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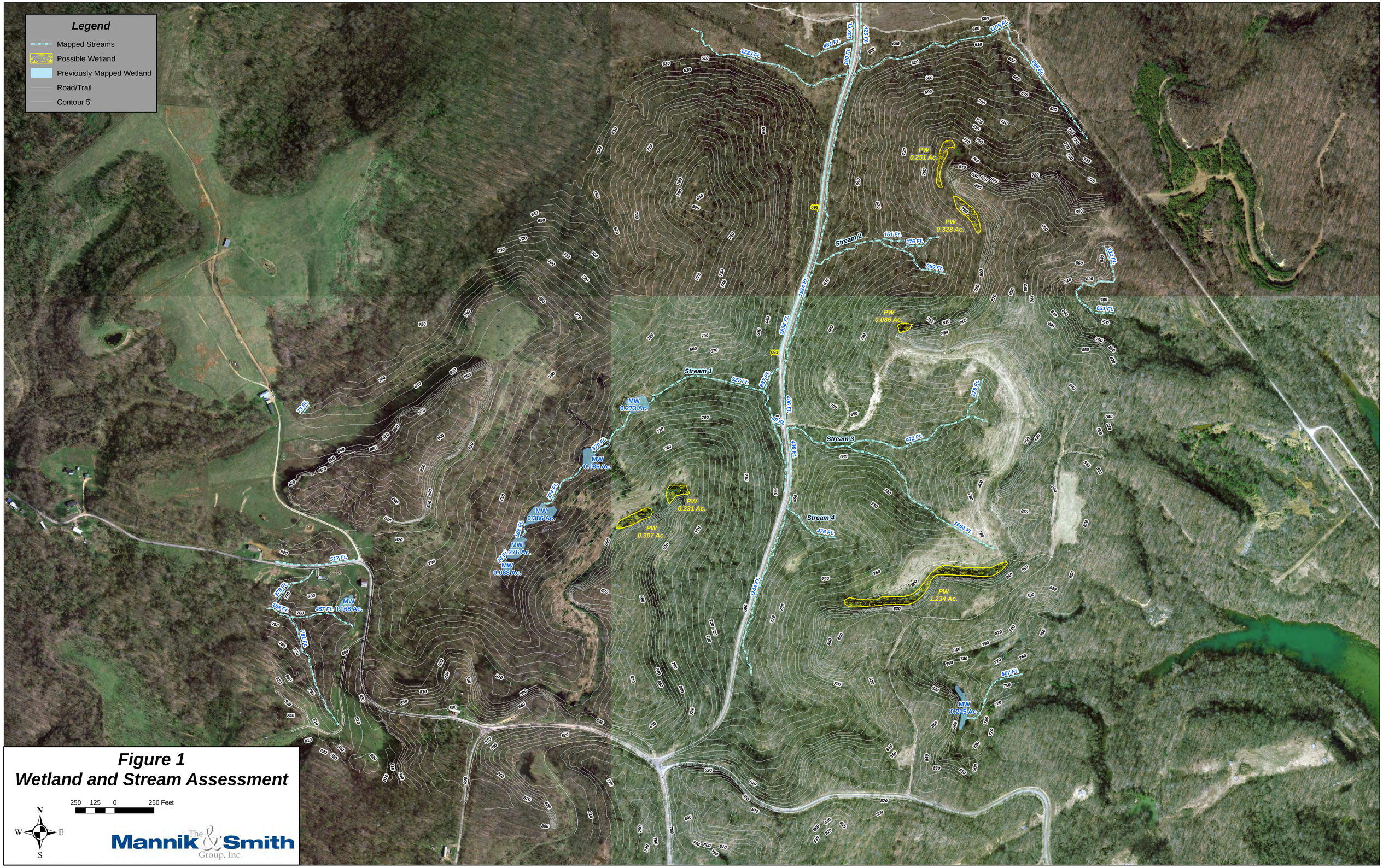

GAVIN PLANT SITING STUDY FOR RESIDUAL WASTE LANDFILL

AMERICAN ELECTRIC POWER

Prepared for

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American Electric Power's (AEP) Gavin Power Station currently operates a 225-acre residual waste landfill (Gavin Landfill), with both the Gavin Power Station and the residual waste landfill being located in northeastern Gallia County, Ohio near Cheshire, Ohio. The current landfill is anticipated to reach its permitted capacity in January 2015. New or additional disposal capacity will be required to be permitted and ready to receive residual waste materials by January 2015. The purpose of this Siting Study is to identify, screen, and rank sites to provide additional long-term disposal for the residual waste materials produced by the Gavin Plant.

The original site selection process for the existing Gavin landfill included two reports issued by AEP in 1990. One, entitled "FGD Retrofit Study: FGD Waste Disposal Report" deals with civil site issues, storage capacity, logistics and disposal costs; the other, entitled "Ohio Power Company, General James M. Gavin Plant, Flue Gas Desulfurization Retrofit, Environmental Report" presents information on environmental, ecological and permitting issues. Both studies identified, described and compared the merits of six (6) potential sites within a 5-mile radius of the Gavin Plant.

In addition, AEP in 2004 commissioned a landfill siting study for planned flue gas scrubbers at Ohio Valley Electric Company's Kyger Creek Plant, which is located approximately 1.5 miles to the southwest of the Gavin Plant. That study identified five (5) potential sites within a 5-mile radius of both power plants. One of the Kyger Creek sites (Site E) overlapped with a site (Site 3 - Jericho Road Site) that had been considered in the 1990 Gavin studies.

Based on AEP's established scope of work, this siting study was limited to the evaluation of the remaining six (6) sites identified by the 1990 studies for Gavin Plant, and the four (4) unique sites identified by the Kyger Creek Plant siting study. These ten (10) sites are referred to as "Green Sites". The green sites plus the Gavin Landfill Expansion Site are referred to as the "candidate sites." Upon evaluation of the candidate sites, the number of sites is reduced to a listing of "viable sites." The list of viable sites will include the remaining Green Sites and the Gavin Landfill Expansion Site. This study then compares the most favorable Green Site to an expansion of the existing Gavin Landfill. This study then provides a recommendation as to whether it is most favorable for AEP to pursue an expansion of the existing Gavin Landfill or to pursue the most favorable of the ten (10) Green Sites.

2.1 GENERAL LOCATION

The study area encompasses a 5-mile radius west of the Ohio River from the Gavin Plant, located in Cheshire, Ohio. The study area includes portions of Cheshire and Addison Townships in northeastern Gallia County, and is situated between Pomeroy and Middleport to the north and Addison and Gallipolis to the south. Refer to **Figure 1**.

2.2 PHYSIOGRAPHICAL SETTING

The study area is located within the Allegheny Plateaus Section of the Appalachian Physiographic Province. This area is typified by maturely dissected uplands with steep slopes and narrow ridge tops (Brockman, 1998). The surface water runoff in the study area flows to Kyger Creek, or to one or more of the following Kyger Creek tributaries: Little Kyger Creek, Stingy Run, or Turkey Run. This area is part of the Kyger Creek Watershed (USDA, 1997). A small southern portion of the study area is part of the Campaign Creek Watershed, and surface water runoff flows to Little Campaign Creek, a tributary to Campaign Creek.

2.3 SOILS

Shallow soils in the study area consist generally of units of the Upshur-Gilpin complex and Guernsey-Gilpin association. These soils are well drained colluvium and residual soils derived from fine-grained sandstone, siltstone, and shale bedrock parent material. Also included in the study area are significant portions of Bethesda channery clay loam soils derived from mine spoil parent material (USDA, 1997). Refer to **Table 4** and **Appendix C** for soil survey information. These soil profiles, where present, may extend to depths of up to several feet below grade. Underlying the soils are unconsolidated materials as described in the following section.

2.4 GEOLOGIC SETTING

The study area lies in the southern, unglaciated portion of Ohio. This area is typified by maturely dissected uplands with steep slopes and narrow ridge tops (Brockman, 1998). Subsurface material in the study area consists generally of unconsolidated residuum, terrace deposits, and alluvium ranging in thickness from 1 to 70 feet (AEP, 1993). These materials generally consist of clayey sands and silty clays (AEP, 1993). Deposits of glacial outwash and lacustrine clays associated with the former Teays River Drainage System are also present in the study area (USDA, 1997; AEP, 1993). Mine spoils consisting of clayey sand, clayey gravel, shale fragments, and sandstone boulders are present throughout the study area on strip mine benches and adjacent slopes (AEP 1993).

Soils and other unconsolidated material in the study area are underlain by Pennsylvanian-age bedrock of the Conemaugh and Monongahela Groups (ODNR, 2002). These groups consist generally of sandstone, shale, siltstone, limestone, and coal deposits of varying thickness and lateral continuity.

2.5 HYDROGEOLOGIC SETTING

Groundwater has been identified in water-bearing zones within both the unconsolidated overburden and the underlying bedrock units. Groundwater within the unconsolidated material is more commonly found within alluvial deposits along the Ohio River, Kyger Creek, Stingy Run and Turkey Run. The flow of groundwater within these units is anticipated to be controlled by topography and generally is towards the nearest surface water drainage feature (e.g., Ohio River) (AEP, 1996). Records indicate that wells installed in the alluvial material located in the floodplain area of the Ohio River are capable of groundwater yields in excess of 500 gallons per minute (gpm). The alluvial deposits associated the smaller tributary streams exhibit lower permeability and do not appear to be capable of producing significant groundwater yields (AEP, 1993).

Groundwater-bearing zones within the underlying bedrock are found within more permeable sandstone units which are interbedded with less permeable shale and limestone units (AEP, 1996). The vertical and horizontal flow of groundwater within these units is controlled by topography as well as the presence of fractures, bedding planes and other stratigraphic features. Water-bearing zones within the bedrock units in the study area exhibit low to moderate permeability. Wells installed in the Cow Run Sandstone had reported groundwater yields of approximately 5 gpm (AEP, 1993). The presence of strip mine disturbances as well as abandoned underground mines will also effect the movement of groundwater within these units in ways that are hard to predict. Site data suggest that the flow of groundwater within the underlying bedrock water-bearing units is generally towards nearby surface drainage features (AEP, 1993; 1996).

