES:

Primary Regulatory Authority

Pennsylvania Dept. of Env. Protection
Office of Oil and Gas Management
Rachel Carson State Office Building
P.O. Box 8765
Harrisburg, PA 17105-8765
717-772-2199

Regional Offices

NW Region: Meadville, 814-332-6860
NC Region: Williamsport, 570-327-3636
SW Region: Pittsburgh, 412-442-4024

Conservation Organizations

PA Dept. of Conservation & Natural Resources

Bureau of Forestry, Ecological Services Section
Rachel Carson State Office Building
400 Market St., P.O. Box 8552
Harrisburg, PA 17105
717-772-0258

Pennsylvania Game Commission
Bureau of Wildlife Habitat Management
2001 Elmerton Avenue
Harrisburg, PA 17110-9797
717-787-6818

Regional Offices

NW Region: Franklin, 814-432-3187
NC Region: Jersey Shore, 570-398-4744
NE Region: Dallas, 570-675-1143
SW Region: Bolivar, 724-238-9523
SC Region: Huntington, 814-643-1831
SE Region: Reading, 610-926-3136

County Conservation Districts (Directory available at PA Association of Conservation Districts – See http://pacd.org/your-district/find-your-district/)

WEST VIRGINIA AGENCIES:

Primary Regulatory Authority

WV Dept. of Environmental Protection
Office of Oil and Gas
601 57th Street, SE
Charleston, WV 25304-2345
304-926-0499

Conservation Organizations

WV Dept. of Natural Resources
Wildlife Resources Section
324 Fourth Avenue
South Charleston, WV 25303
304-558-2771

County Conservation Districts (Directory Available at WV Conservation Agency – See http://www.wvca.us/districts.cfm)

FEDERAL AGENCIES:

U. S. Army Corps of Engineers
For a list of district offices, please see webpage at:
http://www.nap.usace.army.mil/cenap-op/regulatory/districts.html

Appendix E
Site Restoration Recommendations by Government Agencies and Universities

1. U.S. Forest Service Reclamation Web Page. The Forest Service reclamation policy is found in FSM 2840 and can be viewed at http://www.fs.fed.us/geology/mgm_reclamation.html .

2. USDA Natural Resources Conservation Service Web Page. The NRCS web page has much useful information including the Federal noxious weed list for plants that should be eradicated at restoration sites and excluded from any seed mixtures being planted by operators.
Please see http://plants.usda.gov/java/noxious?rptType=Federal

3. International Erosion Control Association Web Page. This web page has many resources and links to many resources on methods to control erosion. Visit http://www.ieca.org/

4. Society for Ecological Restoration International Web Page. This web page has a link to a good article on site restoration in Virginia with applicability to much of Appalachia titled "How to Restore Forests on Surface-Mined Land" Please see
http://www.ser.org/sernw/pdf/VSU_COOP_reforest_surface_mine.pdf

5. West Virginia University Extension Service. Each State Land Grant University has an Extension Service that provides a wealth of information on agriculture and silviculture. For example, WVU's Extension Service has web content called "Recommendation for Tree Planting on Surface Mined Land" available at http://www.wvu.edu/~agexten/landrec/treerec.htm ,

6. Penn State University, College of Agricultural Sciences Web Page. Penn State has a whole series of Marcellus Education Fact Sheets, many of which are relevant to site planning and restoration. Two deal with forest landowners and one is titled "Avoiding and Mitigating Soil Compaction Associated with Natural Gas Development." These fact sheets are available at http://pubs.cas.psu.edu/PubTitle.asp?varTitle=marcellus&Submit=Go

7. Pennsylvania Department of Conservation and Natural Resources (DCNR). The DCNR has an iConservePA website that has a best practices page that includes information on tree planting and invasive species. This information can be viewed at:
http://www.iconservepa.org/plantsmart/bestpractices/index.htm

8. The Pennsylvania Department of Conservation and Natural Resources, through its Bureau of Forestry, oversees the oil and gas operations on leased lands within the Commonwealth's State Forests. It has published a document titled "Guidelines for Administering Oil and Gas Activity on State Forests," available at:
http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_004055.pdf

Appendix F
Habitat, Species, Sportsmen and Agricultural Organizations

These organizations can provide valuable information and guidance for operators seeking to explore options for creative, impactful restoration and site-management opportunities.

The Nature Conservancy - Pennsylvania
http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/pennsylvania/index.htm
The Western Pennsylvania Conservancy
www.paconserve.org
Wildlife for Everyone Foundation
http://www.wildlifeforeveryone.org/
Ducks Unlimited - Pennsylvania
National: www.ducks.org
Pennsylvania: www.pa.ducks.org
The Ruffed Grouse Society
www.rufffedgrousesociety.org
Rocky Mountain Elk Foundation
www.rmef.org
Pheasants Forever
www.pheasantsforever.org
National Audubon Society
www.audubon.org
Pennsylvania Farm Bureau
www.pfb.org
Pennsylvania Federation of Sportsmen's Clubs
www.pfsc.org

Appendix G
References

Enhancement of Wildlife Habitat on Private Lands, Cornell Cooperative Extension Information Bulletin 181.

Managing Northern Forests for Wildlife by Gordon Gullion, 1984.

Managing Openings for Wild Turkeys and Other Wildlife, NWTF, 1995.

Wildlife and Timber from Private Lands: A Landowner's Guide to Planning, Cornell Cooperative Extension Information Bulletin 193.

MARCELLUS
SHALE COALITION™

24 Summit Park Drive • 2nd Fl. • Pittsburgh PA 15275
412.706.5160 • www.MarcellusCoalition.org

MSC RP 2012-1 April 26, 2012