Appendix B: Oil and Gas Management, including the Reasonably Foreseeable Development Scenario (Appendix G of the EIS)

Oil and Gas Management

This appendix contains an evaluation of the reasonably foreseeable future development for oil and gas resources under the Wayne. The Division of Mineral Resources of the Milwaukee Field Office Bureau of Land Management prepared this Reasonably Foreseeable Development Scenario for the WNF, completing it in January 2004.

Lease-specific oil and gas Notifications and Stipulations, which may be added to the standard BLM lease terms for specific parcels that might be leased on the WNF, are listed in Appendix H of the Plan.

Reasonably Foreseeable Development Scenario for Oil and Gas

Increased national demand for energy has increased the price producers receive at the wellhead. Consequently there is increased industry interest in drilling wells on federally owned surface in the WNF. Federally owned surface in the WNF overlies a mix of mineral estate that is classified as either federal, reserved, outstanding, or a combination thereof. Based upon a survey of local oil and gas producers, a forecast of the total number of new wells and associated surface disturbance that will likely occur on federal surface over the next 10 years, regardless of mineral classification, is shown in the following table for each of the three organizational units of the Forest

Table G - 1. New wells and associated surface disturbance that will likely occur on federal surface over the next 10 years.

	Athens Unit	Marietta Unit	Ironton Unit
Number of new wells drilled over next 10 years	24	110	100
Miles of new access road needed	5	21	19
Total acres of surface disturbed by oil & gas drilling activity before reclamation	27	135	110
Total acres of surface needed to support drilled wells that are completed for production (excess disturbance reclaimed)	11	59	51
Number of depleted wells plugged over next 10 years	82	26	0
Total acres reclaimed by plugging depleted wells	45.1	14.3	0

Federally owned minerals make up about 40 percent of the mineral ownership in the WNF. The significance of the amount of federal minerals lies in the fact that it represents the only class of mineral estate the Forest Service has control over whether or not to make the lands available for oil and gas development. The above projection of activity assumes that:

- All federal minerals in the Forest are available for lease (unless precluded by law)
- All federal minerals are timely leased upon request with only standard lease stipulations
- Drilling permits on federal minerals are timely processed
- Oil and gas prices remain at or above current levels.

Petroleum Geology of the WNF

In the case of the WNF, neither the petroleum geology nor its interpretation has changed since it was described in the 1992 Amendment #8 to the WNF and Resource Management Plan. There are three major oil and gas exploration targets on the Forest: the Berea Sandstone, the Ohio Shale, and the "Clinton"-Medina. There also continues to be a number of shallow secondary production zones, particularly in the Marietta Unit, that offer operators a chance to complete a producing well even if they fail to find commercial quantities of oil and gas in one of the three major targets. And finally, there continues to be a remote possibility for commercial potential in the deeper formations such as the Trenton-Black River Dolomite, the Glenwood Sandstone, the Beekmantown Dolomite, the Rose Run Sandstone, and the Mt. Simon Sandstone. For a more complete discussion of the petroleum geology of the WNF, please refer to Appendix B of Amendment #8 – WNF Land and Resource Management Plan.

The extensive history of oil and gas development in the WNF has generated enough geologic data to suggest there is potential for occurrence of hydrocarbons virtually everywhere in the Forest. The geologic analysis necessary to determine specific areas of the Forest considered "high" potential is beyond the scope of this report. However, the definition of "developmental well" used by the American Association of Petroleum Geologists (AAPG) can be used to make a simplified determination of areas that are high potential and therefore more likely to be drilled upon. AAPG defines a "developmental well" as a well completed in a known oil and gas bearing formation within one mile of any well completed in the same formation. Alternately, a well drilled to a formation not usually known to be oil and gas bearing, or is located more than one mile from the nearest well completed in the same formation is classified as an "exploratory well." The significance of developmental versus exploratory wells is in their respective success rates. In Ohio, the statewide success rate for developmental wells in 2002 was 86.5 percent versus 46.5 percent for exploratory wells. In the WNF, there is 127,400 acres, or 53.2 percent of the entire Forest, within one mile of an existing producing well, and therefore, can be considered to be high potential for hosting a

well location. Of course, as new wells are completed the high potential area expands.

