



**United States  
Department  
of the Interior**



**Office of Surface  
Mining  
Reclamation and Enforcement  
Mid-Continent Region**

# **Environmental Assessment**

## **McCurtain Underground Mine Haskell County, Oklahoma**

### **Farrell-Cooper Mining Company Federal Coal Lease OKNM 108097 ODM Permit 4285F**



**January 2013**



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# **Chapter 1. Purpose and Need for Action**

## **1.0 Document Structure**

The Office of Surface Mining Reclamation and Enforcement (OSM), in cooperation with the Oklahoma Department of Mines (ODM), prepared this environmental assessment (EA). This EA is in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The document discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into the following five chapters:

**Chapter 1. Purpose and Need for Action:** This chapter addresses the purpose of, and the need for, Federal action to be taken on a proposed mining plan. The chapter also describes the proposed plan to recover coal from Federal lease OKNM 108097.

**Chapter 2. Alternatives Considered:** This chapter provides a more detailed description of the alternatives available to the Assistant Secretary for Land and Minerals Management (ASLM) for action. Alternatives were developed from interdisciplinary review, applicable laws and regulations, and input from government agencies. The permit application package for ODM Permit 4285F was open to public comment for a 30-day period ending March 7, 2011. The general public made no comments.

**Chapter 3. Affected Environment and Environmental Consequences:** This chapter presents the existing conditions of relevant resource components of the physical, biological, and social environments. It also provides the framework within which the environmental impacts of the action options can be assessed. Information contained here serves as a reference for evaluating and comparing alternatives for action.

**Chapter 4. Consultation and Coordination:** This chapter lists the preparers and agencies consulted during the development of the environmental assessment.

**Chapter 5. References:** This chapter lists documents used in the preparation of this environmental assessment.

## **1.1 Required Federal Action**

The Federal action is a decision by the ASLM whether federally owned coal can be recovered as described in the proposed mining plan. This action is authorized in the Mineral Leasing Act of 1920, as amended.

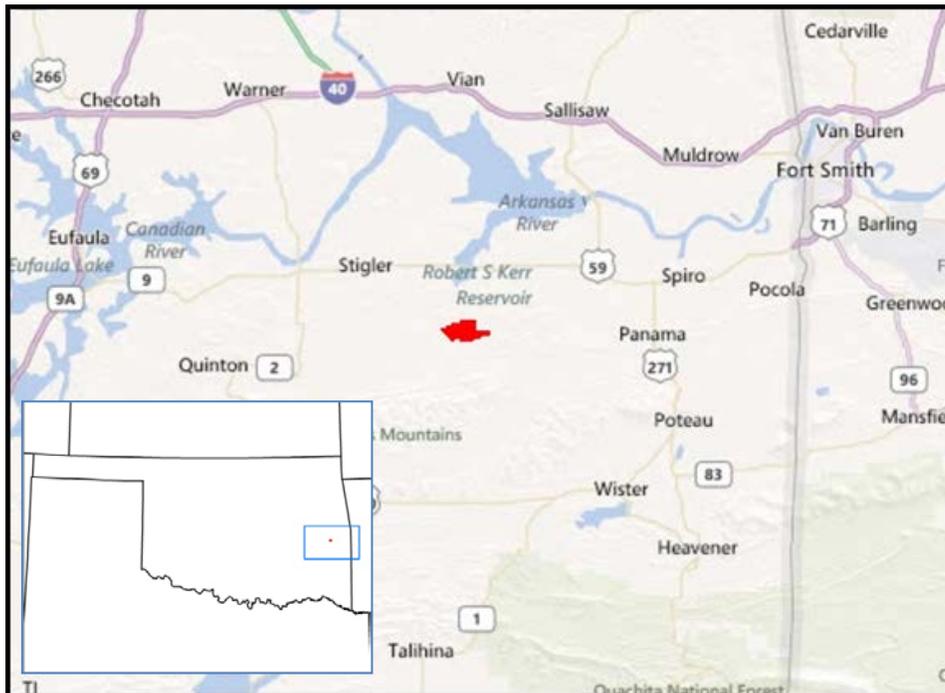
NEPA regulations apply to Federal actions that affect the quality of the human environment. The ASLM decision on the proposed mining plan for the McCurtain Underground Mine is one of those Federal actions. OSM is required, for compliance with Federal regulations at 30 CFR Part 746, to analyze and document the environmental, social, and economic impacts associated with this proposed mining plan.

The assessment will lead OSM to recommend that the ASLM choose one of the following alternatives:

- Disapprove the mining plan.
- Approve the mining plan (the preferred alternative).
- Conditionally approve the mining plan. Specific conditions would be required on the mining plan approval to provide adequate protection for the environment.

## 1.2 Description of Proposed Project

In May 2010, Farrell-Cooper Mining Company (FCMC) applied to ODM for the McCurtain Underground Mine permit. The permit application is for 462 acres of surface support facilities to allow coal recovery from the 2,380-acre Federal Coal Lease OKNM 108097. Figure 1 shows the location of McCurtain Mine (ODM Permit 4285F). The mining operation would recover Federal coal from lease OKNM 108097 by underground mining methods. Federal Coal Lease OKNM 108097 was issued on September 1, 2006, for 2,380 acres. Annual Federal coal production from McCurtain Underground Mine will range from 0.6 to 1.2 million tons. The mine will also recover privately owned coal during the 40 to 80 year proposed life of the operations.



**Figure 1.** Location of the McCurtain Mine.

The 462-acre permit for surface disturbance associated with underground coal recovery was approved by ODM on March 30, 2012. Surface facilities in the disturbance area include an office, maintenance and parking facilities, coal cleaning and load-out, permanent coal waste disposal, sediment and surface water control and haulroads.

### **1.3 General Setting and Background**

The proposed surface disturbance in support of the underground mining operation is within the 462-acre boundary of the ODM Federal lands Permit 4285F. Surface disturbance will be located in Sections 13, 14, and 15, Township 8 N, Range 22 E, Indian Meridian, Haskell County, Oklahoma. Federal Coal Lease OKNM 108097 covers parts of Sections 8, 9, 10, 11, 14, 15, 16, and 17, also in Township 8 N, Range 22 E. The lease further identifies the S1/2 NW1/4 Section 14 as the portal (underground access area) for the mine. These surface support facilities, including the portal, will be approximately one mile north of the town of McCurtain, Oklahoma.

The McCurtain Underground Mine project area is in the southeastern portion of Haskell County. Historically, Haskell County was dominated by extensive oak-hickory-pine forests of the Ouachita Physiographic Province. Rich forested land, range, minerals, and transportation were essential to the early settlement of the area. The majority of Haskell County lies within the Arkansas Valley physiographic section with some southern portions within the Ouachita Mountains section. The county is bordered to the north by the Arkansas and Canadian Rivers and the Robert S. Kerr Reservoir. The Sans Bois Mountains border Haskell County to the south.

Haskell County is classified as a rural area in Oklahoma with an estimated 12,769 residents. The economy of the area is based primarily on agriculture and construction with forestry and pastureland accounting for the vast majority of the existing land uses. Several deposits of coal, limestone, and sandstone are scattered throughout the county. Western sections of the county contain deposits of high-volatile bituminous coal whereas medium-volatile bituminous coals are more prevalent in the east.

Coal mining has been occurring in the vicinity of McCurtain since the early 1900s. Underground coal mining previously occurred adjacent to the project area. Surface disturbance for the proposed McCurtain Underground Mine will occur within 500 feet of these old works to allow for maximum coal recovery. If the mining operation breaks into any section of abandoned works, the permittee will backfill and seal openings with impermeable material. Any water from the underground works will be directed to a sediment pond for treatment to meet water quality standards, as needed.

### **1.4 Related Environmental Documents**

The Bureau of Land Management (BLM) prepared an EA for Federal Coal Lease OKNM 107920, McCurtain Underground Tract, in June of 2004. The EA is entitled *Proposed Resource Management Plan Amendment, Environmental Assessment and Finding of No Significant Impact for Three Competitive Coal Lease Sales in Haskell, Latimer, and LeFlore Counties, Oklahoma*. The BLM EA evaluated the environmental impacts of mining activities within this and other leases.

## **Chapter 2. Alternatives Considered**

### **2.0 Introduction**

This section describes and compares a range of reasonable alternatives including the proposed action and no-action alternative. These alternatives were derived from interdisciplinary analysis, State and Federal regulations. The permit applicant, as required by ODM regulations, invited the public to comment on the proposed McCurtain Underground Mine. No comments were received. Federal agencies are required by NEPA to explore and objectively evaluate all reasonable alternatives. This includes a discussion and analysis of the proposed mining activity and its anticipated effects on the environment.

### **2.1 Alternative Analysis**

#### **Alternative 1 (Recommend Disapproval):**

OSM would recommend that the ASLM disapprove the proposed mining plan. Subsequently, there would be no surface disturbance activities. This alternative provides a baseline against which we describe the environmental impacts of Alternative 2 and Alternative 3. If Alternative 1 is selected, FCMC will not be allowed to recover Federal coal reserves accessed by surface disturbance within the boundary of Permit 4285F. Existing site conditions, such as vegetation composition, soil structure, hydrologic patterns, and socioeconomic settings would not be altered by coal recovery operations.

#### **Alternative 2 (Recommend Approval – Preferred Alternative)**

This alternative recognizes the need for allowing coal to be recovered in compliance with SMCRA. These protections are designed to comply with the BLM coal lease stipulations for wetland protection and complement the U.S. Fish and Wildlife Service (USFWS) document of September 24, 1996, entitled *Formal Biological Opinion and Conference Report on Surface Coal Mining and Reclamation Operations Under the Surface Mining Control and Reclamation Act of 1977*.

This alternative is based on OSM's understanding that the mining operations approved by ODM are intended to prevent surface subsidence by limiting the percent of coal extraction. Should the applicant later propose to employ longwall mining or other high-extraction mining techniques with attendant planned subsidence, such changes would likely require a modification of the proposed mine plan described in Alternative 2 of this EA. The ASLM would then have to render a decision on the mine plan modification as required by Federal regulations at 30 CFR 746.

#### **Alternative 3 (Recommend Approval with Special Conditions on Mining Operations)**

OSM would recommend that the ASLM's approval require the applicant to refrain from, or to institute, certain activities. Such requirements would be in addition to those of the approved SMCRA permit, the Resource Recovery and Protection Plan approval, the coal lease, and the seven standard requirements applied to each mining plan approval. Because no additional conditions to the mining plan approval are necessary, this alternative is not discussed in the following assessment.

## **2.2 Alternative Uses of the Available Resources**

This mining operation does not involve any unresolved conflicts concerning alternative uses of the available resources. Therefore, consideration of alternatives pursuant to section 102(2)(E) of the National Environmental Policy Act of 1969, 42 U.S.C. 4332(2)(E) is not required.

## **Chapter 3. Affected Environment and Environmental Consequences**

### **3.0 Introduction**

This chapter summarizes the physical, biological, and social environments of the action area. It examines how implementing each alternative may affect that environment. The chapter also presents the analytical basis for the comparisons of alternatives presented in Chapter 2. Indirect, direct, and cumulative effects were considered in this analysis.

The action area is defined as all areas that may be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. It encompasses the geographic extent of environmental changes that will result directly and indirectly from the action. The permit area/boundary is defined as the boundary of SMCRA Permit 4285F issued by ODM. The lease area/boundary is defined as the boundary of the Federal coal lease issued by BLM and the limits of all mining of federally owned coal. The project area is defined as the combined boundary of the permit and lease areas (fig. 2). The disturbance area is defined as the limits of all surface disturbance activities within the permit area as currently described by Permit 4285F.

### **3.1 Existing Conditions and Alternative Analysis**

#### **Physical Environment**

##### *(a) Topography and Land Use*

###### **(1) Existing Conditions**

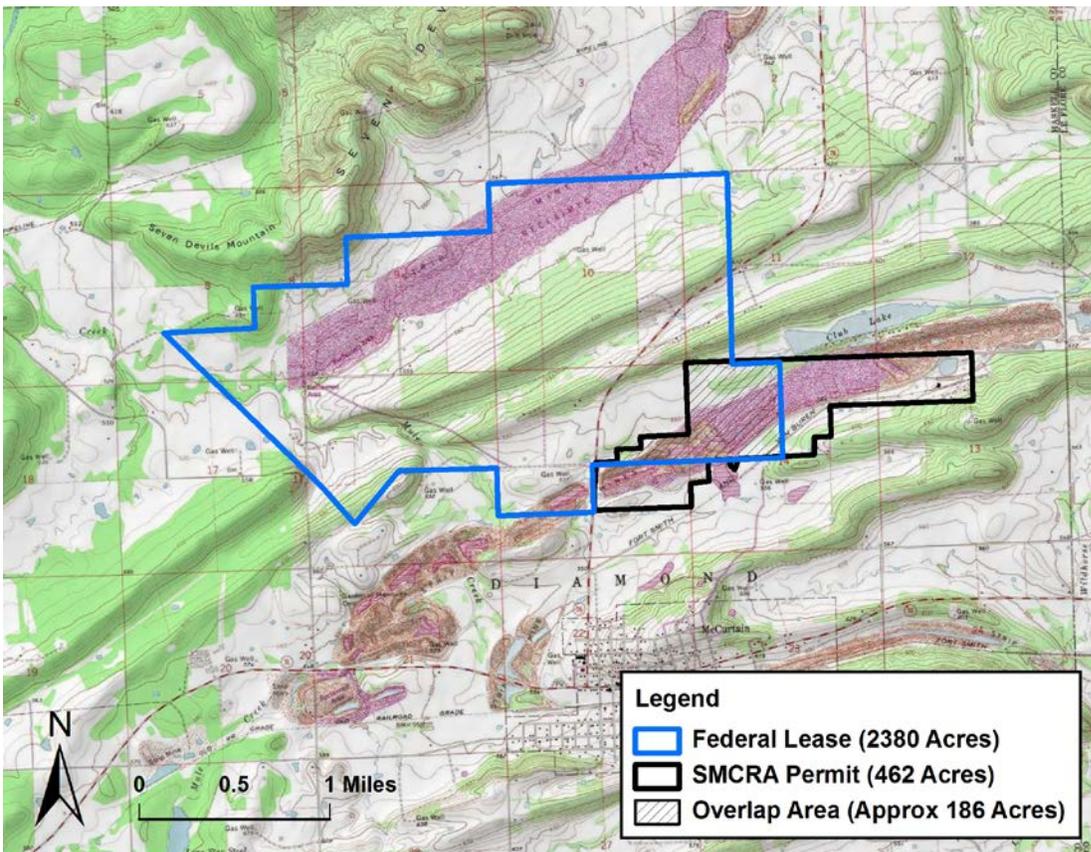
The 2380-acre lease area contains less than half of the 462-acre proposed McCurtain SMCRA mine permit area (fig. 2). The dominant topographic feature of the project area is a pair of closely spaced ridges that run diagonally northeast–southwest. The underlying geology controls the topography of the area. This part of Oklahoma is in the Arkoma geologic basin where bedrock has been folded into a series of east-trending synclines and anticlines. Erosion-resistant sandstone forms the ridges present in the area while intervening valleys developed in thicker beds of more easily erodible shale (Slack, 1983). Elevations in the project area range from 500 feet to 700 feet above mean sea level.

Two surface mined coal seams outcrop parallel the ridges at the northwest and southeast borders of the project area. A surface mine, reclaimed under the Oklahoma abandoned mine lands program, operated in the northern portion of the project area. That mine, located in the Stigler coal seam, advanced in a northwesterly direction down the dip of the coal seam outcrop. The Stigler coal seam is stratigraphically located above the Hartshorne seam. Partially reclaimed or unreclaimed spoil piles and final-cut impoundments in the southern portion of the lease area are the result of surface mining operations at the Hartshorne coal seam outcrop. This surface mining operation also advanced to the northwest, which is down dip from the coal outcrop. Mining apparently ceased when it became uneconomical to remove ever-thickening overburden above the Hartshorne Coal. The proposed McCurtain Underground Mine portal and surface support facilities are located within this Hartshorne coal seam abandoned mine land (AML) area.

Mule Creek is the receiving stream for runoff from the project area. The creek exits the area at the far western border after flowing across its southwest corner. Mule Creek cuts through the ridges in the project area. Unnamed tributaries to Mule Creek flow along valleys underlain by shale.

In winter, the average temperature is 63 degrees Fahrenheit. The summer average temperature is 81 degrees Fahrenheit. The total annual precipitation is 45.4 inches. Of this, 25.9 inches, or about 57 percent, usually occurs in April through September. The growing season for most crops falls within this period.

