Gavin Fly Ash Reservoir

Gavin Power, LLC

2019 Annual Groundwater Monitoring and Corrective Action Report

Gavin Power Plant
Cheshire, Ohio

31 January 2020

Project No.: 0505619

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31 January 2020

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2019 Annual Groundwater Monitoring and Corrective Action Report

Gavin Power Plant
Cheshire, Ohio

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Acronyms and Abbreviations

Name	Description
ASD	Alternate Source Demonstration
CCR	Coal combustion residual
CFR	Code of Federal Regulations
ERM	ERM Consulting & Engineering, Inc.
FAR	Fly Ash Reservoir
Gavin	Gavin Power, LLC
Plant	General James M. Gavin Power Plant
RWL	Residual Waste Landfill
SSI	Statistically significant increase
TDS	Total dissolved solids

EXECUTIVE SUMMARY

On behalf of Gavin Power, LLC (Gavin), ERM Consulting & Engineering, Inc. (ERM) has prepared this 2019 Annual Groundwater Monitoring and Corrective Action Report summarizing groundwater sampling activities at the Fly Ash Reservoir (FAR) at the General James M. Gavin Power Plant (Plant) in Cheshire, Ohio. The FAR is one of three regulated coal combustion residual (CCR) management units at the Plant that are subject to regulation under Title 40, Code of Federal Regulations, Part 257, Subpart D (40 CFR § 257.50 *et seq.*), also known as the CCR Rule.

This report documents the status of the groundwater monitoring program for the FAR, which includes the following as required by 40 CFR § 257.90(e):

- A summary of key actions completed;
- A description of problems encountered and actions taken to resolve the problems; and
- Identification of key activities for the coming year.

The FAR CCR unit groundwater monitoring program began 2019 in a “detection monitoring” program status as defined by 40 CFR § 257.94 and remains in detection monitoring at the end of the 2019 reporting period. Groundwater monitoring in 2019 consisted of two semi-annual monitoring events completed in March and September 2019, which included groundwater level measurements and subsequent groundwater sampling. Groundwater level measurements were used to construct updated groundwater potentiometric surface maps for each of the geologic units monitored.

Groundwater samples were collected for laboratory analysis of CCR Rule Appendix III constituents and the results were compared to previously calculated upgradient well prediction limits to identify statistically significant increases (SSIs) for downgradient wells. The following locations and analytes exhibited SSIs in 2019:

Well	Date Sampled	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids (TDS)
2016-01	Mar-2019	ϕ	ϕ	ϕ	ϕ	X	ϕ	ϕ
	Sep-2019	ϕ	ϕ	ϕ	ϕ	X	ϕ	ϕ
2016-02	Mar-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	X
	Sep-2019	ϕ	X	ϕ	ϕ	ϕ	ϕ	X
2016-07	Mar-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
2016-08	Mar-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
9910	Mar-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ

Notes: ϕ = No SSI; X = SSI; SSI = statistically significant increase

Each identified SSI was evaluated in the corresponding attached Alternate Source Demonstration (ASD) Report. The ASD reports identify regional background (total dissolved solids [TDS] and calcium at 2016-02) and cement-bentonite grout from well installation (pH at 2016-01) as the sources of these SSIs; therefore, these two wells remain in detection monitoring at the conclusion of 2019. Accordingly, no remedial actions were selected, initiated, or performed in 2019.

1. INTRODUCTION

The General James M. Gavin Power Plant (Plant) is a coal-fired generating station located in Gallia County in Cheshire, Ohio, along the Ohio River. The Plant encompasses three regulated coal combustion residual (CCR) management units that are subject to regulation under Title 40, Code of Federal Regulations, Part 257, Subpart D (40 CFR § 257.50 *et seq.*), also known as the CCR Rule: the Residual Waste Landfill (RWL), the Fly Ash Reservoir (FAR), and the Bottom Ash Pond. The FAR is approximately 300 acres in area and located 2.5 miles northwest of the Plant (Figure 1-1). From the mid-1970s until January 1995, fly ash was sluiced from the Plant to the former Stingy Run stream valley. The settled CCR materials were retained behind the Stingy Run Fly Ash Dam in the FAR. After January 1995, CCR materials were placed in the state-permitted RWL. The Ohio Environmental Protection Agency approved the FAR Closure Plan in 2016. Closure of the Fly Ash Reservoir is currently in progress and expected to be completed in 2020.

This report was produced by ERM Consulting & Engineering, Inc. (ERM), on behalf of Gavin Power, LLC, and documents the status of the groundwater monitoring program for the FAR, which includes the following as required by 40 CFR § 257.90(e):

- A summary of key actions completed;
- A description of problems encountered and actions taken to resolve the problems; and
- Identification of key activities for the coming year.

Consistent with the notification requirements of the CCR Rule, this annual groundwater monitoring report will be posted to the Plant operating record no later than 31 January 2020 (40 CFR § 257.105(h)(1)). Within 30 days of placing the report in the operating record, notification will be made to Ohio Environmental Protection Agency, and the report will be placed on the Plant publicly accessible internet site (40 CFR § 257.106(h)(1), 257.107(h)(1)). Table 1-1 cross-references the reporting requirements under the CCR Rule with the contents of this report.

Table 1-1: Regulatory Requirement Cross-References

Regulatory Citation in 40 CFR Part 257, Subpart D	Requirement (paraphrased)	Where Addressed in This Report
§ 257.90(e)	Status of the groundwater monitoring program.	Section 2
§ 257.90(e)	Summarize key actions completed.	Sections 2.3 and 3.1
§ 257.90(e)	Describe any problems encountered and actions taken to resolve problems.	Section 2.3
§ 257.90(e)	Key activities for upcoming year.	Section 4.0
§ 257.90(e)(1)	Map, aerial image, or diagram of coal combustion residual (CCR) Unit and monitoring wells.	Figure 2-1
§ 257.90(e)(2)	Identification of new monitoring wells installed or abandoned during the preceding year and narrative description.	Sections 2.4, 4.0
§ 257.90(e)(3)	Summary of groundwater data, wells sampled, date sampled, and whether sample was required under detection or assessment monitoring.	Section 2.3, 3.2, Appendix C
§ 257.90(e)(4)	Narrative discussion of any transition between monitoring programs.	Section 4.0
§ 257.94(e)(2) (via § 257.90(e)(5))	Any Alternate Source Demonstration (ASD) reports and related certifications.	Appendices A–B

2. PROGRAM STATUS § 257.90(E)

2.1 Monitoring Well Network

Hydrogeology within the FAR is characterized by a shallow zone of saturation that overlies an upper aquifer system that consists of sandstone and interbedded clay and shale units. The uppermost aquifer system, which includes the Morgantown Sandstone and the Cow Run Sandstone, is overlain by the Clarksburg Red Beds, which act as a confining layer.

Figure 2-1 provides the Morgantown and Cow Run monitoring well locations on the site location map. Wells 2016-01 and 2016-02 in the federal sampling program were decommissioned in 2019, after the fall sampling event, due to expansion activities associated with the RWL (Figure 2-1). Replacement wells were installed in fall 2019 along the western boundary of the RWL. The replacement wells will be surveyed and developed in 2020 and incorporated into the monitoring program as replacements for 2016-01 and 2016-02.

2.2 Previous Groundwater Monitoring Activities

The FAR monitoring wells were sampled eight times between August 2016 and July 2017 to establish upgradient well baseline data. Prediction limits were developed using the baseline data and compared to the July 2017 downgradient well results, consistent with the CCR Rule and the Groundwater Monitoring Plan Appendix G Statistical Analysis Plan developed for Gavin (ERM 2017). This comparison resulted in the identification of statistically significant increases (SSIs) for Appendix III analytes in the downgradient FAR wells, which were reported in the 2017 Annual Groundwater Monitoring and Corrective Action Report (ERM 2018a). ERM prepared an Alternate Source Demonstration (ASD) Report (ERM 2018b) to address these SSIs. Downgradient results from the spring and fall 2018 sampling were reported in the 2018 Annual Groundwater Monitoring and Corrective Action Report (ERM 2019a) and SSIs associated with the 2018 results were addressed in additional ASD reports (ERM 2018c and ERM 2019b). Each ASD report concluded that SSIs resulted from alternate sources, and thus the CCR unit remained in detection monitoring. Table 2-1 and Table 2-2 below summarize SSIs identified in 2017 and 2018. Note some wells did not have sufficient volume of water for sampling (e.g., 9910). Downgradient wells 96149 and 96160 were included in the First Semiannual Sampling Event of 2018 Alternate Source Demonstration Report (2018c), but are not currently part of the certified monitoring well network and are not included in this report.

Table 2-1: Previous SSIs for Morgantown Downgradient Wells

Well	Date Sampled	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
2016-01	Jul-2017	ϕ	ϕ	ϕ	X	ϕ	ϕ	ϕ
	Mar-2018	ϕ	ϕ	ϕ	X	X	ϕ	ϕ
	Sep-2018	ϕ	ϕ	ϕ	X	X	ϕ	ϕ
2016-07	Jul-2017	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Mar-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
9910	Jul-2017	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	Mar-2018	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	Sep-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ

Notes: ϕ = No SSI; X = SSI; NA = Not Applicable; SSI = statistically significant increase

Table 2-2: Previous SSIs for Cow Run Downgradient Wells

Well	Date Sampled	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
2016-02	Jul-2017	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Mar-2018	ϕ	X	X	ϕ	ϕ	ϕ	ϕ
	Sep-2018	ϕ	X	X	ϕ	ϕ	ϕ	ϕ
2016-08	Jul-2017	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	May-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ

Notes: ϕ = No SSI; X = SSI; NA = Not Applicable; SSI = statistically significant increase

2.3 2019 Sampling Summary

Groundwater samples were collected in 2019 as part of the detection monitoring program under 40 CFR § 257.94 and analyzed for the constituents listed in Appendix III to 40 CFR Part 257, Subpart D. Tables 2-3 and 2-4 provide a summary of the 2019 sample dates and the well gradient designation (upgradient or downgradient of the CCR unit) for the FAR monitoring well network.

Some monitoring wells could not be sampled due to insufficient water, significant depths to groundwater and/or pump malfunctions in 2019. In an effort to resolve these and other sampling challenges that resulted in the inability to collect samples in 2019, Gavin pilot-tested no-purge sampling in 2019.

Table 2-3: 2019 Sampling Dates for FAR Morgantown Well Network

Sample Date	Upgradient Wells							Downgradient Wells		
	2016-03	2016-05	2016-11	96148	96152	96153R	96154R	2016-01	2016-07	9910
15 Mar 2019	X							X		
26 Mar 2019		Dry							X	X
27 Mar 2019			Dry							
28 Mar 2019				NS	X					
29 Mar 2019						X	X			
19 Sep 2019						X	X			
21 Sep 2019								X		
22 Sep 2019					X				X	X
24 Sep 2019	X		Dry							
26 Sep 2019				X						

Notes: FAR = Fly Ash Reservoir; NS = not sampled

Sampling of certain Morgantown wells was limited in 2019 by the following factors:

(1) Wells with sampling events marked with “Dry” had an insufficient volume of water to allow collection of samples.

(2) Sample attempted for upgradient monitoring well 96148 during the March 2019 sampling event but no sample collected due to a pump malfunction.

(3) Upgradient well 96156 was noted as damaged and could not be sampled in 2019.

Table 2-4: 2019 Sampling Dates for FAR Cow Run Well Network

Sample Date	Upgradient Wells						Downgradient Wells	
	2016-04	**2016-06**	**2016-09**	**2016-10**	**96147**	**MW-20**	**2016-02**	**2016-08**
15 Mar 2019	X						X	
26 Mar 2019		X						X
27 Mar 2019			NS	X				
28 Mar 2019					NS			
19 Sep 2019						X		
21 Sep 2019							X	
22 Sep 2019		X						X
24 Sep 2019	X		X	X				
27 Oct 2019			X					
29 Oct 2019						X		
6 Nov 2019					X			

Notes: FAR = Fly Ash Reservoir; NS = not sampled

Sampling of certain Cow Run wells was limited in 2019 by the following factors:

(1) Well 2016-09 was not sampled during the March 2019 sampling event due to high turbidity (>1000 Nephelometric Turbidity units [NTU]).

(2) Well 96147 was not sampled during the March 2019 sampling event due to a pump malfunction.

2.4 Monitoring Well Installation

As reported in the initial Gavin FAR ASD Report for 2017 (ERM 2018b), Gavin intended to install additional monitoring wells along the downgradient boundary of the FAR in 2018. In December 2018, Gavin attempted to install additional wells downgradient of the FAR, but at the first selected drilling location, the Morgantown Sandstone was absent. This prevented the installation of a monitoring well in this targeted interval; as a result the drilling program was suspended. Gavin plans to evaluate the potential to resume installing these monitoring wells at the downgradient boundary of the FAR after construction activities at the northern end of the RWL are completed, which is currently anticipated to be in 2020.

2.5 Data Quality

ERM reviewed field and laboratory documentation to assess the validity, reliability, and usability of the analytical results. Samples collected in 2019 were analyzed by TestAmerica of North Canton, Ohio. Data quality information reviewed for these results included field sampling forms, chain-of-custody documentation, holding times, laboratory methods, cooler temperatures, laboratory method blanks, laboratory control sample recoveries, field duplicate samples, matrix spikes/matrix spike duplicates, quantitation limits, and equipment blanks. Data qualifiers were appended to results in the project database as appropriate based on laboratory quality measurements (e.g., control sample recoveries) and field quality measurements (e.g., agreement between normal and field duplicate samples). The data quality review found the laboratory analytical results to be valid, reliable, and usable for decision-making purposes with the listed qualifiers. No analytical results were rejected.

3. 2019 RESULTS

3.1 2019 Groundwater Flow Direction and Velocity

Depth to groundwater measurements were collected in March and September 2019 at each monitoring well prior to each sampling event. Groundwater elevations, calculated by subtracting the depth to groundwater from the surveyed reference elevation for each well, were established for each sampling event. Groundwater elevations, interpreted potentiometric surface maps, and interpreted groundwater flow directions for wells screened in the Morgantown Sandstone and Cow Run Sandstone for March and September 2019 are presented on Figures 3-1 through 3-4.

The principal direction of groundwater flow in the uppermost aquifer system under the FAR (both in the Morgantown Sandstone and Cow Run Sandstone) is from the north and northwest to the south and southeast, toward the Ohio River. Groundwater velocity estimates are presented in the next sections.

3.1.1 Morgantown Sandstone Groundwater Velocity

A horizontal hydraulic gradient of 0.010 was calculated for the Morgantown Sandstone using groundwater elevations calculated at Wells 96154R and 2016-21. Based on the measured horizontal hydraulic gradient, a hydraulic conductivity of 7.18 x 10^{-5} centimeters per second (Geosyntec 2012), and an estimated effective porosity value of 0.01 for fractured bedrock, the velocity of groundwater through the Morgantown sandstone is estimated to be about 80 feet/year.

3.1.2 Cow Run Sandstone Groundwater Velocity

A horizontal hydraulic gradient of 0.015 was calculated for the Cow Run Sandstone using groundwater elevations calculated at Wells 2016-09 and 9631 (fall 2019 only). Based on the measured horizontal hydraulic gradient, a hydraulic conductivity of 2.92 x 10^{-5} centimeters per second (Geosyntec 2012), and an effective porosity value of 0.01 for fractured bedrock, the velocity of groundwater through the Cow Run sandstone is estimated to be about 46 feet/year.

3.2 Comparison of Results to Prediction Limits

Consistent with the CCR Rule and with Gavin's Statistical Analysis Plan (ERM 2017), a prediction limit approach was used to identify potential impacts to groundwater. Upper prediction limits were developed for the Appendix III parameters; in the case of pH, a lower prediction limit was also developed. The 2018 Alternate Source Demonstration (ERM 2018b) provides documentation of the most recent revisions of the upper and lower prediction limits for the FAR.

3.2.1 March 2019 Sampling Event Results

Tables 3-1 and 3-2 summarize SSIs observed in the Morgantown and Cow Run downgradient wells for the first semi-annual sampling event of 2019. The event took place between 15 March and 26 March 2019.

Table 3-1: SSIs from March 2019 Sampling Event—Morgantown

Analyte	Monitoring Well		
	2016-01	2016-07	9910
Boron	ϕ	ϕ	ϕ
Calcium	ϕ	ϕ	ϕ
Chloride	ϕ	ϕ	ϕ
Fluoride	ϕ	ϕ	ϕ
pH	X	ϕ	ϕ
Sulfate	ϕ	ϕ	ϕ
Total Dissolved Solids	ϕ	ϕ	ϕ

Notes: ϕ = No SSI; X = SSI; SSI = statistically significant increase
Results are for the downgradient wells sampled on 15–26 March 2019.

Table 3-2: SSIs from March 2019 Sampling Event—Cow Run

Analyte	Monitoring Well	
	2016-02	2016-08
Boron	ϕ	ϕ
Calcium	ϕ	ϕ
Chloride	ϕ	ϕ
Fluoride	ϕ	ϕ
pH	ϕ	ϕ
Sulfate	ϕ	ϕ
Total Dissolved Solids	X	ϕ

Notes: ϕ = No SSI; X = SSI; SSI = statistically significant increase
Results are for the downgradient wells sampled on 15–26 March 2019.

Alternate sources were identified for each of the SSIs identified in the March sampling event data as documented in the First Gavin FAR Semiannual Sampling Event of 2019 ASD Report (ERM 2019c). This ASD Report identified regional background (TDS), naturally occurring brine or mineral-bearing rock (TDS), and cement-bentonite grout from well construction (pH) as the alternate sources for these SSIs.

3.2.2 September 2019 Sampling Event Results

Tables 3-3 and 3-4 summarizes a comparison of the September 2019 results to the identified SSIs based on prediction limits for the following analytes in the downgradient wells.

Table 3-3: SSIs from September 2019 Sampling Event—Morgantown

Analyte	**Monitoring Well**		
	2016-01	**2016-07**	**9910**
Boron	ϕ	ϕ	ϕ
Calcium	ϕ	ϕ	ϕ
Chloride	ϕ	ϕ	ϕ
Fluoride	ϕ	ϕ	ϕ
pH	X	ϕ	ϕ
Sulfate	ϕ	ϕ	ϕ
Total Dissolved Solids	ϕ	ϕ	ϕ

Notes: ϕ = No SSI; X = SSI; SSI = statistically significant increase
Results are for the downgradient wells sampled on 21–22 September 2019.

Table 3-4: SSIs from September 2019 Sampling Event—Cow Run

Analyte	**Monitoring Well**	
	2016-02	**2016-08**
Boron	ϕ	ϕ
Calcium	X	ϕ
Chloride	ϕ	ϕ
Fluoride	ϕ	ϕ
pH	ϕ	ϕ
Sulfate	ϕ	ϕ
Total Dissolved Solids	X	ϕ

Notes: ϕ = No SSI; X = SSI; SSI = statistically significant increase
Results are for the downgradient wells sampled on 21–22 September 2019.

Alternate sources were identified for each of the SSIs detected in the September 2019 data and documented in the Gavin FAR Second Semiannual Sampling Event of 2019 ASD Report (ERM 2020) included as Appendix B. This ASD Report identified regional naturally-occurring brine (TDS and calcium) and cement-bentonite grout from well construction (pH) as the alternate sources for these SSIs.

The FAR Second Semiannual Sampling Event of 2018 ASD Report (ERM 2019b) was submitted as Appendix C of the 2018 annual sampling report in January 2019 (ERM 2019a).

Appendix C provides a summary of all historical and current analytical results obtained from the FAR groundwater monitoring program.

4. KEY FUTURE ACTIVITIES

The five ASD Reports prepared to date concluded that sources other than the FAR were responsible for the identified SSIs. As required by 40 CFR § 257.94(e)(2), the demonstrations were completed within 90 days of detecting the SSIs and were certified by a qualified professional engineer. Because it met these requirements, the FAR currently remains in detection monitoring status. As a result, two groundwater sampling events will be performed in 2020 at the FAR, and the results will be compared to the prediction limits.

Closure of the Fly Ash Reservoir is currently in progress and is expected to be completed in 2020.

In accordance with an Ohio Environmental Protection Agency-issued Permit-to-Install, the Plant intends to continue expanding the RWL to the northwest in 2020. Following the RWL expansion, the Plant intends to evaluate the potential to install additional wells at the downgradient boundary of the FAR.

5. REFERENCES

ERM (ERM Consulting & Engineering, Inc.). 2017. *Groundwater Monitoring Plan. Bottom Ash Complex, Fly Ash Reservoir, and Residual Waste Landfill*, *Gavin Plant, Cheshire Ohio*.

ERM. 2018a. *2017 Annual Groundwater Monitoring and Corrective Action Report. Fly Ash Reservoir, Gavin Plant, Cheshire Ohio,* dated 1-31-2018.

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ERM. 2019a. *2018 Annual Groundwater Monitoring and Corrective Action Report. Fly Ash Reservoir, Gavin Plant, Cheshire Ohio,* dated 1-31-2019.

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Geosyntec. 2012. *Final Permit-To-Install Application. Expansion of the Gavin Plant Residual Waste Landfill. Hydrogeologic Study Report.* OAC 3745-30-05(C)(4)

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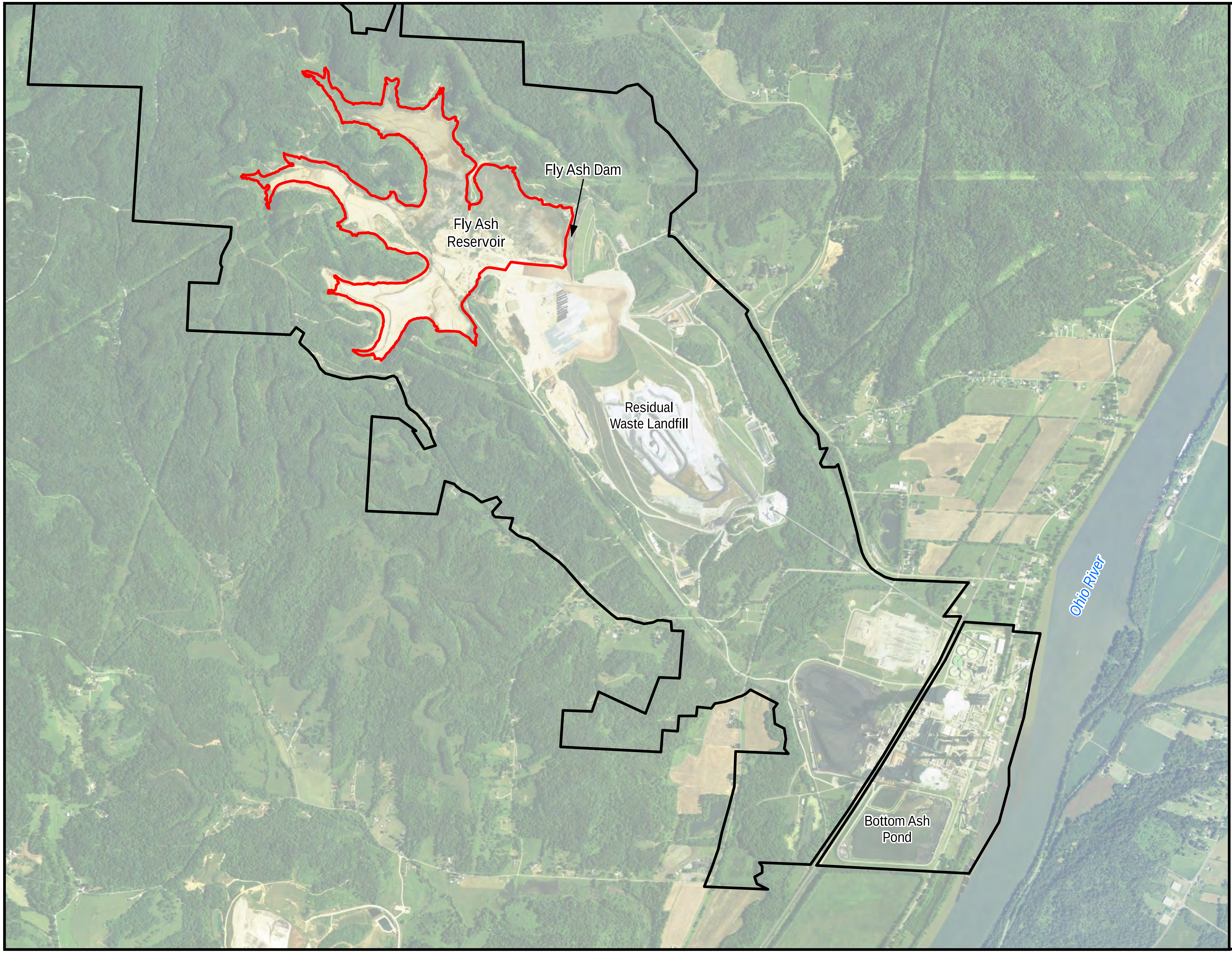
FIGURES



Legend

🟥 Fly Ash Reservoir Approximate Edge of Final Cover

⬜ Gavin Property Boundary

NOTE:
1. Edge of Final Cover from FAR Closure Plan (Geosyntec 2016)

N

0 500 1,000 2,000 3,000 4,000
Feet

Figure 1-1: Fly Ash Reservoir Location

Gavin Generating Station
Cheshire, Ohio

ERM

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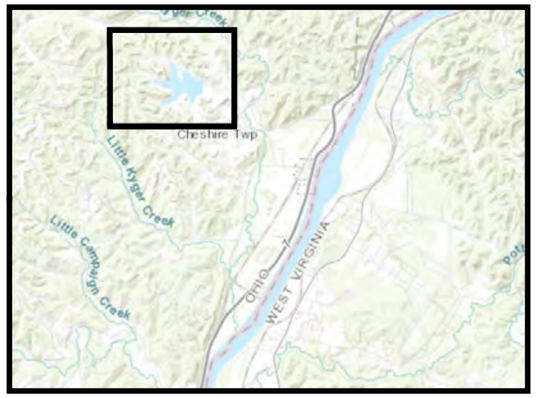

Legend

⊕ Federal Sampling Program Monitoring Well (Morgantown Sandstone)

⊕ Federal Sampling Program Monitoring Well (Cow Run sandstone)

🟥 Fly Ash Reservoir Approximate Edge of Final Cover

NOTES:
1. Locations are approximate
2. Aerial Imagery: USA NAIP 2015
3. Edge of Final Cover from FAR Closure Plan (Geosyntec 2016)

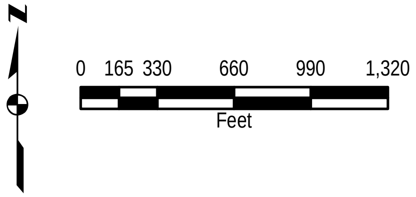

Figure 2-1: Monitoring Well Network Map

Gavin Generating Station
Cheshire, Ohio

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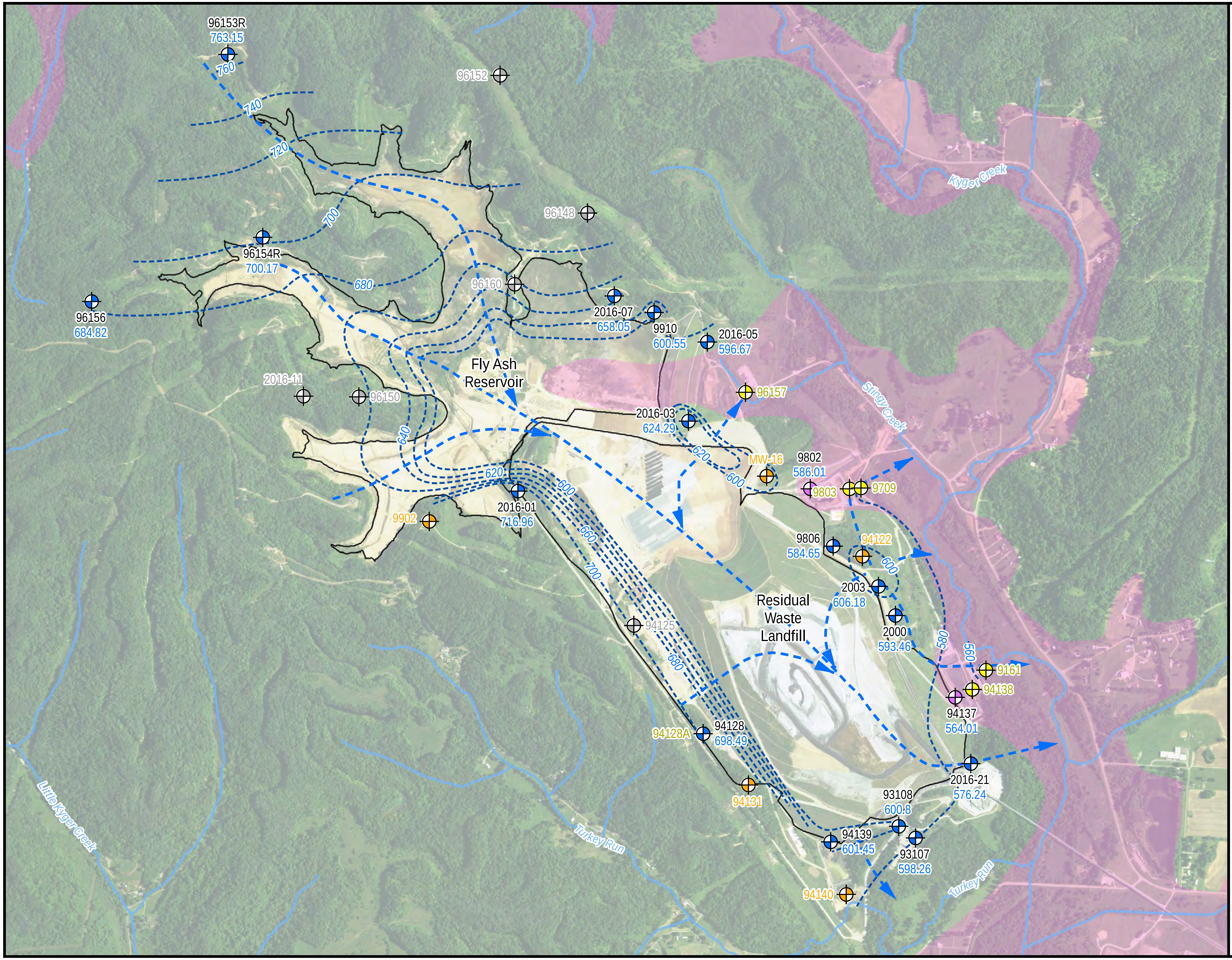

Legend

NOTES:
- * Monitoring Well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging between 3/4/2019 and 3/6/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in March 2019.

