LAND RECLAMATION AND ENVIRONMENTAL COMPLIANCE OF SURFACE COAL MINES - INTERNSHIP WITH KNIGHT HAWK COAL, LLC

BY

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SPECIAL PROJECT REPORT

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ABSTRACT

Surface mine land reclamation is an important field that examines the complexities associated with environmental degradation and environmental repair. This paper provides an analysis of current regulations within the surface mining industry and an overview of reclamation processes completed as part of an internship program with Knight Hawk Coal, LLC. The major focus of this paper will be on three projects completed during the internship:

- Delineation of wetlands and development of recommendations to guide the planning of a haul road in an area with potential wetlands.
- Collection and extrapolation of elevation points, using GPS technology and AutoCAD to create a topographical relief map of a carbon recovery operation to ensure desired surface elevations are met.
- Analysis of permit reclamation requirements, using knowledge of hydrology, plant ecology, and ecological restoration to determine recommendations for requested modification of permit, invasive species control, and plantings.

ACKNOWLEDGEMENTS

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LIST OF ACRONYMS

GIS	Geographic Information System
GPS	Global Positioning System
IDOT	Illinois Department of Transportation
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
KHC	Knight Hawk Coal, LLC
MRR	Midwest Reclamation Resources Inc.
MSHA	Mine Safety and Health Administration
NPDES	National Pollutant Discharge Elimination System
PE	Professional Engineer
SMLRA	Surface Mine Land Reclamation Act
UIUC	University of Illinois at Urbana-Champaign
USDA	United States Department of Agriculture

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CHAPTER 1: INTRODUCTION

1.1 Overview of Knight Hawk Coal, LLC

Knight Hawk Coal, LLC (Knight Hawk), a family-owned coal company, was established in 1998 as a surface coal mining operation in southern Illinois. The operation that reaped southern Illinois' high quality, low chlorine coal expanded in 2006 to include an underground mine. The company continues to grow with ownership of five surface mines, two carbon recovery operations, two underground mines, and a loading dock along the Mississippi River. Today, Knight Hawk produces five million tons of coal annually while providing employment for nearly 400 people (Knight Hawk Coal, 2013d).

According to Knight Hawk, "protecting the environment is more than a mandate, but a mission" (J. Smith, personal communication, 2014). It has created more than 100 acres of new wetlands and has returned nearly 2,000 acres to beneficial use (Knight Hawk Coal, 2013d). It also dedicated 240 acres to expand Pyramid State Park and, in 2012, partnered with Heartland Conservancy to help in the acquisition of the environmentally sensitive Mill Creek Natural Area in Randolph County (Knight Hawk Coal, 2013d).

1.2 Surface Mine Sites

Surface mining is a method of coal extraction that removes soil and rock overlying the mineral deposit. The most common method of surface mining is when a long strip of overburden is removed, and the mineral deposit is excavated, creating a pit. This pit moves throughout the specified area by blasting the forward-moving rim and placing the overburden in the prior excavated area.

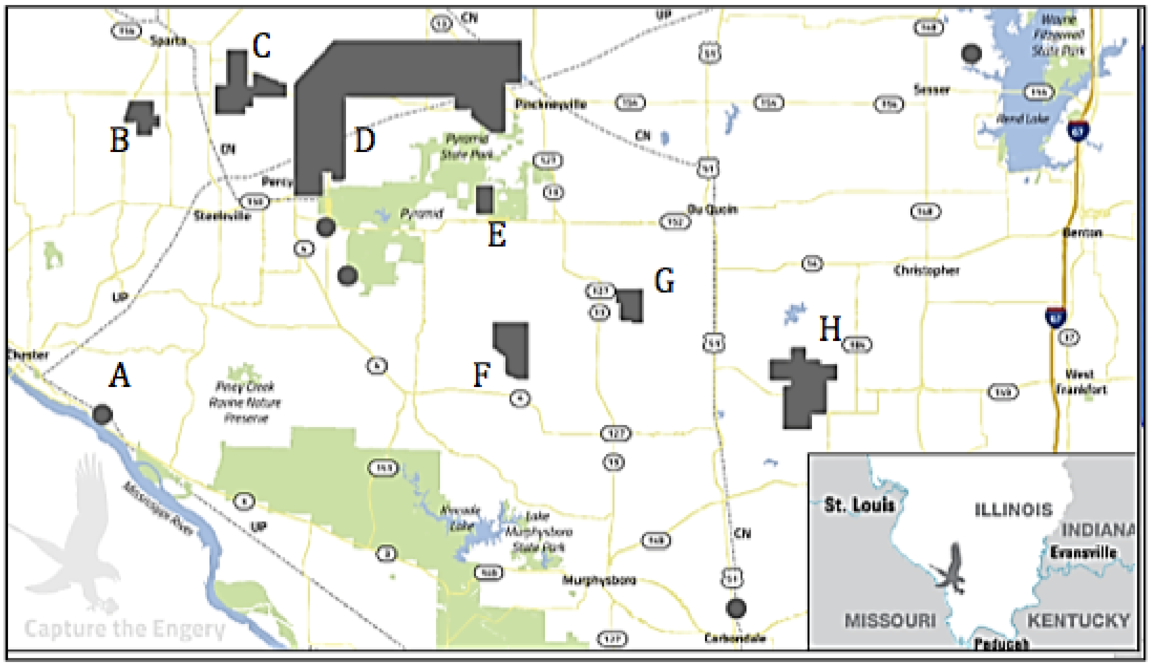
Knight Hawk owns five surface mine locations, four of which are under current operation. The intern worked at each of the five surface mine locations. The first surface mine, Creek Paum Mine, was established in 1998 as the original mine for Knight Hawk. Although a majority of the mine site has been reclaimed to agricultural and wildlife use, 200,000 tons of Murphysboro seam coal remain (Knight Hawk Coal, 2013b). Creek Paum Mine is also the location of Knight Hawk's coal lab where coal samples can be analyzed.

Red Hawk Mine was acquired in 2003 as a surface mining operation. Red Hawk contains 1.5 million tons of reserves in No. 5 and No. 6 Illinois coal seams. In 2011, Red Hawk earned the Illinois Mining Institute's award for safety among state surface mining operations (Knight Hawk Coal, 2013f).

Knight Hawk's largest mine site is its Prairie Eagle Mine. This mine was opened in 2005 as a surface mine and expanded to include two underground mine portals – American Eagle and Prairie Eagle. This 100 million ton reserve of No. 5 and No. 6 Illinois coal seams is also home to Knight Hawk's coal preparation plant and truck loading facility (Knight Hawk Coal, 2013e).

Knight Hawk's Hawkeye Mine was established in Fall 2011. This surface mine contains a 4 million ton reserve of No. 5 and No. 6 Illinois seam coal. A majority of the coal is processed as raw material and blended with washed product. Shortly after the opening of Hawkeye Mine, Blackhawk Mine was established. Blackhawk Mine contains 12 million tons of coal reserve and is one of the larger sized surface mines in operation in Illinois (Knight Hawk Coal, 2013a).

In the near future, as permitting is finalized, Knight Hawk seeks to open its Golden Eagle Reserve. The 3.5 million ton reserve is located adjacently to Pyramid State Park in Pinckneyville, IL. After mining and reclamation activities are finalized, Knight Hawk plans to donate the land to the state of Illinois for wildlife use (Knight Hawk Coal, 2013c).



Map Legend

A – Lone Eagle Dock
B – Hawkeye Mine
C – Blackhawk Mine
D – Prairie Eagle Mine
E – Golden Eagle Mine
F – Creek Paum Mine
G – Red Hawk Mine
H – Royal Falcon Reserve

Figure 1: Areas of shade represent Knight Hawk mine locations (Knight Hawk Coal, 2013g).

1.3 Midwest Reclamation Resources Inc.

Midwest Reclamation Resources Inc. (MRR) is the primary environmental and permitting consultant of Knight Hawk. MRR has provided services to the mining industry for over 17 years and specializes in environmental regulatory and compliance permitting (Midwest Reclamation Resources Inc., 2014a). MRR employs engineers, land surveyors, wildlife biologists, and other specialists in the environmental consultant industry. It utilizes up-to-date technology such as AutoCAD, MircoStation, ArcGIS, Carison, and SEDCAD, in its daily operations. MRR works in close collaboration with state and government agencies including the Illinois Department of Natural Resources (IDNR), the Illinois Environmental Protection Agency (IEPA), the U.S. Army Corps of Engineers, the Mine Safety and Health Administration (MSHA), and the Illinois Department of Transportation (IDOT). Furthermore, MRR staff biologists provide services in forest inventories, animal and plant surveys, wetland and stream monitoring reports, biological stream assessments, and protection and enhancement plans (Midwest Reclamation Resources Inc., 2014b).

1.4 Surface Mining and Coal Production

Domestic energy production is an important component in maintaining the economic stability and global competitiveness of the United States. Providing efficient and cost effective electrical energy to citizens and industry is an essential part of this process. In 2013, approximately 67% of generated electricity was attributed to fossil fuels (coal, natural gas, and petroleum), with 39% from coal alone (U.S. Energy

Information Administration, 2014). Currently, the coal industry is a vital component in meeting the needs of electrical generation in the United States.

The state of Illinois retains a competitive advantage in coal production as it ranks second in the nation in recoverable coal reserves at producing mines (U.S. Energy Information Administration, 2014). Furthermore, Illinois has the largest strippable bituminous coal resource of any state in the nation (Elrick and Korose, 2010). Total production in the state is about 35 million tons per year, down from about 60 million tons per year between 1966 and 1992. Surface mining accounts for 10-15% of the total (Elrick and Korose, 2010).

Although this method of mining is extremely efficient at mining shallower coal seams, it is commonly targeted as a source of environmental degradation from environmental advocates and regulatory agencies. Surface mining disturbs large areas of land creating soil erosion, dust, and water pollution. The temporary removal of vegetation and an interference with natural hydrology reduces habitat and can negatively impact local biodiversity.

