Luminant

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

October 27, 2023
Illinois Environmental Protection Agency
DWPC – Permits MC#15
Attn: 35 I.A.C. § 845.650(e) Alternative Source Demonstration Submittal
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: Baldwin Power Plant Bottom Ash Pond; IEPA ID # W1578510001-06

Dear Mr. LeCrone:

In accordance with Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845.650(e), Dynegy Midwest Generation, LLC (DMG) is submitting this Alternative Source Demonstration (ASD) for exceedances observed from the Quarter 2 2023 sampling event at the Baldwin Power Plant Bottom Ash Pond, identified by Illinois Environmental Protection Agency (IEPA) ID No. W1578510001-06.

This ASD is being submitted within 60 days from the date of determination of an exceedance of a groundwater protection standard (GWPS) for constituents listed in 35 I.A.C. § 845.600. As required by 35 I.A.C. § 845.650 (e)(1), the ASD was placed on the facility's website within 24 hours of submittal to the agency.

One hard copy is provided with this submittal.

Sincerely,

Phil Morris, PE
Senior Director, Environmental

Enclosures
Alternate Source Demonstration, Quarter 2 2023, Bottom Ash Pond Baldwin Power Plant, Baldwin Illinois

Geosyntec consultants

engineers | scientists | innovators

ALTERNATIVE SOURCE DEMONSTRATION

Baldwin Power Plant Bottom Ash Pond
(Unit ID #601)
IEPA ID: W1578510001-06
35 IAC 845.650

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Ilinois 62234

Prepared by

Geosyntec Consultants, Inc.
150 E Wilson Bridge Road
Worthington, Ohio 43085

Project Number: GLP8068

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October 27, 2023

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ACRONYMS AND ABBREVIATIONS

%	percent
‰	per mill
ANOSIM	analysis of similarities
ASD	alternative source demonstration
BAP	Bottom Ash Pond
bgs	below ground surface
BPP	Baldwin Power Plant
CCR	coal combustion residuals
cm/s	centimeters per second
DMG	Dynegy Midwest Generation, LLC
FAPS	Fly Ash Pond System
GWPS	groundwater protection standard
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
LOE	line of evidence
mg/L	milligrams per liter
NAVD88	North American Vertical Datum of 1988
NMDS	nonmetric multidimensional scaling
NPDES	National Pollutant Discharge Elimination System
NRT	Natural Resource Technology, Inc.
PC	principal component
PCA	principal component analysis
USGS	United States Geological Survey

1. INTRODUCTION

Geosyntec Consultants, Inc. has prepared this alternative source demonstration (ASD) on behalf of Dynegy Midwest Generation, LLC (DMG), regarding the Bottom Ash Pond coal combustion residuals (CCR) unit at the Baldwin Power Plant (BPP) near Baldwin, Illinois. The ASD is completed pursuant to the Illinois Administrative Code (IAC) Title 35, Part 845 ("Standards for the Disposal of CCR in Surface Impoundments") and was completed by October 27, 2023, within 60 days of determination of the exceedances (August 28, 2023), as required by 35 I.A.C.§ 845.650(e). This report applies specifically to the CCR Unit referred to as the Bottom Ash Pond (BAP), identification (ID) number (No.) 601, IEPA ID No. W1578510001-06, and National Inventory of Dams (NID) ID No. IL50721.

An exceedance of chloride was identified above the site-specific groundwater protection standard (GWPS) of 1,370 milligrams per liter (mg/L) at downgradient monitoring well MW-370 following the Second Quarter 2023 sampling event. An exceedance of fluoride was identified above the site-specific GWPS of 4.0 mg/L at downgradient monitoring well MW393 following the Second Quarter 2023 sampling event.

Under 35 IAC 845.650(e), the owner or operator of a CCR surface impoundment may submit a demonstration that a source other than the CCR surface impoundment caused the contamination, or that the exceedance of the groundwater protection standard resulted from error in sampling, analysis, or statistical evaluation, natural variation in groundwater quality, or a change in the potentiometric surface and groundwater flow direction.

Pursuant to 35 IAC 845.650(e), the lines of evidence (LOEs) documented in this ASD demonstrate that a source other than the BPP BAP CCR unit was the cause of the GWPS exceedance for chloride at downgradient monitoring well MW-370 and the GWPS exceedance for fluoride at downgradient monitoring well MW-393. Natural variability associated with the lithology of the aquifer was identified as the alternative source for the elevated chloride and fluoride concentrations at MW-370 and MW-393, respectively.

2. BACKGROUND

2.1 Site Location and Description

The BPP is located in Randolph County and St. Clair County in southwest Illinois approximately 0.5 miles west-northwest of the village of Baldwin. The BPP property is bordered by Baldwin Road to the east; the village of Baldwin to the southeast; Illinois Central Gulf railroad tracks, State Road 154, and scattered residences to the south; the Kaskaskia River to the west; and farmland to the north. CCR impoundments present at the BPP include the BAP and the closed Fly Ash Pond System (FAPS), which included the West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond. Non-CCR impoundments present at the BPP include the Secondary Pond, Tertiary Pond, and Baldwin Lake (BPP Cooling Pond). The location of the CCR and non-CCR impoundments are shown in **Attachment 1**. The BAP is immediately north of the FAPS, which is a closed in-place CCR unit approved for closure by the IEPA on August 16, 2016.

2.2 Description of the CCR Unit

The BPP began operation in 1970 and initially burned bituminous coal from Illinois, switching to subbituminous coal in 1999. The BAP is an unlined surface impoundment with a surface area of approximately 177 acres used to store and dispose of sluiced bottom ash from the BPP, some of which is mined for beneficial reuse. The BAP is also used to temporarily store spray dry adsorption waste and to clarify plant process water, including other non-CCR station process wastewaters, which is then discharged in accordance with the station's National Pollutant Discharge Elimination System (NPDES) permit (AECOM 2016; IEPA 2016). The original construction date of the BAP is unknown (AECOM 2016).

2.3 Geology and Hydrogeology

This section provides a summary of the site geology and hydrogeology; additional detail is provided in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (Natural Resource Technology, Inc. [NRT] 2016) and the Hydrogeologic Site Characterization Report (Ramboll 2021).

Three hydrostratigraphic units are present at the BPP, which include the CCR, an unconsolidated Upper Unit, and a Bedrock Unit.

- CCR: Consists primarily of bottom ash, fly ash, and boiler slag and also includes fill materials comprising predominantly of clays and silts excavated on-site for use in berm and road construction around the impoundment. Up to 28.2 feet of bottom ash has been observed towards the center of the BAP (Ramboll 2023b).
- Upper Unit: Predominantly clay with silt and minor sand, silt layers, and occasional sand lenses, and includes lithologies identified as the Cahokia Formation, Peoria Loess, Equality Formation, and Vandalia Till. Thin sand seams present at the contact between the Upper Unit and Bedrock Unit have been identified as potential migration pathways

(PMPs) due to higher hydraulic conductivities in comparison to those in the surrounding clays (e.g., 10^{-4} centimeters per second [cm/s] in sands compared with 10^{-5} cm/s in clays) (Ramboll 2023a). Continuous sand seams have not been observed in the Upper Unit or immediately adjacent to the BAP. Due to the predominance of clay and only thin and intermittent sand lenses, this unit is not considered a continuous aquifer unit within the site boundary (NRT, 2016; Ramboll, 2021).

- Bedrock Unit: Pennsylvanian and Mississippian-aged interbedded shale and limestone continuously underlies the BPP and is considered the uppermost aquifer at the site. The top of bedrock ranges from 12.5 feet below ground surface (bgs) near the Kaskaskia River to 70 feet bgs within the East Fly Ash Pond (part of the FAPS). The Bedrock Unit is the uppermost aquifer.

A geologic cross-section originally included in the Hydrogeologic Characterization Report and locator map are provided as **Attachment 2**.

Groundwater at the site has previously been classified as Class II groundwater in accordance with 35 IAC 620 based on the geometric mean hydraulic conductivity values measured in the monitoring wells screened in both the Upper Unit (3.2×10^{-5} cm/s) and the Bedrock Unit (5.0×10^{-6}) (NRT 2014).

The groundwater monitoring network for the BAP consists of 16 monitoring wells: thirteen downgradient monitoring wells (MW-192, MW-193, MW-356, MW-369, MW-370, MW-382, MW-392, MW-393, MW-394, OW-256, OW-257, PZ-170, and PZ-182) and three background monitoring wells (MW-304, MW-306, and MW-358) (**Attachment 1**). Monitoring wells are screened in both the uppermost aquifer (Bedrock Unit) from approximately 350 to 404 feet and the unconsolidated unit from 388 to 414 feet (North American Vertical Datum of 1988 [NAVD88].

The potentiometric groundwater contours and generalized groundwater flow directions at the site are shown in **Attachment 3**. Groundwater flow in bedrock is toward the northwest in the eastern and central areas of the BAP, and southwest in the east area of the FAPS. Bedrock groundwater flows toward the Secondary and Tertiary Ponds, which were created in a former surface water drainage channel. Groundwater flow directions are generally consistent.

3. ALTERNATIVE SOURCE DEMONSTRATION LINES OF EVIDENCE

This ASD for the chloride GWPS exceedance at MW-370 and the fluoride GWPS exceedance at MW-393 is based on four lines of evidence (LOEs). These LOEs are described and supported below.

3.1 LOE #1: BAP Porewater Concentrations of Chloride and Fluoride are Lower than Groundwater Concentrations.

Porewater (*i.e.*, water within the CCR) samples have been collected from piezometer TPZ-164 since September 2018 and at five new porewater wells (XPW-01, -02, -04, -05, and -06) since October 2022. The chloride and fluoride concentrations reported for these porewater sampling locations are consistently below the concentrations observed for chloride at MW-370 and for fluoride at MW-393, as shown in **Figure 1** and **Figure 2**, respectively. The highest observed chloride concentration in the porewater is consistently more than 10 times lower than the maximum concentration observed at MW-370. Likewise, the highest observed fluoride concentration in the porewater is consistently more than 10 times lower than the maximum fluoride concentration observed at MW-393. The chloride concentrations detected in the porewater samples are less than the lower confidence limits of chloride concentrations observed at downgradient well MW-370 (1,370 mg/L calculated using a confidence band around a linear regression) and fluoride concentrations observed at downgradient well MW-393 (7.49 mg/L calculated using a confidence band around a linear regression) (Ramboll 2023a).

If the BAP were the source of chloride or fluoride in groundwater, BAP porewater concentrations are expected to be greater than the GWPS exceedance concentrations. Given the conservative (non-reactive) nature of both chloride and fluoride, their concentrations are expected to remain stable or decrease along the flow path from the source due to dispersion and dilution. Because the concentrations in the BAP are lower than the concentrations of chloride above the GWPS at monitoring well MW-370 and the concentrations of fluoride above the GWPS at monitoring well MW-393, these exceedances are not attributed to impacts from the BAP unit.

3.2 LOE #2: The Wells of Concern Have a Similar Ionic Composition to Upgradient Monitoring Well MW-358.

The groundwater at both MW-370 and MW-393 has a similar ionic composition to the groundwater from recently installed background monitoring well MW-358, suggesting that these locations are not affected by the BAP. Ramboll (2023b) previously evaluated Stiff diagrams and found that both MW-358 and MW-370 contain groundwater dominated by chloride and monovalent cations. Furthermore, a Piper diagram — an alternative to Stiff diagrams for illustrating the relative concentration of major cations and anions in groundwater samples — shows that groundwater at MW-393 appears to be predominantly composed of chloride and monovalent cations, consistent with the composition of MW-358 and MW-370 (**Figure 3**). This groundwater composition is different from the composition of samples of BAP porewater, which tends to have greater relative contributions of alkalinity, sulfate, and divalent cations such as calcium and magnesium (**Figure 3**).

Piper and Stiff diagrams (Ramboll 2023b) typically show the relative proportions and individual concentrations (respectively) of major cations and anions. Advanced statistical approaches such as principal component analysis (PCA) or non-metric multi-dimensional scaling (NMDS) use a broader suite of analytes to evaluate the similarity or dissimilarity of different samples or groups and identify analytes that are main drivers for dissimilarities.

PCA is often used to simplify large datasets with multiple variables by creating new uncorrelated variables known as principal components (PCs). The PCs are linear combinations of the original variables; the first few PCs typically capture most of the variation within the dataset. Factor loadings are calculated based on the correlation between PCs and the original variables. As such, variables with notably higher positive or negative factor loadings are main drivers of similarity or dissimilarity and clustering of samples. Factor scores are calculated based on the correlation between the combined chemical composition of each sample and the PCs. Samples with similar chemical compositions show similar factor scores and tend to cluster together on a PCA plot.

In this study the dataset used for PCA included 65 samples collected between 2017 and 2023 from background MW-358, downgradient wells MW-370 and MW-393, and porewater wells. PCA requires that input variables have similar scales of measurement and variances. As such, data were standardized by mean-centering and scaling to unit variance prior to performing PCA. The fraction of total variation explained by each PC is shown in **Figure 4a**, with the first two PCs accounting for approximately 70 percent [%] of the total variation in the datasets. Additionally, the quality of representation of each variable is presented in **Figure 4b,** demonstrating that for most variables, the majority of the variation is captured by the first two PCs.

PCA results are often visualized using biplots, where samples are projected on to the first two PCs (i.e., factor scores), and factor loadings are represented as vectors. The closer the data points are on the graph, the greater the similarity in their chemical composition. The result from this study is shown on **Figure 5**, where the background samples are highlighted in orange, the downgradient samples in shades of blue, and the porewater samples in gray. The factor loadings, represented as vectors on the biplot, suggest that constituents such as calcium, magnesium, potassium, and barium are responsible for shifting the chemical signature of samples from within the BAP towards the porewater cluster. In contrast, constituents such as lithium, fluoride, and chloride are drivers for shifting chemical compositions in the direction of the downgradient and background sample clusters. These results are generally consistent with the findings of the Piper Diagram (**Figure 3**).

The 95% bivariate confidence ellipses for each of the three groups of water (porewater from within the BAP, downgradient bedrock groundwater, and background bedrock groundwater) are also depicted on the biplot graph (**Figure 5**). As illustrated on the biplot, the porewater samples cluster relatively separately from the downgradient and background wells, with no overlap in their confidence ellipses. Furthermore, the PCA suggests that the composition of downgradient samples from MW-370 and MW-393 are similar to the composition of background samples from MW-358.

Clustering was further explored using Ward's hierarchical clustering method, a distance measure employed in agglomerative algorithms and commonly applied in hydrogeochemical studies. The analysis was performed on a scaled and centered dataset. As illustrated in the dendrogram (**Figure 6**), this analysis supported the distinction between porewater samples from the combined group of downgradient and background wells.

The different groups of samples were further compared and contrasted using Analysis of Similarities (ANOSIM). ANOSIM is a nonparametric, rank-based test used to evaluate if differences in water quality data between groups are statistically significant. **Table 1** presents the ANOSIM results for three subsets of data.

The first subset compares porewater samples with background samples, and the second subset compares porewater samples with downgradient samples. The third subset compares the background and downgradient samples. The p-values for the first two comparisons are less than 0.05, indicating a significant difference between the porewater samples and both the downgradient and background water samples[1]. However, the high p-value (0.14) for the third dataset comparing background and downgradient wells indicates no statistically significant difference between the background and downgradient clusters.

NMDS analysis of the available dataset from 2023 was conducted to evaluate more recent site conditions and to further compare the combined chemical composition of porewater, background, and key downgradient samples. As some wells were installed in 2022, the 2023 samples are likely to be more representative of equilibrium conditions in the aquifer. While both PCA and NMDS aim to reduce dimensionality and visualize patterns among samples, their methods are distinct. PCA relies on linear transformations and captures maximum variance through orthogonal components, whereas NMDS utilizes rank orders to achieve a non-linear representation of the original distances between samples. Therefore, NMDS is more flexible in relation to input requirement and given the limited number of sampling results available for 2023, NMDS was chosen over PCA when looking at only the most recent samples. Additionally, the results of NMDS analysis can be used for independent validation of previous findings from PCA. The results are displayed in a biplot in **Figure 7**.

Qualitatively, the NMDS findings align closely with those from the PCA (**Figure 5**) and indicate that: (i) the porewater sample cluster is separate from the downgradient and background samples; and (ii) the chemical compositions of the background and downgradient wells appear more similar to each other than to the composition of porewater. These results support the conclusion that

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[1] P-values are a measure indicating the differences between two groups relative to random variations. Generally, p-values <0.05 are assumed to represent statistically significant differences between groups.

downgradient locations MW-370 and MW-393 are not affected by the BAP and their geochemistry is instead influenced by the native lithology.

3.3 LOE #3: Stable Boron Isotopes Provide Further Evidence That the Wells of Concern Have a Geochemical Signature Distinct from the BAP's.

Boron isotopes (^{11}B and ^{10}B) can be useful tracers in groundwater systems in sedimentary environments (United States Geological Survey [USGS] 2004). Depleted (lower) boron isotope ratios (reported as δ^{11}B, which is calculated as the ratio of ^{11}B/^{10}B relative to an international standard) are an indicator of CCR impacts to aqueous samples due to the depleted δ^{11}B found in source coal (Ruhl et al. 2014) and coal ash. Alternatively, sediments formed during deposition from marine environments, such as the shales identified within the uppermost aquifer at the site, can be enriched in δ^{11}B during deposition (Spivack et al. 1987).

Aqueous samples were collected from select locations to represent multiple lithologies and locations relevant to the BAP, as summarized in **Table 2**. These locations included TPZ-164 to represent porewater conditions and compliance well MW-370 to represent wells screened within the downgradient shale. The samples were submitted to SmartGas Sciences, LLC (Columbus, Ohio) for analysis of total boron and stable boron isotopes. A review of the boron stable isotopic signatures for the BAP porewater and groundwater at MW-370, which is representative of conditions within the downgradient shale, are markedly different, providing further evidence that the groundwater chemistry at the wells of concern is not affected by the BAP.

Of the samples with more than 1 mg/L of total boron detected, porewater from TPZ-164 was the most depleted in δ^{11}B, with a reported δ^{11}B of 2.8 per mill (‰). This is consistent with the reported δ^{11}B range for Illinois basin coal-derived CCR of -8.8‰ to +6.3‰ (Ruhl et al 2014) (**Figure 8**). Upgradient well MW-358 and compliance well MW-370 both had enriched δ^{11}B values, with reported results of +31.1‰ and +32.4‰, respectively (**Table 2**). The enrichment of δ^{11}B is inconsistent with influences from CCR. Instead, these results are consistent with elevated δ^{11}B in shale formations due to their deposition from marine environments (Spivack et al. 1987; Warner et al. 2013). Typical ranges for δ^{11}B in groundwater unimpacted by CCR are +4.0‰ to +33.0‰ (Warner et al. 2013) and +8.7‰ to 34.0‰ (Buszka et al. 2007). MW-258, which is also an upgradient well screened within the interbedded limestone and shale formation although at a higher elevation (403-413 feet NAVD88) in comparison with approximately 356-366 feet NAVD88 at downgradient well MW-370) was less enriched in δ^{11}B. This variability in δ^{11}B enrichment with depth within the shale may be attributed to differences in mineralogy or depositional environment over time.

These results provide further evidence that wells screened within the shale lithology, including at downgradient locations such as MW-370, are not influenced by the BAP and instead are more strongly influenced by the bedrock lithology where they are screened.

3.4 LOE #4: Chloride and Fluoride Occur Naturally in the Shale Bedrock of the Uppermost Aquifer.

Solid phase analysis identified chloride and fluoride within the bedrock of the uppermost aquifer at the Site – i.e., these are naturally occurring inorganics within the mineral matrix of the bedrock. The presence of these constituents within the solid phase of the uppermost aquifer (bedrock) likely contributes to elevated and naturally occurring chloride and fluoride in the groundwater. Studies have found that chloride and fluoride concentrations in groundwater are comparable to or higher than those observed at MW-370 and MW-393, respectively, and are often found within the Pennsylvanian and Mississippian-aged interbedded shale and limestone of the uppermost aquifer.

