Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

JAN 0 6 2025

Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Environmental Services
2600 Bull Street
Columbia, South Carolina 29201

Mr. Jon Richards
Savannah River Site Remedial Project Manager
Superfund and Emergency Management Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Richards:

SUBJECT: Savannah River Site's Responses to the Regulatory Comments on the Treatability Study Data Report for Groundwater Injection and Discharge Canal Neutralization at the D-Area Groundwater Operable Unit (OU) (U) 2023 Data and Information (SRNS-TR-2024-00261, Revision 0, June 2024) SEMS Number: 63

The U.S. Department of Energy (DOE) is submitting the subject comment responses for your review. The U.S. Environmental Protection Agency's (EPA) and South Carolina Department of Environmental Services' (SCDES) comments were received on October 1, 2024, and October 8, 2024, respectively. This report will not be revised; however, all comment responses will be included in the next report, as applicable. Please review the enclosures and provide your approval within thirty (30) days from receipt. The effort and time that the EPA and the SCDES have provided on this operable unit are appreciated.

Questions from you or your staff may be directed to me at (803) 952-7805, or the DOE Operable Unit Manager, Khari Bell, at (803) 952-5805.

Sincerely,

AVERY HAMMETT

Digitally signed by AVERY HAMMETT
Date: 2025.01.06 09:57:27 -05'00'

Avery G. Hammett
FFA Project Manager, DOE-Savannah River
Remediation, Deactivation, and Decommissioning Division

RDDD-25-114

JAN 0 6 2025

Ms. Susan Fulmer
Mr. Jon Richards 2

Enclosures:
1. SRS Responses to the South Carolina Department of Environmental Services' Comments on the Treatability Study Data Report for Groundwater Injection and Discharge Canal Neutralization at the D-Area Groundwater Operable Unit (OU) (U) – 2023 Data and Information, SEMS Number: 63 (SRNS-TR-2024-00261, Revision 0, June 2024)
2. SRS Responses to the U.S. Environmental Protection Agency's Comments on the Treatability Study Data Report for Groundwater Injection and Discharge Canal Neutralization at the D-Area Groundwater Operable Unit (OU) (U) – 2023 Data and Information, SEMS Number: 63 (SRNS-TR-2024-00261, Revision 0, June 2024)

cc w/o encl:
M. Reece, SCDES-Columbia
H. J. Porter, SCDES-Columbia
J. Blalock, SCDES-Columbia
S. French, SCDES-Columbia
R. G. Stewart, SCDES-Columbia
G. K. Taylor, SCDES-Columbia
G. O'Quinn, SCDES-Midlands Aiken Environmental Affairs Office
E. G. Downing, SCDES-Midlands Aiken Environmental Affairs Office
H. L. Herlong, SCDES-Midlands Aiken Environmental Affairs Office

cc w/encl:
B. Martin, EPA-Region 4
H. Cathcart, SCDES-Columbia
M. McRae, TechLaw, Inc.

SRS Responses to South Carolina Department of Environmental Services Comments on the Treatability Study Data Report for Groundwater Injection and Discharge Canal Neutralization at the D-Area Groundwater Operable Unit (OU) (U) – 2023 Data and Information, SEMS Number: 63 (SRNS-TR-2024-00261, Revision 0, June 2024)

Comments received October 8, 2024.

SCDES Specific Comments

1. Section 2.0, Project Description, page 5. The first complete sentence on this page indicates a specific acidic groundwater discharge point to the D-Area Effluent Discharge Canal somewhere upgradient of the calcium carbonate reactive structures. Please indicate this discharge point location on a figure and verify that it is upgradient of the newly located structures.

   Response: Agree/Clarification

   Groundwater discharges to the D-Area Effluent Discharge Canal is along the whole stretch of the canal, not at one specific point or location. Groundwater flow is to the southwest and first intersects the D-Area Effluent Discharge Canal to the southwest of the 484-17D DCSA and 489-D CPRB upgradient of surface water station DSWM-4. Groundwater also continues to discharge to the canal past the southward bend. Figure 6, *D-Area Treatability Study Injection Wells, Reactive Structure, and Projected Water Table Elevation* that is referenced in section 2.0 and Figure 11, D-Area Groundwater OU UTRA Potentiometric Surface (2Q203) display the UTRA potentiometric surface and the D-Area Effluent Discharge Canal.