1.5 Permitting and Reclamation Regulations of Surface Mine Operations

As a result of expansive environmental harm from mining activity in the mid-20th century, federal and state regulations were created to mandate reclamation efforts. The first legislation to require reclamation in Illinois was the Open Cut Land Reclamation Act of 1962 (IDNR). The Open Cut Land Reclamation Act required spoil ridge tops near public roads to be leveled, graded, and seeded or planted. Illinois also created the Surface Mine Land Reclamation Act (SMLRA) of 1968 to require buffer zones between mine boundaries and roads or buildings (IDNR). The Illinois SMLRA was amended in 1971 to require mine operators to make a public filing of reclamation plans, provide a public hearing on mine plans, and obtain state approval of a reclamation plan. Federal legislation, similar to the Illinois SMLRA, soon followed with Public Law 95-87 and the 1977 Surface Mining Control and Reclamation Act (IDNR). Today's surface mines must also comply with a series of other federal laws that include: the Clean Water Act, the Clean Air Act, the Federal Coal Mine Health and Safety Act, the Endangered Species Act, the Resource Conservation and Recovery Act, the National Historic Preservation Act, and the Fish and Wildlife Coordination Act.

Before mining in Illinois can be accomplished, a permit must be approved through the IDNR Office of Mines and Minerals. A permit application consists of three major components that include the pre-mining inventory, the mine operation plan, and the mine reclamation plan.

The pre-mining inventory includes information that describes the existing site. Examples of required material include information such as surface and groundwater quality, soil factors, alternative water supplies, existing land use, major plant communities, and archeological sites (IDNR). In addition, maps of the proposed site are required that show information such as ownership boundaries, soil surveys, surface water bodies, and locations of all structures.

The second major component of the permit application, the mine operation plan, discusses proposed procedures for mining activity. Items such as waste disposal areas, access roads, stream diversions, and overburden handling, among others items, must be included. The third major component, the mine reclamation plan, must demonstrate how the site will be reclaimed post-mining. This section of the permit application includes information such as the site's post-mined subsoil and topsoil, how overburden will be graded, how the site will be revegetated, and the restoration process for pre-existing streams.

A state interagency committee will review the permit application. The agencies represented include: the IDNR Office of Realty and Environmental Planning, the IDNR Office of Water Resources, the Illinois EPA, the Illinois Historical Preservation Agency, and the Illinois Department of Agriculture. The Federal Office of Surface Mining Reclamation and Enforcement will oversee Illinois permits and reclamation programs (IDNR). A period of roughly five years for research, review, and revisions of a mining permit can be expected before official approval (R. Balch, personal communication, 2014).

If the interagency committee approves a permit, the permit applicant will provide a surety bond that guarantees the success of the proposed reclamation plan. Bond funds will be used by the state to accomplish reclamation if the site is not sufficiently reclaimed by the operator.

1.6 Internship Experience and Learning Objectives

The primary purpose of the land reclamation and environmental affairs internship with Knight Hawk was to understand and utilize scientific processes in the realm of surface mining operations. Four learning objectives were identified and completed by the intern during the internship. The learning objectives required the intern to:

- Conduct on-site research and to analyze progress of current land reclamation projects at Knight Hawk.
- Evaluate past land reclamation projects at Knight Hawk to determine areas of success and areas of needed improvement.
- Research and provide distinguished requirements set forth by governmental organizations that apply to specific land reclamation projects.
- Create digital maps that incorporated Geographic Information Systems (GIS) and Global Positioning Systems (GPS) in land reclamation projects.

After collaboration with Knight Hawk and MRR, several projects and activities were identified to accomplish learning objectives set forth by the requirements of the internship. Primary activities included completing six mine tours and six hazard trainings, attending a monthly mine inspection at each of the six mine sites, and reviewing past surface mining applications and permits. In addition, the intern initiated self-directed projects that included creating wetland delineations at Burning Star No. 4, contour mapping Old Ed Carbon Recovery and Red Hawk Slurry Pond, and providing recommendations for the reclamation of Walkers Creek at Red Hawk Mine.

The internship experience accounted for 180 hours and was completed between June 23, 2014 and August 1, 2014. Approximately 30 hours per week were completed at locations associated with Knight Hawk, including mine sites owned and operated by Knight Hawk, and at the office of MRR.

CHAPTER 2: LITERATURE REVIEW

2.1 Surface Mine Reclamation for Aquatic Habitats

It is common for all natural topography (e.g., relief, streams, wetlands, vegetation, etc.) to be removed in areas exposed to surface mining. After mining is complete, topography must match the approved permit. It is a typical permit requirement for the post-mining landscape to resemble the pre-mining landscape, especially for aquatic features (IDNR). Mining in landscapes that contain aquatic features, such as streams, pose complex challenges in the reclamation process. Adding to the complexity, approved permits often define explicit physical parameters as a basis for stream creation and can cause problems due to uncertainties over future hydrology and water quality (Mutz, 1998).

Long-term goals of aquatic reclamation sites must be incorporated in the planning and implementation stages of reclamation activity, especially when wildlife habitat and quasi-natural sites are needed. The creation of habitat for temporary or quick fixes may impede long-term objectives, when in fact long-term objectives should be the leading factor behind reclamation activity (Holl, 2002; Kolka, Landman, and Sharitz, 2007).

According to a study by Mutz (1998), past reclamation efforts have generalized three primary goals of the stream restoration process:

1) Provide habitat and migrating channels for biota.

2) Increase the natural input of leaf litter.

3) Contribute to an aesthetic environment with high scenic and recreation value.

Although these goals may be a good starting place to think about stream reclamation, broad scale effectiveness of past stream reclamation efforts are questionable. Palmer and

Hondula (2014) analyzed 434 stream mitigation projects from 117 permits for surface mining. The study found that a majority of reclaimed streams were impaired with biotic indices below state standards and stream conductivity exceeding federal water quality criteria. In addition, 97% of the projects reported suboptimal or marginal habitat after 5 years of monitoring. The study concluded that current stream reclamation efforts in surface mines are not meeting objectives of the Clean Water Act (Palmer and Hondula, 2014).

A new paradigm for reclaiming surface mine sites suggests an approach toward adaptive management, where sites will be monitored and habitat elements adjusted over time based on performance data (Eaton, Fisher, McKenna, and Pollard, 2014). Adaptive management is especially important in the revegetation of a site. Planting vegetation in stages better mimics natural systems allowing an understory and midstory to develop (Eaton, Fisher, McKenna, and Pollard, 2014). A higher interest is also placed at the community level over managing for specific species.

Water quality can be a significant limiting factor determining the success of an aquatic restoration project (Petty, Gingerich, Anderson, and Ziemkiewicz, 2013). In a study analyzing restoration priorities in a mined Appalachian watershed, Merovich and Petty (2007) found that variations in ecological condition are strongly correlated to the variation in water quality. The study concluded that acid mine drainage is the dominant factor limiting ecological recovery and should be the primary target for restoration (Merovich and Petty, 2007). A study conducted by Ellison, Hicks, and Skinner (2008) determined that using best management practices in stream restoration, such as stabilizing stream channels, improving riparian areas, and placing in-stream structures to divert flow during high discharges, offer the most successful restoration. Implementing such strategies results in stream improvements such as reductions in specific conductivity, turbidity, and total dissolved solids (Ellison, Hicks, and Skinner, 2008).

The size of the stream and flow consistency also impacts reclamation success. Hall, Beeson, and Lockwood (2014) compared water quality, habitat, and biological conditions in reclaimed headwater streams to reference streams. Due to overall similarities between reference streams and reclaimed streams, the study suggests that small headwater streams can quickly recover following suitable reclamation techniques.

2.2 Vegetation Recovery on Reclaimed Coal Surface Mines

Adequate and proper vegetation coverage is an important aspect at a surface mine reclamation site. The selection of vegetative coverage depends upon regional attributes (e.g., soil type, climate, site goals, etc.). Ashby, Hannigan, and Kost (1989) found that *Festuca arundinacea* (Tall Fescue), *Bromus inermis* (Smooth Brome Grass), *Andropogon gerardi* (Big Bluestem), *Medicago sativa* (Alfalfa), and *Securigera varia* (Crown Vetch) are the most well suited to optimize coverage in southern Illinois reclamation sites.

Riparian forests increase the amount of leaf litter in streams and support bank stabilization. The primary goal of riparian forest restoration is to establish a sufficient number of trees quickly in order to create forest conditions along the stream (Czapka, Sweeny, and Yerkes, 2002). Creating successful riparian forests can be difficult as low tree survivorship is common in restoration efforts. According to a study conducted by Czapka, Sweeny, and Yerkes (2002), sapling survivorship rates are as low as 12% when no treatment methods are used and can be as high as 89% when tree shelters and herbicide treatments are used. It is recommended that treatment methods be used in reclamation areas that require quick and sufficient tree growth.

2.3 Control Treatments of *Phragmites australis*

Invasive plant species are problematic invaders that outcompete native vegetation. The management of invasive species in the revegetation of reclaimed lands is important to the overall ecological success of a site. A wide variety of chemical, biological, and mechanical controls are used to eradicate invasive species. Large populations of the invasive species *Phragmites australis* (Common Reed) occur throughout the southern Illinois region. *Phragmites australis* is a perennial grass that vigorously spreads through rhizomes and stolons (Knezevic, Datta, and Rapp, 2008). Due to the ability of *Phragmites australis* to spread rapidly, the plant is quick to establish colonies in disturbed areas. *Phragmites australis* needs to be eradicated in areas of vegetative reclamation to ensure the success of reclamation goals.

The control of *Phragmites australis* is extremely difficult and best management practices should be used to most efficiently eradicate the plant. Cross and Flemings (1989) found that the control of Phragmites is achieved most effectively if combined treatments are used. For example, burning during mid-summer and then applying a chemical application to new growth is favorable (Cross and Flemings, 1989). Herbicides are the primary method of control. A study by Knezevic, Rapp, Datta, and Irmak (2013), compared common herbicide treatments and found that doses of imazapry (280 and 560 g active ingredient [a] ha^{-1}) provides the highest level of Phragmites control.

