July 12, 2024 Project No. 31404755.003-002-LTR-0

Ms. Nikie Gagnon
Colorado Division of Reclamation Mining and Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, Colorado 80203

RESPONSE TO ADEQUACY REVIEW COMMENTS FOR TECHNICAL REVISION (TR-12 REV 0) OF PERMIT M-1977-348

Dear Ms. Gagnon:

On behalf of Holcim (US) Inc., WSP USA Inc. (WSP) is submitting this response to the Division of Reclamation, Mining, and Safety (DRMS) preliminary adequacy review[1] of Technical Revision 12 (TR-12 Rev 0) to permit M-1977-348 to modify the groundwater monitoring program for the Boettcher Limestone Quarry (Site) located at 3060 West County Road 56, Laporte, Colorado 80535. This response to comments is being provided in combination with the revised Technical Revision 12 (TR-12 Rev 1).

<u>Comment 1:</u>

> *"The last sentence of the Executive Summary states, "TR-12 requests the discontinuation of the groundwater monitoring program for the Site and release of reclamation liability in accordance with Construction Materials Rule 3 Section 3.17(8)." This rule citation is incorrect.*
>
> *Construction Material Rule 3.1.7(8) requires an operator to demonstrate, to the satisfaction of DRMS, that reclamation has been achieved so that existing and reasonably potential future uses of groundwater are protected. Such a demonstration must be made by the operator and accepted by the Division prior to releasing reclamation liability for the site. The Division acknowledges that the Operator submitted TR-12 to demonstrate that existing and reasonably potential future uses of groundwater are protected. However, approval of TR-12 does not release the Operator from reclamation liability of the affected lands. Please acknowledge that per Rule 4.17, an Operator may file a written notice of completion of reclamation and request for release of reclamation responsibility with the Office whenever an Operator believes the requirements of the Act, the Rules and Regulations, and the approved reclamation plan have been completed. At that time, the Operator shall complete and submit a Request for Full or Partial Release of Permit Area form and submit it to the Division. Please revise the last sentence in the Executive Summary to be consistent with Rule 4.17 and resubmit the report with the additional edits discussed below. Please note the recommendations on page 18 need to be revised accordingly as well."*

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[1] The Division of Reclamation, Mining, and Safety (Division/DRMS). 2024. Boettcher Limestone Quarry, Permit No. M-1977-348, Technical Revision 12 (TR-12) Preliminary Adequacy Review. July 3, 2024.

Response: Text was updated to reflect the suggested changes. The Executive summary now says: "In accordance with Construction Materials Rule 3 Section 3.17(8), TR-12 requests approval of the demonstration that existing and reasonably potential future uses of groundwater are protected and a discontinuation of the groundwater monitoring program for the Site." Additionally, text regarding the release of reclamation liability was removed from Section 1.0 and Section 7.0 as this request should be made in a separate submittal per Rule 4.17. In Section 7.0, a recommendation has been added to request the approval of the demonstration that existing and reasonably potential future uses of groundwater are protected.

Comment 2:

> *"Page 5, last sentence of the first paragraph. The hydraulic conductivity value for the Codell Sandstone is missing a minus sign. Please update the text to show 2.70 x 10-3 ft/day."*

Response: Document text was edited to address this comment.

Comment 3:

> *"Page 8, Selenium paragraph states, "Site wells were consistently below the BSGW and near the practical quantification limit (PQL)." Please define in the text what the PQL value is for selenium."*

Response: Document text was edited to indicate that the selenium is variable with PQL values between 0.00025 and 0.0125 mg/L.

Comment 4:

> *"Page 8, Nitrate+Nitrite paragraph states, "Nitrite values are consistently below the PQL. Please define in the text what the PQL value is for nitrite."*

Response: Document text was edited to indicate that the nitrite PQL is 0.05 mg/L.

Comment 5:

> *"Page 9, last paragraph states, "These values are similar to pH observed in the wells prior to CKD placement in area A2, and do not show the increase over time that would be expected if the groundwater was influenced by CKD." What pre-placement wells are you referring to? Please show this data in a table or provide backup for this statement."*

Response: TR-12 document was modified to address this comment. Text now reads "These values are similar to pH values observed in wells MW-2 though MW-4 which were monitored prior to CKD placement in area A2 (results prior to the October 1999 approval of TR-003), and do not show the increase over time that would be expected if the groundwater was influenced by CKD (Figure C-6 of Appendix C)."

Comment 6:

> *"Page 14, first paragraph Table 10 is incorrectly referenced as listing groundwater velocities. Groundwater velocities are listed in Table 12. Please update the reference."*

Response: Document text was modified to reference Table 12.

Comment 7:

> *"Table 11: Statistical Evaluation of MW-8 includes the statement "All Values below PQL". Please revise the last column in the table to indicate the PQL values for the analytes reporting below PQL and resubmit Table 11."*

Response: Table 11 was updated to include PQL values when all constituent values are below the PQL value.

Additionally, during a follow-up conversation between Nikie Gagnon (DRMS) and Sara Harkins (WSP) regarding the DRMS primary adequacy comments[2], the DRMS suggested text should be added to refer to the possible future uses for the site. Therefore, the following text was added to Section 1.0 to indicate possible future uses for the site after reclamation liability has been released: "Also shown on Figure 1 is the proposed realignment for US Highway 287, which is currently being planned for after site reclamation and release is completed."

If you have any questions, please contact the undersigned.

WSP USA Inc.

Sara Harkins

Sara Harkins
Senior Geologist/Geochemist

Jennifer Thompson
Geochemist

J. Moreno

Joanna Moreno
Senior Technical Principal - Hydrogeology

SH/JT/JM

CC: Travis Weide
Michael Toelle

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[2] Gagnon N. 2024. Colorado Division of Reclamation Mining and Safety (DRMS). Adequacy review for Technical Revision 12 (TR 12) discussion. Telephone conversation with Sara Harkins, geochemist, WSP. July 8, 2024.

REPORT

Request for Technical Revision (TR-12) of Permit M-1977-348: Groundwater Monitoring at the Boettcher Quarry (Revision 1)

Submitted to:

Ms. Nikie Gagnon

Colorado Division of Reclamation Mining and Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, Colorado 80203

Submitted by:

WSP USA Inc.
7245 W Alaska Drive, Suite 200, Lakewood, Colorado, USA 80226

+1 303 980-0540

31404755.003-001-RPT-1

July 12, 2024

EXECUTIVE SUMMARY

This report details a request for a Technical Revision 12 (TR-12) to Permit M-1977-348 to modify the groundwater monitoring program for the Boettcher Limestone Quarry (Site) located at 3060 West County Road 56, Laporte, Colorado 80535.

TR-12 demonstrates that groundwater constituent concentrations elevated above the Colorado Basic Standards for Groundwater (5 CCR 1002) are not indicative of groundwater contamination from the placement of cement kiln dust (CKD) at Boettcher Quarry. An evaluation of the water quality data obtained at side-gradient well MW-8 was performed in accordance with Technical Revision 11 (TR-11), which included an agreed method for comparison to water quality observed at other Site wells screened at similar depths and within the same lithologic unit (MW-4, MW-6, and MW-7). Results of the statistical assessment of MW-8 presented herein indicate that concentrations of the parameters of interest in wells downgradient of the CKD disposal area represent ambient groundwater conditions and not CKD-impacted groundwater. Per TR-11, parameters of interest include barium, boron, chloride, fluoride, gross alpha, iron, manganese, nitrate, nitrate+nitrite, selenium, sulfate, total dissolved solids (TDS), and uranium.

This Technical Revision (TR-12) proposes that existing Site well MW-6 can be classified as the point-of-compliance in accordance with Rule 3.1.7(6) and (7) and that an additional point-of-compliance well, previously requested by the Division of Reclamation, Mining, and Safety (DRMS), well MW-9, is not necessary. TR-12 demonstrates that concentrations observed at the point-of-compliance well (reclassified well MW-6) are reflective of ambient water quality and not CKD-impacted groundwater. Background water quality, as identified in several literature references and monitoring results for MW-8, indicate elevated concentrations of the constituents of interest in lithologic units monitored by Site wells.

Well recharge monitoring, groundwater flow calculations, groundwater age dating, and discussion of the lack of potential downgradient receptors are presented to demonstrate that existing and reasonably potential future uses of groundwater are protected.

In accordance with Construction Materials Rule 3 Section 3.17(8), TR-12 requests approval of the demonstration that existing and reasonably potential future uses of groundwater are protected and a discontinuation of the groundwater monitoring program for the Site.

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APPENDICES

1.0 INTRODUCTION

On behalf of Holcim (US) Inc., WSP USA Inc. (WSP) is submitting this request for a Technical Revision 12 (TR-12) to Permit M-1977-348 to for the Boettcher Limestone Quarry (Site), located at 3060 West County Road 56, Laporte, Colorado 80535. Revision 1 is being submitted to address primary adequacy review comments provided by the Division of Reclamation, Mining, and Safety (DRMS) on July 3, 2024 (DRMS 2024).

In their February 28, 2020, Inspection Report, the DRMS requested the groundwater network for the Site to include two additional monitoring wells, a background well, and a compliance well:

> *"By the corrective action date, the operator shall submit a Technical Revision, with the applicable fee, to revise the groundwater monitoring program to include proposed point(s) of compliance in accordance with Rule 3.1.7(6) and (7) at some distance hydrologically downgradient from the Cement Kiln Dust (CKD) disposal areas. Due to the lack of ambient groundwater quality data for the site required by Rule 3.1.7(b)(viii), the revision shall also include proposed background monitoring well(s) located outside of the CKD disposal areas and screened across similar lithological units as existing downgradient monitoring wells and the proposed compliance well(s). The information obtained from these wells will be used to evaluate protection afforded groundwater quality and compliance with groundwater standards."*

Upon further conversations with the DRMS, it was agreed that the background well (MW-8) would be installed and monitored, and the downgradient compliance well (MW-9) would be installed only if an ambient water quality demonstration using MW-8 was not successful. Technical Revision 11 (TR-11, Golder 2020) outlined the installation and monitoring plan for MW-8, as well as the approach to evaluating the monitoring results. The evaluation at MW-8 is focused on parameters that have previously exceeded the Regulation 41- Colorado Basic Standards for Groundwater (BSGW) (5 CCR 1002) at the existing site wells as well as total dissolved solids (TDS) greater than 10,000 milligrams per liter (mg/L). These parameters are barium, iron, manganese, boron, selenium, uranium, fluoride, chloride, sulfate, nitrate, nitrate+nitrite, gross alpha, and TDS.

This report presents the MW-8 evaluation along with a discussion of risks to potential downgradient receptors to support a proposed path forward for discontinuation of the groundwater monitoring program for the Site.

This report is organized as follows:

- Section 2.0 – A summary of the Site history and groundwater monitoring activities
- Section 3.0 – A description of local and regional geology and hydrogeologic conditions
- Section 4.0 – A summary of regional and Site groundwater quality results
- Section 5.0 – An evaluation of MW-8 results as prescribed by TR-11
- Section 6.0 – A evaluation of groundwater flow and age and including a discussion of risks to downgradient water quality and potential receptors
- Section 7.0 – Summary and recommendations
- Section 8.0 – References

2.0 BACKGROUND INFORMATION

2.1 Site History and CKD Placement

The Site is located in Larimer County near Laporte, Colorado (Figure 1). The quarry comprises portions of Township 8 and 9 North, Range 69 West of the 6th Principal Meridian. The original permit for Ideal Basic Industries to operate the Boettcher Quarry (Permit No. M-1977-348) was approved on October 10, 1978, by the Colorado Mined Land Reclamation Board (MLRB) of the Department of Natural Resources. Although the Boettcher Quarry has had several owners during the active lifetime of the quarry, it is currently owned by Holcim (US) Inc., thus Holcim is referred to as the owner/operator in this document.

Cement kiln dust (CKD) was generated on Site during operations, which occurred from the early 1900s to 2002. Disposal of CKD in mined-out portions of the Boettcher Quarry began in 1980. Per Technical Revision No. 3 (TR-003) to Permit No. M-1977-348 by the Division of Minerals and Geology (DMG), approved on October 15, 1999 (DRMS 1999), CKD disposal would be limited to area A2. CKD disposal in area A2 began in the Fall of 1999, and approximately 140,000 cubic yards were placed in the area by August 2002, when the plant closed. Limestone mining operations ceased in August 2002. Reclamation and monitoring activities have been occurring on Site since the plant closure in 2002 (Holnam 2002; Holcim 2004, 2005, 2006, 2007, and 2009). Figure 1 shows the approximate location of CKD disposal area A2 in the A-band mining cut. Prior to TR-003, CKD was disposed of in the dry CKD area shown in Figure 1.

Also shown on Figure 1 is the proposed realignment for US Highway 287, which is currently being planned for after site reclamation and release is completed.

2.2 Groundwater Monitoring History

Eight monitoring wells (MW-1 through MW-8) are present at the Site. The location of these wells is presented in Figure 1, and the construction details are summarized in Table 1. Appendix A provides monitoring well construction and lithological logs for monitoring wells MW-1, MW-2, and MW-3. No monitoring well construction details are available for monitoring well MW-4, but based on the well depth, the screened interval is assumed to be in the Niobrara. Appendix B provides monitoring well construction and lithological logs for monitoring wells MW-5, MW-6, MW-7, and MW-8. The locations and planned construction depths of MW-5 through MW-8 were provided to the DRMS for review and comment prior to installation (Golder 2012, Golder 2020). The water quality data for these wells are summarized in Tables 2 through 9. A timeline of the groundwater sampling history at the Site is provided below:

- June 1998: MW-1, MW-2, and MW-3 were installed.
- April 1999: MW-4 was installed.
- May 1999 – September 2000: Bi-monthly sampling of MW-1 through MW-4 (8 sampling events) conducted by Secor.
- September 2010: Initial Golder sampling event of MW-1 through MW-4.
- 2011- 2012: Quarterly sampling of MW-1 through MW-4.
- Fall 2012: Installation of MW-5 through MW-7.
- 2013 - 2016: Quarterly sampling of MW-1 through MW-7.

- 2017- 2020: Semi-annual sampling of MW-1 through MW-7.
- November 2020: Installation of MW-8.
- 2021 through present: Semi-annual sampling of MW-1 through MW-8.

3.0 HYDROGEOLOGIC CONDITIONS

3.1 Geology

The Boettcher Quarry was mined for Niobrara Formation limestone, which is of Cretaceous age and marine origin. The Niobrara Formation consists of alternating bands of limestone, argillaceous (i.e., clayey) limestone, and calcareous shale (Ideal 1977). The argillaceous limestone bands are typically fossiliferous and contain trace amounts of pyrite. The Niobrara Formation is bounded (underlain) by the older Codell sandstone (of the Carlile Formation) and overlain in most places by the younger Pierre shale (Ideal 1962). The Niobrara Formation limestone is subdivided into members (bands), identified as A through G from older to younger aged rock. The E-band is further subdivided into bands E1 through E3 based on calcium oxide (CaO) content. The boundaries within the E-band are gradational, rather than discrete, based on physical or chemical characteristics (Ideal 1977). The A-band was mined at the Site because of its high limestone grade. The A through G band names and approximate thicknesses are provided in Figure 2.

The Niobrara Formation strikes north-south and dips approximately 16 degrees to the east (Ideal 1977). The A-band forms a prominent north-south trending ridge or hogback along the west side of the Site and each of the overlying limestone bands form less prominent north-south hogbacks paralleling the A-band outcrop. These ridges are not present where the high lime content bands have been quarried. Changes in strike represent zones of flexure and are seen as a bend or curve in the hogback. There are some minor changes in dip and minor faulting (with small displacements) within these flexure areas (Ideal 1977). Such a curve/band is located in CKD disposal area A2. Figure 3 provides a generalized cross section through CKD disposal area A2 and the extended area downgradient of the Site (developed based on Braddock et al. [1988], Scott and Cobban [1986], and Workman et al. [2018]). Figure 4 provides a generalized cross section through the dry CKD area south of CKD disposal area A2.

Barite-rich nodules were identified within the Niobrara Formation at a site in Fairburn, South Dakota (Tourtelot and Cobban 1968). Within the nodules, barite was noted as a replacement for organic constituents within a surrounding matrix of carbonate. Barite mineralization was not found within the deposit outside of the nodules, or in other nodules identified within the Niobrara by Johnson (1930) near Pueblo, Colorado.

Outside the context of nodule formation, multiple authors have noted the presence of barium as a significant trace metal within various portions of the Niobrara and associated formations. Kulp and Pratt (2004) found a range of barium concentrations in samples from South Dakota and Wyoming of Smoky Hill Chalk (an end-member of the Niobrara Formation) and Pierre Shale (the formation overlying the Niobrara) of 11.45 ± 28.04 milligrams per kilogram (mg/kg) and 503.87 ± 237.38 mg/kg, respectively. Arthur et al. (1985) found regional barium maxima above 1,000 mg/kg in the Bridge Creek Limestone near Pueblo, Colorado, and above 2,500 mg/kg within the Fort Hays and Smoky Hill Members of the Niobrara as sampled at the former Ideal Cement Quarry Site near Fort Collins – now known as the Boettcher Quarry. Arthur et al. (1985) noted that the highest barium concentrations identified within the Niobrara Formation are thought to occur in oxidized zones directly adjacent to strata with increased organic carbon contents. Other representative examples of barium concentrations within the Niobrara and associated surrounding formations can be found in Dean and Arthur (1998) and Landis (1959).

3.2 Hydrogeology

The Site is located in the Colorado Piedmont subprovince. The Dakota-Cheyenne aquifer is the principal aquifer of the Colorado Piedmont subprovince, and is comprised of the Early Cretaceous Dakota Sandstone and the Cheyenne Sandstone Member of the Purgatoire Formation (Topper and others 2003), and is overlain by the Carlile Formation and Niobrara Formation (Figure 3 and Figure 4). The Niobrara Formation and Carlile Formation are not considered to be part of a principal aquifer system, but portions of these units can yield some water to a few stock wells in parts of the Colorado Piedmont (Topper and others 2003). The Niobrara Formation is described by the Colorado Geological Survey as a fractured limestone that locally may yield small amounts of poor-quality water (Pearl 1974). Previous mining activities and the existing monitoring wells at the Site are limited to the Niobrara Formation and the top of the Carlile Formation (the Codell sandstone), and do not penetrate into the Dakota-Cheyenne aquifer.

Groundwater at the Site occurs along the contact of the Codell sandstone and the Fort Hayes limestone (A-band) members (Secor 1998, current site data). While fractures are noted in borehole logs and previous hydraulic studies, the joint structure is unknown and does not appear to be continuous (SEC 1990). An approximately 20-foot-thick sandstone interval at the top of the Codell Sandstone is thought to be the only significant groundwater flow unit near the CKD disposal area (DRMS 2014). The groundwater flow direction was observed to generally flow easterly and, on Site, is constrained to the dipping bed by the overlying low-conductivity Pierre Shale. Downgradient of the Site, the Codell-Niobrara interval comprised of the Codell Sandstone Member of the Carlile Shale and the Niobrara Formation, is a well-known, important hydrocarbon play throughout the Rocky Mountain region (Welker et al. 2013; Sonnenberg 2012; Caraway 1990). As discussed further in Section 6.2, permitted groundwater wells in the vicinity of the site are projected onto the cross sections presented in Figure 3 and Figure 4. As presented in Figure 3 and discussed in Section 6.2, while there are no known groundwater wells downgradient of the Site, there are permitted oil and gas wells likely screened in the Codell-Niobrara interval approximately 6 miles downgradient of Site.

Figure 5 presents a graph of the monitoring well water elevations measured during each sampling. Wells MW-1 and MW-5 exhibit minimal drawdown during sampling and are relatively stable through time, indicating little seasonal influence on groundwater elevation. Historical (1999 - 2000) water level measurements in MW-2 and MW-4 slowly increased with time, indicating that the water levels in these wells had not stabilized since construction and may not have been in equilibrium with the surrounding formation at the time of sampling. The water levels recorded, when monitoring resumed in 2010 (prior to well redevelopment), were higher than the historical measurements and may have reflected recovery to static conditions. Once quarterly monitoring began in 2011, the water levels in MW-2 and MW-4 decreased from levels measured in 2010. Since changing to semi-annual sampling in 2017, water levels have been stable in MW-3. However, water levels in MW-2, MW-4, MW-6, and MW-7 showed an increase following the change to semi-annual sampling indicating increased recharge (i.e., recovery) between sampling events. Well MW-8 was incorporated into the program with semi-annual sampling. After the initial sampling event (conducted shortly after well installation and development), the water levels increased in MW-8, and has since recovery to approximately the water level observed between each subsequent sampling event.

In November 2022, pressure transducers were installed in MW-4, MW-6, MW-7, and MW-8 to monitor water level recovery between sampling events. Figure 6 presents the water elevation vs time between the two most recent sampling events. The water level in the four wells showed an increasing trend at the end of each semi-annual recovery period, indicating that static conditions are not established, even after approximately 6 months of recovery. This extremely slow recovery rate supports the understanding that groundwater flow through the Niobrara Formation is very limited.

Hydraulic testing was performed on six of the monitoring wells at the Site. Hydraulic rising and falling head slug tests were performed on MW-1, MW-2, MW-3, MW-4, and MW-5 (Secor 1998, Golder 2010, and Golder 2012). Hydraulic packer injection testing was performed during the advancement of borehole MW-7 (Golder 2013). Hydraulic testing results are summarized in Table 10. While field hydraulic testing was not conducted for MW-6, the transducer data obtained during recovery at MW-6 in 2023 was utilized to estimate the hydraulic conductivity of the screened interval. The Site-specific hydraulic conductivities presented in Table 10 range from 1.4 x 10^{-6} feet per day (ft/day) (MW-2) to 1.1 x 10^{-2} ft/day (MW-7) and are higher than literature values (presented on Figure 4) for the Niobrara Formation (<2.7 x 10^{-4} ft/day; Micheals [2014]) and Codell Sandstone (2.7 x 10^{-4} to 2.7 x 10^{-3} ft/day; Adam [2017]).

4.0 GROUNDWATER QUALITY

4.1 Regional Water Quality

In Colorado, the Niobrara Formation and its surrounding formations are not generally considered good sources of groundwater due to their low production rates (Pearl 1974). Consequently, information regarding groundwater quality is sparse for the Niobrara in Colorado.

The Wyoming State Geological Survey published the Green River Basin Water Plan II, Groundwater Study in 2010 (Surdam 2010). This study assessed groundwater resources in the Greater Green River Basin (GGRB) of southwestern Wyoming and adjacent areas in Colorado and Utah. This study divided the GGRB basin into sub-basins and characterized the aquifers' groundwater chemistry characteristics for water quality purposes. Two of the sub-basins identified are the Washakie and Sand Wash basins. These basins straddle the Wyoming/Colorado border and are approximately 80 miles west and northwest of the Site. The groundwater in Niobrara Formation in this area is associated with of the Cody shale unit of the Washakie and Sand Wash basins. Five groundwater chemistry samples of produced water were collected from production well heads from the Niobrara Formation. The samples had concentrations of barium between 0.19 and 42 mg/L, with an average concentration of 15.5 mg/L. TDS concentrations in these samples ranged between 2,270 mg/L and 45,600 mg/L, with an average concentration of 22,200 mg/L. Chloride values ranged from 18,800 to 20,800 mg/L, and iron values ranged from 0.05 to 132 mg/L.

Li (2013) characterized produced water quality within the Wattenberg Field in Colorado from wells screened along the interface of the Niobrara Formation and the Codell Sandstone, and solely in the Codell. For the tested produced waters across 66 wells, the average TDS concentration was 18,285 mg/L and the average barium concentration was 18.2 mg/L. Li (2013) attributed the source of barium in the formation water to the relatively high concentrations in the surrounding limestone and shale with average whole rock concentrations of 10 mg/kg and 580 mg/kg, respectively. Iron in the North Wattenberg Field was considered by Li (2013) to be a dominant constituent (average of 80.7 mg/L) in produced water, due to sources from minor Fe-carbonates and pyrite present in the Niobrara shales.

Bern and Stogner (2017) presented river water quality results from the Arkansas River near the city of Florence, Colorado. River water quality in sections that have interacted with the Niobrara Formation had significantly higher TDS, selenium, and uranium than background samples. This study by Bern and Stogner (2017) indicates that the Niobrara Formation shales are responsible for observed increases in surface water TDS, uranium, and selenium.

Bern et al. (2021) reviewed the geochemistry of produced water associated with the Wattenberg oil and gas field hosted in the Niobrara Formation using a United States Geological Survey (USGS) database published in 2018. The waters from the Niobrara Formation had pH values from 7.1 to 8.2, TDS values from 3,789 to 78,047 (average of 23,318 mg/L), and chloride values from 1,600 to 46,600 mg/L (average of 13,726 mg/L). Short-term leach testing of shales in the Niobrara Formation contained elevated barium, calcium, lead, and arsenic compared to testing of materials from other oil producing basins assessed by Bern et al. (2021).

Overall, the groundwater associated with the Niobrara Formation has been shown to be a brine with elevated concentrations of TDS, chloride, calcium, lead, arsenic, barium, selenium, and uranium.

4.2 Site Wells

Water quality sampling results for Site wells are presented in Table 2 through Table 9. The analyte list has varied over the monitoring history; time series graphs through 2023 for routinely monitored constituents are presented in Appendix C. Based on lithology and depth of the wells, groundwater beneath the Site can be classified into three distinct groups (Figure 7).

Group 1 (MW-1 and MW-5): The monitoring wells in Group 1 have screened intervals that are located less than 70 feet below ground surface (ft bgs) and are the furthest west and north of the Site wells. MW-1 is screened across the Niobrara/Codell contact near CKD Area A2 and MW-5 is screened in the overburden above bedrock north of the CKD disposal areas.

Group 2 (MW-2 and MW-3): The monitoring wells in Group 2 are screened from approximately 100 to 200 ft bgs across the Niobrara/Codell contact.

Group 3 (MW-4, MW-6, MW-7 and MW-8): Monitoring wells in Group 3 are screened at depths greater than 180 ft bgs, in the Niobrara Formation above the Niobrara/Codell contact[1].

The monitoring depth and screened lithology influences the observed water chemistry of the groups. The observed chemistry of each group is discussed below and shown in the Piper diagram in Figure 8, timeseries plots in Appendix C, and box and whisker plots for select constituents in Appendix D.

Group 1 (MW-1 and MW-5): The field pH of the November 2022 to November 2023 samples (i.e., the recent samples) collected from these wells ranged between 7.0 and 7.6. The groundwater in this group is sodium-sulfate type water, as shown by the Piper diagram in Figure 8, with recent TDS concentrations between 3,200 and 6,720 mg/L, which is generally lower than the other groups. The groundwater in this group exhibits higher concentrations of calcium, magnesium, and sulfate, and lower alkalinity, fluoride, and chloride than the other groups. Except for selenium, uranium, and iron, dissolved trace metals concentrations for this group are lower than the other groups.

Group 2 (MW-2 and MW-3): The field pH of recent samples collected from these wells ranged between 7.5 and 8.2. The groundwater in this group is sodium-chloride type water (Figure 8) with recent TDS concentrations between 3,840 and 6,370 mg/L. The groundwater in this group of wells exhibits higher alkalinity and fluoride, and lower calcium and magnesium concentrations than that of the other groups. Dissolved trace metals concentrations for this group are generally equal to or lower than Group 3.

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[1] Screened lithology of MW-4 is unknown. MW-4 is assumed for this discussion to be part of Group 3 based on the well depth, hydraulic characteristics and chemical signature.

Group 3 (MW-4, MW-6, MW-7, and MW-8): The field pH of recent samples collected from these wells ranged from 7.3 to 7.8. The groundwater in this group is sodium-chloride type water with TDS concentrations that are greater than 10,000 mg/L. The signatures for groundwater from these four wells plot closely together on a Piper diagram (Figure 8) as the groundwater in this group exhibits higher sodium, chloride, and trace metals concentrations than the other groups.

Water quality results from groundwater samples collected from Group 3 wells indicate that constituent concentrations take longer to reach equilibrium with the surrounding formations as compared to Group 1 and Group 2 wells. Concentrations of chloride and sodium (both relatively conservative constituents[2]) in MW-6 and MW-7 increased for approximately one year following well installation and after reaching relatively stable conditions, constituent concentrations were similar to MW-4 (Appendices C and D). A similar trend was observed in 1999 and 2000 samples for MW-4 following installation for constituents such as chloride and TDS. MW-8 was installed in November 2020, and had increasing trends in barium, chloride, and sodium and decreasing trends in boron from 2020 to 2023. Most constituents had similar concentrations in the last two MW-8 sampling events (June 2023 and November 2023), with the exception of chloride, which increased between the last two events. The delayed stabilization observed in Group 3 wells may indicate that the initial samples from the wells after drilling are likely not in equilibrium with the surrounding formation and may not be reflective of groundwater conditions prior to drilling. These trends may be the result of disturbance to the system created by drilling and well installation.

4.3 Comparison to the Basic Standards for Groundwater

A comparison of water quality results to Regulation No. 41 BSGW, Colorado Code of Regulations 5 CCR 1002-41 is provided on Table 2 through Table 9. A visual comparison of water quality results to the BSGWs is provided for analytes that have exceeded the BSGW in at least one sampling event in box and whisker plots in Appendix D. A detailed discussion of the Synthetic Precipitation Leaching Procedure (SPLP) test results for CKD materials relative to native material is presented in Appendix E.

A discussion of constituent exceedances of the BSGW for analytes of interest in Group 3 wells, which includes MW-8, is as follows:

- Barium: Monitoring wells MW-2, MW-3, MW-4, MW-6, MW-7, and MW-8 have barium concentrations above the BSGW in recent samples (collected between November 2022 to November 2023). Barium concentrations for MW-8 are higher than previous values in the last two sampling events with values of 4.52 and 3.62 mg/L. Generally, barium concentrations are greater in the Group 3 versus Group 2 wells. In the Group 3 wells, barium concentrations generally showed increasing trends in the initial sampling events following installation for each well. Concentrations of barium in SPLP leachate are about a half an order of magnitude greater for CKD samples than for samples of native materials.
- Boron: Boron concentrations are slightly higher in the Group 2 versus Group 3 wells. Exceedances of the BSGW have periodically occurred in the Group 2 and Group 3 wells. In recent samples collected, only one sample (November 2023; MW-3) exceeded the BSGW. The first water quality sample from MW-8 after installation had one of the highest boron concentrations reported in Site groundwater (0.9 mg/L) and boron concentrations have since decreased with recent values of 0.64 mg/L in November 2023, similar to the range

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[2] Conservative constituents are relatively unreactive, and their concentrations are not expected to be changed by geochemical processes such as mineral precipitation and/or sorption along a flow path. Therefore, their concentrations are relatively conservative along a flow path.

reported in MW-6 and MW-7. Concentrations of boron in SPLP leachate are approximately one order of magnitude greater for CKD samples than for samples of native materials.

- Iron: Monitoring wells MW-5, MW-6, and MW-7 water quality iron concentrations are above the BSGW for the most recent sampling events. Iron concentrations in most wells exceeded the BSGW at some point in the monitoring history. Iron concentrations are generally highest in MW-5 and are slightly greater in the Group 3 versus Group 2 wells. Iron concentrations in Site wells are more variable than other metals, but longer term increasing or decreasing trends are not observed. Concentrations of iron in SPLP leachate are approximately equal in CKD and native material samples.
- Manganese: Manganese concentrations are slightly greater in some Group 3 versus Group 2 wells. Exceedances of the BSGW have consistently occurred in some Group 1, Group 2, and Group 3 wells. In the Group 2 and Group 3 wells, manganese concentrations were generally higher in the earlier sampling events for each well and decreased with time. Concentrations of manganese in SPLP leachate are approximately equal in CKD and native material samples.
- Selenium: Selenium concentrations have been historically higher than the BSGW in MW-1, but concentrations have decreased over the monitoring history with concentrations below the BSGW in three of the last four sampling events (June 2022 to November 2023). Selenium concentrations in the other Site wells were consistently below the BSGW and near the practical quantification limit (PQL). The PQL for selenium is variable, with values between 0.00025 and 0.0125 mg/L for samples collected since 2010. Concentrations of selenium in SPLP leachate are approximately three orders of magnitude greater for CKD samples than for samples of native materials.
- Uranium: Uranium concentrations in Group 1 wells (MW-1 and MW-5) and MW-8 have exceeded BSGW levels in multiple sampling events. Group 2 wells and the remaining Group 3 wells have shown relatively low concentrations (<0.01 mg/L). Concentrations of uranium in SPLP leachate are variable in for CKD samples and range from less than one to three orders of magnitude greater than leachate for samples of native materials.
- Chloride: Chloride concentrations are greater in the Group 3 versus Group 2 wells. Exceedances of the BSGW have consistently occurred in the Group 2 and Group 3 wells. In the Group 3 wells, chloride concentrations generally showed increasing trends in the initial sampling events for each well. Chloride concentrations are increasing in MW-8 and do not appear to have stabilized. Concentrations of chloride in SPLP leachate are less than one order of magnitude greater for CKD samples than for samples of native materials.
- Fluoride: Fluoride concentrations are the highest in well MW-3. Fluoride concentrations consistently exceeded the BSGW at well MW-3, but only one sample (MW-4 in May 2010) has exceeded the standard in other Site wells. Fluoride was not monitored from 2015-2017. Concentrations of fluoride in SPLP leachate are approximately one order of magnitude greater for CKD samples than for samples of native materials.
- Nitrate: Nitrate values have been below the BSGW in all monitoring wells, with the exception of MW-1. Nitrate concentrations in MW-1 have been decreasing from about 80 mg/L in 2012 to about 5 mg/L in 2023. All nitrate results in all wells have been below the BSGW since the January 2022 sampling event.
- Nitrate+Nitrite: Nitrite values for Group 3 wells are consistently below the PQL of 0.05 mg/L. Therefore, the nitrate+nitrite trends are similar to nitrate.

- Sulfate: In some of the Group 3 wells (MW-4, MW-7, and MW-8), sulfate concentrations initially exceeded the BSGW but concentrations generally decreased after the initial sampling events for each well to below the BSGW. Exceedances of the BSGW have consistently occurred in the Group 1 wells. Concentrations of sulfate in SPLP leachate are approximately one to two orders of magnitude greater for CKD samples than for samples of native materials.

- Gross Alpha: Gross alpha has been consistently reported at low or negative concentrations with large uncertainty (e.g., -33 ±18 picocuries per liter [pCi/L]) and varies widely within each well and between wells with some values exceeding the BSGW. Gross Alpha was not measured in SPLP leachates.

- TDS: TDS concentrations are greater in the Group 3 versus Group 1 and Group 2 wells. TDS concentrations are consistently greater than the 10,000 mg/L which have consistently occurred in the Group 3 wells. TDS concentrations in SPLP leachate are approximately one to two orders of magnitude greater for CKD samples than for samples of native materials.

The Group 2 wells are located less than 100 feet downgradient from the CKD Area 2 and downgradient Group 3 wells (MW-4, MW-6, and MW-7) are more than 500 feet downgradient from the CKD Area 2. With the exception of boron, fluoride, and selenium, the concentrations of constituents that exceed the BSGW in downgradient wells are higher in samples collected from the downgradient Group 3 wells (MW-4, MW-6, MW-7, and MW-8) than the Group 2 wells (MW-2 and MW-3). This downgradient increase in concentrations suggests that the elevated concentrations reflect the influence of (leaching from) native host materials rather than influence from CKD leachate (from area A2). If the CKD deposited in area A2 was an ongoing source of loading to the groundwater, higher concentrations would be expected in the Group 3 wells closer to CKD disposal area A2 than in the Group 2 wells.

SPLP leachate of the CKD materials is calcium-sulfate dominant and plots in a different region of a Piper diagram than water from the downgradient wells (Groups 2 and 3 wells) (Figure 8). If the CKD was the source of elevated concentrations, sulfate, and calcium concentrations would be expected to increase with time, and groundwater samples in the Piper diagram would migrate away from the sodium-chloride water type that is currently noted. However, following installation, concentrations of sulfate and calcium in Group 3 wells decreased (Appendix C), while concentrations of chloride increased, which is the opposite of what would be expected if CKD leachate were migrating downgradient. MW-8 water chemistry shown in Figure 8 is similar to other Group 3 wells and, as a side-gradient well, indicates that MW-4, MW-6 and MW-7 water chemistry is indicative of background water quality observed at MW-8.

CKD SPLP leachate chemistry can be compared against constituents of interest in downgradient wells to assess potential source characteristics (Appendix E). SPLP leachate pH values are greater than 12 for the CKD material and between 7 and 10 for the native materials. Groundwater pH values in Site wells are between 7 and 9. These values are similar to pH values observed in wells MW-2 though MW-4 which were monitored prior to CKD placement in area A2 (results prior to the October 1999 approval of TR-003) , and do not show the increase over time that would be expected if the groundwater was influenced by CKD (Figure C-6 of Appendix C). In addition, the SPLP leachate concentrations were at least an order of magnitude higher for the CKD material than for the native materials for: arsenic, barium, chromium, lead, lithium, selenium, and thallium, and the majority of major ions. Upward trending concentrations would be expected if CKD was influencing groundwater concentrations in the Site wells. For example, potassium concentrations of approximately 500 mg/L measured in the CKD leachate, are two orders of magnitude greater than that of the native materials. In contrast, concentrations of potassium in groundwater from all wells are typically less than 20 mg/L and show no consistent increasing trends in concentrations. The absence of increasing water quality trends in downgradient wells for constituents elevated in the CKD, indicate that CKD leachate is not the source of BSGW exceedances.

5.0 EVALUATION OF MW-8 RESULTS

5.1 Approach

Per TR-11, the evaluation of parameters at MW-8 is focused on parameters that have previously exceeded the BSGW at the existing site wells and exhibit TDS concentrations greater than 10,000 mg/L. These parameters include barium, iron, manganese, boron, selenium, uranium, fluoride, chloride, sulfate, nitrate, nitrate+nitrite, gross alpha, and TDS.

To evaluate the results from MW-8, an approach was developed to determine the comparability of the new samples with the existing water quality at MW-4, MW-6, and MW-7. Two methods were used for assessing the magnitude of difference between the samples: a visual/graphical comparison and a mathematical comparison. For the visual and graphical comparison, time series and box and whisker plots of the collected data were used and presented in Appendices D and E respectively. Visual observation of MW-8 constituent concentrations shows increasing or decreasing trends (e.g., increasing chloride), which likely indicates that MW-8 water quality is not yet stable after well installation. However, the comparison of MW-8 water quality to other Group 3 wells MW-4, MW-6 and MW-7 is still possible.

For the mathematical approach, MW-8 was assessed using a relative percent difference (RPD) method, treating the samples as though they are laboratory duplicates, to assess whether they are likely to have been drawn from the same population. This approach was selected because it allows for the comparison of individual data points rather than a larger minimum data set (i.e., more sampling events) utilized in other methods, which allows for assessment of differences on an expedited schedule. Since variability in concentrations is observed between sampling events, this comparison was conducted for the three most recent sampling events (i.e., the November 2022, June 2023, and November 2023 sampling events). Per TR-11, if at least one sampling round demonstrates that the MW-8 and other Group 3 well results are comparable, a demonstration can be made that the concentrations observed in MW-4, MW-6, and MW-7 are reflective of background groundwater quality (i.e., similar to MW-8).

RPD values were calculated when both the MW-8 results and the mean of the recent results from MW-4, MW-6, and MW-7 were greater than 5 times the PQL (USEPA 2017). RPDs are calculated according to the following formula (USEPA 2017):

$$\%RPD = \left|\frac{A - B}{A + B}\right| \times 200$$

Where: A is the concentration of the applicable result at MW-8; and B is the corresponding concentration mean of recent data at MW-4, MW-6, and MW-7.

RPD values can range from 0%, indicating perfect correlation between results, to 200%, indicating a significant divergence between results. Results are considered comparable when the RPD is less than 20%, per the National Functional Guidelines for Inorganic Data Review (USEPA 2017). The RPD is not used when results are less than 5 times the PQL for a given analyte in either sample. In that circumstance, the absolute value of the difference between the two results is calculated and the results are considered comparable when the absolute difference is less than the PQL (USEPA 2017). When one of the two results for comparison is below the PQL for a given analyte, the difference is calculated using the PQL as the value of the result that was below the PQL. No comparison is performed when both results are below the PQL.

Large differences interpreted to be due to natural variability are observed between MW-4, MW-6, and MW-7 for barium, iron, gross alpha, and to a lesser extent manganese (Appendix D). Therefore, comparisons for these constituents were made on an individual well basis, rather than pooling data from MW-4, MW-6, and MW-7. Per TR-11, if any of the statistical assessments between individual Group 3 wells and MW-8 are comparable, a demonstration can be made that the concentrations observed in MW-4, MW-6, and MW-7 are reflective of background (i.e., similar to MW-8).

As noted in TR-11, noted gross alpha results have been consistently reported at low or negative concentrations with large uncertainty (e.g., -50 ±26 pCi/L) and vary widely within each well and between wells. The gross alpha results have been ineffective with regard to assessing groundwater quality and the large variability and uncertainty associated with the results make the mathematical comparison to background well MW-8 inappropriate, therefore, gross alpha was only assessed using a visual/graphical comparison.

5.2 Results

Results of the mathematical comparisons are presented in Table 11, and time series and box and whisker plots are presented in Appendices C and D, respectively. The result of the evaluation is summarized by parameter. As noted above, the discussion presented below refers to the results of the three most recent sampling events from November 2022 to November 2023.

Large variability in barium, iron, manganese, and gross alpha concentrations between MW-4, MW-6, and MW-7 requires that the statistical comparison with MW-8 is conducted on an individual well basis. The following is a summary of the barium, iron, manganese, and gross alpha assessments.

- Barium: Barium was detected in wells included in the comparison (MW-4, MW-6, MW-7, and MW-8) and an RPD calculation was used. The RPD was between 93% and 165% for the first sampling period assessed (November 2022), and the downgradient wells are not comparable to side-gradient well MW-8. However, the June 2023 and November 2023 sampling events had barium RPD values from 3 to 15% in MW-7. Therefore, barium concentrations observed in MW-4, MW-6, and MW-7 are reflective of background concentrations.

- Iron: Iron values are within five times the PQL, therefore, the absolute difference between MW-8 and MW-4, MW-6, and MW-7 was compared to the PQL. Iron results for all three sampling periods assessed (November 2022, June 2023, and November 2023) were comparable, as the PQL was greater than the absolute difference for at least one well (MW-4). Therefore, iron concentrations observed in MW-4, MW-6, and MW-7 are reflective of background concentrations.

- Manganese: Manganese concentrations are within five times the PQL value so the absolute difference between MW-8 and MW-4, MW-6, and MW-7 was used for the assessment. For the June 2023 event, the absolute difference between concentrations in MW-4 and MW-6 and concentrations in MW-8 are greater than the PQL. The absolute difference between MW-4 and MW-8 concentrations was less than the PQL in the November 2022 and November 2023 sampling events. In the June 2023 sampling event, the manganese concentration in MW-8 was greater than MW-4. Therefore, manganese concentrations observed in MW-4, MW-6, and MW-7 are reflective of background concentrations.

- Gross Alpha: A statistical assessment of gross alpha was not performed due to the large number of reported errors. A visual assessment of gross alpha results from Appendix C shows that results are variable with neither increasing nor decreasing trends. Gross alpha results for MW-4, MW-6, and MW-7 are in the range of MW-8 results; therefore, concentrations observed in MW-4, MW-6, and MW-7 are reflective of background concentrations.

The remaining constituents of interest including boron, selenium, uranium, chloride, fluoride, nitrate, nitrate+nitrite, and sulfate were assessed using a comparison of MW-8 to the average constituent concentration of MW-4, MW-6, and MW-7.

- Boron: For the November 2022 sampling event, boron values are within five times the PQL, therefore, the absolute difference between MW-8 and the average of MW-4, MW-6, and MW-7 was compared to the PQL. Wells assessed are considered comparable because the PQL value was greater than the concentration difference between the wells. For the June and November 2023 sampling events, the RPD was calculated with values of 2% and 8%, indicating that the average of MW-4, MW-6, and MW-7 have boron values comparable to MW-8 (<20% RPD). Therefore, boron concentrations observed in MW-4, MW-6, and MW-7 are reflective of background concentrations.
- Selenium: MW-4, MW-6, and MW-7 are non-detect and below the BSGW. MW-8 concentrations are also non-detect and below the BSGW. When all sample results are less than the PQL, no statistical assessment is made, therefore, selenium concentrations observed in MW-4, MW-6, and MW-7 are considered reflective of background concentrations.
- Uranium: MW-8 concentrations are greater than MW-4, MW-6, and MW-7 for the three recent sampling events. Therefore, uranium concentrations observed in MW-4, MW-6, and MW-7 are reflective of background concentrations.
- Chloride: Chloride concentrations were greater than five times the PQL, and an RPD was calculated between MW-8 and the average of MW-4, MW-6, and MW-7 with values from 5 to 23% for the three sampling events, with the MW-8 concentrations being higher indicating concentrations were comparable in recent sampling events. Chloride concentrations observed in MW-4, MW-6, and MW-7 are therefore reflective of background concentrations.
- Fluoride: Fluoride values are within five times the PQL value so the absolute difference between MW-8 and the average of MW-4, MW-6, and MW-7 was used for the assessment. Fluoride concentrations in November 2022 were comparable with the difference between MW-8 and the average concentration of MW-4, MW-6, and MW-7 were less than the PQL. Fluoride concentrations for MW-8 in June 2023 and November 2023 were greater than the average concentration of MW-4, MW-6, and MW-7 and MW-8. Fluoride concentrations observed in MW-4, MW-6, and MW-7 are, therefore, reflective of background concentrations.
- Nitrate and Nitrate+Nitrite: In November 2022, nitrate and nitrate+nitrite were below detection, and a statistical comparison was not made. In June 2023, the MW-8 concentration was greater than the average concentration of MW-4, MW-6, and MW-7. The November 2023 results were comparable as the difference between MW-8 and the average concentration of MW-4, MW-6, and MW-7 was less than the PQL. Nitrate and nitrate + nitrite concentrations observed in MW-4, MW-6, and MW-7 are therefore reflective of background concentrations.

- Sulfate: Sulfate results were below detection for the three sampling events and a statistical comparison was not made. Sulfate concentrations observed in MW-4, MW-6, and MW-7 are, therefore, reflective of background concentrations.
- TDS: MW-4, MW-6 and MW-7, and MW-8 TDS concentrations were greater than five times the PQL and a RPD assessment was made using MW-8 and the average of MW-4, MW-6, and MW-7 concentrations. The RPD values were from 2% to 10% for TDS in the three sampling events. TDS concentrations observed in MW-4, MW-6, and MW-7 are therefore reflective of background concentrations.

All constituents included in the comparison of side-gradient well MW-8 and to MW-4, MW-6, and MW-7 concentrations are comparable. In some cases, MW-8 concentrations were greater than MW-4, MW-6, and MW-7 concentrations. Therefore, the results of the statistical assessment of MW-8 indicates that the concentrations of the parameters of interest in MW-4, MW-6, and MW-7 represent background (i.e., ambient) groundwater conditions and not CKD-impacted groundwater.

6.0 RISK TO DOWNGRADIENT RECEPTORS

Although monitoring wells downgradient of the CKD potential source area have been shown to be reflective of ambient conditions, an assessment of the potential risk to downgradient receptors was also conducted.

6.1 Groundwater Flow Velocity

Groundwater velocity can be calculated and used to estimate conservative groundwater travel times within the formations intercepted by the monitoring wells at the Site. Estimating the groundwater travel time helps provide a better understanding as to whether or not the constituents of interest detected in the monitoring wells could possibly be attributed to CKD leachate and to understand the risk to potential receptors downgradient of the Site. Groundwater velocity is calculated using the formula:

$$V_s = \frac{Ki}{n_e}$$

Where:

V_s = Groundwater Velocity
K = Hydraulic Conductivity
i = Hydraulic Gradient
n_e = Effective Porosity

For the purposes of this Technical Revision, the focus is on the flow through the Niobrara Formation because it is the formation monitored for potential impacts downgradient of CKD disposal area A2. Therefore, the calculation was conducted for site wells screened in the Niobrara for which estimates of hydraulic conductivity (presented in Table 10) are available (MW-4, MW-6, and MW-7). Hydraulic conductivity values for the Niobrara Formation in these wells ranged from 1.4×10^{-3} ft/day (MW-4) to 8.3×10^{-3} ft/day (MW-7). In order to produce a conservative estimate of travel time (i.e., fastest travel time) of groundwater, the lowest reported effective porosity was used and no interactions between groundwater and rocks was assumed.

Five core samples of the Codell sandstone at the Boettcher Quarry were tested for porosity (Reservoirs Inc. 1987). Reservoirs Inc. reported porosities values ranging from 5% to 13% by volume (% BV). However, published porosity values for to the Niobrara Formation are as low as 4.3% BV (Micheals 2014).

The hydraulic gradient based on the November 2023 water levels from MW-1 and MW-6 is 0.27 feet per foot (ft/ft). This gradient is similar to the 16-degree dip (or a gradient of 0.28 ft/ft) of the beds which supports the understanding that groundwater flow is constrained by the to the dipping beds. As noted in Section 3.2, water levels in MW-6 do not recover to static conditions between semi-annual sampling event. Therefore, the gradient may be less, which would result in a lower calculated flow velocity.

The groundwater velocity (Vs) was calculated to be between 0.009 ft/day and 0.052 ft/day (Table 12). This groundwater velocity was used to calculate the time it will take for the groundwater to travel from the eastern edge of CKD disposal area A2 to MW-6 and the amended permit boundary. Travel time was then calculated based on the formula:

$$t = \frac{D}{V_s}$$

Where:

t = Travel Time
D = Distance
V_s = Groundwater Velocity

Based on this calculation, groundwater will travel 1 foot through the saturated rock formations beneath the Site in approximately 19 to 113 days. Calculated groundwater travel times are presented in Table 12, with the understanding that the assumed horizontal distances do not take into account the dip of the beds, which would result in longer flow paths. Furthermore, the groundwater velocity calculations do not take into consideration that the particle velocities of metals can be retarded due to sorption by bedrock units. Secor (1998) suggested that the native materials found beneath the Site sorb barium, lead, and thallium, suggesting that these metals would move more slowly than the advective groundwater velocity noted above.

Calculated groundwater travel times indicate that it will take between approximately 32 to 192 years for groundwater to travel from the eastern edge of CKD disposal area A2 to MW-6, and between 66 and 390 years for groundwater to travel from eastern edge of CKD disposal area A2 to the amended permit boundary.

It has been approximately 25 years since CKD disposal in area A2 began in the Fall of 1999, and it is estimated that groundwater has traveled between approximately 80 and 480 feet during that time. Therefore, groundwater that has come into contact with the CKD from area A2 is possibly being monitored in wells MW-3 and MW-2 located, 23 and 72 feet, respectively, downgradient of area A2. However, it is unlikely that groundwater that has come into contact with the CKD material in disposal area A2 is currently being monitored in the further downgradient wells MW-4, MW-6, and MW-7.

6.2 Groundwater Age Dating

To support the groundwater flow calculations and assess the recharge age for the water monitored in the Site wells relative to CKD disposal, groundwater samples were collected in August 2014 for tritium analysis from the Site wells installed at the time (except MW-5). Well MW-5 was not tested for tritium because of its proximity to a non-backfilled pit at the Site which likely acts as a localized recharge zone. A full discussion on the sampling event, analytical methods, and the calculation presented below, and its assumptions are provided in Golder (2015).

Tritium (^3H) is the radiogenic isotope of hydrogen and decays with a half-life of 12.23 years to helium (^3He). Although small amounts of tritium occur naturally through cosmic ray interactions with atmospheric gases, tritium was introduced to the environment in significant concentrations through nuclear weapons testing, which began in 1952. Tritium concentrations in the atmosphere peaked in 1963 (Clark and Fritz 1997). Since 1963, tritium concentrations in precipitation have decreased because of the discontinuation of weapons testing, exchange of water with the oceans, and the short half-life of tritium.

Therefore, assuming a simplified two-component system of a modern water (i.e., August 2014 water) and a pre-1952 water a mixing calculation was performed to calculate the percentage of pre-1952 water that would need to be mixed with current post-1952 recharge water to obtain the reported tritium concentration of the samples collected from each well[3]. The range of calculated pre-1952 water in each well is presented on Figure 7 and Table 13.

The calculations indicate that the Group 2 and Group 3 waters are predominantly older than 1952. As of the August 2014 sampling, well MW-2 and the more recently installed wells MW-6 and MW-7 had a calculated percentage of pre-1952 water between approximately 80% and 90%. Well MW-4 had the lowest percentage of estimated pre-1952 water at 78% to 83%, whereas MW-3 had the highest at 97%.

The percentages of pre-1952 water presented in Figure 7 and Table 13 are minimum estimates assuming the post-1952 percentage of the water has tritium levels similar to modern (August 2014) precipitation. If any part of the post-1952 portion of the water recharged prior to present day, tritium levels of the post-1952 portion of the water would be greater and a higher percentage of pre-1952 water would be calculated. Possible explanations for the presence of a small percentage of post-1952 water in the Site wells include (see Golder 2015 for further explanation):

- Residual drilling water.
- Recharge from the open pit until it was backfilled in 2001.
- Surface water seepage.
- Uncertainty in tritium precipitation levels.
- Analytical uncertainty.

While there is no way to differentiate between these potential sources and uncertainties, the percentage of pre-1952 waters in the Site wells are almost certainly higher than the range shown in Figure 7, indicating that there is a small contribution, if any, from recent recharge water, such as that from CKD leachate or the other sources listed above.

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[3] Mixing due to recharge is considered in this approach and the assumption is implicitly made that parallel flow paths would be similar (i.e. no dispersion or mixing into zones with different hydraulic properties). These are reasonable assumptions in this hydrogeologic regime.

6.3 Downgradient Receptors

A review of the well permits near the Boettcher Quarry included a search of the Colorado Division of Water Resources (DWR) online database for information on local well permits in March 2024. This review resulted in permits for 70 wells from within a mile of the Site permit boundary. The location of these wells is presented in Figure 9 and summarized in Table 14. The DWR search for wells was extended to approximately 8 miles in the area directly downgradient of CKD Area A2. These wells are presented with symbology based on depth (Figure 10) and permitted use (Figure 11).

The DWR search results has limited information on well screened intervals, water levels, and general lithology. In an effort to obtain further information on these permitted wells, the individual well permit DWR's online database was reviewed, and available information is included in Table 14. While the DWR database presents current and past well permit applications, only wells with a reasonable chance of currently existing (i.e., permit status of permit issued or well constructed) are presented on Figures 10 and Figure 11[4].

The majority of the well permits in the DWR database are west (hydraulically upgradient) of the CKD disposal area. Based on the dip of lithological units to the east, as shown in cross-section (Figure 3), only those wells that are located to the east of the CKD disposal area A2 have the potential to be screened across or immediately above the Niobrara/Codell contact.

As discussed in Section 3.2, based on the Site hydrogeology any potential groundwater effects to groundwater from CKD disposal area A2 hydraulically downgradient (east) of Site would likely be contained in the Niobrara and Codell Formations and would not come into contact with Perrie Shale and quaternary deposits overlying the Niobrara Formation.

However, as shown on the Figure 3 cross section, the screened interval of wells east of the Site (when known) is not deep enough to intercept the Niobrara/Codell contact. Since water quality in downgradient wells screened above the Niobrara/Codell contact would not be influenced by the presence of CKD disposal area A2, no potential downgradient receptors have been identified.

While there are no known groundwater wells downgradient of the Site, there are permitted oil and gas wells likely screened in the Niobrara-Codell. The closest of these oil and gas wells directly downgradient CKD disposal area A2 is approximately 6 miles east of Site.

7.0 SUMMARY AND RECOMMENDATIONS

This Technical Revision concludes that monitored groundwater constituent concentrations above the BSGW are not indicative of groundwater contamination from the placement of CKD at Boettcher Quarry. The statistical evaluation of MW-4, MW-6, and MW-7 concentrations as compared with side-gradient MW-8 concentrations discussed in Section 5 showed that each constituent of interest with concentrations above the BSGW represent background water quality and do not indicate a CKD leachate source.

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[4] Note that some wells presented in previous reporting have since been abandoned and are not included here.

The following additional observations support this conclusion:

- Elevated concentrations are related to ambient conditions not CKD. Naturally occurring barium, iron, chloride, uranium, selenium, and TDS concentrations are regionally elevated in groundwater associated with the Niobrara Formation (Section 4.1), providing a likely explanation for elevated values of analytes unrelated to the presence of CKD.
- The pattern of lower and higher concentrations is inconsistent with CKD as a source. If CKD in area A2 was an ongoing source for loading to the groundwater, higher concentrations would be expected in the Group 2 wells that are closer to CKD disposal area A2, than the Group 3 wells that are further downgradient (MW-4, MW-6, and MW-7). However, the data indicate that the opposite occurs (Section 4.3). The highest concentrations of most constituents are in groundwater samples from the Group 3 wells (MW-4, MW-6, and MW-7), which are located more than 500 feet from CKD disposal area A2. Group 2 wells (MW-2 and MW-3) are located less than 100 feet from the CKD disposal area and have lower concentrations of most constituents.
- Water types, concentration trends, and CKD leachate results are inconsistent with CKD materials as a source. SPLP leachate of the CKD materials is calcium-sulfate dominant and plots in a different region of a Piper diagram than water from the downgradient wells (Section 4.3). If the CKD was a source of elevated concentrations, sulfate and calcium would be expected to increase, and groundwater samples in the Piper diagram would migrate away from the sodium-chloride water type. However, following installation, concentrations of sulfate and calcium in Group 3 wells decreased, while concentrations of chloride increased, suggesting no mixing with CKD leachate. MW-8 water chemistry shown in Figure 8 is similar to other Group 3 wells and, as a side-gradient well, indicates that MW-4, MW-6 and MW-7 water chemistry is indicative of background water quality observed at MW-8. The SPLP leachate values for CKD indicate pH values and concentrations of arsenic, barium, chromium, lead, lithium, selenium, and thallium, and the majority of major ions would be expected to increase in groundwater if CKD was influencing groundwater concentrations. However, upward trending concentrations have not been observed (Section 4.3).
- Groundwater travels slowly and CKD-impacted water, if present, has not reached downgradient monitoring wells. As summarized further below, groundwater flow though the Niobrara Formation on Site is very slow, and it is unlikely that groundwater that has come into contact with the CKD material in disposal area A2 is currently being monitored in downgradient wells MW-4, MW-6 and MW-7 (Section 6.1).

Additionally, this Technical Revision concludes that if groundwater contamination occurred due to CKD materials, there would not be any impact on downgradient receptors, therefore, existing and reasonably potential future uses of groundwater are protected. This conclusion is supported by the following:

- Groundwater flow through the Niobrara Formation on Site is very slow as demonstrated by water levels in Group 3 wells not recharging to static conditions between semi-annual sampling events (Section 3.2).
- Based on the low hydraulic conductivity and slow groundwater velocities of the formations beneath the Site, CKD leachate migration to the eastern permit boundary would require more than 66 years (Section 6.1). This travel time estimate is considered a minimum estimated time as it does not account for constituent sorption by bedrock materials and the dipping beds, which would result in longer flow paths. Therefore, water in contact with CKD has not currently traveled beyond the amended permit boundary and would not be received by any off-Site receptors (if present) for centuries, if ever.

- Site groundwater tritium results (Section 6.3) demonstrate that the groundwater sampled from downgradient wells represents predominantly pre-1952 water, further supporting the understanding that groundwater flow though the Niobrara Formation on Site is very slow.
- No known permitted groundwater wells are screened within the Niobrara Formation within 9 miles of the Site (Section 6.3).

Based on these findings, WSP recommends:

1) Existing Site well MW-6 can be classified as the point of compliance in accordance with Construction Materials Rule 3.1.7(6) and (7) and requested well MW-9 is not necessary. MW-6 would be designated the point-of-compliance well as it is directly downgradient of the A2 and A2A CKD areas.
2) Approval of the demonstration provided herein, that in accordance with Construction Materials Rule 3.1.7(8) existing and reasonably potential future uses of groundwater are protected.
3) A discontinuation of the groundwater monitoring program for the Site.

WSP USA Inc.

Sara Harkins

Jennifer Thompson
Geochemist

Sara Harkins
Senior Geologist/Geochemist

J. Moreno

Joanna Moreno
Senior Technical Principal - Hydrogeology

JT/SH/JM/df

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TABLES

Table 1: Monitoring Well Construction Summary

Well No.	Easting[1] (feet)	Northing[1] (feet)	Elevation PVC Top [1] (feet)	Elevation Concrete Pad Top[1] (feet)	Well Installation Date[2]	Well Material Type	Well Depth[3] (ft bgs)	Screened Interval[4] (ft bgs)	Filter Pack Interval (ft bgs)	Bentonite Seal Interval (ft bgs)	Interperted Screened Unit
MW-1	3097466.02	1486791.74	5272.09	5,269.95	6/2/1998	2"/ SCH40 PVC	65.9	45.90	5 - 26	1 - 5	Niobrara/Codell Contact
MW-2	3097623.12	1487456.76	5266.03	5,263.95	6/1/1998	2"/ SCH40 PVC	112	89	87 - 109	81.5 - 87	Niobrara/Codell Contact
MW-3	3097728.68	1486250.38	5261.03	5,258.80	6/1/1998	2"/ SCH40 PVC	107.2	84	81.5 - 113	77.5 - 81.5	Niobrara/Codell Contact
MW-4	3098893.31	1484259.44	5246.13	5,243.77	April, 1999	2"/ SCH40 PVC	188.3	168	unknown	unknown	unknown
MW-5	3097213.94	1489893.21	5276.42	5,273.86	11/30/2012	2"/ SCH40 PVC	57.4	37.3	35.2 - 57.4	32.7 - 35.2	Silt Overburden
MW-6	3098238	1486747.45	5239.68	5,237.64	12/19/2012	4"/ SCH40 PVC	229.7	209.4	205.5-231.1	203.0-205.5	Niobrara
MW-7	3098804.41	1484797.04	5219.61	5,217.22	12/15/2012	4"/ SCH40 PVC	259.2	238.8	236.1-259.2	231.2-236.1	Niobrara
MW-8	3097714.4	1489961.5	5250.5	5,247.50	11/13/2020	4"/ SCH40 PVC	235	205.6	202.1- 227	199.3-202.1	Niobrara

Notes: 1-Coordinates are in Colorado State Plane North Grid NAD 83 and elevations are on NAD 88 datum. Top of well pads about 6 inches above land surface.

2- MW-5 through MW-8 installation date is date the well, filter pack and grout placement were installed in the borehole, but completion with concrete pad, bollards and protective steel riser was conducted at a later date.

3- Well total depths for MW-1 through MW-4 measured by Golder 7/30/2010 from the top of the PVC well casing top; bls = below land surface. Borehole and well construction logs were unavailable for MW-4. Information provided for MW-4 was obtained from a video survey of the well performed on July 30, 2010. MW-1 well casing likely extended sometime after construction based on differences in drilled depth based from borehole log and total depth measurement made 7/30/2010; was reduced by 0.30 feet on 01/10/2013 to enable closing and securing the steel protective riser lid.