2.6 COAL MINING

Coal deposits are prevalent within the study area and vary in thickness from a few inches to several feet, separated by sandstone and shale bedrock. Coal mining has been performed extensively in the area and abandoned underground mines are numerous (ODNR, 1983). Reportedly, the mines are room and pillar type and vary in both size and areal extent based on the amount and accessibility of the available coal (AEP, 1993). Several larger mines are indicated in the central portion of the study area, on the south side of Stingy Run, with numerous smaller mines located northeast of the study area, south of Kyger Creek. Surface mining activity has also occurred within the study area, leaving spoils piles, water-filled pits and vertical highwalls (AEP, 1993).

Mining activity frequently results in increased fracturing of the surrounding bedrock material which affects the flow of groundwater in these areas, and may also indicate an increased potential for land subsidence. Refer to **Appendix D** for the approximate location of known underground mines.

3.1 IDENTIFICATION OF CANDIDATE SITES

This siting study evaluates ten (10) Green Sites identified by previous reports conducted by AEP. In addition to Green Sites, the study will also evaluate an expansion of the existing Gavin Landfill. Together, the Green Sites plus the Gavin Landfill Expansion Site are considered the candidate sites for the study. The following provides a description and source information for each of the 11 candidate sites.

3.1.1 Green Sites

Two reports were issued by AEP in 1990 related to the site selection process for the existing Gavin Landfill. The first, "FGD Retrofit Study: FGD Waste Disposal Report," deals with civil site issues, storage capacity, logistics and disposal costs. The second report, entitled "Ohio Power Company, General James M. Gavin Plant, Flue Gas Desulfurization Retrofit, Environmental Report" presents information on environmental, ecological and permitting issues. Together, these reports identified and evaluated seven (7) potential sites within a 5-mile radius of the plant. The analysis provided in these reports led to the eventual permitting and construction of the existing Gavin landfill. The remaining six (6) sites (Sites 1 through 6) from the 1990 reports will be further evaluated as part of this study.

In addition, AEP commissioned a landfill siting study in 2004 for planned flue gas scrubber waste generated at Ohio Valley Electric Company's (OVEC's) Kyger Creek Plant. The Kyger Creek Plant is located approximately 1.5 miles southwest of the Gavin Plant along State Route 7. The study, entitled "Residual Waste Landfill Siting Study Report," evaluated five (5) candidate sites within a five-mile radius of both power plants and led to the eventual selection and permitting of the Kyger Creek Landfill. Four (4) sites from the 2004 report (Sites A through D) will be further evaluated as part of this study. It should be noted that Site E, identified in the 2004 Kyger Creek report, overlaps the Jericho Road Site (Site 3) considered for evaluation in the 1990 Gavin Plant reports.

Refer to **Figure 2** for the location of each candidate site described below:

<u>Site 1 – Turkey Run</u>

The Turkey Run Site is located approximately 2.1 miles northwest of the Gavin Plant. The site is located in a valley, with both Turkey Run (stream) and Turkey Run Road running north-south through the center of the site. The Turkey Run Site is located directly adjacent to the existing Gavin Landfill and is generally bound by transmission lines and the Gavin landfill to the east, the Stingy Run Fly Ash Reservoir (Reservoir) to the north, Hammack Road to the West, and Grover Road to the south.

<u>Site 2 – Little Kyger</u>

The Little Kyger Site is located approximately 3.0 miles northwest of the Gavin Plant. Turkey Run Road runs north-south through a center ridgeline of the site. A tributary to Little Kyger Creek runs north-south through the western side of the site. The site is

generally bound by Little Kyger Road (County Road 15) to the west, Turkey Run Road and Hammack Road to the south, and the Reservoir to the north and east, with the eastern portion of the site extending over the Reservoir. The site contains electrical transmission lines (trending northwest-southeast) through the center of the site.

Site 3 – Jericho Road

The Jericho Road Site is located approximately 3.7 miles west of the Gavin Plant. The site is generally bound by Shuler Road and Jericho Road to the south, transmission lines (trending north-south) to the east, Poplar Ridge Road (County Road 25) to the west and an unnamed road to the north. A tributary of Little Kyger Creek passes through the southeastern portion of the site. An existing pond is located to the southeast of the site.

Site 4 – Lemley Road

The Lemley Road Site is located approximately 3.6 miles west of the Gavin Plant. The site consists of two valleys that converge at the southern edge of the site. Little Kyger Road (County Road 15) runs north-south through the eastern valley of the site. The site is generally bound by Poplar Ridge Road (County Road 25) to the west, Turkey Run Road to the north, an unnamed road to the south. Little Kyger Creek runs from the northwest to the southeast through the center of the site. The site contains electrical transmission lines (trending northeast-southwest) through the center of the site.

Site 5 – State Route 554

The State Route 554 Site is located approximately 3.9 miles northwest of the Gavin Plant. The site is located in a valley with Poplar Ridge Road (County Road 25) running north-south through the center of the site. The site is generally bound by State Route 554 to the north, Turkey Run Road and Poplar Ridge Road to the south, an unnamed local access road and the Reservoir to the east, and an unnamed road to the west.

Site 6 – Africa Road

The Africa Road Site is located approximately 4.7 miles northwest of the Gavin Plant. The site consists of two valleys that converge at the northern portion of the site. Africa Road (County Road 101) and Swisher Ridge Road run through each valley and segment the site. The site is generally bound by Poplar Ridge Road (County Road 25) to the south, Poplar Church Road to the west, State Route 554 to the north, and an unnamed road to the east. A tributary to Kyger Creek runs north through the center of the site.

Site A

Site A is located approximately 2.3 miles south of the Gavin Plant and nearly adjacent to the Kyger Creek Plant. The site is generally bound by Little Kyger Road (County Road 15) and railroad tracks to the east, Oliver R Road to the north and west and transmission lines (trending east-west) to the south. Also, the existing residual waste conveyor from the Kyger Creek Plant to the Kyger Creek Landfill passes through the northern side of the

site. The existing Kyger Creek Landfill is permitted and partially constructed over the northern portion of the site.

Site B

Site B is located approximately 2.8 miles southwest of the Gavin Plant. The site is located in the valley currently containing Shaver Road. The site is generally bound by Little Kyger Road (County Road 15) to the north, Shaver Road and non-maintained Roush Road to the south and Oliver R Road to the east. The site contains transmission lines (trending north-south) on the eastern edge of the site. The existing Kyger Creek Landfill is permitted and partially constructed over the northern portion of the site.

Site C

Site C is located approximately 3.4 miles southwest of the Gavin Plant. The site is generally bound by Reese Hollow Road (County Road 21) to the west, Swisher Hill Road to the north and Shaver Road to the east. The site contains transmission lines (trending east-west) on the southern portion of the site.

Site D

Site D is located approximately 3.9 miles west of the Gavin Plant. The site is generally bound by Reese Hollow Road (County Road 21) to the south, Jericho Road to the east, Poplar Ridge Road (County Road 25) to the west, and Shuler Road to the north. A tributary to Little Campaign Creek runs northwest to southeast through the center of the site. The site contains transmission lines (trending north-south) on the eastern portion of the site.

3.1.2 Gavin Landfill Expansion

In addition to the ten (10) candidate Green Sites described in Section 3.1.1, an expansion of the existing Gavin Landfill was evaluated. Refer to **Figure 2** for the location of the existing Gavin Landfill and the Gavin Landfill Expansion Site. The current Gavin Landfill, a 225-acre residual waste landfill, is located approximately 1.2 miles northwest of the Gavin Plant. The landfill began construction in 1994 and is anticipated to reach its permitted capacity in January 2015.

The Gavin Expansion is located approximately 2.0 miles from the Gavin Plant, and extends the existing Gavin Landfill to the northwest onto portions of the Reservoir. The expansion is generally bound by the Turkey Run valley to the south and west, the Stingy Run dam to the north, and the existing Gavin Landfill to the south and east. The Gavin Landfill Expansion Site contains transmission lines (trending north-south) through the center of the site and along the southwestern edge of the site.

As directed by AEP, only a horizontal expansion of the landfill is considered. Therefore, the conceptual peak elevation of the Gavin Landfill Expansion is not significantly increased from the currently permitted peak waste elevation of 896.5 feet above mean sea level (MSL).

3.2 CANDIDATE SITE EVALUATION

The principle objective of the study is to locate sites capable of providing disposal capacity for a minimum design life of 20 years. According to AEP, the Gavin Plant generates approximately 2.6 million cubic yards of residual waste each year. Therefore, a candidate site is considered viable if the expected disposal capacity is equal to or greater than 52 million cubic yards.

In order to determine which of the candidate sites were viable and worthy of further investigation, a preliminary evaluation of each of the eleven (11) candidate sites was conducted. The screening of the candidate sites generally included a review of publicly available information, previously conducted siting studies, and landfill design documents. In addition, AEP and URS personnel performed a limited field reconnaissance of the study area on June 19, 2009 to further evaluate the viability of the candidate sites. During the field reconnaissance, only cursory visual observations of the study area were made, and no private properties were entered.

Based on existing topographic survey information obtained from the Gallia County Engineer's office, together with observations and discussions with AEP personnel during the field reconnaissance, the conceptual limit of residual waste placement for each of the candidate sites was developed. Candidate landfill footprints were reconfigured from previous studies as needed in order to take advantage of site topography and maximize available disposal capacity. The disposal capacity of each candidate site was then estimated.

AutoCAD Land Desktop was utilized to perform volume estimates at each potential landfill site. The following assumptions were made in the determination of the capacity estimates:

- An average 3.5:1 (H:V) sideslope was modeled to allow for a maximum 3:1 waste placement grade and stormwater management benches.
- The provided volumes compare existing ground surface to preliminary waste placement grades developed by URS. Therefore, any net excavation during the development of the proposed landfill would provide increased storage capacity.

