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Appendix C: Comment Form

Harrison Power Project

Comment Form
Name: Address: E-mail: Phone Number:
Explanation of comment (attach additional sheets if necessary):
Explanation of corrective measures:
Current Status of Comment:
Signature: _____ Date:_____

Appendix D: Economic Impact Analysis

FTI CONSULTING

SEPTEMBER 2017

THE ECONOMIC IMPACT OF THE PLANNED HARRISON POWER PROJECT IN HARRISON COUNTY, OHIO

KEN DITZEL
SCOTT NYSTROM

EXPERTS WITH **IMPACT**™

Table of Contents

Executive Summary

Harrison Power, LLC (Harrison Power) has proposed constructing and operating a 1,027 MW gas-fired combined cycle power plant in Harrison County, Ohio (the Project). The Project would cost approximately $900 million to build. Harrison Power plans to begin construction of the Project in 2018 and commence operations by early 2021. During the construction peak, there would be up to 500 workers on-site, and during operation, the plant would employ approximately 30 direct full-time equivalent (FTE) employees to maintain and operate the plant.

Harrison Power engaged FTI Consulting, Inc. (FTI) to assess the economic impacts of the construction and operation of the Project on Eastern Ohio (defined as a local region of 26 counties that includes Harrison County) and the rest of Ohio. FTI received data from Harrison Power on its planned expenditures, including the direct employment and expenditures for construction and operations, equipment purchases, materials, services, and natural gas. Harrison Power also provided FTI with data on the location of these purchases – either inside or outside of Ohio and Eastern Ohio.

ES Figure 1: Ohio counties, including Harrison County (orange), the Eastern Ohio region (blue), and rest of Ohio (white)

Harrison County is located between the Columbus, Cleveland-Akron-Canton, and Pittsburgh metropolitan areas in Eastern Ohio and is close to Steubenville, Ohio and Wheeling, West Virginia. The county is an attractive location for a new power plant because it has access to natural gas resources in the Utica Shale in Ohio, demand from the cities and industry in the area, and has access to natural gas pipelines and electricity transmission infrastructure.

The figure below shows the projected impact of the Project during its construction, lasting from 2018 to 2020. The Project would create 805 sustained jobs throughout Ohio for three years, split between the Eastern Ohio region and the rest of the state, and would contribute $210 million towards Ohio's gross domestic product (GDP).

ES Figure 2: Cumulative economic impact of the Project during construction

CATEGORY	OHIO (STATEWIDE)	EASTERN OHIO	REST OF OHIO
Employment (sustained number of jobs)	805	727	78
Sales Output (2017 $ millions)	$464	$406	$58
GDP (2017 $ millions)	$210	$188	$22
Labor Income (2017 $ millions)	$172	$153	$19

The figure below shows the continual impact of the Project once it begins operating in 2021. The Project's operations would contribute 252 jobs throughout Ohio. This figure includes direct employment of approximately 30 full-time workers at the plant, additional employment by businesses providing goods and services to the plant, and employment generated from employees of the plant and its suppliers who spend money in the Ohio economy. Of the 252 jobs, 223 jobs would be in Eastern Ohio. Project operations also would contribute $64 million annually to Ohio's GDP.

ES Figure 3: Annual economic impact of the Project during operations

CATEGORY	OHIO (STATEWIDE)	EASTERN OHIO	REST OF OHIO
Employment (sustained number of jobs)	252	223	29
Sales Output (2017 $ millions)	$95	$90	$5
GDP (2017 $ millions)	$65	$62	$3
Labor Income (2017 $ millions)	$17	$15	$2

The Project also generates significant tax revenues for Eastern Ohio's municipalities, counties, and the state government. The table below shows the expected state and local tax revenues during construction and operations. The construction numbers are cumulative over three years; the operational numbers are annual and ongoing.

ES Figure 4: Cumulative state and local tax revenues from construction phase

REGION	STATE AND LOCAL TAX REVENUES
Ohio (Statewide)	$15.98
Eastern Ohio	$14.29
Rest of Ohio	$1.70

The Project generates nearly $16 million in total state and local tax revenues during its construction. The vast majority of the revenues (89 percent) come from Eastern Ohio and likely goes towards enhancing its public services.

ES Figure 5: Annual state and local tax revenues from operational phase

REGION	STATE AND LOCAL TAX REVENUES
Ohio (Statewide)	$1.73
Eastern Ohio	$1.50
Rest of Ohio	$0.24

Once operational, the Project generates an estimate $1.73 million of additional state and local tax revenues per year.

Introduction

Harrison Power[1] engaged FTI's Economic Impact Group (EIG)[2] to assess the economic impacts of the construction and operations of a new gas-fired, combined cycle power plant in Harrison County, Ohio. The plant, which would be located near the Village of Cadiz, would have a net capacity of 1,027 MW and begin operations in the first quarter of 2021 after three years of construction.[3] This report covers a description of the Project, the economic modeling used to assess its economic impact, and its projected effects and influences on the regional and statewide Ohio economies.

The Harrison Power Project

The Harrison Power Project is a proposed natural gas combined-cycle (NGCC)[4] plant with 1,027 MW of capacity, subject to final heat and mass balance adjustments. It would be located in Harrison County near the Village of Cadiz. The county has a population of 15,300.[5] Important economic activities in the county include fifteen manufacturing firms in the Harrison County Industrial Park, agriculture, and the extraction and development of fossil fuels.[6] Cadiz is the county seat of Harrison County and has a population of 3,350 people (or 22 percent of the country).[7] The Harrison County Improvement Corporation (CIC) is helping to bring the Project to Cadiz and Harrison County, and the plant site would occupy approximately 60 acres in the county's industrial park.[8] The Harrison County Commissioners (HCC) owns the site – Harrison Power currently holds an option to acquire the site at a favorable market price to the HCC.

Figure 1: Metropolitan areas near Harrison County in eastern Ohio, western Pennsylvania, and West Virginia[9]

The Project capital expenditures (or "capex") would be approximately $900 million,[10] which includes land acquisition, site preparation, building materials, power generation and transmission equipment, professional services, and construction labor.

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[1] http://Harrison Power.com/
[2] http://www.fticonsulting.com/services/economic-consulting/economic-impact-analysis
[3] Dan O'Brien, "Fourth Gas-Fueled Power Plant Coming to Utica," *Business Journal Daily*, 29 September 2016, http://www.businessjournaldaily.com/clone3/fourth-gas-fueled-power-plant-coming-to-utica/
[4] "How a Combined-Cycle Power Plant Works," *Tennessee Valley Authority (TVA)*, https://www.tva.gov/Energy/Our-Power-System/Natural-Gas/How-a-Combined-Cycle-Power-Plant-Works
[5] "Harrison County, Ohio," *U.S. Census Bureau*, https://www.census.gov/quickfacts/fact/table/harrisoncountyohio/AGE135216#viewtop
[6] "Harrison County, Ohio: Employment Opportunity," *Harrison County Board of Commissioners*, 30 September 2014, http://www.ccao.org/userfiles/Harrison%20Co%20ED%20Description.pdf
[7] "City and Town Population Totals Tables: 2010-2016," *U.S. Census Bureau*, https://www.census.gov/data/tables/2016/demo/popest/total-cities-and-towns.html
[8] "Cadiz lands 1,000 MW gas-fired power plant," *Harrison News-Herald*, 22 September 2016, http://www.harrisonnewsherald.com/?p=14369
[9] "OHIO – Core Based Statistical Areas (CBSAs) and Counties," *U.S. Census Bureau*, https://www2.census.gov/geo/maps/metroarea/stcbsa_pg/Feb2013/cbsa2013_OH.pdf
[10] "$900 MM Utica Gas-Fired Electric Plant Coming to Harrison County, Ohio," *Marcellus Drilling*, http://marcellusdrilling.com/2016/09/900m-utica-gas-fired-electric-plant-coming-to-harrison-county-oh/

The new plant would generate enough electricity to power between 750,000 and 1 million homes.[11] For comparison, this is enough power to satisfy the needs of the 850,000 households in the Cleveland-Elyria metro area (Cuyahoga, Geauga, Lake, Lorain, and Medina Counties) to the northwest.[12] Construction would begin in the third quarter of 2018 and employ 500 construction workers for three years; operations would begin at the start of 2021 and sustain 30 permanent jobs.[13]

The Project would be the fourth new NGCC in Ohio in the past few years. Plants are under construction in Trumbull County and Carroll County and another is planned in Columbiana County.[14] Given the abundant supply and increasing production from the Utica Shale formation in Ohio, locating gas-fired plants in Ohio is an attractive proposition for serving the electricity needs not only in Ohio but also for the PJM ISO[15] and the larger Eastern Interconnection.[16] Current estimates of the Utica Shale place its recoverable potential between 3.8 and 15.7 trillion cubic feet (TCF) of gas,[17] and there are further natural gas supplies adjacent in Pennsylvania's portion of the Utica Shale and the Marcellus Formation, stretching from New York and across Pennsylvania, Ohio, West Virginia, and south towards the central Appalachians.

In addition to being ideally located near the Utica Shale formation, Harrison County and the larger Eastern Ohio region also have access to major natural gas pipelines and electricity transmission infrastructure. The Rover Pipeline, for example, is about to finish construction and will begin operations across parts of West Virginia, Ohio (including Harrison County), Pennsylvania, Michigan, and Ontario.[18] The 713-mile pipe, which will cost $4.2 billion to build, will transport 3.25 billion cubic feet (BCF) per day of natural gas to Midwestern energy consumers.[19]

According to the *Harrison News-Herald*, "The Project is entertaining multiple proposals to source natural gas from producers in the Ohio area."[20] Furthermore, "There are several natural gas pipelines operated by Dominion East, Spectra, Energy Transfer, and Columbia within a few miles of the Project's site."

On the electricity transmission side, the area already is well developed and there are plans to develop it further. American Electric Power (AEP) has committed to $3.2 billion of transmission line upgrades in Ohio to bring the power generated by the Project and others to market. The Project will require the construction of a 138 kV transmission line to the south from the site towards a new substation.[21] From there, the Project's output would connect into the high-voltage electricity transmission grid. The figure below shows infrastructure within Harrison County, including electric transmission lines and natural gas pipelines.

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[11] "In 2015, the average annual electricity consumption for a U.S. residential utility customer was 10,812 kWh," *Energy Information Administration (EIA)*, 18 October 2016, https://www.eia.gov/tools/faqs/faq.php?id=97&t=3, compared to the 8.76 billion kWh possible from the Harrison Power Project (8.76 billion / 10,812 = 810,211) with some assumed qualitative adjustments made for capacity factors and lower demand for air conditioning in the Midwest

[12] "Cleveland, OH," *Census Reporter*, https://censusreporter.org/profiles/16000US3916000-cleveland-oh/

[13] O'Brien, note 3

[14] Ibid.

[15] http://pjm.com/

[16] https://energy.gov/oe/services/electricity-policy-coordination-and-implementation/transmission-planning/recovery-act-0

[17] "Utica Shale: The Natural Gas Giant Below the Marcellus," *Geology.com*, http://geology.com/articles/utica-shale/

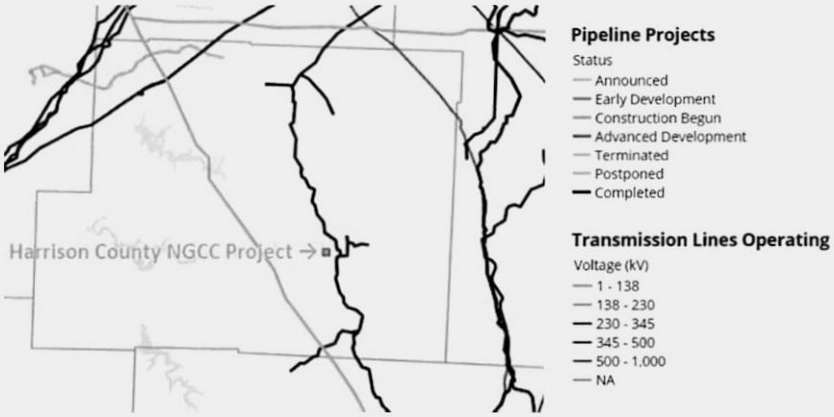
[18] "The Route," *Rover Pipeline*, http://www.roverpipelinefacts.com/the-route.html

[19] Susan King, "Rover Pipeline Receives County Greenlight," *Harrison News-Herald*, 3 February 2017, http://www.harrisonnewsherald.com/?p=14925

[20] Ibid.

[21] "Harrison County, OH," *Harrison Power*, http://Harrison Power.com/wp-content/uploads/2016/06/Harrison.png

Figure 2: Electricity and natural gas transmission assets near Harrison County, Ohio[22]



The Project would help meet growing electricity demand in Ohio and broader PJM region. Harrison County is located roughly two hours east of Columbus, two hours southeast of Cleveland, and one hour west of Pittsburgh. This centralized location puts Harrison County in the middle of power demand from large metropolitan areas. Additionally, industrial activity from the development of the Utica Shale formation will increase power demand in the region. Several fractionation and gas distillation facilities within Harrison County have plans to expand production. Therefore, the Project would fit into the energy economy of Harrison County and the broader region.

Harrison County and Ohio Economic Summaries

This section contains a brief summary of the history and trajectories of the economies of Harrison County and Ohio. It includes population trends, unemployment rates, and socioeconomic data such as poverty and the percentage of the population without health insurance. Harrison County and Ohio had sluggish recoveries from the financial crisis and Great Recession of 2008 and 2009, and the Harrison County Project could help the area continue to recover.

Population

Harrison County has experienced a slow but steady population decline over the past few decades. Its population peaked at 18,150 in 1980, which has declined by 2,850 to 15,300 (a decline of 16 percent).[23] Adding the plant, with its 30 permanent jobs and projected spinoff jobs, could help to halt and reverse this decline.

Ohio, on the other hand, has experienced slow population growth from 1980 through 2016. In 1980, the state's population was 10.8 million.[24] This has since increased by 7 percent to 11.6 million. While Ohio's population is now larger than in the past, the population of the U.S. over the same period grew by 42 percent from 227 million to 323 million.[25] A rebirth in the energy economy and manufacturing in the Midwest[26] is potentially a viable path forward for Ohio to move closer to the national average rates of population, economic, and productivity growth.

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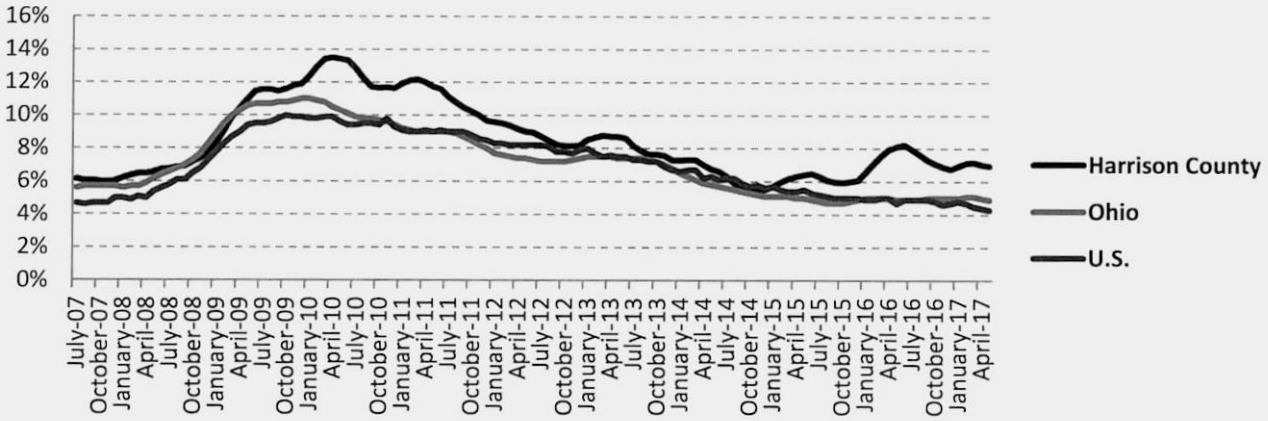
[22] Map generated by and data sourced from S&P Global Market Intelligence and SNL Financial
[23] "Population," *Google Public Data*, https://www.google.com/publicdata/explore?ds=kf7tgg1uo9ude_&met_y=population&idim=county:39067&hl=en&dl=en
[24] "Population," *Google Public Data*, https://www.google.com/publicdata/explore?ds=kf7tgg1uo9ude_&met_y=population&idim=state:39000:26000&hl=en&dl=en
[25] "Population," *Google Public Data*, https://www.google.com/publicdata/explore?ds=kf7tgg1uo9ude_&met_y=population&idim=country:US&hl=en&dl=en
[26] http://www.fticonsulting.com/insights/white-papers/economic-benefits-manufacturing-renaissance

Unemployment Rate

The figure below shows the unemployment rate over the past ten years for Harrison County,[27] Ohio,[28] and the U.S. economy.[29] All areas suffered from the Great Recession of 2008 and 2009 and its aftermath. Harrison County, though, suffered the most, with its peak unemployment rate reaching 13.5 percent in early 2010. Harrison County's unemployment rate has recovered since then, but it is still typically and consistently 1 or 2 percent higher than the U.S. and the rest of Ohio.

Figure 3: Unemployment Rates in Harrison County, Ohio, and U.S. (July 2007 – April 2017)



Harrison County's rate in April 2017 was 7.0 percent compared to 4.9 percent for Ohio and 4.3 percent nationally. The new jobs from the Project would help Harrison County and its surrounding region move closer to the Ohio average.

The map below shows the unemployment rate for Ohio's counties. The exact number for Harrison County (5.8 percent) is different from the number for Harrison County in because lacks any seasonal adjustments. Nonetheless, the regional pattern is clear. The eastern and southeastern part of the state, along the Ohio River and bordering with West Virginia, tend to have higher unemployment rates than the central and western regions. Some of the lowest unemployment rates are in Delaware, Franklin, Madison, and Union Counties in the Columbus metro.[30] Therefore, the eastern part of Ohio stands to gain much from natural gas, power plant, pipeline, and transmission infrastructure developments.

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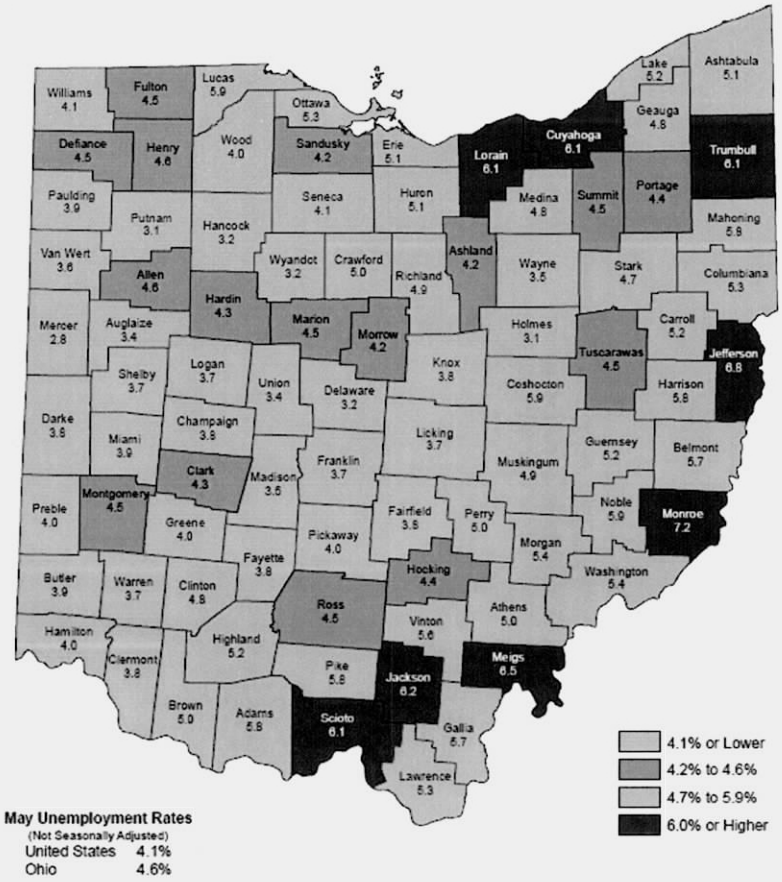
[27] "Unemployment Rate in Harrison County, OH," *Federal Reserve Economic Data (FRED)*, https://fred.stlouisfed.org/series/OHHARR7URN?cid=29443&sid=OHHARR7URN, rolling average of previous six-months' unemployment rates

[28] "Unemployment Rate in Ohio," *Federal Reserve Economic Data (FRED)*, https://fred.stlouisfed.org/series/OHUR

[29] "Civilian Unemployment Rate," *Federal Reserve Economic Data (FRED)*, https://fred.stlouisfed.org/series/UNRATE

[30] "Ohio Metropolitan Statistical Areas," *Ohio Department of Job and Family Services*, http://lmi.state.oh.us/maps/MapofMSAs2010.pdf

Figure 4: Ohio Unemployment Rates (May 2017, not seasonally adjusted)[31]



Household Incomes and Property Values

Households in Harrison County have lower median incomes versus Ohio's median household. Conversely, a rural area such as Harrison County tends to have lower housing prices and a lower cost of living. The median family in Harrison County has a median income of $43,200 and the median property value is $85,400 – and declining.[32] The median family in Ohio has an income of $51,100 and the median property value is $136,400 and increasing between 5 percent and 6 percent per year.[33] These statistics show that Harrison County is behind the rest of the state.

The ratio of median income to median property value in Harrison County is close to 1:2; the ratio in Ohio is 1:2.7, making Harrison County more affordable relative to incomes in other areas. This low cost of living combined with the county's drivable proximity to amenities and entertainment in Columbus, Cleveland, and Pittsburgh could make it an attractive living location with higher job availability from the Project and its spinoffs.

[31] http://ohiolmi.com/laus/ColorRateMap.pdf
[32] "Harrison County, Ohio," *Data USA*, https://datausa.io/profile/geo/harrison-county-oh/
[33] "Ohio," *Data USA*, https://datausa.io/profile/geo/ohio/

Socioeconomics

The current poverty rate in Harrison County is 17.3 percent, around 2.5 percent higher than the Ohio average and nearly 4 percent higher than the U.S. average. Harrison County is also a relatively old county compared to the rest of Ohio with an average age of 46 years compared to 39 years for the Ohio population overall.

Figure 5: Poverty rates in Harrison County, Ohio, and U.S. (2015)

REGION	POVERTY RATE
Harrison County	17.3%
Ohio	14.8%
U.S.[34]	13.5%

Harrison County has a higher high school graduation rate (88 percent) than Ohio (80 percent).[35] Around half of Harrison County residents have some experience with college[36] while 62 percent of Ohio residents have at least some college. When it comes to graduation, 8.6 percent of adults over the age of 25 in Harrison County have a bachelor's degree while 26.1 percent of Ohio residents over age 25 have a bachelor's degree, which is close to the national average.[37] The Project would likely increase the demand for educated and skilled workers in the Eastern Ohio region.

Harrison County ranks behind Ohio and the U.S. when it comes to health insurance coverage. Around 15 percent of Harrison County residents lack health insurance compared to 14 percent for Ohio.[38]

The overall picture for Harrison County and the eastern part of Ohio, using unemployment rates as a proxy measurement for other metrics, is an area of economic distress that is behind the rest of the state and the rest of the nation. Adding jobs and development to the area, creating additional spinoffs, and growing the energy and industrial economy would improve the unemployment rate, economic outcomes, and help the area's socioeconomics.

Methodology and Approach

Determining the economic impact of the planned NGCC plant in Harrison County requires three steps. This section details each step, as well as the major assumptions and inputs used about the Project.

The three main steps of analysis include:

1. Define the regions for the analysis
2. Determine and categorize the nature, location, and timing of the $900 million in capex to build the Project, along with the employment and expenditures needed to operate the Project (opex)
3. Model these inputs in the IMPLAN economic impact model

The following subsections describe the details, data, and assumptions involved with each of the three steps.

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[34] "What is the current poverty rate in the United States," *Center for Poverty Research at the University of California-Davis*, 13 September 2016, https://poverty.ucdavis.edu/faq/what-current-poverty-rate-united-states

[35] "Harrison," *County Health Rankings and Roadmaps*, http://www.countyhealthrankings.org/app/ohio/2014/rankings/harrison/county/outcomes/overall/snapshot

[36] "Ohio County Profiles," *Office of Research*, https://development.ohio.gov/files/research/C1035.pdf

[37] https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_S1501

[38] Note 36

Regions for Analysis

One critical question is determining the formal regions of analysis. As discussed earlier, Harrison County is situated between the metro areas for Columbus (with a population of 2 million), Cleveland-Elyria (2 million), and Pittsburgh (2.4 million).[39] Between Cleveland and Harrison County is the Akron metro area (700,000) and the Canton-Massillon metro area (400,000). Cadiz is a 30-45 minute drive to Steubenville, Ohio and Wheeling, West Virginia (each with a population between 120,000 and 145,000 including adjacent states). With Cadiz and Harrison County relatively small compared to neighboring economies, the impact of constructing and operating the plant is likely to spread across the region.

The economic impact analysis was conducted at three separate levels: (1.) the Ohio level, (2.) the Eastern Ohio region, and (3.) the rest of Ohio. Ohio has 88 counties, and we define "Eastern Ohio" as a collection of 26 counties.

The Ohio Development Services Agency[40] has "economic development regions," or EDRs.[41] There are twelve, and each has between three and ten counties. Four of these EDRs have "East" in their name, and we have combined them into a larger Eastern Ohio geography for this analysis:

- **Region #9: "Northeast Central Ohio"** – Medina, Portage, Stark, Summit, and Wayne Counties
- **Region #10: "East Central Ohio"** – Belmont, Carroll, Columbiana, Coshocton, Guernsey, *Harrison*, Holmes, Jefferson, Muskingum, and Tuscarawas Counties
- **Region #11 "Southeast Ohio"** – Athens, Hocking, Meigs, Monroe, Morgan, Noble, Perry, and Washington Counties
- **Region #12 "Northeast Ohio"** – Ashtabula, Mahoning, and Trumbull Counties

Region #12 above for Northeast Ohio also includes the Youngstown-Warren-Boardman metro area, sometimes known as the Mahoning Valley, which adds a further 550,000 in population to the area around Cleveland. Cleveland, its immediate suburbs, and the layers of cities and towns around it have a combined population of 4.3 million.[42]

A map of these regions is available on the website for the Ohio Department of Job and Family Services.[43]

The figure below shows a map of Ohio's counties with the Eastern Ohio region with Harrison County highlighted in orange. We study the potential impacts for the Eastern Ohio region, the remainder of the state, and the state overall.

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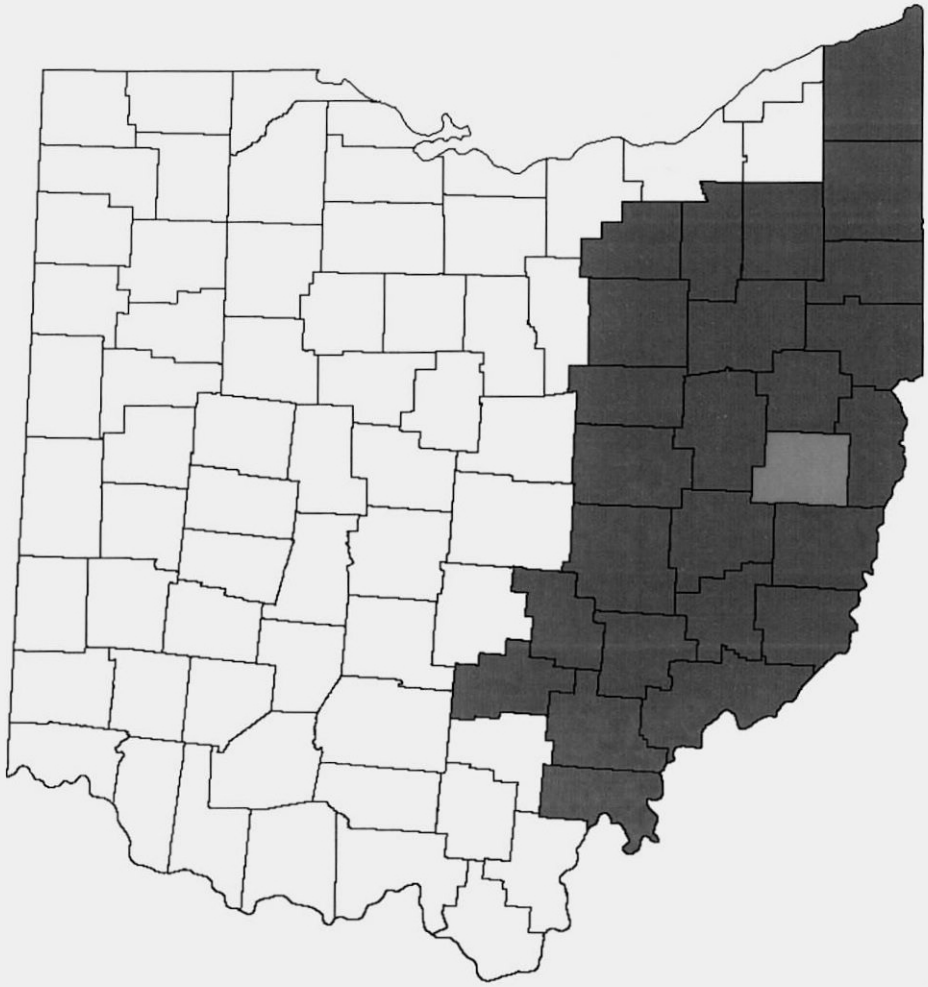
[39] "American Fact Finder," *U.S. Census*, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml
[40] https://development.ohio.gov/
[41] "Ohio Economic Development Regions," *Ohio Department of Job and Family Services*, http://ohiolmi.com/maps/MapofEDRs.htm
[42] "Cleveland-Akron-Canton," *City Population*, https://www.citypopulation.de/php/usa-combmetro.php?cid=184
[43] Note 41

Figure 6: Ohio counties, including Harrison County (orange), the Eastern Ohio region (blue), and rest of Ohio (white)



Model Inputs

With the regions defined, the focus shifts to categorizing the $900 million in capex by type and place of expenditures and the same for the annual operation of the plant. We examined data from Harrison Power on their anticipated spending to build and operate the plant and the anticipated location of their purchases. The results are in the following tables with breakouts for the total (the U.S. aggregate), summative Ohio, and the Eastern Ohio region.

The Project will require specialized equipment and skilled labor during construction. As such, the vast majority of the equipment and material that would be required for the Project would come from suppliers and contractors throughout Eastern Ohio, the rest of Ohio, and the rest of the country. Skilled engineering and design labor, including engineers or the technicians familiar with working on NGCC projects, might come from other parts of the country, which will reduce the local and state level impacts of the Project because of imports into the state.

Once the operation of the facility begins in 2021, the Project would add 30 full-time equivalent jobs in Cadiz and Harrison County. The share of opex supplied by Eastern Ohio and Ohio would be higher in the operational phase than in the construction phase because of the local, permanent nature of the employment and the input needs for operations. Inputs required in this phase include office equipment, general industrial and mechanical tools, vehicles, professional services, insurance, and the natural gas fuel needed in order to run the turbines.