The entire surface of the project area is privately owned. There are 26 land owners and five residences within the boundaries of the lease area. The permit area contains one additional land owner (Farrell-Cooper Land Co.) and no residences. The predominant land uses of the federal leased area are undeveloped woodlands, grazing land, and pastureland. The majority of the mine permitted site (296.7 acres) can be classified as undeveloped woodland due to dominant vegetation types and lack of land management practices. The permit area does not currently support any areas of managed pasture. However, 102 acres of the site are classified as grazing land by the permittee. FCMC has also classified 54.4 acres as developed water resources. This water acreage is distributed among more than a dozen separate features ranging from less than a half acre to more than 20 acres. The majority of this water supports cattle grazing and recreation, such as fishing.



**Figure 2.** Surrounding topography and identification of permit and lease boundaries.

## (2) Direct and Indirect Effects by Alternative

Alternative 1: Under this alternative, there would be no change to the existing topography or land use of the permit area.

Alternative 2 (Preferred Alternative): Under this alternative, ODM permit performance standards require that the land disturbed by mining activities be restored to its approximate original contour. Mine spoil will be used to eliminate highwalls and depressions.

Of the 462 acres within the permit boundary, approximately 245 acres will be disturbed by mining operations. The applicant has proposed land use changes for the disturbance area. The changes are identified in Table 1. The postmining land uses of improved pasture and water are not consistent with the undeveloped premining land use. However, the landowners have agreed to this alternative postmining land use. An approved pasture forage seed mix will be used as ground cover for the majority of the reclaimed areas. The proposed postmining land-use plan will add 202.8 acres of improved pasture while reducing the acreage of undeveloped land, grazing land, and water resources. As a result of this alternative, the productive capacity of the land for livestock will be enhanced.

**Table 1.** Land-Use Accounting

Land-Use Category	Premine Acres	Postmine Acres	Difference in Acreage
Undeveloped	296.7	153.0	-143.7
Grazing Land	102.0	58.8	-43.2
Roads	5.3	3.0	-2.3
Water	54.4	38.9	-15.5
Fish and Wildlife	3.6	5.5	+1.9
Pasture Land	0.0	202.8	+202.8
Total	462.0	462.0	0

The impacts to land use will be long-term and moderate. Wildlife habitat will be reduced, but forage for livestock will increase. Cumulative impacts will be minor because private landowners in Haskell and similar rural counties cycle their property between improved pasture and undeveloped land to meet personal and income needs.

The Hartshorne coal seam is approximately 48 inches thick and will be mined to a maximum depth of 1,300 feet. This 1,300-foot thick overburden includes the McAlester Formation of the Pennsylvanian System. This formation overlies the Hartshorne coal seam and includes several thin sandstone units—the Warner, Lequire, Tahama, and Keota Sandstones in ascending order—separated by thick mudrock sections of the McCurtain Shale and other unnamed shale members. Several thin seams of coal occur as well within this section.

Initially four main entries will be driven 20 feet wide on 90-foot centers with crosscuts on 120-foot centers within the first main. These entries from the portal face up along the highwall will be driven down the northern limb of the Milton anticline at a slope of 7 degrees. Coal production panel development will begin 515 feet from the highwall off the main entries on strike with the coal seam with 20-foot wide pillars on 60 to 70 foot centers.

Occupied dwellings and structures will be undermined. However, no secondary recovery (retreat mining) of pillars will occur under these dwellings or their associated structures within a 20 degree angle of draw. The applicant may conduct retreat mining under other areas and perform pre-subsidence surveys prior to secondary recovery. The survey reports will be forwarded to the ODM. Any pillar design changes will be submitted to the ODM for approval prior to secondary

recovery operations. The applicant is also required to gain written permission from BLM’s authorizing official before subsiding any stream, wetland, or riparian zone within the lease area.

There are no schools, churches, public buildings, and public parks within the lease area. However, there are several occupied dwellings, roads, transmission lines, and utility lines within this area. Prior to the opening/driving of panels from the first main; expected panel dimensions, planned pillar sizes, and surface structures will be submitted to ODM for approval. ODM will then determine any pillar size changes to be implemented and/or any pre-subsidence survey requirements. Should the crushing of pillars occur and result in surface expression, the applicant will inspect the damages and implement corrective actions approved by ODM.

Impacts to topography will be permanent and moderate. Establishment and reclamation of mine support facilities will result in moderate changes in elevation and surface drainage patterns. Mining activities will facilitate the reclamation of over 160 acres of previously disturbed abandoned mine lands. Abandoned spoil areas and pits will provide the base for a coal mine waste disposal site. The proposed reclamation activities will create a 75-acre hill (mine waste disposal site) with 4:1 side slopes rising approximately 40 feet above the surrounding topography.

*(b) Soil and Agricultural Resources*

(1) Existing Conditions

The U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS) mapped 17 soil units within the permit area. Soil mapping units and corresponding acreage within the boundary of ODM Permit 4285F are detailed in Table 2.

**Table 2:** Soil Mapping Units within ODM Permit 4285F

<b>Soil Mapping Unit Symbol</b>	<b>Soil Mapping Unit Name</b>	<b>Acres within the Permit Boundary</b>
CuA*	Counts silt loam, 0-1% slopes	2.43
CuB*	Counts silt loam, 1-3% slopes	37.56
CvE	Counts-Delta complex, 0-20% slopes	0.28
CwB	Counts-Wing complex, 3-30% slopes	3.53
EhD	Enders-Hector complex, 3-15% slopes	39.36
EhE	Enders-Hector complex, 15-30% slopes	0.29
HIC	Hector-Linker complex, 2-5% slopes	0.30
KaE	Kanima shaley silty clay loam, 1-30% slopes	241.68
LcC	Liberal-Spiro complex, 2-5% slopes	12.37
LdE	Liberal & Collinsville soils, 5-20% slopes, stoney	19.5
LnD3	Linker-Hector complex, 2-8% slopes severely eroded	2.74
NaC*	Naldo fine sandy loam, 3-5% slopes	9.54
NaC2	Naldo fine sandy loam, 3-5% slopes, eroded	19.72
Rf	Rexor soils, channeled	2.62
SrA*	Stigler silt loam, 0-1% slopes	0.27
SrB*	Stigler silt loam, 1-3% slopes	11.31
TmB*	Tamaha silt loam, 1-3% slopes	4.45
W	Water	54.40

\* = prime farmland soil mapping unit

Of the 17 soil mapping units, six are classified as prime soils by the NRCS. The six are CuA, CuB, NaC, SrA, SrB, and TmB. The proposed surface support facilities for this mine will disturb prime soils CuA, CuB, and NaC. A crop history statement signed by the landowner stated the prime farmland mapping units that will be disturbed have had hay crops for only four of the ten years preceding the surface lease by FCMC. This hay crop area is north of the stream in Section 14 that will be relocated. The only disturbance proposed for this area is the construction of the relocated stream. The prime soils within the proposed surface disturbance do not meet the “historic” crop production criterion defined in 30 CFR 701.5 and ODM Regulation 460:20-3-5 for salvage and restoration of the subsoil resource. Cropland is not a proposed postmining land use within the permit area.

Areas of undisturbed natural soils that are excavated in the mine development process will be reclaimed by placing topsoil over non-toxic/acid forming graded spoil. Some areas of “negative determination by crop history” soils will be excavated during relocation of the stream. This soil resource will be used to reclaim areas that did not have topsoil available due to previous mining activities.

The majority of the soils in the 245 acres to be disturbed for surface facilities have been previously affected by surface mining with no or minimal reclamation. These previously mined areas are classified as Kanima shaley silty clay loam (KaE). However, 33.5 acres of the 245 acres have topsoil. For these soils, the average premine topsoil depth is 9.8 inches. The permit issued by ODM approves replacement of this topsoil resource to a depth of 5.5 inches on 55 acres.

## (2) Direct and Indirect Effects by Alternative

Alternative 1: With this alternative, there would be no change in the potential for the soils to produce row, small grain, or forage crops. The topsoil and subsoil would remain undisturbed.

Alternative 2 (Preferred Alternative): Under this alternative, the applicant will only be required to remove and replace the topsoil portion of the soil resource. All topsoil resources will be salvaged and replaced over 55 acres. The top six inches of previously disturbed KaE soils will be salvaged to be used as growth media for the remaining 190 acres. Subsoil materials will not be redistributed to support the potential land uses that were available prior to mining.

As presented in the reclamation plan, soils disturbed and reclaimed by mining activities will support the proposed postmining land use of pasture at productivity rates similar to, or higher than, those available prior to mining. This assessment is based on the loss of rooting depth (no subsoil replacement), breakdown of soil structure, and the effects of spoil compaction during soil replacement. Although impacts to soil resources and potential land use capability will be moderate and permanent, impacts to the historical land use of the soil resources on the site will be minor.

## *(c) Water Resources*

### (1) Existing Conditions

#### *—Surface Water*

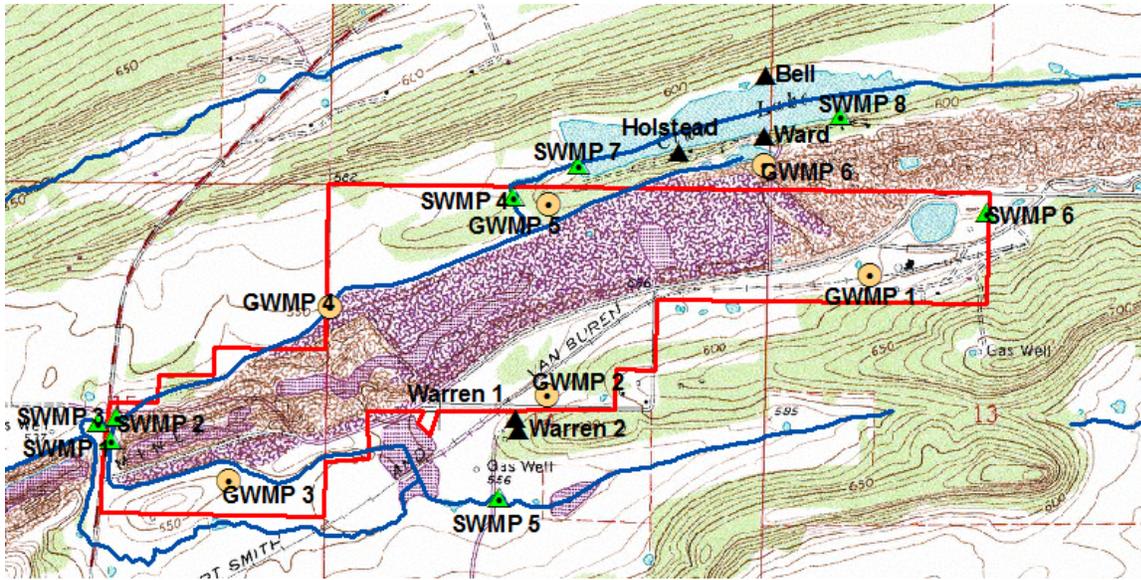
Surface-water resources of the action area consist of a reach of Mule Creek, a number of unnamed tributaries to Mule Creek, and impoundments created from previous coal mining operations. Streams and impoundments are used by wildlife and livestock.

Mule Creek is 0.65 stream miles from the McCurtain Mine permit boundary and has no designated beneficial uses. Another 5.3 miles down Mule Creek is Sans Bois Creek. The Oklahoma Water Resources Board has assigned the following beneficial uses to Sans Bois Creek: public and private water supply, warm water aquatic community, agriculture, industrial and municipal process and cooling water, primary body contact recreation, and aesthetics. About a 28-mile reach of Sans Bois Creek in southwestern Haskell County (well upstream from the project area) does not support primary body contact recreation. The Oklahoma Department of Environmental Quality had a total maximum daily load limit (TMDL) prepared in 2008 for bacteria. From the confluence with Mule Creek, Sans Bois Creek flows about 9 miles northeast before emptying into the 50,000-acre Kerr Reservoir. Kerr Reservoir is part of the McClellan-Kerr Arkansas River Navigation System. The U.S. Environmental Protection Agency (USEPA) 2010 waterbody report for Sans Bois Creek (USEPA 2010) lists this 9-mile reach as impaired by low dissolved oxygen, pathogenic bacteria, and pH. Another 10.8-mile reach of Sans Bois Creek upstream from the confluence with Mule Creek is impaired by low dissolved oxygen, pathogenic bacteria, sulfate, and total dissolved solids. State TMDL development status for these two impaired reaches of Sans Bois Creek is “TMDL needed” (USEPA 2010).

Within the action area, recent measurements of surface-water characteristics are known only for monitoring stations established to support the McCurtain Mine permit application. A U.S. Geological Survey (USGS) study from the early 1980s focused on the hydrology of abandoned mine land just northwest of the town of McCurtain but south of the lease boundary. The study area included a reach of Mule Creek and final-cut impoundments. Mule Creek water was reported to be a sodium sulfate type with median sulfate concentrations that ranged from 26 to 260 mg/L; impounded water generally did not exceed drinking-water limits (Slack, 1983).

Total length of streams the within the project area is approximately 61,000 feet with approximately 10,400 feet within the permit boundary, (according to GIS delineation via the National Hydrologic Dataset (USDA-NRCS, 2012). Impounded water covers about 54 acres. The largest water bodies are pits abandoned after surface coal mining operations of the 1960s and early 1970s.

Four unnamed streams with a total of six monitoring stations (SWMP 1 through SWMP 6) are associated with the proposed mine (fig. 3). All flow to the west, but portions of only three of these streams are within the permit boundary. The eastern-most stream, with its monitoring station SWMP 6 at the permit boundary, is a short waterway that empties into a pond near an abandoned wash plant. The remaining streams eventually combine just west of the permit boundary to form a tributary of Mule Creek, the first named receiving stream for the proposed mining operation.



**Figure 3.** Stream-water monitoring stations (SWMPs), ground-water monitoring stations (GWMPs), and sampled private wells (black triangles) associated with the proposed McCain underground mine (red border encloses ODM Permit 4285F).

The southern-most of the four streams, with station SWMP 5 near the headwaters, will not receive runoff from ground to be disturbed under the proposed permit. Its confluence with other waterways tributary to Mule Creek is just below the furthest downstream monitoring station (SWMP 3) for the McCain Mine. The northern-most stream is fed in part by discharge from the 46-acre Club Lake. Station SWMP 4 is in the upper reaches of the stream, and the downstream monitoring station is SWMP 2. Approximately 6000 feet of waterway separate these two monitoring stations. Much of the channel parallels an abandoned highwall. Another stream, 4215 feet long with a drainage area of about 1.2 square miles, is located across the abandoned pit to the south. This watercourse is monitored at SWMP 1 just before it joins the short reach of stream between SWMP 2 to the northeast and SWMP 3 to the west.

The longest stream that passes through the permit area—the one along the north side of the abandoned final-cut pit—has a drainage area of about 0.4 square miles between SWMP 2 and the Club Lake dam. Club Lake collects runoff from 1.2 square miles. This unnamed watercourse fed by Club Lake discharge is identified as an intermittent stream in the ODM permit application package. During a site visit in July 2011, OSM staff noted small fish and clams in the waterway about 2700 feet downstream from the Club Lake dam. Flow was estimated to be only a few gallons per minute at that location. Because of the aquatic life in the stream and the lack of a “no-flow” reading at SWMP 4, this reach of stream could also be classified as a perennial stream. Since there is no difference between protections afforded a perennial stream compared to an intermittent stream, this EA will discuss this stream as perennial. A portion of this stream will be reconstructed at the northern surface disturbance boundary. The stream is being moved to allow construction of a stable highwall to access the coal seam. As an intermittent or perennial stream, this water body qualifies for protection by a 100-foot buffer zone along each bank. Any disturbance within the buffer zone—in this case relocating the channel—requires a variance. That variance has been granted by ODM. This stream reconstruction is also addressed

in a Clean Water Act, Section 404, Nationwide Permit-21 issued by the Tulsa District Office of the U.S. Army Corps of Engineers.

A monitoring program is in place for those surface-water stations to be regularly sampled throughout the life of the mine. Baseline data are available for the six stream stations plus two more stations, SWMP7 and SWMP 8, on Club Lake (fig. 3). Water testing generally began in the spring of 2010 except that the first analyses of Club Lake samples were from October 2010. Sampling intervals tended to be irregular and the number of baseline water-quality analyses per station varied from one to eight. The permit applicant consistently measured pH, acidity, alkalinity, total dissolved solids, total iron, total manganese, and sulfate. Data for major ions—calcium, magnesium, sodium, potassium, and chloride—were not available for every baseline sampling event.

A single round of samples was also collected from seven surface-water sampling points at impoundments within the mine plan area. This was intended to be a one-time event because many of these water bodies will not exist postmining. This set of analyses did not include the full complement of major ions.