Most management approaches focus on eradicating individual patches of Phragmites. This approach may provide the most economical solution at control, however, current studies suggests that management needs to shift to watershed-scale efforts for long-term success (Hazelton, Mozdzer, Burdick, Kettenring, and Whigham, 2014).

CHAPTER 3: MATERIALS AND METHODS

3.1 Hazard Training and Mine Tours

At the beginning of the internship, the intern conducted hazard trainings and mine tours at each of the six mine sites. Under MSHA Part 46, surface mines are required to conduct annual safety training for appropriate personnel (U.S. Department of Labor, 1999). The intern complied by participating in six on-site hazard training programs. Hazard trainings included, but were not limited to, safety procedures for moving machinery and equipment, stockpile and high-wall hazards, and potential hazards involving fire, electrical, and explosives. The intern signed hazard training completion forms that are kept on record at the office of each mine site (Appendix A). A hazard training completion adhesive is given for individuals to attach to a visual area (e.g., hardhat, clipboard, etc.) while in the mine site.

The intern completed tours with Knight Hawk employees at each mine location. The history, current status, and future outlook of each mine site were discussed as well as successes and needed improvements. Various mining equipment and contracting services were featured at each mine location.

3.2 Illinois Department of Natural Resources Mine Inspections

Mine inspectors from the IDNR Office of Mines and Minerals must inspect each mine site monthly (IDNR). Staff from Knight Hawk and MRR typically joins routine IDNR mine inspections at Knight Hawk mine location. The intern completed at least one routine inspection per each of the six mine sites as part of the internship experience.

Inspections were typically several hours in length with each mine location having an assigned IDNR inspector.

Figure 2: Inspectors from the IDNR Office of Mines and Minerals and representatives from Knight Hawk discuss surface mine reclamation efforts at Red Hawk Mine.

Although there are many factors that inspectors looked for at a mine site, soil erosion and NPDES compliance were major areas of focus during attended inspections. Inspectors also made sure the progress and structure of each mine matched the approved mining permit. Inspectors made recommendations to prevent soil erosion that included using straw bales in gullies and planting cover crops in areas of bare soil. Inspectors collected water samples at each NPDES in which water was flowing. The intern's role during the inspection process was to act as a consultant for Knight Hawk if inspectors had questions or comments that needed to be addressed. The intern interacted with inspectors by helping to identify stockpile locations on a map and discussing soil erosion prevention methods. Although specific results of inspections fall out of the scope of this report, all intern observed inspections successfully passed requirements. Knight Hawk carried out recommendations from inspectors.

3.3 Review of Mining Permit Applications

Permitting of an area for human use (e.g., mining, roadway, parking lot, etc.) requires careful consideration of many environmental factors (IDNR). Landscape hydrology, geological conditions, presence of relevant organisms, and many other factors, often determine if permitting for an area is approved by government agencies (IDNR). It is the pursuer's responsibility to provide rationale, evidence of environmental compliance and feasibility of their proposed plan. Landscapes that exhibit factors for a sensitive ecosystem or that contain appropriate habitat for an endangered species are often avoided. To become familiar with permit applications and permit terminology, the intern reviewed the successful Blackhawk mine permit. The intern reviewed the complete permit, with a focus on the permit's pre-mining inventory, mine operation plan, and mine reclamation plan.

3.4 Wetland Delineations at Burning Star No. 4

The intern and a MRR staff biologist conducted a site analysis and wetland delineation for the previously reclaimed mine site, Burning Star No. 4, located near

Prairie Eagle Mine. Knight Hawk is in the early stages of seeking permitting for a haul road in this area for more efficient transportation leading to the American Eagle portal. The American Eagle portal will allow Knight Hawk to access the balance of the 100 million ton coal reserve in an underground mine (Knight Hawk Coal, 2013). Staff at MRR believed that portions of Burning Star No. 4 demonstrated wetland characteristics, which might impede the efforts to develop the haul road. Wetlands provide value for both humans and wildlife, and act as drainage reservoirs increasing flood control and improving water quality (Gosselink and Mitsch, 2000). Furthermore, wetlands provide vital hydro-landscapes that provide suitable habitat for aquatic and semi-aquatic species (Gosselink and Mitsch, 2000). Due to the benefits of wetlands and potential complications of building over wetlands, attempts will be made to avoid wetland landscapes in the region when constructing the proposed haul road on Burning Star No. 4 property.

The intern examined the location near the proposed roadway and delineated wetland areas using the Midwest Region Wetland Determination Data Form and guidelines provided by the U.S. Army Corps of Engineers (Appendix B). The Midwest Region Wetland Determination Data Form is consistent for identifying and delineating wetlands that may be subject to regulatory jurisdiction under Section 404 of the Clean Water Act (U.S. Army Corps of Engineers, 2010). Classifications of wetland landscapes occur when three identifying factors are met - hydrophytic vegetation is present, hydric soil indicators are present (e.g., 5cm mucky peat, sandy gleyed matrix, redox depression), and hydrology indicators are present (e.g., true aquatic plants, surface water, high water table, etc.) (U.S. Army Corps of Engineers, 2010).

The Midwest Region Wetland Determination Data Form required a vegetative analysis for each site being analyzed. According to the U.S. Army Corps of Engineers (2010), plant community type can help in the determination of wetlands. The intern placed a vegetative analysis plot at the approximate center of each plant community to record plant species. A 5-ft radial plot was used for herbaceous plants, and a 15-ft radius was used for saplings and shrubs. A 30-ft radial plot was used for woody vines and trees. At each plot, the intern recorded plant species present and estimated percent cover.

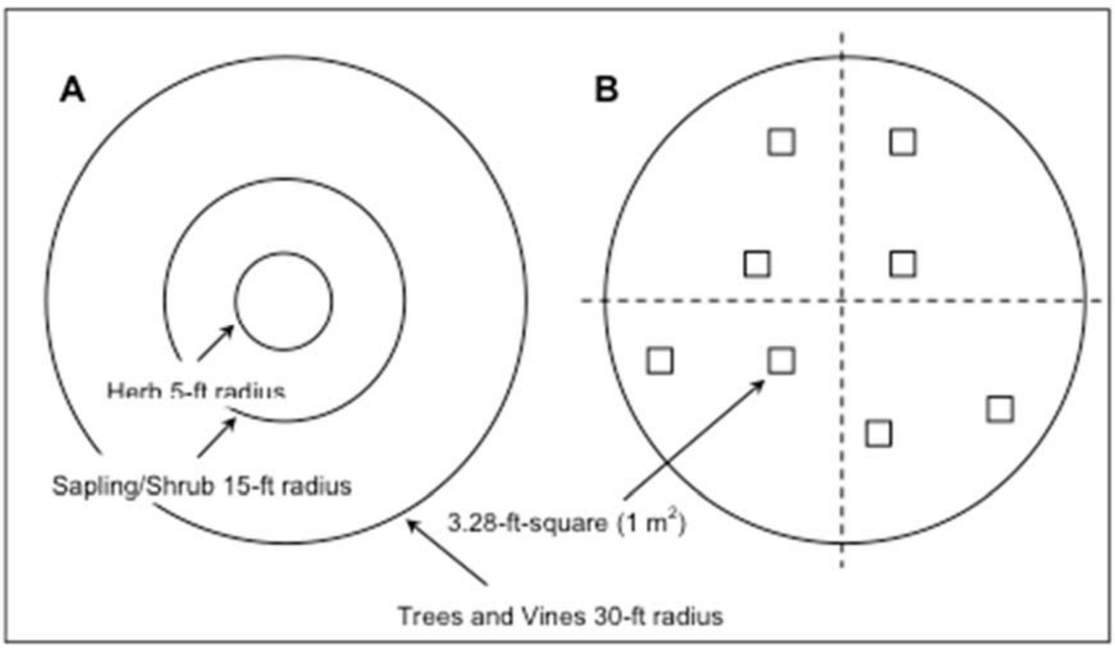


Figure 3: **U.S. Army Corps of Engineers suggested plot arrangements for vegetation sampling. (A) Single plots in graduated sizes. (B) Nested 3.28-by 3.28-ft square (1-m^2) plots for herbs within the 30-ft radius plot. (U.S. Army Corps of Engineers, 2010).**

Five primary levels of vegetative classifications were used to categorize plant species – obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and upland plant species (UPL) (U.S. Army Corps of Engineers, 2010). Four indicators were used to determine hydrophytic vegetation. If any of the four indicators were present, the sampled plant community was labeled as hydrophytic vegetation.

1. *Rapid Test for Hydrophytic Vegetation* – All dominant species are rated FACW and/or OBL.

2. *Dominance Test* – Vegetation rated FACW, FAC, and/or OBL account for more than 50 percent of the dominant plant species.

3. *The Prevalence Index* – The prevalence index formula results in 3.0 or less.

4. *Morphological Adaptations* – The plant community passes either the dominance test or prevalence index after adjustments of plant species that exhibit morphological adaptations characteristic of wetland vegetation.

The intern analyzed soil at each site for the presence of hydric soils. Any overlying debris was removed from the soil (not including decomposing leaf litter) before a 15” spade was used to take a sample. The intern recorded the depth of each layer in the soil profile. For each distinctive layer, the moistened color of the soil was matched to USDA soil taxonomy colorings to determine matrix and redox soil classifications. In addition, the intern determined the soil texture in each layer. The intern examined each soil sample for nineteen hydric soil indicators and five indicators for problematic hydric soils. If any of the hydric soil indicators were present, the soil was classified as hydric.