4- Screened interval is the depth interval of the nominal length of the screen pipe section, and not the actual measured length of the perforations provided on the well construction diagrams.

bgs = Below Group Surface

Table 2: Summary of Monitoring Results for MW-1

Date	Colorado Basic Standards for Groundwater	5/26/1999	7/21/1999	9/16/1999	11/10/1999	1/19/2000	3/13/2000	5/16/2000	7/10/2000	9/27/2010	3/31/2011	6/28/2011	8/31/2011	11/17/2011	3/27/2012	6/27/2012	9/13/2012	11/13/2012	3/19/2013	5/28/2013	8/26/2013	11/14/2013	2/18/2014	5/21/2014
Metals																								
Arsenic, Dissolved (mg/L)	0.01	NA	<0.005 U	0.002 B	0.0046	**0.02** B	**0.027**	0.01 B	**0.013** B	**0.015**	0.005 B	0.01 B	**0.011**	<0.01 U	<0.01 U	0.003 B	0.001 B	0.002 B	0.002 B	<0.005 U	0.002 B	<0.005 U	0.001 B	0.001 B
Barium, Dissolved (mg/L)	2	<0.05 U	0.013 B	<0.05 U	<0.05 U	0.02 B	<0.05 U	<0.05 U	0.014	<0.08 U	0.04 B	0.005 B	<0.08 U	<0.08 U	0.017 B	<0.08 U	0.02 B	0.02 B	0.011 B	<0.08 U	<0.08 U	0.011 B	0.008 B	0.004 B
Boron, Dissolved (mg/L)	0.75	0.36	0.35	0.41	0.46	0.5	0.46	0.51	0.5	0.54	0.59	0.58	0.64	0.64	0.62	0.59	0.71	0.73	0.64	0.69	0.61	0.6	0.61	0.57
Chromium, Dissolved (mg/L)	0.1	<0.3 U	<0.1 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.05	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U
Copper, Dissolved (mg/L)	0.2	0.06 B	<0.1 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.05	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.05 U	<0.05 U
Iron, Dissolved (mg/L)	0.3	<0.3 U	<0.1 U	<0.3 U	<0.3 U	0.14 B	<0.3 U	0.1 B	<0.05	<0.3 U	0.3	<0.05 U	<0.3 U	0.2 B	0.15	**1.4**	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.05 U	<0.05 U
Lead, Dissolved (mg/L)	0.05	<0.01 U	<0.005 U	<0.005 U	<0.001 U	<0.05 U	<0.005 U	0.013	<0.005	0.0019 B	0.0027 B	0.0052	0.0045	0.0007 B	<0.003 U	0.0035	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U
Lithium, Dissolved (mg/L)	2.5	1.1	1.21	1	1	1.2	1.1	1.2	1.05	1.3	1.3	1.18	1.2	1.1	1.15	1.1	1.1	1.2	NA	NA	NA	NA	NA	NA
Manganese, Dissolved (mg/L)	0.05	**0.08** B	0.05	**0.09** B	**0.1**	**0.06**	0.04 B	0.05 B	**0.053**	<0.1 U	0.05 B	0.041	<0.1 U	<0.1 U	0.026 B	0.04 B	0.04 B	0.04 B	0.025	<0.1 U	0.04 B	0.044	**0.054**	0.033
Selenium, Dissolved (mg/L)	0.02	**0.35**	**0.27**	**0.19**	**0.093**	**0.078**	**0.054**	**0.046**	**0.101**	**0.4928**	**0.2684**	**0.2656**	**0.2826**	**0.275**	**0.2328**	**0.2204**	**0.1995**	**0.1756**	**0.1826**	**0.2278**	**0.257**	**0.2616**	**0.2067**	**0.2775**
Thallium, Dissolved (mg/L)	0.002	<5 U	<0.01 U	<5 U	0.00014 B	<0.005 U	<0.001 U	<0.003 U	0.0007 B	0.0016 B	**0.0025** B	0.0014 B	0.0017 B	<0.003 U	<0.003 U	0.0007 B	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	0.0192	0.019	0.0205	0.0199	0.0193	**0.0364**	**0.0303**	**0.0397**	**0.0344**	**0.0403**	**0.0338**	**0.0367**	**0.0433**	**0.0371**	NA	NA	NA	NA	NA	NA
Zinc, Dissolved (mg/L)	2	<0.3 U	<0.1 U	<0.3 U	<0.3 U	0.07 B	<0.3 U	<0.3 U	<0.05	0.13 B	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.3 U	0.02	<0.3 U	<0.3 U	<0.05 U	0.01 B	<0.05 U
Other																								
Chloride (mg/L)	250	20	18	36	22	31	28	25	25	<300 U	<300 U	<300 U	40 B	36.4 B	50 B	<250 U	<250 U	<250 U	86 B	<250 U	55.5 B	<250 U	<250 U	<250 U
Fluoride (mg/L)	2	0.7	0.7	0.6	0.6	0.8	0.7	0.6	0.5	0.4 B	0.5	0.4 B	0.4 B	0.6	0.6	0.6	0.6	0.7	0.6	0.5	0.5	0.5	0.5	0.44
Nitrate as N (mg/L)	10	**14.3**	**19.5**	**19.6**	**14**	9.4	NA	3.77	3.28	**96**	**88**	**70**	**81.6**	**81**	**76**	**89**	**85**	**78.5**	NA	NA	NA	NA	NA	NA
Nitrite as N (mg/L)	1	0.07	0.16	<1	0.56	0.03	NA	0.04 B	0.66	0.24	0.36	0.34	0.4	0.26	0.29	0.56	0.21	0.11	NA	NA	NA	NA	NA	NA
Nitrate+Nitrite as N (mg/L)	10	**14.4**	**19.7**	**19.6**	**14.6**	9.5	NA B	3.81	3.94	**96**	**88**	**70**	**82**	**81**	**76**	**90**	**85**	**78.6**	NA	NA	NA	NA	NA	NA
Lab pH (s.u)	6.5 - 8.5	8	7.3	7.4	7.6	8.1	7.5	7.5	7.6	8.1 H	8.1 H	8.0 H	8.0 H	8.0 H	8.0 H	8.1 H	8.2 H	8.2 H	8.1 H	8.0 H	8.0 H	7.8 H	7.9 H	7.8 H
Total Dissolved Solids, filterable residue (mg/L)	8595	7,690.0	7,000.0	6,820.0	7,190.0	6,650.0	6,810.0	6,750.0	6,020.0	7,770	7,560	7,610	7,540	7,110	7,150	6,770	6,770	6,660	6,610	7,420	6,650 H	7,800 H	7,330	6,910 H
Sulfate (mg/L)	250	**5,210**	**4,780**	**4,470**	**5,180**	**4,530**	**4,370**	**4,410**	**4,000**	**4,840**	**4,540**	**4,820**	**4,620**	**4,306**	**4,056**	**4,090**	**4,041**	**3,991**	**3,980**	**4,610**	**4,230**	**5,150**	**4,980**	**6,850**
Gross Alpha (pCi/L)	15.0	**32**	**62**	**45**	**88**	0	**35**	2.7	4.9	**41 (±31)**	**53 (±31)**	**22 (±25)**	5.8 (±29)	**32 (±30)**	**48 (±30)**	**180 (±52)**	**24 (±23)**	-0.51 (±22)	NA	NA	NA	NA	NA	NA
Gross Beta (pCi/L)	**	0	69	25	100	0.7	18	0	53	39 (±28)	36 (±28)	20 (±28)	23 (±32)	27 (±31)	8.1 (±25)	190 (±36)	25 (±29)	12 (±27)	NA	NA	NA	NA	NA	NA
Field Parameters (Not Available pre-2010))																								
Field pH (s.u)	6.5 - 8.5	NA	NA	NA	NA	NA	NA	NA	NA	7.4	7.42	7.27	7.42	7.42	7.6	7.36	7.42	7.62	7.59	7.23	7.34	7.4	7.39	7.15
Field Conductivity (µS/cm)	none	NA	NA	NA	NA	NA	NA	NA	NA	904	860	7,390	7,960	6,580	7,830	37.21	6,170	7,740	7,620	8,210	7,800	8,888	8,180	9,650
Temperature (Degrees Celsius)	none	NA	NA	NA	NA	NA	NA	NA	NA	16.83	14.6	18.7	20.9	16.1	15.6	18.4	16.1	14.6	14.3	16.3	17.1	13.62	14	15.9
Supplementary Analytes (Not Historically analyzed)																								
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bicarbonate as CaCO3 (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	279	305	309	312	311	333	334	285	337	334	334	330	320	357	333
Carbonate as CaCO3 (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	323	225	305	270	240	198	222	218	169	178	276	258	302	254	330
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	336	240	313	272	246	210	213	203	175	180	265	225	308	256	364
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	22	18	22.7	17	15	14.8	17	17	13	14.5	19	20	20.7	16.5	18.9
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	1,660	1,800	1,680	1,670	1,610	1,680	1,630	1,650	1,770	1,670	1,660	1,580	1,820	1,790	1,910
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 2: Summary of Monitoring Results for MW-1

Date	Colorado Basic Standards for Groundwater	8/27/2014	11/11/2014	2/18/2015	5/27/2015	8/27/2015	11/9/2015	2/15/2016	5/31/2016	8/16/2016	11/9/2016	5/31/2017	11/15/2017	6/6/2018	11/15/2018	6/12/2019	12/12/2019	6/4/2020	12/14/2020	6/23/2021	12/8/2021	6/23/2022	11/21/2022	6/1/2023	11/16/2023
Metals																									
Arsenic, Dissolved (mg/L)	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.001 B	0.0018	0.002 B	0.0027	0.00163	<0.005 U	0.00135 B	0.00145 B	<0.01 U	0.00244 B	0.00104 B
Barium, Dissolved (mg/L)	2.0	0.006 B	0.007 B	0.009 B	<0.08 U	<0.08 U	<0.08 U	0.03 B	<0.08 U	<0.08 U	0.007 B	<0.08 U	<0.08 U	<0.08 U	<0.08 U	<0.2 U	<0.04 U	0.041	0.0104	0.00929 B	0.00991 B	0.0105 B	0.00869 B	0.0176	0.0104 B
Boron, Dissolved (mg/L)	0.75	0.56	0.58	0.59	0.55	0.57	0.52	0.60	0.51	0.51	0.56	0.61	0.61	0.65	0.62	0.70	0.60	0.68	0.744	0.644	0.658	0.645	**0.770**	**0.795**	0.722
Chromium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	<0.002 U	<0.003 U	0.001 B	<0.002 U	<0.01 U	<0.01 U	<0.01 U	<0.02 U	<0.01 U	<0.01 U
Copper, Dissolved (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	0.0028 U	<0.004 U	<0.004 U	<0.002 U	<0.01 U	0.0107	<0.01 U	<0.02 U	<0.01 U	<0.01 U
Iron, Dissolved (mg/L)	0.3	<0.05 U	<0.05 U	<0.05 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	0.018 U	<0.2 U	**0.93**	<0.3 U	<0.75 U	<0.15 U	<0.75 U	<0.75 U	0.234	<0.15 U
Lead, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	<0.0005 U	<0.0005 U	0.002	<0.0005 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	0.00083 B	<0.0025 U
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.13	1.23	1.05	1.09	1.09	1.24	1.28	1.13	1.06	1.12	1.06
Manganese, Dissolved (mg/L)	0.05	0.045	0.041	**0.052**	<0.1 U	0.04 B	<0.1 U	0.04 B	<0.1 U	<0.1 U	0.04	<0.1 U	<0.1 U	<0.1 U	0.022	0.05 B	0.03	0.035	0.038	**0.0741**	**0.0904**	**0.053**	**0.074**	**0.204**	**0.100**
Selenium, Dissolved (mg/L)	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0904**	**0.0998**	**0.0474**	**0.0378**	**0.0271**	**0.219**	**0.034**	0.0174	0.00473	0.0015	**0.0546**
Thallium, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	<0.0005 U	<0.0003 U	<0.001 U	<0.00125 U	0.000465 B	<0.00125 U	<0.00125 U	0.00045 B	0.00007 B	<0.00125 U
Uranium, Dissolved (mg/L)	0.0300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.035**	**0.0352**	**0.0407**	**0.0385**	**0.0308**	**0.0452**	**0.0406**	**0.0395**	**0.0334**	**0.0386**	**0.0435**
Zinc, Dissolved (mg/L)	2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.3 U	<0.3 U	<0.05 U	<0.03 U	<0.015 U	<0.075 U	<0.075 U	<0.075 U	<0.15 U	<0.075 U	<0.075 U
Other																									
Chloride (mg/L)	250	<250 U	<250 U	68.9 B	154 B	<250 U	<250 U	<250 U	<250 U	<250 U	47.5 B	32.2 B	41.3 BH	27.5 B	<200 U	<200 U	36.2 B	36.8 B	36.6 B	<200 U	<200 U	25.4 B	<200 U	<200 U	<200 U
Fluoride (mg/L)	2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.62	0.60	0.70	0.60	0.62	0.44	0.58	0.54	0.63	0.55	0.57
Nitrate as N (mg/L)	10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**15**	**17**	5.93	2.42	0.857	**13** H	2.96	0.468	<0.1 U	0.041 B	6.07
Nitrite as N (mg/L)	1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.06	0.17	0.04 B	0.02 B	0.013 B	0.14 H	<0.05 U	0.013 B	<0.05 U	<0.05 U	0.01 B
Nitrate+Nitrite as N (mg/L)	10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**15.2**	**16.8**	5.97	2.44	0.87	**13.5** H	2.96	0.481	<0.1 U	0.041 B	6.08
Lab pH (s.u)	6.5 - 8.5	7.8 H	8.0 H	7.9 H	7.9 H	8.0 H	7.9 H	7.84	7.9 H	8.1 H	8.1 H	8.2 H	8.0 H	8.3 H	8.2	7.9 H	8.2 H	8.2 H	8.2 H	8.1 H	8.2 H	8.2 H	8.2 H	8.2 H	8.0 H
Total Dissolved Solids, filterable residue (mg/L)	8595	6,950	7,900	7,380	8,210 ^	7,760 ^	8,020	7,660	8,450	8,040	7,460	7,010	7,070	7,240	6,910	6,670	6,280	6,320	6,110	8,260	8,190	6,780 H	6,720	6,280	5,770
Sulfate (mg/L)	250	**4,670**	**4,300**	**4,800**	**5,540**	**5,640**	**5,430**	**5,250**	**5,470**	**5,540**	**4,700**	**4,690**	**4,340** H	**4,530**	**5,090**	**5,040**	**4,230**	**4,120**	**4,470**	**5,730**	**5,750**	**4,400**	**4,170**	**4,480**	**3,990**
Gross Alpha (pCi/L)	15.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**40 (±31)**	**20 (±18)**	**54 (±26)**	**67 (±26)**	**39 (±25)**	7.6 (±18)	**43 (±36)**	5.2 (±24)	**18 (±25)**	**45 (±28)**	**52 (±30)**
Gross Beta (pCi/L)	**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	33 (±29)	28 (±22)	7.9 (±19)	22 (±22)	13 (±21)	-5.6 (±23)	17 (±34)	26 (±32)	16 (±26)	-6.2 (±20)	30 (±22)
Field Parameters (Not Available pre-2010))																									
Field pH (s.u)	6.5 - 8.5	7.35	7.4	7.3	6.99	7.42	7.78	7.84	7.39	7.34	7.56	8.46	7.71	7.46	7.64	7.69	7.85	7.80	7.73	7.46	7.54	7.38	7.61	7.54	7.52
Field Conductivity (µS/cm)	none	8,560	8,600	5,330	8,050	9,130	7,000	6,580	7,650	8,610	8,280	8,380	7,520	8,480	7,900	6,740	4,890	5,700	6,929	7,998	8,895	8,567	6,378	6,953	7,551
Temperature (Degrees Celsius)	none	15.3	9.1	14.3	16	15.8	16.3	13.9	17	18	16.5	16.5	12.9	17	16.6	17.2	13.1	16.5	13.6	17.3	13.84	15.1	13.4	14.3	13.9
Supplementary Analytes (Not Historically analyzed)																									
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.8 U	<1 U	<0.3 U	1.93	0.058	<0.075 U	0.10	<0.075 U	<0.15 U	0.127	<0.075 U
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.004 B	0.0021	0.004 B	0.0024 B	0.00171 B	<0.01 U	0.00233 B	0.00212 B	<0.01 U	<0.01 U	0.00243 B
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.0003 U	<0.0004 U	<0.0003 U	<0.00025 U	<0.00125 U	<0.00125 U	<0.00125 U	<0.00125 U	0.00047 B	<0.00125 U
Bicarbonate as CaCO3 (mg/L)	none	310	325	NA	320	302	306	319	307	329	325	369	361	358	NA	376 H	402	458	421	342	358	413	454	514	471 H
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	NA	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	3.1 B	NA	<20 UH	<2 U	<20 U	<20 U	<20 U	6.7 B	<20 U	<20 U	<20 U	<20 UH
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.0003 U	<0.0003 U	0.0002 B	<0.00025 U	<0.00125 U	<0.00125 U	<0.00125 U	<0.0025 U	0.000418 B	<0.00125 U
Calcium, Dissolved (mg/L)	none	287	309	230	301	320	289	279	345	275	269	187	175	220	163	171	131	110	109	299	161	136	118	114	120
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0018	0.00349	0.0019	0.002	0.00168	0.00708	0.00308	0.00269	0.00299	0.0053	0.00264
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	<0.01 U	<0.003 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 UH	<0.01 U	<0.01 U
Magnesium, Dissolved (mg/L)	none	297	303	247	300	342	301	290	376	301	283	202	188	225	175	170	135	116	116	308	178	139	125	120	124
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.001 U	<0.0002 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.085	0.1 B	0.09	0.084	0.0737	0.0754	0.0826	0.0695	0.0587	0.0559	0.069
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.009 B	<0.2 U	0.007	0.0077	0.00692	0.0261	0.00881	0.00927	0.00695 B	0.00867	0.00953
Potassium, Dissolved (mg/L)	none	19.4	21.8	15.6	19	20	18	18.6	22	16	20.5	13	12	16	12	13	10	10.1	9.56	19.3	11.6	10.7	8.52	9.36	10.3
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	<0.0005 U	<0.0005 U	<0.001 U	<0.0005 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.005 U	<0.0025 U
Sodium, Dissolved (mg/L)	none	1,570	1,510	1,770	1,670	1,740	1,770	1,720	1,570	1,710	1,640	1,710	1,660	1,650	1,760	1,730	1,710	1,680	1,640	1,630	1,850	1,790	1,750	1,730	1,730
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1 U	<0.1 U	<0.003 U	<0.002 U	<0.002 U	<0.01 U	<0.01 U	<0.01 U	<0.02 U	<0.01 U	<0.01 U

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 3: Summary of Monitoring Results for MW-2

Date	Colorado Basic Standards for Groundwater	4/28/1999	7/21/1999	9/16/1999	11/10/1999	1/19/2000	3/13/2000	5/16/2000	7/10/2000	9/27/2010	3/31/2011	6/28/2011	8/31/2011	11/17/2011	3/27/2012	6/27/2012	9/13/2012	11/13/2012	3/19/2013	5/28/2013	8/26/2013	11/14/2013	2/18/2014	5/21/2014
Metals																								
Arsenic, Dissolved (mg/L)	0.01	NA	0.003 B	0.004 B	**0.0567**	**0.05** B	**0.045**	**0.062**	**0.042**	**0.036**	**0.021**	**0.03**	**0.036**	<0.01 U	<0.01 U	<0.01 U	<0.005 U	0.001 B	0.002 B	0.001 B	0.002 B	0.001 B	0.004 B	0.006
Barium, Dissolved (mg/L)	2	0.4	0.42	0.41	0.41	0.4	0.42	0.41	0.398	**2.09**	1.33	1.09	0.96	1.09	1.42	1.55	1.72	1.26	1.3	1.07	1.23	1.22	1.74	**2.28**
Boron, Dissolved (mg/L)	0.75	0.73	0.74	0.72	0.74	0.69	0.73	0.74	0.67	0.7	0.64	0.69	**0.78**	0.64	0.73	0.72	0.70	**0.79**	0.71	**0.76**	0.70	0.74	0.7	0.75
Chromium, Dissolved (mg/L)	0.1	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.05 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U
Copper, Dissolved (mg/L)	0.2	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.05 U	<0.05 U
Iron, Dissolved (mg/L)	0.3	<0.3 U	<0.3 U	0.27 B	0.11 B	0.16 B	0.2 B	**0.5**	0.07	<0.3 U	0.1 B	0.15	<0.3 U	0.3 B	**0.91**	**0.8**	**0.7**	0.16	**1.1**	0.2 B	**0.9**	**1.3**	**1.51**	**2.5**
Lead, Dissolved (mg/L)	0.05	<0.005 U	<0.005 U	0.001 B	<0.005 U	<0.005 U	<0.005 U	0.005 B	0.002 B	<0.003 U	<0.003 U	0.0011 B	0.0006 B	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U
Lithium, Dissolved (mg/L)	2.5	1	1	1	1	1	1.1	1	0.91	1.3	1.2	1.12	1.1	1.1	1.16	1.2	1.2	1.36	NA	NA	NA	NA	NA	NA
Manganese, Dissolved (mg/L)	0.05	**0.49**	**0.44**	**0.4**	**0.33**	**0.33**	**0.33**	**0.33**	**0.329**	**0.08** B	**0.12**	**0.139**	**0.1**	**0.12**	**0.102**	**0.06** B	**0.06** B	**0.114**	**0.121**	**0.09**	**0.11**	**0.127**	**0.099**	**0.097**
Selenium, Dissolved (mg/L)	0.02	<0.005 U	0.002 B	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	0.0006 B	0.0015	0.0006 B	<0.001 U	<0.001 U	<0.001 U	<0.001 U	0.0008 B	0.0007 B	0.0011	0.0032	<0.001 U	0.0006 B	<0.001 U	0.0007 B
Thallium, Dissolved (mg/L)	0.002	<0.01 U	<0.01 U	<5 U	<0.0003 U	<0.005 U	<0.001 U	<0.003 U	<0.003 U	<0.003 U	0.0007 B	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U	<0.003 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	0.00465	0.005	0.0041	0.0037	0.0042	0.0048	0.0033	0.0025 B	<0.003 U	0.0011 B	0.0009 B	0.0012 B	0.0012 B	0.0012 B	NA	NA	NA	NA	NA	NA
Zinc, Dissolved (mg/L)	2	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.05 U	<0.05 U
Other																								
Chloride (mg/L)	250	**2,890**	**2,260**	**2,670**	**2,700**	**2,240**	**2,880**	**3,100**	**2730**	**3,050**	**3,100**	**3,090**	**3,240**	**3,017**	**3,052**	**3,079**	**3,188**	**2,968**	**3,227**	**3,220**	**2,960**	**3,080**	**3,180**	**3,240**
Fluoride (mg/L)	2	1.7	1.8	1.7	1.5	1.8	1.7	**2.1**	1.8	1.7	1.5	1.5	1.4	1.6	1.5	1.6	1.5	1.7	1.7	1.6	1.6	1.5	1.5	1.48
Nitrate as N (mg/L)	10	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.03	NA	<0.1 U	<0.1 U	0.14	0.07 B	0.06 B	0.03 B	<0.1 U	0.04 B	0.04 B	0.03 B	0.04 B	NA	NA	NA	NA	NA	NA
Nitrite as N (mg/L)	1	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	NA	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	NA	NA	NA	NA	NA	NA
Nitrate+Nitrite as N (mg/L)	10	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.03 B	NA	<0.1 U	<0.1 U	0.14	0.07 B	0.06 B	0.03 B	<0.1 U	0.04 B	0.04 B	0.03 B	0.04 B	NA	NA	NA	NA	NA	NA
Lab pH (s.u)	6.5 - 8.5	8.2	8.2	8.1	8	8.5	7.9	8	8.1	**8.6** H	8.2 H	8.4 H	8.3 H	8.2 H	8.3 H	8.3 H	**8.6** H	8.3 H	8.3 H	8.3 H	8.2 H	8.1 H	8.0 H	8.0 H
Total Dissolved Solids, filterable residue (mg/L)	7084	5,680.0	5,640.0	5,680.0	5,700.0	5,600.0	5,740.0	5,600.0	5,700.0	6,270	6,390	6,350	6,320	6,140	6,340	6,120	6,270	6,180	6,300	6,400	6,210 H	6,150 H	5,720	6,040 H
Sulfate (mg/L)	250	140	160	190	210	240	220	220	220	<300 U	60 B	90 B	<100 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U
Gross Alpha (pCi/L)	15	NA	**44**	0	**140**	0.9	0	1	8.4	**15 (±26)**	9.8 (±25)	**18 (±24)**	0 (±26)	**38 (±38)**	-1.1 (±21)	5.1 (±12)	-6.2 (±13)	-12 (±21)	NA	NA	NA	NA	NA	NA
Gross Beta (pCi/L)	**	NA	81	52	80	52	19	26	0	4.5 (±30)	42 (±31)	12 (±29)	0 (±27)	73 (±44)	8.5 (±29)	82 (±30)	21 (±26)	11 (±28)	NA	NA	NA	NA	NA	NA
Field Parameters (Not Available pre-2010))																								
Field pH (s.u)	6.5 - 8.5	NA	NA	NA	NA	NA	NA	NA	NA	8.71	7.84	7.98	7.54	7.91	8.2	7.61	9.58	8.11	7.6	7.74	7.61	7.61	7.6	7.32
Field Conductivity (µS/cm)	none	NA	NA	NA	NA	NA	NA	NA	NA	1,169	1,088	10,160	10,350	10,500	10,630	11	10,640	10,520	6,840	1,130	10,840	11,220	10,440	11,040
Temperature (Degrees Celsius)	none	NA	NA	NA	NA	NA	NA	NA	NA	15.47	16	21.4	22.4	12.5	14.5	14.6	19.4	13.9	12.2	20.8	18.7	12.58	12.9	16.7
Supplementary Analytes (Not Historically analyzed)																								
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bicarbonate as CaCO3 (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	993	965	978	953	914	995	968	964	978	955	963	979	1020	1,060	1,100
Carbonate as CaCO3 (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	108	<20 U	37	22	57	<20 U	21	<20 U	23	29	22	<20 U	<20 U	<20 U	<20 U
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	14	14	14.4	16	15	15.5	14	16	16.3	15.1	18	17	16.9	17.6	18.2
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	8	8	7.8	7	7	7.4	8	8	8	7.5	8	7	7.4	7.3	6.9
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	7 B	8 B	7.4	4 B	6 B	6.6	7 B	7 B	10.8 B	7.0	7	6 B	6.1	6.2	6.5
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	2,480	2,430	2,470	2,410	2,260	2,410	2,420	2,420	2,310	2,550	2,500	2,540	2,490	2,440	2,440
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 3: Summary of Monitoring Results for MW-2

Date	Colorado Basic Standards for Groundwater	8/27/2014	11/11/2014	2/18/2015	5/27/2015	8/27/2015	11/9/2015	2/15/2016	5/31/2016	8/16/2016	11/9/2016	5/31/2017	11/15/2017	6/6/2018	11/15/2018	6/12/2019	12/12/2019	6/4/2020	12/14/2020	6/23/2021	12/8/2021	6/23/2022	11/21/2022	6/1/2023	11/17/2023
Metals																									
Arsenic, Dissolved (mg/L)	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.004 B	0.0063	0.004 B	0.0043	0.00527	0.0041 B	0.00377 B	0.0039 B	<0.01 U	0.00295 B	0.00295 B
Barium, Dissolved (mg/L)	2.0	**2.57**	1.71	**2.03**	**2.65**	**2.04**	1.90	2.0	1.93	**2.23**	1.88	**2.61**	**2.77**	**3.32**	**3.22**	**3.19**	**3.85**	**3.75**	**2.99**	**3.38**	**3.11**	**3.69**	**3.28**	**3.89**	**3.38**
Boron, Dissolved (mg/L)	0.75	0.75	0.74	0.73	0.72	0.75	0.68	**0.79**	0.68	0.73	0.71	**0.77**	0.72	**0.78**	0.75	**0.80**	**0.76**	**0.76**	**0.784**	**0.802**	**0.762**	0.711	0.741	**0.757**	0.741
Chromium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	<0.002 U	<0.003 U	<0.002 U	<0.002 U	<0.01 U	<0.01 U	<0.01 U	<0.02 U	<0.01 U	<0.01 U
Copper, Dissolved (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.005 B	<0.002 U	<0.004 U	<0.002 U	<0.002 U	<0.01 U	<0.01 U	<0.01 U	<0.02 U	<0.01 U	<0.01 U
Iron, Dissolved (mg/L)	0.3	**1.16**	**0.82**	**0.38**	**0.60**	**0.70**	**0.40**	**0.40** B	0.20 B	**1.20**	0.28	**0.50**	0.30	0.30	**0.40**	**0.40**	**0.38**	**0.37**	**0.34**	<0.75 U	0.226	**0.588** B	**0.373** B	0.258	0.24
Lead, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	<0.0005 U	<0.0005 U	<0.0005 U	<0.0005 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.0025 U	<0.0025 U
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.16	1.31	1.83	1.19	1.16	1.15	1.23	1.14	1.09	1.17	1.17
Manganese, Dissolved (mg/L)	0.05	**0.105**	**0.103**	**0.075**	0.05 B	**0.07** B	**0.08** B	**0.08** B	0.05 B	**0.10**	**0.06**	0.05 B	<0.1 U	**0.06** B	0.04 B	**0.07** B	**0.054**	**0.0639**	**0.0556**	**0.0577**	**0.0598**	**0.0529**	**0.0742**	**0.0527**	**0.0538**
Selenium, Dissolved (mg/L)	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	0.0004	<0.0005 U	<0.001 U	<0.005 U	<0.00125 U	<0.00125 U	<0.00125 U	<0.0025 U	<0.005 U	<0.005 U
Thallium, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	<0.0005 U	<0.00005 U	<0.001 U	<0.00125 U	0.000329 B	<0.00125 U	<0.00125 U	<0.00125 U	<0.00025 U	<0.00125 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0028 B	0.0028	0.0026 B	0.0028	0.00232	0.00246 B	0.00227 B	0.00303	0.00302 B	0.00219 B	0.00193 B
Zinc, Dissolved (mg/L)	2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.3 U	<0.3 U	<0.05 U	<0.02 U	<0.015 U	<0.075 U	<0.075 U	<0.075 U	<0.15 U	<0.075 U	<0.075 U
Other																									
Chloride (mg/L)	250	**2,930**	**2,980**	**2,990**	**3,150**	**3,100**	**3,040**	**3,240**	**3,120**	**3,110**	**3,010**	**3,170**	**3,070**	**3,030**	**3,530**	**3,340**	**3,130**	**3,090**	**3,820**	**3,250**	**3,290**	**3,630**	**3,420**	**3,280**	**3,470**
Fluoride (mg/L)	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3	1.6	1.4	1.3	1.39	1.46	1.48	1.35	1.34	1.4	1.61
Nitrate as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.08 B	<0.1 U	0.67	0.06	<0.1	<0.1 UH	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.082 B
Nitrite as N (mg/L)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05 U	<0.05 U	<0.01 U	<0.05 U	<0.05 U	<0.05 UH	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.08 B	<0.1 U	0.67	0.06 B	<0.1 U	<0.1 UH	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.082 B
Lab pH (s.u)	6.5 - 8.5	8.0 H	8.3 H	8.0 H	8.0 H	8.3 H	8.2 H	8.3	8.1 H	8.4 H	8.4 H	8.2 H	8.0 H	8.0 H	8.2 H	8.0 H	8.1 H	8.1 H	8.1 H	8.3 H	8.0 H	8.2 H	8.4 H	8.31 H	8.1 H
Total Dissolved Solids, filterable residue (mg/L)	7084	5,730	6,180	6,230	6,000 ^	5,520 ^	6,020	6,230	6,080	6,010	6,300	6,160	6,400	6,270 H	6,280	6,310	6,210	6,260	6,450	6,270	6,400	6,280 H	6,370	6,230	6,160
Sulfate (mg/L)	250	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<125 U	<250 U	<125 U	<250 U	<200 U	22 B	<100 U	<100 U	<40 U	<100 U	<200 U	<100 U	<100 U	<100 U	<200 U	<200 U	<200 U
Gross Alpha (pCi/L)	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**20 (±18)**	0.14 (±18)	54 (±26)	**20 (±21)**	11 (±23)	7.6 (±18)	43 (±36)	**5.2 (±24)**	18 (±25)	45 (±28)	52 (±30)
Gross Beta (pCi/L)	**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25 (±21)	-3.9 (±30)	7.9 (±19)	22 (±22)	-3.2 (±26)	-5.6 (±23)	17 (±34)	26 (±32)	16 (±26)	-6.2 (±20)	30 (±22)
Field Parameters (Not Available pre-2010))																									
Field pH (s.u)	6.5 - 8.5	6.95	7.6	7.56	7.38	7.53	7.99	8.28	7.51	7.63	7.53	8.02	8.06	7.93	7.53	8.15	8.04	8.03	7.82	8.02	7.95	7.47	7.53	7.70	7.74
Field Conductivity (µS/cm)	none	11,310	11,100	11,440	9,630	11,050	6,750	8,770	10,020	10,890	10,510	10,360	10,570	11,060	11,000	11,080	6,730	8,600	9,622	10,340	11,199	11,428	8,675	9,660	10,621
Temperature (Degrees Celsius)	none	15.7	7.5	11.7	17.3	17.6	14.9	16.8	15.6	17.1	14.3	18.5	12.2	18.1	13.9	18.6	13.3	20	11.5	20.7	13.8	16.1	11	14.9	12.9
Supplementary Analytes (Not Historically analyzed)																									
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.8 U	<1 U	<0.05 U	<0.02 U	<0.015 U	<0.075 U	<0.075 U	<0.075 U	<0.15 U	<0.075 U	<0.075 U
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	0.0023	0.003 B	0.0017 B	<0.01 U	<0.01 U	<0.01 U	0.00349 B	<0.01 U	<0.01 U	0.00352 B
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.0003 U	<0.0004 U	<0.0003 U	<0.00025 U	<0.00125 U	<0.00125 U	<0.00125 U	<0.00125 U	<0.00125 U	<0.00125 U
Bicarbonate as CaCO3 (mg/L)	none	1,080	1,100	NA	1,070	1,040	1,050	1,040	1,100	1,000	1,010	1,070	1,030	1,080	NA	1,090 H	1080	1,140	1,040	1,030	1,020	1,030	1,080 H	1180	1040 H
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	NA	<20 U	<20 U	<20 U	<20 U	<20 U	40.9	40.7	<20 U	<20 U	<20 U	NA	<20 UH	<2 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 UH	9.3 B	<20 UH
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	0.00011 B	<0.0003 U	<0.0003 U	0.000077 B	<0.00125 U	0.000349 B	<0.00125 U	<0.0025 U	<0.00125 U	<0.00125 U
Calcium, Dissolved (mg/L)	none	17.9	17.4	17.5	17.3	17.3	17.2	18	16.9	17.5	16.6	16.7	16.6	16.8	18.6	17.3	18.1	18.6	17.6	18.3	17.6	18.5	17.4	18.6	17.3
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	0.00009 B	<0.0003 U	0.0002 B	0.000073 B	<0.00125 U	<0.00125 U	<0.00125 U	<0.0025 U	0.000319 B	0.001 B
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	0.004 B	<0.003 U	<0.01 U	0.003 B	0.0063 B	0.0037 B	<0.01 U	<0.01 UH	<0.01 U	<0.01 U
Magnesium, Dissolved (mg/L)	none	6.6	7.4	7.4	7.0	8.0	7.0	8.0 B	7.0	8.0	6.6	7.0	7.0	7.0	7.0	6	6.6	6.6	6.95	6.26	6.67	7.03	6.99	7.08	6.87
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.001 U	<0.0002 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	0.0013 U	0.001 B	0.0009 B	0.00102	<0.0025 U	0.00216 B	0.00202 B	0.00279 B	0.00105 B	0.00375
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02 U	<0.001 U	<0.002 U	<0.001 U	<0.001 U	<0.005 U	<0.005 U	<0.005 U	<0.01 U	<0.005 U	<0.005 U
Potassium, Dissolved (mg/L)	none	6.1	6	6.4	7.0	7.0	6.0	8.0	6.0	6.0	6.7	6.0	6.0	6.0	9.0	6	6.8	7.7	5.7	5.54	7.15	5.99	4.75 B	6.15	6.43
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	<0.0005 U	<0.0005 U	0.0006 B	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.005 U	<0.0025 U
Sodium, Dissolved (mg/L)	none	2,330	2,260	2,390	2,270	2,370	2,260	2,560	2,350	2,230	2,430	2,430	2,270	2,360	2,460	2,420	2,420	2,440	2,160	2,360	2,450	2,370	2,360	2,400	2,510
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1 U	<0.1 U	<0.003 U	<0.004 U	0.00185 B	<0.01 U	<0.01 U	<0.01 U	<0.02 U	<0.01 U	<0.01 U

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 4: Summary of Monitoring Results for MW-3

Date	Colorado Basic Standards for Groundwater	4/28/1999	7/21/1999	9/16/1999	11/10/1999	1/19/2000	3/13/2000	5/16/2000	7/10/2000	9/27/2010	3/31/2011	6/30/2011	8/31/2011	11/17/2011	3/27/2012	6/27/2012	9/13/2012	11/13/2012	3/19/2013	5/28/2013	8/26/2013	11/14/2013	2/18/2014	5/21/2014
Metals																								
Arsenic, Dissolved (mg/L)	0.01	NA	0.005	0.005	**0.0362**	**0.03** B	**0.025**	**0.036**	**0.025**	**0.019**	0.01	**0.011**	**0.02**	<0.004 U	<0.01 U	0.0011 B	<0.005 U	0.0005 B	0.0008 B	<0.005 U	0.001 B	<0.002 U	0.0009 B	0.0005 B
Barium, Dissolved (mg/L)	2	0.177	0.172	0.218	0.213	0.249	0.261	0.287	0.307	**2.4**	**2.95**	**2.23**	**2.73**	**2.25**	**2.51**	**2.08**	**2.52**	**2.23**	**2.5**	**2.20**	**2.41**	**2.25**	**2.31**	**2.02**
Boron, Dissolved (mg/L)	0.75	0.63	0.53	0.62	0.58	0.62	0.62	0.6	0.6	**0.77**	0.75	0.74	**0.8**	**0.78**	**0.77**	**0.76**	**0.76**	**0.85**	**0.79**	**0.84**	0.75	**0.76**	0.74	**0.76**
Chromium, Dissolved (mg/L)	0.1	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.05 U	0.003 B	0.001 B	<0.01 U	0.004 B	<0.004 U	<0.01 U	<0.002 U	<0.01 U	<0.01 U	<0.004 U	<0.01 U	<0.01 U	<0.004 U	<0.004 U	<0.004 U
Copper, Dissolved (mg/L)	0.2	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.05 U	<0.1 U	<0.1 U	<0.3 U	<0.1 U	<0.1 U	<0.05 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.05 U	<0.05 U
Iron, Dissolved (mg/L)	0.3	0.02 B	0.03 B	0.12	0.03 B	0.03 B	0.05 B	0.17	0.02 B	0.04 B	0.27	<0.3 U	<0.1 U	0.1	0.22	**0.32**	<0.3 U	0.1	0.11	<0.3 U	<0.3 U	0.14	0.19	0.30
Lead, Dissolved (mg/L)	0.05	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	0.0031	<0.003 U	<0.001 U	0.0007 B	0.0002 *B	0.0004 B	<0.001 U	<0.003 U	0.0007	<0.003 U	0.0003 B	<0.001 U	<0.003 U	<0.003 U	<0.001 U	<0.001 U	0.0002 B
Lithium, Dissolved (mg/L)	2.5	0.71	0.65	0.6	0.7	0.75	0.74	0.7	0.67	0.8	0.74	0.8	0.71	0.64	0.72	0.7	0.7	0.83	NA	NA	NA	NA	NA	NA
Manganese, Dissolved (mg/L)	0.05	**0.19**	0.05	**0.06**	0.05 B	0.05	0.05	**0.07**	**0.06**	0.04 B	0.05	0.03 B	0.04 B	0.03 B	0.021 B	0.034	<0.1 U	0.047	0.026	<0.1	<0.1 U	0.031	0.043	0.05
Selenium, Dissolved (mg/L)	0.02	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	0.0006	0.0012	<0.001 U	0.0005	<0.005 U	0.0065	0.0007	<0.001 U	0.0005 B	0.0006	0.0043	<0.001 U	0.0003 B	<0.0005 U	0.0002 B
Thallium, Dissolved (mg/L)	0.002	<0.01 U	<0.01 U	<2 U	<0.0003 U	<0.005 U	<0.0005 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.003 U	<0.001 U	<0.001 U	<0.003 U	<0.0005 U	<0.003 U	<0.003 U	<0.001 U	<0.003 U	<0.003 U	<0.001 U	<0.001 U	<0.001 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	0.00871	0.007	0.0065	0.0058	0.0058	0.0015	0.0008 B	0.001 B	0.0006 B	0.0012	0.0006 B	0.0011	0.0005 B	0.0005 B	NA	NA	NA	NA	NA	NA
Zinc, Dissolved (mg/L)	2	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.05 U	<0.1 U	<0.1 U	<0.3 U	<0.1 U	<0.1 U	<0.05 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	<0.3 U	<0.3 U	<0.05 U	0.02 B	<0.05 U
Other																								
Chloride (mg/L)	250	**1,480**	**1,350**	**1,310**	**1,450**	**1,360**	**1,480**	**1,400**	**1,460**	**1,550**	**1,530**	**1,550**	**1,620**	**1,530**	**1,565**	**1,505**	**1,681**	**1,721**	**1,665**	**1,620**	**1,570**	**1,610**	**1,570**	**1,580**
Fluoride (mg/L)	2	**2.4**	**2.8**	**3** B	**2.2**	**3** B	**2.6**	**2.8**	**2.6**	**2.4**	**2.3**	**2.2**	**2.4**	**2.4**	**2.3**	**2.5**	**2.3**	**2.4**	**2.3**	**2.4**	**2.4**	**2.3**	**2.4**	**2.4**
Nitrate as N (mg/L)	10	<0.1 U	<0.1 U	0.02	<0.1 U	<0.1 U	NA	<0.1 U	0.17	<0.1 U	0.37	0.79	0.03 B	<0.1 U	<0.1 U	0.02 B	0.17	0.09 B	NA	NA	NA	NA	NA	NA
Nitrite as N (mg/L)	1	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	NA	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	NA	NA	NA	NA	NA	NA
Nitrate+Nitrite as N (mg/L)	10	<0.1 U	<0.1 U	0.02 B	<1 U	<0.1 U	NA	<0.1 U	0.17	<0.1 U	0.37	0.79	0.03 B	<0.1 U	<0.1 U	0.02 B	0.17	0.09 B	NA	NA	NA	NA	NA	NA
Lab pH (s.u)	6.5 - 8.5	8.5	**8.9**	**8.6**	8.4	**8.6**	8.2	8.2	8.4	**8.6** H	8.4 H	**8.6** H	8.5 H	8.2 H	8.4 H	8.4 H	8.5 H	8.5 H	8.5 H	8.4 H	8.5 H	8.4 H	8.4 H	8.3 H
Total Dissolved Solids, filterable residue (mg/L)	4620	3,780.0	3,740.0	3,690.0	3,720.0	3,660.0	3,680.0	3,620.0	3,680.0	3,930	3,940	4,000	3,940	3,860	4,000	3,790	4,000	3,950	3,990	4,000	4,000	3,880 H	3,890	3,910 H
Sulfate (mg/L)	250	140	110	100	100	90	90	90	90	<100 U	<100 U	<300 U	<50 U	<125 U	<125 U	30.1 B	<125 U	<125 U	<125 U	<125 U	<125 U	<125 U	<125 U	<125 U
Gross Alpha (pCi/L)	15	NA	**54**	0	**77**	**15**	8.4	6.2	9.6	5.7 (±13)	**33 (±20)**	5.7 (±17)	**15 (±18)**	**20 (±18)**	8 (±13)	**66 (±27)**	0.85 (±14)	-8.2 (±8.6)	NA	NA	NA	NA	NA	NA
Gross Beta (pCi/L)	**	NA	25	0	64	19	6.7	32	4.7	3.2 (±17)	25 (±21)	7.2 (±18)	5 (±19)	5.4 (±18)	13 (±18)	110 (±24)	15 (±17)	-4.9 (±18)	NA	NA	NA	NA	NA	NA
Field Parameters (Not Available pre-2010))																								
Field pH (s.u)	6.5 - 8.5	NA	NA	NA	NA	NA	NA	NA	NA	8.01	8.06	NA	8.46	7.98	8.36	7.95	8.14	8.34	8.24	8.31	8.25	8.15	8.12	7.78
Field Conductivity (µS/cm)	none	NA	NA	NA	NA	NA	NA	NA	NA	6186	675	NA	6,660	5,240	6,710	7	6,270	6,980	6,840	7,010	6,920	7,093	6,610	7,140
Temperature (Degrees Celsius)	none	NA	NA	NA	NA	NA	NA	NA	NA	17.55	16	NA	30.4	13.8	17.7	22.2	20.4	13.6	14.3	19.1	23.9	14.35	14.8	17.1
Supplementary Analytes (Not Historically analyzed)																								
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bicarbonate as CaCO3 (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	1,110	1,130	1,100	1,090	1,100	1,160	1,130	1,130	1,130	1,140	1,130	1,130	1,170	1,220	982
Carbonate as CaCO3 (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	98	31	96	75	78	50	52	51	78	71	60	75	40	37	57
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	6.6	11.9	7	7.5	6.8	6.3	9.4	7	7.5	6.1	7	8	6.8	6.7	7.2
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	3	3.4	3 B	2.7	2.8	2.9	2.9	4 B	3.6	3.0	3	3 B	2.8	3	3.1
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	4.4	5.5	5.0 B	3.2	3.6	4.2	4.1	4.0 B	6.9	4.4	4.0	4.0 B	3.9	4.0	3.8
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	1,600	1,450	1,560	1,490	1,370	1,550	1,530	1,580	1,550	1,620	1,590	1,600	1,600	1,570	1,610
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

Per Section 41.5 (C) (6) the of Regulation 41, the "Interim Narrative Standard" , is the minimum of Table 1- Table 4 of The Basic Standards for Groundwater (BSGW)

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Interim Narrative Standard

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 4: Summary of Monitoring Results for MW-3

Date	Colorado Basic Standards for Groundwater	8/27/2014	11/11/2014	2/18/2015	5/27/2015	8/27/2015	11/9/2015	2/15/2016	5/31/2016	8/16/2016	11/9/2016	5/31/2017	11/15/2017	6/6/2018	11/15/2018	6/12/2019	12/12/2019	6/4/2020	12/14/2020	6/23/2021	12/8/2021	6/23/2022	11/21/2022	6/1/2023	11/16/2023
Metals																									
Arsenic, Dissolved (mg/L)	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.002 U	0.0009 B	0.0004 B	0.0004 B	<0.001 U	<0.005 U	<0.002 U	0.00046 B	<0.005 U	<0.002 U	0.00051 B
Barium, Dissolved (mg/L)	2.0	**2.23**	**2.62**	**2.25**	**2.83**	**2.47**	**2.81**	**2.58**	**3.16**	**3.16**	**2.57**	**2.45**	**2.93**	**2.18**	**2.4**	**2.93**	**2.77**	**2.42**	1.93	**2.66**	**2.52**	**2.62**	**2.66**	**2.85**	**3.02**
Boron, Dissolved (mg/L)	0.75	**0.76**	**0.78**	**0.81**	0.74	**0.79**	0.74	**0.76**	0.74	**0.79**	**0.77**	0.75	0.74	**0.81**	**0.77**	**0.80**	**0.77**	**0.76**	**0.841**	**0.782**	**0.786**	0.748	**0.770**	**0.791**	**0.763**
Chromium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.004 U	<0.002 U	<0.001 U	<0.002 U	<0.002 U	<0.01 U	<0.004 U	<0.002 U	<0.01 U	<0.004 U	<0.004 U
Copper, Dissolved (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1 U	<0.1 U	<0.002 U	<0.002 U	<0.002 U	<0.01 U	<0.004 U	<0.002 U	<0.01 U	<0.004 U	<0.004 U
Iron, Dissolved (mg/L)	0.3	0.29	0.29	**0.79**	0.19	0.26	0.21	0.2 B	0.2 B	0.17	0.29	0.11	0.14	**0.41**	0.18	<0.2 U	0.07 B	0.16 B	<0.3 U	<0.3 U	0.154	0.154 B	<0.3 U	0.134 B	0.114 B
Lead, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.0005 U	<0.0002 U	<0.0005 U	<0.0005 U	<0.0025 U	<0.001 U	<0.0005 U	<0.0025 U	<0.001 U	<0.001 U
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.69	0.86	0.708	0.711	0.747	0.714	0.737	0.690	0.666	0.708	0.698
Manganese, Dissolved (mg/L)	0.05	0.05	**0.061**	**0.054**	0.02 B	0.03 B	0.03 B	<0.1 U	<0.1 U	0.02 B	0.033	0.01 B	0.01 B	**0.06**	<0.05 U	0.02 B	0.0195	0.0223	0.0259	0.016	0.0154	0.00855	0.0241	0.0181	0.0270
Selenium, Dissolved (mg/L)	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0005 U	0.0002 B	<0.0002 U	<0.0005 U	0.00025 B	<0.00125 U	<0.0005 U	<0.00025 U	<0.00125 U	<0.005 U	<0.0005 U
Thallium, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.0005 U	<0.00005 U	<0.0005 U	<0.0005 U	<0.0005 U	<0.0005 U	<0.0005 U	<0.0005 U	<0.00025 U	<0.0005 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0003 B	0.0008	0.0005 B	0.0004 B	0.0001 B	0.0007 B	<0.001 U	0.00036 B	<0.0025 U	<0.01 U	0.0009 B
Zinc, Dissolved (mg/L)	2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1 U	<0.1 U	<0.01 U	<0.02 U	<0.015 U	<0.075 U	<0.03 U	<0.015 U	<0.075 U	<0.03 U	<0.03 U
Other																									
Chloride (mg/L)	250	**1,520**	**1,540**	**1,530**	**1,620**	**1,570**	**1,560**	**1,640**	**1,690**	**1,550**	**1,550**	**1,550**	**1,580**	**1,560**	**1,750**	**1,660**	**1,620**	**1,640**	**1,670**	**1,670**	**1,670**	**1,650**	**1,780**	**1,800**	**1,570**
Fluoride (mg/L)	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	**2.38**	**2.4**	**2.5**	**2.5**	**2.44**	**2.48**	**2.49**	**2.67**	**2.27**	**2.4**	**2.38**
Nitrate as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1 U	<0.1 U	1.2	0.02 B	<0.1	<0.1 UH	0.055 B	<0.1 UH	<0.1 U	<0.1 U	<0.1 U
Nitrite as N (mg/L)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05 U	<0.05 U	<0.01 U	<0.05 U	<0.05 U	<0.05 UH	<0.05 U	<0.05 UH	<0.05 U	<0.05 U	<0.05 U
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1 U	<0.1 U	1.2	0.02 B	<0.1 U	<0.1 UH	0.055 B	<0.1 UH	<0.1 U	<0.1 U	<0.1 U
Lab pH (s.u)	6.5 - 8.5	8.3 H	8.4 H	8.2 H	8.3 H	8.4 H	8.3 H	8.4	8.3 H	8.5 H	8.4 H	8.5 H	8.3 H	8.3 H	8.4 H	8.4 H	8.4 H	8.5 H	8.4 H	8.5 H	8.4 H	8.2 H	8.5 H	8.54 H	8.3 H
Total Dissolved Solids, filterable residue (m	4620	3,920	3,890	3,920	3,930 ^	3,910 ^	3,970	3,970	4,040	3,790	4,000	3,820	3,940	4,020 H	3,850	3,960	3,940	3,910	3,890	3,890	3,930	3,960	3,990	3,840	3,940
Sulfate (mg/L)	250	<125 U	<125 U	<125 U	<125 U	<125 U	<125 U	<50 U	<50 U	<50 U	<50 U	<50 U	<40 U	<40 U	<40 U	<40 U	<8 U	<40 U	<40 U	<100 U	<40 U	<100 U	<100 U	<100 U	<40 U
Gross Alpha (pCi/L)	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.15 (±7.4)	3.5	54 (±26)	10 (±13)	-7.4 (±13)	7.6 (±18)	43 (±36)	5.2 (±24)	18 (±25)	45 (±28)	52 (±30)
Gross Beta (pCi/L)	**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.7 (±15)	1.6	7.9 (±19)	22 (±22)	-5.4 (±20)	-5.6 (±23)	17 (±34)	26 (±32)	16 (±26)	-6.2 (±20)	30 (±22)
Field Parameters (Not Available pre-2010))																									
Field pH (s.u)	6.5 - 8.5	7.94	7.9	7.78	7.78	7.83	8.02	8.4	8.05	7.52	7.77	NA	8.61	7.98	7.83	8.25	8.23	8.25	8.1	8.02	8.04	7.95	8.22	8.03	8.12
Field Conductivity (µS/cm)	none	7,220	6,800	7,140	6,120	7,010	5,820	4,850	6,290	6,710	7,030	NA	6,730	7,160	6,790	7,030	4,348	5,730	6,140	6,452	6,743	7,225	5,585	6,097	6,902
Temperature (Degrees Celsius)	none	17.0	9.0	14	19.7	18.5	17.3	11.4	18.6	20.7	20.7	NA	10.8	20.1	16	21.8	12.4	25.1	13.2	26	16.7	22.2	12.8	16.7	16.7
Supplementary Analytes (Not Historically analyzed)																									
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.3 U	<0.5 U	<0.05 U	0.008 B	0.0057 B	<0.075 U	<0.03 U	0.0146 B	<0.075 U	<0.03 U	0.0101 B
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.004 U	0.0007 B	<0.0008 U	<0.002 U	<0.004 U	<0.01 U	<0.004 U	<0.002 U	<0.004 U	<0.004 U	0.00103 B
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0005 U	<0.0003 U	<0.0002 U	<0.0003 U	<0.00025 U	<0.00125 U	<0.0005 U	<0.00025 U	<0.0005 U	<0.0005 U	<0.0005 U
Bicarbonate as CaCO3 (mg/L)	none	1,270	1,260	NA	1,200	1,170	1,230	1,210	1,300	1,170	1200	1160	1160	1250	NA	1,260 H	1190	1,240	1,160	1,140	1,120	1,190	1,200 H	1280	1190 H
Carbonate as CaCO3 (mg/L)	none	<20 U	41.6	NA	56.5	98.5	30.6	37.4	21.4	71.5	44.9	54.5	26.7	19.6 B	NA	<20 UH	55.1	60.4	51.2	74.5	54.3	<20 U	71.2 H	81.6	58.6 H
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0005 U	<0.0003 U	<0.0001 U	<0.0003 U	<0.00025 U	<0.00125 U	<0.0005 U	<0.00025 U	<0.00125 U	<0.0005 U	<0.0005 U
Calcium, Dissolved (mg/L)	none	6.7	7.7	8.7	7	7.6	6.9	6.7	7.4	7.8	7.3	6.8	6.5	6.9	7.4	6.7	6.9	6.7	6.69	6.45	6.25	7.36	6.21	7.02	6.3
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.0003 U	<0.0001 U	0.0001 B	<0.00025 U	<0.00125 U	<0.0005 U	<0.00025 U	<0.00125 U	<0.0005 U	0.00066
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	<0.01 U	<0.003 U	<0.01 U	<0.01 U	0.0031 B	<0.01 U	<0.01 U	<0.01 UH	<0.01 U	<0.01 U
Magnesium, Dissolved (mg/L)	none	3.4	3.2	3.3	2.8	3.1	2.9	2.8	3.0 B	3.2	2.6	2.5	2.6	3.1	2.5	2.5	2.6	2.5	2.91	2.57	2.78	2.60	2.73	2.75	2.72
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001 U	<0.001 U	<0.0002 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2 U	<0.2 U	0.0004 B	<0.001 U	0.00032 B	<0.0025 U	<0.001 U	0.00047 B	<0.0025 U	0.00047 B	0.00044 B
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.08 U	<0.08 U	<0.0008 U	<0.001 U	<0.001 U	<0.005 U	<0.002 U	0.0006 B	<0.005 U	<0.002 U	<0.002 U
Potassium, Dissolved (mg/L)	none	4.0	4.1	4.0	5.3	4.0	4.0	4.1	4.0	4	4.4	3.5	4.0	3.4	3.6	3.9	3.7	3.3	3.82	3.86	3.95	3.61	3.22	4.21	4.61
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05 U	<0.0005 U	<0.0002 U	<0.001 U	<0.001 U	<0.0025 U	<0.001 U	<0.0005 U	<0.0025 U	<0.005 U	<0.001 U
Sodium, Dissolved (mg/L)	none	1,500	1,490	1,430	1,480	1,450	1,480	1,540	1,510	1,470	1600	1430	1410	1490	1500	1,560	1,540	1,490	1,460	1,460	1,530	1,440	1,490	1,510	1,610
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05 U	<0.05 U	<0.001 U	<0.002 U	<0.002 U	<0.01 U	<0.004 U	<0.002 U	<0.01 U	<0.004 U	<0.004 U

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 5: Summary of Monitoring Results for MW-4

Date	Colorado Basic Standards for Groundwater	5/26/1999	7/21/1999	9/23/1999	11/10/1999	1/19/2000	3/13/2000	5/16/2000	7/10/2000	9/27/2010	3/31/2011	6/28/2011	8/31/2011	11/172011	3/27/2012	6/27/2012	9/13/2012	11/13/2012	3/19/2013	5/28/2013	8/26/2013	11/15/2013	2/18/2014	5/21/2014
Metals																								
Arsenic, Dissolved (mg/L)	0.01	NA	<0.005 U	NA	**0.0894**	**0.08**	**0.075**	**0.103**	**0.08**	**0.068**	**0.04**	**0.055**	**0.076**	<0.02 U	<0.02 U	0.0009 B	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U
Barium, Dissolved (mg/L)	2	0.14	0.29	0.461	0.55	0.69	0.81	0.92	0.972	**8.69**	**8.84**	**7.83** *	**8.93**	**7.94**	**8.73**	**8.41**	**8.91**	**8.67**	**9.22**	**8.74**	**9.13**	**8.8**	**8.58**	**9.64**
Boron, Dissolved (mg/L)	0.75	0.49	0.54	0.53	0.59	0.56	0.6	0.6	0.55	0.7	0.5 B	0.62 *	0.7	0.7	0.7	**0.8** B	0.5	0.72	0.7	0.7	0.6	0.7	0.63	0.6
Chromium, Dissolved (mg/L)	0.1	<0.3 U	<0.3 U	<0.25 U	<0.3 U	<0.3 U	NA	<0.3 U	<0.05 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	0.0014 B	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U
Copper, Dissolved (mg/L)	0.2	<0.3 U	<0.3 U	0.11 B	<0.3 U	<0.3 U	NA	<0.3 U	<0.05 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<1 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.3 U	<0.5 U
Iron, Dissolved (mg/L)	0.3	<0.3 U	<0.3 U	**1.13**	0.07 B	0.05 B	0.17 B	**0.44**	0.04 B	0.3 B	0.3 B	0.28 *	**0.8**	<0.5 U	**0.6**	**1.0**	<0.5 U	**0.32** U	**0.8**	**0.5** U	**0.4** B	0.3 B	**0.8**	0.2 B
Lead, Dissolved (mg/L)	0.05	<0.01 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	NA	0.009	<0.01 U	<0.005 U	<0.005 U	0.002 B	0.001 B	<0.005 U	<0.005 U	<0.01 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U
Lithium, Dissolved (mg/L)	2.5	0.9	1.2	1.3	1.4	1.5	1.6	1.5	1.51	2	1.9	2.25 *	1.8	1.6	1.8	1.9 B	1.9	2.38	NA	NA	NA	NA	NA	NA
Manganese, Dissolved (mg/L)	0.05	**0.21**	**0.89**	**0.977**	**0.94**	**0.87**	**0.81**	**0.75**	**0.703**	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.5 U	<0.3 U	0.018 B	<0.3 U	<0.3 U	<0.3 U	<0.3 U	<0.1 U	<0.3 U
Selenium, Dissolved (mg/L)	0.02	<0.5 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.003 U	0.012	<0.003 U	<0.003 U	<0.003 U	0.007	0.0029	<0.003 U	0.002 B	0.003 B	0.006	<0.003 U	<0.003 U	<0.003 U	<0.003 U
Thallium, Dissolved (mg/L)	0.002	<5 U	<0.01 U	<5 U	<0.0003 U	<0.005 U	<0.001 U	<0.003 U	<0.005 U	<0.005 U	0.001 B	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.01 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	0.0235	0.019	0.0168	0.0138	0.015	<0.005 U	0.001 B	<0.005 U	0.002 B	<0.005 U	<0.005 U	<0.01 U	<0.005 U	<0.005 U	NA	NA	NA	NA	NA	NA
Zinc, Dissolved (mg/L)	2	1.07	1.03	1.71	<0.3 U	<3 U	<0.3 U	<0.3 U	0.01 B	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<1.0 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.3 U	<0.5 U
Other																								
Chloride (mg/L)	250	**2,770**	**2,940**	**4,260**	**4,800**	**4,970**	**5,200**	**6,900**	**5,300**	**6,300**	**6,200**	**6,200**	**6,500**	**6,282**	**6,063**	**6,105**	**6,566**	**6,077**	**6,744**	**6,490**	**6,470**	**6,750**	**7,080**	**6,450**
Fluoride (mg/L)	2	1	1.1	0.9	0.9	1.1	1.1	1.4	1.1	1.1	1.1	1	1.1	1.1	1.0	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.13
Nitrate as N (mg/L)	10	<0.1 U	0.07	<0.1 U	<0.1 U	0.13	NA	<0.1 U	0.73	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	1.83	0.04 B	0.04 B	0.04 B	NA	NA	NA	NA	NA	NA
Nitrite as N (mg/L)	1	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	NA	<0.05 U	<0.05 U	<0.05 U	0.01 B	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U	NA	NA	NA	NA	NA	NA
Nitrate+Nitrite as N (mg/L)	10	<0.1 U	0.07 B	<0.1 U	<0.1 U	0.13	NA	<0.1 U	0.73	<0.1 U	0.02 B	<0.1 U	<0.1 U	<0.1 U	1.83	0.04 B	0.04 B	0.04 B	NA	NA	NA	NA	NA	NA
Lab pH (s.u)	6.5 - 8.5	8.1	7.7	7.8	7.8	8.1	7.6	8	8	8.3 H	8.2 H	8.2	8.2 H	8.3 U	8.1 H	8.1 H	8.1 H	8.2 H	8.1 H	8.2 H	8.1 H	8.1 H	8.00 H	7.9 H
Total Dissolved Solids, filterable residue (mg/L)	10,212*	5,870.0	7,610.0	8,170.0	8,660.0	8,670.0	9,110.0	8,980.0	9,350.0	**11,000**	**11,100**	**11,100**	**10,900**	**11,100**	**11,200**	**10,800**	**11,100**	**10,800**	**11,100**	**11,000**	**10,900**	**10,300** H	**10,800** H	**10,300** H
Sulfate (mg/L)	250	**970**	**600**	**460**	**390**	**3150**	**290**	**270**	250	<500 U	<500 U	<500 U	<300 U	<500 U	<500 U	<500 U	<500 U	<500 U	<500 U	<500 U	<500 U	<500 U	<500 U	<500 U
Gross Alpha (pCi/L)	15	**26**	12	**53**	-4.3	**57**	4.7	0	**65**	-10 (±39)	**73 (±47)**	**16 (±37)**	**40 (±52)**	**19 (±52)**	-33 (±18)	**260 (±76)**	-0.11 (±17)	-15 (±30)	NA	NA	NA	NA	NA	NA
Gross Beta (pCi/L)	**	23	37	27	-24	18	20	4.7	8.6	-7.5 (±53)	80 (±49)	22 (±45)	51 (±57)	66 (±63)	38 (±51)	270 (±61)	53 (±53)	9.9 (±42)	NA	NA	NA	NA	NA	NA
Field Paramters (Not Avalible pre-2010))																								
Field pH (s.u)	6.5 - 8.5	NA	NA	NA	NA	NA	NA	NA	NA	7.95	7.85	7.68	7.97	7.92	8.23	7.48	7.84	8.05	7.53	7.36	7.73	6.57	7.27	7.25
Field Conductivity (µS/cm)	none	NA	NA	NA	NA	NA	NA	NA	NA	1,825	1,959	17,420	18,450	18,230	18,500	9	17,080	18,790	11,720	18,800	18,750	19,055	18,020	19,380
Temperature (Degrees Celsius)	none	NA	NA	NA	NA	NA	NA	NA	NA	17.7	15	19.9	23.4	14	14.6	18.6	22.0	12.3	12.1	16.7	18.8	11.46	12.1	14.9
Supplementary Analytes (Not Historically analyzed)																								
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bicarbonate as CaCO3 (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	585	565	569	562	573	597	580	576	571	573	567	590	576	606	623
Carbonate as CaCO3 (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	16 B	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	37	38	79	37	35	36	42	38	39.2	37	37	37	36	36.1	38
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	18	18	38	16	16	17	22	19	18.9	18	18	17	16	16	17
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	10 B	12 B	20 B	7.0 B	9.0 B	7.0 B	15 B	10 B	22	10 B	10 B	9.0 B	9 B	9	9 B
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved (mg/L)	none	NA	NA	NA	NA	NA	NA	NA	NA	4,270	4,180	4,280	4,200	3,930	4,220	4,240	4,250	4,150	4,390	4,260	4,350	4070	4120	4360
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 5: Summary of Monitoring Results for MW-4

Date	Colorado Basic Standards for Groundwater	8/27/2014	11/11/2014	2/18/2015	5/27/2015	8/27/2015	11/9/2015	2/15/2016	5/31/2016	8/16/2016	11/9/2016	5/31/2017	11/15/2017	6/6/2018	11/15/2018	6/12/2019	12/12/2019	6/4/2020	12/14/2020	6/23/2021	12/8/2021	6/23/2022	11/21/2022	6/1/2023	11/17/2023
Metals																									
Arsenic, Dissolved (mg/L)	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01 U	0.0004 B	<0.002 U	<0.02 U	0.00055 B	<0.01 U	<0.01 U	<0.02 U	<0.02 U	<0.01 U	<0.01 U
Barium, Dissolved (mg/L)	2.0	**8.01**	**8.56**	**8.77**	**8.76**	**8.81**	**8.80**	**8.66**	**8.79**	**8.91**	**8.61**	**8.95**	**8.60**	**9.00**	**8.90**	**8.42**	**8.94**	**9.17**	**7.95**	**8.80**	**8.58**	**8.73**	**9.18**	**9.18**	**8.99**
Boron, Dissolved (mg/L)	0.75	0.7	0.7	**0.8** B	0.6	0.7	0.6	0.7	0.6	0.6	0.61	0.7	0.6	**0.8**	0.6	0.7 B	0.63	0.63	**0.76**	0.747 B	0.67	0.705 B	0.71 B	0.671	0.671
Chromium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02 U	<0.002 U	<0.005 U	<0.002 U	<0.002 U	<0.02 U	<0.02 U	<0.002 U	<0.04 U	<0.02 U	<0.02 U
Copper, Dissolved (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02 U	<0.002 U	<0.008 U	<0.002 U	<0.002 U	<0.02 U	<0.02 U	<0.04 U	<0.04 U	<0.02 U	<0.02 U
Iron, Dissolved (mg/L)	0.3	**0.5**	0.3 B	<1 U	0.3 B	0.1 B	**0.4** B	0.2 B	0.14	<0.5 U	0.15	<0.5 U	<0.5 U	<0.5 U	0.15	0.114 U	0.12	0.11 B	<0.75 U	<1.5 U	<0.15	<1.5 U	<1.5 U	0.141 B	0.145 B
Lead, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.005 U	<0.0005 U	<0.001 U	<0.0005 U	<0.0005 U	<0.005 U	<0.005 U	<0.01 U	<0.01 U	<0.005 U	<0.005 U
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.76	1.93	1.81	1.91	1.81	1.80	1.98	1.78	1.67	1.82	1.91
Manganese, Dissolved (mg/L)	0.05	<0.3 U	<0.3 U	<0.5 U	<0.3 U	<0.1 U	<0.3 U	<0.3 U	<0.03 U	<0.3 U	<0.03 U	<0.3 U	<0.3 U	<0.3 U	0.008 B	0.0065 U	0.007 B	0.011 B	0.00724	0.00612 B	0.00886 B	0.00752	<0.04 U	0.00903 B	0.02
Selenium, Dissolved (mg/L)	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.017	0.0014	<0.001 U	<0.003 U	<0.002 U	<0.0025 U	<0.0025 U	0.00026	<0.005 U	<0.0125 U	<0.0125 U
Thallium, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.005 U	<0.0005 U	<0.0001 U	<0.003 U	<0.0025 U	0.000825 B	<0.0025 U	<0.0025 U	<0.0025 U	<0.0005 U	<0.0025 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.005 U	0.0001 B	<0.001 U	<0.01 U	0.0003 B	<0.005 U	<0.005 U	<0.01 U	<0.01 U	<0.005 U	<0.005 U
Zinc, Dissolved (mg/L)	2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.5 U	<0.5 U	<0.01 U	<0.02 U	<0.015 U	<0.15 U	<0.15 U	<0.015 U	<0.3 U	<0.15 U	0.135 B
Other																									
Chloride (mg/L)	250	**5,600**	**6,260**	**6,650**	**6,410**	**6,630**	**6,880**	**6,530**	**6,290**	**6,350**	**5,960**	**6,390**	**6,170** H	**6,150**	**7,780**	**7,140**	**7,100**	**7,020**	**6,160**	**6,680**	**7,010**	**6,490** H	**7,670**	**6,900** H	**8,140**
Fluoride (mg/L)	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.03	1.10	1.10	1.10	1.07	1.10	1.11	1.25	1.00	1.06	1.13
Nitrate as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1 U	0.12	<0.02 U	<0.1 U	<0.1 U	<0.1 UH	<0.1 U	<0.1 UH	<0.1 U	<0.1 U	0.057 B
Nitrite as N (mg/L)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05 U	<0.05 U	0.01 B	<0.05 U	<0.05 U	<0.05 UH	<0.05 U	<0.05 UH	<0.05 U	<0.05 U	<0.05 U
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1 U	0.12	<0.02 U	<0.1 U	<0.1 U	<0.1 UH	<0.1 U	<0.1 UH	<0.1 U	<0.1 U	0.057 B
Lab pH (s.u)	6.5 - 8.5	8.1 H	8.2 H	8.00 H	8.1 H	8.2 H	8.2 H	8.2	7.9 H	8.3 H	8.2 H	8.3 H	7.9 H	8.1 H	8.1	8.00 H	8.2 H	8.1 H	8.00 H	8.1 H	8.00 H	8.00 H	8.20 H	8.18 H	8.10 H
Total Dissolved Solids, filterable residue (mg/L)	10,212	9,530	**10,900**	**10,600**	**10,600** ^	9,720 ^	**10,800**	**10,900**	10,100	**10,800**	**11,100**	**10,500**	**11,000**	**10,900**	**11,200**	**11,000**	**10,600**	**11,700**	**11,000**	11,200	11,500	**10,600** H	**11,000**	**11,000**	**11,200** H
Sulfate (mg/L)	250	<500 U	<500 U	<500 U	<500 U	<500 U	<500 U	<500 U	<250 U	<250 U	<250 U	<250 U	<200 UH	<200 U	<200 U	<200 U	<40 U	<200 U	<400 U	<200 U	<200 U	<400 U	<200 U	<200 UH	<400 U
Gross Alpha (pCi/L)	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.83 (±26)	-17 (±22)	54 (±26)	**19(±31)**	**19 (±44)**	7.6 (±18)	**43 (±36)**	5.2 (±24)	**18 (±25)**	45 (±28)	52 (±30)
Gross Beta (pCi/L)	**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38 (±39)	-11 (±57)	7.9 (±19)	22 (±22)	-2.6 (±53)	-5.6 (±23)	17 (±34)	26 (±32)	16 (±26)	-6.2 (±20)	30 (±22)
Field Parameters (Not Available pre-2010))																									
Field pH (s.u)	6.5 - 8.5	7.52	7.56	7.54	9.09	7.49	8.26	8.2	7.74	7.31	7.65	8.05	7.81	7.89	7.63	7.96	7.79	8.28	7.86	7.9	7.94	7.71	7.78	7.71	7.81
Field Conductivity (µS/cm)	none	19,500	18,510	19,550	16,610	19,050	14,650	13,890	16,140	18,530	19,320	17,800	18,260	19,620	18,570	18,390	11,030	15,330	16,872	17,690	19,307	20,248	14,998	17,145	18,528
Temperature (Degrees Celsius)	none	14.5	11.7	12.5	17.5	16.6	13.1	11.6	16	18.3	16.1	14.7	12.4	16.8	14	15.6	7.3	22.4	11.3	20.7	14.8	16.1	11.4	14.1	11.6
Supplementary Analytes (Not Historically analyzed)																									
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2 U	<3 U	<0.05 U	<0.02 U	<0.015 U	<0.15 U	<0.15 U	<0.015 U	<0.3 U	<0.15 U	<0.15 U
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.006 B	<0.002 U	0.005 B	<0.04 U	<0.02 U	<0.02 U	<0.02 U	<0.002 U	<0.02 U	<0.02 U	<0.02 U
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	<0.0003 U	<0.0008 U	<0.0003 U	<0.00025 U	<0.0025 U	<0.0025 U	<0.00025 U	<0.0025 U	<0.0025 U	<0.0025 U
Bicarbonate as CaCO3 (mg/L)	none	616	611	NA	604	599	615	606	664	613	619	612	592	602	NA	601 H	606	644	585	595	567	586	605	667	604 H
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	NA	<20 U	<20 U	<20 U	<20 U	<20 U	6.2 B	<20 U	<20 U	<20 U	<20 U	NA	<20 UH	<2 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 UH
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	0.00007 B	<0.0005 U	<0.0003 U	<0.00025 U	<0.0025 U	<0.0025 U	<0.00025 U	<0.005 U	<0.0025 U	<0.0025 U
Calcium, Dissolved (mg/L)	none	37	37	38	38	36.9	38	38	36	37	35.8	36	36	36	36	35	37	35.6	35.7	36.8	34.1	36.00	34.6	36.5	34.9
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.003 U	0.00015 B	0.0012 B	<0.005 U	0.000116 B	<0.0025 U	<0.0025 U	0.000119 B	<0.005 U	0.000636 B	0.00455
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.004 B	0.009 B	<0.003 U	<0.01 U	0.0061 B	0.0097 B	<0.01 U	<0.01 U	<0.01 UH	<0.01 U	<0.01 U
Magnesium, Dissolved (mg/L)	none	18	18	21	17	18	17	17	16.4	18	16.1	16	16	17	17	15	16.6	16.00	16.4	15.6	15.8	16.2	16.0	17.1	16.6
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0002 B	<0.001 U	<0.0002 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.03 U	0.0002 U	<0.002 U	<0.01 U	0.00045 B	<0.005 U	0.00216 B	<0.0005 U	<0.01 U	0.00219 B	<0.005 U
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.03 U	<0.001 U	<0.004 U	<0.001 U	<0.001 U	<0.01 U	<0.01 U	<0.02 U	<0.02 U	<0.01 U	<0.01 U
Potassium, Dissolved (mg/L)	none	9 B	10	12 B	9	9	10	11	9.1	9	9	10	9	8 B	10	8 B	11.7	15.3	8.34	8.04 B	10.90	8.60 B	6.55 B	8.76	10.5
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.005 U	<0.0005 U	<0.001 U	<0.01 U	<0.005 U	<0.005 U	<0.005 U	<0.0005 U	<0.01 U	<0.01 U	<0.005 U
Sodium, Dissolved (mg/L)	none	4050	3950	4070	4040	4030	4050	4290	4020	4000	4160	4080	3950	4030	4130	4,030	4,180	4,240	3,830	4,050	4,050	3,940	4,050	4,070	4,400
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02 U	<0.002 U	<0.005 U	<0.04 U	0.00067 B	<0.02 U	<0.02 U	0.00059 B	<0.04 U	<0.02 U	<0.02 U