Solid phase analysis of bedrock from background boring location MW-358 identified both chloride and fluoride in the solid phase materials (**Attachment 4**). The boring logs for these locations are provided in **Attachment 5**. Solid phase samples were also submitted for analysis of mineralogy via x-ray diffraction (XRD). Fluorapatite [$Ca_5(PO_4)_3F$], a fluoride-bearing mineral, was identified in samples collected from the shale formation at downgradient well MW-392 (**Table 3**; **Attachment 6**). The highest abundance of fluorapatite (2.7%) was identified in a sample collected at 80 to 82 feet below ground surface at downgradient well MW-392, which is the same depth interval as the well screen of MW-393. The presence of chloride and fluoride within the aquifer solids of the shale in the uppermost aquifer, including the presence of a fluoride-bearing mineral, provide an alternative source for these constituents in groundwater other than the BAP.

A USGS summary found that water within the upper parts of the Pennsylvanian-aged aquifers is generally similar throughout the Illinois and Indiana basins (Cable et al, 1971). This groundwater is influenced by the interaction with the variable interbedded rock types - present in the uppermost aquifer at the BAP and can vary from a sodium bicarbonate to a sodium chloride type within a few feet of change in depth (Lloyd and Lyke 1995). Concentrations of chloride as high as 1,400 mg/L, which is consistent with the concentrations at MW-370, were reported in Pennsylvanian-aged aquifers (Cable et al, 1971).

Furthermore, seeps with high salinity (i.e., brines) are known to occur in southern Illinois. Samples of seeps and shallow wells affected by brine in Illinois had highly variable chloride concentrations ranging from ~100 mg/L up to more than 15,000 mg/L (Panno, et al. 2005). Similarly, Lloyd and Lyke (1995) noted that "the fluoride content of the water [in Pennsylvanian-aged aquifers] is great enough to mottle the teeth of persons who drink it on a continual basis," with concentrations reported as high as 15 mg/L. These results suggest that contact with Pennsylvanian-aged bedrock can result in natural variability in the reported chloride and fluoride concentrations in groundwater at ranges consistent with those observed at the site.

4. CONCLUSIONS

It has been demonstrated that the chloride GWPS exceedance at MW-370 and the fluoride GWPS exceedance at MW-393 are not caused by a release from the BAP CCR unit, but instead are attributed to a source other than the BAP. The following summarizes the four LOEs used to support this demonstration:

1. Chloride and fluoride concentrations in the BAP porewater are historically more than 10 times lower than the chloride concentrations observed at MW-370 and the fluoride concentrations observed at MW-393.

2. Compliance monitoring locations MW-370 and MW-393 have similar geochemical signatures as upgradient monitoring well MW-358. Moreover, a statistical evaluation has shown that their groundwater compositions are distinct from the porewater geochemical signature.

3. The stable boron isotopic ratio in groundwater at MW-370 is similar to the same ratio in groundwater at upgradient monitoring well MW-358 and dissimilar from the BAP porewater, providing further evidence that groundwater geochemistry at MW-370 is not influenced by the BAP.

4. Solid phase analysis of rock cores from the uppermost aquifer (i.e., bedrock) identified chloride and fluoride within the naturally occurring minerals of the bedrock, thereby providing an alternative source of these constituents in groundwater. Based on a review of literature, elevated concentrations of chloride and fluoride are known to occur in groundwater within the shale-limestone bedrock (i.e., uppermost aquifer at the BAP) and is likely due to the influence of the solid phase composition.

The alternative source of both chloride and fluoride is the influence of the shale bedrock lithology on the groundwater composition. This demonstration meets the expectations in both 35 IAC 845.650(e) and the technical manual for the Municipal Solid Waste Landfill federal regulatory program (Code of Federal Regulations, Title 40, Section 258) that a statistically significant increase may result from natural variation in groundwater quality.

The information serves as the written ASD prepared in accordance with 35 IAC 845.650(e) demonstrating that the GWPS exceedances for chloride at MW-370 and for fluoride at MW-393 are not due to the BAP CCR unit. Therefore, implementation of corrective measures is not required for chloride or fluoride at the BAP CCR unit.

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TABLES

Table 1 - ANOSIM Hypothesis Test Results
Baldwin Power Plant

Data	R	p-Value	Conclusion
Comparing porewater and background well	1	< 0.001	Water quality of porewater and background wells is different.
Comparing porewater and downgradient wells	1	< 0.001	Water quality of porewater and downgradient wells is different.
Comparing background and downgradient wells	0.09	0.14	Water quality of background and downgradient wells is similar.

Notes:

ANOSIM- Analysis of Similarities

R: ANOSIM test statistics; an R value close to "1.0" suggests a high dissimilarity between groups, while an R value close to "0" indicates an even distribution of high and low ranks both within and between groups.

p-Value: A measure indicating the differences between two groups relative to random variations. Generally, p-values < 0.05 are assumed to represent statistically significant differences between groups.

Table 2 - Boron Isotope Analytical Results
Baldwin Power Plant

Sample ID	Sample Location	Sample Description	δ11B (‰)	Total Boron (µg/L)
20230206 TPZ-164	TPZ-164	Porewater	2.8	1116
20230206 Cooling Pond	Cooling Pond	Surface Water	5.7	240
20230206 MW-370	MW-370	Downgradient Shale	32.4	2061
20230206 PZ-170	PZ-170	Downgradient PMP	43.2	326
20230206 MW-158R	MW-158R	Background PMP	18.0	86
20230207 MW-358	MW-358	Background Deep Shale	31.1	1778
20230207 MW-258	MW-258	Background Shale	14.2	1248

Notes:

1. The standard error for all boron isotope samples was 1.2 ‰

‰: parts per thousand (per mill)

µg/L: micrograms per liter

PMP: potential migration pathway

Table 3 - Summary of Rietveld Quantitative Analysis
X-Ray Diffraction Results
Baldwin Power Plant

Well ID			**MW-358**	**MW-358**	**MW-392**	**MW-392**
Depth (ft bgs)			**(47-49)**	**(86-88)**	**(66-68)**	**(80-82)**
Location			**Upgradient**	**Upgradient**	**Downgradient**	**Downgradient**
Boring Log Description			**Shallow Shale**	**Deeper Shale Body**	**Shale**	**Shale transitioning to limestone**
Mineral/Compound	**Formula**	**Mineral Type**	(wt %)	(wt %)	(wt %)	(wt %)
Quartz	SiO_2	Silicate	29.2	30.7	22.7	29.8
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	Mica	18.8	19.7	15.9	13.1
Albite	$NaAlSi_3O_8$	Feldspar	0.4	2.5	0.6	0.6
Microcline	$KAlSi_3O_8$	Feldspar	8.6	5.9	5.1	1.0
Diaspore	aAlO.OH	Oxyhydroxide	-	-	2.8	-
Magnetite	Fe_3O_4	Oxide	0.5	0.3	0.1	1.4
Anatase	TiO_2	Oxide	0.8	1.8	1.0	0.8
Calcite	$CaCO_3$	Carbonate	0.5	1.0	14.9	28.1
Fluorapatite	$Ca_5(PO_4)_3F$	Phosphate	-	-	0.2	2.7
Ankerite	$CaFe(CO_3)_2$	Carbonate	-	-	0.8	-
Clay Minerals						
Kaolinite	$Al_2Si_2O_5(OH)_4$	Kaolin	4.8	15.0	3.6	5.5
Montmorillonite	$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet 10H_2O$	Smectite	6.8	4.8	5.8	3.5
Nontronite	$Fe_2(Al,Si)_4O_{10}(OH)_2Na_{0.3}(H_2O)_4$	Smectite	4.6	4.3	3.3	4.2
Illite/Montmorillonite	$KAl_4(Si,Al)_8O_{10}(OH)_4 \bullet 4H_2O$	Mixed Layer I/S	8.8	2.7	7.1	3.6
Illite	$K(Al,Mg,Fe)_2(Si,Al)_4O_{10}(OH)_2$	Illite	15.0	9.2	10.4	4.1
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	Chlorite	1.3	2	6.1	1.6
Clay Minerals Total			41	38	36	23
Clays + Muscovite Total			60	58	52	36

Notes

Only samples collected within the shale bedrock are shown. Additional sample data is provided in Attachment 5.

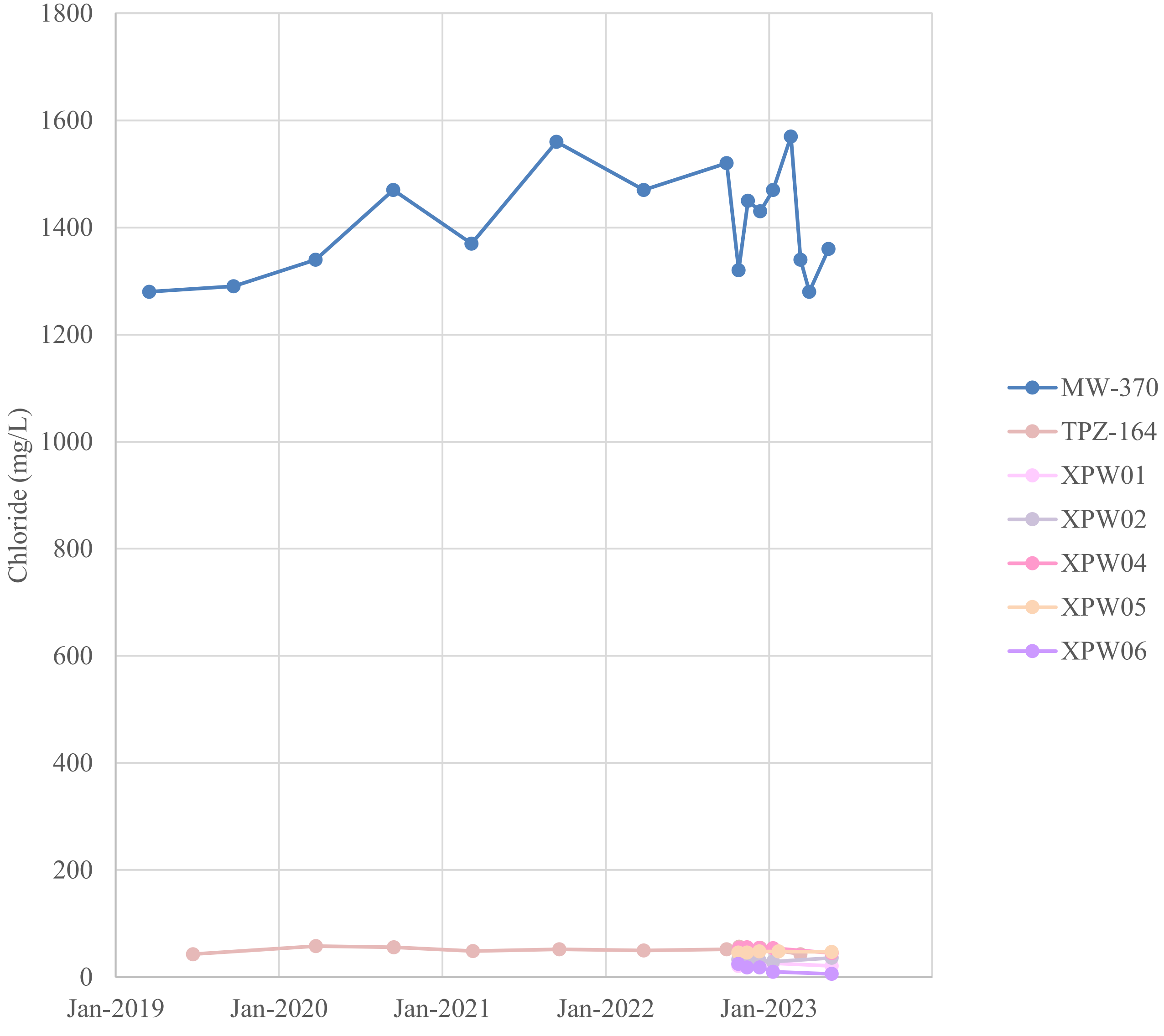
Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

Sample depths are shown in feet below ground surface (ft bgs).

wt %: percentage by weight

FIGURES



Notes:

1. Chloride data at MW-370 are available back to 12/29/15. Historically, results have been consistent, and the dataset is truncated for ease of view here.

mg/L: milligrams per liter

Chloride Time Series Graph

Baldwin Power Plant

Geosyntec consultants

Columbus, Ohio

October 2023

Figure

1

Notes:
mg/L: milligrams per liter

Fluoride Time Series Graph

Baldwin Power Plant

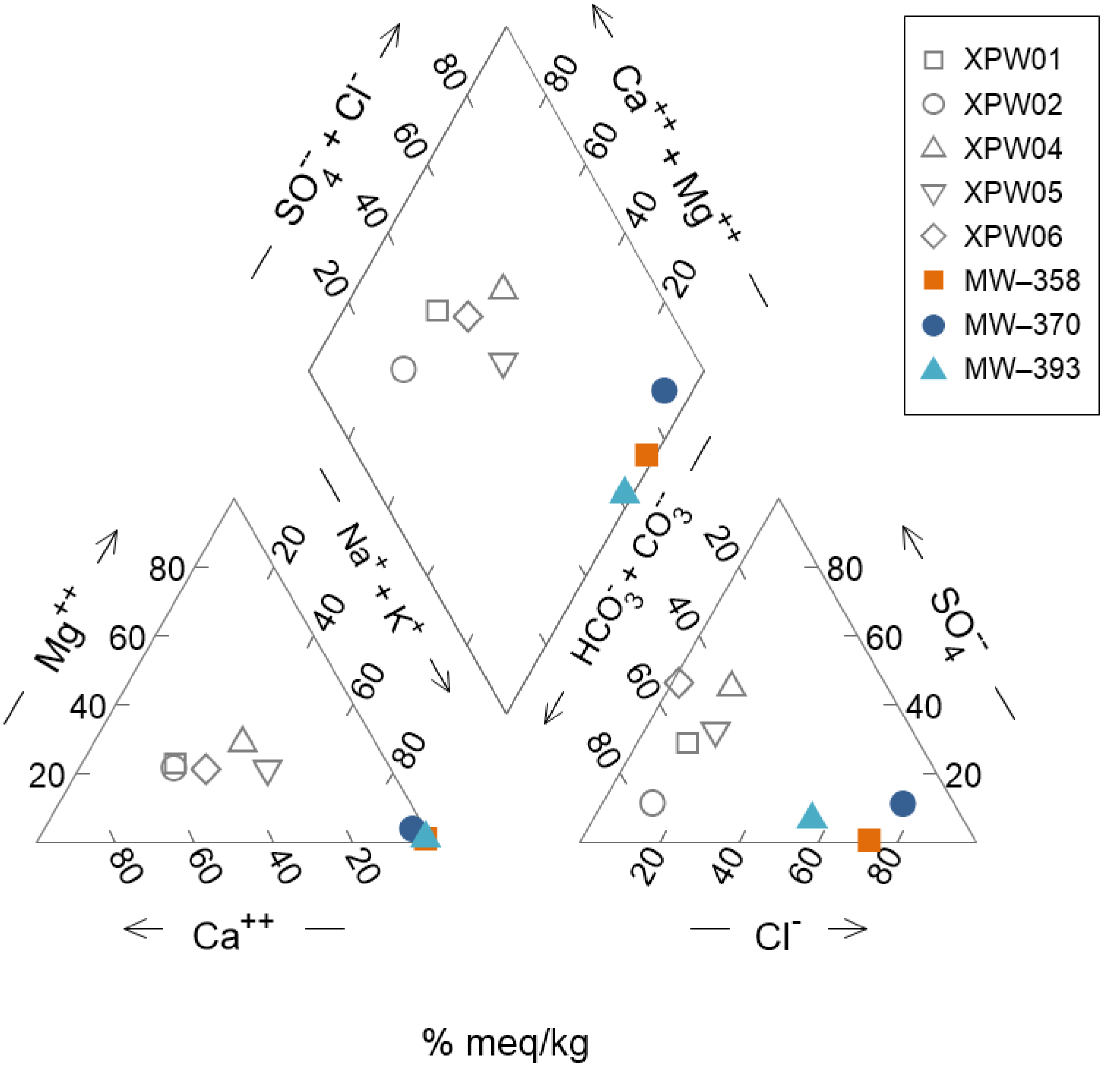
Geosyntec consultants

Figure

2

Columbus, Ohio

October 2023



Notes:

1. Data from May 2023 are shown.

% meq/kg: percent milliequivalents per kilogram

Piper Diagram

Baldwin Power Plant – Bottom Ash Pond

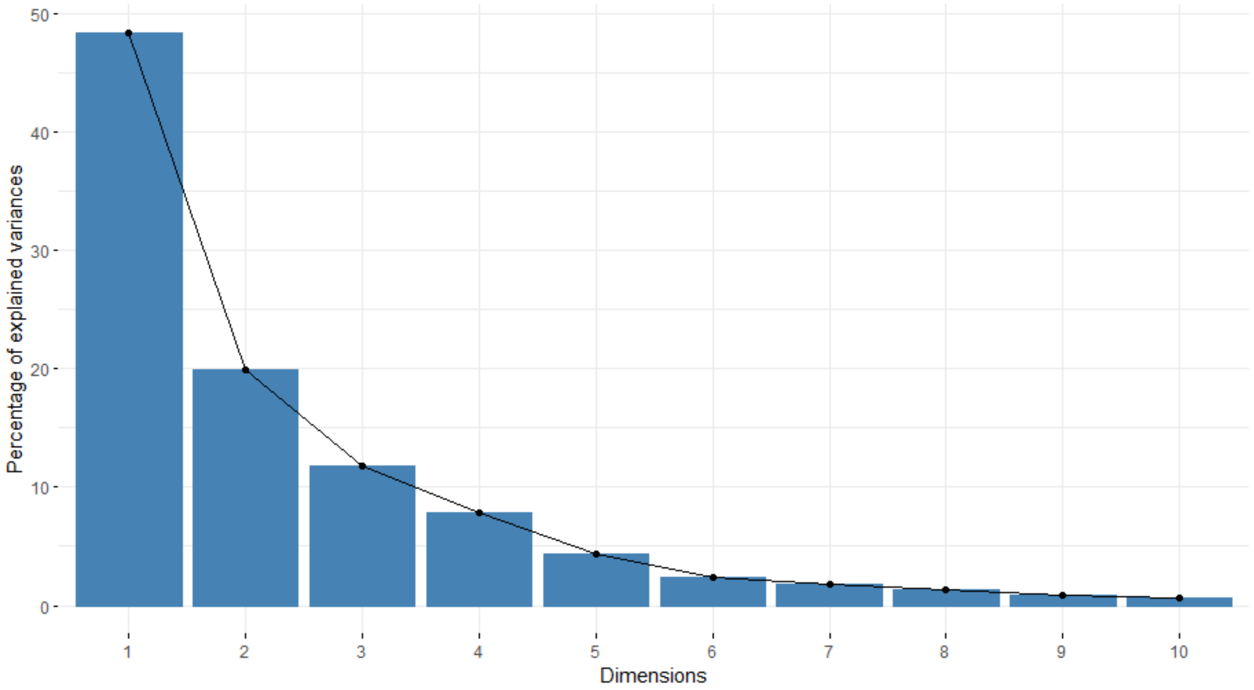
Geosyntec consultants

Figure

3

Columbus, Ohio

October 2023



Notes:
Samples collected from background well MW-358, downgradient wells MW-370 and MW-393, and porewater wells TPZ-164, XPW-1, XPW-2, XPW-3, XPW-5, and XPW-6 were included in the evaluation.