The third category, wetland hydrology indicators, is the most transitional of the three categories (U.S. Army Corps of Engineers, 2010). Wetland hydrology indicators determine that soil saturation has occurred recently and are not always indicative of long-term wetland characteristics (U.S. Army Corps of Engineers, 2010). Temporal and seasonal fluxes can determine if hydrology indicators are present. The U.S. Army Corps of Engineers Wetland Delineation manual uses four groups of hydrology indicators (U.S. Army Corps of Engineers, 2010). Group A indicators are based upon visual observation of groundwater and surface water. Group B indicators evaluate if the site is prone to water ponding or flooding. Group C indicators evaluate if the soil in the site is currently saturated. Lastly, Group D indicators consist of vegetative and landscape characteristics that are indicative of historically wet conditions. The intern examined twenty primary wetland hydrology indicators and eight secondary wetland hydrology indicators at each of the three sites.

If sites were determined to be indicative of wetlands, the intern walked the perimeter of each area using a Garmin GPS Maps 62 hand-held device. Using an application from the Minnesota Department of Natural Resources called DNRGPS and ArcMap 10.1, the intern created shapefiles showing outlines of the wetlands and uploaded them to existing base maps of the region.

3.5 Contour Mapping Old Ed Carbon Recovery and Red Hawk Slurry Pond

Analyzing the topography of a landscape is an essential component of many land management practices. The study of an area's topography, or more specifically the relief of an area, can influence management decisions regarding water control, soil erosion, and ultimately the use of the landscape. In the surface mining industry, the terrain of the landscape is periodically monitored due to the changing landscape caused by soil excavation and replacement. Furthermore, accurate terrain mapping during all stages (e.g., pre-mining, mining, land reclamation) of a surface mine's operation is required by regulatory agencies (IDNR, 2008).

Techniques for collecting terrain data at a mine location can vary from contracting a firm to conduct aerial terrain mapping to using hand-held GPS devices and AutoCAD software. Using contractors for aerial terrain mapping is costly and done sparingly. However, an advantage of aerial terrain mapping is that large spatial scales can be mapped relatively quickly as opposed to other methods (Vasic, Ninkov, Bulatovic, Susic, and Markovic, 2014). For most projects Knight Hawk and MRR use their own engineering staff to collect elevation points in the field using a portable GPS device and then extrapolate those points to create relief mapping with specific AutoCAD software designed for the mining industry. The main advantage of using software and portable GPS devices to create terrain maps is the ease and accuracy by which maps can be created. Furthermore, land elevations can be monitored in the field to make sure mining plans are being followed.

The intern collected four hundred fifty elevation points using a Trimble R6 GNSS Model 2 rover with a staking rod and a Trimble TSC3 receiver. The advantage of this system is that it does not require a base station, as it is built into the rover, however internet connectivity is required and a cell phone with hot spot capabilities must be used during data collection. Although the Trimble R6 can be stationed on an ATV or vehicle, the rough terrain of the landscape required data to be collected on foot. The location of the data points were collected based upon visual observation of changes in elevations, and additional points were collected in areas of specific interest (e.g., slurry ponds, hillsides, ridges, etc.).

The more data points collected in a given area allow for the creation of more accurate and detailed terrain maps. Once the intern collected all data points using GPS hardware in the field, the elevations of all points were uploaded into AutoDesk Natural Resources Mining & Metals package software. Under the guidance of a professional engineer, the data point elevations were then extrapolated to create a map of contours that demonstrate the landscape terrain.

Figure 4: Intern using a Trimble R6 GPS to take elevation points of Old Ed Carbon Recovery Mine.

The intern collected data at Red Hawk Mine using the same hardware and software mentioned. Data points of the bathymetry (underwater relief) and elevation of a slurry pond were collected to determine the volume of water held in the slurry pond. The intern used a depth finder and portable boat to collect 150 points along the shoreline and cross sections of the lake. The volume of water in slurry ponds change as slurry settles to the bottom of the pond and water is pumped or decanted into other water features. The volume of water must be measured periodically to assess how much additional slurry can fill the pond.

Figure 5: Slurry is being pumped into a slurry pond at Red Hawk Mine.

3.6 Walkers Creek at Red Hawk Mine Reclamation Project

Knight Hawk acquired its Red Hawk surface mine in 2003 (Knight Hawk Coal, 2013). The area was under mine operations when ownership transitioned to Knight Hawk. Upon the takeover of the mine, Knight Hawk became responsible for ensuring that reclamation and mining activities met standards outlined in the existing permit.

A large portion of the internship at Knight Hawk was dedicated to determining the requirements of the Walkers Creek reclamation site set forth in Permit No. 314, created by Buckridge Environmental Engineering Inc. Prior to mining activity in the Walkers Creek floodplain, a diversion ditch was created to re-route the creek around the proposed mining area. According to Permit No. 314, when mining concludes from the Walkers Creek area, the creek is to be replaced in its original location and the diversion ditch is to be filled. Mining is finished in the Walkers Creek area, and while the diversion ditch still exists, a portion of the reclaimed creek has been dug. However, there are concerns whether the recently dug reclaimed creek channel follows Permit No. 314 guidelines. The intern analyzed Permit No. 314 in order to assess the degree to which the re-dug channel complies with the proposed creek channel.

In addition to analyzing Permit No. 314, the intern investigated cross-section maps of the existing re-dug Walkers Creek channel to better understand the current creek width and depth. The cross-section maps were completed before the internship period as part of a terrain mapping project by MRR. The intern compared cross section maps to requirements set forth in Permit No. 314. Specific requirements, such as creek width and floodplain width were identified at points along the creek path. Furthermore, ArcGIS 10.1 was used to create a geodatabase for Permit No. 314. Map layers including satellite imagery, permit boundary, NPDES outfall sampling locations, NPDES stream sampling locations, groundwater well locations, and storm water monitoring locations were identified.

The intern digitized a hard copy map of the proposed creek channel found in Permit No. 314. The intern then georeferenced the digitized map in ArcGIS and added it to the permit geodatabase (Appendix D). Furthermore, the intern digitized existing landscape categories (agriculture, intermediate area, mining, road, shrubland/prairie, water, wooded) in Permit No. 314. The total acreage of each category was determined to assess compliance with Permit No. 314 acreage requirements.

The intern collected on-site data on vegetation type in the Walkers Creek floodplain. The intern walked perimeters of *Phragmites australis* (Common Reed) patches using a Trimble R6 GNSS Model 2 rover with a staking rod. From the data, the intern created a shapefile of the perimeters of the *Phragmites australis* (Common Reed) patches and uploaded them to an existing geodatabase of the site.

Figure 6: Intern using a Trimble R6 GNSS GPS to map areas of *Phragmites australis.*

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Wetland Delineation at Burning Star No. 4

Three delineations of wetland areas were conducted in areas under investigation at Burning Star No. 4. All sampling areas were under normal circumstances and had typical hydrologic conditions at the time of sampling.

The first wetland delineation (HR W03) had a depression and concave relief. The slope of the site was determined to be less than 1%, and the soil map unit name was determined to be 824B – Swanwick silt loam. All three wetland indicators, wetland-specific vegetation, wetland-specific substrate, and appropriate residence time were present.

The vegetation analysis of site HR W03 was indicative of hydrophytic vegetative traits. Tree species found within the 50' radius of the sample were *Quercus macrocarpa* (Bur Oak) at 25% absolute cover, *Fraxinus pennsylvanica* (Green Ash) at 25% absolute cover, and *Liquidambar styraciflua* (Sweet Gum) at 10% absolute cover. Major OBL herb species in a 20' sampling radius included *Scirpus atrovirens* (Common Bulrush) at 20% absolute cover, *Juncus effuses* (Common Rush) at 20% absolute cover, and *Alisma subcordatum* (American Water Plantain) at 20% absolute cover. Hydrophytic vegetative indicators 2 (dominance test) and 3 (prevalence index <3.0) were present.

Hydric soils were present at site HR W03. Soil type 10YR 5/1 at 60% and 10 YR 5/6 at 40% was found. A sandy loam texture was determined and a sandy redox hydric soil indicator was found. There was a low chroma matrix with iron redox concentrations. Iron redox concentrations are typically rust colored, red or orange. They occur when iron is reduced in anaerobic conditions and becomes soluble in soil solution. The iron in the solution oxidizes and re-precipitates when the solution encounters air.

Figure 7: **A handful of soil is obtained at site HR W03 to test if hydric soil indicators are present. Iron redox concentrations (orange areas) can be seen.**

Wetland hydrology indicators were present at site HR W03. Indicators included visible surface water, a high water table, and soil saturation.

The second wetland delineation (HR W04) had a depression landform and concave relief. The slope of the site was determined to be less than 1%, and the soil map unit name was determined to be 824B – Swanwick silt loam. All three wetland indicators were present. It was determined that the site had a shallow forested depression with a perched water table dominated by wetland vegetation.

FACW woody vegetation at the site consisted of *Liquidambar styraciflua* (America Sweet Gum) at 20% absolute cover and *Platanus occidentalis* (American Sycamore) at 10% absolute cover. A 10% absolute cover of *Quercus alba* (White Oak), with a FACU indicator status was found. The only dominant herb stratum found was *Spartina pectinata* (Tall Marshgrass), with a FACW indicator status and 60% absolute cover. Hydrophytic vegetative indicators 2 (dominance test) and 3 (prevalence index <3.0) were present.

Figure 8: A vegetative analysis is conducted at site HR W04 within Burning Star No. 4.

A perched water table above 10", a loamy gleyed matrix, and a depleted matrix indicate that hydric soils are present at site HR W04. Primary wetland hydrology indicators of surface water, a high water table, and saturation indicated that wetland hydrology was present. The area was also prone to poor drainage.

At the third site, sampling point HR PH01, determined the site was a wetland. A concave relief with a shallow pond was found at the sampling site. The depressional area was dominated by *Phragmites australis* (Common Reed) at 80% absolute cover. Other vegetation included a 20% absolute cover of *Scirpus atrovirens* (Green Bulrush), with an indicator status of OBL, and a 20% absolute cover of *Festuca arundinacea* (Tall Fescue) with an indicator status of FACU. The prevalence index was 2.07, resulting in a presence of hydrophytic vegetation.