   Additionally, Figure 2, *D-Area Groundwater 2Q2023 pH and Beryllium Plume* displays the groundwater and surface water pH results, which identifies the groundwater area most affected by low-pH (<4.5 pH). As seen in Figure 2, the area of low-pH groundwater that can discharge to the D-Area Effluent Discharge Canal is located in the upstream section of the canal upgradient of surface water station DSWM-4C. The two reactive structures are located downgradient of this area.

   The locations of the original and reworked reactive structures are shown on Figure 21. No changes to the June 2024 Data Report are proposed.

   Contact: Ashley Shull (803) 952-7090 ashley.shull@srs.gov

2. Section 4.0, Sampling and Analysis, page 6. The third paragraph states that water elevations dropped 3-5 feet overall in the D-Area between 2Q2020 and 2Q2023 in wells upgradient or side gradient of the injection wells. However, Section 5.1.2, Water Level Observations, discusses the increase in water elevation between 2022 and 2023 and states that water elevations decreased across D-Area from 2020 to 2022. Please clarify if there is any overall decreasing trend in water elevation between 2020 and 2023, or if the water elevation decrease is specifically between the 2020 to 2022 time period.

   Response: Clarification

   Water elevations decreased from 2020 to 2022, then increased in 2023 but not to the previous 2020 levels. Section 4 and Section 5.1.2 will be revised in future reports to

provide a clearer description of water elevation fluctuations. No changes to the June 2024 Data Report are proposed.

Contact: Ashley Shull (803) 952-7090 ashley.shull@srs.gov

3. Section 7.0, Summary, page 14. The last complete sentence of this page states that for the majority of injection wells installed to date, the ability to accept more water than originally anticipated has compensated for installing half of the proposed wells (10 of 20). This statement implies that these 10 injection wells will be sufficient, and that the remaining 10 injection wells would not be installed as originally planned. Please clarify.

   Response: Clarification

   SRS is currently not planning on installing the 10 additional injection wells. SRS is evaluating if and how to increase flow to the 10 existing injections wells to reach higher total gpm injections. Future reports will explicitly state if additional injection wells are or are not being considered to be installed. No changes to the June 2024 Data Report are proposed.

   Contact: Ashley Shull (803) 952-7090 ashley.shull@srs.gov

4. Section 7.0, Summary, page 16. The second paragraph of this page states that surface water stations DSWM-8 and -8A are being removed from the monthly schedule and being replaced for monthly pH monitoring by surface water stations DSWM-4C, -6 and -7. Table 3, which lists all monitoring wells and surface water stations in the treatability study monitoring network, does not list DSWM-8 and -8A at all, implying that these wells are being removed completely from the monitoring network and not just the monthly pH monitoring schedule. Please clarify if these wells will remain in the monitoring network and if so, in which capacity/ monitoring frequency, and revise Section 7.0 and/or Table 3 accordingly.

   Response: Clarification

   Surface water monitoring stations DSWM-8 and DSWM-8A were originally added for the DAG OU Treatability Study to monitor upgradient and between the reactive structures. Since the reactive structures have been reworked and the upgradient reactive structure is now located further upstream, stations DSWM-4C, DSWM-6, and DSWM-7 are being added to the monthly pH monitoring to monitor upstream, between, and downgradient of the reactive structures. DSWM-8 and DSWM-8A will no longer be monitored due to the new placement of the reactive structures. Also, continued monitoring at these stations would be redundant due to their close proximity to each other and to surface water station DSWM-9. For these reasons, DSWM-8 and DSWM-8A are not shown on Table 3 as part of the Treatability Study monitoring network for 2024. No changes to the June 2024 Data Report are proposed.

Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

5. Appendix D, Section 1.0 Alternate Estimation of Injection Time Based on Site Complexity at D Area, page D-3. This section lists certain assumptions that were made during original calculations for determining the injection volume required to adjust the pH of acidic groundwater at D-Area, along with changes made from these original assumptions. The second paragraph of page 3 of the data report indicates a porosity value of 0.3 was used in original calculations for determining the pore space volume in this area; however, this section of Appendix D indicates this porosity value was changed to 0.2. This change in original calculation assumptions should be noted in this section, as well as the reason for the change in this assumption.