Figures and tables in Appendix A present analyses of the baseline surface-water data. Among the three categories of surface water—streams, Club Lake, and AML impoundments—Club Lake had the lowest median concentrations of iron, manganese, sulfate, and dissolved solids. The manganese concentration in lake water, however, was just over twice the USEPA national secondary drinking water standard of 0.05 mg/L. Median pH, acidity, and alkalinity of Club Lake water were lower than measured in the mine plan area. AML impoundments had the poorest quality water, but that was still generally protective of aquatic life and is suitable for consumption by wildlife and livestock.

Those water bodies for which major ions had been measured (the streams and Club Lake) produced samples of a magnesium- or calcium-bicarbonate type except that samples from station SWMP 1 were a magnesium-sulfate type. SWMP 1 stands out from the other monitoring stations on the Stiff diagrams and Durov plot in Appendix A. Runoff from previously disturbed and unreclaimed ground passes through SWMP 1.

Statistically, there was no difference at the 95 percent confidence level between values for 13 of 14 stream monitoring parameters in data sets for SWMP 4 (about 800 feet downstream from the Club Lake dam ) and SWMP 3 (the furthest downstream monitoring point on the tributary to Mule Creek). The Mann-Whitney comparison-of-medians test detected a statistically significant difference only in total dissolved solids which was higher at SWMP 3.

#### *—Ground Water*

As with stream water, ground-water characteristics of the action area are known primarily from information contained in the McCurtain Mine permit application. Older data are available from a USGS hydrology study. The USGS drilled five wells in 1980. Four wells were installed in spoil and one was drilled into nearby bedrock. Ground water, predominately a sodium sulfate type, was alkaline with median pHs that ranged from 7.2 to 7.6 and concentrations of dissolved solids, iron, manganese, and sulfate that generally exceeded drinking-water standards (Slack, 1983).

Ground water is produced from monitoring wells within the proposed permit boundary for the McCurtain underground mine and from private wells adjacent to that boundary. Water-quality information is presented in Appendix B by Durov plots, Stiff diagrams, and tables.

FCCM had six monitoring wells installed in boreholes drilled to depths that range from 40 feet to 175 feet (fig. 3). Shallow wells (GWMP 1 through GWMP 3) were completed in sandstone, interbedded sandstone and shale, or shale above the Hartshorne coal bed in the up-dip direction. The three deeper wells (GWMP 4 through GWMP 6) are screened across this northwest-dipping coal seam. Monitoring wells produced 0.002 gallon per minute to 0.05 gallons per minute.

The baseline quality of water from these six McCurtain Mine monitoring wells was generally fair. Median iron concentration and median manganese concentration both exceeded USEPA national secondary drinking water standards (0.3 mg/L and 0.05 mg/L, respectively). Median total dissolved solids, at 498.5 mg/L was close to the national secondary standard of 500 mg/L. Ground-water samples were either of the calcium/sodium-bicarbonate type or sodium-sulfate type. One sample taken from GWMP 6 (the deepest well) had anomalously high concentrations of sulfate (22,000 mg/L), magnesium (3400 mg/L), sodium (31,000 mg/L), potassium (7200 mg/L) and total dissolved solids (65,000 mg/L). That same GWMP 6 sample and one other from this well had iron concentrations mostly 100-or-more-times higher than reported for samples taken from other wells of the ground-water monitoring network. Median water-quality values at GWMP 6 tended to be not so different from median values at the other monitoring wells. Unlike stream water, samples from monitoring wells show a greater variation in the concentrations of major ions; this is indicated by the lack of data-point clustering in the central box of the Durov plot.

Despite the low yield of the rock strata tapped by the monitoring wells, local bedrock does provide useable quantities of water to private wells. Several residences within one-half mile of the proposed permit boundary have wells. However, only five residents gave the permit applicant information about their wells and requested that a water sample be tested (fig. 3). Two properties each had two wells. The permit applicant could not sample one pair of wells because these had been "closed for winter." Among the five wells that the permit applicant sampled, two produced water for domestic purpose (presumably drinking water) and the other wells were either not used or supplied water for nondrinking use. Water types were either sodium-bicarbonate or, in one case, sodium-sulfate. Private wells range in depth from 50 feet to 65 feet, but two wells are of unknown depth. The two wells of unknown depth are south of the abandoned final-cut pit and within 500 feet of the proposed permit boundary. The other three wells are along the shore of Club Lake.

Four of 12 median values of water-quality characteristics for private wells fell outside the 95% confidence interval for median water-quality characteristics for monitoring wells. Median pH was below the confidence interval while total iron, sulfate, and chloride, were above the confidence interval calculated for the six monitoring wells.

## (2) Direct and Indirect Effects by Alternative

Alternative 1: Since there would be no mining or reclamation operations, there would be no change in surface- or ground-water quality or quantity under this alternative.

Alternative 2 (Preferred Alternative):

### —*Surface Water*

The quality of surface water may deteriorate during mining primarily due to increased concentration of sediments. Earth materials will be mobilized during the construction of sedimentation ponds and diversion channels and the relocation of the highwall stream. Once these features of the water-management plan are in place, all mine runoff will be routed through sediment ponds before being discharged through Mule Creek and Sans Bois Creek and on into Kerr Reservoir. Potential impacts to Mule Creek could occur during construction of water-control structures but they will be minor and temporary. No measureable effects are expected for Sans Bois Creek or Kerr Reservoir.

Mining will relocate an approximate 2,500-foot reach of stream toward the north, away from the portal development area. As shown on the Post-Mining Land Uses and Wildlife Enhancement Plan Map (MP-7 of the PAP), no other streams within the permit will be relocated.

Ordinarily, under a plan of recovering coal using the room-and-pillar mining method with 50% coal extraction, there will be no planned subsidence and, therefore, little if any, impact on surface-water drainage. The Resource Recovery and Protection Plan (R2P2) approved by BLM recognized that retreat or secondary mining (shaving or splitting of coal pillars that support the mine roof) and/or full pillar extraction might be employed with restrictions at the McCurtain Underground Mine. This additional mining could increase the recovery to an average of 70% of the minable reserves. The R2P2 approval is conditioned so that secondary extraction operations will not occur under fixed structures, occupied dwellings, or protective zones. Protective zones include areas underlying Mule Creek, its tributaries, wetlands, and other water bodies. A patchwork pattern of collapsed mine voids could permanently affect the overlying topography. Depressions produced from mine subsidence might collect enough runoff to periodically reduce the productivity of the land. Those water bodies shielded from subsidence may lose some drainage area should land outside the protective zone eventually subside.

The permittee has not proposed to mine the Hartshorne Coal by longwall mining or other planned subsidence mining techniques. Consequently, there is no engineering or environmental analysis in the permit document for planned subsidence.

The surface area of impounded water of the permit area will decrease from 54.4 acres premine to 38.9 acres postmine (Table 1). Water in the main abandoned final-cut pit will be pumped out. This activity will allow the highwall to be cut back to expose competent bedrock for the mine portals. Another existing impoundment, located along the Hartshorne seam AML highwall will also be dewatered. The resulting low areas will be filled with coal processing waste. Water from the impoundment will pass through a sediment pond and then discharge to another abandoned final-cut pit in the southwest corner of the permit area. At the conclusion of underground mining operations, an approximate 16-acre impoundment will be established at the

portal area. Another much smaller pond, about 2.5 acres, will be constructed for the mining operation and remain as a postmining feature.

Impacts to surface water resources within the permit area will be moderate and permanent due to the decrease in water resource acreage that supports the postmining land use change to improved pasture. Unlike the existing final-cut impoundments, the new water bodies will presumably allow easier access by cattle. Impacts to surface water resources external to the proposed surface disturbance of the project will be very minor and permanent. Postmining runoff may be somewhat greater than premine. A planned 28% decrease in impounded water surface area means less water will be lost through direct evaporation.

The permittee will be required to systematically monitor stream-water quantity (stream flow) and quality to demonstrate the successful completion of mine reclamation. This monitoring will be in addition to what is required under the separate NPDES permit for sediment-pond effluent.

#### *—Ground Water*

Hydraulic characteristics of mine-site bedrock down to and including the Hartshorne coal bed, as measured at the monitoring wells, suggests a hydrogeologic setting that has little capacity to store and transmit useable quantities of ground water. If this is the case, the effects of the proposed mining operation on ground-water resources will be highly localized. Nevertheless, there are a few water-supply wells in this area.

Information about the construction of the private wells is very limited, but their reported range of depth falls within that of the monitoring wells. The area adjacent to the proposed mine is underlain by an aquifer (or aquifers) of undetermined extent and depth. An aquifer is a saturated subsurface rock or sediment body that is sufficiently permeable to transmit economic quantities of water to wells or springs. Well test results, in particular the very low numbers reported for flow, indicate that none of the monitoring wells tap a local aquifer. A local aquifer (or aquifers) has limited areal extent, but could still be affected by the proposed coal recovery and reclamation operation. Ground-water supply at private wells will decrease where the underground mine works are hydrologically connected to the aquifer.

Water quality at private wells could be affected by on-site refuse (coal processing waste) storage. Coal processing waste is a potentially acid-forming earth material. The ODM permit requires the operator to isolate these potentially toxic materials from the ground-water system. Earth materials with very low permeability will be used to line the disposal areas. Similar earthen material will be used in the 4-foot-thick cap over the refuse. The upper portion of the refuse will be tested and neutralized with agricultural limestone before it is capped and a soil/rooting layer is put in place to support the improved pasture postmining land use.

The ODM permit also requires the mine entries to be sealed when underground mining operations are complete. The mine entries will be sealed to reduce the possibility of surface water entering the abandoned mine works and generating acid mine drainage.

Impacts to ground-water resources are not as easy to assess as those to surface-water resources because of the unknown lateral extent of any localized aquifers. Among the few private wells identified within a half mile of the permit boundary, two will be 600 to 900 feet from the coal

refuse waste deposit. If there were to be a hydraulic connection between waste deposits and aquifers, a favorable hydraulic gradient could drive mineralized water out of the waste areas and eventually into private wells. Travel time for water from the refuse disposal area to the nearest private wells could be 80-some years based on a rough calculation of average linear velocity using the highest hydraulic conductivity from the monitoring well tests ( $1.3 \times 10^{-3}$  cm/sec), a hydraulic gradient of 0.01, and an effective porosity of 0.22. The potential effect on the water-supply wells could be long term.

Wells drilled into shallow aquifers above mine works might exhibit a water-level drop should the underlying mine void collapse. Rocks may respond to tensile stress caused by roof falls into the mine void by fracturing vertically and separating along bedding planes. These responses suddenly increase aquifer porosity. Lowered water levels spread outward through the aquifer as water flows toward the zone of increased porosity. Provided fractures are not opened from the caved-in mine works to the aquifer, recovery of water levels in shallow aquifers may occur within a few months to a few years after a localized mine void collapse. Fracture-enhanced permeability within a subsidence zone may make overlying wells more productive in the long term.

The permittee will regularly test water produced from monitoring wells. Ground-water testing will continue throughout the mining and reclamation phases until the state releases the permittee from final reclamation liability and returns the bond. Monitoring parameters will include total dissolved solids. SMCRA regulations require the permittee to replace an underground or surface water source in legitimate use that has been contaminated, diminished, or interrupted by the mining operation.

#### *(d) Stream, Wetland, and Floodplain Concerns*

##### *(1) Existing Conditions*

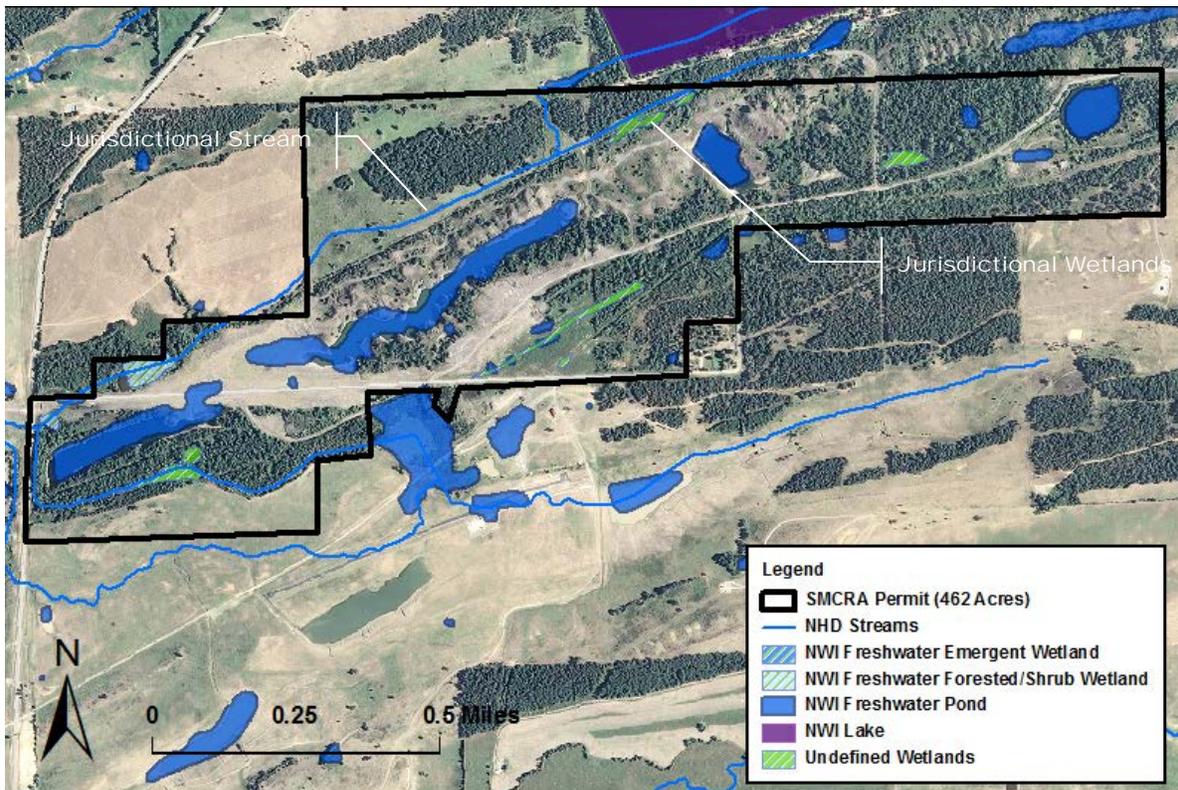
Stream resources within the permit boundary are limited to the few small watercourses described in the preceding section. These features are channelized and lack well defined floodplains (fig. 4). The permit area is not within a recognized floodplain of some larger stream (Mule Creek or Sans Bois Creek) or the Kerr Reservoir.

The National Wetlands Inventory (NWI) identified 18 records of features within the permit boundary including 16 freshwater ponds (50.4 acres) and 2 forested/shrub wetlands (2.7 acres). Figures 5 and 7 show the locations of NWI features. The NWI



**Figure 4.** Riparian area within the proposed McCurtain permit area.

forested shrub wetlands are located at the northwest corner of permit area outside of the proposed disturbance area. None of the riparian zones associated with the streams within the permit area were identified as wetlands by the NWI.



**Figure 5.** National Wetlands Inventory (NWI) polygons, existing streams, and other identified wetlands within the permit boundary of the McCurtain Mine.

Additional wetlands were identified by the USACE while issuing a nationwide permit (NWP 21) for jurisdictional wetlands under the Clean Water Act (CWA). They include 2870 feet of stream channel and 0.62 acres of undefined wetlands within the proposed disturbance area. If impacted, the NWP establishes mitigation guidelines calling for the recreation of 4305 feet of stream channel and 0.84 acres of wetlands.

The permit area contains approximately 6 additional acres of undefined wetlands. The majority are isolated pockets of shrub-scrub and emergent wetlands not considered jurisdictional under the CWA. The mine permit classifies these areas as either developed water resources or fish and wildlife habitat.

## (2) Direct and Indirect Effects by Alternative

**Alternative 1:** With this alternative there would be no change in the surface water values. Drainage patterns associated with the streams would not be modified. All ponds and wetlands would remain unaltered.

**Alternative 2 (Preferred Alternative):** Under this alternative, the applicant will mine through and replace approximately 2870 linear feet of jurisdictional perennial stream channel and adjacent

riparian areas. FCMC will reconstruct the stream including a 50-foot riparian buffer zone approximately 300 feet to the north of its current location. The constructed channel is intended to mimic the characteristics of current conditions including a meandering inner-berm channel and riffle-pool complexes. FCMC will utilize boulders, tree trunks, and rootwads to provide “natural” habitat features. Detailed stream morphology design specifications within the approved SMCRA permit and 404 mitigation plans are limited. Available cross section design plans within the SMCRA permit require increases in both channel width and depth creating a trapezoidal cross-sectional profile with greatly reduced bank slopes. This change to the stream’s dimension will increase the channel’s capacity and in the near -term reduce flood frequency. However, the oversized channel will quite likely aggrade over time and develop a new narrower channel within. Without sufficient details in the proposed designs or baseline surveys it’s difficult to precisely predict channel evolution or how these changes to the stream’s current morphology will impact in-stream and downstream form and function in the near and long term.