Redox depressions were found within the soil sample at site HR PH01. Although a high water table was not present at the site, surface water at a depth of 6" was found in a depression, as well as soil saturation, indicating that wetland hydrology was present.

It is my recommendation that the new haul road avoid areas HR PH01, HR W03, and HR W04. These areas demonstrate wetland characteristics as determined by the U.S. Army Corps of Engineers. Building a haul road over wetland areas will be more costly, and perhaps even require wetland mitigation. A professional engineer (PE) at MRR or Knight Hawk will develop the layout of the anticipated new haul road.

Figure 9: Delineated wetlands HR PH01, HR W03, and HR W04 at Burning Star No. 4.

4.2 Contour Mapping Old Ed Carbon Recovery and Red Hawk Slurry Pond

Four hundred fifty data points across the Old Ed Carbon Recovery site were recorded using Trimble GPS hardware. The data points were uploaded into AutoDesk Natural Resources Mining and Metals package software and extrapolated to create an updated relief map for the Old Ed carbon recovery site.

Engineers will utilize the contours and other land features to develop appropriate locations for future coal mining features (e.g., slurry ponds, haul roads, stockpiles, etc.). Furthermore, current contours will be examined in areas of reclamation activity to ensure they meet requirements set forth from approved permits.

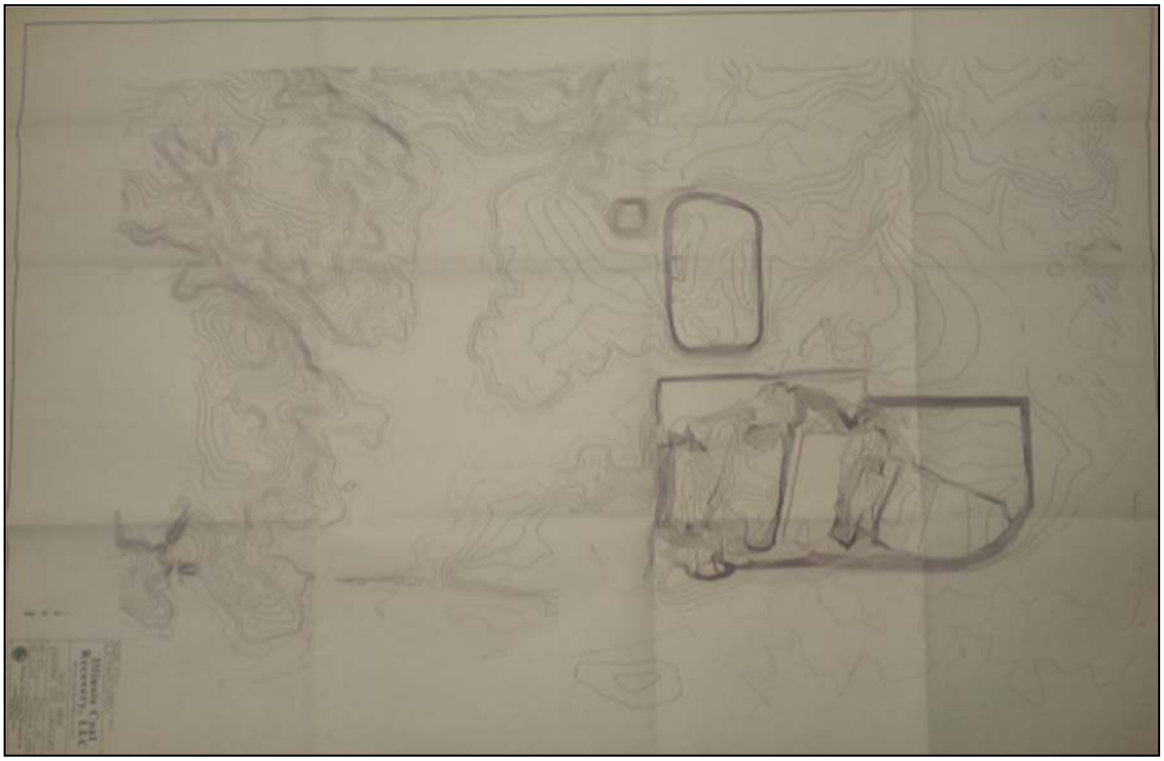


Figure 10: A relief map showing the contours of the Old Ed Carbon Recovery site.

4.3 Walkers Creek at Red Hawk Mine Reclamation Project

The complete and approved Permit No. 314, created by Buckridge Environmental Engineering Inc., was examined to identify specific requirements for the Walkers Creek reclamation site. The proceeding information is a summary of information found in Permit No. 314 that pertains to the Walkers Creek area. Historically, Walkers Creek was an intermittent stream that flowed during the spring and early summer. Typically the stream had zero flow and often dried during late summer and early fall. Along the entire stream length within the study area, vegetation consisted of mature trees or brush. According to Permit No. 314, the original creek was also severely impacted by refuse disposal activities by previous mining activity upstream of the diversion. The historical floodplain ranged from 91 to 152 meters (300 to 500 feet) wide within the mining area.

The stream channel was trapezoidal with bottom widths varying from 3 to 4.5 meters (10 to 15 feet) and an average depth of the stream channel between 1.2 and 1.5 meters (4 and 5 feet). The total length of the stream that was diverted to allow mining was approximately 2,469 meters (8,100 feet) with an upstream drainage area of 4 kilometers (2.5 square miles).

According to Permit No. 314, the final restored creek channel must have a total length of approximately 1,824 meters (5,985 feet). The creek channel will need to retain the historical trapezoidal shape with a bottom width of 3.6 meters (12 feet) and a depth of 1.2 meters (4 feet). A riparian floodplain of 106.6 to 167.6 meters (350 to 550 feet) along the creek is required. The permit also determined that approximately 26.7 hectares (66 acres) of stream riparian habitat was located adjacently to the original stream channel and must be mitigated in the final restored stream channel. The vegetation along the riparian floodplain is required to be wetland type trees planted at a rate of 182 trees per hectare (450 trees per acre).

Existing vegetative cover was analyzed in the current Walkers Creek floodplain in order to predict the ease in which wetland type trees could be planted. The most common vegetative species present was *Ambrosia artemisiifolia* (Common Ragweed) making up approximately 15% of the floodplain, followed by *Bromus inermis* (Smooth Bromegrass), *Festuca arundinacea* (Tall Fescue), *Lespedeza cuneata* (Chinese Bushclover), *Phragmites australis* (Common Reed), and *Rosa multiflora* (Multiflora Rose) each making up approximately 10% of the total vegetative cover.

Scientific Name	Common Name	Approximate Cover Percentage
Ambrosia artemisiifolia	Common Ragweed	15%
Bromus inermis	Smooth Bromegrass	10%
Festuca arundinacea	Tall Fescue	10%
Lespedeza cuneata	Chinese Bushclover/Lespedeza	10%
Phragmites australis	Common Reed	10%
Rosa multiflora	Multiflora Rose	10%
Dactylis glomerata	Orchard Grass	5%
Trifolium pratense	Red Clover	5%
Typha latifolia	Bulrush/Common Cattail	5%
Xanthium strumarium	Common Cocklebur	5%
Andropogon gerardii	Big Bluestem	2%
Eutrochium maculatum	Joe-Pye Weed	2%
Ambrosia trifida	Giant Ragweed	1%
Asclepias syriaca	Common Milkweed	1%
Cyperus esculentus	Yellow Nutsedge	1%
Panicum virgatum	Switchgrass	1%
Populus deltoides	Eastern Cottonwood	1%
Salix nigra	Black Willow	1%
Bulbostylis capillaris	Hairsedge	<1%
Carex vulpinoidea	Fox Sedge	<1%
Cirsium arvense	Canada Thistle	<1%
Juncus effusus	Common Rush	<1%
Lactuca serriola	Prickly Lettuce	<1%
Persicaria maculosa	Lady's Thumb Smartweed	<1%
Persicaria pensylvanica	Pennsylvania Smartweed	<1%
Phleum pratense	Timothy	<1%
Rhus copallina	Dwarf Sumac	<1%
Rumex crispus	Curly Dock	<1%
Scirpus atrovirens	Green Bulrush	<1%
Sorghastrum nutans	Yellow Indiangrass	<1%
Verbena hastata	Blue Vervain	<1%

Table 1: Vegetation analysis at Walkers Creek riparian buffer at Red Hawk Mine.

The current vegetation cover had very few wetland type trees (less than 2%) and the existing vegetation will need to be removed. A majority of the vegetation can be easily removed through disc tillage and chemical spray. When the area is cleared wetland tree saplings should be planted. It is estimated that *Phragmites australis* makes up 10% of the vegetation cover. This area should be avoided during disc tillage and may require several seasons of active eradication before wetland saplings are planted.

Controlling *Phragmites australis* is difficult as this extremely dense invasive species spreads rapidly through rhizome transport and seedling establishment (Brisson, Blois, and Lavoie, 2010). Unfortunately, it will take several seasons of control to eradicate *Phragmites australis,* and spot treatments will likely be used to avoid contact with tree saplings. The timeline for complete restoration of the restored Walkers Creek channel is five years. Bond release for Permit No. 314 is contingent upon the successful survival of wetland trees at the approved rate, as well as the establishment of Walkers Creek according to permit specifications (or modification specifications).

A delineated map of *Phragmites australis* was created to help in managing future eradication efforts. Knight Hawk staff can use the map to locate the most extensive patches of *Phragmites australis* during control treatments. A calculation of the total area of *Phragmites australis* within Permit No. 314 can be determined from the digital map and utilized to predict the amount of control treatments necessary (e.g., amount of chemical spray needed). Lastly, the map can be used to model the spread or reduction of *Phragmites australis* patches over time.

Figure 11: A delineation of patches of *Phragmites australis* in the Walkers Creek site.