Figure 7: Categorized cumulative expenditures for U.S., Ohio, and Eastern Ohio for capex (2017 $ millions)

Category	U.S. spending	Ohio spending	% of total	Eastern Ohio spending	% of total
Construction labor	$111.0	$111.0	100%	$111.0	100%
Site and structures	$62.4	$62.4	100%	$62.4	100%
Engineering and design	$33.9	$3.4	10%	$1.7	5%
Generation equipment	$403.0	$21.6	5%	$5.7	1%
Transmission equipment	$28.5	$9.6	34%	$7.5	26%
Gas-related equipment	$22.3	$3.8	17%	$1.4	6%
Other equipment	$14.2	$3.5	25%	$3.4	24%
Bulk materials (e.g., lumber)	$182.7	$40.0	22%	$29.8	16%
Total =	$858.0	$255.2	30%	$222.9	26%

Figure 8: Categorized annual expenditures for U.S., Ohio, and Eastern Ohio for opex (2017 $ millions)

Category	U.S. spending	Ohio spending	% of total	Eastern Ohio spending	% of total
Operations labor	$4.5	$4.5	100%	$4.5	100%
Office and overhead	$0.4	$0.3	97%	$0.3	94%
Equipment and tools	$1.0	$1.0	95%	$0.9	89%
General maintenance	$7.8	$7.2	92%	$6.1	78%
Plant vehicles	$0.1	$0.1	100%	$0.1	100%
Consumable inputs	$2.2	$1.4	65%	$1.1	52%
Transmission costs	$1.2	$1.2	100%	$1.2	99%
Insurance and services	$7.4	$6.5	88%	$5.1	68%
Taxes and fees	$1.8	$1.8	100%	$1.8	100%
Total =	$26.3	$24.0	91%	$21.1	80%

The $111 million for construction labor covers up to 500 direct jobs for around three years (with an implied average wage of $74,000 per year). The $4.5 million per year for operational labor covers the wages associated with the 30 permanent jobs created to run and maintain the power plant (at an average wage of $75,000 per year[SMN1]).

Total expenditures for the Project's development are $858 million. Of that, $225 million (30 percent) of the total spending would be in Ohio while $223 million (26 percent) would be in Eastern Ohio. The remainder is "leakage" for specialized labor and equipment purchases from other parts of the U.S., which then become imports into Ohio.

The share of dollars staying local would be higher, with 91 percent of the total $26.3 million per year staying in Ohio and 80 percent remaining in Eastern Ohio. The numbers in the table would be ongoing and throughout the operational life of the Project as it needs inputs, materials, and services every year to continue operations.

IMPLAN Methodology

For the last step of the approach, the various numbers and categories were converted into inputs for the IMPLAN model. IMPLAN is a generalized input-output (IO) model for determining the regional footprint of a project or a new policy. More details on the methodology and operation of IMPLAN are in Appendix A.

The inputs were mapped into IMPLAN categories, spreading them between industries and over time, and we then used the local purchase reported by the Project and in the columns in the tables. We also adjusted between direct and induced expenditures where IMPLAN might label contractor employment and spending as "direct" when the Project reports precisely 500 direct construction jobs and 30 jobs upon commencement.

IMPLAN generates economic activity of three main types – "direct" impacts, "indirect" impacts, and "induced" impacts. The direct impact includes the actual construction and operational jobs associated with the plant. The indirect and induced groups include the ancillary jobs of the influence of the Project on the broader economy:

- **DIRECT** – Direct impacts are the economic activities associated with immediate expenditures and employment. In this scenario, this includes 500 construction jobs and 30 operational jobs.
- **INDIRECT** – Indirect jobs are those for contractors and suppliers to the Project, including the suppliers of the specialized generation and transmission equipment and bulk materials. This includes professional service firms in design and engineering and mundane expenses such as office supplies, as well.
- **INDUCED** – The induce category includes the economic activity related to the spending by Project employees and the indirect employees of supply chain businesses. For instance, a construction worker employed by the Project would receive a paycheck and likely spend it – any impact from that consumption, including on the retail industry, real estate, healthcare, or any other of their purchases falls under the induced category.

Economic Impact Results

Our results include the categories above, three regions (Ohio, Eastern Ohio, and rest of state), and during the construction of the Project (2018 to 2020) and the operational phase (starting in 2021). With three regions and two phases of the Project to report, our main set of results includes six outputs. Results for the capex phase are cumulative across three years while the operational expenditures are both annualized and ongoing for the Project.

The impacts reported include employment, sales output, GDP, labor income, and state and local tax revenues. Employment includes sustained jobs from the Project. Sometimes known as "new business sales," sales output includes new revenues for businesses. GDP is the sum of new economic activity after adjusting for intermediate inputs, such as subtracting the value of the tires from the sale price of a new automobile. Labor income is any income for households because of the Project. Lastly, we include a subsection for the potential state and local tax revenues generated for the state of Ohio and its various counties, municipalities, cities, towns, and villages because of the Project.

Economic Impact of Capital Expenditure Phase

This section is the potential influence of the Project's capex. Results shown are the cumulative impact on sales output, GDP, and labor income as well as the sustained job creation over the construction phase of the Project.

Figure 9: Cumulative impact of Harrison County capex on Ohio (statewide)

CATEGORY	DIRECT	INDIRECT	INDUCED	TOTAL
Employment (sustained average)	500	66	239	805
Sales Output (2017 $ millions)	$260	$104	$100	$464
GDP (2017 $ millions)	$121	$31	$58	$210
Labor Income (2017 $ millions)	$111	$29	$32	$172

Figure 10: Cumulative impact of Harrison County capex on Eastern Ohio

CATEGORY	DIRECT	INDIRECT	INDUCED	TOTAL
Employment (sustained average)	500	13	214	727
Sales Output (2017 $ millions)	$260	$57	$89	$406
GDP (2017 $ millions)	$121	$15	$52	$188
Labor Income (2017 $ millions)	$111	$13	$29	$153

Figure 11: Cumulative impact of Harrison County capex on the rest of Ohio

CATEGORY	DIRECT	INDIRECT	INDUCED	TOTAL
Employment (sustained average)	0	53	25	78
Sales Output (2017 $ millions)	$0	$48	$10	$58
GDP (2017 $ millions)	$0	$17	$6	$22
Labor Income (2017 $ millions)	$0	$16	$3	$19

The Project would have a significant impact on the Ohio economy and especially in Eastern Ohio. The construction of the Harrison County power plant would generate 500 direct jobs, 728 total jobs in Eastern Ohio, and 805 jobs statewide. Jobs in the rest of the state would have two sources. One source is suppliers for the Project located outside the 26 counties, and the other is workers in Eastern Ohio spending money outside the region, such as on a visit to Sandusky. The Project would boost the GDP of Ohio by a cumulative $210 million and the GDP of Eastern Ohio by a cumulative $187 million.

Economic Impact of Operational Expenditure Phase

This section shows the sustained, annual, and ongoing impact of the Project. Results are the projected annual impact on sales output, GDP, and labor income, and the continued jobs in Ohio and the two sub-regions.

Figure 12: Annual impact of Harrison County opex on Ohio (statewide)

CATEGORY	DIRECT	INDIRECT	INDUCED	TOTAL
Employment (sustained average)	30	139	83	252
Sales Output (2017 $ millions)	$57	$27	$11	$95
GDP (2017 $ millions)	$44	$14	$7	$65
Labor Income (2017 $ millions)	$4	$9	$4	$17

Figure 13: Annual impact of Harrison County opex on Eastern Ohio

CATEGORY	DIRECT	INDIRECT	INDUCED	TOTAL
Employment (sustained average)	30	119	74	223
Sales Output (2017 $ millions)	$57	$23	$10	$90
GDP (2017 $ millions)	$44	$12	$6	$62
Labor Income (2017 $ millions)	$4	$8	$3	$15

Figure 14: Annual impact of Harrison County opex on the rest of Ohio

CATEGORY	DIRECT	INDIRECT	INDUCED	TOTAL
Employment (sustained average)	0	20	9	29
Sales Output (2017 $ millions)	$0	$4	$1	$5
GDP (2017 $ millions)	$0	$2	$1	$3
Labor Income (2017 $ millions)	$0	$1	$0	$2

The long-term operation of the Project would also have a significant, positive influence on the Ohio economy. The Project would sustain 252 jobs statewide to go with the direct 30, and 223 of the total are in Eastern Ohio.

There would be more of an indirect and induced impact in the operational phase compared to the construction phase. The Project would purchase more supplies and materials relative to its total costs from Eastern Ohio in the operational phase, however, compared to the capex phase's inputs mostly coming from imports into the region.

State and Local Government Tax Revenues

This section shows the potential impact on the revenues gained by state and local governments in Ohio. Like most states, Ohio has an income tax[44] and state/local sales taxes.[45] Ohio also has a unique business tax called the "commercial activities tax," also known as CAT,[46] a severance tax,[47] local property taxes, and various user fees.

IMPLAN calculates the projected impact to tax revenues based on the change in economic activity, such as additional income earned in Eastern Ohio contributing to state income tax revenues. The results for the capex phase are cumulative for the whole construction period while the opex numbers are again annual and repeating.

Figure 15: Cumulative state and local tax revenues from capex phase (2017 $ millions)

CATEGORY	OHIO (STATEWIDE)	EASTERN OHIO	REST OF OHIO
Income Taxes	$4.01	$3.59	$0.42
Sales Taxes	$5.34	$4.77	$0.57
Property Taxes	$4.60	$4.11	$0.49
Business Taxes	$1.19	$1.06	$0.13
User Fees	$0.83	$0.74	$0.09
Total Revenues	$15.98	$14.29	$1.70

Figure 16: Annual state and local tax revenues from opex phase (2017 $ millions)

CATEGORY	OHIO (STATEWIDE)	EASTERN OHIO	REST OF OHIO
Income Taxes	$0.37	$0.32	$0.05
Sales Taxes	$0.61	$0.53	$0.08
Property Taxes	$0.53	$0.46	$0.07
Business Taxes	$0.14	$0.12	$0.02
User Fees	$0.08	$0.07	$0.01
Total Revenues	$1.73	$1.50	$0.24

[44] "Individual," *Ohio Department of Taxation*, http://www.tax.ohio.gov/Individual.aspx
[45] "2017 List of Ohio Local Sales Tax Rates," *Sales Tax Handbook*, https://www.salestaxhandbook.com/ohio/rates
[46] "Commercial Activities Tax (CAT)," *Ohio Department of Taxation*, http://www.tax.ohio.gov/commercial_activities.aspx
[47] "Chapter 5749: Severance Tax," *Ohio Laws and Rules*, http://codes.ohio.gov/orc/5749

Comparisons to Peer Research

This section compares our results to another study for the South Field Energy Project (South Field)[48] in Columbiana County, which is also in our Eastern Ohio region.[49] That study examined a 1,110 MW facility near Wellsville, Ohio at a total cost of $922.5 to design, engineer, build, and begin operating the plant. That study used a 22 county "Northeast Ohio" region, on the other hand, which has many of the same counties as our Eastern Ohio region but *does not* include many of the same counties to the south of Harrison County and *does* include the Cleveland-Elyria metro area.

The figures below compare the findings of their modeling to ours as a mutual benchmark.

Figure 17: Comparison of capex inputs and economic findings for Ohio

FACILITY	TOTAL PROJECT CAPEX	OHIO SHARE OF CAPEX	REGIONAL SHARE OF CAPEX	SALES OUTPUT (OHIO TOTAL)	GDP (OHIO TOTAL)	EMPLOYMENT (OHIO TOTAL)
South Field Energy Project	$922.5 million	$291.7 million	$223.5 million	$680 million	$380 million	1,352 sustained
Harrison County Project	$858.0 million	$255.2 million	$222.9 million	$464 million	$210 million	805 sustained

The South Field Energy Project is a slightly larger plant – 1,100 MW as opposed to 1,027 MW in Harrison County – and, therefore, has additional spending in Ohio and the region. This and the industry mixture of suppliers account for the larger impact from the South Field Energy Project. The project also has a greater number of peak construction jobs at (implied) lower wages, leading to the greater number of aggregate jobs from the project.

Figure 18: Comparison of opex inputs and economic findings for Ohio

FACILITY	ANNUAL PROJECT OPEX SPENDING	OHIO SHARE OF OPEX	REGIONAL SHARE OF OPEX	SALES OUTPUT (OHIO ANNUAL)	GDP (OHIO ANNUAL)	EMPLOYMENT (OHIO TOTAL)
South Field Energy Project	$25.3 million	$23.2 million	$20.3 million	$58 million	$38 million	285
Harrison County Project	$26.3 million	$24.0 million	$21.1 million	$95 million	$65 million	252

The two projects have similar impacts on employment throughout Ohio. The Harrison County Project has a larger economic impact because its material inputs – more construction labor and equipment – for operations tend to have a higher regional multiplier than the ones implied by South Field. The direct spending per year of operations between the two projects is similar, with Harrison County needing $24.0 million in Ohio and South Field needing $23.3 million in Ohio.

[48] http://www.southfieldenergy.com/
[49] http://www.southfieldenergy.com/index.php/about-us/

Conclusion

Construction of the Project would require an investment of approximately $900 million and would last three years. Businesses in the Ohio economy would experience increased sales of $464 million due to the Project, and the Ohio economy would increase its GDP by a cumulative $210 million over three years.

Within the region of 26 counties we defined as Eastern Ohio, businesses would grow their sales by $406 million during construction, and the Project's contribution to regional GDP would be $188 million. The capex phase would support 805 total jobs – 500 direct construction jobs, an additional 227 jobs in Eastern Ohio, and 78 more jobs in the rest of the state. The total contribution to labor income statewide would be $172 million with $153 million going to the families of Eastern Ohio. These jobs and this new economic activity would help boost the state and Eastern Ohio's economies during construction.

The impact of the opex phase also would be significant. Business in Ohio would experience an increased annual sales boost of $95 million, and the state's annual GDP would increase by $65 million. At the Eastern Ohio level, businesses would see their annual sales increase by $90 million, and the region would grow its annual GDP contribution by $62 million. The Project would sustain 252 new Ohio jobs – 30 direct plant jobs, an additional 193 jobs in Eastern Ohio and 29 more jobs in the rest of the state. The statewide impact on labor income would be $17 million annually with the majority of it ($15 million or 90 percent) staying in Eastern Ohio.

Appendix A: IMPLAN Methodology

IMPLAN, produced by MIG, Inc.,[50] is a software program containing an input-output model of the U.S. or regional economies. Our version of the software here included Ohio as well as the various counties of Eastern Ohio. IMPLAN sees wide application throughout economic impact analysis and policy research areas.[51]

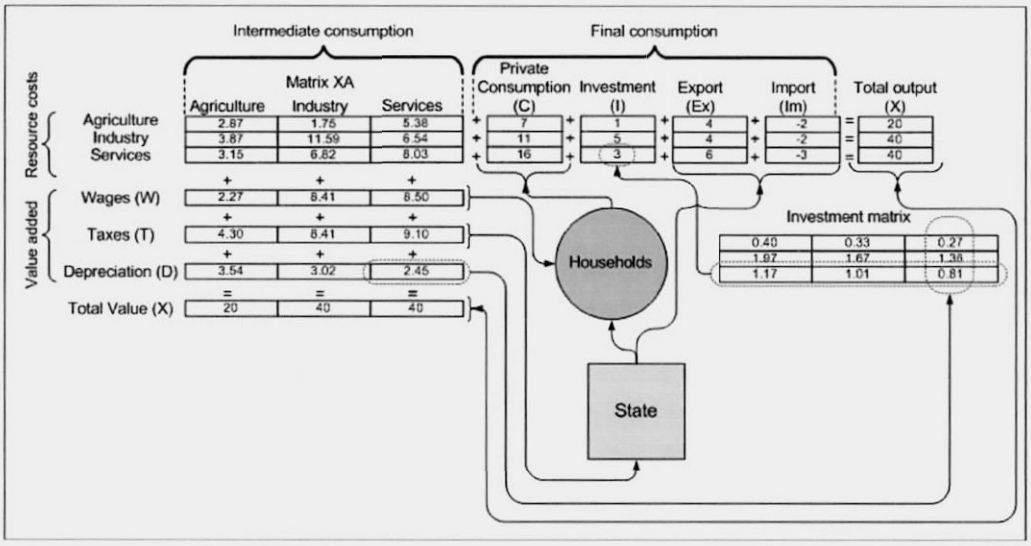
IMPLAN works by constructing a series of multipliers throughout the economy where an initial, "direct" activity stimulates a supply chain and related industry. A classic example involves automotive manufacturing in the Midwest or Southeast, where an automobile assembly plant has a complex supply chain of parts suppliers feeding into it from throughout the region, the U.S., and even the rest of the world in a long and complex production process.

The suppliers needed to construct a final automobile – parts, materials suppliers of glass, rubber, leather, electronics, legal, and accounting – are "indirect" in the IMPLAN model. The direct and indirect industries pay wages and salaries to their employees, which support the living expenses of households and families. These include the standard accoutrements of daily life in any family budget, such as housing and groceries. IMPLAN calls the impact of consumer spending the "induced" effect, which it also includes inside of its modeling and the overall impact results.

The core of IMPLAN is in IO model, otherwise known as a Leontief model. Named for Wassily Leontief, a Nobel Laureate for this and other research,[52] an IO model imagines the economy as a series of transactions between buyer and seller. Every transaction must have both sides to exist. Most transactions are between industries (the supply chain) though there are also transactions between businesses and households (through either consumption or the labor market).

Leontief built a matrix, with inputs and outputs from each industry and households on each axis, to show the volume of the transactions between every sector to one another and allow for the computation of changes to the existing structure. The matrix then shows how exogenous spending flows through into other industries.

Figure 19: Structure of an example input-output model with three industries[53]



[50] http://implan.com/
[51] "Overview of IMPLAN," *City of Richmond*, http://www.ci.richmond.ca.us/DocumentCenter/Home/View/6474
[52] "Wassily Leontief," *The Concise Encyclopedia of Economics*, http://www.econlib.org/library/Enc/bios/Leontief.html
[53] Danylo Kozub, "Microsimulation model of national economy MSMNE-02," http://dankozub.com/simulation/

Notes

Appendix E: Wetland Report

WETLAND DELINEATION AND STREAM ASSESSMENT REPORT
HARRISON COUNTY COMMUNITY IMPROVEMENT CORPORATION
INDUSTRIAL PARK ROAD
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July 2017

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List of Acronyms & Abbreviations

Ohio EPA	Ohio Environmental Protection Agency
ODNR	Ohio Department of Natural Resources

1.0 Introduction

At the request of EmberClear Corporation (EmberClear), APTIM was authorized to complete a wetland delineation and stream assessment for the proposed natural gas-fired combined-cycle electric generating facility in the Cadiz Industrial Park located in Cadiz, Ohio. A site investigation was completed by Jill Vovaris and Rebecca Clarke of APTIM on November 10 and November 11, 2016, and Rebecca Clarke and Mike Walor on July 6, 2017. During the investigation, six wetlands and five streams were identified in the project area.

1.1 Site Overview

The subject property is located in Cadiz, Harrison County, Ohio, off of Industrial Park Road. The property is located wholly on reclaimed coal strip mine land, and consists of rolling hills previously used for grazing. A reclamation pond is located on the western portion of the property, surrounded by moderate slopes on all sides.

1.2 Purpose

APTIM was authorized in November 2016 by EmberClear Corporation to undertake delineation activities associated with the referenced property.

This study is to identify and delineate wetlands and streams present on site to determine possible impacts resulting from the installation of the proposed facility, associated roads, and staging areas.

2.0 Site Conditions

A road was constructed for an unutilized facility pad that sits to the northeast of the property. Several pipelines run through the property belonging to MarkWest Energy Partners and Energy Transfer Partners. To the east of the property, a moderate slope leads to a forested area surrounding Harris Pond Dam. Three laydown areas are located to the north, west, and far west of the site.

3.0 Methods

The site review for wetlands and the delineation of wetlands was conducted within the study area and in general accordance with the U.S. Army Corps of Engineers (USACE) 1987 Wetland Manual (Environmental Laboratory, 1987) and Eastern Mountains and Piedmont Regional Supplement (USACE, April 2012).

The identification and delineation of jurisdictional wetlands requires the evaluation of three factors, including the dominance of wetland plant species (hydrophytes), the presence of hydric soils, and evidence of hydrological conditions conducive to wetland formation and maintenance.

Ohio's Wetland Antidegradation Rule (OAC Rule 3745-1-54) categorizes wetlands based on their functions, sensitivity to disturbance, rarity and irreplaceability and scales the strictness of avoidance, minimization, and mitigation to a wetland's category. Three categories were established: Category 1 wetlands with minimal wetland function and/or integrity; Category 2 wetlands with moderate wetland function and/or integrity; and Category 3 wetlands with superior wetland function and/or integrity. Ohio EPA developed its own wetland delineation methodology known as the Ohio Rapid Assessment method (ORAM) for wetlands. The ORAM is designed to categorize a wetland based on whether it is a particular type of wetland (e.g. fen, bog, old growth forest, etc.) or contains threatened or endangered species, or based on its "score." Recalibration of the scoring ranges using actual measures of a wetland's biology and functions has been a continuing need. The ORAM scores have therefore been calibrated by comparing wetland classes and scores with those of the Vegetation Indices of Biotic Integrity (VIBIs), which were developed for emergent, forested, and scrub-shrub wetland vegetation classes. Scoring ranges are summarized in Table 1. Wetlands at the project site were scored based on the ORAM scoring methodology.

Table 1: Interim scoring breakpoints for wetland regulatory categories for ORAM and Vegetation Index of Biotic Integrity (VIBI) scores

category	ORAM v. 5.0 score	VIBI score
1	0 - 29.9	0 - 21
1 or 2 gray zone	30 - 34.9	----
modified 2	35 - 44.9	22 - 44
2	45 - 59.9	45 - 66
2 or 3	60 - 64.9	----
3	65 - 100	67 - 100

3.1 Soils Methodology

For the soils parameter, a small soil pit was excavated in order to determine the presence or absence of hydric soil features in the top 6 to 24 inches of soil. The soil sample points were collected from the surface by using a sharpshooter shovel. The depth of the samples were sufficient to determine changes in upper horizons and to observe field indicators of nonhydric/hydric soils. Features such as colors indicating reducing conditions, and the presence or absence of redoximorphic features were utilized in making the determination of whether a soil was considered hydric. Munsell® Soil Color Charts were used to assign standard notations to the samples. Hydric soils are present when the soil matrix has a chroma of 1 or a chroma of 2 with mottles. Chroma colors are derived from the Munsell color charts.

Sample points were described and compared to descriptions found on the Natural Resources Conservation Service (NRCS) Web Soil Survey. According to the National Resources Conservation Service's Web Soil Survey website, two mapped soil units were present within the area of investigation, Morristown channery silty clay loam 0-8% (MoB) and Morristown channery silty clay loam 8-25% (MoD). Both soils present are rated as nonhydric. Water (W) was also noted as being present by the Soil Survey.

MoB is found on hills. The natural drainage class is well drained. The soil not have the frequency to flood or pond. The NRCS does not rate this component as hydric.

MoD is found on hills. The natural drainage class is well drained. The soil does not have the frequency to flood or pond. The NRCS does not rate this component as hydric.

3.2 Vegetation Methodology

A walk-over reconnaissance of the site was conducted and a vegetation inventory was compiled. In 2006, the USACE assumed the responsibility of administering the list of wetland plants, and the list formerly administered by the U.S. Fish and Wildlife Service (USFWS) is officially obsolete. Therefore, scientific names and wetland indicator statuses for the vegetation conform to those listed in the *National Wetland Plant List: 2014 Update of Wetland Ratings*. The indicator statuses specific to the *Eastern Mountains and Piedmont Region* as defined by the USACE apply to the study area location.

The current definitions for vegetation wetland indicator statuses are as follows.

- Obligate Wetland (OBL) - Almost always occur in wetlands.
- Facultative Wetland (FACW) - Usually occur in wetlands, but may occur in nonwetlands.
- Facultative (FAC) - Occur in wetlands or non-wetlands.
- Facultative Upland (FACU) - Usually occur in non-wetlands, but may occur in wetlands.
- Obligate Upland (UPL) - Almost never occur in wetlands.

3.3 Hydrology Methodology

The presence, potential presence, or absence of wetland hydrology was determined in accordance with the indicators presented in the USACE supplement. The indicators are categorized into seventeen primary and twelve secondary indicators which are outlined below in Table 2.

Table 2: Wetland Hydrology Indicators for the Eastern Mountains and Piedmont Region

Indicator	Category	
	Primary	Secondary
Group A – Observation of Surface Water or Saturated Soils		
A1 – Surface water	X	
A2 – High water table	X	
A3 – Saturation	X	
Group B – Evidence of Recent Inundation		
B1 – Water marks	X	
B2 – Sediment deposits	X	
B3 – Drift deposits	X	
B4 – Algal mat or crust	X	
B5 – Iron deposits	X	
B7 – Inundation visible on aerial imagery	X	
B9 – Water-stained leaves	X	
B13 – Aquatic fauna	X	
B14 – True aquatic plants	X	
B6 – Surface soil cracks		X
B8 – Sparsely vegetated concave surface		X
B10 – Drainage patterns		X
B16 – Moss trim lines		X
Group C – Evidence of Current or Recent Soil Saturation		
C1 – Hydrogen sulfide odor	X	
C3 – Oxidized rhizospheres along living roots	X	
C4 – Presence of reduced iron	X	
C6 – Recent iron reduction in tilled soils	X	
C7 – Thin muck surface	X	
C2 – Dry-season water table		X
C8 – Crayfish burrows		X
C9 – Saturation visible on aerial imagery		X
Group D – Evidence from Other Site Conditions or Data		
D1 – Stunted or stressed plants		X
D2 – Geomorphic position		X
D3 – Shallow aquitard		X
D4 – Microtopographic relief		X
D5 – FAC-neutral test		X

In addition to the wetland hydrology indicators listed above, the site delineation included a thorough *assessment of watercourse identification. The United States Environmental Protection Agency* (EPA) classifies the three different types of stream channels as:

1) Perennial- typically has water flowing in them year-round. Most of the water comes from smaller upstream waters or groundwater while runoff from rainfall or other precipitation is supplemental.

2) Intermittent- flow during certain times of the year when smaller upstream waters are flowing and when groundwater provides enough water for stream flow. Runoff from rainfall or other precipitation supplements the flow of seasonal stream. During dry periods, seasonal streams may not have flowing surface water.

3) Ephemeral- flow only after precipitation. Runoff from rainfall is the primary source of water for these streams.

4.0 Desktop Review

One USFWS National Wetlands Inventory (NWI) wetland was located within the area of investigation, which was a former reclamation pond. This wetland was listed as a freshwater pond, or PUBGx, by the USFWS NWI Mapper. The project overlaps two watersheds; part of the western portion of the AOI is located in the Tuscarawas River watershed, and the remainder of the AOI is located in the Upper Ohio-Wheeling watershed. Neither watershed carries any special protections.

A Natural Heritage Data Request Form was sent to the Ohio Department of Natural Resources (ODNR), and it was determined that no known impacts to threatened and endangered species and/or special concern species and resources were identified within the project area.

5.0 Observations

As indicated earlier in this report, the identification and delineation of jurisdictional wetlands requires the evaluation of three factors. The three factors include the dominance of wetland plant species (hydrophytes), the presence of hydric soils, and evidence of hydrological conditions conducive to wetland formation and maintenance.

Six wetlands were delineated as part of this study (W-1, W-2, W-3, W-4, W-5, and W-6). Four of these wetlands (W-1, W-2, W-4, and W-6) were small, Category 1 Palustrine Emergent (PEM) wetlands. Wetlands 1, 2, and 4 are located in the northeastern quadrant of the Area of Investigation (AOI) and Wetland 6 is located in the far western laydown area on the other side of Industrial Parkway Road. W-1 was noted as disturbed, with two feet of a mixture of fill and refuse covering wetland soils.

Wetland 3, a Category 2 PEM wetland, was identified to the north of the freshwater pond and continued off the northern edge of the AOI. Wetland 5 (W-5), which formerly served as a reclamation pond in the western half of the AOI, was listed on the National Wetlands Inventory as a freshwater pond (PUBGx). Wetland areas are noted in Table 3.

All five streams identified were ephemeral channels. Two of the streams emptied into the pond on the northern and southern sides, and two of the streams originated toward the eastern edge of the property,

continuing east out of the AOI. One stream was present in the northern laydown area. The total length of streams in the AOI is 567.54 linear feet.

Table 3 - Wetland Summary					
Wetland ID	**Latitude**	**Longitude**	**Classification**	**Total Wetland Area (Acres)**	
W-1	40.253115	-81.013135	PEM	0.398	
W-2	40.252361	-81.013853	PEM	0.014	
W-3	40.253678	-81.016934	PEM	0.414	
W-4	40.253240	-81.013933	PEM	0.026	
W-5*	40.252336	-81.017771	PUBGx	2.07	
W-6	40.253244	-81.021402	PEM	0.22	
				Total Acreage	3.142

*NWI wetland

5.1 Soils

Ten soil pits were dug during the on-site investigation to determine the presence or absence of hydric soils.

Soil Pit W-1 was excavated in the Wetland 1 area within the MoB soil series. The corresponding Munsell Soil color for the soil depth of 24"-27" was 10YR 3/1 with 10YR 5/8 redox features. Texture was classified as silty clay loam. From 0"-24", fill and refuse covered the depression. Hydric soil indicators were present in W-1.

Soil Pit W-2 was excavated in the Wetland 2 area within the MoB soil series. The corresponding Munsell Soil color for the soil depth of 0'-14" was 10YR 3/1 with 10YR 4/6 redox features. Texture was classified as clay. Hydric soil indicators were present in W-2.

Soil Pit W-3 was excavated in the Wetland 3 area within the MoD soil series. The corresponding Munsell Soil color for the soil depth of 0'-6" was 10YR 3/1 with 10YR 5/8 redox features. Texture was classified as silty clay loam. A restrictive layer of limestone was noted throughout Wetland 3 at a consistent 6" depth. Hydric soil indicators were present in W-3.

Soil Pit W-4 was excavated in Wetland 4 within the MoD soil series. The corresponding Munsell Soil color for the soil depth of 0'-5" was 10YR 3/4 with 10YR 5/6 redox features. The soil color for the soil depth of 6"-16" was 10YR 3/4 with 10YR 5/6 redox features. Texture was classified as clay loam throughout. Hydric soil indicators were present in W-4.

Soil Pit W-5 was excavated in Wetland 5 within the MoB soil series. The corresponding Munsell Soil color for the soil depth of 0'-18" was 10YR 4/1 with 2.5YR 3/4 redox features. Texture was classified as silty clay loam. Hydric soil indicators were present in W-5.

Soil Pit W-6 was excavated in Wetland 6 within the MoB soil series. The corresponding Munsell Soil color for the soil depth of 0-8" was 5Y 4/1 with 7.5YR 4/6 in the pore lining and 10YR 4/3 mottling. Texture was classified as clay. Hydric soil indicators were present in W-6.

Soil Pit UP-1 was excavated in an upland area within the MoB soil series. The corresponding Munsell Soil color for the soil depth of 0'-8" was 10YR 3/1. Texture was classified as silty loam. No hydric soil indicators were present in UP-1.

Soil Pit UP-2 was excavated in an upland area within the MoD soil series. The corresponding Munsell Soil color for the soil depth of 0'-6" was 7.5YR 3/1 and 7.5 YR 4/4. Texture was classified as silty clay loam. No hydric soil indicators were present in UP-2.

Soil Pit UP-3 was excavated in an upland area within the MoD soil series. The corresponding Munsell Soil color for the soil depth of 0'10" was 7.5YR 5/1. Texture was classified as silty loam. No hydric soil indicators were present in UP-3. Soil was noted as disturbed due to the presence of fill from strip mining activities.

Soil Pit UP-4 was excavated in an upland area within the MoB soil series. The corresponding Munsell Soil color for the soil depth of 0'10" was 7.5YR 4/2. Texture was classified as clay and soil was dry. No hydric soil indicators were present in UP-4.

5.2 Vegetation

Hydrophytic vegetation communities and habitat types were present within Wetland 1, Wetland 2, Wetland 3, Wetland 4, Wetland 5, and Wetland 6. Vegetation observed during the site delineation in each wetland is listed in the inventory below:

Wetland 1

No vegetation was noted at Wetland 1, due to its status as a disturbed wetland with abnormal circumstances.