   Response: Agree/Clarification

   The porosity value of 0.3 was generically chosen in the original pore volume estimation but may have been over-estimated based on the abundance of fine sediments and clays that were encountered during installation of the injection wells. Therefore, the lower porosity value of 0.2 was used to estimate the revised pore volume (effective porosity).

   The original pore volume was estimated at 19 million gallons and the revised estimate (assuming a porosity of 0.2) was estimated to be 154 million gallons. This assumption further led to the estimated time taken to inject one pore volume, which is about 2.4 years. Increasing the assumed porosity value to 0.3 would lead to an increase in the estimated injection time of one pore volume to 3.6 years. The analytical transport modeling conducted to analyze the system provided a similar estimate of time needed for injection of one pore volume at 3 years. Therefore, varying the porosity values between 0.2 and 0.3 would vary the time required to inject one pore volume by about a year. The estimates will continue to be refined as more information is obtained from monitoring the system. Any changes to the calculation assumptions will be discussed in more detail in future reports. No changes to the June 2024 Data Report are proposed.

   Contact: Rohit Goswami (803)989-5383 rohit.goswami@srs.gov

SRS Responses to United States Environmental Protection Agency Comments on the Treatability Study Data Report for Groundwater Injection and Discharge Canal Neutralization at the D-Area Groundwater Operable Unit (OU) (U) – 2023 Data and Information, SEMS Number: 63 (SRNS-TR-2024-00261, Revision 0, June 2024)

Comments received October 1, 2024

USEPA GENERAL COMMENTS

1. It is unclear why there are no time-series plots for cobalt (Co) or nickel (Ni), since Figure 24, Surface Water Concentrations of pH and Cobalt and Nickel at DSWM-8, DSWM-8A, and DSWM-9 includes plots of pH compared to concentrations of these metals. Figure 24 would be easier to interpret if times-series plots were included for these metals. Also, it is unclear if there are correlations between Co and pH or between Ni and pH as the text does not discuss these metals. Please revise the TSDR to include time-series plots for Co and Ni and revise the text to discuss whether changes in pH correlate with changes in the concentrations of these metals.

   Response: Agree/Clarification

   Figure 24, *Surface Water Concentrations of pH and Cobalt and Nickel at DSWM-8, DSWM-8A, and DSWM-9* was provided to show examples of the effect of pH changes from the reactive structures on metals concentrations in surface water. Figure 24 shows that as pH increases, concentrations of both Co and Ni decrease in surface water, similar to the aluminum and beryllium results displayed in Figure 23. Time-series plots for Co and Ni were not included in the report because groundwater impacts for these constituents are more localized than aluminum and beryllium, which are more widespread in D-Area groundwater.

   Interpretation of the data presented in Figures 23 and 24 within the text will be included in future DAG TS Data Reports. No changes to the June 2024 Data Report are proposed.

   Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

2. It is not possible to verify statements about injection well flow rates or the data presented on Figure 17, Graph of Injection Well Flow Rates for 2022 and 2023, and Figure 18, Cumulative Groundwater Injection Volumes Per Well (in millions of gallons). A table with monthly and cumulative injection well flow data should be included to support the text and figures. Please revise the TSDR to include a table with injection well flow data.

   Response: Agree/Clarification

   Bi-weekly rounds (usually on Mondays and Thursdays) are conducted at each of the injection wells. These bi-weekly readings are compiled and used to generate the graphs presented in the DAG TS report. Due to the large number of data points, the electronic Excel version of these data and graphs will be included with future DAG TS Data Reports in place of a table. No changes to the June 2024 Data Report are proposed.

   Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

3. A borrow pit immediately west-southwest of the 488-4D Ash Landfill is shown on several figures; however, the TSDR does not discuss the current operational status of the borrow pit and it is unclear whether based on the inverted elevation, the local groundwater flow direction is being impacted. Although unlabeled, the borrow pit shown on Figure 1, D-Area Powerhouse Associated Facilities, appears to have surface water present and it is unclear whether this represents the groundwater table.