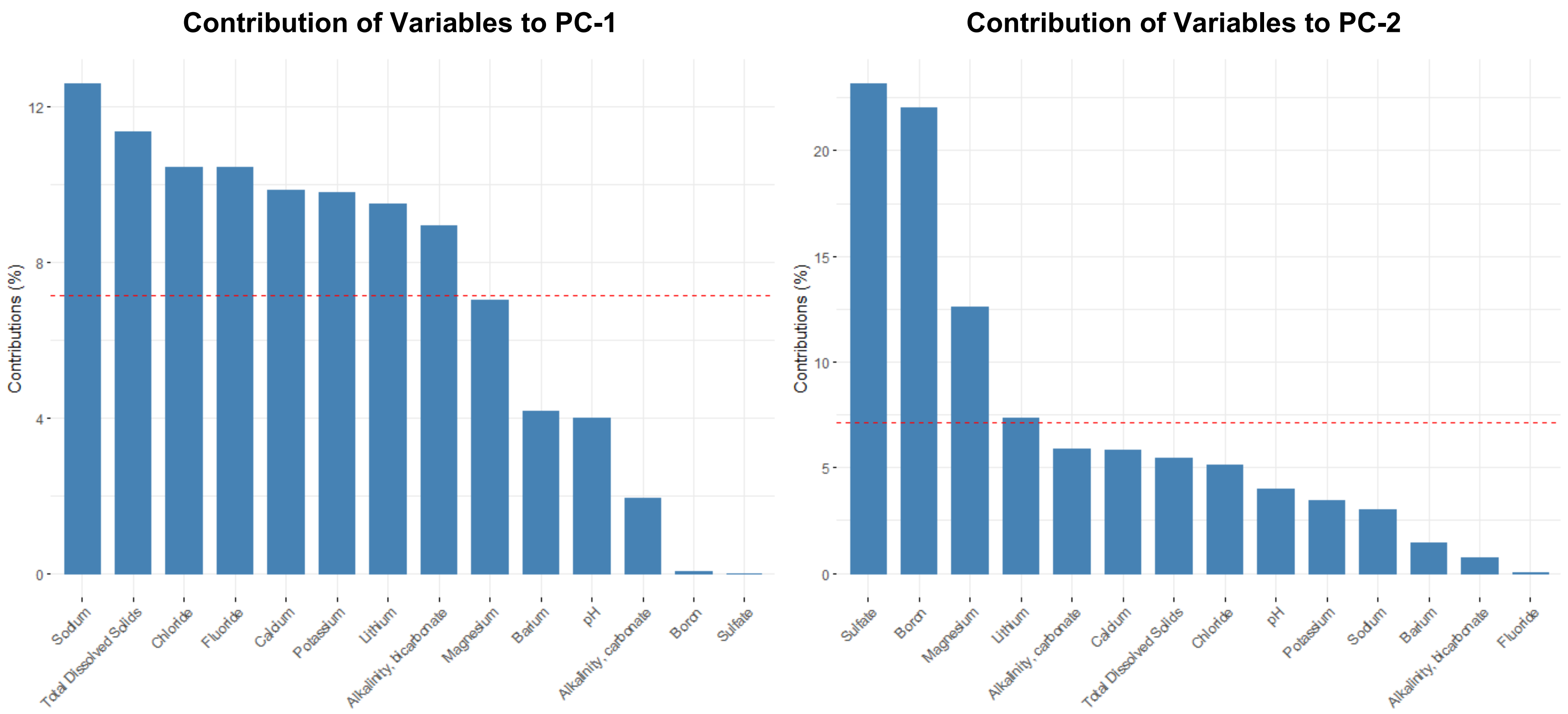
PCA Analysis - Quality of Representation of PCs
Baldwin Power Plant – Bottom Ash Pond

Geosyntec consultants

Columbus, Ohio

October 2023

Figure
4a



Notes:

1. The dashed red line represents the anticipated value for uniform contribution. The constituents with a contribution exceeding the reference line are considered significant in its contribution to each PC (principal component).

Contribution of Variables to First Two PCs

Baldwin Power Plant

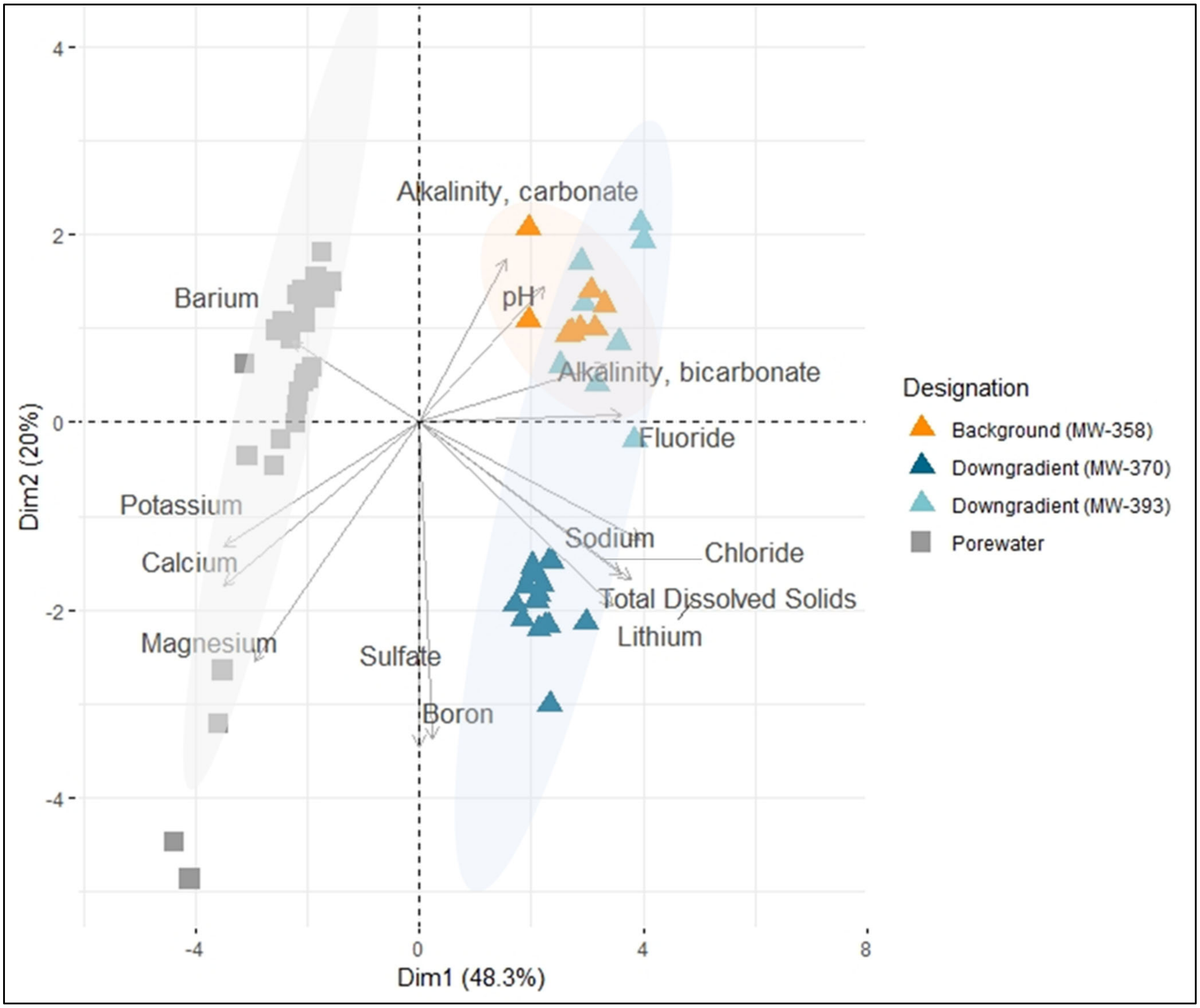
Geosyntec
consultants

Columbus, Ohio

October 2023

Figure

4b



Notes:
1. The ellipse containing data points within the 95% confidence interwall for each group is outlined and shaded in gray, orange, and blue for porewater, background and downgradient groups.
2. The arrows signify the correlations between the constituents and the principal components.

PCA Biplot

Baldwin Power Plant – Bottom Ash Pond

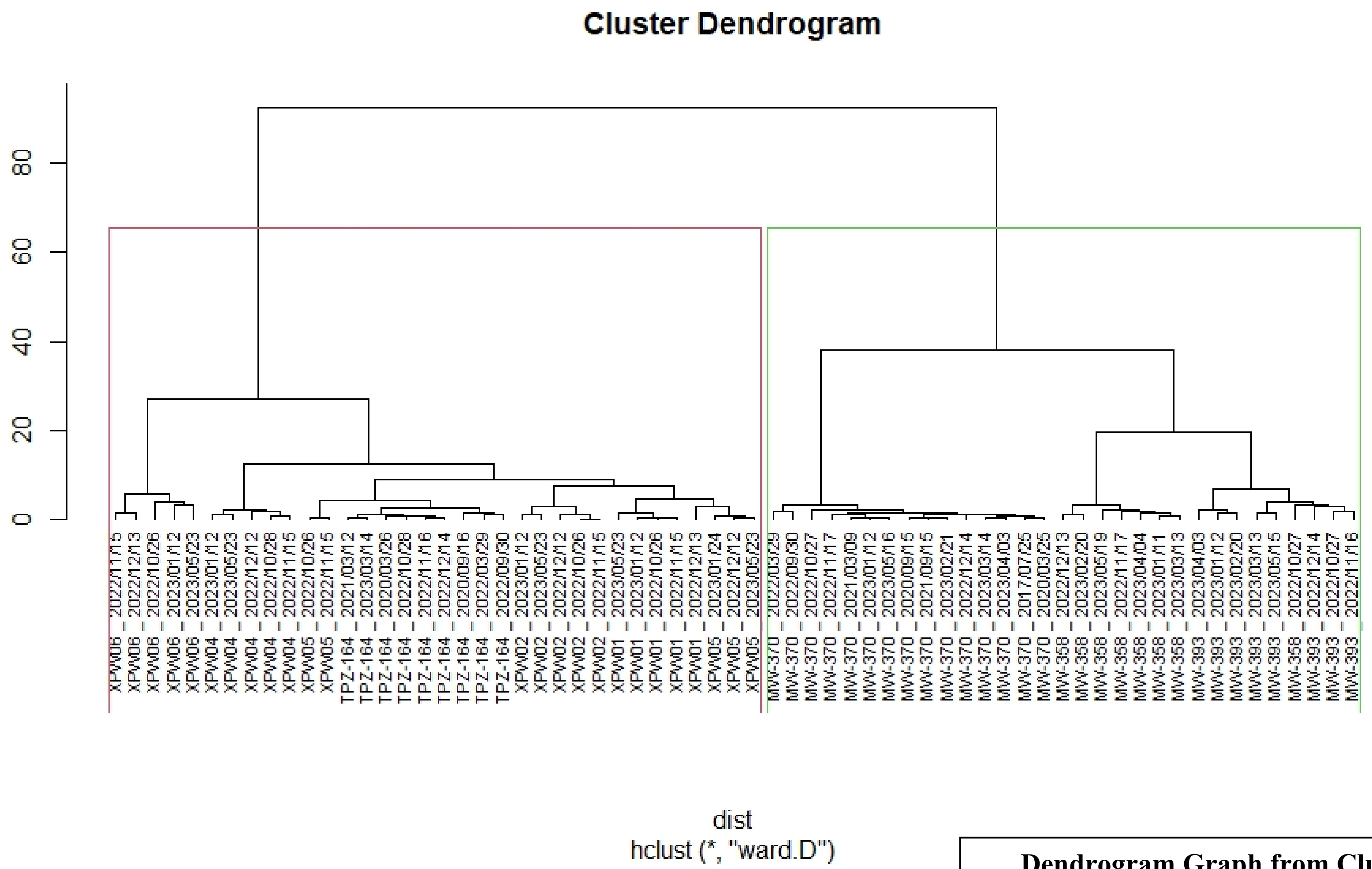
Geosyntec consultants

Figure

5

Columbus, Ohio

October 2023



Notes:
1. The cluster analysis used Euclidean distances as the similarity measure and Ward's method as the clustering algorithm.

Dendrogram Graph from Cluster Analysis

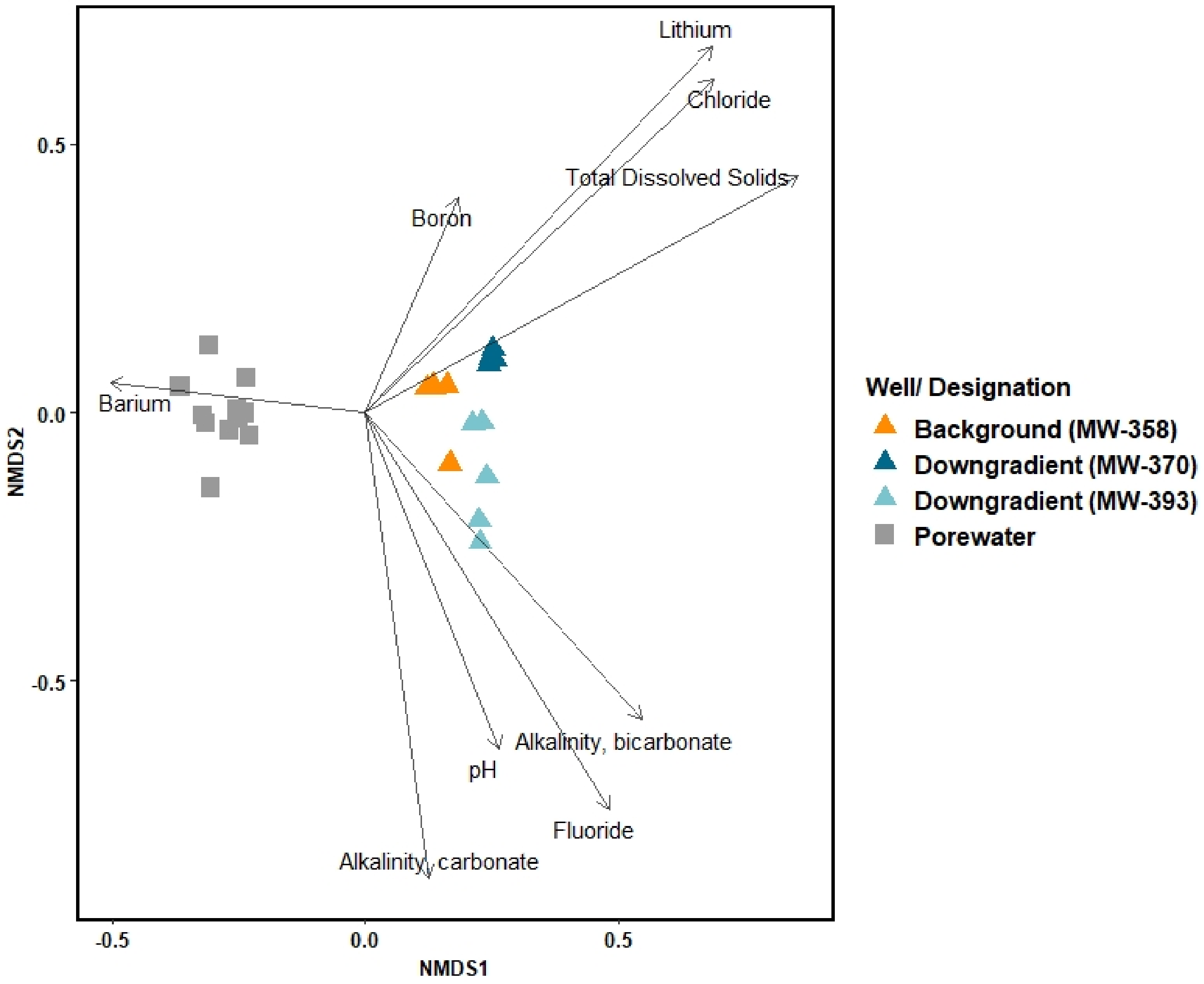
Baldwin Power Plant

Geosyntec consultants

Figure
6

Columbus, Ohio

October 2023



Notes:

1. The arrows represent the correlations between the constituents and the NMDS axes.
2. NMDS: Non-metric Multidimensional Scaling

NMDS Biplot

Baldwin Power Plant – Bottom Ash Pond

Geosyntec consultants

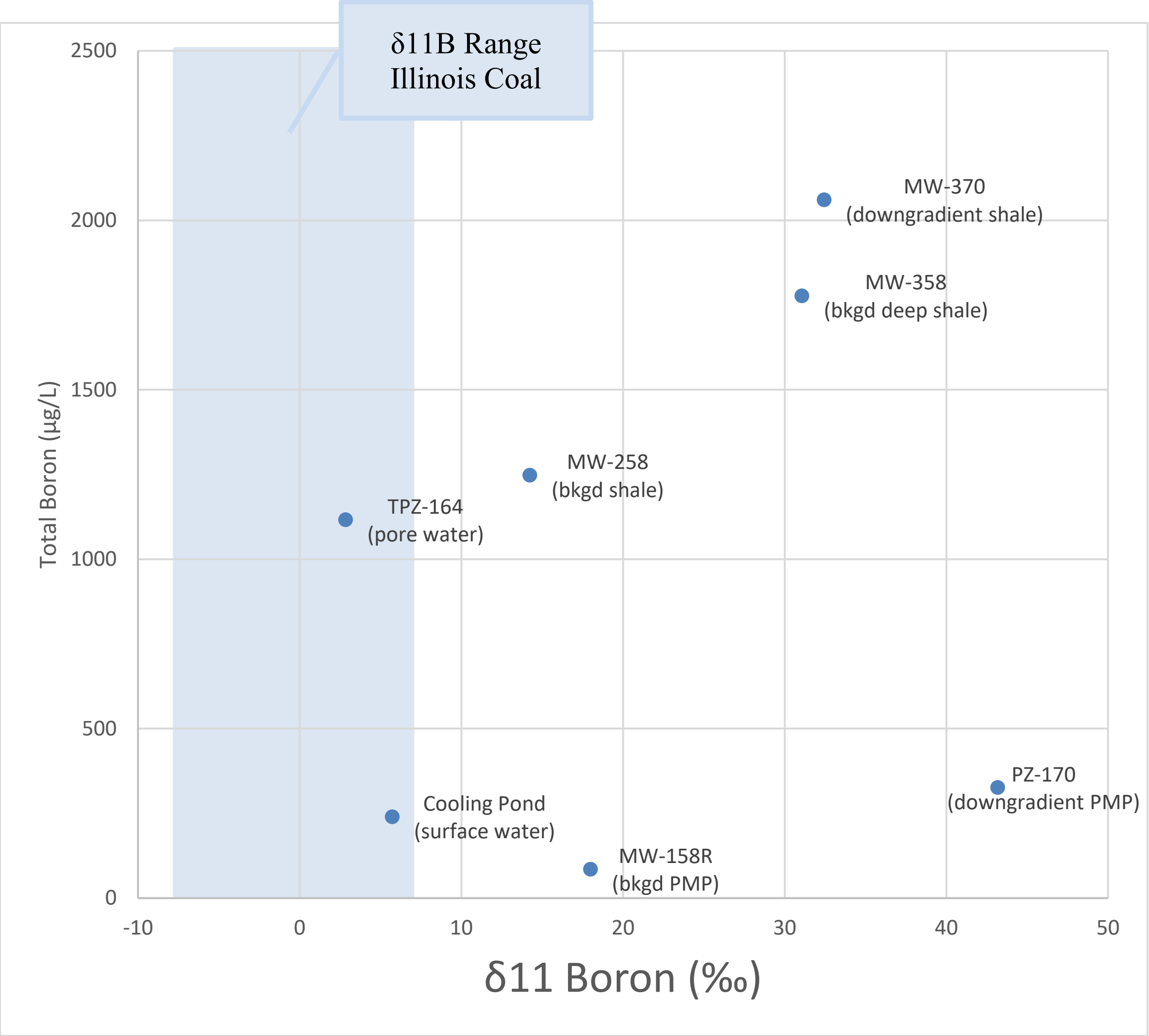
Columbus, Ohio

October 2023

Figure

7

Vistra - Groundwater Compliance - Documents\General\2023_Data_Gap_Assessment\Baldwin\2023-09 Cl and F ASD Report