Aerial imagery was obtained and digitized to create an existing land cover map of the entire Permit No. 314 boundary. The map shows seven land cover classifications and demonstrates the current status of Permit No. 314. As can be seen in Figure 9, a majority of the permit is currently in agriculture production. These areas have been successfully reclaimed and are consistent with permit requirements. Furthermore, a large portion of Permit No. 314 is still being mined or is in a transitional area. The transitional and mining areas will need to be reclaimed when mining is complete.

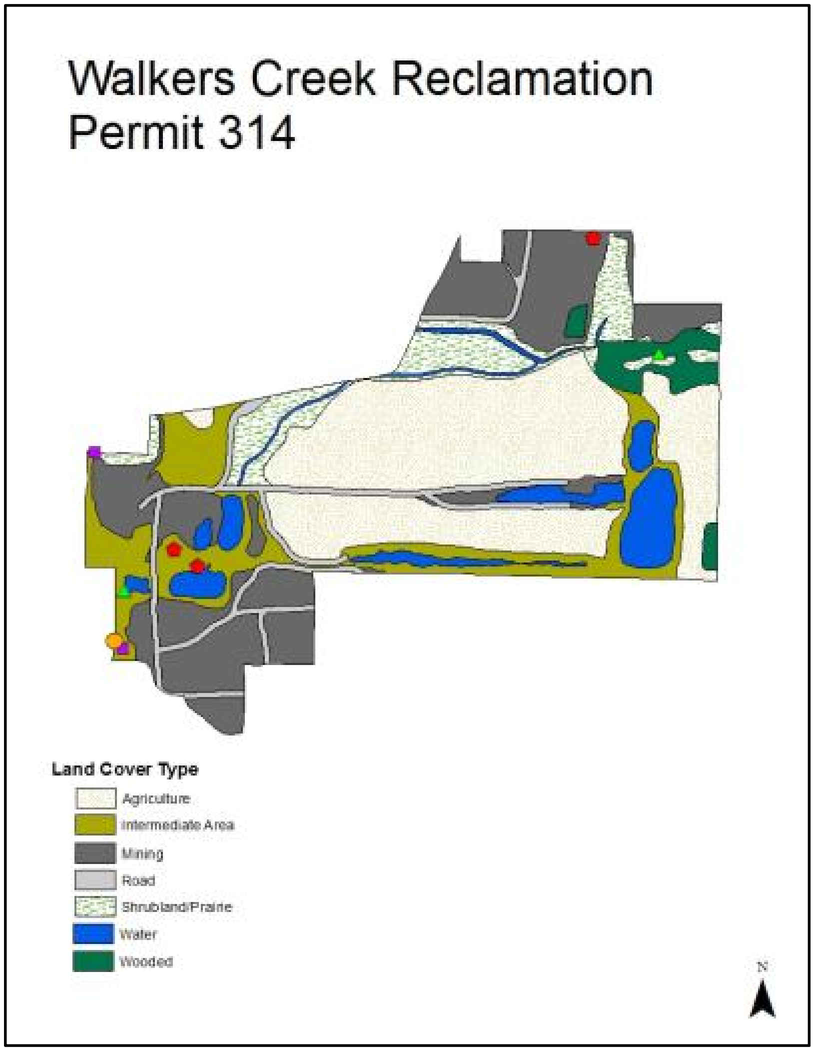


Figure 12: Digitized land classifications at Walkers Creek reclamation site (Permit No. 314).

CHAPTER 5: RECOMMENDATIONS

5.1 Incorporate Additional Roles of ArcGIS in Business Practice

The primary computer software used by Knight Hawk is AutoCAD. This powerful software is utilized for most engineering and mapping practices. Although AutoCAD is likely the best-fit software for most of the work objectives that Knight Hawk and MRR accomplishes, the use of ArcGIS could be expanded. Currently, the MRR staff wildlife biologist uses ArcGIS to create maps for delineations of land features (e.g., wetlands, bat habitat, plant communities, etc.) and other general map layers. However, ArcGIS has the potential to provide additional impact upon environmental and economic business decisions. For example, Peabody Energy, the world's largest private-sector coal company, uses ArcGIS and an interface called easiTool to conduct watershed erosion modeling on surface mine operations (Huang et al., 2012). With this ArcGIS feature, Peabody can demonstrate that post-mining sediment yields are less than pre-mining sediment yields and reclaimed lands are relatively stable with respect to erosion (Huang et al., 2012). According to Esri, ArcGIS and easiTool can also be used for quick identification of watershed units, calculation of attributes like hill slope cover type and channel gradient, determination of spatial relations between watershed units, and visualization of modeling results (Huang et al., 2012). It is recommended that Knight Hawk incorporates ArcGIS for environmental, economic, and efficiency benefits. ArcGIS features, such as erosion modeling and identification of watershed units, can improve overall operation of the land reclamation process.

5.2 Recommendations for Walkers Creek Reclamation Site

Five stages of reclamation in the Walkers Creek area have been created to complete the reclamation project.

1) Eliminate *Phragmites australis* patches in Walkers Creek riparian zone in order for the successful future establishment of wetland type trees.
2) Prepare modification request of Permit No. 314 to change the proposed creek layout to match the existing re-dug creek path and topography. After georeferencing the proposal creek outlined with the existing re-dug creek channel, slight variations of meandering in the creek channel and floodplain width can be seen. After consulting with MRR, it has been suggested the re-dug creek channel be left as is, depending on if the Office of Mines and Minerals will approve a modified permit.
3) Once a modification request is approved, re-grade several “damaged” areas of existing Walkers Creek channel and add riprap to determined areas as discussed in a modified permit.
4) Plant wetland type trees in the riparian zone to match requirements of Permit No. 314.
5) Connect re-established Walkers Creek channel to the original creek point and fill divergent ditch to restore the creek and intermittent wetland hydrology in the Walkers Creek reclamation area.

CHAPTER 6: INTERNSHIP EVALUATION

The Capstone Internship experience was a great conclusion to the Master of Science in Natural Resources and Environmental Sciences degree at the University of Illinois, Urbana-Champaign (UIUC). The 180-hour internship at Knight Hawk provided valuable fieldwork and practical career-oriented knowledge that will be helpful in a foreseeable career. The internship experience allowed for the opportunity to develop hands-on skills in data collection and analysis that included using GIS, GPS, and field surveys (e.g., vegetative, hydrology, soils). Due to my lack of previous experience in scientific field research and on-site data collection, an internship of this type was not only valuable, but also needed.

My prior work experience and knowledge in the agricultural industry helped during duties associated with the internship. Topics involving soil fertility, crop yields, and grazing pastures, were common when discussing reclaimed surface mine sites. Furthermore, my current position as a high school agricultural education and environmental science instructor allowed me to use my knowledge of agriculture in the southern Illinois region and apply it to the internship experience. The work experience at Knight Hawk will allow me to better teach students about localized efforts in land reclamation and natural resource management. It is probable that several of these students will work for Knight Hawk or a contracting service they utilize in the future.

Knowledge gained through graduate coursework at UIUC prior to the internship experience was used throughout the internship experience. Course topics from NRES 401 “Watershed Hydrology”, NRES 598 “Wildlife Ecology and Ag. Policy”, NRES 598 “Issues in Aquatic Ecosystems”, NRES 511 “Principles in Applied Ecology”, and NRES

454 “GIS in Natural Resource Management” were valuable during internship projects. Relief mapping and factors that determine wetland type and efficiency (e.g., vegetation type, residence time, loading rate, etc.) were discussed in the course “Watershed Hydrology”. Wetland delineations were discussed in “Watershed Hydrology” and applied during the mapping project at Burning Star No. 4. Topics dealing with human dimensions of the environment, such as The Clean Water Act and land reclamation, were discussed in “Wildlife Ecology and Ag. Policy”. Perhaps the most used course topics during the internship were related to “GIS in Natural Resource Management”. Knowledge gained in this course allowed me to take a leading role in developing maps with ArcGIS software. In total, courses at UIUC provided background knowledge applicable to nearly every component of the Capstone Internship and will be of great value for future career aspirations.

Although I wouldn’t trade any of the experiences completed during the Capstone Internship at Knight Hawk, I would revisit several learning objectives and tasks listed on the Graduate Internship Approval Form (GIAF). A majority of objectives and tasks listed on the GIAF were completed during the internship. However, like most on-the-job experiences, new duties arise that take priority and others are omitted. In the field of surface mining and land reclamation, projects are often in a dynamic state as weather conditions, mine progress, and inspector recommendations influence them.

The learning objective that was omitted during this internship was “to serve as a liaison between Knight Hawk and regional environmental advocacy groups by expanding outreach opportunities for both parties”. Although acting in the role of a liaison between environmental advocacy groups and Knight Hawk may have appeared to be a proper internship objective, and perhaps a noble idea, after reconsideration, the task was avoided due to potential business conflicts. For example, as an intern of the company, when speaking with environmental advocacy groups such as the Sierra Club, it could have been perceived as a conflict of interest in the event of inadvertently disseminating proprietary information.

Severe environmental damage and minimal reclamation efforts from past surface mines have lead environmental advocacy groups to strongly opposed surface mining across the United States. Despite the fact that Illinois surface mines cause significantly less environmental damage today and put forth large economic investments to meet reclamation requirements, some environmental advocacy groups want mining operations to cease indefinitely due to unavoidable environmental disturbance. Even though Knight Hawk operates surface mines with great attention, effort, and expense dedicated to its reclamation efforts and often surpass the minimum requirements within environmental mandates, I made the decision to remove myself from the liaison role and any activity that could inadvertently harm the success of the company.

The internship at Knight Hawk provided valuable real-world experience that will be used in future career endeavors. A holistic understanding of the reclamation process was learned through completing mine tours, reading surface mine permits, and attending IDNR mine inspections. I hope Knight Hawk will be able to use pieces of my work and act upon suggestions that were discussed in this paper. During the construction of a haul road at Burning Star #4, I urge Knight Hawk to avoid delineated wetland areas. I also hope Knight Hawk engineers can use the updated topographical relief map for its Old Ed Carbon Recovery Site. Lastly, I hope my dissection and recommendations of the

Walkers Creek site can be used to reclaim the site in an efficient and environmentally favorable manner.