Wetland 2

- Fox Sedge (*Carex vulpinoidea*) – OBL
- Common Yarrow (*Achilliea millefolium*) – FACU
- Common Burdock (*Arctium minus*) – FACU
- White Clover (*Trifolium repens*) – FACU
- Deer Tongue (*Dichanthium clandestinum*) – FAC
- Daisy Fleabane (*Erigeron annuus*) – FACU

Wetland 3

- Broom Sedge (*Andropogon virginicus*) – FACU
- Spike Rush (*Eleocharis palustris*) – OBL
- Shallow Sedge (*Carex Lurida*) – OBL

Wetland 4

- Crooked Stem Aster (*Aster prenanthoides*) – FAC
- Fox Sedge (*Carex vulpinoidea*) – OBL
- Common Yarrow (*Achilliea millefolium*) – FACU
- Spike Rush (*Eleocharis palustris*) – OBL

Wetland 5

- Lady Thumb Smartweed (*Persicaria maculosa*) – FACW
- English Plantain (*Plantago lanceolate*) – UPL

- Waterweed (*Elodea Canadensis*) – OBL
- Green Algae (*Pediastrum boryanum*) – OBL
- Rock Fir Moss (*Huperzia porophila*) – OBL

Wetland 6

- Spike Rush (*Eleocharis palustris*) – OBL
- Shallow Sedge (*Carex Lurida*) – OBL
- Fox Sedge (*Carex vulpinoidea*) – OBL
- Bitter dock (*Rumex obstusifolius*) - FACU
- Lamp rush (*Juncus effusus*) - FACW

Upland vegetation communities were present within the areas of UP-1, UP-2, UP-3, and UP-4. Vegetation observed during the site delineation is listed below.

Upland 1

- American Purple Vetch (*Vicia Americana*) – FACU
- Broom Sedge (*Andropogon virginicus*) – FACU
- Common Yarrow (*Achillea millefolium*) – FACU
- Common Dandelion (*Taraxacum officinale*) – FACU

Upland 2

- American Purple Vetch (*Vicia Americana*) – FACU
- Broom Sedge (*Andropogon virginicus*) – FACU
- Common Yarrow (*Achillea millefolium*) – FACU
- Orchard Grass (*Dactylis glomerata*) - FACU

Upland 3

- American Purple Vetch (*Vicia Americana*) – FACU
- Orchard Grass (*Dactylis glomerata*) - FACU
- Timothy grass (*Phleum pretense*) - FACU
- Birdsfoot trefoil - FACU

Upland 4

- Timothy grass (*Phleum pretense*) - FACU
- Birdsfoot trefoil - FACU
- Common Yarrow (*Achillea millefolium*) – FACU
- Broom Sedge (*Andropogon virginicus*) – FACU
- Crooked Stem Aster (*Aster prenanthoides*) – FAC

5.3 Hydrology

Wetland 1

Wetland 1 had three primary hydrology indicators, including Oxidized Rhizospheres on Living Roots, Presence of Reduced Iron, and Iron Deposits; and one secondary indicator, Saturation Visible on Aerial Imagery.

Wetlands 2 and 3

Wetlands 2 and 3 had one primary hydrology indicator, Oxidized Rhizospheres on Living Roots.

Wetland 4

Wetland 4 had two primary hydrology indicators, including Oxidized Rhizospheres on Living Roots and Presence of Reduced Iron.

Wetland 5

Wetland 5 had four primary hydrology indicators, including Water Marks, True Aquatic Plants, Oxidized Rhizospheres on Living Roots, and Presence of Reduced Iron; and two secondary indicators, Surface Soil Cracks and Saturation Visible on Aerial Imagery.

Wetland 6

Wetland 6 had three primary hydrology indicators, including Algal Mat or Crust, Presence of Reduced Iron, and Oxidized Rhizospheres on Living Roots; and one secondary indicator, Surface Soil Cracks.

All five streams identified on site were ephemeral channels.

6.0 Evaluation

Based on field observation, it is concluded that six wetlands and five streams were present in the AOI. Total wetland area in the AOI is 3.142 acres. Total length of stream channel within the AOI is 567.54 linear feet.

This delineation represents APTIM's best professional judgement. The wetland delineation services performed by APTIM were conducted in accordance with the methodology presented in the *1987 USACE Manual* and the *Eastern Mountains and Piedmont Regional Supplement* and with the level of care and skill ordinarily exercised by members of the environmental consulting profession. The Ohio Department of Environmental Protection (Ohio EPA) and USACE are not bound to the findings in this report.

Appendix A

W-1

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: EmberClear City/County: Cadiz, Harrison County Sampling Date: 11-10-16

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): JV, RC Section, Township, Range: _____

Landform (hillslope, terrace, etc.): fallow field Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

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

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

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

Remarks: depressional wetland filled. 2 feet deep. no vegetation observed due to disturbed state.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W-1

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No X

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

SOIL

Sampling Point: W1-

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
2 ft.-2-3	10YR 3/1	75%	10YR 5/8	25%			Silty Clay loam	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks:

wetland soil present at 2 feet. Upper 2 feet organic fill with cow manure odor.

W-2

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: EmberClear City/County: Harrison County Sampling Date: 11-10-16

Applicant/Owner: State: Sampling Point:

Investigator(s): JV, RC Section, Township, Range:

Landform (hillslope, terrace, etc.): Mild slope Local relief (concave, convex, none): Slope (%):

Subregion (LRR or MLRA): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

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

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

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

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes X No

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WL-2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 15)			
1. fox sedge (Carex vulpinoidea)	40		
2. yarrow (Achillea millefolium)	10		
3. burdock (Arctium minus)	20		
4. white clover (Trifolium repens)	5		
5. deer tongue (Dichanthium	3		
6. daisy fleabane Clandestinum)	2		
7. (Erigeron annuus)			
8.			
9.			
10.			
11.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No _____

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

SOIL Sampling Point: W-2

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	95	10YR 4/6	5		PL,M	clay	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

W-3

Project/Site: Ember Clear City/County: Harrison County Sampling Date: 11/10/16

Applicant/Owner: State: Sampling Point:

Investigator(s): JV, RC Section, Township, Range:

Landform (hillslope, terrace, etc.): valley Local relief (concave, convex, none): Slope (%):

Subregion (LRR or MLRA): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

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

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

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

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

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

Remarks: wetland has rock layer at 6 inches (clay stone)

Drains into stream 2.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): ___

Water Table Present? Yes X No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W-3

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 15') (Andropogon virginicus)			
1. Broom Sedge ~~(Andropogon virginicus)~~	5		
2. Spike rush (Eleocharis palustris)	70		
3. Carex lurida (shallow sedge)	40		
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No _____

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

SOIL Sampling Point: WW-3

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/1	95	10YR 5/8	5		PL,M	silty clay loam	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: rock

Depth (inches): 16 inches

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

W-4

Project/Site: EmberClear City/County: _____ Sampling Date: 11-11-16

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): JV, RC Section, Township, Range: _____

Landform (hillslope, terrace, etc.): fallow field Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

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

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No ___	Depth (inches): ___
Water Table Present?	Yes ___	No ___	Depth (inches): ___
Saturation Present? (Includes capillary fringe)	Yes ___	No ___	Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W-4

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 15') (Aster prenanthoides)			
1. Crooked stem aster	30		
2. fox Sedge (Carex vulpinoidea)	10		
3. Yarrow (Achillea millefolium)	3		
4. Spike rush (Eleocharis palustris)	50		
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No _____

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

SOIL Sampling Point: W-4

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/4	95	10YR 5/6	5		PL,M	clay loam	
6-16	10YR 3/4	70	10YR 5/6	30		M	clay loam	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ *Sandy Redox (S5)*
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ *Piedmont Floodplain Soils (F19)* **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: EmberClear City/County: Harrison County Sampling Date: 11-11-16
Applicant/Owner: State: Sampling Point: W-5
Investigator(s): JV, BC Section, Township, Range:
Landform (hillslope, terrace, etc.): basin Local relief (concave, convex, none): Slope (%):
Subregion (LRR or MLRA): Lat: Long: Datum:
Soil Map Unit Name: NWI classification: PUBGx
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (if no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks:
Pond previously used for stormwater. May be an oxbow lake from a pre-existing river. Possibly fed by underground seep.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- X Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No	Depth (inches):
Water Table Present?	Yes	No	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	No	Depth (inches):

Wetland Hydrology Present? Yes X No

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W-5

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Sapling Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Shrub Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Herb Stratum (Plot size: 15')			
1. Smartweed (Persicaria maculosa)	1		
2. moss	2		
3. english plantain (Plantago lanceolata)	1		
4. algae (Spirogyra)	1		
5. Waterweed (~~Egeria densa~~ Elodea canadensis)	70		
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ____

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

SOIL Sampling Point: W-5

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 4/1	90	2.5 YR 3/4			M, PL	Si Hy clay loam	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Ember Clear City/County: Harrison County Sampling Date: 11-16-16
Applicant/Owner: State: Sampling Point: UP-02
Investigator(s): JV, RC Section, Township, Range:
Landform (hillslope, terrace, etc.): valley, mild slope Local relief (concave, convex, none): Slope (%):
Subregion (LRR or MLRA): Lat: Long: Datum:
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present?	Yes ____	No \	**Is the Sampled Area within a Wetland?** Yes ____ No \
Hydric Soil Present?	Yes ____	No ____	
Wetland Hydrology Present?	Yes ____	No /	

Remarks:
upland for wetlands 3 and 5. Area previously mined.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____
Water Table Present? Yes ____ No ____ Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: UP-02

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5')			
1. Broom sedge (Andropogon virginicus)	90		
2. Crown vetch (Securigera varia)	5		
3. Yarrow (Achillea millefolium)	3		
4. Orchard grass (Dactylis glomerata)	2		
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No X

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

SOIL Sampling Point: UP-02

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR3/1	97	7.5YR4/4	3			Silty clay loam	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: clay rock

Depth (inches): 6

Hydric Soil Present? Yes ___ No X

Remarks:

area mined

11-10-16

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Ember Clear City/County: Harrison County Sampling Date: UP-1
Applicant/Owner: JV, RC State: _____ Sampling Point: _____
Investigator(s): _____ Section, Township, Range: _____
Landform (hillslope, terrace, etc.): fallow field Local relief (concave, convex, none): _____ Slope (%): _____
Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks:
upland for wetlands 1, 2, and 4.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____
Water Table Present? Yes _____ No X Depth (inches): _____
Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: UP-1

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Sapling Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5')			
1. Vetch (Securigera varia)	50		
2. broom sedge (Andropogon virginicus)	30		
3. yarrow (Achillea millefolium)			
4. dandelion (Taraxacum officinale)			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No X

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

SOIL

Sampling Point: UP-1

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/1	100%					silty loam	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: rock

Depth (inches): 8 inches

Hydric Soil Present? Yes ____ No X

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Harrison Power City/County: Cadiz Sampling Date: 7/6/17

Applicant/Owner: State: Sampling Point: ~~WP-01~~ WP-3

Investigator(s): Section, Township, Range:

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

Subregion (LRR or MLRA): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

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

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

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

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

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

Remarks: area reclaimed strip mine. Erosion control plants present.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ____	Depth (inches): ____
Water Table Present?	Yes ____	No ____	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ____	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: UP-01 UP-01

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5)			
1. Birdsfoot trefoil	40		FACU
2. Crown vetch	30		FACU
3. Timothy grass	5		UPL
4. orchard grass	5		FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No X

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

SOIL

Sampling Point: UP-01 UP-02

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 10	7.5YR 5/1						rocky, silty loam	disturbed

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: CADIZ, OH City/County: _____ Sampling Date: 7/6/17
Applicant/Owner: _____ State: OH Sampling Point: WDG-SB-01
Investigator(s): _____ Section, Township, Range: _____
Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____
Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No ✓
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.) DRY 90° HOT

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ✓ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

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

Remarks: REDUCED MATRIX, OXIDIZED ROOTS

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WO4-SP-01

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size:)			
1. SPIKE RUSH	95%	Y	OBL
2. JUNC(Y) (RC)	2%		FACW
3. CAREX LURIDA	1%		OBL
4. BITTER DOCK	1%		FAC
5. CAREX LUPULINOIDEA	1%		OBL
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

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

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

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

SOIL Sampling Point: WG-SP-01

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	5YR 4/1	90	7.5YR 4/6	7	RM	PL	CLAY	
			[redacted]	3	D	M		
			10YR 4/3					

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ✓ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

DEPLETED + OX 01760

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: _____ City/County: _____ Sampling Date: UP-06 UP-01

Applicant/Owner: _____ State: _____ Sampling Point: _____

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

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.) DRY; MOWED

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No _____	Depth (inches): _____
Water Table Present?	Yes _____	No _____	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No _____	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

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

Remarks:

DRY; MOWED RECENTLY

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: UP-06 UP-0c

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Sapling Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Herb Stratum (Plot size: _____)			
1. BROADLEAF TREFOIL	5%		FACU
2. YARROW	2%		FACU
3. CROOKED ASTER	2%		FAC
4. TIMOTHY GRASS	1%		FACU
5. ~~SAE (PLEO)~~ Broom sedge (Andropogon virginicus)	10%	Y	FACU
6.			
7.			
8.			
9.			
10.			
11.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** _____ **No** _____

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

SOIL

Sampling Point: ~~UP-06~~ UP-02

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	7.5YR 4/2	100					CLAY	DRY

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

DRY

Appendix B

Photographic Record

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 1 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward wetland 1.	

Photograph No. 2 **Date:** 11/10/16 **Direction:** East	
Description: Looking in an eastern direction toward wetland 2.	

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 3 **Date:** 11/10/16 **Direction:** East	
Description: Looking in an eastern direction toward a stream.	

Photograph No. 4 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward wetland 3.	

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 5 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward wetland 3.	

Photograph No. 6 **Date:** 11/10/16 **Direction:** West	
Description: Looking in a western direction toward wetland 3.	

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 7 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward wetland 5.	

Photograph No. 8 **Date:** 11/10/16 **Direction:** West	
Description: Looking in a western direction toward wetland 5.	

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 9 **Date:** 11/10/16 **Direction: West**	
Description: Looking in a western direction toward a stream channel.	

Photograph No. 10 **Date:** 11/10/16 **Direction:** West	
Description: Looking in a western direction toward a stream channel.	

Appendix C

Ohio Department of Natural Resources
DIVISION OF WILDLIFE

DNR 5203 (R0915)

NATURAL HERITAGE DATA REQUEST FORM

ODNR Division of Wildlife
Ohio Natural Heritage Program
2045 Morse Rd., Bldg. G-3
Columbus, OH 43229-6693
Phone: 614-265-6818
Email: obdrequest@dnr.state.oh.us

INSTRUCTIONS:

Please complete all the information on both sides of this form, sign (required) and email it to the address given above. Please provide a description of the work to be performed at the project site, and a map detailing your project site boundaries. If you have GIS capabilities or request a GIS response, please also submit a shapefile of your project site (unbuffered). Data requests will be completed within approximately 30 days, usually sooner. There is currently no charge to process requests.

WHAT WE PROVIDE:

As applicable to your project, the Ohio Natural Heritage Database (ONHD) will provide records for state and federally listed plants and animals, high quality plant communities, geologic features, breeding animal concentrations, scenic rivers, protected natural areas (managed areas), and significant unprotected natural areas (conservation sites). A one mile radius around the project site will automatically be searched. Because the ONHD contains sensitive information, it is our policy to provide only the data needed to complete your project.

Please note that this information is provided without comment on potential impacts to the species and their habitats, and therefore does not constitute coordination with ODNR under NEPA, the Fish & Wildlife Coordination Act, the Federal Water Pollution Control Act and other laws. If your project requires ODNR coordination, please submit it for a more extensive environmental review to environmentalreviewrequest@dnr.state.oh.us. Additional information on the environmental review process is available at http://realestate.ohiodnr.gov/environmental-review. If you have questions, please contact John Kessler at 614-265-6621 or john.kessler@dnr.state.oh.us. A ONHD search is included as part of the environmental review process.

Date: 11/8/2016 **Company name:** CB&I

Name of person response letter should be addressed to:

Mr. ☐ **Ms.** ☑ **Rebecca Clarke**

Address: 500 Penn Center Boulevard

City/State/Zip: Pittsburgh, PA 15235

Phone: (412) 380-4242

E-mail address: *rebecca.clarke@cbi.com*

Project Name: **Harrison Power Project**

Project Site Address: 43029 Industrial Park Road Cadiz, OH 43907

Project County: Harrison County

Project City or Township: Cadiz, Ohio

Project site is located on the following USGS 7.5 minute topographic quad(s):

Jewett, Flushing

Project latitude and longitude: 40.251308, -81.018754

Description of work to be performed at the project site:

EmberClear proposes to develop a natural gas-fired combined-cycle electric generating facility in the Harrison Industrial Park of Cadiz, Ohio. The facility will utilize existing natural gas resources within the region and delivered to the facility via nearby new and existing natural pipeline infrastructure.

How do you want your data reported? (Both formats provide the same data. The manual search is most appropriate for small scale projects or for those without GIS capabilities. With this option we will send you a list of records and a map showing their location. If you request a GIS shapefile, we will send you a shapefile of data layers. You will then need to make your own map and list of data for your report. You must have GIS capabilities. If you choose this option, please email your project shapefile with your request. If you do not make a selection, a manual search will be performed. Please choose only one option below.)

☑ **Printed list and map (manual search)** **OR** ☐ **GIS shapefile (computer search)**

Other than the standard data (see "what we provide" at top of form), additional information you require:

How will the information be used?

The information will be used to determine environmental impacts at the facility.

The chief of the Division of Wildlife has determined that the release of the ONHD information you have requested could be detrimental to the conservation of a species or unique natural feature. Pursuant to section 1531.04 of the Ohio Revised Code, this information is not subject to section 149.43 of the Revised Code. By signing below, you certify that the data provided will not be disclosed, published, or distributed beyond the scope of your specific project.

Signature _____ **Date:** _____

Appendix D

Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR JAMES ZEHRINGER, DIRECTOR

Ohio Division of Wildlife
Raymond W. Petering, Chief
2045 Morse Rd., Bldg. G
Columbus, OH 43229-6693
Phone: (614) 265-6300

November 28, 2016

Rebecca Clarke
CB&I
500 Penn Center Blvd.
Pittsburgh, PA 15235

Dear Ms. Clarke,

After reviewing the Natural Heritage Database, I find the Division of Wildlife has no records of rare or endangered species in the Harrison Power Electric Generating Facility project area, including a one mile radius, in Cadiz Township, Harrison County, Ohio. We are unaware of any unique ecological sites, geologic features, animal assemblages, scenic rivers, state wildlife areas, nature preserves, parks or forests, national wildlife refuges, parks or forests or other protected natural areas within a one mile radius of the project area.

Our inventory program has not completely surveyed Ohio and relies on information supplied by many individuals and organizations. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. This letter only represents a review of rare species and natural features data within the Ohio Natural Heritage Database. It does not fulfill coordination under the National Environmental Policy Act (NEPA) or the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S. C. 661 et seq.) and does not supersede or replace the regulatory authority of any local, state or federal agency nor relieve the applicant of the obligation to comply with any local, state or federal laws or regulations.

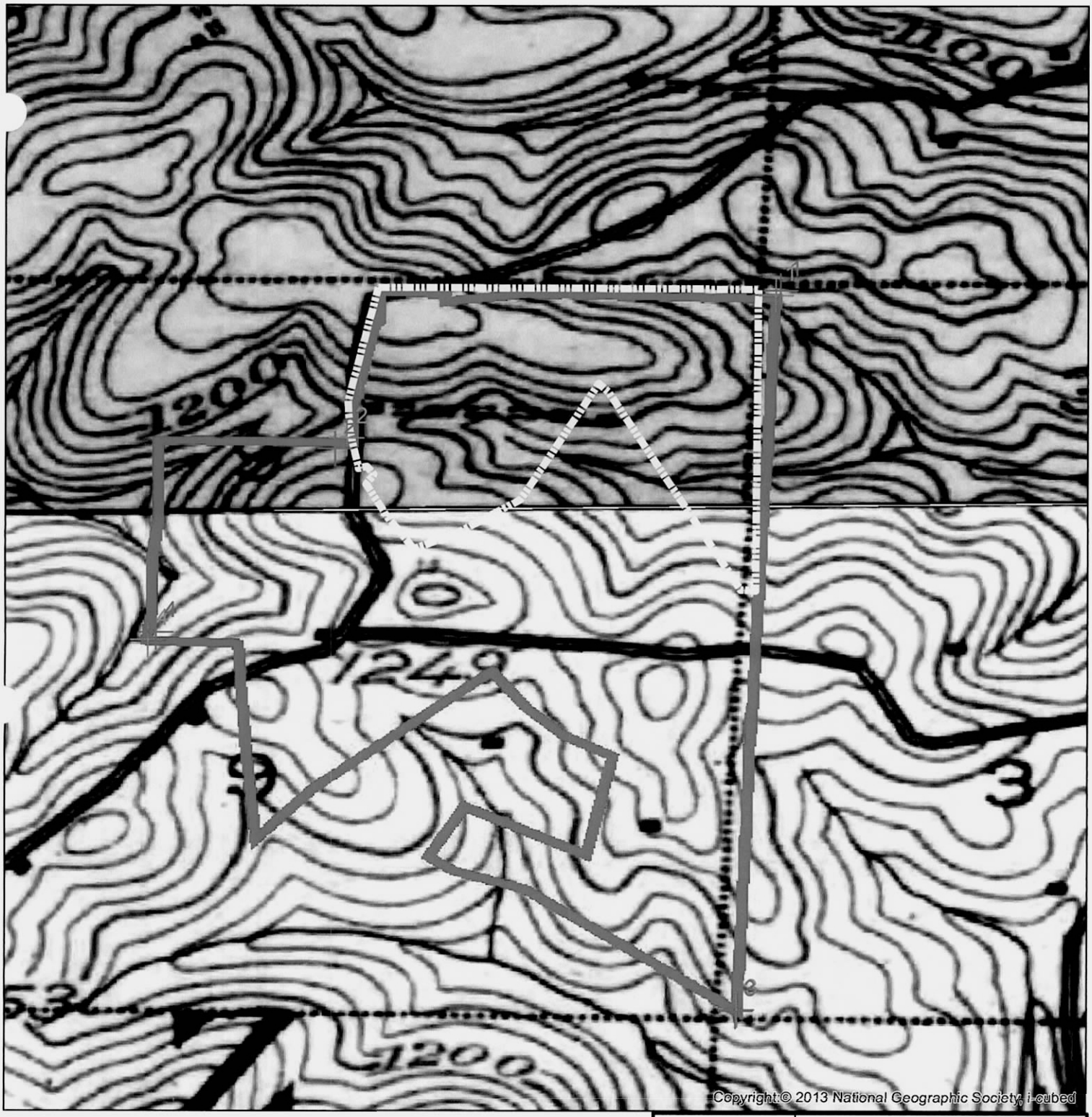
Please contact me at 614-265-6818 if I can be of further assistance.

Sincerely,

Debbie Woischke

Debbie Woischke
Ohio Natural Heritage Database Program

Appendix E



Legend

Proposed Site Boundary

Tax Parcel

1 inch = 1,000 feet

N

APTIM

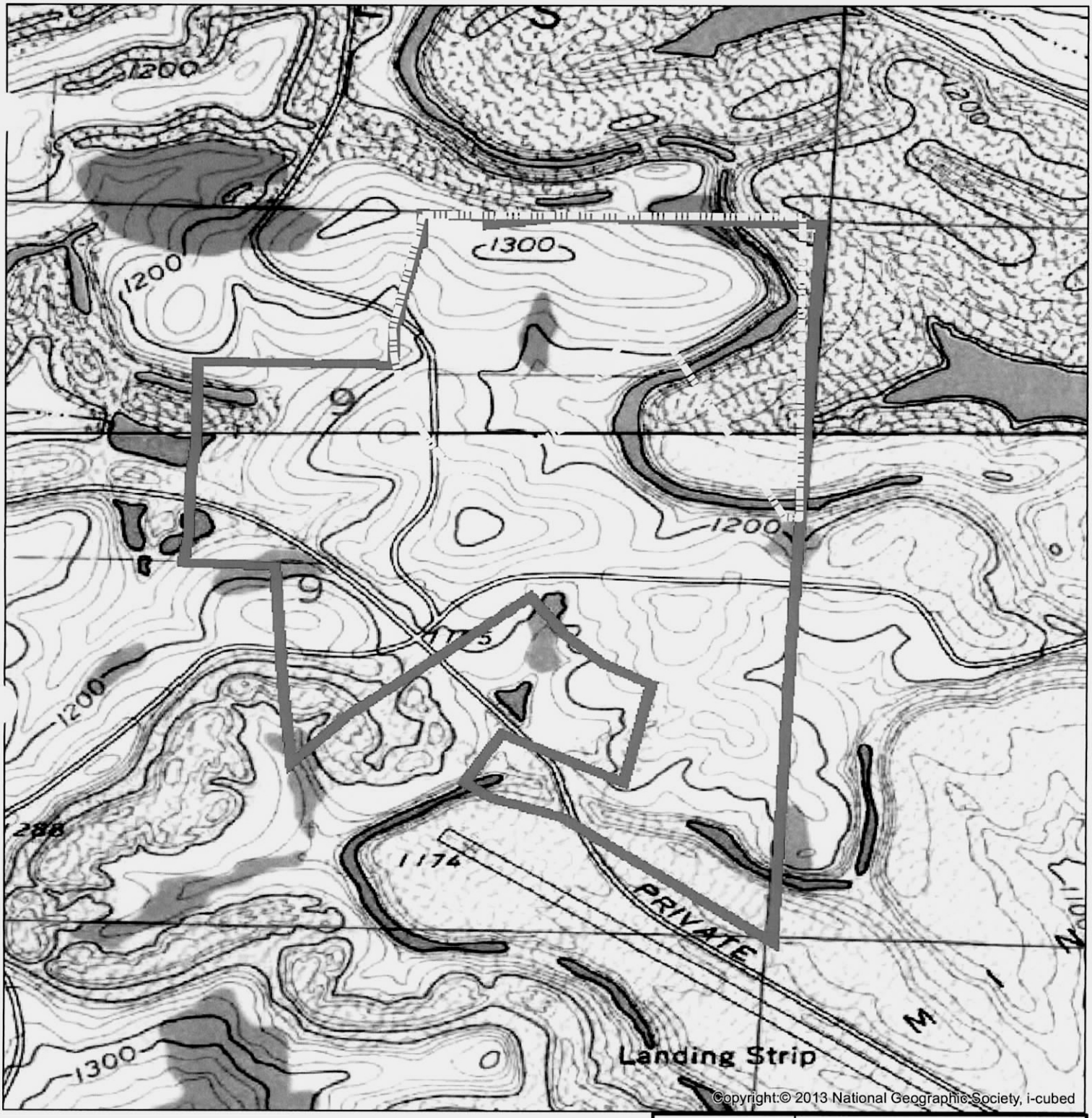
APTIM
500 Penn Center Boulevard Pittsburgh,
PA 15235

EmberClear Corporation

HISTORIC TOPOGRAPHICAL

1905

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907



Legend

Proposed Site Boundary

Tax Parcel

1 inch = 1,000 feet

N

APTIM

APTIM
500 Penn Center Boulevard Pittsburgh, PA 15235

EmberClear Corporation

HISTORIC TOPOGRAPHICAL

1960

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Copyright © 2013 National Geographic Society, i-cubed, Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Legend

Proposed Site Boundary

Tax Parcel

1 inch = 1,000 feet

N

APTIM

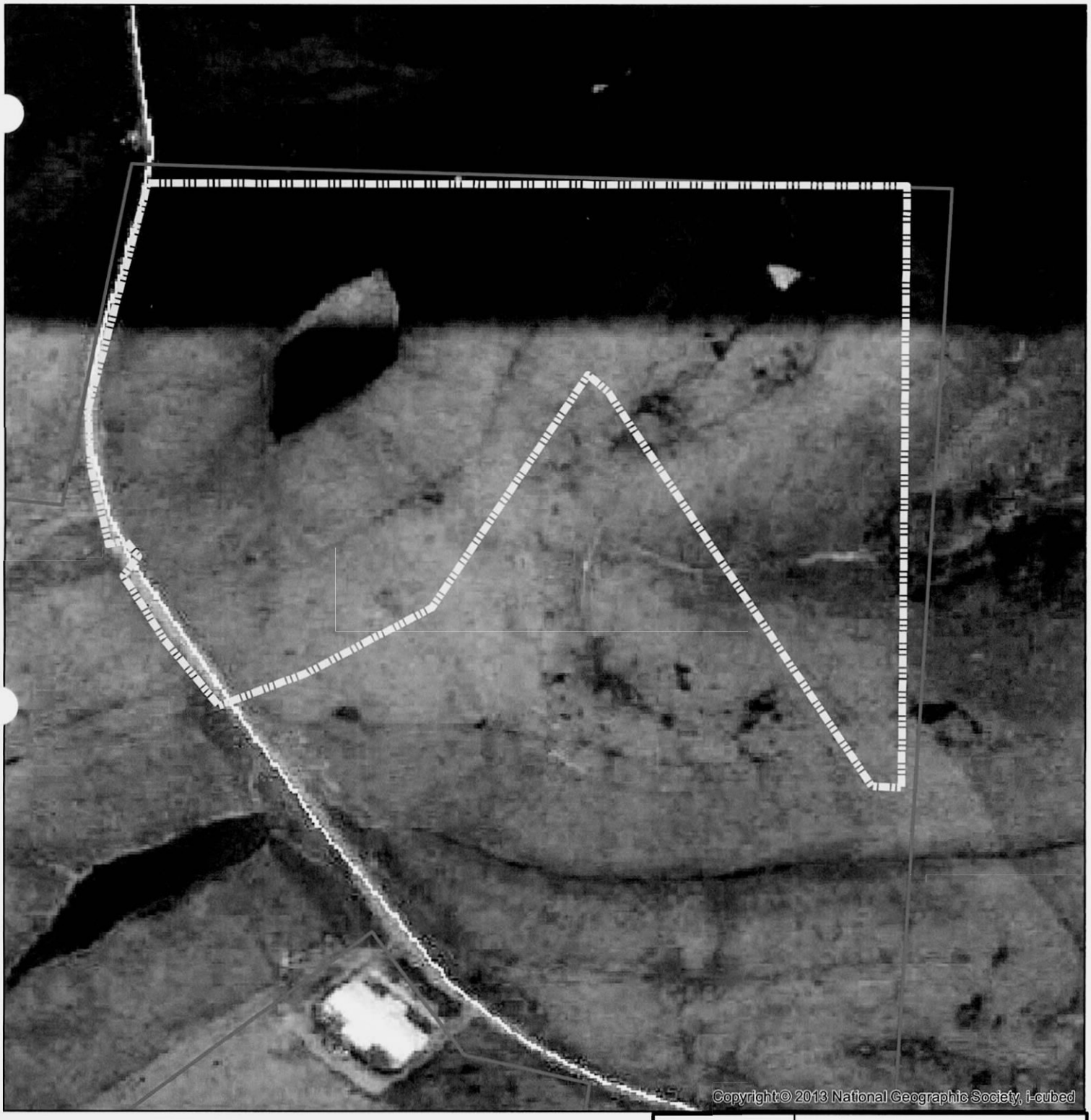
APTIM
500 Penn Center Boulevard Pittsburgh, PA 15235