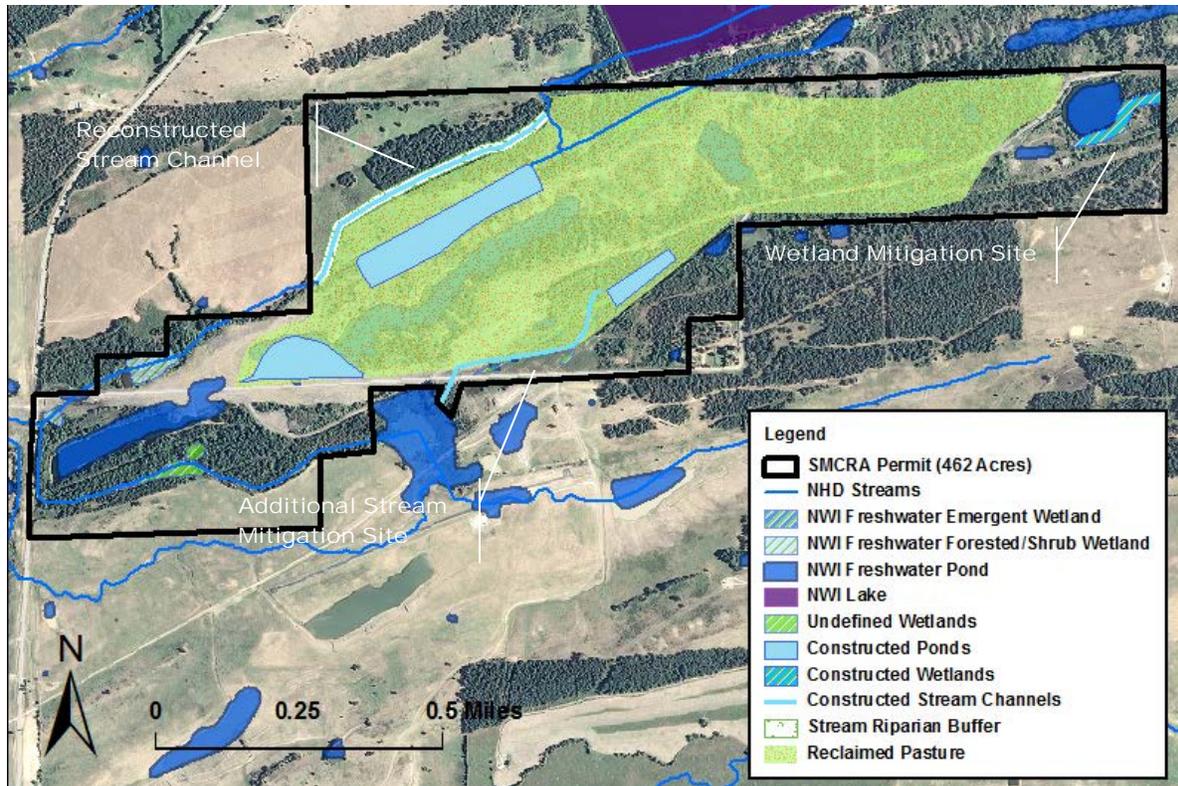
The constructed stream will be monitored throughout the life of the mining activity. This period will exceed the USACE’s required five-year timeframe. For the purpose of the USACE, the stream will be monitored each year after construction, and annual reports will be submitted to the USACE. Trees and shrubs will be counted in the third year of monitoring. If the survival rate is less than 75% of 300 trees per acre, additional trees and shrubs will be planted. Should trees meet the required 5-year survival rate and the stream is functioning as designed with morphology and aquatic life comparable to what existed before proposed mining, FCMC will ask permission from the USACE to terminate the monitoring requirements.

In order to meet CWA Section 404 mitigation requirements, FCMC will receive credit for constructing 2470 feet of additional ephemeral stream channel. This stream is integrated into a berm channel intended to drain the southern edge of the permit area. The approved mitigation plan calls for incorporating natural stream design features such as riffles and pools, but does not specifically require the planting or maintenance of a riparian buffer zone or establishment of any monitoring plan.

FCMC will mine through and/or fill approximately 42.26 acres of ponds and developed water resources. They will also construct four new ponds and impoundments totaling 26.76 acres. The anticipated loss of surface water on site is 15.5 acres or 29%. This loss includes approximately four acres of undefined non-jurisdictional wetlands.

FCMC will avoid 0.20 acres and directly impact approximately 0.42 acres of jurisdictional wetlands. The approved NWP21 mitigation plan calls for the creation of a 1.5 acre emergent wetland. FCMC intends to construct this wetland at the far eastern end of the permitted area adjacent to a large existing pond (fig. 6). The constructed wetland will be monitored quarterly (with annual monitoring reports sent to USACE) and must meet an 80% ground cover rate of desirable wetland or aquatic plants species within three years.

Impacts to the stream, wetland, and floodplain resources within the disturbance area will be moderate and permanent because of the decrease in developed water and wetland acreage and the change from unmanaged hydrophilic vegetation to improved pasture. Cumulative impact to the watershed of the coal recovery area will be minor because the total acreage modified by the mining operation is a small percentage of the actual watershed acreage.



**Figure 6.** Anticipated postmining configuration of streams and wetlands within the McCurtain Mine permit.

## Biological Environment

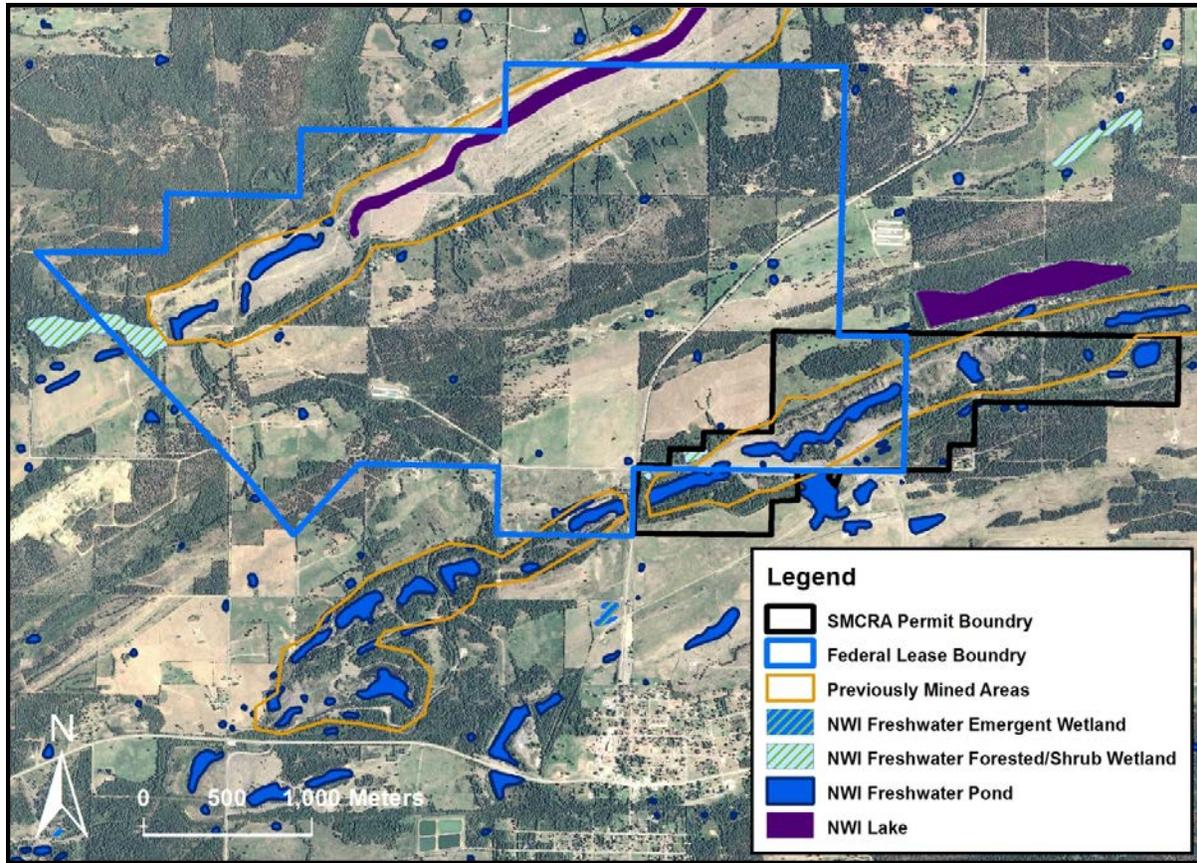
### (a) Vegetation

#### (1) Existing Conditions

The action area lies within the western most portion of Arkansas Valley Plains, a USEPA Level IV Ecoregion (37d). The Arkansas Valley Plains are located within the rain shadow of the Fourche Mountains and features a mildly undulating topography on droughty soils. Historically, large areas were subjected to routine fire which facilitated widespread prairies with scattered savanna and woodland cover types. Woodlands within the Arkansas Valley Plains are primarily dominated by oak-hickory or oak-hickory-pine forests (Anderson, 2006). Current and past land uses have converted much of the natural prairies and savannas within the ecoregion to pasture and hay land.

Historically, the action area was likely entirely forested. However, prior mining and tree clearing for grazing purposes have highly altered the vegetative community. Most of the permitted area was surface mined in the 1960s and early 70s, as was an additional section on the northwestern edge of the lease area (fig. 7). Areas unsuitable for grazing purposes due to steep unreclaimed spoil ridges were quickly colonized by local volunteer species. A small portion of the western side of the permit area was regraded and reclaimed to pasture in 2006 by the

Oklahoma Conservation Commission’s Abandoned Mine Land Program (OCC). Four distinct vegetation types exist within the action area. The vegetation types include (A) oak-hickory woodlands, (B) grazingland with native and introduced grasses, (C) improved Bermuda grass pasture, and (D) wetlands.



**Figure 7.** Premine vegetation (aerial photo: 2010 National Agriculture Imagery Program).

#### A. Oak-Hickory Woodland/Forest

The primary vegetation community of the action area is a woodland complex with an oak and hickory association. The common canopy species found on the site include post oak (*Quercus stellata*), black oak (*Quercus velutina*), American elm (*Ulmus americana*), hickory (*Carya sp.*), white oak (*Quercus alba*), hackberry (*Celtis occidentalis*), and sycamore (*Platanus occidentalis*). Common understory trees for this association include flowering dogwood (*Cornus florida*), redbud (*Cercis canadensis*), persimmon (*Diospyros uirginiana*), and eastern redcedar (*Juniperus virginiana*). Additional understory woody vegetation includes: sumacs (*Rhus spp.*), hawthorns (*Crataegus spp.*), honeysuckle (*Lonicera spp.*), blackberries (*Rubus spp.*), greenbriers (*Smilax spp.*), and Virginia creeper (*Parthenocissus quinquefolia*). The herbaceous components of the wooded areas within this association are dominated by grasses. Common species include switchgrass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), and broomsedge bluestem (*Andropogon virginicus*).

The current successional stage of these woodlands varies across the action area from mid-successional to full climax. The areas cleared by mining or logging within the last 30-50 years feature reduced canopy coverage and a higher proportion of herbaceous plants as well as faster growing soft wood species. If left undisturbed, these areas will eventually develop into a well forested oak-hickory climax community. Grazing activity has also impacted the composition and natural succession of these woodlands. Over grazing limits the establishment of climax species like oaks and hickories, encourages the spread of invasive species, and reduces the coverage rates of palatable grasses and forbs. Some of the previously mined unreclaimed areas on the eastern side of the permit area feature fairly healthy stands of mid-successional oak/hickory woodlands. The steep unreclaimed spoil ridges and valley are less suitable to cattle grazing and as a result these areas have sustained several decades of fairly undisturbed natural succession.

### B. Grazingland with Native and Introduced Grasses

Areas which make up this vegetative community were likely once oak-hickory woodlands (fig. 8). Historical tree clearing coupled with routine grazing has allowed native, non-native, and introduced grasses and forbs to become dominant. Commonly encountered species include:



**Figure 8.** Grazing area with native and introduced grasses within the proposed McCurtain permit area bordered by mid to late succession Oak-hickory woodlands.

switchgrass, Indian grass, little bluestem, big bluestem (*Andropogon gerardii*), Bermuda grass (*Cynodon dactylon*), tall fescue (*Festuca arundinacea*), and sericea lespedeza (*Lespedeza cuneata*). Overgrazing in some portions has allowed the establishment of less palatable invader species such as broomsedge bluestem (*Andropogon virginicus*), western ragweed (*Ambrosia psilostachya*), crabgrass (*Digitaria* spp.), and foxtail (*Hordeum* spp.).

### C. Improved Bermuda Grass Pasture

The improved pasture within the action area consists primarily of Bermuda grass and tall fescue. Tall fescue is a perennial grass with broad, coarse basal leaves. It is less palatable than many other cool season varieties but is widely adapted to soil and climatic conditions in eastern Oklahoma. Tall fescue grows well on poor soils and furnishes abundant grazing during the late fall and spring. During warmer months when fescue is less productive, Bermuda grass, the primary cattle forage on the site, provides increased grazing potential and opportunities for an economical hay crop. Bermuda is a perennial warm-season grass that spreads by extensive

stolons and underground root stocks (rhizomes). Bermuda grass tolerates close, continuous grazing and, like fescue, is drought tolerant. While these exotic forages provide improved land use capability for livestock, they adversely impact vegetative biodiversity through increased competition and colonization over native plant populations.

#### D. Wetlands

The action area contains a diverse array of freshwater aquatic habitats including: open water (lakes and ponds), streams, forested/shrub and emergent wetlands. The vegetative communities of the wetland areas differ significantly from the three previously discussed upland vegetation types. The majority of the aquatic habitats within the permitted area are remnant cuts, spoil piles, and diversion channels left over from historic surface mining in the 1960s and early 70s. These features were colonized by hydrophilic volunteer plant species and naturally developed into beneficial fish and wildlife habitats.



**Figure 9.** Wetland area within the proposed McCurtain permit area.

The majority of wetlands on site include emergent and submergent vegetation, shrub scrub, and dead timber (fig. 9). Commonly encountered species include: pond lilies (*Nymphaea sp*), waterweed (*Elodea sp*), common rush (*Juncus effusus*), smartweed (*Polygonum sp*), rose mallow (*Hibiscus moscheutos*), button bush (*Cephalanthus occidentalis*), water willow (*Justicia americana*), cattail (*Typha sp*), and honey locust (*Gleditsia triacanthos*).

#### (2) Direct and Indirect Effects by Alternative

Alternative 1: With this alternative, there would be no change in vegetation composition other than the normal succession of the woodlands on the site. The continuance of livestock grazing within the area would impact the herbaceous and wooded plant communities. All aquatic resources (wetland, ponds, and streams) and their associated vegetative communities would remain unaltered.

Alternative 2 (Preferred Alternative): Impacts to vegetation resulting from Alternative 2 include the conversion of 203 acres of woodland, native grasslands, and wetlands to improved Bermuda grass pasture.

Oklahoma's Comprehensive Wildlife Conservation Strategy has identified Post Oak/Blackjack Oak Woodland as a Moderate Priority Conservation Landscape. The report cites a lack of historic fire regime and fragmentation due to land use conversion as the primary conservation issues. According to the Partner's in Flight Bird Conservation Plan for the Ozark Ouachitas (Physiographic Area 19), 50% of Haskell County is forested. The expected loss due to mining activity is less than 0.1% of the total forested area in Haskell County.

Providing moderate flexibility with regards to planting season and conditions, Permit 4285F requires FCMC to establish a minimum of two permanent cover species from an approved seeding list included in the permit's appendix. Species approved for planting on areas reclaimed to pasture include: Bermuda grass, tall fescue excluding KY-31, crimson clover (*Trifolium subterraneum*), perennial ryegrass (*Lolium perenne*), common lespedeza (*Lespedeza striata*), weeping lovegrass (*Eragrostis curvula*), redtop (*Agrostis alba*), dalliagrass (*Paspalum dillatatum*), and bahiagrass (*Paspalum notatum*). Species approved for planting on areas reclaimed to fish and wildlife habitat include: big bluestem, little bluestem, Indiangrass, switchgrass, sideoats grama (*Boutelous curtipendula*), partridge pea (*Cassia fasciculata*), common lespedeza, and native sunflower (*Helianthus maximiliani*). Other species found more suitable in the future may be planted with written approval from the ODM.

