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May 28, 2021

Ms. Nancy McDuffie
New Mexico Environment Department
Ground Water Quality Bureau
121 Tijeras Avenue NE
Albuquerque, New Mexico 87102

Dear Ms. McDuffie:

On behalf of Doña Ana Dairies, Inc., EA Engineering, Science, and Technology, Inc., PBC is submitting this Annual Groundwater Monitoring Report for Doña Ana Dairies located in Mesquite, Vado, and Anthony, New Mexico. The report discusses the annual groundwater sampling event conducted to fulfill requirements of the Stage 2 Abatement Plan for Doña Ana Dairies.

Please let me know if you have any questions regarding the information provided in this report.

Sincerely,

Gina Mullen
Project Manager

Jay Snyder
Senior Hydrogeologist

Enclosure

Cc: Linda Armstrong, Doña Ana Dairies
File

ANNUAL GROUNDWATER MONITORING REPORT DOÑA ANA DAIRIES MESQUITE, NEW MEXICO

Prepared for:

Doña Ana Dairies
Mesquite, New Mexico

Prepared by:

EA Engineering, Science,
and Technology, Inc., PBC
320 Gold Avenue SW, Suite 1300
Albuquerque, New Mexico 87102

May 2021

EA Project No. 1464107.05

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Project Manager

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1.0 INTRODUCTION

On behalf of Doña Ana Dairies (Dairies), EA Engineering, Science, and Technology, Inc., PBC (EA) has prepared this Quarterly Monitoring Report for Doña Ana Dairies located south of Las Cruces, New Mexico (Figure 1). The report was completed in accordance with the *Stage 2 Abatement Plan* and the *Sampling and Analysis Plan, Doña Ana Dairies, Doña Ana County, New Mexico* dated November 7, 2013 and August 11, 2008, respectively, and the Conceptual Work Plan (CWP) dated February 1, 2008. All were prepared to satisfy requirements stated in the New Mexico Administrative Code (NMAC), Title 20, Chapter 6, Part 2, Sections 4106 through 4110 (20.6.2.4106 – 20.6.2.4110 NMAC). The Sampling and Analysis Plan was approved by the New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) on September 25, 2008. On March 25, 2015, the stipulated agreement to additional requirements to the Dona Ana Dairies Stage 2 Abatement Plan was agreed upon by NMED, Dona Ana Dairies, and the Rio Valle Concerned Citizens. On April 10, 2015, the Stage 2 Abatement Plan was approved by NMED by Final Order. Document references are provided in Section 10.0.

1.1 Objective

The objective of this monitoring program is to satisfy the requirements set forth in the Stage 2 Abatement Plan and the Stipulated Agreement and to satisfy the requirements set forth in 20.6.2.4110 NMAC.

The following work was performed to meet the objective of the monitoring program:

- Representatives from D&H Petroleum and Environmental Services, Inc. (D&H) gauged discharge plan (DP) monitoring wells, abatement plan (AP) monitoring wells, and Anthony Waste Water Treatment Plant (WWTP) wells from February 10 through February 12, 2021. Glorieta Geoscience, Inc. (Glorieta) gauged Organ Dairy wells on February 9, 2021.

- From February 15 through March 17, 2021, D&H representatives collected groundwater samples from all AP, DP, and irrigation/supply wells that contained sufficient water. Glorieta sampled Organ Dairy wells on February 9, 2021; irrigation well LRG-458 S will be sampled next quarter. Samples were analyzed for nitrate, chloride, total dissolved solids (TDS), and total Kjeldhal nitrogen (TKN). Field parameters including specific conductance, pH, temperature, oxidation reduction potential (ORP), and dissolved oxygen were monitored and recorded on field forms during sampling.

- Updated analyte trend analysis for the southern portion of DAD. Trend analyses for the northern and central areas were presented in the Five-Year Evaluation (EA 2020).

- Analyzed first order decay rate for nitrate at wells with decreasing nitrate concentrations in the southern portion of DAD. First order decay rates for the northern and central areas were presented in the Five-Year Evaluation (EA 2020).

- Performed geostatistical analysis of analytes for the northern, central, and southern portions of DAD.