EmberClear Corporation

HISTORIC AERIAL

1978

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907



Legend

Proposed Site Boundary

Tax Parcel

1 inch = 500 feet

N

APTIM

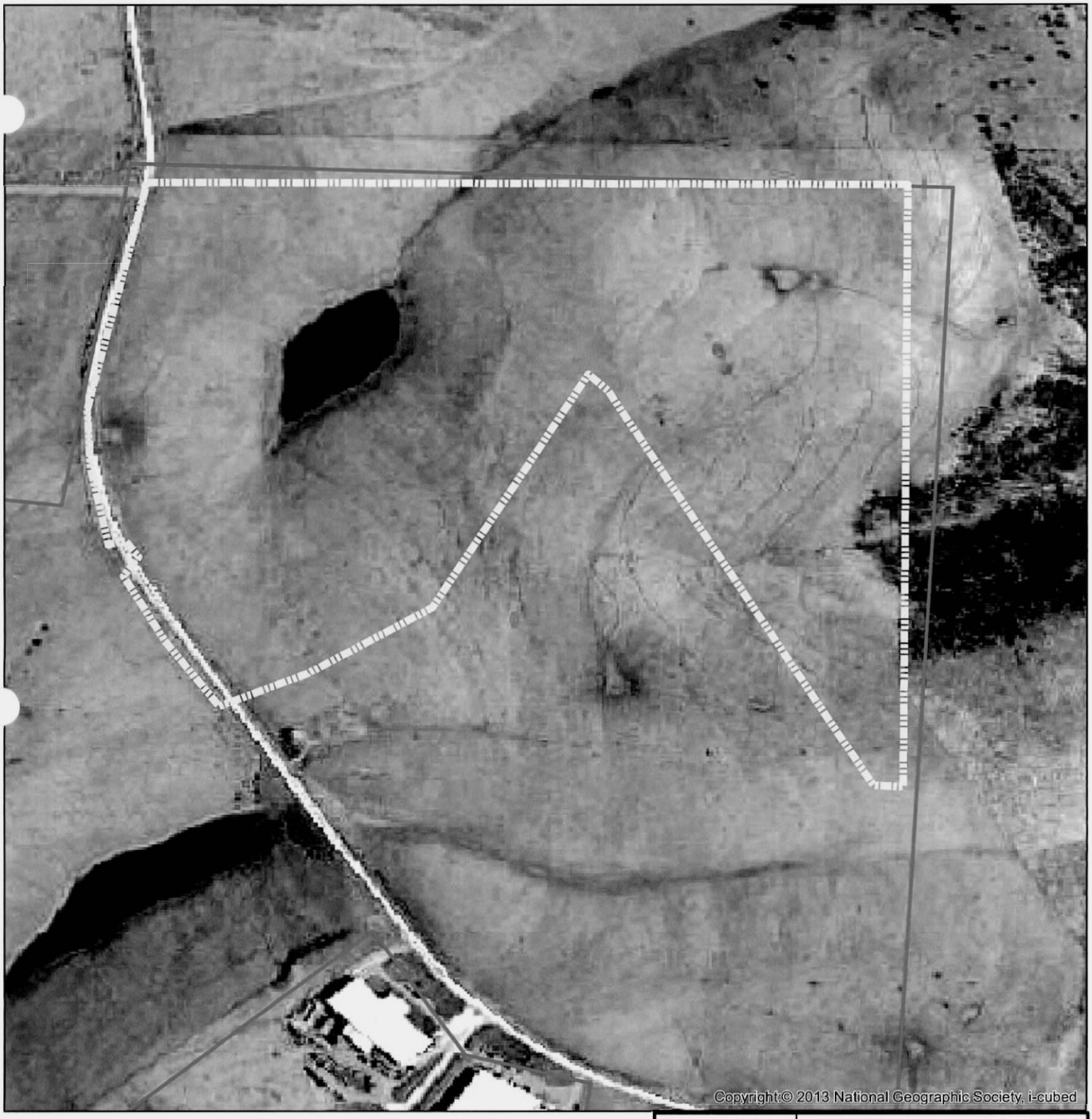
APTIM
500 Penn Center Boulevard Pittsburgh,
PA 15235

EmberClear Corporation

HISTORIC AERIAL

1994

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907



Legend

Proposed Site Boundary

Tax Parcel

1 inch = 500 feet

N

APTIM

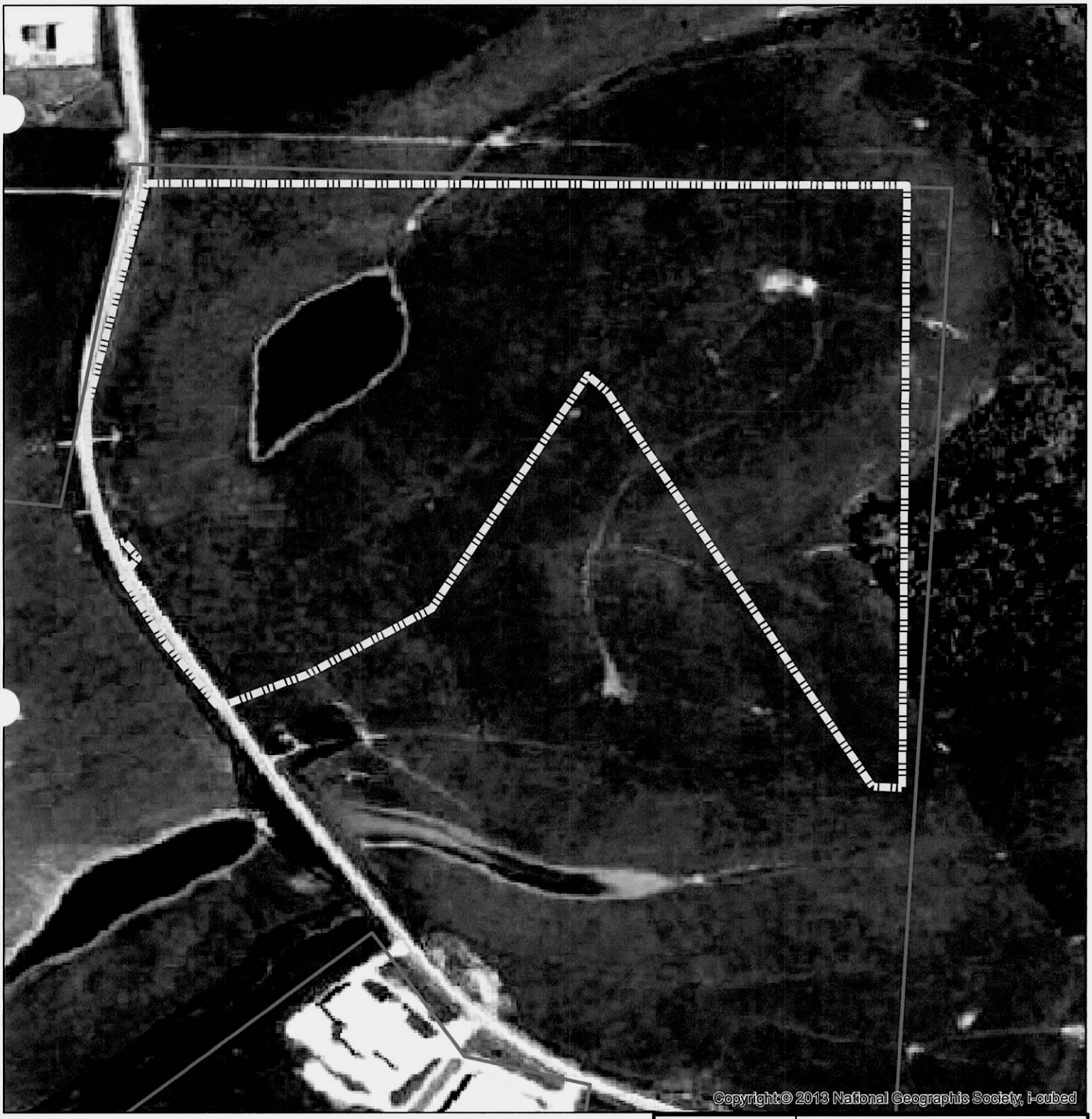
APTIM
500 Penn Center Boulevard Pittsburgh,
PA 15235

EmberClear Corporation

HISTORIC AERIAL

2006

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907



Legend

Proposed Site Boundary

Tax Parcel

1 inch = 500 feet

N

APTIM

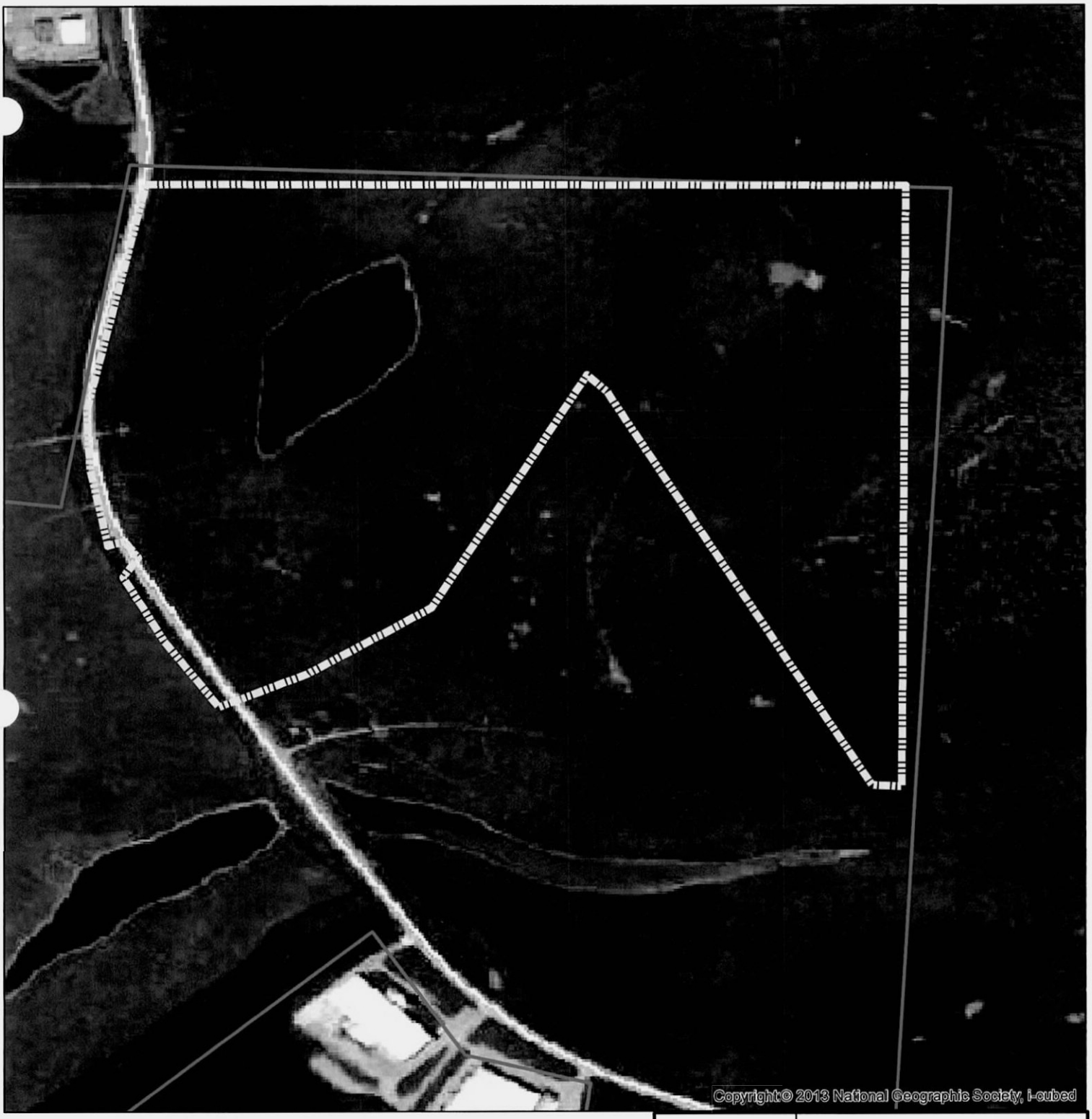
APTIM
500 Penn Center Boulevard Pittsburgh,
PA 15235

EmberClear Corporation

HISTORIC AERIAL

2010

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907



Legend

Proposed Site Boundary

Tax Parcel

1 inch = 500 feet

N

APTIM

APTIM
500 Penn Center Boulevard Pittsburgh,
PA 15235

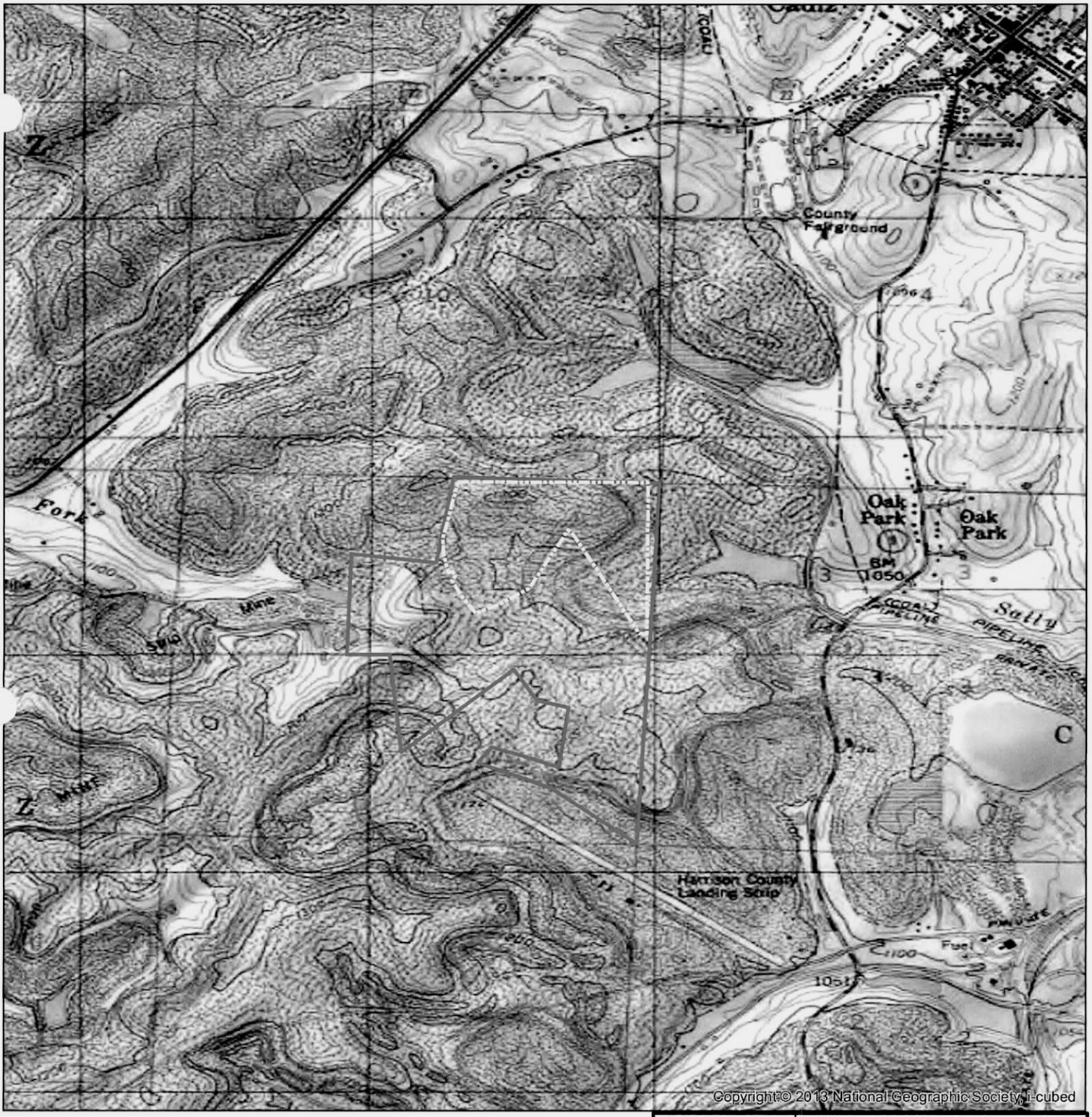
EmberClear Corporation

HISTORIC AERIAL

2012

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907

Figures



Legend

proposed site boundary

tax parcel

1 inch = 2,000 feet

N

APTIM

APTIM
500 Penn Center Boulevard Pittsburgh, PA 15235

EmberClear Corporation

FIGURE 1

Project Location

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907

Legend

proposed site boundary

tax parcel

1 inch = 500 feet

N

APTIM

APTIM
500 Penn Center Boulevard Pittsburgh, PA 15235

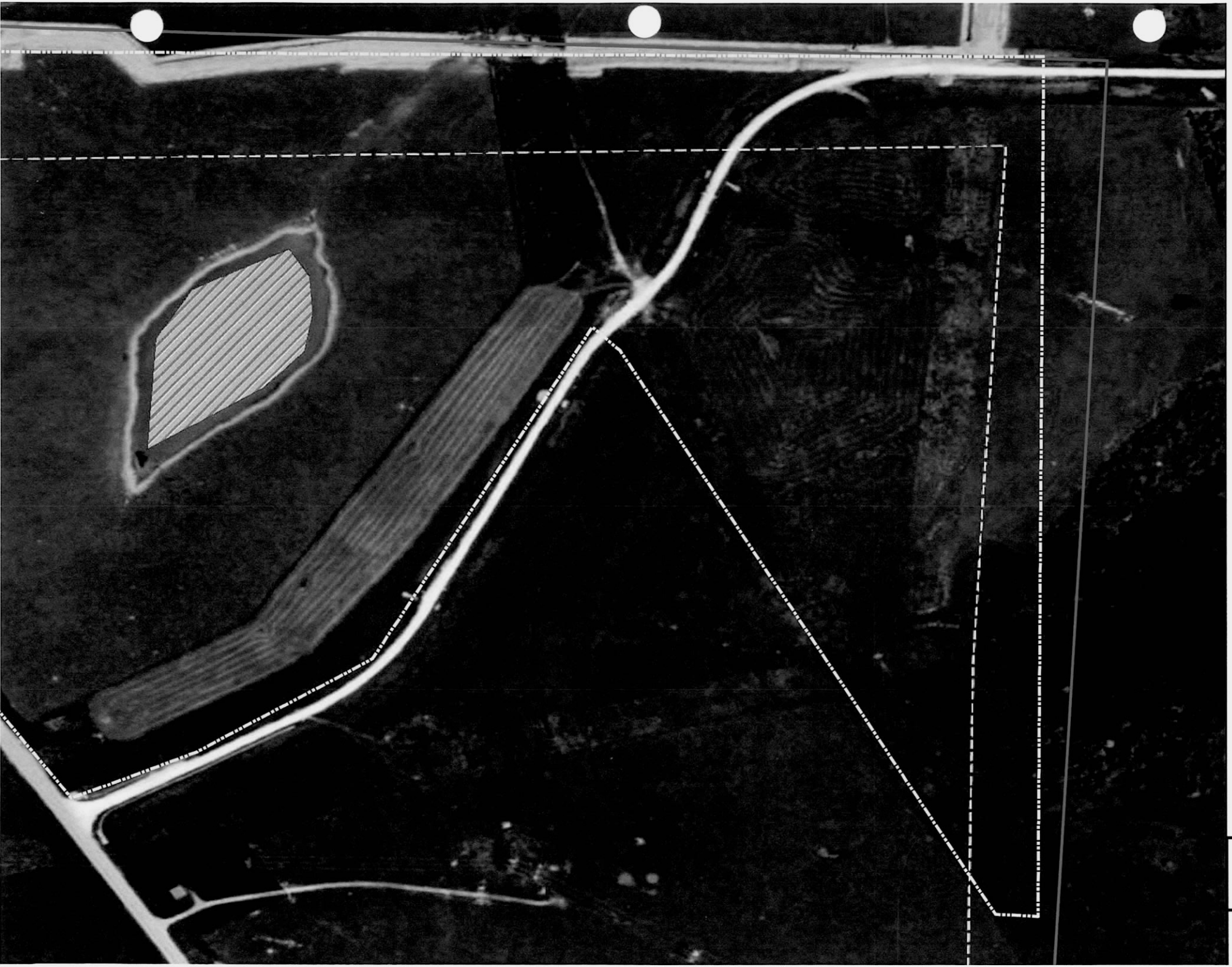
EmberClear Corporation

FIGURE 2

Area of Interest (AOI)

HARRISON COUNTY INDUSTRIAL PARK
CADIZ, OHIO 43907


W



Legend

- Streams
- Laydown Areas
- Project Area
- Pond
- Wetlands

N

EmberClear

Wetland Report

FIGURE NUMBER	AOI Resources Map
5	

APTIM
500 Penn Center Blvd., Suite 1000
Pittsburgh, PA 15235

R:\Clarke\GIS\CBI_LetterLandscape_RightLegend.mxd; Analyst: ; Date: 6/24/2015 10:26:01 AM

Appendix F: Section 106 Project Summary and Agency Response

OHIO HISTORICAL SOCIETY
Ohio Historic Preservation Office

OHIO HISTORIC PRESERVATION OFFICE:
RESOURCE PROTECTION AND REVIEW

Section 106 Review - Project Summary Form

For projects requiring a license from the Federal Communications Commission, please use FCC Forms 620 or 621. DO NOT USE THIS FORM.

SECTION 1: GENERAL PROJECT INFORMATION

All contact information provided must include the name, address and phone number of the person listed. Email addresses should also be included, if available. Please refer to the Instructions or contact an OHPO reviewer (mailto:Section106@ohiohistory.org) if you need help completing this Form. Unless otherwise requested, we will contact the person submitting this Form with questions or comments about this project.

Date: February 7, 2017

Name/Affiliation of person submitting form: Rebecca Clarke/CB&I

Mailing Address: 500 Penn Center Blvd. Pittsburgh, PA 15235

Phone/Fax/Email: 412-380-4242

A. Project Info:

1. This Form provides information about:
   New Project Submittal:
   YES NO

   Additional information relating to previously submitted project:
   YES **NO**

   OHPO/RPR Serial Number from previous submission: N/A

2. Project Name (if applicable): Harrison Power Project

3. Internal tracking or reference number used by Federal Agency, consultant, and/or applicant to identify this project (if applicable): N/A

B. Project Address or vicinity: Harrison County Community Improvement Corporation property / City of Cadiz Property, Industrial Park Road

C. City/Township: Cadiz

D. County: Harrison County

E. Federal Agency and Agency Contact. USACE, Pittsburgh District

F. Type of Federal Assistance: Permit Review

G. State Agency and Contact Person (if applicable): Ohio Power and Siting Board

H. Type of State Assistance: OPSB Application Review

I. Is this project being submitted at the direction of a state agency **solely** under Ohio Revised Code 149.53 or at the direction of a State Agency? *Answering yes to this question means that you are sure that no federal funding, permits or approvals will be used for any part of your project, and that you are seeking comments only under ORC 149.53.*

YES **NO**

J. Public Involvement- Describe how the public has been/will be informed about this project and its potential to affect historic properties. Please summarize how they will have an opportunity to provide comments about any effects to historic properties. (This step is required for all projects under 36 CFR § 800.2): A public meeting will be held in the project area and attendees will have the opportunity to provide comments and view informational exhibits.

K. Please list other consulting parties that you have contacted/will contact about this project, such as Indian Tribes, Certified Local Governments, local officials, property owners, or preservation groups. (See 36 CFR § 800.2 for more information about involving other consulting parties). Please summarize how they will have an opportunity to provide comments: Coordination with the Harrison County Community Improvement Corporation has been conducted.

SECTION 2: PROJECT DESCRIPTION AND AREA OF POTENTIAL EFFECTS (APE)

Provide a description of your project, its site, and geographical information. You will also describe your project's Area of Potential Effects (APE). Please refer to the Instructions or contact an OHPO reviewer if you need help with developing the APE or completing this form.

For challenging projects, provide as much information as possible in all sections, and then check the box in Section 5.A. to ask OHPO to offer preliminary comments or make recommendations about how to proceed with your project consultation. This is recommended if your project involves effects to significant historic properties or if there may be challenging procedural issues related to your project. Please note that providing information to complete all Sections will still be required and that asking OHPO for preliminary comments may tend to delay completion of the review process for some projects.

A. Does this project involve any Ground-Disturbing activity: **YES** NO
(If **Yes**, you must complete all of Section 2.A. If **No**, proceed directly to Section 2. B.)

1. General description of width, length and depth of proposed ground disturbing activity: The proposed area of disturbance is approximately 75 acres in size.

2. Narrative description of previous land use and past ground disturbances, if known: The area underwent strip mining activities in the mid-1970s. In the 1990s, strip mining reclamation occurred throughout the area, and a reclamation pond and Industrial Park Road remain.

3. Narrative description of current land use and conditions: The site remains unchanged since the 1990s, except for the development of a site to the northwest of the property along Industrial Park Road.

4. Does the landowner know of any archaeological resources found on the property?
YES **NO** If yes, please describe:

B. Submit the exact project site location on a USGS 7.5-minute topographic quadrangle map for all projects. Map sections, photocopies of map sections, and online versions of USGS maps are acceptable as long as the location is clearly marked. Show the project's Area of Potential Effects (APE). It should be clearly distinguished from other features shown on the map:
1. USGS Quad Map Name: Jewett

2. Township/City/Village Name: Cadiz

C. Provide a street-level map indicating the location of the project site; road names must be identified and legible. Your map must show the exact location of the boundaries for the project site. Show the project's Area of Potential Effects (APE). It should be clearly distinguished from other features shown on the map:

Provide a verbal description of the APE, including a discussion of how the APE will include areas with the potential for direct and indirect effects from the project. Explain the steps taken to identify the project's APE, and your justification for the specific boundaries chosen: An APE was established based on areas of proposed earth disturbance and distance. Because the tallest visual element will be the Preliminary HRSG stack, at 165 ft above grade, a distance zone of 0.5 miles was established based on the Nationwide Programmatic Agreement for Review of Effects on Historic Properties. The APE is shown on Figure 1.

D. Provide a detailed description of the project. This is a critical part of your submission. Your description should be prepared for a cold reader who may not be an expert in this type of project. The information provided must help support your analysis of effects to historic properties, not other types of project impacts. Do not simply include copies of environmental documents or other types of specialized project reports. If there are multiple project alternatives, you should include information about all alternatives that are still under active consideration:

The proposed Project will be located on property owned by the Harrison County Community Improvement Corporation and the City of Cadiz in the Industrial Park of Cadiz, Ohio, located in Harrison County. The Facility's site is located near Highway 9. The Project is a nominal 2x500 megawatt (MW) Net Power Output natural gas-fired single shaft configuration combined cycle combustion turbine electric generating facility.

Each unit of the two unit facility will employ an air cooled condenser (ACC) for steam turbine exhaust heat sink. Fuel will be based on natural gas only. Each unit will be rated for high efficiency, full load CTG operation without duct burners on annual average temperature case. Each unit will be required to match the full load output for the annual average temperature case during the summer design condition with duct fired operation. Preliminary HRSG stack height will be 165 ft above grade.

SECTION 3: IDENTIFICATION OF HISTORIC PROPERTIES

Describe whether there are historic properties located within your project APE. To make that determination, use information generated from your own Background Research and Field Survey. Then choose one of the following options to report your findings. Please refer to the Instructions and/or contact an OHPO reviewer if you are unsure about how to identify historic properties for your project.

If you read the Instructions and you're still confused as to which reporting option best fits your project, or you are not sure if your project needs a survey, you may choose to skip this section, but provide as much supporting documentation as possible in all other Sections, then check the box in Section 5.A. to request preliminary comments from OHPO. After reviewing the information provided, OHPO will then offer comments as to which reporting option is best suited to document historic properties for your project. Please note that providing information to complete this Section will still be required and that asking OHPO for preliminary comments may tend to delay completion of the review process for some projects.

Recording the Results of Background Research and Field Survey:

A. **Summary of discussions and/or consultation with OHPO** about this project that demonstrates how the Agency Official and OHPO have agreed that no Field Survey was necessary for this project (typically due to extreme ground disturbance or other special circumstances). Please **attach copies** of emails/correspondence that document this agreement. You must explain how the project's potential to affect both archaeological and historic resources were considered.

The project area was significantly disturbed due to surface mining that occurred in the 1970s. A field visit was therefore not completed. A literature review was undertaken for the area within 0.5 miles of the facility, utilizing the Ohio History Connection and National Park Service databases. No cultural resource landmarks or historic structures were identified within the APE.

B. **A table that includes the minimum information** listed in the OHPO Section 106 Documentation Table (which is generally equivalent to the information found on an inventory form). This information must be printed and mailed with the Project Summary Form. To provide sufficient information to complete this Section, you must also include summary observations from your field survey, background research and eligibility determinations for each property that was evaluated in the project APE.

C. **OHI (Ohio Historic Inventory) or OAI (Ohio Archaeological Inventory) forms**- New or updated inventory forms may be prepared using the OHI pdf form with data population capabilities, the Internet IForm, or typed on archival quality inventory forms. To provide sufficient information to complete this Section, you must include summary observations from your field survey and background research. You must also include eligibility

determinations for each property that was evaluated in the project APE

D. **A historic or archaeological survey report** prepared by a qualified consultant that meets professional standards. The survey report should meet the Secretary of the Interior's Standards and Guidelines for Identification and OHPO Archaeological Guidelines. You may also include new inventory forms with your survey, or update previous inventory forms. To complete this section, your survey report must include summary observations from your field survey, background research and eligibility determinations for each property that was evaluated within the APE.

E. **Project Findings**. Based on the conclusions you reached in completing Section 3, please choose one finding for your project. There are (mark one): No Historic Properties Present in the APE

SECTION 4: SUPPORTING DOCUMENTATION

This information must be provided for all projects.

A. Photographs/Photo map must be keyed to a street-level map, and should be included as attachments to this application. Please label all forms, tables and CDs with the date of your submission and project name, as identified in Section 1. You must present enough documentation to clearly show existing conditions at your project site and convey details about the buildings, structures or sites that are described in your submission. Faxed or photocopied photographs are not acceptable. See Instructions for more info about photo submissions or 36 CFR § 800.11 for federal documentation standards.
    1. Provide photos of the entire project site and take photos to/from historic properties from/towards your project site to support your determination of effect in Section 5.
    2. Provide current photos of all buildings/structures/sites described.
B. Project plan, specifications, site drawings and any other media presentation that conveys detailed information about your project and its potential to affect historic properties.
C. Copies or summaries of any comments provided by consulting parties or the public.

A photo map is included as Figure 2 and a photo log is included as Appendix item A. A plan is included as Figure 3.

SECTION 5: DETERMINATION OF EFFECT

A. **Request Preliminary Comments.** For challenging projects, provide as much information as possible in previous sections and ask OHPO to offer preliminary comments or make recommendations about how to proceed with your project consultation. This is recommended if your project involves effects to significant historic properties, if the public has concerns about your project's potential to affect historic properties, or if there may be challenging procedural issues related to your project. Please be aware that providing information in all Sections will still be required and that asking OHPO for preliminary comments may tend to delay completion of the review process for some projects.

    1. We request preliminary comments from OHPO about this project:
       YES **NO**

    2. Please specify as clearly as possible the particular issues that you would like OHPO to examine for your project (for example- help with developing an APE, addressing the concerns of consulting parties, survey methodology, etc.): N/A

B. **Determination of Effect.** If you believe that you have gathered enough information to conclude the Section 106 process, you may be ready to make a determination of effect and ask OHPO for concurrence, while considering public comments. Please select and mark one of the following determinations, then explain the basis for your decision on an attached sheet of paper:

No historic properties will be affected based on 36 CFR § 800.4(d) (1). Please explain how you made this determination:

No Adverse Effect [36 CFR § 800.5(b)] on historic properties. This finding cannot be used if there are no historic properties present in your project APE. Please explain why the Criteria of Adverse Effect, [36 CFR Part 800.5(a) (1)], were found not to be applicable for your project: The Criteria of Adverse Effect were found to be not applicable to this project. Extensive surface mining occurred during the 1970s and caused an extreme ground disturbance. A figure showing the surface mined area is included as Figure 4 with this submission.