Mineral Ownership and Leasing

Table 3.1 in Chapter 3 of the Draft EIS summarizes the complex surface and mineral ownership situation in the Wayne. Presently, of the 239,497 acres of surface managed by the Forest Service, 60 percent of the mineral estate is privately owned and 40 percent is federally owned. The percentages of mineral ownership in the Forest will change over time as some mineral rights revert from private to federal ownership and as new mineral estate is acquired by the Forest Service. While the Forest Service has complete discretion over most surface disturbing activities on federal surface/federal minerals, it is restricted in its ability to control when and where mineral development occurs on federal surface/Private minerals. Regardless of the degree of Forest Service authority over the two basic types of mineral ownerships, the projections of new drilling activity contained in this report are made without regard to mineral ownership.

For both federal and private minerals, a lease is generally the legal instrument that conveys the right to drill on a tract of land. No lease, no drilling. We know that just over 21 percent (139 leases) of the 96,246 acres of federally owned minerals are presently leased. There are 307 existing leases on the 143,251 acres of privately owned mineral estate beneath federal surface. Although there is no available estimate of how acreage is encompassed by the 307 leases, it is reasonable to assume it is considerably more than the amount of federal minerals leased. Regardless of the current status of leased lands, the projections of new drilling activity contained in this report assume that all lands are leased in accordance with federal guidelines for preparing base development scenarios.

Well Spacing

The State of Ohio has rules governing the location of wells, or “spacing” requirements. Spacing establishes how many wells can be drilled within a given field or pool. Spacing requirements vary by depth as reflected in Table G - 2:

Table G - 2. State of Ohio Spacing Requirements.

Depth to oil & gas pool	0 to 1,000 Ft.	1,000 to 2,000 Ft.	2,000 to 4,000 Ft.	Over 4,000 Ft.
Minimum acres of tract or drilling unit hosting well	1	10	20	40
Minimum distance between other wells in the same pool	200’	460’	600’	1,000’
Minimum distance from any boundary of subject tract or drilling unit	100’	230’	300’	500’

The distance and acreage requirements shown above apply to the actual location of the bottom of the drilled well, or bottomhole location. Given the availability of directional drilling techniques, it is possible for a surface location to be offset

from its intended bottomhole location. The State may grant exceptions to its spacing requirements but such exceptions are rare and must be technically justified. In addition to the above bottomhole restrictions, the wellheads of all newly drilled wells, regardless of depth:

- Cannot be closer than 50 feet to the traveled portion of a road which is considered to be the berm of the roadway
- Must have a 100-foot minimum setback requirement from homes.

It is important to keep in mind that the spacing requirements are *minimum* distances and acreages. Factors such as terrain, surface/mineral ownership issues, economics, and operator preference can contribute to the actual well spacing being greater than State minimums. For example, even though the State spacing requirements for Clinton wells in Lawrence County call for a minimum drilling unit size of 20 acres, one operator in the area reports using drilling units 60 to 70 acres in size.

In areas of the WNF where there are multiple potentially productive zones at varying depths, the potential exists for a higher density of wells due to overlapping spacing units. Two wells could be located side by side and still satisfy spacing requirements because they are completed at different depths. However, operators will seek to produce multiple formations within a single wellbore whenever possible rather than incur the expense of drilling another well.

The majority of the foreseeable drilling targets within the WNF are between 2,000 to 4,000 feet deep, which means most new wells will be drilled on a minimum density of one well per 20 acres. In addition, there is growing interest in drilling to the Clinton-Medina Formation in the Marietta Unit, which lies over 4,000 feet deep and requires a minimum density of one well for every 40 acres.

Directional/Horizontal Drilling

The Oil and Gas Potential Analysis contained in the 1992 Amendment #8 to the WNF Forest Plan concluded that directional or horizontal drilling would not be economically feasible in the Forest. It further stated that given the unwillingness of operators to use directional drilling methods, applying no surface occupancy restrictions on tracts over 20 acres in size would in effect, prevent the tract from being developed.

Since 1992, there have been a dozen wells drilled and completed using directional drilling methods in the 12 county area where the WNF is located. None of these wells were drilled on the Forest. Ten of the 12 wells were drilled to target formations over 4000 feet deep while the remaining two wells used horizontal drilling technology in formations that were 2,200 to 2,700 feet in depth. The operators of the two shallower horizontal wells reported technical problems that needed to be resolved before use of horizontal techniques can be considered economically feasible. This kind of operator feedback coupled with the fact that only 12 wells out of 1,704 permitted during the 10 year period were directional

wells, suggest that this type of technology is still not yet economically feasible within the WNF.