Figure 3-1: Morgantown Sandstone Potentiometric Surface Map
March 2019
Gavin Generating Station
Cheshire, Ohio

ERM

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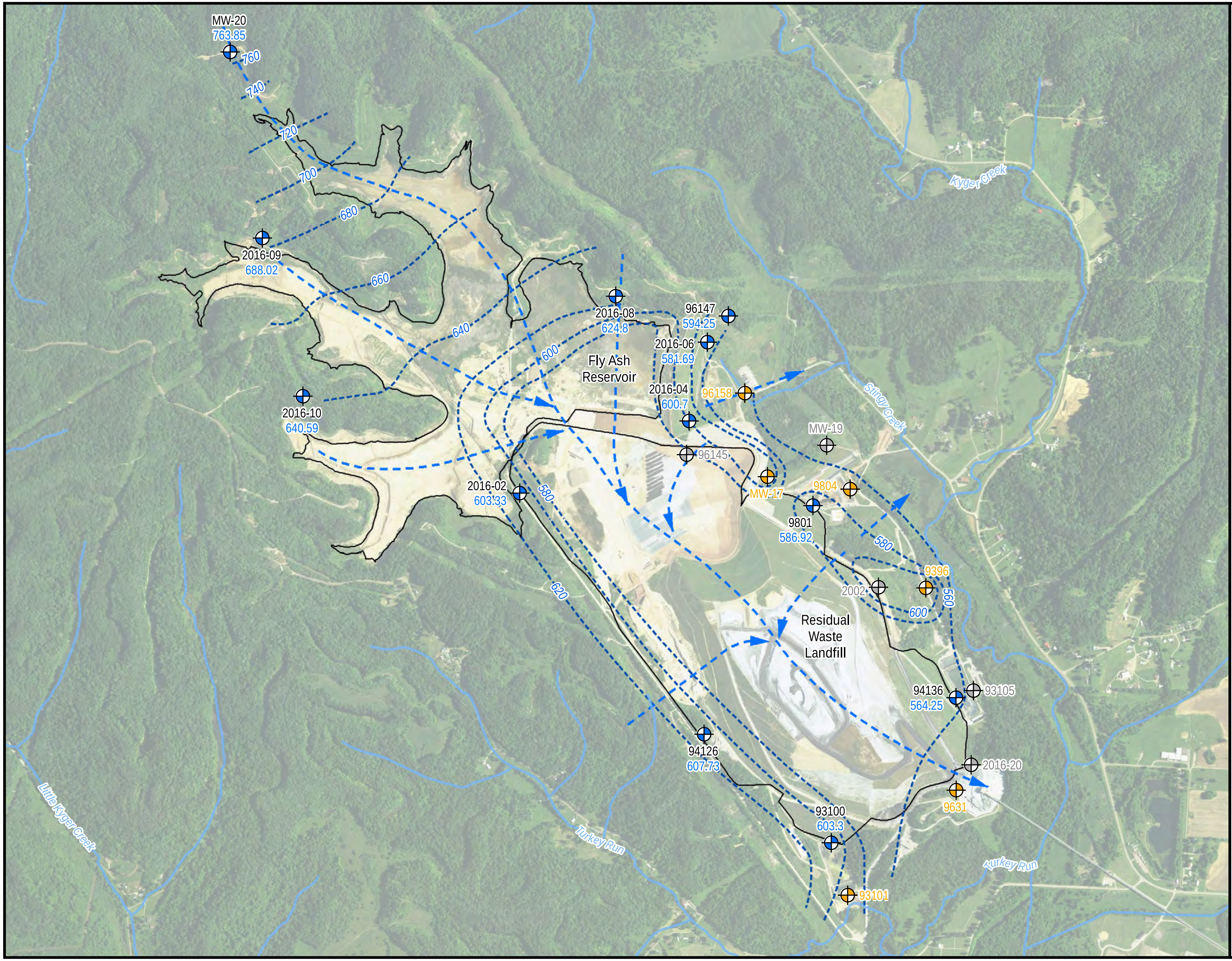

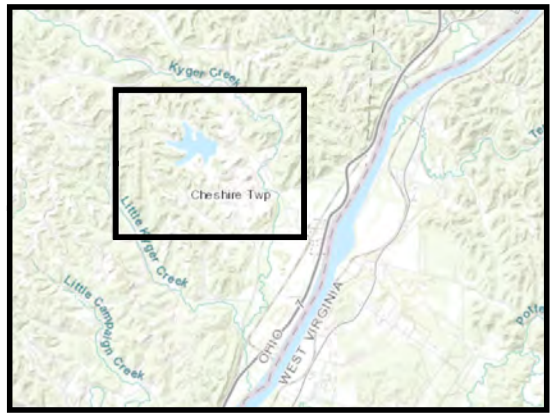

Legend

⊕	Cow Run Sandstone Monitoring Well
⊕	Cow Run Sandstone Monitoring Well - Low Recharge or Dry*
⊕	Cow Run Sandstone Monitoring Well - Not Gauged*
605.82	Groundwater Elevation (ft)
- - -	Interpreted Groundwater Elevation Contour
- ➤	Interpreted Groundwater Flow Direction
—	Stream/Creek
☐	Coal Combustion Residual Unit

NOTES:
- Cow Run Sandstone is present through entire site.
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging between 3/4/2019 and 3/6/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in March 2019.

N

0 500 1,000 2,000
Feet

Figure 3-2: Cow Run Sandstone Potentiometric Surface Map March 2019

Gavin Generating Station
Cheshire, Ohio

ERM

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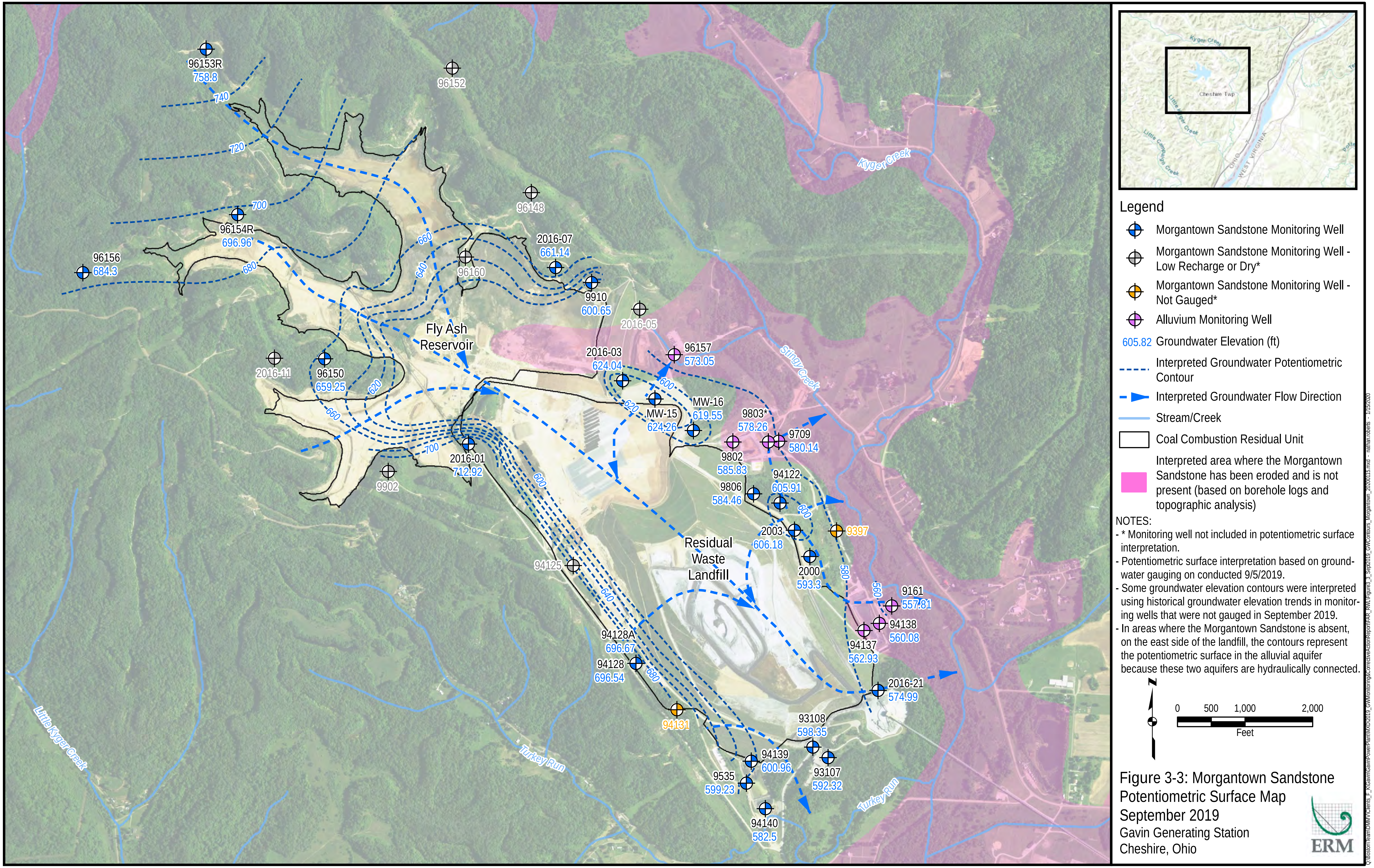

Legend

⊕ Morgantown Sandstone Monitoring Well

⊕ Morgantown Sandstone Monitoring Well - Low Recharge or Dry*

⊕ Morgantown Sandstone Monitoring Well - Not Gauged*

⊕ Alluvium Monitoring Well

605.82 Groundwater Elevation (ft)

- - - Interpreted Groundwater Potentiometric Contour

- - ► Interpreted Groundwater Flow Direction

— Stream/Creek

☐ Coal Combustion Residual Unit

🟪 Interpreted area where the Morgantown Sandstone has been eroded and is not present (based on borehole logs and topographic analysis)

NOTES:

- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging on conducted 9/5/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in September 2019.
- In areas where the Morgantown Sandstone is absent, on the east side of the landfill, the contours represent the potentiometric surface in the alluvial aquifer because these two aquifers are hydraulically connected.

Figure 3-3: Morgantown Sandstone Potentiometric Surface Map September 2019

Gavin Generating Station
Cheshire, Ohio

ERM

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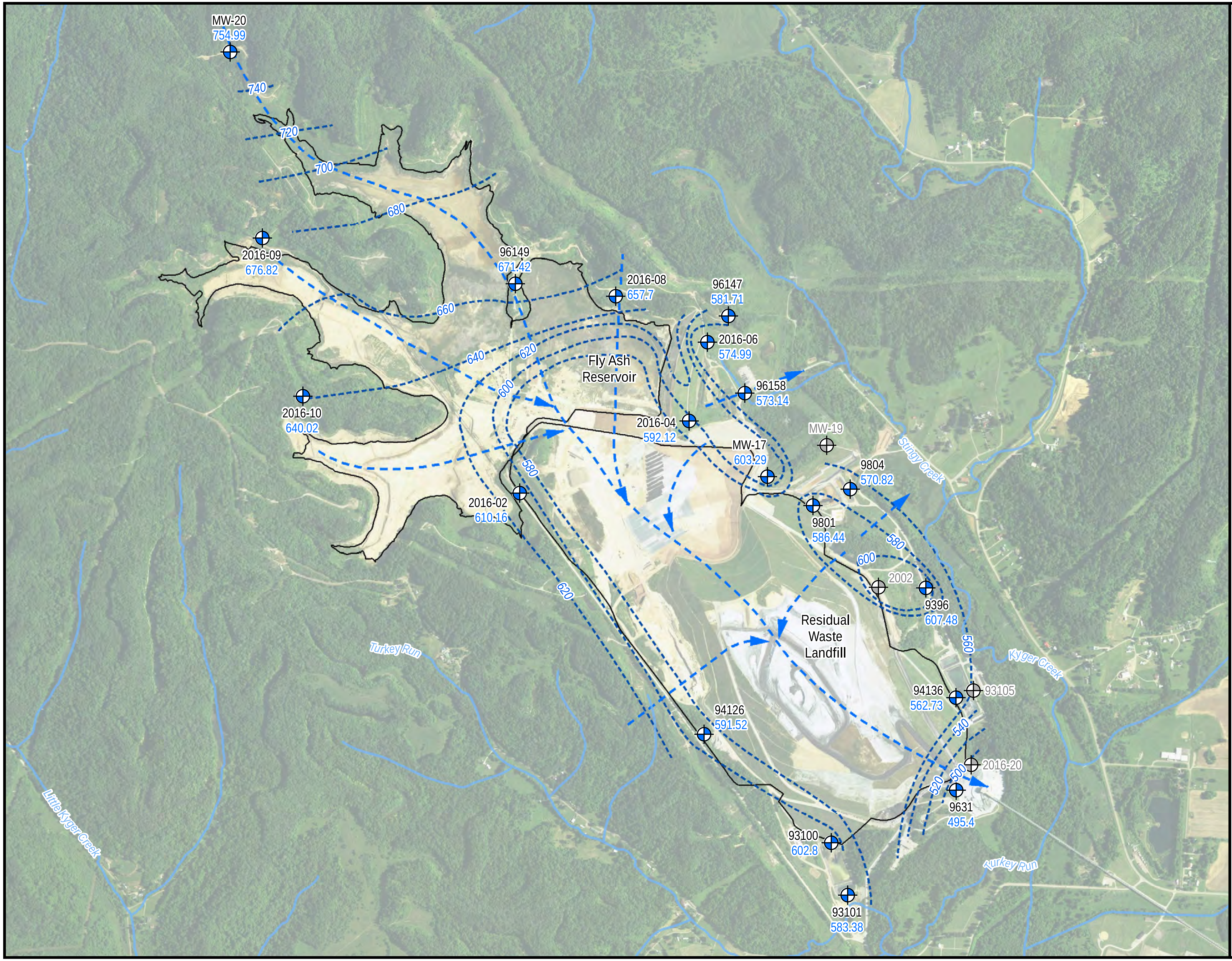

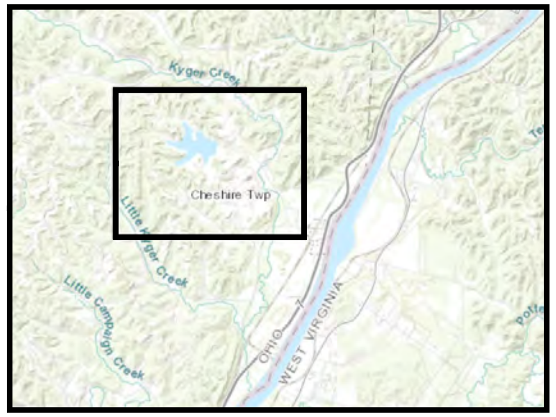

Legend

⊕	Cow Run Sandstone Monitoring Well
⊕	Cow Run Sandstone Monitoring Well - Low Recharge or Dry*
605.82	Groundwater Elevation (ft)
- - -	Interpreted Groundwater Potentiometric Contour
- ►	Interpreted Groundwater Flow Direction
—	Stream/Creek
☐	Coal Combustion Residual Unit

NOTES:
- Cow Run Sandstone is present through entire site.
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging on conducted 9/5/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in September 2019.

N

0 500 1,000 2,000
Feet

Figure 3-4: Cow Run Sandstone Potentiometric Surface Map September 2019
Gavin Generating Station
Cheshire, Ohio

ERM

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APPENDIX A GAVIN FLY ASH RESERVOIR FIRST SEMIANNUAL SAMPLING EVENT OF 2019 ALTERNATE SOURCE DEMONSTRATION REPORT

Gavin Fly Ash Reservoir

Gavin Power, LLC

First Semiannual Sampling Event of 2019 Alternate Source Demonstration Report

Gavin Power Plant
Cheshire, Ohio

04 November 2019

Project No.: 0505619

The business of sustainability

ERM

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Acronyms and Abbreviations

CCR	Coal Combustion Residuals
CCR Rule	Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments
CCR Unit	Fly Ash Reservoir CCR Surface Impoundment
CFR	Code of Federal Regulations
FAR	Fly Ash Reservoir
Gavin	Gavin Power, LLC
NETL	National Energy Technology Laboratory
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
Plant	General James M. Gavin Power Plant
RWL	Residual Waste Landfill
SSI	Statistically significant increase
UPL	Upper prediction limit
USEPA	United States Environmental Protection Agency
USEPA Guidance	Solid Waste Disposal Facility Criteria Technical Manual, USEPA 530-R-93-017
USGS	United States Geological Survey

1. INTRODUCTION

1.1 Regulatory and Legal Framework

In accordance with 40 Code of Federal Regulations (CFR) Part 257 Subpart D—Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments ("CCR Rule"), Gavin Power, LLC ("Gavin") has been implementing the groundwater monitoring requirements of 40 CFR § 257.90 *et seq.* for its Fly Ash Reservoir CCR Surface Impoundment ("FAR," or the "CCR Unit") at the General James M. Gavin Power Plant (the "Plant"). Gavin calculated background levels and conducted statistical analyses for Appendix III constituents in accordance with 40 CFR § 257.93(h). Currently, Gavin is performing detection monitoring at the FAR in accordance with 40 CFR § 257.94. Statistically significant increases (SSIs) over background concentrations were detected in downgradient monitoring wells for Appendix III constituents for the first half of 2019 (January - June) and are explained in this Report.

An SSI for one or more Appendix III constituents is a potential indication of a release of constituents from the CCR unit to groundwater. In the event of an SSI, the CCR Rule provides that "the owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality" (40 CFR § 257.94(e)(2)). If it can be demonstrated that the SSI is due to a source other than the CCR unit, then the CCR unit may remain in the Detection Monitoring Program instead of transitioning to an Assessment Monitoring Program. An Alternate Source Demonstration (ASD) must be made in writing, and the accuracy of the information must be verified through certification by a qualified Professional Engineer (40 CF § 257.94(e)(2)).

The guidance document, "Solid Waste Disposal Facility Criteria Technical Manual, USEPA 530-R-93-017, Subpart E" (Nov. 1993) ("USEPA Guidance"), lays out the six lines of evidence that should be addressed to determine whether an SSI resulted from a source other than the regulated disposal unit:

1. An alternative source exists.
2. Hydraulic connection exists between the alternative source and the well with the significant increase.
3. Constituent(s) (or precursor constituents) are present at the alternative source or along the flow path from the alternative source prior to possible release from the unit.
4. The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the unit when the fate and transport characteristics of the constituents are considered.
5. The concentration observed in ground water could not have resulted from the unit given the waste constituents and concentrations in the unit leachate and wastes, and site hydrogeologic conditions.
6. The data supporting conclusions regarding the alternative source are historically consistent with the hydrogeologic conditions and findings of the monitoring program.

This ASD Report addresses each of these lines of evidence for the SSIs detected in the groundwater beneath the FAR.

1.2 Background

The Plant is a coal-fired generating station located in Gallia County in Cheshire, Ohio, along the Ohio River (Figure 1-1). The FAR is one of three CCR units at the Plant that are subject to regulation under the

CCR Rule. The FAR is approximately 300 acres and is located about 2.5 miles northwest of the Plant (Figure 1-2). From the mid-1970s until January 1995, fly ash was sluiced from the Plant to the former Stingy Run stream valley. The settled CCR materials were retained behind the Stingy Run Fly Ash Dam in the FAR.

A Groundwater Monitoring Network Evaluation was performed to provide an assessment of the compliance of the groundwater monitoring network with 40 CFR § 257.91. This evaluation identified an uppermost aquifer composed of sandstone and interbedded clayshale units, specifically the Morgantown Sandstone and Cow Run Sandstone, and indicated groundwater flows to the south and east (Geosyntec 2016). Consistent with the CCR Rule and the Groundwater Monitoring Plan developed for Gavin (ERM 2017), a prediction limit approach was used to identify potential impacts to groundwater. Upper prediction limits (UPLs) and lower prediction limits were established based on the upgradient groundwater data. The 2017 Annual Groundwater Monitoring and Corrective Action Report identified SSIs in the downgradient monitoring wells for the period from August 2016 to August 2017 (ERM 2018a). The SSIs identified in the 2017 Annual Groundwater Monitoring and Corrective Action Report were addressed in the Gavin FAR ASD Report (ERM 2018b). The SSIs identified for samples collected in March and April 2018 were addressed in the Gavin FAR First Semiannual Sampling Event of 2018 ASD Report (ERM 2018c). The SSIs identified for samples collected in September and October 2018 were addressed in the Gavin FAR Second Semiannual Sampling Event of 2018 ASD Report (ERM 2018d). This ASD Report addresses SSIs for samples collected from the Cow Run and Morgantown monitoring wells in March of 2019, as summarized in Table 1-1 and Table 1-2, respectively.

Table 1-1: SSIs in FAR Cow Run Monitoring Wells

Analyte	2016-02	2016-08
Boron	ϕ	ϕ
Calcium	ϕ	ϕ
Chloride	ϕ	ϕ
Fluoride	ϕ	ϕ
pH	ϕ	ϕ
Sulfate	ϕ	ϕ
Total Dissolved Solids	X	ϕ

ϕ = No SSI; X = SSI
Results are for the downgradient wells sampled in March 2019.

Table 1-2: SSIs in FAR Morgantown Monitoring Wells

Analyte	2016-01	2016-07	9910
Boron	ϕ	ϕ	ϕ
Calcium	ϕ	ϕ	ϕ
Chloride	ϕ	ϕ	ϕ
Fluoride	ϕ	ϕ	ϕ
pH	X	ϕ	ϕ
Sulfate	ϕ	ϕ	ϕ
Total Dissolved Solids	ϕ	ϕ	ϕ

ϕ = No SSI; X = SSI

Results are for the downgradient wells sampled in March 2019.

This ASD Report identifies alternate sources for the total dissolved solids and pH SSIs. Supporting information and discussion of each of the lines of evidence discussed in Section 1.1 are presented in subsequent sections of this report.

2. HYDROGEOLOGIC INTERPRETATION

A detailed interpretation of hydrogeological conditions can be found in the Gavin FAR ASD Report (ERM 2018b). Key conclusions from this analysis include the following:

- A region of lower hydraulic pressure than the surrounding areas exists within the portion of the aquifer under the southeastern portion of the FAR, and extends southeastward under the Residual Waste Landfill (RWL) as shown on Figures 2-1 and 2-2. This area of lower hydraulic pressure is located under portions of the FAR and RWL that have received CCR materials that act to reduce infiltration due to their lower permeability. The forested and pastured areas surrounding the FAR and RWL are more permeable and have higher infiltration than the fine compacted material in the FAR and RWL. Groundwater flows from the areas of higher pressure surrounding the FAR and RWL to areas of lower pressure within the FAR and RWL.
- On the western side of the FAR, groundwater flows from west to east, toward the groundwater trough, and then turns to the southeast and flows toward the Ohio River.
- On the northeastern boundary of the FAR, groundwater flows from north to south, and then turns to the southeast and flows toward the Ohio River.

3. DESCRIPTION OF ALTERNATE SOURCES

3.1 pH

A pH value above the UPL was identified at Well 2016-01 for the sample collected in March 2019. As discussed in Section 7 of this document, neither the regional hydrogeological conditions nor the seepage and discharge from the FAR are likely sources of elevated pH in the groundwater. Based on a review of the bore log and well construction diagram prepared for Well 2016-01, a likely source for the elevated pH of the sample was improper well construction. This improper well construction could have enabled contact between the screened interval and the cement-bentonite grout used during well construction.

Impacts on groundwater quality caused by cement-based grout are typically associated with groundwater pH values above 10, and, in low-permeability formations, the impacts of grout materials may persist for longer than 18 months due to the slower rate of flushing of the well screen by moving groundwater (Pohlmann and Alduino 1992, Barcelona et al. 1988). Based on the elevated pH values observed at this well between August 2016 and September 2018, it appears that incorrect well construction methods have influenced the quality of groundwater collected from this well, and thus the alternate source of the elevated pH is cement used during well construction.

3.2 Total Dissolved Solids

The regional bedrock geology near the Plant includes Pennsylvanian-age sedimentary rocks from the Monongahela and Conemaugh Groups. These sedimentary rocks consist primarily of shale and siltstone, with minor amounts of mudstone, sandstone, and incidental amounts of limestone and coal (USGS 2005). Overlying the Pennsylvanian-age rocks are Quaternary-age alluvium that consists primarily of sand, silt, clay, and gravel (OEPA 2018). These sedimentary rocks form the ridges and valleys west of the Ohio River, and the unconsolidated sand, silt, clay, and gravel is located along the Ohio River. The consolidated sedimentary rocks and the unconsolidated alluvium (sand, silt, clay, and gravel) form the two major aquifers near the Plant (Figure 3-1). The interaction of groundwater with rocks and minerals within these aquifers can influence the concentration of Appendix III constituents, including TDS (ORSANCO 1984).

Naturally-occurring brine, which is known to be rich in calcium, sodium, chloride, sulfate, fluoride and other trace elements, has naturally elevated total dissolved solids, and exists in the subsurface and at the land surface in the Ohio River Valley (ORSANCO 1984; ODNR 1995). The Cow Run is the shallowest sedimentary rock formation that carries a brine of marine origin (Geological Survey of Ohio 1932). The presence of naturally occurring brine in the region indicates the potential for brine to be the alternate source of TDS. As noted previously in this report, Well 2016-02 is constructed within the Cow Run formation.

To account for natural and anthropogenic influences on Appendix III constituents on a regional scale, background groundwater data were obtained from United States Geological Survey (USGS) databases. The background groundwater data set is discussed further in Section 5.

4. HYDRAULIC CONNECTIONS TO THE ALTERNATE SOURCES

4.1 pH

As described in Section 3.1, the source of the elevated pH in Well 2016-01 appears to be cement-bentonite grout used during well construction. Given that the cement-bentonite grout was injected into the borehole during construction, concrete may have penetrated the sand pack or fractures within the bedrock immediately surrounding the well screen, and groundwater migrating through these fractures and the sand pack could come into contact with the cement. Thus, the alternate source of elevated pH (cement-bentonite grout) is hydraulically connected with groundwater entering Well 2016-01.

4.2 Total Dissolved Solids

As described in Section 3.2, the source of the elevated TDS in Well 2016-02 appears to be naturally occurring brines. Brines are common in the region and are known to exist within the Cow Run formation (Ohio Geological Survey 1932). Precipitation that falls in areas of higher topographic elevation northwest of the Plant infiltrates the land surface and recharges the underlying aquifers. Groundwater then flows from areas of higher hydraulic head (i.e., high topographic elevation) to areas of lower hydraulic head (i.e., low topographic elevation) toward the Ohio River. As groundwater flows from northwest to southeast, it migrates both horizontally and vertically through the fracture network within the sedimentary bedrock. As shown on Figure 4-1, regional groundwater flow near and surrounding the FAR occurs primarily within fractured sedimentary rocks of the Monongahela Group and the Conemaugh Group, which contain the Cow Run Sandstone (USGS 1981, USGS 2016). Based on these considerations, the Cow Run Sandstone is hydraulically connected to the regional alternate sources that result in elevated concentrations of TDS.

5. CONSTITUENTS ARE PRESENT AT THE ALTERNATE SOURCES OR ALONG FLOW PATHS

5.1 pH

Cement mixtures are strongly basic and can have a pH between 12 and 13 (Portland Cement Association 2018). Groundwater that entered the well screen of Well 2016-01 likely contacted uncured cement, and the elevated pH has persisted 3 years after well installation due to the naturally low groundwater velocity of the Morgantown formation, and the limited flushing of the well screen interval. Thus, the alternate source (cement-bentonite grout) is along the flow path of groundwater entering Well 2016-01.

5.2 Total Dissolved Solids

The Cow Run is the shallowest sedimentary rock formation that carries naturally occurring brines in the region of the Plant (Ohio Geological Survey 1932). The brines consist of high concentrations of dissolved salts, primarily sodium chloride, which consequently result in elevated concentrations of TDS. Figure 4-1 conceptualizes the flow path from upgradient brine impacted water and the groundwater flowing underneath the FAR. Figure 5-1 presents the difference in TDS concentration between the Morgantown and Cow Run Sandstone units. As presented in green, TDS is always higher in the deeper brine-impacted Cow Run formation than in the shallower Morgantown formation. Figure 5-2 compares geochemical signatures of brine samples collected within 50 miles of the site (NETL 2015) with the chemical signature of monitoring well 2016-02. The result demonstrates that the geochemical composition of groundwater in monitoring well 2016-02 is similar to the composition of the regional brine samples.

These combined lines of evidence demonstrate that TDS is present at the alternate sources (brine) and along the flow path underneath the FAR.

6. LINKAGES OF CONSTITUENT CONCENTRATIONS AND DISTRIBUTIONS BETWEEN ALTERNATE SOURCES AND DOWNGRADIENT WELLS

6.1 pH

As discussed in Section 5, the pH of the groundwater detected at monitoring Well 2016-01 is consistent with the typical pH of cement used for well construction.

6.2 Total Dissolved Solids

As described in Section 5.1, The Cow Run is the shallowest sedimentary rock formation that carries naturally occurring brines in the region of the Plant (Ohio Geological Survey 1932). The brines consist of high concentrations of dissolved salts, primarily sodium chloride, which consequently result in elevated concentrations of TDS. The Cow Run Sandstone is laterally extensive throughout southeast Ohio, and thus the elevated TDS observed regionally in the Cow Run is consistent with the elevated TDS measured in downgradient monitoring well 2016-02.

7. A RELEASE FROM THE FAR IS NOT SUPPORTED AS THE SOURCE

7.1 Piper Diagrams

As seen on Figures 7-1 and 7-2, the FAR discharge and FAR seepage results plot in the upper portion of the piper diagram, which represents a high calcium and sulfate fingerprint, while groundwater from the Cow Run Sandstone and Morgantown Sandstone has elevated sodium, potassium, and chloride. The FAR discharge and FAR seepage results represent water that has been in contact with CCR within the FAR. Specifically, the discharge samples are collected from standing water within the FAR. The seepage samples represent FAR water collected from the engineered collection system at the toe of the dam.

With the exception of MW-20, which is an upgradient well and only coincidentally has a signature similar to the leachate (due to the elevated sulfate signature associated with nearby coal mines), the groundwater chemical signatures from the Morgantown and Cow Run monitoring wells are distinct from the FAR discharge and FAR seepage chemical signatures. If water in contact with fly ash (e.g., seepage water or discharge water) were released from the FAR and mixed with groundwater, the signature of the resulting mixture would become more like the discharge and seepage signatures (i.e., plot higher in the diamond portion of the piper diagram).

Results from 2016-01 where pH is elevated from water coming in contact with cement grout from well construction plot as a slightly different signature in the diagram; however, the signature is more similar to the Site wide groundwater than to the leachate.

Based on the data presented on Figures 7-1 and 7-2, it is clear that groundwater in the Cow Run Sandstone and Morgantown Sandstone has not mixed with FAR discharge or seepage because they plot in distinct regions on the piper diagram, and thus the FAR is not the source of the constituents detected in Wells 2016-01 and 2016-02.

7.2 Leachate Constituents vs Groundwater Constituents

If the FAR had a release and seepage or discharge mixed with groundwater, the concentrations of individual analytes in the resulting mixture would depend on the volume and initial concentration of the release. In order for a release to result in an increase in the concentration of an analyte in groundwater, the concentration of the analyte in the seepage or discharge would need to be higher than the respective existing background concentrations in groundwater. However, at the FAR, the opposite conditions exist: the concentrations of TDS are significantly lower in discharge and seepage than in Cow Run formation groundwater where the TDS UPL exceedance was observed, as summarized in Table 7-1.

Table 7-1: Comparison of Discharge, Seepage and Groundwater TDS Results

Analyte	**Units**	**FAR Discharge (2017–2019)**		**FAR Seepage (2017-2019)**		**Well 2016-02 (2016–2019)**	
		MIN	MAX	MIN	MAX	MIN	MAX
TDS	mg/L	1,000	1,100	1,100	1,600	13,000	28,000

mg/L = milligrams per liter

The concentrations of TDS in FAR discharge and seepage are all less than the concentrations in the deep groundwater of the Cow run formation where the TDS SSI was observed. Based on this the FAR seepage or discharge are unlikely to be the source of the TDS observed at well 2016-02. The fact that the Morgantown Sandstone is located between the FAR and the Cow Run Sandstone, and TDS in the Morgantown is consistently lower than in the Cow Run (Figure 5-1), also demonstrate that seepage or discharge from the FAR are unlikely to be the source of the TDS observed at well 2016-02.