Notes:
1. δ11B range from Ruhl et al 2014.
µg/L: micrograms per liter
‰: parts per thousand
PMP: potential migration pathway

Boron Isotope Distribution

Baldwin Power Plant – Bottom Ash Pond

Geosyntec consultants

Figure

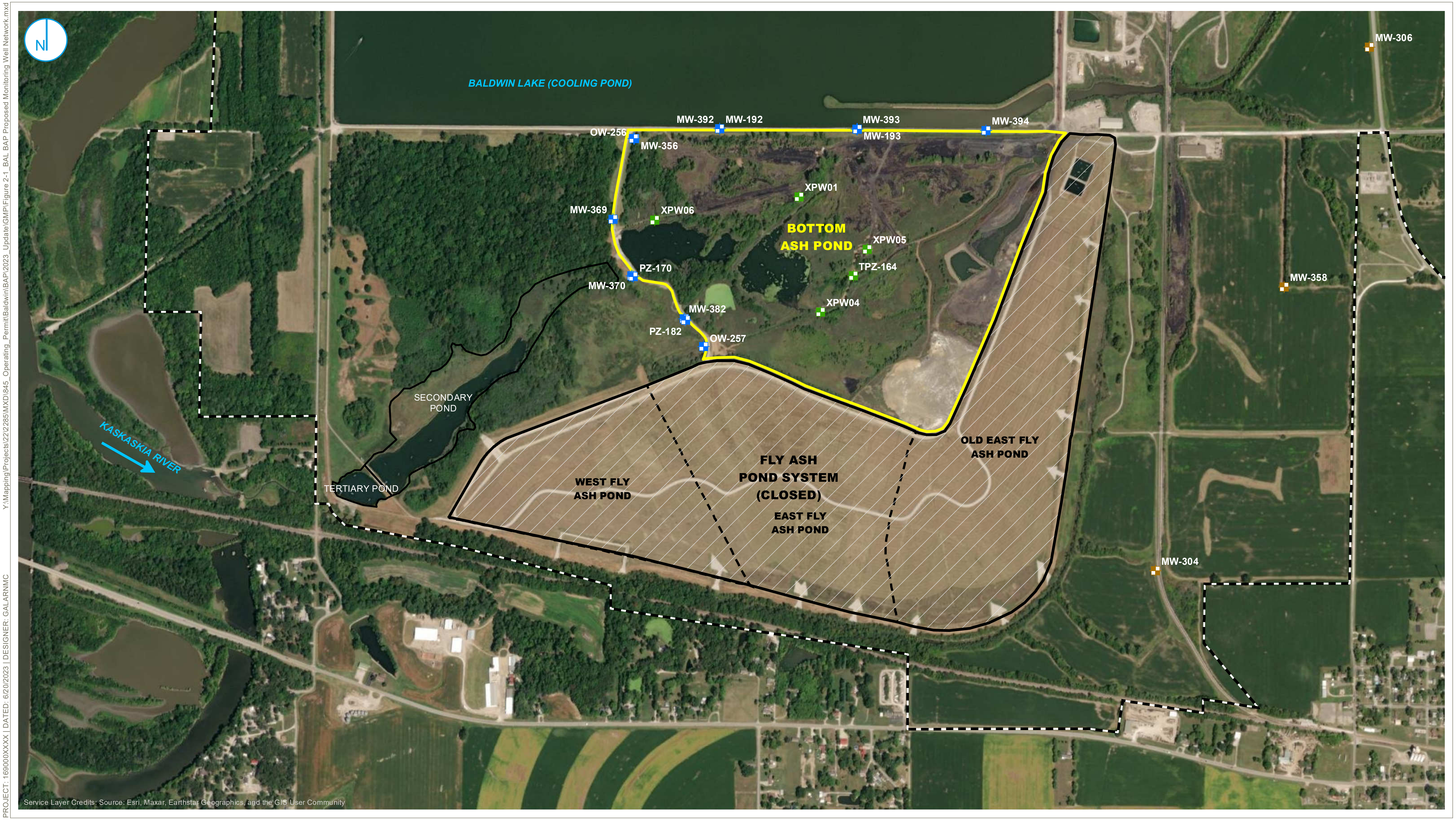
8

Columbus, Ohio

October 2023

ATTACHMENT 1

Part 845 Groundwater Monitoring Network



BACKGROUND WELL
COMPLIANCE WELL
PORE WATER WELL

REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
CAPPED AREA
PROPERTY BOUNDARY

0 400 800 Feet

35 I.A.C. § 845 GROUNDWATER MONITORING WELL NETWORK

BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

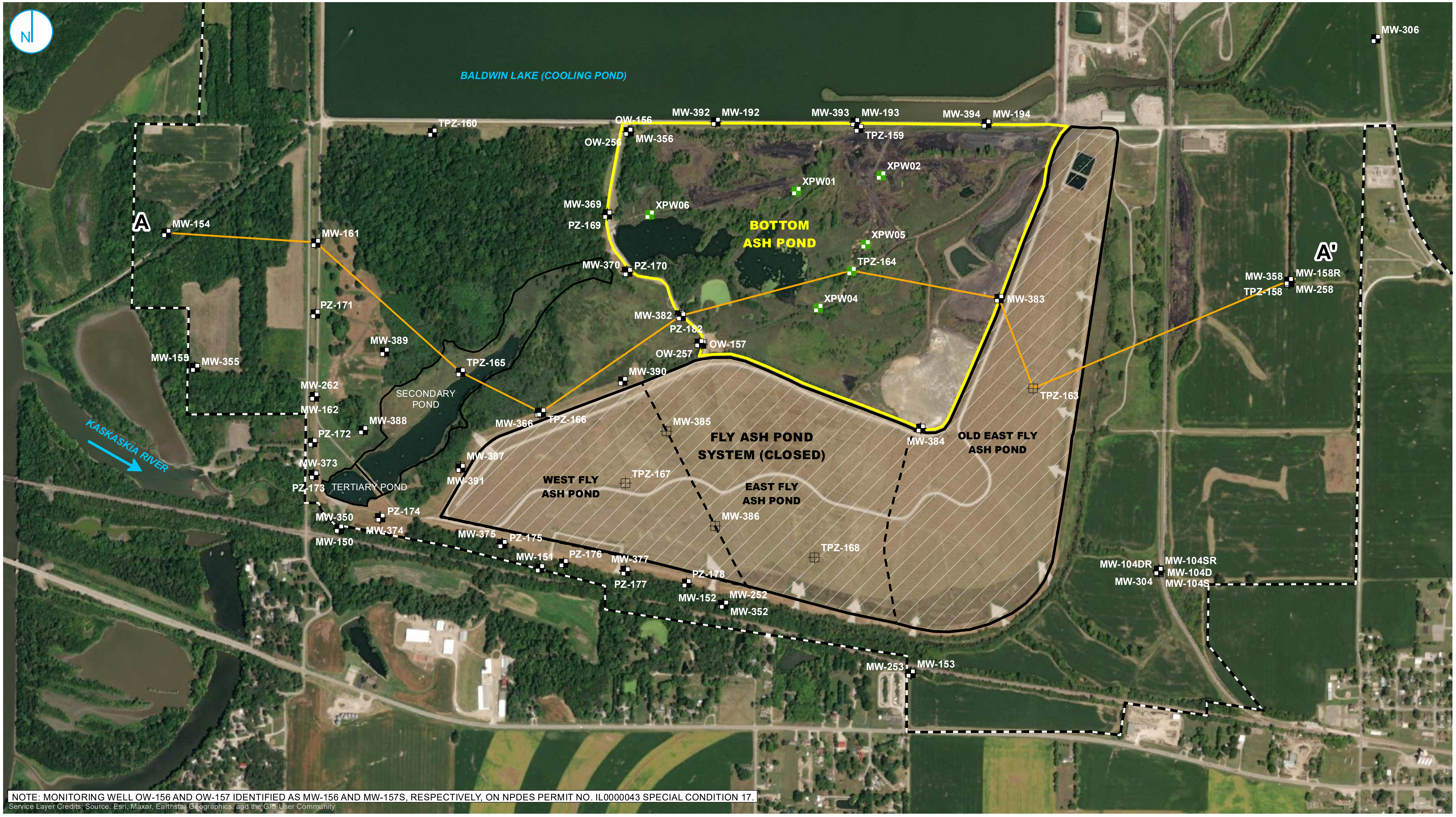
FIGURE 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT 2

Geologic Cross Section



NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

⊞ MONITORING WELL AND PIEZOMETER LOCATION
🟩 PORE WATER WELL
⊞ CLOSED MONITORING WELL
● CCR SOURCEWATER SAMPLE

CROSS SECTION TRANSECT

— A to A'

0 400 800 Feet

☐ REGULATED UNIT (SUBJECT UNIT) FLY ASH
☐ POND SYSTEM (CLOSED)
☐ SITE FEATURE
▨ LIMITS OF FINAL COVER
☐ PROPERTY BOUNDARY

CROSS SECTION LOCATION MAP

ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

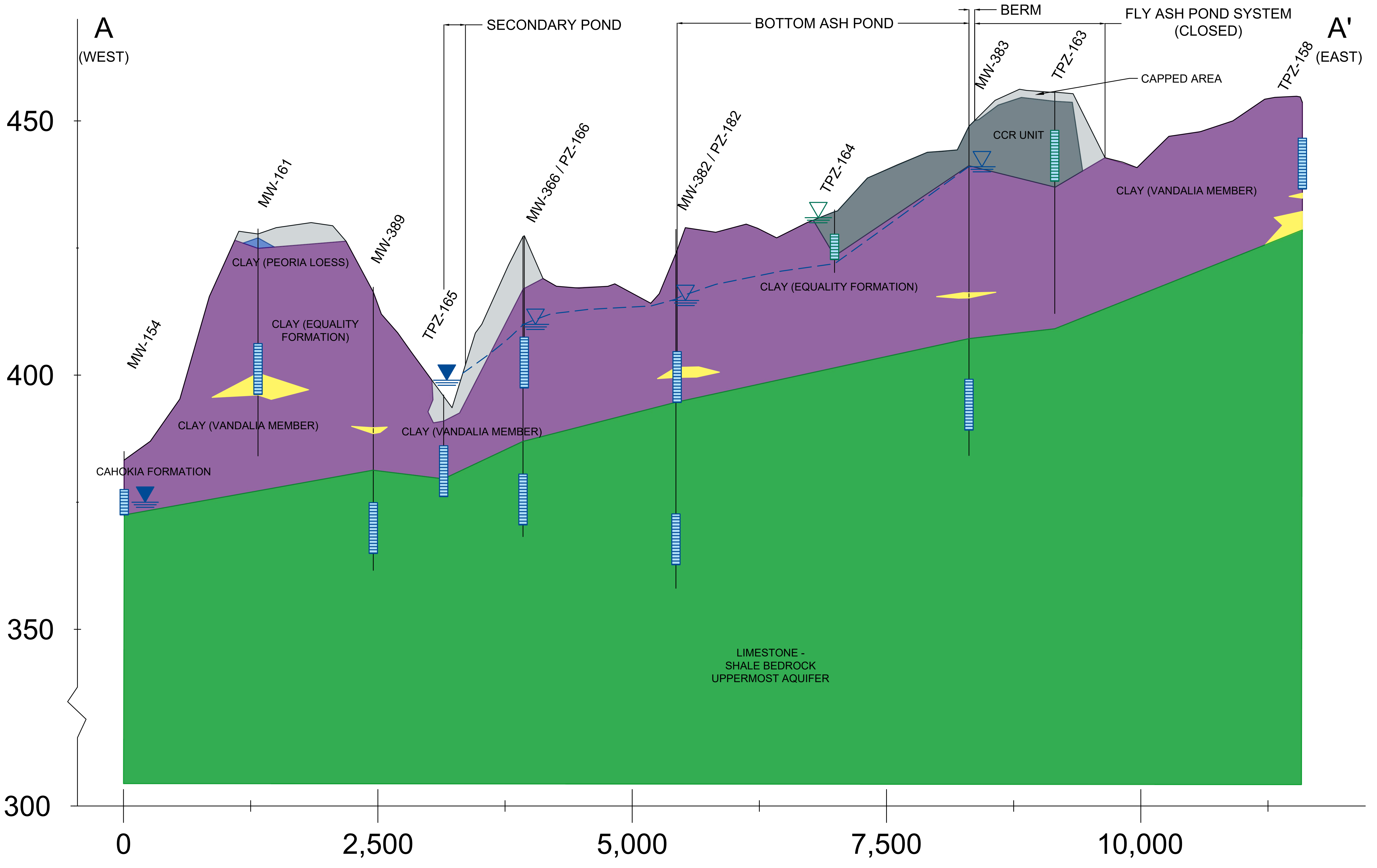
FIGURE 3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Baldwin_AP\2023\Figure 3_Cross Section Locations.mxd

PROJECT: 169000XXXX | DATED: 4/24/2023 | DESIGNER: GALARNMC

NOTES
1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 50X.
4. Groundwater elevations measured on September 15, 2020.



LEGEND

■	COAL COMBUSTION RESIDUALS (CCR)
☐	FILL
■	CLAY (CL/CH)
■	SILT (ML)
🟨	SAND (SP/SM/SW)
🟩	BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
▤	WELL SCREEN INTERVAL
- - -	UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
▽	UPPERMOST AQUIFER GROUNDWATER ELEVATION
▽	POREWATER ELEVATION
▼	OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

CROSS SECTIONS A-A'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILINNOIS

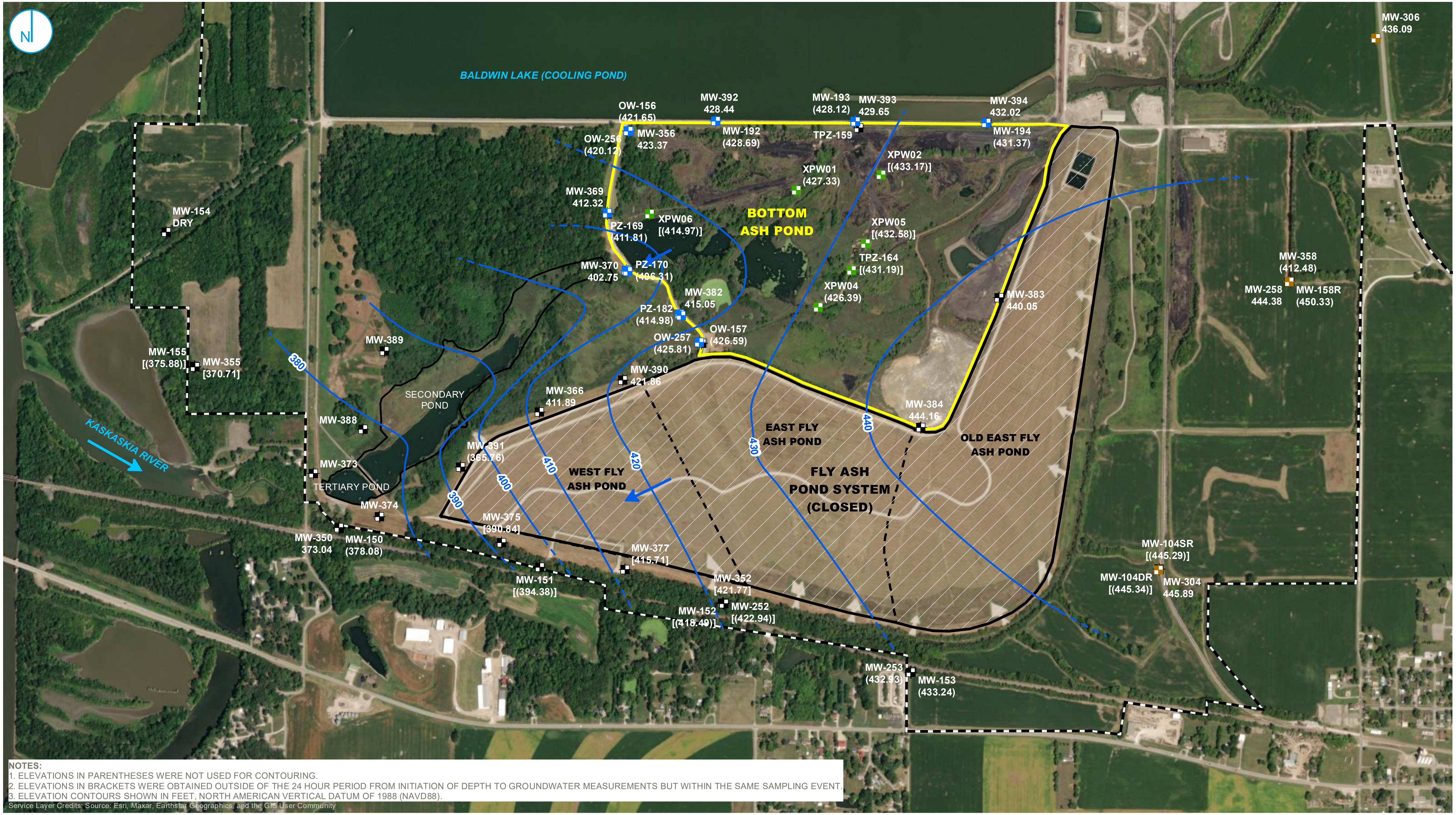
FIGURE 2-7

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT 3

Uppermost Aquifer Potentiometric Surface Map – May 15-17, 2023



NOTES:

1. ELEVATIONS IN PARENTHESES WERE NOT USED FOR CONTOURING.
2. ELEVATIONS IN BRACKETS WERE OBTAINED OUTSIDE OF THE 24 HOUR PERIOD FROM INITIATION OF DEPTH TO GROUNDWATER MEASUREMENTS BUT WITHIN THE SAME SAMPLING EVENT.
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

🟦 COMPLIANCE MONITORING WELL
🟫 BACKGROUND MONITORING WELL
⬛ MONITORING WELL
🟩 PORE WATER WELL

— GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- - INFERRED GROUNDWATER ELEVATION CONTOUR
→ GROUNDWATER FLOW DIRECTION

🟨 REGULATED UNIT (SUBJECT UNIT)
☐ FLY ASH POND SYSTEM
☐ SITE FEATURE
▨ CAPPED AREA
☐ PROPERTY BOUNDARY

0 400 800
Feet

POTENTIOMETRIC SURFACE MAP
MAY 15-17, 2023

2023 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/25/2023 | DESIGNER: GALARNMC
Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_2023\Baldwin\BAP_601\BAL 601 BAP Pot Surface 20230516.mxd

ATTACHMENT 4

Solid Phase Anions Laboratory Analytical Report

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19226-NOV22**
Reference: Baldwin Power Plant Drilling

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	**1: Analysis Start Date**	**2: Analysis Start Time**	**3: Analysis Completed Date**	**4: Analysis Completed Time**	**6: MW-358 (47-49)**	**7: MW-358 (86-88)**	**8: MW-392 (80-82)**	**12: MW-392 (66-68)**
Sample Date & Time					06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	26-Sep-22 12:00
Cl [µg/g]	15-Dec-22	20:55	---	---	22	70	34	45
SO4 [µg/g]	15-Dec-22	20:55	29-Dec-22	13:45	50	620	280	100
F [%]	08-Dec-22	18:18	12-Dec-22	08:47	0.091	0.091	0.42	0.095
TKN [as N %]	30-Nov-22	09:28	02-Dec-22	11:00	0.06	0.05	< 0.01	0.05
Ra226 [Bq/g]	12-Dec-22	08:48	12-Dec-22	14:33	0.07	< 0.01	0.09	< 0.01