Typical Surface Disturbance

Access Roads

Each new well will require an adequate access road to accommodate the large, heavy equipment needed to drill the well. Adequate access can be provided by:

- Using existing roads, some of which may need upgrading
- Constructing a new road
- A combination of both.

Experience has shown that in areas, such as the WNF, where wells only produce marginally economic quantities, operators tend to seek surface locations that minimize the amount of access road that needs to be constructed. For analysis purposes, it will be assumed that an average of 1000 feet of new access road will be constructed for each new well drilled. Road construction will require clearing a width of 24 feet to provide a "running" surface of 16 feet. If the involved well is completed for production, disturbance beyond the "running" surface will be re-vegetated leaving 0.38 acres of net surface disturbance for the average road. The access road remains in place to provide all weather access to the well and its facilities for the life of the well.

Well Pads/ Production Facilities

Typically a new well drilled in the WNF will require, on average, a 0.69-acre well-pad area (150 by 200 ft.) to be cleared and leveled. Wells drilled to formations over 5,000 feet deep use a larger drill rig and would need a 1.1 acre (250 by 200 ft.) well pad area cleared.

If commercial quantities of oil and/or gas are discovered, roughly a 50-by-50 foot portion of the disturbed well pad is used to set up the piping, tanks, and production equipment necessary to produce the well. Additional area of the pad will also be used as a turnaround area used for inspection and maintenance vehicles/equipment. This report assumes that about 25 percent of the disturbed pad area (0.17 acres) will remain in use for the producing life of the well. The balance of the pad area not needed for production is then revegetated.

In some instances, the production facilities are remotely located from the wellhead in order to be closer to an all weather road. Whenever this occurs, well fluids are transported from the wellhead to the facility by a pipeline. The pipeline may be buried or laid on the surface.

Dry Holes

If oil and gas are not found in commercial quantities, the drilled wellbore is plugged with cement. The well pad and access road are restored to original contour and all disturbed area reseeded. The operator must ensure that vegetation

is satisfactorily established over the affected areas to stabilize the soil and prevent erosion.

Typical Oil and Gas Operations

Drilling Operations

Initially, heavy earth moving equipment is used to build the access road and well pad. Topsoil is stockpiled for use in reclaiming areas not needed during the production phase. A large "reserve" pit is dug on the well pad. Material excavated from the pit during construction is stockpiled on-site to backfill the pit when drilling is finished.

The majority of wells will be drilled by a rotary rig. Less commonly, wells will be drilled by a cable tool rig. Both types of rigs are powered by diesel engines. During drilling, the mast of a rotary rig extends from 80 to 100 feet in height. Since drilling is a continuous operation until the total depth of the well is reached, the lights and engine noise from the rig are evident throughout the day and night. It takes a rotary rig about 3 to 5 days to drill a typical well on the WNF.

Cable-tool rigs use a weighted tool which chips away at the rock as the percussion tool is moved up and down on the end of a steel cable. A small amount of water is poured into the hole to suspend the cuttings while drilling progresses. After about 5 feet of hole have been drilled, the bit is pulled to the surface and a "bailer" is lowered to the bottom of the drilled hole to remove the cuttings. The cuttings are then dumped into the reserve pit. Cable tool rigs use less equipment than rotary rigs and can operate in about half the space as a rotary rig. Cable tool rigs take over four times as long to drill a well as a rotary rig, which is why their use is not common.

Rotary rigs use a toothed, tricone cutting bit mounted on successive lengths of rotating drill pipe to drill the hole. Either a water-based mud (with additional conditioning agents as needed) or compressed air is used as the circulating agent. In a mud based system, pumps direct mud down the drill pipe, back up the hole, and out to the reserve pit where the rock fragments will settle. In a compressed air system, air compressors direct air down the drill pipe, thereby forcing the rock cuttings up the well bore and into the reserve pit. The air compressors are either self-contained as a part of the drill rig or a separate independently-powered component. Even with air drilling systems, the operator will keep drilling clay (i.e. bentonite) and a tank of water at the drill site in case conditions require converting to a mud-based system.