Adverse Effect [36 CFR § 800.5(d) (2)] on historic properties. Please explain why the criteria of adverse effect, [36 CFR Part 800.5(a) (1)], were found to be applicable to your project. You may also include an explanation of how these adverse effects might be avoided, reduced or mitigated:

Please print and mail completed form and supporting documentation to:

Ohio Historic Preservation Office
Attn: Resource Protection and Review Department Head
Resource Protection and Review
800 E. 17th Avenue
Columbus, OH 43211-2497

Figure 1 – Project Location

Legend

- Area of Potential Effects
- Project Boundary

N

Emberclear Corporation
Harrison Power Project

Section 106 Form

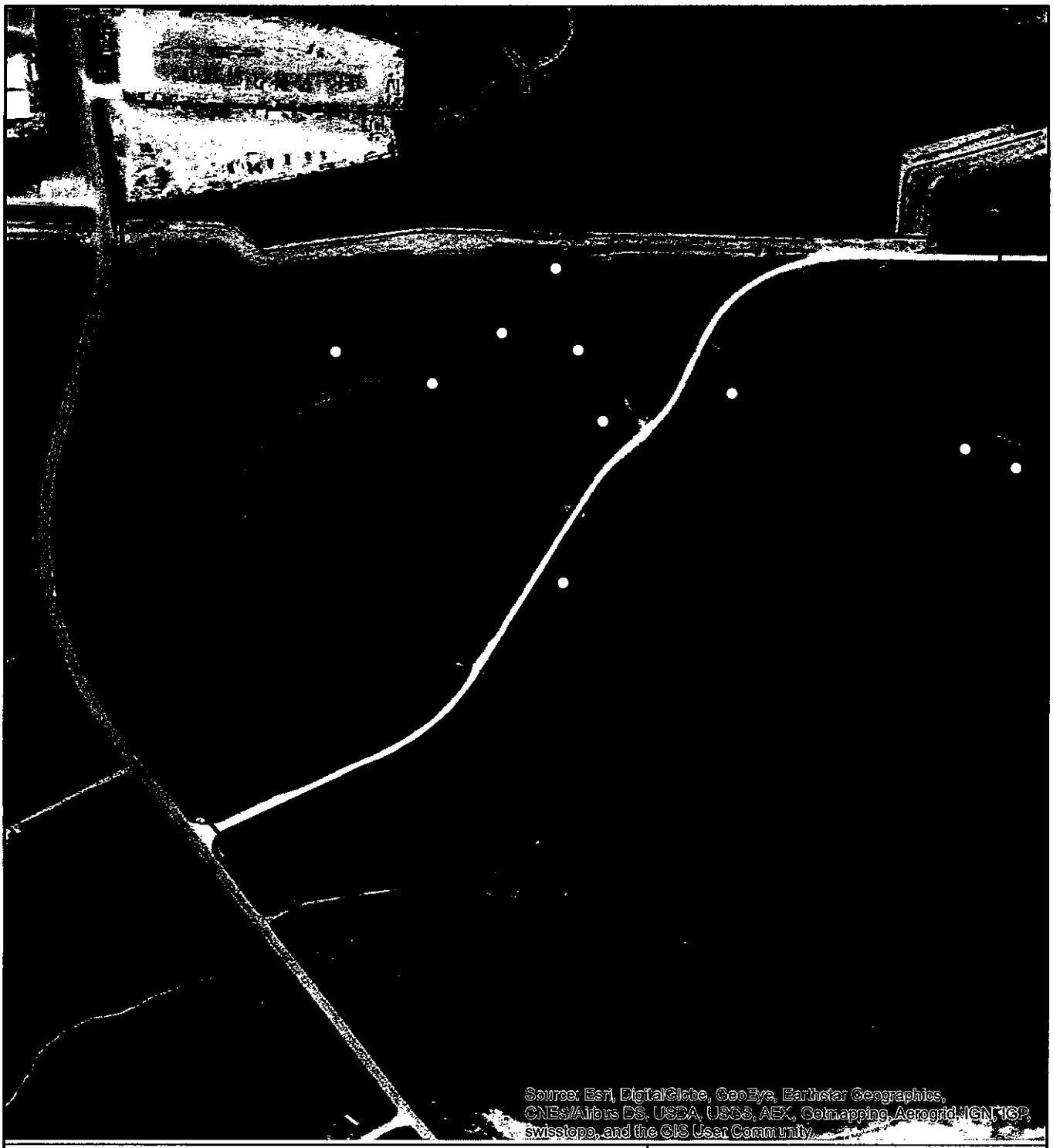
FIGURE NUMBER 1

Project Location

CBI

500 Penn Center Blvd. Suite 1000
Pittsburgh, PA 15235

Figure 2 – Photo Map



Legend

Photo Location

Project Boundary

N

Emberclear Corporation
Harrison Power Project

Section 106 Form

FIGURE NUMBER 2

Photo Location Map

CBI

500 Penn Center Blvd. Suite 1000
Pittsburgh, PA 15235

Figure 3- Plans

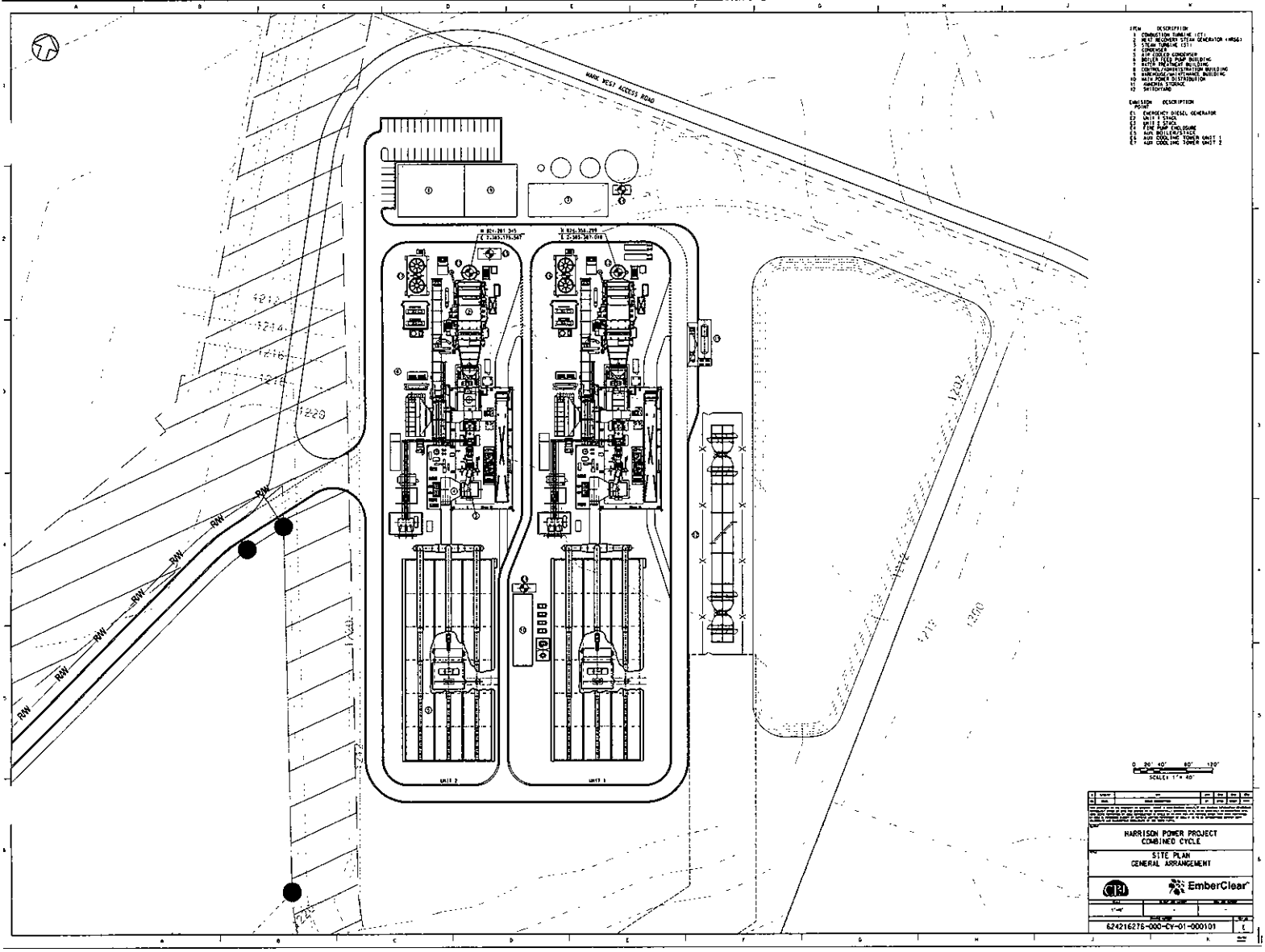
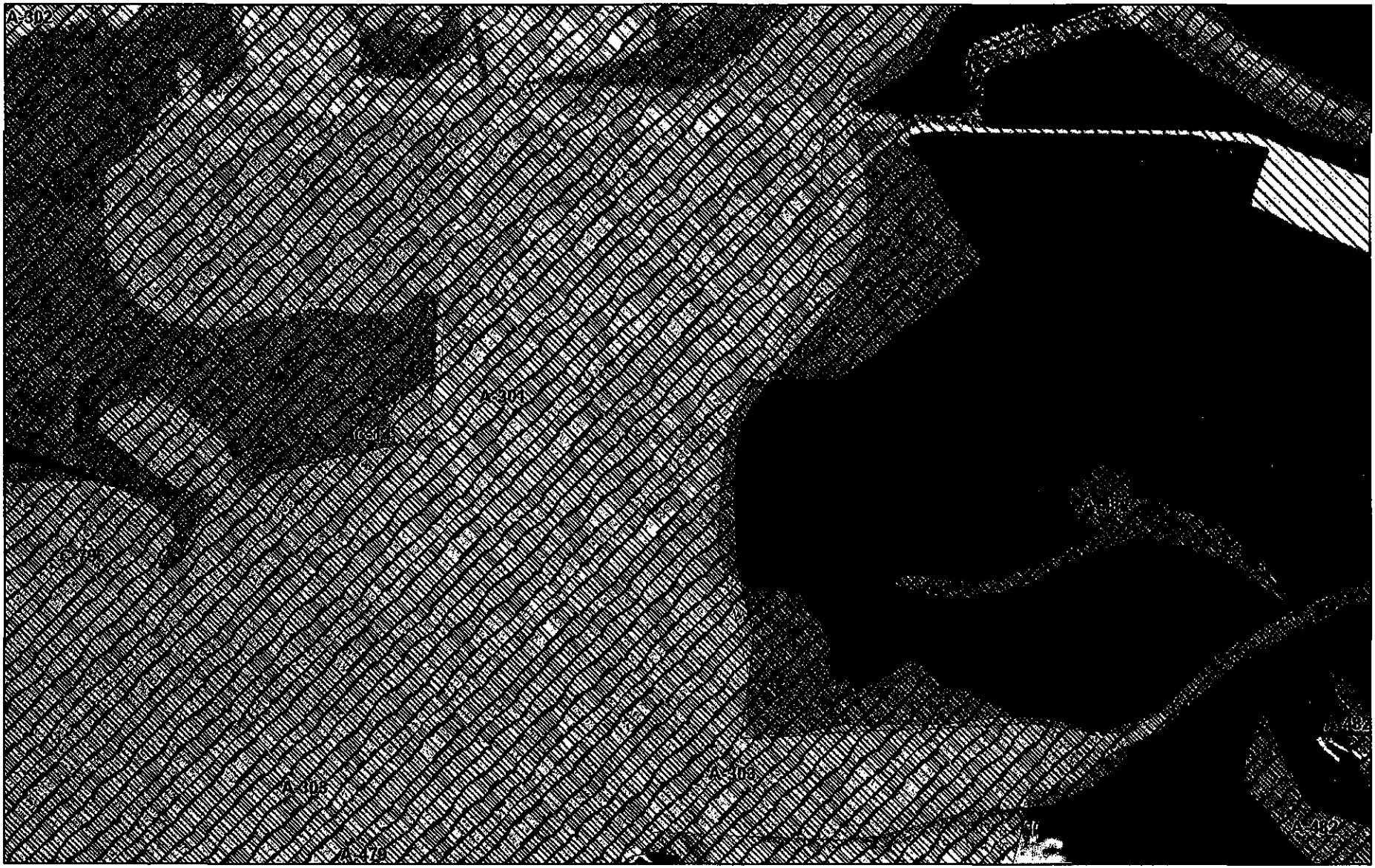

MARK WEST ACCESS ROAD
RW
RW
RW
RW
RW
RW
1212
1214
1216
1218
1220
1222
1200
UNIT 2
UNIT 1
0 20' 40' 80' 120'
SCALE: 1" = 40'
HARRISON POWER PROJECT
COMBINED CYCLE
SITE PLAN
GENERAL ARRANGEMENT
EmberClear
624216276-000-CV-01-000101

Figure 4 – Surface / Underground Mine Mapping

Surface Coal Mining



November 1, 2016

Current

- Air Shaft
- Drift Entry
- Vertical Mine Shaft

N

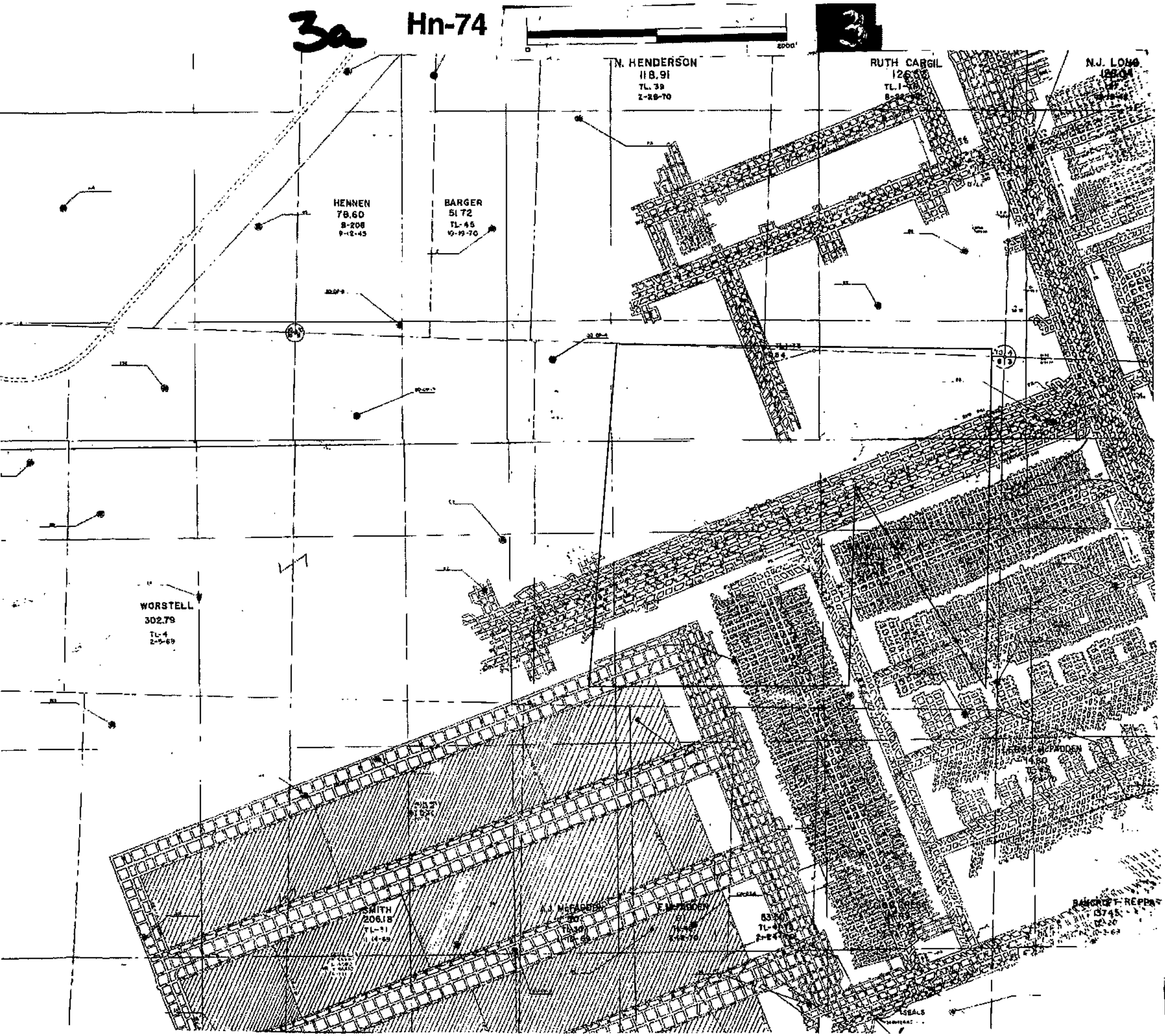
0 0.075 0.15 0.3 mi

0 0.1 0.2 0.4 km

1:9,028

Ohio Dept. of Natural Resources

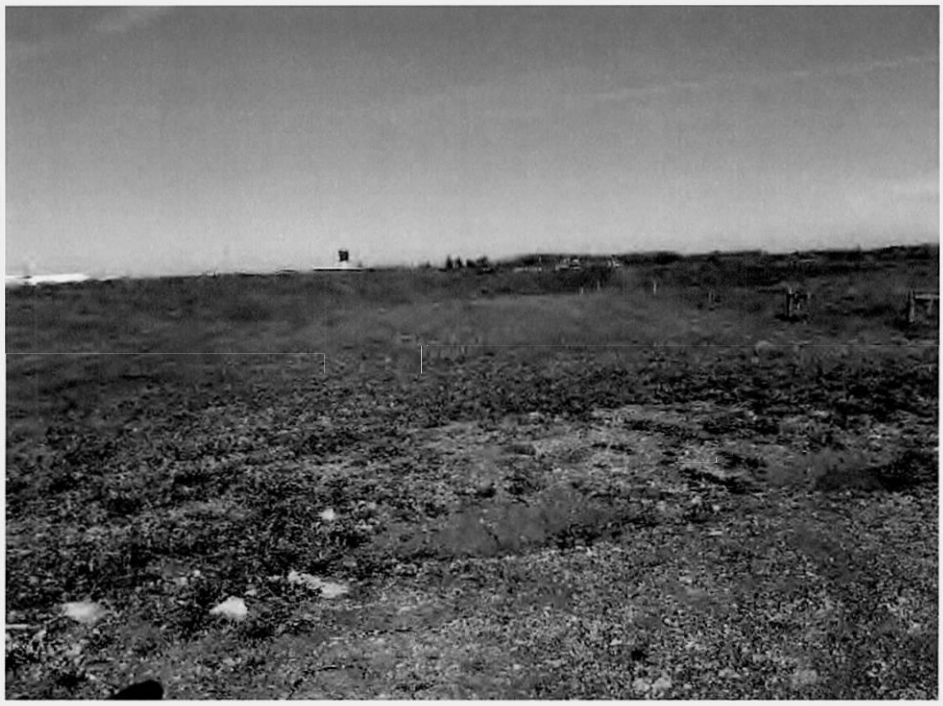
3a Hn-74


0
2000'
N. HENDERSON
118.91
TL. 39
2-28-70
RUTH CARGIL
BARGER
51.72
TL-45
10-19-70
HENNEN
78.60
B-208
9-12-45
WORSTELL
302.79
TL-4
2-5-69
SMITH
206.18
TL-31
N.J. LONG
BANCROFT-REPPERT
SEALS

Appendix 1 – Photo Log

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 1 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward the northeast quadrant of the project area.	

Photograph No. 2 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward metering station.	

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 3 **Date:** 11/10/16 **Direction:** East	
Description: Looking in an eastern direction toward a stream outside of the project area.	

Photograph No. 4 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward the southwest quadrant of the proposed project area.	

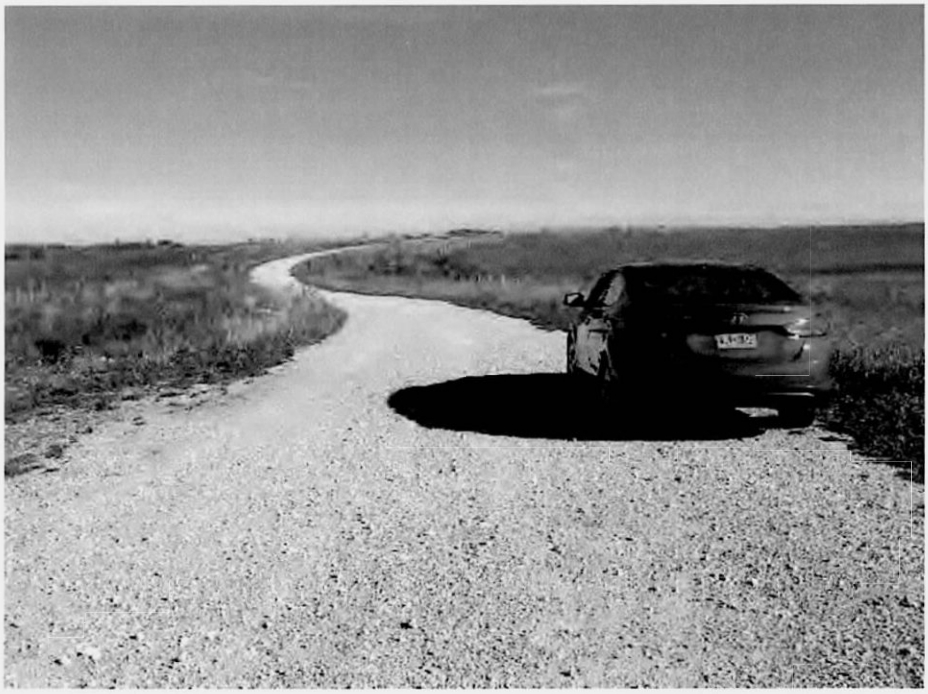
Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 5 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward the southwest quadrant of the proposed project area.	

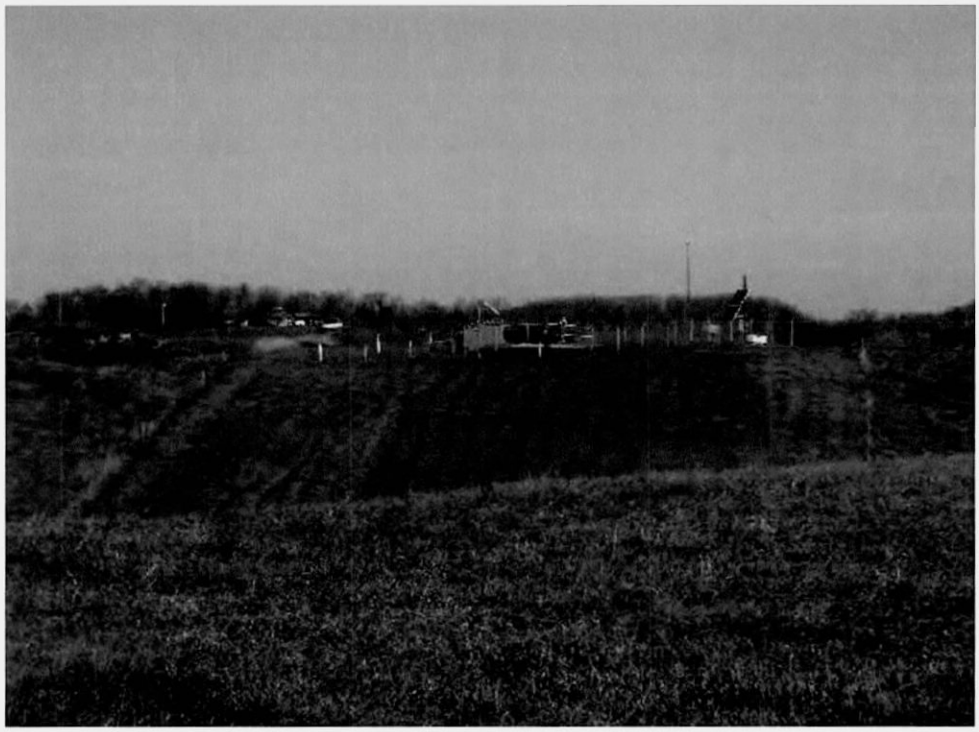
Photograph No. 6 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward a fence and gas marker located in the southwest quadrant of the proposed project area.	

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 7 **Date:** 11/10/16 **Direction:** Southwest	
Description: Looking in a southwestern direction toward reclamation pond.	

Photograph No. 8 **Date:** 11/10/16 **Direction:** Northeast	
Description: Looking in a northeastern direction along existing access road.	

Client: EmberClear Corporation **Prepared by:** CB&I
Location: Cadiz, OH

Photograph No. 9 **Date:** 11/10/16 **Direction:** North	
Description: Looking in a northern direction toward metering station.	

Photograph No. 10 **Date:** 11/10/16 **Direction:** West	
Description: Looking in a western direction toward the outside of the northeast portion of the project area.	

OHIO HISTORY CONNECTION

In reply refer to
2017-HAS-38234

March 21, 2017

Rebecca Clarke
CB&I
500 Penn Center Blvd.
Pittsburgh, PA 15235

Dear Ms. Clarke:

RE: Harrison Power, Cadiz, Harrison County, Ohio

This is in response to your transmittal, received on March 10, 2017, concerning the proposed project. The comments of the State Historic Preservation Office are submitted in accordance with the provisions of Section 106 of the National Historic Preservation Act of 1966, as amended.

The project involves construction of a new natural gas fired power station in Cadiz, Harrison County, Ohio. Based on the information submitted, it is my opinion that the proposed undertaking will not affect properties listed in or eligible for listing in the National Register of Historic Places. No further coordination with this office is necessary, unless the project changes or unless new or additional historic properties are discovered during implementation of this project. Should this happen, this office should be notified as required by 36 CFR 800.13

If you have any questions regarding this matter, please call me, at (614) 298-2000. Thank you for your cooperation.

Sincerely,

Nathan J. Young, Project Reviews Manager
Resource Protection and Review

Appendix G: Feasibility Report

Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-103

Nottingham 138 kV

April 2017

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

The Interconnection Customer proposes to install PJM Project #AC1-103, a 1050.0 MW (1026.0 MW Capacity) natural gas generating facility in Cadiz, Ohio (see Figure 2). The plant will consist of two (2) 1x1 combined cycle units. The point of interconnection will be a direct connection to AEP's Nottingham 138 kV substation (see Figure 1).

The requested backfeed date is January 30, 2020.

The requested in service date is December 30, 2020.

Attachment Facilities

Point of Interconnection (Nottingham 138 kV Substation)

To accommodate the interconnection at the Nottingham 138 kV substation, the substation will have to be expanded requiring the installation of three (3) 138 kV circuit breakers, extending the two 138 kV buses, and starting a new string (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required.

Note: This is a conceptual level proposal and will have to be reviewed by engineering in the subsequent studies to determine what is actually feasible and provides the best performance in terms of reliability.

Nottingham Station Work:

- Expand the Nottingham 138 kV substation, start a new string, extend the two 138 kV buses and install three (3) 138 kV circuit breakers (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required.
    - **Estimated Station Cost: $4,000,000**

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for Non-Direct Connection work is given in the following tables below:

For AEP building Direct Connection cost estimates:

Description	Estimated Cost
138 kV Revenue Metering	**$300,000**

Upgrade line protection and controls at the expanded Nottingham 138 kV substation.	**$300,000**
Upgrade line protection and control settings at the Knox, Brookside, Longview, and Harmon FE 138 kV substations to coordinate with the expanded Nottingham 138 kV substation. As a part of the Impact Study, PJM will coordinate with FE to identify the scope and cost to replace relays or upgrade relay settings at the remote end substations. The AC1-103 customer can expect to see a similar cost as AEP's estimate below	To be provided by FE
Upgrade line protection and control settings at the Freebyrd, Yager, and Holloway AEP 138 kV substations to coordinate with the expanded Nottingham 138 kV substation.	**$200,000**
Total	**$800,000**

Table 1

It is understood that The Interconnection Customer is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP (or FE, where noted.) The cost of The Interconnection Customer's generating plant and the costs for the line connecting the generating plant to The Interconnection Customer's switching station are not included in this report; these are assumed to be The Interconnection Customer's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

Interconnection Customer Requirements

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx

Network Impacts

The Queue Project AC1-103 was evaluated as a 1050.0 MW (Capacity 1026.0 MW) injection at the Nottingham 138kV substation in the AEP area. Project AC1-103 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-103 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Base Case Used

Summer Peak Analysis – 2020 Case

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1	
Contingency Name	Description
9038	CONTINGENCY '9038' OPEN BRANCH FROM BUS 239354 TO BUS 247460 CKT 1 / 239354 02HARMON 138 247460 05NOTTINGHAM 138 1 OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 2 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 2 END
8971_B2	CONTINGENCY '8971_B2' OPEN BRANCH FROM BUS 242932 TO BUS 247627 CKT 1 / 242932 05CANTNC 345 247627 Y2-050 TAP 345 1 END
9110_C2_05NOTTINGHAM 138-J	CONTINGENCY '9110_C2_05NOTTINGHAM 138-J' OPEN BRANCH FROM BUS 247131 TO BUS 247460 CKT 5 / 247131 05HOLLOW 138 247460 05NOTTINGHAM 138 5 OPEN BRANCH FROM BUS 247460 TO BUS 247700 CKT 1 / 247460 05NOTTINGHAM 138 247700 05YAGER 138 1 END
B2-TIE-138-810	CONTINGENCY 'B2-TIE-138-810' /* LINE 05YAGER TO 05NOTTINGHAM 138 CK 1 (FE OWNS TL) DISCONNECT BRANCH FROM BUS 247700 TO BUS 247460 CKT 1 /* 05YAGER 138 05NOTTINGHAM138 END
B2-TIE-345-521_A	CONTINGENCY 'B2-TIE-345-521_A' /* WYLIE RIDGE - TIDD 345KV APS-AEP TIE DISCONNECT BRANCH FROM BUS 235707 TO BUS 922161 CKT 1 /* 01WYLIE R 345 AA2-121 TAP END
P12_301	CONTINGENCY 'P12_301' OPEN BRANCH FROM BUS 242946 TO BUS 253965 CKT 1 / 242946 05TIDD 345 253965 15COLLIE 345 1

	END

Table 2

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

Option 1 AC1-103 Generator Deliverability															
	Contingency				Bus				Loading		Rating				
#	Type	Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	MW Con.	FG App.	
1	N-1	B2-TIE-138-810	AEP - AEP	05NOTTINGHAM-05YAGER 138 kV line	247460	247700	2	DC	57.19	109.02	ER	242	125.42		
2	N-1	8971_B2	AEP - AP	AA2-121 TAP-01WYLIE R 345 kV line	922161	235707	1	DC	95.44	101.67	NR	1542	95.94		

Table 3

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

AC1-103 Multiple Facility Contingency														
	Contingency				Bus				Loading		Rating			
#	Type	Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	MW Con.	FG App.
1	DCTL	9038	AEP - AEP	05NOTTINGHAM-05YAGER 138 kV line	247460	247700	1	DC	52.23	102.95	ER	291	147.6	1
2	LFFB	9110_C2_05NOTTINGHAM 138-J	AEP - AEP	05NOTTINGHAM-05YAGER 138 kV line	247460	247700	2	DC	54.88	110.7	ER	242	135.09	2

Table 4

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Note: Please see Appendices for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Appendix.

AC1-103 Contribution to Previously Identified Overloads															
	Contingency				Bus				Loading		Rating				
#	Type	Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	MW Con.	FG App.	
1	N-1	B2-TIE-345-521_A	AEP - DLCO	05TIDD-15COLLIE 345 kV line	242946	253965	1	DC	102.12	108.89	NR	1229	83.24	3	
2	N-1	P12_301	AEP - AP	AA2-121 TAP-01WYLIE R 345 kV line	922161	235707	1	DC	101.84	109.42	NR	1542	116.84	5	

Table 5

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

#	Over-Duty Circuit Breaker	Duty Percent with AC1-103	Duty Percent without AC1-103	Duty Percent Difference
#1	South Canton 138 kV Circuit Breaker M	100.18%	99.52%	**0.66%**
#2	South Canton 138 kV Circuit Breaker M2	100.18%	99.52%	**0.66%**
#3	South Canton 138 kV Circuit Breaker B1	100.07%	98.82%	**1.25%**

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

AC1-103 Delivery of Energy Portion of Interconnection Request															
	Contingency				Bus				Loading		Rating				
#	Type	Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	MW Con.	FG App.
1	N-1	B2-TIE-138-810	AEP - AEP	05NOTTINGHAM -05YAGER 138 kV line	247460	247700	2	DC	57.19	110.23	ER	242	128.35	

Table 6

Affected System Analysis & Mitigation

LGEE Impacts:

LGEE Impacts to be determined during later study phases (as applicable).

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

OVEC Impacts to be determined during later study phases (as applicable).