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 6: Summary of Monitoring Results for MW-5

Date	Colorado Basic Standards for Groundwater	3/19/2013	5/28/2013	8/26/2013	11/14/2013	2/18/2014	5/21/2014	8/27/2014	11/11/2014	2/18/2015	5/27/2015	8/27/2015	11/9/2015	2/15/2016	5/31/2016	8/16/2016	11/9/2016	5/31/2017	11/15/2017
Metals																			
Arsenic, Dissolved (mg/L)	0.01	0.002 B	0.0004 B	0.005	<0.002 U	0.0004 B	<0.002 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved (mg/L)	2	0.015 B	0.014 B	0.015 B	0.014 B	0.015 B	0.006 B	0.008 B	0.011 B	0.012 B	0.009 B	<0.03 U	0.015 B	0.017 B	0.013 B	0.006 B	0.013 B	0.01 B	<0.03 U
Boron, Dissolved (mg/L)	0.75	0.37	0.33	0.25	0.32	0.33	0.36	0.33	0.36	0.36	0.26	0.3	0.29	0.33	0.26	0.26	0.29	0.36	0.36
Chromium, Dissolved (mg/L)	0.1	<0.01 U	<0.004 U	<0.004 U	<0.004 U	<0.004 U	<0.004 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved (mg/L)	0.2	<0.05 U	<0.1 U	<0.1 U	<0.05 U	<0.05 U	<0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved (mg/L)	0.3	**17.5**	**15.6**	**85.4**	**1.39**	**9.56**	0.15	**0.7**	**8.11**	**19.6**	0.05	**0.6**	**20.3**	**7.11**	**0.58**	**11.6**	**33.5**	**2.15**	**10.3**
Lead, Dissolved (mg/L)	0.05	<0.003 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved (mg/L)	0.05	**0.168**	**0.13**	**0.16**	**0.074**	**0.091**	**0.069**	**0.12**	**0.093**	**0.109**	**0.072**	<0.3 B	**0.11**	**0.1**	**0.07**	**0.09**	**0.11**	**0.09**	**0.09**
Selenium, Dissolved (mg/L)	0.02	0.0008 B	**0.0593**	0.0013	0.0027	0.0005	**0.023**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium, Dissolved (mg/L)	0.002	<0.003 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved (mg/L)	2	0.01 B	<0.1 U	<0.1 U	<0.05 U	<0.05 U	<0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other																			
Chloride (mg/L)	250	79.4 B	27.6 B	36.3 B	18.6	26.4 B	27.9 B	<125 U	<125 U	50.8 B	27 B	44.5 B	<250 U	<250 U	18.5 B	18.6 B	42.4 B	45.4 B	25.8 BH
Fluoride (mg/L)	2	0.8	0.7	1.3	0.6	0.7	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite as N (mg/L)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lab pH (s.u)	6.5 - 8.5	7.5 H	7.7 H	7.3 H	7.4 H	7.4 H	7.6 H	7.5 H	7.7 H	7.4 H	7.6 H	7.5 H	7.5 H	7.2	7.3 H	7.9 H	7.7 H	7.8 H	7.3 H
Total Dissolved Solids, filterable residue (mg/L)	1.25 x Background*	4,950	3,360	3,710	3,110	3,100	3,010 H	2,970	3,140	3,240	3,160 ^	3070 ^	3220	3540	3140	2850	3310	3,970	3,160
Sulfate (mg/L)	250	**3,273**	**2,050**	**2,200**	**1,690**	**1,770**	**1,870**	**1,630**	**1,690**	**1,900**	**1,860**	**1,720**	**1,940**	**2,250**	**1,920**	**1,770**	**1,940**	**2,540**	**1,820** H
Gross Alpha (pCi/L)	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gross Beta (pCi/L)	**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Parameters (Not Available pre-2010))																			
Field pH (s.u)	6.5 - 8.5	6.65	6.67	7	6.74	6.83	6.56	6.76	6.77	6.67	6.47	6.76	7.06	7.2	6.77	6.74	6.59	7.23	7.04
Field Conductivity (µS/cm)	none	2,631	3,735	3,774	3324	3,262	3,370	3,345	33,200	3,787	3,016	3,340	2,900	2,800	2,649	3,192	3,546	4,530,000	3,280
Temperature (Degrees Celsius)	none	12	14.3	15.8	11.34	12.3	13.9	13.8	10.5	11.1	15.1	14.4	13.9	10.7	14.1	16.1	12.8	15.4	12.8
Supplementary Analytes (Not Historically analyzed)																			
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bicarbonate as CaCO3 (mg/L)	none	225	320	205	343	380	410	378	377	NA	347	376	377	361	409	357	311	348	375
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	NA	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved (mg/L)	none	426	464	523	446	433	441	442	461	453	505	520	478	464	486	495	494	429	461
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved (mg/L)	none	147	126	131	101	109	106	101	111	118	112	115	115	124	112	113	122	128	119
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved (mg/L)	none	10.1	8.1	10.2	6.2	7.1	6.5	6.3	6.9	7.7	6	6	7.1	7.6	6	6.6	8.7	8.2	7.2
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved (mg/L)	none	865	373	312	269	332	308	257	285	344	232	209	260	450	229	221	281	614	322
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 6: Summary of Monitoring Results for MW-5

Date	Colorado Basic Standards for Groundwater	6/6/2018	11/15/2018	6/12/2019	12/12/2019	6/4/2020	12/14/2020	6/23/2021	12/8/2021	6/23/2022	11/21/2022	6/1/2023	11/17/2023
Metals													
Arsenic, Dissolved (mg/L)	0.01	NA	0.0019 B	0.0018	0.0011 B	0.0037	0.00273	<0.002 U	0.00167 B	0.00284	<0.005 U	0.00222 B	0.00208
Barium, Dissolved (mg/L)	2	<0.03 U	<0.03 U	0.02 B	0.01 B	0.011	0.0106	0.00986	0.0128	0.0121	0.0116 B	0.0151	0.0114
Boron, Dissolved (mg/L)	0.75	0.35	0.33	0.35	0.35	0.33	0.32	0.307	0.344	0.315	0.347	0.383	0.399
Chromium, Dissolved (mg/L)	0.1	NA	<0.004 U	<0.002 U	<0.001 U	<0.002 U	<0.002 U	<0.004 U	<0.004 U	<0.002 U	<0.01 U	<0.01 U	<0.004 U
Copper, Dissolved (mg/L)	0.2	NA	<0.1 U	<0.1 U	<0.002 U	<0.002 U	<0.002 U	<0.004 U	<0.004 U	<0.004 U	<0.01 U	<0.01 U	<0.004 U
Iron, Dissolved (mg/L)	0.3	**0.97**	**32.8**	**7.67**	**9.22**	**38**	**28.1**	**0.404**	**17.0**	**39.7**	**15.0**	**13.2**	**17.1**
Lead, Dissolved (mg/L)	0.05	NA	<0.001 U	<0.0005 U	<0.0002 U	<0.0005 U	<0.0005 U	<0.001 U	<0.001 U	<0.001 U	<0.0025 U	<0.0025 U	<0.001 U
Lithium, Dissolved (mg/L)	2.5	NA	0.3	0.39	0.417	0.364	0.385	0.242	0.344	0.317	0.363	0.433	0.328
Manganese, Dissolved (mg/L)	0.05	**0.08**	**0.09**	**0.09** B	**0.0772**	**0.0775**	**0.0935**	**0.0767**	**0.0899**	**0.105**	**0.0946**	**0.102**	**0.0986**
Selenium, Dissolved (mg/L)	0.02	NA	0.0017	0.0005	0.0002 B	0.001	0.00154	0.00503	<0.0005 U	0.00055	<0.00125 U	0.00082 B	0.00023 B
Thallium, Dissolved (mg/L)	0.002	NA	<0.001 U	0.0001 B	0.00007 B	0.0002 B	0.00021 B	0.00044 B	<0.0005 U	<0.0005 U	<0.0005 U	0.000118 B	<0.0005 U
Uranium, Dissolved (mg/L)	0.03	NA	**0.0379**	0.0261	0.0241	**0.0465**	0.0243	**0.0416**	**0.031**	**0.0381**	0.0217	0.0258	0.028
Zinc, Dissolved (mg/L)	2	NA	<0.1 U	<0.1 U	<0.01 U	0.007 B	0.0075 B	<0.03 U	<0.03 U	0.0123 B	<0.075 U	<0.075 U	<0.03 U
Other													
Chloride (mg/L)	250	19.7 B	36.2 B	29.8 B	36 B	27.3 B	30.8 B	11.8 B	<100 U	31.6 U	31.6 B	31 B	21 B
Fluoride (mg/L)	2	NA	0.72	0.60	0.70	0.70	0.73	0.47	0.74	0.95	0.66	0.64	0.68
Nitrate as N (mg/L)	10	NA	NA	NA	0.57	<0.1 U	<0.1 U	<0.1 UH	0.188	<0.1 UH	<0.1 U	<0.1 U	<0.1 U
Nitrite as N (mg/L)	1	NA	NA	NA	<0.01 U	<0.05 U	<0.05 U	<0.05 UH	0.014 B	<0.05 UH	<0.05 U	<0.05 U	<0.05 U
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	0.57	0.1 U	<0.1 U	<0.1 UH	0.202	<0.1 UH	<0.1 U	<0.1 U	<0.1 U
Lab pH (s.u)	6.5 - 8.5	7.7 H	7.5	7.7 H	7.7 H	7.6 H	7.4 H	7.6 H	7.4 H	7.3 H	7.8 H	8.0 H	7.7 H
Total Dissolved Solids, filterable residue (mg/L)	1.25 x Background*	3,020 H	3,340	3,630	3,800	3630	3830	2,910	3,300	3640	3,780	4,160	3,200
Sulfate (mg/L)	250	**1,780**	**2,190**	**2,180**	**2,480**	**2,290**	**2,530**	**1,860**	**2,120**	**2,190**	**2,300**	**2,410**	**1,740**
Gross Alpha (pCi/L)	15	NA	8.6 (±11)	8.5 (±9.2)	**24(±14)**	**32(±15)**	**26 (±13)**	**31(±13)**	**38(±19)**	**20(±16)**	13(±17)	11(±14)	12(±12)
Gross Beta (pCi/L)	**	NA	18 (±13)	8.2 (±13)	25(±12)	12(±12)	19 (±13)	20(±9.2)	8.6(±12)	31(±17)	3.1(±13)	20(±15)	15(±13)
Field Parameters (Not Available pre-2010))													
Field pH (s.u)	6.5 - 8.5	6.81	6.85	7.06	7.08	7.06	7.27	6.93	6.79	6.78	7.08	7.02	6.96
Field Conductivity (µS/cm)	none	3,397	3,622	3,983	2,416	2,808	3,810	2,928	3,921	3,899	3,350	4,162	3,582
Temperature (Degrees Celsius)	none	16	13.6	15.2	12.2	14.3	11.2	15.9	12.5	13.6	12.4	13.1	13.6
Supplementary Analytes (Not Historically analyzed)													
Aluminum, Dissolved (mg/L)	5	NA	<0.3 U	<0.5 U	<0.05 U	<0.02 U	0.013 B	<0.03 U	<0.03 U	<0.015 U	<0.075 U	<0.075 U	<0.03 U
Antimony, Dissolved (mg/L)	0.006	NA	<0.004 U	<0.002 U	<0.0008 U	<0.002 U	<0.002 U	<0.004 U	<0.004 U	<0.002 U	<0.004 U	<0.01 U	<0.004 U
Beryllium, Dissolved (mg/L)	0.004	NA	<0.0005 U	<0.0003 U	<0.0002 U	<0.0003 U	<0.00025 U	<0.0005 U	<0.0005 U	<0.00025 U	<0.0005 U	<0.00125 U	<0.0005 U
Bicarbonate as CaCO3 (mg/L)	none	401	NA	392 H	354	328	304	360	323	258	346	393	383 H
Carbonate as CaCO3 (mg/L)	none	<20 U	NA	<20 UH	<2 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 UH
Cadmium, Dissolved (mg/L)	0.005	NA	<0.0005 U	<0.0003 U	<0.0001 U	0.00014 B	<0.00025 U	<0.0005 U	<0.0005 U	<0.00025 U	<0.00125 U	<0.00125 U	<0.0005 U
Calcium, Dissolved (mg/L)	none	425	490	402	405	474	427	477	433	475	385	410	419
Cobalt, Dissolved (mg/L)	0.05	NA	0.0047	0.00595	0.0046	0.00805	0.00527	0.00582	0.00508	0.00554	0.00491	0.00723	0.00836
Cyanide, Free (mg/L)	0.2	NA	<0.01 U	<0.01 U	<0.003 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 UH	<0.01 U	<0.01 U
Magnesium, Dissolved (mg/L)	none	109	121	113	116	117	120	104	109	114	113	120	112
Mercury, Dissolved (mg/L)	0.002	NA	<0.001 U	<0.001 U	<0.0002 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Molybdenum, Dissolved (mg/L)	0.21	NA	<0.2 U	<0.2 U	0.0045	0.0146	0.0089	0.00157	0.00892	0.0126	0.00913	0.00782	0.0101
Nickel, Dissolved (mg/L)	0.1	NA	0.05 B	0.04 B	0.021	0.0511	0.0436	0.0237	0.0268	0.0477	0.0214	0.0291	0.0263
Potassium, Dissolved (mg/L)	none	6.6	8.1	8.1	9.4	9.7	9.03	6.08	8.49	8.08	8.77	9.33	9.04
Silver, Dissolved (mg/L)	0.05	NA	<0.05 U	<0.0005 U	<0.0002 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.0005 U	<0.0025 U	<0.005 U	<0.001 U
Sodium, Dissolved (mg/L)	none	329	317	501	617	439	497	230	413	356	569	700	417
Vanadium, Dissolved (mg/L)	0.1	NA	<0.05 U	<0.05 U	<0.001 U	<0.002 U	<0.002 U	<0.004 U	<0.004 U	<0.002 U	<0.01 U	<0.01 U	<0.004 U

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 7: Summary of Monitoring Results for MW-6

Date	Colorado Basic Standards for Groundwater	3/19/2013	5/28/2013	8/27/2013	11/14/2013	2/18/2014	5/21/2014	8/27/2014	11/11/2014	2/18/2015	5/27/2015	8/27/2015	11/9/2015	2/15/2016	5/31/2016	8/16/2016	11/9/2016
Metals																	
Arsenic, Dissolved (mg/L)	0.01	0.002 B	<0.01 U	<0.01 U	<0.01 U	0.004 B	0.007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved (mg/L)	2	0.97	**3.22**	**3.56**	**4.12**	**5.95**	**3.32**	**3.46**	**4.37**	**7.37**	**7.47**	**8.74**	**8.12**	**8.34**	**8.26**	**8.42**	**8.25**
Boron, Dissolved (mg/L)	0.75	0.6	0.7	0.6	0.6	0.58	0.7	0.6	0.7	0.6 B	0.6	0.65	0.6	0.57	0.5	0.5	0.55
Chromium, Dissolved (mg/L)	0.1	<0.01 U	<0.02 U	0.018 B	<0.02 U	<0.02 U	<0.01 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved (mg/L)	0.2	<0.5 U	<0.5 U	<0.5 U	<0.3 U	<0.3 U	<0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved (mg/L)	0.3	**1.0**	**1.3**	**0.6**	**0.6**	**0.6**	**2.1**	**1.9**	**1.3**	**2.5**	**4.1**	**3.9**	**5.2**	**5.3**	**5.5**	**5.4**	**5**
Lead, Dissolved (mg/L)	0.05	<0.003 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.003 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved (mg/L)	0.05	**0.33**	**0.29** B	**0.2** B	**0.19**	**0.19**	**0.21** B	**0.2** B	**0.25** B	**0.3** B	**0.31**	**0.39**	**0.42**	**0.45**	**0.37**	**0.35**	**0.31**
Selenium, Dissolved (mg/L)	0.02	0.0048	0.007	0.0016	0.002 B	0.001 B	0.0033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium, Dissolved (mg/L)	0.002	<0.003 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.003 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved (mg/L)	2	<0.5 U	<0.5 U	<0.5 U	<0.3 U	<0.3 U	<0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other																	
Chloride (mg/L)	250	**5,090**	**5,680**	**6,080** U	**5,860**	**6,020**	**6,520**	**5,610**	**6,110**	**5,960**	**5,680**	**5,880**	**5,800**	**5,590**	**5,520**	**6,050**	**5620**
Fluoride (mg/L)	2	1.3	1.4	1.4	1.3	1.3	1.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite as N (mg/L)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lab pH (s.u)	6.5 - 8.5	8.1 H	8.2 H	8.2 H	8.2 H	8.2 H	7.9 H	8.0 H	8.1 H	7.7 H	7.8 H	7.8 H	7.7 H	7.78	7.4 H	7.6 H	7.7 H
Total Dissolved Solids, filterable residue (mg/L)	1.25 x Background*	9,110	10,200	9,340 H	10,100 H	10,900	8,800 H	9,350	10,400	10,600	10,300 ^	8,840 ^	10,200	9,780	10,800	10,400	10500
Sulfate (mg/L)	250	249.7	<250 U	<250 U	98.6 B	<250 U	52.5 B	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U
Gross Alpha (pCi/L)	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gross Beta (pCi/L)	**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Parameters (Not Available pre-2010))																	
Field pH (s.u)	6.5 - 8.5	7.91	7.67	7.58	7.46	7.85	7.47	7.46	7.75	7.43	7.55	7.2	7.51	7.78	7.32	6.6	7.24
Field Conductivity (µS/cm)	none	9,340	16,470	17,850	18,064	17,460	18,250	18,670	17,940	18,880	16,370	18,670	13,820	14,380	16,600	17,790	17,570
Temperature (Degrees Celsius)	none	12.8	17	18.4	13.72	11.3	16.1	17.1	7.9	14.5	17.1	19.8	12.7	15.3	17.8	18.3	18.9
Supplementary Analytes																	
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bicarbonate as CaCO3 (mg/L)	none	463	507	513	529	558	580	608	632	NA	656	673	702	691	736	716	715
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	NA	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved (mg/L)	none	58	44	33	34	32.2	40	41	45	51	49	57.9	63	68	67	69	66.1
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved (mg/L)	none	21	20	18	17	16	16	17	18	22	17	18	17	18	16	19	17.3
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved (mg/L)	none	14 B	12 B	12 B	11	10	11	10	10	13 B	10	10	10	11	9 B	10	10.7
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved (mg/L)	none	3,600	3,920	3,860	4,000	3,960	4,060	3,770	3,710	3,840	3,930	3,850	3,840	4,100	3,770	3,780	3,960
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 7: Summary of Monitoring Results for MW-6

Date	Colorado Basic Standards for Groundwater	5/31/2017	11/15/2017	6/6/2018	11/15/2018	6/12/2019	12/12/2019	6/4/2020	12/14/2020	6/23/2021	12/8/2021	6/23/2022	11/21/2022	6/1/2023	11/16/2023
Metals															
Arsenic, Dissolved (mg/L)	0.01	NA	NA	NA	0.007 B	0.0074	0.007 B	0.009 B	0.00928	0.00574 B	0.00479 B	0.00603 B	<0.02 U	0.00887 B	0.00803 B
Barium, Dissolved (mg/L)	2	**7.85**	**7.77**	**7.65**	**7.25**	**6.66**	**6.84**	**6.64**	**6.00**	**5.81**	**6.01**	**6.57**	**6.27**	**5.96**	**5.92**
Boron, Dissolved (mg/L)	0.75	0.7	**0.8**	0.6	0.6	0.6 B	0.67	0.58	**0.757**	**0.765** B	0.657	0.594 B	0.659 B	0.645	0.534
Chromium, Dissolved (mg/L)	0.1	NA	NA	NA	<0.02 U	<0.002 U	<0.005 U	<0.04 U	<0.002 U	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U
Copper, Dissolved (mg/L)	0.2	NA	NA	NA	<0.02 U	<0.002 U	<0.008 U	0.05	0.00195 B	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U
Iron, Dissolved (mg/L)	0.3	**1.7**	**3.4**	**3.0**	**2.9**	**2.2**	**2.87**	**1.93**	**2.99**	**3.14**	**3.62**	**3.69**	**2.57**	**3.68**	**2.93**
Lead, Dissolved (mg/L)	0.05	NA	NA	NA	<0.005 U	<0.0005 U	<0.001 U	<0.01 U	<0.0005 U	<0.005 U	<0.005 U	<0.005 U	<0.01 U	<0.005 U	0.00179 B
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	1.74	1.87	2.21	1.81	1.79	1.76	1.96	1.74	1.60	1.82	1.80
Manganese, Dissolved (mg/L)	0.05	**0.14** B	**0.07** B	**0.06** B	**0.09**	**0.0733** U	**0.079**	**0.072**	**0.0585**	**0.0862**	**0.0831**	**0.0667**	**0.0513**	**0.113**	**0.0977**
Selenium, Dissolved (mg/L)	0.02	NA	NA	NA	<0.003 U	0.0009	<0.001 U	<0.003 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.0125 U	<0.0025 U
Thallium, Dissolved (mg/L)	0.002	NA	NA	NA	<0.005 U	<0.0005 U	<0.0001 U	<0.003 U	<0.0025 U	0.000924 B	<0.0025 U	<0.0025 U	<0.0025 U	<0.0005 U	<0.0025 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	0.004	0.0023	0.004 B	0.003 B	0.00322	0.00264 B	0.00306 B	0.00361 B	0.00398 B	0.00543	0.00651
Zinc, Dissolved (mg/L)	2	NA	NA	NA	<0.5 U	<0.5 U	<0.05 U	<0.02 U	<0.015 U	<0.15 U	<0.15 U	<0.15 U	<0.3 U	<0.15 U	<0.15 U
Other															
Chloride (mg/L)	250	**6,130**	**5,900**	**5,880**	**6,490**	**6,610** H	**6,390**	**7,100**	**6,110**	**6,810**	**6,190**	**6,730**	**6,130**	**6,390** H	**5,830**
Fluoride (mg/L)	2	NA	NA	NA	1.09	1.20	1.20	1.10	1.12	1.18	1.27	1.01	1.00	0.94	1.04
Nitrate as N (mg/L)	10	NA	NA	NA	NA	NA	<0.02 U	<0.1 U	<0.1 U	<0.1 UH	<0.1 U	0.032 B	<0.1 U	<0.1 U	<0.1 U
Nitrite as N (mg/L)	1	NA	NA	NA	NA	NA	<0.01 U	<0.05 U	<0.05 U	<0.05 UH	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	NA	NA	<0.02 U	<0.1 U	<0.1 U	<0.1 UH	<0.1 U	0.032 B	<0.1 U	<0.1 U	<0.1 U
Lab pH (s.u)	6.5 - 8.5	8.1 H	7.7 H	7.8 H	8 H	7.9 H	8.1 H	8.1 H	8 H	7.9 H	7.9 H	8.1 H	8.3 H	8.11 H	7.9 H
Total Dissolved Solids, filterable residue (mg/L)	1.25 x Background*	10,500	10,400	10,500	10,700	10,600	10,300	10,700	10,600	11,100	10,500	10,400 H	10,600	10,600	10,100
Sulfate (mg/L)	250	<250 U	<200 U	51 B	<200 U	<200 U	<40 U	<200 U	<200 U	<200 U	<200 U	<200 U	<200 U	<200 UH	<200 U
Gross Alpha (pCi/L)	15	NA	NA	NA	**47 (±36)**	-33 (±24)	0.0(±52)	**16(±29)**	14 (±33)	**65(±40)**	**21(±56)**	**19(±53)**	**32(±66)**	-8.4(±36)	**82(±57)**
Gross Beta (pCi/L)	**	NA	NA	NA	43 (±35)	56 (±47)	0.78(±63)	33(±46)	-28 (±47)	57(±44)	-0.71(±50)	630(±110)	6(±60)	18(±55)	50(±54)
Field Parameters (Not Available pre-2010))															
Field pH (s.u)	6.5 - 8.5	7.79	7.86	7.76	7.34	7.76	7.72	7.29	7.72	7.52	7.52	7.56	7.76	7.35	7.42
Field Conductivity (µS/cm)	none	17,850	17,470	18,950	17,560	18,000	11,290	14,930	16,067	16,612	19,008	19,509	13,868	16,557	18,024
Temperature (Degrees Celsius)	none	16.6	11.3	17.7	11.1	17.9	10	21.5	12.1	19.4	11.95	16.6	12.0	15.1	15.7
Supplementary Analytes (Not Historically analyzed)															
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	<2 U	<3 U	<0.05 U	<0.3 U	<0.015 U	<0.15 U	<0.15 U	<0.15 U	<0.3 U	<0.15 U	<0.15 U
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	<0.02 U	0.0014 B	<0.004 U	<0.04 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	<0.003 U	<0.0003 U	<0.0008 U	<0.0003 U	<0.00025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U
Bicarbonate as CaCO3 (mg/L)	none	658	639	652	NA	685 H	702	720	647	625	629	624	691	827	700 H
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	<20 U	NA	<20 UH	<2 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 UH
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	<0.003 U	0.00006 B	<0.0005 U	<0.0003 U	<0.00025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.0025 U	<0.0025 U
Calcium, Dissolved (mg/L)	none	51	44	41	47	40	45.4	43.2	41.1	45.7	40.3	44.4	40.8	57.7	52.6
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	<0.003 U	0.00024 B	<0.0005 U	<0.005 U	0.000315	0.000693 B	0.000723 B	0.000533 B	<0.005 U	0.00136 B	0.00115 B
Cyanide, Free (mg/L)	0.2	NA	NA	NA	0.009 B	0.012	<0.003 U	0.004 B	0.005 B	0.008 B	0.0088 B	<0.01 U	<0.01 UH	<0.01 U	<0.01 U
Magnesium, Dissolved (mg/L)	none	16	16	16	16	14	15.8	15	15.8	14.7	14.7	16.2	15.4	17.3	15.6
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	<0.001 U	<0.001 U	<0.0002 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	0.025 B	0.0208 U	0.021	0.022	0.0279	0.0177	0.0254	0.0291	0.0369	0.0362	0.0397
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	0.007 B	0.0063 U	0.01	0.02	0.023	0.0204	0.0167	0.019	0.0195 B	0.0204	0.0189
Potassium, Dissolved (mg/L)	none	9 B	9 B	8 B	10	9 B	11.6	14.8	8.7	7.67 B	10.6	9.1 B	7.11 B	9.2	10.5
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	<0.005 U	<0.0005 U	<0.001 U	<0.01 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.01 U	<0.01 U	<0.005 U
Sodium, Dissolved (mg/L)	none	3,920	4,060	3,870	3,960	3,910	3,960	3,890	3,710	3,860	3,900	3,940	3,910	3,970	3,950
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	<0.02 U	0.0005 U	<0.005 U	<0.04 U	0.00145 B	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 8: Summary of Monitoring Results for MW-7

Date	Colorado Basic Standards for Groundwater	3/19/2013	5/29/2013	8/27/2013	11/14/2013	2/18/2014	5/21/2014	8/27/2014	11/11/2014	2/18/2015	5/27/2015	8/27/2015	11/9/2015	2/15/2016	5/31/2016	8/16/2016	11/9/2016
Metals																	
Arsenic, Dissolved (mg/L)	0.01	0.010	0.010 B	**0.011**	0.008 B	**0.015**	0.009 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved (mg/L)	2	0.16 B	0.14 B	0.33	**2.08**	1.78	**3.52**	**2.35**	**3.7**	**5.43**	**4.74**	**2.66**	**2.65**	**4.66**	**3.79**	1.24	**4.19**
Boron, Dissolved (mg/L)	0.75	0.6	**0.9**	**0.79**	0.75	0.75	0.7	**0.8**	**0.8**	0.7 B	0.6	0.73	0.7	**0.8**	0.6	0.5	0.63
Chromium, Dissolved (mg/L)	0.1	<0.01 U	<0.02 U	0.009 B	<0.02 U	<0.02 U	<0.02 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved (mg/L)	0.2	**<0.5** U	<0.5 U	<0.3 U	<0.3 U	<0.3 U	<0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved (mg/L)	0.3	**1.6**	**3.4**	**1.5**	**2.9**	**2.9**	**2.8**	**4.4**	**3.8**	**4.6**	**5.8**	**4.7**	**4.6**	**6.3**	**5.9**	**2.3**	**3.26**
Lead, Dissolved (mg/L)	0.05	<0.003 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved (mg/L)	0.05	**0.27**	**0.66**	**0.51**	**0.61**	**0.53**	**0.41**	**0.66**	**0.45**	**0.3** B	**0.38**	**0.37**	**0.36**	**0.3**	**0.3**	**0.26** B	**0.205**
Selenium, Dissolved (mg/L)	0.02	0.0025	0.006	<0.003 U	0.002 B	0.001 B	0.001 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium, Dissolved (mg/L)	0.002	<0.003 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved (mg/L)	2	<0.5 U	<0.5 U	<0.3 U	<0.3 U	<0.3 U	<0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other																	
Chloride (mg/L)	250	**3,701**	**5,280**	**6,040**	**6,430**	**6,030**	**6,510**	**5,330**	**5,850**	**6,140**	**6,330**	**5,860**	**5,680**	**6,230**	**5,850**	**5,550**	**5,990**
Fluoride (mg/L)	2	1.3	1.0	1.1	1.1	1	1.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite as N (mg/L)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lab pH (s.u)	6.5 - 8.5	8.1 H	8.0 H	7.9 H	7.9 H	8.0 H	7.6 H	7.9 H	7.9 H	7.8 H	7.8 H	7.9 H	7.8 H	7.75	7.6 H	7.6 H	8 H
Total Dissolved Solids, filterable residue (mg/L)	1.25 x Background*	8,640	11,500	10,200 H	10,700 H	10,300	10,600 H	10,100	10,600	10,500	10,200 ^	8,800 ^	10,400	10,800	10,900	10,100	10,700
Sulfate (mg/L)	250	**1,589**	**1,240**	**510**	130 B	104 B	60.9 B	80.2 B	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	<250 U	179 B	101 B
Gross Alpha (pCi/L)	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gross Beta (pCi/L)	**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Parameters (Not Available pre-2010))																	
Field pH (s.u)	6.5 - 8.5	7.85	7.08	6.86	7.55	7.27	6.95	7.37	6.94	7.05	6.27	7.08	7.42	7.75	7.22	6.91	7.3
Field Conductivity (µS/cm)	none	13	19,280	19,810	19,358	18,640	18,880	18,970	18,440	8,770	16,170	18,020	14,000	13,820	16,530	17,520	18,050
Temperature (Degrees Celsius)	none	13.4	12.2	20.5	13	11.3	16.2	15.1	8	13.5	17.2	18.3	12.1	13.3	17.6	18.1	16.1
Supplementary Analytes																	
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bicarbonate as CaCO3 (mg/L)	none	458	596	696	715	838	822	785	837	NA	765	853	828	821	828	844	836
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	NA	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved (mg/L)	none	105	142	103	72	67.8	58	56	51	50	47	52	53	54	50	54	47.1
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide, Free (mg/L)	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved (mg/L)	none	40	43	30	25	22	21	21	20	23	19	19	18	20	18	19	18
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved (mg/L)	none	11 B	13 B	12	11	10	10	11	9 B	13 B	9 B	9	10	11	10	10	8.8
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved (mg/L)	none	3,200	4,150	4,720	4,280	4,020	4,350	3,910	3,740	3,970	4,010	3,930	3,880	4,240	3,930	3,820	4,330
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

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*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 8: Summary of Monitoring Results for MW-7

Date	Colorado Basic Standards for Groundwater	5/31/2017	11/15/2017	6/6/2018	11/15/2018	6/12/2019	12/12/2019	6/4/2020	12/14/2020	6/23/2021	12/8/2021	6/23/2022	11/21/2022	6/1/2023	11/16/2023
Metals															
Arsenic, Dissolved (mg/L)	0.01	NA	NA	NA	0.002 B	0.0031	0.002 B	0.0039	0.00175	<0.01 U	0.0026 B	0.00265 B	<0.02 U	<0.01 U	0.00379 B
Barium, Dissolved (mg/L)	2	**3.96**	**3.8**	**5.5**	**3.42**	**4.42**	**2.86**	1.06	**2.54**	**4.32**	**2.28**	**3.05**	**2.52**	**4.4**	**3.12**
Boron, Dissolved (mg/L)	0.75	0.7	**0.8**	0.7	0.7	0.7 B	0.64	0.65	0.735	0.717 B	0.634	0.604 B	0.55 B	0.632	0.665
Chromium, Dissolved (mg/L)	0.1	NA	NA	NA	<0.02 U	<0.002 U	<0.005 U	<0.004 U	<0.002 U	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U
Copper, Dissolved (mg/L)	0.2	NA	NA	NA	<0.02 U	<0.002 U	<0.008 U	<0.004 U	0.00177 B	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U
Iron, Dissolved (mg/L)	0.3	**5.5**	**6.1**	**3.2**	**3.9**	**2**	**2.81**	**11.6**	**0.932**	**2.95**	**1.96**	**2.07**	**0.622** B	**1.04**	**3.78**
Lead, Dissolved (mg/L)	0.05	NA	NA	NA	<0.005 U	<0.0005 U	<0.001 U	<0.0005 U	0.00012 B	<0.005 U	<0.005 U	<0.005 U	<0.01 U	<0.005 U	<0.005 U
Lithium, Dissolved (mg/L)	2.5	NA	NA	NA	1.84	2.02	2.30	1.92	1.84	1.88	2.06	1.85	1.66	1.87	1.93
Manganese, Dissolved (mg/L)	0.05	**0.19** B	**0.18** B	**0.14** B	**0.11** B	**0.2** B	**0.122**	**0.166**	**0.117**	**0.112**	**0.14**	**0.109**	**0.119**	**0.168**	**0.129**
Selenium, Dissolved (mg/L)	0.02	NA	NA	NA	<0.003 U	0.001	<0.001 U	<0.003 U	<0.001 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.0125 U	<0.0025 U
Thallium, Dissolved (mg/L)	0.002	NA	NA	NA	<0.005 U	<0.0005 U	<0.0001 U	<0.003 U	<0.0025 U	0.000757 B	<0.0025 U	<0.0025 U	<0.0025 U	<0.0005 U	<0.0025 U
Uranium, Dissolved (mg/L)	0.03	NA	NA	NA	0.005	0.004	0.005	0.0093	0.00185	0.00426 B	0.00494 B	0.00423 B	0.00344 B	0.00318 B	0.00566
Zinc, Dissolved (mg/L)	2	NA	NA	NA	<0.5 U	0.1 B	0.19 B	0.01 B	<0.015 U	<0.15 U	<0.15 U	0.116 B	<0.3 U	<0.15 U	<0.15 U
Other															
Chloride (mg/L)	250	**6,480**	**6,240**	**6,440**	**7,310**	**7,480** H	**6,780**	**6,550**	**6,690**	**7,410**	**6,420**	**6,650** H	**6,480**	**6,340** H	**6,320**
Fluoride (mg/L)	2	NA	NA	NA	0.88	1.00	0.90	0.80	1.00	0.95	0.90	0.91	0.90	0.92	0.87
Nitrate as N (mg/L)	10	NA	NA	NA	NA	NA	0.57	<0.1 U	0.083	0.05 BH	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U
Nitrite as N (mg/L)	1	NA	NA	NA	NA	NA	<0.01 U	0.02 B	<0.05 U	<0.05 UH	<0.05 U	<0.05 U	<0.05 0	<0.05 U	<0.05 U
Nitrate+Nitrite as N (mg/L)	10	NA	NA	NA	NA	NA	0.57	0.03 B	0.083 B	0.052 BH	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U
Lab pH (s.u)	6.5 - 8.5	8 H	7.8 H	7.7 H	7.9 H	7.9 H	7.9 H	8 H	7.8 H	7.8 H	7.8 H	8 H	8.2 H	8.2 H	7.9 H
Total Dissolved Solids, filterable residue (mg/L)	1.25 x Background*	11,100	11,300	11,500 H	11,300	11,300	11,200	11,200	11,300	12,100	11,100	11,200 H	11,100	11,200	10,300
Sulfate (mg/L)	250	59 B	58 B	75 B	83.9 B	63.8 B	54.1 B	125 B	<200 U	43 B	<200 U	94.8 B	<200 U	<200 UH	<200 U
Gross Alpha (pCi/L)	15	NA	NA	NA	5.8 (±29)	**23 (±41)**	-50(±26)	2.4(±37)	-21 (±31)	**64(±53)**	-19(±51)	-23(±35)	**150(±85)**	11(±39)	**15(±24)**
Gross Beta (pCi/L)	**	NA	NA	NA	34 (±42)	42 (±252)	35(±59)	11(±53)	1.9 (±53)	92(±58)	26(±67)	39(±66)	-2.3(±56)	20(±56)	-1.9(±51)
Field Parameters (Not Available pre-2010))															
Field pH (s.u)	6.5 - 8.5	7.65	7.17	7.37	7.19	7.61	7.58	7.85	7.69	7.71	7.32	7.18	7.33	7.27	7.28
Field Conductivity (µS/cm)	none	19,350	18,550	20,050	19,200	19,110	11,900	15,310	17,263	17,831	19,845	20,634	14,884	17,050	18,898
Temperature (Degrees Celsius)	none	22.5	12.3	16.4	12.9	16.3	8.3	19.8	12.5	20.9	12.14	17.4	13.2	14.1	15.8
Supplementary Analytes (Not Historically analyzed)															
Aluminum, Dissolved (mg/L)	5	NA	NA	NA	<2 U	<3 U	<0.05 U	<0.02 U	0.0067 B	<0.15 U	<0.15 U	<0.15 U	<0.3 U	<0.15 U	<0.15 U
Antimony, Dissolved (mg/L)	0.006	NA	NA	NA	<0.02 U	0.0015 B	<0.004 U	0.0045	<0.02 U	**0.00691** B	<0.02 U	<0.02 U	<0.02 U	**0.0145** B	**0.0138** B
Beryllium, Dissolved (mg/L)	0.004	NA	NA	NA	<0.003 U	<0.0003 U	<0.0008 U	<0.0003 U	<0.00025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U
Bicarbonate as CaCO3 (mg/L)	none	745	700	714	NA	681 H	701	876	663	650	713	688	765	836	776 H
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	<20 U	NA	<20 UH	<2 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 UH
Cadmium, Dissolved (mg/L)	0.005	NA	NA	NA	<0.003 U	0.00007 B	<0.0005 U	<0.0005 U	0.000056 B	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.0025 U	<0.0025 U
Calcium, Dissolved (mg/L)	none	52	55	52	54	53	54.4	54.2	52.5	56.8	52	54	52.1	52.7	53.1
Cobalt, Dissolved (mg/L)	0.05	NA	NA	NA	<0.003 U	0.00025 B	<0.0005 U	0.0004 B	0.000208 B	0.000587 B	<0.0025 U	<0.0025 U	<0.005 U	<0.0025 U	0.00125 B
Cyanide, Free (mg/L)	0.2	NA	NA	NA	0.005 B	0.012	0.003 B	0.003 B	0.0096 B	0.0098 B	0.0197	<0.01 U	<0.01 UH	0.0101	<0.01 U
Magnesium, Dissolved (mg/L)	none	19	20	20	19	18	18.5	17.9	18.4	17.9	17.1	18.8	17.7	19.4	18.4
Mercury, Dissolved (mg/L)	0.002	NA	NA	NA	<0.001 U	<0.001 U	<0.0002 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Molybdenum, Dissolved (mg/L)	0.21	NA	NA	NA	0.022 B	0.0182 U	0.017	0.0416	0.00375	0.0148	0.0103	0.012	0.00734 B	0.00509	0.0222
Nickel, Dissolved (mg/L)	0.1	NA	NA	NA	<0.03 U	<0.001 U	<0.004 U	0.0015 B	<0.001 U	<0.01 U	<0.01 U	<0.01 U	<0.02 U	<0.01 U	<0.01 U
Potassium, Dissolved (mg/L)	none	11	9 B	9 B	11	11	12.7	17.6	8.85	9.09 B	10.9	9.98 B	7.47 B	10.1	12.5
Silver, Dissolved (mg/L)	0.05	NA	NA	NA	<0.005 U	<0.0005 U	<0.001 U	<0.001 U	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.01 U	<0.01 U	<0.005 U
Sodium, Dissolved (mg/L)	none	4,240	4,320	4,170	4,250	4,220	4,250	4,070	3,840	4,160	4,160	4,260	4,030	4,220	4,270
Vanadium, Dissolved (mg/L)	0.1	NA	NA	NA	<0.02 U	0.0008 U	<0.005 U	<0.004 U	0.00118 B	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

The Basic Standards for Groundwater (BSGW) is the minimum of Table 1- Table 4 Per Section 41.5 (C) (6) the of Regulation 41

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Colorado Basic Standards for Groundwater

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 9: Summary of Monitoring Results for MW-8

Date	Colorado Basic Standards for Groundwater	12/14/2020	6/23/2021	12/8/2021	6/23/2022	11/21/2022	6/1/2023	11/16/2023
Metals								
Arsenic, Dissolved (mg/L)	0.01	0.00546	<0.01 U	0.0025 B	0.00361 B	<0.02 U	0.00333 B	0.00368 B
Barium, Dissolved (mg/L)	2	0.299	0.137	0.161	0.847	0.885	**4.52**	**3.62**
Boron, Dissolved (mg/L)	0.75	**0.9**	**0.823** B	**0.763**	0.682 B	**0.763** B	0.701	0.637
Chromium, Dissolved (mg/L)	0.1	<0.002 U	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U
Copper, Dissolved (mg/L)	0.2	0.00306	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U
Iron, Dissolved (mg/L)	0.3	<0.75 U	<1.5 U	0.13 B	<1.5 U	<1.5 U	<0.15 U	0.147 B
Lead, Dissolved (mg/L)	0.05	<0.0005 U	<0.005 U	<0.005 U	<0.005 U	<0.01 U	<0.005 U	<0.005 U
Lithium, Dissolved (mg/L)	2.5	1.55	1.70	1.97	1.80	1.71	1.91	1.97
Manganese, Dissolved (mg/L)	0.05	0.0161	0.0336	0.0455	0.0233	0.0174 B	0.0395	0.0341
Selenium, Dissolved (mg/L)	0.02	0.00179 B	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.0125 U	<0.0025 U
Thallium, Dissolved (mg/L)	0.002	<0.0025 U	0.000826 B	<0.0025 U	<0.0025 U	<0.0025 U	<0.0005 U	<0.0025 U
Uranium, Dissolved (mg/L)	0.03	0.0167	**0.056**	**0.0452**	**0.0311**	0.0046 B	0.0107 B	**0.0309**
Zinc, Dissolved (mg/L)	2	0.0091 B	<0.15 U	<0.15 U	<0.15 U	<0.3 U	<0.15 U	<0.15 U
Other								
Chloride (mg/L)	250	**5,910**	**7,000**	**6,910**	**7,130**	**7,130**	**7,580** H	**8,500** H
Fluoride (mg/L)	2	1.66	1.54	1.40	1.34	1.15	1.36	1.62
Nitrate as N (mg/L)	10	<0.1 U	<0.1 UH	<0.1 U	0.041 B	<0.1 U	0.23	0.03 B
Nitrite as N (mg/L)	1	<0.05 U	<0.05 UH	<0.05 U	<0.05 U	<0.05 U	<0.05 U	<0.05 U
Nitrate+Nitrite as N (mg/L)	10	<0.1 U	<0.1 UH	<0.1 U	0.041 B	<0.1 U	0.23	0.034 B
Lab pH (s.u)	6.5 - 8.5	8.3 H	8.0 H	8.0 H	8.1 H	8.2 H	8.1 H	8.0 H
Total Dissolved Solids, filterable residue (mg/L)	1.25 x Background*	10,100	12,600	12,300	11,600 H	12000	12,000	10,300
Sulfate (mg/L)	250	**529**	**885**	**444**	135 B	<200 U	<200 UH	<400 U
Gross Alpha (pCi/L)	15	**45 (±45)**	**-1.4(±38)**	**36(±60)**	4.9(±46)	6.1(±54)	-6.5(±30)	**51(±50)**
Gross Beta (pCi/L)	**	9.1 (±44)	-1.9(±57)	7.8(±67)	-5.8(±56)	-35(±57)	33(±69)	77(±59)
Field Parameters (Not Available pre-2010))								
Field pH (s.u)	6.5 - 8.5	8.15	8.00	7.47	7.62	7.32	7.56	7.67
Field Conductivity (µS/cm)	none	14,360	18,379	21,344	21,985	17,322	18,782	20,907
Temperature (Degrees Celsius)	none	12.5	21.3	13.3	18.5	12.7	14.2	14
Supplementary Analytes (Not Historically analyzed)								
Aluminum, Dissolved (mg/L)	5	0.0057 B	<0.15 U	<0.15 U	<0.15 U	<0.3 U	<0.3 U	<0.15 U
Antimony, Dissolved (mg/L)	0.006	**0.0125** B	**0.0102** B	**0.0109** B	**0.0134** B	<0.02 U	**0.00926** B	**0.0519**
Beryllium, Dissolved (mg/L)	0.004	<0.00025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.0025 U
Bicarbonate as CaCO3 (mg/L)	none	664	612	582	545	615	622	514 H
Carbonate as CaCO3 (mg/L)	none	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 UH
Cadmium, Dissolved (mg/L)	0.005	<0.00025 U	<0.0025 U	<0.0025 U	<0.0025 U	<0.005 U	<0.0025 U	<0.0025 U
Calcium, Dissolved (mg/L)	none	23.4	56.1	93.6	92.4	91	108	81.7
Cobalt, Dissolved (mg/L)	0.05	0.000745	0.000951 B	0.00158 B	0.00122 B	0.00113 B	0.000787 B	0.0022 B
Cyanide, Free (mg/L)	0.2	<0.01 U	0.0128	0.0158	<0.01 U	<0.01 UH	<0.01 U	<0.01 U
Magnesium, Dissolved (mg/L)	none	18.8	18.4	19.7	21.2	20.1	20.8	19.5
Mercury, Dissolved (mg/L)	0.002	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Molybdenum, Dissolved (mg/L)	0.21	0.0225	0.0469	0.0425	0.0193	<0.01 U	0.00974	0.0463
Nickel, Dissolved (mg/L)	0.1	0.00469	0.00575 B	0.00905 B	0.00634 B	<0.02 U	<0.01 U	0.00989 B
Potassium, Dissolved (mg/L)	none	16.6	12.5	14.4	12.5	8.03 B	11.7	15.5
Silver, Dissolved (mg/L)	0.05	<0.005 U	<0.005 U	<0.005 U	<0.005 U	<0.01 U	<0.01 U	<0.005 U
Sodium, Dissolved (mg/L)	none	3,380	4,260	4,490	4,530	4,410	4,680	4,490
Vanadium, Dissolved (mg/L)	0.1	0.0044	<0.02 U	<0.02 U	<0.02 U	<0.04 U	<0.02 U	<0.02 U

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

NA = Analyte not analyzed

^ = Second and third quarter 2015 reports presented calculated total dissolved solids results

Per Section 41.5 (C) (6) the of Regulation 41, the "Interim Narrative Standard" , is the minimum of Table 1- Table 4 of The Basic Standards for Groundwater (BSGW)

*TDS standard is 1.25 * Background, where background is the average of the 1999-2000 sampling (when available)

Values in **bold** indicate a value greater than the Interim Narrative Standard

**The regulatory standard for Gross Beta is provided in units of exposure, millirems per year (mrems/yr), which would require the measurement of specific nuclides (Tritium and Strontium) with known energy levels. Specific nuclides were not part of the approved constituent list.

Table 10: Hydraulic Testing Results Summary

Monitoring Well	Test Method	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Interperted Testing Interval
MW-1	Slug (rising head)	9.2×10^{-7}	2.6×10^{-3}	Niobrara/Codell Contact
MW-2 [1/]	Slug (rising head)	4.9×10^{-10}	1.4×10^{-6}	Niobrara/Codell Contact
MW-3	Slug (rising head)	7.1×10^{-9}	2.0×10^{-5}	Niobrara/Codell Contact
MW-4	Slug (rising and falling head)	5.0×10^{-7}	1.4×10^{-3}	Niobrara
MW-5 [2/]	Slug (rising and falling head)	See notes	See notes	Silt Overburden
MW-6 [3/]	Analysis of Recovery	6.5×10^{-7}	1.8×10^{-3}	Niobrara
MW-7	Wireline Packer from 55-61 feet	2.3×10^{-6}	6.5×10^{-3}	Niobrara
	Wireline Packer from 251-271 feet	2.9×10^{-6}	8.3×10^{-3}	Niobrara
	Wireline Packer from 261-271 feet	4.0×10^{-6}	1.1×10^{-2}	Codell

Notes:

1/MW-2 was estimated because water levels recovered to higher levels than “static” at the beginning of the test (Secor 1998).

2/Recovery too rapid and water displacements too small in slug tests conducted in monitoring well MW-5 for analysis.

3/Recovery too slow to conduct meaningful slug test in MW-6; hydraulic conductivity estimated from water level recovery between November 2022 and June 2023 sampling events.

Table 11: Statistical Evaluation of MW-8

Monitorning Well Results											Relative Percent Difference Calculation				Absolute Difference Between Assessment Well and MW-8					MW-8 Comparison
Date	Colorado Basic Standards for Groundwater	MW-8		MW-4		MW-6		MW-7		Average (MW-4, MW-6, MW-7)	MW-4	MW-6	MW-7	Average (MW-4, MW-6, MW-7)	MW-4	MW-6	MW-7	Average (MW-4, MW-6, MW-7)	PQL (MW-8)	
November 2022 Sampling Event (Q4)											**November 2022 Sampling Event (Q4)**				**November 2022 Sampling Event (Q4)**					
Metals											**Metals**				**Metals**					
Barium, Dissolved (mg/L)	2	**0.885**		**9.18**		**6.27**		**2.52**		**6.0**	165	151	96	149	-	-	-	-	-	Non-Comparable
Boron, Dissolved (mg/L)	0.75	**0.763**	B	0.71	B	0.659	B	0.55	B	0.640	-	-	-	-	0.05	0.10	0.21	0.12	1.00	Comparable
Iron, Dissolved (mg/L)	0.3	< 1.5	U	< 1.5	U	**2.57**		0.622	B	**1.56**	-	-	-	-	(PQL)	1.07	0.88	0.06	1.50	Comparable
Manganese, Dissolved (mg/L)	0.05	0.0174	B	< 0.04	U	**0.051**		**0.119**		**0.07**	-	-	-	-	0.023	0.034	0.102	0.053	0.04	Comparable
Selenium, Dissolved (mg/L)	0.02	< 0.005	U	< 0.005	U	< 0.005	U	< 0.005	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 0.005 mg/L
Thallium, Dissolved (mg/L)	0.002	< 0.0025	U	< 0.0025	U	< 0.0025	U	< 0.0025	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 0.0025 mg/L
Uranium, Dissolved (mg/L)	0.03	0.0046	B	< 0.01	U	0.00398	B	0.00344	B	0.0058	-	-	-	-	0.0054	0.0006	0.0012	0.0012	0.01	Comparable
Other																				
Chloride (mg/L)	250	**7,130**		**7,670**		**6,130**		**6,480**		**6,760**	7	15	10	5	-	-	-	-	-	Comparable
Fluoride (mg/L)	2	1.15		1		1.0		0.9		1.0	-	-	-	-	0.15	0.15	0.25	0.18	0.35	Comparable
Nitrate as N (mg/L)	10	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 0.1 mg/L
Nitrate+Nitrite as N (mg/L)	10	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 0.1 mg/L
Sulfate (mg/L)	250	< 200	U	< 200	U	< 200	U	< 200	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 200 mg/L
Total Dissolved Solids (mg/L)	1.25 x Background*	12,000		11,000		10,600		11,100		10,900	9	12	8	10	-	-	-	-	-	Comparable
Supplementary Analytes (Not Historically analyzed)																				
Antimony, Dissolved (mg/L)	0.006	< 0.02	U	< 0.02	U	< 0.02	U	< 0.02	U	< 0.02	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)		All Values below PQL of 0.02 mg/L
June 2023 Sampling Event (Q2)											**June 2023 Sampling Event (Q2)**				**June 2023 Sampling Event (Q2)**					
Metals											**Metals**				**Metals**					
Barium, Dissolved (mg/L)	2	**4.52**		**9.18**		**5.96**		**4.40**		**6.51**	68	27	3	36	-	-	-	-	-	Comparable
Boron, Dissolved (mg/L)	0.75	0.701		0.671		0.645		0.632		0.65	4	8	10	8	-	-	-	-	-	Comparable
Iron, Dissolved (mg/L)	0.3	< 0.15	U	0.141	B	3.68		1.04		1.62	-	-	-	-	0.01	3.53	0.89	1.47	0.15	Comparable
Manganese, Dissolved (mg/L)	0.05	0.0395		0.0090	B	**0.113**		**0.168**		**0.10**	-	-	-	-	0.03	0.07	0.13	0.06	0.02	Not Comparable (MW-8 is higher)
Selenium, Dissolved (mg/L)	0.02	< 0.0125	U	< 0.0125	U	< 0.0125	U	< 0.0125	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 0.0125 mg/L
Thallium, Dissolved (mg/L)	0.002	< 0.0005	U	< 0.0005	U	< 0.0005	U	< 0.0005	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 0.0005 mg/L
Uranium, Dissolved (mg/L)	0.03	0.0107	B	< 0.005	U	0.00543		0.00318	B	0.0045	-	-	-	-	0.01	0.01	0.01	0.01	0.03	Comparable
Other																				
Chloride (mg/L)	250	**7,580**	H	**6,900**	H	**6,390**	H	**6,340**	H	**6,543**	9	17	18	15	-	-	-	-	-	Comparable
Fluoride (mg/L)	2	1.36		1.06		0.94		0.92		0.97	-	-	-	-	0.30	0.42	0.44	0.39	0.35	Not Comparable (MW-8 is higher)
Nitrate as N (mg/L)	10	0.231		< 0.1	U	< 0.1	U	< 0.1	U	(PQL)	-	-	-	-	0.13	0.13	0.13	0.13	0.10	Not Comparable (MW-8 is higher)
Nitrate+Nitrite as N (mg/L)	10	0.231		< 0.1	U	< 0.1	U	< 0.1	U	(PQL)	-	-	-	-	0.13	0.13	0.13	0.13	0.10	Not Comparable (MW-8 is higher)
Sulfate (mg/L)	250	< 200	UH	< 200	UH	< 200	UH	< 200	UH	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 200 mg/L
Total Dissolved Solids (mg/L)	1.25 x Background*	12,000		11,000		10,600		11,200		10,933	9	12	7	9	-	-	-	-	-	Comparable
Supplementary Analytes (Not Historically analyzed)																				
Antimony, Dissolved (mg/L)	0.006	**0.00926**	B	< 0.02	U	< 0.02	U	**0.0145**	B	**0.0182**	-	-	-	-	0.01	0.01	0.01	0.01	0.02	Comparable
November 2023 Sampling Event (Q4)											**November 2023 Sampling Event (Q4)**				**November 2023 Sampling Event (Q4)**					
Metals											**Metals**				**Metals**					
Barium, Dissolved (mg/L)	2	**3.62**		**8.99**		**5.92**		**3.12**		**6.01**	85	48	15	50	-	-	-	-	-	Comparable
Boron, Dissolved (mg/L)	0.75	0.637		0.671		0.534		0.665		0.62	5	18	4	2	-	-	-	-	-	Comparable
Iron, Dissolved (mg/L)	0.3	0.147	B	0.145	B	**2.93**		**3.78**		**2.29**	-	-	-	-	0.002	2.78	3.63	2.14	0.15	Comparable
Manganese, Dissolved (mg/L)	0.05	0.0341		0.02		**0.0977**		**0.129**		**0.08**	-	-	-	-	0.01	0.06	0.09	0.05	0.02	Comparable
Selenium, Dissolved (mg/L)	0.02	< 0.0025	U	< 0.0125	U	< 0.0025	U	< 0.0025	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	MW-4 below PQL of 0.0125 mg/L and MW-6, MW-7 and MW-8 below PQL of 0.0025 mg/L
Thallium, Dissolved (mg/L)	0.002	< 0.0025	U	< 0.0025	U	< 0.0025	U	< 0.0025	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	All Values below PQL of 0.0025 mg/L
Uranium, Dissolved (mg/L)	0.03	**0.0309**		< 0.005	U	0.00651		0.00566		0.00572	-	-	-	-	0.026	0.024	0.025	0.025	0.005	Not Comparable (MW-8 is higher)
Other																				
Chloride (mg/L)	250	**8,500**	H	**8,140**		**5,830**		**6,320**		**6,763**	4	37	29	23	-	-	-	-	-	Not Comparable (MW-8 is higher)
Fluoride (mg/L)	2	1.62		1.13		1.04		0.87		1.01	-	-	-	-	0.49	0.58	0.75	0.61	0.35	Not Comparable (MW-8 is higher)
Nitrate as N (mg/L)	10	0.034	B	0.057	B	< 0.1	U	< 0.1	U	0.09	-	-	-	-	0.02	0.07	0.07	0.05	0.10	Comparable
Nitrate+Nitrite as N (mg/L)	10	0.034	B	0.057	B	< 0.1	U	< 0.1	U	0.09	-	-	-	-	0.02	0.07	0.07	0.05	0.10	Comparable
Sulfate (mg/L)	250	< 400	U	< 400	U	< 200	U	< 200	U	(PQL)	-	-	-	-	(PQL)	(PQL)	(PQL)	(PQL)	-	MW-8 and MW-4 below PQL of 400 mg/L and MW-6 and MW-7 below PQL of 200 mg/L
Total Dissolved Solids (mg/L)	1.25 x Background*	10,300		11,200	H	10,100		10,300		10,533	8	2	0	2	-	-	-	-	-	Comparable
Supplementary Analytes (Not Historically analyzed)																				
Antimony, Dissolved (mg/L)	0.006	**0.0519**		< 0.02	U	< 0.02	U	**0.0138**	B	**0.0179**	-	-	-	-	0.03	0.03	0.04	0.03	0.02	Not Comparable (MW-8 is higher)

Notes:

B = Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U = Analyte not detected, reported less than the practical quantitation limit

H = Analysis exceeded method hold time. pH is a field test with an immediate hold time.