As the well is deepened, using one of the above methods, steel pipe called casing will be periodically cemented into the hole along its length to seal the rock formations and their native fluids from the drilling (and later producing) environment. Federal regulations require casing to be installed in a manner that will protect fresh water zones and isolate other zones which contain oil, gas, and water. Casing is also used to seal off potentially valuable minerals, such as coal seams, and other underground features, such as caves, vugs, or large fractures.

Federal regulations require that the rigs be equipped with blow-out preventers which are capable of preventing the hole from an uncontrolled flow in case a high pressure zone is encountered. Drilling in the Wayne has not encountered high pressure zones. Anticipated pressures are 0.4 to 0.5 psi per foot of drilling depth or less. No other unusual or difficult geologic conditions are anticipated while drilling.

During drilling and immediately after total depth is reached, a variety of testing devices are placed down the hole on a wire cable. These are used to determine rock characteristics and to ascertain the presence of hydrocarbons. In the event of a commercial discovery, the drill rig is moved off the site and a smaller truck mounted rig and two to three 400-barrel tanks are moved onto the site to begin the completion phase. Specialized trucks pump water or nitrogen mixed with sand or a mild acid into the well to fracture the producing formation to increase its flow rate. A large amount of the fluid volume that is pumped into the well is "flowed back" into the tanks that were brought on site. Completing a well usually begins shortly after the hole is drilled, but may be delayed for several weeks pending availability of equipment. The truck mounted completion equipment is typically removed from the site in one to three days. The tanks may remain for a longer period until the well is "cleaned up", that is, most of the injected fluid is recovered. Either during or shortly after the completion process, the production facility is constructed. At this time, the reserve pit is backfilled and the portion of drill pad not necessary for the production phase is revegetated. Then the access road is often upgraded at this time to provide all-weather, year-round access to the wellhead and production facility. This includes revegetating the portion of the roadway beyond the running width.

Production Operations

The typical producing oil well and its associated production facility consists of one or two 100-barrel steel oil/water storage tanks surrounded by an earthen dike, a pump-jack and motor to bring the oil to the surface, an electric line to run the motor, a separator (a vessel that separates the raw well stream into oil, gas, and water), and if gas is being produced with the oil, a gas meter. If an electric source isn't readily available, pumpjack motors can be run by natural gas drawn off the well. A typical producing gas well and its facility typically consist of an assortment of valves on the wellhead, a 100-barrel tank for produced water, a separator, and a gas meter.

Hydrocarbons are transported from the wellbore to the production equipment by means of varying lengths of 2-inch diameter pipe. Where feasible, pipelines are buried at least 24 inches below the ground surface. There may be a permanent flare to dispose of small quantities of natural gas that are not economic to sell. When natural gas can be marketed, gathering pipelines transmit the gas from the production facility to secondary collector lines and on to main transmission lines. Given the long history of gas production in the WNF, there is already a well developed pipeline infrastructure in place which should minimize the need for lengthy gathering lines to service new wells.

Water produced along with the oil and gas is generally salty and sometimes sulphurous. Federal and State regulations require this saltwater, or brine, to be properly disposed of. The most common method of disposal in Ohio is for the brine to be trucked to a State-licensed disposal well where it is injected into underground formations already containing brine. A less common disposal method allowed in certain townships is road spreading of brine for the purpose of dust and ice control. Producing wells in the WNF typically produce only small amounts of brine.

Access to the site will probably be through a locked gate located at the start of the lease access road. The company employee, called a “pumper", regularly inspects and maintains the well and facility. Tanker trucks will pick up oil and/or salt water from the production tanks on a schedule determined by the volumes produced.

Occasionally, producing oil and gas wells experience mechanical problems in the wellbore that require a process called a “workover”. A workover involves bringing a smaller service rig to the location to perform any needed service on the well. Workovers take place on the existing well pad and sometimes may require a small pit to contain any fluids circulated from the wellbore. After the workover is complete, any fluids remaining in the pit are vacuumed out and disposed of in accordance with State requirements. The pit is then backfilled and revegetated as appropriate.