3.3 RESULTS OF CANDIDATE SITE EVALUATION

URS and AEP met on June 19, 2009 to discuss the preliminary results of the candidate site evaluation. Upon review of the candidate sites, Sites B and C were removed from consideration. It was determined that further consideration of these sites would be intrusive to the development of the Kyger Creek Landfill, which is situated between Sites B and C. Refer to **Figure 2.**

The disposal capacity of the remaining nine (9) candidate sites is summarized in the following table. Viable sites, which provide the minimum 20-year disposal capacity of 52 million cubic yards, are presented in **bold.**

Preliminary Site Volume Estimates

Site	Disposal Area (Acres)	Capacity (Million Cubic Yards)	20 year disposal capacity? (Minimum 52 Million Cubic Yards)
Site 1 - Turkey Run	**259**	**52.1**	**Yes**
Site 2 - Little Kyger Rd	**211**	**52.3**	**Yes**
Site 3/E - Jericho Rd	225	39.1	No
Site 4 - Lemley Rd	308	46.2	No
Site 5 – CR 554	**223**	**52.3**	**Yes**
Site 6 - Africa Rd	**548**	**114.9**	**Yes**
Site 7 – Gavin LF Expansion	**259**	**53.8**	**Yes**
Site A	101	16.5	No
Site D	134	19.4	No

The preliminary volume analysis resulted in five (5) viable sites capable of providing adequate disposal capacity. However, upon further review of the viable sites, Africa Road (Site 6) was removed from consideration due to the considerable distance from the Gavin Plant and concerns related to the need for significant property acquisitions and disturbance of residents in the Africa Road valley.

The candidate site evaluation resulted in the selection of four (4) viable sites to be considered for further investigation: Turkey Run, Little Kyger, State Route 554, and the Gavin Landfill Expansion. As a preliminary evaluation of these viable sites, a regulatory screening analysis was performed and a conceptual design was developed for each site. The following section describes the methodology and results of the preliminary evaluation.

4.1 IDENTIFICATION/DESCRIPTION OF VIABLE SITES

4.1.1 Turkey Run

Existing conditions at the Turkey Run Site are shown in **Figure 4A.** The Turkey Run Site consists of a single watershed which drains to the south along Turkey Run Road toward Grover Road. Of the four viable sites, the Turkey Run Site is the most developed. Approximately 27 homes are located along Turkey Run Road between Grover Road to the south and Little Kyger Road to the north. The homes receive drinking water from a Gallia Rural water distribution line running north along Turkey Run Road and terminating just north of the Turkey Run Site. The location of the existing Gallia Rural water line was anonymously confirmed with Gallia Rural.

The site has been extensively strip mined, resulting in roughly 50 to 75-foot highwalls surrounding the eastern and western perimeter of the site. Existing topography ranges from approximate elevations of 625 feet in the bottom of the valley to elevation 850 feet on the ridges surrounding the site. The 138 kV Gavin Extension No. 1 transmission line follows a ridge dividing the Turkey Run Site, the existing Gavin Landfill to the east, and the Reservoir to the north.

4.1.2 Little Kyger

Existing conditions at the Little Kyger Site are shown in **Figure 5A.** The Little Kyger Site is divided by Turkey Run Road, which follows a ridge running north-south through the center of the site. The watershed to the west of the ridge drains to a stream tributary to Little Kyger Creek which runs south towards Thompson Hollow Road. The watershed to the east of the ridge drains east to the Reservoir. Approximately six (6) homes are located along Turkey Run Road in the vicinity of the site. The eastern portion of the site is located on currently open water areas of the Reservoir.

The site has been extensively strip mined, resulting in highwalls up to 100 feet tall throughout the site. Existing topography ranges in elevation from approximately 725 feet in the valleys and up to 900 feet on the northernmost ridge of the site. An existing 800 MHz communications tower is located along Turkey Run Road in the center of the site, and the Gavin 138 kV Extension No. 1 transmission line traverses southeast to northwest through the site.

4.1.3 State Route 554 (SR 554)

Existing conditions at the State Route 554 Site are shown in **Figure 6A.** The State Route 554 Site consists of a single watershed which drains to the north along Poplar Ridge Road toward

State Route 554. A small bridge is located along Poplar Ridge Road, just south of State Route 554. Three homes are located to the west of the site along Africa Road.

The site has been strip mined along the perimeter ridges of the watershed, resulting in roughly 75-foot highwalls surrounding the eastern, southern, and western perimeter of the site. Existing topography ranges from approximate elevations of 625 feet in the bottom of the valley to elevation 900 feet on the ridges surrounding the site. No existing transmission lines traverse the State Route 554 Site.

4.1.4 Gavin Landfill Expansion

Existing conditions at the Gavin Landfill Expansion Site are shown in **Figure 7A.** The area is divided into three watersheds. The first is located directly west of the existing Gavin Landfill and drains south to Turkey Run. The second watershed is located just north of the Gavin Landfill and drains northeast toward Stingy Creek Road. The third and largest watershed drains to the Stingy Run Fly Ash Reservoir. The closest homes are located south of the site along Turkey Run Road.

The southern portion of the Gavin Landfill Expansion Site has been strip mined, resulting in highwalls up to 75 feet tall. A considerable portion of the proposed site is located over the Reservoir, the majority of which was previously covered by AEP with a layer of excess rock and soil excavated during the development of the existing Gavin Landfill. Existing topography ranges in elevation from approximately 700 feet in the Reservoir, 650 feet in the valley north of the existing landfill, and up to 850 along the southern ridges of the site. The steel truss superstructure for a previously used belt conveyor runs north through the Reservoir in the area of the expansion. The Leading Creek raw water supply line follows the alignment of the old conveyor running along the western edge of the existing Gavin Landfill and crossing the Reservoir by means of the elevated steel truss superstructure. The raw waterline carries water from a well field located near Cheshire to a water treatment plant located north of the study area. The Gavin 138 kV Extension No. 2 transmission line runs through the Gavin Landfill Expansion Site along the western and northern edge of the existing landfill.

4.2 REGULATORY SITING CRITERIA

4.2.1 Definition of Siting Criteria

The site identified by this siting study or otherwise selected by AEP would be permitted through the Ohio EPA's Division of Solid and Infectious Waste as a residual waste landfill. Residual solid waste landfills are governed by Ohio Administrative Code (OAC) Chapter 3745-30. These regulations provide minimum performance standards for a residual solid waste facility as well as criteria limiting the locations of those facilities. These siting criteria are located in OAC 3754-30-06(H).

The regulations prohibit construction of a residual solid waste facility within 1000 feet of a domicile, within 1000 feet of a National/State Park or Forest, within 1000 feet of a water supply well, within 300 feet or the property line, etc. In addition, residual waste landfills are prohibited from being located in areas which include, but are not limited to, areas that contain a high yield

aquifer system (>100 gpm), in an area of potential subsidence due to mine activity and/or karst topography, in a floodplain, and in a sand/gravel quarry. **Table 1** provides a summary of the regulatory siting criteria in OAC 3745-30-06(H). For more specific information on these siting restrictions, the latest version of the residual solid waste regulations can be found on the Ohio EPA's website (http://www.epa.ohio.gov/dsiwm/).

4.2.2 Source of Data

Information gathered for this siting study in order to determine if the viable sites meet the regulatory siting criteria was gathered from information provided by AEP (including the 1990 Gavin Study, 2004 Kyger Creek Siting Study, drawings, design and permitting documents, personal communications, AEP's Land Development Department, Transmission and Delivery Department, and Engineering Department, etc.), data from the Gallia County Engineer's Office, information from Ohio Department of Natural Resources (ODNR) and Ohio EPA, National Wetlands Inventory, and other publicly available data. URS personnel conducted cursory site visits at each of the potential sites, where possible, but no intrusive field investigations were conducted as part of this siting study. A summary table of sources of data used in this study is included in **Table 1.**

4.2.3 Preliminary Evaluation of Siting Criteria

The viable sites, including the three (3) viable Green Sites along with the Gavin Landfill Expansion Site were evaluated against the regulatory siting criteria based on the available data. **Figure 3** provides an overview of key regulatory siting criteria identified for all viable sites. **Table 2** indicates whether each viable site meets or does not meet the regulatory siting criteria and provides a brief comment for each site for each siting criterion. Some common siting criteria that some or all of the viable sites do not meet include the minimum 300 feet distance to the property line, having a domicile within 1000 feet, having a water supply well within 1000 feet, being located in an area of potential underground mine subsidence, and being located within 200 feet of a stream, lake, or wetland. All of these siting criteria, in general, can be managed through property acquisition, engineering remedies, and/or mitigation activities.

4.2.3.1 Siting Criteria Evaluation - Turkey Run

The northeastern portion of the proposed site is located in an area that potentially contains underground mines. This area will need to be remediated prior to construction of the landfill. Remediation may include filling of the mine, excavation of the mine, and/or providing analyses that show that this area is stable. For the purposes of this study, it is assumed that the presence of mines is not a fatal flaw for the site and that the mines will be excavated as part of construction.

Records from ODNR indicate the presence of a well within 1000 feet of the proposed limit of waste. This well appears to be located on AEP property and for the purposes of this study it is assumed that this well is controlled by AEP and will be abandoned in accordance with ODNR requirements prior to the construction.

Residual solid waste landfill regulations require that the limit of waste be at least 300 feet from the property line and at least 1000 feet from a domicile. As shown in **Figure 4B**, the 300 foot offset of the limit of waste for Turkey Run crosses onto several adjacent properties and the 1000-foot offset contains twenty five (25) buildings identified by aerial mapping some or all of which may be domiciles. Some of these buildings are located on AEP property (16 out of the 25 buildings), but the remaining nine (9) buildings not on AEP property must be acquired or agreements with the landowners must be made in order to meet this siting criteria. All property within 300 feet of the limit of waste must be acquired by AEP.

Based on information from the National Wetlands Inventory, the site contains several wetlands and the site also contains a named stream (Turkey Run). Residual solid waste siting criteria require that the limit of waste be at least 200 feet from streams, lakes, and wetlands. Removal or relocation of Turkey Run and other wetlands, along with any other regulated streams and wetlands delineated at the site during a thorough site investigation will need to be permitted through the US Army Corps of Engineers and the Ohio EPA. Any required mitigation activities will also need to be permitted through those agencies.

A summary comparison of the regulatory siting criteria is provided in **Table 2**.

4.2.3.2 Siting Criteria Evaluation – Little Kyger

ODNR records indicate that approximately 20% of the proposed limit of waste lies in areas which contain underground mines. This area will need to be remediated prior to construction of the landfill. Remediation may include filling of the mine, excavation of the mine, and/or providing analyses that show that this area is stable. For the purposes of this study, it is assumed that the presence of mines is not a fatal flaw for the site and that the mines will be excavated as part of construction.