(PQL) = All water quality results are below the practical quantification limit

Non- detects replaced with detection limit for calculations

Monitoring well results are bold where they exceed the Colorado Basic Standards for Groundwater

Shading For MW-8 Comparision
No Shadding - All values below PQL
Result comparable to MW-8
Result not comparable to MW-8; MW-8 concentration is higher
Result not comparable to MW-8; MW-8 concentration is lower

Table 12: Groundwater Travel Time Calculations

Monitoring Well	Hydraulic Conductivity Test Method	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Velocity (ft/day) [1, 2]	Time to MW-6 From Edge of CKD (Years)[3]	Time to Amended Permit Boundary From Edge of CKD (Years)[4]
MW-4	Slug (rising and falling head)	5.0×10^{-7}	1.4×10^{-3}	0.0089	192	390
MW-6	Analysis of Recovery	6.5×10^{-7}	1.8×10^{-3}	0.012	146	296
MW-7	Wireline Packer from 55-61 feet	2.3×10^{-6}	6.5×10^{-3}	0.041	41	84
	Wireline Packer from 251-271 feet	2.9×10^{-6}	8.3×10^{-3}	0.052	32	66

Notes:

1- Assumes hydraulic gradient (i) of 0.27 ft/ft based on the November 2023 water levels from MW-1 and MW-6

2- Assumes effective porosity (n_e) of 4.3 % based on Micheals (2014)

3- Distance between eastern edge of CKD Area A2 and MW-6 is 620 feet

4- Distance between eastern edge of CKD Area A2 and Amended Permit Boundary is 1260 feet

Table 13: Calculated Percentages of Pre-1952 Water

Well	Tritium Concentration (Tritium Units)	Percentage of pre-1953 Water
MW-1	8.5	0
MW-2	1.2	86% - 90%
MW-3	0.6	97% - 97%
MW-4	1.7	78% - 83%
MW-6	1.5	81% - 86%
MW-7	1.2	86% - 90%

- percentages calculated based on estimated level of tritium in precipitation of 6.2 TU to 8.1 TU

Table 14: Permitted Well search within 1 mile of the Boettcher Quarry Permitted Boundary

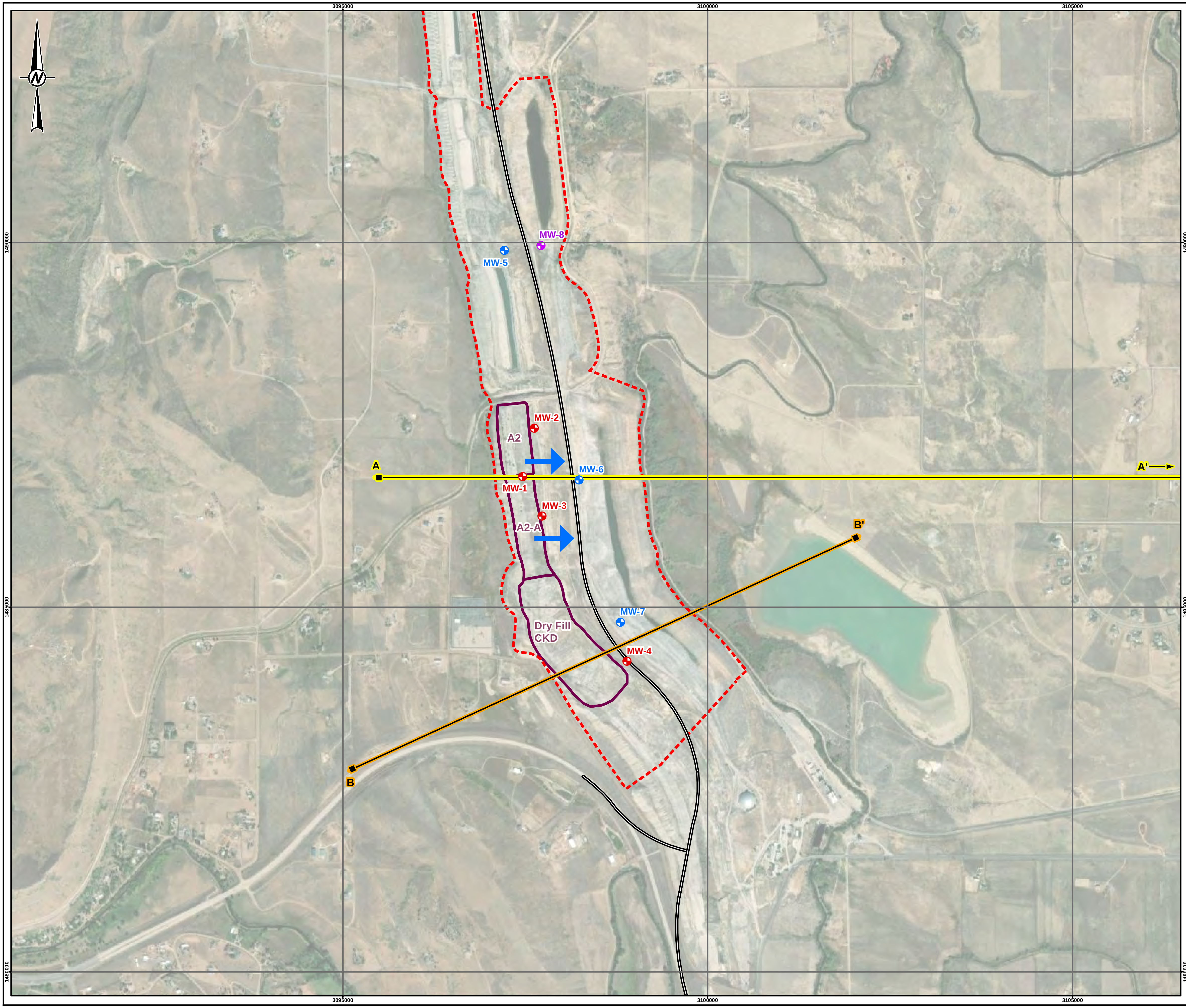
Permit Number	Use	UTM_X	UTM_Y	Completion Depth	Screened Interval (start)	Screened Interval (End)
				feet below ground surface		
98352-VE	Household use only	486839.2	4501806.1	0	0	0
53855-MH	Monitoring/Sampling	489261.5	4501276.7	20	10	20
127-GX	Geothermal	486298	4500625	200	0	0
90549-	Household use only	486270.1	4500645.9	0	0	0
91341-	Household use only	486074.9	4500456	0	0	0
95472-	Household use only	487211	4501110	200	0	0
106543-	Household use only	486011.2	4500831.7	200	120	200
122571-	Domestic	488968.3	4503882.2	0	0	0
130120-	Household use only	486125.7	4501276.7	200	160	195
137464-	Domestic	486747.3	4500890.5	80	60	80
141936-	Household use only	486270.1	4500645.9	118	78	118
150437-	Domestic, Stock	486194.7	4501946.2	100	60	100
153440--A	Domestic	486125.3	4500495.1	135	75	135
157281-	Stock	486638	4500245.5	0	0	0
169125-	Domestic	487613.2	4500457.6	180	100	180
169634-	Domestic	486371.9	4503498.8	340	270	340
170764-	Domestic	486190.9	4503453.9	260	200	260
172936-	Domestic	486596.7	4500794.7	240	130	240
172837-	Domestic	486530.1	4502398	200	70	200
172838-	Domestic	486024.2	4502771.8	445	110	445
173466-	Domestic	486115.5	4502890.3	380	340	380
175572-	Domestic	487005.2	4502262.1	500	440	500
169779--A	Domestic	486666.4	4503338.7	380	310	380
178492-	Domestic	486658	4503890.8	300	240	300
178355-	Domestic	486746.4	4503046.1	500	430	500
178589-	Domestic	486335	4501917	100	80	100
178577-	Domestic	486547.8	4503071.3	320	240	320
179181-	Domestic	486268.7	4502579.1	300	230	300
197177-	Domestic	486991	4502661	540	380	540
202634-	Domestic	486101.9	4502222.1	250	170	250
203824-	Domestic	486508.8	4503833.5	300	240	300
205932--A	Household use only	486839.1	4501798.4	300	180	300
222864-	Household use only	485965.9	4501553.7	560	500	560
222958-	Domestic, Stock	486194.7	4501946.2	440	360	440
4722--A	Domestic	486912.1	4501568.6	650	580	650
178634--A	Domestic	486612.9	4501975.9	320	220	280
70959--A	Household use only	486285.4	4501110.9	250	170	230
251534-	Domestic	486776.1	4499984.9	80	0	0
150616--A	Domestic	486802.3	4501582.8	150	120	125
251204-	Domestic	486638	4500246	400	60	400
326906-	Stock	489207.8	4502424.6	0	0	0
333476-	Other	487211	4500067	450	0	0
271601--A	Domestic	486914.9	4501327.7	300	80	300
43-GX	Geothermal	488611.1	4503436.9	0	0	0
234563--A	Domestic, Stock	487384.8	4500692.8	400	310	370
290444-	Monitoring/Sampling	487840.2	4501426	259	239	259
296009-	Domestic	487681.8	4503582.8	360	300	360
297994-	Monitoring/Sampling	489219	4501446.9	31	19	29
297995-	Monitoring/Sampling	489242.4	4501446.7	15	5	15
298385-	Household use only	487447	4501206	500	420	500
303297-	Commercial	486687.8	4500549.8	280	120	280
6-GX	Geothermal	489232	4503146	280	0	0
314177-	Domestic	485939.7	4500978.1	80	0	0
2335-	Domestic	488987.1	4500636	23	0	0
5562-	Stock	488987.1	4500636	22	0	0
9277-	Domestic	486112.9	4503853.3	80	0	0
14093-	Domestic	486926.4	4500626.7	114	0	0
14212-	Domestic	486926.4	4500626.7	34	0	0
14448-R	Irrigation	489414.2	4502623.7	16	0	0
19530-	Domestic	486926.4	4500626.7	45	0	0
22825-	Domestic	486132.9	4501440.3	100	0	0
30016-	Domestic	486138.4	4501840.5	80	18	63
31888-	Domestic	486121.7	4500635.7	70	0	0
33780-	Domestic	486931.9	4501029	78	0	0
65576-	Domestic	486117.4	4500408.3	110	100	110
67544-	Domestic	486172.2	4500497	135	88	135
68337-	Household use only	486541.3	4501376	135	85	135
77108-	Household use only	486134.8	4501028	245	160	245
78363-	Household use only	486056	4501106	170	120	170
81036-	Household use only	486639.1	4501439	100	0	0

Notes:

UTM coordinates presented in the table are WGS 84 - UTM zone 13N

Wells presented were filtered to only include wells containing the permit issued or well constructed permit status

FIGURES



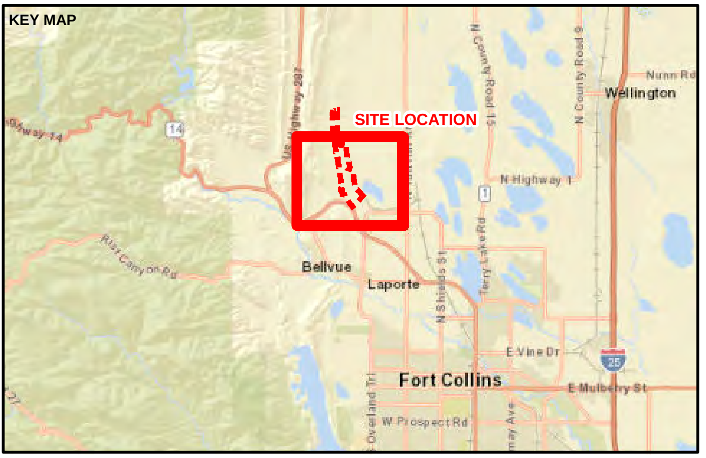
LEGEND

- 🟥 APPROXIMATE PERMIT BOUNDARY
- ▬ APPROXIMATE CKD DISPOSAL AREA BOUNDARY
- ═ PROPOSED ROAD ALIGNMENT
- ■-■ CROSS SECTION A-A'
- ■-■ CROSS SECTION B-B'
- ➡ APPROXIMATE GROUNDWATER FLOW DIRECTION

SITE MONITORING WELLS

- ● PRE-2012 MONITORING WELL
- ● MONITORING WELL INSTALLED 2012
- ● MONITORING WELL INSTALLED 2020

KEY MAP



0 0.125 0.25 0.5 Miles

NOTES

1. PROPERTY AND PERMIT BOUNDARIES PROVIDED BY HOLCIM (US) INC.
2. COORDINATE SYSTEM: NAD83 STATE PLANE COLORADO NORTH (US FT).
3. AERIAL IMAGERY: ESRI BASEMAPS, VIVID. MAXAR. IMAGERY COLLECTED 09/22/2021.
4. PROPOSED ROAD ALIGNMENT DIGITIZED FROM MAP PROVIDED BY MULLER ENGINEERING (NOVEMBER 20, 2019) AND SHOULD BE CONSIDERED APPROXIMATE.
5. FULL EXTENT OF CROSS SECTION LINE A TO A' IS SHOWN IN FIGURE 10.

CLIENT
HOLCIM (US) INC.

PROJECT
BOETTCHER LIMESTONE QUARRY
LARIMER COUNTY, COLORADO

TITLE
SITE LOCATION PLAN

CONSULTANT

YYYY-MM-DD	2024-06-07
DESIGNED	JAT
PREPARED	RHG
REVIEWED	SAH
APPROVED	SAH

PROJECT NO.	REV.	FIGURE
31404755.003	1	1

1 in 0 IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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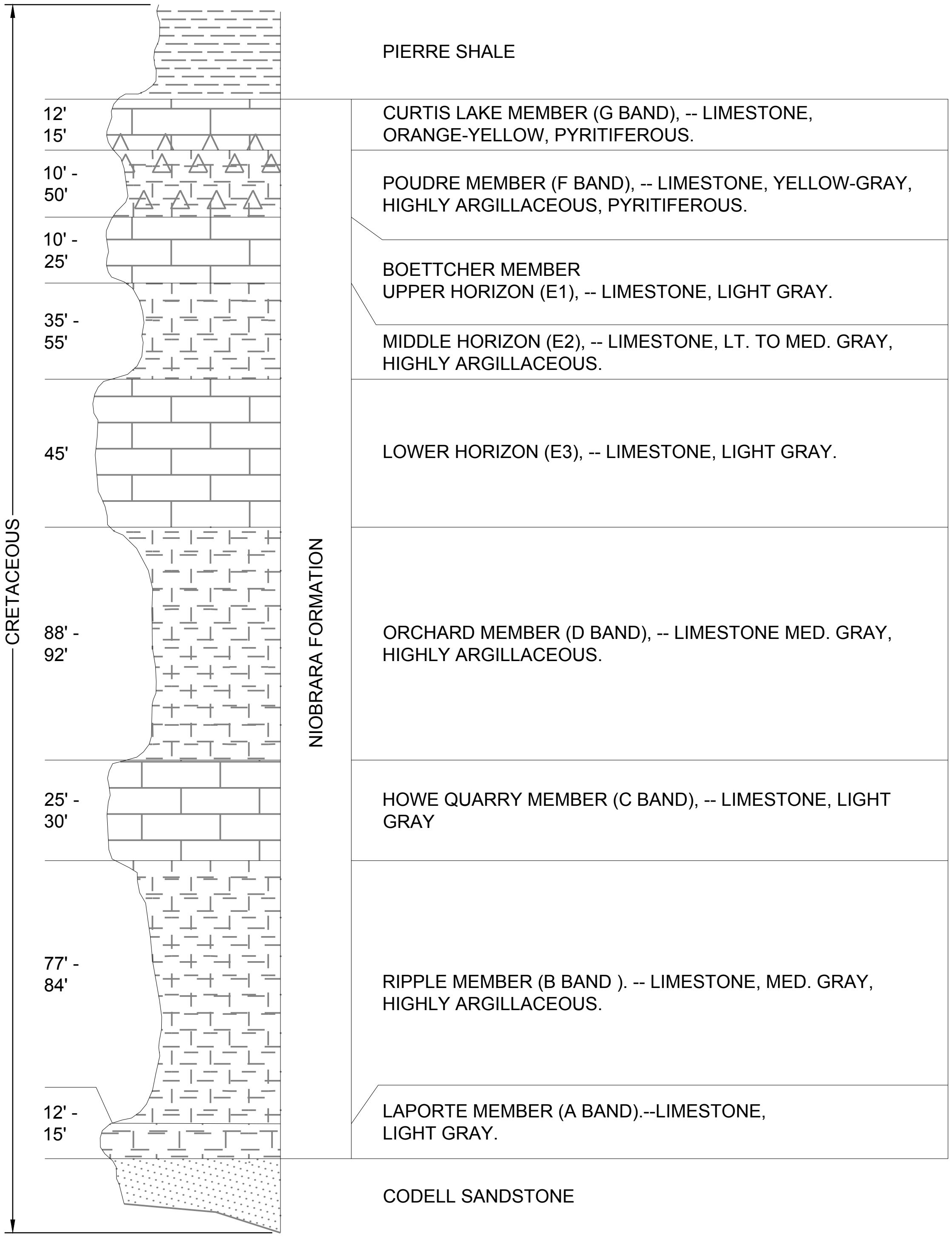


COLUMNAR SECTION, BOETTCHER QUARRY AREA

REFERENCE

INFORMATION WAS DIGITISED FROM: PAGE 6 COLUMNAR SECTION. A REPORT OF INVESTIGATIONS, BOETTCHER PROPERTIES, CO. (IDEAL 1962) AND MODIFIED BY WSP

CLIENT
HOLCIM (US) INC.

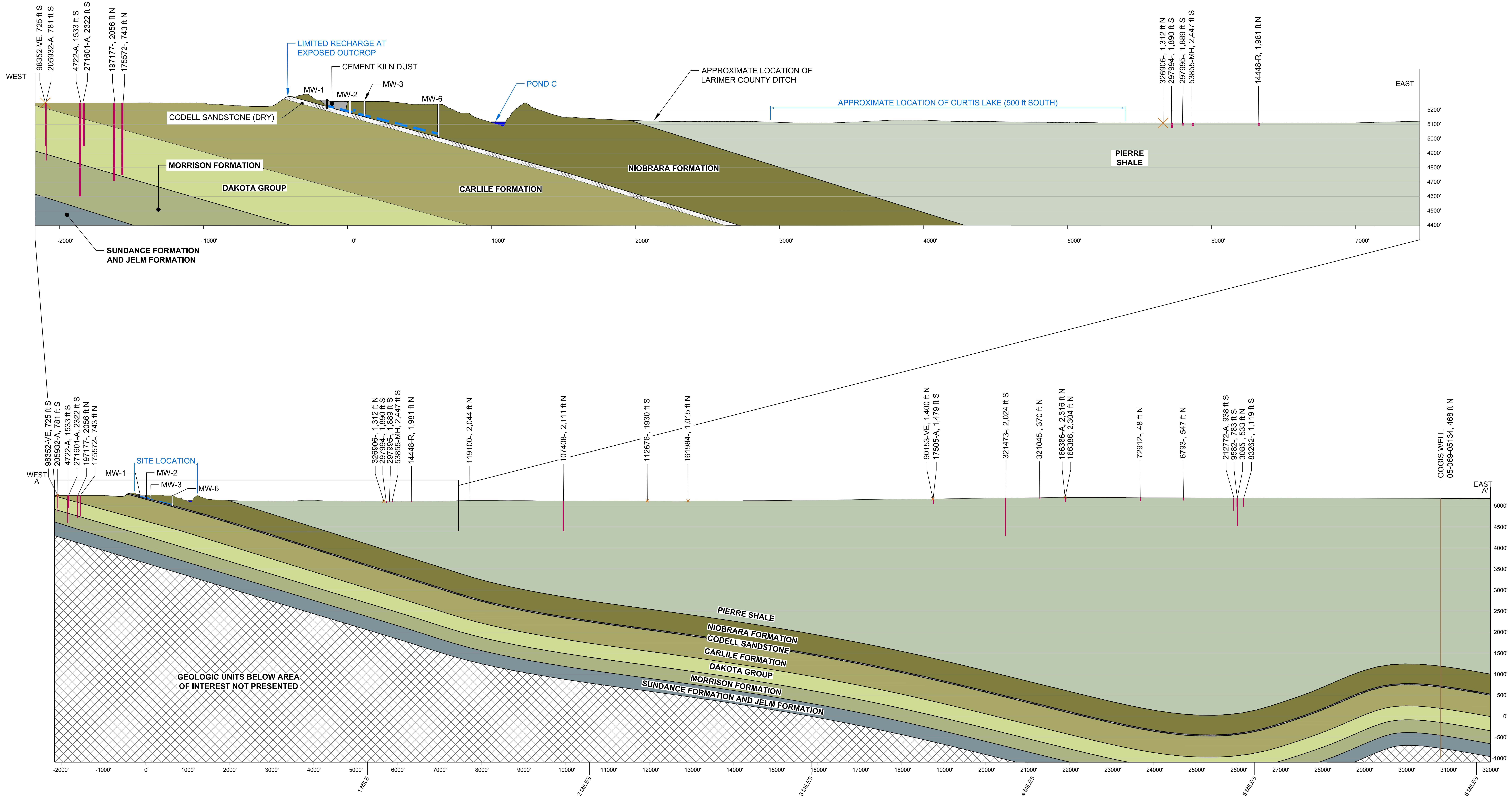
PROJECT
BOETTCHER LIMESTONE QUARRY
LARIMER COUNTY, COLORADO

CONSULTANT
wsp

YYYY-MM-DD	2024-05-17
DESIGNED	LS
PREPARED	CAJ
REVIEWED	LS
APPROVED	SAH

TITLE
STRATIGRAPHIC SECTION OF BOETTCHER QUARRY AREA

PROJECT NO.	REV.	FIGURE
31404755.003	1	2



A
3

SECTION A-A'
GENERALIZED CROSS SECTION REGIONAL GEOLOGY

LEGEND

▨	CEMENT KILN DUST
■	SURFACE WATER
▼	APPROXIMATE GROUNDWATER ELEVATION IN VICINITY OF CKD AREA A2
━	PROJECTED WELL LOCATION AND DEPTH
×	PROJECTED WELL LOCATION WHERE DEPTH INFORMATION IS NOT AVAILABLE

REFERENCE

INFORMATION WAS DIGITISED FROM: FIGURE BCC-1580, IDEAL BASIC INDUSTRIES CEMENT DIVISION, BRADDOCK ET AL. (1988), SCOTT AND COBBAN (1986), AND WORKMAN ET AL. (2018), AND MODIFIED BY WSP.

NOTES

WELL DEPTH AND LOCATIONS PROJECTED ONTO CROSS SECTION ARE APPROXIMATE.

ALLUVIAL DEPOSITS PRESENT ABOVE PERRIE SHALE ARE NOT VISIBLE IN THE CROSS SECTION.

WELL LABELS INDICATE WELL ID AND PROJECTED DISTANCE FROM THE CROSS SECTION LINE. PERMITTED WELLS WITHIN ONE-HALF MILE OF THE CROSS SECTION LINE ARE SHOWN.

CLIENT
HOLCIM (US) INC.

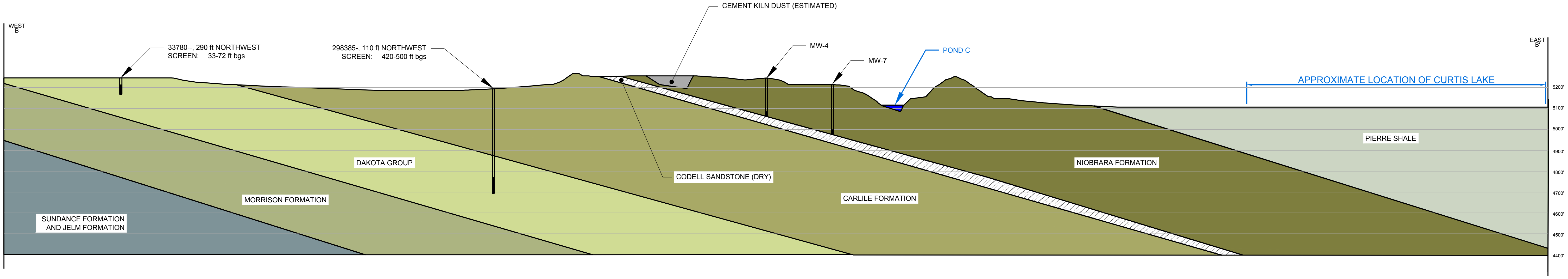
CONSULTANT
wsp

YYYY-MM-DD	2024-06-05
DESIGNED	BJF
PREPARED	BJF
REVIEWED	SAH
APPROVED	JM

PROJECT
BOETTCHER LIMESTONE QUARRY
LARIMER COUNTY, COLORADO

TITLE
GENERALIZED CROSS SECTIONS THROUGH CKD FILL AREA A2 AND REGIONAL GEOLOGY

PROJECT NO.	REV.	FIGURE
31404755.003	1	3



B
4
SECTION B-B'
GENERALIZED CROSS SECTION OF CKD DISPOSAL AREA

UNIT PROPERTIES

Unit	Hydraulic Conductivity, k (ft/day)	Porosity, n (%)	k Reference	n Reference
Pierre Shale	2.0x10-7	20	Bredehoeft, J.D., Neuzil, C.E., & Milly, P.C.D., (1983). Regional Flow in the Dakota Aquifer: A Study of the Role of Confining Layers. U.S. Geological Survey, Water Supply Paper 2237, p. 45.	Schultz and others (1980) Composition and properties of the Pierre Shale and equivalent rocks, northern Great Plains region. (Geochemistry of the Pierre Shale and equivalent rocks of Late Cretaceous age) (Geological Survey Professional Paper 1064-B)
Niobrara FM	<2.7x10-4	4.30	Michaels (2014) Pore Systems of the B Chalk and Lower A Marl Zones of the Niobrara Formation, Denver-Julesburg Basin, Colorado	Matthies (UNDERSTANDING AND MAPPING VARIABILITY OF THE NIOBRARA FORMATION ACROSS WATTENBERG FIELD, DENVER BASIN
Codell Sandstone	2.7x10-4 to 2.7x10-3	8 to 15	Adam (2017) CSU Thesis Hydrologic Characterization Sediments in Larimer Cty Colorado	Adam (2017) CSU Thesis Hydrologic Characterization Sediments in Larimer Cty Colorado
Carlile FM	2.2x10-5	20	Bredehoeft, J.D., Neuzil, C.E., & Milly, P.C.D., (1983). Regional Flow in the Dakota Aquifer: A Study of the Role of Confining Layers. U.S. Geological Survey, Water Supply Paper 2237, p. 45.	Bredehoeft, J.D., Neuzil, C.E., & Milly, P.C.D., (1983). Regional Flow in the Dakota Aquifer: A Study of the Role of Confining Layers. U.S. Geological Survey, Water Supply Paper 2237, p. 45.

LEGEND

▨	CEMENT KILN DUST
🟦	SURFACE WATER
☰	WELL SCREEN

REFERENCE

INFORMATION WAS DIGITISED FROM: FIGURE BCC-1580, IDEAL BASIC INDUSTRIES CEMENT DIVISION AND BRADDOCK ET AL. (1988) AND MODIFIED BY WSP.

NOTES

WELL DEPTH AND LOCATIONS PROJECTED ONTO CROSS SECTION ARE APPROXIMATE.
SELECT UPGRADIENT WELLS SHOWN FOR DISCUSSION PURPOSES.
NO PERMITTED WELLS WITHIN ONE-HALF MILE OF CROSS SECTION DOWNGRADIENT OF SITE.

CLIENT
HOLCIM (US) INC.

CONSULTANT
wsp

YYYY-MM-DD	2024-06-05
DESIGNED	BJP
PREPARED	BJP
REVIEWED	SAH
APPROVED	JM

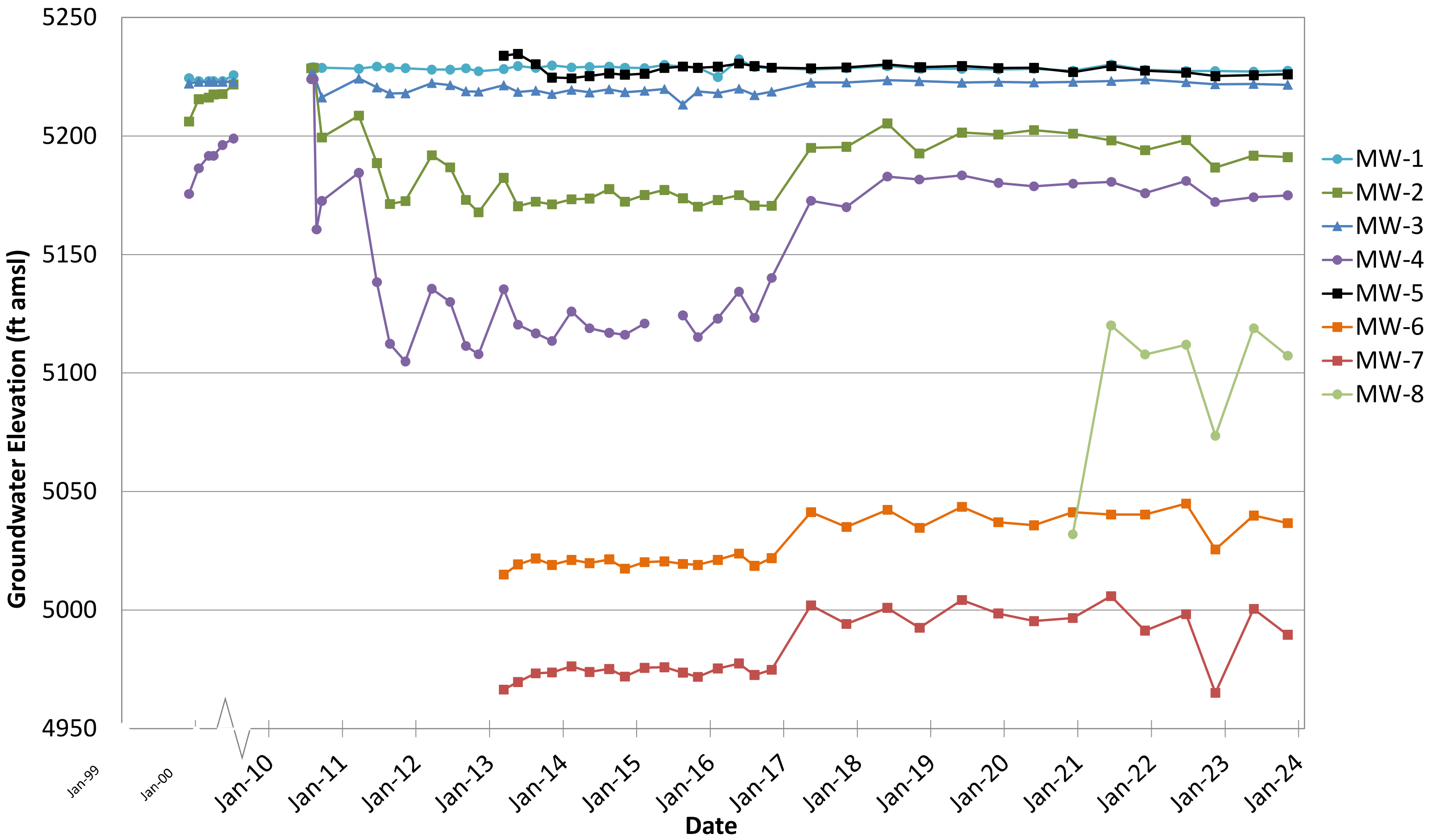
PROJECT
BOETTCHER LIMESTONE QUARRY
LARIMER COUNTY, COLORADO

TITLE
GENERALIZED CROSS SECTION THROUGH DRY CKD FILL

PROJECT NO. 31404755.003
REV. 1
FIGURE 4

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

Path: \\golder.gds\complexdata\office\denver\acad\HOLCIM\Boettcher Quarry\99_PROJECTS\19134436_QuarryClosure\Quarry Cross Sections\02_PRODUCTION\DWG\ | File Name: 19134436_BoettcherQuarry_CrossSectionb_14MAY24.dwg | Last Edited By: bfischer Date: 2024-05-23 Time:12:31:42 PM | Printed By: BBradley Date: 2024-06-05 Time:12:13:30 PM



Notes:
Unable to collect water level measurement at MW-4 on 5/20/2015 ft
amsl: feet above mean sea level

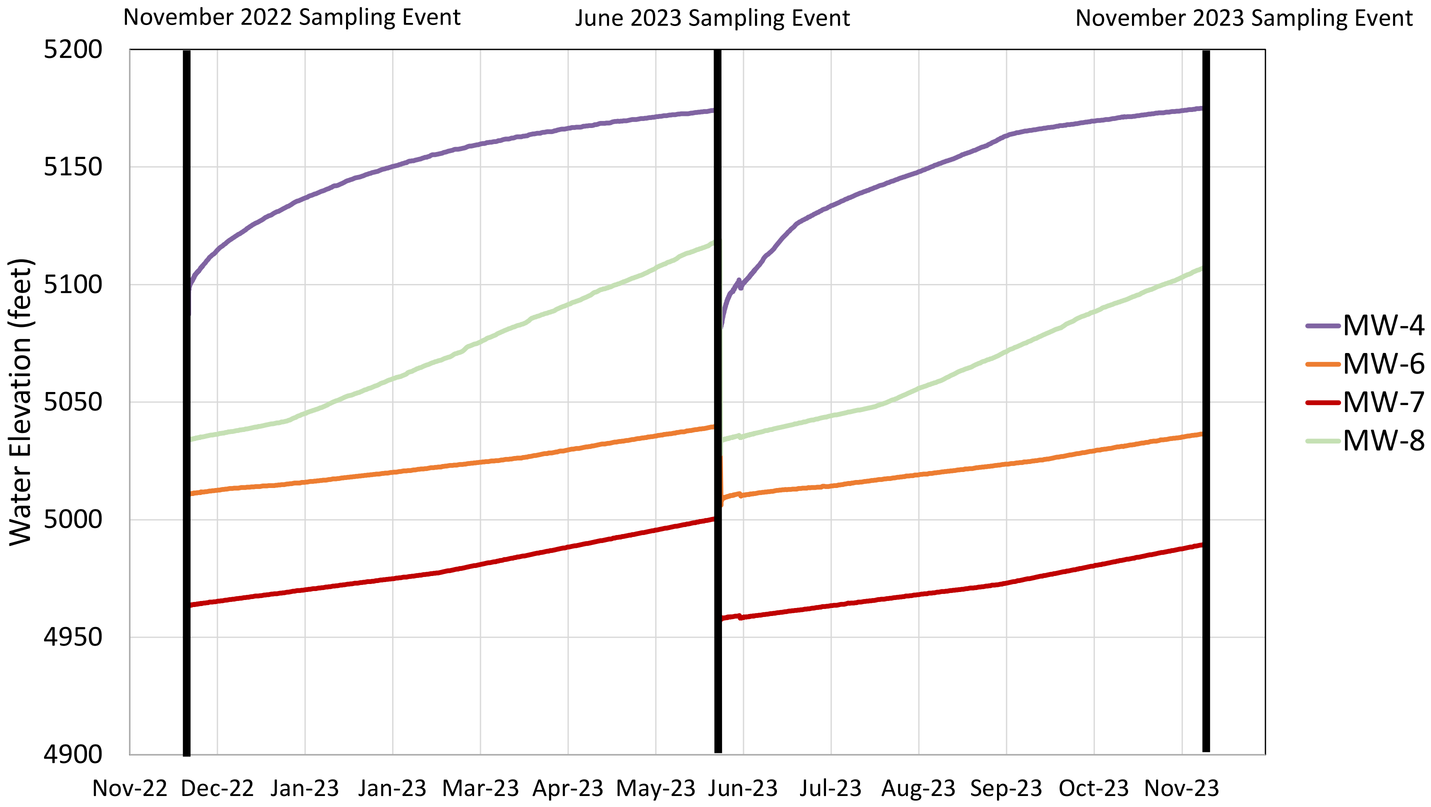
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Water level time series

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	5



Note:
ft amsl: feet above mean sea level

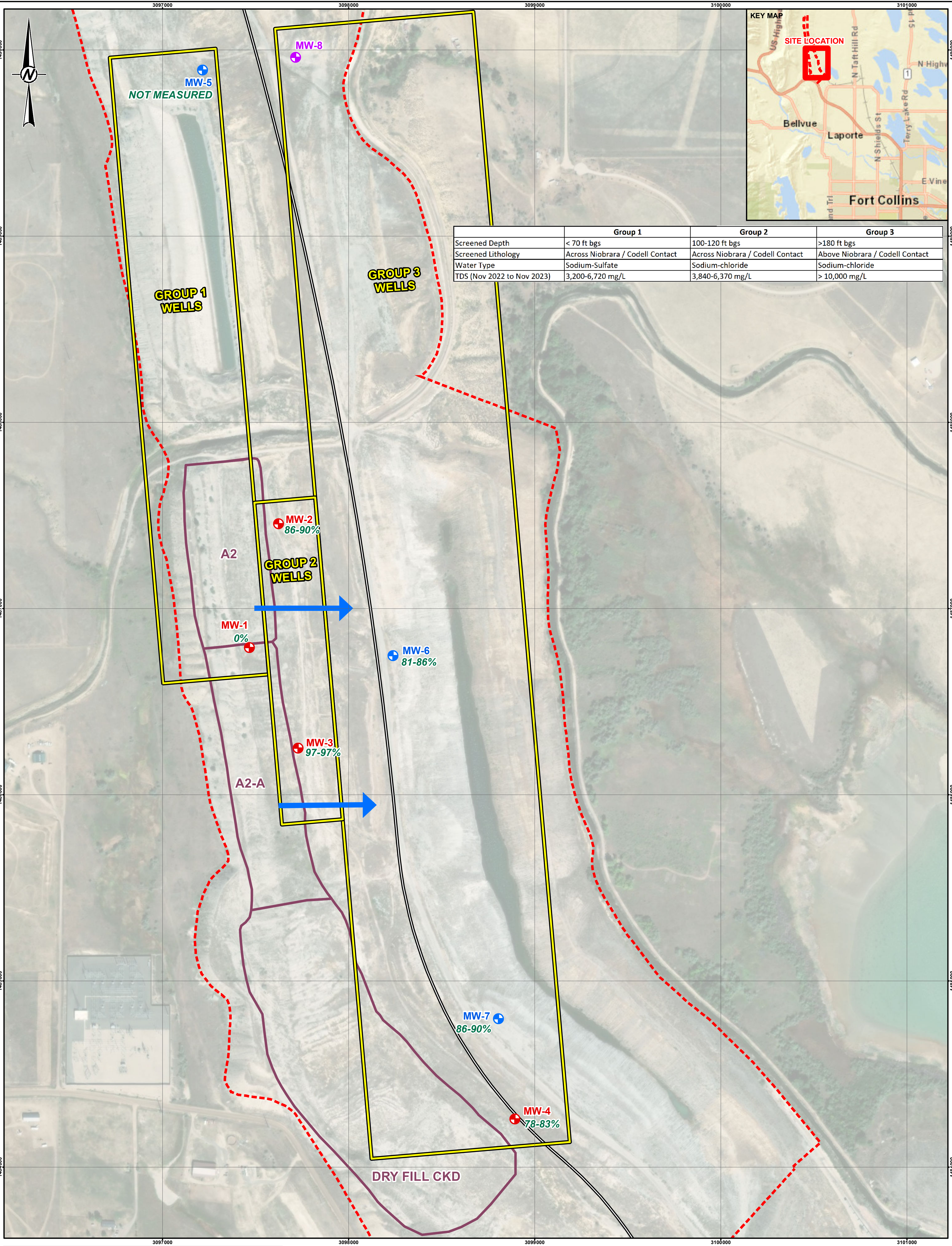
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Transducer Timeseries

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	6



	Group 1	Group 2	Group 3
Screened Depth	< 70 ft bgs	100-120 ft bgs	>180 ft bgs
Screened Lithology	Across Niobrara / Codell Contact	Across Niobrara / Codell Contact	Above Niobrara / Codell Contact
Water Type	Sodium-Sulfate	Sodium-chloride	Sodium-chloride
TDS (Nov 2022 to Nov 2023)	3,200-6,720 mg/L	3,840-6,370 mg/L	> 10,000 mg/L

LEGEND

- MW-1 ● PRE-2012 MONITORING WELL
- MW-6 ● MONITORING WELL INSTALLED 2012
- MW-8 ● MONITORING WELL INSTALLED 2020
- (78-83%) PERCENTAGE OF PRE-1952 WATER (BASED ON ISOTOPIC DATING)
- ━ APPROXIMATE CKD DISPOSAL AREA BOUNDARY
- - - APPROXIMATE PERMIT BOUNDARY
- ═ PROPOSED ROAD ALIGNMENT
- ➡ APPROXIMATE GROUNDWATER FLOW DIRECTION

0 500 1,000
Feet

NOTES

1. PROPERTY AND PERMIT BOUNDARIES PROVIDED BY HOLCIM (US) INC.
2. COORDINATE SYSTEM: NAD83 STATE PLANE COLORADO NORTH (US FT).
3. RANGE OF PERCENTAGE OF PRE-1952 WATER CALCULATED BASED ON 8/27/2014 TRITIUM CONCENTRATION AND ESTIMATED LEVEL OF TRITIUM IN PRECIPITATION OF 6.2-8.1 TU.
4. AERIAL IMAGERY: ESRI BASEMAPS, VIVID. MAXAR. IMAGERY COLLECTED 09/22/2021.
5. PROPOSED ROAD ALIGNMENT DIGITIZED FROM MAP PROVIDED BY MULLER ENGINEERING (NOVEMBER 20, 2019) AND SHOULD BE CONSIDERED APPROXIMATE.

CLIENT
HOLCIM (US) INC.

PROJECT
BOETTCHER LIMESTONE QUARRY
LARIMER COUNTY, COLORADO

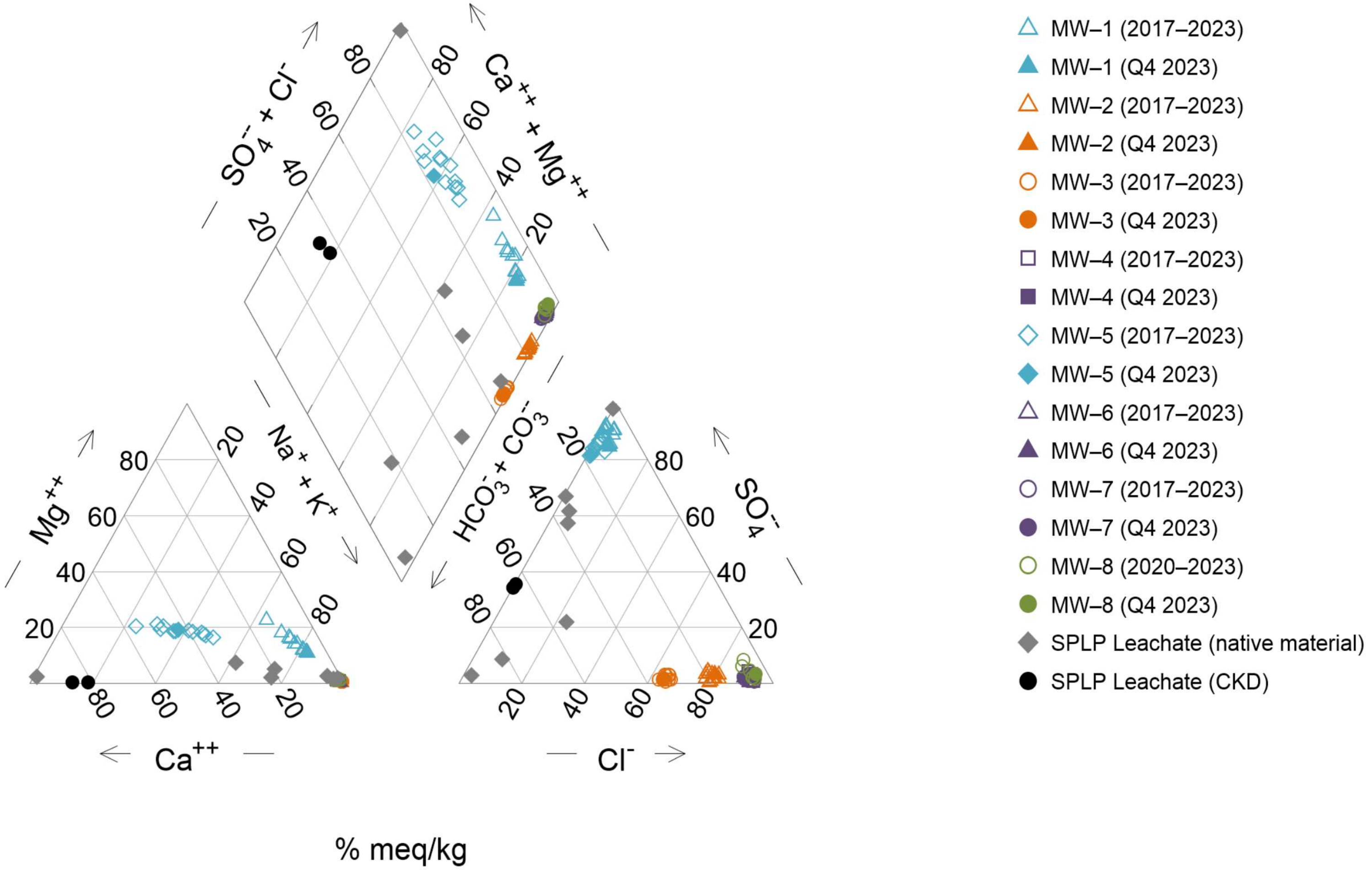
TITLE
SUMMARY OF WELL GROUPS

CONSULTANT
wsp

YYYY-MM-DD	2024-05-16
DESIGNED	JAT
PREPARED	RHG
REVIEWED	SAH
APPROVED	SAH

PROJECT NO.
31404755.003

FIGURE
7



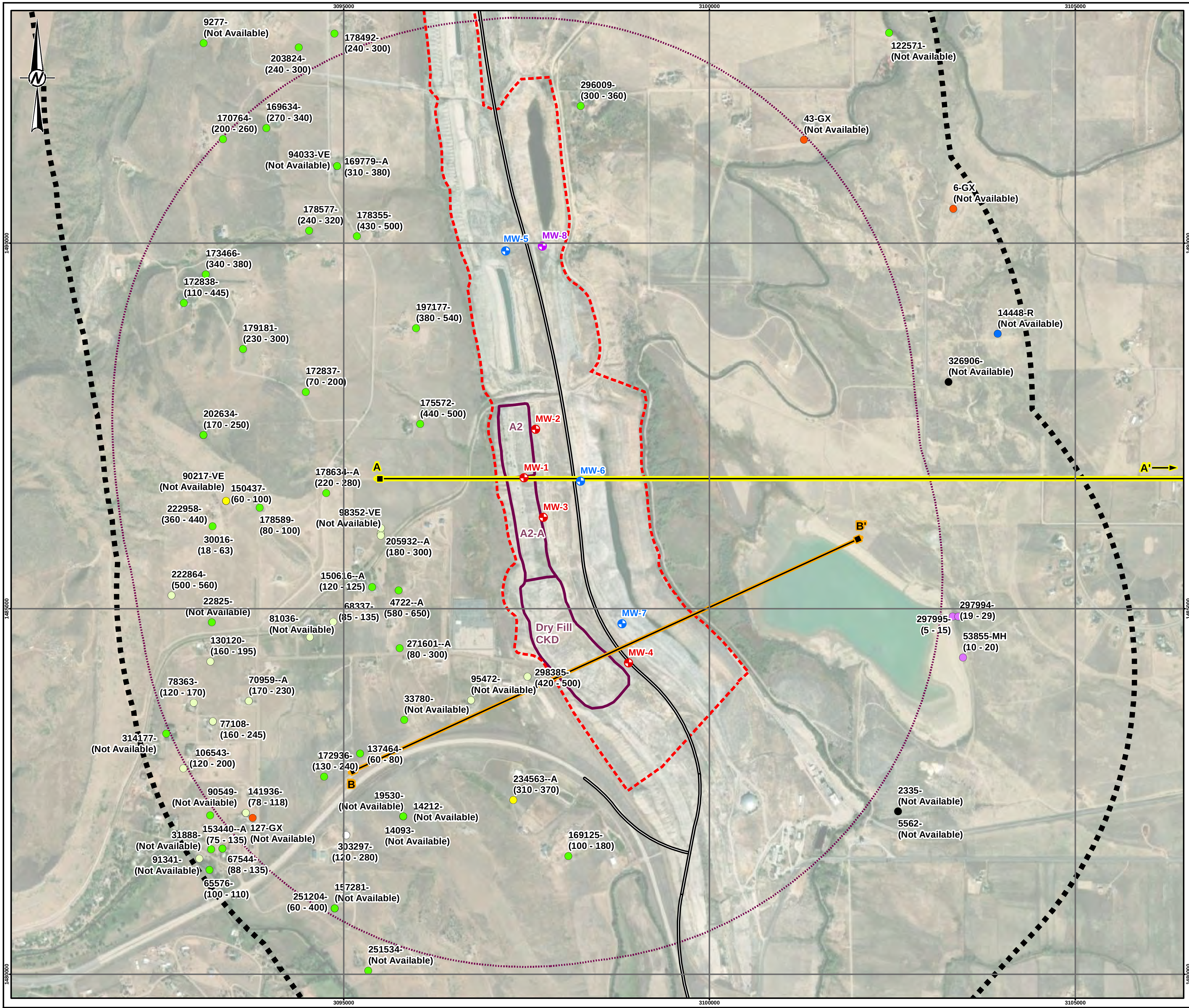
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Piper Diagram of Groundwater Results

PROJECT NO.	PHASE	RV.	FIGURE
31404755.003	001	1	8



LEGEND

- APPROXIMATE PERMIT BOUNDARY
- 1-MILE PERMIT BOUNDARY RADIUS
- DISPOSAL AREA
- 1-MILE DISPOSAL AREA RADIUS
- CROSS SECTION A-A'
- CROSS SECTION B-B'
- PROPOSED ROAD ALIGNMENT

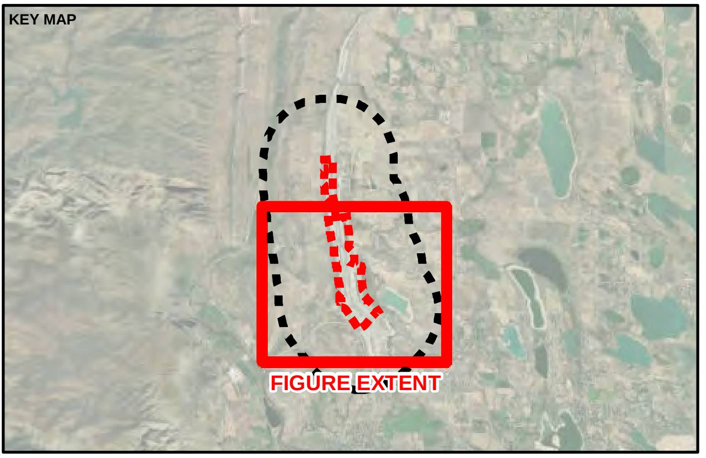
SITE MONITORING WELLS

- PRE-2012 MONITORING WELL
- MONITORING WELL INSTALLED 2012
- MONITORING WELL INSTALLED 2020

WATER WELL PERMIT WITHIN 1 MILE OF PERMIT BOUNDARY
LABELLED WITH PERMIT ID AND SCREENED INTERVAL
(FEET BELOW GROUND SURFACE)

○ COMMERCIAL	● HOUSEHOLD USE ONLY
● DOMESTIC	● IRRIGATION
● DOMESTIC, STOCK	● MONITORING/SAMPLING
● GEOTHERMAL	● STOCK

KEY MAP



0 0.125 0.25 0.5 Miles

NOTES
1. WATER WELL PERMIT DATA OBTAINED FROM COLORADO DIVISION OF WATER RESOURCES, FEBRUARY 2024.
2. PROPERTY AND PERMIT BOUNDARIES PROVIDED BY HOLCIM (US) INC.
3. COORDINATE SYSTEM: NAD83 STATE PLANE COLORADO NORTH (US FT).
4. AERIAL IMAGERY: ESRI BASEMAPS, VIVID. MAXAR. IMAGERY COLLECTED 09/22/2021.
5. PROPOSED ROAD ALIGNMENT DIGITIZED FROM MAP PROVIDED BY MULLER ENGINEERING (NOVEMBER 20, 2019) AND SHOULD BE CONSIDERED APPROXIMATE.

CLIENT
HOLCIM (US) INC.

PROJECT
BOETTCHER LIMESTONE QUARRY
LARIMER COUNTY, COLORADO

TITLE
PERMITTED WELLS WITHIN 1 MILE OF PERMIT BOUNDARY

CONSULTANT
wsp

YYYY-MM-DD	2024-06-07
DESIGNED	JAT
PREPARED	RHG
REVIEWED	SAH
APPROVED	SAH

PROJECT NO.	REV.	FIGURE
31404755.003	1	9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
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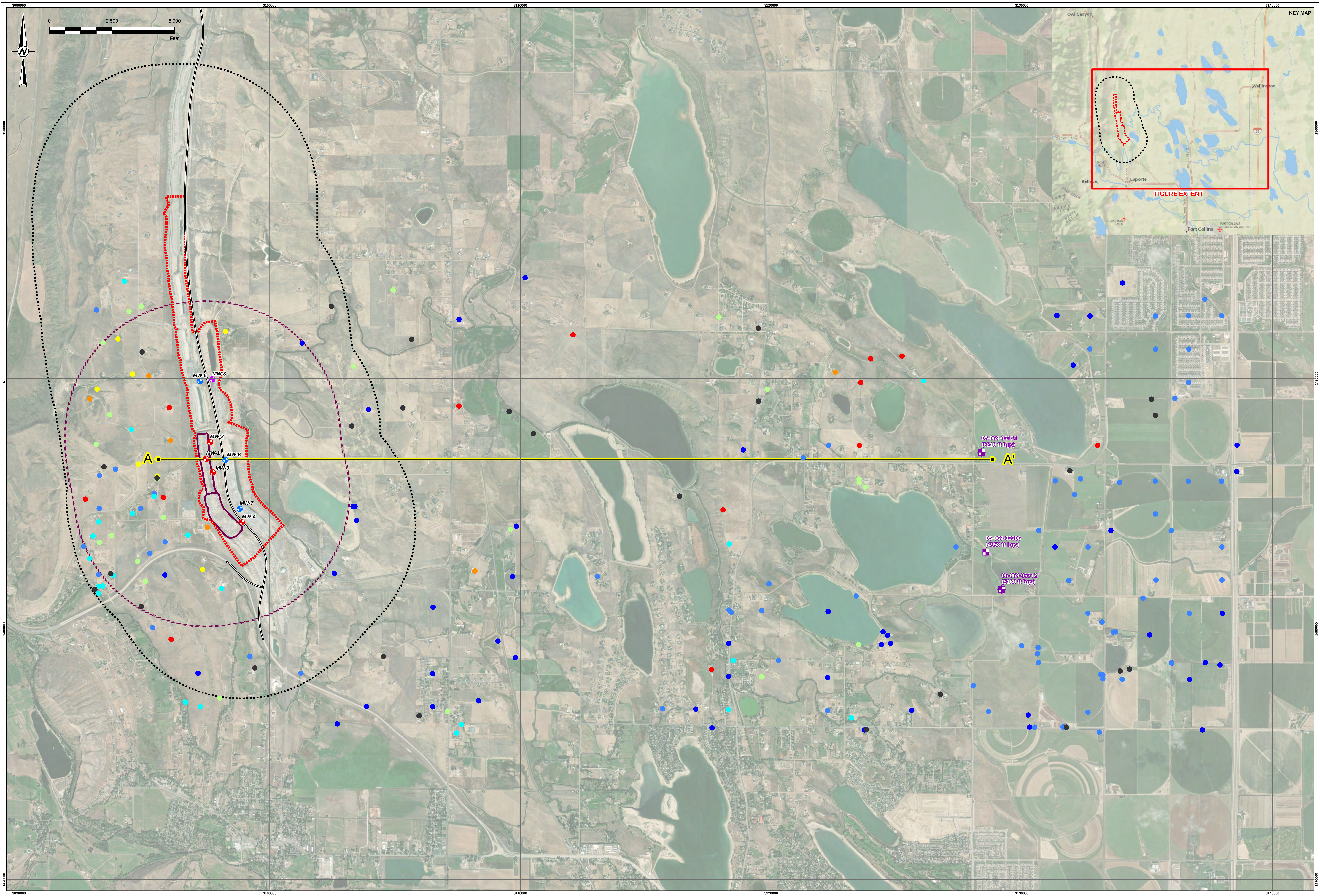

LEGEND

- APPROXIMATE PERMIT BOUNDARY
- 1-MILE PERMIT BOUNDARY RADIUS
- DISPOSAL AREA
- 1-MILE DISPOSAL AREA RADIUS
- COGCC WELL SCREENED IN CODELL FORMATION (WITH TOTAL DEPTH)

SITE MONITORING WELLS

- PRE-2012 MONITORING WELL
- MONITORING WELL INSTALLED 2012
- MONITORING WELL INSTALLED 2020
- CROSS SECTION A-A'
- PROPOSED ROAD ALIGNMENT

CDWR PERMITTED WELL

TOTAL DEPTH (ft bgs)

●	< 50
●	51 - 100
●	101 - 200
●	201 - 300
●	301 - 400
●	401 - 500
●	> 500
●	DEPTH INFORMATION NOT AVAILABLE

NOTES

1. COORDINATE SYSTEM: NAD83 STATE PLANE COLORADO NORTH (US FT)
2. WELL SEARCH EXTENTS SPANNED 13,000 FEET NORTH, 11,000 FEET SOUTH, AND 40,000 FEET DOWNGRADIENT OF CKD DISPOSAL.

REFERENCES

1. WATER WELL PERMIT DATA OBTAINED FROM COLORADO DIVISION OF WATER RESOURCES, FEBRUARY 2024.
2. COGCC WELLS PLOTTED FROM WELL LOG COORDINATES OBTAINED FROM COLORADO OIL AND GAS COMMISSION.
3. PROPERTY AND PERMIT BOUNDARIES PROVIDED BY HOLCIM (US) INC.
4. AERIAL IMAGERY: ESRI BASEMAPS, VIVID. MAXAR. IMAGERY COLLECTED 09/22/2021.
5. PROPOSED ROAD ALIGNMENT DIGITIZED FROM MAP PROVIDED BY MULLER ENGINEERING (NOVEMBER 20, 2019)

CONSULTANT

YYYY-MM-DD	2024-06-07
DESIGNED	JAT
PREPARED	RHG
REVIEWED	SAH
APPROVED	SAH

CLIENT
HOLCIM (US) INC.

PROJECT
BOETTCHER LIMESTONE QUARRY
LARIMER COUNTY, COLORADO

TITLE
PERMITTED WELLS - WELL DEPTHS

PROJECT NO.
31404755.003

REV.
1

FIGURE
10

PATH: M:\Holcim_Boettcher\Mapping\202405\34x44_31404755_003_Fig10_WellPermits_Depth.mxd PRINTED ON: 2024-06-07 AT: 2:49:25 PM

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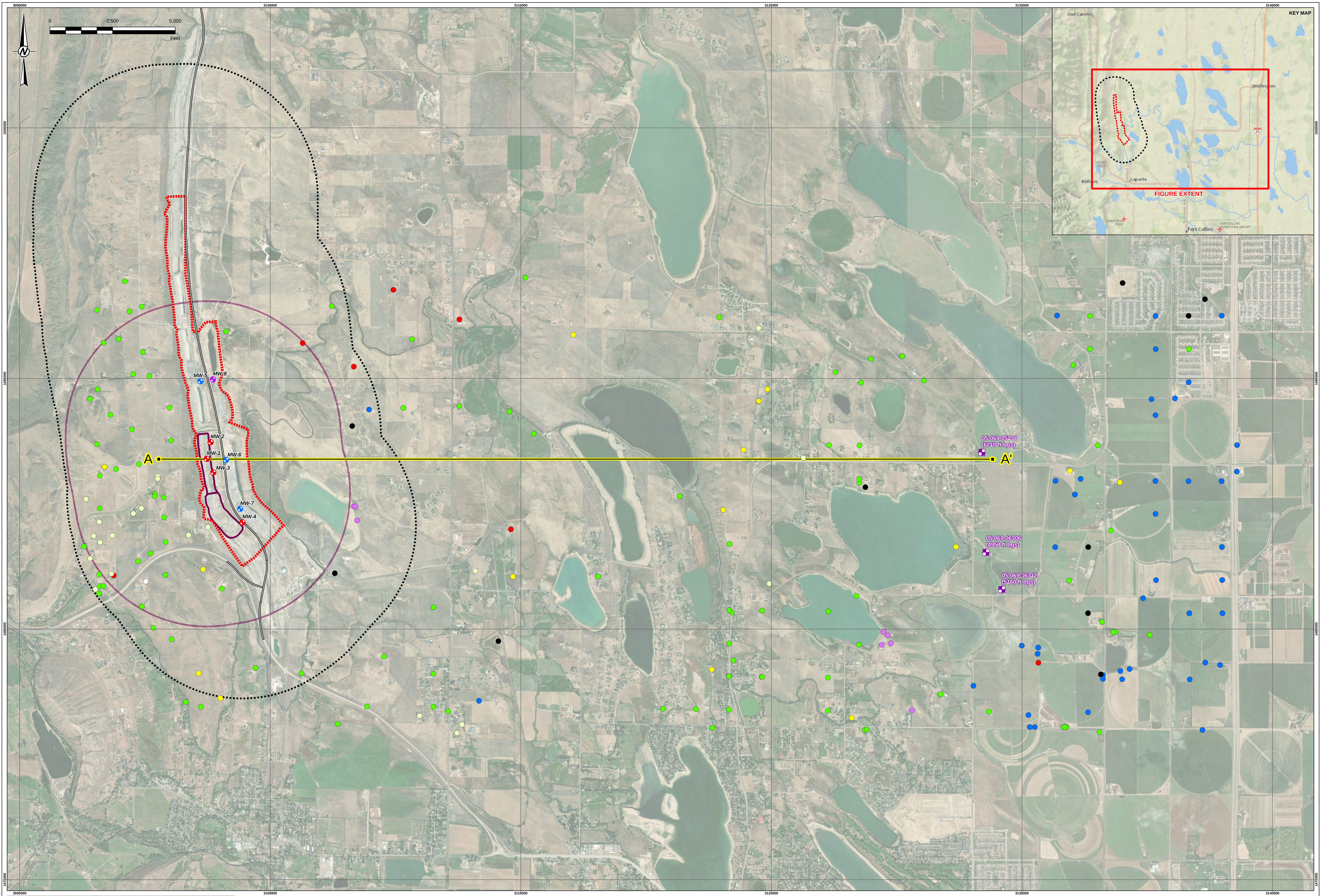


LEGEND

▨ APPROXIMATE PERMIT BOUNDARY
▨ 1-MILE PERMIT BOUNDARY RADIUS
▭ DISPOSAL AREA
▭ 1-MILE DISPOSAL AREA RADIUS
▨ COGCC WELL SCREENED IN CODELL FORMATION (WITH TOTAL DEPTH)

SITE MONITORING WELLS

● PRE-2012 MONITORING WELL
● MONITORING WELL INSTALLED 2012
● MONITORING WELL INSTALLED 2020
■━■ CROSS SECTION A-A'
═ PROPOSED ROAD ALIGNMENT

CDWR PERMITTED WELL

PERMITTED USE

○ COMMERCIAL
● DOMESTIC
● DOMESTIC, STOCK
● GEOTHERMAL
● HOUSEHOLD USE ONLY
● IRRIGATION
● MONITORING/SAMPLING
● STOCK

NOTES

1. COORDINATE SYSTEM: NAD83 STATE PLANE COLORADO NORTH (US FT)
2. WELL SEARCH EXTENTS SPANNED 13,000 FEET NORTH, 11,000 FEET SOUTH, AND 40,000 FEET DOWNGRADIENT OF CKD DISPOSAL.

REFERENCES

1. WATER WELL PERMIT DATA OBTAINED FROM COLORADO DIVISION OF WATER RESOURCES, FEBRUARY 2024.
2. COGCC WELLS PLOTTED FROM WELL LOG COORDINATES OBTAINED FROM COLORADO OIL AND GAS COMMISSION.
3. PROPERTY AND PERMIT BOUNDARIES PROVIDED BY HOLCIM (US) INC.
4. AERIAL IMAGERY: ESRI BASEMAPS, VIVID. MAXAR. IMAGERY COLLECTED 09/22/2021.
5. PROPOSED ROAD ALIGNMENT DIGITIZED FROM MAP PROVIDED BY MULLER ENGINEERING (NOVEMBER 20, 2019) AND SHOULD BE CONSIDERED APPROXIMATE.

CONSULTANT

wsp

YYYY-MM-DD	2024-06-07
DESIGNED	JAT
PREPARED	RHG
REVIEWED	SAH
APPROVED	SAH

CLIENT
HOLCIM (US) INC.

PROJECT
BOETTCHER LIMESTONE QUARRY
LARIMER COUNTY, COLORADO

TITLE
PERMITTED WELLS - PERMITTED USE

PROJECT NO.	REV.	FIGURE
31404755.003	1	11

PATH: M:\Holcim_Boettcher\Mapping\202405\34x44_31404755_003_Fig11_WellPermits_Use.mxd PRINTED ON: 2024-06-07 AT: 2:50:13 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI E

0
1 in

APPENDIX A

Lithology Logs for MW-1 through MW-3

Monitoring Well No. 1

PROJECT: Holman Inc.
CME-75
INITIAL GW DEPTH: N/A

DATE: 06/01-02/98
HOLE DIA.: 6 in.
FINAL GW: N/A

LOGGED BY: J. Schneller
SAMPLER: 10'-2"0 Core Barrel
GROUND ELEV.: N/A

DESCRIPTION

Fill, limestone and soil mix. Augers drilled to 4 feet, start air rotary.

LIMESTONE: dark gray, massive, no fracturing, no free water,

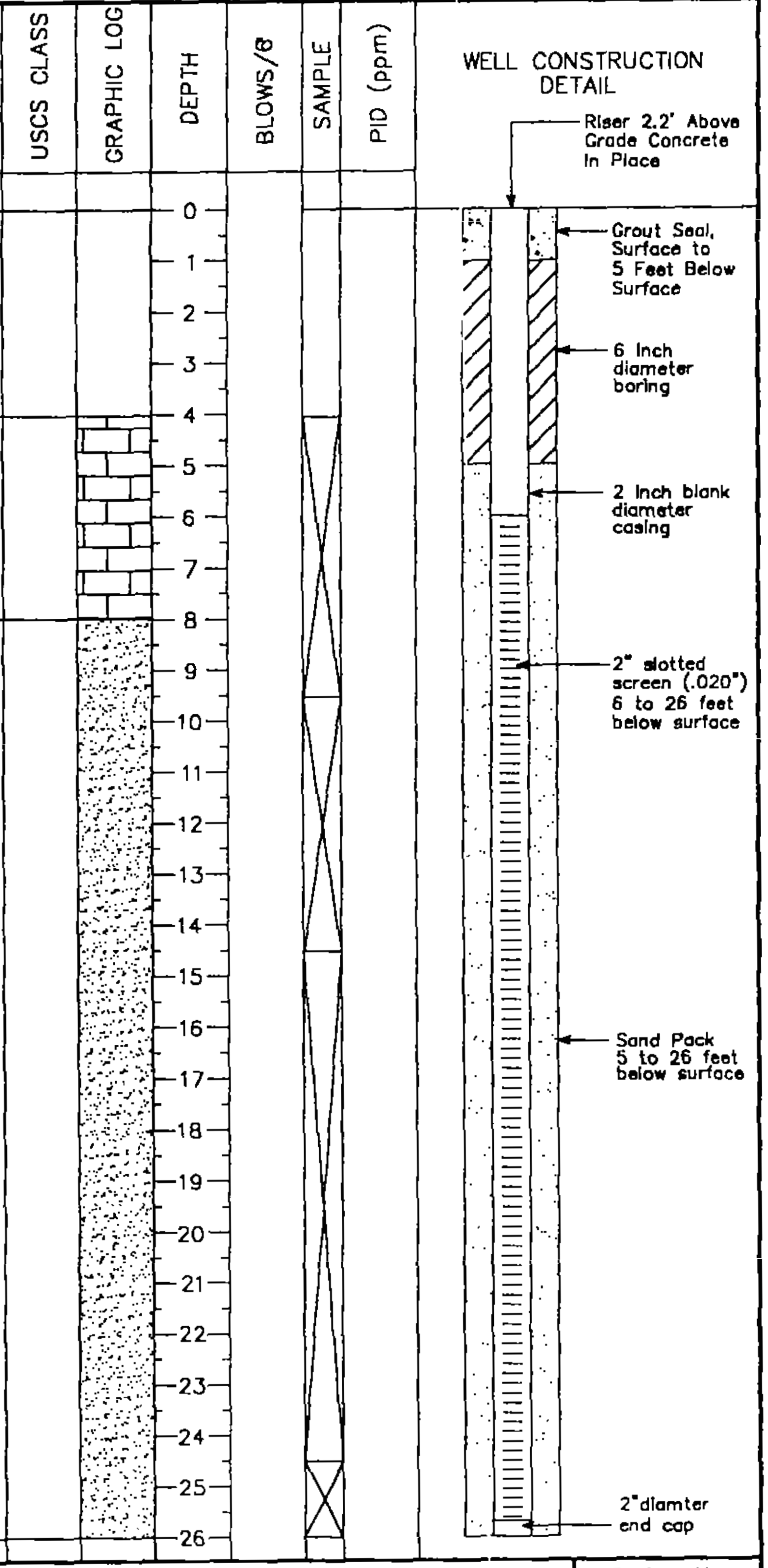
CORDILLO SANDSTONE: gray, fine grain, massive to thinly bedded, black streaks, slightly fractured, weathered, moist, to free water at approximately 14 feet, sharp, contact.

Increase in moisture with depth

free water observed

Finely laminated bedding, free water

Bottom of test hole at 26.0 feet



SECOR

Secor International Incorporated
Lakewood, Colorado 80228

Notes:
Good Circulation for Drilling.

Project No.
D0178-003-01
LOG-0696

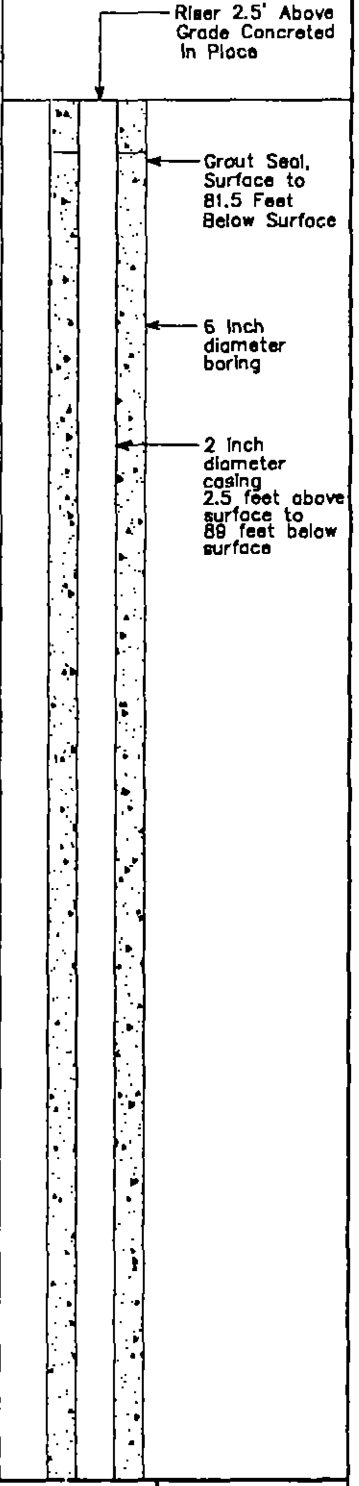
Page 1 of 1

Monitoring Well No.2

PROJECT: Holman Inc.
DATE: 06/01/98
LOGGED BY: J. Schneller
DRILL RIG.: Hollow Stem Auger
HOLE DIA.: 6 in.
SAMPLER: 10 – 2"0 Core Barrel
INITIAL GW DEPTH: N/A
FINAL GW: N/A
GROUND ELEV.: N/A

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	BLOWS/6"	SAMPLE	PID (ppm)
Weathered limestone and soil.			0			
			1			
			2			
			3			
LIMESTONE: auger drilled at 9', start air rorary at 9.0'			4			
			5		AUGER	
			6			
			7			
			8			
LIMESTONE: light to dark gray, fresh to slightly weathered, slight fracturing, narrow fractures at 30° from core axis with small crystals in fracturtes.			9			
			10			
			11			
			12			
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			20			
			21			
			22			
			23			
			24			
			25			
			26			

WELL CONSTRUCTION DETAIL



SECOR

Secor International Incorporated
Lakewood, Colorado 80228

Notes:
Good Circulation through-out Drilling.