Abandonment and Final Reclamation

Permanent abandonment of depleted producing wells is required by both Ohio and federal regulations to occur quickly after all oil and gas operations have ceased. If there will be an excessive interval of time between one phase of activity and another, federal and State regulations require that the well be temporarily plugged.

Because of the shallow depths and lack of geologic hazards, well plugging operations can typically be completed within three days on wells located in the WNF. Activity at the site will entail use of a smaller truck mounted service rig and several large trucks which will be used for the retrieval of well casing and the placement of cement plugs and hydrostatic mud in the bore hole. All horizons of hydrocarbon occurrence, unusual water flows, and fresh water zones will be sealed from the bore hole by the cement plugs. Remaining surface equipment is removed at this time. Surface restoration and reclamation should be completed within 1 year of well abandonment.

Production History and Life Expectancy of Producing Fields

The average life expectancy of producing wells within the Wayne is fifteen to thirty years, with the notable exception of the Ohio Shale, where life expectancy is twenty five to forty years. Numerous examples can be given on both ends of the life expectancy spectrum, including wells that have been produced continuously

since the early 1900s to economic wells which never produce due to legal hindrances.

With the exception of the Ohio Shale, all of the formations underlying the Wayne will produce at a relatively high rate for the first few years, and after experiencing a rapid decline in production they will continue to produce at a low rate for the remainder of a well's life. Production from the Ohio Shale is typified by a relatively long well life with only a minor decline in production throughout its production history. Production will usually continue until the operator determines that the well will no longer produce enough hydrocarbons to pay for the day to day operating expenses.

General Development Trends

Information on well completions in the 12 counties where the WNF is located were examined for development trends that may impact Forest lands. The 30-year period from 1973 to 2002 were broken up into three separate 10-year periods to look at timeframes that are equivalent to Forest planning periods. The results of this breakdown are as follows:

- **For the period 1973 to 1982** – A total of 1,861 wells were completed in the twelve subject counties. Of this total, 600 wells, or 32.24 percent, were completed within the Forest proclamation boundary. Of the wells drilled within the Forest proclamation boundary, 121 wells, or 20.17 percent, were completed on surface managed by the Forest Service.
- **For the period 1983 to 1992** – A total of 4,924 wells were completed in the twelve subject counties. Of this total, 1,073 wells, or 21.79 percent, were completed within the Forest proclamation boundary. Of the wells drilled within the Forest proclamation boundary, 213 wells, or 19.85 percent, were completed on surface managed by the Forest Service.
- **For the period 1993 to 2002** – A total of 1,180 wells were completed in the twelve subject counties. Of this total, 330 wells, or 27.97 percent, were completed within the Forest proclamation boundary. Of the wells drilled within the Forest proclamation boundary, 22 wells, or 6.67 percent, were completed on surface managed by the Forest Service.

This information suggests that for the past 10 years, oil and gas drilling on federally owned surface has been lagging behind the average drilling pace on Forest Service surface of the previous twenty years. From this, one could conclude that there is increased potential for drilling sites on federally owned surface in the WNF. Whether or not that potential is realized will depend on the availability of WNF lands, the ability of Forest Service and BLM to respond to requests to drill, and energy prices.

Development Forecast for the Ironton Unit

Two principal potentially productive targets present throughout the Ironton Unit are the Ohio Shale, and the Clinton-Medina. Secondary targets present throughout the Ironton Unit consist of the Glenwood, the Beekmantown, the Rose Run, and the Mt. Simon formations. In addition, the Ironton Unit has the potential for minor production from the Berea and other shallow zones as they are intersected in wells being drilled to one of the aforementioned primary or secondary targets. Natural gas is produced from these target formations, except for formations above the Berea where oil may also be produced.

In 1992, there were no wells on federal surface ownership in the Ironton Unit. At that time, the Forest plan projected that by the year 2000 there would be 5 wells on Forest Service surface. That projection proved to be fairly accurate as there were actually 6 wells located on Forest Service surface in 2000. For the period 1992 -1999, both the projected and actual well totals for the Ironton Unit reflected low natural gas prices that did not exceed $2.74 per thousand cubic feet (Mcf). However, beginning in 2000, the average annual wellhead price jumped to $4.06/Mcf, which sparked a significant increase in drilling activities in Gallia, Jackson, and Lawrence Counties. The connection between drilling permits issued in the three aforementioned counties and natural gas pricing since 1992 is shown in the **Figure G - 1**:

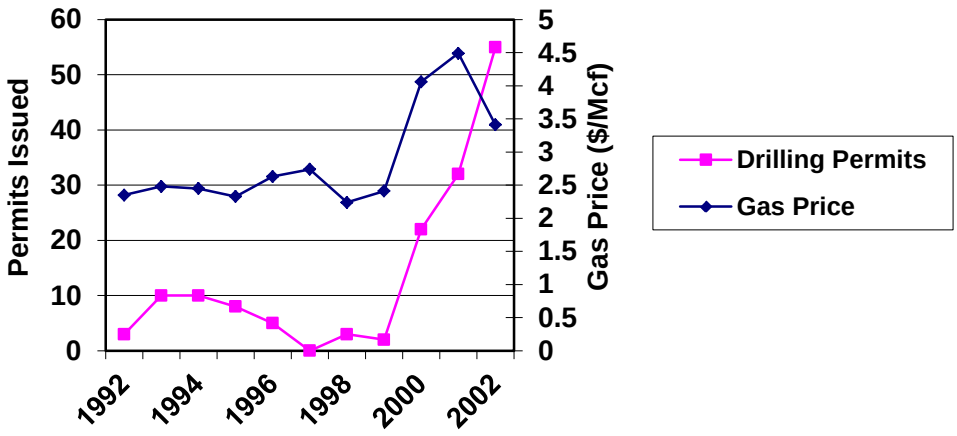

Figure G - 1. Gas Price vs. Permits Issued in Gallia, Jackson, and Lawrence Counties.

Still, the majority of the increase in activity in the three-county area over the last three years has not been on Forest Service surface. This is likely due to the fact that only 4.2 percent of federal mineral estate in the Ironton Unit is presently leased even though the Ironton Unit has more federally owned mineral estate than the Athens and Marietta Units combined. However, current gas prices coupled with the amount of undeveloped mineral estate within the Ironton Unit leads one to reasonably expect an increase of activity on Forest Service surface. This was demonstrated in February 2003, when applications were filed to drill 6 wells to

test the Clinton formation on existing federal leases in Aid Township, Lawrence County. Later in 2003, a request was submitted to the Bureau of Land Management to lease an additional 11,000 acres for oil and gas in the Ironton Unit.

One major operator has a significant lease position in the area and possess the financial and technical resources to initiate and sustain an active drilling program. Although only a relatively small number of companies currently operate in the vicinity of the Ironton Unit, positive drilling results would likely spur additional leasing and drilling interest in the Unit. Members of the industry were surveyed about their future development plans on federally owned surface. Based on that survey it is reasonable to expect up to 100 wells could be drilled on Forest Service surface in the Ironton Unit over the 10-year planning period.

Success Ratio

All of the wells drilled in Lawrence and Gallia Counties in 2002 were classified as "developmental" wells, as defined on page 2 of this report. Developmental wells in Lawrence County enjoyed a 95.6 percent success ratio (i.e. percent productive) while those in Gallia County were 88.9 percent productive. Should any exploratory wells (as defined on page 2) be drilled in the area, it is expected they would experience a success ratio similar to the statewide average for exploratory wells which was 46 percent in 2002.

Assuming all of the projected wells drilled in the Ironton Unit would be developmental wells, the local success ratios suggest that we could expect 8 of the projected total wells drilled would be unproductive or "dry holes". Dry holes are immediately plugged upon completion of drilling and the associated well pad and access road would be reclaimed to a stabilized vegetated state.

Abandonment of Depleted Producers

With only 10 producing wells currently in the Ironton Unit, it would not be meaningful to perform a statistical analysis based on the history of depleted producing wells plugged in the local counties over the past 10 years. This report assumes that there will be no depleted producing wells plugged over the planning period.

Projected Surface Disturbance

Using the number of new wells projected in the aforementioned section and the typical amount of surface disturbance associated with drilling new wells less than 5,000 feet in depth, it is estimated that oil and gas activity in the Ironton Unit for the planning period will result in:

- 19 miles of new access road construction
- 41 gross acres of surface disturbance for road construction
- 17 miles of roads equating to 35 net acres of surface disturbance to service 92 producing wells

- 69 gross acres of surface disturbance for well pad construction
- 16 net acres of surface disturbance for turnaround/production facility areas to service 92 producing wells.

