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DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

EMLA-2022-BF018-02-001

November 30, 2021

Mr. Rick Shean
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Submittal of the Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73." Submittal of this work plan fulfills a proposed fiscal year 2022 milestone of Appendix B of the 2016 Compliance Order on Consent.

If you have any questions, please contact Joe Sena at (505) 551-2964 (joseph.sena@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

ARTURO DURAN

Digitally signed by ARTURO DURAN
Date: 2021.11.29 12:20:45 -07'00'

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosure(s):
1. Two hard copies with electronic files – Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73 (EM2021-0764)

cc (letter and enclosure[s] emailed):
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Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73

Primary Objectives and Purpose	This work plan presents the objectives, drilling approach, and conceptual design for groundwater monitoring well R-73. The primary objective for R-73 is to further characterize chromium contamination in the eastern portion of the chromium plume (Figure 1). R-73 was proposed in the "Assessment Report for the Evaluation of Conditions in the Regional Aquifer Around Well R-70" to characterize vertical extent of contamination in the vicinity of R-70 and to further assess potential effects of pumping from nearby water-supply well PM-3 (N3B 2021, 701506). Chromium concentrations in the deeper of two screens at R-70 (screen 2) were initially approximately 270 ppb and have since declined to a concentration of approximately 207 ppb as of September 2021. The concentrations in the upper screen (screen 1) were approximately 30 ppb in January 2021 and are at approximately 12 ppb as of September 2021. The decreases in concentration at R-70, screens 1 and 2, may be in response to chromium interim measure (IM) operations (Figure 2). However, even in light of the decreasing chromium concentrations in R-70 screen 2, the vertical extent of contamination in the vicinity of R-70 is not defined and it is also unknown how IM operations may be affecting potential contamination at depth. The proposed approach for R-73 includes characterizing vertical extent with R-73 screen 2 placed deeper within the aquifer than R-70 screen 2. The specific depth of R-73 screen 2 will be determined from information gained during drilling and geophysical logging. The vertical distance between R-70 screen 2 and R-73 screen 2 will be proposed in a well-design package submitted to the New Mexico Environment Department (NMED) after drilling for review and approval. The upper screen proposed for R-73 would be in the interval represented by R-70 screen 2 to further characterize and monitor downgradient extent of chromium contamination and IM performance. A shallower position for the upper screen, set somewhere in the R-70 screen 1 interval, was considered in order to evaluate whether there are higher chromium concentrations present in strata within that interval. However, the R-70 screen 1 interval for the R-73 upper screen is not proposed because a higher priority is placed on the benefit of characterizing and monitoring IM-related changes in the downgradient extent of chromium in the R-70 screen 2 interval. Because of constraints on drilling locations posed by terrain and cultural sites in the R-70 area, the proposed drilling site would be from an eastern extension of the existing R-70 well pad. The well would be drilled at an angle of approximately 25 degrees from vertical with an azimuth of approximately N40E that would result in an intersection of the regional aquifer at a location approximately as shown in Figure 1. This approximate 25-degree angle from vertical will result in a lateral offset of approximately 400 ft from the R-73 wellhead to the intersection of the water table. The offset to the well screens within the regional aquifer would add approximately an additional 50 ft of offset from the wellhead. This configuration would also result in screen positions approximately 350 ft downgradient of R-70. The importance of this proposed target for R-73 is to ensure reasonable proximity to R-70 for the purpose of characterizing the vertical extent of contamination observed in R-70 screen 2. Figure 3 shows two cross-sections; one along a line from CrEX-5 through R-70 to the proposed R-73 location, and a second along a line from R-45 through R-70 to the proposed R-73 location. The stratigraphy and position of R-73 screen 2 is conceptual and will be refined and included in the final well-design package submitted to NMED after drilling for review and approval.
Drilling Approach	The proposed drilling approach for R-73 will use fluid-assisted, air-rotary, reverse circulation with casing-advance methods. Telescoping casing sizes between 24 in. and 14 in. and dual-rotary methods will be used to advance the borehole to a depth within the upper 200 ft of the regional aquifer. This approach will produce a borehole that can accommodate an approximately 3-in. annular filter pack around the 8-in. well screen.