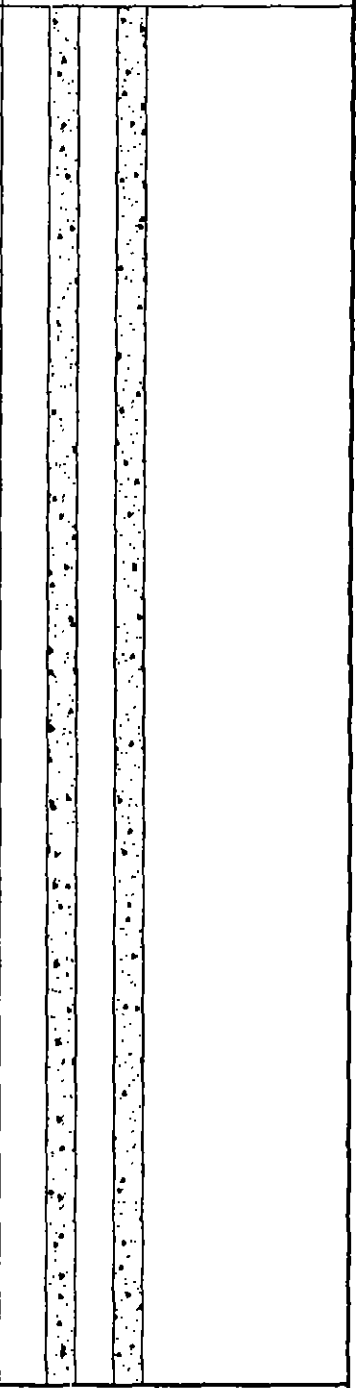
Project No.
D0178-003-01
LOG-0697

Monitoring Well No.2

PROJECT: Holman Inc.
DATE: 06/01/98
LOGGED BY: J. Schneller
DRILL RIG.: Hollow Stem Auger
HOLE DIA.: 6 in.
SAMPLER: 10'-2"O Core Barrel
INITIAL GW DEPTH: N/A
FINAL GW: N/A
GROUND ELEV.: N/A

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	BLOWS/6"	SAMPLE	PID (ppm)
			30			
			31			
			32			
			33			
			34			
Massive, no fracturing, no free water			35			
			36			
			37			
			38			
			39			
			40			
			41			
			42			
			43			
			44			
Massive, dark grey, no fracturing, no fossils no shale beds, very hard to drill no free water			45			
			46			
			47			
			48			
			49			
			50			
			51			
			52			
			53			
			54			
Light to dark grey, massive, no fracturing, no free water, fossils at 62-62.5'			55			
			56			

WELL CONSTRUCTION DETAIL



SECOR

Secor International Incorporated
Lakewood, Colorado 80228

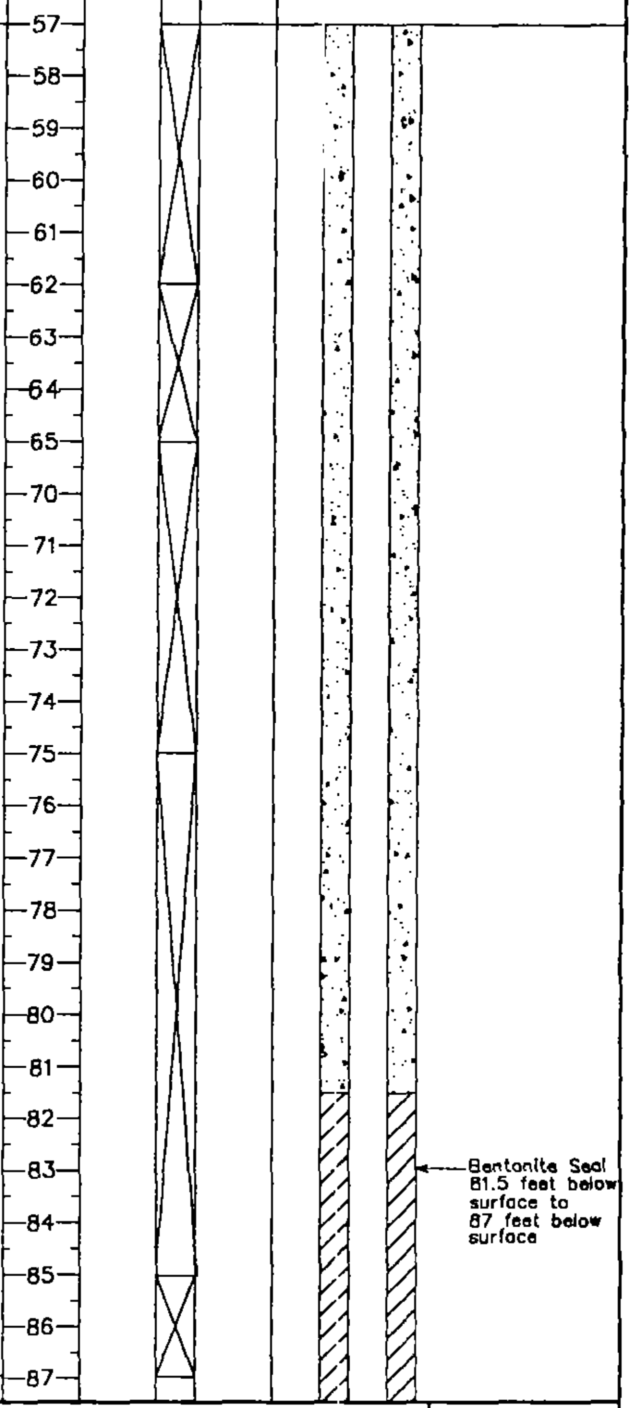
Notes:

Project No.
D0178-003-01
LOG-0697

Monitoring Well No.2

PROJECT: Holman Inc.
DATE: 06/01/98
LOGGED BY: J. Schneller
DRILL RIG.: CME 75
HOLE DIA.: 6 in.
SAMPLER: 10'–2"0 Core Barrel
INITIAL GW DEPTH: N/A
FINAL GW: N/A
GROUND ELEV.: N/A

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	BLOWS/6	SAMPLE	PID (ppm)	WELL CONSTRUCTION DETAIL
Very hard to drill, gray to dark gray, spandic fossils, smooth 65–67' and 71–72.5', hard, and sandy soft fine grain intervals and soft, of softer and harder layers.			57–87				



SECOR

Secor International Incorporated
Lakewood, Colorado 80228

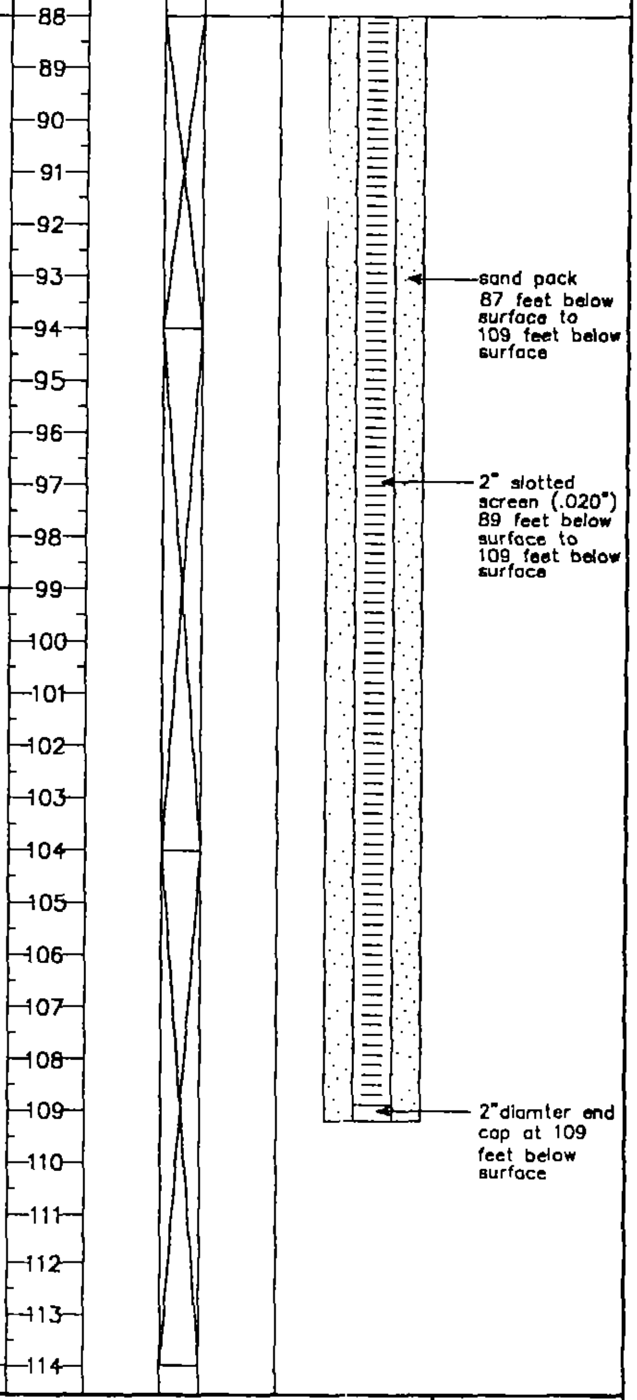
Notes:

Project No.
D0178–003–01
LOG–0697

Monitoring Well No.2

PROJECT: Holman Inc.
DATE: 06/01/98
LOGGED BY: J. Schneller
DRILL RIG.: Hollow Stem Auger
HOLE DIA.: 6 in.
SAMPLER: 10'-2"0 Core Barrel
INITIAL GW DEPTH: N/A
FINAL GW: N/A
GROUND ELEV.: N/A

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	BLOWS/6	SAMPLE	PID (ppm)	WELL CONSTRUCTION DETAIL
Yellowish grey interbedded thin shale layers at approx. 6–8 inch separation massive, no fracturing observed, contains fossils very hard to drill, no free water.			88–99				
CORDILLO SANDSTONE: fine to medium grain, massive no no fractures observed, light to dark gray moltled texture, hard, fresh, no free water, observed.			99–114				
Bottom Test Hole @ 114.0 feet							



SECOR

Secor International Incorporated
Lakewood, Colorado 80228

Notes:

Project No.
D0178-003-01
LOG-0697

Page 4 of 4

Monitoring Well No.3

PROJECT: Holman Inc.
DRILL RIG.: CME 75
INITIAL GW DEPTH: N/A

DATE: 06/01/98
HOLE DIA.: 6 in.
FINAL GW: N/A

LOGGED BY: J. Schneller
SAMPLER: 10'-2"0 Core Barrel
GROUND ELEV.: N/A

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	BLOWS/6"	SAMPLE	PID (ppm)
Fill, Limestone and soil			0			
			1			
Limestone, dark grey, sand fine grain, highly weathered, shaled at 15–15.2', vertical fracture at 16' narrow with small crystals, no other staining, sporadic fossils–highly weathered interval at 19.1–19,2', highly sandy interval at 23–23.5'.			2			
			3			
			4			
			5			
			6			
			7		AUGER	
			8			
			9			
			10			
			11			
			12			
			13			
			14			
			15			
			16			
			17			
			18			
			19			
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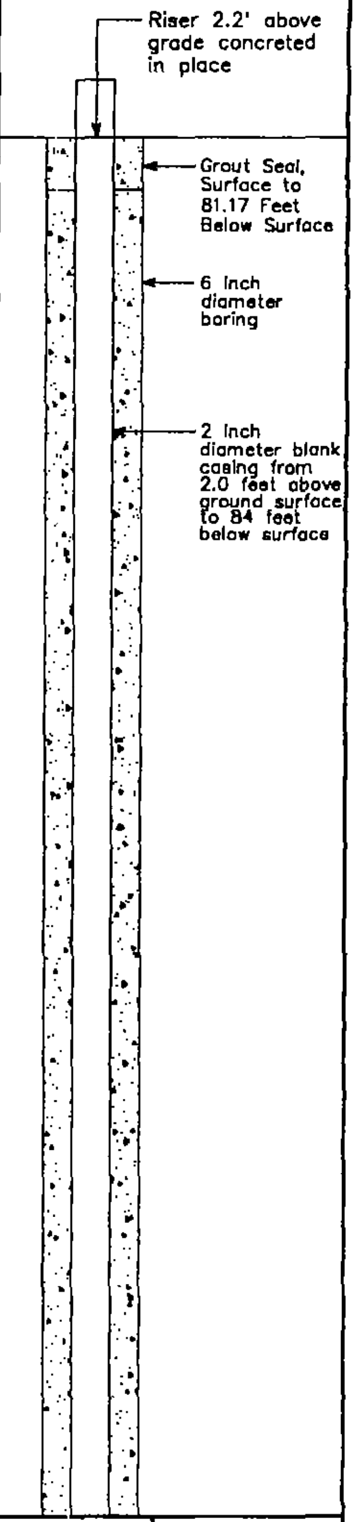
			21			
			22			
			23			
			24			
			25			
			26			

WELL CONSTRUCTION DETAIL



SECOR

Secor International Incorporated
Lakewood, Colorado 80228

Notes:
Poor Little to no Circulation During Drilling.

Project No.
D0178-003-01
LOG-0698

Monitoring Well No.3

PROJECT: Holman Inc.
DRILL RIG.: CME 75
INITIAL GW DEPTH: N/A

DATE: 06/01/98
HOLE DIA.: 6 in.
FINAL GW: N/A

LOGGED BY: J. Schneller
SAMPLER: 1C'-2"0 Core Barrel
GROUND ELEV.: N/A

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	BLOWS/6"	SAMPLE	PID (ppm)	WELL CONSTRUCTION DETAIL
Dark gray, soft to very hard shale layer ~36.5–36.7' vertical fracture–narrow w/small crystals and iron oxide stain at 38.5' no free water.			27		☒		
			28				
			29				
			30				
			31				
			32				
			33				
			34				
			35				
			36				
			37				
dark gray, to black, massive, sporadic fossils, no free water, no fractures observed, hard drilling, no staining, no shale layers from 39–59'.			38				
			39				
			40				
			41				
			42				
			43				
			44				
			45				
			46				
			47				
			48				
			49				
			50				
			51				
			52				
water, fossils at 62–62.5'			53				

SECOR

Secor International Incorporated
Lakewood, Colorado 80228

Notes:

Project No.
D0178–003–01
LOG–0698

Monitoring Well No.3

PROJECT: Holman Inc.
DRILL RIG.: Hollow Stem Auger
INITIAL GW DEPTH: N/A

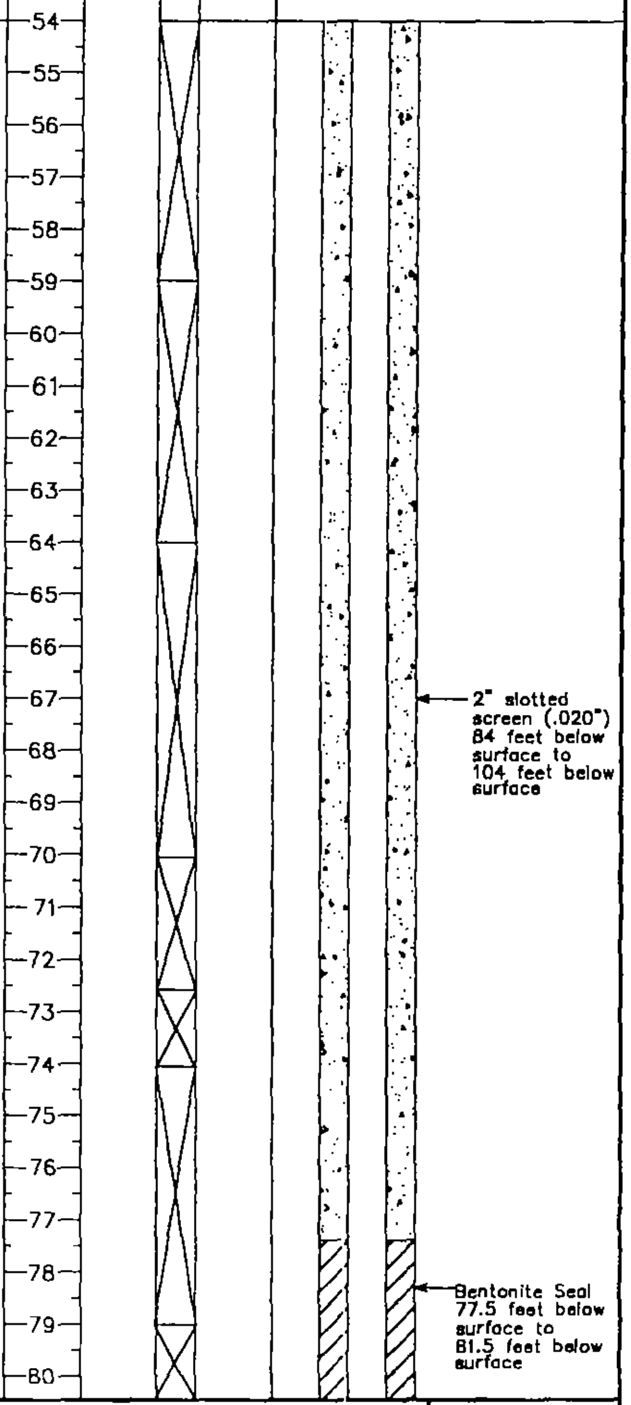
DATE: 06/01/98
HOLE DIA.: 6 in.
FINAL GW: N/A

LOGGED BY: J. Schneller
SAMPLER: 10'–2"0 Core Barrel
GROUND ELEV.: N/A

DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | BLOWS/6" | SAMPLE | PID (ppm) | WELL CONSTRUCTION DETAIL

light to dark to black, fossils
very hard, shale layers from 67' to 79'
shale 1 to 2 inches thick–partially washed away
by drilling–black, spacing 1 to 2' between shale layers.

light gray to yellow grey,
extremely hard to drill, interbedded
w/shale beds 1 to 3" thick, closed
fractures in ~ 30 ° from
filled with core axis/pyritecrystals
shale beds at 1 to 2 feet interval,
contains calcium replaced fossil shells.



2" slotted screen (.020") 84 feet below surface to 104 feet below surface

Bentonite Seal 77.5 feet below surface to 81.5 feet below surface

SECOR

Secor International Incorporated
Lakewood, Colorado 80228

Notes:

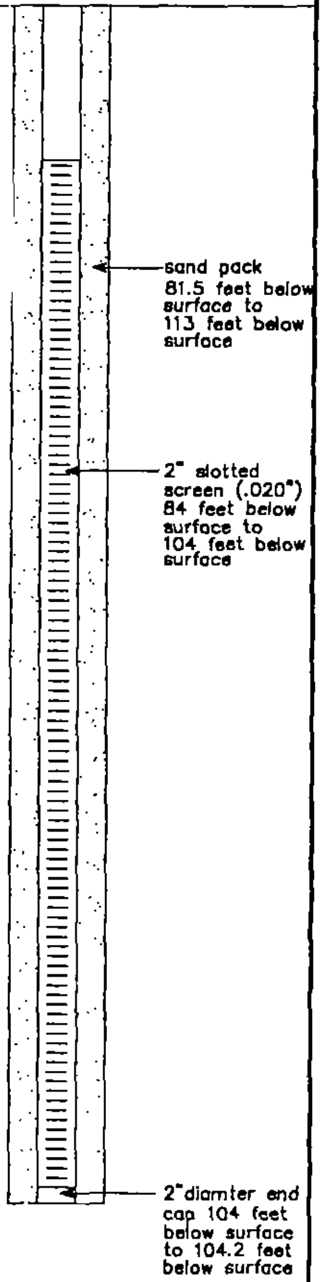
Project No.
D0178–003–01
LOG–0698

Monitoring Well No.3

PROJECT: Holman Inc.
DATE: 06/01/98
LOGGED BY: J. Schneller
DRILL RIG.: Hollow Stem Auger
HOLE DIA.: 6 in.
SAMPLER: 10'-2"0 Core Barrel
INITIAL GW DEPTH: N/A
FINAL GW: N/A
GROUND ELEV.: N/A

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	BLOWS/6"	SAMPLE	PID (ppm)
			81			
			82			
			83			
increase in fine grain sand content continues to a graditional contact to the sandstone at 94'.			84			
			85			
			86			
			87			
			88			
			89			
			90			
			91			
			92			
			93			
CORDILLO SANDSTONE, light to dark grey mix, fine to slightly medium grain mollted texture homogeneus sandstone, massive, hard, no fractures,			94			
			95			
			96			
			97			
			98			
			99			
			100			
			101			
			102			
			103			
			104			
			105			
Bottom test hole at 106.0'			106			

WELL CONSTRUCTION DETAIL



SECOR

Secor International Incorporated
Lakewood, Colorado 80228

Notes:

Project No.
D0178-003-01
LOG-0698

APPENDIX B

Borehole Logs for MW-5 through MW-8

DRAFT

RECORD OF BOREHOLE MW-5

SHEET 1 of 2

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger
DATE/TIME STARTED: 12/12/2012
DRILLED DEPTH: 60.0 ft

COORDINATES:
N: 1,489,893.21 E: 3,097,213.94
GS ELEVATION: 5274.0 ft

DEPTH W.L.: 39.5 ft
ELEVATION W.L.: 5234.5 ft
INCLINATION: -90

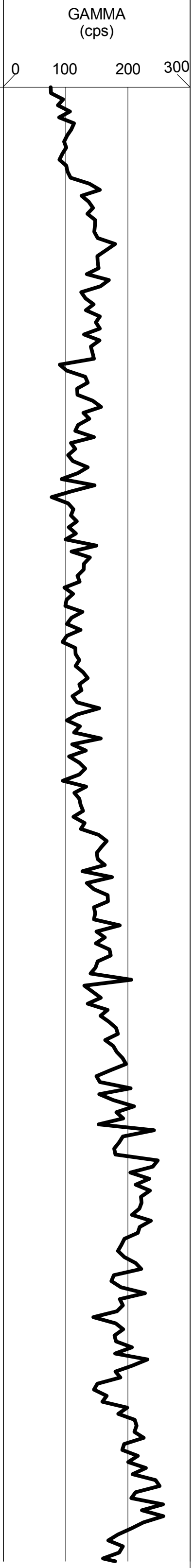
SOIL PROFILE

DEPTH (ft)	ELEVATION (ft)
0	
	5270
5	
	5265
10	
	5260
15	
	5255
20	
	5250
25	
	5245
30	
	5240
35	
	5235
40	

LITHOLOGY DESCRIPTION
0.0 - 3.2ft (ML) clay SILT, low plasticity, some fine to coarse gravel, pale brown, dry, very stiff, calcareous, cohesive
3.2 - 5.4ft (ML) SILT, dark gray, dry, calcareous
5.4 - 10.0ft (ML) clayey SILT, low plasticity, some fine sand, yellow brown and gray orange, dry, firm to very soft, calcareous, cohesive
10.0 - 11.2ft (ML) SILT, dark gray, dry, calcareous
11.2 - 14.0ft (ML) clayey SILT, low plasticity, some fine sand, gray orange, dry, firm, calcareous, cohesive
14.0 - 20.4ft (ML) SILT, some clay, dark gray, dry, calcareous
20.4 - 26.8ft (ML) clayey SILT, low plasticity, trace fine sand, gray orange, dry, firm to stiff, damp between 25 to 26.75, calcareous, cohesive
26.8 - 31.0ft (ML) SILT, light gray, dry, calcareous, wet 29 to 29.5 feet
31.0 - 32.1ft (ML) SILT, low plasticity, trace fine sand, dark gray, dry, very stiff, calcareous and cohesive
32.1 - 35.2ft (ML) SILT, low plasticity, trace clay, trace fine sand, yellow brown and gray orange, dry, very stiff to stiff, cohesive
35.2 - 37.2ft (ML) clayey SILT, low plasticity, trace fine sand, dark yellow brown, moist, stiff, cohesive
37.2 - 37.4ft (ML) SILT, light olive gray, wet, calcareous
<< Continued>>

SAMPLE INFORMATION

SAMPLE DEPTH (ft)	NUMBER	SAMPLE TYPE	BLOWS per 6 in	N	REC ATT (ft)	REMARKS
0.0-2.0	S-1	SS	14-10-11-11	21	1.10 / 2.00	
2.0-4.0	S-2	SS	7-7-7-8	14	1.70 / 2.00	
4.0-6.0	S-3	SS	12-8-7-8	15	1.20 / 2.00	
6.0-8.0	S-4	SS	5-4-4-6	8	1.20 / 2.00	
8.0-10.0	S-5	SS	3-2-4-7	6	1.50 / 2.00	
10.0-12.0	S-6	SS	6-6-8-15	14	1.50 / 2.00	
12.0-14.0	S-7	SS	4-3-3-2	6	1.40 / 2.00	
14.0-16.0	S-8	SS	13-11-10-11	21	1.50 / 2.00	
16.0-18.0	S-9	SS	9-9-10-7	19	1.20 / 2.00	
18.0-20.0	S-10	SS	6-5-9-6	14	1.20 / 2.00	
20.0-22.0	S-11	SS	6-5-4-4	9	1.60 / 2.00	
22.0-24.0	S-12	SS	4-4-4-3	8	1.40 / 2.00	
24.0-26.0	S-13	SS	4-3-3-8	6	1.70 / 2.00	
26.0-28.0	S-14	SS	8-16-28-16	44	1.90 / 2.00	
28.0-30.0	S-15	SS	7-6-12-15	18	1.60 / 2.00	
30.0-32.0	S-16	SS	11-8-17-16	25	2.00 / 2.00	
32.0-34.0	S-17	SS	11-16-13-10	29	2.00 / 2.00	
34.0-36.0	S-18	SS	4-3-6-6	9	1.80 / 2.00	
36.0-38.0	S-19	SS	7-5-5-5	10	1.30 / 2.00	
38.0-40.0	S-20	SS	2-3-4-6	7	1.80 / 2.00	▼ 39.45ft 11/29/2012



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-5

SHEET 2 of 2

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger
DATE/TIME STARTED: 12/12/2012
DRILLED DEPTH: 60.0 ft

COORDINATES:
N: 1,489,893.21 E: 3,097,213.94
GS ELEVATION: 5274.0 ft

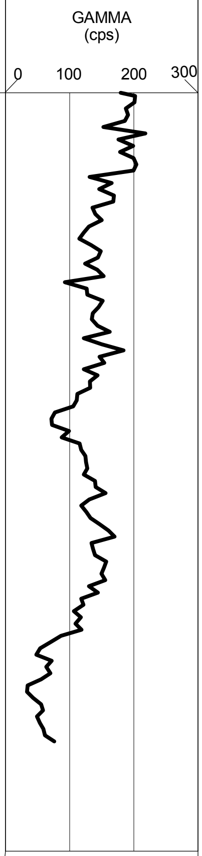
DEPTH W.L.: 39.5 ft
ELEVATION W.L.: 5234.5 ft
INCLINATION: -90

SOIL PROFILE

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG
40		37.4 - 39.0ft (ML) clayey SILT, low plasticity, trace fine sand, dark yellow brown, moist, firm, mottled with pale red, dark yellowish-orange and dark gray	
		39.0 - 40.0ft (ML) SILT, dark gray, wet, calcareous	
	5230	40.0 - 41.1ft (ML) SILT, medium plasticity, trace clay, trace fine sand, trace fine gravel, dark yellow brown, wet, firm to stiff, saturated and flowing	
45		41.1 - 42.0ft (ML) SILT, dark gray, wet, calcareous	
		42.0 - 54.5ft (ML) SILT, low plasticity, some fine gravel, trace clay, trace fine sand, brown black and brown gray, wet, soft to firm, calcareous	
	5225		
50			
	5220		
55		54.5 - 55.8ft (CL-ML) SILTY CLAY, high plasticity, brown gray, moist, soft to firm, calcareous	▨
	5215		
60		Borehole discontinued at 60-ft depth.	

SAMPLE INFORMATION

SAMPLE DEPTH (ft)	NUMBER	SAMPLE TYPE	BLOWS per 6 in	N	REC ATT (ft)	REMARKS
40.0-42.0	S-21	SS	4-5-3-7	8	2.00 2.00	
42.0-44.0	S-22	SS	4-8-6-4	14	1.50 2.00	
44.0-46.0	S-23	SS	4-5-8-6	13	1.50 2.00	
46.0-48.0	S-24	SS	0-4-4-5	8	1.00 2.00	
48.0-50.0	S-25	SS	4-5-4-4	9	1.30 2.00	
50.0-52.0	S-26	SS	5-4-5-6	9	1.10 2.00	
52.0-54.0	S-27	SS	3-4-8-4	12	1.00 2.00	
54.0-55.8	S-28	SS	3-3-7-50/5.5"	10	1.50 1.80	
56.0-56.4	S-29	SS	50/5"	Refusal	0.40 0.40	
58.0-58.2	S-30	SS	50/2"	Refusal	0.30 0.20	
						60.0ft Hole was air lifted for one hour prior to setting well. Yield estimated at about 10 GPM. 2.6' of cuttings fill the bottom. Screened across water table.



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-6

SHEET 1 of 6

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/Air Rotary
DATE/TIME STARTED: 12/16/2012 4:00:05 PM
DRILLED DEPTH: 231.1 ft

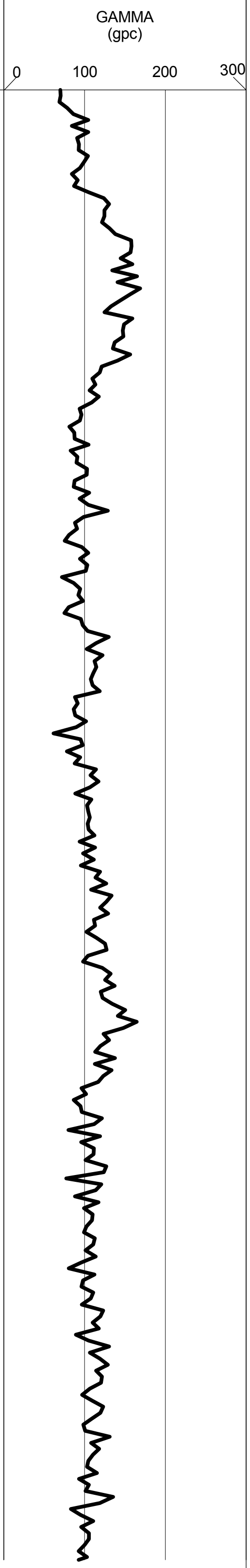
COORDINATES:
N: 1,486,747.45 E: 3,098,238.00
GS ELEVATION: 5237.6 ft

DEPTH W.L.: NA
ELEVATION W.L.: NA
INCLINATION: -90

DEPTH (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	REMARKS
0	0.0 - 20.0ft gravelly SILT, non plastic, dark gray, dry, (FILL)	▨	0.0ft 8 1/4" ID Hollow stem auger from 0-19.5 ft.
19.5			19.5ft Swith drilling method to air rotary. Material descriptions were logged from recovered cuttings at 5-ft intervals.
20	20.0 - 75.0ft Silty LIMESTONE, dark gray, argillaceous, R-1 to R-2	▦	

DEPTH (ft): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

ELEVATION (ft): 5236 5234 5232 5230 5228 5226 5224 5222 5220 5218 5216 5214 5212 5210 5208 5206 5204 5202 5200 5198



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-6

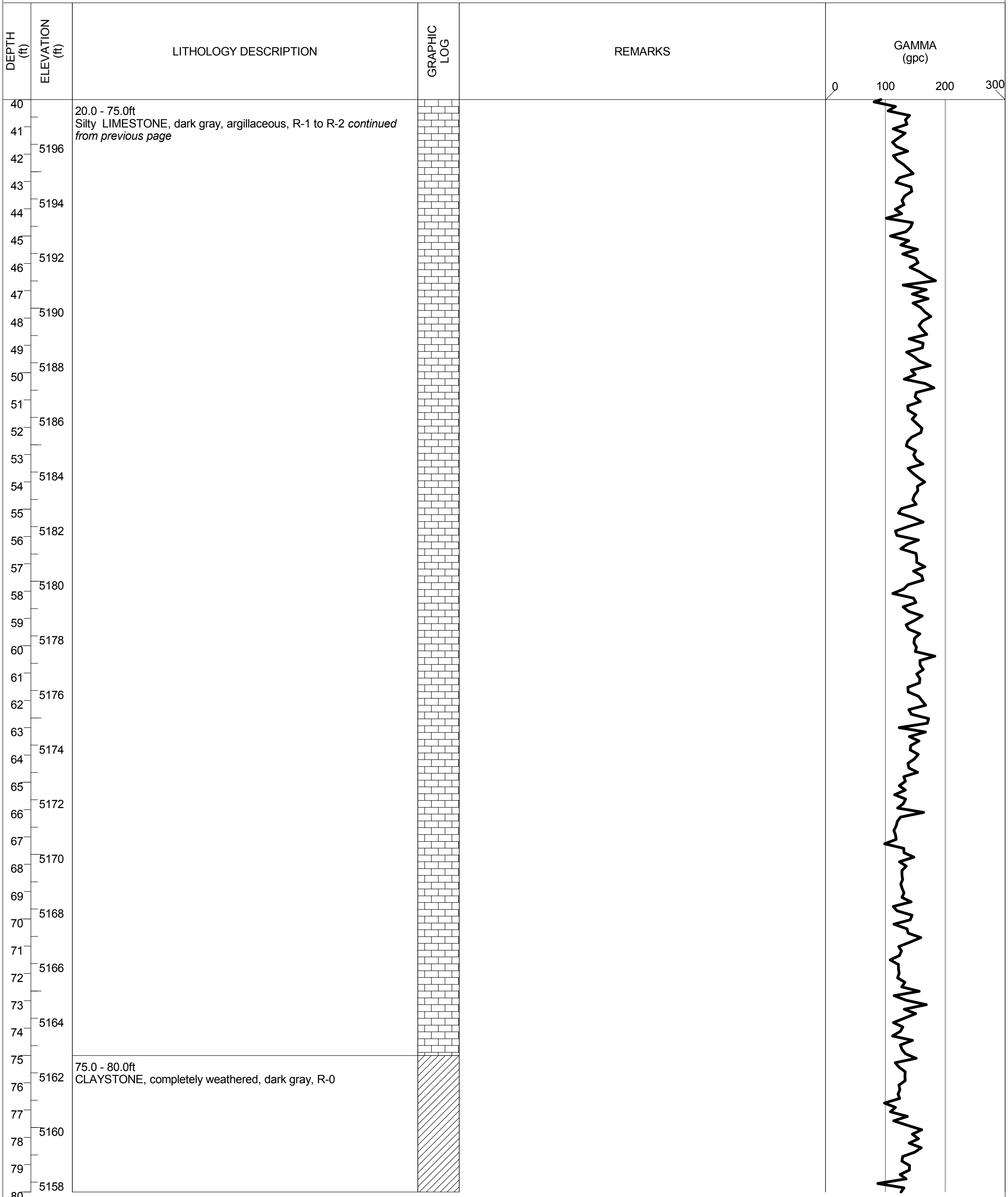
SHEET 2 of 6

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/Air Rotary
DATE/TIME STARTED: 12/16/2012 4:00:05 PM
DRILLED DEPTH: 231.1 ft

COORDINATES:
N: 1,486,747.45 E: 3,098,238.00
GS ELEVATION: 5237.6 ft

DEPTH W.L.: NA
ELEVATION W.L.: NA
INCLINATION: -90



20.0 - 75.0ft
Silty LIMESTONE, dark gray, argillaceous, R-1 to R-2 *continued from previous page*

75.0 - 80.0ft
CLAYSTONE, completely weathered, dark gray, R-0

DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-6

SHEET 3 of 6

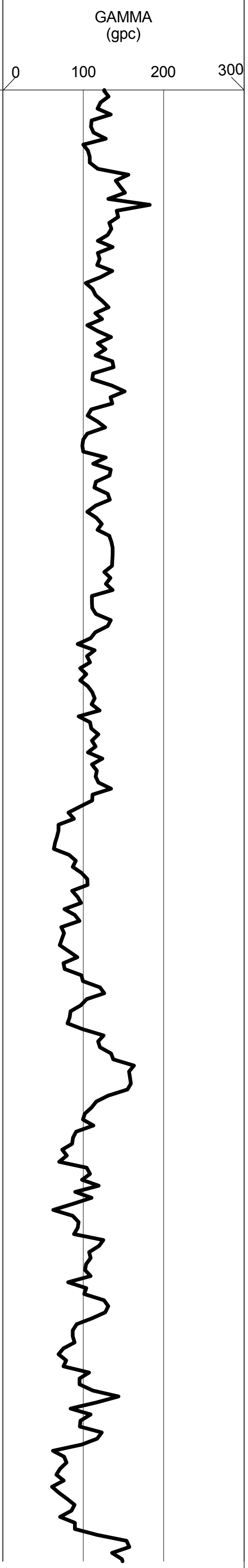
PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/Air Rotary
DATE/TIME STARTED: 12/16/2012 4:00:05 PM
DRILLED DEPTH: 231.1 ft

COORDINATES:
N: 1,486,747.45 E: 3,098,238.00
GS ELEVATION: 5237.6 ft

DEPTH W.L.: NA
ELEVATION W.L.: NA
INCLINATION: -90

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	REMARKS
80		80.0 - 135.0ft Silty LIMESTONE, dark gray, argillaceous, R-1 to R-2, pyrite at 130 ft.		
81	5156			
82				
83	5154			
84				
85	5152			
86				
87	5150			
88				
89	5148			
90				
91	5146			
92				
93	5144			
94				
95	5142			
96				
97	5140			
98				
99	5138			
100				
101	5136			
102				
103	5134			
104				
105	5132			
106				
107	5130			
108				
109	5128			
110				
111	5126			
112				
113	5124			
114				
115	5122			
116				
117	5120			
118				
119	5118			
120				



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-6

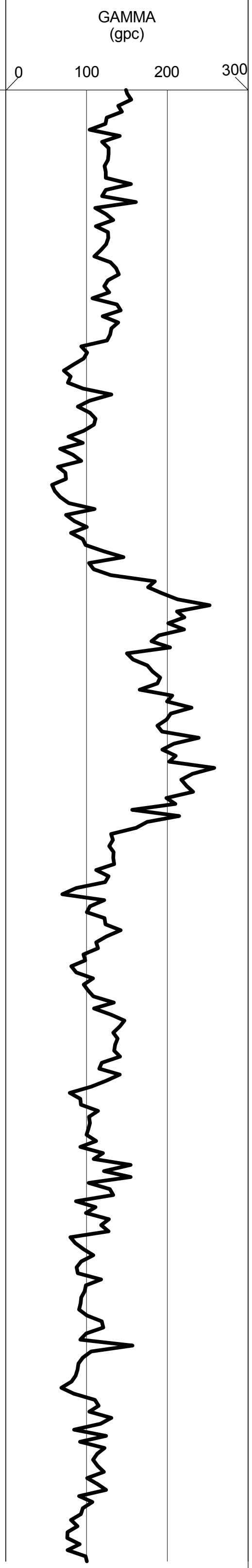
SHEET 4 of 6

PROJECT: Boettcher Limestone Quarry	DRILL METHOD: Hollow Stem Auger/Air Rotary	COORDINATES:	DEPTH W.L.: NA
PROJECT NUMBER: 103-81640A	DATE/TIME STARTED: 12/16/2012 4:00:05 PM	N: 1,486,747.45 E: 3,098,238.00	ELEVATION W.L.: NA
LOCATION: Laporte, CO	DRILLED DEPTH: 231.1 ft	GS ELEVATION: 5237.6 ft	INCLINATION: -90

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	REMARKS
120		80.0 - 135.0ft Silty LIMESTONE, dark gray, argillaceous, R-1 to R-2, pyrite at 130 ft. *continued from previous page*		
135		135.0 - 215.0ft Silty LIMESTONE, fossiliferous, gray black, argillaceous, R-1 to R-2, possible thin shale or clay interbeds at 150 ft, 170 ft., 180 ft., 190-200 ft.		

DEPTH (ft): 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160

ELEVATION (ft): 5116, 5114, 5112, 5110, 5108, 5106, 5104, 5102, 5100, 5098, 5096, 5094, 5092, 5090, 5088, 5086, 5084, 5082, 5080, 5078



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

DRAFT

RECORD OF BOREHOLE MW-6

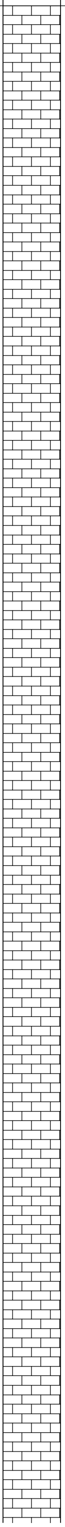
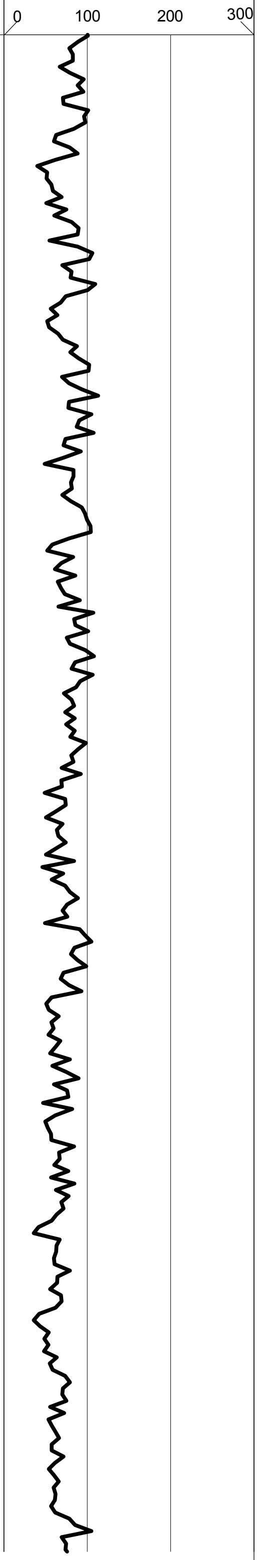
SHEET 5 of 6

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/Air Rotary
DATE/TIME STARTED: 12/16/2012 4:00:05 PM
DRILLED DEPTH: 231.1 ft

COORDINATES:
N: 1,486,747.45 E: 3,098,238.00
GS ELEVATION: 5237.6 ft

DEPTH W.L.: NA
ELEVATION W.L.: NA
INCLINATION: -90

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	REMARKS	GAMMA (gpc)
160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200	5076 5074 5072 5070 5068 5066 5064 5062 5060 5058 5056 5054 5052 5050 5048 5046 5044 5042 5040 5038	135.0 - 215.0ft Silty LIMESTONE, fossiliferous, gray black, argillaceous, R-1 to R-2, possible thin shale or clay interbeds at 150 ft, 170 ft., 180 ft., 190-200 ft. *continued from previous page*			

DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-6

SHEET 6 of 6

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

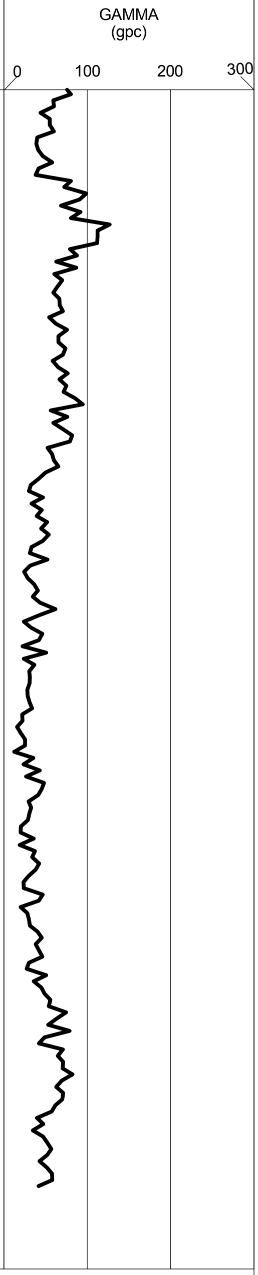
DRILL METHOD: Hollow Stem Auger/Air Rotary
DATE/TIME STARTED: 12/16/2012 4:00:05 PM
DRILLED DEPTH: 231.1 ft

COORDINATES:
N: 1,486,747.45 E: 3,098,238.00
GS ELEVATION: 5237.6 ft

DEPTH W.L.: NA
ELEVATION W.L.: NA
INCLINATION: -90

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	REMARKS
200 201 202 203 204 205 206 207 208 209 210 211 212 213 214	5036 5034 5032 5030 5028 5026 5024	135.0 - 215.0ft Silty LIMESTONE, fossiliferous, gray black, argillaceous, R-1 to R-2, possible thin shale or clay interbeds at 150 ft, 170 ft., 180 ft., 190-200 ft. *continued from previous page*		
215 216 217 218 219 220 221 222 223 224 225 226 227 228 229	5022 5020 5018 5016 5014 5012 5010	215.0 - 230.0ft Silty LIMESTONE, very light gray, R-2, Shale interbeds, siliceous from 225 ft.		
230 231	5008	230.0 - 231.0ft Silty SANDSTONE, very light gray and brown black, fine grained grained, calcareous, R-2		

Borehole discontinued at 231.1-ft depth.



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

DRAFT

RECORD OF BOREHOLE MW-7

SHEET 1 of 7

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

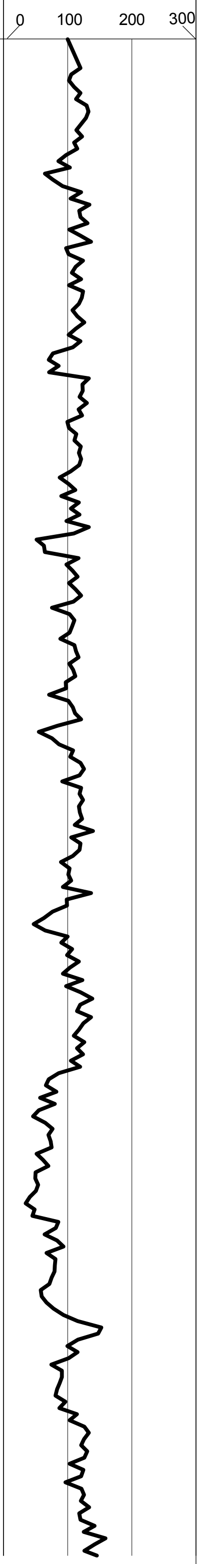
DRILL METHOD: Hollow Stem Auger/NQ Core
DATE/TIME STARTED: 12/1/2012 10:30:08 AM
DRILLED DEPTH: 271.0 ft

COORDINATES:
N: 1,484,797.04 E: 3,098,804.41
GS ELEVATION: 5217.2 ft

DEPTH W.L.: 57.8 ft
ELEVATION W.L.: 5159.4 ft
INCLINATION: -90

J-Joint F-Fault B-Bedding
PL-Planar ST-Stepped K-Slickensided
SM-Smooth R-Rough
CA-Calcite CL-Clay

LITHOLOGY DESCRIPTION	RUN NUMBER	REC / ATT (ft)	RQD (ft)	ROCK STRENGTH	DISCONTINUITY TYPE and SURFACE DESCRIPTION	REMARKS
0.0 - 19.4ft (ML) gravelly SILT, non plastic, trace clay, and rock fragments, some cobbles, brown gray, dry, (FILL)						0.0ft Hollow stem auger from 0-33.8ft
19.4 - 27.7ft (GM) SILTY GRAVEL, brown gray, dry, angular						
27.7 - 28.5ft (CL-ML) silty CLAY, medium plasticity, some fine gravel, brown gray, moist						
28.5 - 28.9ft (GC) GRAVEL, light gray, dry, Limestone						
28.9 - 33.8ft (GM) SILTY GRAVEL, brown gray, dry, angular						
33.8 - 87.6ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, light gray, argillaceous, close to very close fracture spacing, dry	Run-1	4.0 / 4.0	2.83	R-2	B, PL, R 70° B, PL, R 70° J, PL, R 10° B, PL, SM, CL 70°	33.8ft Top of Bedrock (Niobrara Formation). Contains kerogen. Blow counts: 50/2". Change drilling method to NQ air coring.
	Run-2	3.2 / 3.2	0.84			



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

DRAFT

RECORD OF BOREHOLE MW-7

SHEET 2 of 7

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/NQ Core
DATE/TIME STARTED: 12/1/2012 10:30:08 AM
DRILLED DEPTH: 271.0 ft

COORDINATES:
N: 1,484,797.04 E: 3,098,804.41
GS ELEVATION: 5217.2 ft

DEPTH W.L.: 57.8 ft
ELEVATION W.L.: 5159.4 ft
INCLINATION: -90

J-Joint
F-Fault
B-Bedding

PL-Planar
ST-Stepped
K-Slickensided

SM-Smooth
R-Rough

CA-Calcite
CL-Clay

DEPTH (ft)	ELEVATION (ft)
40	
41	5176
42	
43	5174
44	
45	5172
46	
47	5170
48	
49	5168
50	
51	5166
52	
53	5164
54	
55	5162
56	
57	5160
58	
59	5158
60	
61	5156
62	
63	5154
64	
65	5152
66	
67	5150
68	
69	5148
70	
71	5146
72	
73	5144
74	
75	5142
76	
77	5140
78	
79	5138
80	

LITHOLOGY DESCRIPTION

33.8 - 87.6ft
Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, light gray, argillaceous, close to very close fracture spacing, dry *continued from previous page*

57.8
Becomes wet

RUN NUMBER	REC / ATT (ft)	RQD (ft)	ROCK STRENGTH	DISCONTINUITY TYPE and SURFACE DESCRIPTION
Run-2	3.2 / 3.2	0.84	R-2	J, PL, SM 50°
Run-3	8.0 / 10.0	0.67		J, PL, SM 50° B, PL, SM 70° B, PL, SM 70° B, PL, SM 70° B, PL, SM 70° B, PL, SM 70° B, PL, SM 70° B, PL, SM 80° B, PL, SM 80° B, PL, SM 80° B, PL, SM 80° B, PL, SM 80°
Run-4	0.7 / 5.0	0.00		
Run-5	1.1 / 5.3	0.00		
Run-6	5.1 / 5.1	4.80		B, PL, SM 80° B, ST, R, CL 80° B, ST, R, CL 80°
Run-7	10.0 / 10.0	9.87		J, ST, R 80°
Run-8	10.0 / 10.0	9.29		J, PL, SM 30°

REMARKS

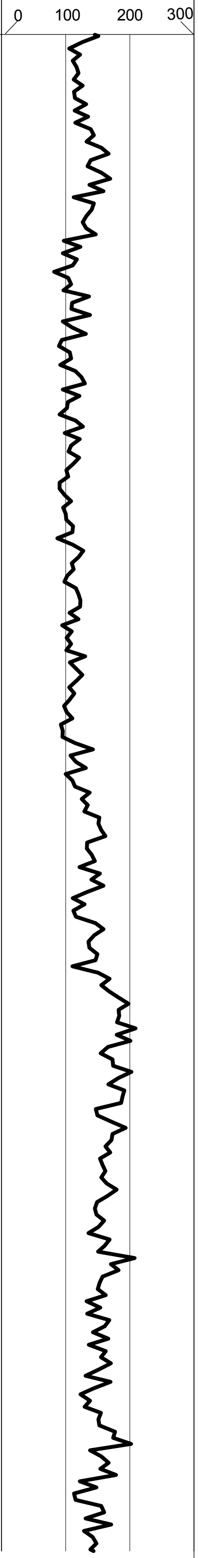
51.0ft
Air coring method yielded poor quality core and incomplete recovery from 51 ft to 61.3 ft. Switched to coring with water from 61.3 ft.

▼ 57.8 ft water encountered, water level rose to 55.7ft in about 30 minutes

59.0ft
Wet at two intervals estimated at 59.25 ft and between 56 and 58 ft, poor recovery, rock too broken to estimate depths accurately.

63.0ft
Fracture voids at 63.8 to 63.85 may transmit water.

66.6ft
0.01 ft to 0.04 ft thick clayey silt seams at 66.6 ft, 68 ft, and 71.4 ft.



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-7

SHEET 3 of 7

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/NQ Core
DATE/TIME STARTED: 12/1/2012 10:30:08 AM
DRILLED DEPTH: 271.0 ft

COORDINATES:
N: 1,484,797.04 E: 3,098,804.41
GS ELEVATION: 5217.2 ft

DEPTH W.L.: 57.8 ft
ELEVATION W.L.: 5159.4 ft
INCLINATION: -90

J-Joint
F-Fault
B-Bedding

PL-Planar
ST-Stepped
K-Slickensided

SM-Smooth
R-Rough

CA-Calcite
CL-Clay

DEPTH (ft)	ELEVATION (ft)
80	
81	5136
82	
83	5134
84	
85	5132
86	
87	5130
88	
89	5128
90	
91	5126
92	
93	5124
94	
95	5122
96	
97	5120
98	
99	5118
100	
101	5116
102	
103	5114
104	
105	5112
106	
107	5110
108	
109	5108
110	
111	5106
112	
113	5104
114	
115	5102
116	
117	5100
118	
119	5098
120	

LITHOLOGY DESCRIPTION
33.8 - 87.6ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, light gray, argillaceous, close to very close fracture spacing, dry *continued from previous page*
87.6 - 87.8ft See Note 1
87.8 - 88.3ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry
88.3 - 88.9ft See Note 1
88.9 - 92.4ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry
92.4 - 92.6ft See Note 1
92.6 - 98.5ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry
98.5 - 98.7ft See Note 2
98.7 - 100.8ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry
100.8 - 101.0ft See Note 2
101.0 - 101.4ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry
101.4 - 101.5ft See Note 2
101.5 - 102.1ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry
102.1 - 102.2ft See Note 1
102.2 - 109.2ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry
109.2 - 109.4ft See Note 1
109.4 - 153.4ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry

RUN NUMBER	REC / ATT (ft)	RQD (ft)
Run-8	10.0 / 10.0	9.29
Run-9	10.1 / 10.1	4.22
Run-10	9.9 / 9.9	9.34
Run-11	9.9 / 10.0	9.66
Run-12	9.7 / 10.0	9.67

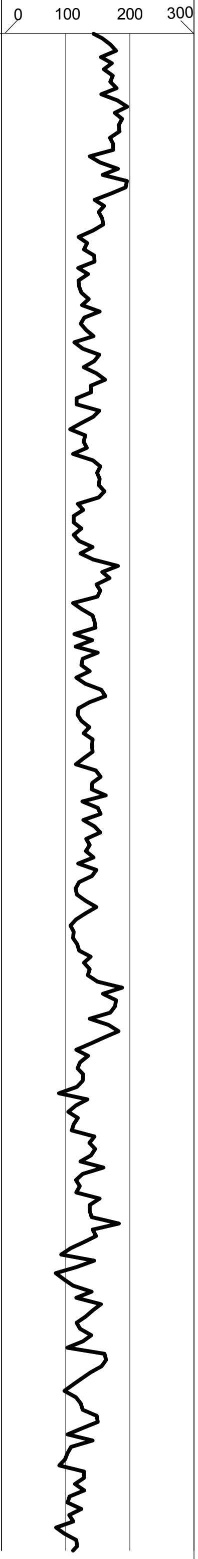
ROCK STRENGTH
R-2
R-0
R-2
R-0
R-2
R-0
R-2
R-0
R-2
R-0
R-2
R-0
R-2
R-0
R-2
R-0
R-2

DISCONTINUITY TYPE and SURFACE DESCRIPTION	
B, ST, SM, CL	80°
J, PL, SM	30°
B, ST, SM, CL	80°
B, ST, SM, CL	80°
J, ST, SM	30°

REMARKS

87.6ft
NOTE 1:
CLAYSTONE, completely weathered, some silt, olive gray, wet, weak, strong reaction to acid

98.5ft
NOTE 2:
CLAYSTONE, completely weathered, laminated, light green gray, wet, no reaction to acid



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-7

SHEET 4 of 7

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/NQ Core
DATE/TIME STARTED: 12/1/2012 10:30:08 AM
DRILLED DEPTH: 271.0 ft

COORDINATES:
N: 1,484,797.04 E: 3,098,804.41
GS ELEVATION: 5217.2 ft

DEPTH W.L.: 57.8 ft
ELEVATION W.L.: 5159.4 ft
INCLINATION: -90

J-Joint
F-Fault
B-Bedding

PL-Planar
ST-Stepped
K-Slickensided

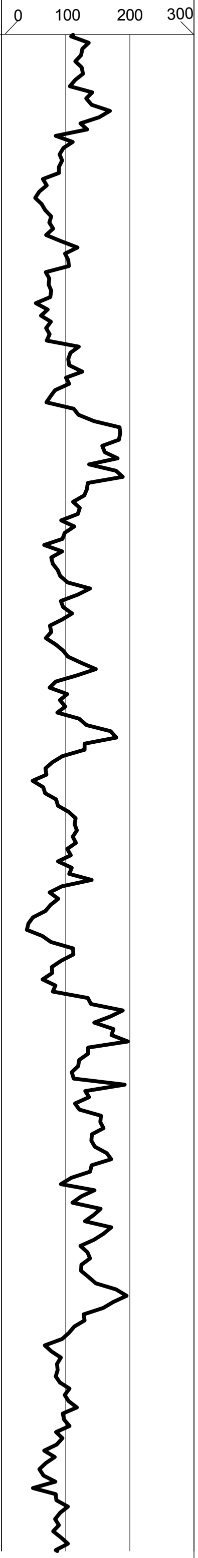
SM-Smooth
R-Rough

CA-Calcite
CL-Clay

DEPTH (ft)	LITHOLOGY DESCRIPTION	RUN NUMBER	REC / ATT (ft)	RQD (ft)	ROCK STRENGTH	DISCONTINUITY TYPE and SURFACE DESCRIPTION	REMARKS
120	109.4 - 153.4ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, gray, argillaceous, medium to very close fracture spacing, dry *continued from previous page*	Run-12	9.7 / 10.0	9.67	R-2	B, U, R, CL 80° B, ST, R, CL 80°	
		Run-13	9.9 / 10.0	8.74		B, ST, R, CL 80°	
		Run-14	10.0 / 10.0	10.00			
		Run-15	10.0 / 10.0	10.00		J, ST, R, CL 65° J, ST, R, CL 65° J, ST, R, CL 65° J, ST, R, CL 65°	
153.4	153.4 - 153.5ft See Note 1				R-0		153.4ft Laminated, clay seam between 153.4 and 153.5 ft, wet at clay seams. Driller reports pressuring up water coring at end of run 15, which may have disintegrated the rock creating what looks like a clay seam.
153.5	153.5 - 171.2ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, dark gray, argillaceous, medium fracture spacing, dry	Run-16	6.3 / 6.4	6.40	R-2		

DEPTH (ft)	ELEVATION (ft)
120	
121	5096
122	
123	5094
124	
125	5092
126	
127	5090
128	
129	5088
130	
131	5086
132	
133	5084
134	
135	5082
136	
137	5080
138	
139	5078
140	
141	5076
142	
143	5074
144	
145	5072
146	
147	5070
148	
149	5068
150	
151	5066
152	
153	5064
154	
155	5062
156	
157	5060
158	
159	5058
160	

GAMMA (gpc)



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-7

SHEET 5 of 7

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/NQ Core
DATE/TIME STARTED: 12/1/2012 10:30:08 AM
DRILLED DEPTH: 271.0 ft

COORDINATES:
N: 1,484,797.04 E: 3,098,804.41
GS ELEVATION: 5217.2 ft

DEPTH W.L.: 57.8 ft
ELEVATION W.L.: 5159.4 ft
INCLINATION: -90

J-Joint
F-Fault
B-Bedding

PL-Planar
ST-Stepped
K-Slickensided

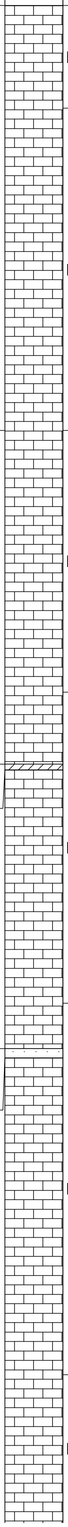
SM-Smooth
R-Rough

CA-Calcite
CL-Clay

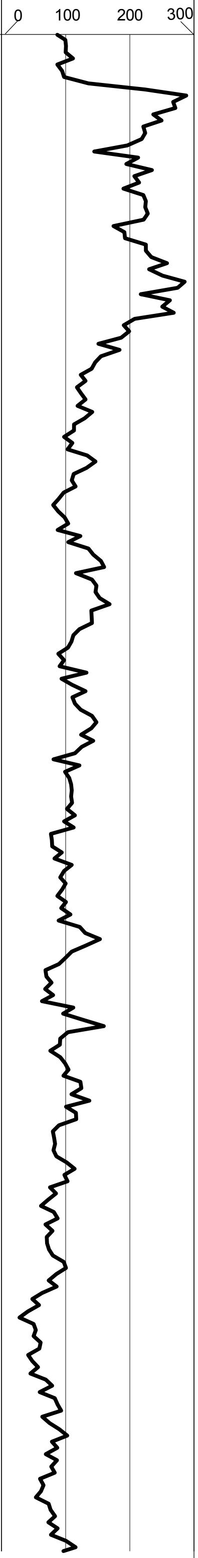
DEPTH (ft)	LITHOLOGY DESCRIPTION	RUN NUMBER	REC / ATT (ft)	RQD (ft)	ROCK STRENGTH	DISCONTINUITY TYPE and SURFACE DESCRIPTION	REMARKS
160–171.2	153.5 - 171.2ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, dark gray, argillaceous, medium fracture spacing, dry *continued from previous page*	Run-16	6.3 / 6.4	6.40	R-2		160.0ft Laminated, wet at clay seams, pyritic from about 148 ft, large pyrite nodule at 148 ft, 163.5 ft., 167.7 ft
		Run-17	8.3 / 8.5	7.65			
171.2–180.0	171.2 - 180.0ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, dark gray, argillaceous, medium fracture spacing, dry	Run-18	6.9 / 6.9	6.90			171.5ft Laminated, wet at sand seams, rock overall seems coarser grained
180.0–180.2	180.0 - 180.2ft See Note 1	Run-19	7.7 / 8.2	7.20	R-0		
180.2–187.5	180.2 - 187.5ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, dark gray, argillaceous, medium fracture spacing, dry				R-2	J, PL, SM 45° J, PL, R 70° F, PL, K, CA 45°	186.1ft slickensides
187.5–187.8	187.5 - 187.8ft Silty SANDSTONE, completely weathered, light brown gray, moist, weakly cemented	Run-20	9.8 / 9.8	9.80	R-0		
187.8–200	187.8 - 201.6ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, dark gray, argillaceous, medium fracture spacing, dry				R-2		
		Run-21	10.1 / 10.1	10.10			

DEPTH (ft)	ELEVATION (ft)
160	
161	5056
162	
163	5054
164	
165	5052
166	
167	5050
168	
169	5048
170	
171	5046
172	
173	5044
174	
175	5042
176	
177	5040
178	
179	5038
180	
181	5036
182	
183	5034
184	
185	5032
186	
187	5030
188	
189	5028
190	
191	5026
192	
193	5024
194	
195	5022
196	
197	5020
198	
199	5018
200	

GRAPHIC LOG



GAMMA (gpc)



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

DRAFT

RECORD OF BOREHOLE MW-7

SHEET 6 of 7

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/NQ Core
DATE/TIME STARTED: 12/1/2012 10:30:08 AM
DRILLED DEPTH: 271.0 ft

COORDINATES:
N: 1,484,797.04 E: 3,098,804.41
GS ELEVATION: 5217.2 ft

DEPTH W.L.: 57.8 ft
ELEVATION W.L.: 5159.4 ft
INCLINATION: -90

J-Joint
F-Fault
B-Bedding

PL-Planar
ST-Stepped
K-Slickensided

SM-Smooth
R-Rough

CA-Calcite
CL-Clay

DEPTH (ft)	ELEVATION (ft)
200	
201	5016
202	
203	5014
204	
205	5012
206	
207	5010
208	
209	5008
210	
211	5006
212	
213	5004
214	
215	5002
216	
217	5000
218	
219	4998
220	
221	4996
222	
223	4994
224	
225	4992
226	
227	4990
228	
229	4988
230	
231	4986
232	
233	4984
234	
235	4982
236	
237	4980
238	
239	4978
240	

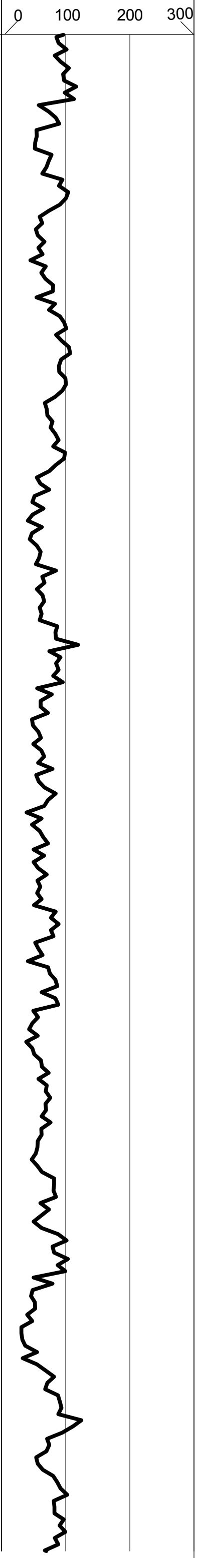
LITHOLOGY DESCRIPTION	ROCK STRENGTH
	R-2
201.6 - 201.7ft Sandy SILTSTONE, completely weathered, light olive gray, slightly calcareous, moist, trace clay	R-0
201.7 - 203.5ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, dark gray, argillaceous, medium fracture spacing, dry	R-2
203.5 - 203.6ft Sandy SILTSTONE, completely weathered, light olive gray, slightly calcareous, moist, trace clay	R-0
203.6 - 245.9ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, dark gray, argillaceous, medium fracture spacing, dry	R-2

RUN NUMBER	REC / ATT (ft)	RQD (ft)
Run-21	10.1 / 10.1	10.10
Run-22	10.1 / 10.1	10.10
Run-23	9.4 / 9.4	9.40
Run-24	5.6 / 5.6	5.60
Run-25	10.0 / 10.0	10.00

REMARKS

230.0ft
Laminated, wet at sand seams, fossil beds at 230 ft and 231 ft, rock overall seems coarser grained.

GAMMA (gpc)



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE MW-7

SHEET 7 of 7

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger/NQ Core
DATE/TIME STARTED: 12/1/2012 10:30:08 AM
DRILLED DEPTH: 271.0 ft

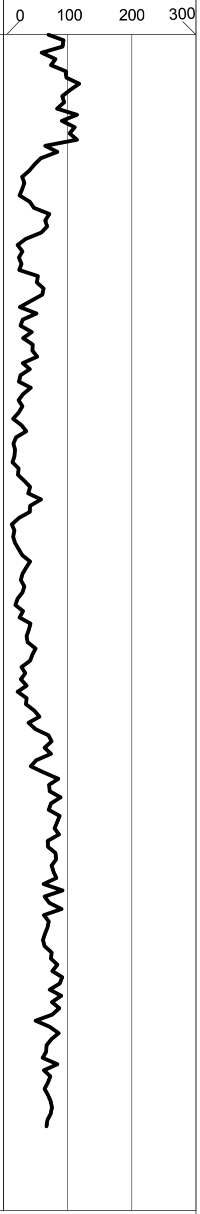
COORDINATES:
N: 1,484,797.04 E: 3,098,804.41
GS ELEVATION: 5217.2 ft

DEPTH W.L.: 57.8 ft
ELEVATION W.L.: 5159.4 ft
INCLINATION: -90

J-Joint F-Fault B-Bedding
PL-Planar ST-Stepped K-Slickensided
SM-Smooth R-Rough
CA-Calcite CL-Clay

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	RUN NUMBER	REC / ATT (ft)	RQD (ft)	ROCK STRENGTH	DISCONTINUITY TYPE and SURFACE DESCRIPTION	GRAPHIC LOG	REMARKS
240		203.6 - 245.9ft Silty LIMESTONE, moderately weathered, medium bedded, fossiliferous, dark gray, argillaceous, medium fracture spacing, dry *continued from previous page*		Run-25	10.0 / 10.0	10.00				
241	4976									
242										
243	4974						R-2			
244										
245	4972									
246		245.9 - 262.0ft LIMESTONE, moderately weathered, medium, interbedded, fossiliferous, very light gray, pyritic, wide fracture spacing, dry, thin (0.1 to 0.3 ft thick) shaley interbeds throught, occasional thin, noncontinuous, grayish green (5G 5/2) stringers(glaucontie), stylites below 250 ft.		Run-26	10.0 / 10.0	10.00	R-3			
247	4970									
248										
249	4968									
250										
251	4966									
252										
253	4964									
254							R-1			
255	4962									
256				Run-27	10.0 / 10.0	10.00				
257	4960							J, PL, R 40°		
258										
259	4958									
260										
261	4956									
262		262.0 - 271.0ft Silty SANDSTONE, slightly weathered, medium bedded, gray and gray black, very fine grained to fine grained, calcareous, wide fracture spacing, mottled								
263	4954									
264										
265	4952									
266				Run-28	9.7 / 9.7	9.70	R-2			
267	4950									
268										
269	4948									
270										
271		Borehole discontinued at 271-ft depth.								