Records from ODNR indicate the presence of a well within 1000 feet of the proposed limit of waste. This well appears to be located on AEP property and for the purposes of this study it is assumed that this well is controlled by AEP and will be abandoned in accordance with ODNR requirements prior to the construction.

Residual solid waste landfill regulations require that the limit of waste be at least 1000 feet from a domicile. As shown in **Figure 5B**, the 1000-foot offset contains approximately seven (7) buildings identified by aerial mapping some or all of which may be domiciles. All of these buildings are located on AEP property and must be removed as part of construction.

Based on information from the National Wetlands Inventory, the site contains several wetlands and the site also contains an unnamed stream running through the western portion of the site. Residual solid waste siting criteria require that the limit of waste be at least 200 feet from streams, lakes, and wetlands. Removal or relocation of the unnamed stream and other wetlands, along with any other regulated streams and wetlands delineated at the site during a thorough site investigation will need to be permitted through the US Army Corps of Engineers and the Ohio EPA. Any required mitigation activities will also need to be permitted through those agencies.

A summary comparison of the regulatory siting criteria is provided in **Table 2**.

4.2.3.3 Siting Criteria Evaluation – SR554

ODNR mining records do not show any underground mines within the footprint of SR554. It does, however, indicate that some mining activity took place at the site. A more thorough investigation of the records and the subsurface conditions is required to confirm whether underground mines exist in the site area.

Residual solid waste landfill regulations require that the limit of waste be at least 1000 feet from a domicile. As shown in **Figure 6B**, the 1000-foot offset contains two (2) buildings identified by aerial mapping which may be domiciles. One of these buildings is located on AEP property and must be removed as part of construction. The remaining two buildings must be acquired or agreements with the landowners must be made in order to meet this siting criterion.

Based on information from the National Wetlands Inventory, the site does not contain any known wetlands or streams. However, as stated in **Table 2,** based on field observations a drainage feature tributary to Kyger Creek exists along Poplar Ridge Road and may be regulated as a stream. A thorough walkover and delineation will need to be conducted as part of the permitting process. Removal or relocation of any identified streams and/or wetlands, will need to be permitted through the US Army Corps of Engineers and the Ohio EPA. Any required mitigation activities will also need to be permitted through those agencies.

A summary comparison of the regulatory siting criteria is provided in **Table 2**.

4.2.3.4 Siting Criteria Evaluation – Gavin Landfill Expansion

ODNR records indicate that the northwestern portion of the proposed Gavin Landfill Expansion Site is located in an area that potentially contains underground mines. This area will need to be remediated prior to construction of the landfill. Remediation may include filling of the mine, excavation of the mine, and/or providing analyses that show that this area is stable. For the purposes of this study, it is assumed that the presence of mines is not a fatal flaw for the site and that the mines will be excavated as part of construction.

Records from ODNR indicate the presence of a well within 1000 feet of the proposed limit of waste. This well appears to be located on AEP property and for the purposes of this study it is assumed that this well is controlled by AEP and will be abandoned in accordance with ODNR requirements as part of construction.

Residual solid waste landfill regulations require that the limit of waste be at least 1000 feet from a domicile. As shown in **Figure 7B**, the 1000-foot offset contains approximately three (3) buildings identified by aerial mapping some or all of which may be domiciles. All of these buildings are located on AEP property must be removed prior to construction.

Based on information from the National Wetlands Inventory, the site does not contain any known wetlands and streams other than the existing Reservoir, which has been mislabeled as a

wetland. According to AEP, since the fly ash pond is a water treatment pond it is not classified as a wetland or water of the state. Therefore, it is not anticipated that the fly ash pond will be regulated as a wetland during the permitting process. A thorough walkover and delineation will need to be conducted as part of the permitting process. Removal/relocation of any identified streams and/or wetlands will need to be permitted through the US Army Corps of Engineers and the Ohio EPA. Any required mitigation activities will also need to be permitted through those agencies.

A summary comparison of the regulatory siting criteria is provided in **Table 2**.

4.2.4 Identification of Fatal Flaws

For the three (3) viable Green Sites and the Gavin Landfill Expansion Site, no fatal flaws that would eliminate their viability were identified as part of this study. There are several siting issues at each of the four (4) sites which must be addressed in order to avoid those issues becoming fatal flaws. Two (2) of the three (3) Green Sites (Turkey Run Site and Little Kyger Site) and the Gavin Landfill Expansion Site contain known underground mines which must be mitigated in order to avoid potential issues of subsidence. This mitigation could include filling or complete removal of the underground mines (removal of the overlying rock), providing sufficient evidence to the regulatory authorities that the mines will remain stable with the addition of the landfill construction and operation, or potential redesign of the landfill footprint to avoid these potential areas of subsidence while still achieving the desired life of the landfill. For the purpose of this study, it was assumed that all overlying rock above the underground mine would be excavated within the landfill footprint.

Property ownership and domiciles located within 1000 feet of the landfill footprint also are potential fatal flaws for Turkey Run. Approximately 53 acres of land must be acquired in order to meet the 300 foot buffer offset requirements and approximately nine (9) dwellings must be purchased. Five (5) of the houses are located within the limit of waste. Available records indicate that this land is subdivided into many small parcels, making purchase agreements and acquisition with potentially multiple owners difficult. Acquisition of property and dwellings could prove to be a fatal flaw for the Turkey Run Site.

Similarly, two (2) domiciles are located within 1000 feet of the landfill footprint for SR 554 Site and are potential fatal flaws. These two dwellings must be purchased or agreements with the landowners will need to be made in order to meet this siting criteria. Acquisition of dwellings could prove to be a fatal flaw for the SR554. It should be noted that the two (2) houses are approximately 600 feet and 800 feet from the limit of waste. Because these properties are located relatively far from the limit of waste, there is potential to redesign the footprint to stay 1000 feet from the limit and still achieve the desired landfill life should one or both properties prove difficult to acquire. For the purposes of this study, it is assumed that these houses will be purchased by AEP.

A summary comparison of the regulatory siting criteria is provided in **Table 2**.

4.2.5 Conceptual Designs

A conceptual design was developed for each viable landfill Site. The conceptual designs provide a means of comparing each viable site economically and technically, as well as comparing waste transport and potential construction or access concerns. The conceptual designs include the following elements:

- A Conceptual Layout depicting the proposed landfill footprint, construction phases, leachate and stormwater management ponds, and residual waste transportation routes to the site (**Figures 4C, 5C, 6C, and 7C**).
- A Conceptual Top of Waste Plan depicting the final development of the landfill (**Figures 4D, 5D, 6D, and 7D**).
- Two generalized cross-sections (transverse and longitudinal) depicting the existing grade, projected conceptual top of waste grades, and conceptual construction phases (**Figures 4E, 5E, 6E, and 7E**).

The conceptual designs and associated cost estimates (Section 5.2.4) are based on the following design assumptions:

Isolation Distance: It is assumed that 5 feet of Added Geologic Material (AGM) will be required to provide the minimum required isolation distance from the upper aquifer system prior to construction of the landfill liner. Onsite soils will be excavated, reworked as needed, and recompacted to create the 5 foot AGM base. Excavation costs in areas containing mine spoil material are escalated when compared to the excavation of native (undisturbed) soils.

Liner: The liner system consists of 18-inches of Recompacted Soil Liner (RSL) with a permeability no greater than $1x10^{-7}$ centimeters per second. A 60 mil HDPE flexible membrane liner is installed above the RSL (a 30-mil PVC geomembrane could also be used as an acceptable equivalent for the bottom liner system; however this Report assumes a 60 mil HDPE). It is assumed that approximately half of the RSL material will be imported from off-site borrow areas.

Leachate Collection and Management: The leachate collection system consists of a geocomposite drainage layer overlain by a 12-inch bottom ash drainage layer and a network of perforated HDPE pipes to convey leachate to collection sumps at the perimeter of the landfill. Combined leachate and stormwater management ponds will be constructed to manage the leachate generated at the landfill. These ponds will be constructed using the same liner as the landfill to provide equivalent environmental protection. It is assumed that the leachate collection and management system will flow by gravity (i.e. no pumped extraction system), in accordance with the current Gavin Landfill design.

Cap System: The cap system consists of a 40 mil LLDPE flexible membrane liner overlain by 18-inches of cover soil and 6-inches of topsoil to promote vegetation on the

cap system. A 30-mil PVC geomembrane could also be used in the cap system as an acceptable equivalent; however this Report assumes a 60 mil HDPE.)

Stormwater Management: Stormwater will be managed by incorporating benches into the sideslopes of the landfill as the site is developed. It is assumed that the external sideslopes will have a maximum effective slope of 3.5:1 (H:V). Stormwater letdowns and perimeter channels will direct collected stormwater from the landfill to stormwater management ponds or combined leachate and stormwater management ponds.

Hauling and Conveyance: The existing Gavin Landfill conveys the residual waste material produced at the Gavin Plant by means of a dual-belt conveyor to a stackout pad located in the southeast corner of the site. Off-road trucks are then loaded to haul the residual material from the stackout pad to the active area of the landfill.

For cost comparison purposes, both off-road hauling and conveyance were considered to transport the residual waste to each viable site. If hauling is preferential, a new haul road will be constructed in conjunction with potential upgrades to existing roads, to transport waste from the existing stackout pad to the active area of the new landfill site. If conveyance is preferential, a single pipe conveyor system will be extended from the existing stackout pad at the Gavin Landfill to a new stackout pad to be located adjacent to the proposed landfill site. A haul road would also be constructed as a backup means for transporting material to the proposed site. (A separate evaluation was conducted to compare the relative costs of using a single conveyor system together with a haul road instead of extending the dual conveyance system to the proposed site. In all cases a single conveyor and haul road were economically preferable to the dual conveyor system. In addition, pipe conveyors were found to be comparable and in some cases less expensive than traditional belt conveyors). For the conveyance option, it is assumed that waste will be loaded from the new stackout pad onto off-road trucks to haul the material to the active area of the new landfill, similar to the methods currently used at the existing Gavin Landfill.

Highwall Excavation: Highwalls will require rock excavation and blasting in order to create a suitable subgrade prior to construction of the landfill. The approximate quantity of highwall excavation or blasting was calculated based on the available topography, assuming a maximum 3:1 (H:V) excavation slope.