Similarly, the pH of the FAR discharge and seepage is lower than the pH of groundwater from well 2016-01, as summarized in Table 7-2.

Table 7-2: Comparison of Discharge, Seepage and Groundwater pH

Analyte	FAR Discharge (2017–2019)		FAR Seepage (2017-2019)		Well 2016-01 (2016–2019)	
	MIN	MAX	MIN	MAX	MIN	MAX
pH	7.07	8.20	7.20	7.94	10.96	12.4

Based on this, the FAR seepage or discharge are unlikely to be the source of the elevated pH observed at well 2016-01.

8. ALTERNATE SOURCE DATA ARE HISTORICALLY CONSISTENT WITH HYDROGEOLOGIC CONDITIONS

8.1 pH

The elevated pH that has been observed at Well 2016-01 since it was constructed in March 2016 is consistent with the errors that likely occurred during well construction, and the use of cement to build the well. In addition, the persistence of the elevated pH is consistent with the groundwater velocities of the Morgantown Sandstone and expected low rate of flushing of the monitoring well screen interval.

8.2 Total Dissolved Solids

This ASD Report provides background groundwater quality for the fractured sedimentary bedrock aquifers found within and beyond the boundary of the FAR. The patterns of regional groundwater flow through fractured rock near the FAR were established after the last deglaciation, which occurred approximately 14,000 years ago (Hansen 2017). Assuming a conservatively high effective porosity of 1 percent results in an estimated groundwater velocity for the Morgantown Sandstone and Cow Run Sandstone of 50 feet per year and 80 feet per year (ERM, 2019), respectively, which would allow ample time for groundwater to migrate from upgradient regional sources onto Plant property since the end of the last glaciation. The data supporting these conclusions are historically consistent with hydrogeological conditions and findings of the monitoring program.

9. CONCLUSIONS

The SSIs identified in this report for samples from monitoring wells located downgradient of the FAR were detected in March 2019. The data were reviewed for quality assurance, and reported to Gavin on 07 August 2019. In response to the SSIs, this ASD Report was prepared within the required 90-day period in accordance with 40 CFR § 257.94(e)(2).

All SSIs in the downgradient FAR monitoring wells have been determined to result from alternate sources that include regional background concentrations, naturally occurring brine, and cement from improper well construction. Table 9-1 summarizes the six lines of evidence of an ASD for each of the SSIs.

Table 9-1: FAR ASD Summary

Line of Evidence	pH	TDS
Alternate source	Elevated pH is due to improper well construction.	TDS is present in background groundwater and can be attributed to regional sources such as naturally occurring brine or mineral-bearing rock.
Hydraulic connection	Cement from well construction is in contact with groundwater.	Regional groundwater flows under the FAR.
Constituent present at source or along flow path	Cement from well construction is likely located in or near the well screen.	Elevated TDS is present along flow path.
Constituent distribution more strongly linked to alternate source	The observed pH levels are consistent with the expected pH of groundwater in contact with cement.	TDS in Cow Run groundwater below the FAR is consistent with the regional presence of brine in the Cow Run.
Constituent exceedance could not have resulted from the FAR	Piper diagrams show different chemical fingerprints between FAR discharge and seepage, and groundwater.	Piper diagrams show different chemical fingerprints between groundwater and FAR seepage and discharge. The concentrations of TDS in FAR seepage and discharge are lower than in Cow Run groundwater where the SSI for TDS was observed.
Data are historically consistent with hydrogeological conditions	Timing of well installation is consistent with likely impacts from cement.	Groundwater velocities suggest there is ample time for upgradient TDS to migrate to Cow Run Well 2016-02.

In conclusion, the FAR is not the source of the SSIs identified in the first semiannual groundwater sampling event of 2019 and thus the Plant will continue detection monitoring at the FAR in accordance with 40 CFR § 257.94(e)(2).

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I or an agent under my review has prepared this Alternate Source Demonstration Report for the Fly Ash Reservoir and it meets the requirements of 40 CFR § 257.94(e)(2). To the best of my knowledge, the information contained in this Report is true, complete, and accurate.

STATE OF OHIO
JAMES
HEMME
72851
11/4/19
REGISTERED
PROFESSIONAL ENGINEER

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FIGURES

Figure 1-1: Gavin Plant Location
Fly Ash Reservoir First Semi-Annual Sampling
Event of 2019 Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

ERM

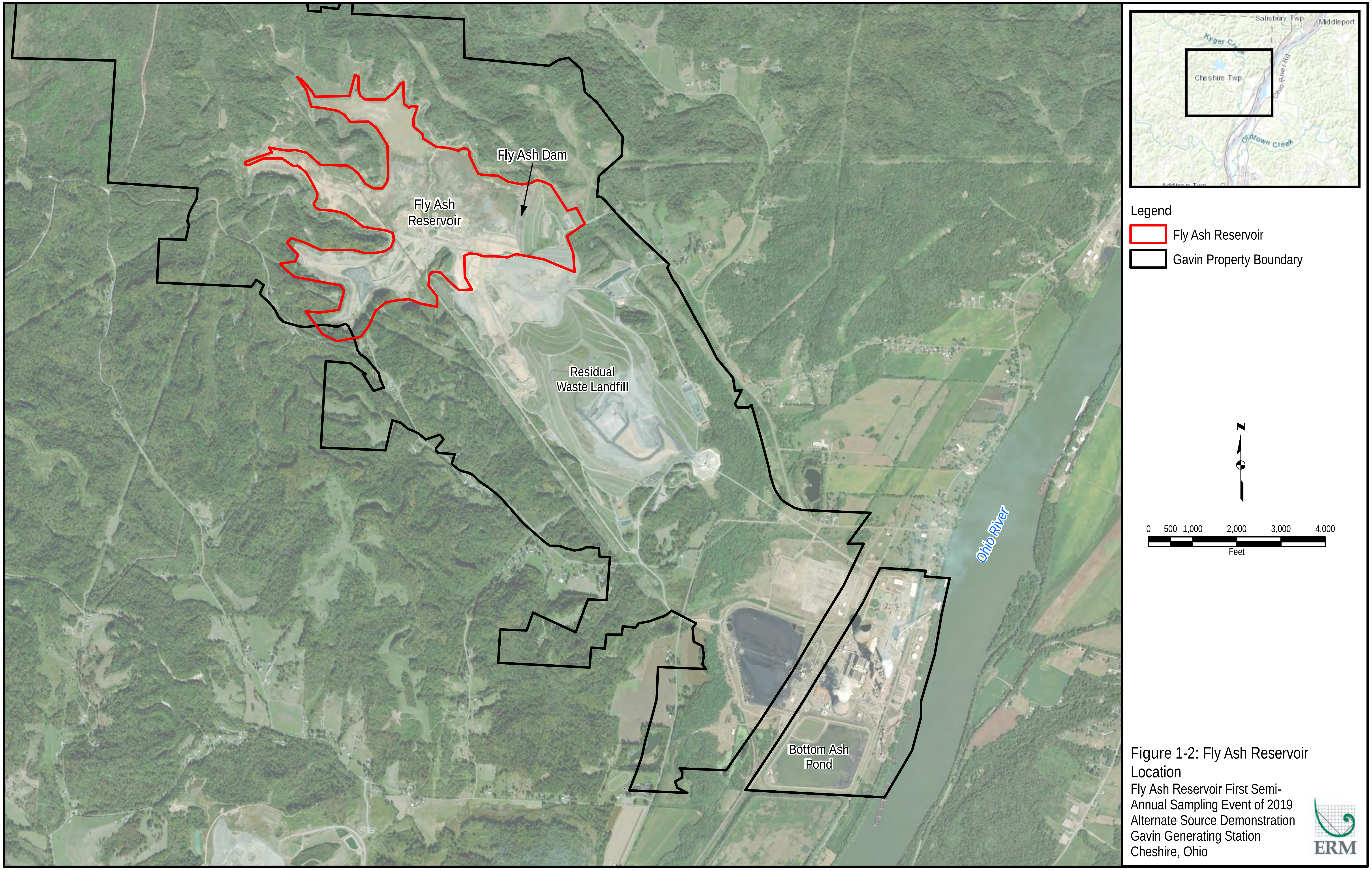
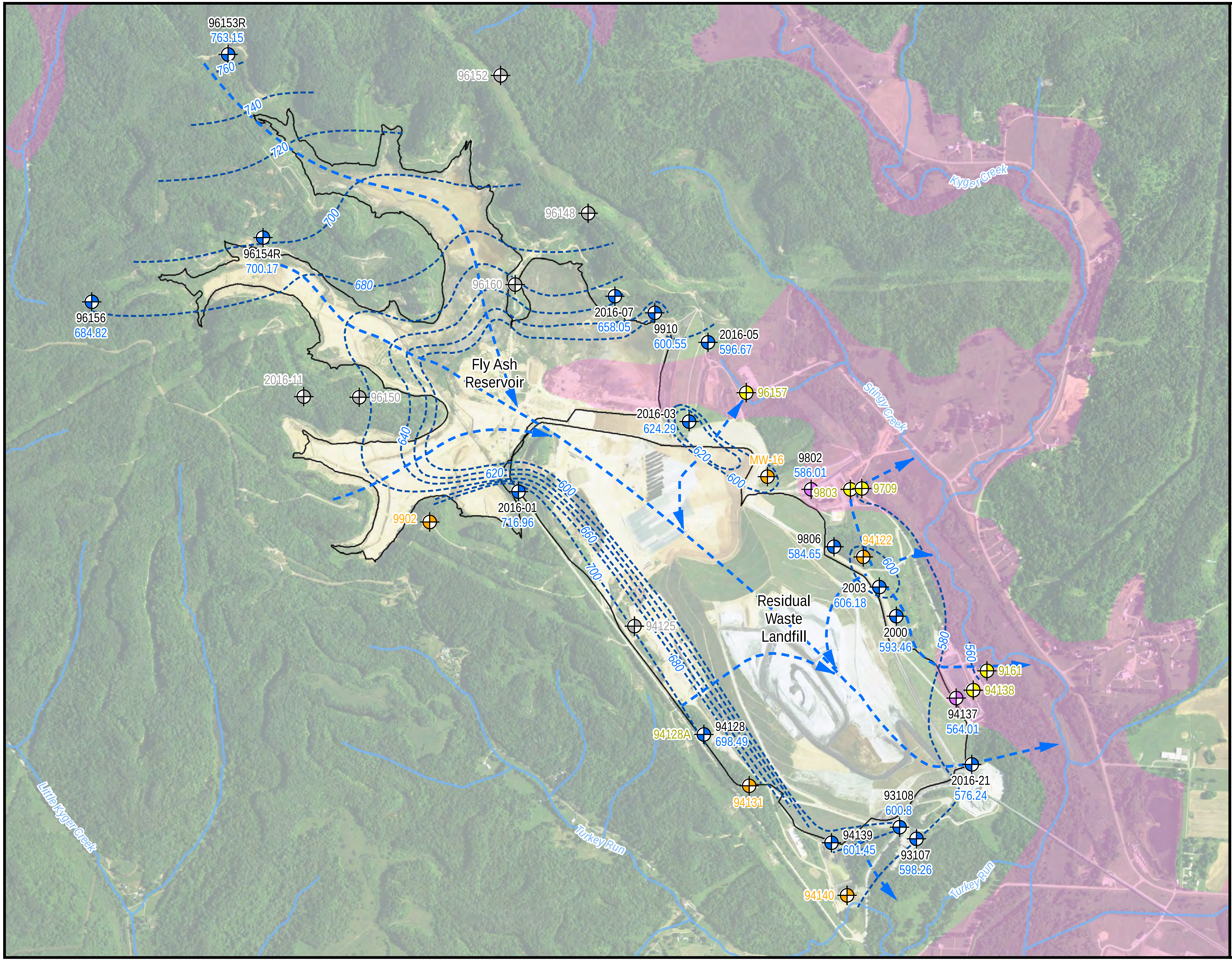
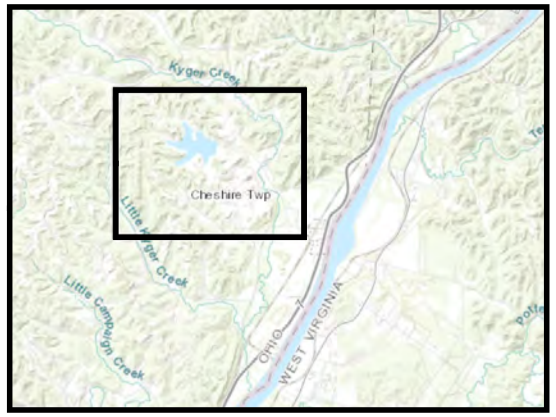


Figure 1-2: Fly Ash Reservoir Location
Fly Ash Reservoir First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

ERM





Legend

⊕	Morgantown Sandstone Monitoring Well
⊕	Morgantown Sandstone Monitoring Well - Low Recharge or Dry*
⊕	Morgantown Sandstone Monitoring Well - Not Gauged*
⊕	Alluvium Monitoring Well
⊕	Alluvium Monitoring Well - Not Gauged*
605.82	Groundwater Elevation (ft)
- - -	Interpreted Groundwater Potentiometric Contour
- -►	Interpreted Groundwater Flow Direction
—	Stream/Creek
☐	Coal Combustion Residual Unit
🟪	Interpreted area where the Morgantown Sandstone has been eroded and is not present (based on boring logs and topographic analysis)

NOTES:

- * Monitoring Well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging between 3/4/2019 and 3/6/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in March 2019.

N

0 500 1,000 2,000

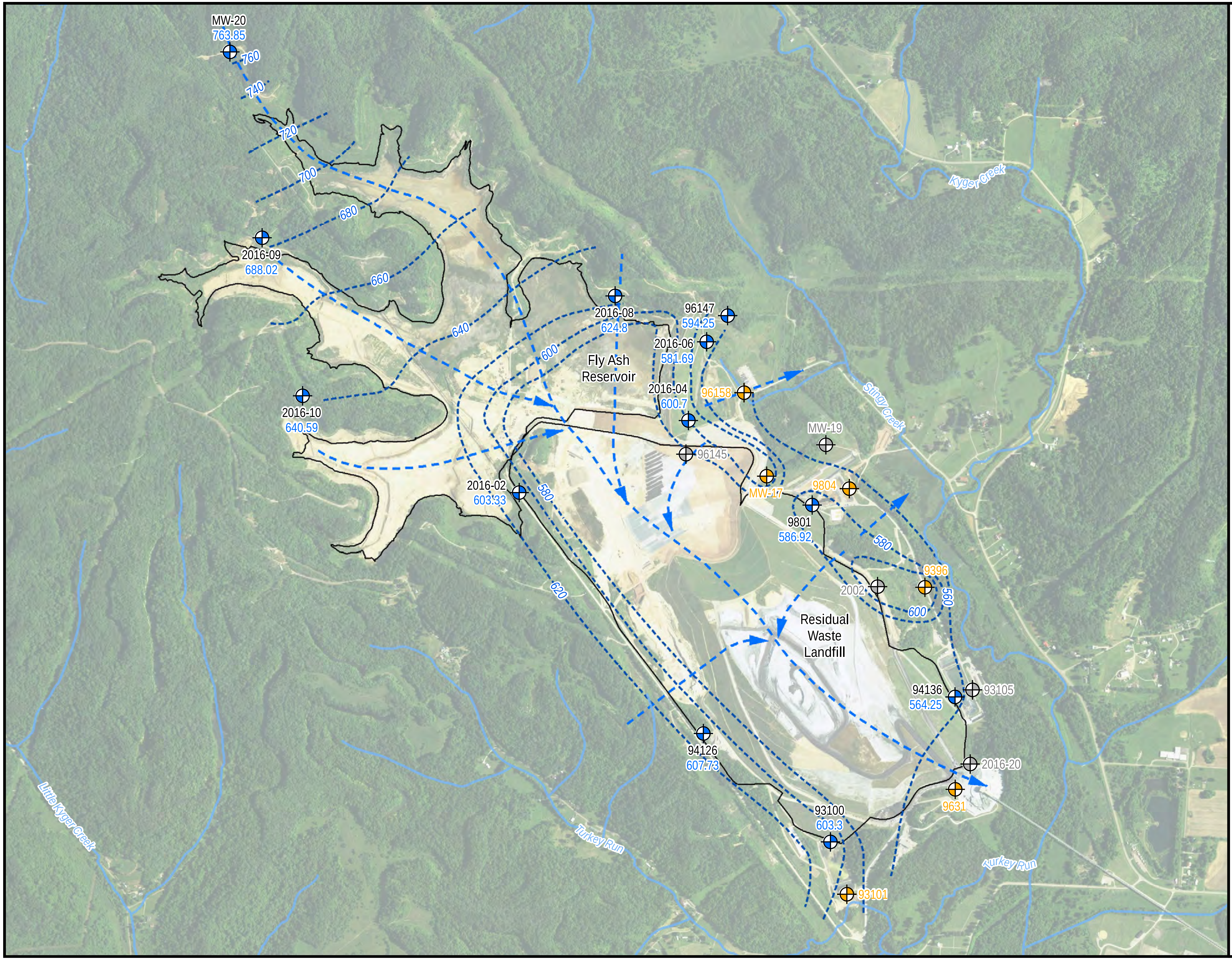
Feet

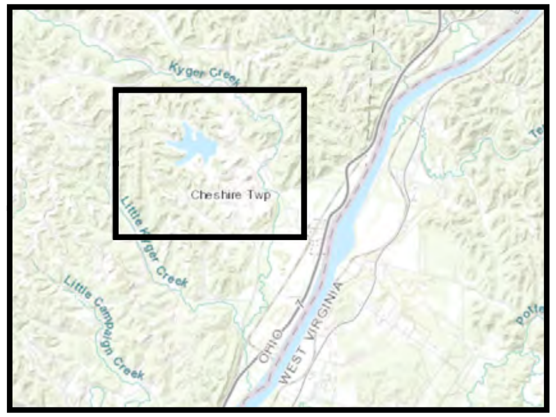
Figure 2-1: Morgantown Sandstone Potentiometric Surface Map

Fly Ash Reservoir First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

ERM

Q:\Boston\Team\DMMV\Clients_F_K\Gavin\GavinPowerPlant\MXD\2019_GWMonitoring&CorrectiveActionReport\FAR_RWL\Figure3_1_March2019_GWContours_Morgantown_20200115.mxd - nathan.roberts - 1/15/2020





Legend

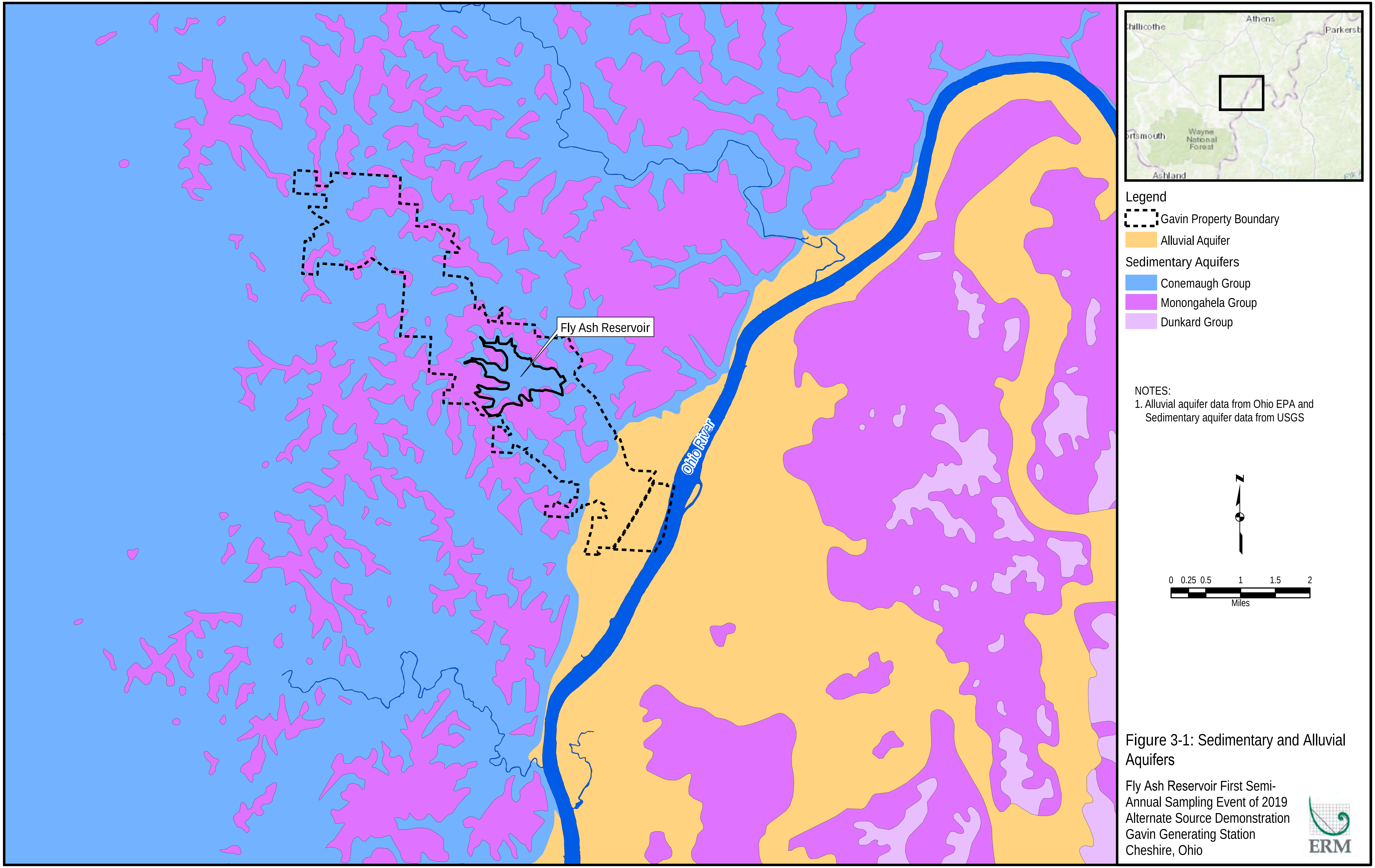
⊕	Cow Run Sandstone Monitoring Well
⊕	Cow Run Sandstone Monitoring Well - Low Recharge or Dry*
⊕	Cow Run Sandstone Monitoring Well - Not Gauged*
605.82	Groundwater Elevation (ft)
- - - -	Interpreted Groundwater Elevation Contour
- - ➤	Interpreted Groundwater Flow Direction
—	Stream/Creek
☐	Coal Combustion Residual Unit

NOTES:
- Cow Run Sandstone is present through entire site.
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging between 3/4/2019 and 3/6/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in March 2019.

Figure 2-2: Cow Run Sandstone Potentiometric Surface Map
Fly Ash Reservoir First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

ERM

Q:\TeamDMM\VClients_F_K\Gavin\GavinPowerPlant\MXD\2019_GWMonitoring&CorrectiveActionReport\FAR_RWL\Figure3_2_March2019_GWContours_CowRun_20200117.mxd - nathan.roberts - 1/17/2020

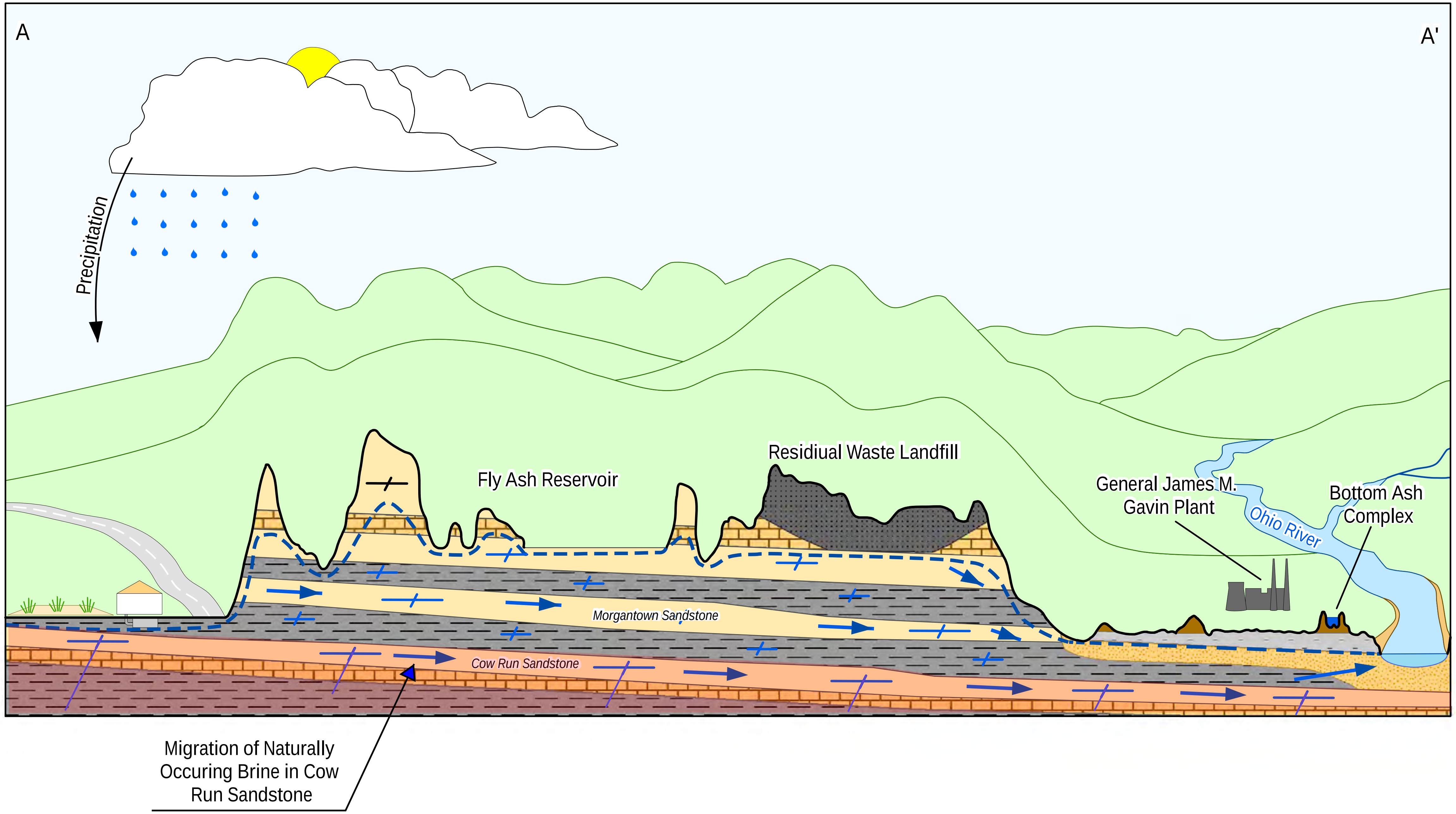


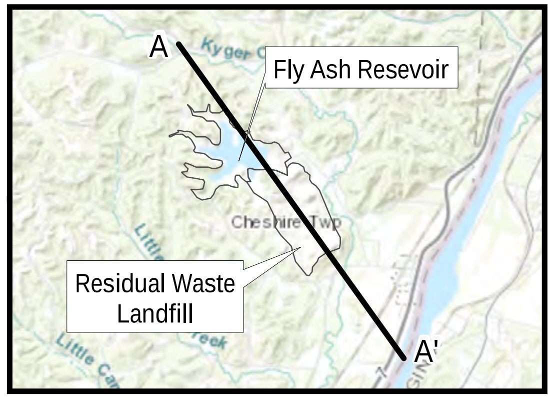
NOTES:
1. Alluvial aquifer data from Ohio EPA and Sedimentary aquifer data from USGS

Figure 3-1: Sedimentary and Alluvial Aquifers

Fly Ash Reservoir First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

ERM





Legend

- Groundwater Flow Direction
- Water Table
- Saturated Fractures
- Unsaturated Fractures
- Naturally Occuring Brine
- FGD Material
- Fill
- Interbedded Silt/Clay
- Sand
- Course Sand Deposits
- Sandstone
- Fractured Limestone
- Fractured Shale

NOTES:
1. Sandstone bedrock units represent the Conemaugh Group and Monongahela Group Sedimentary Aquifers