In addition, the presence of surface water within the borrow pit potentially poses an unacceptable risk due to exposure to acidic and metals contaminated groundwater. Please revise the TSDR to discuss the borrow pit, including whether surface water in this feature is at the same elevation as groundwater, and if it potentially poses an unacceptable risk to groundwater or ecological receptors.

Response: Clarification

The borrow pit was originally constructed in 1994 to provide material to raise the height of the 488-4D Ash Basin berm. Stormwater runoff from the 488-D Ash Basin and 488-4D Ash Landfill converged into a drainage ditch and flowed into the borrow pit. The base of pit consists of a dense clay which holds water. The area holds the stormwater, is swampy, and often contains standing water due to the perching effects of the clay. It is not indicative of groundwater as it's surface elevation (~104 – 106 ft amsl) is above the water table surface (~95 – 100 ft amsl).

Sampling of surface water and sediment were conducted in 2001 at three locations within the Borrow Pit as part of the D-Area Expanded Operable Unit (DEXOU) RFI/RI Work Plan (WSRC-RP-2001-4162, Rev 1, June 2003) and to support obtaining a Solid Waste Landfill Permit for use of the borrow pit as stormwater management retention basin. The screening concluded that there was insignificant impact to the borrow pit, and the pit could continue to be used as a stormwater management retention basin. A NPDES permit was obtained for the discharge from the borrow pit (Outfall D-02).

After closure of the D-Area ash basins and to support the subsequent closure of the D-02 Outfall, SCDES requested new sampling be conducted. Five sediment and surface water samples were collected within the borrow pit. Sediment data screening results revealed concentrations of ash related constituents in the were well below concentrations from SRS ash units and below background levels. No surface water constituents from the borrow pit exceeded their respective MCL or RSL. The 2011 results can be found in the report *Sampling Results for the 2021 Sampling of the D-Area Borrow Pit in Support of Closure of Outfall D-02* (SRNS-RP-2021-05180, Rev 0, November 2021). After closure of the NPDES permit, the overflow discharge at the outfall was breached to allow more natural flow from the borrow pit. Some standing water is still contained within the pit.

No changes to the June 2024 report are proposed.

Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

4. Several of the figures do not have north arrows. North arrows are missing from Figures 2, 6, 7, 10, and 11. Please revise these figures to include a north arrow.

Response: Agree

All planar figures are oriented in UTM Zone 17 true north orientation, such as shown in Figure 3, *D-Area Groundwater 2Q2020 pH and Beryllium Plume*. Figures in future reports will include north arrows on every map as appropriate. No changes to the June 2024 Data Report are proposed.

Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

5. There are two page numbers on each page of the text, tables, and figures. For example, the page where Section 7.0, Summary, begins is numbered 14 of 72 at the top right of the page and 20 of 256 at the bottom left of the page. Please choose one page numbering system and delete the other.

   Response: Clarification

   Page numbers were added to the bottom left in the PDF version because the document had to be split for electronic submittal due to email file size limitations. This additional PDF page numbering was to assist recipients in recombining the document in the correct order. Future reports will list additional page numbering as "PDF Page ## of ##" for clarity. No changes to the June 2024 Data Report are proposed.

   Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

USEPA SPECIFIC COMMENTS

1. **Section 5.1.2, Water Level Observations, Pages 9 and 10 of 72:** Given that 63 inches of rainfall represents nearly 50 percent more rainfall in 2023 than the average rainfall at the Savanah River Site, it is unclear if the observed increase in water levels in 2023 was due to the increased rainfall, to the injections, or to both. An analysis of the impact of the observed precipitation based on infiltration rates and evapotranspiration was not presented in the TSDR, so the impact of the increased precipitation on water levels is unclear. Please revise the TSDR to include an analysis of the impact of the increased precipitation on measured water levels.