Underground Mines: For the purposes of the study, it is assumed that all underground mines located in the footprint of the viable sites will be excavated by means of blasting. Underground mine maps obtained from ODNR (Refer to **Appendix C**) were utilized to estimate the amount of excavation required to remove the underground mines. However, it should be noted that unknown mines may exist in the study area, and a thorough site investigation will be required during permitting and design in order to identify the extent of underground mines. Geotechnical demonstrations during the detailed design phase may eliminate the need to excavate or otherwise mitigate subsidence concerns related to underground mines.

Construction over the Stingy Run Fly Ash Reservoir: The Little Kyger and Gavin Landfill Expansion Sites propose construction of the landfill above the existing Stingy Fly Ash Reservoir (Reservoir). These footprints have been discussed extensively with AEP as part of the preparation of this siting study. In order to construct over the existing Reservoir, improvements to the fly ash material below the proposed landfill must be made prior to construction to prevent excessive settlement and global instability. Additional geotechnical investigation is required to determine the condition of the fly ash and subsurface and to adequately design a system that allows for the construction of a landfill over the Reservoir.

For the purpose of this study, it is assumed that a wick drain system will be installed over the areas of the Reservoir where the landfill is proposed. In addition, it is assumed that approximately 100-feet of soil material will be placed to pre-load the area prior to construction of the landfill. Wick drain systems are commonly constructed to relieve pore pressure as the pre-loading and eventual landfill loading consolidates the fly ash material beneath the landfill.

It is possible that a more extensive engineering solution may be required to provide structural integrity for the landfill. Such solutions may include the partial or complete draining of the Reservoir and/or the construction of a splitter dike between the proposed landfill and the rest of the Reservoir. Another alternate method that could be used for stabilization of the Reservoir includes a phased loading/construction approach to allow the weight of the landfill ash material (above an installed liner system) to consolidate the existing sluiced ash in the Reservoir. This approach would include a wick drain system below the landfill liner system to release pore pressure as the landfill is developed. Instrumentation would be required to verify that the ash material in the Reservoir was adequately consolidated at each stage of landfill development. However, the feasibility of this loading/construction method, and the ability of this method to meet OEPA geotechnical design requirements, is not clear without further geotechnical investigation and analysis. Refer to **Appendix I**, which provides a more detailed discussion of the geotechnical analysis recommended to further evaluate landfill expansion over the Stingy Run Fly Ash Pond.

4.2.5.1 Turkey Run Conceptual Design

The conceptual layout of the Turkey Run Site is provided in **Figure 4C.** The limit of waste placement at the Turkey Run Site is approximately 259 acres and is divided into three (3) construction phases that will be developed moving south across the site. One combined stormwater and leachate management pond will collect and manage leachate generated at the south end of the landfill, with two additional stormwater management ponds constructed along the north and west sides of the site.

Haul distance from the existing stacker pad at the existing Gavin Landfill to the center of the Turkey Run Site is approximately 1.7 miles one-way. If a new conveyor is installed, approximately 1.0 mile of new conveyor will be constructed to transport material to a new stackout pad located on the east side of the landfill. Portions of the Gavin 138 kV Extension No.

1 transmission line will be relocated around the proposed landfill, and the Gallia Rural water distribution line running through Turkey Run will be removed. Approximately 1.0 million cubic yards of rock excavation/blasting is estimated in order to remove highwalls and underground mines at the site.

The conceptual top of waste placement for Turkey Run is shown in **Figure 4D**, and cross-sections of the site are shown in **Figure 4E**. The facility will be developed to a peak elevation of approximately 914 feet, or between 65 and 300 feet higher than the surrounding topography.

4.2.5.2 Little Kyger Conceptual Design

The conceptual layout of the Little Kyger Site is provided in **Figure 5C.** The limit of waste placement at the Little Kyger Site is approximately 211 acres and is divided into three (3) construction phases, with the western phase of the site developed prior to constructing the final two phases of the landfill. Phases 2 and 3 include approximately 20 acres which will be constructed over the Reservoir. One combined stormwater and leachate management pond at the south end of the landfill will collect and manage leachate generated from Phase 1. A second leachate and stormwater management pond will be constructed on the east side of the site to manage leachate generated from Phases 2 and 3. Two additional stormwater management ponds will be constructed along the north and west sides of the site.

Haul distance from the existing stacker pad to the center of the Little Kyger Site is approximately 2.3 miles one-way. If a new conveyor is installed, approximately 1.7 miles of new conveyor will be constructed to transport material to a new stackout pad located at the southeast corner of the landfill. The Gavin 138 kV Extension No. 1 transmission line will be relocated south around the landfill. The existing 800 MHz communications tower in the center of the site will need to be removed or relocated, and approximately 8.2 million cubic yards of rock excavation/blasting is estimated in order to remove highwalls and substantial underground mines at the site. Refer **Figure 5C** for the Conceptual Layout.

The conceptual top of waste placement for Little Kyger is shown in **Figure 5D**, and cross-sections of the site are shown in **Figure 5E**. The facility will be developed to a peak elevation of approximately 1024 ft, approximately 125-300 feet higher than the surrounding topography

4.2.5.3 State Route 554 Conceptual Design

The conceptual layout of the State Route 554 Site is provided in **Figure 6C.** The limit of waste placement at the State Route 554 Site is approximately 223 acres and is divided into four (4) construction phases that will be developed moving clockwise beginning with the easternmost phase of the site. One combined stormwater and leachate management pond at the north end of the site will collect and manage leachate generated at the facility, with two additional stormwater management ponds constructed along the east and west sides of the site.

Haul distance from the existing stacker pad to the center of the State Route 554 Site is approximately 3.3 miles one-way. If a conveyor is installed, approximately 2.8 miles of new conveyor will be constructed to transport material to a new stackout pad located on the east side

of the landfill. Approximately 1.2 million cubic yards of rock excavation/blasting is estimated in order to remove highwalls at the site.

The conceptual top of waste placement for State Route 554 is shown in **Figure 6D**, and cross-sections of the site are shown in **Figure 6E**. The facility will be developed to a peak elevation of approximately 964 feet, approximately 65 to 340 feet higher than the surrounding topography

4.2.5.4 Gavin Landfill Expansion Conceptual Design

The conceptual layout of the Gavin Landfill Gavin Landfill Expansion Site is provided in **Figure 7C.** The limit of waste placement at the Gavin Landfill Expansion is approximately 259 acres and is divided into three (3) construction phases that will be developed by extending the existing Gavin Landfill moving northwest across the site. Phases 2 and 3 include approximately 90 acres which will be constructed above the Reservoir. Each of the three (3) phases of the landfill has a dedicated stormwater and leachate management pond. Haul distance from the existing stacker pad to the center of the Gavin Landfill Gavin Landfill Expansion Site is approximately 1.4 miles. If a conveyor is installed, approximately 1.1 miles of new conveyor will be constructed to transport material to a new stackout pad located on the northeast side of the expansion. The Gavin 138 kV Extension No. 2 transmission line will be relocated south around the proposed landfill. Portions of the existing conveyor superstructure will need to be removed, and the Leading Creek raw water supply line running through Gavin Landfill Expansion area will be removed and relocated along the west side of the site. Approximately 3.0 million cubic yards of rock excavation/blasting is estimated in order to remove highwalls and underground mines.

The conceptual top of waste placement for Gavin Landfill Expansion is shown in **Figure 7D**, and cross-sections of the site are shown in **Figure 7E**. The facility will be developed to a peak elevation of approximately 914 feet, approximately 65 to 265 feet higher than the surrounding topography and only 17.5 feet higher than peak permitted elevation of the existing Gavin Landfill.

5.1 IDENTIFICATION OF EVALUATION CRITERIA

Each of the three Green Sites along with the Gavin Landfill Expansion Site were evaluated with respect to the following six (6) criteria: Potential Permitting Issues/Regulatory Siting Criteria, Site Characteristics, Property Characteristics and Ownership, Economics, Public Perception, and Construction/Technical Challenges. Each of these evaluation criteria is discussed in the following section.

5.2 DESCRIPTION OF EVALUATION CRITERIA

5.2.1 Potential Permitting Issues/Regulatory Siting Criteria

This criterion encompasses both potential fatal flaws identified in Section 4 and potential engineering challenges which may lead to difficulties with permitting. These engineering challenges may include items such as potential for highly variable subsurface conditions, high settlement expectations, potential slope stability concerns, potential for unknown abandoned underground mines beyond the extent already known, etc. Concerns such as these may lead the Ohio EPA to be concerned about the use of the particular site for the landfill and may lead to a lengthened permitting process, increased investigation costs, etc.

5.2.2 Site Characteristics

Site Characteristics include landfill capacity/landfill life, waste transportation considerations, and anticipated subsurface conditions. As discussed in Section 3.3, each of the viable sites were calculated to have airspace capacity capable of providing 20 years of life at an assumed generation rate of 2.6 million cubic yards per year. However, some sites have the potential for additional capacity or the potential for a future expansion after the planned 20 year life.

Waste transportation considerations include distance to the viable site and potential difficulties/concerns with construction of either a new or improved haul road or a new pipe conveyor with a haul road as backup to transport residual waste material from the existing Gavin Landfill stackout pad. Residual Waste will be transported from the existing stackout pad at the Gavin Landfill to the potential site either by off-road trucking or by conveyor. Each of these two transportation options will be evaluated for potential difficulties in siting the haul road or conveyor. Refer to Section 4.2.5 for more information on the evaluation of waste transportation options (hauling and conveyance).

The anticipated subsurface conditions of the viable sites are the last major factor of site characteristics. The subsurface conditions of the sites are affected by prior mining activities and by the presence of the Reservoir in portions of the site. Mining activities in the area have left high walls, minespoil, and abandoned underground mines. In the areas of the Reservoir utilized by a site, the subsurface conditions are anticipated to consist of loose and saturated fly ash that has the potential for high settlement, low strength properties, liquefaction susceptibility, and has the potential to build up excessive pore water pressures when loaded (thus further reducing the strength of the subsurface).

5.2.3 Property Characteristics/Property Ownership

Ranking of the characteristics of the property where the potential landfill site is to be located include required property acquisition, number of property owners for each viable site property (with more property owners being less favorable), structures that need to be removed/relocated, utility relocation, and oil/natural gas abandonment.