0 500 1,000 2,000 3,000 4,000 5,000
Feet

Figure 4-1: Regional Groundwater Flow Patterns

Fly Ash Reservoir First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

ERM

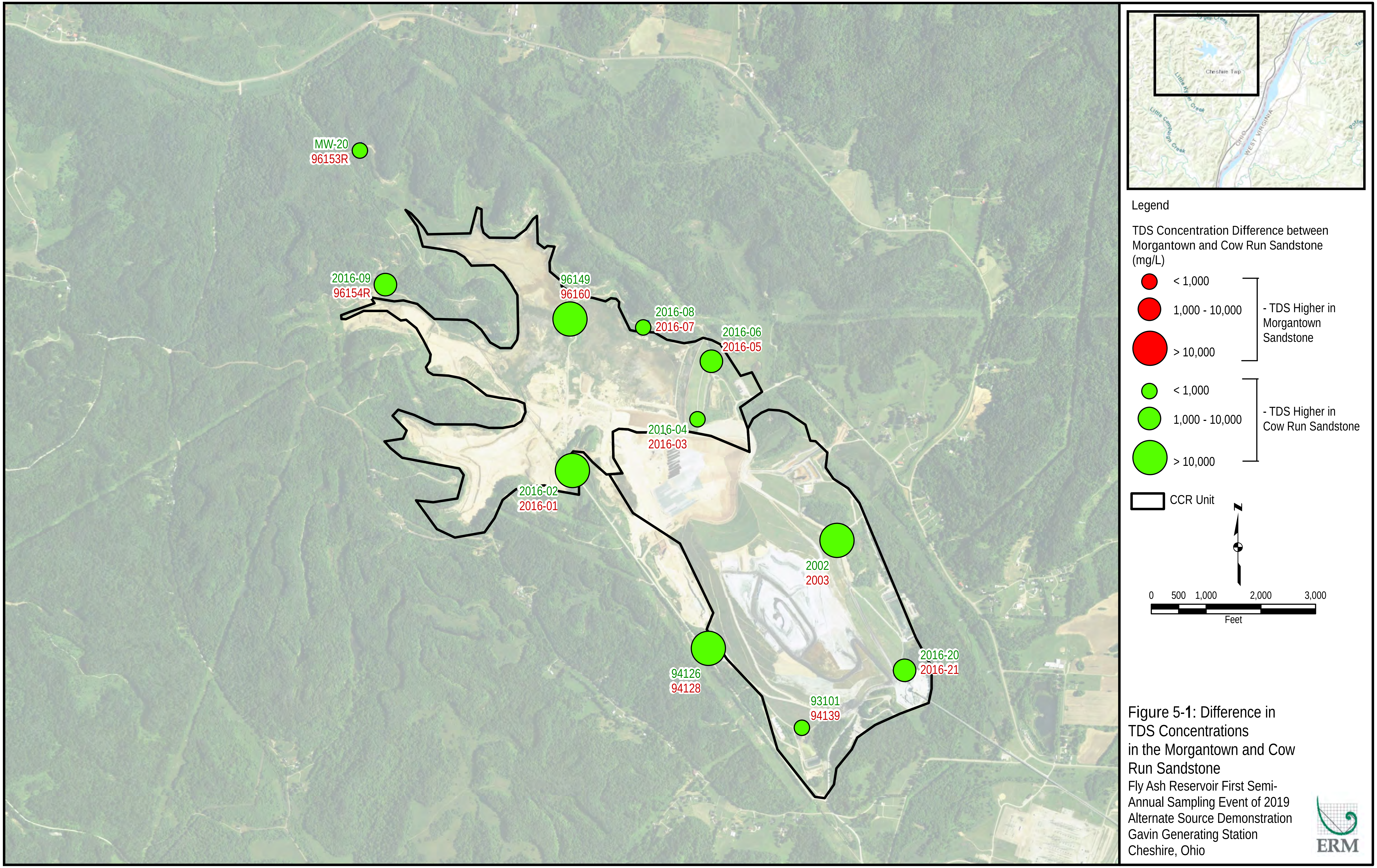
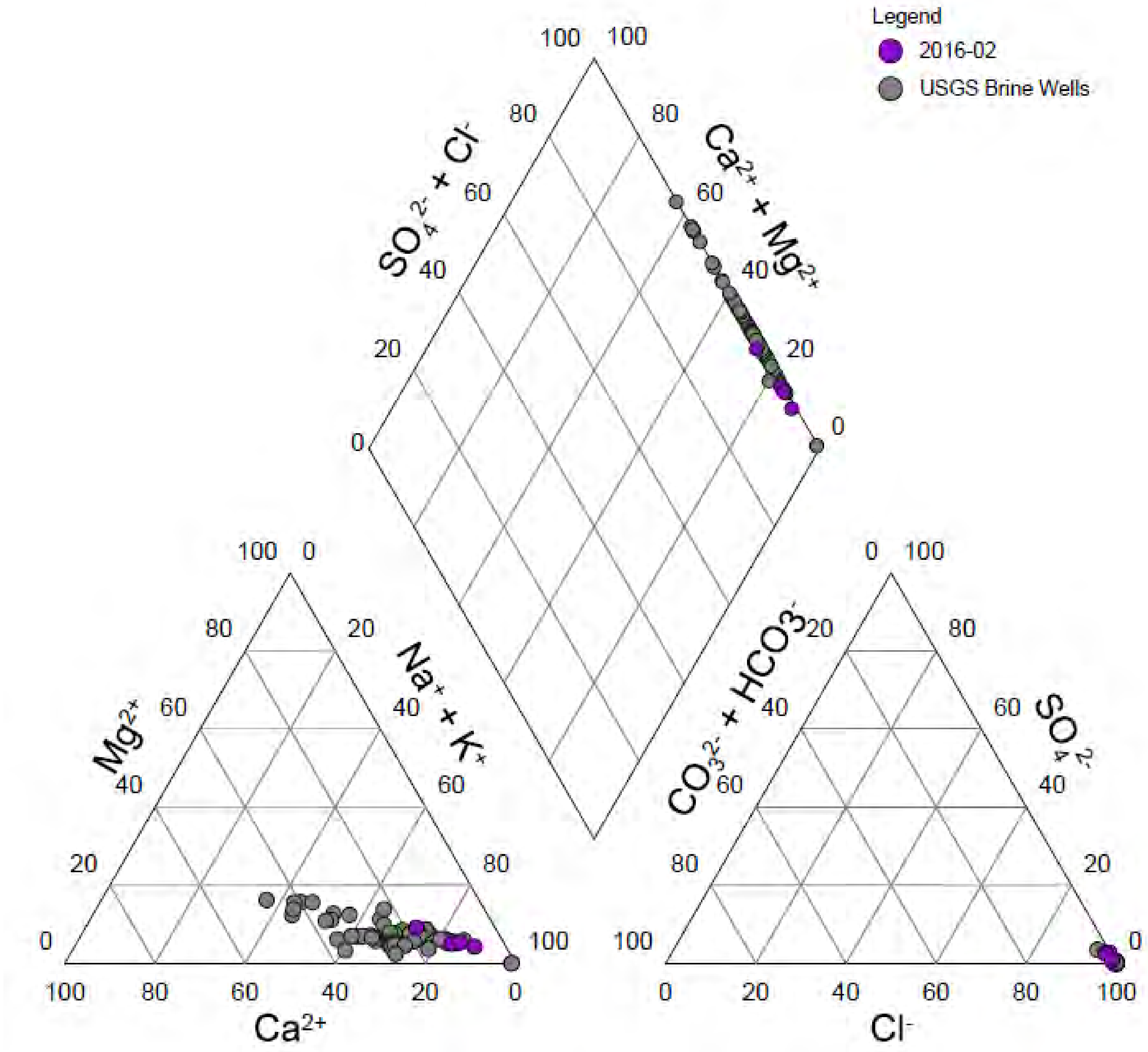


Figure 5-1: Difference in TDS Concentrations in the Morgantown and Cow Run Sandstone

Fly Ash Reservoir First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

ERM

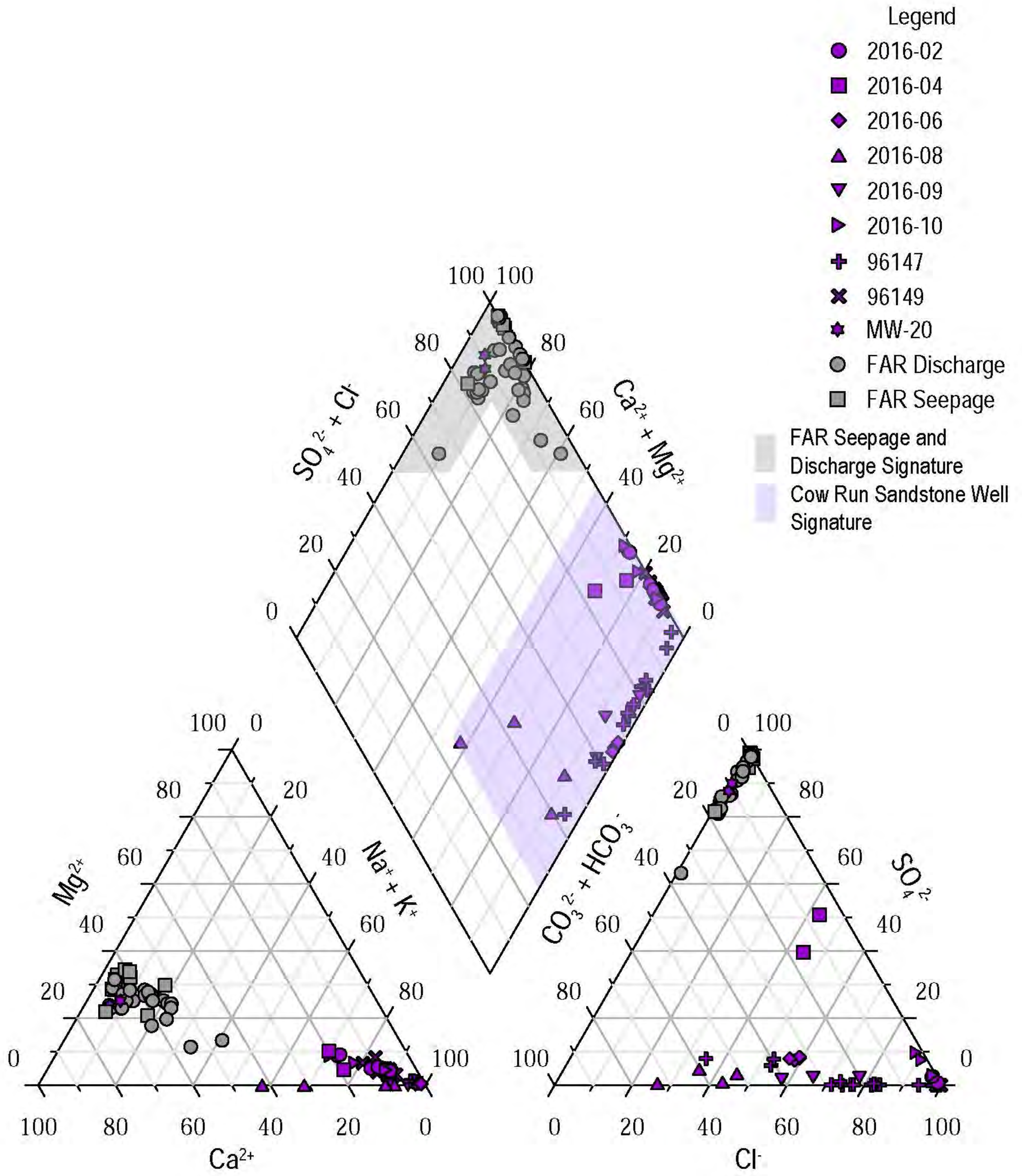


NOTES:
1. Brine results from NATCARB database
2. Only includes wells complete with all 8 piper diagram analytes are presented.
3. Only includes wells within 50 miles of the site.
4. On-site well 2016-02 samples from January 2017 - March 2019

Figure 5-2: FAR Piper Diagram for Regional Brine

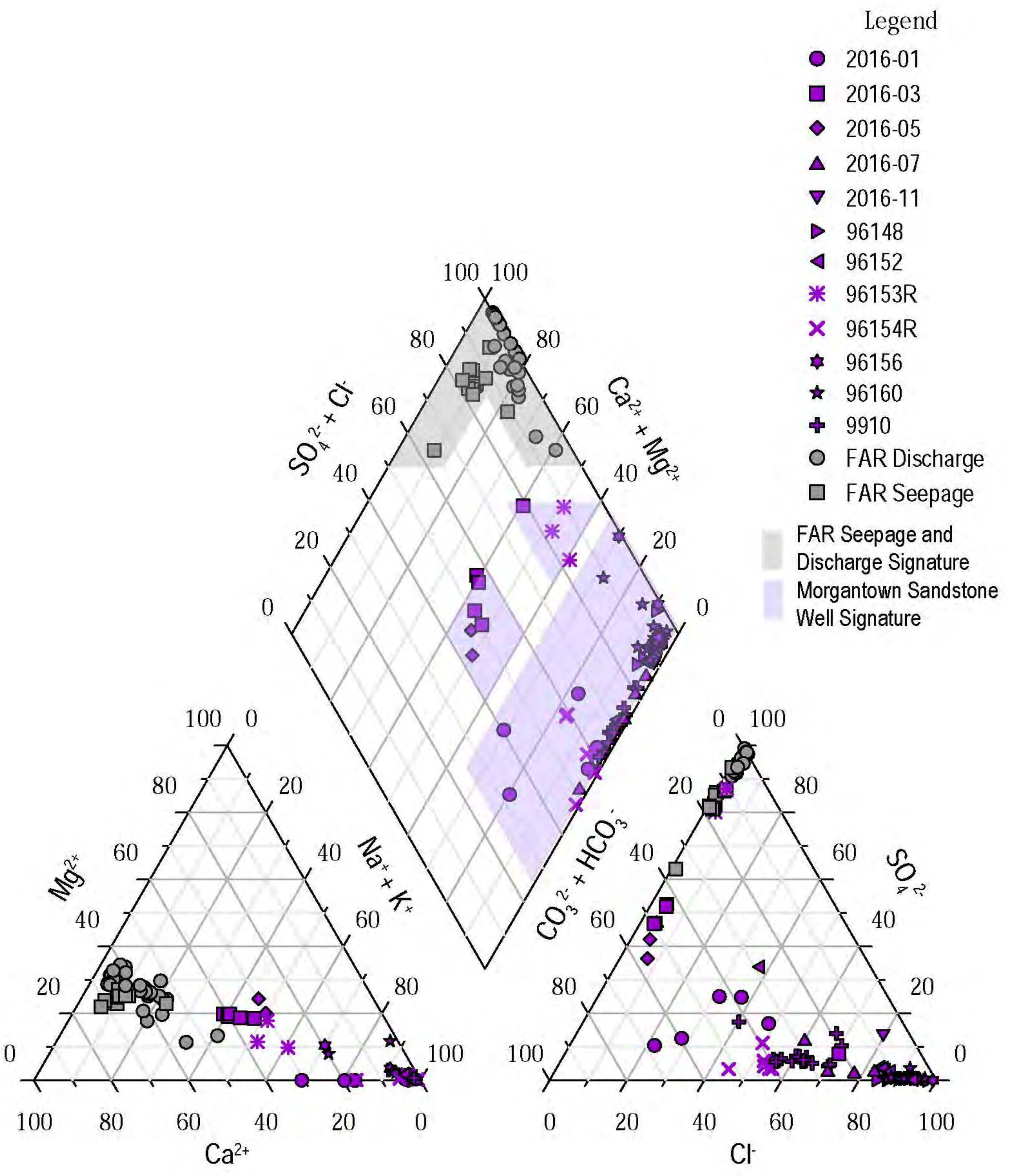
Fly Ash Reservoir First Semi-Annual Sampling Event of
2019 Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

ERM



NOTES:
1. Data Range: May 1999 to April 2019
2. Only wells with complete data including all 8
   piper diagram analytes are presented.

Figure 7-1: FAR Piper Diagram for the Cow Run Sandstone
Fly Ash Reservoir First Semi-Annual Sampling Event of 2019 Alternate
Source Demonstration
Gavin Generating Station
Cheshire, Ohio



NOTES:
1. Data Range: May 1999 to April 2019
2. Only wells with complete data including all 8 piper diagram analytes are presented.

Figure 7-2: FAR Piper Diagram for the Morgantown Sandstone
Fly Ash Reservoir First Semi-Annual Sampling Event of 2019 Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

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APPENDIX B GAVIN FLY ASH RESERVOIR SECOND SEMIANNUAL SAMPLING EVENT OF 2019 ALTERNATE SOURCE DEMONSTRATION REPORT

Gavin Fly Ash Reservoir

Gavin Power, LLC

Second Semiannual Sampling Event of 2019 Alternate Source Demonstration Report

Gavin Power Plant
Cheshire, Ohio

31 January 2020

Project No.: 0505619

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Signature Page

31 January 2020

Gavin Fly Ash Reservoir

Second Semiannual Sampling Event of 2019 Alternate Source Demonstration Report

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Cheshire, Ohio

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Acronyms and Abbreviations

Name	**Definition**
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
CCR Unit	Fly Ash Reservoir CCR Surface Impoundment
CFR	Code of Federal Regulations
FAR	Fly Ash Reservoir
Gavin	Gavin Power, LLC
NETL	National Energy Technology Laboratory
OEPA	Ohio Environmental Protection Agency
Plant	General James M. Gavin Power Plant
RWL	Residual Waste Landfill
SSI	Statistically significant increase
TDS	Total dissolved solids
USEPA	United States Environmental Protection Agency

1. INTRODUCTION

1.1 Regulatory and Legal Framework

In accordance with 40 Code of Federal Regulations (CFR) Part 257 Subpart D—Standards for the Disposal of Coal Combustion Residuals (CCR) in Landfills and Surface Impoundments (CCR Rule), Gavin Power, LLC (Gavin) has been implementing the groundwater monitoring requirements of 40 CFR § 257.90 *et seq.* for its Fly Ash Reservoir (FAR) CCR Surface Impoundment (CCR Unit) at the General James M. Gavin Power Plant (Plant). Gavin calculated background levels and conducted statistical analyses for Appendix III constituents in accordance with 40 CFR § 257.93(h). Currently, Gavin is performing detection monitoring at the FAR in accordance with 40 CFR § 257.94. Statistically significant increases (SSIs) over background concentrations were detected in downgradient monitoring wells for Appendix III constituents for the second half of 2019 and are explained in this report.

An SSI for one or more Appendix III constituents is a potential indication of a release of constituents from the CCR unit to groundwater. In the event of an SSI, the CCR Rule provides that "the owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality" (40 CFR § 257.94(e)(2)). If it can be demonstrated that the SSI is due to a source other than the CCR unit, then the CCR unit may remain in the Detection Monitoring Program instead of transitioning to an Assessment Monitoring Program. An Alternate Source Demonstration (ASD) must be made in writing and the accuracy of the information must be verified through certification by a qualified Professional Engineer (40 CF § 257.94(e)(2)).

The United States Environmental Protection Agency (USEPA) guidance document, "Solid Waste Disposal Facility Criteria Technical Manual, USEPA 530-R-93-017, Subpart E" (USEPA 1993), lays out the six lines of evidence that should be addressed to determine whether an SSI resulted from a source other than the regulated disposal unit:

1. An alternative source exists.
2. Hydraulic connection exists between the alternative source and the well with the significant increase.
3. Constituent(s) (or precursor constituents) are present at the alternative source or along the flow path from the alternative source prior to possible release from the unit.
4. The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the unit when the fate and transport characteristics of the constituents are considered.
5. The concentration observed in groundwater could not have resulted from the unit given the waste constituents and concentrations in the unit leachate and wastes, and site hydrogeologic conditions.
6. The data supporting conclusions regarding the alternative source are historically consistent with the hydrogeologic conditions and findings of the monitoring program.

This ASD Report addresses each of these lines of evidence for the SSIs detected in the groundwater beneath the FAR.

1.2 Background

The Plant is a coal-fired generating station located along the Ohio River in Gallia County in Cheshire, Ohio, (Figure 1-1). The FAR is one of three CCR units at the Plant that are subject to regulation under the

CCR Rule. The FAR is approximately 300 acres and is located about 2.5 miles northwest of the Plant (Figure 1-2). From the mid-1970s until January 1995, fly ash was sluiced from the Plant to the former Stingy Run stream valley. The settled CCR materials were retained behind the Stingy Run Fly Ash Dam that formed the FAR.

A Groundwater Monitoring Network Evaluation was performed to provide an assessment of the compliance of the groundwater monitoring network with 40 CFR § 257.91. This evaluation identified an uppermost aquifer composed of sandstone and interbedded clay shale units, specifically the Morgantown Sandstone and Cow Run Sandstone, and indicated groundwater flows to the south and east (Geosyntec 2016). Consistent with the CCR Rule and the Groundwater Monitoring Plan developed for Gavin (ERM 2017), a prediction limit approach was used to identify potential impacts to groundwater. Upper and lower prediction limits were established based on the upgradient groundwater data. The following reports were previously prepared and posted to identify alternate sources for identified SSIs:

- SSIs associated with the August 2016 to August 2017 period were addressed in the Gavin FAR ASD Report (ERM 2018a).
- SSIs associated with the spring 2018 sampling event were addressed in the *Gavin FAR First Semiannual Sampling Event of 2018 ASD Report* (ERM 2018b).
- The SSIs identified for samples collected in September and October 2018 were addressed in the *Gavin FAR Second Semiannual Sampling Event of 2018 ASD Report* (ERM 2019a).
- The SSIs identified for samples collected in March 2019 were addressed in the *Gavin FAR First Semiannual Sampling Event of 2019 ASD Report* (ERM 2019b).

This ASD Report addresses SSIs for samples collected from the Cow Run and Morgantown monitoring wells in September of 2019, as summarized in Table 1-1 and Table 1-2, respectively.

Table 1-1: SSIs in FAR Cow Run Monitoring Wells

Analyte	2016-02	2016-08
Boron	ϕ	ϕ
Calcium	X	ϕ
Chloride	ϕ	ϕ
Fluoride	ϕ	ϕ
pH	ϕ	ϕ
Sulfate	ϕ	ϕ
Total Dissolved Solids	X	ϕ

ϕ = No SSI; X = SSI
Results are for the downgradient wells sampled in September 2019.

Table 1-2: SSIs in FAR Morgantown Monitoring Wells

Analyte	2016-01	2016-07	9910
Boron	ϕ	ϕ	ϕ
Calcium	ϕ	ϕ	ϕ
Chloride	ϕ	ϕ	ϕ
Fluoride	ϕ	ϕ	ϕ
pH	X	ϕ	ϕ
Sulfate	ϕ	ϕ	ϕ
Total Dissolved Solids	ϕ	ϕ	ϕ

ϕ = No SSI; X = SSI
Results are for the downgradient wells sampled in September 2019.

This ASD Report identifies alternate sources for the SSIs of calcium, total dissolved solids (TDS), and pH. Supporting information and discussions of each of the lines of evidence in Section 1.1 are presented in subsequent sections of this report.

2. HYDROGEOLOGIC INTERPRETATION

A detailed interpretation of hydrogeological conditions can be found in the Gavin FAR ASD Report (ERM 2018a). Key conclusions from this analysis include the following:

- The section of the aquifer under the southeastern portion of the FAR and extending toward the southeast under the Residual Waste Landfill (RWL) in the Morgantown and Cow Run Sandstone contains a region of lower hydraulic pressure (in comparison to the surrounding areas), as depicted on Figures 2-1 and 2-2, respectively. This area of lower hydraulic head (i.e. pressure)is located under portions of the FAR and RWL that have received CCR materials which act to reduce infiltration due to their lower permeability, and where an engineered geosynthetic liner system has been installed beneath the RWL. The forested and pastured areas surrounding the FAR and RWL are more permeable and exhibit greater infiltration than the fine-grained, compacted material within the FAR and RWL. Groundwater flows from the areas of higher pressure surrounding the FAR and RWL to areas of lower pressure below the FAR and RWL.
- On the western side of the FAR, groundwater flows from west to east toward the groundwater trough and then turns to the southeast and flows toward the Ohio River.
- On the northeastern boundary of the FAR, groundwater flows from north to south and then turns to the southeast and flows toward the Ohio River.

3. DESCRIPTION OF ALTERNATE SOURCES

3.1 Calcium and Total Dissolved Solids

The regional bedrock geology near the Plant includes Pennsylvanian-age sedimentary rocks from the Monongahela and Conemaugh Groups. These sedimentary rocks consist primarily of shale and siltstone, with minor amounts of mudstone, sandstone, and incidental amounts of limestone and coal (USGS 2005). Overlying the Pennsylvanian-age rocks are Quaternary-age alluvium that consists primarily of sand, silt, clay, and gravel (OEPA 2018). These sedimentary rocks form the ridges and valleys west of the Ohio River and the unconsolidated sands, silts, clays, and gravels are located along the Ohio River. The consolidated sedimentary rocks and the unconsolidated alluvium (sand, silt, clay, and gravel) form the two major aquifers near the Plant (Figure 3-1). The interaction of groundwater with rocks and minerals within these aquifers can influence the concentration of Appendix III constituents (ORSANCO 1984).

Naturally-occurring brine, which is known to be rich in calcium, sodium, chloride, sulfate, fluoride, and other trace elements, has naturally elevated TDS, and exists in the subsurface and at the land surface in the Ohio River Valley (ORSANCO 1984; ODNR 1995). The Cow Run Sandstone, where well 2016-02 is screened, is the shallowest sedimentary rock formation that contains a brine of marine origin (Stout et al. 1932). The presence of brine in the region indicates the potential for brine to be the alternate source for calcium and TDS observed in the Cow Run Sandstone.

3.2 pH

A pH value above the upper prediction limit was identified at well 2016-01 for the sample collected in September 2019. As discussed in Section 7 of this document, neither the regional hydrogeologic conditions nor the seepage and discharge from the FAR are likely sources of elevated pH in the groundwater. Based on a review of the boring log and well construction diagram prepared for well 2016-01, a likely source for the elevated pH of the sample is cement used during well construction. The well construction methodology could have enabled contact between the screened interval and the cement-bentonite grout used during well construction.

Impacts on groundwater quality caused by cement-based grout are typically associated with groundwater pH values above 10, and, in low-permeability formations, the impacts of grout materials may persist for significant periods of time due to the slower rate of flushing of the well screen by migrating groundwater (Pohlmann and Alduino 1992; Barcelona et al. 1988). Based on the elevated pH values observed at this well between August 2016 and March 2019, it appears that incorrect well construction methods have influenced the quality of groundwater collected from this well; thus, the alternate source of the elevated pH is likely cement used during well construction.

4. HYDRAULIC CONNECTIONS TO THE ALTERNATE SOURCES

4.1 Calcium and Total Dissolved Solids

As depicted on Figure 3-1, regional groundwater flow near and surrounding the FAR occurs primarily within fractured sedimentary rocks of the Conemaugh Group, which contain the Morgantown and the Cow Run Sandstone (Wyrick and Borchers 1981; USGS 2016). These sedimentary rock groups extend west of the FAR where naturally occurring brine could contribute calcium and TDS to groundwater. Figure 4-1 illustrates the pathway for regional groundwater flows through the fractured bedrock from the northern and western regions under the FAR, to the southern and eastern regions toward the Ohio River. While migrating through the fractured bedrock, groundwater has the potential to interact with naturally occurring brine containing elevated calcium and TDS concentrations. Based on these considerations, the fractured rock of the Conemaugh Group, which includes the Cow Run Sandstone, is hydraulically connected to the potential alternate sources of calcium and TDS.

4.2 pH

As described in Section 3.2, the source of the elevated pH in well 2016-01 appears to be cement-bentonite grout used during well construction. Given that the cement-bentonite grout was injected into the borehole during construction, concrete may have penetrated the sand pack or fractures within the bedrock immediately surrounding the well screen. As a result, groundwater migrating through these fractures and the sand pack could come into contact with the cement. Thus, the alternate source of elevated pH (cement-bentonite grout) is liklely hydraulically connected with groundwater entering well 2016-01.

5. CONSTITUENTS ARE PRESENT AT THE ALTERNATE SOURCES OR ALONG FLOW PATHS

5.1 Calcium and Total Dissolved Solids

To account for natural sources of calcium on a regional scale, brine data were obtained from the National Energy Technology Laboratory's (NETL) NATCARB database (NETL 2015). Figure 5-1 presents the concentration of calcium in brine and illustrates how elevated calcium concentrations are present throughout the region surrounding the Plant. As discussed in Section 3.1, brine is commonly found at relatively shallow depths or at the land surface in the Ohio River Valley. The fractured bedrock aquifers of the Monongahela and Conemaugh rocks could act as the flow pathways where brine could mix with groundwater (Figure 4-1).

The Cow Run is the shallowest sedimentary member that carries naturally occurring brine in the region of the Plant (Ohio Geological Survey 1932). The brines consist of high concentrations of dissolved salts, which consequently result in elevated concentrations of TDS. Figure 5-2 presents the difference between Morgantown and Cow Run Sandstone TDS for well couplets in the FAR and RWL where data from both intervals was available. At the majority of the locations, the TDS concentrations are greater in the deeper brine-impacted Cow Run formation (green circles) compared to the shallower Morgantown formation.

The piper diagram is a graphical procedure commonly used to interpret sources of dissolved constituents in water and evaluate the potential for mixing of waters from different sources (Piper 1944). Figure 5-3 compares geochemical signatures of brine samples collected within 50 miles of the site (NETL 2015) with the chemical signature of well 2016-02. The result demonstrates that the geochemical composition of groundwater in monitoring well 2016-02 is similar to the composition of the regional brine samples.

These combined lines of evidence demonstrate that calcium and TDS are present at the alternate sources (brine) and along the flow path underneath the FAR.

5.2 pH

Cement mixtures are strongly basic and can have a pH between 12 and 13 (Portland Cement Association 2018). Groundwater that entered the well screen of well 2016-01 likely contacted uncured cement, and the elevated pH has persisted 3 years after well installation due to the naturally low groundwater velocity of the Morgantown formation and the limited flushing of the well screen interval. Thus, the alternate source (cement-bentonite grout) is along the flow path of groundwater entering well 2016-01.

6. LINKAGES OF CONSTITUENT CONCENTRATIONS AND DISTRIBUTIONS BETWEEN ALTERNATE SOURCES AND DOWNGRADIENT WELLS

6.1 Calcium and Total Dissolved Solids

As described in Sections 4 and 5, regional concentrations of calcium in brine within the Conemaugh formation (which contains the Cow Run Sandstone) are higher than in well 2016-02. This demonstrates that naturally occurring brine could be an alternate source. The brine consists of high concentrations of dissolved salts, which consequently results in elevated TDS concentrations. The Cow Run Sandstone is laterally extensive throughout southeast Ohio where regional brine is known to exist. Figure 4-1 shows how groundwater in the Cow Run Sandstone could come into contact with brine, then flow under the FAR, and eventually discharge to the Ohio River.

6.2 pH

As discussed in Section 5, the pH of the groundwater detected at monitoring well 2016-01 is consistent with the typical pH of cement used for well construction.

7. A RELEASE FROM THE FAR IS NOT SUPPORTED AS THE SOURCE

7.1 Piper Diagrams

As seen on Figures 7-1 and 7-2 which depict chemical signatures of groundwater from the Morgantown and Cow Run Sandstone, respectively, the FAR discharge and FAR seepage results plot in the upper portion of the piper diagram. This indicates a high calcium and sulfate fingerprint. The FAR discharge and FAR seepage results represent water that has been in contact with CCR. Specifically, the discharge samples are collected from standing water within the FAR. The seepage samples represent FAR water collected from the engineered collection system at the toe of the dam.

Conversely, groundwater from the Cow Run Sandstone and Morgantown Sandstone, both upgradient and downgradient of the FAR, generally exhibit elevated concentrations of sodium, potassium, and chloride. The two exceptions are monitoring wells MW-20 (Cow Run Sandstone) and 96153R (Morgantown Sandstone), which are upgradient wells and only coincidentally have signatures similar to the leachate due to the elevated sulfate concentrations associated with nearby coal mines. The groundwater chemical signatures from the Morgantown and Cow Run monitoring wells are distinctly different from the FAR discharge and FAR seepage chemical signatures. If water in contact with fly ash (e.g., seepage water or discharge water) were released from the FAR and mixed with groundwater, the signature of the resulting mixture would become more like the discharge and seepage signatures (i.e., plot higher in the diamond portion of the piper diagram).

Results from 2016-01 where pH is elevated from water coming in contact with cement grout from well construction plot as a slightly different signature in the diagram; however, the signature is more similar to the site-wide groundwater than to the leachate.

Based on the data presented on Figures 7-1 and 7-2, the groundwater in the Cow Run Sandstone and Morgantown Sandstone has not mixed with FAR discharge or seepage since they plot in distinct regions on the piper diagram. This indicates that the FAR is not the source of the constituents detected in wells 2016-01 and 2016-02.

7.2 Leachate Constituents versus Groundwater Constituents

If the FAR experienced a release and seepage or discharge mixed with groundwater, the concentrations of individual analytes in the resulting mixture would depend on the volume and initial concentration of the release. In order for a release to result in an increase in the concentration or value of an analyte in groundwater, the concentration of the analyte in the seepage or discharge would need to be higher than the respective existing background concentrations in groundwater. However, at the FAR, the opposite conditions exist: the concentrations of calcium, TDS, and pH are significantly lower in the discharge and seepage than in the respective formation groundwater where the SSIs were observed (Table 7-1).

Table 7-1: Comparison of FAR Discharge, Seepage and Groundwater for SSI Analytes

Analyte	**Units**	**FAR Discharge (2016–2019)**		**FAR Seepage (2016-2019)**		**Well 2016-02 (2016–2019)**		**Well 2016-01 (2016-2019)**	
		Mean	Median	Mean	Median	Mean	Median	MIN	Median
Calcium	mg/L	156	-	232	-	492	-	-	-
TDS	mg/L	929	-	1,010	-	18,825	-	-	-
pH	S.U.	-	7.4	-	7.66	-	-	-	12.03

Notes: mg/L = milligrams per liter
S.U. = standard units

Additionally, the fact that the FAR is located above the Morgantown Sandstone where TDS concentrations are consistently lower than in the underlying Cow Run (Figure 5-1), further demonstrates that FAR seepage or discharge is unlikely to be the source of the TDS observed at Well 2016-02.

Based on this, the FAR seepage or discharge are unlikely to be the source of the calcium, TDS, and pH SSIs observed at Wells 2016-01 and 2016-02.