Tall fescue is a cool season perennial grass native to Europe. Fescue forms dense, low growing mats, which inhibit the establishment of other plant populations (both woody and herbaceous). Tall fescue is also allelopathic. An allelopath releases toxic substances that suppress the growth of surrounding plants. Tall fescue may become invasive in some habitats and displace desirable vegetation if not properly managed. Tall fescue's drought tolerance is enhanced by the presence of an endophytic fungus, *Neotyphodium coenophialium*, which produces alkaloids toxic to wildlife and livestock (Bates, 1997). Most fescue pastures in the United States are dominated by a tall fescue variety known as Kentucky 31. These pastures are highly endophyte infected. Fescue toxicity can cause several different ailments to cattle and horses including fat necrosis, gangrenous extremities, loss of milk production, foaling problems and death (Puntum and others, 1990). Varieties of endophyte-free and novel endophyte tall fescue are now readily available throughout the country. Novel endophyte varieties of tall fescue contain special strains of the fungus which are non-toxic but still provide the benefits of drought tolerance and pest resistance. Permit 4285F has approved the planting of tall fescue on lands reclaimed to pasture but prohibits use of the Kentucky 31 cultivar.

Reclamation to improved pasture will increase available forage crops for livestock and hay production. However, the indirect and long-term effects resulting from exclusive pasture reclamation include the loss of native plant populations and a decrease in the wildlife diversity that they support. Under this alternative, forage availability for cattle will increase at the expense of losing native plant communities well into the foreseeable future. Impacts to the existing vegetation resources will be moderate and permanent within the disturbance boundary. More than 140 acres of land with an undeveloped land use (unmanaged woodland habitat) will be converted to improved pasture. This change is consistent with the desire of the surface owners to place their property in production for support of increased livestock operations. The cumulative impact to vegetation in the local area becomes very minor because the acreage is a

very small percentage of the total forested and woodland acreage available to support wildlife resources.

*(b) Fish and Wildlife Resources*

(1) Existing Conditions

Overall wildlife resources are directly related to the habitat types occurring on the site. Existing wildlife habitat within the action area includes: mid-successional oak-hickory woodlands, grazingland with native and introduced grasses, improved Bermuda grass pasture, and aquatic resources including wetlands, ponds, and streams. State and Federal fish and wildlife agencies have not identified any sensitive habitat required for migratory birds of high Federal interest within the proposed project area. The USFWS and the Oklahoma Natural Heritage Inventory (ONHI) list the American burying beetle as an endangered species that may be found within the action area.

Common forest species of southeast Oklahoma are expected to occupy most of the project area and include up to 48 mammal species in addition to a wide variety passerine birds, reptiles, and amphibians. A few black bears may be present. The more open early-successional woodlands and unmanaged pasture areas provide habitat for eastern cottontail rabbits, coyotes, raccoons, beaver, striped skunk, opossum, and red fox.

Wildlife diversity on the permit area is enhanced by the small streams, shallow herbaceous and forested wetlands, and large and small ponds. These landscape features provide a drinking water source for larger mammals, larval habitat for a variety of amphibians, habitat for reptiles associated with water, succulent herbaceous browse in the form of hydrophytic vegetation, and foraging areas for insectivorous bats and birds.

White-tailed deer and game bird species such as the eastern wild turkey and northern bobwhite are the most important game species in the action area. Northern bobwhite populations within the vicinity of the permit area have been substantially reduced by the conversion of native grasslands to coastal Bermuda grass and tall fescue. Small populations of mourning doves may inhabit open land during the annual migrations. Important small game mammals in the area include eastern fox squirrel, eastern gray squirrel, and eastern cottontail rabbit.

A diversity of nongame wildlife species (i.e. passerines, raptors, amphibians, and reptiles) are associated with habitats of the action area. The dominant habitats found within the area –oak-hickory woodlands—support a variety of resident and seasonal nongame species. Passerines are numerous and use the entire range of the site.

FCCM conducted a bird survey of the site in September of 2011. FCCM's survey identified 13 species of migratory birds (as defined by USFWS's official migratory bird list) within or in close proximity to the permit area. The migratory birds found during the survey include the following: great blue heron, turkey vulture, eastern meadowlark, field sparrow, red winged blackbird, American crow, great roadrunner, red-bellied woodpecker, red shoulder hawk, mourning dove, hairy woodpecker, and tufted titmouse. Species lists from a nearby breeding bird survey route (Pocola) were reviewed to identify additional species common to the area that are expected to occupy the premining habitats on the permit area. Common migratory bird species expected to

use the woodlands of the site are yellow-billed cuckoo, downy woodpecker, eastern wood-pewee, great crested flycatcher, eastern kingbird, summer tanager, chipping sparrow, and Baltimore oriole. Common migratory bird species expected to be utilizing the early-successional woodlands and scrub habitats on the site include Bell's vireo, northern mockingbird, common yellowthroat, yellow breasted chat, field sparrow, northern cardinal, blue grosbeak, indigo bunting, and painted bunting. A full listing of all bird species found in the past ten years at the nearby Pocola Breeding Bird Survey route is provided in Appendix C.

## (2) Direct and Indirect Effects by Alternative

Alternative 1: Under this alternative, no changes would occur to the wildlife habitat characteristics, and, therefore, site conditions would likely remain the same. No temporary impacts such as removal of existing soil and vegetation from the proposed mining area would occur. Existing resident and migrant wildlife species and habitats would remain undisturbed.

Alternative 2 (Preferred Alternative): The loss of habitat and the land use conversion will have a direct and predictable effect on the wildlife populations within the permit area. Land reclaimed to improved pasture will support a different wildlife community—one that is expected to be less diverse and abundant than what is there now.

Wildlife species preferring open, early-successional (recently disturbed) habitats will initially benefit from the effects of mining activities as woodlands and forest are cleared and weedy vegetation invades portions of the mine site. Animals expected to benefit from an increase in early-successional habitats include bobwhite quail, dickcissel, horned lark, field sparrow, meadowlarks, American goldfinch, a wide variety of wintering sparrows (white-throated, white-crowned, Leconte's, field, etc.), coyote, deer mouse, white-tailed deer, hispid cotton rat, and cottontail rabbit. Due to recent population declines, the bobwhite and field sparrow are listed as a priority species for the Partners in Flight Ozark-Ouachita physiographic area.

As disturbed areas are regraded and converted to improved pasture, wildlife diversity and abundance will decrease. Not only do pasture grasses have limited browse and seed value for species such as white-tailed deer, cottontail rabbits, bobwhite quail, and wild turkey, the sod-forming nature and invasive characteristics of the forage crops will displace other plants beneficial to wildlife. Plant species proposed for the improved pasture have been examined for their value to wildlife, and their overall value is low. The wildlife habitat value of the established pastures will be dependent on management practices by the landowners following bond release. These practices will ultimately determine the structural diversity and species diversity of the reclaimed areas. A lack of cover on closely grazed or hayed pastures will contribute to a further decreased wildlife habitat value for this land use category.

Four temporary and permanent impoundments are included in the reclamation plan and will be constructed as a result of mining activities. These impoundments range from 2.1 acres to 16.2 acres. They are proposed for various locations throughout the permit area and will replace some of the open water aquatic habitat loss, as well as provide a perennial water source for wildlife species. The constructed 1.5-acre wetland will help mitigate some of the wetlands lost to mining operations and provide valuable habitat for fish and wildlife.

As with the game and non-game wildlife species described above, numerous species subject to the Migratory Bird Treaty Act will suffer a permanent loss of habitat in the postmine landscape due to the land use conversion. A large number of nesting migratory birds could be disrupted by the clearing of the forests and woodlands during the nesting season. To minimize the impacts to migratory bird species during their nesting season, the clearing of undeveloped woodland will be conducted as much as possible during the months of August through March, as recommended by the USFWS. If clearing is required within the nesting period, a migratory bird nest survey will be conducted to determine the presence of migratory birds. Any active nests will be left in place until the eggs have hatched and the young have fledged. As woodlands are converted to pasture, the impacts on land use will extend into habitats outside of the disturbance area. Increased fragmentation could impact woodland migratory bird species that are area sensitive—species preferring sizable blocks of continuous habitats.

Migratory birds favoring early-successional habitats will see a dramatic increase in available habitat as land clearing and mining proceed. This consequence will likely continue until reclamation is complete and the perennial dominated improved pastures are fully established. Following pasture establishment, a few species capable of utilizing grazed or hayed pastures for foraging or nesting (scissor-tailed flycatcher, eastern meadowlarks, eastern bluebird, northern rough-winged swallow, barn swallow, killdeer, red-winged blackbirds, and brown-headed cowbirds) will see an increase in available habitat as a result of the land-use conversion. The new ponds will create open-water habitat with shallower open shorelines more favorable to Canada geese, migrating ducks, and wading birds during the spring and fall migrations.

The cumulative impact due to the conversion of migratory bird habitat and potential loss of nest or young during land clearing will be confined to the permit area and is not expected to have any impact on the range-wide status of the species involved.

*(c) Threatened and Endangered Species*

(1) Existing Conditions

The USFWS listed the following threatened or endangered species as occurring in Haskell County: American burying beetle (ABB), interior least tern, and the piping plover. The Oklahoma Natural Heritage Inventory list five species of concern occurring in Haskell County (Table 3).

**Table 3.** Oklahoma species of conservation concern known to occur in Haskell County

	Federal Status	State Status	Scientific Name	Common Name
Fish		T	<i>Percina maculata</i>	Blackside Darter
Reptiles		CS SS2	<i>Macrochelys temminckii</i>	Alligator Snapping Turtle
Insects	E	E	<i>Nicrophorus americanus</i>	American Burying Beetle
Birds	T	E	<i>Haliaeetus leucocephalus</i>	Bald Eagle
Mammals		SS2	<i>Mustela frenata</i>	Long-Tailed Weasel

T = threatened E = endangered CS = Statewide Closed Season SS2 = Species of Special Concern

The interior least tern and piping plover utilize sand and gravel bars associated with large river systems. Suitable habitat for these two birds does not exist within the action area. The blackside darter is represented by natural heritage data within the Robert S. Kerr Reservoir eight-digit HUC watershed, but is considered extirpated/possibly extirpated within Haskell County (NatureServe, 2009). This fish prefers cool clear streams with moderate current, gravel substrate, and deep pools. The long-tailed weasel and alligator snapping turtle are assigned a State rank of “SS2” in Oklahoma. These are species identified by technical experts as possibly threatened or extirpated, but for which additional information is needed. The weasel is a wide-ranging habitat generalist and activities on the project area are not expected to influence the range-wide status of the species. The alligator snapping turtle is the largest freshwater turtle in the world. Leaving the water only to lay eggs, the turtle’s habitat includes primarily large rivers and their backwaters. Hunting is the primary reason for the alligator snapping turtles decline in Oklahoma.

The ABB occurs in Haskell County and is known to utilize the type of habitat found at the project area. This insect is a large, black-and-orange carrion beetle once found in 32 states and Canada, but now known to exist only in Rhode Island, Massachusetts, South Dakota, Nebraska, Kansas, Arkansas, Texas, and Oklahoma. The ABB was designated in August 1989 as a Federal endangered species. Before 1990, the Oklahoma ABB population was known from the capture of ten specimens. During the summer of 1990, the Oklahoma Natural Heritage Inventory (ONHI) reported the capture of four specimens in Latimer County. Since then, captures have been made in Latimer and surrounding counties. In eastern Oklahoma, the presence of the ABB has been documented as of mid-1996 in Tulsa, Cherokee, Muskogee, Sequoyah, Haskell, Pittsburg, Latimer, LeFlore, and Bryan Counties.

Reasons for the decline of this species are not well understood, but habitat fragmentation and pesticides are possible contributing factors. This insect buries carcasses of small vertebrates for its own food and for that of its hatching larvae. Like other carrion beetles, burying beetles play an important role in ecosystems by recycling dead materials. Predators and other scavengers such as American crow, raccoon, fox, opossum, and skunk compete with the ABB for carrion. The ABB are known to particularly utilize grass/forb/shrub seral stages of pine-oak or oak-dominated open- and closed-canopy forests, mesic hardwood forests, dry-mesic oak woodlands, and dry oak woodland habitats within its range. At this time, no critical ABB habitat has been designated by the USFWS or Oklahoma Department of Wildlife Conservation (ODWC).

## (2) Direct and Indirect Effects by Alternative

Alternative 1: Under this alternative, mining activities would not take place. Therefore, site conditions and habitat would remain the same as it currently relates to threatened and endangered species.

Alternative 2 (Preferred Alternative): As determined in the SMCRA permit findings and in this EA, no impacts are expected to occur to any species protected under the Endangered Species Act as a result of this alternative. Potential habitat for the piping plover and interior least tern is not present within the action area. This action will have no effect on the piping plover or interior least tern. Potential habitat for the American burying beetle (ABB) is present within the action

area; however, an ABB surveys (2010-2012) of the site failed to capture any ABB. This action may affect but is not likely to adversely affect the American burying beetle.

An August 2012 survey covering the western half of the permit area (portal area) failed to capture any ABB. However, based on the annual cyclic nature of ABB populations, survey results are only valid until the beginning of species' next active season, May 20<sup>th</sup> of the following year. If FCMC does not begin ground disturbance activities before May 20, 2013, they will be required to resurvey the portal area for ABB and report the results to USFWS. An additional ABB survey will be required before ground disturbance activities begin on the eastern half of the permit area (coal waste disposal area) which is outside the valid range of the August 2012 survey. If any future survey indicates the presence of ABB's the USFWS recommends formal consultation with the Service in order to provide "take" coverage through an incidental take permit under Section 7 of the Endangered Species Act.

## Social Environment

### *(a) Recreation Resources*

#### (1) Existing Conditions

There are no national, state, county, or municipal parks in the action area. Designated wilderness, trails, wild and scenic rivers, or lands with other special environmental or recreational classifications do not exist within the project area. No public lands will be affected by the proposed action.

The primary recreational use of the permit area is seasonal hunting. However, the land is under private ownership and hunting is limited to only those individuals granted access. Potential game species found on the site include whitetail deer, wild turkey, eastern cottontail, mourning dove, bobwhite quail, squirrel, and raccoon.

#### (2) Direct and Indirect Effects by Alternative

Alternative 1: Under this alternative, there would be no change to the existing recreational resources in the permit area.

Alternative 2 (Preferred Alternative): Impacts to the recreational resource values of the permit area will be minor and temporary—limited to the life of the mining and reclamation plus the time necessary for wildlife populations to become reestablished. New open-water impoundments will provide habitat for fish, wetland species, and wildlife. Some game species should return to the area as cover and food sources are reestablished. Mining activities may change the movement patterns and the habitats of the game associated with seasonal hunting in this area. Hunters and fishermen will be restricted from the project area during the life of the mining and reclamation operations.

*(b) Visual Resources*

(1) Existing Conditions

The proposed mine site is located in a rural setting in eastern Haskell County. County landscape is moderately to strongly sloping wooded hills with stream corridors and interspaced agricultural fields. The leased area lies below the Seven Devils and Campground Spring Mountains. The majority of the permitted area was historically mined and then abandoned. The visual resources within the permit boundary are highly disturbed and unnatural in comparison to the surrounding landscape. Access to potential overlooks is limited by private ownership of the land and the lack of well traveled roads.

(2) Direct and Indirect Effects by Alternative

Alternative 1: Under this alternative, there would be no change to the existing visual resources in the permit area.

Alternative 2 (Preferred Alternative): Impacts to the visual resource values will be minor and temporary. The visual resource values of the proposed permit area are typical of the region. There are no unique values identified on the proposed mine unit and the area is not visible from any known sensitive observation point. The mine site cannot be seen from any major highway or scenic travel route.

*(c) Parks, Historical, and Cultural Resources*

(1) Existing Conditions

In December 2010, FCMC's consulting archaeologist investigated the archaeological, historical, cultural, and paleontological resources of the proposed permit area. The consultant found a historic homestead, a site containing prehistoric materials, and evidence of historic coal mining. The Oklahoma Historical Society (OHS), Oklahoma Archeological Survey (OAS), and Choctaw Nation of Oklahoma had an opportunity to examine the survey report during the permit application review process.

In a letter dated April 27, 2012, the Deputy State Historic Preservation Officer (SHPO) of OHS declared no sites were eligible for listing on the National Register of Historic Places within the ODM permitted area. The OAS gave clearance for the project in April 2012. In January 2011, the Choctaw Nation of Oklahoma gave clearance for the project to proceed. No historic properties were identified by the Section 106 process.

No State or Federal parks or recreation areas exist within or adjacent to the proposed project area.

(2) Direct and Indirect Effects by Alternative

Alternative 1: There would be no change in the condition of the proposed permit area, so there would be no adverse effects to heritage resources as a result of this alternative.

Alternative 2 (Preferred Alternative): There will be no adverse impacts to heritage resources as a result of this alternative because no historic or cultural properties will be affected by the proposed action and no parks are within or adjacent to the permit area. Standard conditions found in the ODM permit and ASLM mining plan approval document for the McCurtain operation will protect any future discoveries of heritage resources from mining impact by requiring timely notification of such discoveries be made to both ODM and OSM.