Catharine Arnold

CHARTERED
CATHARINE ARNOLD
CHEMIST

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

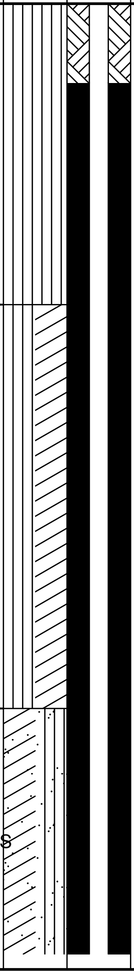
ATTACHMENT 5

MW-358 and MW-392 Boring Logs

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name: Baldwin Power Plant
License/Permit/Monitoring Number:
Boring Number: MW358
Boring Drilled By: Name of crew chief (first, last) and Firm: Blake Weller, Cascade Drilling
Date Drilling Started: 10/5/2022
Date Drilling Completed: 10/8/2022
Drilling Method: Sonic
Common Well Name: MW358
Final Static Water Level: Feet (NAVD88)
Surface Elevation: 453.59 Feet (NAVD88)
Borehole Diameter: 6.0 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,726.26 N, 2,387,756.63 E E /[✓ W]
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 42.9882"
Long -89° 50' 57.9018"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W
Facility ID:
County: Randolph
State: IL
Civil Town/City/ or Village: Baldwin

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	180 97		1 2 3	0 - 3.8' **SILT:** ML, very dark grayish brown (10YR 3/2), organic material (0-10%), moist to wet. 2.1' dry.	ML									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			4 5 6 7 8	3.8 - 8.9' **CLAYEY SILT:** ML/CL, light gray (10YR 7/2), very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/8) mottling (20-30%), dry.	ML/CL									
			9 10 11 12	8.9 - 13' **SILTY CLAY WITH SAND:** (CL/ML)S, grayish brown (10YR 5/2), strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling (20-30%), organic material (0-10%), low toughness, low to medium plasticity, stiff.	(CL/ML)S									

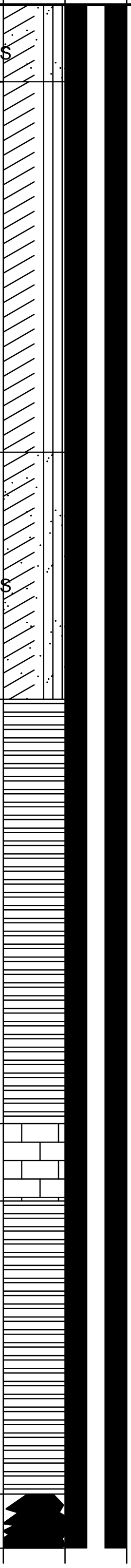
I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW358



Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
					(CL/ML)S									
2 CS	60 60		13 14 15 16 17	13 - 17.8' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling (20-30%), low toughness, medium to high plasticity, stiff to very stiff. 16.1' mottling discontinues.	CL/ML									
3 CS	48 36		18 19 20	17.8 - 21' **SILTY CLAY WITH SAND:** (CL/ML)S, brown (10YR 5/3), strong brown (7.5YR 5/6) and gray (10YR 6/1) mottling (20-30%), gravel (5-15%), no dilatancy, high toughness, low to medium plasticity, hard, moist.	(CL/ML)S									
4 CORE	36 32		21 22 23 24 25 26	21 - 26.5' **SHALE:** BDX (SH), dark gray (GLEY 1 4/N), weathered, thin bedding, moderately fractured. 24' -25.2' wet.	BDX (SH)									RUN #4: Modified RQD = (21/32) = 66%
5 CORE	36 29		27	26.5 - 27.5' **LIMESTONE:** BDX (LS), dark gray (5Y 4/1), shaley, fossiliferous, very strong.	BDX (LS)									RUN #5: Modified RQD = (0/29) = 0%
6 CORE	72 60		28 29 30 31	27.5 - 31.3' **SHALE:** BDX (SH), grayish black (N2), weathered, highly decomposed to residual soil, wet to moist. 29.3' thinly bedded, moderately decomposed. 30' slightly decomposed to competent, moderately fractured.	BDX (SH)									RUN #6: Modified RQD = (45/60) = 75%
			32	31.3 - 32' **COAL:** COAL, black (N1).	COAL									

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW358

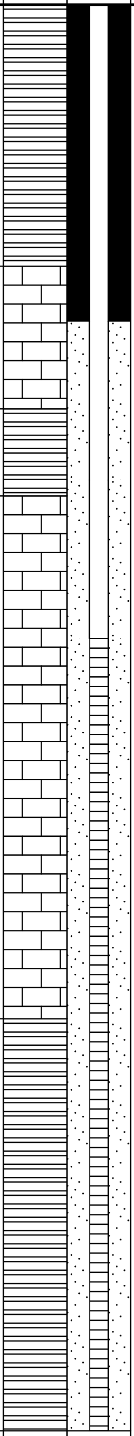
Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	32 - 33' **SHALE:** BDX (SH), grayish black (N2), slightly decomposed to competent, moderately fractured, wet to moist.	BDX (SH)									
			34 35	33 - 36' **SHALEY LIMESTONE:** BDX (LS/SH), medium gray (N5), weathered, shaley, higly decomposed, slightly fractured.	BDX (LS/SH)									
7 CORE	72 71		36 37 38 39 40	36 - 40.8' **SHALEY LIMESTONE:** to **SHALE:** BDX (LS/SH), interbedded shale.	BDX (LS/SH)									RUN #7: Modified RQD = (67/71) = 94%
			41	40.8 - 42' **LIMESTONE:** BDX (LS), medium light gray (N6), strong to moderately fractured, slightly decomposed, narrow apertures.	BDX (LS)									
8 CORE	96 85		42 43 44 45 46 47	42 - 58.9' **SHALE:** BDX (SH), medium gray (N5) to medium dark gray (N4), weathered, weak, thinly bedded, moderately to highly fractured.	BDX (SH)									RUN #8: Modified RQD = (81/85) = 94%
			48 49	47.5' dark grayish brown (10YR 4/2), pale olive (5Y 6/4) discoloration, more competent.										
9 CORE	60 60		50	50.2' weak to moderate.										RUN #9: Modified RQD = (52/60) = 87%
			51 52	50.8' olive gray (5Y 5/2).										

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW358

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			53	42 - 58.9' **SHALE:** BDX (SH), medium gray (N5) to medium dark gray (N4), weathered, weak, thinly bedded, moderately to highly fractured. *(continued)* 52.2' dark grayish green (5GY 4/2).										
			54	54.1' medium dark gray (N4) to medium gray (N5), weak, highly decomposed, no visible bedding, dry.										
10 CORE	60 58		55		BDX (SH)									RUN #10: Modified RQD = (42/58) = 72%
			56	55.7' dark grayish green (5GY 4/2).										
			57	57.2' light brownish gray (10YR 6/2), thinly bedded, laminated.										
			58	58.2' medium dark gray (N4), strong, intensely fractured, thinly bedded.										
			59	58.9 - 64' **LIMESTONE:** BDX (LS), medium gray (N5), very strong, moderately fractured, visible laminations.										
			60											
11 CORE	36 31		61		BDX (LS)									RUN #11: Modified RQD = (8/31) = 26%
			62											
12 CORE	36 36		63											RUN #12: Modified RQD = (31/36) = 86%
			64	64 - 75.3' **SHALE:** BDX (SH), medium dark gray (N4) to medium gray (N5), strong, thinly bedded to laminated, moderately fractured. 64.3' grayish green (5GY 5/2), weathered, weak, decomposed.										
			65											
13 CORE	48 48		66											RUN #13: Modified RQD = (43/48) = 90%
			67											
			68		BDX (SH)									
			69	69.3' medium dark gray (N4), weathered, moderate strength.										
14 CORE	60 58		70											RUN# 14: Modified RQD = (57/58) = 99%
			71											
			72											

Boring Number MW358



Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			73 74 75	64 - 75.3' **SHALE:** BDX (SH), medium dark gray (N4) to medium gray (N5), strong, thinly bedded to laminated, moderately fractured. *(continued)*	BDX (SH)									
15 CORE	60 56		76 77	75.3 - 77.1' **LIMESTONE:** BDX (LS), gray (5Y 6/1), fossiliferous, very strong.	BDX (LS)									RUN #15: Modified RQD = Not Recorded
			78	77.1 - 78.2' **SHALE:** BDX (SH), medium dark gray (N4), weathered, weak to moderate strength, moderately decomposed.	BDX (SH)									
16 CORE	60 51		79 80 81 82 83 84	78.2 - 84.8' **LIMESTONE:** BDX (LS), medium dark gray (N4) to medium gray (N5), shaley, fossiliferous, very strong, moderately fractured, laminations (0-5%).	BDX (LS)									RUN #16: Modified RQD = (23/51) = 45%
17 CORE	60 60		85 86 87 88 89 90	84.8 - 90' **SHALE:** BDX (SH), dark gray (N3), weathered, weak to moderate strength, moderately decomposed, moderately fractured, thin bedding.	BDX (SH)									RUN #17: Modified RQD = (28/60) = 47%
				90' End of Boring.										

SOIL BORING LOG INFORMATION

Page 1 of 5

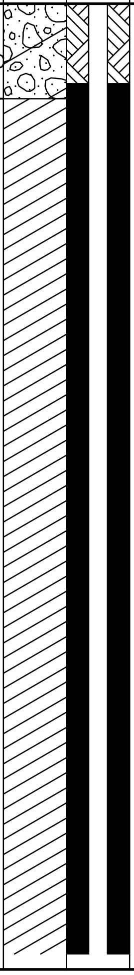
Facility/Project Name Baldwin Power Plant	License/Permit/Monitoring Number	Boring Number MW392

Boring Drilled By: Name of crew chief (first, last) and Firm Blake Weller Cascade Drilling	Date Drilling Started 9/9/2022	Date Drilling Completed 9/26/2022	Drilling Method Sonic

Common Well Name MW392	Final Static Water Level Feet (NAVD88)	Surface Elevation 434.07 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,140.20 N, 2,382,717.92 E E/[✓ W]
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 57.132"
Long -89° 52' 0.9632"
Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County Randolph	State IL	Civil Town/City/ or Village Baldwin

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 46		1	0 - 1.2' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, pinkish gray (7.5YR 6/2), angular, moist.	(FILL) GW-GC									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			2 3 4 5 6 7 8 9	1.2 - 16' **FILL, LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	(FILL) CL									
2 CS	120 62		10 11 12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL

SOIL BORING LOG INFORMATION SUPPLEMENT

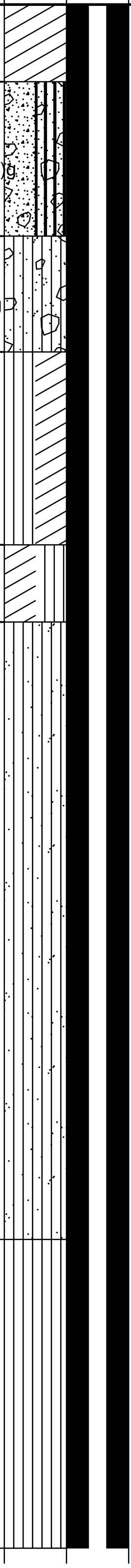
Boring Number MW392

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13 14 15	1.2 - 16' **FILL, LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist. *(continued)*	(FILL) CL									
			16 17 18 19	16 - 20' **LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	CL									
3 CS	120 33		20 21 22 23 24 25 26 27 28 29	20 - 33' **LEAN CLAY:** CL, pinkish gray (7.5YR 6/2), sand (0-5%), medium to high plasticity, stiff, moist.	CL									
4 CS	120 104		30 31 32	30' increasing sand and gravel content.										

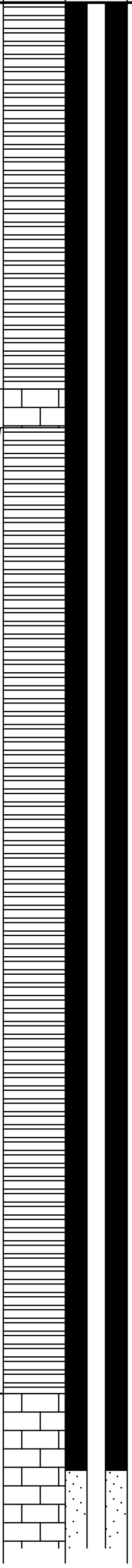
SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW392

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				20 - 33' **LEAN CLAY:** CL, pinkish gray (7.5YR 6/2), sand (0-5%), medium to high plasticity, stiff, moist. *(continued)*	CL									
			33 34	33 - 35' **WELL-GRADED SAND WITH SILT AND GRAVEL:** (SW-SM)g, fine to medium sand, dry.	(SW-SM)g									
			35 36	35 - 36.5' **SANDY SILT WITH GRAVEL:** s(ML)g, light yellowish brown (10YR 6/4), dry.	s(ML)g									
			37 38	36.5 - 39' **CLAYEY SILT:** ML/CL, gray (7.5YR 5/1), sand (5-10%), coal (0-5%), gravel (0-5%), dry.	ML/CL									
			39	39 - 40' **SILTY CLAY:** CL/ML, sand (0-5%), low to medium plasticity, stiff.	CL/ML									
5 CS	120 108		40 41 42 43 44 45 46 47	40 - 48' **SILT WITH SAND:** (ML)s, light brownish gray (10YR 6/2), dry. 44' increasing clay content. 45' (2.5Y 6/2).	(ML)s									
6 CS	84 81		48 49 50 51 52	48 - 52' **SILT:** ML, gray (2.5Y 5/1), sand (0-5%), dry.	ML									



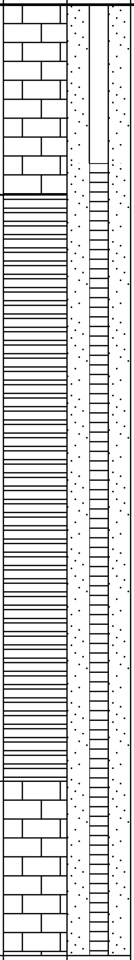
Boring Number MW392



Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				52 - 57' **SHALE:** BDX (SH), dark gray (5Y 4/1), highly weathered, hard, dry.										
			53	53' very dark gray (7.5YR 3/1).										
			54											
			55		BDX (SH)									
			56											
7 CORE	60 4		57	57 - 57.5' **LIMESTONE:** BDX (LS), gray (5Y 6/1), slightly fractured.	BDX (LS)									RUN #7: Modified RQD = 0% (No Solid Recovery > 4")
			58	57.5 - 70' **SHALE:** BDX (SH), dark gray (5Y 4/1), weathered, soft, moderately fractured to highly fractured limestone beds (0-5%).										
			59											
			60											
			61											
8 CORE	96 78		62											RUN #8: Modified RQD = (28/78) = 36%
			63											
			64		BDX (SH)									
			65											
			66	66.3' - 67.2' highly fractured, very soft, wet.										
			67											
			68											
			69											
9 CORE	120 62		70	70 - 74.4' **LIMESTONE:** BDX (LS), gray (5Y 6/1), moderately to intensely fractured, moderately wide apertures.										RUN #9: Modified RQD = (28/78) = 36%
			71		BDX (LS)									
			72											

Boring Number MW392

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			73 74	70 - 74.4' **LIMESTONE:** BDX (LS), gray (5Y 6/1), moderately to intensely fractured, moderately wide apertures. *(continued)*	BDX (LS)									
10 CORE	48 48		75 76 77 78 79 80 81	74.4 - 81.8' **SHALE:** BDX (SH), medium dark gray (N4) to dark gray (N3), slightly weathered, moderately fractured, thinly bedded.	BDX (SH)									RUN #10: Modified RQD = (28/48) = 58%
			82 83	81.8 - 84' **LIMESTONE:** BDX (LS), medium light gray (N6), shaley, fossiliferous, moderately fractured, thinly bedded. 83.2' medium gray (N5).	BDX (LS)									
			84	84' End of Boring.										



ATTACHMENT 6

X-ray Diffraction Laboratory Analytical Report

SGS

Quantitative X-Ray Diffraction by Rietveld Refinement

Report Prepared for: *Environmental Services*

Project Number/ LIMS No. *Custom XRD/MI4508-DEC22*

Sample Receipt: *December 7, 2022*

Sample Analysis: *December 15, 2022*

Reporting Date: *April 24, 2023*

Instrument: BRUKER AXS D8 Advance Diffractometer

Test Conditions (Bulk):
Co radiation, 35 kV, 40 mA; Detector: LYNXEYE
Regular Scanning: Step: 0.02°, Step time: 0.75s, 2θ range: 6-80°

Test Conditions (Clay):
Co radiation, 35 kV, 40 mA; Detector: LYNXEYE
Regular Scanning: Step: 0.02°, Step time: 1s, 2θ range: 3-80°
Clay Section Scanning: Step: 0.01°, Step time:0.2s, 2θ range: 3-40°

***Interpretations*:** PDF2/PDF4 powder diffraction databases issued by the International Center for Diffraction Data (ICDD). DiffracPlus Eva and Topas software.

***Detection Limit*:** 0.5-2%. Strongly dependent on crystallinity.

Contents:

1) Method Summary
2) Quantitative XRD Results
3) XRD Pattern(s)

Kim Gibbs

Kim Gibbs, H.B.Sc., P.Geo.
Senior Mineralogist

Huyun Zhou

Huyun Zhou, Ph.D., P.Geo.
Senior Mineralogist

ACCREDITATION: SGS Natural Resources Lakefield is accredited to the requirements of ISO/IEC 17025 for specific tests as listed on our scope of accreditation, including geochemical, mineralogical and trade mineral tests. To view a list of the accredited methods, please visit the following website and search SGS Canada Inc. - Minerals: https://www.scc.ca/en/search/palcan.

Method Summary

The Rietveld Method of Mineral Identification by XRD (ME-LR-MIN-MET-MN-D05) method used by SGS Natural Resources is accredited to the requirements of ISO/IEC 17025.

Mineral Identification and Interpretation:

Mineral identification and interpretation involves matching the diffraction pattern of an unknown material to patterns of single-phase reference materials. The reference patterns are compiled by the Joint Committee on Powder Diffraction Standards - International Center for Diffraction Data (JCPDS-ICDD) database and released on software as Powder Diffraction Files (PDF).

Interpretations do not reflect the presence of non-crystalline and/or amorphous compounds, except when internal standards have been added by request. Mineral proportions may be strongly influenced by crystallinity, crystal structure and preferred orientations. Mineral or compound identification and quantitative analysis results should be accompanied by supporting chemical assay data or other additional tests.

Clay Mineral Separation and Identification:

Clay minerals are typically fine-grained (<2 μm) phyllosilicates in sedimentary rock. Due to the poor crystallinity and fine size of clay minerals, separation of the clay fraction from bulk samples by centrifuge is required. A slide of the oriented clay fraction is prepared and scanned followed by a series of procedures (the addition of ethylene glycol and high temperature heating). Clay minerals are identified by their individual diffraction patterns and changes in their diffraction pattern after different treatments. Clay speciation and mineral identification of the bulk sample are performed using DIFFRACplus EVA (Bruker AXS).

Quantitative Rietveld Analysis:

Quantitative Rietveld Analysis is performed by using Topas 4.2 (Bruker AXS), a graphics based profile analysis program built around a non-linear least squares fitting system, to determine the amount of different phases present in a multicomponent sample. Whole pattern analyses are predicated by the fact that the X-ray diffraction pattern is a total sum of both instrumental and specimen factors. Unlike other peak intensity-based methods, the Rietveld method uses a least squares approach to refine a theoretical line profile until it matches the obtained experimental patterns.

Rietveld refinement is completed with a set of minerals specifically identified for the sample. Zero values indicate that the mineral was included in the refinement calculations, but the calculated concentration was less than 0.05wt%. Minerals not identified by the analyst are not included in refinement calculations for specific samples and are indicated with a dash.

Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	**MW-358 (13-15)** **DEC4508-1** (wt %)	**MW-358 (47-49)** **DEC4508-2** (wt %)	**MW-358 (86-88)** **DEC4508-3** (wt %)	**MW-392 (80-82)** **DEC4508-4** (wt %)	**MW-392 (32-33.5)** **DEC4508-5** (wt %)	**MW-393 (24-25.5)** **DEC4508-6** (wt %)	**MW-394 (20.5-22)** **DEC4508-7** (wt %)	**MW-392 (66-68)** **DEC4508-8** (wt %)
Quartz	52.7	29.2	30.7	29.8	52.1	64.1	55.4	22.7
Muscovite	7.7	18.8	19.7	13.1	9.0	5.5	7.6	15.9
Albite	12.3	0.4	2.5	0.6	9.1	6.4	12.8	0.6
Microcline	7.3	8.6	5.9	1.0	6.5	10.1	7.3	5.1
Diaspore	0.3	-	-	-	-	0.2	0.5	2.8
Magnetite	0.9	0.5	0.3	1.4	0.1	0.0	0.1	0.1
Anatase	0.2	0.8	1.8	0.8	0.6	0.3	0.3	1.0
Calcite	-	0.5	1.0	28.1	0.0	0.0	0.2	14.9
Fluorapatite	-	-	-	2.7	0.3	-	0.2	0.2
Ankerite	-	-	-	-	1.4	0.9	0.5	0.8
Clay								
Kaolinite	5.3	4.8	15.0	5.5	6.8	3.2	4.2	3.6
Montmorillonite-12A	4.9	6.8	4.8	-	-	-	-	5.8
Montmorillonite-14A	-	-	-	3.5	3.3	3.5	3.6	-
Nontronite	0.6	4.6	4.3	4.2	1.6	1.4	0.5	3.3
Illite/Mont - 11A	-	8.8	2.7	3.6	2.7	2.1	3.0	7.1
Illite	5.0	15.0	9.2	4.1	0.7	1.0	0.6	10.4
Chlorite IIb	2.6	1.3	2.0	1.6	5.8	1.2	3.1	6.1
TOTAL	100	100	100	100	100	100	100	100

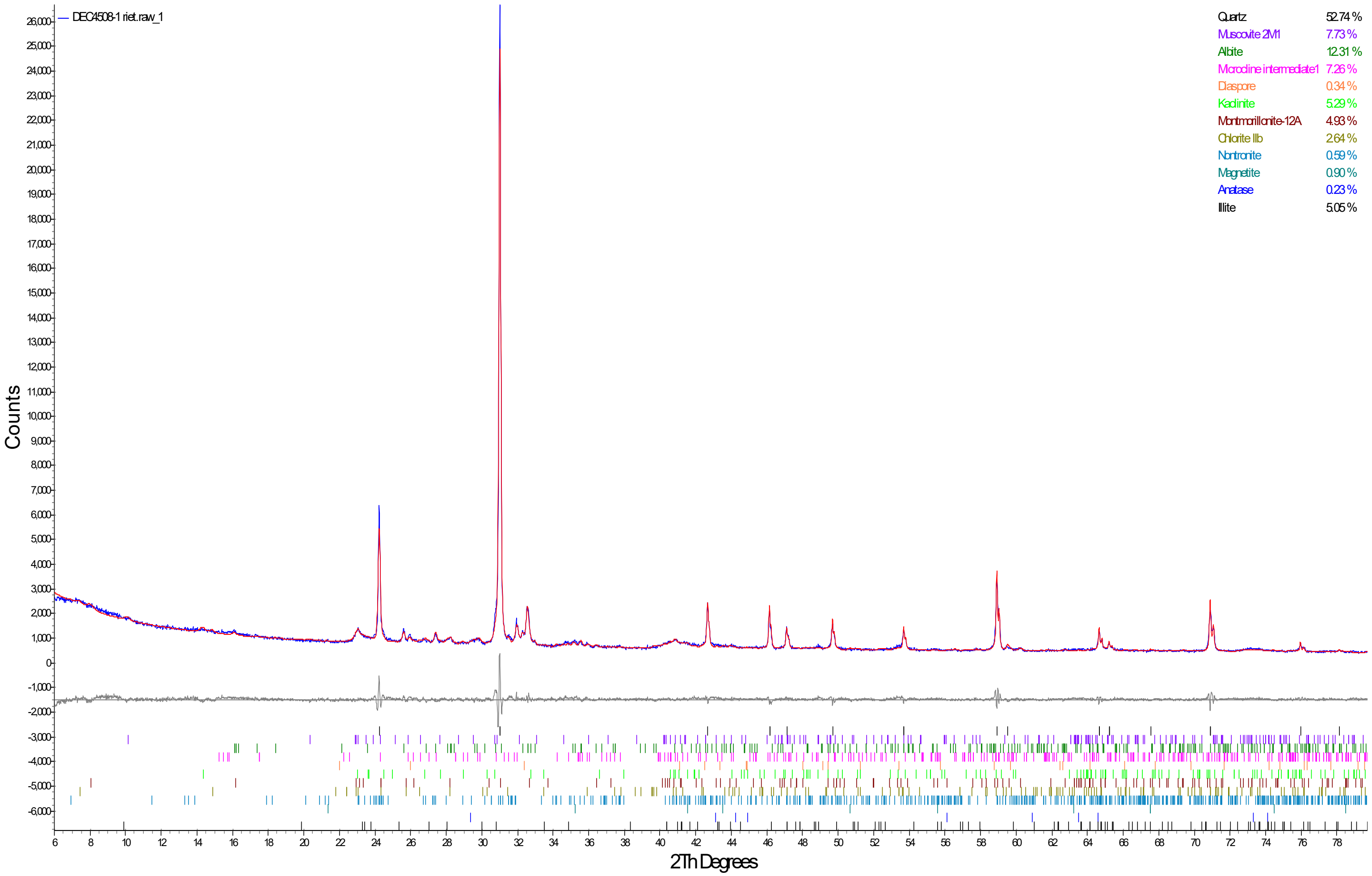
Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.

Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

Mineral/Compound	**Formula**
Quartz	SiO_2
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Albite	$NaAlSi_3O_8$
Microcline	$KAlSi_3O_8$
Diaspore	aAlO.OH
Magnetite	Fe_3O_4
Anatase	TiO_2
Calcite	$CaCO_3$
Fluorapatite	$Ca_5(PO_4)_3F$
Ankerite	$CaFe(CO_3)_2$
Kaolinite	$Al_2Si_2O_5(OH)_4$
Montmorillonite	$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot 10H_2O$
Nontronite	$Fe_2(Al,Si)_4O_{10}(OH)_2Na_{0.3}(H_2O)_4$
Illite/Mont	$KAl_4(Si,Al)_8O_{10}(OH)_4 \cdot 4H_2O$
Illite	$(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,(H_2O)]$
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$

MW-358 (13-15)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12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
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-2,000
-3,000
-4,000
-5,000
-6,000
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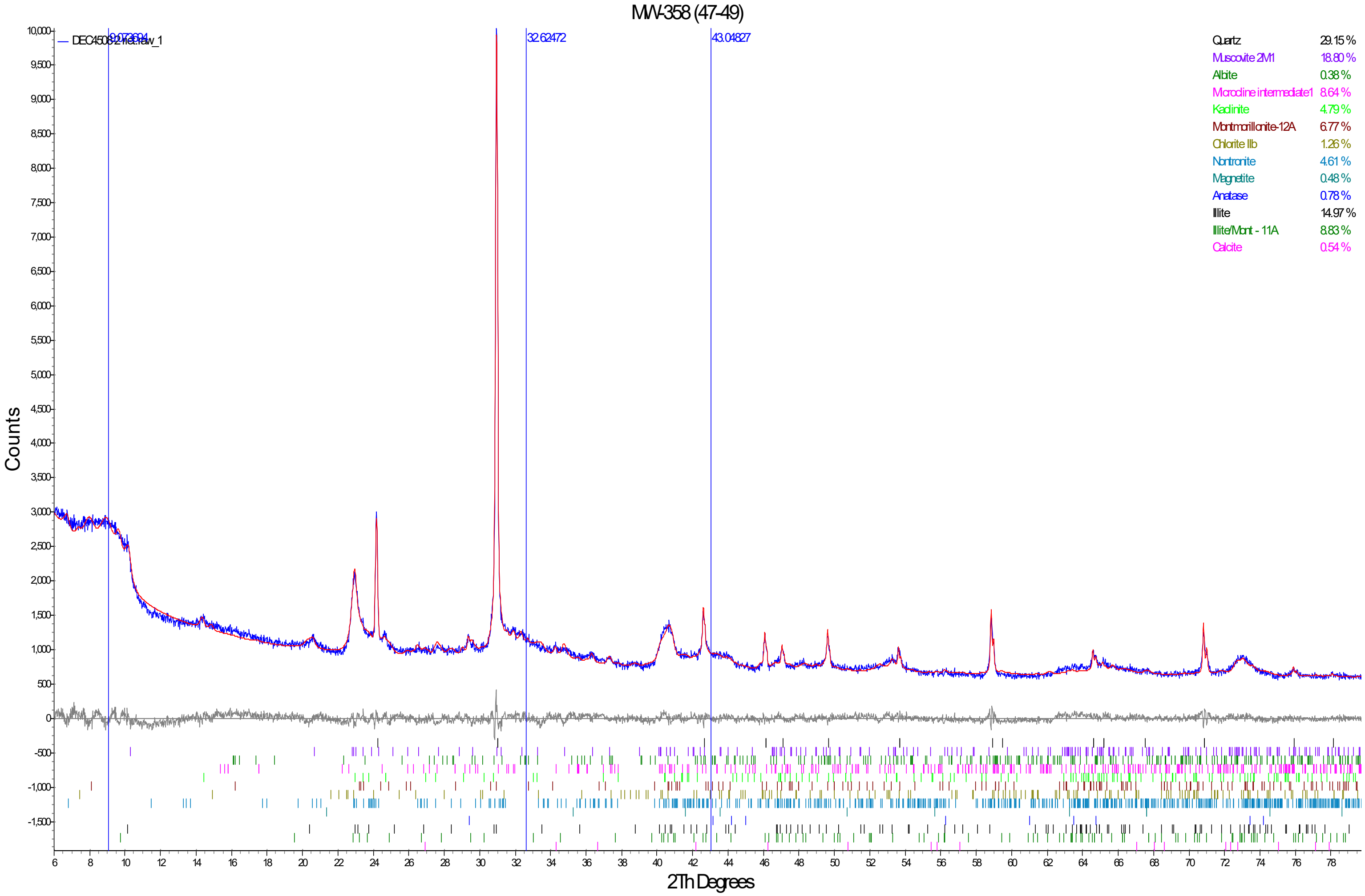
60
62
64
66
68
70
72
74
76
78
2Th Degrees
Quartz 52.74 %
Muscovite 2M1 7.73 %
Albite 12.31 %
Microcline intermediate1 7.26 %
Diaspore 0.34 %
Kaolinite 5.29 %
Montmorillonite-12A 4.93 %
Chlorite IIb 2.64 %
Nontronite 0.59 %
Magnetite 0.90 %
Anatase 0.23 %
Illite 5.05 %



MW-358 (47-49)

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43.04827
Quartz 29.15 %
Muscovite 2M1 18.80 %
Albite 0.38 %
Microcline intermediate1 8.64 %
Kaolinite 4.79 %
Montmorillonite-12A 6.77 %
Chlorite IIb 1.26 %
Nontronite 4.61 %
Magnetite 0.48 %
Anatase 0.78 %
Illite 14.97 %
Illite/Mont - 11A 8.83 %
Calcite 0.54 %
Counts
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60
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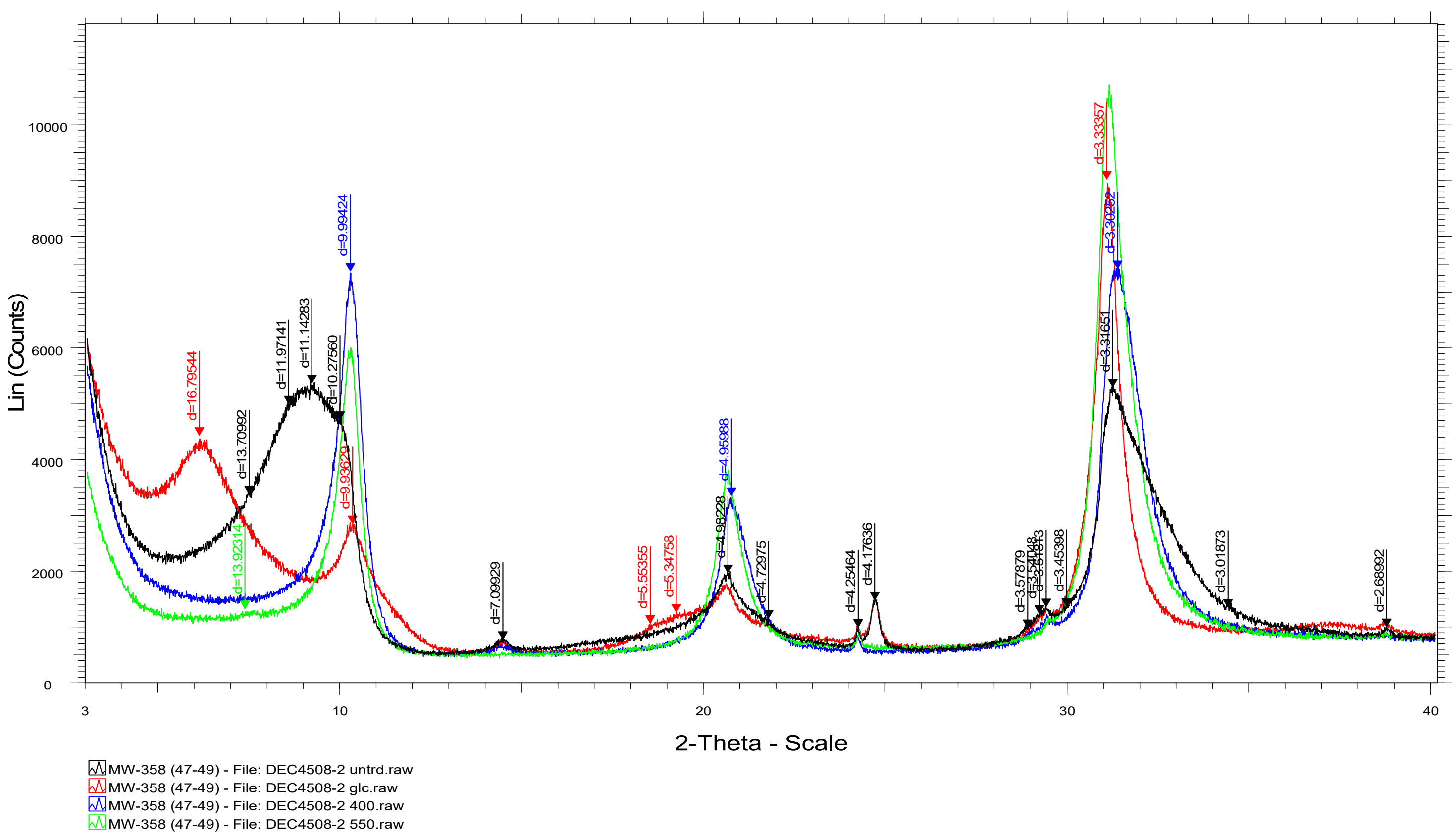
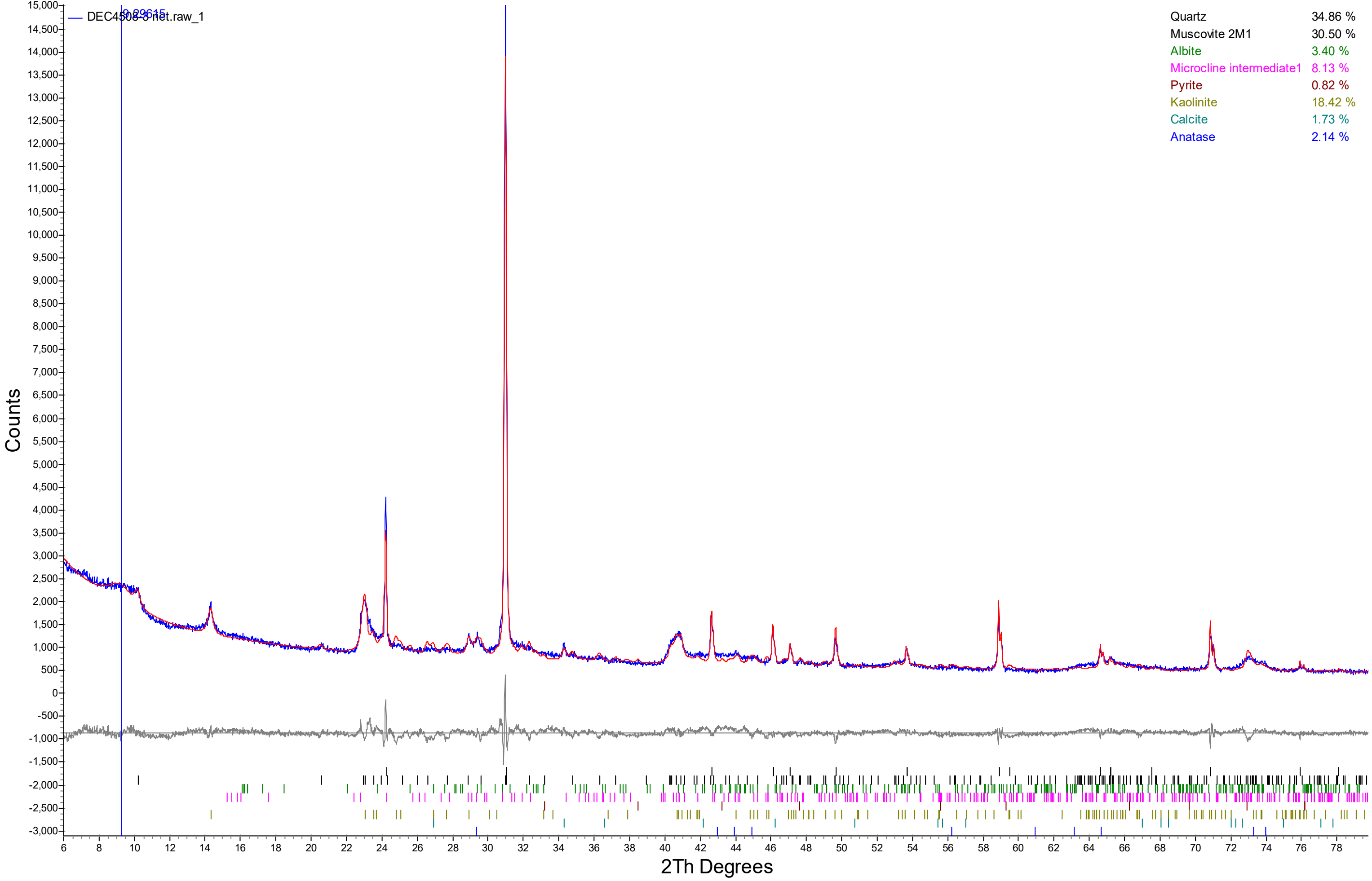
2Th Degrees

Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22

MW-358 (47-49)