Gas Storage Potential

The development scenario in the 1992 Amendment #8 to the WNF Land and Resource Management Plan discussed the potential for gas storage but concluded that gas storage operations would not likely occur before 2020. Since then, the BLM has had no expressed interest in gas storage within the Ironton Unit. Accordingly, it is reasonable to expect that there would be no gas storage related activities on the Ironton Unit over the course of the planning period.

Development Forecast for the Marietta Unit

The three major exploration targets within the Marietta Unit are, in descending order, the Berea, the Ohio Shale, and the Clinton-Medina. More than any other unit of the Forest, the Marietta Unit has a number of shallow targets that serve as "back-up" completion formations in the event a well is not successful in being completed in its primary target. In Monroe County, the major targeted reservoir for 2002 drilling activity was the Ohio Shale at an average depth of 2,490 feet. The Clinton-Medina has just recently become a regular target in Washington County as the price of gas has increased. The average depth drilled to reach the Clinton-Medina in Washington County in 2002 was 5,395.

In 1992, there were 634 wells on federal surface in the Marietta Unit (including outstanding, reserved, and federal mineral rights). At that time, it was projected that by the year 2000 there would be 700 wells on Forest Service surface. As of 2003, there are actually 921 wells located on Forest Service surface, 45 percent more wells than existed in 1992, and 31.6 percent more than projected. Remarkably, from 1992 to 2000, only 7 new wells were drilled on Forest Service surface during the period. The remainder of the increase in the well total was existing wells on lands purchased by the Forest Service during the period.

Despite a 140-year long history of oil and gas production, Washington and Monroe Counties have continued to experience significant drilling activity over the past 10 years. Washington County has consistently been one of the top 10 Ohio counties for permits issued and wells drilled. Monroe County ranked 12th in wells drilled in 2001 and moved up to 5th in 2002. With only 7 wells on federal surface over the last 8 years, the extensive drilling in Washington and Monroe Counties has not significantly impacted the WNF. This lack of drilling activity in the Marietta Unit is most likely attributed to operator's disdain for the additional paperwork and operating requirements associated with being on Forest Service surface and their unwillingness to wait for the necessary authorization to begin their projects (The average time to receive a drilling permit from the Ohio Division of Oil and Gas was 12.6 days in 2002 compared to Forest Service processing times requiring from 60 days to one year.). However, given the

continuing prospect of higher energy prices, the prospect of higher revenues will be incentive enough for operators to brave the federal bureaucracy.

Seven local producers with extensive experience in operating in the Marietta Unit were surveyed in order to project how much drilling activity could be expected on Forest Service surface over the next 10 years. Their responses were optimistic about the prospect of drilling wells on Forest Service surface, reflecting the belief that energy prices will remain strong for some time. Taking into account the thoughts of these producer's, current prices, and the strong industry interest in Washington and Monroe Counties, it is reasonable to expect that up to 11 wells per year could be drilled on Forest Service surface in the Marietta Unit. Over the 10-year planning period, this would yield up to 110 total new wells drilled.

Success Ratio

Any well drilled within the Marietta Unit would be classified as a developmental well as the entire Unit is within one mile of an existing producing well. In 2002, developmental wells in Monroe County had a 96.4 percent completion rate, while Washington County had a 100 percent completion rate. Even wells drilled to the Clinton formation, which generally are exploratory wells in the Marietta Unit and subject to a lower success ratio, would likely be completed in a shallower zone if commercial quantities of hydrocarbons are not found in the Clinton. This report will assume that 98 percent of new wells drilled in the Marietta Unit, or 108 wells, will be completed as producers.

Abandonment of Depleted Producers

Although wells in the Marietta Unit have unusually long producing lives, Washington and Monroe Counties had 281 wells plugged from 1993 to 2002. Assuming a similar rate of plugging and considering the Marietta Unit occupies about 9 percent of the total area of these two counties, this report projects that 26 depleted producers would be plugged over the life of the plan. Using 0.55 acres as the average amount of net surface disturbance associated with a producing well (e.g., 0.38 acres of road and 0.17 acres of well pad), plugging 26 depleted producers will result in 14.3 acres of restored surface over the life of the plan.