Drilling Fluids, Composition, and Use	Fluids and additives will be used to facilitate drilling and may include those previously authorized for use by NMED, including the following: • Potable water, municipal water supply, to aid in delivery of other drilling additives and to cool the drill bit, • QUIK-FOAM, a blend of alcohol ethoxy sulfates, used as a foaming agent to lift cuttings, and • AQF-2, an anionic surfactant, used as a foaming agent to lift cuttings. Given the diameter and length proposed for the borehole, fluids may be used for the borehole's entire length, including within the regional aquifer. Complete records will be maintained detailing the type, amount, and volume of fluids and additives used and the depth at which fluids or additives were added to the borehole.
Potential Groundwater Occurrence and Detection	Although perched-intermediate groundwater was not encountered at R-70, it could be encountered during drilling of R-73. Methods to identify perched-intermediate groundwater will include driller's observations, water-level measurements, and borehole video. The top of the regional aquifer is projected to occur at approximately 860 ft below ground surface (or approximately 950 linear ft along the angled borehole).
Geophysical Testing	Geophysical logging will be conducted when the borehole has been drilled to total depth. Logging data will be used to refine estimates of the top of regional saturation and to characterize the hydraulic properties of strata beneath the water table. Downhole directional surveys will be made in the angled borehole at several points during drilling (e.g., just below the top of basalt and at prescribed depths within the basalt) to ensure aquifer intersection targets are met.
Cuttings Characterization	Cuttings collection and characterization methods are intended to optimize representative retention of the fine-grained fraction, particularly within the regional aquifer.
Well Development	The well filter pack may be developed by both mechanical and chemical means. Mechanical means include airlift swabbing, bailing, and pumping. Chemical means include the use of additives to remove clays and/or chlorination to kill bacteria that may be introduced during well completion. Filter pack development during placement will be considered complete when less than 2/10 ml/L of sand is passing through the well screen. • After initial airlift swabbing and bailing during filter pack placement, a 6-in. submersible pump will be used to complete the development process following well completion. A 6-in. pump will be capable of removing significantly higher volumes of water than the 4-in. pump that will be part of the final sampling system. Sand production will be measured with a Rossum Sand Tester. • Water-quality parameters will be measured in a flow-through cell. The parameters to be monitored are pH, specific conductance, dissolved oxygen, temperature, turbidity, oxidation-reduction potential, and total organic carbon (TOC). • If water-quality parameters cannot be brought to within the target values specified below during well development, the use of chemical well development may be discussed with NMED. No chemicals will be added without NMED's approval. Chemical development methods that may be used include AQUA-CLEAR PFD or a similar product to remove clays, and/or chlorination with sodium hypochlorite. Well development will be considered complete when target water-quality parameters and sand production quantities are met and a volume of water equivalent to that which was introduced into the aquifer during drilling and construction is removed. The target water-quality parameters are turbidity <5 nephelometric turbidity units and TOC <2 ppm. The target sand production quantity is less than 1 mg/L.
Hydraulic Testing	Both screened intervals will be hydraulically tested following development.

Water-Quality Sampling	If perched-intermediate groundwater is encountered, attempts will be made to collect screening-level samples using air-lifting or bailing methods. The first groundwater samples from the completed well will be collected at the end of the hydraulic test in each of the two screens. These samples will be analyzed for metals, general inorganics (including nitrate, perchlorate, sulfate, etc.), semivolatile organic compounds, volatile organic compounds, and radionuclides (including low-level tritium). Subsequent samples will be collected from the dedicated sampling system described below.
Sampling System Installation	A dual-access-port valve sampling system will be designed and installed in the well. The system will be capable of delivering water to the surface separately from each screened interval. The system will use a typical 4-in. pump and motor to maintain sampling purge rates at or near 5 gallons per minute. An inflatable packer will be part of the system to achieve separation between the screen intervals. The total amount of time the two screen intervals are in cross-communication with one another will be documented for the entire project, and the sampling system will be used to purge cross-flow from the appropriate screen before sampling.
Investigation-Derived Waste Management	Investigation-derived waste will be managed in accordance with Standard Operating Procedure (SOP) N3B-EP-DIR-SOP 10021, "Characterization and Management of Environmental Programs Waste." This SOP incorporates the requirements of applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy orders, and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) requirements. The primary waste streams will include drill cuttings, drilling water, drilling fluids and additives, development water, purge water generated during hydraulic testing, decontamination water, and contact waste. Drill cuttings will be managed in accordance with the NMED-approved "Decision Tree for the Land Application of Drill Cuttings" (April 2016). Drilling, purge, and development waters will be managed in accordance with the NMED-approved "Decision Tree for Land Application of Drilling, Development, Rehabilitation, and Sampling Purge Water" (November 2016). Initially, drill cuttings and drilling fluids will be stored in a lined pit. Representative samples of the drill cuttings and drilling fluids will be collected and analyzed, and waste determinations will be made from validated data. If validated analytical data show these wastes cannot be land-applied, they will be removed from the pit, containerized, and placed in accumulation areas appropriate for the type of waste. Development and hydraulic testing water that meets the requirements to be treated and land-applied will be managed under Discharge Permit 1793. Decontamination water will be containerized separately at the point of generation, placed in an accumulation area appropriate to the type of waste, and directly sampled. Contact waste will be containerized at the point of generation, placed in an appropriate accumulation area, and characterized using acceptable knowledge or the media with which it came in contact.
Schedule	The drilling and installation of R-73 will occur in fiscal year 2022. A letter report documenting completion of the well and collection of first samples (at the end of the hydraulic test in each screen) will be submitted to NMED by August 31, 2022. This completion date is dependent, in part, on both NMED's approval of the drilling work plan no later than February 1, 2022, and subsequent approval of the drilling permit application by the New Mexico Office of the State Engineer by March 31, 2022.