8. ALTERNATE SOURCE DATA ARE HISTORICALLY CONSISTENT WITH HYDROGEOLOGIC CONDITIONS

8.1 Calcium and Total Dissolved Solids

This ASD Report provides background groundwater quality for the fractured sedimentary bedrock aquifers found within and beyond the boundary of the FAR. The patterns of regional groundwater flow through fractured rock near the FAR were established after the last deglaciation, which occurred approximately 14,000 years ago (Hansen 2017). A conservatively high effective porosity of 1 percent results in an estimated groundwater velocity for the Morgantown Sandstone and Cow Run Sandstone of 80 feet per year and 50 feet per year (ERM, 2020a), respectively, which would allow ample time for groundwater to migrate from upgradient regional sources onto Plant property since the end of the last glaciation. The data supporting these conclusions are historically consistent with hydrogeological conditions and findings of the monitoring program.

8.2 pH

The elevated pH that has been observed at well 2016-01 since it was constructed in March 2016 is consistent with the use of cement-bentonite grout during well construction. In addition, the persistence of the elevated pH is consistent with the groundwater velocities of the Morgantown Sandstone and expected low rate of flushing of the monitoring well screen interval.

9. CONCLUSIONS

The SSIs identified in this report for samples from monitoring wells located downgradient of the FAR were detected in September 2019. The data were reviewed for quality assurance, statistically analyzed, and reported to Gavin on 18 December 2019. In response to the SSIs, this ASD Report was prepared within the required 90-day period in accordance with 40 CFR § 257.94(e)(2).

All SSIs in the downgradient FAR monitoring wells are determined to have resulted from alternate sources that include regional background concentrations, naturally occurring brine, and cement from well construction. Table 9-1 summarizes the six lines of evidence of an ASD for each of the SSIs.

Table 9-1: FAR ASD Summary

Line of Evidence	Calcium	pH	TDS
Alternate source	Calcium is present in regional sources such as naturally occurring brine.	Elevated pH results from cement used during well construction.	TDS is present in background groundwater and can be attributed to regional sources such as naturally occurring brine.
Hydraulic connection	Regional groundwater flows under the FAR.	Cement from well construction is in contact with groundwater.	Regional groundwater flows under the FAR.
Constituent present at source or along flow path	Calcium is present along flow path.	Cement from well construction is likely located in or near the well screen.	Elevated TDS is present along the flow path.
Constituent distribution more strongly linked to alternate source	Calcium in FAR groundwater is within the range of regional brine concentrations.	The observed pH levels are consistent with the expected pH of groundwater in contact with cement.	TDS in Cow Run groundwater below the FAR is consistent with the regional presence of brine in the Cow Run.
Constituent exceedance could not have resulted from the FAR	Piper diagrams show different chemical fingerprints between groundwater and FAR seepage and discharge. Calcium concentrations are lower in the CCR unit leachate and discharge than in the downgradient well.	Piper diagrams show different chemical fingerprints between FAR discharge/seepage and groundwater.	Piper diagrams show different chemical fingerprints between groundwater and FAR seepage and discharge. The concentrations of TDS in FAR seepage and discharge are lower than in Cow Run groundwater where the SSI for TDS was observed.
Data are historically consistent with hydrogeological conditions	Regional groundwater flows under the FAR.	Timing of well installation is consistent with likely impacts from cement.	Groundwater velocities suggest there is ample time for upgradient TDS to migrate to Cow Run well 2016-02.

In conclusion, the FAR is not the source of the SSIs identified in the second semiannual groundwater sampling event of 2019; thus, the Plant will continue detection monitoring at the FAR in accordance with 40 CFR § 257.94(e)(2).

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I, or an agent under my review, have prepared this Alternate Source Demonstration Report for the Fly Ash Reservoir and it meets the requirements of 40 CFR § 257.94(e)(2). To the best of my knowledge, the information contained in this report is true, complete, and accurate.

1/30/20
JAMES
HEMME
72851

James A. Hemme, P.E.
State of Ohio License No.: 72851

Date: 1/30/2020

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FIGURES

Figure 1-1: Gavin Plant Location
Gavin Generating Station
Cheshire, Ohio

ERM

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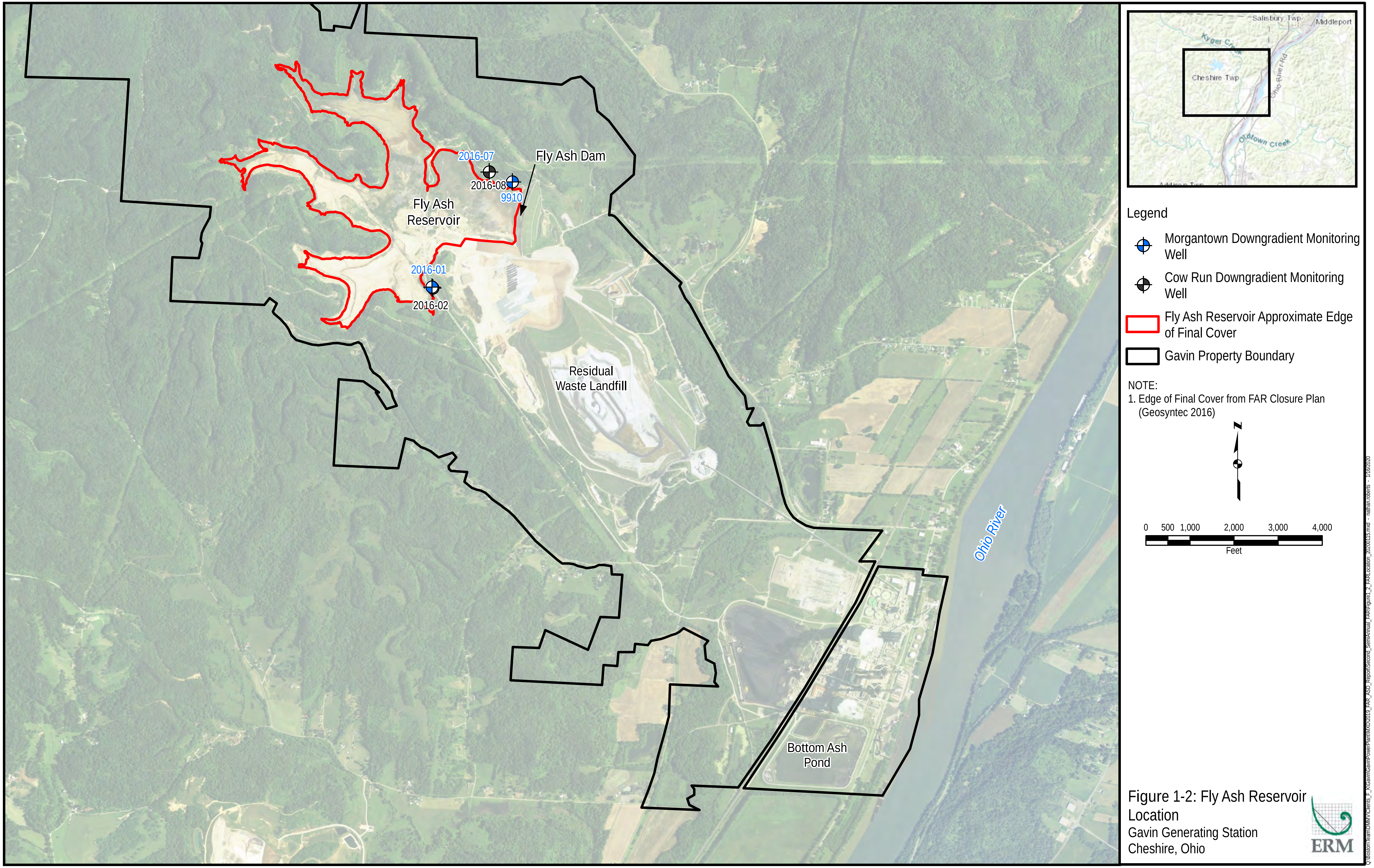
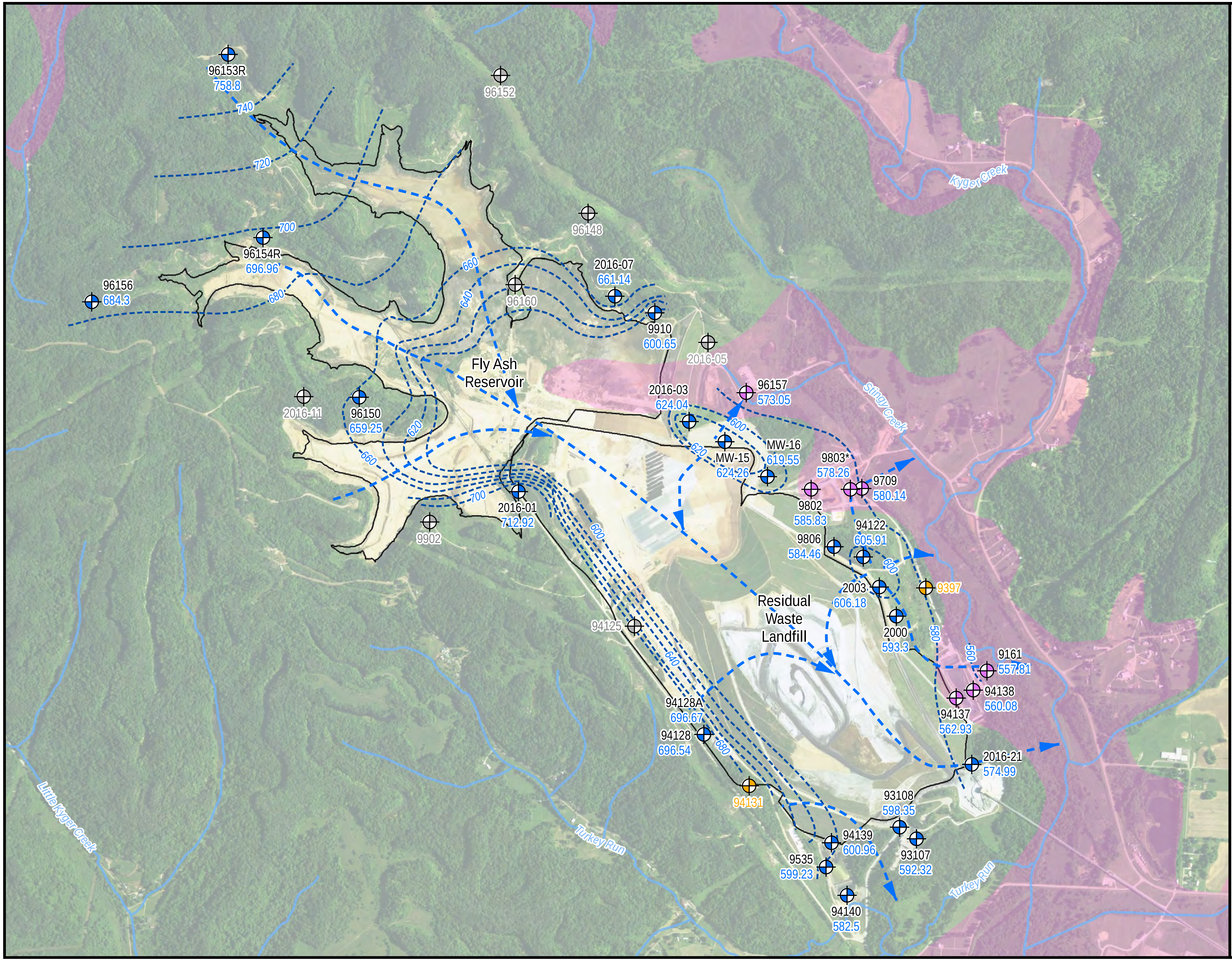
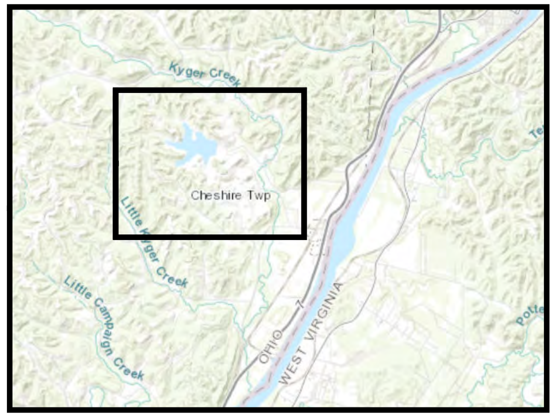


Figure 1-2: Fly Ash Reservoir Location
Gavin Generating Station
Cheshire, Ohio





Legend

⊕	Morgantown Sandstone Monitoring Well
⊕	Morgantown Sandstone Monitoring Well - Low Recharge or Dry*
⊕	Morgantown Sandstone Monitoring Well - Not Gauged*
⊕	Alluvium Monitoring Well
605.82	Groundwater Elevation (ft)
- - -	Interpreted Groundwater Potentiometric Contour
- ►	Interpreted Groundwater Flow Direction
—	Stream/Creek
☐	Coal Combustion Residual Unit
🟪	Interpreted area where the Morgantown Sandstone has been eroded and is not present (based on borehole logs and topographic analysis)

NOTES:

- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on ground-water gauging on conducted 9/5/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in September 2019.
- In areas where the Morgantown Sandstone is absent, on the east side of the landfill, the contours represent the potentiometric surface in the alluvial aquifer because these two aquifers are hydraulically connected.

N

0 500 1,000 2,000
Feet

Figure 2-1: Morgantown Sandstone Potentiometric Surface Map
September 2019
Gavin Generating Station
Cheshire, Ohio

ERM

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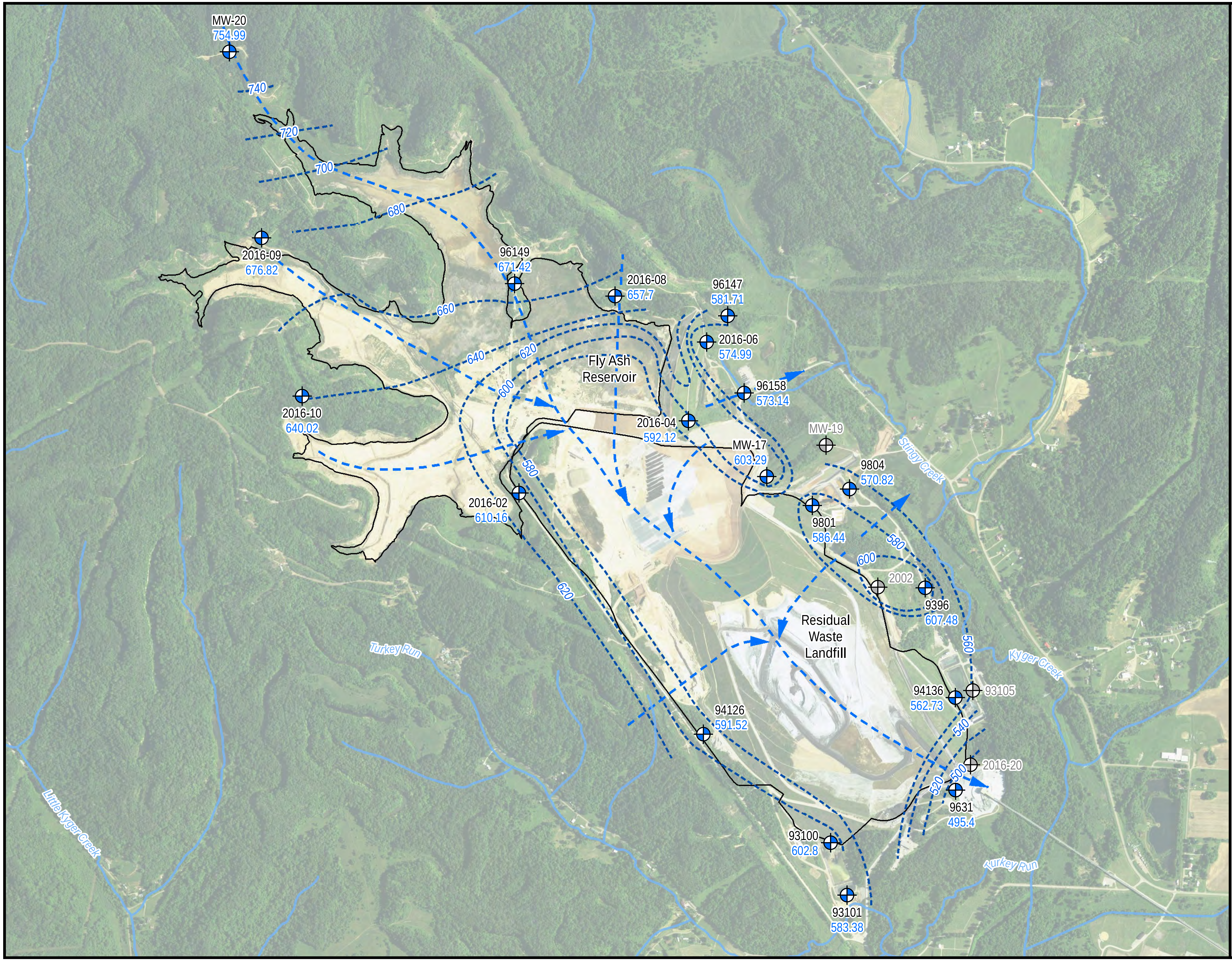

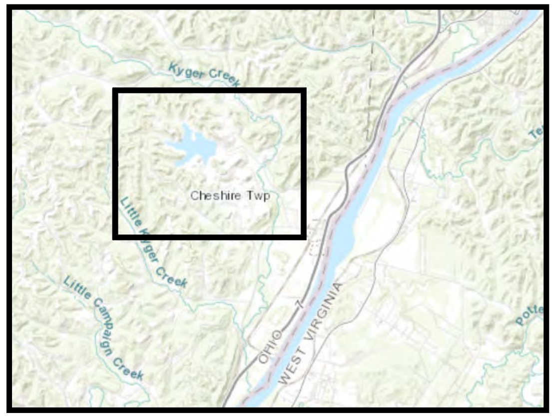

Legend

⊕ Cow Run Sandstone Monitoring Well

⊕ Cow Run Sandstone Monitoring Well - Low Recharge or Dry*

605.82 Groundwater Elevation (ft)

--- Interpreted Groundwater Potentiometric Contour

➤ Interpreted Groundwater Flow Direction

— Stream/Creek

☐ Coal Combustion Residual

NOTES:
- Cow Run Sandstone is present through entire site.
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging on conducted 9/5/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in September 2019.

N

0 500 1,000 2,000

Feet

Figure 2-2: Cow Run Sandstone Potentiometric Surface Map September 2019
Gavin Generating Station
Cheshire, Ohio

ERM

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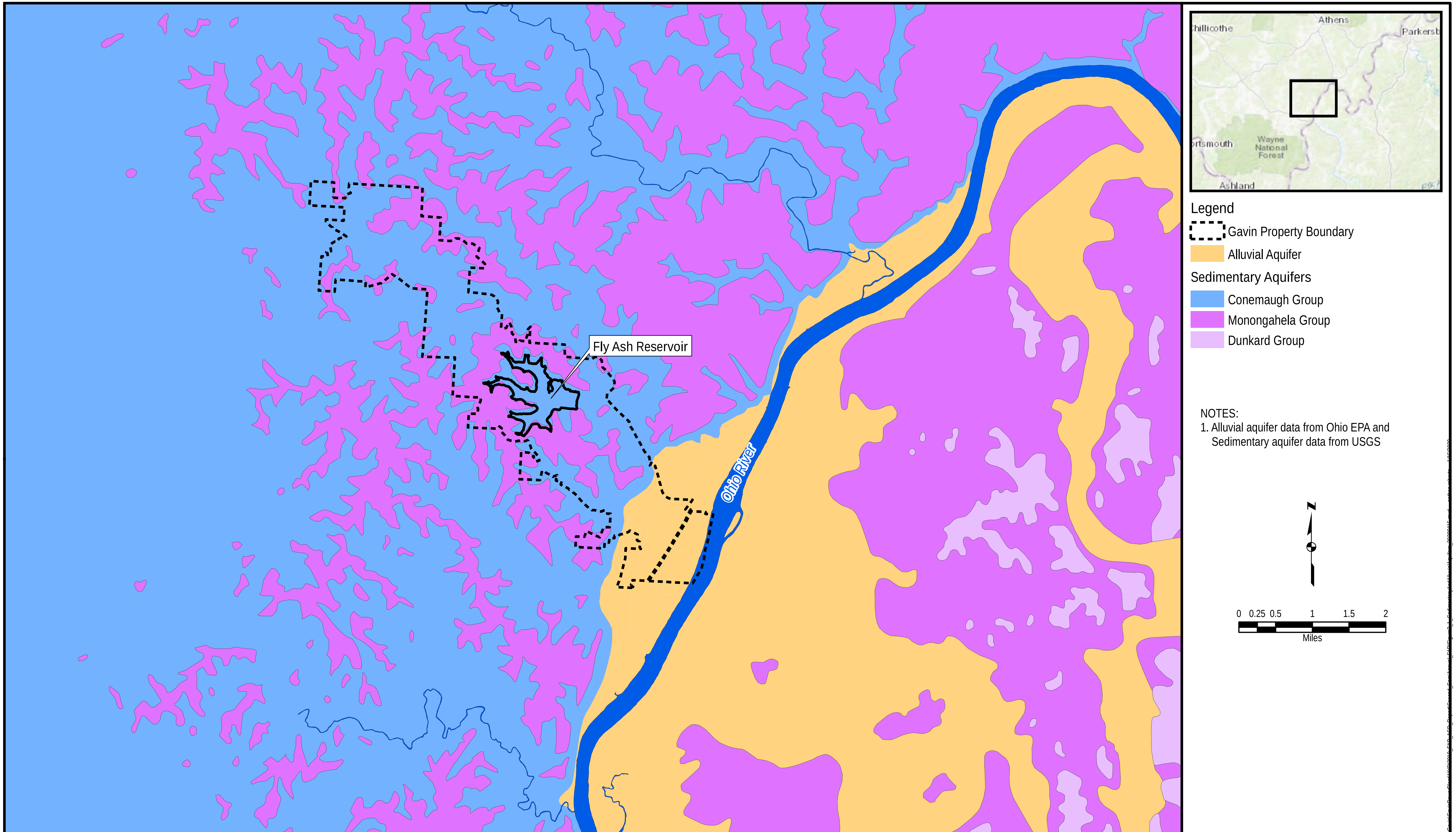
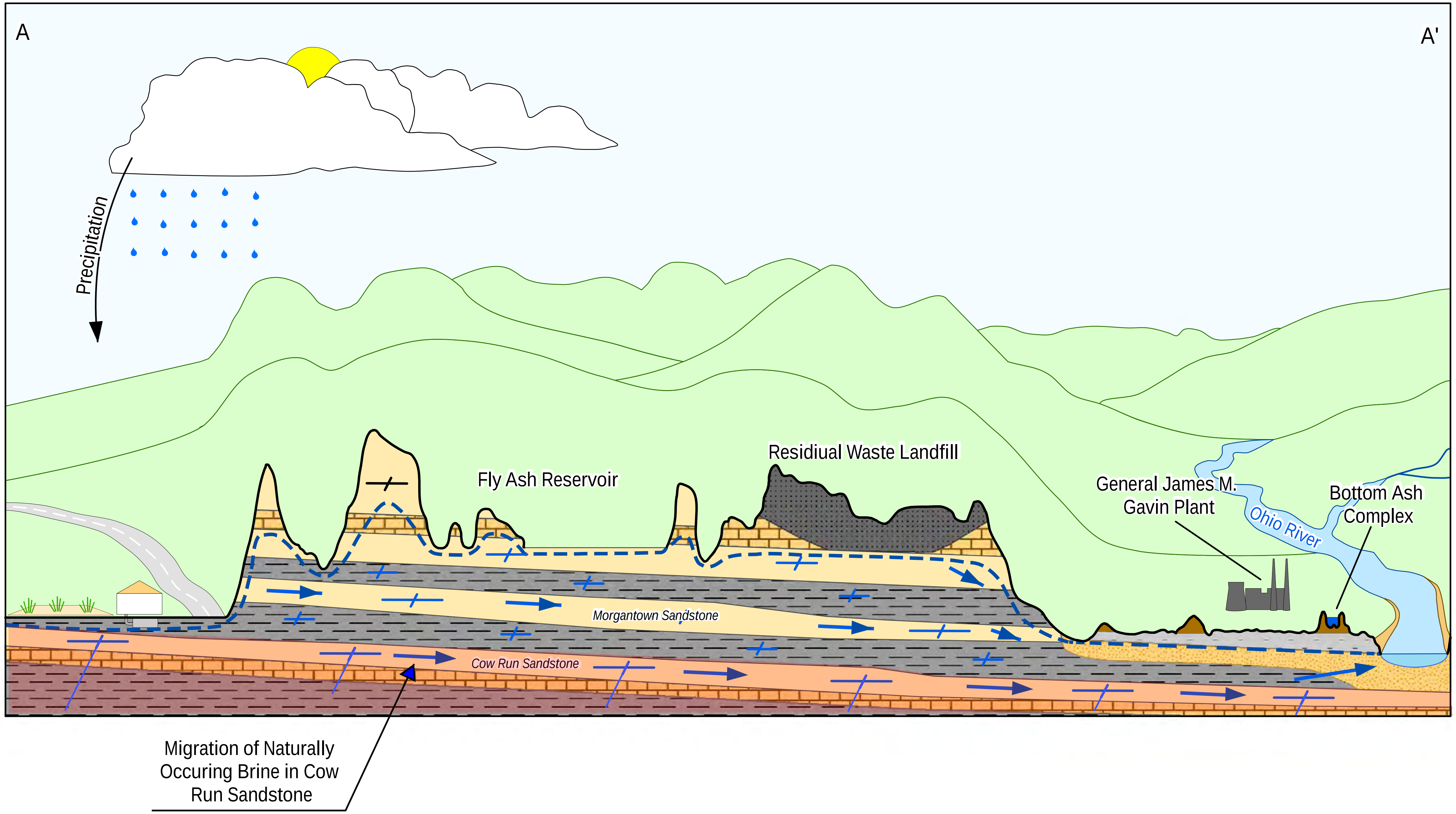
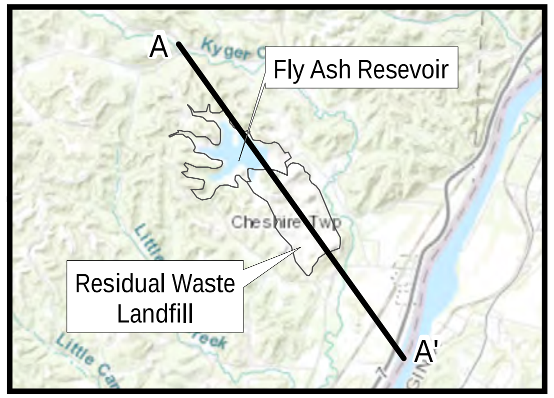


NOTES:
1. Alluvial aquifer data from Ohio EPA and Sedimentary aquifer data from USGS

Figure 3-1: Sedimentary and Alluvial Aquifers
Gavin Generating Station
Cheshire, Ohio

ERM





Legend

- ➔ Groundwater Flow Direction
- - - Water Table
- ― Saturated Fractures
- ― Unsaturated Fractures
- 🟥 Naturally Occuring Brine
- ▩ FGD Material
- 🟫 Fill
- ▤ Interbedded Silt/Clay
- ▨ Sand
- 🟨 Sandstone
- ▦ Fractured Limestone
- ▤ Fractured Shale

NOTES:
1. Sandstone bedrock units represent the Conemaugh Group and Monongahela Group Sedimentary Aquifers

0 500 1,000 2,000 3,000 4,000 5,000
Feet

Figure 4-1: Regional Groundwater Flow Patterns

Gavin Generating Station
Cheshire, Ohio

ERM

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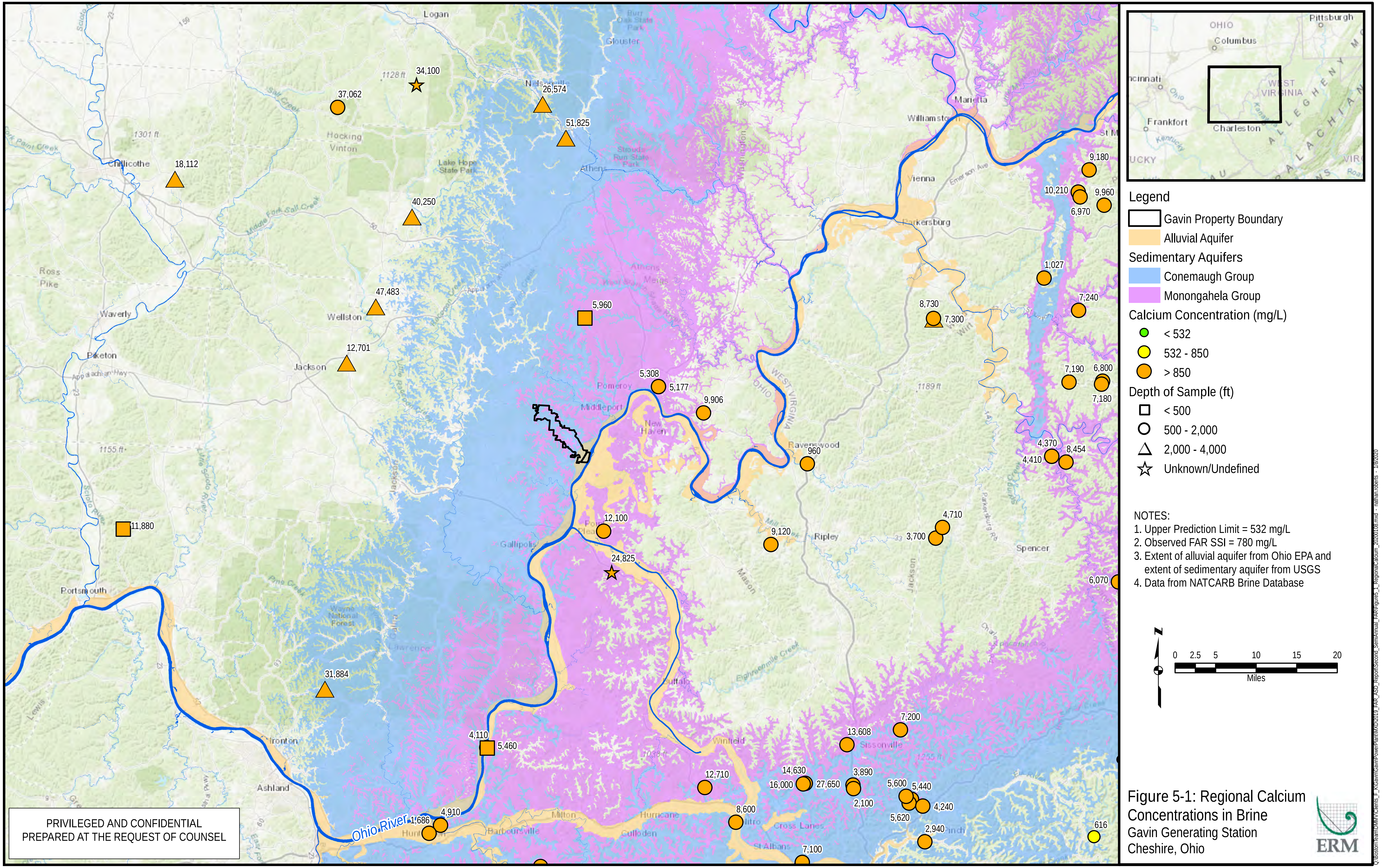

Legend

- ▭ Gavin Property Boundary
- 🟧 Alluvial Aquifer

Sedimentary Aquifers

- 🟦 Conemaugh Group
- 🟪 Monongahela Group

Calcium Concentration (mg/L)

- ● < 532
- ● 532 - 850
- ● > 850

Depth of Sample (ft)