GAMMA (gpc)



DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME 55

LOGGED BY: Krambis
CHECKED BY: A. Hobson
DATE:

Golder Associates

DRAFT

RECORD OF BOREHOLE CKD-1

SHEET 1 of 1

PROJECT: Boettcher Limestone Quarry
PROJECT NUMBER: 103-81640A
LOCATION: Laporte, CO

DRILL METHOD: Hollow Stem Auger
DATE/TIME STARTED: 12/28/12 09:35:00 AM
DRILLED DEPTH: 19.5 ft

COORDINATES:
Not Surveyed
GS ELEVATION:

DEPTH W.L.: NA
ELEVATION W.L.: NA
INCLINATION: -90

SOIL PROFILE				SAMPLE INFORMATION						
DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	SAMPLE DEPTH (ft)	NUMBER	SAMPLE TYPE	BLOWS per 6 in	N	REC / ATT (ft)	REMARKS
0		0.0 - 5.2ft Light olive gray, LIMESTONE fines, with limestone rock fragments, dry. (FILL)		0.00-2.00	S-1	SS	10-16-14-15	30	1.60 / 2.00	0.0ft Appeared to be the same fill encountered at MW-6 and MW-7
5		5.2 - 10.3ft Pinkish-gray cement kiln dust, stratified in thin layers, packed tightly, breaks into fine powder, dry.		5.00-7.00	S-2	SS	34-50/5"	Refusal	0.95 / 2.00	5.0ft Refusal at 5' 11"
10		10.3 - 19.5ft Yellowish-gray cement kiln dust, slightly to moderately compacted, dry.		10.00-11.50	S-3	SS	3-2-2	4	1.40 / 1.50	10.0ft Drove second spoon immediately below first spoon in order to collect enough sample.
				11.50-13.00	S-4	SS	2-3-2	5	1.50 / 1.50	11.5ft First sample for testing.
15				15.00-16.50	S-5	SS	8-7-7	14	1.20 / 1.50	15.0ft Second sample for testing taken 5' below first sample. Sample taken between 15.0' and 19.5' were mixed into a representative sample and bagged for both Golder and Holcim.
				16.50-18.00	S-6	SS	3-4-8	12	1.50 / 1.50	
				18.00-19.40	S-7	SS	12-18-50/5	Refusal	1.50 / 1.40	

Borehole discontinued at 19.5-ft depth.

DRILLING CONTRACTOR: Precision Sampling
DRILLER: McInroy
DRILL RIG: CME55

LOGGED BY: Pribulick
CHECKED BY: A. Hobson
DATE:

Golder Associates

PROJECT: Holcim Boettcher Quarry 2020 Well Installation
PROJECT NUMBER: 20378105

RECORD OF BORING **MW-8**

LOCATION: MW-8

COORDINATES: N: 1,489,961.5 E: 3,097,714.4
GROUND SURFACE ELEVATION: 5,247.5 ft

DRILL RIG: CME-75

PROJECTION: UTM Zone 13

INCLINATION: -90°

DATUM: North Zone State Plane NAD 83

DRILLING METHOD: HSA, air rotary, and air-coring

HORIZONTAL UNITS: feet

DATE STARTED: 11/11/20 10:00

TOTAL DEPTH: 235 ft

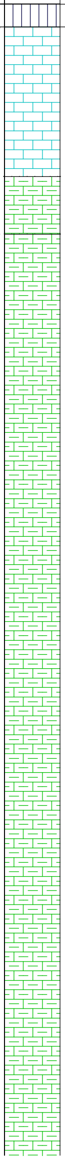
DATE COMPLETED: 11/13/20 13:30

BOTTOM ELEVATION: 5,012.5 ft

DRILL FLUIDS: none

HOLE DIAMETER: 8 inches

DRILL LUBRICANTS: air



DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	COMMENTS
0.0		0.0 - 2.0 Light olive gray (5Y 5/2) SILT with gravel (< 2 in), dry, no odor		5245.5 2.0	ML	Cuttings collected and observed every 5 ft during HSA and air-rotary Continue with HSA into bedrock at 2 ft bgs - drillers feel bedrock at 2 ft bgs - NIOBRARA FORMATION -
	5245					
5.0						
	5240	2.0 - 15.0 Cuttings similar to above			Limestone	
10.0						
	5235	Light brownish gray (5YR 6/1), limestone, dry, no odor				Drilling becomes more difficult at 12 ft bgs, switch to air-rotary at 15 ft bgs
15.0		15.0 - 20.0 Medium gray (N5), limestone and calcareous shale, dry, no odor		5232.5 15.0		
	5230				Limestone	
20.0				5227.5 20.0		
	5225	20.0 - 115.0 Light olive gray (5YR 6/1), limestone and calcareous shale, dry, no odor				
25.0						
	5220					
30.0						
	5215					
35.0						
	5210					
40.0						
	5205					
45.0						
	5200					
50.0						
	5195					
55.0						
	5190					
60.0					Limestone	
	5185					
65.0						Drilling becomes more difficult at 65 ft - harder material
	5180					
70.0						
	5175					
75.0						
	5170					
80.0						
	5165					
85.0						
	5160					
90.0						
	5155					
95.0						
	5150					
100.0						

Log continued on next page

GOLDER

DRILLING CONTRACTOR: Drilling Engineers
DRILLER: Sean

GEOLOGIST: T. Hall
CHECKED: S. Harkins
DATE: 2/5/2021

PROJECT: Holcim Boettcher Quarry 2020 Well Installation
PROJECT NUMBER: 20378105

LOCATION: MW-8

RECORD OF BORING **MW-8**

COORDINATES: N: 1,489,961.5 E: 3,097,714.4
GROUND SURFACE ELEVATION: 5,247.5 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	COMMENTS
100.0 105.0 110.0	5145 5140 5135	20.0 - 115.0 Light olive gray (5YR 6/1), limestone and calcareous shale, dry, no odor		5132.5 115.0	Limestone	
115.0	5130	115.0 - 120.0 Light olive gray (5Y 5/2), limestone and calcareous shale, wet, no odor		5127.5 120.0	Limestone	Water dripping out of air hose
120.0 125.0 130.0 135.0 140.0 145.0 150.0 155.0 160.0	5125 5120 5115 5110 5105 5100 5095 5090 5085	120.0 - 165.0 Light olive gray (5Y 5/2), limestone and calcareous shale, moist, no odor		5082.5 165.0	Limestone	
165.0	5080	165.0 - 168.0 Medium light gray (N6), wackestone, well indurated, trace pyrite, moderately spaced bedding plane fractures, weathered bedding planes		5079.5 168.0	Wackestone	Switch to air-coring at 165 ft
170.0 175.0	5075 5070	168.0 - 178.0 Medium light gray (N6), fossiliferous limestone, well indurated, slightly laminated at 169 ft, minor bioturbation, pyrite along weathered bedding planes, moderately spaced bedding plane fractures		5069.5 178.0	Limestone	
180.0 185.0 190.0 195.0 200.0 205.0	5065 5060 5055 5050 5045	178.0 - 206.0 Medium light gray (N6), limestone, well indurated, massive, slightly laminated, trace pyrite alteration, becomes more bioturbated at 183 ft with few very fine sandstone lenses		5041.5 206.0	Limestone	Poor recovery likely due to mechanical fracturing Poor recovery, mechanical fracturing may be causing core to fall out of core barrel
	5040	206.0 - 208.0 Medium light gray (N6), fossiliferous limestone, very well indurated, bioturbated, slightly laminated, massive		5039.5 208.0	Limestone	
210.0	5035	208.0 - 215.0 Medium light gray (N6), limestone, well indurated, few bedding plane fractures with subvertical joints at 208 and 212 ft, slightly weathered bedding planes, very fine sandstone lenses 213 - 214 ft		5032.5 215.0	Limestone	
215.0 220.0 225.0	5030 5025				Limestone	

Log continued on next page

DRILLING CONTRACTOR: Drilling Engineers
DRILLER: Sean

GEOLOGIST: T. Hall
CHECKED: S. Harkins
DATE: 2/5/2021

PROJECT: Holcim Boettcher Quarry 2020 Well Installation
PROJECT NUMBER: 20378105

LOCATION: MW-8

RECORD OF BORING **MW-8**

COORDINATES: N: 1,489,961.5 E: 3,097,714.4
GROUND SURFACE ELEVATION: 5,247.5 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	COMMENTS
225.0	5020	215.0 - 230.0 Very light gray (N8) with medium gray (N5) intervals, limestone, very well indurated, massive, very fine grained sand-infilled burrows, rip up clasts and styolites beginning at 220 ft		5017.5 230.0	Limestone	
230.0	5015	230.0 - 235.0 - CODELL SANDSTONE - Medium light gray (N8), very fine to fine grained sandstone, subrounded, well sorted, quartz and black lithics, heavily bioturbated from 230 - 232 ft, salt and pepper appearance from 232 - 235 ft		5012.5 235.0	Sandstone	- CODELL SANDSTONE -
235.0 240.0 245.0 250.0 255.0 260.0 265.0 270.0 275.0 280.0 285.0 290.0 295.0 300.0 305.0 310.0 315.0 320.0 325.0 330.0 335.0 340.0 345.0 350.0		**Boring completed at 235 ft.**				**Boring completed at 235 ft.**

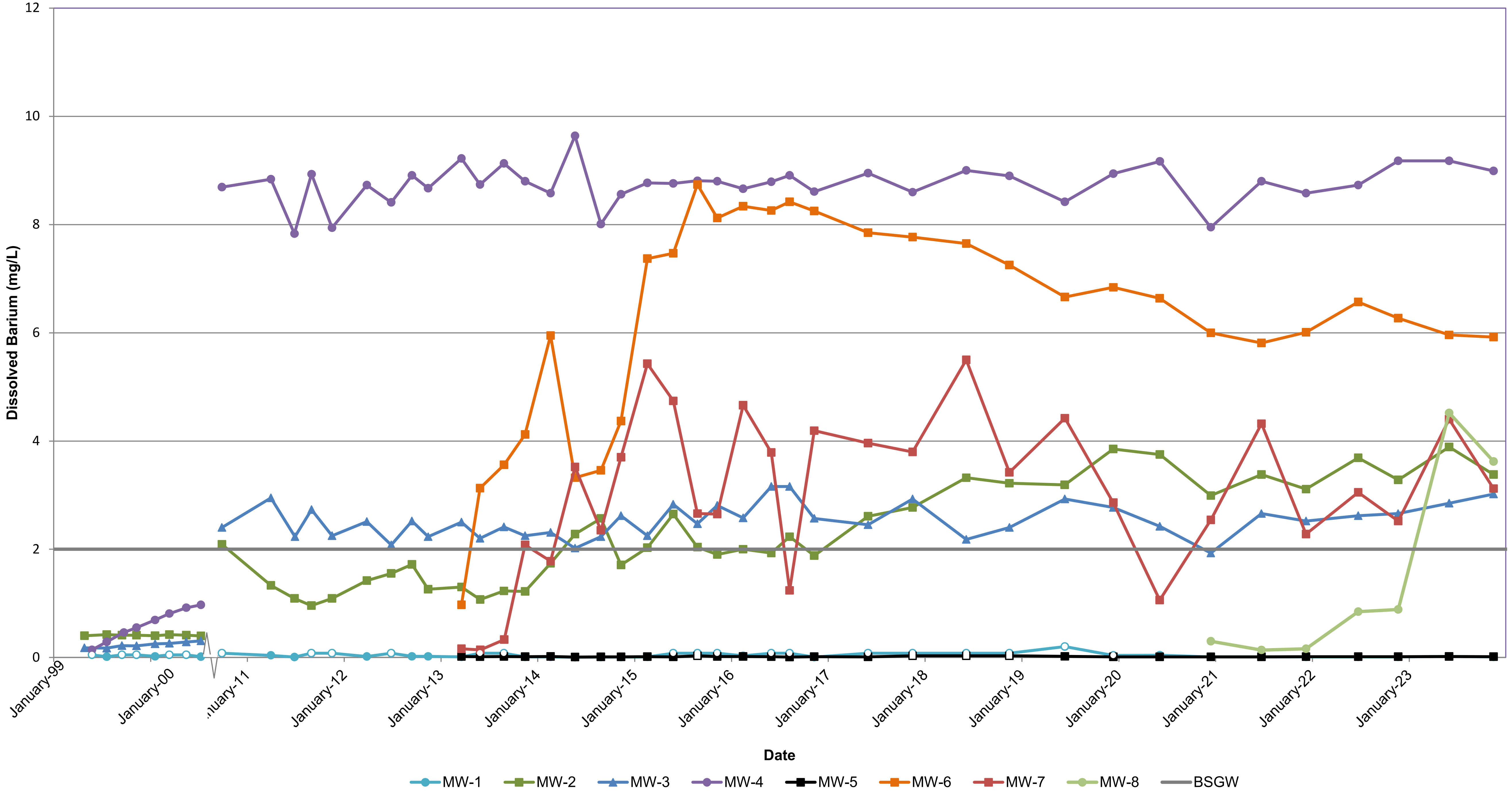
GOLDER

DRILLING CONTRACTOR: Drilling Engineers
DRILLER: Sean

GEOLOGIST: T. Hall
CHECKED: S. Harkins
DATE: 2/5/2021

APPENDIX C

Timeseries Plots of Monitoring Well Water Quality



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

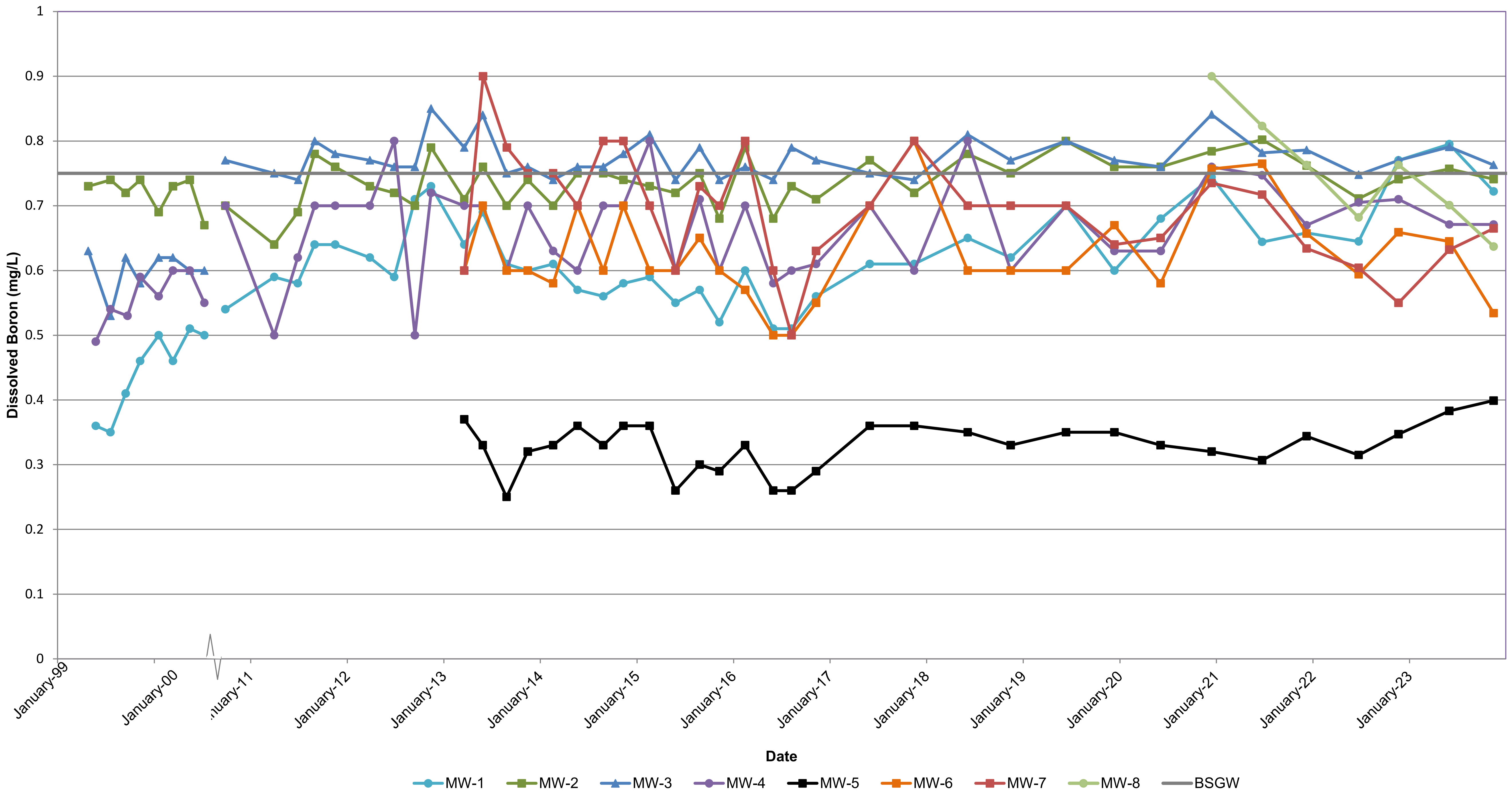
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Dissolved Barium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 1



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

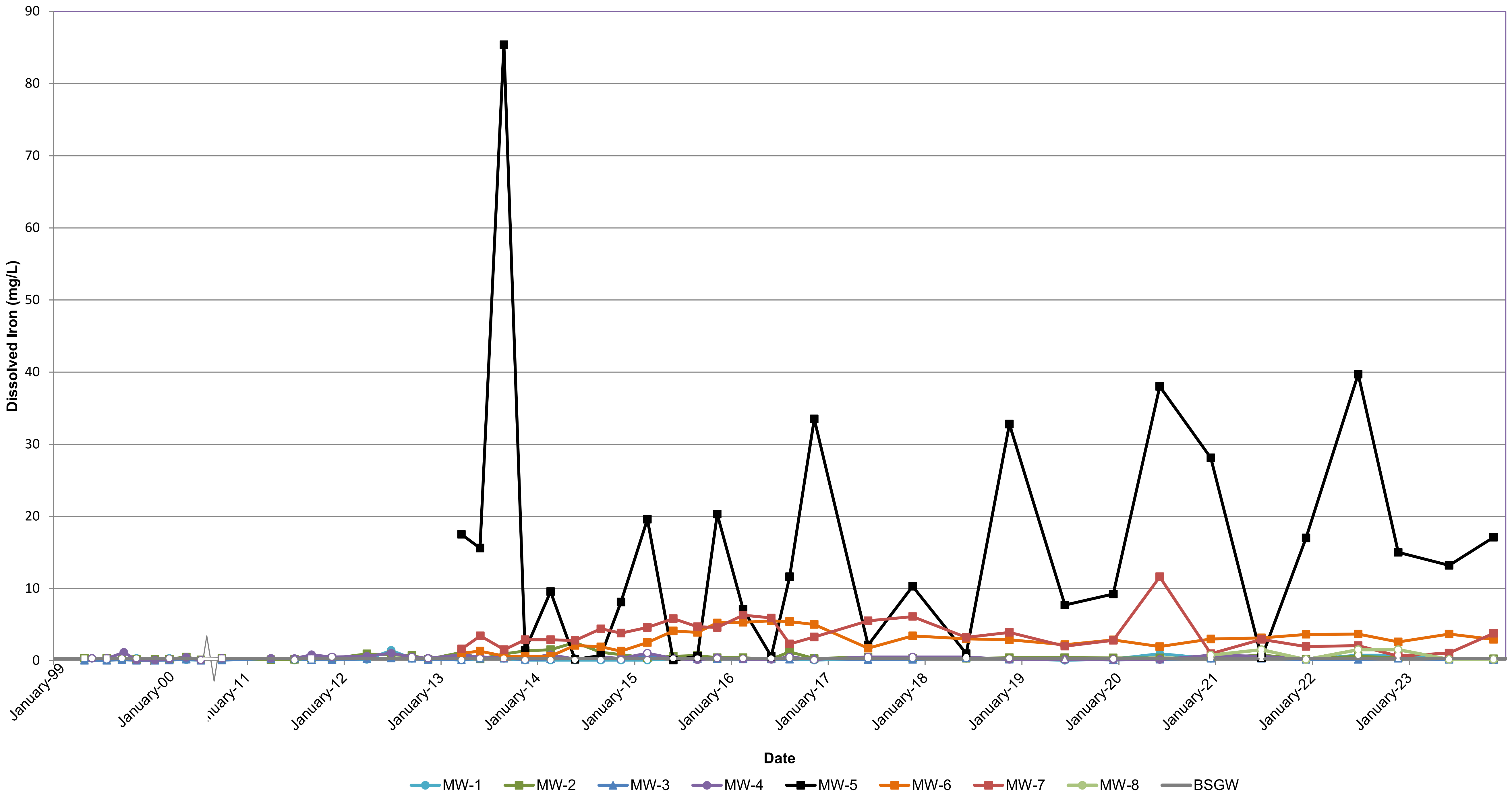
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Timeseries Plot: Dissolved Boron

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 2



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

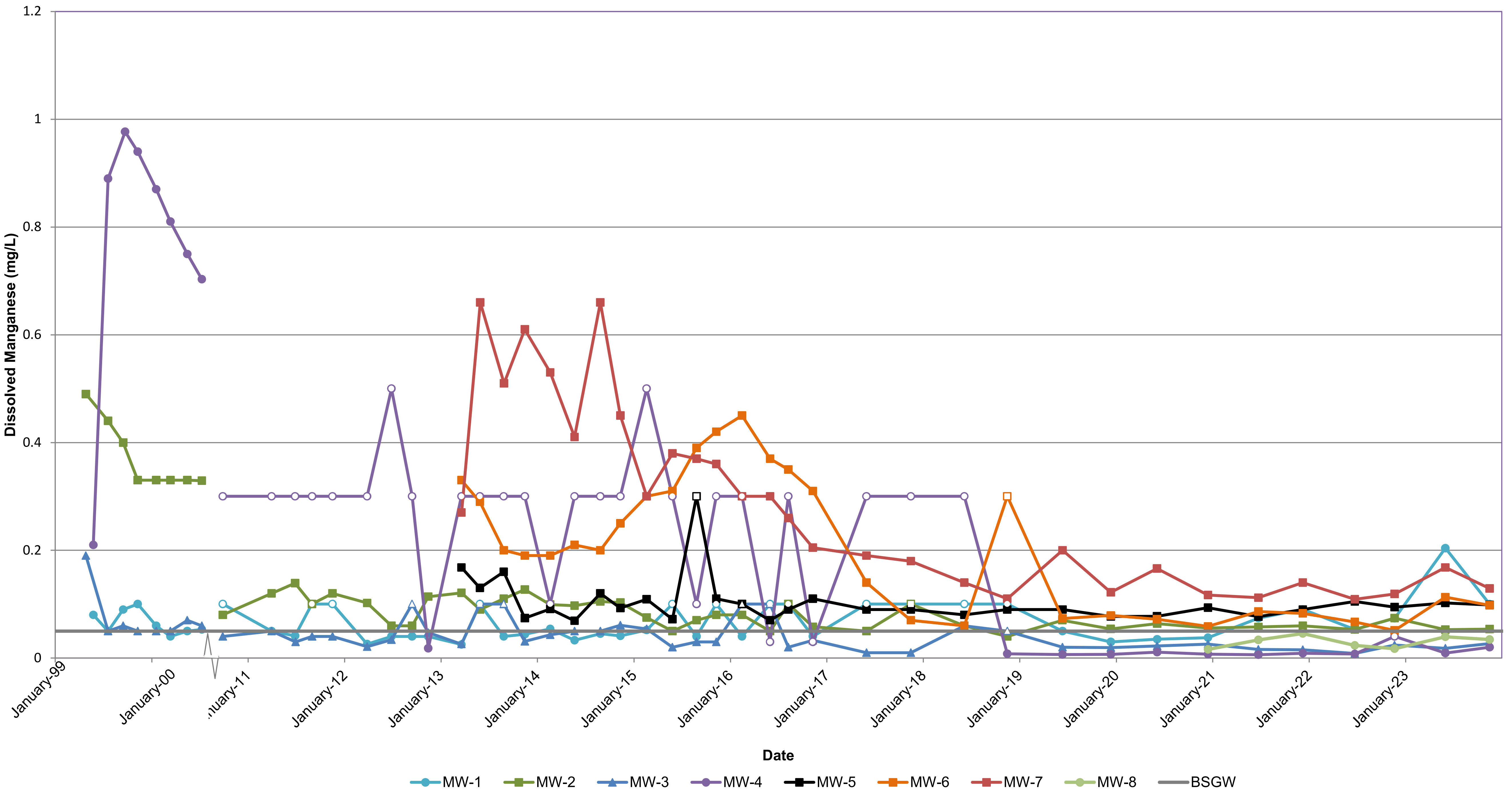
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Timeseries Plot: Dissolved Iron

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 3



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

CLIENT
Holcim (US) Inc.

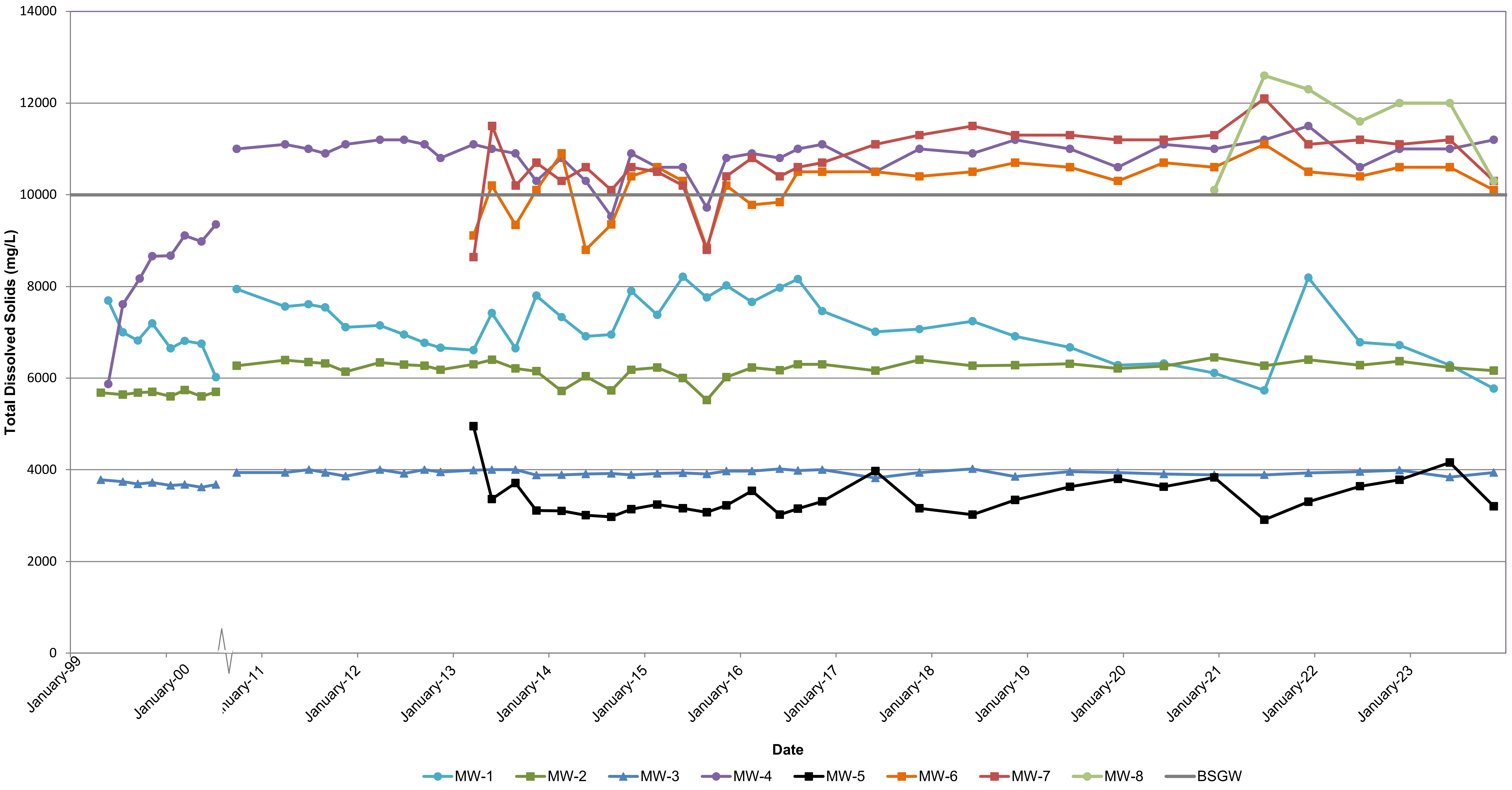
PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
WSP

TITLE
Timeseries Plot: Dissolved Manganese

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 4

PATH: https://wsponlinenam.sharepoint.com/Sites/US-HolcimBoettcherQua/Shared Documents/2023_202319184_2023-2024_Technical Revision/5_ Technical Work/Rev 0/Appendices | FILE NAME: Appendix C Time Series Plots.xlsm



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

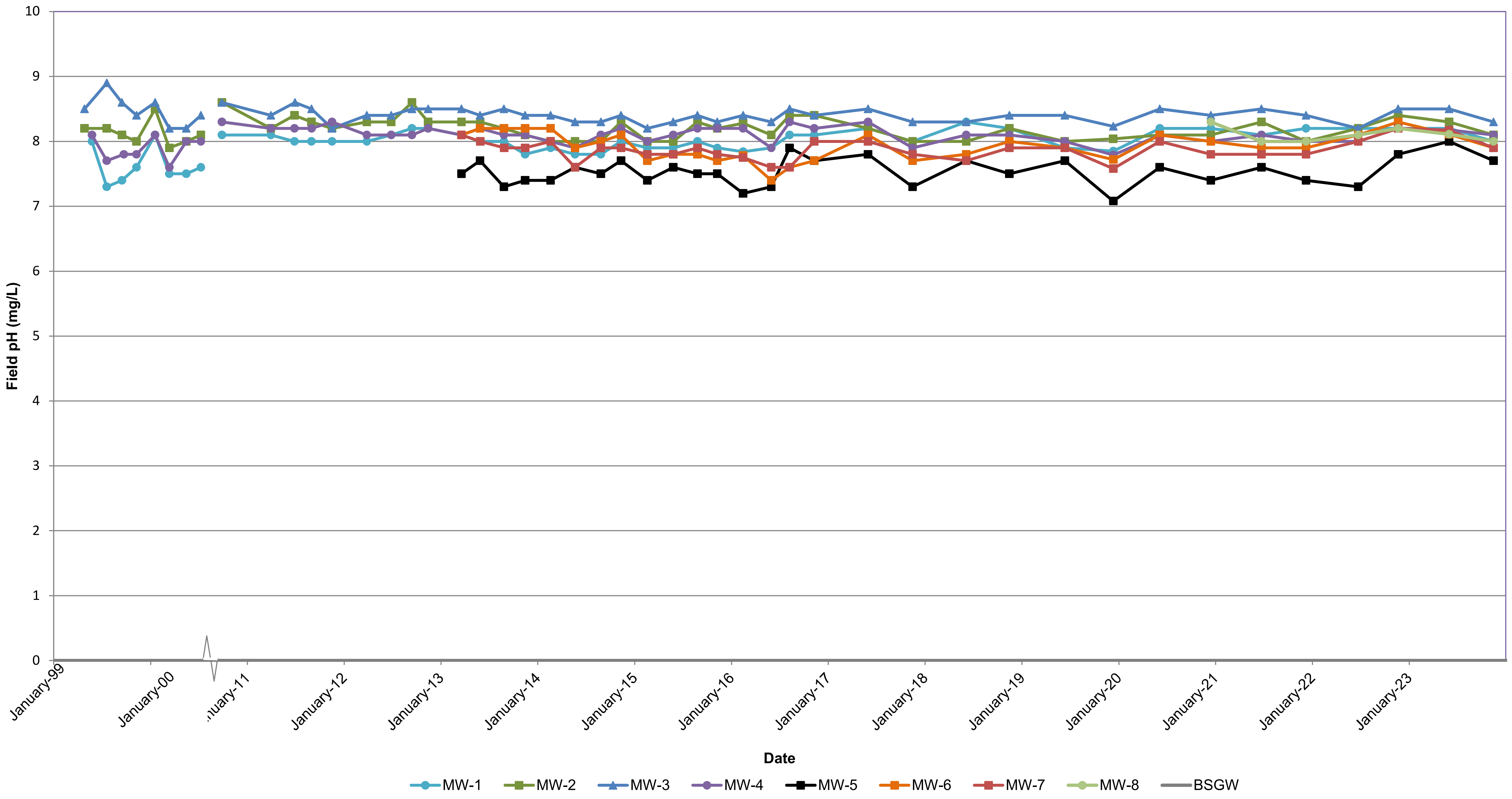
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Total Dissolved Solids

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 5



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

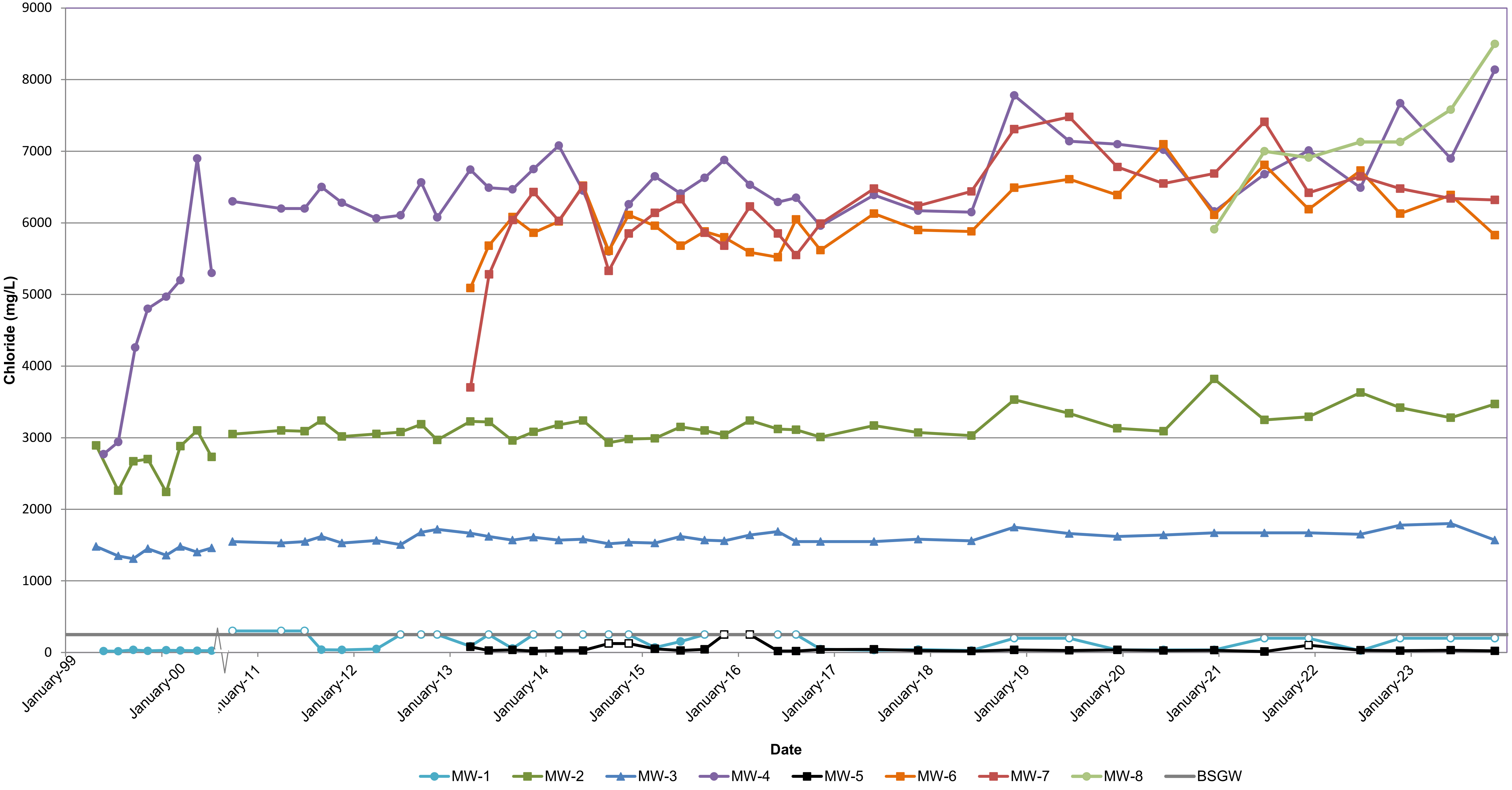
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Field pH

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 6



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

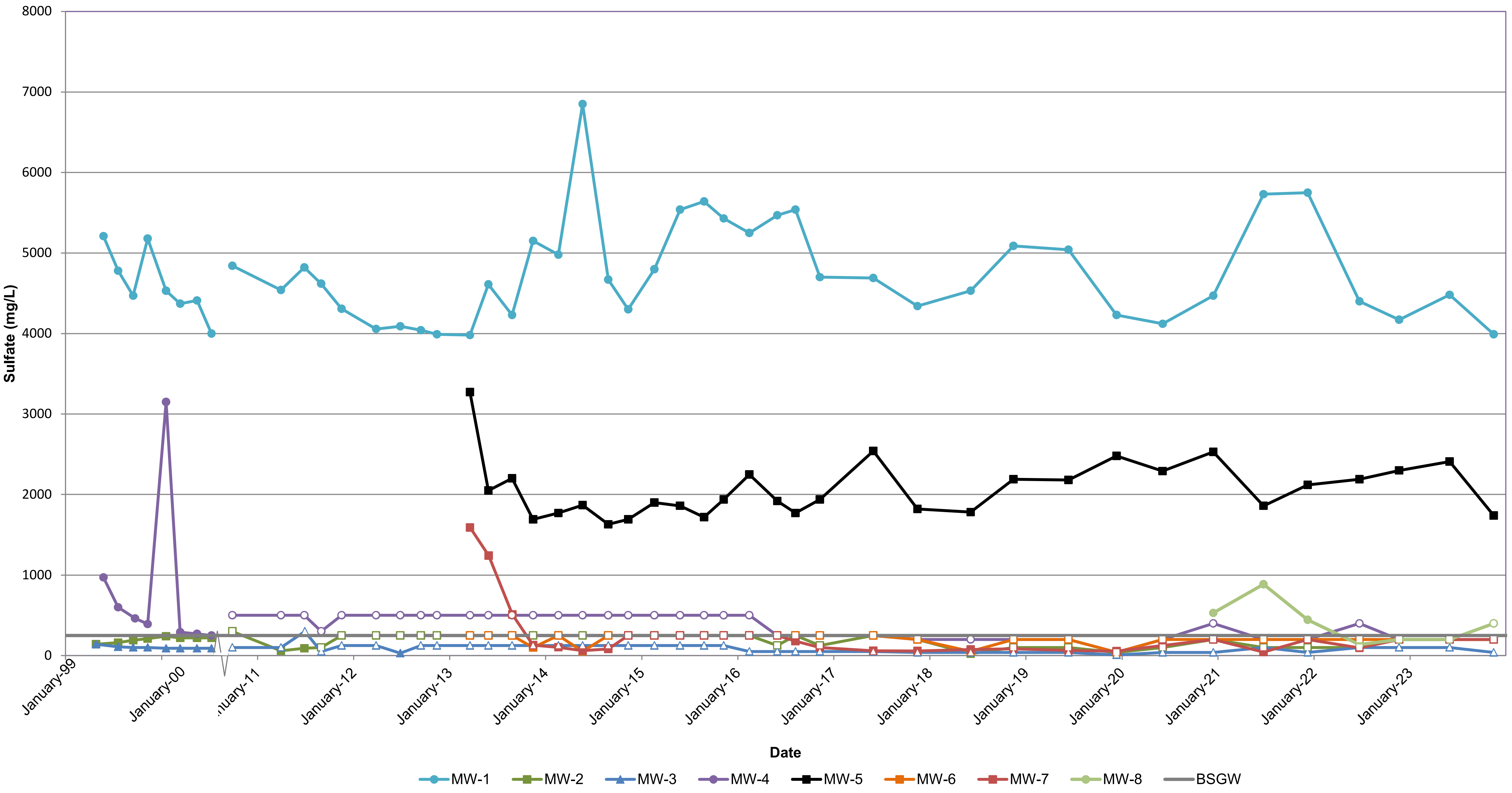
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Timeseries Plot: Chloride

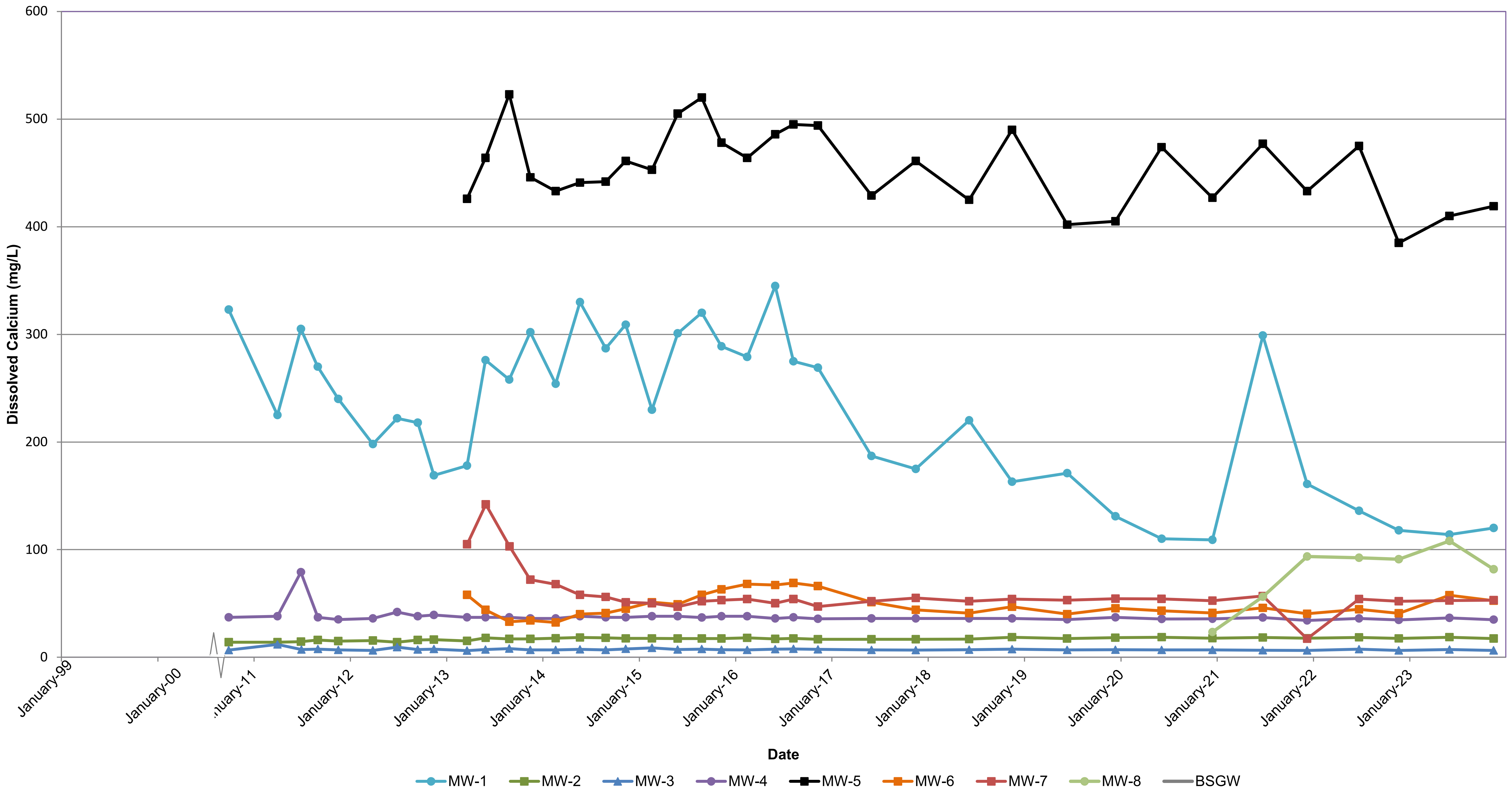
PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 7



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

CLIENT Holcim (US) Inc.	PROJECT Boettcher Limestone Quarry Larimer County, Colorado
CONSULTANT wsp	TITLE Timeseries Plot: Sulfate

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 8



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
 Minimum of Table 1- Table 4.

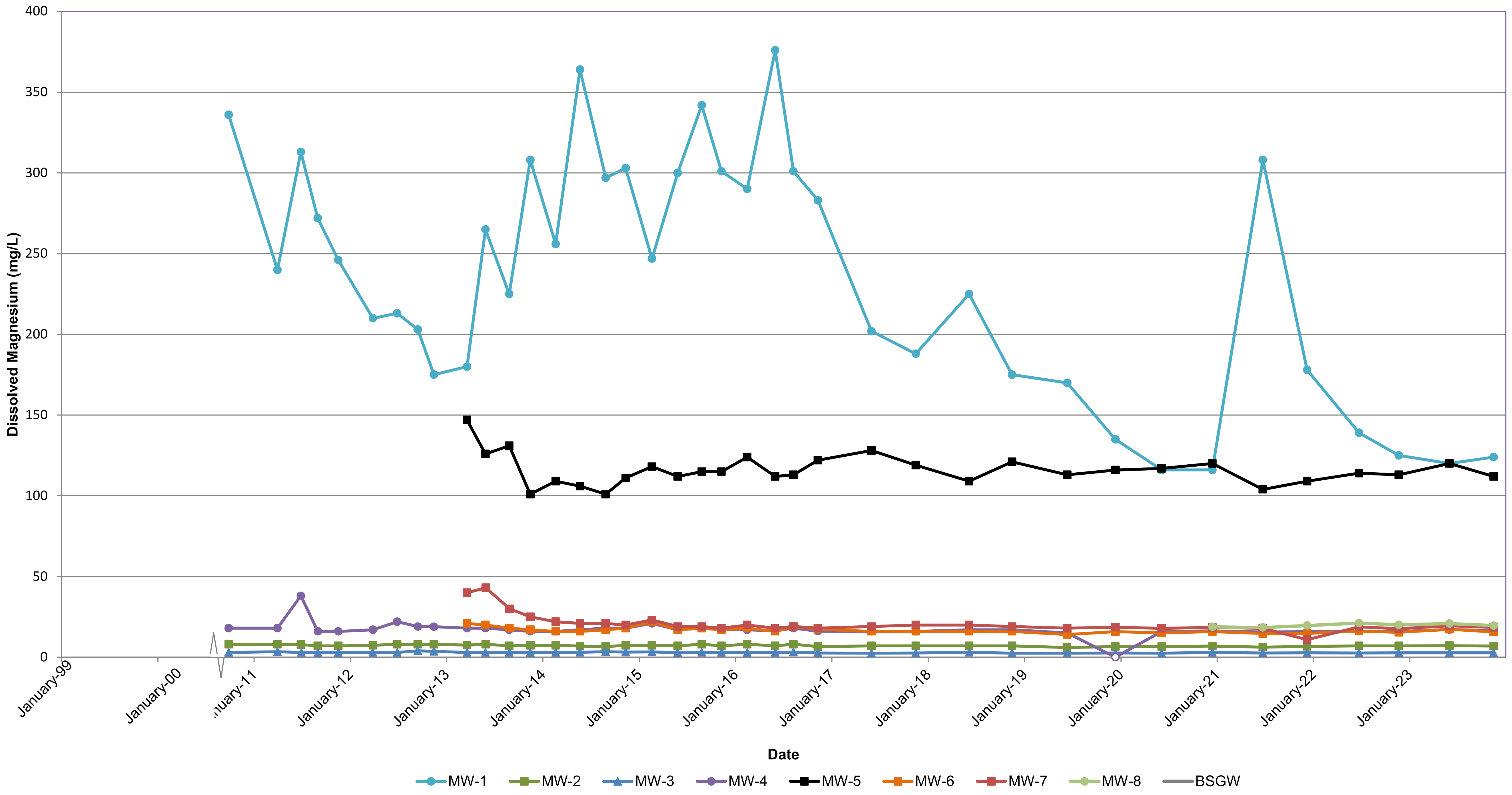
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Dissolved Calcium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 9



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

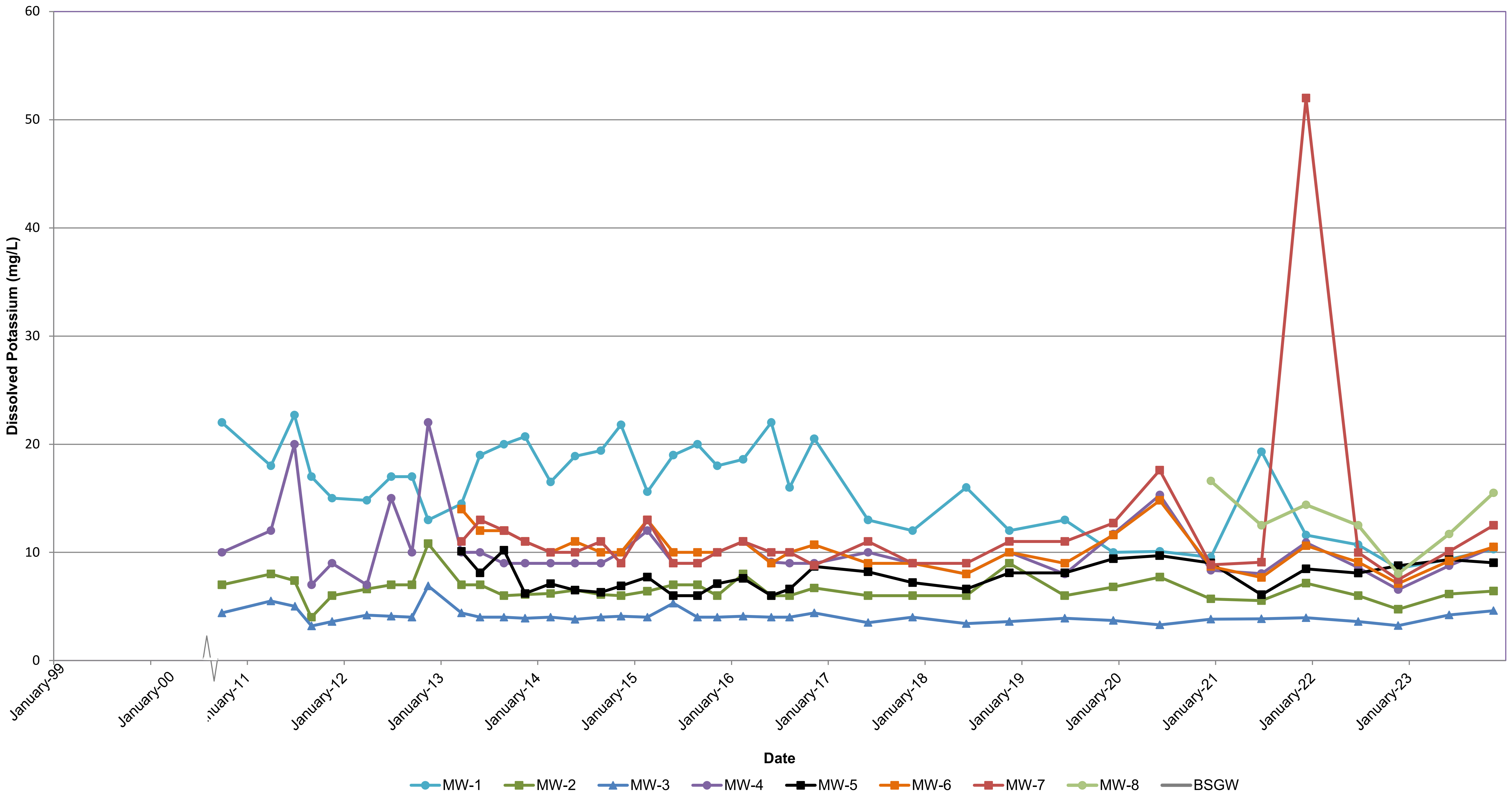
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT

TITLE
Timeseries Plot: Dissolved Magnesium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 10



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

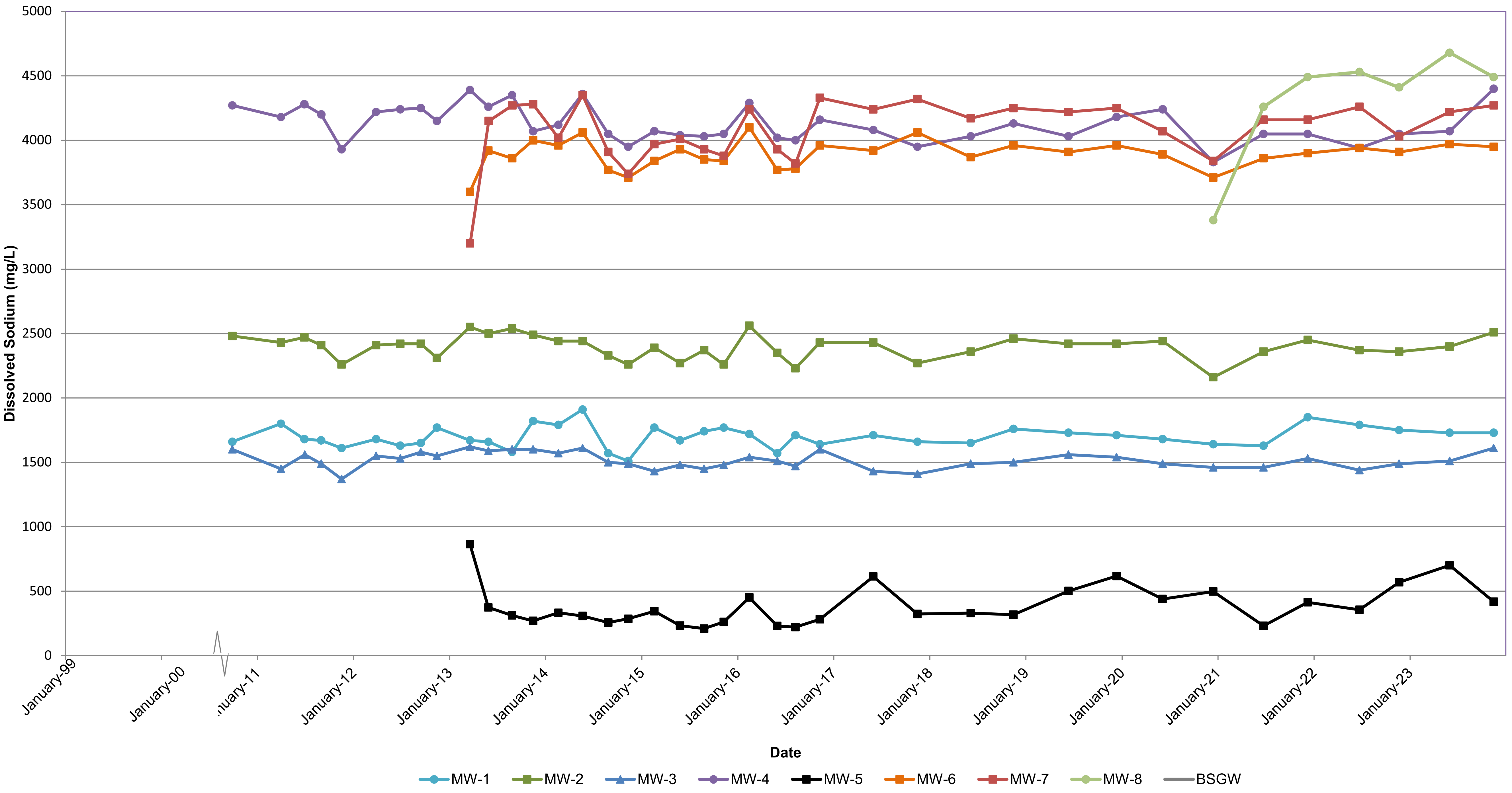
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT

TITLE
Timeseries Plot: Dissolved Potassium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 11



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

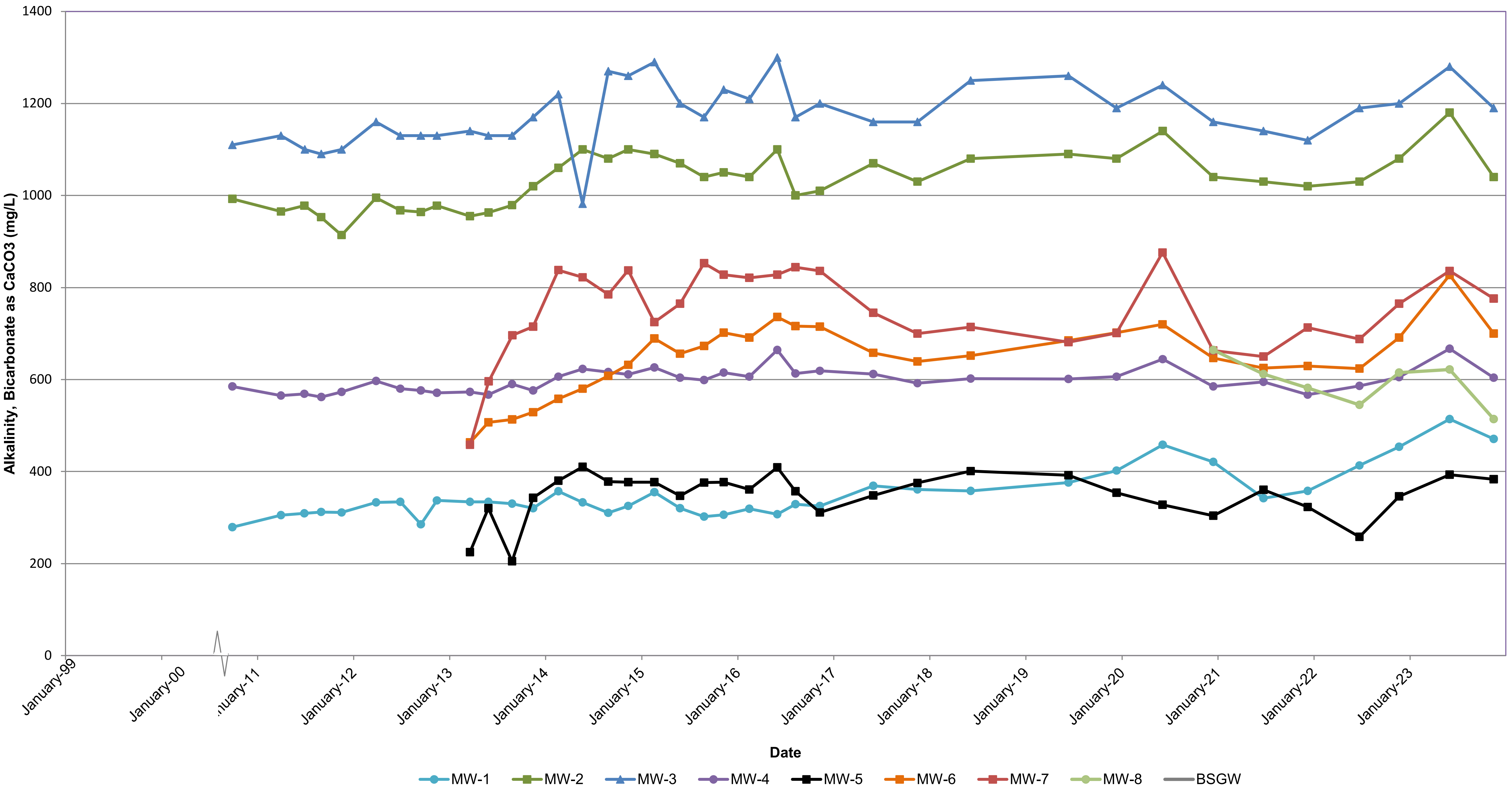
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Dissolved Sodium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 12



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

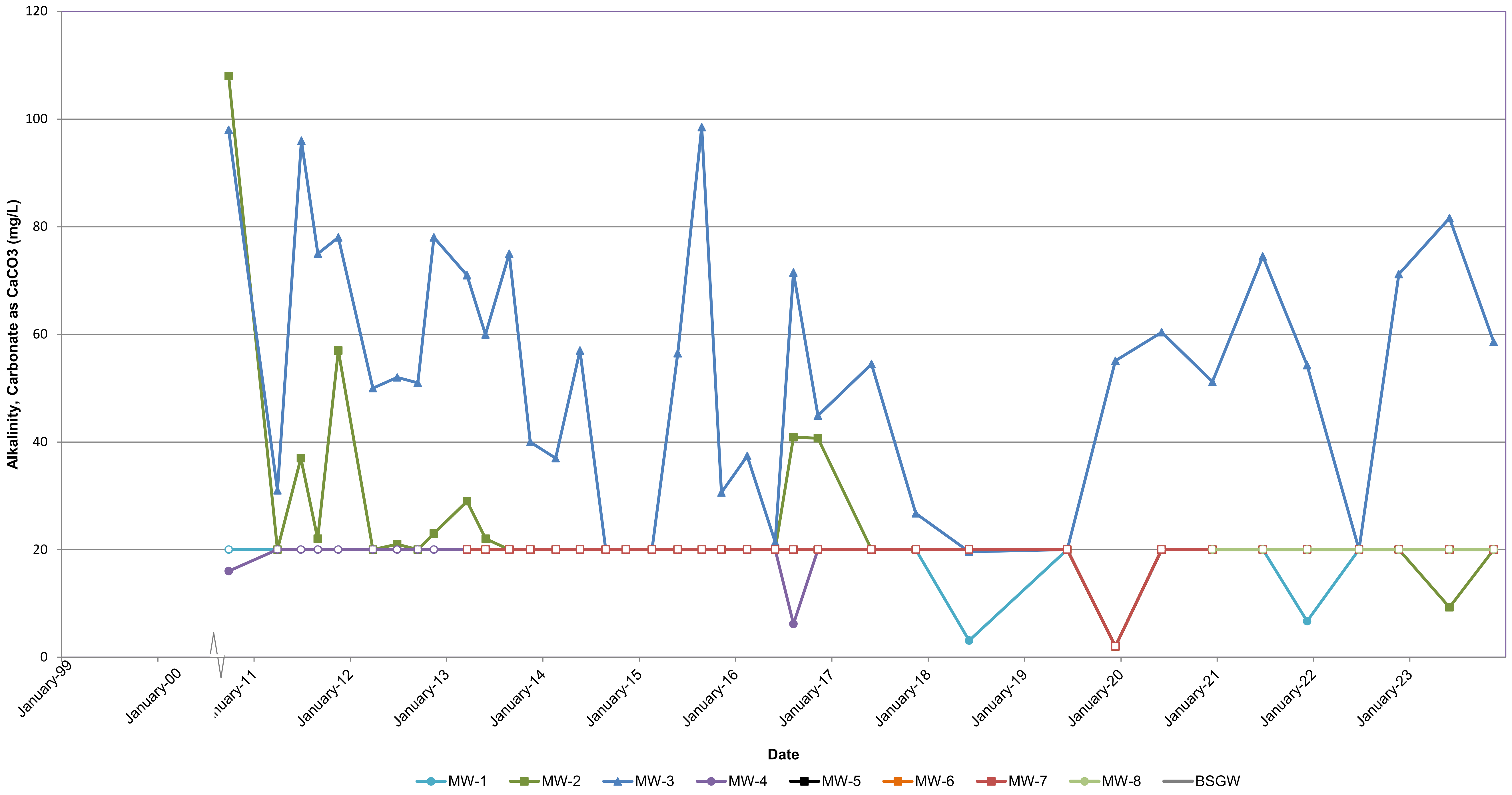
CLIENT
Holcim (US) Inc.

CONSULTANT
WSP

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Timeseries Plot: Alkalinity, Bicarbonate as CaCO3

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 13



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

CLIENT
Holcim (US) Inc.