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APPENDIX A: HAZARD TRAINING FORM

Certificate of Training

U.S. Department of Labor
Mine Safety and Health Administration

Approved OMB Number 1219-0009, Expires July 31, 2014.

This certificate is required under Public Law 91-173 as amended by Public Law 95-164. Failure to comply may result in penalties and other sanctions as provided by sections 108 and 110, Public Law 91-173 as amended by Public Law 95-164.

➡ Issue Certificate Immediately Upon Completion of Training

Serial Number (for operator's use) [redacted]

1. Print Full Name of Person Trained (first, middle, last)
Blake Colasure

2. Check Type of Approved Training Received:
☐ Annual Refresher ☐ Experienced Miner ☒ Hazard Training
☐ New Task (specify below) ☐ Newly Employed, Inexperienced Miner ☐ Other (specify)

Date	Task	Initials (Instr / Stud)	Date	Task	Initials (Instr / Stud)

3. Check Type of Operation and Related Industry:
A. ☒ Surface ☐ Construction ☐ Underground ☐ Shaft & Slope
B. ☒ Coal ☐ Metal ☐ Nonmetal

4. Date Training Requirements Completed
7-9-14
☐ Check if not completed and go to item 5, below.
➡ If completed, go to item 6, below.

5. Check Subjects Completed (use only for partially completed training):
☐ Introduction to Work Environment
☐ Hazard Recognition
☐ Emergency Medical Procedures
☐ H&S Aspects of Tasks Assigned
☐ Statutory Rights of Miners
☐ Self-Rescue & Respiratory Devices
☐ Transport & Communication Systems
☐ Roof/Ground Control & Ventilation
☐ Mine Map; Escapeways; Emergency Evacuation; Barricading
☐ Cleanup; Rock Dusting
☐ Mandatory Health & Safety Standards
☐ Authority & Responsibility of Supervisors & Miners' Representatives
☐ Health
☐ Electrical Hazards
☐ First Aid
☐ Mine Gases
☐ Explosives
☐ Prevention of Accidents
☐ Other (specify)

6. **False certification is punishable under section 110 (a) and (f) of the Federal Mine Safety & Health Act (P. L. 91-173 as amended by P. L. 95-164).**

I certify that the above training has been completed (signature of person responsible for training)

7. Mine Name, ID, & Location of Training (if institution, give name & address)
KHC Red Hawk 11-03045

8. Date
7-9-14

I verify that I have completed the above training (signature of person trained)
X

MSHA Form 5000-23, Jan. 99 (revised)

Copy 2 - Employer's Record Copy

APPENDIX B: WETLAND DETERMINATION DATA FORMS

Reference:

U.S. Army Corps of Engineers. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region. U.S. Army Corps of Engineers Research and Development Center. 2:1-139.

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: ______ City/County: ______ Sampling Date: ______

Applicant/Owner: ______ State: ______ Sampling Point: ______

Investigator(s): ______ Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______

Slope (%): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ______ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ______ No ______	**Is the Sampled Area within a Wetland?**	**Yes ______ No ______**
Hydric Soil Present?	Yes ______ No ______		
Wetland Hydrology Present?	Yes ______ No ______		
Remarks:			

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ______	x 1 = ______
FACW species ______	x 2 = ______
FAC species ______	x 3 = ______
FACU species ______	x 4 = ______
UPL species ______	x 5 = ______
Column Totals: ______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ______ No ______

Remarks: (Include photo numbers here or on a separate sheet.)

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SOIL

Sampling Point: __________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix: Color (moist)	Matrix: %	Redox Features: Color (moist)	Redox Features: %	Redox Features: Type[1]	Redox Features: Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5)
__ 2 cm Muck (A10)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ 5 cm Mucky Peat or Peat (S3)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

__ Coast Prairie Redox (A16)
__ Dark Surface (S7)
__ Iron-Manganese Masses (F12)
__ Very Shallow Dark Surface (TF12)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________________

Depth (inches): ______________________

Hydric Soil Present? Yes _____ No _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1)
__ Sediment Deposits (B2)
__ Drift Deposits (B3)
__ Algal Mat or Crust (B4)
__ Iron Deposits (B5)
__ Inundation Visible on Aerial Imagery (B7)
__ Sparsely Vegetated Concave Surface (B8)
__ Water-Stained Leaves (B9)
__ Aquatic Fauna (B13)
__ True Aquatic Plants (B14)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres on Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Gauge or Well Data (D9)
__ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

__ Surface Soil Cracks (B6)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Stunted or Stressed Plants (D1)
__ Geomorphic Position (D2)
__ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): ___________

Water Table Present? Yes _____ No _____ Depth (inches): ___________

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): ___________

Wetland Hydrology Present? Yes _____ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Prairie Eagle - Hual Road IBR City/County: Perry Sampling Date: 6/26/14
Applicant/Owner: Knight Hawk Coal, LLC State: IL Sampling Point: HR W03
Investigator(s): Blake Colclasure & S. Duncan Section, Township, Range: Section 21, Township 5S Range
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave
Slope (%): 0-1 Lat: 38.074735 Long: 89.54278 Datum: WGS84
Soil Map Unit Name: 824B - Swanwick silt loam NWI classification: PEM/PFO

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland? Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks: Forested depression with hydric vegetation, soil indicators, and hydrology.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 50' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus macrocarpa	25	Y	FAC
2. Fraxinus pennsylvanica	25	Y	FACW
3. Liquidambar styraciflua	10	N	FACW
4.			
5.			
	60	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum (Plot size: 20' radius)			
1. Scirpus atrovirens	20	Y	OBL
2. Juncus effusus	20	Y	OBL
3. Alsima subcordatum	20	Y	OBL
4. Bulbostylis capillaris	15	N	FACU
5. Carex vulpinodea	15	N	FACW
6. Carex tribuloides	10	N	OBL
7.			
8.			
9.			
10.			
	100	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 1.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	70	x 1 = 70
FACW species	50	x 2 = 100
FAC species	25	x 3 = 75
FACU species	15	x 4 = 60
UPL species		x 5 =
Column Totals:	160 (A)	305 (B)

Prevalence Index = B/A = 1.91

Hydrophytic Vegetation Indicators:

☐ 1 - Rapid Test for Hydrophytic Vegetation
☑ 2 - Dominance Test is >50%
☑ 3 - Prevalence Index is ≤3.0[1]
☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)
Wetland vegetation dominant. Mix of Cyperacea plants and small-flowered water plantain.

SOIL

Sampling Point: ___________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 5/1	60	10YR 5/6	40	C	M	Sandy L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☑ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Dark Surface (S7)
- ☐ Iron-Manganese Masses (F12)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___________

Depth (inches): ___________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

Sandy reduced soil within forested depression. Low chroma matrix with redox concentrations.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Gauge or Well Data (D9)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ☑ No ☐ Depth (inches): 0-1"

Water Table Present? Yes ☑ No ☐ Depth (inches): Surface

Saturation Present? (includes capillary fringe) Yes ☑ No ☐ Depth (inches): Surface

Wetland Hydrology Present? Yes ☑ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

On-site inspection

Remarks:

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Prairie Eagle - Hual Road IBR City/County: Perry Sampling Date: 6/30/14
Applicant/Owner: Knight Hawk Coal, LLC State: IL Sampling Point: HR W04
Investigator(s): Blake Colclasure & S. Duncan Section, Township, Range: Section 21, Township 5S Range
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave
Slope (%): 0-1 Lat: 38.075720 Long: 89.544806 Datum: WGS84
Soil Map Unit Name: 824B - Swanwick silt loam NWI classification: PEM/PFO

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland? Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks: Shallow forested depression with a perched watertable dominated by wetland vegetation. Gleyed soils present.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 50' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	20	Y	FACW
2. Platanus occidentalis	10	Y	FACW
3. Quercus alba	10	Y	FACU
4.			
5.			
	40	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum (Plot size: 20' radius)			
1. Spartina pectinata	60	Y	FACW
2. Juncus effusus	15	N	OBL
3. Carex vulpinoidea	10	N	FACW
4. Alisma subcordatum	10	N	OBL
5.			
6.			
7.			
8.			
9.			
10.			
	95	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: .75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	25	x 1 = 25
FACW species	100	x 2 = 200
FAC species	0	x 3 = 0
FACU species	10	x 4 = 40
UPL species	0	x 5 = 0
Column Totals:	135 (A)	265 (B)

Prevalence Index = B/A = 1.96

Hydrophytic Vegetation Indicators:

☐ 1 - Rapid Test for Hydrophytic Vegetation
☑ 2 - Dominance Test is >50%
☑ 3 - Prevalence Index is ≤3.0[1]
☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)
Prairie cordgrass dominates herb stratum. Other herb species are wetland associated.

SOIL

Sampling Point: ___________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	60	10YR 5/6	40	C	M	CL	Depleted Matrix
8-10			10Y 6/1	60	RM	M	CL	Gleyed Matrix
8-10			10YR 5/6	40	C	M	CL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] 2 cm Muck (A10)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] 5 cm Mucky Peat or Peat (S3)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1)
- [x] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- [ ] Coast Prairie Redox (A16)
- [ ] Dark Surface (S7)
- [ ] Iron-Manganese Masses (F12)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: Perched watertable abov
Depth (inches): 10

Hydric Soil Present? Yes [x] No [ ]

Remarks:
Gleyed Matrix, Perched watertable, Depleted matrix above gleyed soils.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] True Aquatic Plants (B14)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Gauge or Well Data (D9)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Drainage Patterns (B10)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes [x] No [ ] Depth (inches): 0-1"
Water Table Present? Yes [x] No [ ] Depth (inches): Surface
Saturation Present? (includes capillary fringe) Yes [x] No [ ] Depth (inches): Surface

Wetland Hydrology Present? Yes [x] No [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
On-site inspection

Remarks:
Forested depression with perched watertable and poor drainage.