   Response: Agree/Clarification

   The observed increase in water levels in 2023 was due to increased rainfall. The precipitation values in the years 2022 and 2023 were similar to those in the years 2012 and 2013. Precipitation was 60.6 inches in the year 2013, up from 41.8 inches in the year 2012. Similar conditions existed in the year 2022 and 2023 when rainfall totals went from 42.7 inches to 62.9 inches. It can be seen in the hydrographs in Appendix B that the water level increases between 2022 and 2023 are similar to those between 2012 and 2013. The effects of the injections can most readily be seen in the significant increase between 2021 and 2022, especially for wells close to the injection area (DCB087A and DCB 8). Future reports will provide more detailed descriptions of water level observations, as appropriate. No changes to the June 2024 Data Report are proposed.

   Contact: Rohit Goswami (803)989-5383 rohit.goswami@srs.gov

2. **Section 5.2, CaCO3 Reactive Structures, Page 13 of 72 and Figure 20, CaCO3 Reactive Structure Surface Water pH Results:** Figure 20 indicates that the pH at all three stations increased in December 2023, and it is unclear if this change is related to breaching and the removal of the calcium carbonate (CaCO3) reactive structures. The text does not state when in December 2023 the structures were removed or whether the pH measurements were made before, during, or after the

structures were breached and removed. Please revise the text to discuss whether the increase in the measured pH at all three stations in December 2023 was related to the removal of the CaCO3 reactive structures and whether these measurements were taken before, during, or when the structures were breached and removed.

Response: Agree/Clarification

The pH increases seen in December 2023 (specifically measured on Dec 12, 2023) were a result of the reactive structures being breached the day before on Dec 11, 2023. The breaching significantly agitated and released carbonate material which increased the pH of the surface water, especially downstream at station DSWM-9. Future reports will identify the dates of changes to the reactive structures. No changes to the June 2024 Data Report are proposed.

Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

3. **Section 5.2, CaCO3 Reactive Structures, Page 14 of 72:** The text discusses the relationship between metals and pH but does not discuss whether there is an observable trend in the relationship between sulfate and pH, as depicted on Figure 23, Surface Water Concentrations of pH and Beryllium, Aluminum, and Sulfate at DSWM-8, DSWM-8A, and DSWM-9. The text should be revised to discuss whether low pH correlates with lower sulfate concentrations, particularly at downgradient location DSWM-9. Please revise the text to discuss how pH and sulfate concentrations are related.

   Response: Agree

   The last sentence in section 5.2 CaCO3 Reactive Structures on page 14 should read, "The increases in pH generally cause decreases in surface water metal and sulfate concentrations." This correction will be made in future reports, as appropriate. No changes to the June 2024 Data Report are proposed.

   Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

4. **Figure 2, D-Area Groundwater 2Q2023 pH and Beryllium Plume, Page 27 of 72:** An acid groundwater plume should be drawn around DWP 8 where the pH was measured at 3.8. In addition, data for this location and the other wetland monitoring wells are not included in Table A-1, D-Area Groundwater Treatability Study Data Table (2023). Please revise Figure 2 to include an acid groundwater plume surrounding DWP 8 and revise Table A-1 to include the missing data from the wetland monitoring wells.

   Response: Agree/Clarification

   Future report figures will depict a low-pH plume drawn around wetland well DWP 8 as appropriate.

   Table A-1 includes the groundwater and surface water stations that are monitored as part of the D-Area Treatability Study. Wetland well DWP 8 is monitored under the DAG OU and is therefore not included in Table A-1. Plume maps, including Figure 2, are developed using data

collected in 2Q from both the DAG Treatability Study sampling event and the DAG OU sampling event to provide overall D Area plume coverages.

No changes to the June 2024 Data Report are proposed.