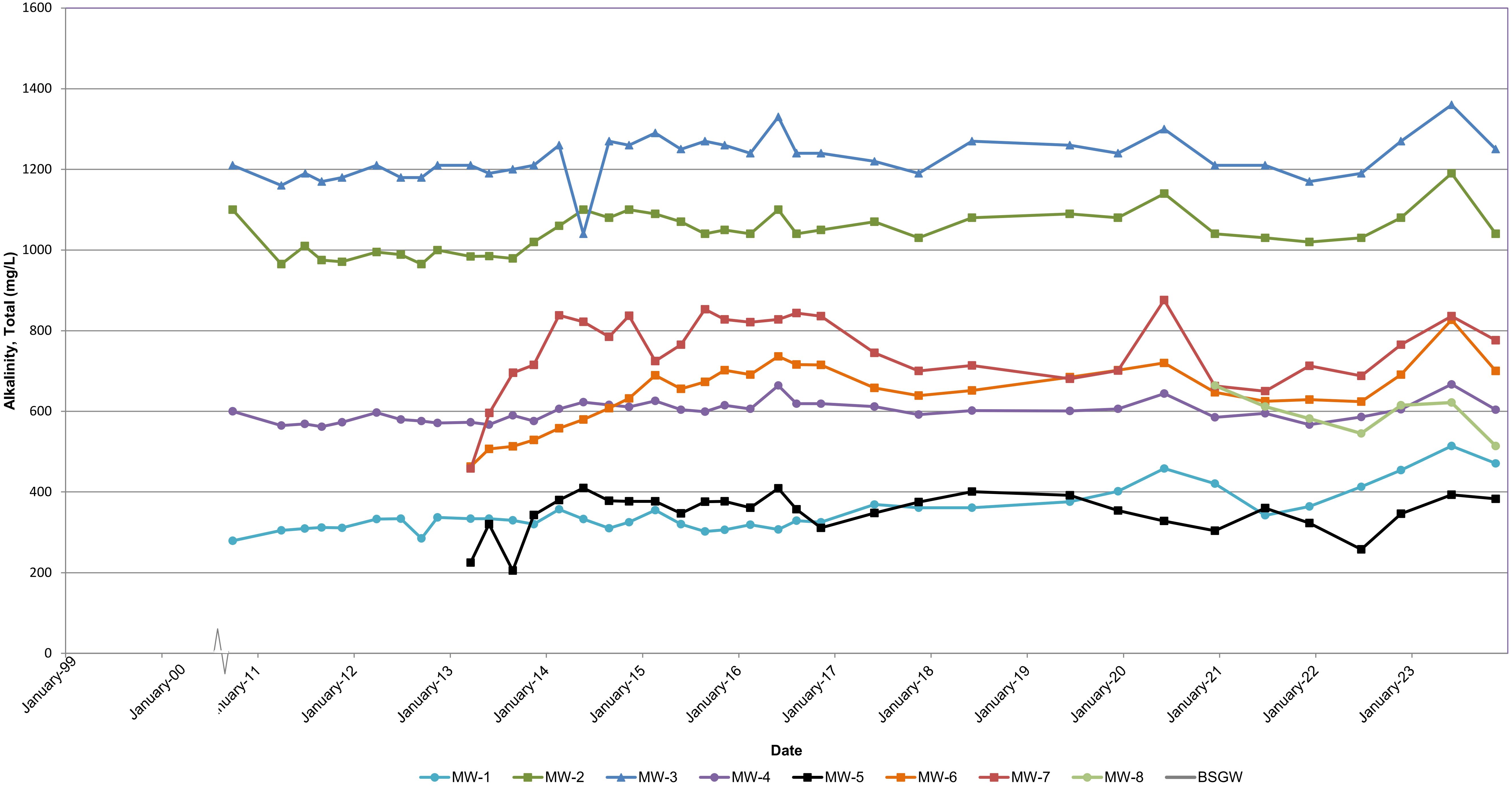
PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Alkalinity, Carbonate as CaCO3

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 14

PATH: https://wsponlinenam.sharepoint.com/Sites/US-HolcimBoettcherQua/Shared Documents/2023_202319184_2023-2024_Technical Revision/5_ Technical Work/Rev 0/Appendices | FILE NAME: Appendix C Time Series Plots.xlsm



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

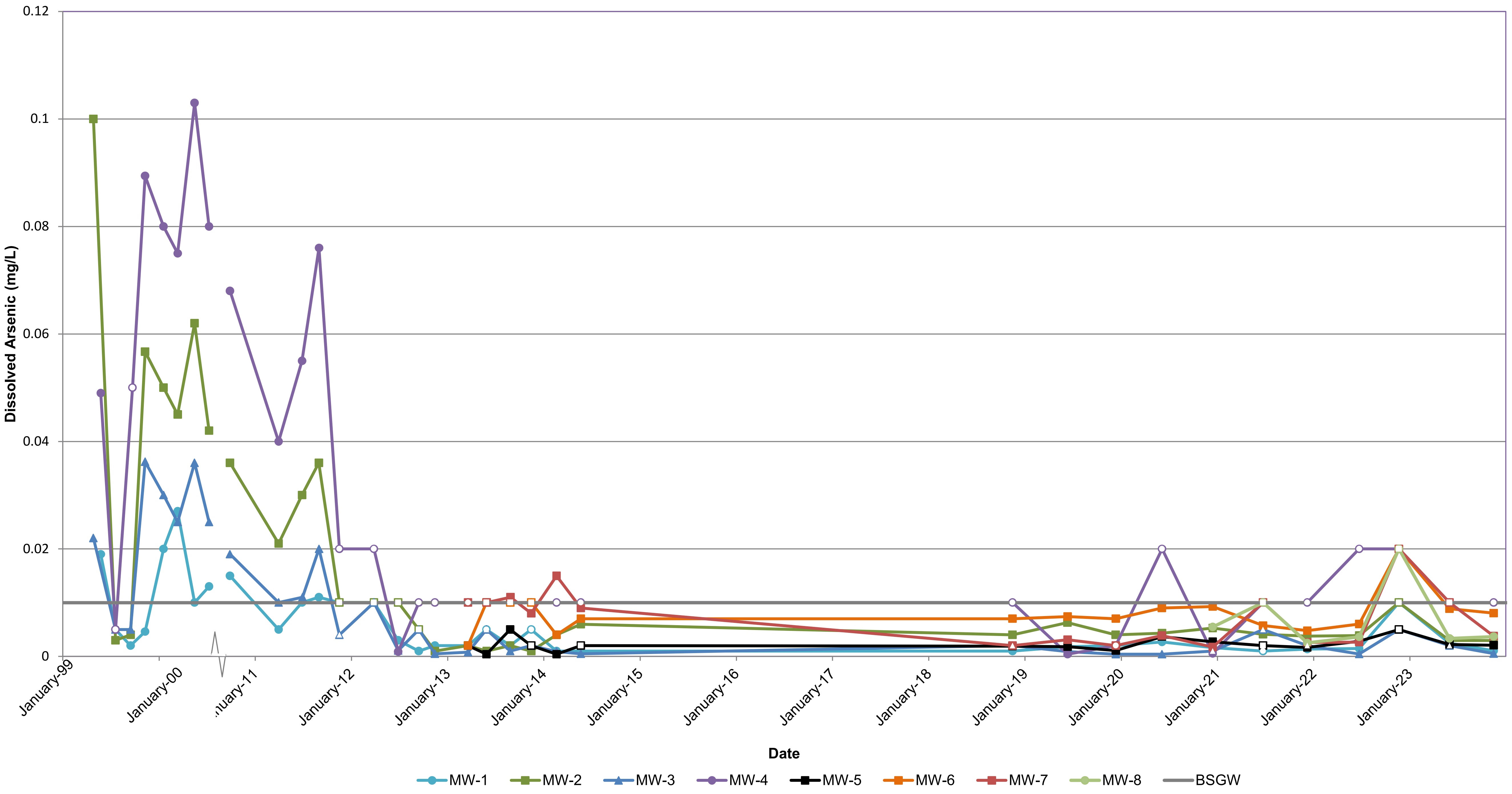
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT

TITLE
Timeseries Plot: Alkalinity, Total

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 15



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

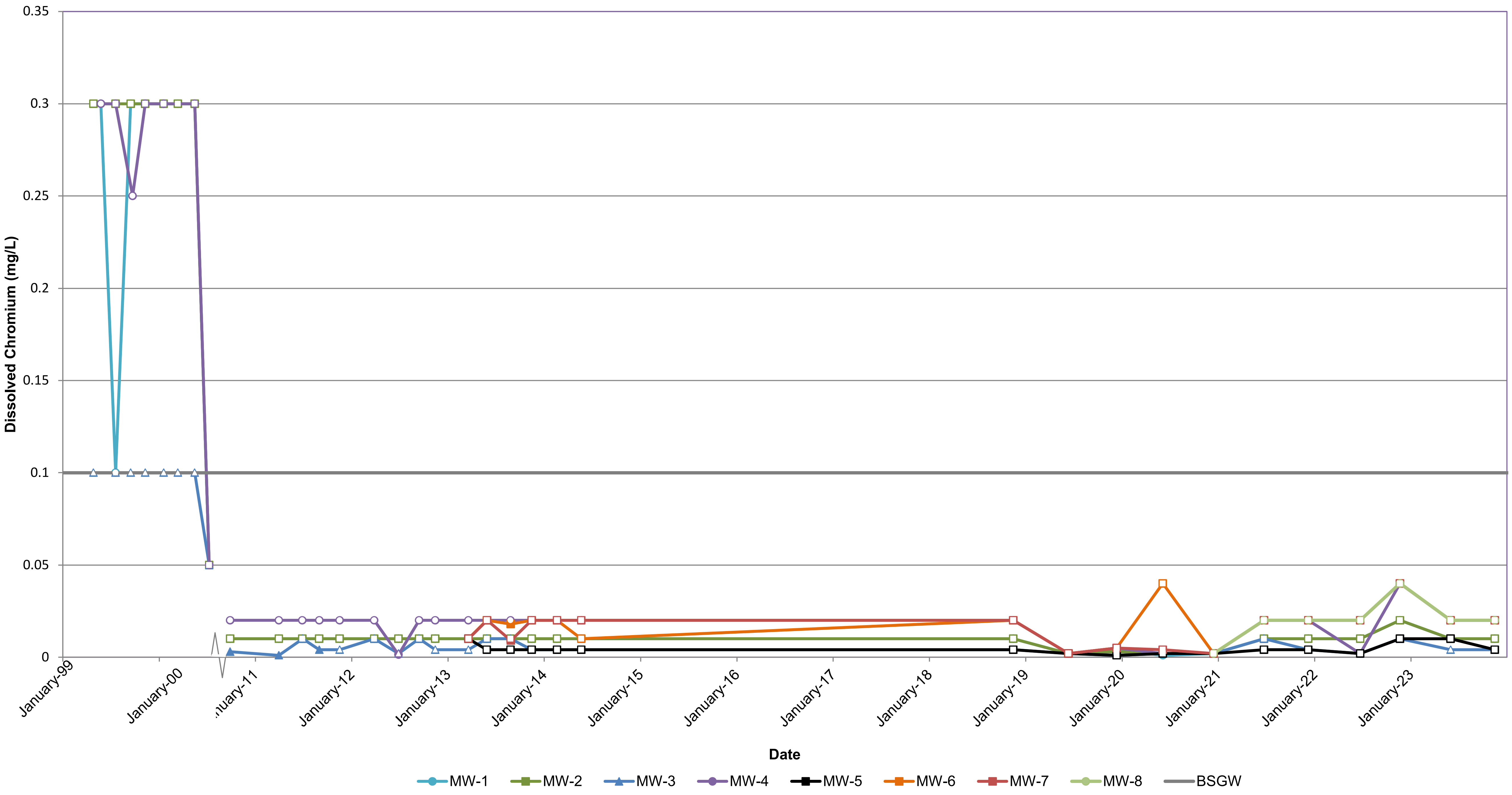
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Dissolved Arsenic

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 16



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
 Minimum of Table 1- Table 4.

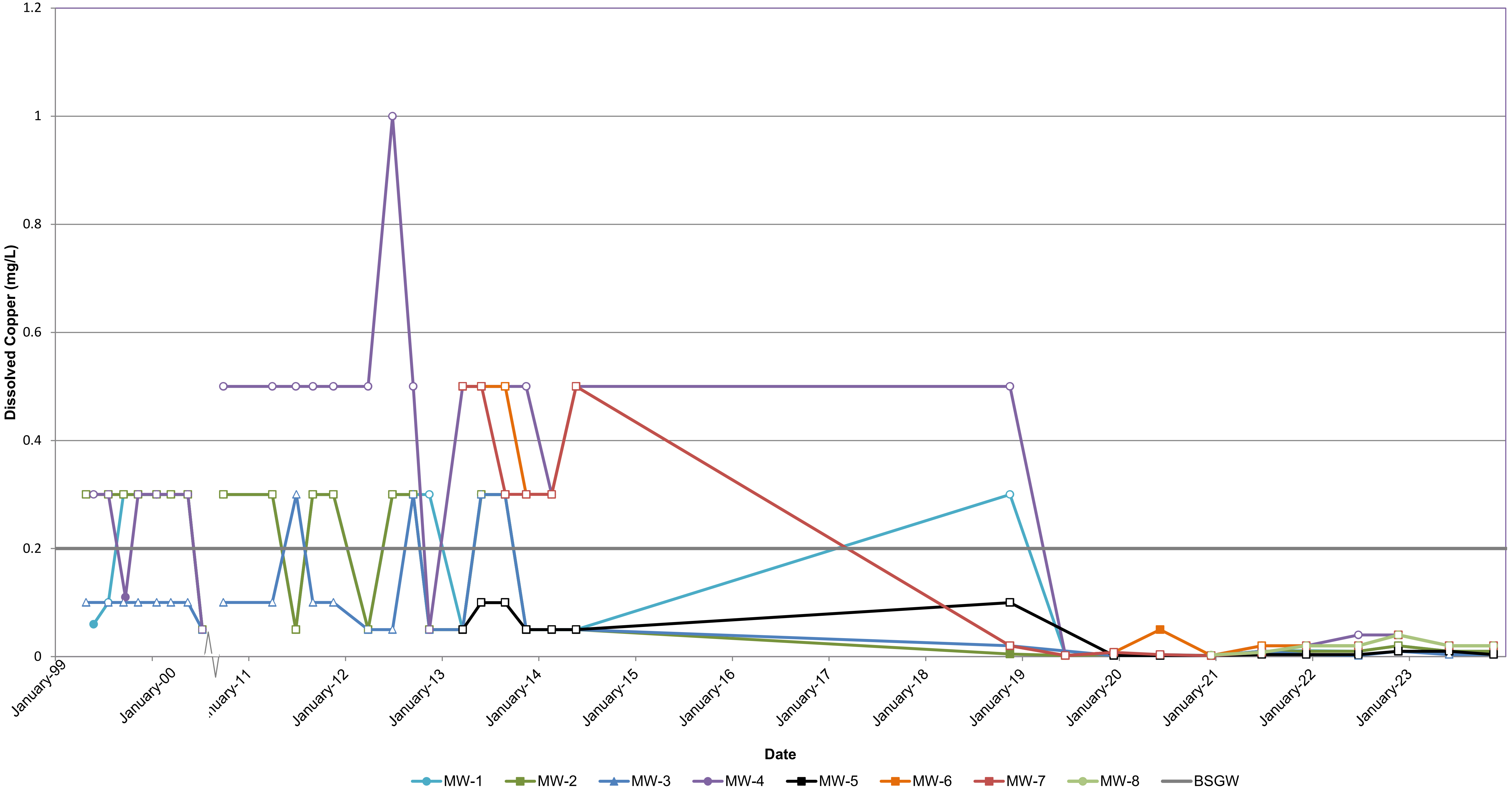
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Timeseries Plot: Dissolved Chromium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 17



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

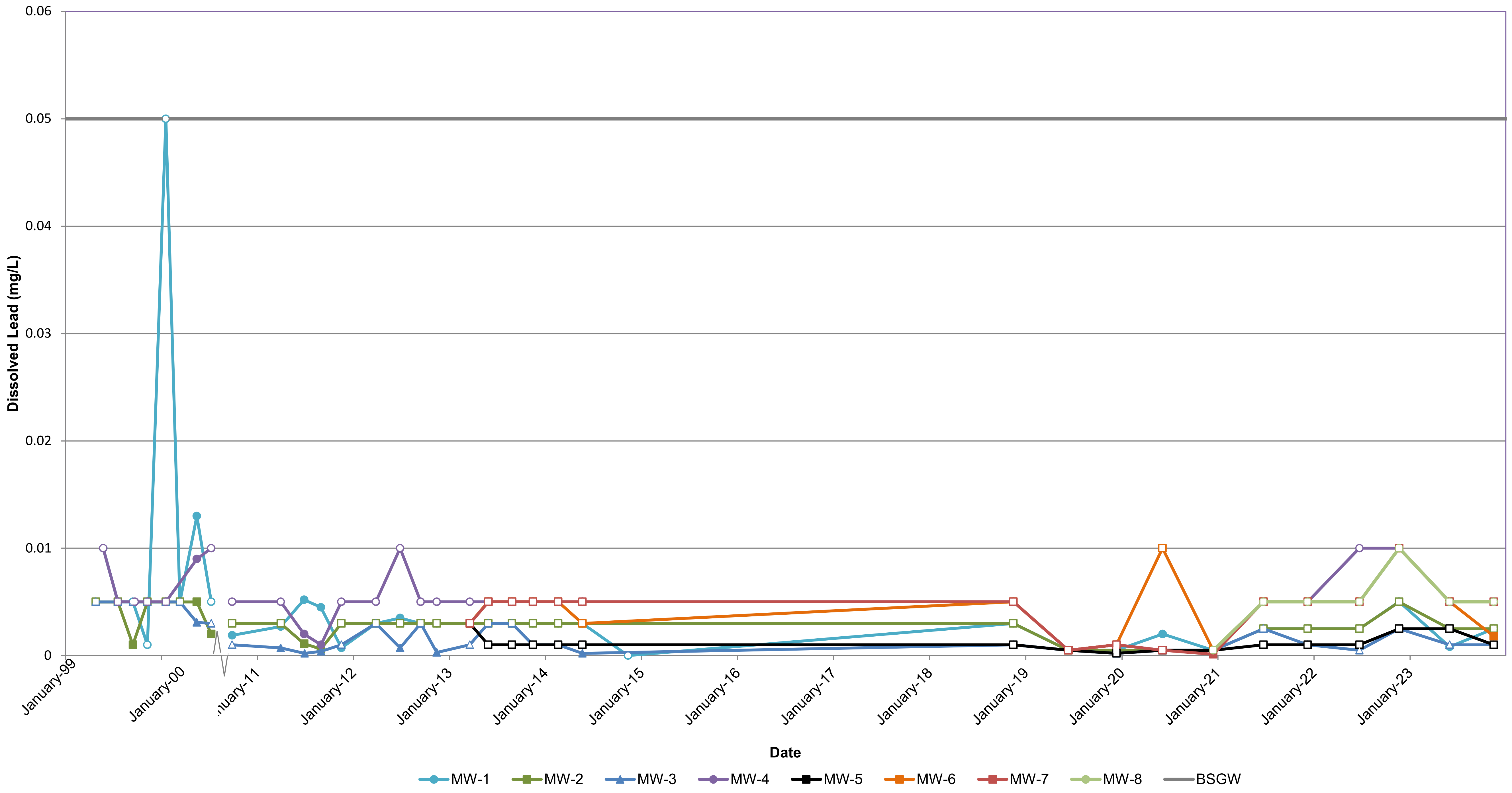
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Timeseries Plot: Dissolved Copper

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 18



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

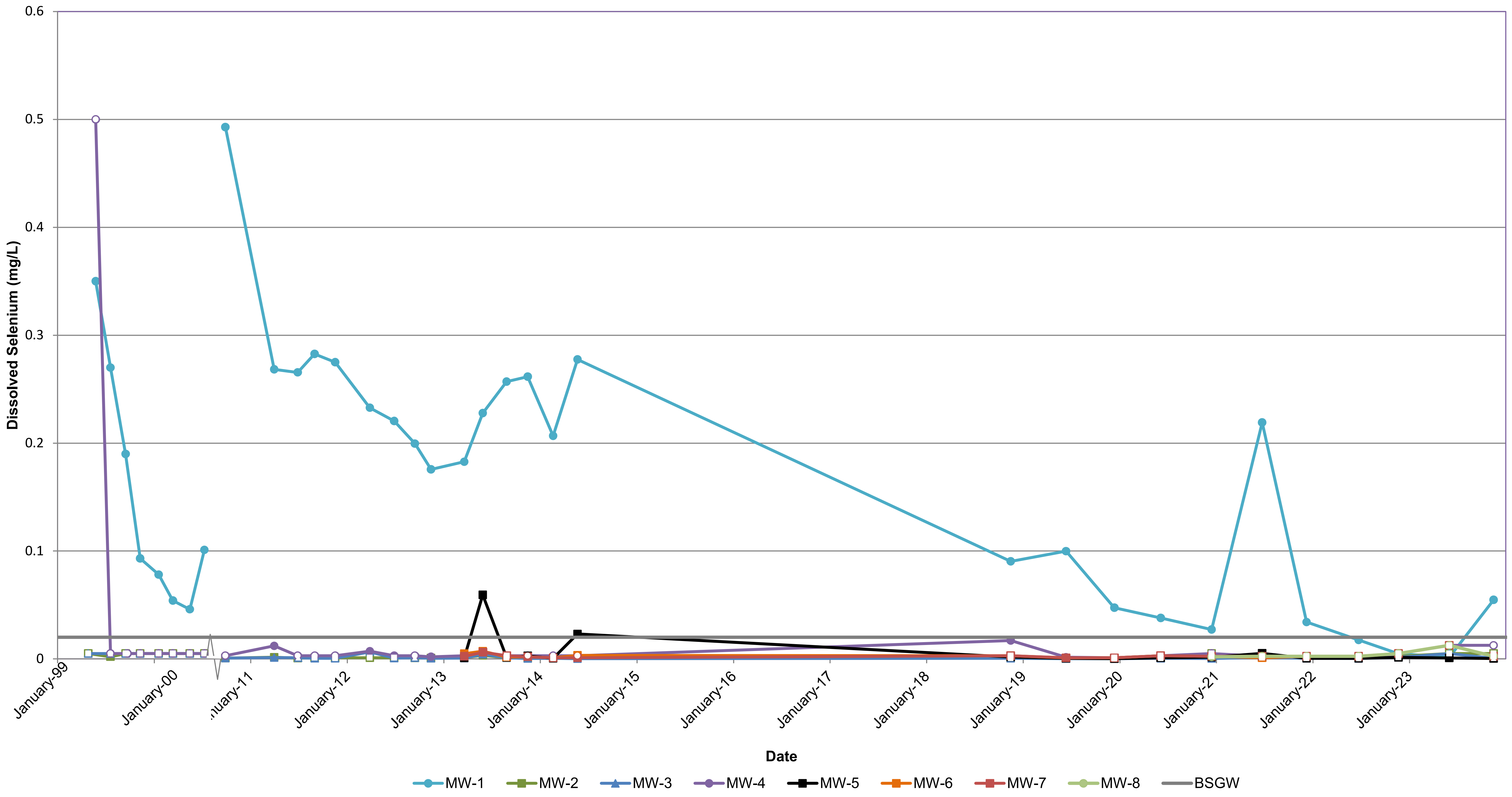
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
WSP

TITLE
Timeseries Plot: Dissolved Lead

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 19



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

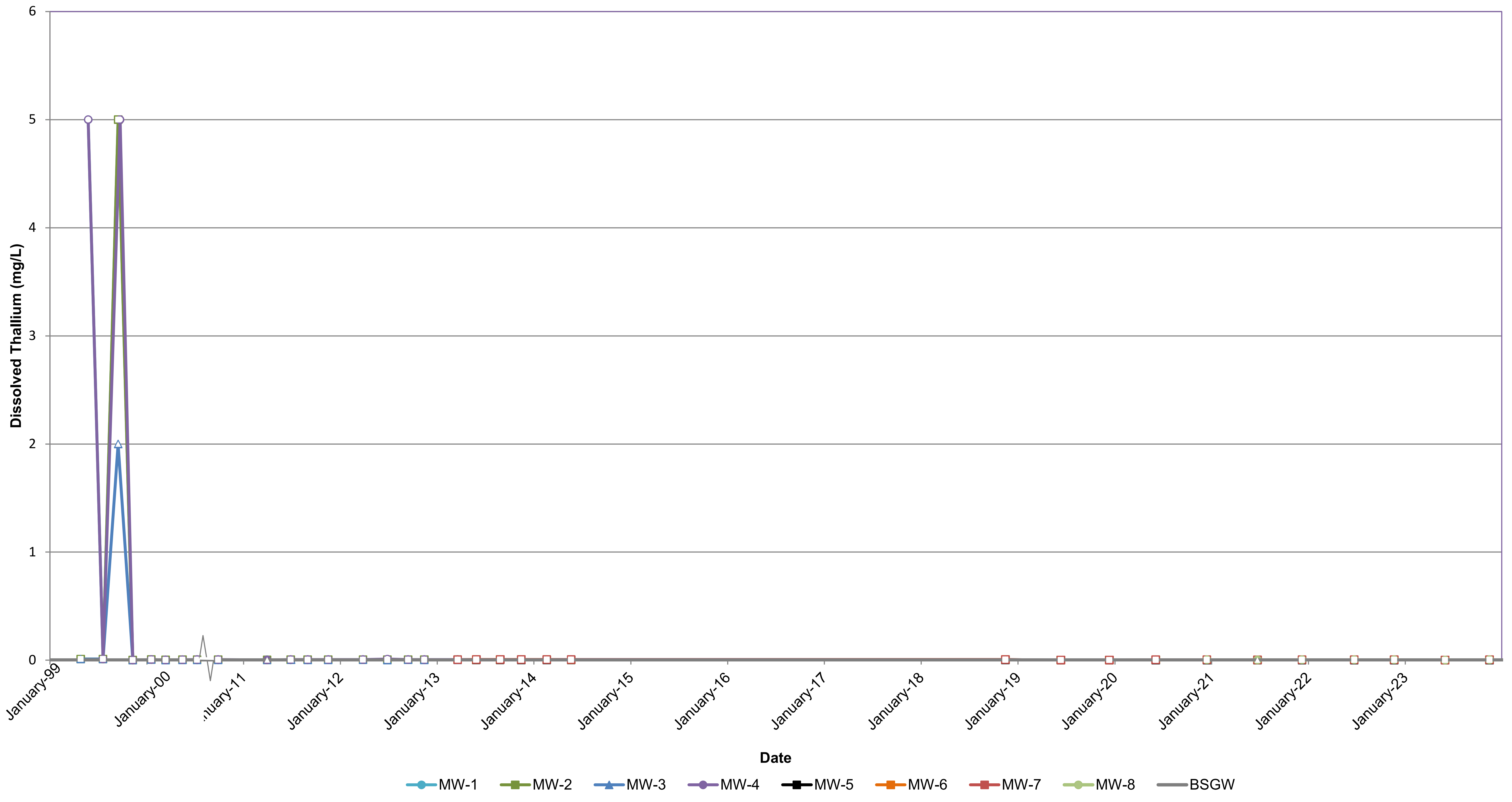
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Dissolved Selenium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 20



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

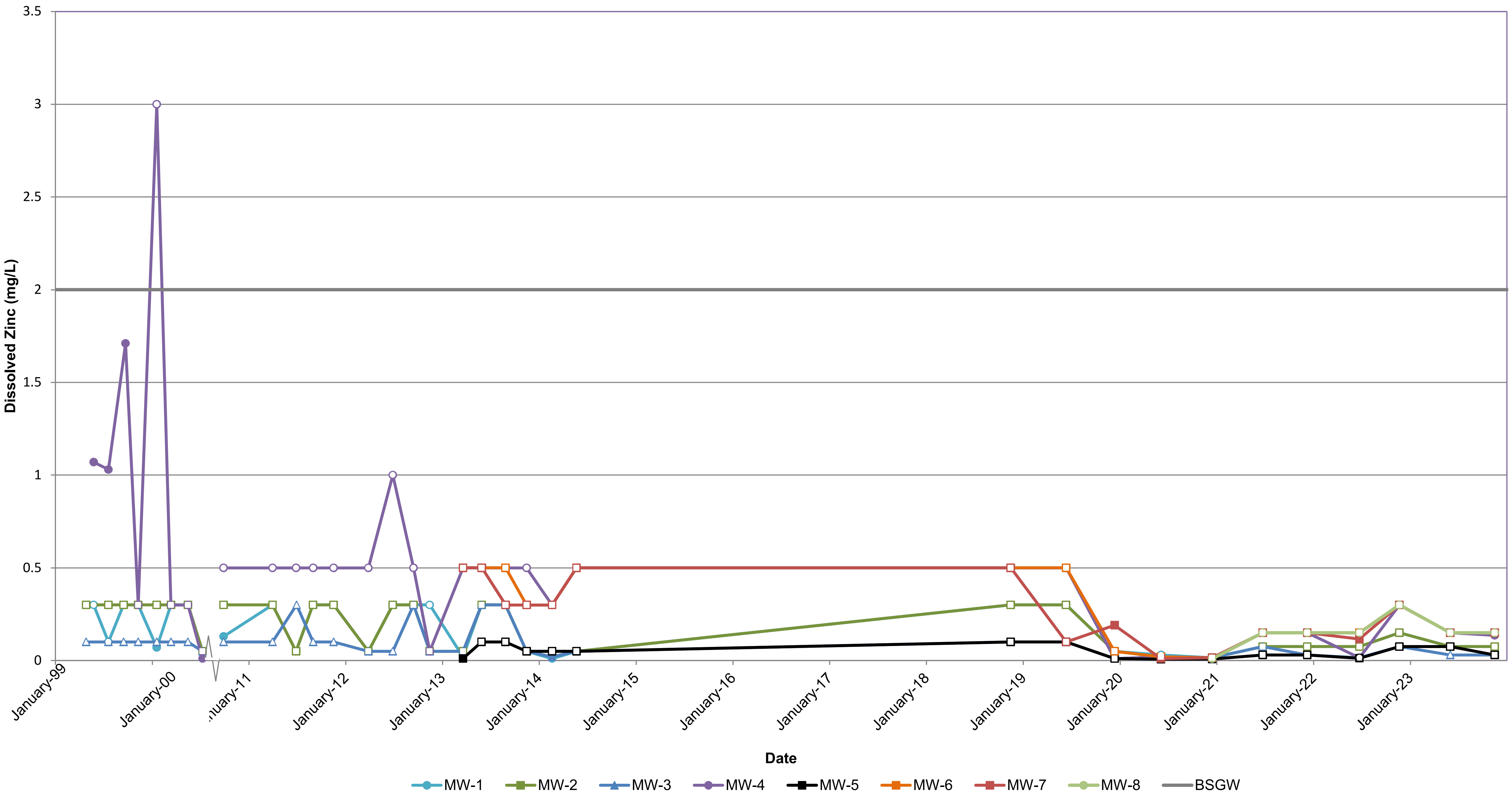
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Timeseries Plot: Dissolved Thallium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 21



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

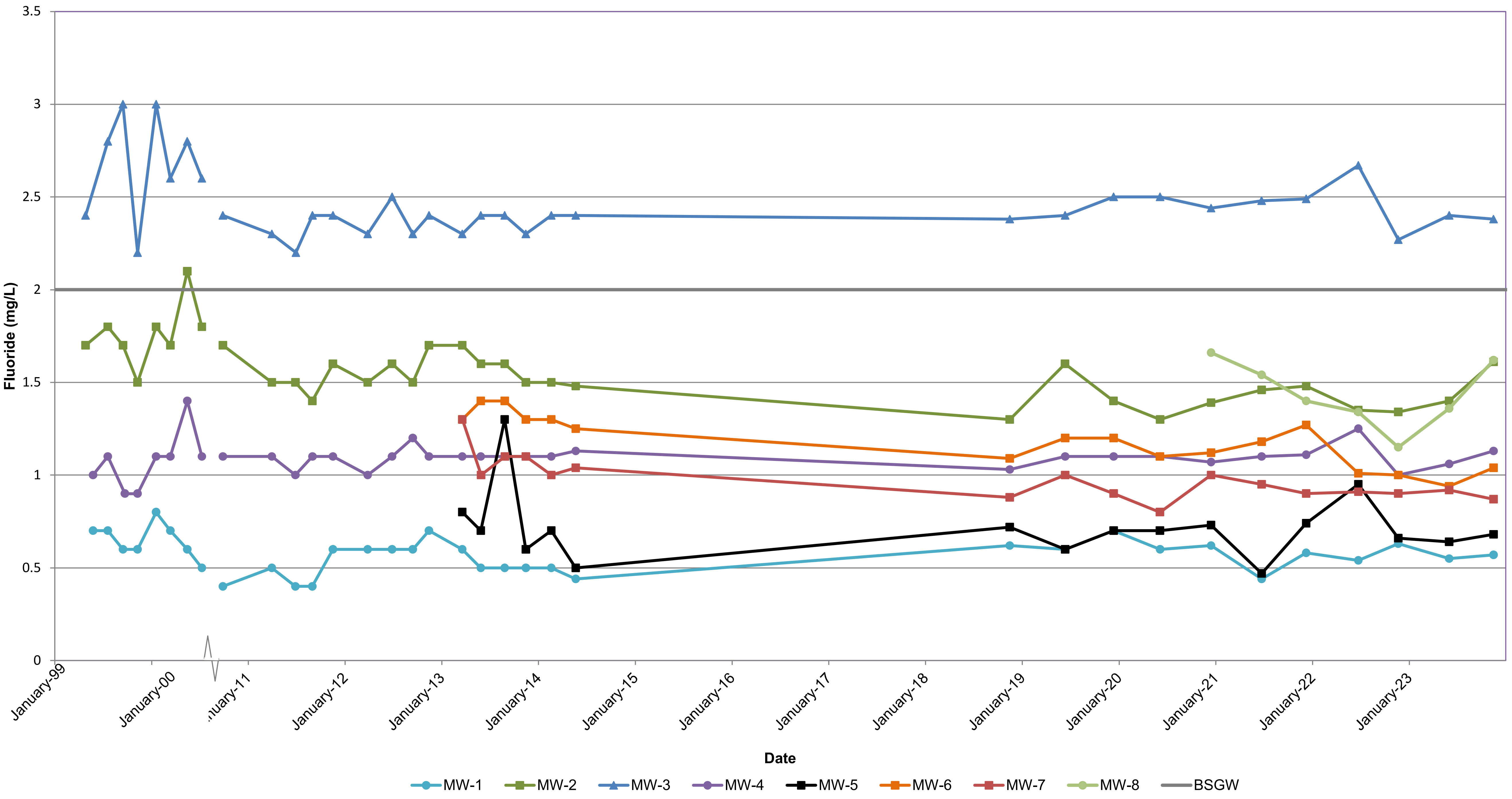
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT

TITLE
Timeseries Plot: Dissolved Zinc

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 22



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

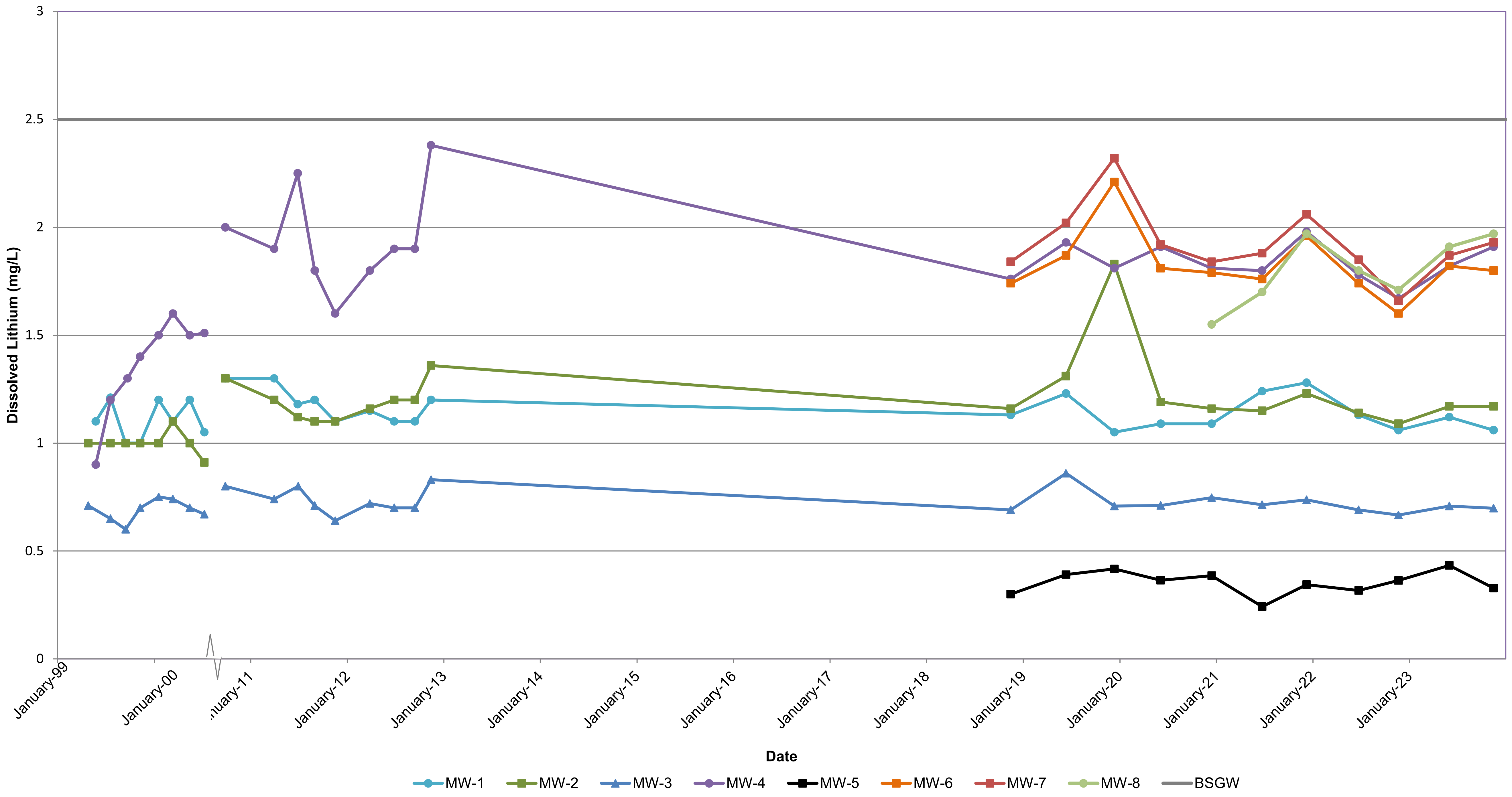
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Timeseries Plot: Fluoride

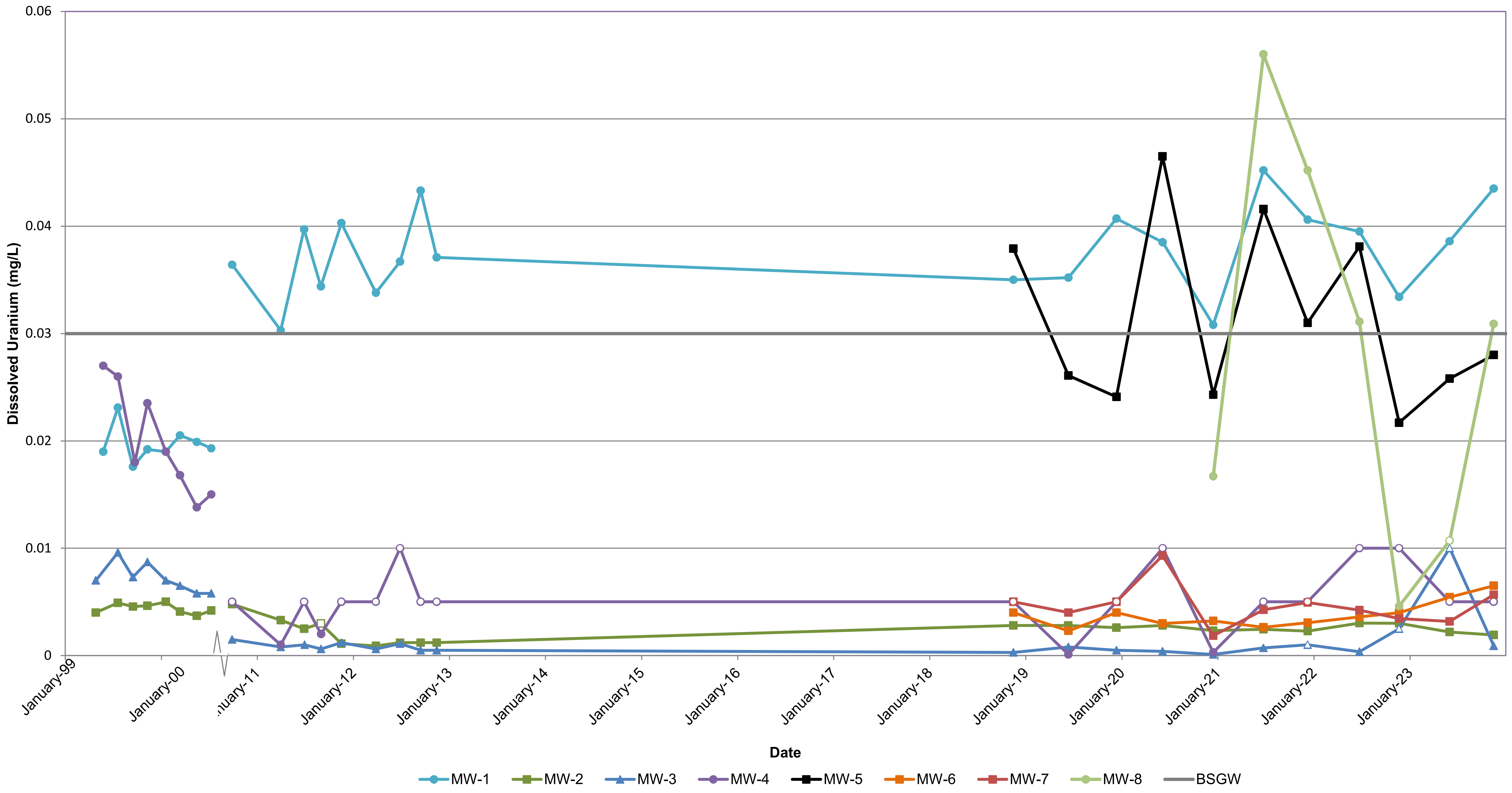
PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 23



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

CLIENT Holcim (US) Inc.	PROJECT Boettcher Limestone Quarry Larimer County, Colorado
CONSULTANT wsp	TITLE Timeseries Plot: Dissolved Lithium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 24



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

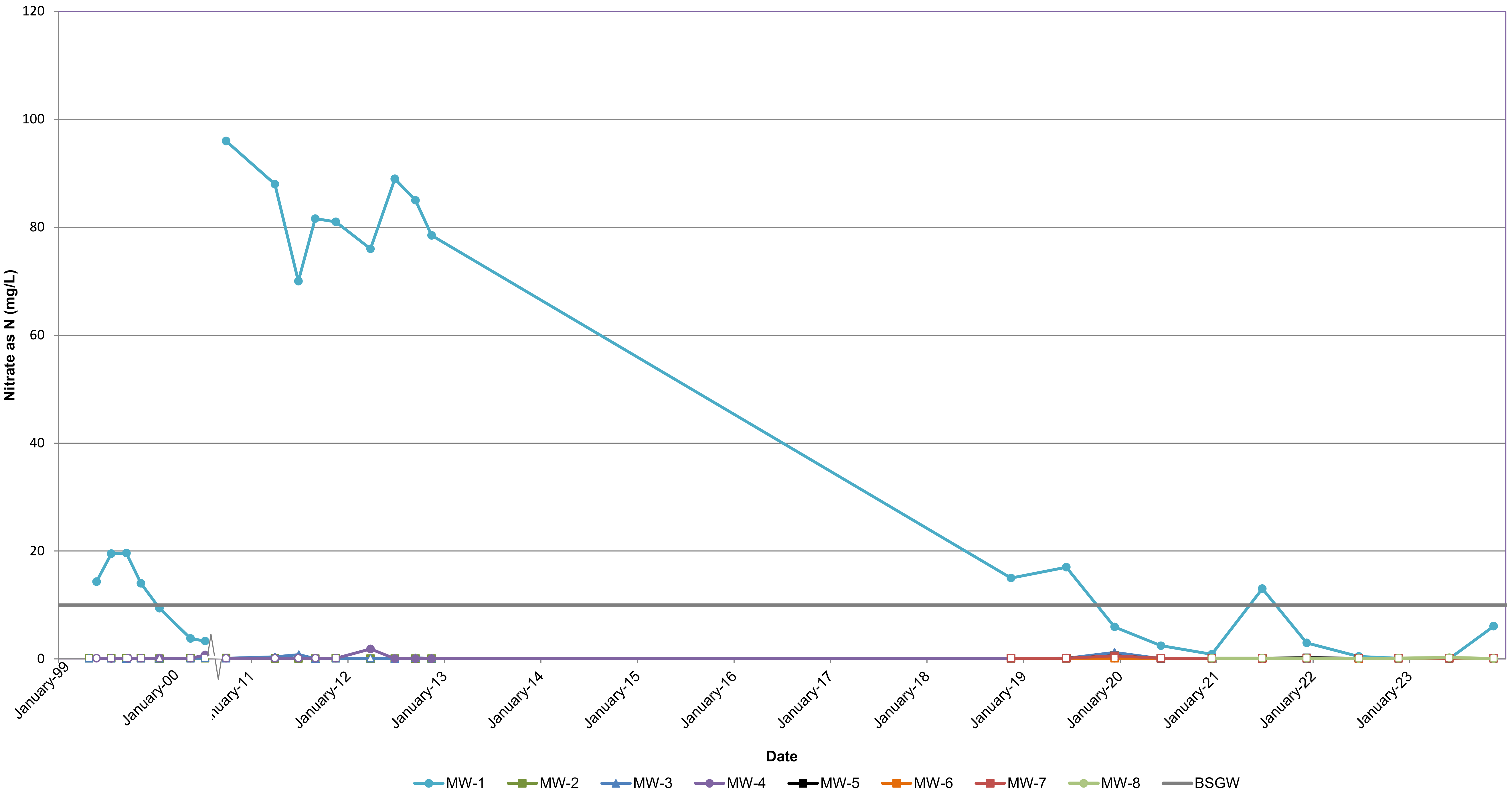
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Dissolved Uranium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 25



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

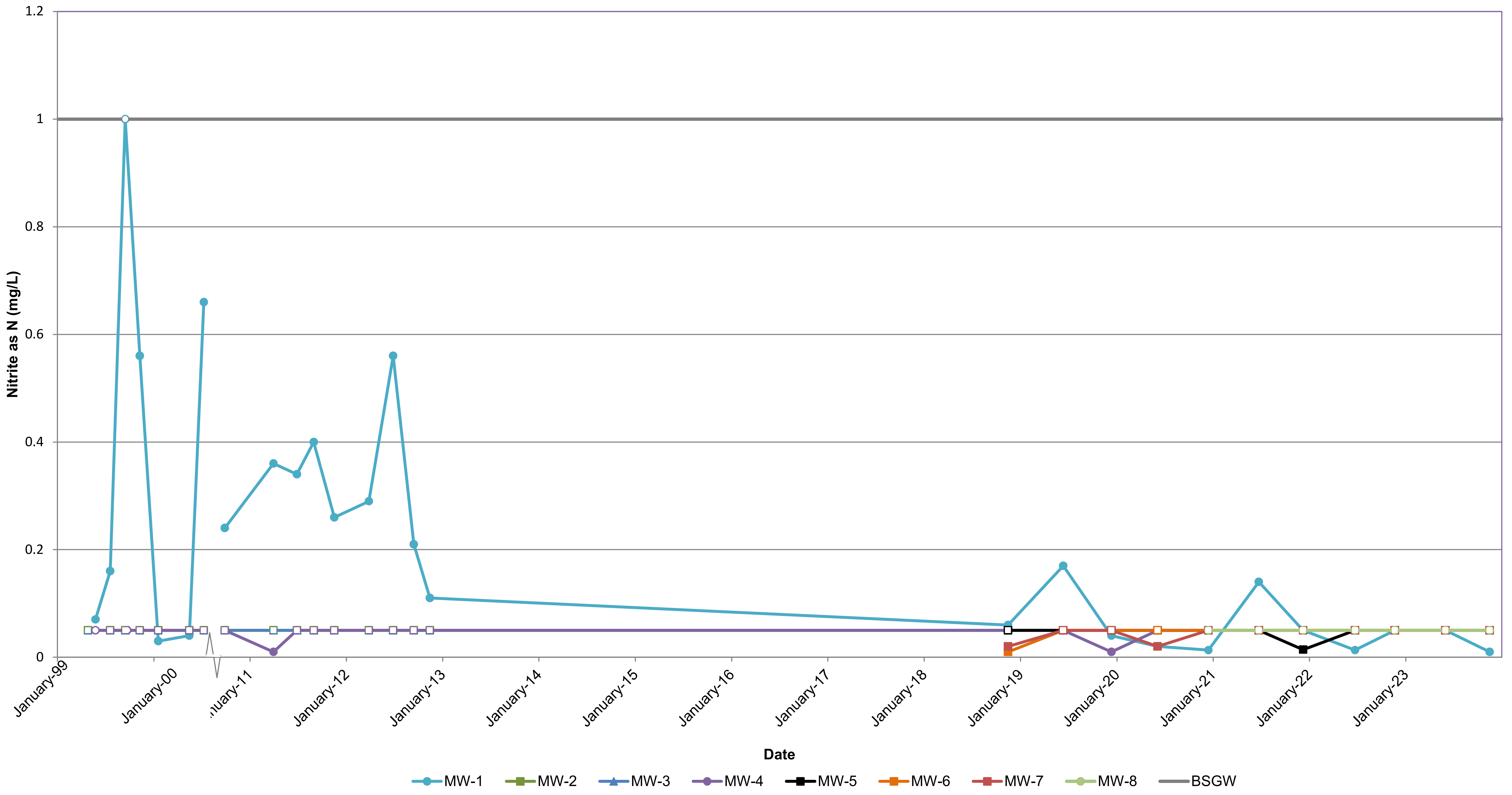
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT

TITLE
Timeseries Plot: Nitrate as N

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 26



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1- Table 4.

CLIENT
Holcim (US) Inc.

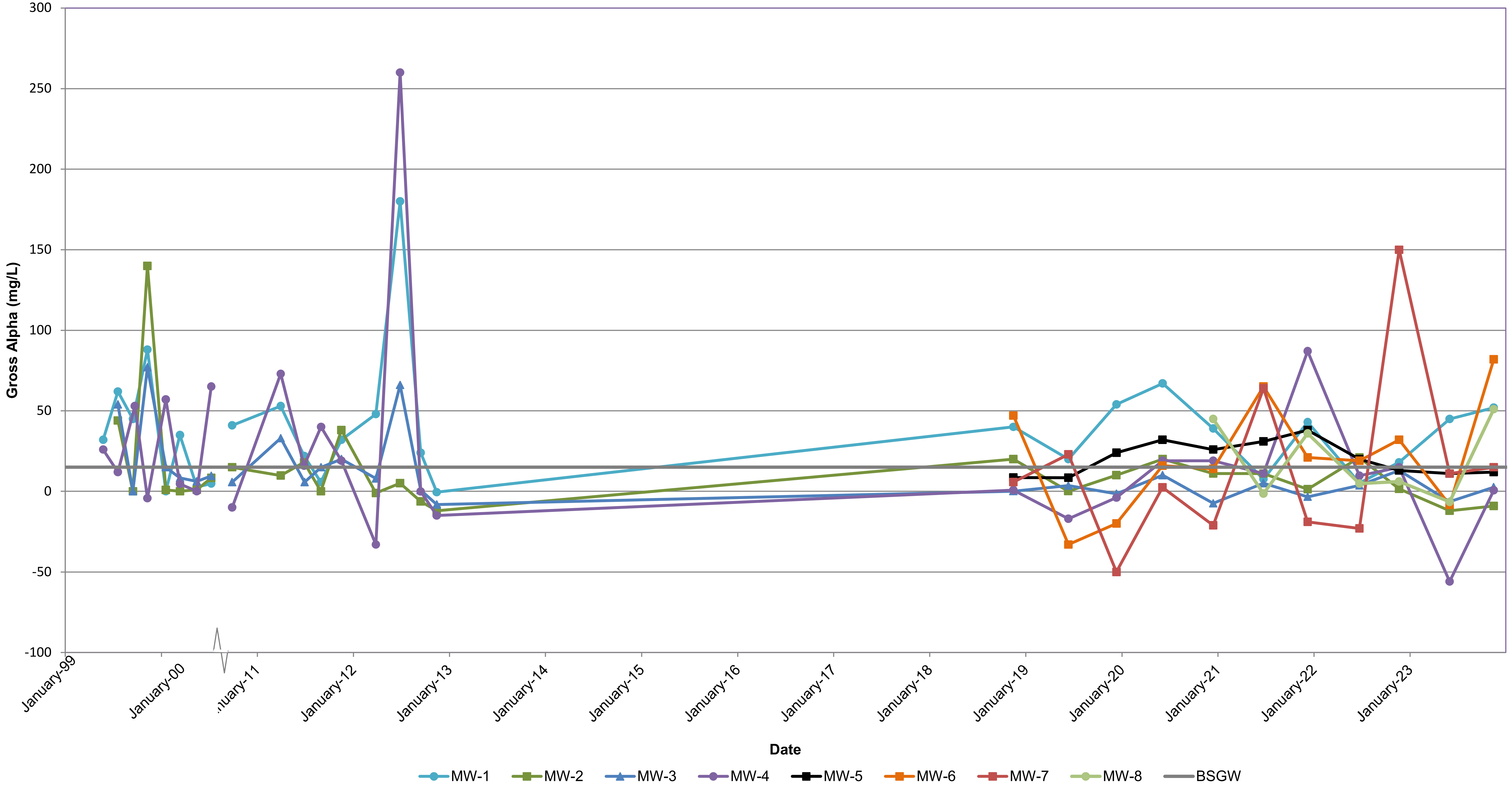
PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Nitrite as N

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 27

PATH: https://wsponlinenam.sharepoint.com/Sites/US-HolcimBoettcherQua/Shared Documents/2023_202319184_2023-2024_Technical Revision/5_ Technical Work/Rev 1/Appendices | FILE NAME: Appendix C Time Series Plots.xlsm



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

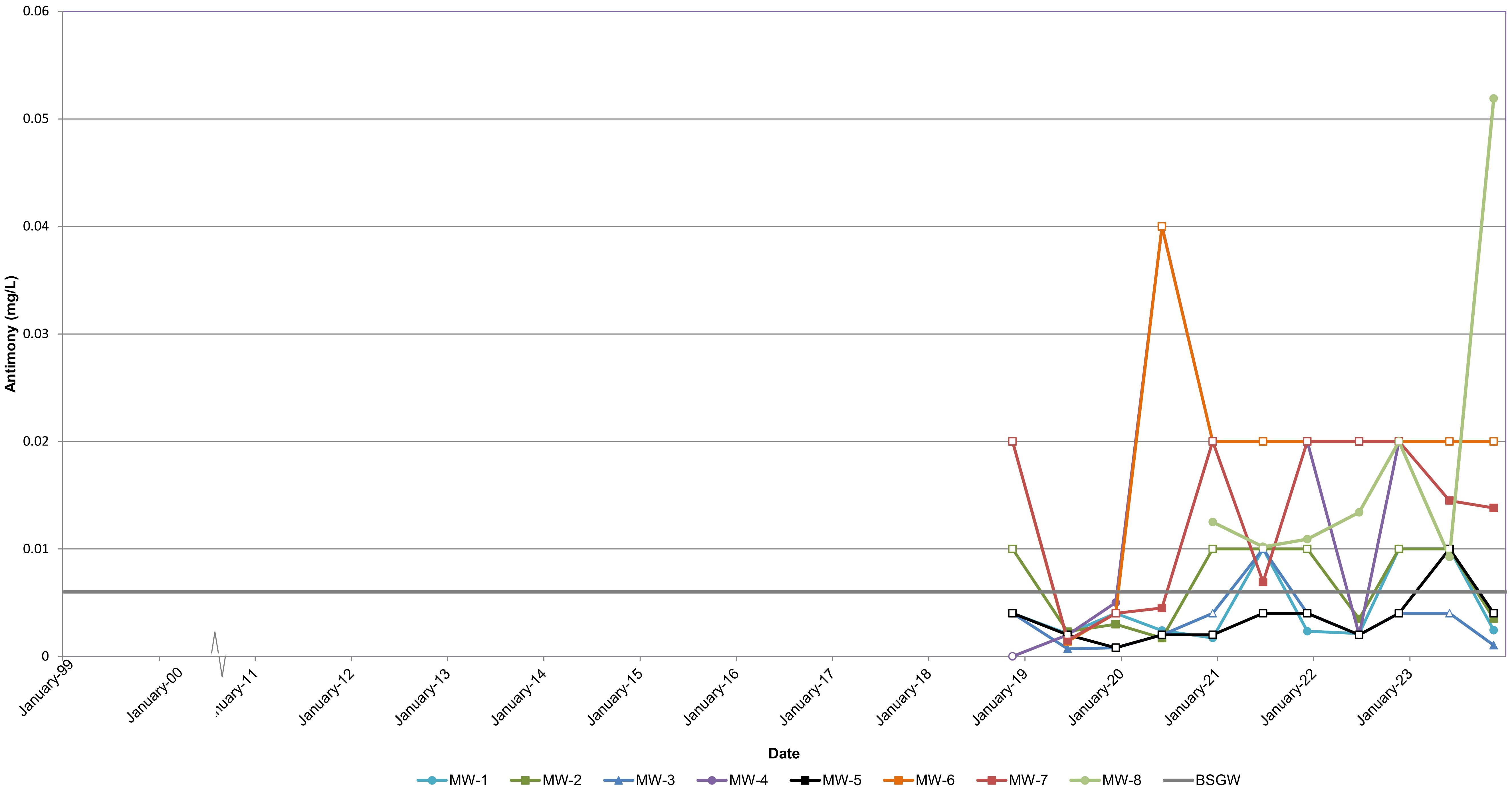
CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

CONSULTANT
wsp

TITLE
Timeseries Plot: Gross Alpha

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 28



Notes:
-Non-detect values plotted with an open symbol at the practical quantitation limit
-Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW)
Minimum of Table 1- Table 4.

CLIENT
Holcim (US) Inc.

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

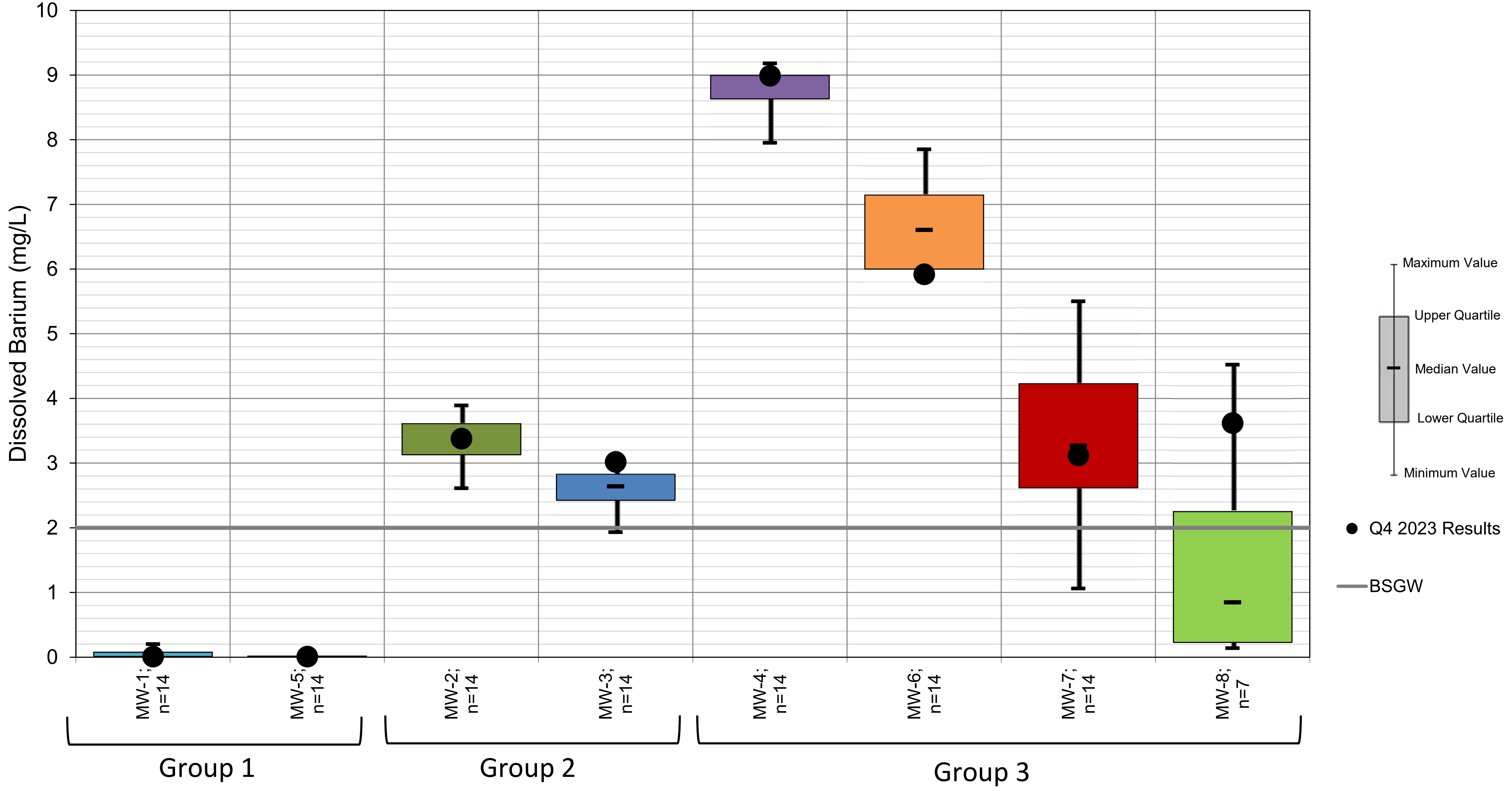
CONSULTANT
wsp

TITLE
Timeseries Plot: Antimony

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	1	C - 29

APPENDIX D

Box and Whisker Plots



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

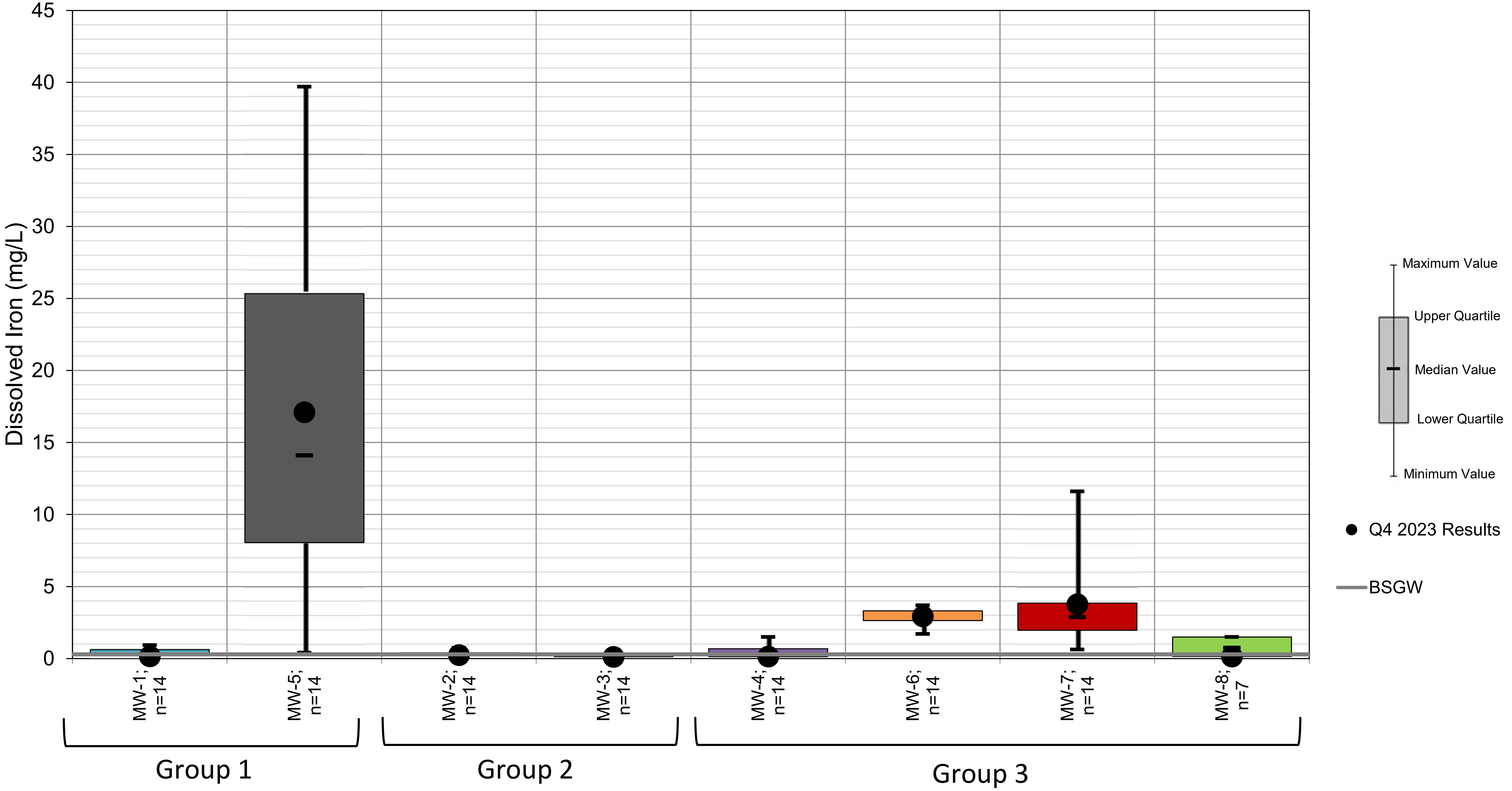
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Dissolved Barium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-1



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

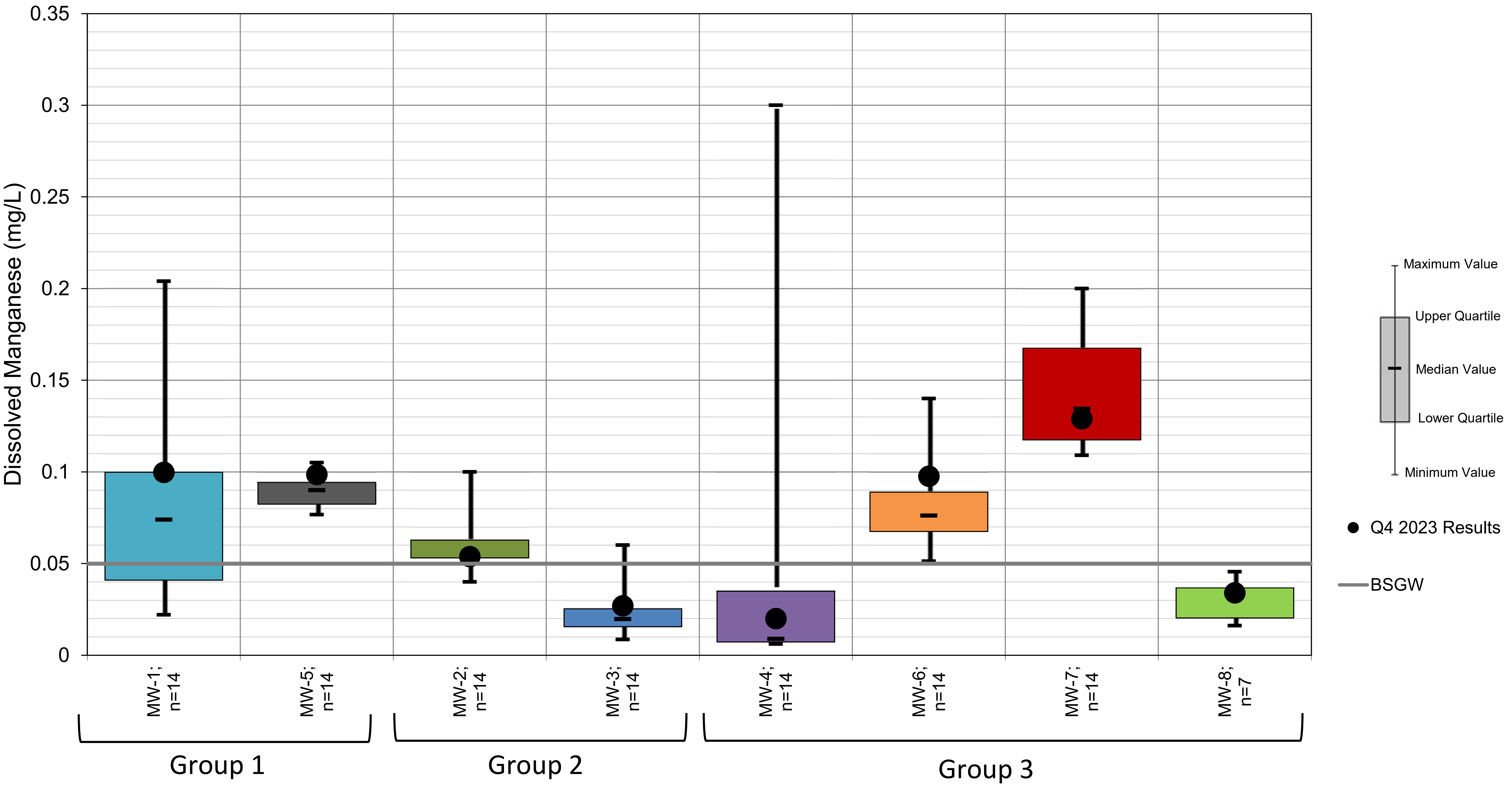
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Dissolved Iron

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-2



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

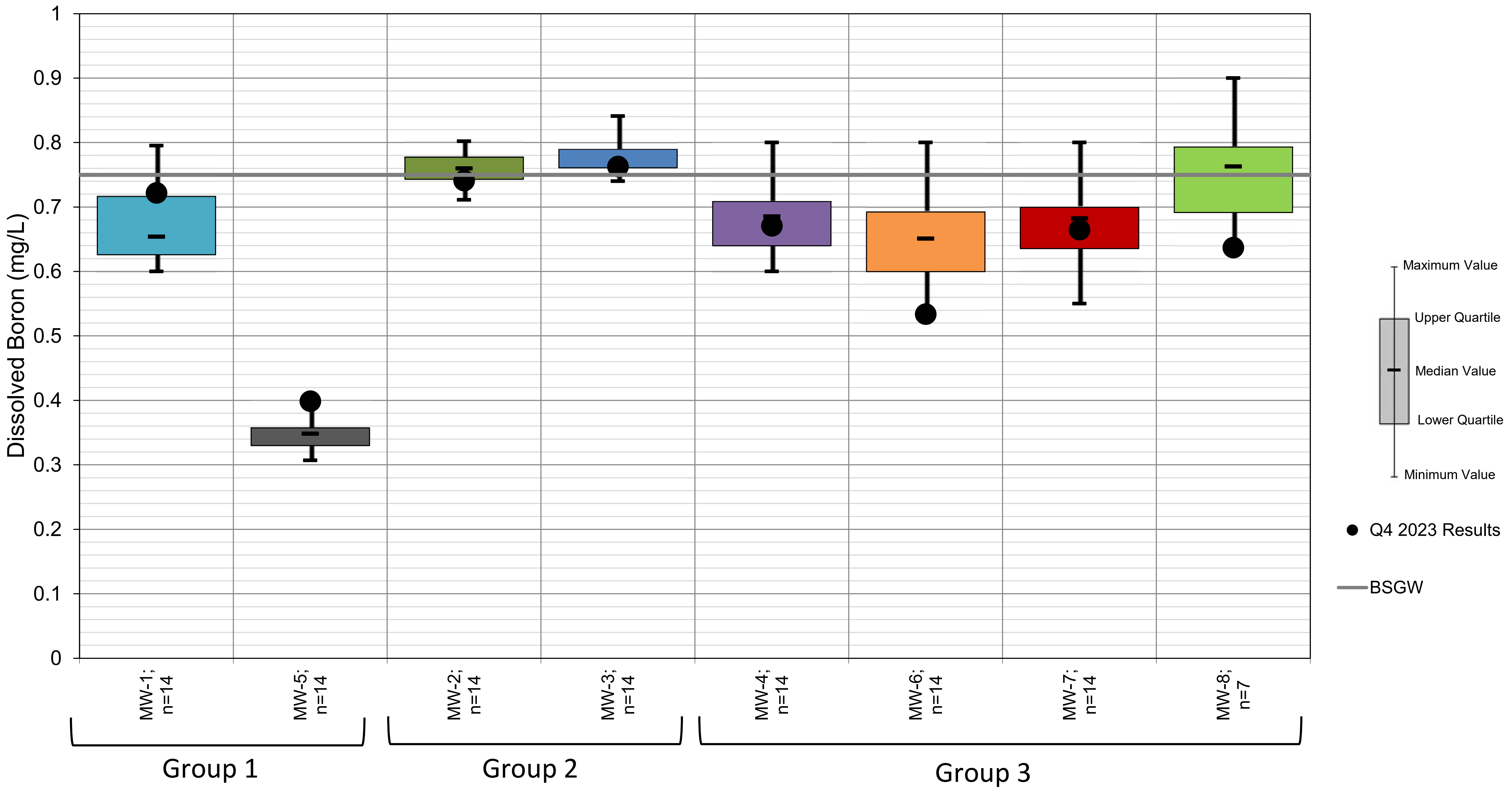
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Dissolved Manganese