MW-358 (86-88)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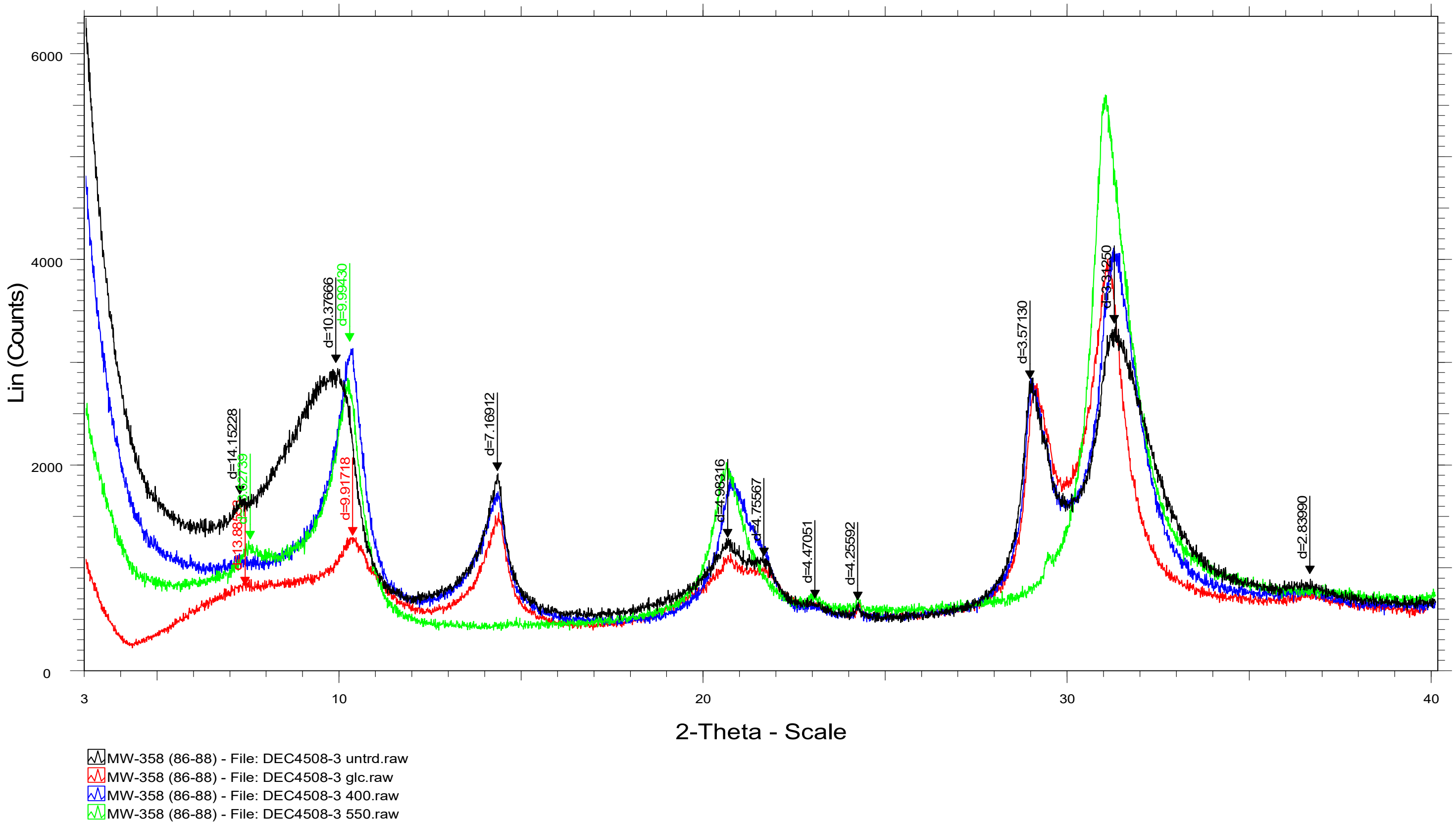
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
2Th Degrees
Quartz 34.86 %
Muscovite 2M1 30.50 %
Albite 3.40 %
Microcline intermediate1 8.13 %
Pyrite 0.82 %
Kaolinite 18.42 %
Calcite 1.73 %
Anatase 2.14 %

MW-358 (86-88)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d=9.99430
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d=2.83990
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MW-358 (86-88) - File: DEC4508-3 glc.raw
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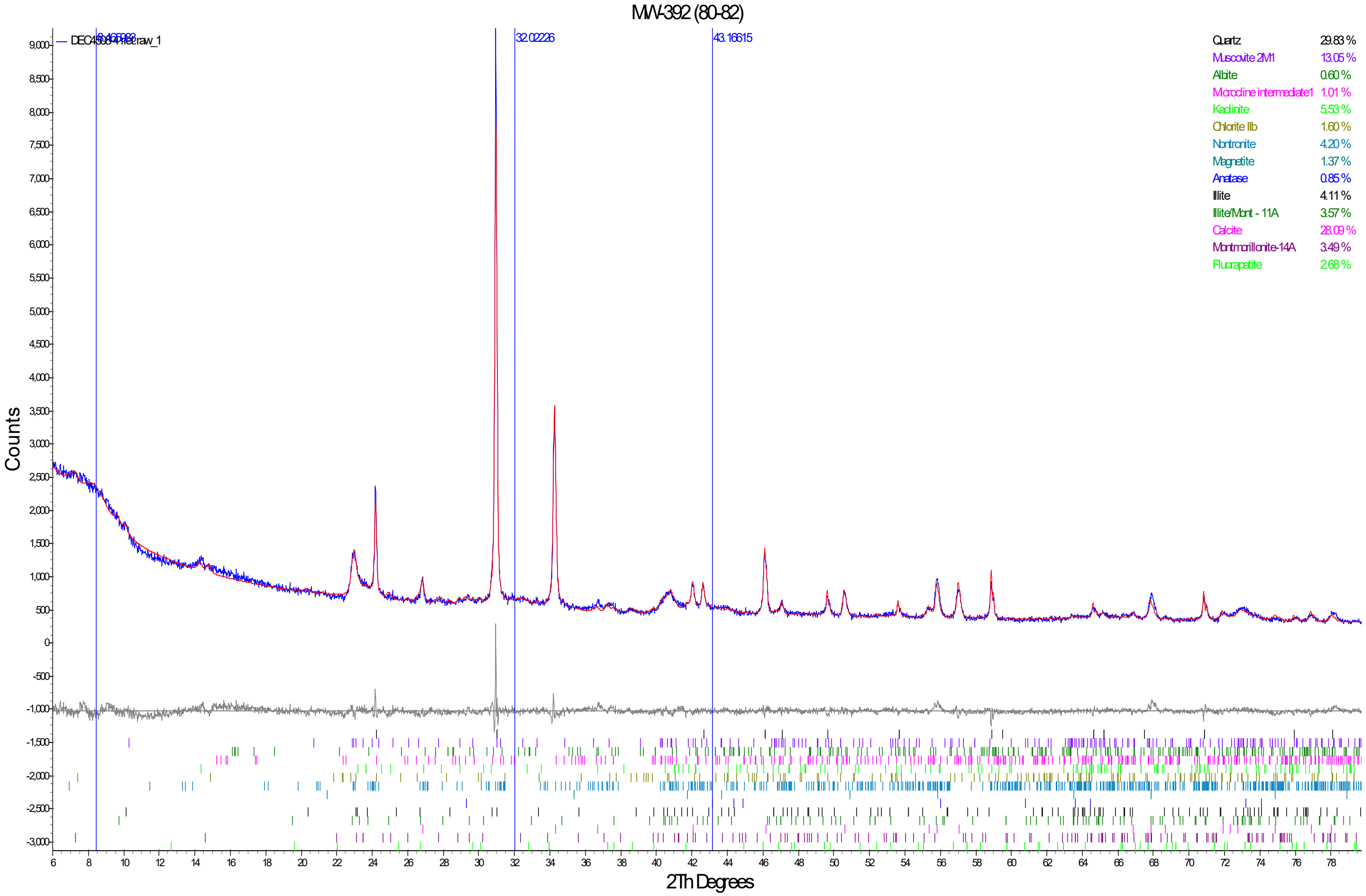
MW-358 (86-88) - File: DEC4508-3 550.raw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Quartz 29.83 %
Muscovite 2M1 13.05 %
Albite 0.60 %
Microcline intermediate1 1.01 %
Kaolinite 5.53 %
Chlorite IIb 1.60 %
Nontronite 4.20 %
Magnetite 1.37 %
Anatase 0.85 %
Illite 4.11 %
Illite/Mont - 11A 3.57 %
Calcite 28.09 %
Montmorillonite-14A 3.49 %
Fluorapatite 2.68 %
Counts
9,000
8,500
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6,000
5,500
5,000
4,500
4,000
3,500
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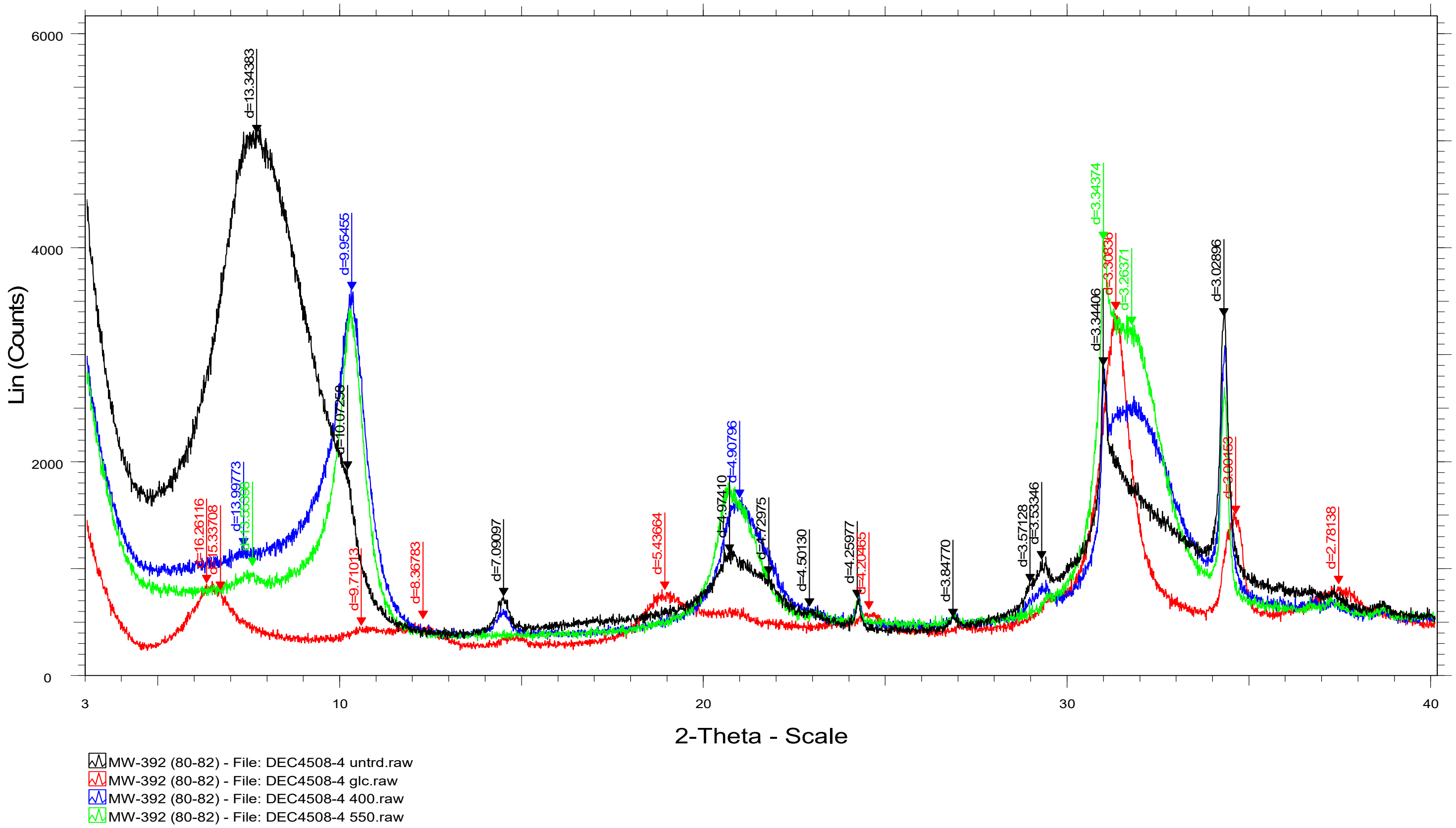
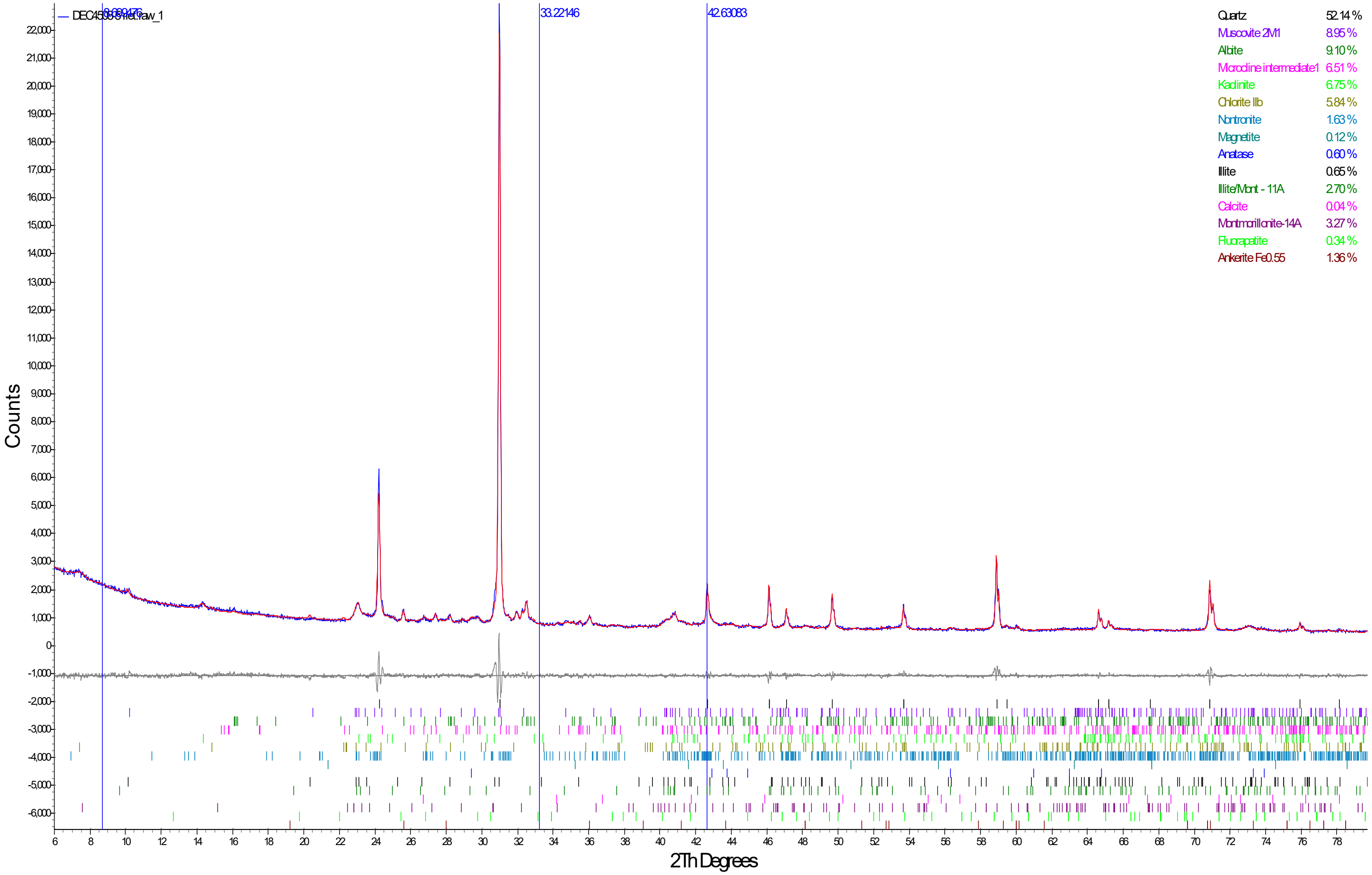
2Th Degrees

Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22

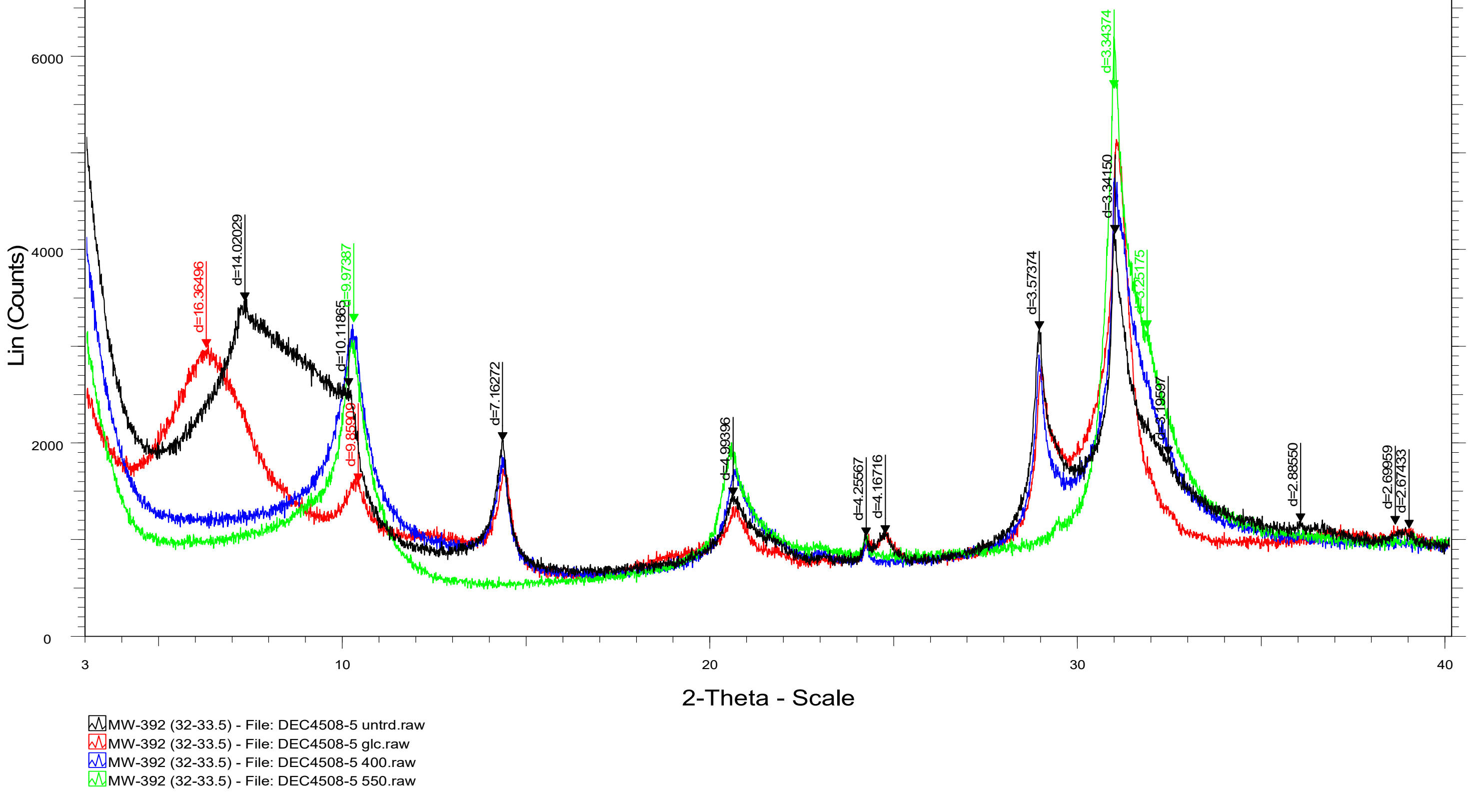
MW-392 (80-82)