New System Reinforcements

#	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05NOTTINGHAM-05YAGER 138 kV Circuit #2	AEP-end ratings are S/N: 487 MVA S/E: 504 MVA. No upgrade is requirement from AEP. As a part of the Impact Study, PJM will coordinate with FE to make sure their equipment will not limit this line.		
#2	05NOTTINGHAM-05YAGER 138 kV Circuit #1	AEP-end ratings are S/N: 398 MVA S/E: 398 MVA. No upgrade is requirement from AEP. As a part of the Impact Study, PJM will coordinate with FE to make sure their equipment will not limit this line.		
#3	AA2-121 TAP-01WYLIE R 345 kV line	No upgrade is requirement from AEP. The overloaded portion of the AA2-121 – Wylie Ridge 345 kV line is owned by APS. As a part of the Impact Study, PJM will coordinate with APS to make sure their equipment will not limit this line.		
#4	05TIDD-15COLLIE 345 kV line	AEP-end ratings are S/N: 1409 MVA S/E: 1718 MVA. No upgrade is requirement from AEP. As a part of the Impact Study, PJM will coordinate with DLCO to make sure their equipment will not limit this line.		
#5	South Canton 138 kV Circuit Breaker M	Replace the South Canton 138 kV Circuit Breaker M	An approximate construction time will be 12 months after signing of an interconnection agreement.	**$800,000**
#\6	South Canton 138 kV Circuit Breaker M	Replace the South Canton 138 kV Circuit Breaker M2	An approximate construction time will be 12 months after signing of an interconnection agreement.	**$800,000**
#7	South Canton 138 kV Circuit Breaker M	Replace the South Canton 138 kV Circuit Breaker B1	An approximate construction time will be 12 months after signing of an interconnection agreement.	**$800,000**
			Total New Network Upgrades	**$2,400,000**

Table 7

Schedule

It is anticipated that the time between receipt of executed agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would be between 24 to 36 months after signing an interconnection agreement.

Note: The time provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed Backfeed Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this Feasibility Study, the construction of the 1050.0 MW (1026.0 MW Capacity) natural gas generating facility of The Interconnection Customer (PJM Project #AC1-103) will require the following additional interconnection charges. This plan of service will interconnect the proposed generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the The Interconnection Customer generating facility.

Cost Breakdown for Primary Point of Interconnection (Nottingham 138 kV Substation)		
Attachment Cost	Expand Nottingham 138 kV Substation	**$4,000,000**
Non-Direct Connection Cost Estimate	138 kV Revenue Metering	**$300,000**
	Upgrade line protection and controls at the expanded Nottingham 138 kV substation.	**$300,000**
	Upgrade line protection and control settings at the Freebyrd, Yager, and Holloway AEP 138 kV substations to coordinate with the expanded Nottingham 138 kV substation.	**$200,000**
	Upgrade line protection and control settings at the Knox, Brookside, Longview, and Harmon FE 138 kV substations to coordinate with the expanded Nottingham 138 kV substation. PJM will have to coordinate this upgrade with FE.	
	Replace the South Canton 138 kV Circuit Breaker M	**$800,000**
	Replace the South Canton 138 kV Circuit Breaker M2	**$800,000**
	Replace the South Canton 138 kV Circuit Breaker B1	**$800,000**
	Total Estimated Cost for Project AC1-103	**$7,200,000**

Table 8

The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. Estimates for FE and DLCO facility upgrades are not included in this document.

Appendix H: County-wide Geotechnical Report

HULL | JHA

Memorandum

TO: Mr. John Molinaro (Appalachian Partnership for Economic Growth)

FROM: Dan Pratt and Shawn McGee, P.E.

DATE: December 22, 2016

RE: Executive Summary for the Preliminary Geotechnical Exploration Letter Report at the Harrison County Industrial Park Located in Cadiz, Harrison County, Ohio; APG005.0002.

We have prepared this Executive Summary to accompany the Preliminary Geotechnical Exploration Letter Report for the Harrison County Industrial Park Site (Hull document APG005.0001) dated December 22, 2016. This summary provides relevant findings and considerations in the context of future development of commercial properties at the Site:

- The Site is located in region with a long legacy of surface and underground coal mining. The topography in the area is directly influenced by these operations; furrows, benches, and highwalls are expected throughout the area.

- Based on Hull's review of the Ohio Department of Natural Resources (ODNR) Mines of Ohio GIS, the parcels comprising the site intersect 9 mine features, specifically one *abandoned underground drift mine, 2 historic surface mines, and 6 inactive surface mines* with A, C, and D-Law permits.

- Hull completed a field exploration that consisted of advancing 20 geotechnical borings spatially distributed across the Site between December 6 through 9, 2016. Site soils consist of uncontrolled placed mine spoil; clay, silt, sand, and gravel with highly variable consistencies (i.e., soft to hard) and densities (i.e., very loose to very dense) resulting from reclamation of previously mined areas. Engineering properties of the soils vary both horizontally and vertically.

- Groundwater was not encountered during the subsurface exploration, however the hydraulic properties of mine spoil vary widely and perched zones or seasonal springs and seeps may be encountered.

- Because mine spoil is present at the Site, there is a greater than typical risk of unacceptable settlement of shallow foundations constructed when bearing on the mine spoil. Therefore, it is not recommended at this time that conventional shallow foundation systems be used to support commercial development without completing additional geotechnical borings and more detailed evaluations once site development plans and a structure are selected.

The following foundation options can be considered for the proposed Site.

- Extended type foundation;
- Rammed stone columns;
- Adjusting building design to tolerate settlement;
- Undercutting and replacement of existing material;
- Deep Dynamic Compaction; or,
- Preloading

The final choice of the foundation type should be based on the relative economic, design feasibility, and construction advantages.

- The preliminary observations presented in the Report are based on information disclosed by the limited number of borings that were spatially distributed across the Site. The purpose of this preliminary exploration was to provide basic information to assist others in the preliminary designing and planning phases of the project. Additional borings will be required at the specific location of the building once known, to develop a detailed foundation design (structural) or economic analysis of foundation alternatives. The initial information provided in this report should not be relied upon for preparing final design and construction specifications.

If you have any questions or comments, please feel free to contact Shawn McGee or Dan Pratt at (440) 232-9945 at your first opportunity.

HULL | JHA

December 22, 2016

Mr. John Molinaro, CEO and President
Appalachian Partnership for Economic Growth
35 Public Square
PO Box 456
Nelsonville, OH 45764

RE: Preliminary Geotechnical Exploration Letter Report at the Harrison County Industrial Park Located in Cadiz, Harrison County, Ohio; APG005.0001.

Dear Mr. Molinaro:

Hull & Associates, Inc. (Hull) is pleased to provide to the Appalachian Partnership for Economic Growth (APEG) this Preliminary Geotechnical Exploration Letter Report (Report) at the Harrison County Industrial Park located in Cadiz, Harrison County, Ohio (Site). The purpose of the limited geotechnical exploration is to better understand the existing subsurface conditions of the Site in anticipation of future commercial development by spatially distributing geotechnical borings across the parcels. This Report summarizes the findings and observations concerning the future development of commercial property in the context of a legacy of historic mining activities, geological hazards, and the engineering properties of the Site soils in their current condition at the time of drilling. A geotechnical engineer has planned and supervised the performance of the geotechnical engineering services, evaluated the findings, and prepared this report in accordance with industry accepted geotechnical engineering practices.

SITE AND PROJECT DESCRIPTION

The Site consists of two areas of adjacent parcels located within the Harrison County Industrial Park in the southwestern boundaries of the Village of Cadiz, Ohio. The northern group of three parcels totals approximately 195 acres and consists predominantly of open fields intersected by oil and gas infrastructure. The northern parcels are bounded by the developed corridor along Industrial Park Drive to the west, Sally Buffalo Park Reservoir to the northeast, and additional open fields to the south. The southern group of two parcels totals approximately 128 acres and also consists largely of open fields bounded by Industrial Park Drive to the north, Harrison County Airport to the south, and Route 9 to the east.

The Site areas generally coincide with ridge tops which are relatively flat. The reservoir to the east of the northern parcels possess a drainage network of small tributary valleys that dissect the flat upland areas leaving vegetated slopes. The southern parcels are incised by an approximately 50 to 60-foot deep trench running from northwest to southeast. The geometry of the trench, extensive evidence of benching in the surrounding areas, and the records of historic surface mining operations (discussed below) suggest that this trench may have been modified or excavated at an unknown time in the past to support surface or drift mining operations.

Surface and Underground Mines

Based on Hull's review of the Ohio Department of Natural Resources (ODNR) Mines of Ohio GIS, the parcels comprising the site intersect 9 mine features, specifically one abandoned underground drift mine, 2 historic surface mines, and 6 inactive surface mines with A, C, and D-Law permits (see Table 1). The underground mine has a reported coal elevation for the Lower Freeport No. 6A seam of 617 feet above sea level, which is roughly 550 feet below the average upland elevation within the Site areas. The layout, loads, and location of commercial structures were not provided prior to the field exploration. However, future loads of

reasonable magnitude and properly founded would likely pose minimal risk to inducing mine subsidence due to the attenuation of pressure with depth as well as the possibility that mine voids may have already collapsed in the past. However, once a site development plan is finalized, an evaluation of the risk associated with the underground mines located directly beneath the site should be completed to determine if additional measures should be implemented during design and construction.

Table 1 – ODNR Mining Summary

Mine Type	Mine Code/Site ID/ Permit ID	Owner	Coal Seam	Coal Elevation (ft MSL)
Abandoned Underground Drift	HN-074	Consolidation Coal Co.	Lower Freeport No. 6A	617
Historic Surface	5895	Not Listed	Not Listed	Not Listed
Historic Surface	5398	Not Listed	Not Listed	Not Listed
Inactive Surface	A-301	Consolidation Coal Co.	Not Listed	Not Listed
Inactive Surface	A-303	Consolidation Coal Co.	Not Listed	Not Listed
Inactive Surface	A-482	Consolidation Coal Co.	Not Listed	Not Listed
Inactive Surface	C-14	Consolidation Coal Co.	Not Listed	Not Listed
Inactive Surface	C-796	Consolidation Coal Co.	Not Listed	Not Listed
Inactive Surface	D-0357	Consolidation Coal Co.	Not Listed	Not Listed

In addition, extensive surface mining is evident in ODNR records, the existing topography, and the findings of the subsurface borings. Each of the 20 borings advance during the subsurface exploration encountered reclaimed strip mine spoils from ground surface to the termination depths. Mine spoil consists of variable mixtures of clay, silt, sand, gravel, and rock fragments of varying consistencies and densities (i.e., overburden excavated during surface mining operations) placed in an uncontrolled manner to reclaim the land surface after mining. Significant void spaces or in-situ coal deposits were not encountered at the boring locations – see Attachments A and C.

Geological Hazards

Hull reviewed the Landslides and Related Features of the Jewett and Flushing, Ohio Quadrangles prepared by the United States Geological Survey (USGS 1978) (See Attachment B). The proposed Site areas do not appear to intersect mapped landslide features. Rather, the surrounding slopes in the vicinity of the site are symbolized as strip mine areas designated as "bench with highwall," "multiple furrows and multiple benches," and "reclaimed by secondary use." Though no landslide features are mapped within the Site areas, the geologic formations present throughout the region are broadly susceptible to landsliding due to rapid changes via loading and/or excavation. Much of the geomorphic expression of historic landslides may have been modified through extensive reworking of the overburden due to strip mining practices.

FIELD EXPLORATION

Hull completed a field exploration that consisted of advancing 20 geotechnical borings using a Diedrich D-50 track-mounted drill rig operated by EnviroCore on December 6 through 9, 2016. Hull field personnel observed Standard Penetration Tests (SPTs), recovered split-spoon samples for laboratory analyses, and conducted visual-manual examinations of the collected samples. The borings were advanced in accessible areas spatially distributed across the Site within the parcels identified by APEG. Boring locations were

located in the field using a hand held global positioning system (GPS) unit with sub-meter accuracy. The Ohio Utility Protection Service (OUPS) and Ohio Oil and Gas Producers Underground Protection Service (OGPUPS) were notified at least 48-hours prior to drilling for clearance of underground utilities.

Split-spoon samples were collected from the borings using the SPT Method (American Society of Testing and Materials [ASTM] D1586). The SPT method involves measuring the number of blows required to drive the split spoon sampler 18 inches into the soil. Blow counts for each six (6) inch interval are recorded separately and the SPT test result is the number of blows required to advance the last 12 inches (N-value). The SPT N-value serves as an indicator of soil consistency for cohesive soils and density of granular soils. SPT data was recorded and representative soil samples were collected at 2.5-foot intervals for the upper 10 t o15 feet of depth, followed by 5-foot intervals to the termination depth of the boring for each boring. All borings were advanced to their respective target depths or auger or sampler (N-value greater than 50 blows over a 2-inch or less penetration with the split spoon sampler) refusal, whichever occurred first.

The predominant overburden soil types consisted almost exclusively of mine spoils that consisted of various amounts of sandstone, shale, and coal fragments in a soft to hard brown and grey lean clay and very loose to very dense sand and gravel. Auger refusal was encountered at 9 locations at depths ranging from 10 to 21.5 feet BGS. These auger refusal depths are assumed to represent competent bedrock though it must be noted that the heterogeneous nature of mine spoil can result in the presence of shallow boulders capable of producing auger refusal.

Table 1 summarizes the coordinates, existing ground surface elevations, depth to the top of weathered bedrock, and termination depths at each boring location. The soil borings were immediately backfilled with drill cuttings upon completion of drilling.

Table 2 – Summary of Borings

Boring	Boring Locations		Elevation of Existing Ground Surface[1]	Topsoil Thickness (in)	Depth to Auger Refusal (ft. BGS[2])	Termination Depth (ft. BGS[2])
	Latitude	Longitude				
B16-1	40.250464	-81.018703	1198	N/A	N/A	25.0
B16-2	40.253477	-81.019087	1204	N/A	N/A	25.0
B16-3	40.253193	-81.016064	1201	3.0	21.0	21.0
B16-4	40.255032	-81.013549	1225	N/A	19.0	19.0
B16-5	40.259212	-81.017310	1196	N/A	N/A	25.0
B16-6	40.262681	-81.018228	1201	6.0	N/A	25.0
B16-7	40.260058	-81.014623	1144	6.0	19.0	19.0
B16-8	40.256724	-81.014798	1226	N/A	17.5	17.5
B16-9	40.255096	-81.009472	1203	6.0	N/A	25.0
B16-10	40.257566	-81.011881	1195	3.0	10.0	10.0
B16-11	40.243052	-81.016282	1220	4.0	N/A	25.0
B16-12	40.243771	-81.013691	1171	4.0	N/A	25.0
B16-13	40.243093	-81.010057	1228	N/A	17.5	17.5
B16-14	40.242653	-81.012332	1175	5.0	16.5	16.5
B16-15	40.241650	-81.005804	1141	6.0	N/A	25.0
B16-16	40.240660	-81.011291	1168	6.0	12.5	12.5
B16-17	40.239397	-81.007539	1167	6.0	N/A	25.0
B16-18	40.241830	-81.013681	1206	6.0	N/A	25.0
B16-19	40.241306	-81.008909	1179	6.0	21.5	21.5
B16-20	40.238083	-81.006304	1148	N/A	N/A	25.0

1. Elevation data and coordinates were provided from the Ohio Geographically Referenced Program (OGRIP).
2. BGS = below existing ground surface
3. N/A = not encountered

Refer to the boring logs in Attachment C for more detailed descriptions of subsurface units, sample data, SPT results, groundwater conditions, pocket penetrometer test results, and other pertinent information. All soil borings were completed under the direct supervision of a geologist from Hull. In addition to drilling oversight, Hull personnel recorded observations of existing ground cover thicknesses, groundwater conditions, surface features, and other site observations deemed important to the planned site development.

See Figure 1 for a map that illustrates the locations of the "as drilled" borings including the coordinates of the borings.

GROUNDWATER OBSERVATIONS

Water levels in each soil boring were measured immediately upon the completion of drilling. The borings were found to be dry at completion. The boreholes were subsequently backfilled with soil cuttings and bentonite on the same day. Hydrostatic groundwater levels and upper (perched) saturation zones should be expected to fluctuate seasonally due to variations in rainfall, runoff, evapotranspiration, and other

factors. Consequently, the measured groundwater levels shown on the boring log only represent conditions at the time the readings were collected and may thus be different at the time of construction. Furthermore, the actual groundwater levels and localized saturated conditions may be observed at shallower depths during periods of heavy precipitation. As mentioned above, due to the highly heterogeneous nature of mine spoil, the hydraulic properties of the Site soils can vary widely, resulting in perched water tables and springs with potential seasonal variability.

LABORATORY TESTING PROGRAM

Soil samples collected by Hull were described based on the visual-manual examination method (ASTM D2488). Select samples collected from the borings were subjected to grain-size analyses (ASTM D422), moisture content determination (ASTM D2216), Atterberg Limits tests (ASTM D4318). The laboratory-testing program was conducted in general accordance with applicable ASTM specifications.

Laboratory testing indicated that the select soil samples tested classified as clayey sand with gravel (SC), silty sand with gravel (SM), silty sand (SM), and silty gravel with sand (GM) under the Unified Soil Classification System (USCS). Atterberg limit testing indicated that clayey samples had liquid limits that ranged from 31 to 41, and plasticity indices that ranged from 6 to 17. Moisture contents as received by the laboratory were also completed for select soil and rock samples and ranged from 9.0 to 23.6 percent.

It is anticipated that the measured moisture contents suggest in situ Site water contents will probably be above and below their optimum moisture. This would indicate that the earthwork contractor may need to moisture condition the soils (i.e., wet or dry) to achieve proper moisture content and desired compaction in some areas during earthwork activities. Proctor testing will be necessary prior to construction to characterize and evaluate moisture-density relationships of Site soils.

Copies of the laboratory test results are provided in Attachment D. Remaining soil samples will be stored at our geotechnical/materials testing laboratory for 90 days from the date of this report unless otherwise directed by you.

GEOTECHNICAL OBSERVATIONS AND CONSTRUCTION CONSIDERATIONS

Based on the proposed grading plans prepared by Hull, field observations, laboratory test results, Hull's experience with similar projects and geologic settings, and our engineering analyses; the subsurface conditions will be able to support the proposed development when the subgrade is prepared as discussed below:

Preliminary Design Considerations

Hull understands that site development plans for the proposed Harrison County Industrial Park have not been completed as of the writing of this Report. Therefore, actual structural/foundation drawings, grading plans, or structural loads were not available or provided to Hull.

The mine spoil encountered in each of the borings appears to be have been placed randomly and varies in density from very loose to very dense, and soft to hard, with variable moisture contents. The depth and engineering characteristics of the mine spoils, such as composition, strength, and compressibility are considered to be variable. There is no specific documentation available that describes in detail the origin, method of placement, or the extent of moisture and compaction control during placement. As such, without

records of reclaimed mine spoil placement monitoring and testing, the possibility exists that the spoil may contain other deleterious material not disclosed by the borings. Consequently, there is a greater than typical risk of unacceptable settlement of shallow foundations constructed when bearing on the mine spoil, or of any fill where placement records are unavailable. Therefore, it is not recommended at this time that conventional shallow foundation systems be used to support commercial development without completing additional geotechnical borings and more detailed evaluations once site development plans and a structure are selected.

The following foundation options can be considered for the proposed Site.

- An extended type foundation, such as driven piles and auger cast in place piles, which would bypass the spoil and potentially compressible soils and end bear in an appropriate soil stratum and depth.

- Modification of the fill/compressible materials by using rammed stone columns that penetrate the unsuitable material and stiffen the compressible spoil material to provide support for the foundations. If this option is chosen, a rammed stone column design and build company, such as the Geopier Foundation Company, Inc. or an engineering equivalent can be contacted for pricing and design information. Hull can assist Geopier or equivalent with the design and provide site-specific design information

- Placing the footings in the existing mine spoil and designing the building to tolerate potentially more than normal amounts of settlement. There is always the risk that conditions may exist in the mine spoil not disclosed by the borings that may result in inadequate support or excessive settlement of footings founded in the fill. If this option is selected the owner must be willing to accept this risk.

- Excavation and replacement. This option would involve the removal of the existing fill and any underlying unsuitable soils and replacing with engineered fill. As observed in the borings, the existing fill and unsuitable soils may extend to a depth of at least 10 feet BGS that would require removal.

- Deep Dynamic compaction (DDC). This option is typically used for compaction of granular materials. This option might be suitable if the building is situated in an area of the Site that has predominantly granular spoil material.

- Preloading. This option may not be feasible depending on the time constraints regarding planned construction. If this is the case, this option is not recommended.

The final choice of the foundation type should be based on the relative economic, design feasibility, and construction advantages. A system of grade beams may also be necessary to support the wall loads of the proposed structures and suitably reinforcement per structural needs.

Drainage

Though most borings were dry at the completion of drilling, it is anticipated that some water seepage may be encountered during excavation of building foundations. Dewatering and water management may be required to maintain a reasonably dry excavation and work area. The contractors should be prepared to

deal with any seepage or surface water that may accumulate in the work area. Adequate drainage should be established at the Site to minimize any increase in the moisture content of the subgrade material. Surface water runoff should be properly controlled and drained away from the work area. It should be noted that the subgrade soils are subject to shrinking and swelling whenever their seasonal moisture contents vary.

Next Steps

The preliminary observations presented in this report are based on information disclosed by the limited number of borings that were spatially distributed across the Site. The boring information must be extrapolated to determine the subsurface conditions occurring over the entire project. This extrapolation is based on the limited understanding of previous Site operations, knowledge of soil forming geological processes, and on past experience. Therefore, the observations presented in this report are based in part on the assumption that certain natural conditions will actually be encountered and not be altered during construction.

As previously discussed, the purpose of this preliminary exploration was to provide basic information to assist others in the preliminary designing and planning phases of the project. Additional borings will be required at the specific location of the building once known, to develop a detailed foundation design (structural) or economic analysis of foundation alternatives. The initial information provided in this report should not be relied upon for preparing final design and construction specifications.

CLOSING REMARKS

The evaluations, conclusions, and observations presented in this Report are based on information disclosed by the limited number of soil borings, our interpretation of the field and laboratory data obtained during the exploration, and our understanding of the project. The information obtained from the individual borings are representative of the subsurface conditions at the specific boring locations at the time of drilling, and must be extrapolated to get an understanding of the subsurface conditions between the borings advanced over the entire Site. This extrapolation is based on the knowledge of soil forming geological processes, our understanding that surface mining activities did not occur at the Site, and on past experience. Therefore, the recommendations presented in this Report are based in part on the assumption that certain natural conditions will actually be encountered and not be altered during construction. Consequently, it is recommended that Hull perform the construction observation and testing to make certain the intent of our recommendations as presented in this Report is being followed and to make real-time changes to our recommendations in the event that site conditions vary from those observed in the borings. The recommendations in this report are considered final only if Hull observes the excavation and other earthwork activities to determine if actual subsurface conditions differ from those encountered during this exploration.

Furthermore, any revision in the plans for the proposed Site from those enumerated in this Report should be brought to the attention of Hull so it may be determined if changes in the earthwork recommendations are required. If additional data are needed for design purposes or if deviations from the noted subsurface conditions are encountered during construction, they should all be brought immediately to the attention of Hull. At that time, it may be necessary for Hull to submit modified or supplementary recommendations, if needed.

STANDARD OF CARE AND LIMITATIONS

The observations presented herein are based on the level of effort and investigative techniques using that degree of care and skill ordinarily exercised under similar conditions by reputable members of the profession practicing in the same or similar locality at the time of service. No other warranties, expressed or implied, are made or intended by this report. An evaluation of past or present compliance with federal, state, or local environmental or land use laws or regulations has not been conducted. Conclusions presented by Hull regarding the Site are consistent with the level of effort specified and investigative techniques employed. Reports, opinions, letters, and other documents do not evaluate the presence or absence of any compound or parameter not specifically analyzed and reported. Hull makes no guarantees regarding the completeness or accuracy of any information obtained from public or private files or information provided by subcontractors. In addition, Hull makes no guarantees on the conditions of the Site or changes in Site records after the date reviewed as indicated in the report.

Furthermore, this letter-report is prepared and made available for the sole use of APEG and their assigns for the specific purposes mentioned above. The contents thereof may not be used or relied upon by any other person or entity, without the express written consent and authorization of APEG and Hull.

If you have any questions or comments, please feel free to contact either of the undersigned at (440) 232-9945 at your first opportunity.

Sincerely,

Daniel R. Pratt
Engineer II

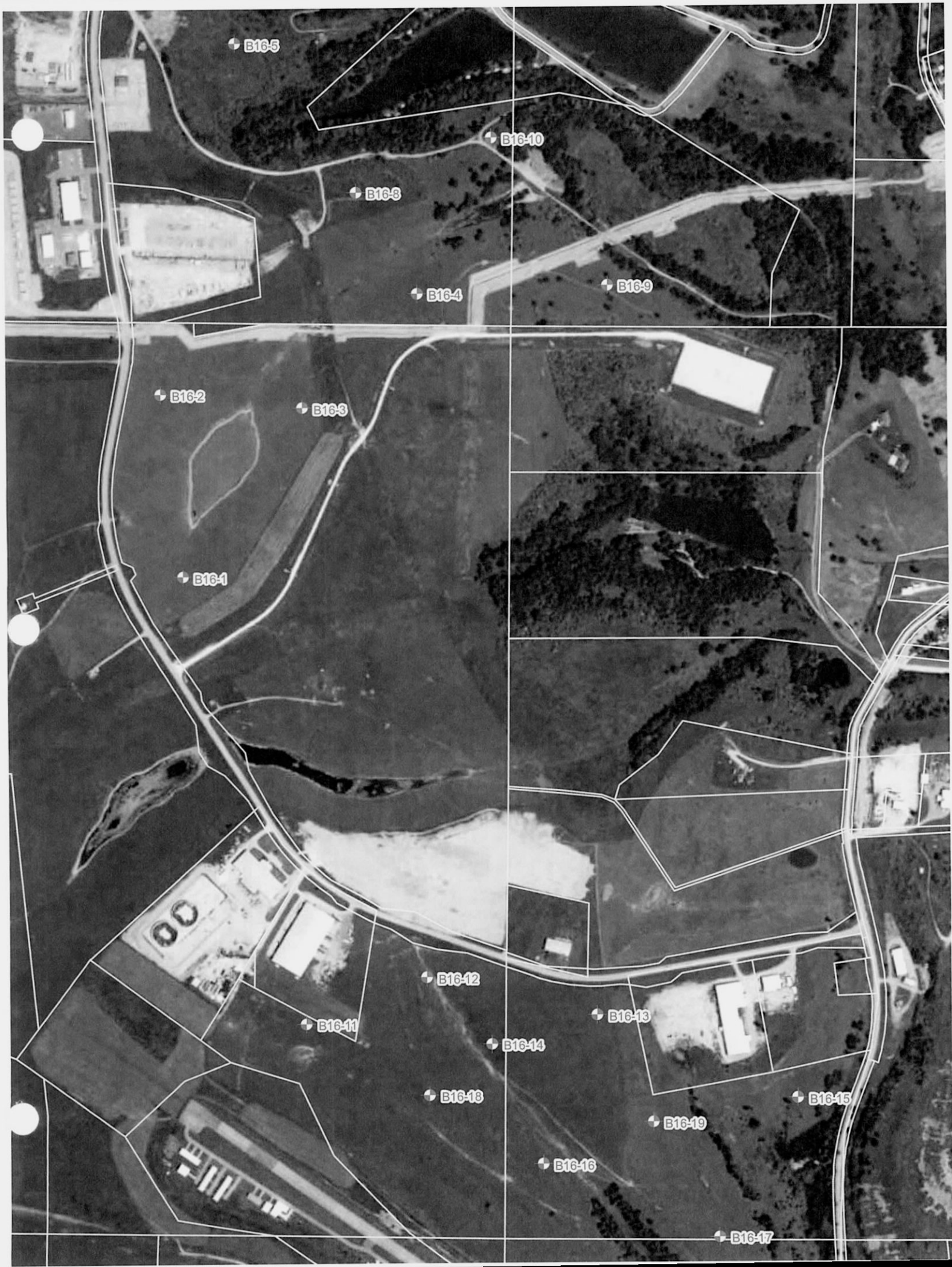
Shawn D. McGee, P.E.
Geotechnical Practice Leader

STATE OF OHIO
SHAWN
D.
McGEE
E-68761
REGISTERED
PROFESSIONAL ENGINEER

Attachments

cc: Nicholas Homrighausen, Harrison County (w/Attachments)
Paige Kelley, Jobes Henderson (w/Attachments)
Justin Lowe, P.E., Jobes Henderson (w/Attachments)

FIGURES


B16-5
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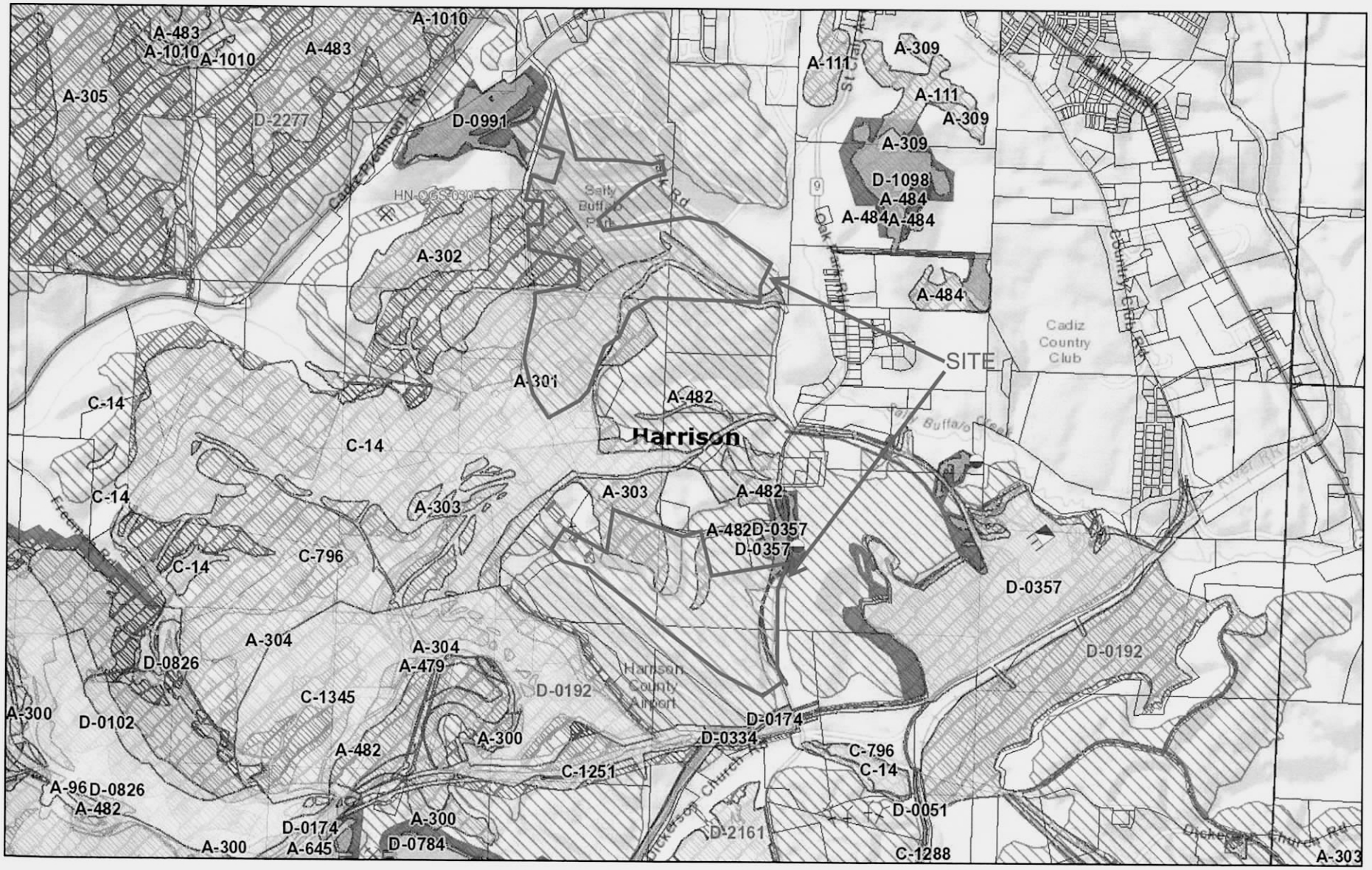
ATTACHMENT A