- □ < 500
- ○ 500 - 2,000
- △ 2,000 - 4,000
- ☆ Unknown/Undefined

NOTES:
1. Upper Prediction Limit = 532 mg/L
2. Observed FAR SSI = 780 mg/L
3. Extent of alluvial aquifer from Ohio EPA and extent of sedimentary aquifer from USGS
4. Data from NATCARB Brine Database

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Figure 5-1: Regional Calcium Concentrations in Brine
Gavin Generating Station
Cheshire, Ohio

ERM

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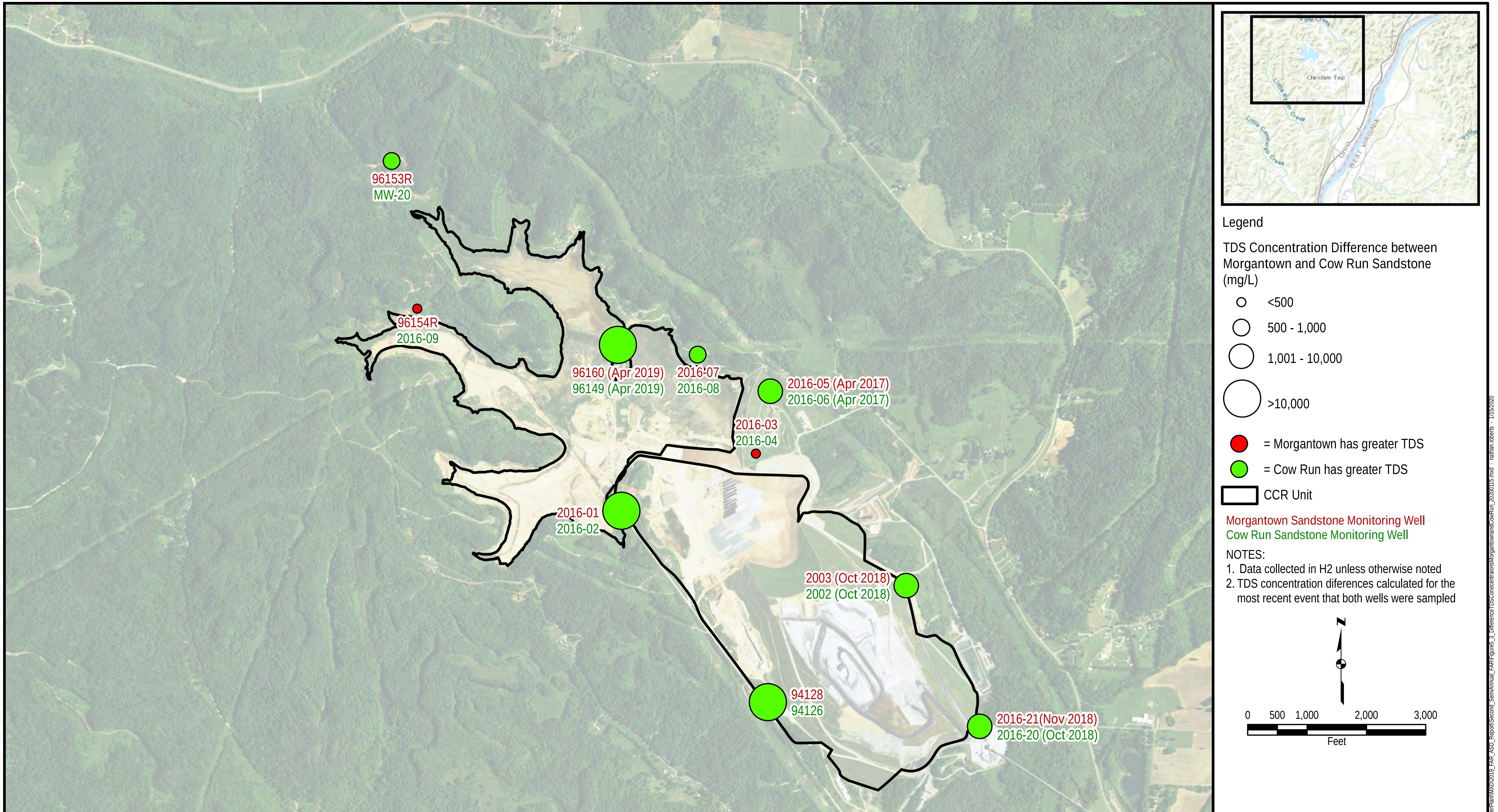
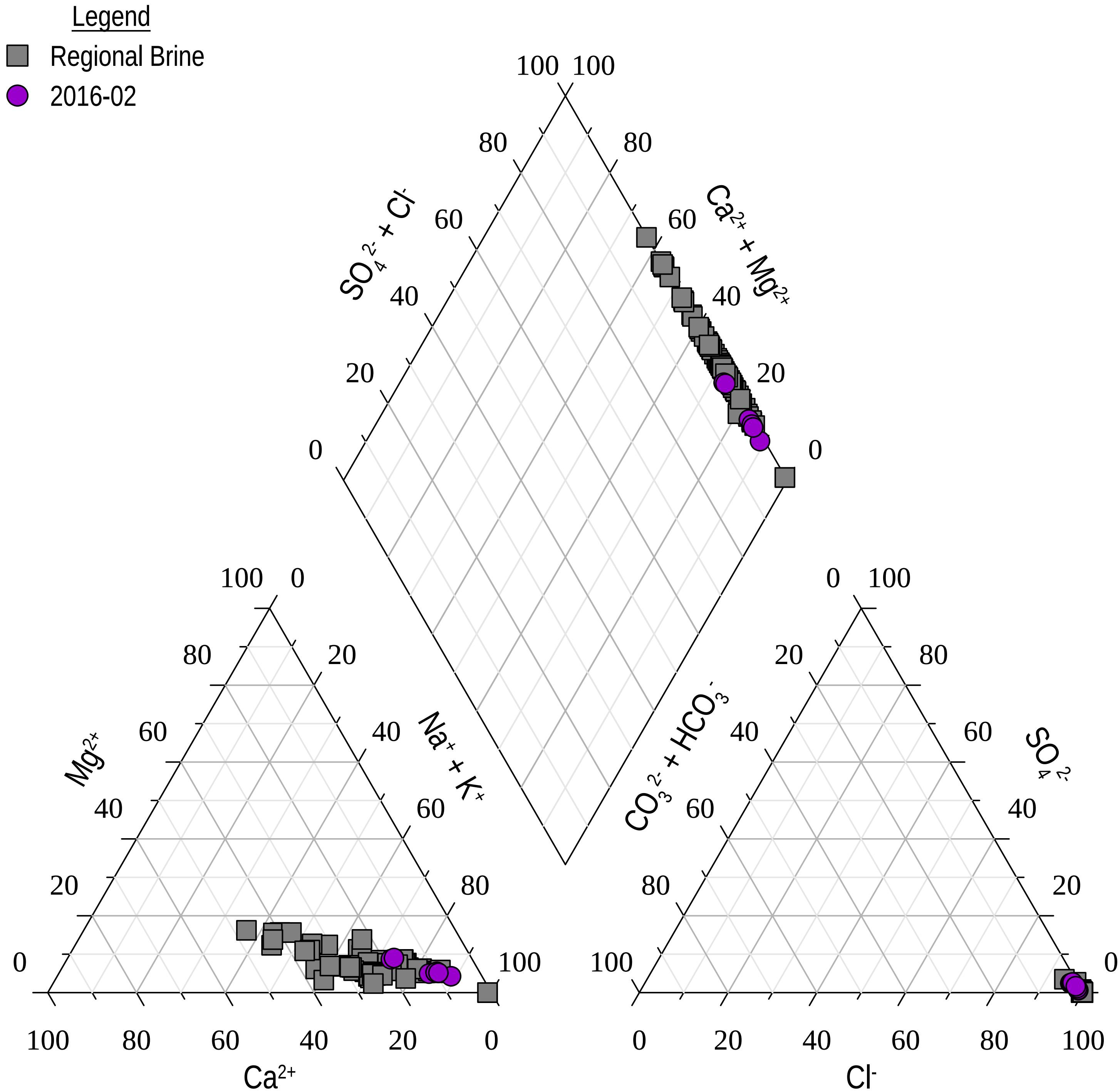


NOTES:
1. Data collected in H2 unless otherwise noted
2. TDS concentration diferences calculated for the most recent event that both wells were sampled

Figure 5-2: Difference in TDS Concentrations in the Morgantown and Cow Run Sandstone

Gavin Generating Station
Cheshire, Ohio

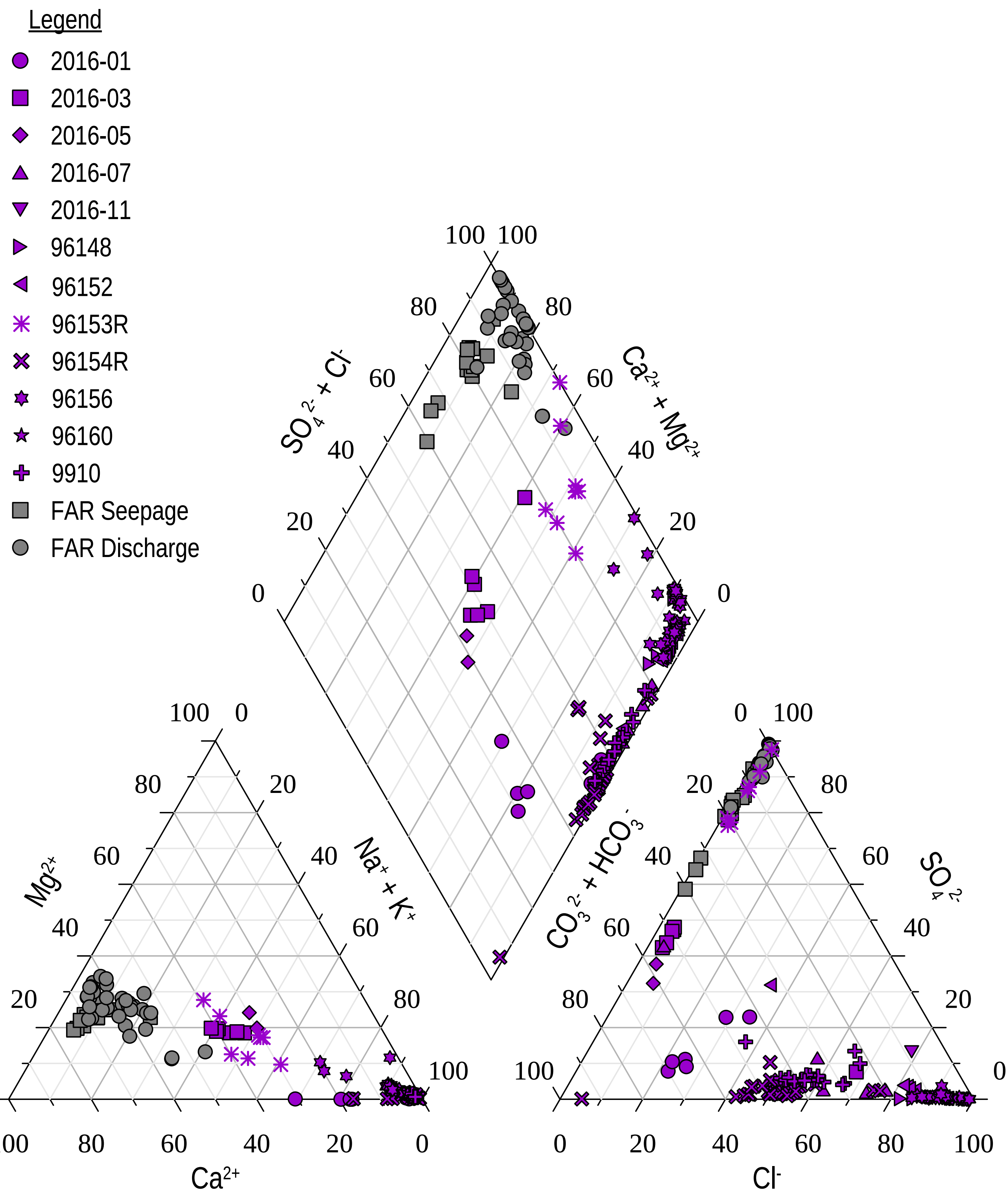
ERM



NOTES:

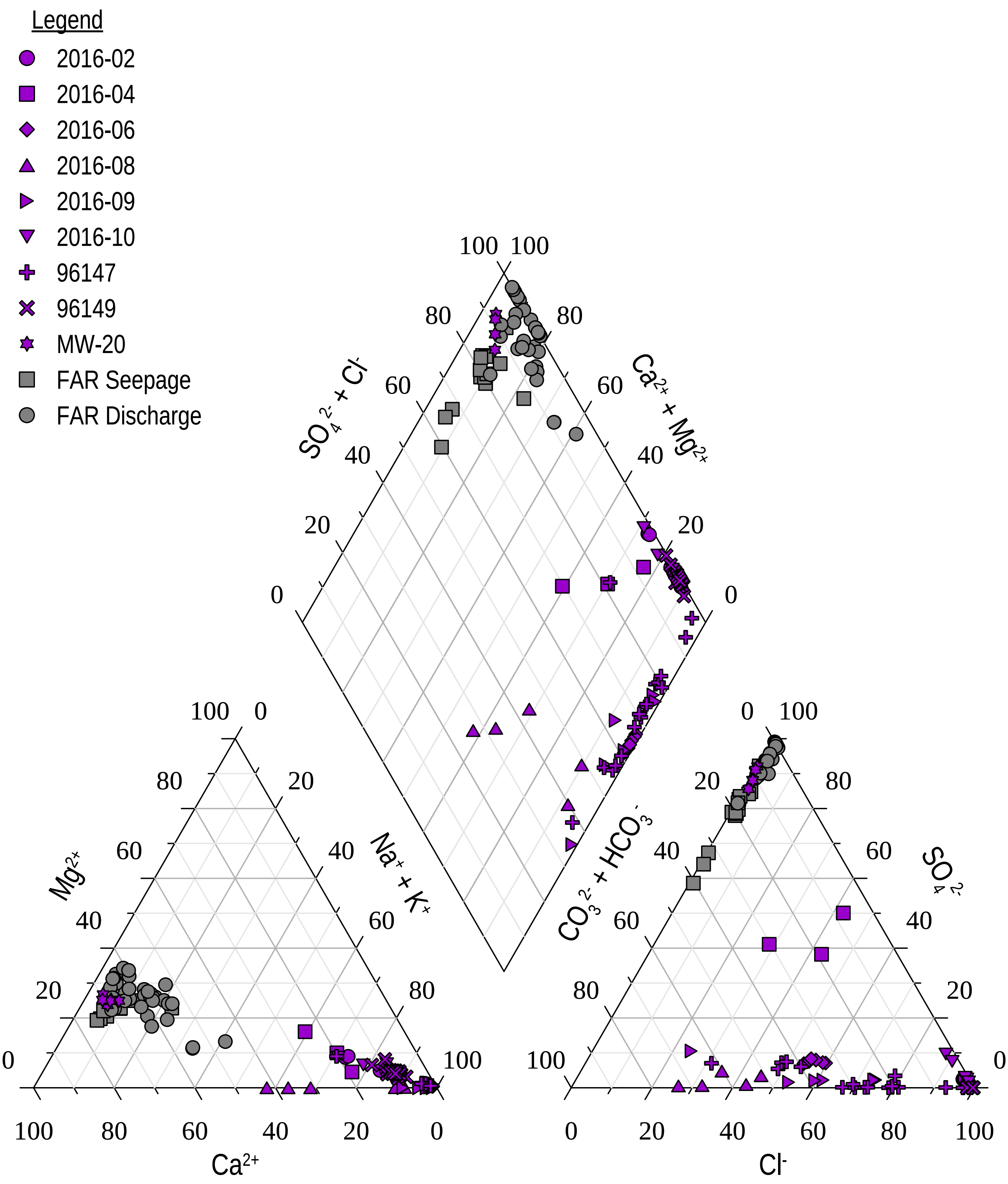
1. Brine results from NATCARB Database.
2. Only includes wells within 50 miles of the site.
3. On-site well 2016-02 samples from November 2016 to September 2019.

Figure 5-3: FAR Piper Diagram for Regional Brine September 2019
Gavin Generating Station
Cheshire, Ohio



NOTES:
1. Date Range: November 1996 to November 2019
2. Only wells with complete data including all 8 piper diagram analytes are presented

Figure 7-1: FAR Piper Diagram for Morgantown Sandstone
November 2019
Gavin Generating Station
Cheshire, Ohio



NOTES:

1. Date Range: May 1999 to November 2019
2. Only wells with complete data including all 8 piper diagram analytes are presented

Figure 7-2: FAR Piper Diagram for Cow Run Sandstone
November 2019
Gavin Generating Station
Cheshire, Ohio

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APPENDIX C ANALYTICAL \SUMMARY

Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

		FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL
	Location ID	2016-01	2016-01	2016-01	2016-01	2016-01	2016-01	2016-01	2016-01	2016-01	2016-01	2016-01
	Date	2016-08-24	2016-10-05	2016-11-30	2017-01-31	2017-03-22	2017-04-26	2017-06-07	2017-07-13	2018-03-19	2018-09-25	2019-03-15
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L			700	529					660	800	740
Aluminum	mg/L					9.3 J	0.86	3.1	3.8			
Antimony	mg/L	0.00092	0.00091	0.00088	0.00045	0.0019 J	0.00085 J	0.00068 J	0.002 U			
Arsenic	mg/L	0.0158	0.0188	0.0187	0.00739	0.0055	0.0051	0.0043 J	0.0061			
Barium	mg/L	0.098	0.0908	0.071	0.0823	0.12 JB	0.071	0.094	0.094			
Beryllium	mg/L	3E-05	8E-05	3.5E-05	0.000134	0.001 U	0.001 U	0.00032 J	0.00037 J			
Bicarbonate Alkalinity as CaCO3	mg/L									5	5	5
Boron	mg/L	0.243	0.228	0.263	0.267	0.23	0.26	0.3	0.35	0.25	0.25	0.21
Bromide	mg/L			1.2	0.807	0.93 J	5 U	5 U	5 U			
Cadmium	mg/L	7E-05	3E-05	4E-05	0.00017	0.00052 J	0.001 U	0.0003 J	0.0003 J			
Calcium	mg/L	14.4	18.9	13.9	15.6	5.5 B	4.1	7.3 J	8.6	140	78	84
Carbonate Alkalinity as CaCO3	mg/L									110	110	64
Chloride	mg/L	247	297	294	302	260	230	220	210	180	180	170
Chromium	mg/L	0.0014	0.0023	0.00159	0.00139	0.01 J	0.0015 J	0.0037	0.0048			
Cobalt	mg/L	0.000358	0.000396	0.000326	0.000893	0.0018	0.00066 J	0.00072 J	0.001			
Conductivity, Field	uS/cm	4632	4252	2448	2624							
Copper	mg/L					0.042 JB	0.014	0.027 B	0.028 B			
Dissolved Oxygen, Field	mg/L	1.99	1.43	1.77	1.38					1.99		
Dissolved Solids, Total	mg/L	1840	1830	1700	1500	1300	1300 J	990	950 J	1300	1100	1100
Fluoride	mg/L	2.8	2.85	3.34	8.34	11	13 J	17	16	7.9	5.8	4.3
Iron	mg/L					3.1 JB	0.38	1.1	1.5			
Lead	mg/L	0.000671	0.000487	0.000718	0.00204	0.0062 J	0.00093 J	0.0029	0.0036			
Lithium	mg/L	0.435	0.317	0.238	0.15	0.23 J	0.23 J	0.25 J	0.25			
Magnesium	mg/L			0.273	0.955	1.4 B	1 U	0.55 J	0.71 J	0.22	1	1
Manganese	mg/L					0.059 B	0.013	0.02	0.026			
Mercury	mg/L	8E-06	7E-06	2.4E-05	3.5E-05	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U			
Molybdenum	mg/L	0.11	0.124	0.137	0.18	0.18 J	0.18	0.16	0.15			
Nickel	mg/L					0.0075	0.0029	0.0038	0.0047			
pH, Field	pH units	12.24	12	12.06	11.41	11.9	10.96	11.06	11.03	12.38	12.2	12.4
Potassium	mg/L			71.5	40.7	41 JB	33	29 J	26	39	30	24
Radium 226	pCi/L	0.485	0.67	0.278	0.698	0.567	0.6	0.37	0.405 J			
Radium-226/228	pCi/L	0.887	2.58	0.562	0.938	0.896	1.44	0.578	0.482			
Radium-228	pCi/L	0.402	1.91	0.284	0.24	0.329 U	0.837	0.209 U	0.0768 U			
Redox Potential, Field	mV	-100.3	-34.5	-118.2	-79.5							
Selenium	mg/L	0.0011	0.0015	0.0013	0.0009	0.0026 J	0.0015 J	0.00094 J	0.0024 J			
Silver	mg/L					0.00035 J	0.001 U	9.4E-05 J	0.00016 J			
Sodium	mg/L			454	439	430 JB	410	380 B	340 B	340	420	380
Specific Conductivity, Field	uS/cm									4521		
Strontium	mg/L			0.778	0.757	0.7 JB	0.65	0.61 JB	0.72 B			
Sulfate	mg/L	333	364	317	273	220	180 J	160 J	150	110	86	110
Temperature, Field	deg C	15.6	14.8	13.2	12.5					14		
Thallium	mg/L	2E-05	4E-05	3E-05	5E-05	0.001 U	0.001 U	0.001 U	0.001 U			
Turbidity, Field	NTU	20.3	13.2	28.6	35.6	23.8	34.9	16.5	30.3	6.8	2.9	
Vanadium	mg/L					0.016						
Zinc	mg/L					0.012 J	0.02 U	0.02 U	0.02 U			

Notes:

FD = Field duplicate sample
N = Normal environmental sample
deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
B: Compound was found in the blank and sample.
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
U: Indicates the analyte was analyzed for but not detected.
Empty cells = Not analyzed

Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

		FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL
	Location ID	2016-01	2016-02	2016-02	2016-02	2016-02	2016-02	2016-02	2016-02	2016-02	2016-02	2016-02
	Date	2019-09-21	2016-08-24	2016-10-05	2016-11-30	2017-01-31	2017-03-22	2017-03-22	2017-04-26	2017-04-26	2017-06-07	2017-06-07
		N	N	N	N	N	FD	N	FD	N	FD	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	670			210	196						
Aluminum	mg/L						0.034 J	0.048 J	0.05 U	0.05 U	0.071	0.25 U
Antimony	mg/L		0.0003	0.0001	0.0005	7E-05	0.00057 J	0.0016 J	0.002 U	0.002 U	0.01 U	0.01 U
Arsenic	mg/L		0.0149	0.00732	0.012	0.00988	0.011 J	0.012 J	0.0093	0.0097	0.0057	0.009 J
Barium	mg/L		1.06	0.606	0.807	0.752	0.95 JB	1 JB	0.84	0.83	0.87	0.88
Beryllium	mg/L		0.0002	8E-05	0.0002	1E-05	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L	5 U										
Boron	mg/L		0.396	0.355	0.406	0.457	0.54	0.55	0.52	0.51	0.57	0.62
Bromide	mg/L				43.2	44.4	46	46	63	55	87	51
Cadmium	mg/L		9E-05	0.00032	5E-05	9E-06	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U	0.005 U
Calcium	mg/L		400	313	348	358	410 B	420 B	360	360	400	380
Carbonate Alkalinity as CaCO3	mg/L	96										
Chloride	mg/L	190	10500	9310	8700	9740	9600	9600	15000	13000	19000	11000
Chromium	mg/L		0.0013	0.0007	0.000682	0.000832	0.0023 J	0.00078 J	0.002 U	0.002 U	0.0012 J	0.01 U
Cobalt	mg/L		0.00279	0.00171	0.00174	0.00114	0.0015	0.0018	0.0016	0.0017	0.0029	0.0029 J
Conductivity, Field	uS/cm		28478	31865	20661	28545						
Copper	mg/L						0.0018 JB	0.0016 JB	0.002 U	0.002 U	0.0024 B	0.01 U
Dissolved Oxygen, Field	mg/L		1.78	0.41	0.73	1.3						
Dissolved Solids, Total	mg/L	1200	17000	15900	15300	15700	14000	13000	18000 J	100 J	13000	16000
Fluoride	mg/L	4.9	0.74	0.94	2	0.9	0.94 J	0.88 J	5 U	5 U	5 U	5 U
Iron	mg/L						4.7 JB	4.8 JB	3.2	3.3	4.6	5.4
Lead	mg/L		0.00167	0.00154	0.0002	0.00121	0.00053 J	0.00084 J	0.001 U	0.001 U	0.00048 J	0.00066 J
Lithium	mg/L		0.171	0.141	0.177	0.221	0.13	0.15	0.16	0.17	0.17	0.17
Magnesium	mg/L				100	112	140 B	140 B	120	120	190	150
Manganese	mg/L						2 B	2.1 B	2	2	2.7	2.7
Mercury	mg/L		4E-06	1E-05	1.5E-05	4E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L		0.195	0.107	0.203	0.29	0.29 J	0.3 J	0.3	0.3	0.23	0.28
Nickel	mg/L						0.0033	0.0017 J	0.0021	0.002	0.009	0.01 U
pH, Field	pH units	12.3	7.18	7.16	7.06	7.07		7.24		7.09		7.21
Potassium	mg/L				30.8	30.2	15 JB	15 JB	14	14	13	13
Radium 226	pCi/L		1.25	1.91	2.61	2.37	1.89	1.93	2.15	1.72	1.74	1.93
Radium-226/228	pCi/L		4.82	7.68	8	8.25	4.46	4.49	7.99	6.63	5.93	5.73
Radium-228	pCi/L		3.57	5.77	5.39	5.88	2.57	2.56	5.84	4.92	4.19	3.8
Redox Potential, Field	mV		-118.7	-144.6	-100.7	-118.7						
Selenium	mg/L		0.0003	0.0004	0.0005	0.0001	0.0012 J	0.0025 J	0.005 U	0.005 U	0.025 U	0.025 U
Silver	mg/L						0.00078 J	0.001 U	0.001 U	0.001 U	9.2E-05 J	0.005 U
Sodium	mg/L				1570	1710	6000 JB	6000 JB	4900	4800	5300 B	5600 B
Specific Conductivity, Field	uS/cm											
Strontium	mg/L				25.6	26.9	30 JB	32 JB	30	30	26 B	23 B
Sulfate	mg/L	90	228	351	302	325	330	340	300	280	720	380
Temperature, Field	deg C		14.3	15.6	13.6	11.5						
Thallium	mg/L		0.000956	0.0002	0.0002	5.6E-05	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Turbidity, Field	NTU	4	48.3	4.4	5.8	9.3		4.5		2.2		2.8
Vanadium	mg/L						0.00065 J	0.005 U				
Zinc	mg/L						0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.1 U

Notes:
FD = Field duplicate sample
N = Normal environmental sample
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mg/L = Milligrams per liter
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NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 2016-02	FEDERAL 2016-02	FEDERAL 2016-02	FEDERAL 2016-02	FEDERAL 2016-02	FEDERAL 2016-02	FEDERAL 2016-02	FEDERAL 2016-03	FEDERAL 2016-03	FEDERAL 2016-03	FEDERAL 2016-03
	Date	2017-07-13	2017-07-13	2018-03-19	2018-09-25	2019-03-15	2019-09-21	2019-09-21	2016-08-24	2016-10-03	2016-12-01	2017-01-31
		FD	N	N	N	N	FD	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L			150	150	170	150	140			482	443
Aluminum	mg/L	0.12	0.074									
Antimony	mg/L	0.002 U	0.002 U						0.00096	0.00041	0.0004	0.00026
Arsenic	mg/L	0.012 J	0.011 J						0.00059	0.00092	0.0007	0.00063
Barium	mg/L	1.4	1.4						0.0321	0.0383	0.0256	0.0241
Beryllium	mg/L	0.00039 J	0.001 U						1E-05	7.2E-05	1E-05	6E-06
Bicarbonate Alkalinity as CaCO3	mg/L			150	150	170	150	140				
Boron	mg/L	0.52	0.53	0.47	0.48	0.64			0.43	0.35	0.361	0.416
Bromide	mg/L	49 J	46 J								0.614	3.5
Cadmium	mg/L	0.00025 J	0.001 U						0.00012	0.0001	0.00016	6E-05
Calcium	mg/L	490	480	850	730	460			149	129	128	134
Carbonate Alkalinity as CaCO3	mg/L			5	5	5	5 U	5 U				
Chloride	mg/L	11000	10000	14000	14000	11000	13000	13000	21.7	21.8	22.7	867
Chromium	mg/L	0.0014 J	0.002 U						0.0002	0.0002	0.000162	0.000852
Cobalt	mg/L	0.0026	0.0025						0.000403	0.000563	0.0005	0.000246
Conductivity, Field	uS/cm								1564	1599	1595	1328
Copper	mg/L	0.002 U	0.002 U									
Dissolved Oxygen, Field	mg/L			0.23					4.38	1.15	1.77	2.38
Dissolved Solids, Total	mg/L	19000 J	17000 J	20000	19000	28000	28000	26000	1090	1080	1020	1990
Fluoride	mg/L	5 U	5 U	2.5	2.5	0.54	2.5 U	2.5 U	0.2	0.18	0.16	2.33
Iron	mg/L	6.1	6									
Lead	mg/L	0.00088 J	0.00047 J						0.000324	0.000456	0.000213	0.000105
Lithium	mg/L	0.19	0.19						0.03	0.03	0.034	0.031
Magnesium	mg/L	170	170	220	250	170					38.6	40.5
Manganese	mg/L	3.2	3.2									
Mercury	mg/L	0.0002 U	0.0002 U						1.1E-05	4E-05	3.9E-05	1.8E-05
Molybdenum	mg/L	0.15	0.14						0.0154	0.00646	0.00649	0.00523
Nickel	mg/L	0.006	0.0053									
pH, Field	pH units		7.09	7.11	7.04	7.31		7.21	7.07	6.91	6.99	6.93
Potassium	mg/L	16	15	18	19	17					4.63	5.03
Radium 226	pCi/L	2.23 J	2.18 J						0.306	0.225	0.266	0.854
Radium-226/228	pCi/L	6.97 J	7.5 J						0.409	1.295	0.44	1.121
Radium-228	pCi/L	4.74	5.32						0.103	1.07	0.174	0.267
Redox Potential, Field	mV								20.9	48.2	50.5	73.5
Selenium	mg/L	0.0022 J	0.0016 J						0.0002	0.0003	0.0001	0.0001
Silver	mg/L	5.4E-05 J	0.001 U									
Sodium	mg/L	5300 B	5500 B	7000	7400	6700					171	156
Specific Conductivity, Field	uS/cm			37033								
Strontium	mg/L	33 B	35 B								2.95	3.25
Sulfate	mg/L	200	240	120	140	410	300	210	446	445	362	132
Temperature, Field	deg C			13.3					15.8	15.6	12.8	13
Thallium	mg/L	0.001 U	0.001 U						2E-05	3E-05	2E-05	2E-05
Turbidity, Field	NTU		7.5	4.3	4.9			7	6.4	9	8.1	4.9
Vanadium	mg/L											
Zinc	mg/L	0.02 U	0.02 U									