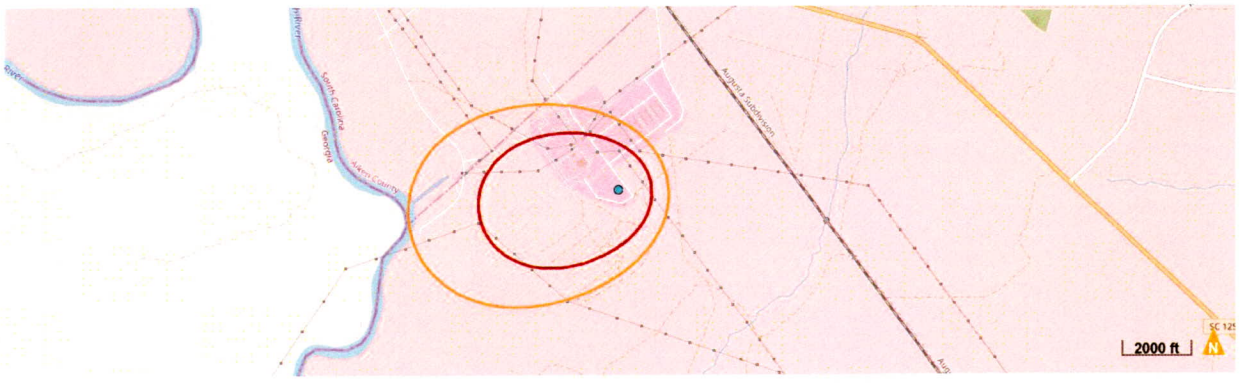
Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

5. **Appendix D, DAG OU Treatability Study Injection Reevaluation, Section 2.0, Analytical Transport Modeling of Injected Water at the DAG OU, Pages D-6 and D-7 of D-12:** A number of assumptions were made for the transport modeling, but a sensitivity analysis was not conducted, so the extent to which the assumptions would impact the model results is unclear. For example, the aquifer hydraulic conductivity (K) was estimated as 20 feet per day (ft/day), even though slug testing indicated the maximum K is 15 ft/day. A sensitivity analysis should be conducted to evaluate the extent to which various parameters would impact the model; this should include, but not be limited to K, dispersion, and the injection flow rate. Please conduct a sensitivity analysis for the transport modeling and revise the TSDR to present the results.

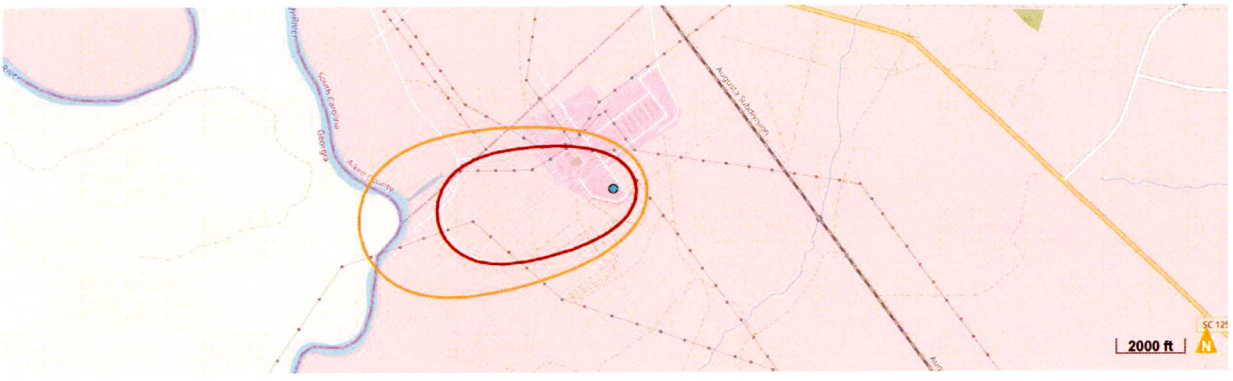
   Response: Agree/Clarification

   Some parameter values used to estimate the impact on model results were changed to be more representative of the site conditions. The injection flow rate was assumed to be constant throughout time. However, changes in the aquifer hydraulic conductivity does impact the estimated extent of the injected water over time. . Presented below are results from two scenarios where horizontal hydraulic conductivity (K_h) values were changed to 10 ft/d and 15 ft/d respectively. The red polygon shows the extent of the injectate without considering dispersion while the orange polygon shows the extent of the mixing zone (dispersion considered). Therefore, impact of dispersion are built into the model results as viewed.