*(d) Environmental Justice*

(1) Existing Conditions

Executive Order No. 12898 requires Federal agencies to respond to the issue of environmental justice by “identifying and addressing disproportionately high adverse human health and environmental effects of its programs, policies, and activities on minority and low income populations.” Haskell County, Oklahoma encompasses the analysis area. According to the 2010 U.S. Census data, there are approximately 12,769 people who reside within the county. Within this population demographic, 72.5% are persons of White/Caucasian descent, 16.2% are Native American, 3.6% are persons of Hispanic or Latino origin, 0.7% are persons of black or African-American descent, and 0.6 % are of Asian origin. The other 6.4% of the population reported as being some other race or combination of races.

As reported by the U.S. Census, the median household income for Haskell County in 2006-2010 was \$37,474 and the poverty rate was at 12.3%. In comparison, the 1999 Census demographics for the state of Oklahoma demonstrated a median household income of \$42,979 and a poverty rate of 16.2%. These data indicate that Haskell County is marginally above the Oklahoma state poverty average and below mean household income levels. In addition, the demographic data indicate that few minorities reside within the county.

(2) Direct and Indirect Effects by Alternative

Alternative 1: This alternative neither adds to nor diminishes the local economy or employment opportunities. Likewise, there would be no adverse environmental impacts on minority populations as a result of this alternative.

Alternative 2 (Preferred Alternative): This alternative will add to the local economy and employment opportunities for the skilled and unskilled labor workforce through (1) continued employment of mining and contracted personnel from existing permits, (2) potential creation of new employment opportunities to accommodate on-going mining operations, and (3) strengthening the local economy and tax base by the addition of local revenue through workforce development.

Due to the rural location of the proposed action and nominal level of minority individuals and families residing in Haskell County, there will be minimal environmental consequences on these populations as a result of Alternative 2.

*(e) Socioeconomics*

(1) Existing Conditions

As stated in the environmental justice analysis in this chapter, the census data demonstrates that Haskell County is marginally above the Oklahoma state poverty average and below mean household income levels. There is a potential for impacts on the population and economic base of the local area as a result of the proposed action. Approximately 50 individuals will be employed at the McCurtain Mine at an annual income higher than the county average. Secondary employment is estimated at 75 persons and mine life is projected to be 40 to 80 years.

(2) Direct and Indirect Effects by Alternative

Alternative 1: If this alternative is selected, there would be no immediate change in the existing opportunities for employment or in the economic base of the area. However, increased economic stimulus from mining, coal sales, and support enterprises would be lost under this alternative.

Alternative 2 (Preferred Alternative): Under this alternative, coal mining operations will proceed. The results will be an increase in economic stimulus through employment opportunities and support services for the mine. Active mining will occur over a 40 to 80 year period with production of about 7.5 million tons of Federal coal from lease OKNM 108097. Final reclamation activities and reclamation bond liability will continue for a couple of years after the last coal is recovered. Local economic stimulus will likely increase or remain the same as a result of this alternative. The proposed action balances coal production while protecting sensitive environmental resources within the action area.

*(f) Noise and Transportation*

(1) Existing Conditions

Primary travel routes which overlap the project area include several improved county roadways (E1265, E1270, E1275, D1275 N4510, N4515, N4520, N45 and N4550) and a primary paved highway (US 26). These roads currently carry local light vehicle and heavy truck traffic. Highway 26 bisects the lease area, but lies outside and to the west of the permit area. Existing noise impacts include highway and county road traffic.

(2) Direct and Indirect Effects by Alternative

Alternative 1: Under this alternative, there would be no change to the current background noise of the area. Transportation routes would remain unaltered and not be subjected to any additional traffic.

Alternative 2 (Preferred Alternative): Mining activities at the proposed mine will contribute to an increased level of noise above the natural background of a sparsely populated rural area. Sources of noise pollution from coal mine development activities include blasting and operation of bulldozers, haul trucks, and other heavy equipment. Once the mine begins normal operations, sources of noise pollution will be heavy equipment or conveyors moving coal, ventilation fans,

and a coal processing plant. During mining operations, this noise pollution will be slightly attenuated because it will occur in a depression created for access to the coal seam. Noise impacts, affecting people living within a few miles of the mine, will be minor and long term. The noise pollution will no longer exist after mining operations cease.

Noise from blasting and equipment operations, including mine ventilation fans, may also affect wildlife populations and nesting behavior. Noise could result in the displacement of numerous animal and bird species in the area, although this impact will be minor and cease after the close of mining operations.

There will be minor and temporary impacts to the highway and county roads near the permit area. In some locations, CR E1275, CR D1275, and CR N45 are within 100 feet of the proposed disturbance boundary. FCMC has received a variance from the LeFlore County Commission, and ODM, to mine within 100 feet of these public roads. County Road (CR) E1275 runs along the southern edge of the permit and is expected to serve as the primary access and haul road transporting mined coal off the site and onto HWY 26. Heavy- and light-truck traffic on CR E1275 and HWY 26 will increase under this alternative. Coal trucks and employee personal vehicles will utilize these transportation routes frequently, increasing impacts to these roads.

CR N45 bisects an area proposed for a coal mine waste disposal site. CR N45 serves as the sole access road to several small residences along the banks of Club Lake. Construction of the mine waste site will require the temporary closure and/or detour of CR N45.

During blasting operations, traffic on CR E1270, CR E1275, CR D1275, and CR N45 may be blocked to prevent vehicles and personnel from entering the blasting area. FCMC will do this to minimize the chance of people being injured by falling blast debris. These impacts will be temporary, ending when the mine development phase is complete. Construction of subsequent refuse storage facilities should not require blasting. If blasting is required after the highwall for underground access is complete, the operator will have to obtain a permit revision from ODM and meet all regulatory requirements for safety.

#### *(g) Air Quality*

##### (1) Existing Conditions

The USEPA established National Ambient Air Quality Standards in 1971. The Oklahoma Department of Environmental Quality has adopted similar standards for statewide air quality protection. This legislation requires air quality planning that classifies an area as “attainment” or “nonattainment.” Nonattainment refers to those areas that do not presently meet the national air quality standards. Haskell County is considered an attainment area. The proposed mine site is located in a rural area dominated by pasture and other agricultural land uses. There are currently no substantial impacts to air quality, industrial or otherwise, in the area of the proposed mine.

## (2) Direct and Indirect Effects by Alternative

Alternative 1: Under this alternative, there would be no change to the air quality in the action area.

Alternative 2 (Preferred Alternative): Under this alternative, air quality impacts typical of underground mining operations will affect the action area. Local air quality deterioration will result from increased dust levels and emissions from coal mining/processing equipment and over-the-road coal trucks. Dust emissions will be controlled by watering roads and spraying coal as it is processed and stockpiled. Air quality impacts to the few local residents living near the proposed permit boundary will be minor and temporary. National and State air quality standards will not be exceeded under this alternative. Air quality impacts will occur during the mine development and coal-recovery phases of the McCurtain Mine. The impacts will be minor and long-term, ending once the site is reclaimed.

### *(h) Gas Resources*

#### (1) Existing Conditions

The land surface above where both Federal and private coal will be extracted by underground mining methods (underground mine plan area) also overlies gas-producing strata. Appendix D lists 27 gas wells that are in the underground mine plan area, as that area is illustrated in the ODM-approved permit. Some of these wells date from the 1960s, but all are either still producing gas or have not been plugged. Information for Appendix D came from public records (“Imaged Documents”—Form #1002A Completion Report and Form #1300 Plugging Record) accessible through the Oklahoma Corporation Commission web site: <http://www.occeweb.com>.

Completion reports for wells in the mine plan area list gas zones as either “Hartshorne,” “Spiro,” or “Cromwell.” The Hartshorne Formation contains the Hartshorne coal (the seam to be recovered by the McCurtain underground mine) and the underlying Hartshorne sandstone. Both the coal bed and the sandstone contain commercially recoverable volumes of gas—coal-bed methane (CBM) in the case of the Hartshorne coal seam and natural gas in the case of the Hartshorne sandstone. The Atoka Formation underlies the Hartshorne Formation and has a natural gas reservoir rock, Spiro sandstone, near its base. Beneath the Atoka Formation are rocks of the Morrowan Series which include the gas-bearing Cromwell sandstone.

Gas production from the Hartshorne appears to be CBM. In order to extract gas from a reservoir rock, the steel well casing and the layer of cement sealing that casing to the borehole must be perforated opposite the reservoir rock. Hartshorne perforation zones range in vertical distance from two to five feet. These numbers are consistent with the thickness of the Hartshorne coal bed, but are much too small for the Hartshorne sandstone. Gas zones, or perforated intervals for the Spiro and Cromwell sandstone bodies, on the other hand, span greater distances—12 to 192 feet (median of 52 feet).

## (2) Direct and Indirect Effects by Alternative

Alternative 1: Since there would be no mining or reclamation operations, there would be no change in gas production under this alternative.

Alternative 2 (Preferred Alternative): Under this alternative, the productive capacity of those wells that extract methane from the Hartshorne coal bed near the lease area will be permanently destroyed since the reservoir rock, the coal seam, will be removed. Even those CBM wells that might be physically preserved because they happen to be within coal pillars will stop producing gas as mining advances toward and around them.

Deeper gas reservoir rocks, the Spiro and Cromwell sandstones, will not be affected by the proposed mining operation. These natural-gas production zones are thousands of feet below the level of the proposed mine works. However, wells tapping those reservoirs must pass through the overlying Hartshorne coal bed. For safety purposes, mine operators must leave a coal barrier sufficient to ensure natural gas from the well does not enter the mine atmosphere, thus protecting the well and natural gas resource.

### 3.2 Cumulative Impact Consideration

Alternative 1: Under this alternative, coal reserves estimated to be 7.5 million tons would not be recovered and the United States would not realize the income from royalties paid by the mine operator. The local economy would not realize any economic benefit that could have been expected from increased or continued employment. The lease holder would not receive any benefit from the work and expense of obtaining lease OKNM 108097. Underground coal mining in the vicinity could however be initiated and coal resources recovered from privately held coal reserves. Additional federally owned coal could eventually be recovered by underground mining methods on a pending lease adjacent to lease OKNM 108097.

Alternative 2 (Preferred Alternative): Under the preferred alternative, cumulative impacts will primarily result from proposed land use and vegetation changes, as well as potential subsidence impacts. The conversion of mixed oak-hickory woodlands and wetlands to improved pasture will reduce wildlife habitat. The introduction of exotic plants including Bermuda grass in once-forested areas will decrease vegetative biodiversity within the project area but increase land-use capability for livestock operations.

The scope of the cumulative effects on the physical and biological environments within the permit boundary will be minor because of pre-existing surface disturbances resulting from abandoned mining activities. Many of the soil resources in the disturbance area have been lost during the previous mining activities, so there will be limited topsoil to place on the disturbed areas. Because of the increase in the amount of pasture postmining land use with the associated reclamation of abandoned mine land, we anticipate minor and long-term cumulative effects relating to soil resources.

As coal recovery occurs at greater depths, the volume of CBM trapped in the Hartshorne coal seam may require control beyond conventional underground mine ventilation. The potential

exists for CBM venting or recovery ahead of the mining operations. CBM recovery from gas wells has been occurring in the vicinity of the proposed operations since 2001.

As mining progresses underground away from the portal area, construction of ventilation and emergency access shafts may be required. Any mining related ground disturbance outside of the permit area will require ODM approval and a revision to Permit 4285F. Fans used for ventilation will increase ambient noise in the local area and may impact nearby residents and wildlife. This impact would be minor, local and temporary.

BLM published a notice of Notice of Intent (NOI) in the Federal Register on June 24, 2011, to amend its Resource Management Plan (RMP) for Oklahoma. The proposed RMP amendment includes a proposed lease for the McCurtain No. 2 Mine. The McCurtain No. 2 Mine is a 1,300 acre proposed coal lease which could expand the underground shadow area of the McCurtain Mine approximately 2.5 miles to the east. This proposed lease will have a cumulative positive effect on socioeconomic resources of the area. Employment opportunities and local revenue will increase in both scale and duration. Negative impacts associated with the underground shadow area of the McCurtain mine such as the potential for subsidence will increase in spatial and temporal scale. Surface impacts such as land use changes and loss of wildlife habitat will increase should additional entry portals and/or coal mine waste disposal areas be required.

The potential addition of the coal reserves in the pending 1,300-acre lease to the currently proposed operation may require additional water resources for coal processing activities. The additional coal reserves could allow the mine operator to produce a larger tonnage of coal by operating multiple mining units from the proposed mine portals and surface support facilities.

The county road and state highway systems will be subject to a long term increase in impacts from loaded coal transport trucks. If the pending coal lease is added to the current acreage, the number of trucks per day may be increased and the need for coal transportation facilities will continue for a longer time period.

Much of the permitted area was strip mined and abandoned prior to 1977 and the implementation of SMCRA. As such, several public safety and environmental issues exist on the unreclaimed site. The Oklahoma Conservation Commission's (OCC) AML Program has identified 170 acres within and around the permit for reclamation under an approved AML plan. Some of this work has already been done. FCMC has asked OCC to remove 20 acres from this plan in order to conduct mining operations. If the mine plan is approved, FCMC will be responsible for reclaiming the 20-acre portion, saving the public approximately \$240,000 in AML program costs and result in a minor impact to socioeconomic and environmental resources.

Considering the scale and potential longevity of the proposed mining operation, the overall cumulative impact of mining activities associated with Alternative 2 (Preferred Alternative) will be moderate and long term.

### 3.3 Federal, State, Regional and Local Land Use Plans and Policies

There are no Federal, State, or local land use plans or policies that will be impacted by this mine.

## Chapter 4. Consultation and Coordination

### Preparers

<b>OSM</b>		
<b>NAME</b>	<b>TITLE</b>	<b>RESPONSIBILITY</b>
Larry Emmons	Soil Scientist	Mining Plan Decision Document
Brian Hicks	Hydrologist	Water Resources
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Willam Joseph	Program Support Division Chief	NEPA Deciding Official

<b>ODM</b>		
Darrell Shults	Geologist	NEPA Consultation
Doug Cross	Ecologist	NEPA Consultation
Tek Tsegay	Hydrologist	NEPA Consultation

The following agencies were contacted during EA development and review:

- U.S. Army Corps of Engineers, Tulsa District
- U.S. Department of the Interior, Fish and Wildlife Service, Tulsa Field Office
- U.S. Department of the Interior, Bureau of Land Management
- Choctaw Nation of Oklahoma
- Oklahoma Department of Wildlife Conservation
- Oklahoma Archeological Survey
- Oklahoma Historical Society, State Historic Preservation Officer

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## APPENDIX A Surface Water

**Table A-1.** Summary statistics for baseline data from six stream water monitoring stations of the mine plan area.

(mg/L, milligram per liter; N, number of samples; cfs, cubic feet per second)

Constituent	Units	N	Minimum	Mean	Median	Maximum
pH	standard units	29	6.1	7.5	7.5	8.8
Acidity	mg/L as CaCO <sub>3</sub>	26	2	17	16	60
Alkalinity	mg/L as CaCO <sub>3</sub>	26	10	117	120	200
Total iron	mg/L	29	0.13	2.55	0.74	13.30
Total manganese	mg/L	29	0.03	1.70	0.37	19.40
Sulfate	mg/L	29	7	111	83	290
Chloride	mg/L	16	1.0	8.0	10.0	15.0
Calcium	mg/L	16	8.0	26.6	23.2	72.0
Magnesium	mg/L	16	2.1	19.0	17.5	46.0
Sodium	mg/L	16	6.8	19.5	19.5	36.0
Potassium	mg/L	16	1.4	2.4	2.0	7.0
Total dissolved solids	mg/L	29	44	289	256	841
Flow	cfs	47	0	0.1	0.1	0.7

**Table A-2.** Summary statistics for baseline data from two water monitoring stations on Club Lake.

(mg/L, milligram per liter; N, number of samples)

Constituent	Units	N	Minimum	Mean	Median	Maximum
pH	standard units	7	6.8	7.7	7.45	8.8
Acidity	mg/L as CaCO <sub>3</sub>	7	2	13	10	40
Alkalinity	mg/L as CaCO <sub>3</sub>	7	52	116	80	220
Total iron	mg/L	7	0.16	0.34	0.27	0.91
Total manganese	mg/L	7	0.01	0.08	0.11	0.12
Sulfate	mg/L	7	12	62	66	95
Total dissolved solids	mg/L	7	20	138	148	148

**Table A-3.** Summary statistics for baseline data from seven impoundments in the mine plan area.

(mg/L, milligram per liter; N, number of samples)