ODNR Mining Location GIS Map

APG005 Harrison County Industrial Park



December 16, 2016

Current

- Air Shaft
- Drift Entry
- Vertical Mine Shaft
- Slope Entry

Past

- Air Shaft
- Drift Entry
- Vertical Mine Shaft
- Slope Entry
- Locations

N

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

1:36,112

Ohio Dept. of Natural Resources

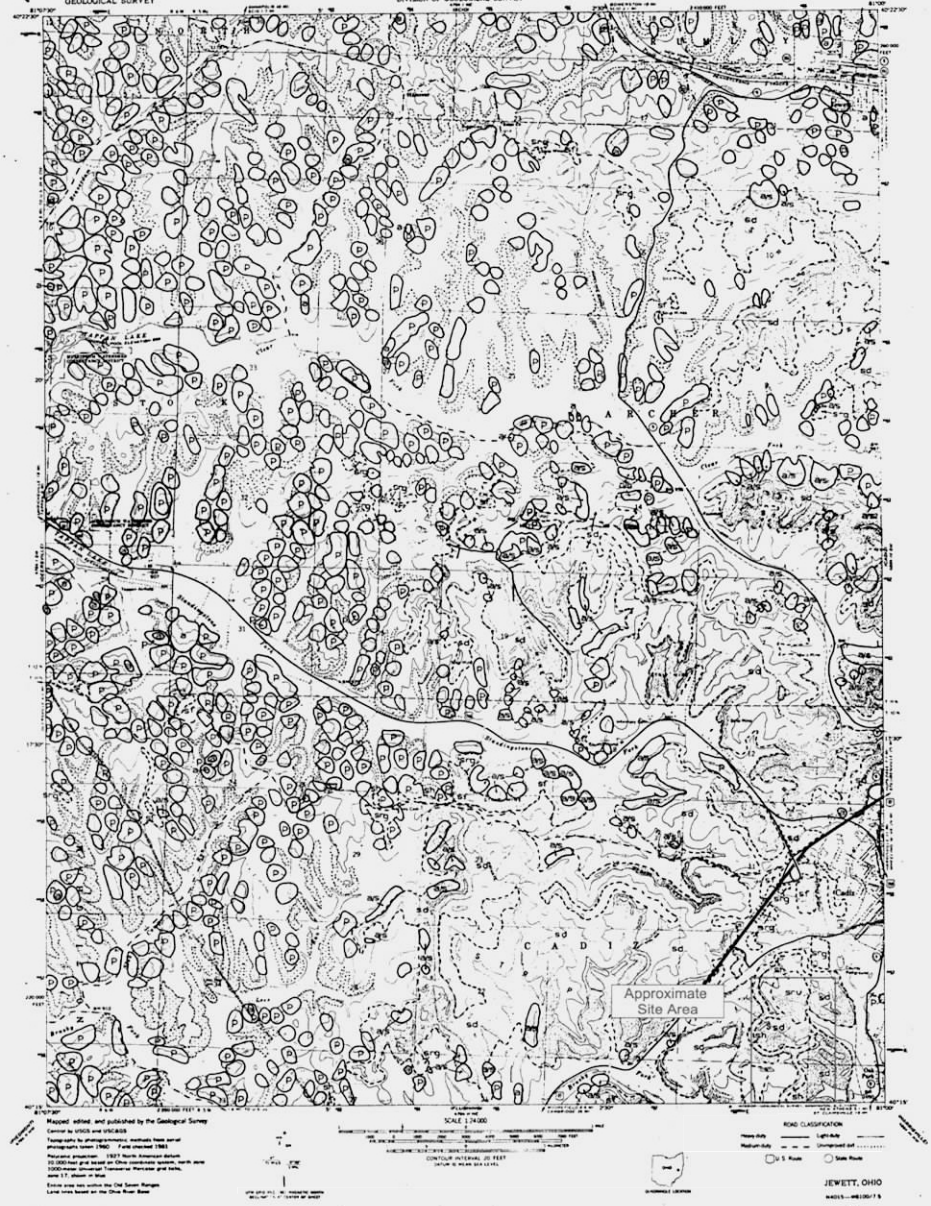
ATTACHMENT B

"Landslides and Related Features of the Jewett and Flushing, Ohio Quadrangles"
prepared by the United States Geological Survey (USGS 1978)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY

JEWETT QUADRANGLE
OHIO—HARRISON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1960. Field checked 1961

Projection: 1927 North American datum
10,000-foot grid based on Ohio coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue

Entire area lies within the Old Seven Ranges
Land lines based on the Ohio River Base

SCALE 1:24000

CONTOUR INTERVAL 20 FEET

ROAD CLASSIFICATION

JEWETT, OHIO

1994

Landslides and related features interpreted from aerial photographs:
1:40,000 scale black and white 1973
1:40,000 scale black and white 1955
1:80,000 scale black and white 1976

Photointerpretation and field check 1976. This map has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

LANDSLIDES AND RELATED FEATURES

OF THE JEWETT, OHIO QUADRANGLE

by

WILLIAM E. DAVIES and GREGORY C. OHLMACHER
1978

U. S. Geological Survey
OPEN FILE MAP 78-1053(C-8)

ACTIVE OR RECENTLY ACTIVE LANDSLIDE
Complex landslide composed of earthflow, debris slide, earth and rock slump. Identified from historical records, and from scars, debris and other field evidence. Ground extremely unstable; sliding accelerated by excavation, loading and changes in drainage conditions. May include areas with several active slides too small to be shown separately. Questioned where doubtful.

LANDSLIDE
Area of extensive hummocky ground caused by earthflow and earth and rock slump. Lacks clear evidence of active sliding. Relatively stable in natural, undisturbed state, generally not affected by small structures properly sited in areas away from the edge of the toe; can be reactivated by extensive, rapid excavation, loading, and changes in ground water and surface water conditions. Area of old landslide probably includes recent ones not identified from field evidence or otherwise documented. Upslope boundary of landslide generally defined by modified scarp, but downslope (toe) may be gradational and not well defined. Questioned where doubtful.

COLLUVIAL SLOPE
Valley wall along major streams with slope as steep as 40° (85%); stony, clayey silt soil up to 50 ft. (15 m) thick; commonly buttressed by a terrace or bench at the toe of the slope; very susceptible to sliding by cutting of toe area, removal of terrace or bench, and overloading; landslide commonly activated without apparent cause.

AREAS SUSCEPTIBLE TO DEBRIS FLOWS AND DEBRIS AVALANCHES
Primarily shallow, narrow ravines and chutes with accumulation of stony colluvium generally 10 ft. (3 m) or less in thickness; susceptible to rapid movement during intense rainfall. Most ravines designated show evidence of former debris flows and avalanches. Symbol - ⚠ - designates historical debris flow or debris avalanche.

AREAS SUSCEPTIBLE TO ROCKFALL
Steep, locally vertical, natural and man-made slopes and cliffs, 15 ft. (4.5 m) or higher, formed dominantly of sandstone, limestone, sandy shale, mudstone and claystone. Interbedded mudstone, claystone and shale weather rapidly leaving sandstone and limestone rock faces unsupported.

COVE UNDERLAIN BY CLAY LAYER
Rounded or U-shaped valley with steep concave slope of valley floor (cove) and valley heads underlain by clayey soils forming a coherent layer generally 8 ft. (2.5 m) or less in thickness. Zone of water commonly at the base of the clay layer is under 2 to 8 ft. (0.6 - 2.5 m) artesian head. Clay soil is underlain by claystone and shale. Clay slab moves as a coherent mass up to 1 ft. (0.3 m) per year; very susceptible to more rapid sliding when overloaded by fill or structure and by excavations that break the continuity of slope. Recent soil slips (earth flows) as much as 40,000 square feet (3,700 square meters) in size are common.

SOIL AND ROCK SUSCEPTIBLE TO LANDSLIDING
Soil and rock similar to that involved in landslides elsewhere in map area; primarily areas underlain by claystone, mudstone and shale associated with other rock types. Rock weathers rapidly on exposure forming clayey soil highly susceptible to sliding.

AREAS LEAST PRONE TO LANDSLIDES
Map areas in which no patterns or symbols are shown; primarily valley floors, ridge tops and broad benches; modification by excavation and fill may lead to local landslides.

The first five digits of the open file number designate the specific 1:250,000 scale map sheet of which this quadrangle is a part. The last two digits designate the position of the quadrangle in a subdivision of the 1:250,000 scale map based on rows and tiers shown in the diagram to the right. The location of this quadrangle is shown by the black square.

NOTE
Information shown is intended as a general guide to ground conditions as of the date of field check. Additional landslides and rockfalls should be anticipated in all map units. The map unit depicts the dominant condition in the area delineated and variations in slope stability may occur at any point in the unit. This map is suitable for general planning purposes and as a supplement to more detailed studies for site selection. The map cannot be used as a substitute for detailed geologic and engineering investigations to establish design and construction criteria of specific sites. Some symbols may not appear on this map because the description is applicable to a series of maps.

MAN-MADE FEATURES
Strip mines (combination of letter symbols indicates complex formed of more than one type of strip mine)

sh	bench with high wall
sf	furrowed with high wall
sd	multiple furrows and multiple benches
srg	reclaimed by grading
sru	reclaimed by secondary use
sh/r	regraded in part, high wall remains

Coal refuse banks

r	identified on aerial photographs; not classified in field check
rb	not burnt nor on fire
rbb	burnt
rbd	burning
rbs	sludge

Quarries

q	quarry site
qsb	spoil bank, quarry waste

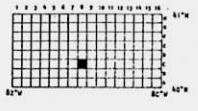
Gravel pits

g	site of gravel pit

Slides in man-made features

a/f	earth flow in fill
a/s	earth flow in strip castings
a/r	earth flow in coal refuse

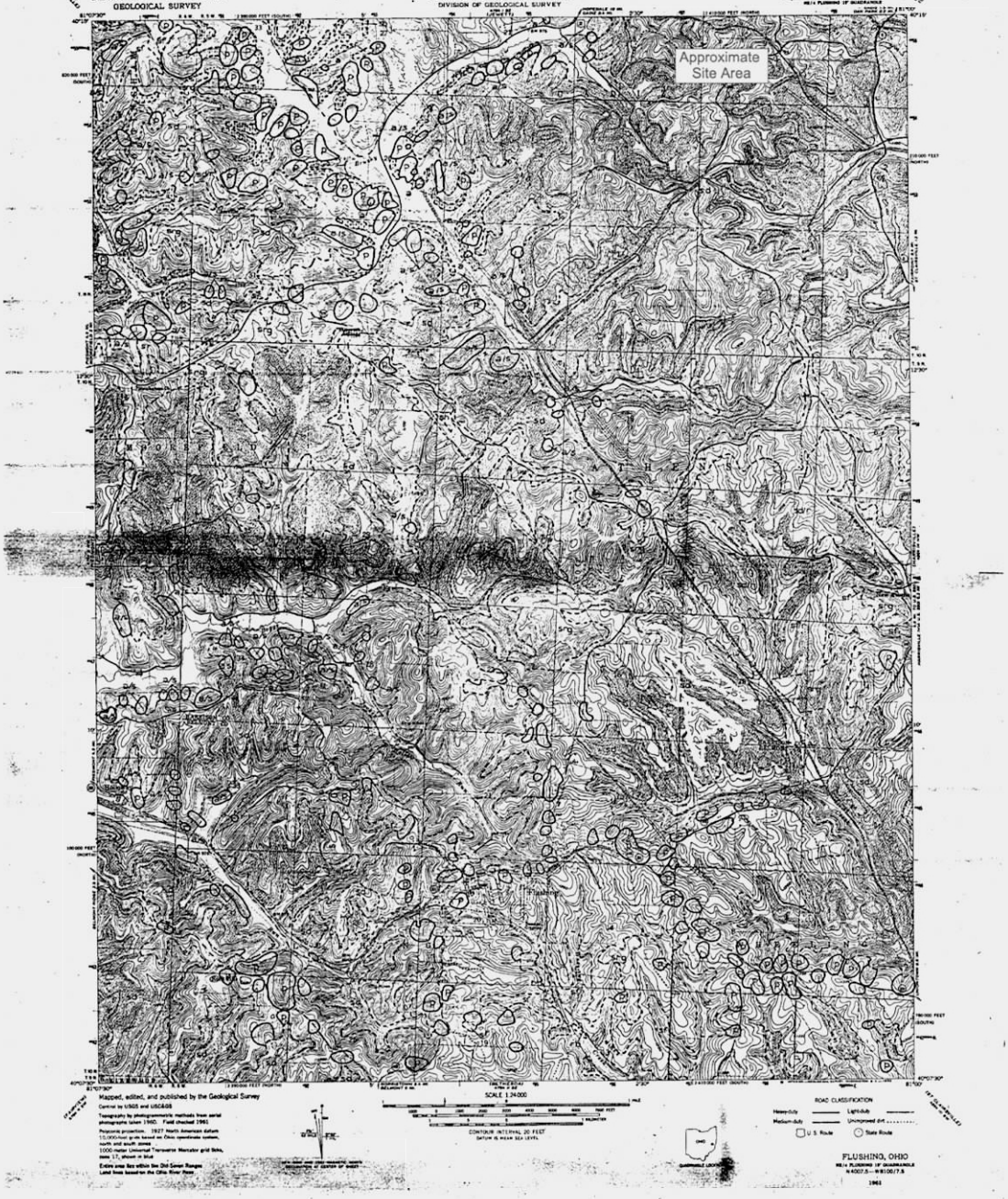
CANTON 1° x 2° MAP SHEET



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY

FLUSHING QUADRANGLE
OHIO
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1960. Field checked 1961

Projection: 1927 North American datum
10,000-foot grids based on Ohio coordinate system, north and south zones
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue

Entire area lies within the Old Seven Ranges
Land lines based on the Cities Service Plans

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
Heavy-duty — Light-duty —
Medium-duty — Unimproved dirt .....
U.S. Route ○ State Route

FLUSHING, OHIO
NE/4 FLUSHING 15' QUADRANGLE
N 4007.5—W 8100/7.5
1961

LANDSLIDES AND RELATED FEATURES

OF THE FLUSHING, OHIO QUADRANGLE

By

WILLIAM E. DAVIES and GREGORY C. DHLMACHER

1978

U. S. Geological Survey
OPEN FILE MAP 78-1057 (B-8)

Landslides and related features interpreted from aerial photographs:
1:60,000 scale black and white 1959
1:40,000 scale black and white 1973
1:80,000 scale black and white 1976

Photointerpretation and field check 1975.
This map has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

ACTIVE OR RECENTLY ACTIVE LANDSLIDE
Complex landslide composed of earthflow, debris slide, earth and rock slump. Identified from historical records, and from scars, debris and other field evidence. Ground extremely unstable; sliding accelerated by excavation, loading and changes in drainage conditions. May include areas with several active slides too small to be shown separately. Questioned where doubtful.

LANDSLIDE
Area of extensive hummocky ground caused by earthflow of earth and rock slump. Lacks clear evidence of active sliding. Relatively stable in natural, undisturbed state, generally not affected by small structures properly sited in areas away from the edge of the toe; can be reactivated by extensive, rapid excavation, loading, and changes in ground water and surface water conditions. Area of old landslide probably includes recent ones not identified from field evidence or otherwise documented. Upslope boundary of landslide generally defined by modified scarp, but downslope (toe) may be gradational and not well defined. Questioned where doubtful.

COLLUVIAL SLOPE
Valley wall along major streams with slope as steep as 40° (85%); stony, clayey silt soil up to 50 ft. (15 m) thick; commonly buttressed by a terrace or bench at the toe of the slope; very susceptible to sliding by cutting of toe area, removal of terrace or bench, and overloading; landslide commonly activated without apparent cause.

AREAS SUSCEPTIBLE TO DEBRIS FLOWS AND DEBRIS AVALANCHES
Primarily shallow, narrow ravines and chutes with accumulation of stony colluvium generally 10 ft. (3 m) or less in thickness; susceptible to rapid movement during intense rainfall. Most ravines designated show evidence of former debris flows and avalanches. Symbol - ⚠ - designates historical debris flow or debris avalanche.

AREAS SUSCEPTIBLE TO ROCKFALL
Steep, locally vertical, natural and man-made slopes and cliffs, 15 ft. (4.5 m) or higher, formed dominantly of sandstone, limestone, sandy shale, mudstone and claystone. Interbedded mudstone, claystone and shale weather rapidly leaving sandstone and limestone rock faces unsupported.

COVE UNDERLAIN BY CLAY LAYER
Rounded or U-shaped valley with steep concave slope of valley floor (coves) and valley heads underlain by clayey soils forming a coherent layer generally 8 ft. (2.5 m) or less in thickness. Zone of water commonly at the base of the clay layer is under 2 to 8 ft. (0.6 - 2.5 m) artesian head. Clay soil is underlain by claystone and shale. Clay slab moves as a coherent mass up to 1 ft. (0.3 m) per year; very susceptible to more rapid sliding when overloaded by fill or structure and by excavations that break the continuity of slope. Recent soil slips (earth flows) as much as 40,000 square feet (3,700 square meters) in size are common.

SOIL AND ROCK SUSCEPTIBLE TO LANDSLIDING
Soil and rock similar to that involved in landslides elsewhere in map area; primarily areas underlain by claystone, mudstone and shale associated with other rock types. Rock weathers rapidly on exposure forming clayey soil highly susceptible to sliding.

AREAS LEAST PRONE TO LANDSLIDES
Map areas in which no patterns or symbols are shown; primarily valley floors, ridge tops and broad benches; modifications by excavation and fill may lead to local landslides.

The first five digits of the open file number designate the specific 1:250,000 scale map sheet of which this quadrangle is a part. The last two digits designate the position of the quadrangle in a subdivision of the 1:250,000 scale map based on rows and tiers shown in the diagram to the right. The location of this quadrangle is shown by the black square.

NOTE
Information shown is intended as a general guide to ground conditions as of the date of field check. Additional landslides and rockfalls should be anticipated in all map units. The map unit depicts the dominant condition in the area delineated and variations in slope stability may occur at any point in the unit. This map is suitable for general planning purposes and as a supplement to more detailed studies for site selection. The map cannot be used as a substitute for detailed geologic and engineering investigations to establish design and construction criteria of specific sites. Some symbols may not appear on this map because the description is applicable to a series of maps.

MAN-MADE FEATURES
Strip mines (combination of letter symbols indicates complex formed of more than one type of strip mine)
- sh — bench with high wall
- sf — furrowed with high wall
- sd — multiple furrows and multiple benches
- srg — reclaimed by grading
- sru — reclaimed by secondary use
- sh/r — regraded in part, high wall remains

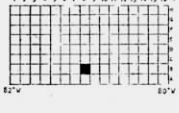
Coal refuse banks
- r — identified on aerial photographs; not classified in field check
- rb — not burnt nor on fire
- rbb — burnt
- rbd — burning
- rbs — sludge

Quarries
- q — quarry site
- qub — spoil bank, quarry waste

Gravel pits
- g — site of gravel pit

Slides in man-made features
- a/f — earth flow in fill
- a/s — earth flow in strip castings
- a/r — earth flow in coal refuse

CANTON 1° x 2° MAP SHEET



ATTACHMENT C

General Information, Drilling Procedures, and Logs of Borings
Definition of Terms Used to Describe Subsurface Materials on Boring Logs
Geotechnical Soil Boring Logs – 20 Borings

HULL

GENERAL INFORMATION, DRILLING PROCEDURES AND LOGS OF BORINGS

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standardized methods of investigation of subsurface conditions concerning geotechnical engineering considerations. Borings were drilled with either a truck-mounted or ATV-mounted drill rig.

Drive split-barrel sampling was performed in 1.5-foot increments at intervals not exceeding 5 feet. In the event the sampler encountered resistance to penetration of 6 inches or less after 50 blows of the drop more representative samples were preserved from each sampling increment.

In borings where rock was cored, NXM or NQ sized diamond coring tools were used.

Depth of water recorded in the boring is measured from the top of existing ground surface to the top of water level. Initial water level measurement indicates the water level observed during the drilling activities and the static water level indicates the water level observed immediately after drilling. In relatively pervious soils, such as sandy soils, the indicated depth is considered a reliable groundwater level for that date. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils. In fine-grained soils, such as clay and silt, such readings are less reliable.

In the laboratory, all samples were described based on the visual-manual examination soil classification system in accordance with ASTM D2488. Moisture contents of representative fine-grained soil samples were determined. A limited number of samples, considered representative of foundation materials present, were selected for performance of grain-size analyses and plasticity characteristics test.

The boring logs included in the Attachment have been prepared on the basis of the field record of drilling and sampling, and the results of the laboratory examination and testing of samples. Stratification lines on the boring logs indicating changes in soil stratigraphy represent depths of changes approximated by the driller, by sampling effort and recovery, and by laboratory test results. Actual depths to changes may differ somewhat from the estimated depths, or transitions may occur gradually and not be sharply defined. The boring logs presented in this report therefore contain both factual and interpretative information and are not an exact copy of the field log.

Although it is considered that the borings have disclosed information generally representative of actual site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil/rock samples will be stored at Hull & Associates Inc.'s laboratory for a period of 90 days. After this period of time, they will be discarded, unless notified to the contrary by the client.

HULL

DEFINITION OF TERMS USED TO DESCRIBE SUBSURFACE MATERIALS ON BORING LOGS

DESCRIPTION OF SOILS

The soil descriptions on the boring logs are based on visual-manual examination (ASTM D 2488) of soil samples, Standard Penetration Test (ASTM D 1586) results, and the results of laboratory testing on selected soil samples. Soils are described as to density or consistency, color, grain size distribution, moisture condition, and other pertinent properties, in that order. SAA indicates material can be described as "Same As Above", with any differences noted. Soil descriptions are according to the following criteria, with the principal constituent, written in capital letters.

Standard Penetration Test (ASTM D 1586)

In the Standard Penetration Test, a 2.0-inch outside diameter, 1.375-inch inside diameter split-spoon sampler is driven 18 inches into soil by means of a 140-pound hammer falling freely through a vertical distance of 30 inches. The sampler is normally driven in three successive 6-inch increments. The total number of blows required to drive the split spoon sampler over 12 inches of penetration during the second and third successive increments is the Standard Penetration Test N-Value. If the blow count for any half foot increment exceeded 50, the SPT was stopped and the distance the sampler was driven was measured and recorded (e.g., 50/3 indicates 50 blows were recorded for a 3-inch penetration).

Sampling method abbreviations

Methods by which soil samples are collected for analysis are abbreviated as follows:

AS - Auger Sample - directly from auger flight
SP - Split Spoon Sample
ST - Shelby Tube Sample
RC - Rock Core
DP - Direct Push Sample

Density of cohesionless soils

Density of **cohesionless** soils is based upon results of Standard Penetration Tests as indicated below:

Density Term	N-Value (Blows per foot)
Very loose	0-4
Loose	5-10
Medium Dense	11-30
Dense	31-50
Very Dense	Over 50

Consistency of cohesive soils

Consistency of cohesive soils is based on Standard Penetration Test results and the unconfined compressive strength.

Consistency Term	N-Value (Blows per foot)	Unconfined Compressive Strength (tons per square foot)
Very soft	<2	<0.25
Soft	2-4	0.25-0.5
Medium stiff	5-8	0.5-1.0
Stiff	9-15	1.0-2.0
Very stiff	16-30	2.0-4.0
Hard	>30	>4.0

Color

Soil color is described in basic terms, such as brown, black, red, grey, and yellow. If the soil is a uniform color throughout, the term is single, modified by adjectives such as light and dark. If the predominant color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled".

Component definitions by grain size (ASTM D 653)

Material	Definitions	Fractions	Sieve Limits	
			Upper	Lower
Boulders	Material too large to pass through an opening 12 in. square.			
Cobbles	Material passing through a 12 in. square opening and retained on the 3-inch sieve.			
Gravel	Material passing the 3 in. sieve and retained on 1/4 in. (No. 4) sieve.	Coarse Fine	3 in 3/4 in.	3/4 in No. 4 (1/4in.)
Sand	Material passing the No. 4 sieve and retained on the No. 200 Sieve.	Coarse Medium Fine	No. 4 (1/4") No. 10 (1/8") No. 40 (1/32")	No. 10 (1/8") No. 40 (1/32") No. 200
Silt	Material passing the No. 200 sieve, which is usually non-plastic or very slightly plastic in character and exhibits little or no strength when air dried.		No. 200	
Clay	Material passing the No. 200 sieve, which can also be made to exhibit plasticity within a certain range of moisture contents and which exhibits considerable strength when air dried.		No. 200	

Soil constituents may be stated in terms of percentages (by weight) of gravel, sand, and fines, as follows:

Trace - particles of a given size range present, but present at <5%
Few - 5 to 15%
Little - 15 to 25%
Some - 30 to 45%
Mostly - 50 to 100%

Moisture condition

Moisture contents may be written as dry, moist or wet as described below:

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible moisture
Wet	Visible free water, usually soil below the water table

DESCRIPTION OF ROCK

The following terms are used to describe the degree of weathering of the rock specimen relative to that of the comparable unweathered parent rock. (Do not confuse relative strength/hardness with weathering.):

Unweathered	No evidence of any chemical or mechanical alternation of the rock mass. Mineral crystals have a bright appearance with no discoloration. Fractures show little or no staining on surfaces.
Slightly Weathered	<10% of rock volume altered. Slight discoloration of the surface w/minor alterations along open fractures.
Moderately Weathered	Portions of the rock mass are discolored as evident by a dull appearance. Surfaces may have a pitted appearance. Isolated zones of varying rock strengths due to alteration may be present. 10 to 15 percent of the rock volume presents alterations.
Highly Weathered	Entire rock mass appears discolored and dull. Some pockets of slightly to moderately weathered rock may be present and some areas of severely weathered materials may be present.
Severely Weathered	Majority of the rock mass reduced to a soil-like state with visible relict rock texture. Zones of more resistant rock may be present, but the material can generally be molded and crumbled by hand pressures.

The following terms are used to describe the relative strength/hardness of the bedrock:

Very Weak	Can be easily scratched by fingernail or knife. Pieces 1 inch (25 mm) or more in thickness can be broken by finger pressure.
Weak	Can be grooved or gouged readily by a knife or pick. Can be excavated in small fragments by moderate blows of a pick point. Small, thin pieces can be broken by finger pressure.
Moderately Strong	Can be scratched with a knife or pick. Grooves or gouges to ¼" (6mm) deep can be excavated by hand blows of a geologist's pick. Requires moderate hammer blows to detach specimen.
Strong	Can be scratched with a knife or pick only with difficulty. Requires hard hammer blows to detach specimen.
Very Strong	Cannot be scratched by a knife or sharp pick. Breaking of hand specimens requires hard repeated blows of the geologist hammer.

Rock Quality Designation, RQD – This value is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core recovered.

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BORING NUMBER B16-1

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/6/16 **COMPLETED** 12/6/16
GROUND ELEVATION 1198 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.250464,-81.018703
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		MINE SPOIL: Medium dense, ROCK FRAGMENTS, clay, sand, trace coal, moist	SS 1	78	6-4-8			15.1				
			SS 2	78	5-5-6							
5		MINE SPOIL: Loose, ROCK FRAGMENTS, clay, sand, trace coal, moist	SS 3	67	4-3-5							
			SS 4	50	3-3-3							
10												
15			SS 5	11	4-3-4							
20			SS 6	44	3-4-4							
25		MINE SPOIL: Medium dense, ROCK FRAGMENTS, clay, sand, trace coal, moist	SS 7	17	6-9-9							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-2

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/6/16 **COMPLETED** 12/6/16
GROUND ELEVATION 1204 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING —
COORDINATES 40.253477,-81.019087
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		MINE SPOIL: Medium dense, clayey SAND with gravel, moist (SC).	SS 1	50	5-6-9							
5			SS 2	89	5-6-7			14.2	34	22	12	44
		MINE SPOIL: Medium dense, clayey SAND with gravel, trace coal, moist.	SS 3	56	7-14-11							
10			SS 4	50	5-6-7							
15		MINE SPOIL: Very dense, clayey SAND with gravel, trace coal, moist.	SS 5	47	4-6-50							
20			SS 6	19	10-5-50							
25			DNS 7	0	13-50/1							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-3

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/6/16 **COMPLETED** 12/6/16
GROUND ELEVATION 1201 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.253193,-81.016064
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (3")										
		MINE SPOIL: Stiff, gray, lean CLAY, some shale, sandstone and limestone fragments, few sand, trace coal, moist.	SS 1	39	3-7-8							
5		MINE SPOIL: Hard, gray, lean CLAY, some shale, sandstone and limestone fragments, few sand, trace coal, moist.	SS 2	36	6-50/5							
10		MINE SPOIL: Cobbles										
		MINE SPOIL: Loose, ROCK FRAGMENTS comprised of limestone and sandstone, moist.	SS 3	17	10-6-4							
15			SS 4	22	3-4-5							
20		MINE SPOIL: Stiff, lean CLAY, some rock fragments and sand, moist.	SS 5	39	2-5-5							

Auger refusal at 21 feet.
Bottom of borehole at 21 feet.

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BORING NUMBER B16-4

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/7/16 **COMPLETED** 12/7/16
GROUND ELEVATION 1225 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.255032,-81.013549
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		MINE SPOIL: Loose, brown and gray, silty SAND with gravel, some fock fragments, moist (SM).	SS 1	61	4-5-5							
5			SS 2	72	3-4-5			15.2	33	24	9	50
			SS 3	78	4-3-5							
10		MINE SPOIL: Very loose, brown and gray, silty SAND with gravel, some fock fragments, moist.	SS 4	33	3-2-2							
15		MINE SPOIL: Loose, brown and gray, silty SAND with gravel, some fock fragments, moist.	SS 5	61	4-4-3			17.4				
		MINE SPOIL: Very dense, brown and gray, silty SAND with gravel, some fock fragments, moist.	SS 6	75	50/2							
		Auger refusal at 19 feet. Bottom of borehole at 19 feet.										

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BORING NUMBER B16-5

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/8/16 **COMPLETED** 12/8/16
GROUND ELEVATION 1196 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.259212,-81.01731
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		MINE SPOIL: Medium dense, brown, ROCK FRAGMENTS, some clay, sand, and coal fragments, moist.	SS 1	61	3-5-9			17.4				
5		MINE SPOIL: Loose, brown, ROCK FRAGMENTS, some clay, sand, and coal fragments, moist.	SS 2	56	3-3-3			16.1				
			SS 3	44	3-4-3							
10		MINE SPOIL: Medium dense, brown, ROCK FRAGMENTS, some clay, sand, and coal fragments, moist.	SS 4	11	5-7-6							
15		MINE SPOIL: Loose, brown, ROCK FRAGMENTS, some clay, sand, and coal fragments, moist.	SS 5	17	7-3-6							
20			SS 6	33	5-6-4							
25		MINE SPOIL: Very dense, brown, ROCK FRAGMENTS, some clay, sand, and coal fragments, moist.	SS 7	40	7-50/4							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-6

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/7/16 **COMPLETED** 12/7/16
GROUND ELEVATION 1201 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.262681,-81.018228
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (6")										
		MINE SPOIL: Very stiff, gray, lean CLAY, some sandstone, shale, limestone, and coal fragments, moist.	SS 1	72	13-9-18							
5		MINE SPOIL: Stiff, gray, lean CLAY, some sandstone, shale, limestone, and coal fragments, moist.	SS 2	67	7-6-9							
		MINE SPOIL: Medium stiff, gray, lean CLAY, some sandstone, shale, limestone, and coal fragments, moist.	SS 3	17	4-3-5							
10		MINE SPOIL: Very stiff, gray, lean CLAY, some sandstone, shale, limestone, and coal fragments, moist.	SS 4	78	7-13-12			10.1	41	24	17	
15		MINE SPOIL: Stiff, gray, lean CLAY, some sandstone, shale, limestone, and coal fragments, moist.	SS 5	56	12-8-5							
20			SS 6	67	5-4-7							
25			SS 7	72	4-6-4							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-7

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/7/16 **COMPLETED** 12/7/16
GROUND ELEVATION 1144 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.260058,-81.014623
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (6")										
		MINE SPOIL: Stiff, gray lean CLAY, some sand, gravel, and coal fragments, moist.	SS 1	72	4-5-8			19.3	34	21	13	
5			SS 2	17	2-3-6							
		MINE SPOIL: Hard, gray lean CLAY, some sand, gravel, and coal fragments, moist.	SS 3	133	7-50/3							
		MINE SPOIL: Cobbles.										
10		MINE SPOIL: Medium stiff, gray lean CLAY, some sand, gravel, and coal fragments, moist.	SS 4	78	5-3-4							
15		MINE SPOIL: Stiff, gray lean CLAY, some sand, gravel, and coal fragments, moist.	SS 5	39	8-7-4			9.3				
		MINE SPOIL: Hard, gray lean CLAY, some sand, gravel, and coal fragments, moist.	SS 6	0	50/3							
		Auger refusal at 19 feet. Bottom of borehole at 19 feet.										