Notes:
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deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID Date	FEDERAL 2016-03 2017-03-27 N	FEDERAL 2016-03 2017-04-27 N	FEDERAL 2016-03 2017-06-07 N	FEDERAL 2016-03 2017-07-14 N	FEDERAL 2016-03 2018-03-21 N	FEDERAL 2016-03 2018-09-25 N	FEDERAL 2016-03 2019-03-15 N	FEDERAL 2016-03 2019-09-24 N	FEDERAL 2016-04 2016-08-24 N	FEDERAL 2016-04 2017-01-31 N	FEDERAL 2016-04 2017-03-27 N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L					430	430	440	450		50.7	
Aluminum	mg/L	0.03 J	0.05 U	0.05 U	0.045 J							0.39 J
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U					0.00116	0.00033	0.00067 JB
Arsenic	mg/L	0.00058 J	0.001 J	0.00082 J	0.00088 J					0.00421	0.00259	0.0054
Barium	mg/L	0.026 JB	0.024	0.026	0.025					0.117	0.065	0.14 JB
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U					4E-05	2.2E-05	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L					430	430	440	450			
Boron	mg/L	0.43	0.44 B	0.45	0.44	0.43	0.43	0.41		0.343	0.227	0.27
Bromide	mg/L	0.4 J	2.5 U	2.5 UJ	2.5 U						0.896	4 J
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U					5E-05	7E-05	0.001 U
Calcium	mg/L	140 B	140	150	140	140	140	120		9.88	47.6	22 B
Carbonate Alkalinity as CaCO3	mg/L					5	5	5	5 U			
Chloride	mg/L	22	23	22 J	22	24	23	23	24	1060	204	820
Chromium	mg/L	0.00064 JB	0.002 U	0.002 U	0.002 U					0.0305	0.00651	0.0054 JB
Cobalt	mg/L	0.00029 J	0.00055 J	0.00019 J	0.00034 J					0.000641	0.000173	0.00026 J
Conductivity, Field	uS/cm									6270	1328	
Copper	mg/L	0.0018 JB	0.002 U	0.002 U	0.002 U							0.0024 B
Dissolved Oxygen, Field	mg/L					0.26				1.04	2.38	
Dissolved Solids, Total	mg/L	1100	1100 J	1000	1000 J	1100	1000	1000	1000	2630	952	1900
Fluoride	mg/L	0.21 J	0.19 J	0.21 J	0.19 J	0.24	0.22	0.19	0.23	1.28	0.5	1.4
Iron	mg/L	0.087 JB	0.068 J	0.064 J	0.087 J							0.38 JB
Lead	mg/L	0.00026 J	0.001 U	0.001 U	0.001 U					0.000238	0.000454	0.00043 J
Lithium	mg/L	0.029	0.034	0.029	0.034					0.236	0.035	0.044
Magnesium	mg/L	40 B	40	46	40	40	41	40			6.97	3.8 B
Manganese	mg/L	0.051 B	0.1	0.11	0.061							0.0083 B
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U					1.3E-05	7E-06	0.0002 U
Molybdenum	mg/L	0.0049 J	0.0043 J	0.004 J	0.0038 J					0.0864	0.0728	0.12 J
Nickel	mg/L	0.0015 JB	0.002 U	0.002 U	0.002 U							0.0034 B
pH, Field	pH units	6.93	6.9	6.88	6.93	7.03	7	7.13	7.27	8.4	6.93	7.79
Potassium	mg/L	4.3 JB	4.4	4.8	4.6	4.6	4.6	8.4			7.01	7.3 JB
Radium 226	pCi/L	0.194	0.195	0.201	0.207					0.656	0.617	0.823
Radium-226/228	pCi/L	0.456	0.541	0.59	1.02					1.08	1.328	1.51
Radium-228	pCi/L	0.262 U	0.347	0.389	0.816					0.424	0.711	0.689
Redox Potential, Field	mV									-174.3	73.5	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U					0.0021	0.0007	0.0026 J
Silver	mg/L	3E-05 J	0.001 U	0.00041 J	0.00044 J							0.00016 J
Sodium	mg/L	150 JB	160 B	150 B	150 B	160	150	190			219	670 JB
Specific Conductivity, Field	uS/cm					1511						
Strontium	mg/L	3.6 JB	3.7	4.4 B	3.4 J						1.34	0.94 JB
Sulfate	mg/L	390	420	440 J	400	400	410	400	360	252	326	330
Temperature, Field	deg C					12.6				15.2	13	
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U					3E-05	1E-05	0.001 U
Turbidity, Field	NTU	2.1	1.3	1.4	6.4	1	1.68		4	9.1	4.9	6.4
Vanadium	mg/L											
Zinc	mg/L	0.02 U	0.02 U	0.02 U	0.02 U							0.02 U

Notes:
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mg/L = Milligrams per liter
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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 2016-04	FEDERAL 2016-04	FEDERAL 2016-04	FEDERAL 2016-04	FEDERAL 2016-04	FEDERAL 2016-04	FEDERAL 2016-04	FEDERAL 2016-05	FEDERAL 2016-05	FEDERAL 2016-05	FEDERAL 2016-05
	Date	2017-04-27	2017-06-07	2017-07-14	2018-03-22	2018-09-11	2019-03-15	2019-09-24	2016-06-08	2016-08-25	2016-10-05	2016-12-01
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L				210	250	290	300				229
Aluminum	mg/L	0.05 U	0.058	0.05 U								
Antimony	mg/L	0.00087 J	0.002 U	0.00097 J		0.002				0.00015	0.0001	8E-05
Arsenic	mg/L	0.0044 J	0.0019 J	0.0039 J		0.0016				0.00078	0.00074	0.00051
Barium	mg/L	0.16	0.41	0.24		0.091				0.052	0.0432	0.0382
Beryllium	mg/L	0.001 U	0.001 U	0.00038 J		0.00058				0.000107	6E-05	3.4E-05
Bicarbonate Alkalinity as CaCO3	mg/L				210	250	290	300				
Boron	mg/L	0.27 B	0.36	0.3	0.35	0.38				0.116	0.088	0.088
Bromide	mg/L	7.4 J	9.3 J	4.8 J			1					0.552
Cadmium	mg/L	0.001 U	0.001 U	0.001 U		0.001				3E-05	2E-05	1E-05
Calcium	mg/L	18	33	24	75	87				40.2	35.8	45
Carbonate Alkalinity as CaCO3	mg/L				5	5	5	5 U				
Chloride	mg/L	1700	2100 J	1100	340	240	180	200		16.3	17.2	16.9
Chromium	mg/L	0.0027	0.002 U	0.0016 J		0.002				0.0015	0.0012	0.000802
Cobalt	mg/L	0.001 U	0.001 U	0.00027 J		0.001				0.00299	0.00267	0.00158
Conductivity, Field	uS/cm									717	670	694
Copper	mg/L	0.002 U	0.002 U	0.002 U								
Dissolved Oxygen, Field	mg/L				3.92					7.62	8.64	7.9
Dissolved Solids, Total	mg/L	3300 J	3600	2400 J	1300	1100	1200	920		474	406	430
Fluoride	mg/L	1.2	1.2 J	1.1	0.42	0.36	0.29	0.32		0.19	0.19	0.19
Iron	mg/L	0.1 U	0.1 U	0.1 U								
Lead	mg/L	0.001 U	0.001 U	0.00055 J		0.001				0.00194	0.00137	0.000848
Lithium	mg/L	0.072	0.066	0.066		0.053				0.019	0.016	0.011
Magnesium	mg/L	4.2	13	5.8	23							18.1
Manganese	mg/L	0.005	0.022	0.01								
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U		0.0002	0.0002			8E-06	1E-05	1.7E-05
Molybdenum	mg/L	0.11	0.051	0.093		0.015				0.00109	0.00115	0.00231
Nickel	mg/L	0.002 U	0.002 U	0.0015 J								
pH, Field	pH units	7.82	7.8	8.22	7.75	7.62	7.62	7.71	7.88	7.89	7.93	7.79
Potassium	mg/L	13	7.2	9.3	8.9							2.72
Radium 226	pCi/L	0.651	0.481	0.552 J		0.247	0.307			0.5	0.369	0.299
Radium-226/228	pCi/L	1.27	1.19	1.21		0.512	0.482			1.027	0.703	1.429
Radium-228	pCi/L	0.614	0.71	0.663		0.265	0.175			0.527	0.334	1.13
Redox Potential, Field	mV									162.5	206.5	119.4
Selenium	mg/L	0.0022 J	0.005 U	0.0032 J		0.005				0.0005	0.0005	0.0002
Silver	mg/L	0.001 U	0.00017 J	7E-05 J								
Sodium	mg/L	710	1400 B	880 B	300							84.5
Specific Conductivity, Field	uS/cm				2138							
Strontium	mg/L	1.3	1.5 B	1.5								0.879
Sulfate	mg/L	230	190 J	290	410	420	410	390		138	120	116
Temperature, Field	deg C				12.3					18.2	16.8	13
Thallium	mg/L	0.001 U	0.001 U	0.001 U		0.001				2E-05	0.0002	2E-05
Turbidity, Field	NTU	2.8	2.8	6.4	3	1.28		4	8.5	280.1	160.9	56.6
Vanadium	mg/L											
Zinc	mg/L	0.02 U	0.02 U	0.02 U								

Notes:

FD = Field duplicate sample
N = Normal environmental sample
deg C = Degree Celcius
mg/L = Milligrams per liter
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Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 2016-05	FEDERAL 2016-05	FEDERAL 2016-05	FEDERAL 2016-05	FEDERAL 2016-05	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06
	Date	2017-02-01	2017-03-27	2017-04-27	2017-06-08	2017-07-14	2016-08-25	2016-10-03	2016-12-01	2017-02-01	2017-03-27	2017-04-27
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	211							490	554		
Aluminum	mg/L		0.3 J	0.05 U	0.5	0.55					3.7 J	0.17
Antimony	mg/L	4E-05	0.002 U	0.00072 J	0.00067 J	0.002 U	0.00019	0.00025	0.00023	0.00026	0.00047 JB	0.00078 J
Arsenic	mg/L	0.00028	0.005 U	0.005 U	0.00088 J	0.00079 J	0.00225	0.0023	0.00195	0.00214	0.0034 J	0.0017 J
Barium	mg/L	0.0331	0.049 JB	0.043	0.044 B	0.038	0.0707	0.0649	0.0525	0.0515	0.068 JB	0.05
Beryllium	mg/L	8E-06	0.001 U	0.001 U	0.00067 J	0.001 U	0.000198	0.000143	3.4E-05	6.8E-05	0.001 U	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L											
Boron	mg/L	0.11	0.1	0.1 JB	0.11	0.1	0.501	0.424	0.418	0.463	0.5	0.52 B
Bromide	mg/L	0.155	0.17 J	0.15 J	0.23 J	0.26 J			2.18	1.85	2.4 J	2.1 J
Cadmium	mg/L	8E-06	0.001 U	0.001 U	0.001 U	0.001 U	1E-05	2E-05	3E-05	4E-05	0.00061 J	0.001 U
Calcium	mg/L	39.7	66 B	53	40	31	5.87	5.51	4.6	4.45	5 B	3.5
Carbonate Alkalinity as CaCO3	mg/L											
Chloride	mg/L	11.4	9.2	9.6	14	16	545	560	515	548	550	550
Chromium	mg/L	0.000582	0.0017 JB	0.002 U	0.0033	0.0025	0.0092	0.077	0.0205	0.0625	0.068 JB	0.022
Cobalt	mg/L	0.000274	0.00042 J	0.00028 J	0.0011	0.00088 J	0.00208	0.00283	0.00156	0.00106	0.0019	0.00068 J
Conductivity, Field	uS/cm	708					2898	2931	3126	2933		
Copper	mg/L		0.00073 JB	0.002 U	0.0039	0.0042 B					0.005 JB	0.002 U
Dissolved Oxygen, Field	mg/L	9.83					0.6	0.58	1.02	1.4		
Dissolved Solids, Total	mg/L	388	500	460 J	410	400 J	1560	1560	1570	1540	1600	1600 J
Fluoride	mg/L	0.18	0.2	0.21	0.22	0.22	5.28	5.09	4.89	5.2	6	5.9
Iron	mg/L		0.45 JB	0.1 U	0.93	0.78					3.4 JB	0.24
Lead	mg/L	0.000206	0.00036 J	0.001 U	0.0012	0.00077 J	0.00371	0.00151	0.00039	0.000607	0.0016 J	0.001 U
Lithium	mg/L	0.012	0.011	0.013	0.012	0.014	0.029	0.024	0.027	0.034	0.034	0.032
Magnesium	mg/L	19.6	22 B	20	19	16			1.28	1.4	1.7 B	1
Manganese	mg/L		0.0099 B	0.005 U	0.022	0.02					0.022 B	0.0068
Mercury	mg/L	5E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 U	5E-06	1.1E-05	1.6E-05	3E-06	0.0002 U	0.0002 U
Molybdenum	mg/L	0.00071	0.00064 J	0.01 U	0.0012 J	0.01 U	0.0595	0.0952	0.0674	0.0804	0.091 J	0.076
Nickel	mg/L		0.0013 JB	0.002 U	0.0026	0.0027					0.031 B	0.029
pH, Field	pH units	7.8	7.48	7.82		8.01	8.51	8.36	8.36	8.45	8.44	8.49
Potassium	mg/L	2.35	2.4 JB	2.3	2.5	2.3			3.45	10.5	7.2 JB	6
Radium 226	pCi/L	0.4	0.176	0.14	0.0681 U	0.13	0.325	0.818	0.392	0.252	0.163	0.163
Radium-226/228	pCi/L	0.40713	0.365 U	0.0784 U	0.0846 U	0.575	0.756	2.268	1.052	0.604	0.381	0.395
Radium-228	pCi/L	0.00713	0.189 U	-0.0618 U	0.0165 U	0.445	0.431	1.45	0.66	0.352	0.217 U	0.232 U
Redox Potential, Field	mV	162.7					72.2	60.6	79.4	107.6		
Selenium	mg/L	0.0001	0.005 U	0.005 U	0.005 U	0.005 U	0.0003	0.0002	0.0003	0.0003	0.005 U	0.005 U
Silver	mg/L		0.001 U	0.001 U	0.001 U	0.0013					0.0012	0.001 U
Sodium	mg/L	69.3	71 JB	74 B	82	74 B			637	499	610 JB	620
Specific Conductivity, Field	uS/cm											
Strontium	mg/L	0.89	1.1 JB	1.1	0.87 B	0.81			0.274	0.269	0.3 JB	0.29
Sulfate	mg/L	132	150	160	140	130	103	96.5	95.1	94.8	110	110
Temperature, Field	deg C	11.8					19.1	16	12.9	12		
Thallium	mg/L	3E-05	0.001 U	0.001 U	0.001 U	0.001 U	3E-05	2E-05	2E-05	2E-05	0.001 U	0.001 U
Turbidity, Field	NTU	9.6	5.4	13.6		7.7	99.6	45.2	52.9	48.5	43.5	68.6
Vanadium	mg/L											
Zinc	mg/L		0.02 U	0.02 U	0.02 U	0.02 U					0.0097 J	0.02 U

Notes:
FD = Field duplicate sample
N = Normal environmental sample
deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
B: Compound was found in the blank and sample.
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
U: Indicates the analyte was analyzed for but not detected.
Empty cells = Not analyzed

Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-06	FEDERAL 2016-07	FEDERAL 2016-07	FEDERAL 2016-07	FEDERAL 2016-07
	Date	2017-06-08	2017-07-14	2018-03-22	2018-09-25	2018-09-25	2019-03-26	2019-09-22	2016-08-24	2016-10-05	2016-11-30	2017-01-31
		N	N	N	FD	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L			540	490	490	510	500			514	483
Aluminum	mg/L	3.6	1.7									
Antimony	mg/L	0.002 U	0.002 U						0.00126	0.00091	0.00079	0.00045
Arsenic	mg/L	0.0026 J	0.0024 J						0.00772	0.00705	0.00666	0.0042
Barium	mg/L	0.064 B	0.059						0.107	0.141	0.115	0.188
Beryllium	mg/L	0.00035 J	0.001 U						0.000368	0.00027	0.000183	0.000428
Bicarbonate Alkalinity as CaCO3	mg/L			490	460	470	460	470				
Boron	mg/L	0.52	0.5	0.49	0.48	0.49	0.5		0.313	0.297	0.348	0.365
Bromide	mg/L	2.3 J	2.1 J								5.48	0.308
Cadmium	mg/L	0.001 U	0.001 U						7E-05	8E-05	0.0001	8E-05
Calcium	mg/L	4.1	4	4.6	4.4	4.8	4.9		13.3	11.5	8.2	9.9
Carbonate Alkalinity as CaCO3	mg/L			44	26	23	41	35				
Chloride	mg/L	570	540	570	600	620	580	540	421	609	643	23.6
Chromium	mg/L	0.058 J	0.062						0.0015	0.0022	0.00163	0.00322
Cobalt	mg/L	0.0038	0.0018						0.00105	0.000905	0.000573	0.00167
Conductivity, Field	uS/cm								2883	3250	2246	3388
Copper	mg/L	0.0071	0.007 B									
Dissolved Oxygen, Field	mg/L			0.38					3.47	3.81	3.75	1.94
Dissolved Solids, Total	mg/L	1700	1600 J	1500	1400	1400	1600	1500	1740	1850	1900	1000
Fluoride	mg/L	6.3	6.1	5.7	5.8	5.7	5.6	5.8	1.89	2.04	1.94	0.18
Iron	mg/L	3.3	1.7									
Lead	mg/L	0.0013	0.00083 J						0.00336	0.00292	0.00215	0.00336
Lithium	mg/L	0.031	0.032						0.235	0.193	0.202	0.163
Magnesium	mg/L	1.8	1.3	1.5	1.4	1.4	1.6				1.36	2.83
Manganese	mg/L	0.019	0.018									
Mercury	mg/L	0.0002 U	0.0002 U						1.2E-05	1.7E-05	8E-06	5E-05
Molybdenum	mg/L	0.074	0.073						0.0808	0.0841	0.0953	0.0689
Nickel	mg/L	0.13	0.05									
pH, Field	pH units	8.39	8.28	8.43		8.24	8.52	8.59	10.86	10.56	10.61	10.01
Potassium	mg/L	5.6	4.8	3.8	3	3.4	4.8				33.9	24.1
Radium 226	pCi/L	0.195	0.152						0.427	0.977	1.13	1.18
Radium-226/228	pCi/L	0.362 U	0.651						0.427	3.077	2.17	2.84
Radium-228	pCi/L	0.167 U	0.498							2.1	1.04	1.66
Redox Potential, Field	mV								6.4	63	20.4	22
Selenium	mg/L	0.005 U	0.001 J						0.0008	0.001	0.0007	0.0008
Silver	mg/L	9.1E-05 J	0.00017 J									
Sodium	mg/L	590	600 B	570	600	610	600				562	635
Specific Conductivity, Field	uS/cm			2792								
Strontium	mg/L	0.24 B	0.27								0.624	0.815
Sulfate	mg/L	120	110	110	100	100	110	110	229	235	178	371
Temperature, Field	deg C			13.3					15.6	15.3	14.1	12.8
Thallium	mg/L	0.001 U	0.001 U						8.4E-05	9E-05	4E-05	6.1E-05
Turbidity, Field	NTU	59.1	30.7	49		43.9		71	213	98.2	88.1	455.1
Vanadium	mg/L											
Zinc	mg/L	0.02 U	0.02 U									

Notes:
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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 2016-07	FEDERAL 2016-07	FEDERAL 2016-07	FEDERAL 2016-07	FEDERAL 2016-07	FEDERAL 2016-07	FEDERAL 2016-07	FEDERAL 2016-08	FEDERAL 2016-08	FEDERAL 2016-08	FEDERAL 2016-08
	Date	2017-03-22	2017-04-27	2017-08-10	2018-04-05	2018-10-23	2019-03-26	2019-09-22	2016-08-24	2016-10-05	2016-11-30	2017-01-31
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L				360	300	430	320			1580	1400
Aluminum	mg/L	57 J	9.8	40								
Antimony	mg/L	0.0015 J	0.0024	0.0017 JB					0.00134	0.00083	0.00095	0.00078
Arsenic	mg/L	0.016	0.0034 J	0.016					0.00795	0.00691	0.00652	0.00489
Barium	mg/L	0.83 JB	0.7	1.3					0.312	0.279	0.416	0.446
Beryllium	mg/L	0.0026	0.00091 J	0.0028					4E-05	0.000182	0.000123	5.9E-05
Bicarbonate Alkalinity as CaCO3	mg/L				190	120	72	59				
Boron	mg/L	0.4	0.42 B	0.44	0.45	0.42	0.38		0.318	0.286	0.294	0.279
Bromide	mg/L	4.5 J	8 J	5.5							5.56	2.93
Cadmium	mg/L	0.001 U	0.001 U	0.00059 J					2E-05	3E-05	5E-05	1E-05
Calcium	mg/L	15 B	25	41	12	12	6.3		33.8	48.9	57	80.6
Carbonate Alkalinity as CaCO3	mg/L				170	180	350	260				
Chloride	mg/L	1000	1900	1200	1200	1100	810	1000	452	645	650	879
Chromium	mg/L	0.063 J	0.011	0.059					0.0012	0.0033	0.00434	0.00374
Cobalt	mg/L	0.016	0.0028	0.015					0.000353	0.00278	0.00172	0.00095
Conductivity, Field	uS/cm								8521	8800	5904	7708
Copper	mg/L	0.044 JB	0.0079	0.04 B								
Dissolved Oxygen, Field	mg/L				2.48				10.52	5.81	6.2	4.23
Dissolved Solids, Total	mg/L	2300	3900 J	2500 J	2300	1800	2100	1900	2480	2660	2730	2750
Fluoride	mg/L	2.3	1.6	2.6	2.8	2.9	2.6	3.3	1.92	1.85	1.56	2.03
Iron	mg/L	49 JB	8.5	47								
Lead	mg/L	0.031 J	0.0054	0.036 B					0.000143	0.00216	0.00207	0.000987
Lithium	mg/L	0.16	0.062	0.19					0.665	0.6	0.702	0.652
Magnesium	mg/L	11 B	8.3	12	3.9	3.4	2.6				0.41	0.162
Manganese	mg/L	0.24 B	0.075	0.31								
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U					2.4E-05	7E-06	3.7E-05	9E-06
Molybdenum	mg/L	0.092 J	0.056	0.11 B					0.121	0.0735	0.0982	0.102
Nickel	mg/L	0.043	0.0086	0.051								
pH, Field	pH units	9.94	9.44	9.1	9.49	9.75	10.41	10.4	12.52	12.41	12.59	12.45
Potassium	mg/L	23 JB	6.5	19	6.6	6.8	8.4				92.4	99.3
Radium 226	pCi/L	2.63	6.4	3.74 J					0.768	1.06	0.975	1.43
Radium-226/228	pCi/L	4.35	12.7	8.09 J					1.898	2.97	2.005	2.62
Radium-228	pCi/L	1.72	6.29	4.34					1.13	1.91	1.03	1.19
Redox Potential, Field	mV								-71.6	-38.5	-81.2	-89.5
Selenium	mg/L	0.004 J	0.0015 J	0.0052					0.0028	0.0022	0.0019	0.0012
Silver	mg/L	0.00078 J	0.00019 J	0.0037								
Sodium	mg/L	930 JB	1300	1000	920	850	840				704	747
Specific Conductivity, Field	uS/cm				4913							
Strontium	mg/L	1.3 JB	2.3	2.8 B							3.59	4.23
Sulfate	mg/L	120	99	77	60	49	46	36	133	126	120	90.4
Temperature, Field	deg C				13.8				16	16.2	13.8	13.1
Thallium	mg/L	0.00052 J	0.001 U	0.00066 J					9E-05	7E-05	5E-05	3E-05
Turbidity, Field	NTU	850	13721	1037	174	81.4		32	871	253.7	121.7	110.9
Vanadium	mg/L	0.066										
Zinc	mg/L	0.12	0.02	0.12								

Notes:

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mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 2016-08	FEDERAL 2016-08	FEDERAL 2016-08	FEDERAL 2016-08	FEDERAL 2016-08	FEDERAL 2016-08	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-09
	Date	2017-03-22	2017-04-27	2017-06-07	2018-09-25	2019-03-26	2019-09-22	2016-08-23	2016-10-03	2016-11-29	2017-01-30	2017-03-21
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L				1700	2000	1800			1250	1830	1400
Aluminum	mg/L	4.7 J	0.39	8.1								
Antimony	mg/L	0.0012 J	0.0051	0.0013 J				0.00076	0.00087	0.00082	0.00078	0.0014 J
Arsenic	mg/L	0.0054	0.0075	0.014				0.0117	0.0145	0.0149	0.0144	0.026 J
Barium	mg/L	0.97 JB	0.7	0.76				0.684	0.566	0.49	0.433	0.42 JB
Beryllium	mg/L	0.001 U	0.001 U	0.005 U				8.5E-05	3E-05	2E-05	2E-05	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L				5	5	5 U					
Boron	mg/L	0.22	0.28 B	0.32	0.1	0.056		0.093	0.411	0.126	0.131	0.19
Bromide	mg/L	3.1 J	25 U	5 J						6.45	5.69	5.8 J
Cadmium	mg/L	0.001 U	0.001 U	0.001 U				6E-05	6E-05	4E-05	1E-05	0.001 U
Calcium	mg/L	190 B	140	140	340	450		78.6	202	49.7	42.3	30 B
Carbonate Alkalinity as CaCO3	mg/L				140	70	100					
Chloride	mg/L	700	890	1200 J	920	510	610	1500	1520	1490	1520	1600
Chromium	mg/L	0.011 J	0.0027	0.015 J				0.0455	0.0371	0.0299	0.0256	0.027 J
Cobalt	mg/L	0.0024	0.00039 J	0.0037				0.00056	0.000324	0.000245	0.000208	0.00092 J
Conductivity, Field	uS/cm							14047	13957	15285	12613	
Copper	mg/L	0.026 JB	0.019	0.043 B								
Dissolved Oxygen, Field	mg/L							5.1	2.86	2.39	2.91	
Dissolved Solids, Total	mg/L	2700	2900 J	3000	2400	2900	2700	4820	4480	4180	3900	4100
Fluoride	mg/L	2	1.8 J	2.3 J	1.4	0.99	1.1	1.67	1.58	1.02	1.39	1.9 J
Iron	mg/L	4.5 JB	0.1 U	8.6								
Lead	mg/L	0.0044 J	0.001 U	0.006				0.00215	0.000743	0.000281	0.000118	0.0021 J
Lithium	mg/L	0.85	0.75	0.64				0.561	0.082	0.392	0.324	0.23
Magnesium	mg/L	0.75 JB	1 U	1.4	1	1				0.058	0.006	
Manganese	mg/L	0.031 B	0.005 U	0.051								0.016 B
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U				1.2E-05	4E-06	6E-06	5E-06	0.0002 U
Molybdenum	mg/L	0.094 J	0.12	0.14				0.18	0.155	0.149	0.137	0.19 J
Nickel	mg/L	0.01	0.004	0.013								
pH, Field	pH units	12.65	12.35	12.42	12.45	12.67	12.43	12.49	12.6	12.64	12.66	12.55
Potassium	mg/L	110 JB	77	59	44	48				55	48.8	28 JB
Radium 226	pCi/L	4.8	4.25	2.11				1.06	0.889	1.34	1.65	1.95
Radium-226/228	pCi/L	6.4	5.53	2.43				1.924	2.559	1.729	2.472	2.69
Radium-228	pCi/L	1.6	1.27	0.319 U				0.864	1.67	0.389	0.822	0.744 U
Redox Potential, Field	mV							-68.6	-135.4	-113.7	-112.6	
Selenium	mg/L	0.002 J	0.0022 J	0.0043 J				0.0042	0.0038	0.0037	0.0029	0.0051 J
Silver	mg/L	0.001 U	0.001 UJ	0.00026 J								
Sodium	mg/L	920 JB	1100	1200 B	830	680				591	997	1700 JB
Specific Conductivity, Field	uS/cm											
Strontium	mg/L	7.2 JB	6.7	5.7 B						2.74	2.34	1.8 JB
Sulfate	mg/L	71	70	89 J	27	14	16	77.1	72.2	73	61.7	64
Temperature, Field	deg C							15.9	15	13.5	9.3	
Thallium	mg/L	0.001 U	0.001 U	0.001 U				7E-05	4E-05	0.0002	4E-05	0.001 U
Turbidity, Field	NTU	108.8	627.3	380.4	17.6		94	8.7	8.6	6.8	2.1	22.3
Vanadium	mg/L	0.017										
Zinc	mg/L	0.1 U	0.02 U	0.03								

Notes:

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N = Normal environmental sample
deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
B: Compound was found in the blank and sample.
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
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Empty cells = Not analyzed

Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-09	FEDERAL 2016-10	FEDERAL 2016-10	FEDERAL 2016-10	FEDERAL 2016-10
	Date	2017-04-25	2017-06-06	2017-07-12	2018-03-22	2018-03-22	2018-09-13	2019-09-24	2016-08-23	2016-10-03	2016-11-29	2017-01-30
		N	N	N	FD	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L				890	890	820	1100			217	199
Aluminum	mg/L	1.3	3.3	1.9 B								
Antimony	mg/L	0.0012 J	0.02 U	0.001 JB					0.00027	9E-05	0.0002	0.00023
Arsenic	mg/L	0.016	0.016 J	0.016					0.00323	0.00281	0.00304	0.00443
Barium	mg/L	0.52	0.53	0.52					0.235	0.183	0.162	0.339
Beryllium	mg/L	0.001 U	0.001 UJ	0.001 U					8E-05	0.0001	0.0002	1E-05
Bicarbonate Alkalinity as CaCO3	mg/L				5	5	5	5 U				
Boron	mg/L	0.16 J	0.18 B	0.16 B	0.22	0.22			0.449	0.386	0.438	0.421
Bromide	mg/L	50 U	7.5	5.8 J							30.4	35.8
Cadmium	mg/L	0.001 U	0.01 U	0.001 U					4E-05	0.0001	4E-05	0.00026
Calcium	mg/L	35	47	55	33	33	16		179	209	254	344
Carbonate Alkalinity as CaCO3	mg/L				410	400	180	120				
Chloride	mg/L	2000	1700	1600	2000	2000	1800	1200	3600	5000	6040	7380
Chromium	mg/L	0.025	0.029 J	0.025					0.0007	0.0003	0.00461	0.00983
Cobalt	mg/L	0.00032 J	0.01 U	0.00071 J					0.000699	0.000869	0.00198	0.00275
Conductivity, Field	uS/cm								8802	16158	15133	19419
Copper	mg/L	0.013	0.022 B	0.017								
Dissolved Oxygen, Field	mg/L					0.32			3.72	2.77	6.96	4.79
Dissolved Solids, Total	mg/L	4300 J	4300	3900 J	3900	3700		2100	6820	9040	11000	12600
Fluoride	mg/L	2.1 J	1.8	1.5 J	1.9	1.9	2	1.9	0.66	0.5	0.5	0.7
Iron	mg/L	0.1 U	1.2	0.55								
Lead	mg/L	0.001 U	0.001	0.00068 J					0.00143	0.000325	0.000492	0.00257
Lithium	mg/L	0.3	0.27	0.25					0.138	0.142	0.189	0.246
Magnesium	mg/L	1 U	10 U	0.22 J	1	1	1				67.4	91.1
Manganese	mg/L	0.005 U	0.05 U	0.0041 J								
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U					4E-06	5E-06	2E-06	3E-06
Molybdenum	mg/L	0.17	0.17	0.16					0.0367	0.0128	0.0278	0.0258
Nickel	mg/L	0.0015 J	0.02 U	0.0031								
pH, Field	pH units	12.44	12.46	12.49		12.59	12.07	12.45	9.79	7.48	8.29	7.68
Potassium	mg/L	31	29	24	15	16	15				30.8	42.9
Radium 226	pCi/L	1.33	1.93	1.83 J					1.31	1.47	1.32	0.874
Radium-226/228	pCi/L	2.29	3.76	2.61 J					2.85	2.5	3.15	2.304
Radium-228	pCi/L	0.966	1.83	0.772 J					1.54	1.03	1.83	1.43
Redox Potential, Field	mV								70.1	104.1	122.9	103.2
Selenium	mg/L	0.0029 J	0.05 U	0.0034 JB					0.001	0.0002	0.0005	0.0003
Silver	mg/L	0.001 U	0.00031 J	0.00074 J								
Sodium	mg/L	1600	1700 B	1500	1400	1400	1600				1510	1370
Specific Conductivity, Field	uS/cm					9465						
Strontium	mg/L	2.6	1.4 B	2.2							12.1	16.2
Sulfate	mg/L	88 J	65	85	83	81	74	56	874	857	897	834
Temperature, Field	deg C					12.8			16.8	15.9	15	11.3
Thallium	mg/L	0.001 U	0.001 U	0.001 U					7E-05	0.0002	5E-05	8E-05
Turbidity, Field	NTU	56.3	35.1	61.3		9	20.8	103	30.6	8.7	2.4	21.9
Vanadium	mg/L											
Zinc	mg/L	0.02 U	0.2 U	0.02 U								