1.2 Background

In correspondence dated April 7, 2006, NMED required a Stage 1 Abatement Plan for 13 dairies (Organ Dairy [Former Daybreak and Del Norte Dairy], Mountain View Dairy, Buena Vista I Dairy, Bright Star Dairy, Dominguez 2 (Former D&J Dairy], Dominguez Dairy, Gonzales Dairy, Buena Vista Dairy II, River Valley Dairy, Big Sky Dairy, Sunset Dairy, Desert Land Dairy, and Del Oro Dairy) in Doña Ana County, based on analytical results from DP monitoring of on-site compliance monitoring wells that showed concentrations of nitrate, chloride and TDS exceeding ground water standards promulgated in New Mexico Water Quality Control Commission (NMWQCC) Regulations (20.6.2.3103 NMAC). On October 30, 2006, the Dairies notified NMED that they had reached an agreement to work as a group and submit a joint response to NMED's request (Doña Ana Dairies 2006). Currently the Dona Ana Dairies consortium consisted of 9 dairies with the departure from the group by Buena Vista I Dairy in 2011, River Valley Dairy in April 2019, and Gonzalez Dairy in October 2020.

The Dairies are broken into the northern area, central area and southern area. The northern portion of the dairies currently consists of Organ Dairy, Mountain View Dairy, Bright Star Dairy, Dominguez 2 Dairy, and Dominguez Dairy. The northern land application is also included in the northern portion of DAD. Buena Vista Dairy and Gonzalez Dairy, though no longer members of the consortium, are located within the northern area. The central area consists of Buena Vista Dairy II, Big Sky Dairy, and Sunset/Desert Land Dairy. Though no longer a member of the consortium, River Valley Dairy is also located in the central area. The southern area includes only Del Oro Dairy.

On December 11, 2006, on behalf of the Doña Ana Dairies, Golder Associates (Golder) submitted a Stage 1 and 2 Abatement Plan Proposal to address impacts to groundwater in the area of the Dairies (Golder 2006). The first major deliverable in the Abatement Plan Proposal was an Existing Data Report (EDR) to bring together in one document historical data and practices of the constituent dairies.

The EDR, submitted on February 1, 2008 (Golder 2008a), was intended to satisfy the Dairies' commitment for compilation and submission of existing data identified in the Doña Ana Dairies response (2006) to the NMED requirement for Stage I Abatement Plans. Section 9 of the EDR outlined data gaps identified during the preparation of the report, as well as the actions recommended. To facilitate the discussion of the path forward after the submittal of the EDR and concurrent with the EDR submission, a conceptual work plan (CWP) was prepared. (Golder 2008b).

On July 15, 2008, the Dairies, Golder and NMED met (Golder 2008c). During that meeting, plume maps presented in the EDR (Golder 2008a), new monitoring data, and knowledge of well locations and groundwater chemistry results at adjacent DP-regulated facilities were used to

identify data gaps with respect to ground water flow direction and plume delineation. The agreed upon data gaps yielded well locations (including contingency locations) recorded in the meeting minutes (Golder 2008c) and depicted in the Sampling and Analysis Plan (SAP) dated August 8, 2008 (Golder 2008d). The SAP outlined the details of the field operations to be implemented for completion of data gaps, such that a Site Investigation Report (§4106.C.6) and Stage 2 Abatement Plan (§4106.D) could be prepared.

Groundwater gauging was conducted concurrent to discussions with NMED at the Dairies for four quarters, February 2008, June 2008, September 2008, and December 2008, to determine the current and historical site groundwater gradient.

In May 2009, field work was conducted as outlined in the SAP and ten (10) AP monitoring wells (DAD-01 through DAD-10) were installed. In July 2009, the Site Investigation Report was submitted to the NMED.

On February 9, 2012, the Final Site Investigation Report was submitted to NMED. The report summarized field activities that occurred from October 10 through October 14, 2011, and November 10 through 18, 2011, during which eleven soil borings were advanced at the site and converted into monitoring wells DAD-12 through DAD-14, DAD-16 through DAD-22, and DP well 177-03A.

On August 16, 2012, soil boring/monitoring well DAD-15 was installed and on August 20, 2012, well DAD-15 was sampled. An addendum to the Final Site Investigation Report was submitted to NMED on September 7, 2012, which summarized DAD-15 field activities.