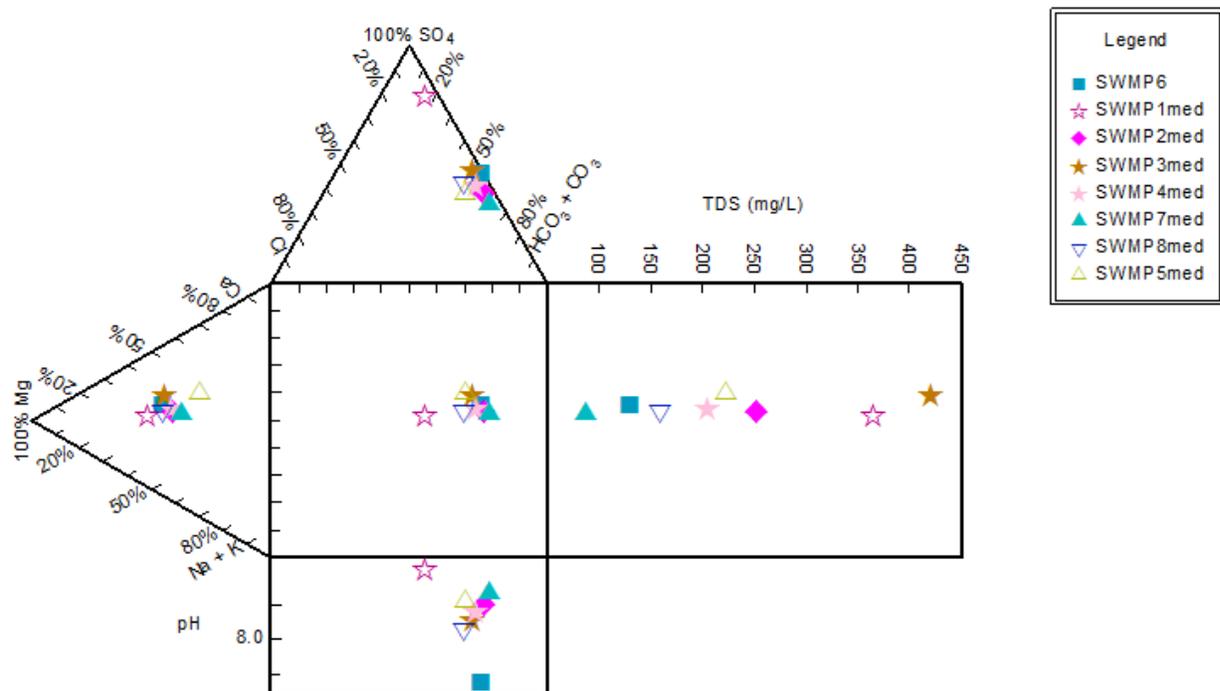
Constituent	Units	N	Minimum	Mean	Median	Maximum
pH	standard units	7	7.3	7.9	7.8	9.4
Acidity	mg/L as CaCO <sub>3</sub>	7	2	25	20	40
Alkalinity	mg/L as CaCO <sub>3</sub>	7	60	117	116	200
Total iron	mg/L	7	0.31	7.76	2.61	21.60
Total manganese	mg/L	7	0.06	1.07	1.24	1.91
Sulfate	mg/L	7	43	287	200	850
Total dissolved solids	mg/L	7	93	434	335	939

## APPENDIX A Continued

**Table A-4.** Mann-Whitney comparison of medians (baseline record)—upstream station (SWMP 4) of the highwall stream versus the furthest downstream station (SWMP 3) for all combined drainage from the mine plan area.

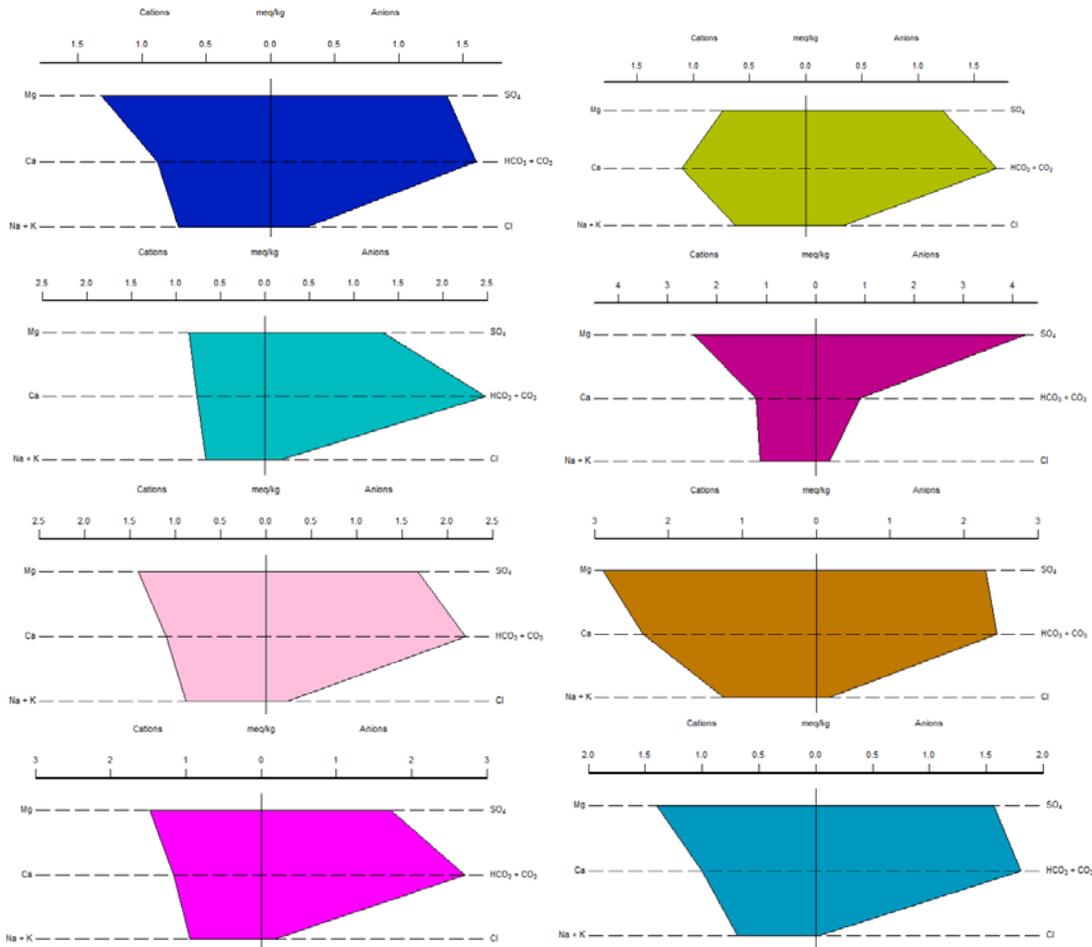
(mg/L, milligram per liter; N, number of samples; cfs, cubic feet per second)

Constituent	Units	SWMP3		SWMP4		Medians are different at 95% confidence level
		N	Median	N	Median	
pH	standard units	6	7.74	8	7.61	NO
Acidity	mg/L as CaCO <sub>3</sub>	6	23.0	8	15.0	NO
Alkalinity	mg/L as CaCO <sub>3</sub>	6	122.0	8	110	NO
Total iron	mg/L	6	1.10	8	0.61	NO
Total manganese	mg/L	6	0.36	8	0.20	NO
Sulfate	mg/L	6	110.0	8	70.5	NO
Chloride	mg/L	2	6.25	4	8.5	NO
Calcium	mg/L	2	46.8	4	22.0	NO
Magnesium	mg/L	2	35.0	4	17.0	NO
Sodium	mg/L	2	27.5	4	19.0	NO
Potassium	mg/L	2	1.95	4	1.85	NO
Total suspended solids	mg/L	6	7.0	8	6.5	NO
Total dissolved solids	mg/L	6	420.5	8	204.5	YES
Flow	cfs	6	0.3	8	0.2	NO



**Figure A-1.** Major-ion composition, pH, and total dissolved solids (TDS) of water sampled from surface water monitoring stations of the proposed McCurtain underground mine. Unlike the other stations which display median values, SWMP 6 shows an analysis of a single sample.

APPENDIX A Continued



**Figure A-2.** Major-ion composition (median values) of water from surface water monitoring stations at the proposed McCurtain underground mine. Left column from the top: SWMP 8 and SWMP 7 (both Club Lake stations), stream stations SWMP 4 and SWMP 2 below Club Lake; right column from the top: SWMP 5, SWMP 1, water from all stations passes through SWMP 3 except that SWMP 6 (for which there was only one sampling event ) is in a different watershed.

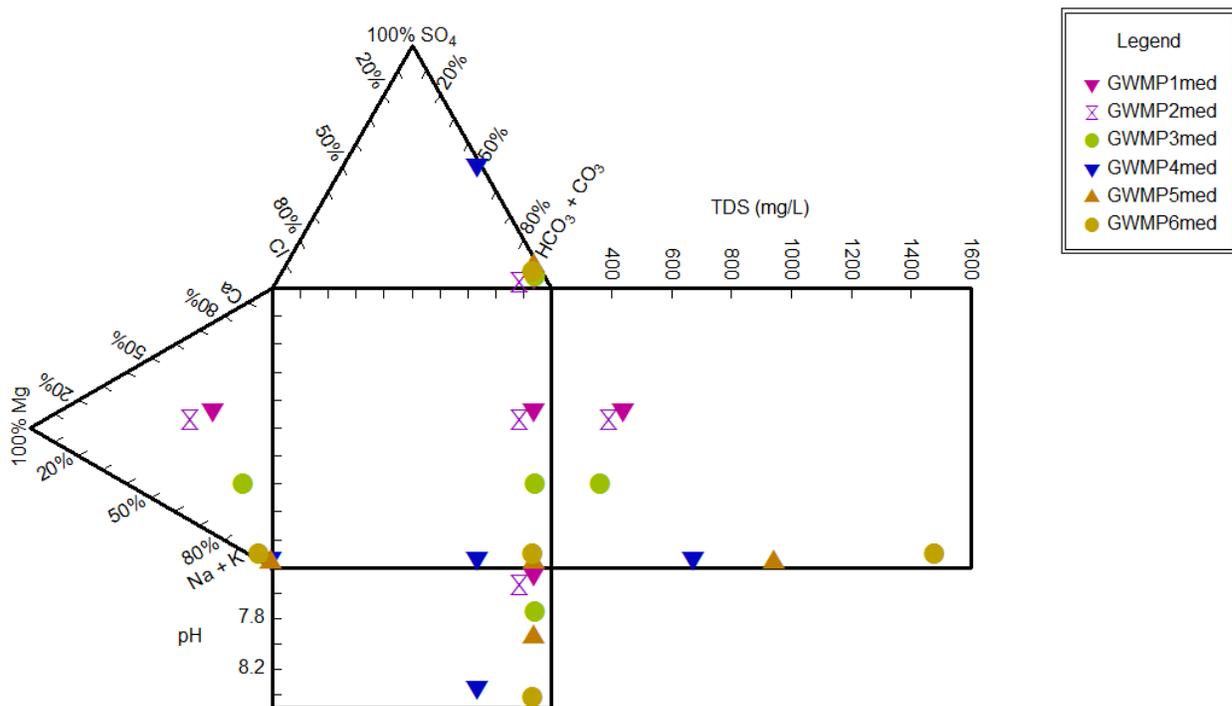
## APPENDIX B Ground Water

**Table B-1.** Summary baseline ground-water data for three residential wells and six monitoring wells.

(mg/L, milligram per liter; N, number of samples; TDS, total dissolved solids)

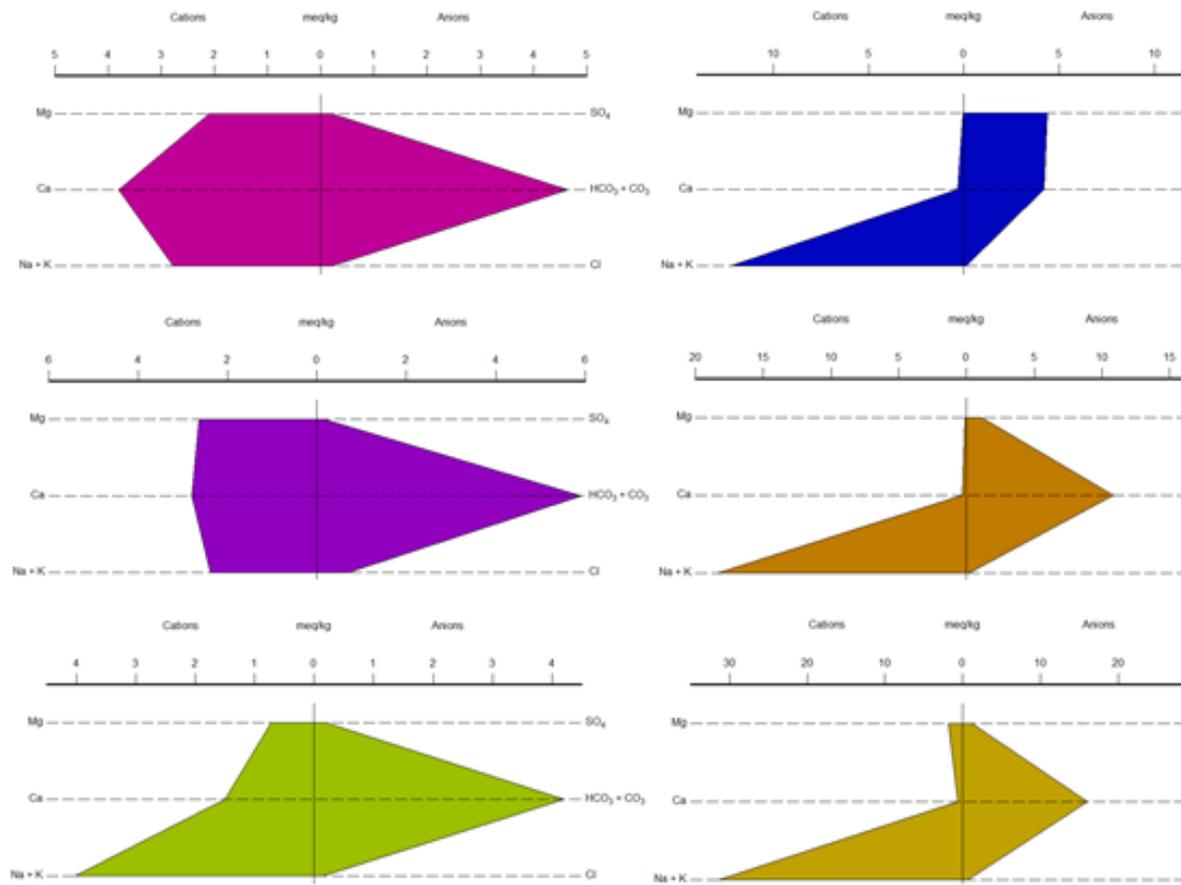
Constituent	Units	Residential well water			Monitoring well water			95% confidence interval for median*
		N	Range	Median	N	Range	Median	
pH	standard units	5	6.3–7.6	7.3	36	6.4–9.2	7.75	7.6–8.0
Acidity	mg/L as CaCO <sub>3</sub>	5	<2–60	<2	36	<2–80	6	2.0–20.0
Alkalinity	mg/L as CaCO <sub>3</sub>	5	60–360	200	36	30–1060	300	224–400
Total iron	mg/L	5	1.08–6.13	2.52	36	0.199–291.2	1.025	0.610–2.10
Total manganese	mg/L	5	0.093–1.35	0.22	36	<0.01–5.35	0.290	0.155–0.410
Sulfate	mg/L	5	18–260	90	36	2–22,000	35	18.5–51.5
Chloride	mg/L	5	10.0–15.0	15.0	24	2.5–50.0	8.25	5.0–13.25
Calcium	mg/L	5	17.6–56.0	24.0	24	4.0–80.0	22.0	8.0–40.0
Magnesium	mg/L	5	8.4–37.0	12.0	23	0.4–3400	9.1	1.4–25.0
Sodium	mg/L	5	32.0–210.0	120.0	23	42.0–31,000	120.0	68.0–370.0
Potassium	mg/L	5	1.0–5.5	1.2	23	1.0–7200	1.5	1.2–1.8
TDS	mg/L	5	220–797	460	36	270–65,000	498.5	418–727