Projected Surface Disturbance

Of the total number of wells projected for the Marietta Unit, it is estimated that 30 percent, or 33 wells, would be drilled deeper than 5,000 feet which would require a 1.1-acre drill pad to be constructed. The remaining 77 wells would be less than 5,000 feet in depth and require construction of the smaller 0.69-acre drill pad. Using these wells estimates and assuming an average 1,000 feet of new access road is constructed per well, it is estimated that oil and gas activity in the Marietta Unit for the planning period will result in:

- 21 gross miles of new access road construction
- 46 gross acres of surface disturbance for road construction

- 20 net miles of roads equating to 41 net acres of surface disturbance to service 108 producing wells
- 89 gross acres of surface disturbance for well pad construction
- 18 net acres of surface disturbance for turnaround/production facility areas to service 108 producing wells.

As noted in the previous section, the land reclaimed by plugging depleted producers will offset the surface disturbance associated with drilling new wells and produce a net gain in reclaimed surface.

Development Forecast for the Athens Unit

The principal exploration targets of the Athens Unit are, in descending order, the Berea and Clinton-Medina formations. The Clinton-Medina is less than 4,000 feet deep in the Athens Unit equating to a minimum drilling unit size of 20 acres per well. There is potential for production from formations shallower than the Berea, but to date no significant production has been established from these zones in the area. There is also potential for production deeper than the Clinton-Medina, but drilling below the Clinton has been rare for the area and is not expected in the foreseeable future.

In 1992, there were 413 wells located on Forest Service surface in the Athens Unit (including outstanding, reserved, and federal mineral rights). At that time, it was projected that by the year 2000 there would be 453 wells on Forest Service surface. As of 2003, there are actually 315 wells located on Forest Service surface, a reduction of 23.7 percent from the number of wells than existed in 1992. The number of new wells drilled has not kept pace with the number of wells plugged in the Athens Unit. For example, in 2002 there were only four new wells drilled in Athens, Hocking, Perry, and Vinton Counties combined. Alternately, there were 46 wells plugged in Perry County alone in 2002 and a total of 165 well pluggings in the county over the last three years.

Seven producers with a history of operating in the area were surveyed in order to project how much drilling activity could be expected on Forest Service surface in the Athens Unit over the next 10 years. Their combined response indicates that it would be reasonable to expect a total of 24 new wells to be drilled in the Athens Unit over the next 10 years.

Success Ratio

In 2002, the three developmental wells drilled in the four counties within the Athens Unit were all completed as producers for a 100 percent success ratio. Although three wells are not enough to provide for a reliable statistical average, it is reasonable to assume that developmental wells drilled within the Athens Unit would have a success ratio no less than the 2002 statewide average of 83.6 percent. Should exploratory wells be drilled within the Athens Unit, one could reasonably expect the success rate to be close to the 2002 statewide average of 46 percent. Assuming that all of the projected wells drilled in the Athens Unit are

developmental wells and applying the statewide success ratio, it is reasonable to expect 20 of the 24 projected wells would be completed as producers.

Abandonment of Depleted Producers

Athens, Hocking, and Perry Counties had 1,047 wells plugged from 1993 to 2002. Assuming a similar rate of plugging and considering the Athens Unit occupies nearly 8 percent of the total area of these two counties, this report projects that 82 depleted producers would be plugged over the life of the plan. Using 0.55 acres as the average amount of net surface disturbance associated with a producing well (e.g., 0.38 acres of road and 0.17 acres of well pad), plugging 82 depleted producers will result in 45.1 acres of restored surface over the life of the plan.

Projected Surface Disturbance

Using the number of new wells projected in the aforementioned section and the typical amount of surface disturbance associated with drilling new wells less than 5,000 feet in depth, it is estimated that oil and gas activity in the Athens Unit for the 10-year planning period will result in:

- 5 gross miles of new access road construction
- 10 gross acres of surface disturbance for road construction
- 4 net miles of roads equating to 8 net acres of surface disturbance to service 20 producing wells
- 17 gross acres of surface disturbance for well pad construction
- 3 net acres of surface disturbance for turnaround/production facility areas to service 20 producing wells.

As noted in the previous section, the land reclaimed by plugging depleted producers will more than offset the surface disturbance associated with drilling new wells and produce a net gain of 24.1 acres in reclaimed surface.