Ohio regulations require the purchase of all properties within 300 feet of the limit of residual waste placement. In addition, no domiciles may exist within 1000 feet of the limit of residual waste placement without consent from the property owners within 1000 feet. For the purpose of this study, AEP has stated a preference to purchase all property within 1000 feet of the conceptual limit of residual waste placement.

All viable sites contain residences located on AEP property. It is assumed that all homes currently leasing from AEP will be removed. The removal of these domiciles is not considered as a factor when evaluating the property ownership or public perception of the viable sites.

5.2.4 Public Perception

The anticipated public perception of the landfill site includes property acquisition issues as well the overall anticipated public perception of the project. The overall public perception of the project can be affected by how visible the site will be to the surrounding homes and surrounding public roads, property acquisition, impact of closing local roads, potential for noise issues, etc.

Sites located farther from the existing Gavin Landfill stackout pad are also considered less favorable due to the perceived disconnect from the plant and increased exposure of the operation to the public including visibility of the waste transportation system. Landfill siting or expansion over areas that are already owned by AEP and are already considered impacted, such as the Reservoir, may be perceived more positively by the public since new “green” or unimpacted areas are not being affected by the proposed waste disposal.

5.2.5 Construction and Technical Challenges

Construction and technical challenges may be present at the viable site due to mining activities or construction over the Reservoir or due to logistical issues associated with construction at the site. Construction challenges could include limited space for stockpiling excess soil; difficulty in maintaining stormwater drainage due to the presence of high walls; access for material and equipment deliveries, etc. Design related technical challenges can be due to challenging subsurface conditions; anticipated steep liner slopes and the impacts to slope stability; complex construction staging planning; complicated arrangements to enable efficient leachate collection and conveyance, etc.

5.2.6 Economics

An economic evaluation was performed for each of the viable sites to develop an effective cost comparison tool. Each site was evaluated for economic implications associated with site Characteristics, Property Characteristics/Property Ownership, and Construction and Technical

Challenges. Unit prices were derived and applied uniformly to the economic categories to maintain a consistent basis by which to compare the cost of each site.

The primary economic categories by which the viable sites were evaluated include Capital Costs (Site Development, Landfill Construction, and Landfill Closure) and Operations and Maintenance Costs. Within each of these economic categories lie secondary categories that have been combined to form the primary categories.

Site Development includes the costs associated with mobilization, site preparation, erosion and sediment control, stormwater management, abandonment of existing structures, and acquisition of property. These secondary categories describe work that is predominantly completed prior to beginning the construction of the landfill cell.

Landfill Construction includes excavation, liner construction, leachate management system, perimeter road construction and infrastructure related to the two options considered for waste transportation- truck hauling and a conveyor. Although the conceptual design of each viable site includes both three (3) phase and four (4) phase construction, in practice the landfill may be constructed in several subphases and not follow the conceptual phase layout. Therefore, in order to have an equivalent base of comparison, the costs associated with construction of each viable site were evenly distributed into four (4) increments over the 20 year lifespan of the landfill (beginning in year 1, year 5, year 10, and year 15).

Landfill Closure includes the cost of capping the landfill upon reaching final permitted elevations. The economic evaluation assumes that the entire landfill will be capped at the end of the 20-year life span as opposed to phased capping throughout the life of the landfill.

Operations and Maintenance include the cost of transporting the waste, placing the waste, and miscellaneous site maintenance costs associated with operating a landfill. The two waste transportation options (truck hauling and conveyor) were evaluated and the most cost effective option was included for each viable site. Operations costs were distributed evenly over the entire 20-year life of the landfill.

The costs generated during the economic evaluation were evaluated for each of the viable sites. The costs were estimated in 2010 dollars and a 3% inflation rate was applied over the 20-year period. These inflated totals were then summed and the Net Present Value was calculated assuming an 8% discount rate. The final 20-year Net Present Value for each viable site was calculated and evaluated on a cost per cubic yard basis.

The final two sites (the Preferred and Alternate sites) were evaluated further by conducting an additional cost evaluation of the 10-year Net Present Value. After determining the expected capacity of each phase of the preferred and alternate sites, a 10-year Net Present Value was performed based on the expected construction and development of the sites.

6.1 EVALUATION OF GREEN SITES

6.1.1 Evaluation of Turkey Run Site

6.1.1.1 Potential Permitting Issues/Regulatory Siting Criteria

The northeastern portion of the Turkey Run Site contains abandoned underground mines. These mines will need to be mitigated as part of construction of the Turkey Run Site. A thorough site investigation will need to be performed in order to delineate the mines as part of the permitting process to alleviate any concerns of a potentially unknown abandoned underground mine. The feasibility of the Turkey Run Site is also contingent on the ability to purchase the property required to develop the facility. Inability to purchase the adjacent properties may require a revision of the footprint, thus reducing the volume available at the site. There may also be a significant permitting effort required related to the removal of Turkey Run.

6.1.1.2 Site Characteristics

The Turkey Run Site has a potential capacity of 52 million cubic yards, plus feasible space for an expansion to the south or to the east to fill areas between the Turkey Run Site and the existing Gavin Landfill. It is the closest Green Site to both the plant and to the existing stackout pad (approximately 1.7 mile one-way haul distance). The site has been heavily mined and is surrounded on the north, east, and west by highwalls. Portions of the site contain abandoned underground mines.

6.1.1.3 Property Ownership

Approximately 92-acres will need to be purchased in order to obtain all property within 1000 feet of the Turkey Run Site. The property to be acquired contains nine (9) homes or other buildings which will need to be purchased. The property to acquire is owned by at least nine (9) separate owners. In addition, a 138 kV transmission line must be relocated and an existing Gallia Rural water distribution line which runs along Turkey Run Road will need to be abandoned as part of development of the landfill. The site also contains at least eight (8) oil/gas wells which must be abandoned.

6.1.1.4 Public Perception

Construction of a residual waste landfill at the Turkey Run Site will cause the abandonment of the existing Turkey Run Road. Alternate routes to Turkey Run Road include Little Kyger Road and State Route 554. Both detours would be approximately twice the distance to reach the intersection of Turkey Run Road, Africa Road, and Poplar Ridge Road. As mentioned previously, nine (9) homes on approximately 53-acres must be purchased. There are also an additional 17 residences or buildings to the south and southwest of the Turkey Run Site located within 2000 feet but outside of the 1000-foot required setback from homes along Turkey Run Road and Grover Road.

Because of the property purchase requirements, additional residences or buildings located downgradient of the proposed Turkey Run Site, and the required abandonment of a public road, there may be substantial public opposition to this landfill site. After construction commencement, remaining landowners downgradient of the landfill may potentially complain about perceived increased stormwater runoff, noise, and dust from the operation of the site.

6.1.1.5 Construction and Technical Challenges

Potential construction and technical challenges include abandonment of the underground mines, removal of highwalls, and design of the landfill floor to limit stability concerns. Other than the removal of underground mines and highwalls, the site is not anticipated to require significant subsurface improvements due to poor foundation conditions, but a thorough site investigation will identify any potential areas for concern. For the purposes of this study, it is assumed that all underground mines will be removed as part of construction. AEP has previously conducted significant mine removal by over-excavation or specialized filling of these areas and has also conducted extensive highwall removal within this study area. Known underground mines within the Turkey Run Site appear to be minimal in size and are approximately 50-75 ft below existing grade, based on available ODNR mine maps and coal seam information.

6.1.1.6 Economics

A detailed breakdown of the estimated costs (capital and O&M) for a landfill at the Turkey Run Site is located in **Appendix A**. Two waste transportation options were evaluated; a conveyance system and truck hauling. The result of the economic evaluation for the conveyor option resulted in a 20-year Net Present Value of $146,551,912 or $2.82 per cubic yard of residual waste. The economic evaluation performed for the truck hauling option resulted in an estimated 20-year Net Present Value of $152,057,012or $2.92 per cubic yard of residual waste.

6.1.2 Evaluation of Little Kyger Site

6.1.2.1 Potential Permitting Issues/Regulatory Siting Criteria

The site contains approximately 42 acres of known abandoned underground mines and numerous highwalls throughout the footprint. These mines and highwalls will need to be mitigated as part of construction of the Gavin Landfill Expansion Site. Alternatively, it may be possible to modify the proposed Gavin Landfill Expansion footprint to potentially avoid construction overtop the existing mines. A thorough site investigation will need to be performed in order to delineate the mines as part of the permitting process to alleviate any concerns of potential subsidence due to known and unknown abandoned underground mines. In addition, a portion of the Little Kyger Site extends onto the Reservoir. This area is anticipated to have potential for high settlement and potentially low strength which could pose a stability concern. A specialized investigation will need to be performed to provide data to compute the conditions of the settled fly ash in the pond and to be able to predict potential settlement and instability of the Little Kyger Site due to the poor subsurface conditions of the pond. Additional permitting may be required related to the removal of the stream tributary to Little Kyger Creek located in Phase 1 of the site.

Over the past several months, the United States Environmental Protection Agency (US EPA) has worked to identify and to assess the structural integrity of wet-handled coal combustion byproduct facilities across the country. As of August 2009, 49 units at 30 different locations across the country have been assigned a "high hazard potential" rating, using the criteria developed by the National Dam Safety Program for the National Inventory of Dams. The Stingy Run Fly Ash Reservoir is one of the 49 units to be assigned a "high hazard potential" rating by the US EPA. While the rating is not an indication of the structural integrity of the Stingy Run Dam, additional regulatory scrutiny or resistance is likely for any residual waste landfill proposed above the Reservoir.

Since a portion of the Little Kyger Site extends onto land which is currently used for the existing Reservoir, the expansion over the Reservoir could also serve as a permanent closure cap for the Reservoir – as part of a larger plan to permanently close the Reservoir. Closure of the Reservoir will also have the secondary benefit of addressing potential discharges to groundwater.

6.1.2.2 Site Characteristics

The Little Kyger Site has a potential capacity of 52 million cubic yards. The one-way haul distance to the site is approximately 2.3 miles from the existing Gavin stackout pad. The proposed conveyor and haul roads for Little Kyger Site can be constructed without crossing over public roads or onto non-AEP property. The site has been heavily mined and contains a large number of highwalls and abandoned underground mines throughout the footprint.