REFERENCE

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above). IDs are used to locate documents in N3B's Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), June 2021. "Assessment Report for the Evaluation of Conditions in the Regional Aquifer Around Well R-70," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2021-0321, Los Alamos, New Mexico. (N3B 2021, 701506)

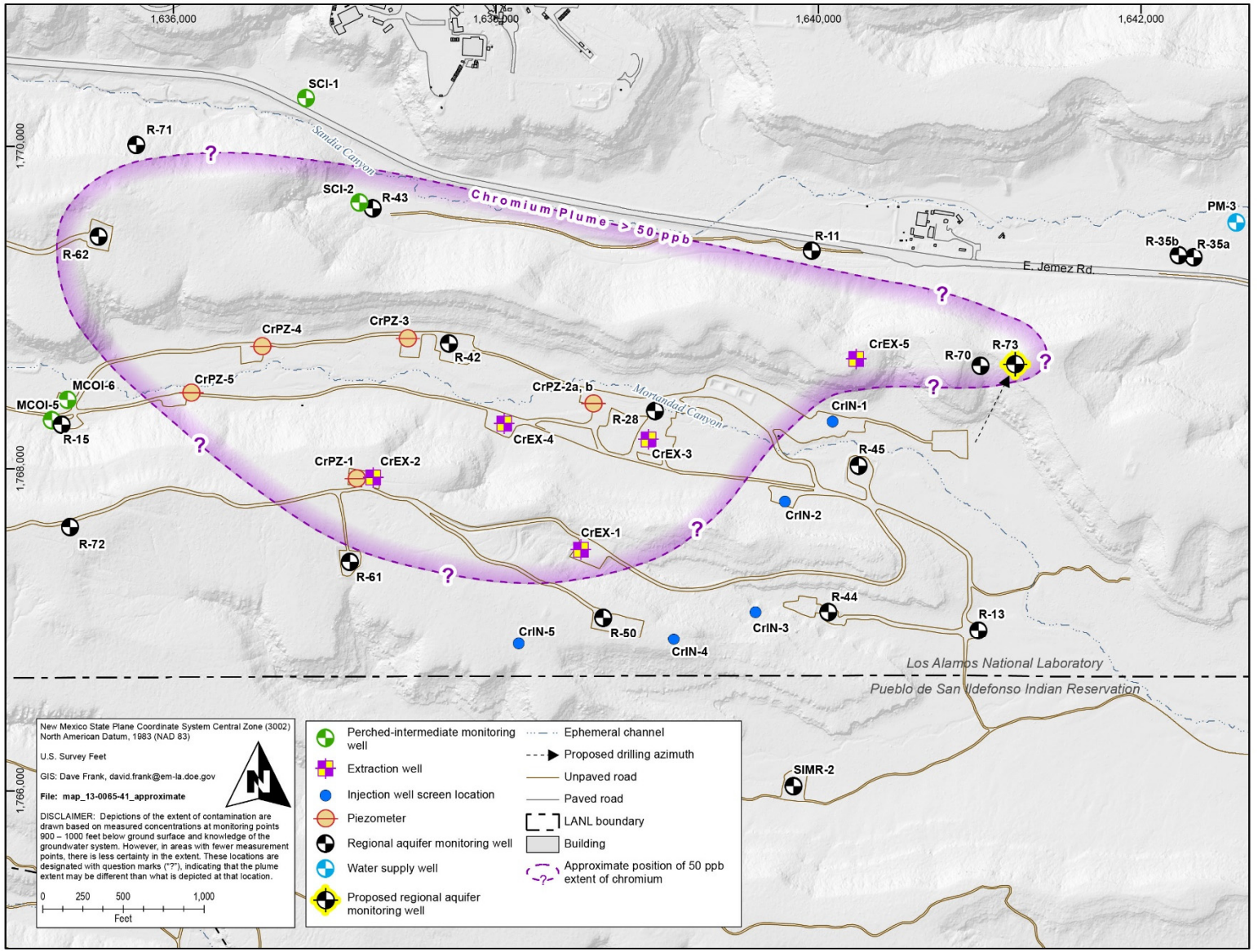


Figure 1 Proposed location for R-73 showing the drilling azimuth and the approximate location for screens within the regional aquifer