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Prairie Eagle - Hual Road IBR City/County: Perry Sampling Date: 6/30/14
Applicant/Owner: Knight Hawk Coal, LLC State: IL Sampling Point: HR PH01
Investigator(s): Blake Colclasure & S. Duncan Section, Township, Range: Section 21, Township 5S Range
Landform (hillslope, terrace, etc.): Depression/shallow pond Local relief (concave, convex, none): Concave
Slope (%): 0-1 Lat: 38.078517 Long: 89.542189 Datum: WGS84
Soil Map Unit Name: 871B - Lenzburg gravelly silty clay loam NWI classification: PEM/PAB
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐ No ☐	Is the Sampled Area within a Wetland? Yes ☐ No ☐
Hydric Soil Present?	Yes ☐ No ☐	
Wetland Hydrology Present?	Yes ☐ No ☐	

Remarks: Depressional area dominated by Phragmites australis that had saturated soils at the time of inspection. Small pool of water on one end of emergent wetland.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 20' radius)			
1. Elaeagnus umbellata	5	Y	FACU
2.			
3.			
4.			
5.			
= Total Cover	5		
Herb Stratum (Plot size: 20' radius)			
1. Phragmites australis	80	Y	FACW
2. Scirpus atrovirens	20	N	OBL
3. Festuca arundinacea	20	N	FACU
4. Carex tribuloides	10	N	OBL
5. Rubus occidentalis	10	N	FACU
6. Lemna minor	10	N	OBL
7.			
8.			
9.			
10.			
= Total Cover	150		
Woody Vine Stratum (Plot size:)			
1.			
2.			
= Total Cover			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: .50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	40	x 1 = 40
FACW species	80	x 2 = 160
FAC species		x 3 =
FACU species	30	x 4 = 120
UPL species		x 5 =
Column Totals:	150 (A)	310 (B)

Prevalence Index = B/A = 2.07

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)
Wet depressional area dominated by common reed. Small pool of shallow water covered with common duckweed.

SOIL

Sampling Point: ___________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/3	60	10YR 5/6	40	C	M	SCL	
6-10	10YR 5/3	50	10YR 5/6	50	C	M	SCL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☑ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Dark Surface (S7)
- ☐ Iron-Manganese Masses (F12)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___________

Depth (inches): ___________

Hydric Soil Present? Yes ☑ No ☐

Remarks:
Prominent concentrations indicate redox conditions within a depression.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Gauge or Well Data (D9)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ FAC-Neutral Test (D5)

Field Observations:

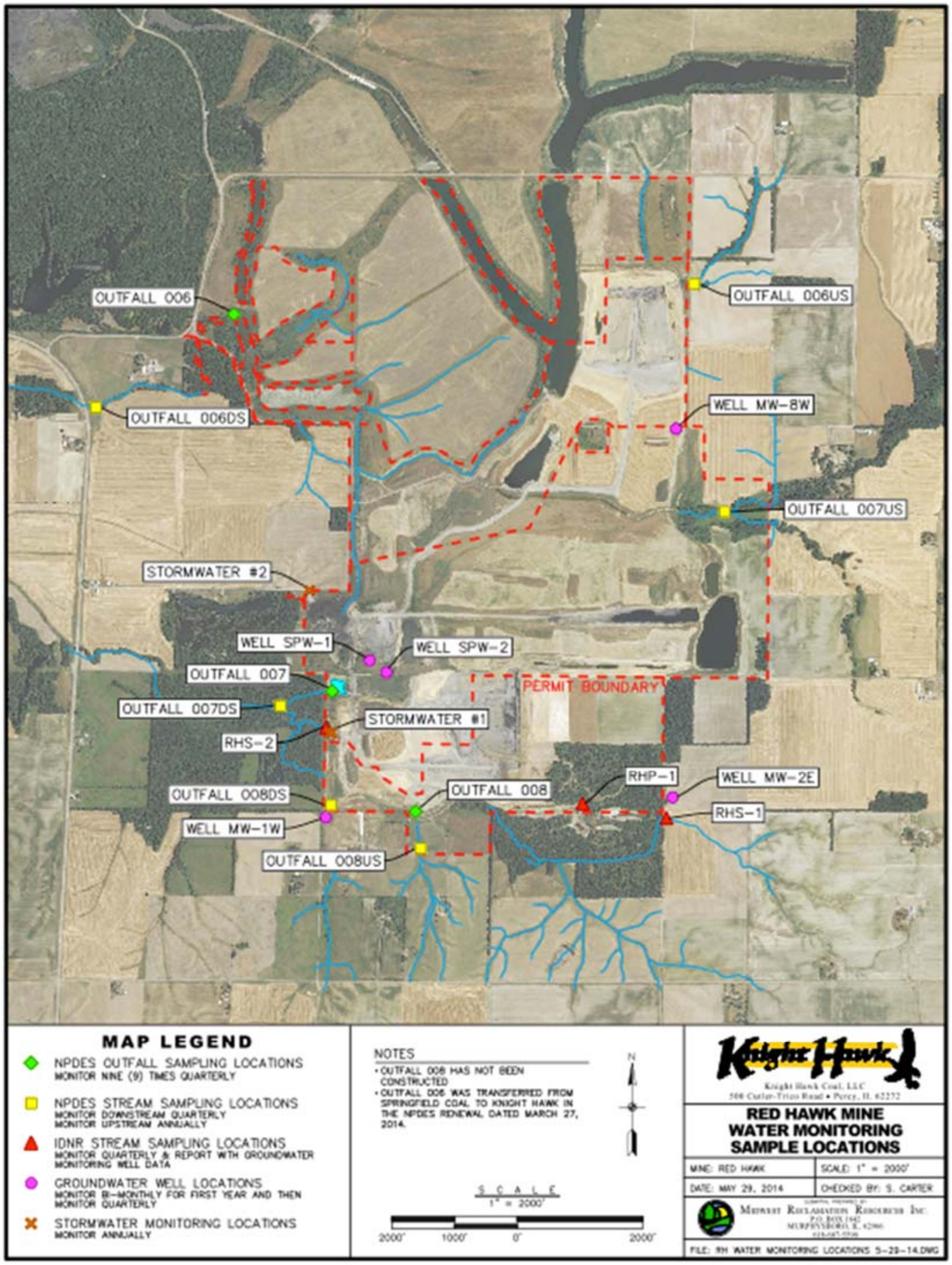
	Yes	No	Depth (inches)
Surface Water Present?	☑	☐	6"
Water Table Present?	☐	☑	
Saturation Present? (includes capillary fringe)	☑	☐	Surface

Wetland Hydrology Present? Yes ☑ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
On-site inspection

Remarks:

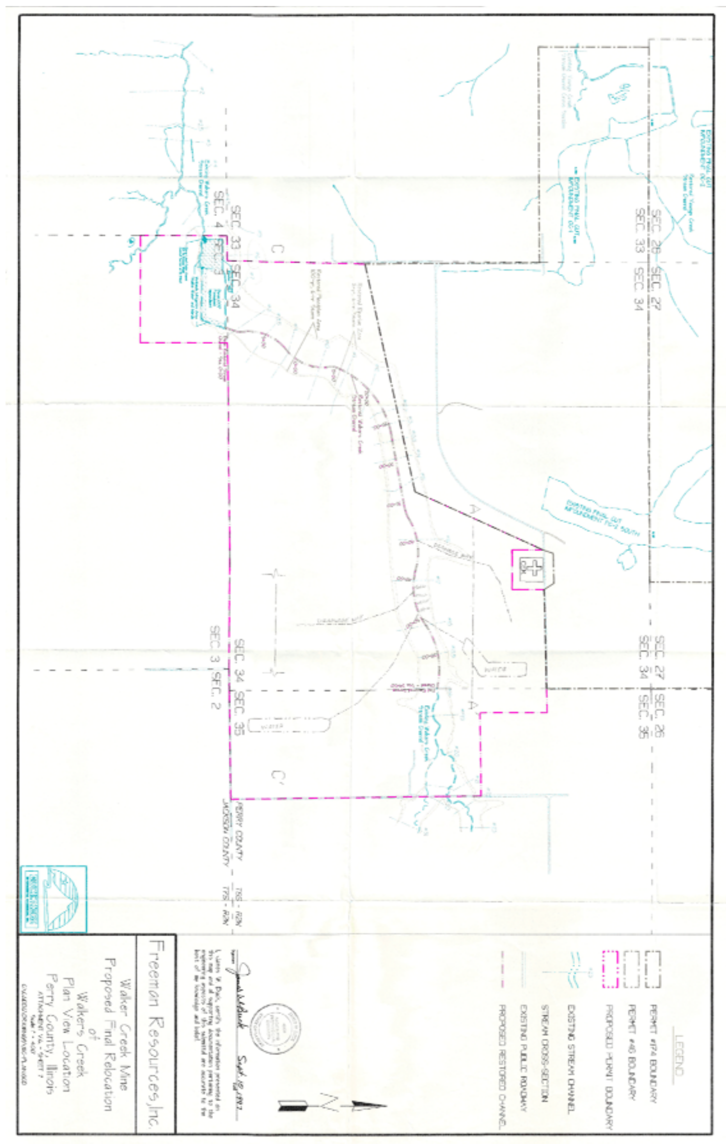
APPENDIX C: RED HAWK MINE MAP



APPENDIX D: ORIGINAL WALKERS CREEK PROPOSAL MAP

Reference:

Buckridge Environmental Consulting Inc. Permit No. 314: Illinois Department of Natural Resources Office of Mines and Minerals. Print.



APPENDIX E: INTERNSHIP PHOTOS - KNIGHT HAWK COAL

A tractor removes overburden at Old Ed Carbon Recovery Site.

Mine spoil at Old Ed Carbon Recovery Site.

A large patch of *Phragmites australis* at Red Hawk Mine.

A reclamation effort at an NPDS point at Black Hawk Mine.