6.1.2.3 Property Characteristics and Ownership

Approximately 18-acres will need to be purchased in order to obtain all property within 1000 feet of the Little Kyger Site. The property to acquire is owned by at least two (2) separate owners. Construction at the site will require relocation of a 138 kV transmission line and abandonment or relocation of the existing communication tower. The site also contains four (4) oil/gas wells which will need to be abandoned.

6.1.2.4 Public Perception

Construction of a residual waste landfill at the Little Kyger Site will require the abandonment of Turkey Run Road. Alternate routes to Turkey Run Road include Little Kyger Road and State Route 554. Both detours would be approximately twice the distance to reach the intersection of Turkey Run Road, Africa Road, and Poplar Ridge Road.

Minimal property acquisition is required as part of this site construction and no homes are located within 1000 feet of the limit of waste. The proposed Little Kyger Site also includes land which is largely unusable for other public uses because it contains abandoned underground mines and highwalls, which may be a positive aspect of the project.

6.1.2.5 Construction and Technical Challenges

The Little Kyger Site presents a number of construction and technical challenges due to the prevalent mining activity throughout the site and due to the anticipated condition of the existing Reservoir. For the purposes of this study, it is assumed that all underground mines will be removed as part of construction. AEP has previously conducted significant mine removal by over-excavation or specialized filling of these areas and has also conducted extensive highwall removal within this study area. Known underground mines exist under a significant portion of the Little Kyger Site, and are approximately 75-100 ft below existing grade, based on available ODNR mine mapping and coal seam information.

This site requires a large amount of highwall and rock removal which not only has economic implications, but has implications on the construction schedule due to the significantly greater construction time compared to the other Green Sites. This may require a compressed permitting schedule to allow for the increase in construction time. It is possible that OEPA may allow AEP to begin site preparations, at risk, prior to receiving a permit to install (PTI) for the landfill construction, thereby potentially reducing or eliminating the schedule implications.

Significant technical challenges are presented by the proposed footprint extending onto the existing Reservoir. It is anticipated that the settled fly ash will present a saturated, weak, and compressible foundation material for the landfill. The exact subsurface improvements needed to make the project feasible are unknown but it is anticipated that, at a minimum, a preloading program coupled with wick drain installation to relieve pore pressure in the fly ash will be needed. Implementation of a preloading program will decrease the consolidation potential and increase the strength of the fly ash by increasing its density and reducing moisture content. A thorough investigation of the fly ash's condition and associated modeling will be necessary to determine if this preloading program will improve the subsurface enough to alleviate geotechnical concerns at the site or if additional measures are necessary, such as a structural wall or structural dike, soil mixing, phased loading/construction or other method to increase the stability of the fly ash in the Reservoir.

6.1.2.6 Economics

A detailed breakdown of the estimated costs (capital and O&M) for a landfill at the Little Kyger Site is located in **Appendix A**. Two waste transportation options were evaluated; a conveyance system and truck hauling. The result of the economic evaluation for the conveyor option resulted in an estimated 20-year Net Present Value of $211,090,034 or $4.06 per cubic yard of residual waste. The economic evaluation performed for the truck hauling option resulted in an estimated 20-year Net Present Value of $225,909,468 or $4.34 per cubic yard of residual waste.

6.1.3 Evaluation of SR 554 Site

6.1.3.1 Potential Permitting Issues/Regulatory Siting Criteria

The feasibility of the SR 554 Site is also contingent on the ability to purchase the two (2) homes within 1000 feet of the limit of waste that are located on private property. Inability to purchase the adjacent properties may require a revision of the footprint, thus reducing the volume available at the site. No other significant permitting challenges are apparent based on the existing data.

6.1.3.2 Site Characteristics

The SR 554 Site has a potential capacity of 52 million cubic yards. The one-way haul distance to the site is approximately 3.3 miles from the existing Gavin stackout pad. The proposed conveyor and haul roads for SR 554 Site can be constructed without crossing over any public roads or onto non-AEP property. The site shows indication of surface mining activity, but does not contain any known abandoned underground mines. However, detailed reconnaissance will be required to confirm the presence or lack of underground mines at the site.

6.1.3.3 Property Characteristics and Ownership

The SR 554 Site is proposed entirely on AEP property, but there are currently two (2) houses on private property within 1000-feet of the limit of waste which will require acquisition. Approximately 29-acres will need to be purchased in order to obtain all property within 1000 feet of the SR 554. The property to acquire is owned by at least three (3) separate owners. In addition, there are six (6) oil/gas wells which will need to be abandoned prior to construction.

6.1.3.4 Public Perception

Construction of the SR 554 Site requires the purchase of two (2) existing homes. It also will require abandonment of Poplar Ridge Road (County Road 25) which bisects the site and serves as a local connection to SR 554. The alternate connection route to SR 554 is Africa Road. The detour would be approximately three times the distance to reach the intersection of Poplar Ridge Road and SR 554.

6.1.3.5 Construction and Technical Challenges

Construction and technical challenges for the SR 554 Site include removal of highwalls and design of the landfill floor to limit stability concerns. Based on the available data, there are no known engineering challenges due to subsurface conditions or abandoned underground mines. AEP has previously conducted extensive highwall removal within this study area.

6.1.3.6 Economics

A detailed breakdown of the estimated costs (capital and O&M) for a landfill at the Little Kyger Site is located in **Appendix A**. Two waste transportation options were evaluated; a conveyance system and truck hauling. The result of the economic evaluation for the conveyor option resulted in an estimated 20-year Net Present Value of $151,378,852 or $2.91 per cubic yard of residual waste. The economic evaluation performed for the truck hauling option resulted in an estimated 20-year Net Present Value of $182,904,440 or $3.52 per cubic yard of residual waste.

6.2 EVALUATION OF EXISTING GAVIN LANDFILL EXPANSION

6.2.1 Potential Permitting Issues/Regulatory Siting Criteria

The southwestern and northwestern portions of the Gavin Landfill Expansion Site contain numerous highwalls and abandoned underground mines. These highwalls and mines will need to be mitigated as part of construction of the Gavin Landfill Expansion Site. Alternatively, it may be possible to modify the proposed Gavin Landfill Expansion footprint to potentially avoid construction overtop the existing mines. A thorough site investigation will need to be performed in order to delineate the mines as part of the permitting process to alleviate any concerns of potential subsidence due to known or unknown abandoned underground mines. In addition, a large portion (approximately 90 acres) of the Gavin Landfill Expansion Site extends onto the existing Reservoir. This area is anticipated to have potential for high settlement and potentially low strength which could pose a stability concern. A specialized investigation will need to be performed to provide data to compute the conditions of the settled fly ash in the pond and to be able to predict potential settlement and instability of the Gavin Landfill Expansion Site due to the poor subsurface conditions of the Reservoir.

Over the past several months, the United States Environmental Protection Agency (US EPA) has worked to identify and to assess the structural integrity of wet-handled coal combustion byproduct facilities across the country. As of August 2009, 49 units at 30 different locations across the country have been assigned a “high hazard potential” rating, using the criteria developed by the National Dam Safety Program for the National Inventory of Dams. The Stingy Run Fly Ash Reservoir is one of the 49 units to be assigned a “high hazard potential” rating by the US EPA. While the rating is not an indication of the structural integrity of the Stingy Run Dam, additional regulatory scrutiny or resistance is likely for any residual waste landfill proposed above the Reservoir.

Since the proposed Gavin Landfill Expansion Site also uses land which is currently used for the existing Reservoir, the expansion over the Reservoir could also serve as a permanent closure cap for the Reservoir – as part of a larger plan to permanently close the Reservoir. Closure of the Reservoir will also have the secondary benefit of addressing potential discharges to groundwater.

6.2.2 Site Characteristics

The Gavin Landfill Expansion Site has a potential capacity of 52 million cubic yards plus room for further potential expansion either onto the existing ash pond or a potential vertical expansion. The one-way haul distance to the site is approximately 1.4 miles from the existing Gavin stackout pad. The proposed conveyor and haul roads for the Gavin Landfill Expansion Site can be constructed without crossing over public roads or onto non-AEP property. The site contains a number of highwalls and one known area of abandoned underground mines.

6.2.3 Property Characteristics and Ownership

The Gavin Landfill Expansion Site can be constructed without any acquisition of additional property or domiciles. Construction at the site will require relocation of a 138 kV transmission and the abandonment of two (2) oil/gas wells. In addition, the Leading Creek raw water supply line running through Gavin Landfill Expansion area will be removed and relocated along the west side of the site.

6.2.4 Public Perception

No property acquisition is required as part of this site construction and no homes that are on private property are located within 1000 feet of the limit of waste. The proposed Gavin Landfill Expansion Site also uses land which is currently used for the existing fly ash pond and may be received positively by the public if the ash pond is partially or fully dewatered and closed as part of this project.

6.2.5 Construction and Technical Challenges

The Gavin Landfill Expansion Site presents a number of construction and technical challenges primarily due to the anticipated condition of the existing Reservoir and the presence of highwalls and underground mines at the site. Significant technical challenges are presented by the proposed Gavin Landfill Expansion Site's footprint extending onto the existing Reservoir. It is anticipated that the settled fly ash will present a saturated, weak, and compressible foundation material for the landfill. The exact subsurface improvements needed to make the project feasible are unknown but it is anticipated that, at a minimum, a preloading program coupled with wick drain installation to relieve pore pressure in the fly ash will be needed. Implementation of a preloading program will decrease the consolidation potential and increase the strength of the fly ash by increasing its density and reducing moisture content. A thorough investigation of the fly ash's condition and associated modeling will be necessary to determine if this preloading program will improve the subsurface enough to alleviate geotechnical concerns at the site. Alternatively, additional measures may be necessary, such as construction of a structural wall or structural dike, soil mixing, a phased loading/construction approach (refer to the "Construction Over the Stingy Run Fly Ash Reservoir" paragraph presented in Section 4.2.5), or other methods to increase the stability of the fly ash. Refer to **Appendix I**, which provides a more detailed discussion of the geotechnical analysis recommended to further evaluate landfill expansion over the Stingy Run Fly Ash Pond.

For the purposes of this study, it is assumed that all underground mines will be removed as part of construction. AEP has previously conducted significant mine removal by over-excavation or specialized filling of these areas and has also conducted extensive highwall removal within this study area. Known underground mines within the Gavin Landfill Expansion Site appear to be minimal in size and are approximately 50-75 ft below existing grade, based on available ODNR mine maps and coal seam information.