   K_h= 10 ft/d –

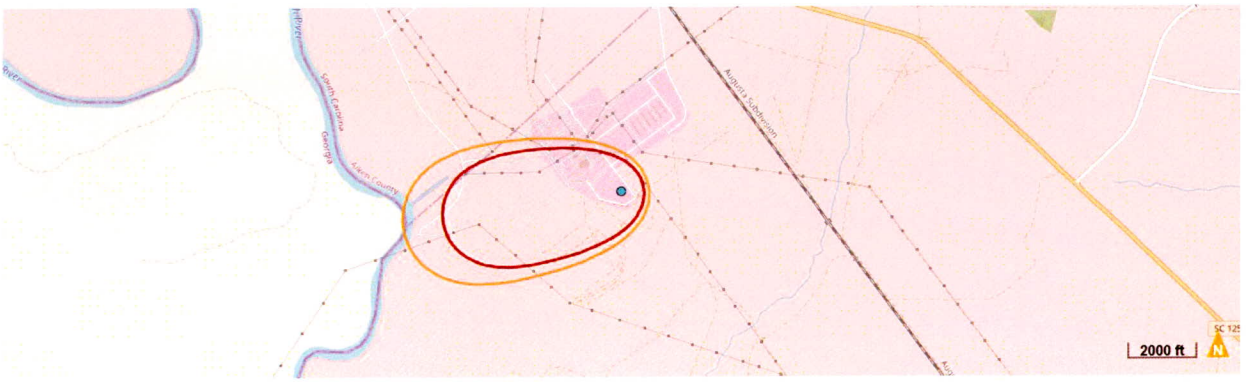


K_h=15 ft/d –

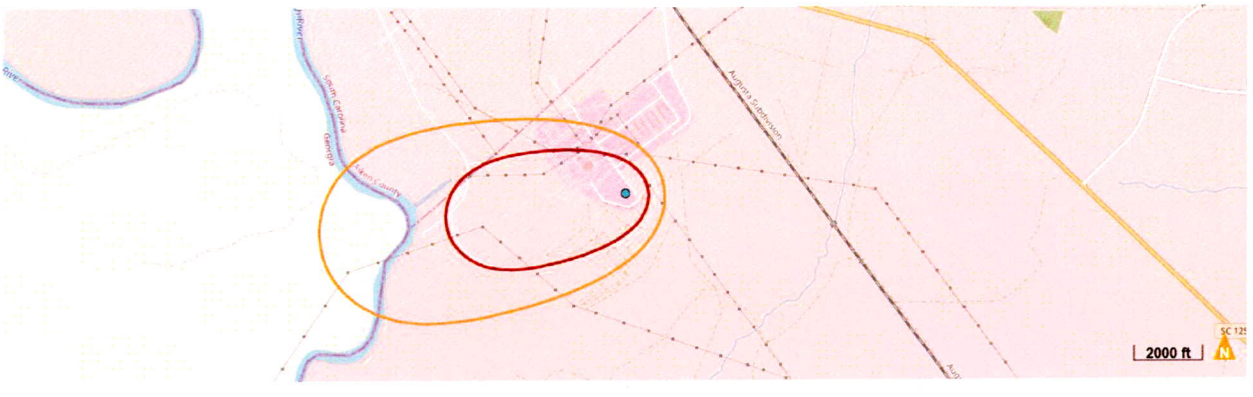


Changing the dispersion values will increase or decrease the extent of the orange polygon (no change in the red polygon) corresponding to increase or decrease dispersivity values. This is shown below by changing the dispersivity value to 500 ft and 50 ft respectively from a base value of 200 ft.

dispersivity = 50 ft –



dispersivity = 500 ft –



SRS Responses to United States Environmental Protection Agency Comments on the Treatability Study Data Report for Groundwater Injection and Discharge Canal Neutralization at the D-Area Groundwater Operable Unit (OU) (U) – 2023 Data and Information, SEMS Number: 63 (SRNS-TR-2024-00261, Revision 0, June 2024)

Comments received October 1, 2024
Page 7 of 7

A full sensitivity analysis is beyond the scope of this Treatability Study Data Report. However, a quantitative groundwater model is being conducted for the D-Area Groundwater operable unit that will support the future remedial investigation report. No changes to the June 2024 Data Report are proposed.

Contact: Rohit Goswami (803)989-5383 rohit.goswami@srs.gov