Notes:

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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID Date	FEDERAL 2016-10 2017-03-21 N	FEDERAL 2016-10 2017-04-25 N	FEDERAL 2016-10 2017-06-06 N	FEDERAL 2016-10 2017-07-12 N	FEDERAL 2016-10 2018-04-06 N	FEDERAL 2016-10 2018-10-01 N	FEDERAL 2016-10 2019-03-27 N	FEDERAL 2016-10 2019-09-24 N	FEDERAL 2016-11 2016-08-23 N	FEDERAL 2016-11 2016-08-26 N	FEDERAL 2016-11 2017-01-30 N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	170				180	140	150	130			326
Aluminum	mg/L		0.05 U	0.5 U	0.035 JB							
Antimony	mg/L	0.002 U	0.002 U	0.02 U	0.002 U					0.00533		0.00068
Arsenic	mg/L	0.0037 J	0.0025 J	0.05 U	0.0039 J					0.0038		0.00586
Barium	mg/L	0.17 JB	0.17	0.25	0.24					0.154		0.681
Beryllium	mg/L	0.001 U	0.001 U	0.001 UJ	0.001 U					4E-05		9.2E-05
Bicarbonate Alkalinity as CaCO3	mg/L					180	140	150	130			
Boron	mg/L	0.56	0.49	0.57 B	0.54 B	0.55	0.52	0.51		0.278		0.3
Bromide	mg/L	35	53	50	49							10.5
Cadmium	mg/L	0.001 U	0.001 U	0.01 U	0.001 U					0.0002		0.00027
Calcium	mg/L	380 B	390	440	500	610	650	550		10.3		25
Carbonate Alkalinity as CaCO3	mg/L					50	5	5	5 U			
Chloride	mg/L	7800	12000	11000	12000	14000	16000	13000	15000		403	2170
Chromium	mg/L	0.00071 J	0.002 U	0.02 U	0.0011 J					0.0349		0.00944
Cobalt	mg/L	0.0015	0.0013	0.0069 J	0.0046					0.000731		0.00238
Conductivity, Field	uS/cm									7110		7954
Copper	mg/L		0.002 U	0.02 U	0.002 U							
Dissolved Oxygen, Field	mg/L					1.53				7.22		3.52
Dissolved Solids, Total	mg/L	9600	17000 J	17000	15000 J	20000	23000	16000	24000		3060	4400
Fluoride	mg/L	2.5 U	5 U	1.3 U	2.5 U	5	2.5	2.9	2.5 U		2.21	2.01
Iron	mg/L		0.13	2.9	2.8							
Lead	mg/L	0.00056 J	0.001 U	0.001 U	0.001 U					0.00261		0.00424
Lithium	mg/L	0.21	0.23	0.29	0.29					0.593		0.086
Magnesium	mg/L		110	160	160	200	210	190				9.05
Manganese	mg/L	0.68 B	0.52	1.8	1.4							
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U					8E-06		8E-06
Molybdenum	mg/L	0.011 J	0.015	0.011 J	0.016					0.223		0.248
Nickel	mg/L		0.0053	0.02 U	0.024							
pH, Field	pH units	7.31	7.21	7.51	7.86	7.1	7.11	7.25	7.27	12.23		8.5
Potassium	mg/L	26 JB	28	29	29	28	29	31				32.5
Radium 226	pCi/L	0.869	1.05	1.47	1.61 J					1.44		1.07
Radium-226/228	pCi/L	1.71	2.19	3.93	4.91 J					2.62		2.041
Radium-228	pCi/L	0.839	1.14	2.45	3.29					1.18		0.971
Redox Potential, Field	mV									-93.7		40.3
Selenium	mg/L	0.0015 J	0.005 U	0.05 U	0.0014 JB					0.0054		0.0007
Silver	mg/L		0.001 U	0.0008 J	0.00062 J							
Sodium	mg/L	4700 JB	4400	5900 B	6000	7300	7100	6900				911
Specific Conductivity, Field	uS/cm					35660						
Strontium	mg/L	20 JB	21	27 B	26							1.72
Sulfate	mg/L	790	1100	640	670	540	560	550	350		529	497
Temperature, Field	deg C					13.5				16.2		12.1
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U					0.000266		0.000105
Turbidity, Field	NTU	4.1	77.3	10.1	10.3	4	2.62		7	7.1		67.4
Vanadium	mg/L											
Zinc	mg/L		0.02 U	0.2 U	0.02 U							

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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 2016-11	FEDERAL 2016-11	FEDERAL 96147	FEDERAL 96147	FEDERAL 96147	FEDERAL 96147	FEDERAL 96147	FEDERAL 96147	FEDERAL 96147	FEDERAL 96147	FEDERAL 96147
	Date	2017-03-21	2017-04-25	2016-08-24	2016-10-05	2016-11-30	2017-01-31	2017-03-22	2017-04-27	2017-06-07	2017-07-13	2018-03-28
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	290				925	881					900
Aluminum	mg/L		0.05 U					75 J	0.65	68	97	
Antimony	mg/L	0.002 U	0.00081 J	0.00017	0.0002	5E-05	8E-05	0.00097 J	0.0012 J	0.0011 J	0.001 J	
Arsenic	mg/L	0.0049 J	0.0022 J	0.00241	0.00906	0.00467	0.00379	0.013	0.0042 J	0.013	0.021	
Barium	mg/L	0.33 JB	0.41	0.77	0.929	0.464	0.372	0.43 JB	0.18	0.34	0.64	
Beryllium	mg/L	0.001 U	0.001 U	0.000155	0.00926	0.00294	0.00206	0.0032	0.001 U	0.0027 J	0.0075	
Bicarbonate Alkalinity as CaCO3	mg/L											860
Boron	mg/L	0.36	0.35	0.438	0.48	0.397	0.445	0.46	0.48 B	0.49	0.5	0.48
Bromide	mg/L	10	11 J			2.99	2.81	2.8 J	2.4 J	2.9 J	2 J	
Cadmium	mg/L	0.00035 J	0.001 U	0.00067	0.00198	0.00022	0.00018	0.001 U	0.001 U	0.00057 J	0.00036 J	
Calcium	mg/L	28 B	34	31.1	85.6	21.5	18.9	15 B	11	14	19	9.1
Carbonate Alkalinity as CaCO3	mg/L											34
Chloride	mg/L	2400	2800	3240	1650	332	659	600	570	690 J	460	700
Chromium	mg/L	0.037 J	0.002 U	0.0013	0.0062	0.00233	0.00105	0.077 J	0.002 U	0.071 J	0.13	
Cobalt	mg/L	0.00076 J	0.0013	0.00113	0.0255	0.00586	0.0028	0.017	0.00066 J	0.018	0.037	
Conductivity, Field	uS/cm				8060	3243	2933					
Copper	mg/L		0.003					0.16 JB	0.0044	0.39 B	0.35 B	
Dissolved Oxygen, Field	mg/L				3.65	4.01	4.8					1
Dissolved Solids, Total	mg/L	5200	4900 J	5760	3840	2660	3040	2200	2100 J	2000	1800 J	2200
Fluoride	mg/L	2.4	2.2 J	1.78	2.54	3.53	4.21	4.8	5.3	5.2 J	4.6	4.6
Iron	mg/L		0.1 U					43 JB	0.45	38	88	
Lead	mg/L	0.0054 J	0.001 U	0.00737	0.0574	0.0332	0.0227	0.044 J	0.00081 J	0.051	0.088	
Lithium	mg/L	0.08	0.074	0.077	0.075	0.03	0.034	0.082	0.034	0.084	0.15	
Magnesium	mg/L		11			5.81	4.04	12 B	3.8	12	19	2.8
Manganese	mg/L	0.031 B	0.039					0.28 B	0.063	0.28	0.47	
Mercury	mg/L	0.0002 U	0.0002 U	4E-05	0.00167	0.00013	0.000206	0.0002 U	0.0002 U	0.0002	0.00027	
Molybdenum	mg/L	0.14 J	0.14	0.00729	0.00114	0.0125	0.0179	0.046 J	0.05	0.053	0.04	
Nickel	mg/L		0.038					0.044	0.002 U	0.04	0.098	
pH, Field	pH units	8.95	8.35		7.93	8.01	8.1	8.02	7.95	8.22	7.95	7.99
Potassium	mg/L	21 JB	15			3.69	4.54	12 JB	2.4	9.4	14	2.2
Radium 226	pCi/L	0.934	1	1.2	0.989	0.0683	1.98	3.23	1.89	1.87	4.59 J	
Radium-226/228	pCi/L	1.81	1.56	3.94	5.469	4.8483	9.87	7.29	4.65	4.72	12 J	
Radium-228	pCi/L	0.872	0.564	2.74	4.48	4.78	7.89	4.05	2.76	2.85	7.41	
Redox Potential, Field	mV				-37.1	182.7	102.3					
Selenium	mg/L	0.003 J	0.005 U	0.0002	0.0013	0.0006	0.0003	0.0024 J	0.005 U	0.0027 J	0.0089	
Silver	mg/L		0.0001 J					6.6E-05 J	9.6E-05 J	9.3E-05 J	0.00016 J	
Sodium	mg/L	1800 JB	1800			777	638	770 JB	1100	860 B	720 B	820
Specific Conductivity, Field	uS/cm											3868
Strontium	mg/L	2.1 JB	2.7			1.17	0.974	1 JB	1	0.74 B	1.3 B	
Sulfate	mg/L	560	750	25.3	82.1	101	99.6	110	110	110 J	140	140
Temperature, Field	deg C				15.5	16.3	13					13.5
Thallium	mg/L	0.001 U	0.001 U	8E-05	0.000836	0.000267	0.000142	0.00085 J	0.001 U	0.001	0.0013	
Turbidity, Field	NTU	22.4	73.2		3569.2	4054.1	1533.1	3297	1687.1	537.7	2269.5	52
Vanadium	mg/L							0.074				
Zinc	mg/L		0.015 J					0.24	0.02 U	0.3	0.46	

Notes:

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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 96147	FEDERAL 96147	FEDERAL 96148	FEDERAL 96152	FEDERAL 96152	FEDERAL 96153R	FEDERAL 96153R	FEDERAL 96153R	FEDERAL 96153R	FEDERAL 96153R	FEDERAL 96153R
	Date	2018-10-04	2018-10-23	2019-09-26	2019-03-28	2019-09-22	2016-08-23	2016-10-03	2016-11-29	2017-03-21	2017-04-25	2017-06-06
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L		780	350	450	450			262	84		
Aluminum	mg/L										0.56	0.47
Antimony	mg/L						0.00059	0.00036	0.00024	0.00085 J	0.002 U	0.00057 J
Arsenic	mg/L						0.00237	0.00142	0.0013	0.0044 J	0.005 U	0.005 U
Barium	mg/L						0.0315	0.0901	0.136	0.061 JB	0.027	0.037
Beryllium	mg/L						0.000515	0.000196	0.00019	0.012	0.0048	0.00038 J
Bicarbonate Alkalinity as CaCO3	mg/L		780	350	450	450						
Boron	mg/L		0.46		0.43		0.448	0.423	0.463	0.23	0.25	0.48 B
Bromide	mg/L								0.2	5 U	5 U	5 U
Cadmium	mg/L						8E-05	0.0001	2E-05	0.00036 J	0.00024 J	0.001 U
Calcium	mg/L		10		85		189	208	177	210 B	200	72
Carbonate Alkalinity as CaCO3	mg/L		5	5 U	5	5 U						
Chloride	mg/L		640	9100	4900	4300	34.3	16.1	11.6	16	20	35
Chromium	mg/L						0.0034	0.0027	0.00261	0.0028 J	0.002 U	0.002 U
Cobalt	mg/L						0.0234	0.0266	0.00693	0.3	0.29	0.012
Conductivity, Field	uS/cm						3013	2934	2473			
Copper	mg/L										0.002 U	0.002 U
Dissolved Oxygen, Field	mg/L						4.65	3.74	1.71			
Dissolved Solids, Total	mg/L		1900	15000	6400	6200	2300	2160	1700	1800	1900 J	1800
Fluoride	mg/L		5.6	0.64	0.84	0.91	0.8	0.72	0.67	2.3	2.3	1.4
Iron	mg/L										30	0.94
Lead	mg/L						0.00648	0.00278	0.00277	0.0014 J	0.001 U	0.00045 J
Lithium	mg/L						0.096	0.081	0.053	0.18	0.2	0.069
Magnesium	mg/L		2.6		28				33.6		73	17
Manganese	mg/L									18 B	17	1.6
Mercury	mg/L						8E-06	2E-06	1.5E-05	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L						0.0126	0.0114	0.00812	0.0065 J	0.0042 J	0.02
Nickel	mg/L										0.27	0.018
pH, Field	pH units	8		7.21	7.71	7.55	7.18	6.99	7.35	6.46	6.19	7.2
Potassium	mg/L		2.4		14				6.7	10 JB	11	5.3
Radium 226	pCi/L						0.634	0.403	0.968	0.476	0.475	0.335
Radium-226/228	pCi/L						2.434	1.963	1.64	0.764	0.926	0.607
Radium-228	pCi/L						1.8	1.56	0.672	0.288 U	0.451	0.272 U
Redox Potential, Field	mV						36.1	136.7	227.2			
Selenium	mg/L						0.0009	0.0005	0.0006	0.0053 J	0.0017 J	0.0014 J
Silver	mg/L										0.001 U	0.001 U
Sodium	mg/L		880		2800				287	160 JB	190	490 B
Specific Conductivity, Field	uS/cm											
Strontium	mg/L								3.22	1.5 JB	1.4	1.3 B
Sulfate	mg/L		130	32	19	16	1290	1320	973	1200	1700	1000
Temperature, Field	deg C						14.3	14.6	13.3			
Thallium	mg/L						5E-05	8E-05	2E-05	0.001 U	0.001 U	0.001 U
Turbidity, Field	NTU	20.8		20		252	141.2	65	49.6	113.6	87.4	19.2
Vanadium	mg/L											
Zinc	mg/L										0.61	0.018 J

Notes:
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mg/L = Milligrams per liter
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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 96153R	FEDERAL 96153R	FEDERAL 96153R	FEDERAL 96153R	FEDERAL 96153R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R
	Date	2017-07-12	2018-03-22	2018-09-13	2019-03-29	2019-09-19	2016-08-23	2016-10-03	2016-11-29	2017-01-30	2017-03-21	2017-04-25
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L		270	71	140	5 U			558	607	600	
Aluminum	mg/L	0.085 B										0.42
Antimony	mg/L	0.002 U		0.002			0.00091	0.00098	0.00046	0.00078	0.0014 J	0.0014 J
Arsenic	mg/L	0.005 U		0.005			0.00644	0.00668	0.00409	0.00277	0.0049 J	0.0093
Barium	mg/L	0.03		0.028			0.13	0.115	0.219	0.194	0.28 JB	0.067
Beryllium	mg/L	0.001 U		0.0052			0.000546	0.000319	0.000679	0.000166	0.001 U	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L		270	71	140	5 U						
Boron	mg/L	0.48 B	0.51	0.32	0.39		0.441	0.395	0.504	0.454	0.49	0.5
Bromide	mg/L	5 U							1.48	1.36	1.5 J	1.4 J
Cadmium	mg/L	0.001 U		0.00027			5E-05	2E-05	4E-05	4E-05	0.001 U	0.001 U
Calcium	mg/L	130	140	150	150		9.41	5.34	10.5	22.1	31 B	2.1
Carbonate Alkalinity as CaCO3	mg/L		5	5	5	5 U						
Chloride	mg/L	19	26	19	21	20	413	452	410	446	410	410
Chromium	mg/L	0.002 U		0.002			0.0022	0.0057	0.0121	0.00249	0.0051 J	0.002 U
Cobalt	mg/L	0.0063		0.2			0.00204	0.00176	0.00443	0.000799	0.00095 J	0.00037 J
Conductivity, Field	uS/cm						2462	2602	2562	2549		
Copper	mg/L	0.0034										0.002 U
Dissolved Oxygen, Field	mg/L		0.12				0.68	0.59	1.16	1.02		
Dissolved Solids, Total	mg/L	1600 J	1600	1600	1500	1600	1940	1550	1850	1590	1400	1400 J
Fluoride	mg/L	1.2	1.1	1.4	1.1	2.6	3.32	3.36	3.4	3.33	4.2	4.5
Iron	mg/L	0.14										0.29
Lead	mg/L	0.001 U		0.001			0.00565	0.00371	0.00967	0.0031	0.0021 J	0.001 U
Lithium	mg/L	0.054		0.16			0.08	0.054	0.04	0.137	0.24	0.19
Magnesium	mg/L	26	28		53				4.24	1.48		0.55 J
Manganese	mg/L	0.99									0.02 B	0.011
Mercury	mg/L	0.0002 U		0.0002			2.5E-05	1E-05	3E-05	1.8E-05	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0068 J		0.003			0.0557	0.102	0.0724	0.0692	0.09 J	0.093
Nickel	mg/L	0.0061										0.002 U
pH, Field	pH units	7.49	7.14	6.04	6.59	5.31	9.5	9.36	8.67	9.64	10.67	10.32
Potassium	mg/L	5.8	6.1		15				7.64	33.8	58 JB	41
Radium 226	pCi/L	0.05 U		0.328			1.21	0.53	1.68	0.96	0.696	0.664
Radium-226/228	pCi/L	0.702		0.72			1.566	1.434	2.328	1.762	1.21	0.894
Radium-228	pCi/L	0.652 J		0.393			0.356	0.904	0.648	0.802	0.51	0.23 U
Redox Potential, Field	mV						97.1	54.8	175.9	139.8		
Selenium	mg/L	0.001 JB		0.005			0.001	0.001	0.002	0.0006	0.00096 J	0.005 U
Silver	mg/L	0.001 U										0.001 U
Sodium	mg/L	330	330		280				478	449	540 JB	510
Specific Conductivity, Field	uS/cm		2256									
Strontium	mg/L	2.6							0.425	1.37	2.6 JB	0.57
Sulfate	mg/L	1000	1000	1100	1100	1100	99.2	87.4	125	66.8	64	60
Temperature, Field	deg C		12.2				16.5	14.4	13.3	11.2		
Thallium	mg/L	0.001 U		0.001			6.4E-05	0.000144	0.000121	0.000114	0.001 U	0.001 U
Turbidity, Field	NTU	30.7	7	69.4		85	737	209.7	642.7	349.1	98.6	63.9
Vanadium	mg/L											
Zinc	mg/L	0.02 U										0.02 U

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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96154R	FEDERAL 96156	FEDERAL 96156	FEDERAL 96156	FEDERAL 96156
	Date	2017-06-06	2017-07-12	2018-03-22	2018-09-13	2019-03-29	2019-03-29	2019-09-19	2016-08-23	2016-10-03	2016-11-29	2017-01-30
		N	N	N	N	FD	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L			640	460	350	350	280				165
Aluminum	mg/L	1.4	0.96 B									
Antimony	mg/L	0.002 U	0.0006 JB						0.0001	0.00141	0.00208	0.00022
Arsenic	mg/L	0.0022 J	0.0025 J						0.0141	0.0184	0.0398	0.00202
Barium	mg/L	0.12	0.11						16.2	17.4	17.7	14.8
Beryllium	mg/L	0.001 UJ	0.001 U						0.0002	0.000129	0.0003	2E-05
Bicarbonate Alkalinity as CaCO3	mg/L			370	110	5	5	5 U				
Boron	mg/L	0.53 B	0.53 B	0.53		0.38	0.38		0.394	0.357	0.375	0.379
Bromide	mg/L	2.4	1.8 J									58.6
Cadmium	mg/L	0.001 U	0.001 U						0.00022	0.00221	0.00419	0.0001
Calcium	mg/L	4.8	4.3	2.9	3.2	61	61		409	354	399	346
Carbonate Alkalinity as CaCO3	mg/L			270	350	130	130	180				
Chloride	mg/L	470	490	470	410	340	330	350	11700			12000
Chromium	mg/L	0.0078 J	0.0013 J						0.0011	0.0195	0.0598	0.000629
Cobalt	mg/L	0.00042 J	0.00022 J						0.00194	0.00371	0.00517	0.00145
Conductivity, Field	uS/cm								30150	32283	17682	30266
Copper	mg/L	0.0043 B	0.002 U									
Dissolved Oxygen, Field	mg/L			0.15					2.61	2.64	5.31	4.89
Dissolved Solids, Total	mg/L	1500	1500 J	1500		860	850	900	18300			18100
Fluoride	mg/L	4.1	4.5	3.9	4.4	3.3	3.3	3.9	0.33			2
Iron	mg/L	1.4	0.64									
Lead	mg/L	0.00077 J	0.00048 J						0.00236	0.0218	0.0455	0.00115
Lithium	mg/L	0.048	0.049						0.269	0.252	0.296	0.294
Magnesium	mg/L	1.5	1.4	0.99	0.51	0.34	0.41				117	111
Manganese	mg/L	0.013	0.0053									
Mercury	mg/L	0.0002 U	0.0002 U						5E-06	0.0002	2.1E-05	1.1E-05
Molybdenum	mg/L	0.1	0.1						0.00987	0.017	0.0225	0.0054
Nickel	mg/L	0.0028	0.002 U									
pH, Field	pH units	8.76	8.82	9.85	10.11		12.06	11.7	7.07	6.83	7.23	6.77
Potassium	mg/L	6	6.1	15	12	20	20				36.5	47.4
Radium 226	pCi/L	0.251	0.213						33.8			51.2
Radium-226/228	pCi/L	0.655	0.577						75.85	41.96		122.3
Radium-228	pCi/L	0.405	0.364 UJ						42.05	41.96		71.1
Redox Potential, Field	mV								-82.4	-66.3	176.5	102.7
Selenium	mg/L	0.005 U	0.005 U						0.0006	0.0004	0.001	0.0001
Silver	mg/L	0.0017	0.00021 J									
Sodium	mg/L	540 B	590	580	450	340	340				2620	1400
Specific Conductivity, Field	uS/cm			2650								
Strontium	mg/L	0.36 B	0.38								30.4	25.3
Sulfate	mg/L	100	100	51	42	29	29	33	1.9			1
Temperature, Field	deg C			12.6					15.2	16.1	15.7	9.1
Thallium	mg/L	0.001 U	0.001 U						0.0005	0.0002	0.0002	3E-05
Turbidity, Field	NTU	44.8	16.2	6	6.23			41	9	38.2	123.8	64.8
Vanadium	mg/L											
Zinc	mg/L	0.02 U	0.02 U									

Notes:

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mg/L = Milligrams per liter
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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

	Location ID Date	FEDERAL 96156 2017-03-21 N	FEDERAL 96156 2017-04-25 N	FEDERAL 96156 2017-06-06 N	FEDERAL 96156 2017-07-12 N	FEDERAL 96156 2018-03-26 N	FEDERAL 9910 2016-10-03 N	FEDERAL 9910 2018-09-25 N	FEDERAL 9910 2019-03-26 N	FEDERAL 9910 2019-09-22 N	FEDERAL MW-20 2016-08-23 N	FEDERAL MW-20 2016-10-05 N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	150				190		830	860	850		
Aluminum	mg/L		0.05 U	0.079	0.084 B							
Antimony	mg/L	0.0025	0.002 U	0.0017 J	0.0012 JB						4E-05	0.0002
Arsenic	mg/L	0.0035 J	0.0042 J	0.0043 J	0.0036 J						0.00938	0.01
Barium	mg/L	16 JB	16	16	15						0.0274	0.0228
Beryllium	mg/L	0.00043 J	0.001 U	0.001 UJ	0.001 U						0.000234	0.000265
Bicarbonate Alkalinity as CaCO3	mg/L					190		830	840	840		
Boron	mg/L	0.46	0.4	0.43 B	0.4 B	0.41		0.52	0.52		0.126	0.272
Bromide	mg/L	57	73	67	51							
Cadmium	mg/L	0.00043 J	0.00027 J	0.00088 J	0.0015						8E-05	2E-05
Calcium	mg/L	380 B	380	390	370	400		12	13		495	483
Carbonate Alkalinity as CaCO3	mg/L					5		5	23	6.9		
Chloride	mg/L	13000	17000	12000	12000	13000		840	880	800	60.1	25.2
Chromium	mg/L	0.0011 J	0.002 U	0.0077 J	0.016						0.0028	0.0018
Cobalt	mg/L	0.0021	0.0016	0.0015	0.0017						0.128	0.134
Conductivity, Field	uS/cm						4918				2819	3042
Copper	mg/L		0.82	1.3 B	1.3							
Dissolved Oxygen, Field	mg/L					0.24	1.58				2.93	1.5
Dissolved Solids, Total	mg/L	15000	19000 J	21000	15000 J	19000		2400	2900	2700	2660	2710
Fluoride	mg/L	2.5 U	5 U	1.3 U	2.5 U	5		2	1.9	2	0.95	1
Iron	mg/L		4.5	7.7	2.7							
Lead	mg/L	0.0022 J	0.001 U	0.0055	0.0033						0.000201	0.00013
Lithium	mg/L	0.22	0.25	0.25	0.23						0.174	0.171
Magnesium	mg/L		130	140	130	140		4	4.2			
Manganese	mg/L	0.93 B	0.75	0.79	0.74							
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U						5E-06	5E-06
Molybdenum	mg/L	0.0056 J	0.0073 J	0.017	0.0086 J						0.0089	0.00543
Nickel	mg/L		0.0045	0.0049	0.055							
pH, Field	pH units	8.93	8.32	7.26	8.04	7.4	7.58	7.64	7.76	7.8	6.88	6.52
Potassium	mg/L	22 JB	22	22	21	22		2.9	3.2			
Radium 226	pCi/L	94	86.5	64.4	59.3 J						0.31	0.344
Radium-226/228	pCi/L	189	189	138	119 J						0.684	1.494
Radium-228	pCi/L	95.2	103	73.4	60.2						0.374	1.15
Redox Potential, Field	mV						208.7				-41	-55.5
Selenium	mg/L	0.0013 J	0.005 U	0.00091 J	0.0011 JB						0.0001	0.0002
Silver	mg/L		6.6E-05 J	0.001 U	8.9E-05 J							
Sodium	mg/L	6800 JB	6100	1 U	6400	6800		1100	1100			
Specific Conductivity, Field	uS/cm					32509						
Strontium	mg/L	31 JB	33	31 B	27							
Sulfate	mg/L	50 U	100 U	25 U	50 U	100		110	120	100	1610	1810
Temperature, Field	deg C					12.7	16.7				16.53	15.4
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U						0.000598	0.00033
Turbidity, Field	NTU	81.7	72.5	83.2	48	1	184.3	46.5		69	42.4	9.6
Vanadium	mg/L											
Zinc	mg/L		0.19	0.18	0.16							

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Appendix C
Analytical Data Summary
Fly Ash Reservoir
Gavin Power Plant

		FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL
	Location ID	MW-20	MW-20	MW-20	MW-20	MW-20	MW-20
	Date	2016-12-01	2017-04-25	2017-06-06	2017-07-14	2018-03-26	2019-09-19
		N	N	N	N	N	N
Analyte	Unit						
Alkalinity, Total as CaCO3	mg/L	259				220	150
Aluminum	mg/L		0.05 U	0.043 J	0.15		
Antimony	mg/L	0.0001	0.002 U	0.002 U	0.002 U		
Arsenic	mg/L	0.00917	0.0048 J	0.0086	0.013		
Barium	mg/L	0.0233	0.025	0.027	0.029		
Beryllium	mg/L	0.000276	0.00032 J	0.00055 J	0.00088 J		
Bicarbonate Alkalinity as CaCO3	mg/L					220	150
Boron	mg/L	0.104	0.15 J	0.19 B	0.15	0.16	
Bromide	mg/L	0.422	5 U	0.5 U	5 U		
Cadmium	mg/L	4E-05	0.001 U	0.001 U	0.001 U		
Calcium	mg/L	465	500	500	500	480	
Carbonate Alkalinity as CaCO3	mg/L					5	5 U
Chloride	mg/L	16.4	11	6.5	8.2 J	12	1.9
Chromium	mg/L	0.00121	0.002 U	0.0018 J	0.0025		
Cobalt	mg/L	0.143	0.13	0.13	0.14		
Conductivity, Field	uS/cm	2935					
Copper	mg/L		0.002 U	0.002 U	0.002 U		
Dissolved Oxygen, Field	mg/L	4.67				1.76	
Dissolved Solids, Total	mg/L	2620	2500 J	2600	2600 J	2600	2600
Fluoride	mg/L	1	1.2	0.93	0.9	1	1.3
Iron	mg/L		27	32	37		
Lead	mg/L	3E-05	0.001 U	0.001 U	0.00089 J		
Lithium	mg/L	0.188	0.16	0.16	0.16		
Magnesium	mg/L	106	100	100	110	99	
Manganese	mg/L		15	15	16		
Mercury	mg/L	5E-06	0.0002 U	0.0002 U	0.0002 U		
Molybdenum	mg/L	0.00249	0.0016 J	0.002 J	0.0027 J		
Nickel	mg/L		0.1	0.11	0.12		
pH, Field	pH units	6.5	6.51	6.52	6.51	6.56	6.35
Potassium	mg/L	9.01	7.8	7.8	8	7.4	
Radium 226	pCi/L	0.322	0.181	0.192	0.327		
Radium-226/228	pCi/L	0.866	0.594	0.425	0.73		
Radium-228	pCi/L	0.544	0.413	0.234 U	0.404		
Redox Potential, Field	mV	-47.5					
Selenium	mg/L	0.0001	0.005 U	0.005 U	0.0015 J		
Silver	mg/L		0.001 U	0.001 U	0.001 U		
Sodium	mg/L	64.6	52	51 B	53 B	47	
Specific Conductivity, Field	uS/cm					2817	
Strontium	mg/L	3.08	3.6	3.3 B	3.2 B		
Sulfate	mg/L	1610	2200	1700	1600	1700	1700
Temperature, Field	deg C	12.1				12.4	
Thallium	mg/L	9E-05	0.001 U	0.001 U	0.001 U		
Turbidity, Field	NTU	9.2	6.1	1.4	4.8	1	67
Vanadium	mg/L						
Zinc	mg/L		0.02 U	0.02	0.038		

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