This site requires a large amount of rock removal due to existing highwalls, which not only has economic implications, but has implications on the construction schedule due to the significantly greater construction time compared to the other sites. This may require a compressed permitting schedule to allow for the increase in construction time. It is possible that OEPA may allow AEP to begin site preparations, at risk, prior to receiving a permit to install (PTI) for the landfill construction, thereby potentially reducing or eliminating the schedule implications.

6.2.6 Economics

A detailed breakdown of the estimated costs (capital and O&M) for the Gavin Landfill Expansion Site is located in **Appendix A**. A more detailed discussion on the cost-related components associated with the expansion over portions of the Reservoir is included in **Appendix H**. Two waste transportation options were evaluated; a conveyance system and truck hauling. The economic evaluation performed for the conveyor option resulted in an estimated 20-year Net Present Value of $234,403,655 or $4.51 per cubic yard of residual waste. The result of the economic evaluation for the truck hauling option resulted in an estimated 20-year Net Present Value of $230,670,083 or $4.44 per cubic yard of residual waste.

7.1 SITE RANKING PROCESS

URS was directed by AEP to select the most favorable viable Green Site and then compare that most favorable Green Site against the Gavin Landfill Expansion Site. Sites were evaluated on a 1 to 3 scale with 1 being least favorable (or significant concern) and 3 being most favorable (or little to no concern). Sites were not ranked relative to one another. For example, if public perception at all three sites is anticipated to be favorable, all may receive a "3" for that criteria. In addition, each ranking category was ranked on a 1 to 5 weighting factor with "1" being of lowest importance and "5" being of highest importance. The sites with the highest overall scores are considered preferable.

Ranking of the Green Sites is shown in **Table 6**. Ranking of the Preferred Green Site versus the Gavin Landfill Expansion Site is shown in **Table 7**.

7.2 RESULTS OF SITE RANKING

As shown in **Table 6**, the most favorable Green Site is the State Route 554 Site. The 20-year Net Present Value for the SR 554 Site is slightly greater than the second most favorable Green Site, the Turkey Run Site. However, the SR 554 Site is anticipated to have the least technical challenges associated with construction, requires less property acquisition than Turkey Run, contains the least amount of highwalls, and contains no known abandoned underground mines. The most favorable transportation route for SR 554 is by a single pipe-conveyor with a haul road to be used as backup. Although the SR 554 Site requires the longest conveyor of the three (3) viable Green Sites, the conveyor would predominantly follow the former coal conveyor alignment reducing design concerns and potential costs associated with the conveyor alignment.

Table 7 shows the comparison of the final two sites (Preferred and Alternate) – the SR 554 Site and the Gavin Landfill Expansion Site. From this comparison, the SR 554 Site is more favorable than the Gavin Landfill Expansion Site. The 20-year net present value cost of the Gavin Landfill Expansion Site is approximately 34% higher ($79 million) than the 20-year Net Present Value cost for the SR 554 Site.

An additional cost evaluation was conducted as another means of comparison between the SR 554 and Gavin Landfill Expansion sites. This additional evaluation considered the 10-year Net Present Value, solely considering Phases 1 and 2 of each of the two final sites. A volume analysis was performed and it was determined that it takes just over 10-years for Phases 1 and 2 to be constructed and reach their volume capacity for both the SR 554 Site and the Gavin Landfill Expansion Site. The results of the phase volume analysis and a summary of the 20-year and 10-year NPV costs are provided in **Table 8**. Based on a 10-year Net Present Value cost analysis, the SR 554 Site remains the less expensive option by approximately 18% ($23 million) between the two sites during the first 10-years of operation.

In addition, the Gavin Landfill Expansion Site contains considerable unknowns with respect to the condition of the Reservoir which could affect the permitting issues/regulatory siting criteria, economics, and technical challenges of the site. The cost of constructing the Gavin Landfill Expansion Site could increase considerably if more significant subsurface improvements and/or

structural features are required to enable construction over the existing Reservoir. However, if an alternate subsurface stabilization method is used for the Reservoir area, such as phased loading with waste materials overtop the landfill liner; the construction cost may be reduced significantly. A comprehensive subsurface investigation over the Reservoir is required to further define these potential savings and/or benefits.

In addition to the economic concerns associated with the Gavin Landfill Expansion Site, it is anticipated that the subsurface improvements required for the portions of the expansion over the Reservoir may lead to significant regulatory permitting concerns and may present significant construction challenges with respect to construction staging and site monitoring associated with the subsurface improvement program. However, AEP's experience has been successful in permitting the expansion of an existing landfill overtop a fly ash pond (e.g. Cardinal FAR I, Tanners Creek and Conesville).

8.1 CONCLUSIONS

The SR 554 Site (a "Green" site) scores the highest value in the Site Ranking Matrix (matrix) and has the second lowest overall disposal cost of $2.91/CY; by using a conveyor option to transport waste. The Turkey Run Site (also a "Green" site) has the second highest matrix score and has the lowest overall disposal cost of $2.82/CY; using a conveyor to transport waste. The 20-year NPV unit price disposal cost for each of these two sites is within 3 percent of each other.

The Turkey Run Site's matrix score was penalized for requiring more land purchase, increased permitting and engineering challenges due to presence of underground mines, and more utility relocations than the SR 554 site. It also requires the closure of Turkey Run Road, a major county through fare which may create local resistance in permitting the site.

The Gavin Landfill Lateral Expansion option matrix score (60 points) is only slightly lower than the SR 554 Site's score (68 points) when the cost component of the scores is removed. The unknown subsurface conditions and the need to engineer and construct a significant subsurface stabilization system in areas extending over the Stingy Fly Ash Reservoir penalized the matrix score of the Gavin Landfill Lateral Expansion option.

The Gavin Landfill Lateral Expansion option has some viable features by being an existing landfill. The option requires no land purchases; AEP owns 100 percent of the site; the site has fewer oil/gas well closures; and disturbing an existing landfill and use of an existing area over the Reservoir may be more acceptable locally. AEP's experience has been successful in permitting the expansion of an existing landfill (e.g. Conesville) and an expansion can be more cost efficient because the operational infrastructure is already in place.

A summary of the economic evaluations performed on the SR 554 and Gavin Landfill Expansion Sites is provided in **Table 8**.

Table 8: Summary of Economic Evaluation

Economic Evaluation	Gavin Landfill Expansion Site		State Route 554 Site	
	Total NPV cost	$/cy	Total NPV cost	$/cy
20 year NPV - All Phases (with Reservoir stabilization costs)	$230,670,083	$4.44	$151,378,852	$2.91
20 year NPV - All Phases (without Reservoir stabilization costs)	$172,112,767	$3.31	$151,378,852	$2.91
10 year NPV - Phase 1 and 2 (with Reservoir stabilization costs)	$125,293,112	$4.82	$102,403,492	$3.94
10 year NPV - Phase 1 and 2 (without Reservoir stabilization costs)	$116,390,851	$4.48	$102,403,492	$3.94

For the Gavin Landfill Lateral Expansion option, the cost of stabilizing the subsurface area (approximately 90-acres) proposed to extend overtop the Reservoir created a $79-million ($1.53/CY) difference between the 20-year NPV costs of construction at the SR 554 and the Gavin Landfill Lateral Expansion sites. If the cost of the Reservoir stabilization is not included, the difference in 20-year NPV costs of construction is reduced to $21-million ($0.40/CY) between these two sites.

Another means of comparison is the 10-year NPV cost analysis that considered Phases 1 and 2 of each of the two sites and their volume capacity. Based on a 10-year NPV cost analysis, the Gavin Landfill Lateral Expansion is approximately $23-million ($0.88/CY) greater than the SR 554 Site during the first 10-years of operation. However, if the cost of the Reservoir stabilization is not included, the difference in 10-year NPV costs of construction is reduced to $14-million ($0.54/CY) between these two sites.

URS recommends that an engineering study be performed to potentially reduce the $79 million cost differential between these two sites before AEP proceeds with the SR 554 as the primary future landfill site for the Gavin Plant. The engineering study is further discussed below in the Recommendations section.

8.2 RECOMMENDATIONS

Expanding the existing Gavin Landfill creates economic opportunities in extending current waste disposal operations on one site. The lateral expansion of the landfill overtop areas of the Stingy Run Fly Ash Reservoir creates a significant cost difference that can be attributed to the need to stabilize the fly ash subsurface in the Reservoir before constructing the last phases of the landfill. The development costs have been based on assumptions and limited subsurface geotechnical data regarding the Reservoir. URS recommends that AEP perform an engineering study of the Gavin Landfill Lateral Expansion site with the goal to reduce the $79-million difference ($1.53/CY) in 20-year NPV disposal costs between the SR 554 site and the Gavin Landfill Lateral Expansion site.

The engineering study for the Gavin Landfill Lateral Expansion should focus on identifying and reducing the primary cost driver, the subsurface stabilization of the landfill areas that are proposed to extend overtop the Reservoir, and reduce the unit price of waste disposal to be more comparable to the SR 554 Site. To quantify those costs the scope of the study should generally include the following:

1) **Subsurface investigation;** A subsurface (geotechnical) investigation should be conducted to evaluate subsurface conditions of the Stingy Run Fly Ash Reservoir in order to support the design of the stabilization methodology below the lateral expansion area. This investigation will provide insight into the strength and compressibility characteristics of the fly ash material in the Reservoir both before and after the necessary subsurface improvements. In general, components of the geotechnical investigation should include: drilling and sampling of the existing ash materials, laboratory testing of reconstituted ash samples, geotechnical analyses and potentially pilot testing. Each of these components is discussed in more detail in **Appendix I.**

2) **Value engineering;** Based on the results of the subsurface investigation and further engineering analyses, the conceptual design could be modified to determine the most cost-effective configuration and expansion method overtop the Reservoir. Value engineering of the lateral expansion footprint would also include an evaluation to reduce surcharge and wick drain costs in the construction of the landfill, as well as consideration of a phased construction method as discussed below.

3) **Footprint and configuration modification;** Evaluate the currently proposed conceptual footprint and configuration of the lateral expansion and possibly incorporate the best features of the adjacent Turkey Run Site and avoid features that drive up the costs to develop that site, and the potential regulatory closure of the Stingy Run Fly Ash