\*Bootstrap intervals for monitoring well water constituents—500 subsamples



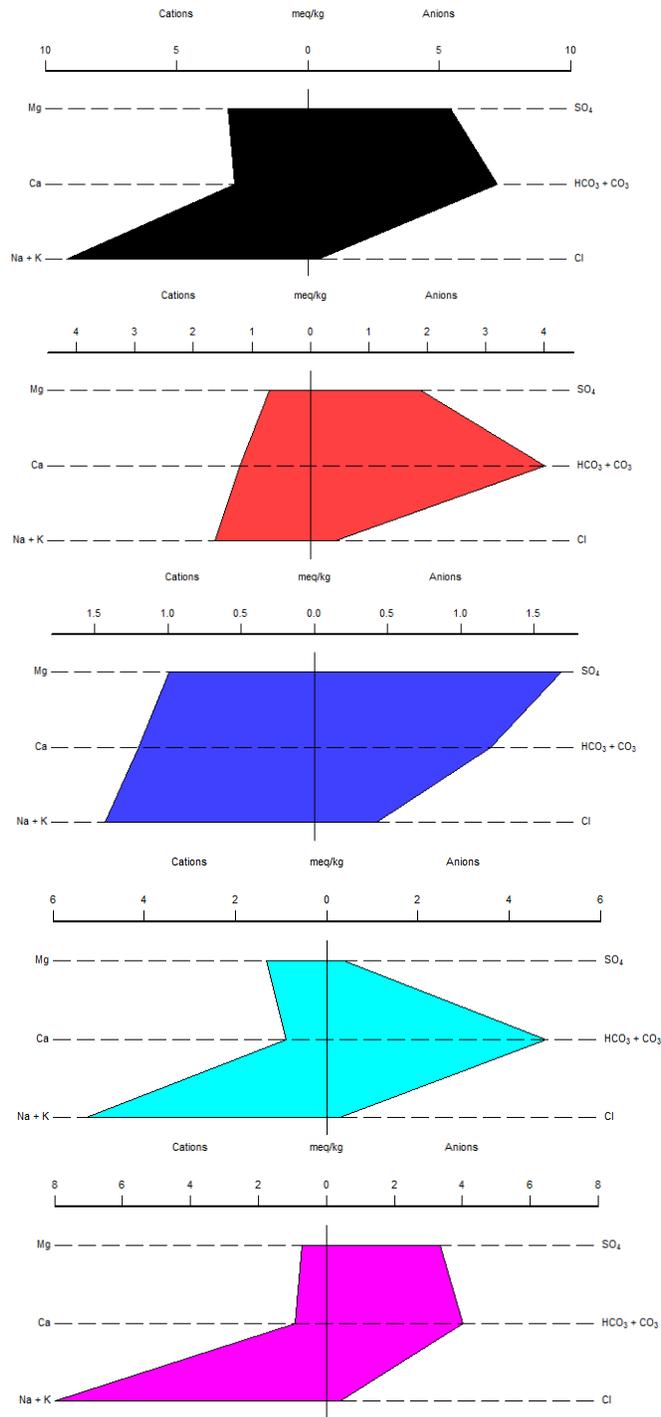
**Figure B-1.** Major-ion composition, pH, and total dissolved solids (TDS) of water produced from monitoring wells of the proposed McCurtain underground mine. All wells are completed in bedrock, either above (GWMPs 1, 2, and 3) or within (GWMPs 4, 5, and 6) the Hartshorne Coal. Median values were used to generate this Durov diagram.

APPENDIX B Continued



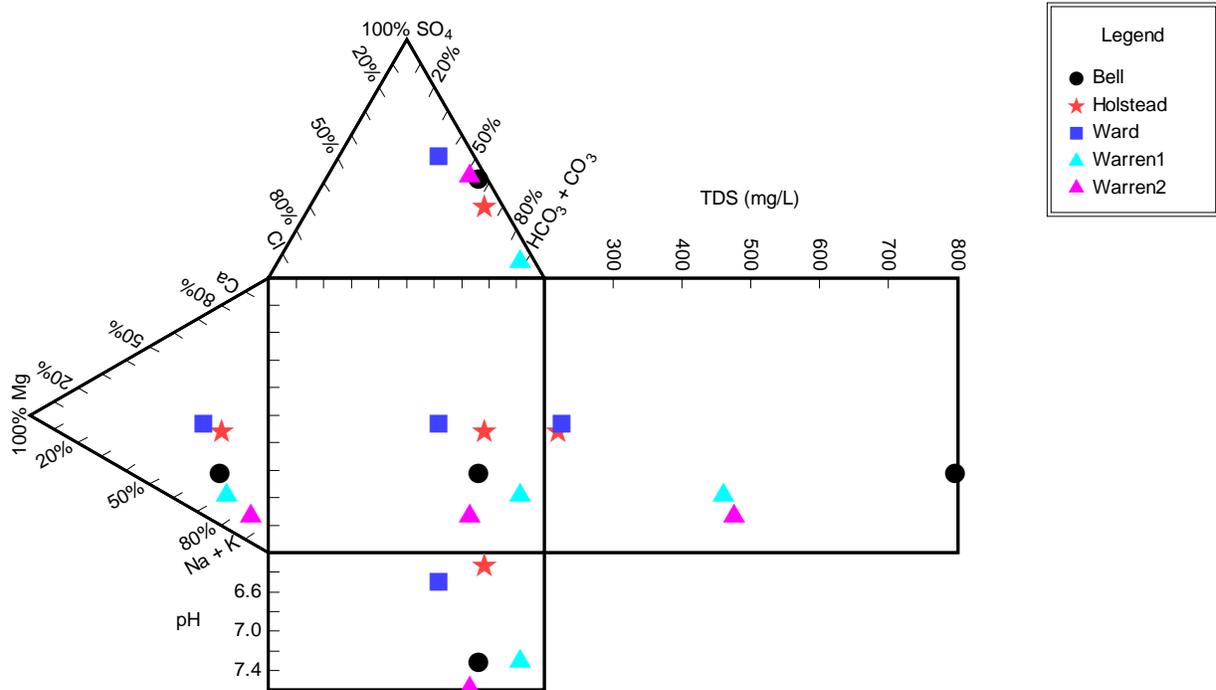
**Figure B-2.** Major-ion composition (median values) of water from monitoring wells of the proposed McCurtain underground mine. Left column from the top: GWMP 1, GWMP 2, and GWMP 3; right column from the top: GWMP 4, GWMP 5, and GWMP 6.

APPENDIX B Continued



**Figure B-3.** Major-ion composition of water from private wells near the McCurtain proposed underground mine. From top to bottom, the wells are: Bell, Holstead, Ward, Warren 1, and Warren 2.

APPENDIX B Continued



**Figure B-4.** Major-ion composition, pH, and total dissolved solids (TDS) of water produced from private wells in the area of the proposed McCurtain underground mine. All wells are completed in bedrock, either above the Hartshorne Coal (Bell, Holstead, and Ward) or below this coal bed (Warren 1 and Warren 2).

**APPENDIX C** All historical records of breeding bird species detected at sample locations along BBS Route 67057 (Pocola, Okla.), query date 06/26/2012

Species List	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
(Yellow-shafted Flicker) Northern Flicker	0	2	0	0	-	0	0	0	0	-	-
Acadian Flycatcher	22	0	0	0	-	4	0	1	0	-	-
American Crow	38	43	35	49	-	42	26	18	45	-	-
American Goldfinch	4	4	6	1	-	3	6	5	2	-	-
American Robin	39	33	31	39	-	18	25	20	24	-	-
Bald Eagle	0	0	0	0	-	2	0	0	0	-	-
Baltimore Oriole	3	1	0	2	-	2	3	4	1	-	-
Barn Swallow	30	41	30	30	-	48	52	37	27	-	-
Barred Owl	1	1	0	0	-	0	0	0	0	-	-
Bell's Vireo	23	5	9	4	-	3	9	6	5	-	-
Belted Kingfisher	1	0	0	0	-	0	0	0	1	-	-
Bewick's Wren	4	3	4	1	-	2	0	3	0	-	-
Black Vulture	0	5	0	0	-	0	0	0	0	-	-
Black-and-white Warbler	2	2	0	1	-	0	3	0	1	-	-
Blue Grosbeak	16	16	21	22	-	24	20	14	14	-	-
Blue Jay	9	7	12	5	-	13	12	17	14	-	-
Blue-gray Gnatcatcher	21	16	12	15	-	19	21	11	15	-	-
Broad-winged Hawk	0	1	0	0	-	0	0	0	0	-	-
Brown Thrasher	2	5	8	6	-	5	3	5	7	-	-
Brown-headed Cowbird	38	42	30	30	-	46	39	28	40	-	-
Canada Goose	0	0	0	0	-	0	3	0	0	-	-
Carolina Chickadee	10	9	12	23	-	10	6	13	9	-	-
Carolina Wren	3	7	7	6	-	1	10	9	4	-	-
Cattle Egret	32	0	1	61	-	0	15	0	0	-	-
Chimney Swift	3	6	3	4	-	3	3	5	3	-	-
Chipping Sparrow	5	6	4	9	-	0	4	3	8	-	-
Chuck-will's-widow	1	2	0	0	-	0	0	0	0	-	-
Common Grackle	14	13	28	17	-	21	9	10	8	-	-
Common Nighthawk	1	0	0	0	-	0	0	0	0	-	-
Common Yellowthroat	1	5	5	1	-	7	0	5	1	-	-
Cooper's Hawk	0	0	0	0	-	1	0	0	1	-	-
Dickcissel	75	100	114	86	-	72	33	57	52	-	-
Downy Woodpecker	2	8	11	13	-	10	5	9	9	-	-
Eastern Bluebird	19	28	21	25	-	24	48	17	16	-	-
Eastern Kingbird	11	9	9	13	-	24	31	11	13	-	-
Eastern Meadowlark	101	114	113	162	-	118	77	82	96	-	-
Eastern Phoebe	10	4	11	9	-	7	7	9	8	-	-
Eastern Wood-Pewee	22	13	10	19	-	19	14	10	11	-	-
Eurasian Collared-Dove	0	0	0	0	-	1	1	5	2	-	-
European Starling	32	64	66	82	-	74	56	37	58	-	-
Field Sparrow	14	21	18	14	-	22	25	8	9	-	-
Fish Crow	10	5	3	6	-	0	6	5	6	-	-
Grasshopper Sparrow	0	3	0	2	-	0	0	0	0	-	-
Gray Catbird	1	1	2	3	-	11	0	1	1	-	-
Great Blue Heron	2	1	1	3	-	6	4	2	0	-	-
Great Crested Flycatcher	14	4	4	7	-	9	5	4	4	-	-

Great Egret	0	0	1	0	-	4	1	0	2	-	-
Great Horned Owl	0	1	1	2	-	0	0	0	0	-	-
Great-tailed Grackle	0	1	0	0	-	4	0	0	2	-	-
Greater Roadrunner	0	0	0	1	-	0	0	1	0	-	-
Green Heron	1	3	1	2	-	3	2	6	2	-	-
Hairy Woodpecker	0	0	0	0	-	2	0	1	0	-	-
House Finch	3	1	3	2	-	19	2	6	0	-	-
House Sparrow	65	95	103	103	-	26	39	22	49	-	-
Indigo Bunting	26	26	20	17	-	32	41	34	47	-	-
Kentucky Warbler	1	2	5	1	-	9	1	1	2	-	-
Killdeer	7	9	6	15	-	13	13	11	13	-	-
Lark Sparrow	4	8	3	6	-	6	9	3	3	-	-
Little Blue Heron	0	0	0	0	-	5	0	0	0	-	-
Loggerhead Shrike	3	2	1	1	-	1	3	3	1	-	-
Mourning Dove	23	32	49	57	-	37	25	37	36	-	-
Northern Bobwhite	20	26	30	41	-	16	15	12	13	-	-
Northern Cardinal	53	68	65	68	-	59	73	59	67	-	-
Northern Mockingbird	113	125	125	137	-	105	120	99	102	-	-
Northern Parula	4	3	2	3	-	5	1	0	4	-	-
Northern Rough-winged Swallow	5	2	4	3	-	9	7	5	1	-	-
Orchard Oriole	1	1	1	2	-	1	1	1	1	-	-
Painted Bunting	34	21	34	15	-	26	26	25	24	-	-
Pileated Woodpecker	0	2	1	2	-	2	2	1	2	-	-
Pine Warbler	0	0	0	0	-	0	0	1	0	-	-
Prothonotary Warbler	1	1	0	0	-	1	1	2	0	-	-
Purple Martin	2	11	6	1	-	4	1	5	6	-	-
Red-bellied Woodpecker	13	16	19	20	-	15	12	13	19	-	-
Red-eyed Vireo	1	2	4	0	-	2	3	1	2	-	-
Red-headed Woodpecker	0	2	3	1	-	1	1	1	0	-	-
Red-shouldered Hawk	1	2	2	2	-	0	0	0	0	-	-
Red-tailed Hawk	1	2	2	0	-	5	1	4	2	-	-
Red-winged Blackbird	20	38	28	33	-	24	14	17	32	-	-
Rock Pigeon	0	0	0	0	-	4	0	0	0	-	-
Ruby-throated Hummingbird	5	4	1	3	-	4	3	2	4	-	-
Scissor-tailed Flycatcher	13	19	21	25	-	33	16	13	18	-	-
Snowy Egret	0	0	0	2	-	0	0	0	0	-	-
Summer Tanager	1	2	2	1	-	4	4	3	1	-	-
Tufted Titmouse	25	43	21	30	-	28	14	18	31	-	-
Turkey Vulture	2	1	1	4	-	10	6	6	4	-	-
Warbling Vireo	3	2	0	0	-	0	0	0	0	-	-
Western Kingbird	0	1	0	0	-	0	0	0	0	-	-
White-breasted Nuthatch	2	1	0	1	-	0	2	0	2	-	-
White-eyed Vireo	2	3	0	2	-	4	2	1	2	-	-
White-winged Dove	0	0	0	0	-	0	0	1	0	-	-
Wood Thrush	0	0	0	0	-	22	0	0	0	-	-
Yellow-billed Cuckoo	15	19	12	12	-	15	14	8	3	-	-
Yellow-breasted Chat	3	1	0	0	-	1	4	1	1	-	-
Yellow-crowned Night-Heron	0	3	0	0	-	0	1	0	0	-	-
Yellow-throated Vireo	0	0	0	0	-	1	0	1	0	-	-
<b>Total Species</b>	<b>71</b>	<b>77</b>	<b>63</b>	<b>67</b>	<b>0</b>	<b>72</b>	<b>67</b>	<b>69</b>	<b>65</b>	<b>0</b>	<b>0</b>
<b>Total individuals</b>	<b>1088</b>	<b>1251</b>	<b>1218</b>	<b>1385</b>	<b>0</b>	<b>1233</b>	<b>1061</b>	<b>896</b>	<b>1013</b>	<b>0</b>	<b>0</b>

**APPENDIX D** Extant gas wells in the McCurtain underground mine plan area

<i>Well name by section, township, and range</i>	<i>Drilled</i>	<i>Gas-bearing geologic unit</i>	<i>Gas zone or perforated interval, feet below ground level</i>
<b><u>Sec 32, T9N, R22E</u></b>			
Frederick A1	1984	Spiro / Cromwell	6166–6222 / 6624–6636
<b><u>Sec 33, T9N, R22E</u></b>			
Frederick 2A	1978	Cromwell	6646–6660
<b><u>Sec 2, T8N, R22E</u></b>			
Myers 3-2	2002	Hartshorne	837–840
Gross 3	1998	Cromwell	6138–6154
Shaw 2-2	2001	Hartshorne	796–800
<b><u>Sec 3, T8N, R22E</u></b>			
Shaw 1A	1974	Cromwell	6300–6336
<b><u>Sec 4, T8N, R22E</u></b>			
McCurtain 1	1965	Spiro	6234–6286
McCurtain 3	1977	Cromwell	6390–6444
<b><u>Sec 5, T8N, R22E</u></b>			
Steelco 2	1988	Spiro	6268–6378
<b><u>Sec 8, T8N, R22E</u></b>			
Lone Star 1	1965	Spiro	6286–6348
<b><u>Sec 9, T8N, R22E</u></b>			
Cummings Estate 1	1965	Spiro	6104–6296
Cummings Estate 2	1977	Cromwell	6416–6485
Cummings Estate 3X	1999	Spiro	6005–6078
Kennedy 1-9	2002	Hartshorne	806–808
Shaw 2-9	2002	Hartshorne	984–987
Shaw 4-9	2002	Hartshorne	809–811
<b><u>Sec 10, T8N, R22E</u></b>			
Shaw 1-10	2001	Hartshorne	779–784
Shaw 2-10	2002	Hartshorne	808–810
Shaw 3-10	2002	Hartshorne	759–761
D. R. Condo 1	1962	Spiro	5834–5883
D. R. Condo 3	1987	Spiro	5940–6034
<b><u>Sec 11, T8N, R22E</u></b>			
Shaw 2-11	2002	Hartshorne	775–777
Greenwood 1	1969	Spiro	5744–5794
<b><u>Sec 15, T8N, R22E</u></b>			
Federal College Unit 1	1964	Spiro	5840–6016
<b><u>Sec 16, T8N, R22E</u></b>			
Federal Porter 3	1987	Cromwell	6402–6458
<b><u>Sec 17, T8N, R22E</u></b>			
Frank Hightower Unit 1	1965	Spiro	6125–6297
Frank Hightower 2	1989	Spiro	6139–6242