A Stage 2 Abatement Plan was submitted to NMED on March 13, 2013. Based on an NMED response in August 2013, a Revision to the Stage 2 Abatement Plan was submitted on November 7, 2013.

On March 25, 2015, the stipulated agreement to additional requirements to the Dona Ana Dairies Stage 2 Abatement Plan was agreed to by NMED, Dona Ana Dairies, and the Rio Valle Concerned Citizens. On April 10, 2015 the Stage 2 Abatement Plan with the stipulated agreement was approved by NMED by Final Order.

EA began implementation of the Stage 2 Abatement Plan and stipulated agreement as directed by the Final Order in December 2015. In order to meet objectives, four monitoring wells were installed (DAD-23 through DAD-26) and Del Oro Dairy discharge plan (DP) well 692-01 was plugged and abandoned. Details on implementation of these tasks are included *Stage 2 Implementation and Quarterly Groundwater Monitoring Report,* July 2016.

In accordance with the approved Stage 2 Abatement Plan and stipulated agreement, a baseline compound specific isotope analysis (CSIA) for nitrogen 14 and nitrogen 15 ($^{15}N/^{14}N$ [$\delta^{15}N$]) and total organic carbon (TOC) was completed for 16 wells in spring of 2016. Additionally, existing conditions concentrations were recalculated for the contaminants of concern. Results of these analyses are presented in the *Stage 2 Implementation and Quarterly Groundwater Monitoring Report,* July 2016. A five-year review containing results of repeated CSIA sampling and

recalculated existing conditions concentrations was submitted to NMED in December 2020 (EA 2020).

Contaminant concentration trend analysis as well as geospatial analysis to evaluate changes in plume behavior are required on an annual basis and are provided in this report. Trend analysis for the southern area is provided in this report; trend analysis for northern and central areas were presented in the Five-Year GloEvaluation (EA 2020). Also presented in this report are the geospatial analysis (northern, central, and southern areas), results of the annual sampling of irrigation and supply wells, and concentration trends of analytes in AP and DP wells.

A Stage 2 Abatement Plan Modification proposal was submitted to NMED on August 10, 2018 to address plume instability in the perched aquifer nitrate plume at Del Oro Dairy. Following discussions with NMED, a revised Stage 2 Abatement Plan Modification proposal was submitted on May 1, 2019. A public meeting to discuss the plan was held in Anthony, New Mexico on May 17, 2019. The Stage 2 Abatement Plan Modification proposal was revised based on additional input from NMED and the public and submitted on July 26, 2019. Public notice for the proposal was initiated on October 23, 2019 and closed on December 31, 2019. An addendum to the Stage 2 Abatement Plan Modification proposal was submitted on July 13, 2020.

2.0 GROUNDWATER MONITORING ACTIVITIES

Groundwater monitoring activities included gauging DP and AP monitoring wells, irrigation and water supply wells, and Anthony Waste Water Treatment Plant monitoring wells. Groundwater gauging and sampling was conducted for Organ Dairy by Glorieta; gauging and sampling for all other wells was conducted by D&H. Groundwater samples were analyzed for nitrate, chloride, TDS, and TKN. The resulting data from this groundwater monitoring event are compiled and presented herein.

2.1 Well Gauging

From February 10 through February 12, 2021, representatives from D&H gauged DP monitoring wells, AP monitoring wells, and Anthony WWTP wells with an electronic water level indicator. Organ Dairy wells were gauged by Glorieta on February 9, 2021. Table 1 provides a summary of the groundwater gauging data collected from the monitoring network. Data obtained during gauging are shown on potentiometric surface maps included as Figures 2, 3, 4, and 5. Well gauging field forms are available in Appendix A.

2.2 AP and DP Well Groundwater Sampling

D&H sampled all AP monitoring wells with sufficient water from March 1 through March 8, 2021. AP well DAD-06 was dry and, thus, was not sampled; well DAD-06 has been dry since September 2013. The Stage 2 Abatement Plan proposal discusses plans for a drilling company to attempt to remove silt at the bottom of the well through redevelopment. Redevelopment will occur when the plan is approved. Groundwater sampling from AP wells was accomplished with

new, disposable bailers. Three well casing volumes were purged unless the well contained insufficient water.