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-3



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

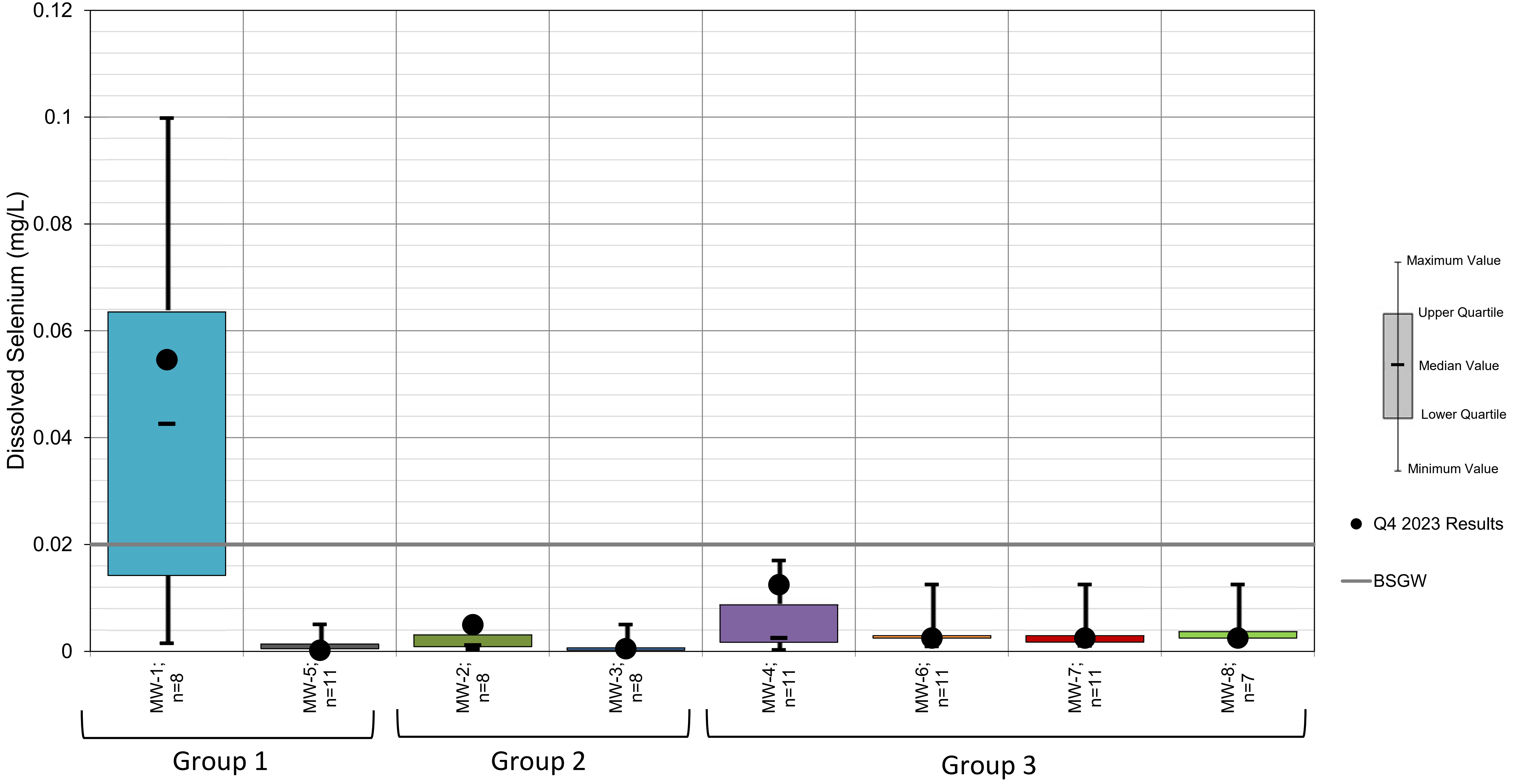
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Dissolved Boron

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-4



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

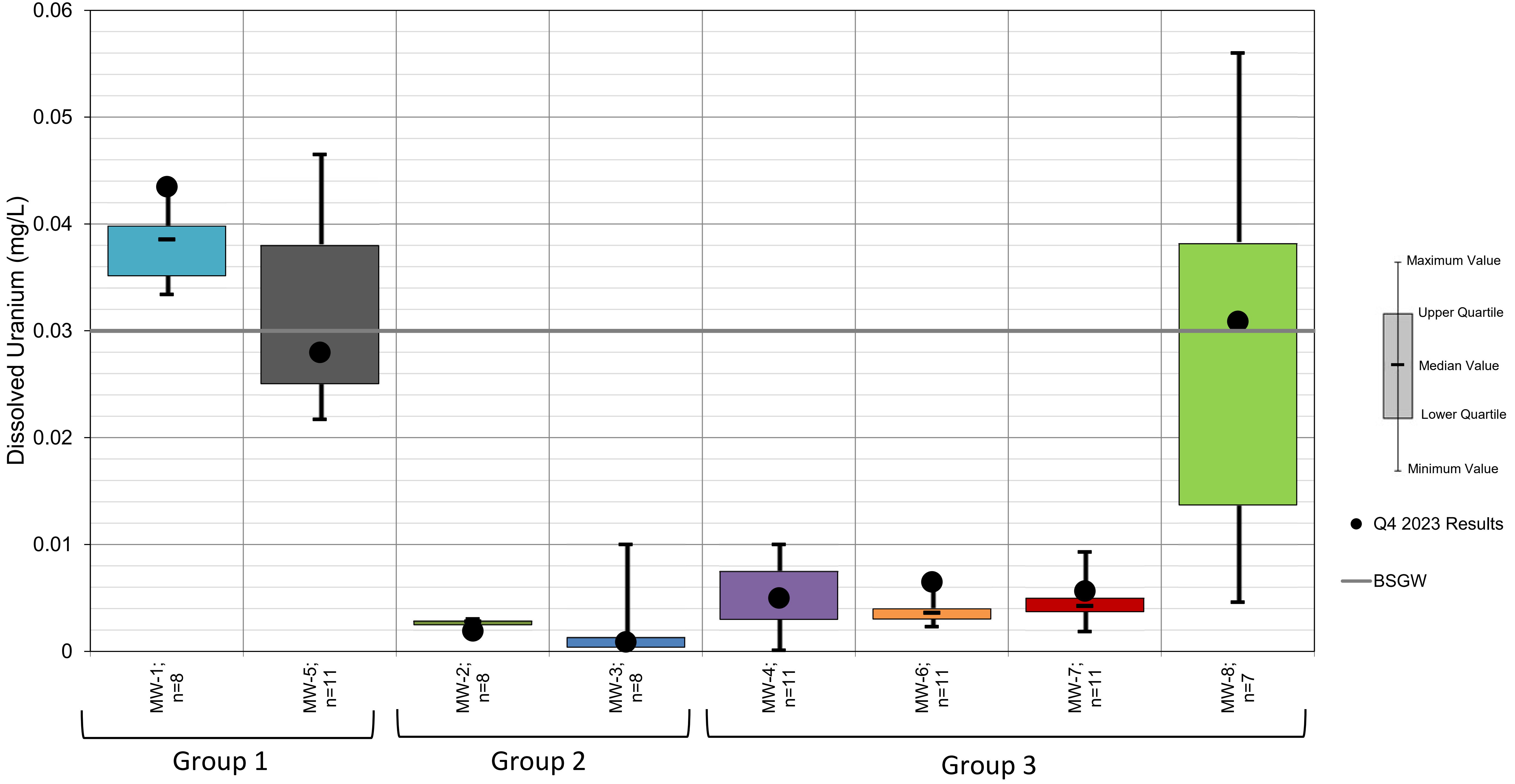
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Dissolved Selenium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-5



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

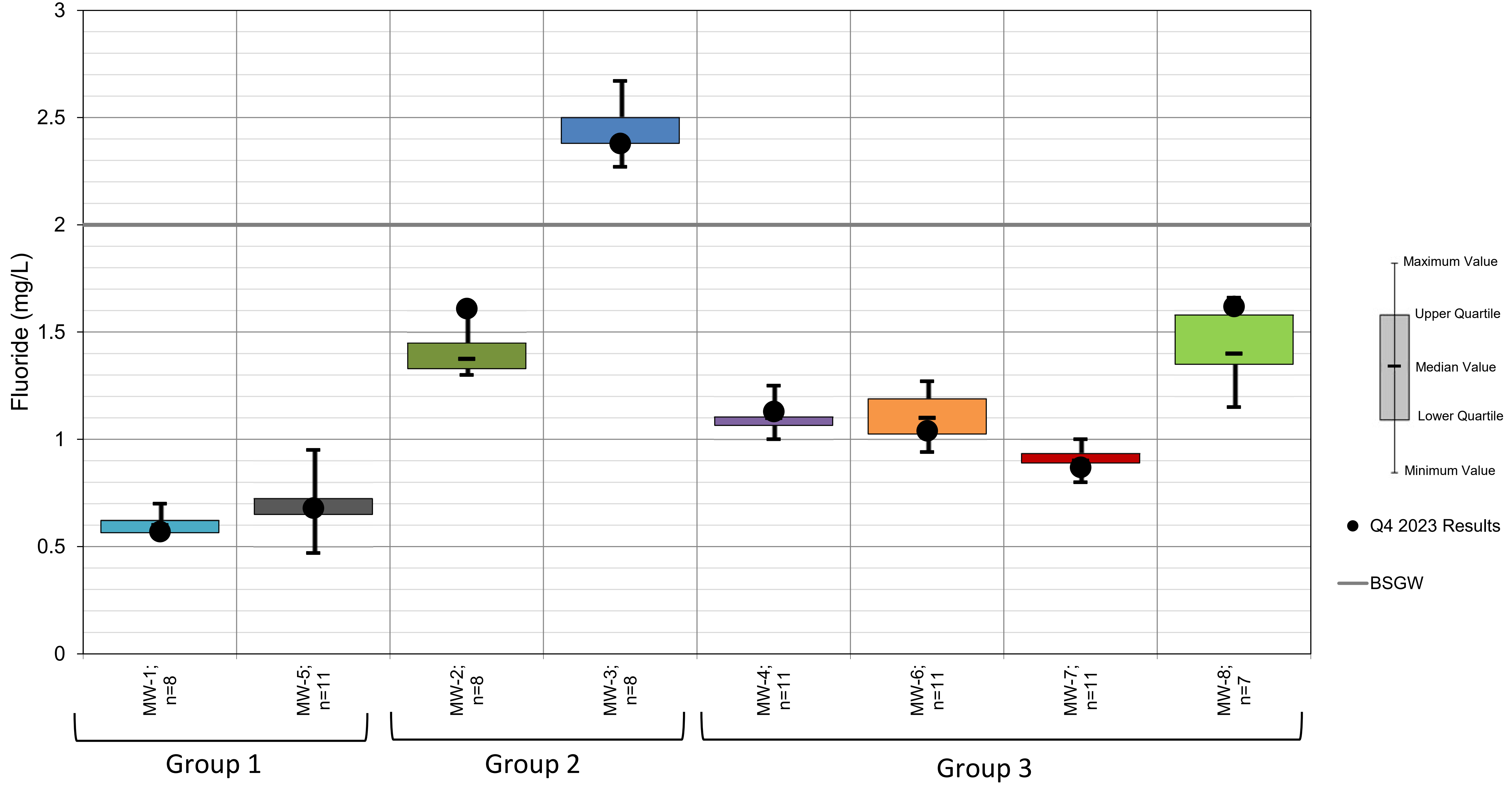
CLIENT
Holcim (US) Inc.

CONSULTANT

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Dissolved Uranium

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-6



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

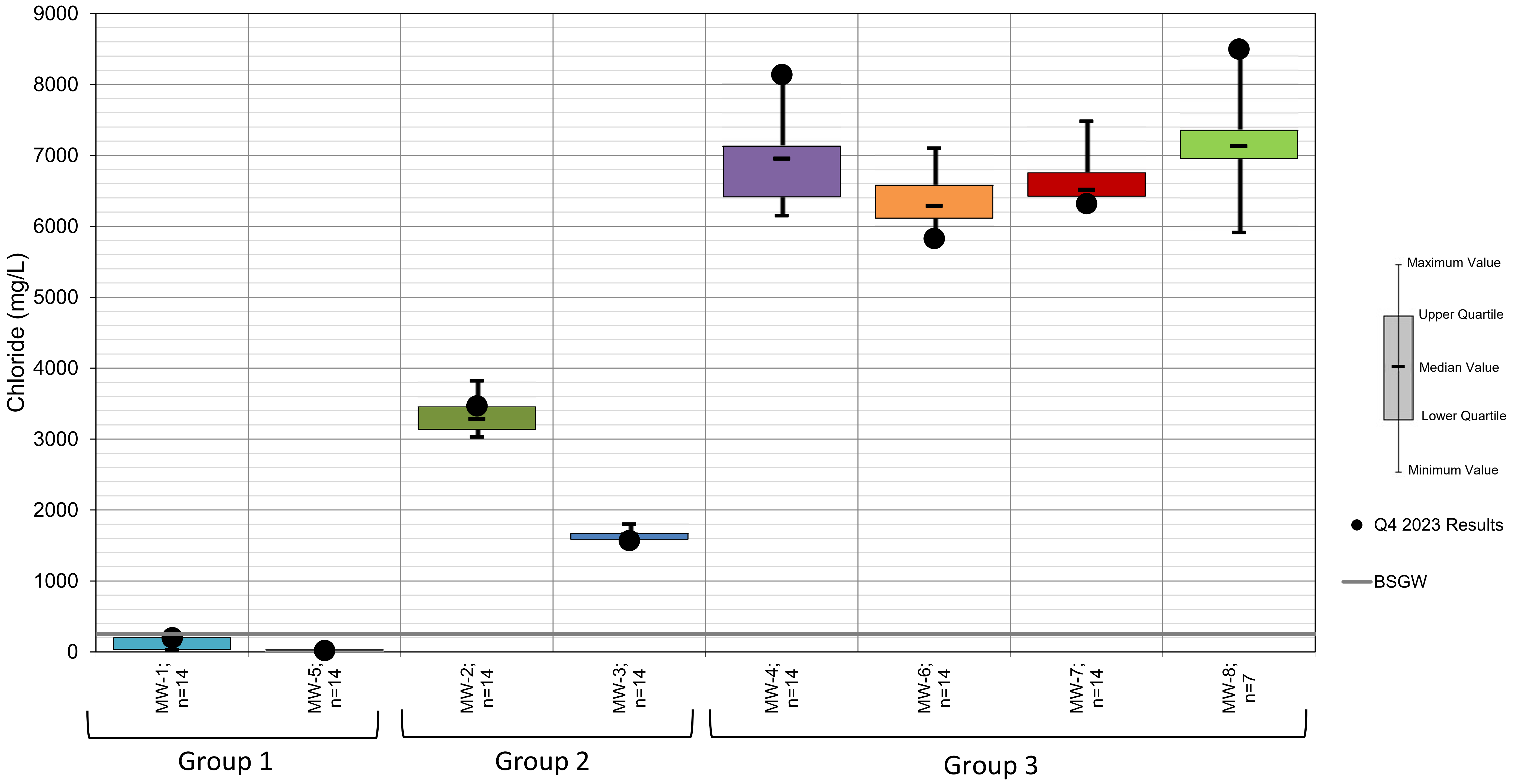
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Fluoride

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-7



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

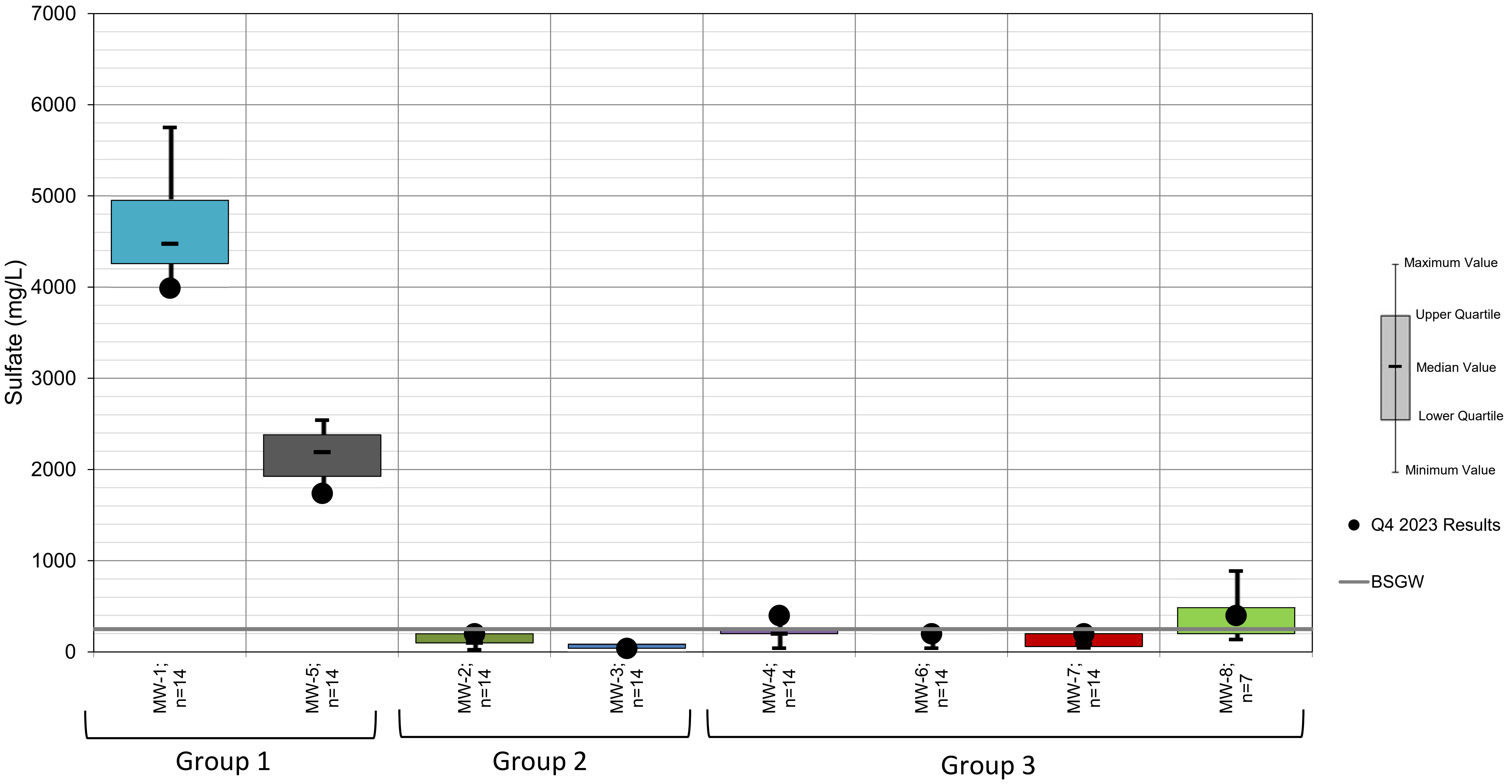
CLIENT
Holcim (US) Inc.

CONSULTANT

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Chloride

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-8



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

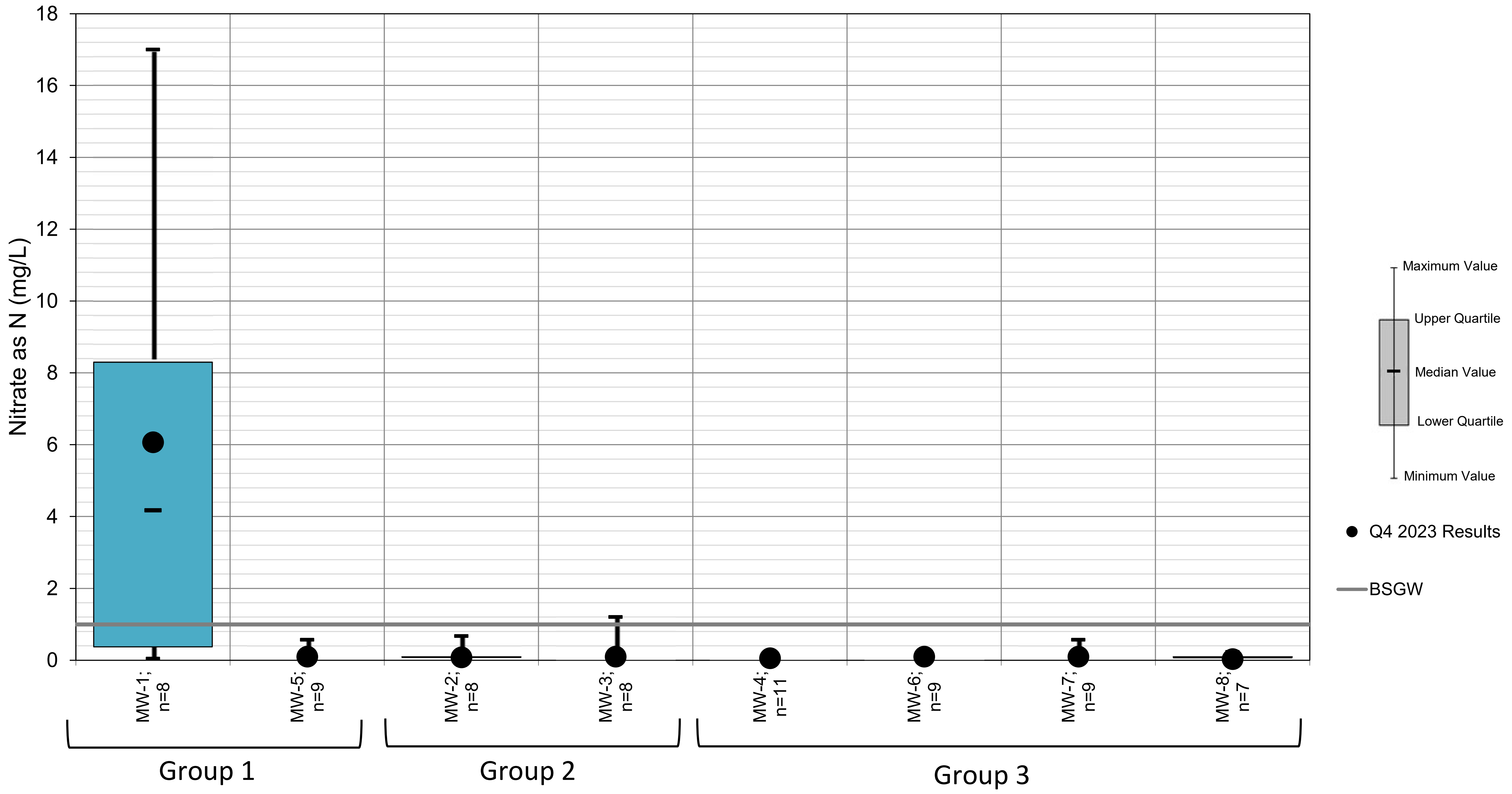
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Sulfate

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-9



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

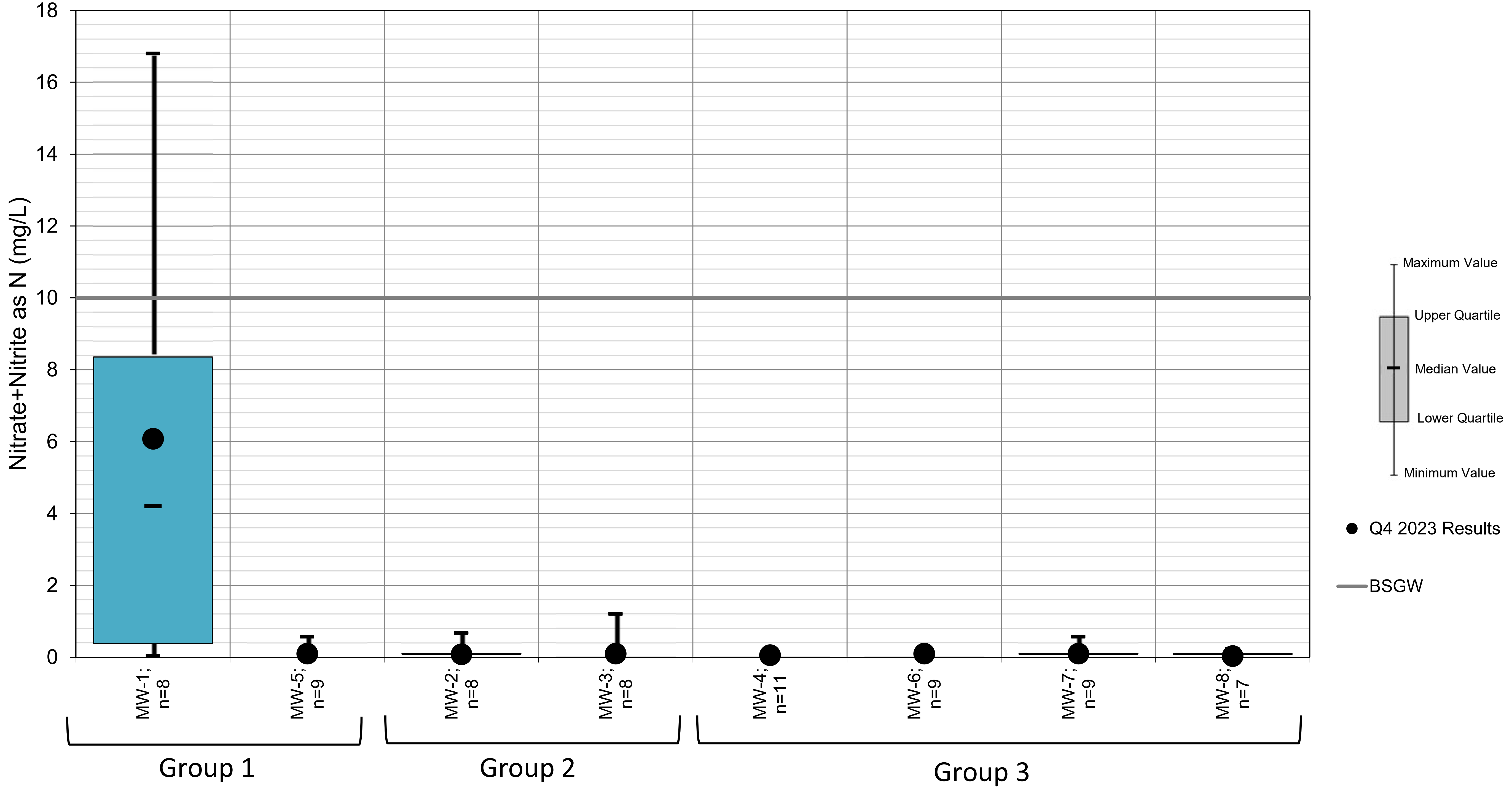
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Nitrate as N

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-10



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

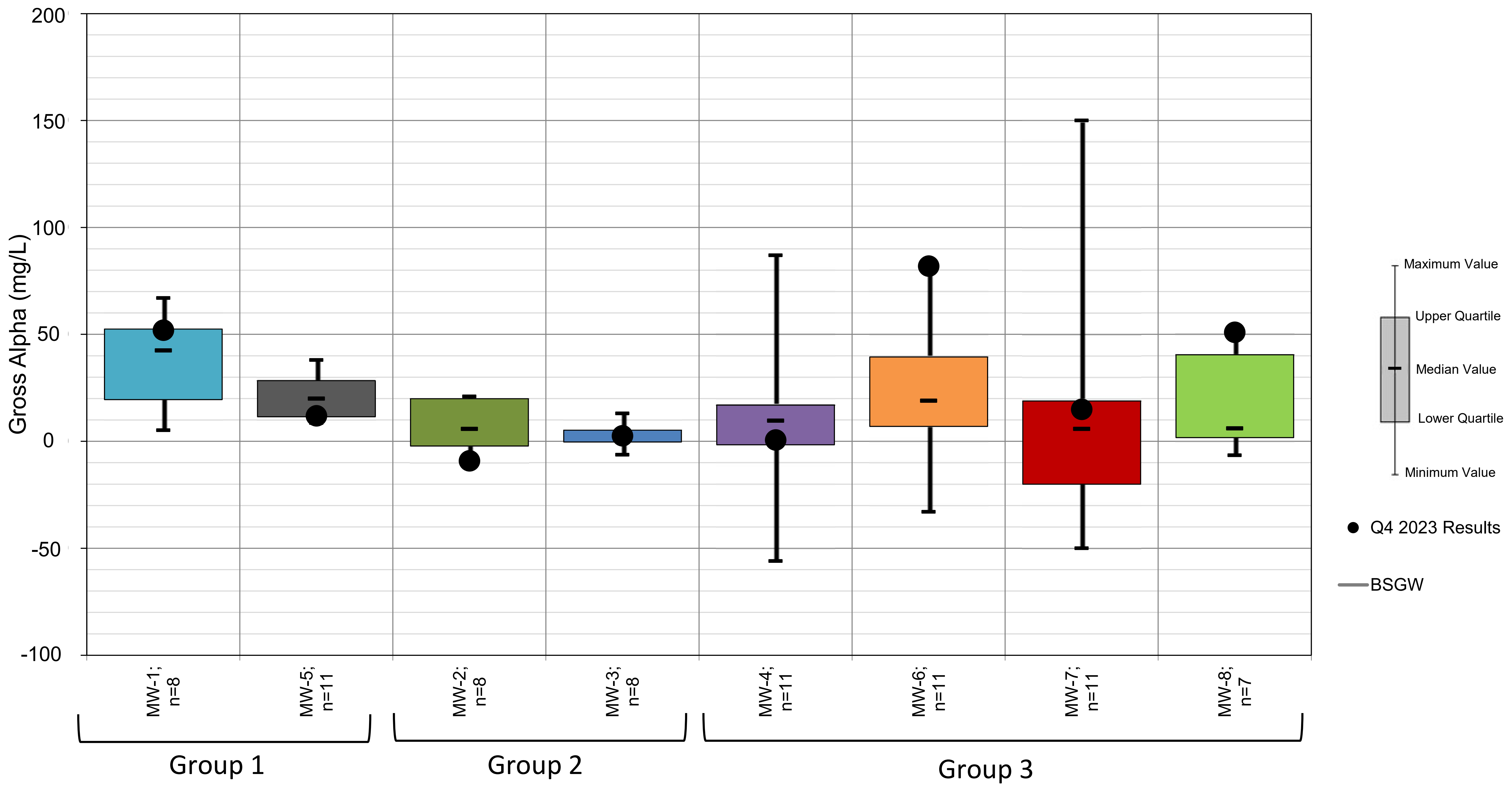
CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Nitrate+Nitrite as N

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-11



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

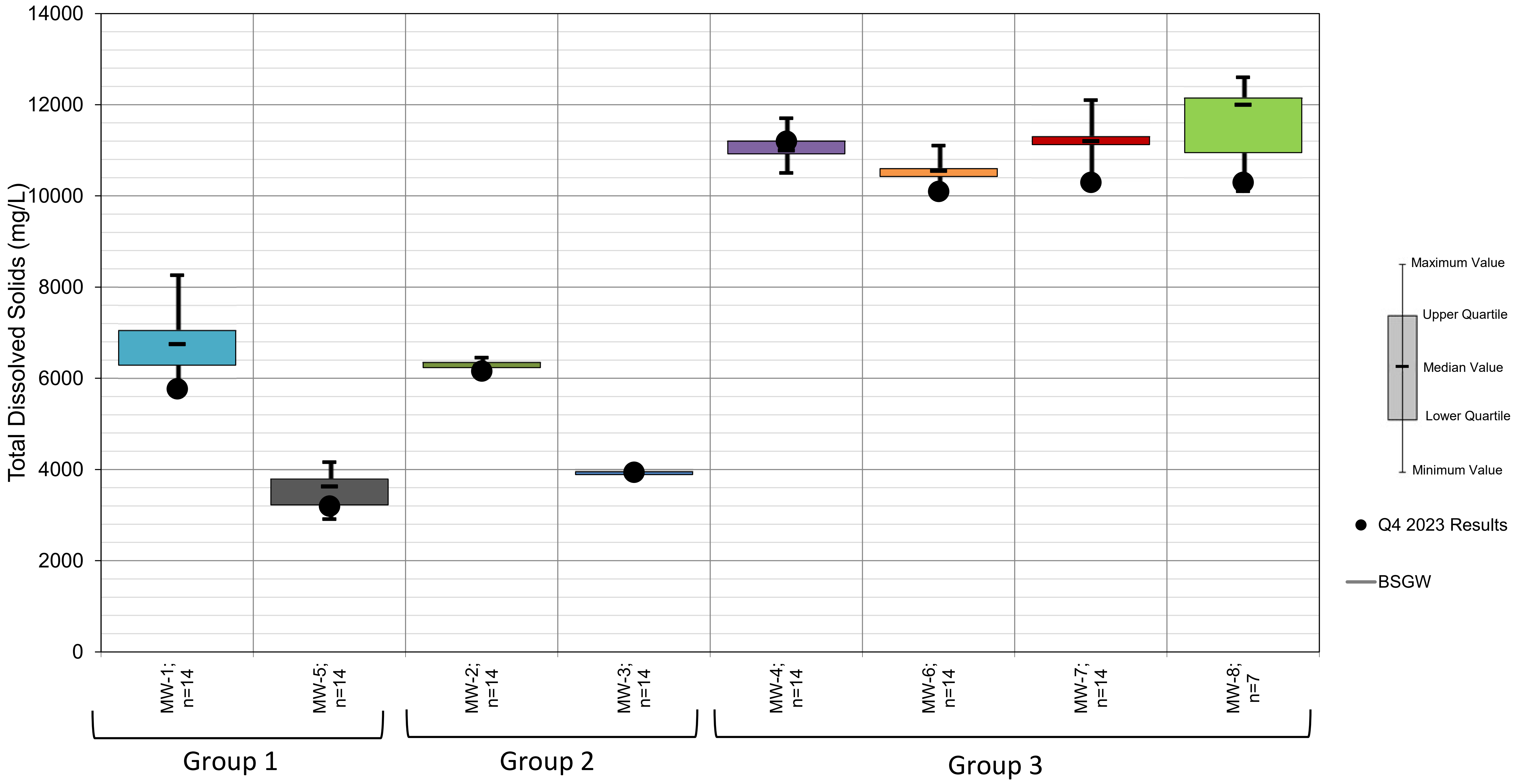
CLIENT
Holcim (US) Inc.

CONSULTANT

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Gross Alpha

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-12



Note: Well water quality results shown are limited to sampling events from 2017 to 2023
Water Quality Control Commission Regulation No. 41, The Basic Standards for Groundwater (BSGW) Minimum of Table 1-4.

CLIENT
Holcim (US) Inc.

CONSULTANT
wsp

PROJECT
Boettcher Limestone Quarry
Larimer County, Colorado

TITLE
Box and Whisker Plot: Total Dissolved Solids

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001		D-13

APPENDIX E

CKD Testing Summary - Boettcher Quarry

July 11, 2024

MEMORANDUM

CKD TESTING SUMMARY- BOETTCHER QUARRY

Golder collected and analyzed native materials and cemented kiln dust (CKD) (Golder 2014), to provide additional context for potential water quality effects from contact with these materials. Samples collected include:

- One sample of silt from the screened interval of well MW-5.
- Four samples of limestone from the screened intervals of wells MW-6 and MW-7.
- Two samples of sandstone from below the screened intervals of wells MW-6 and MW-7.
- Two samples of CKD from a borehole drilled in area A2.

Analytical testing of the CKD material was conducted by Secor and Holnam (Secor 1998). The results of the solids analysis are discussed below.

1.0 BULK TESTING

Solid-phase chemical analysis was performed on the soil and rock samples (Golder 2014). The chemical analysis was performed in a two-step process including digestion of the sample in acid to release the elements into the solution phase (EPA Method M3010A) followed by analysis of the elements in the resulting digestion by inductively coupled plasma mass spectrometry (ICP-MS; EPA Method M6020). The results from solid-phase chemical analysis were used to make an inference regarding elements of potential environmental concern, although it should be understood that a high concentration of a particular element does not necessarily imply that this element will indeed be mobilized in concentrations that may lead to environmental impacts. The elemental compound concentrations from the solid-phase analysis conducted at part of the Golder program are detailed in Table E-1. Additionally, under the direction of Holcim samples of the CKD materials were analyzed for total metals once in 1991 and then quarterly beginning in the first quarter of 1993 through the first quarter of 2002, with the exception of 1994. Summary statistics of these results are provided in Table E-2. Schoeller diagrams are provided in Figure E-1 and Figure E-2.

Concentrations reported for the CKD testing conducted by Golder and the quarterly testing by Holcim are within the same range of values. The CKD material has elemental compounds that are higher than the native materials, including: boron, calcium, lead, potassium, selenium, thallium, and zinc. The lead, selenium, and thallium concentrations are elevated by at least a full order of magnitude. The CKD materials exhibited concentrations of arsenic, barium, chromium, and manganese that were similar to or less than the native materials. The concentrations of arsenic, barium, copper, manganese, thallium, uranium, and zinc are greater in the CKD and native materials than in published concentrations for carbonates and sandstones (Price 1997).

2.0 SYNTHETIC PRECIPITATION LEACHING PROCEDURE

The synthetic precipitation leaching procedure (SPLP) is a test where material such as soil or rock is saturated with a solution designed to mimic meteoric water or natural weathering solutions. The materials undergo grain size reduction such that all components pass through a 0.375” sieve. The solution to rock ratio is 20 to 1, and the test concludes after 18 hours, at which point the leachate is collected and analyzed for the constituents of interest. Metals are generally analyzed by US EPA Methods 200.7 or 200.8 by ICP or ICP-MS, respectively. The leachate solution has a weakly acidic pH of 5.0 to approximate rainfall (extraction fluid #2 in US EPA Method 1312). The test is not designed to definitively predict material long-term leachate water quality as field results are complicated by a number of variables such as surface area exposure, weathering rates, flow rates, and water to rock ratios.

SPLP testing was performed as part of the Golder and Secor programs. The SPLP testing was performed on four samples of CKD (two by Golder and two by Secor), one sample of silt, four samples of limestone and two samples of sandstone. The analytical results for the SPLP leachate analysis are tabulated in Table E-3. Schoeller diagrams are provided in Figure E-3 and Figure E-4.

The SPLP leachate pH values are greater than 12 for the CKD material and between 7 and 10 for the native materials, indicating a n increase of pH over time would be expected if the waters were being influenced by CKD. In addition, the SPLP leachate concentrations were at least an order of magnitude higher for the CKD material than for the native materials for: arsenic, barium, chromium, lead, lithium, selenium, and thallium, and the majority of major ions. Therefore, upward trending concentrations would be expected if CKD was influencing groundwater concentrations in the Site wells. In particular, potassium concentrations measured in the CKD leachate of approximately 500 mg/L are two orders of magnitude greater than that of the native materials and would be expected to increase if the waters were being influenced by CKD.

3.0 SEQUENTIAL BATCH TESTING

Secor performed sequential batch testing on the leachates produced by the SPLP tests as part of their 1998 hydrogeologic and geochemical assessment. The analytical methodology and results for the sequential batch testing are detailed in Secor (1998). The purpose of the sequential batch testing was to evaluate the attenuation capacity of the bedrock materials. The assessment looked at the behavior of arsenic, barium, chromium, lead, selenium and thallium. Secor reported that barium, lead and thallium from CKD leachate would sorb to the native materials and be attenuated along the groundwater flow path and that the particle velocity of these metals would be slower than groundwater velocity. The study was inconclusive for determining the sorption behavior for arsenic, chromium, and selenium.

4.0 REFERENCES

Golder, 2014. Groundwater Characterization Report, Boettcher Limestone Quarry, Laporte, Colorado. Golder Associates Inc., Lakewood, Colorado, April 28, 2014.

Price, W.A., 1997. Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine sites in British Columbia. BC Ministry of Employment and Investment.

Secor, 1998. Hydrogeologic and Geochemical Assessment of Holnam, Inc.'s Proposed Cement Kiln Dust Disposal Site, Laporte, Colorado. Secor International Incorporated, December 1998.

Table E-1: 2012 Whole Rock Acid Digestion Results

Sample Location		CKD-1	CKD-1	MW-5	MW-6	MW-6	MW-7	MW-7	MW-6	MW-7	Average Crustal Material[1]	
Start Depth (ft bgs)		10.3	15	39	200	215	239	252.6	230	265		
End Depth (ft bgs)		13	19.5	58.25	210	225	241.3	254.1	233	266.7		
Material Type		CKD	CKD	silt	limestone	limestone	limestone	limestone	sandstone	sandstone	sandstones	carbonates
Major Ions												
Calcium	mg/kg	379,000	396,000	212,000	223,000	318,000	191,000	298,000	141,000	35,500	39,100	302,300
Magnesium	mg/kg	5,280	5,610	3,680	4,960	3,210	5,610	4,250	2,060	910	7,000	47,000
Potassium	mg/kg	17,800	15,200	3,970	4,710	2,750	6,100	4,290	2,200	1,550	10,700	2,700
Sodium	mg/kg	3,260	2,590	470	1,860	830	2,880	1,430	630	780	3,300	400
Metals												
Arsenic	mg/kg	15.2	16.6	52.9	5.7	5.2	4.1	14.4	7.3	3.9	1	1
Barium	mg/kg	423	391	303	174	132	224	130	368	542	0.1	10
Boron	mg/kg	75	61	12	12	2.50	14	9	3	2.50	35	55
Chromium	mg/kg	78	68	20	12	9	9	13	73	35	35	11
Copper	mg/kg	35	34	34	14	10	11	16	8	2	1	4
Iron	mg/kg	9,060	8,620	31,300	9,870	7,030	10,400	10,600	10,300	3,730	9,800	3,800
Lead	mg/kg	138	85.8	12.3	10.2	5.5	14.7	9.01	6.17	5.2	7	9
Lithium	mg/kg	24	20	11	13	8	14	12	6	5	15	5
Manganese	mg/kg	197	157	136	496	792	594	791	276	77.2	2.5	1,100
Selenium	mg/kg	119	101	25.3	1.25	1.34	0.49	1.19	2.26	0.42	0.05	0.08
Thallium	mg/kg	18	16.1	3.29	0.37	0.31	0.35	0.39	0.44	0.11	0.3	0.04
Uranium	mg/kg	10.3	11.1	16.7	1.92	1.77	1.37	1.08	1.84	0.98	0.45	2.2
Zinc	mg/kg	241	224	145	56	40	69	60	32	11	16	20
Other												
Paste pH	pH units	12.5	12.8	7.5	8.4	8.4	9.1	9.2	10	10.7	NA	NA

Notes:

mg/kg - milligrams per kilogram

ft bgs - feet below ground surface

NA - Data not available

Average Crustal Material from Price 1997

Table E-2: Summary Statistics for Historic Whole Rock Analysis of CKD

Analyte	Summary Statistics			
	Minimum (mg/kg)	Maximum (mg/kg)	Average (mg/kg)	Std.Dev. (mg/kg)
Silver	<1.00	11.00	3.20	2.91
Arsenic	<1.00	64.00	19.56	13.91
Barium	33.00	672.00	322.28	135.81
Berillium	<0.10	2.20	0.94	0.53
Cadmium	1.38	70.00	39.31	17.73
Chromium	30.00	116.00	56.84	21.47
Copper	ND	53.00	36.72	7.32
Manganese	ND	291.00	184.67	49.26
Nickle	<1.00	57.00	39.80	11.05
Lead	3.75	290.00	57.66	53.59
Antimony	<1.00	37.00	10.00	10.89
Selenium	11.44	164.00	71.85	36.40
Titanium	<1.00	68.00	38.06	15.38
Zinc	ND	343.00	203.43	50.24
Mercury	<0.10	2.14	0.39	0.68
pH	12.57	14.01	12.99	0.31

Notes:
ND = Non detect, no detection limit provided
mg/kg = Milligrams per Kilograms or Parts Per Million

Table E-3: Secor and 2012 Synthetic Precipitation Leaching Procedure Results

Sample Location		CKD A[1]	CKD B[1]	CKD-1	CKD-1	MW-5	MW-6	MW-6	MW-6	MW-7	MW-7	MW-7
Start Depth (ft bgs)		NA	NA	10.3	15	39	200	215	230	239	252.6	265
End Depth (ft bgs)		NA	NA	13	19.5	58.25	210	225	233	241.3	254.1	266.7
Material Type		CKD	CKD	CKD	CKD	silt	limestone	limestone	sandstone	limestone	limestone	sandstone
Metals												
Arsenic	mg/L	0.011	0.01	0.002 B	0.001 B	0.0009 B	0.0031	0.0015	0.0014	0.0034	0.0011	0.009
Barium	mg/L	0.32	0.33	0.265	0.268	0.045	0.013 B	0.071	0.061	< 0.02 U	0.056	0.041
Boron	mg/L	NA	NA	< 0.3 U	< 0.3 U	< 0.05 U	0.04 B	0.03 B	0.03 B	0.03 B	0.01 B	0.02 B
Calcium	mg/L	NA	NA	1,520	1,650	591	1.5	6.7	11.6	0.6 B	4	1.5
Chromium	mg/L	0.1	0.08	0.32	0.18	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U
Copper	mg/L	ND	NA	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U
Iron	mg/L	NA	NA	< 0.05 U	< 0.05 U	< 0.05 U	0.03 B	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U
Lead	mg/L	0.0264	0.0389	0.1042	0.0565	< 0.001 U	0.0003 B	0.0002 B	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U
Lithium	mg/L	NA	NA	0.25	0.16	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
Magnesium	mg/L	NA	NA	< 1 U	< 1 U	7.8	< 1 U	1	1.6	< 1 U	0.2 B	< 1 U
Manganese	mg/L	ND	NA	< 0.03 U	< 0.03 U	0.02 B	< 0.03 U	< 0.03 U	< 0.03 U	< 0.03 U	< 0.03 U	< 0.03 U
Potassium	mg/L	NA	NA	541	411	2.5	2	2	2.3	1.3 B	1.2 B	1.3 B
Selenium	mg/L	0.18	0.18	0.649	0.4232	0.0188	0.0147	0.006	0.0041	0.0047	0.0017	0.0016
Sodium	mg/L	NA	NA	81.9	57.4	8	63.5	28.6	25.3	53	14.9	37.8
Thallium	mg/L	0.19	0.358	0.3412	0.2758	0.0009 B	< 0.0005 U	< 0.0005 U	< 0.0005 U	0.0001 B	< 0.0005 U	< 0.0005 U
Uranium	mg/L	NA	NA	< 0.003 U	< 0.003 U	0.0082	0.001	0.0005 B	0.0007	0.0005	< 0.0005 U	0.0005
Zinc	mg/L	ND	NA	0.01 B	0.01 B	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	0.01 B	< 0.05 U	< 0.05 U
Wet Chemistry												
Alkalinity, Bicarbonate as CaCO3	mg/L	NA	NA	< 20 U	< 20 U	20	30	24	20	50	27	5 B
Alkalinity, Carbonate as CaCO3	mg/L	NA	NA	1,070	122	10 B	20 B	9 B	12 B	96	44	61
Alkalinity, Hydroxide as CaCO3	mg/L	NA	NA	2,340	3,290	< 20 U	< 20 U	< 20 U	< 20 U	< 20 U	< 20 U	< 20 U
Alkalinity, Total	mg/L	NA	NA	3,400	3,420	30	50	33	32	146	71	66
Chloride	mg/L	NA	NA	24 B	19 B	< 5 U	1 B	4 B	3 B	3 B	6	20
Fluoride	mg/L	NA	NA	2.3	2.4	0.5 B	0.3 B	0.2 B	0.2 B	0.4 B	0.1 B	0.1 B
Nitrate as N	mg/L	NA	NA	0.45	0.3	0.03 B	< 0.1 U	< 0.1 U	< 0.1 U	0.03 B	0.02 B	0.05 B
Nitrite as N	mg/L	NA	NA	0.13	0.07	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U
Nitrogen, Nitrate-Nitrite	mg/L	NA	NA	0.58	0.37	0.03 B	< 0.1 U	< 0.1 U	< 0.1 U	0.03 B	0.02 B	0.05 B
pH	pH units	12.8	NA	12.3	12.5	7.7	9.6	9.1	8.8	10.2	9.6	10.1
pH*	pH units	NA	NA	12.5	12.5	7.8	9.6	9.2	9	10.2	9.8	9.8
Conductivity	umhos/cm	NA	NA	12,800	12,600	2,260	336	201	212	284	110	212
Sulfate	mg/L	NA	NA	1,800	1,700	1,500	98	49	55	4 B	7	25
Total Dissolved Solids	mg/L	NA	NA	5,230	4,830	2,250	200	110	100	160	50	120

Notes:

B: Estimated value, less than the practical quantitation limit for that analyte, but greater than the method detection limit

U: Result less than method detection limit for that analyte

mg/L: milligrams per liter

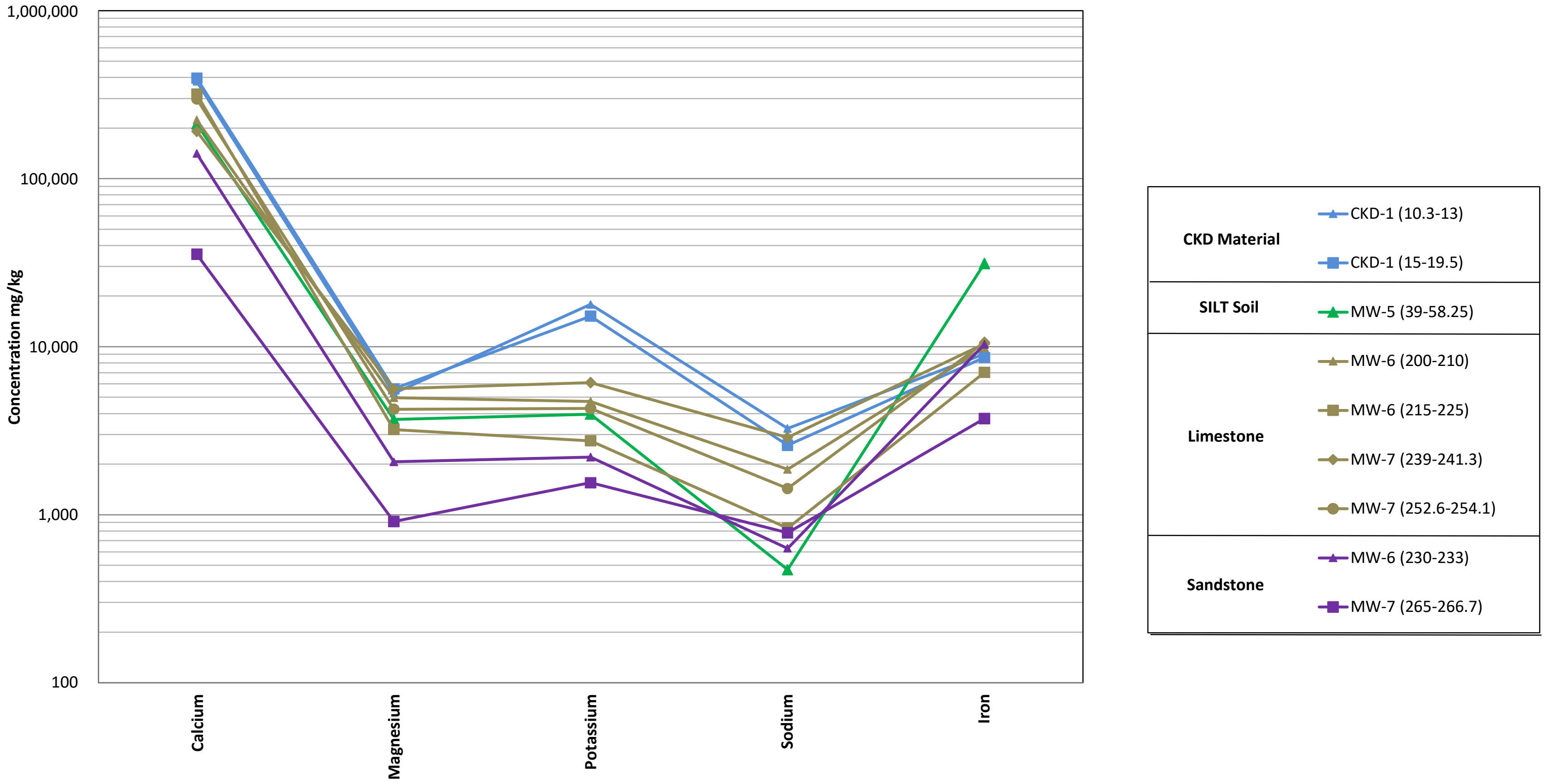
umhos/cm: microhms per centimeter

ft bgs: feet below ground surface

* Leachate pH with a deionized water lixiviant

1 - CKD Sample collected by Secor in 1998

PATH: https://wsponlinenam.sharepoint.com/Sites/US-HolcimBoettcherQua/Shared Documents/2023_202319184_2023-2024_Technical Revision/5_ Technical Work/Rev 0/Appendices/Appendix E | FILE NAME: 20240515_Fig 1-4.xlsx



Note: Non-detects are plotted at 1/2 the practical quantitation limit

CLIENT
Holcim (US) Inc.

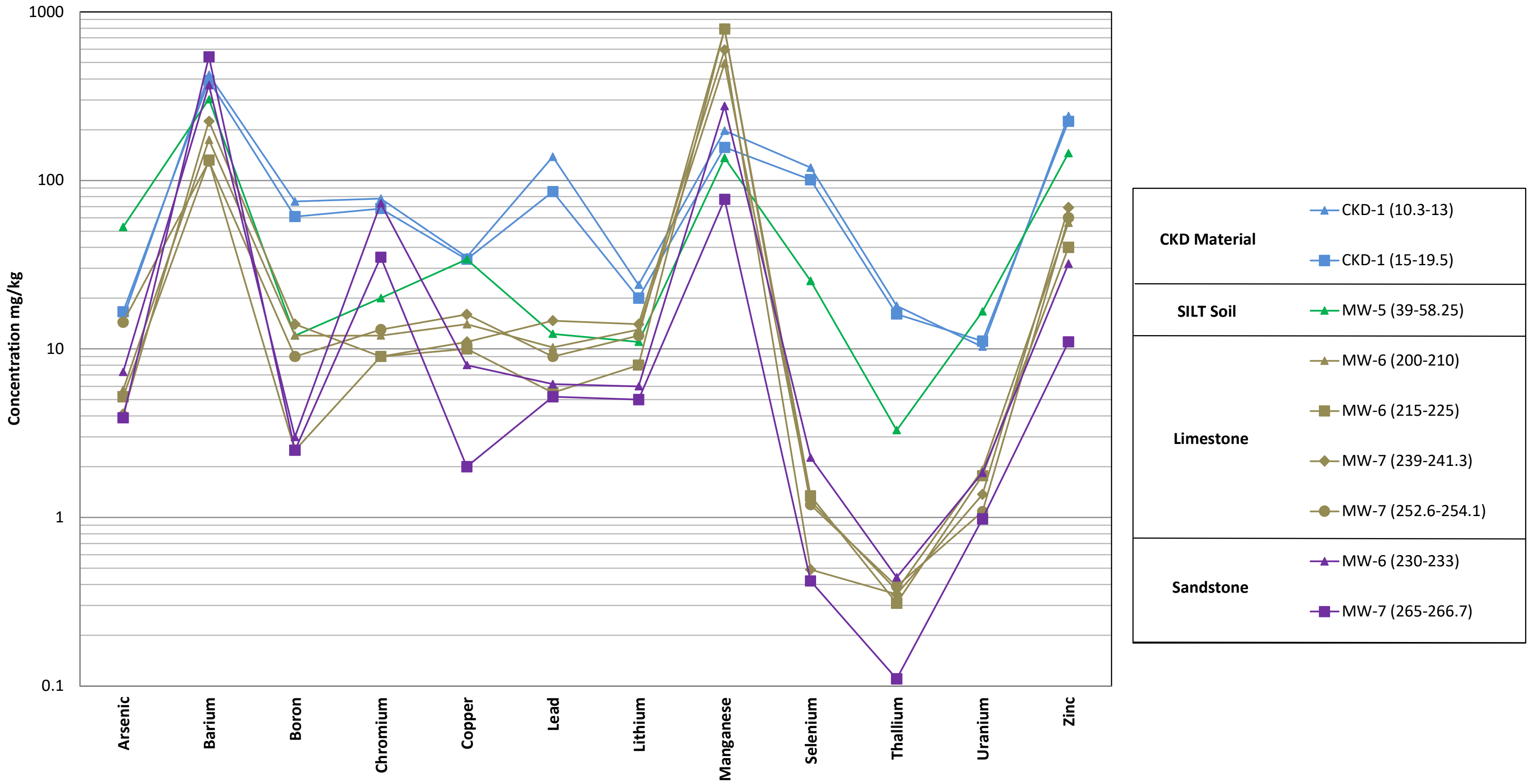
CONSULTANT

PROJECT
CKD Testing Summary- Boettcher Quarry

TITLE
Schoeller Diagram of Whole Rock Acid Digestion:
Major Ions and Iron

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	0	E - 1

PATH: https://wsponlinenam.sharepoint.com/Sites/US-HolcimBoettcherQua/Shared Documents/2023_202319184_2023-2024_Technical Revision/5_ Technical Work/Rev 0/Appendices/Appendix E | FILE NAME: 20240515_Fig 1-4.xlsx



Note: Non-detects are plotted at 1/2 the practical quantitation limit

CLIENT
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PROJECT
CKD Testing Summary- Boettcher Quarry

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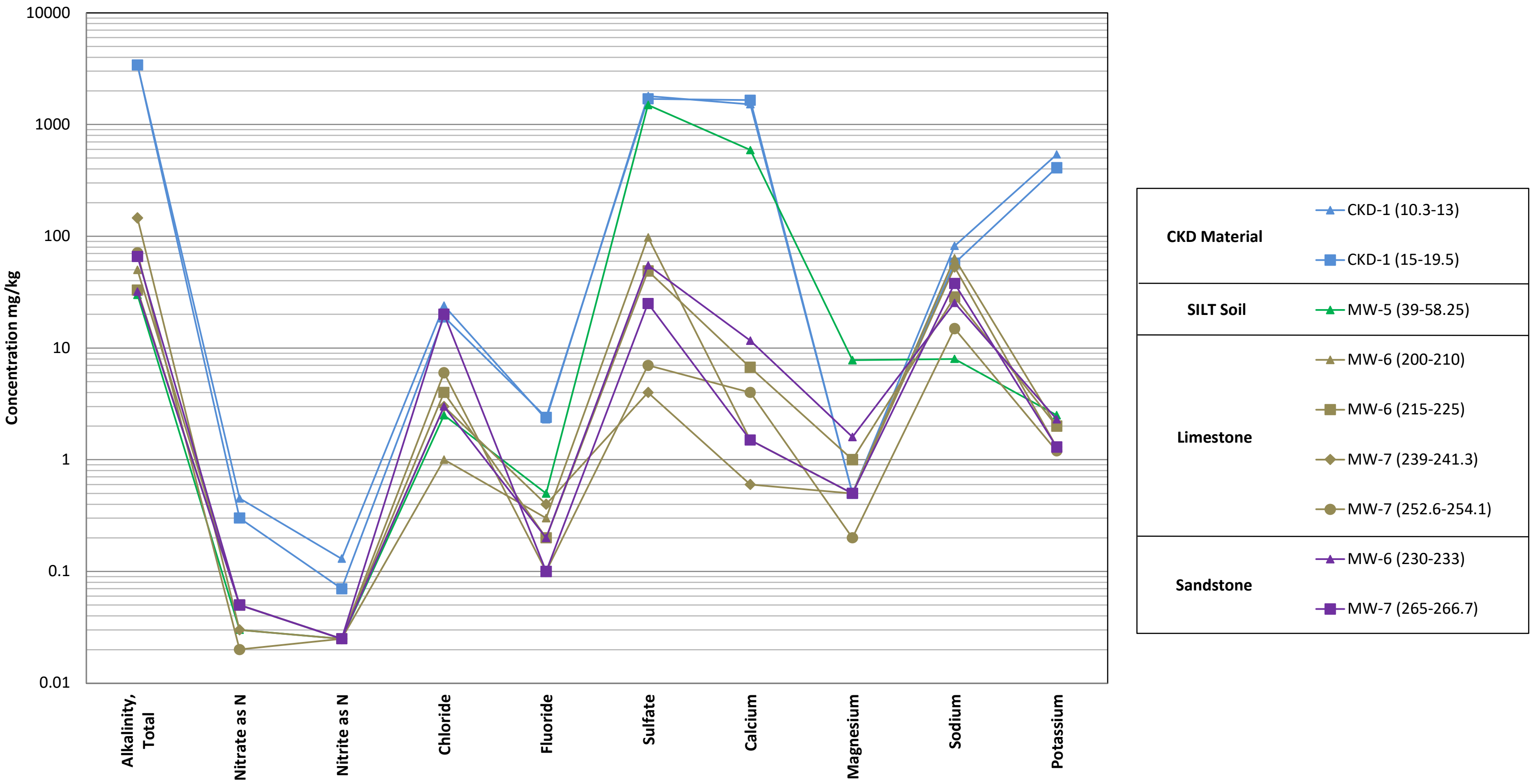
TITLE
Schoeller Diagram of Whole Rock Acid Digestion: Trace Metals

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	0	E - 2

PATH: https://wsponlinenam.sharepoint.com/Sites/US-HolcimBoettcherQua/Shared Documents/2023_202319184_2023-2024_Technical Revision/5_ Technical Work/Rev 0/Appendices/Appendix E | FILE NAME: 20240515_Fig 1-4.xlsx



Note: Non-detects are plotted at 1/2 the practical quantitation limit

CLIENT
Holcim (US) Inc.

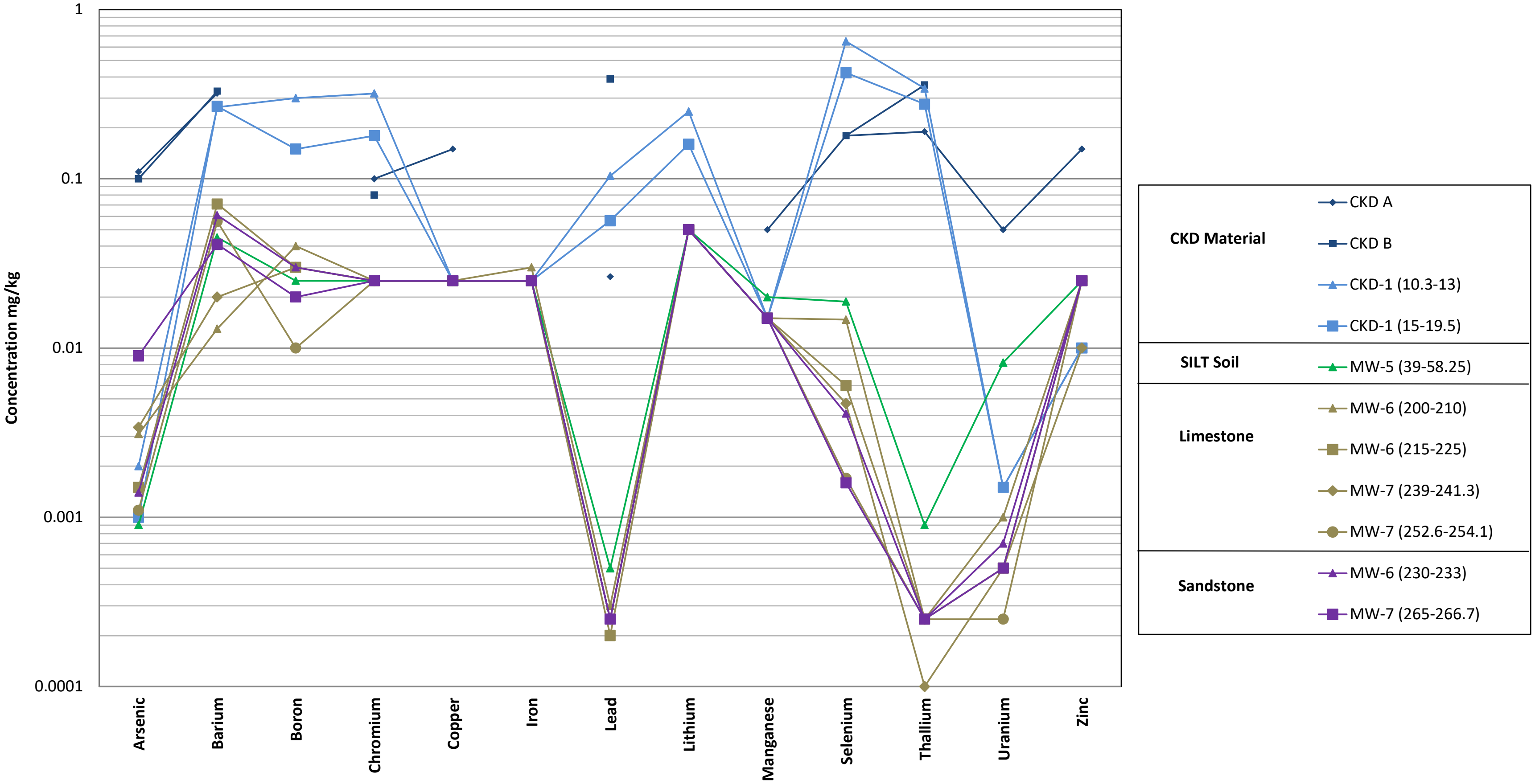
PROJECT
CKD Testing Summary- Boettcher Quarry

CONSULTANT
wsp

TITLE
Schoeller Diagram of SPLP Results: Major Ions and Iron

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	0	E - 3

PATH: https://wsponlinenam.sharepoint.com/Sites/US-HolcimBoettcherQua/Shared Documents/2023_202319184_2023-2024_Technical Revision/5_ Technical Work/Rev 0/Appendices/Appendix E | FILE NAME: 20240515_Fig 1-4.xlsx



Note: Non-detects are plotted at 1/2 the practical quantitation limit

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PROJECT
CKD Testing Summary- Boettcher Quarry

TITLE
Schoeller Diagram of SPLP Results: Trace Metals

PROJECT NO.	PHASE	REV.	FIGURE
31404755.003	001	0	E - 4

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