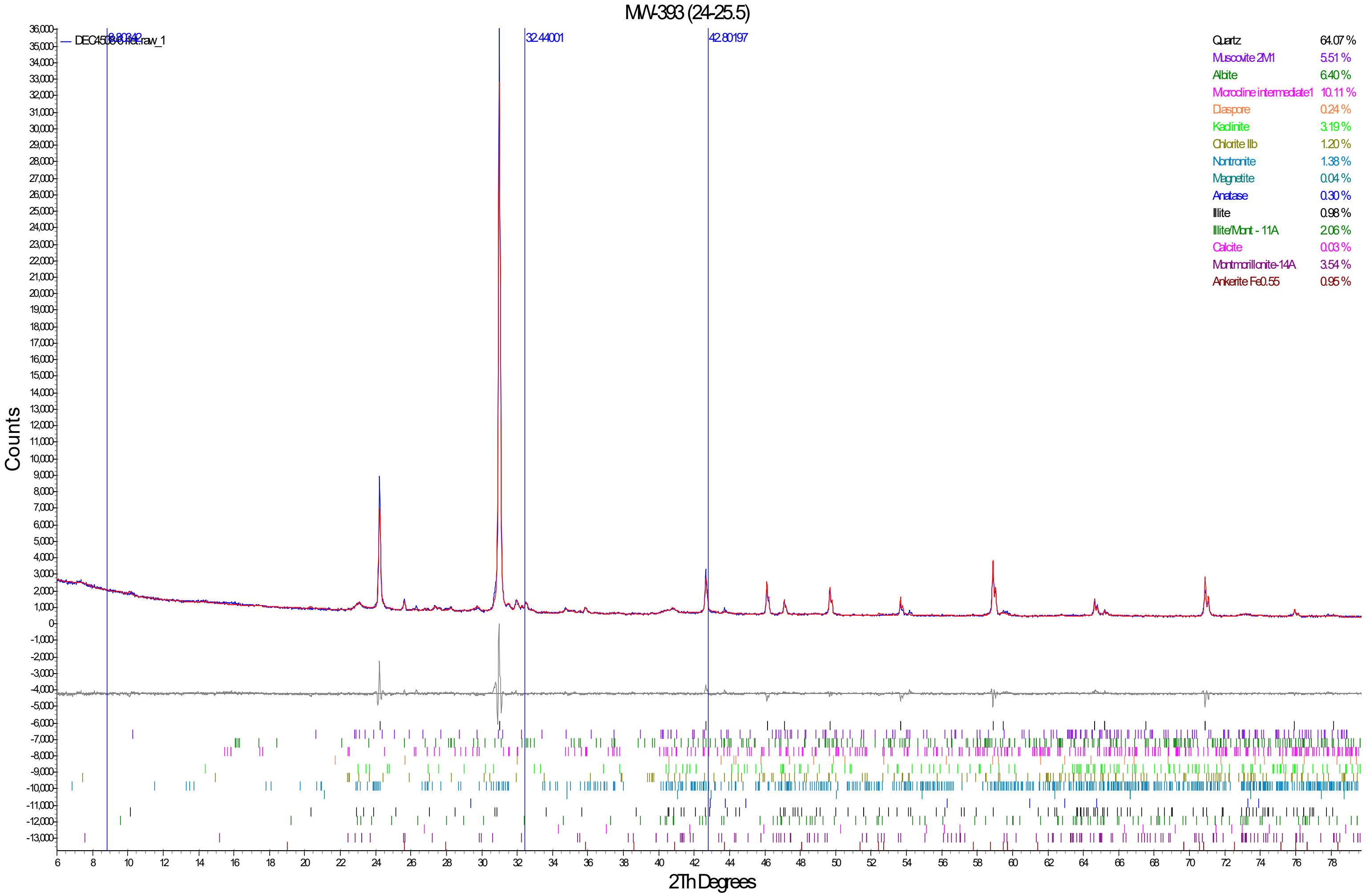


MW-392 (32-33.5)

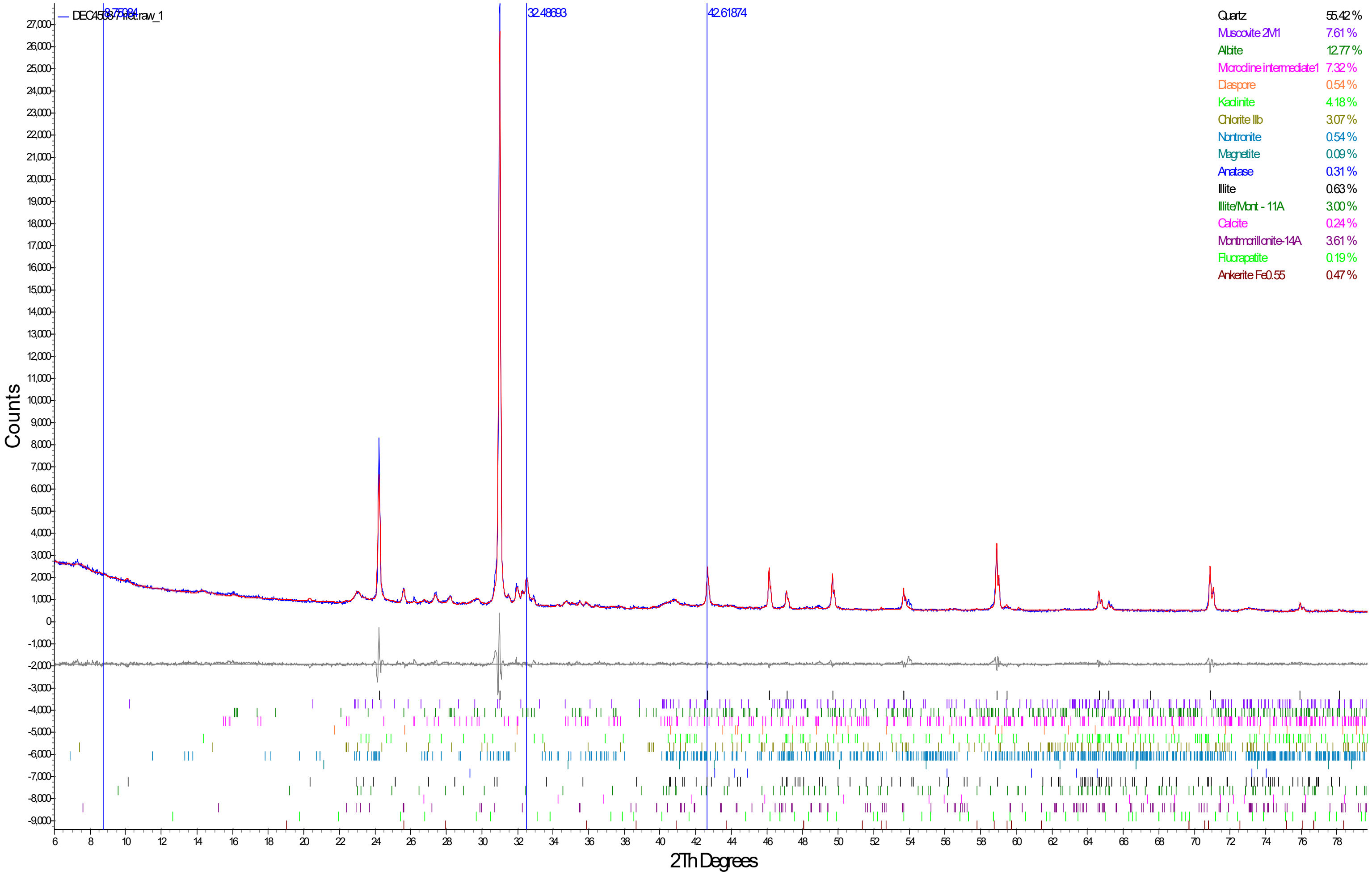

DEC4508-5 ret.raw_1
8.699476
33.22146
42.63083
Counts
22,000
21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
2Th Degrees
Quartz 52.14 %
Muscovite 2M1 8.95 %
Albite 9.10 %
Microcline intermediate1 6.51 %
Kaolinite 6.75 %
Chlorite IIb 5.84 %
Nontronite 1.63 %
Magnetite 0.12 %
Anatase 0.60 %
Illite 0.65 %
Illite/Mont - 11A 2.70 %
Calcite 0.04 %
Montmorillonite-14A 3.27 %
Fluorapatite 0.34 %
Ankerite Fe0.55 1.36 %

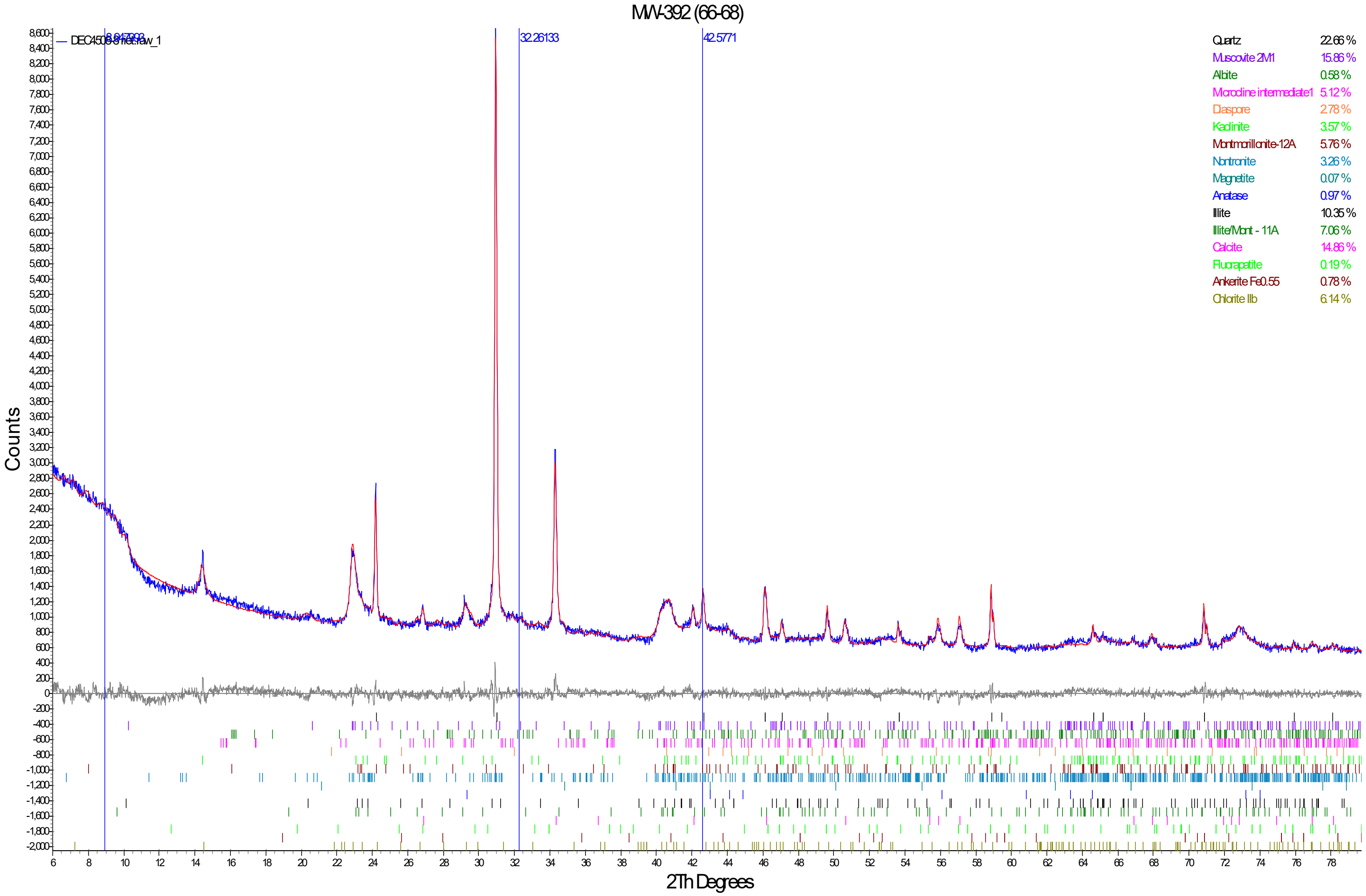
MW-392 (32-33.5)


d=16.36496
d=14.02029
d=10.11865
d=9.97387
d=9.85909
d=7.16272
d=4.99396
d=4.25567
d=4.16716
d=3.57374
d=3.34374
d=3.34150
d=3.25175
d=3.19597
d=2.88550
d=2.69959
d=2.67433
Lin (Counts)
6000
4000
2000
0
3
10
20
30
40
2-Theta - Scale
MW-392 (32-33.5) - File: DEC4508-5 untrd.raw
MW-392 (32-33.5) - File: DEC4508-5 glc.raw
MW-392 (32-33.5) - File: DEC4508-5 400.raw
MW-392 (32-33.5) - File: DEC4508-5 550.raw

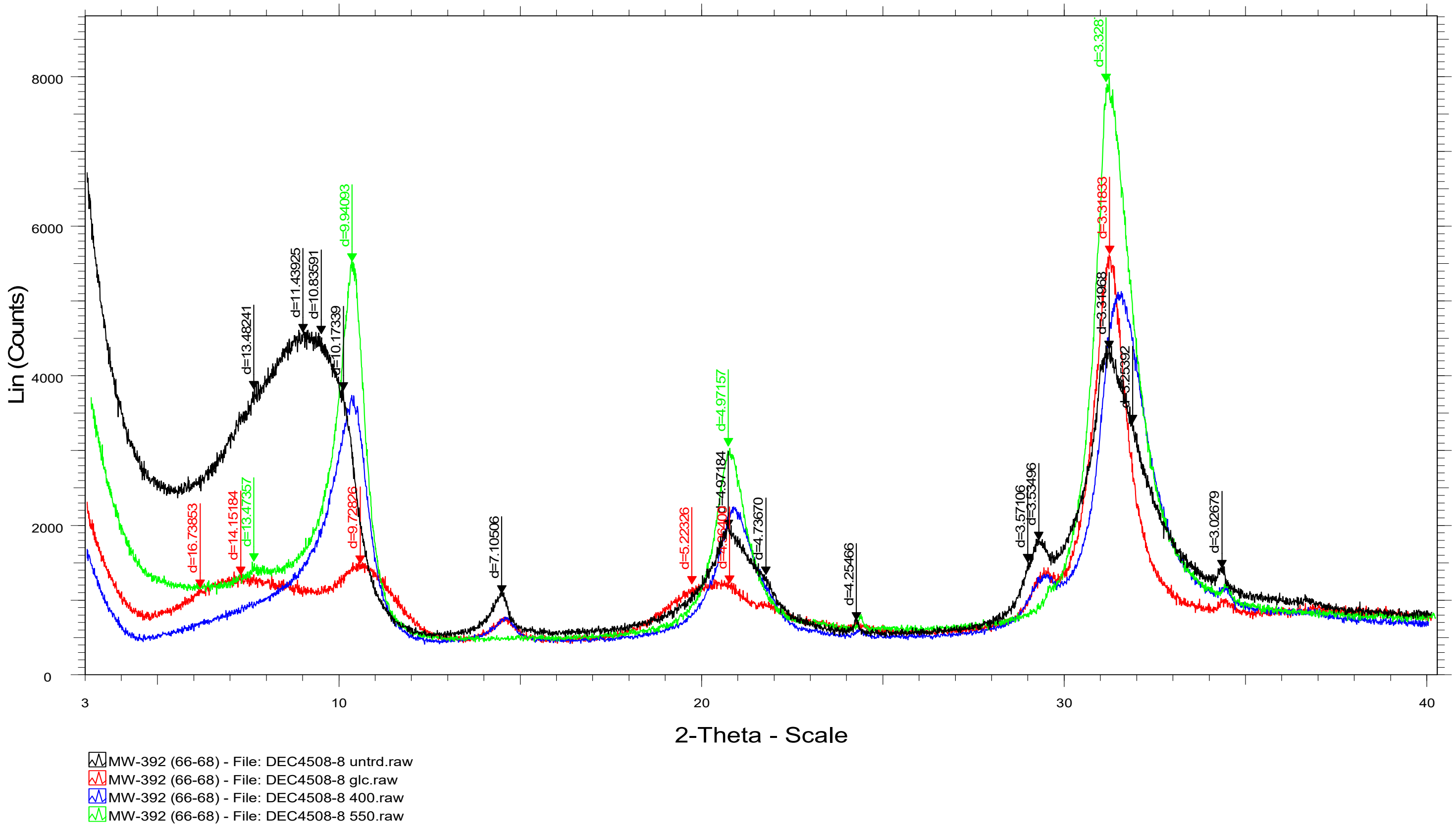

MW-393 (24-25.5)
DEC4508-6 ret.raw_1
8.80342
32.44001
42.80197
Counts
36,000
35,000
34,000
33,000
32,000
31,000
30,000
29,000
28,000
27,000
26,000
25,000
24,000
23,000
22,000
21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
-9,000
-10,000
-11,000
-12,000
-13,000
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
2Th Degrees
Quartz 64.07 %
Muscovite 2M1 5.51 %
Albite 6.40 %
Microcline intermediate1 10.11 %
Diaspore 0.24 %
Kaolinite 3.19 %
Chlorite IIb 1.20 %
Nontronite 1.38 %
Magnetite 0.04 %
Anatase 0.30 %
Illite 0.98 %
Illite/Mont - 11A 2.06 %
Calcite 0.03 %
Montmorillonite-14A 3.54 %
Ankerite Fe0.55 0.95 %

MW-394 (20.5-22)


DEC4508-7-ret.raw_1
8.75084
32.48693
42.61874
Quartz 55.42 %
Muscovite 2M1 7.61 %
Albite 12.77 %
Microcline intermediate1 7.32 %
Diaspore 0.54 %
Kaolinite 4.18 %
Chlorite IIb 3.07 %
Nontronite 0.54 %
Magnetite 0.09 %
Anatase 0.31 %
Illite 0.63 %
Illite/Mont - 11A 3.00 %
Calcite 0.24 %
Montmorillonite-14A 3.61 %
Fluorapatite 0.19 %
Ankerite Fe0.55 0.47 %
Counts
27,000
26,000
25,000
24,000
23,000
22,000
21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
-9,000
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
2Th Degrees


MW-392 (66-68)
DEC4508-8 riet.raw_1
8.947993
32.26133
42.5771
Counts
2Th Degrees
8,600
8,400
8,200
8,000
7,800
7,600
7,400
7,200
7,000
6,800
6,600
6,400
6,200
6,000
5,800
5,600
5,400
5,200
5,000
4,800
4,600
4,400
4,200
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
-1,200
-1,400
-1,600
-1,800
-2,000
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
Quartz 22.66 %
Muscovite 2M1 15.86 %
Albite 0.58 %
Microcline intermediate1 5.12 %
Diaspore 2.78 %
Kaolinite 3.57 %
Montmorillonite-12A 5.76 %
Nontronite 3.26 %
Magnetite 0.07 %
Anatase 0.97 %
Illite 10.35 %
Illite/Mont - 11A 7.06 %
Calcite 14.86 %
Fluorapatite 0.19 %
Ankerite Fe0.55 0.78 %
Chlorite IIb 6.14 %

MW-392 (66-68)


Lin (Counts)
0
2000
4000
6000
8000
3
10
20
30
40
2-Theta - Scale
d=13.48241
d=11.43925
d=10.83591
d=10.17339
d=9.94093
d=16.73853
d=14.15184
d=13.47357
d=9.72826
d=7.10506
d=5.22326
d=4.97184
d=4.97157
d=4.73670
d=4.25466
d=3.57106
d=3.53496
d=3.328
d=3.31833
d=3.31968
d=3.25392
d=3.02679
MW-392 (66-68) - File: DEC4508-8 untrd.raw
MW-392 (66-68) - File: DEC4508-8 glc.raw
MW-392 (66-68) - File: DEC4508-8 400.raw
MW-392 (66-68) - File: DEC4508-8 550.raw