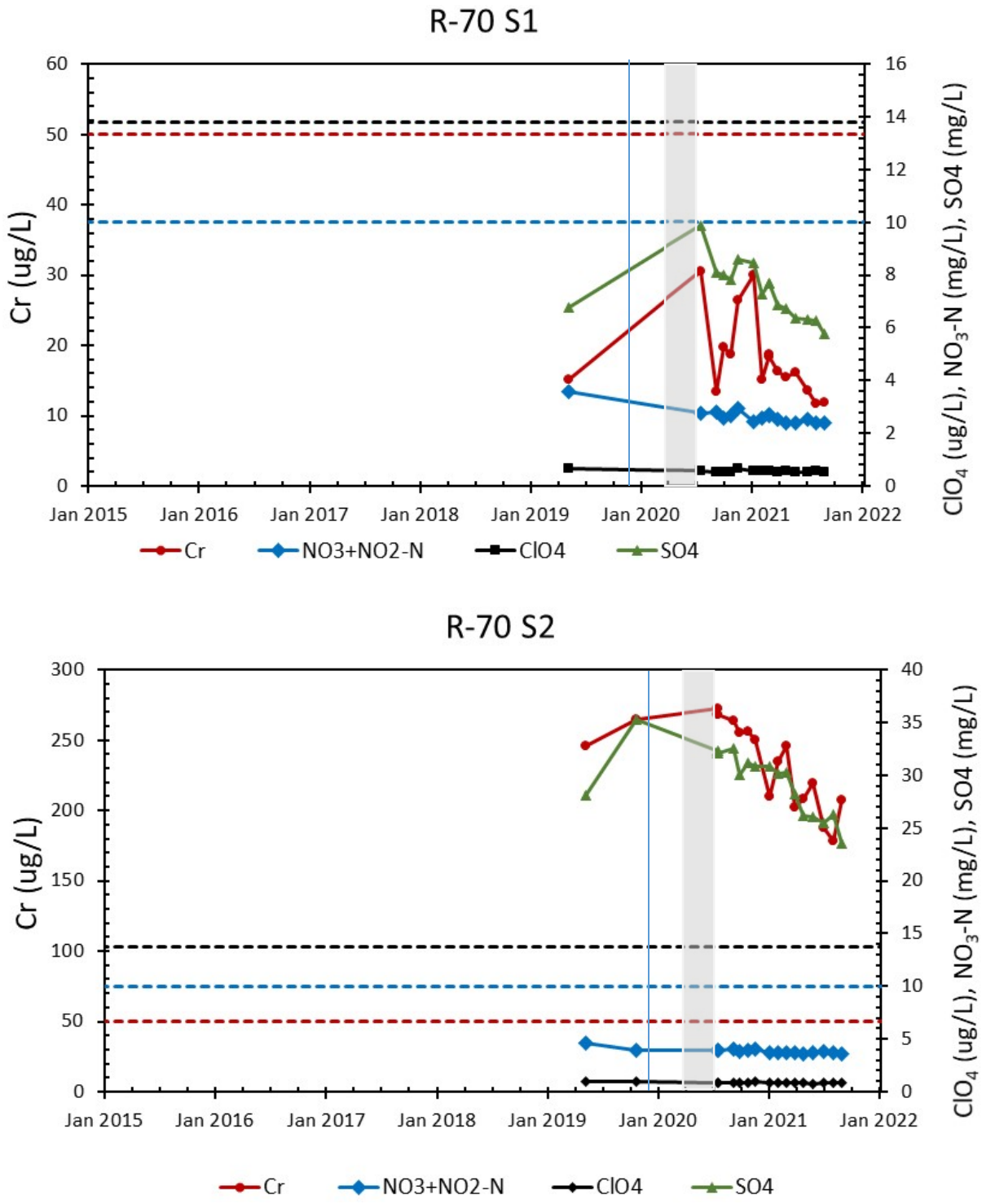
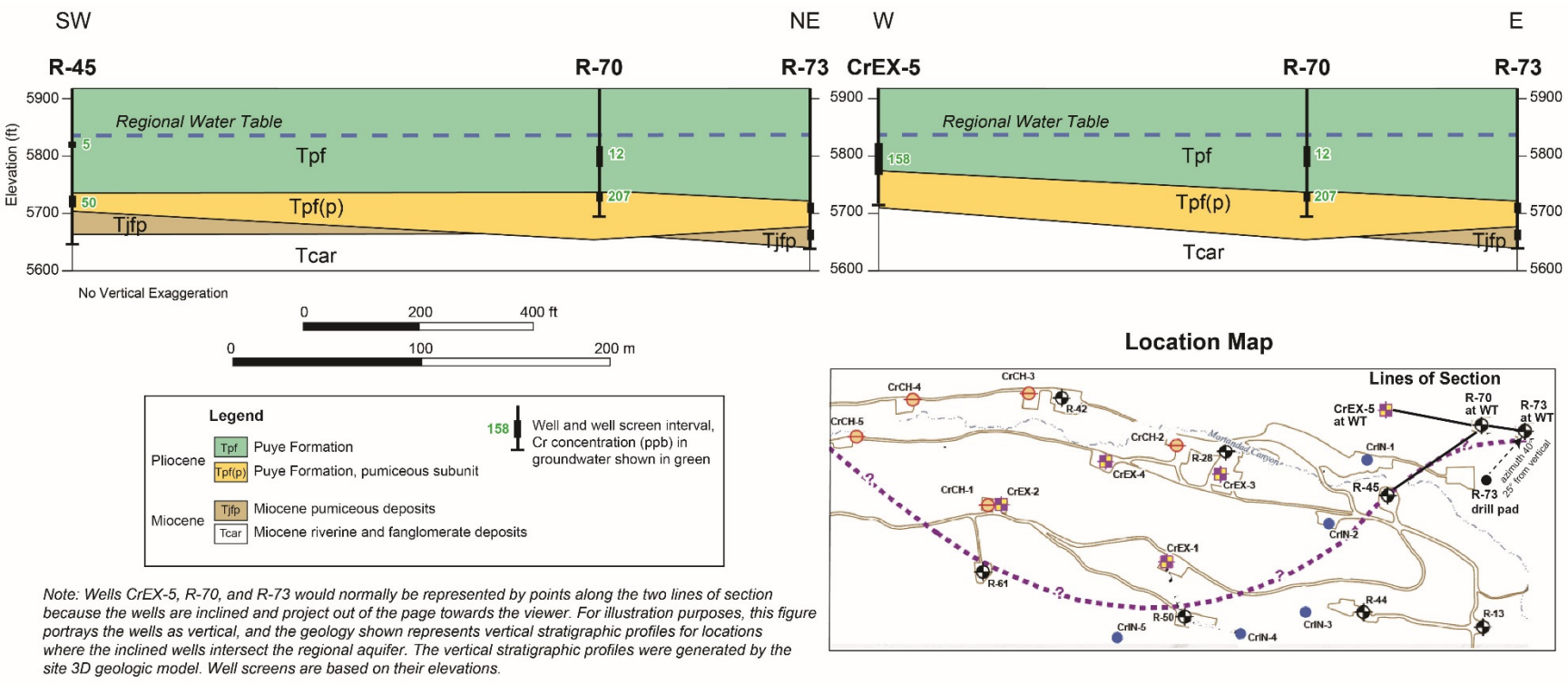


Figure 2 **Trends for chromium, nitrate (as nitrogen), perchlorate, and sulfate at R-70 Screen 1 (S1; top) and R-70 Screen 2 (S2; bottom). The vertical blue line represents the start of eastern area IM operations. The vertical shaded area represents the COVID-19-related shutdown period in 2020. Horizontal dashed lines correspond to the applicable groundwater standard for chromium (red), nitrate (blue), and screening level perchlorate (black). The groundwater standard for sulfate is 600 mg/L.**



Note: Wells CrEX-5, R-70, and R-73 would normally be represented by points along the two lines of section because the wells are inclined and project out of the page towards the viewer. For illustration purposes, this figure portrays the wells as vertical, and the geology shown represents vertical stratigraphic profiles for locations where the inclined wells intersect the regional aquifer. The vertical stratigraphic profiles were generated by the site 3D geologic model. Well screens are based on their elevations.

Figure 3 **Cross-sections from R-45 to R-73 (left) and CrEX-5 to R-73 (right) showing proposed approximate well screen positions for R-73**