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BORING NUMBER B16-8

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/7/16 **COMPLETED** 12/7/16
GROUND ELEVATION 1226 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING — DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING —
COORDINATES 40.256724,-81.014798
AFTER DRILLING —

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		MINE SPOIL: Medium dense, ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 1	78	5-7-9							
5		MINE SPOIL: Loose, ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 2	67	4-4-5							
		MINE SPOIL: Medium dense, ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 3	67	4-5-6							
10		MINE SPOIL: Loose, ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 4	72	7-4-5							
15			SS 5	56	6-4-5							

Auger refusal at 17.5 feet.
Bottom of borehole at 17.5 feet.

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BORING NUMBER B16-9

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/7/16 **COMPLETED** 12/7/16
GROUND ELEVATION 1203 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.255096,-81.009472
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (6")										
		MINE SPOIL: Medium dense, brown ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 1	78	7-9-4							
		MINE SPOIL: Very dense, brown ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 2	200	50/3							
5		MNE SPOIL: Cobbles.										
		MINE SPOIL: Medium dense, brown ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 3	72	4-5-6			17.7	40	24	16	
			SS 4	67	4-4-10			17.5				
10												
			SS 5	78	6-5-21							
15												
			SS 6	72	11-6-7							
20												
			SS 7	83	8-9-10							
25												

Bottom of borehole at 25 feet.

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BORING NUMBER B16-10

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/7/16 **COMPLETED** 12/7/16
GROUND ELEVATION 1203 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.256667,-81.009135
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (3")										
		MINE SPOIL: Medium dense, brown, ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 1	44	5-10-7							
5			SS 2	56	3-7-7			15.1				
			SS 3	44	7-5-6							
10		MINE SPOIL: Very dense, brown, ROCK FRAGMENTS, some clay and sand, trace coal, moist.	SS 4	56	3-5-50/4							

Auger refusal at 10 feet.
Bottom of borehole at 10 feet.

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BORING NUMBER B16-11

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/9/16 **COMPLETED** 12/9/16
GROUND ELEVATION 1220 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING —
COORDINATES 40.243052,-81.016282
AFTER DRILLING —

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (4")										
		MINE SPOIL: Stiff, gray, lean CLAY, some sand, rock fragments, and coal, moist.	SS 1	72	4-5-10			12.7	34	25	9	
5			SS 2	67	5-7-7							
		MINE SPOIL: Medium stiff, gray, lean CLAY, some sand, rock fragments, and coal, moist.	SS 3	61	3-3-3							
10			SS 4	28	3-2-3							
15			SS 5	17	3-4-3							
		MINE SPOIL: Stiff, gray, lean CLAY, some sand, rock fragments, and coal, moist.	SS 6	39	5-5-6							
20												
25			SS 7	78	6-8-6							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-12

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/9/16 **COMPLETED** 12/9/16
GROUND ELEVATION 1171 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.243771,-81.013691
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (4")										
		MINE SPOIL: Loose, brown, silty SAND, some rock fragments, trace coal, moist.	SS 1	89	4-3-4			16.4				
5		MINE SPOIL: Medium dense, brown, silty SAND, some rock fragments, trace coal, moist.	SS 2	56	7-6-5							
		MINE SPOIL: Very loose, brown, silty SAND, some rock fragments, trace coal, moist (SM).	SS 3	22	3-2-2			11.6	31	25	6	40
10		MINE SPOIL: Loose, brown, silty SAND, some rock fragments, trace coal, moist.	SS 4	22	2-3-3							
15		MINE SPOIL: Very dense, brown, lean CLAY, some rock fragments and sand, trace coal, moist.	SS 5	67	18-26-36							
20		MINE SPOIL: Loose, brown, silty SAND, some rock fragments, trace coal, moist.	SS 6	33	4-3-4							
25			SS 7	67	3-5-4							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-13

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/8/16 **COMPLETED** 12/8/16
GROUND ELEVATION 1228 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING — DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.243093,-81.010057
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		MINE SPOIL: Stiff, gray and brown, lean CLAY, some rock fragments and sand, moist.	SS 1	83	5-3-11							
5		MINE SPOIL: Very stiff, gray and brown, lean CLAY, some rock fragments, sand and coal, moist.	SS 2	61	6-7-17							
		MINE SPOIL: Stiff, gray and brown, lean CLAY, some rock fragments and sand, moist.	SS 3	72	5-5-5							
10		MINE SPOIL: Medium stiff, gray and brown, lean CLAY, some rock fragments and sand, moist.	SS 4	22	3-3-4							
15		MINE SPOIL: Hard, gray and brown, lean CLAY, some rock fragments and sand, moist.	SS 5	50	8-50/2							
		MINE SPOIL: Cobbles.										

Auger refusal at 17.5 feet.
Bottom of borehole at 17.5 feet.

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BORING NUMBER B16-14

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/8/16 **COMPLETED** 12/8/16
GROUND ELEVATION 1175 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.242653,-81.012332
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (5")										
		MINE SPOIL: Stiff, gray, lean CLAY, some rock fragments and sand, trace coal, moist.	SS 1	72	4-4-5							
5			SS 2	39	2-7-5			21.4	33	25	8	
			SS 3	50	2-1-12							
10		MINE SPOIL: Soft, gray, lean CLAY, some rock fragments and sand, trace coal, moist.	SS 4	50	2-2-2							
15			SS 5	61	2-2-2							
		Auger refusal at 16.5 feet. Bottom of borehole at 16.5 feet.										

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BORING NUMBER B16-15

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/8/16 **COMPLETED** 12/8/16
GROUND ELEVATION 1141 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.241650,-81.005804
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (6")										
		MINE SPOIL: Stiff, gray, lean CLAY, rock fragments and send, trace coal, moist.	SS 1	56	5-5-5							
5			SS 2	67	3-3-7							
		Cobbles										
10		MINE SPOIL: Very stiff, gray, lean CLAY, rock fragments and send, trace coal, moist.	SS 3	33	26-18-10							
15		MINE SPOIL: Medium stiff, gray, lean CLAY, rock fragments and send, trace coal, moist.	SS 4	56	3-3-4							
20		MINE SPOIL: Stiff, gray, lean CLAY, rock fragments and send, trace coal, moist.	SS 5	0	5-7-4							
25		MINE SPOIL: Very stiff, gray, lean CLAY, rock fragments and send, trace coal, moist.	SS 6	44	7-9-8							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-16

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/9/16 **COMPLETED** 12/9/16
GROUND ELEVATION 1168 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.240660,-81.011291
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (6")										
		MINE SPOIL: Medium dense, gray, silty GRAVEL with sand, trace coal, moist.	SS 1	89	6-9-10			14.8				
5			SS 2	72	5-5-7							
		MINE SPOIL: Loose, gray, silty GRAVEL with sand, trace coal, moist (GM).	SS 3	78	6-5-4			9.0	38	29	9	23
10		MINE SPOIL: Medium dense, gray, silty GRAVEL with sand, trace coal, moist.	SS 4	78	6-5-7							
		MINE SPOIL: Cobbles										

Auger refusal at 12.5 feet.
Bottom of borehole at 12.5 feet.

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BORING NUMBER B16-17

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/8/16 **COMPLETED** 12/8/16
GROUND ELEVATION 1167 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.239397,-81.007539
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (6")										
		MINE SPOIL: Medium dense, brown, ROCK FRAGMENTS, some clay and sand, trace clay, moist.	SS 1	28	6-9-7			23.6				
5			SS 2	39	5-5-6							
			SS 3	83	5-5-9							
10			SS 4	39	5-9-11							
15			SS 5	67	4-7-4							
20		MINE SPOIL: Loose, brown, ROCK FRAGMENTS, some clay and sand, trace clay, moist.	SS 6	61	4-4-4							
25		MINE SPOIL: Medium dense, brown, ROCK FRAGMENTS, some clay and sand, trace clay, moist.	SS 7	61	6-5-6							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-18

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/8/16 **COMPLETED** 12/8/16
GROUND ELEVATION 1206 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING — DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.241830,-81.013681
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (6")										
		MINE SPOIL: Stiff, brown, lean CLAY, some rock fragments and sand, moist.	SS 1	56	5-8-4							
5			SS 2	61	6-4-5							
		MINE SPOIL: Very stiff, brown, lean CLAY, some rock fragments and sand, moist.	SS 3	72	5-7-10							
10		MINE SPOIL: Stiff, brown, lean CLAY, some rock fragments and sand, moist.	SS 4	56	8-6-6							
15		MINE SPOIL: Medium stiff, brown, lean CLAY, some rock fragments and sand, moist.	SS 5	39	4-4-4							
20		MINE SPOIL: Medium stiff, brown, lean CLAY, some rock fragments, coal, and sand, moist.	SS 6	50	5-3-4							
25		MINE SPOIL: Stiff, brown, lean CLAY, some rock fragments, coal, and sand, moist.	SS 7	61	8-4-6							

Bottom of borehole at 25 feet.

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BORING NUMBER B16-19

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/8/16 **COMPLETED** 12/8/16
GROUND ELEVATION 1179 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.241306,-81.008909
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (6")										
		MINE SPOIL: Loose, brown ROCK FRAGMENTS, some clay, sand, and coal fragments, moist.	SS 1	78	3-3-6			20.4	35	22	13	
5		MINE SPOIL: Medium dense, brown ROCK FRAGMENTS, some clay, sand, and coal fragments, moist.	SS 2	33	5-7-6							
			SS 3	78	5-7-16			11.3				
10			SS 4	33	8-5-10							
15			SS 5	50	5-5-9							
20			SS 6	61	7-7-5							

Auger refusal at 21.5 feet.
Bottom of borehole at 21.5 feet.

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BORING NUMBER B16-20

CLIENT Appalachian Partnership for Economic Growth
PROJECT NAME Harrison Co. Industrial Park
PROJECT NUMBER APG005
PROJECT LOCATION Cadiz, Ohio
DATE STARTED 12/8/16 **COMPLETED** 12/8/16
GROUND ELEVATION 1148 ft
DRILLING CONTRACTOR EnviroCore
GROUND WATER LEVELS:
RIG TYPE Diedrich D-50 **DRILLING METHOD** 3.25" Hollow Stem Auger
AT TIME OF DRILLING --- DRY
LOGGED BY D. Sansone **CHECKED BY** D. Pratt
AT END OF DRILLING ---
COORDINATES 40.238083,-81.006304
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		MINE SPOIL: Medium stiff, gray, lean CLAY, some sand, rock fragments, and coal, moist.	SS 1	72	4-4-4							
5			SS 2	72	3-2-3							
		MINE SPOIL: Stiff, gray, lean CLAY, some sand, rock fragments, and coal, moist.	SS 3	78	3-4-5			16.4				
10		MINE SPOIL: Medium stiff, gray, lean CLAY, some sand, rock fragments, and coal, moist.	SS 4	33	3-3-5							
15		MINE SPOIL: Stiff, gray, lean CLAY, some sand, rock fragments, and coal, moist.	SS 5	78	3-3-6							
20		MINE SPOIL: Medium stiff, gray, lean CLAY, some sand, rock fragments, and coal, moist.	SS 6	67	3-4-3			16.3	35	23	12	
25			SS 7	50	3-3-5							

Bottom of borehole at 25 feet.

ATTACHMENT D

Geotechnical Laboratory Testing Results

Resource International, Inc.

SUMMARY OF LABORATORY RESULTS

PROJECT HARRISON COUNTY INDUSTRIAL PARK (NORTH) **RII PROJECT NO.:** N-16-034-10

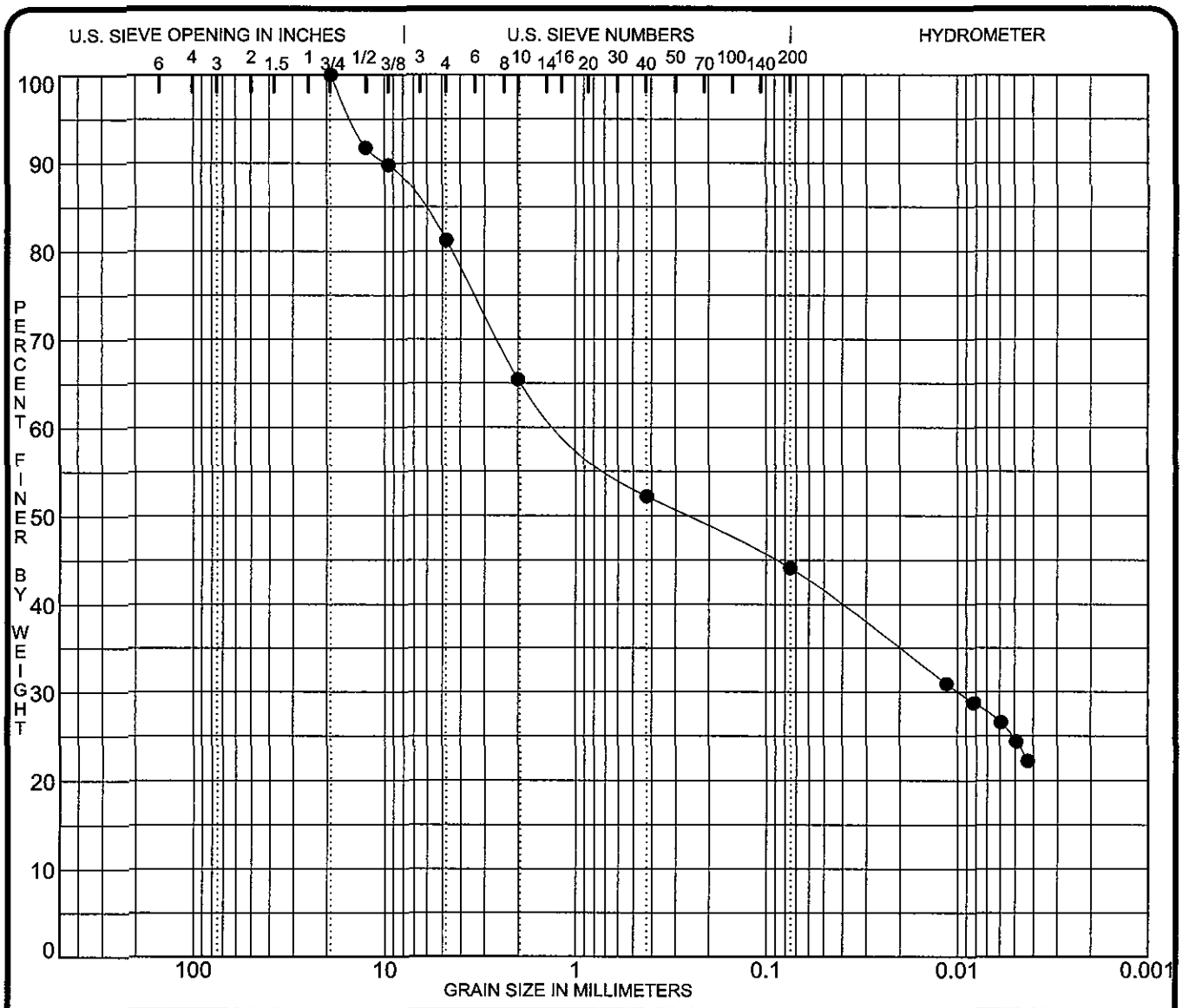
Borehole	Sample	Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	%<#200 Sieve	Classification	LOI
B-16-1	SS-1	1.0	15.1						
B-16-10	SS-2	3.5	15.1						
B-16-2	SS-2	3.5	14.2	34	22	12	44	CLAYEY SAND with GRAVEL SC	
B-16-4	SS-2	3.5	15.2	33	24	9	50	SILTY SAND with GRAVEL SM	
B-16-4	SS-5	13.5	17.4						
B-16-5	SS-1	1.0	17.4						
B-16-5	SS-2	3.5	16.1						
B-16-6	SS-4	8.5	10.1	41	24	17			
B-16-7	SS-1	1.0	19.3	34	21	13			
B-16-7	SS-5	13.5	9.3						
B-16-9	SS-3	6.0	17.7	40	24	16			
B-16-9	SS-4	8.5	17.5						

Resource International, Inc.

SUMMARY OF LABORATORY RESULTS

PROJECT HARRISON COUNTY INDUSTRIAL PARK (SOUTH) **RII PROJECT NO.:** N-16-034-11

Borehole	Sample	Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	%<#200 Sieve	Classification	LOI
B-16-11	SS-1	1.0	12.7	34	25	9			
B-16-12	SS-1	1.0	16.4						
B-16-12	SS-3	6.0	11.6	31	25	6	40	SILTY SAND SM	
B-16-14	SS-2	3.5	21.4	33	25	8			
B-16-16	SS-1	1.0	14.8						
B-16-16	SS-3	6.0	9.0	38	29	9	23	SILTY GRAVEL with SAND GM	
B-16-17	SS-1	1.0	23.6						
B-16-19	SS-1	1.0	20.4	35	22	13			
B-16-19	SS-3	6.0	11.3						
B-16-20	SS-3	6.0	16.4						
B-16-20	SS-6	18.5	16.3	35	23	12			



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

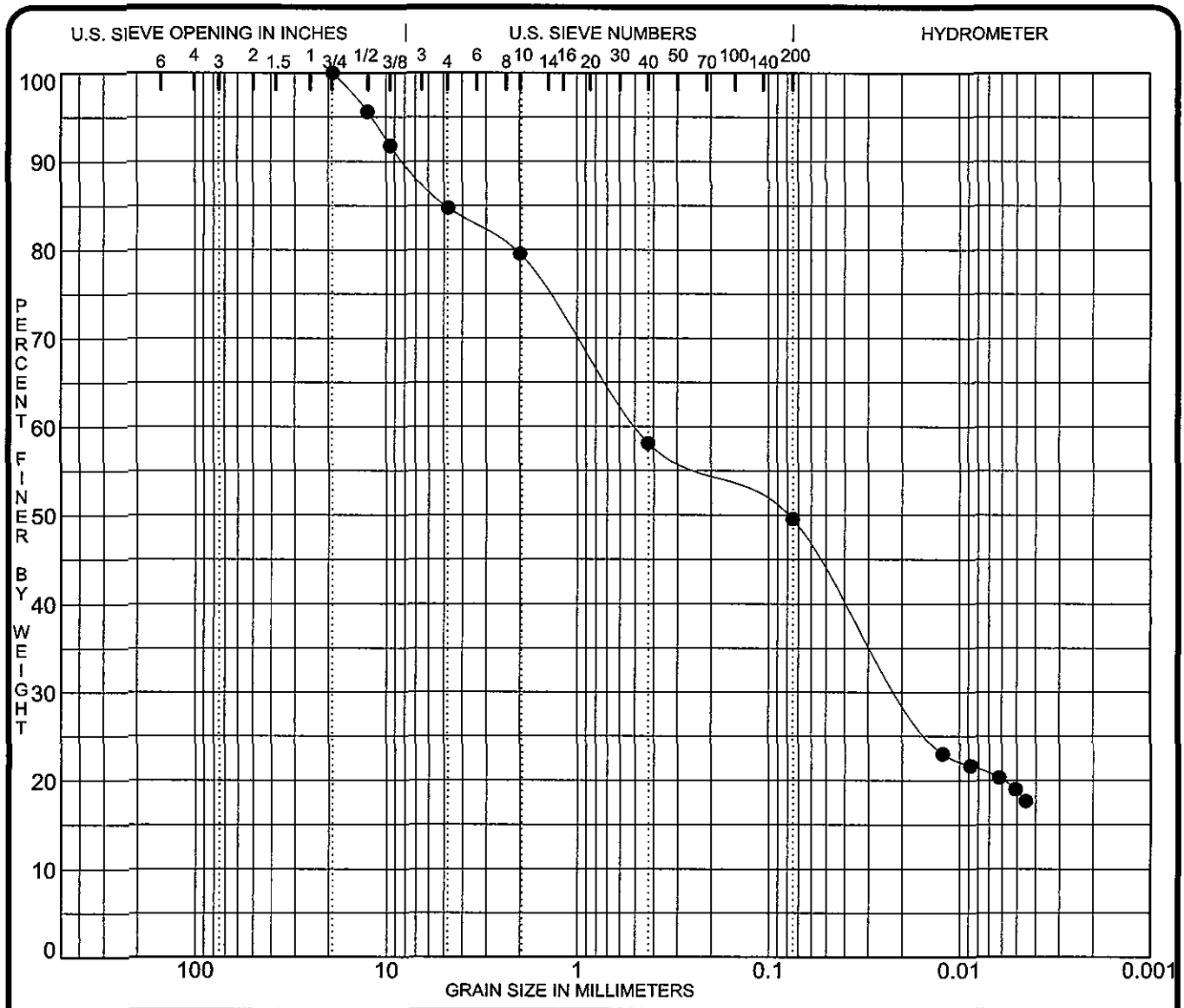
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-16-2	3.5	CLAYEY SAND with GRAVEL SC	14	34	22	12		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-16-2	3.5	19.00	1.06	0.010		0.0	18.8	15.8	13.3	8.1	19.5	24.6

PROJECT Harrison County Industrial Park (North) PROJECT NO. N-16-034-10

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

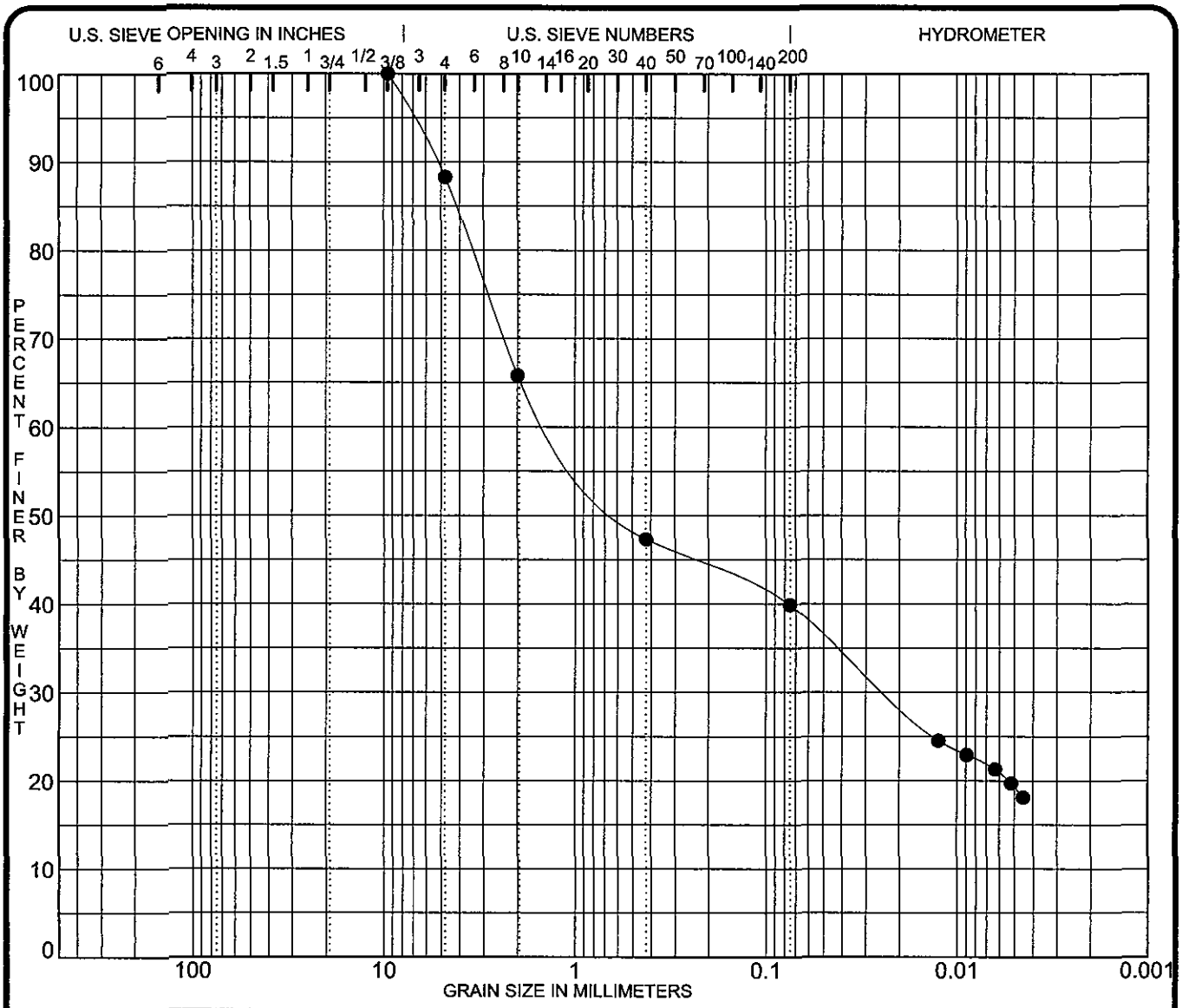
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-16-4	3.5	SILTY SAND with GRAVEL SM	15	33	24	9		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-16-4	3.5	19.00	0.49	0.020		0.0	15.3	5.2	21.4	8.6	30.8	18.8

PROJECT Harrison County Industrial Park (North) PROJECT NO. N-16-034-10

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

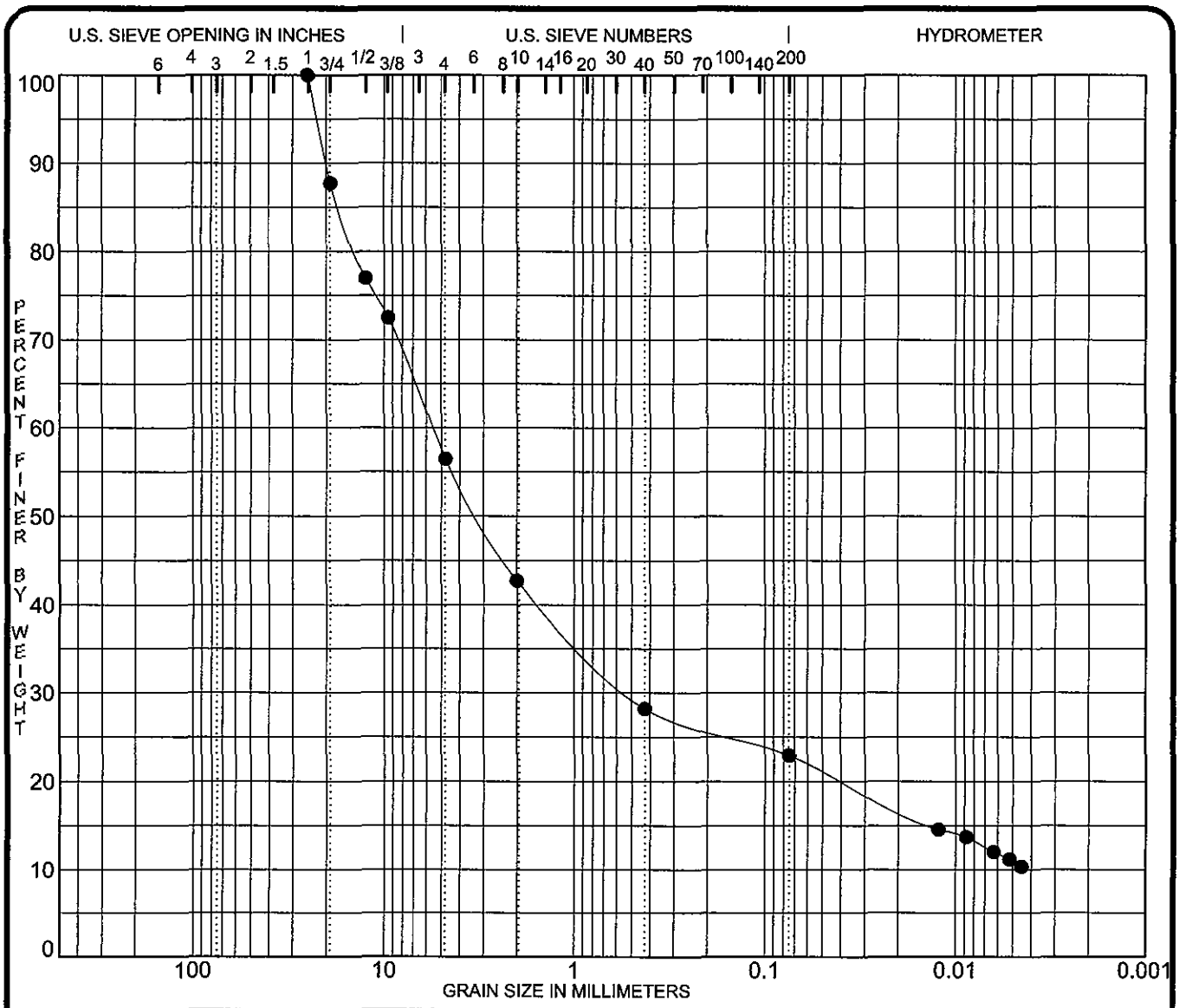
Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
● B-16-12	6.0	SILTY SAND SM	12	31	25	6		

Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
● B-16-12	6.0	9.50	1.23	0.024		0.0	11.7	22.5	18.5	7.4	20.6	19.3

PROJECT Harrison County Industrial Park (South) PROJECT NO. N-16-034-11

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-16-16	6.0	SILTY GRAVEL with SAND GM	9	38	29	9		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-16-16	6.0	25.00	5.53	0.515		12.3	31.3	13.8	14.5	5.3	12.0	11.0

PROJECT Harrison County Industrial Park (South) PROJECT NO. N-16-034-11

GRADATION CURVES

RII

Appendix I: Letter to Airport

EmberClear

3000 Wilcrest Drive, Suite 200 Houston TX 77042

September 21, 2017

Mr. Hamilton
Harrison County Airport
43000 Airport Road
Cadiz, OH 43907

Dear Sir,

As you are aware EmberClear is developing and plans to build an approximately 1,050 MW power plant in the Harrison County Industrial Park, known as Harrison Power LLC (HPL). The project location is across the street and south of the MarkWest gas processing facility also located in the industrial park.

HPL is to the north and west of the airport and is not in the flight plan. We will also have two stacks that are approximately 165 feet. Additionally, we have had two public comment meetings on the site at the Sally Buffalo Creek on May 18, 2017, and at the Cadiz library on July 27, 2017. The placed ads in the local paper prior to each meeting and a local reporter covered the second meeting with an article, subsequently. Mr. Nicholas Homrighausen stated to me that he had explained the opportunity for the Village and the County some time back.

HPL wanted to notify you directly of our intent and we look forward to working with you. EmberClear's chief engineer is an avid pilot and he looks forward to meeting you soon as do I. If you have any questions or comments, please do not hesitate to contact me at your convenience at 888-582-4460 ext. 44.

Sincerely,

Stephen Goff
Vice President