D&H sampled DP wells from February 15 through March 11, 2021. Glorieta sampled Organ Dairy DP wells on February 9, 2021. Due to a lower water table, several DP wells were dry or contained insufficient water for sampling. Prior to sampling, the DP wells were purged of three well casing volumes, if practicable, by either (1) hand-bailing with new, disposable bailers and twine, (2) pumping with a submersible pump and new polyethylene tubing, or (3) pumping with a dedicated pump and new polyethylene tubing.

The wells were sampled from historically clean to dirty to the extent possible to minimize cross-contamination potential. All non-dedicated or disposable equipment was decontaminated between wells with an Alconox™ solution to further ensure sample quality. All meters were calibrated and/or checked with standards in accordance with the manufacturer's specifications prior to daily use. Purge water was ground discharged.

When sufficient water was available, field parameters including specific conductance, temperature, pH, and ORP were monitored using a Myron L Ultrameter II and recorded on field forms. Dissolved oxygen was measured using a YSI 556 MPS. Dissolved oxygen and ORP were only measured in the first set of readings. Field parameters from August 2015 to present are presented in Table 2. The sampling field forms are presented in Appendix A.

All groundwater samples were collected immediately after purging. Sampling was accomplished by carefully pouring groundwater from the bailer into the sample containers or by pumping groundwater through new polyethylene tubing into the sample container. Sample containers were provided by Hall Environmental Analysis Laboratory, Inc. (Hall). Container size, type, sample preservatives, analytical methods, and holding times are specified in Table 3. All samples were preserved in accordance with method requirements, labeled, then immediately cooled to <6°C with ice and delivered under chain-of-custody to Hall in Albuquerque, New Mexico. All analytical laboratory reports are provided in Appendix B.

2.3 Irrigation/Supply Well Groundwater Sampling

Twelve irrigation/supply locations were sampled March 16 through March 17, 2021. Samples were analyzed for nitrate, chloride, TDS, and TKN. Irrigation/supply wells were sampled by collecting a grab aliquot from a faucet or tank located nearest to the pump outlet. Tap samples were collected while the pumps were running; as a result no purging was completed. Organ Dairy well LRG-458 S was not sampled this quarter but will be sampled in May 2021.

Two samples were collected from irrigation wells. One is located at the Mountain View Land Application Area (LRG-457) and one at the Dominguez Dairy pecan orchard (LRG-00590-S-6). The irrigation well LRG-314495-POD1 adjacent to AP well DAD-08 was not sampled since it has not been operational for several years.

Ten of the samples are from dairy supply wells located near their respective milking parlors. The supply wells at Mountain View Dairy, Bright Star Dairy, Dominguez Dairy, Dominguez

Dairy 2, Buena Vista Dairy II, Big Sky, Sunset Dairy, and Del Oro Dairy were sampled from their holding tanks using new disposable bailers, from taps located on the tank, or from valves located on lines going into the tank. At Del Oro Dairy three supply wells pumped water into the holding tank; therefore, the groundwater sample collected was a composite sample.

3.0 GROUNDWATER MONITORING RESULTS

3.1 Hydraulic Gradient and Direction of Groundwater Flow

This quarter, groundwater was present beneath the site at depths ranging from 11.58 feet below top-of-casing (ft btoc) in Sunset well 257-03 to 132.50 ft btoc in Dominguez 2 DP well 42-12. Groundwater was encountered at shallower depths near the Mesquite Drain and at greater depths near I-10 where the topographic elevation increases.

AP monitoring well DAD-25 may have been completed in a perched aquifer, as groundwater elevations have consistently measured several feet higher than groundwater elevations in surrounding wells. As a result, this groundwater elevation has not been used in contouring for the central area potentiometric surface map.

Potentiometric surface maps were completed using the monitoring well gauging data for the northern, central, and southern portions (perched and regional aquifers) of the Dairies. Groundwater elevation data are provided in Table 1 and potentiometric surface maps are provided as Figures 2, 3, 4, and 5. Hydrographs were completed for select monitoring wells in each area and are provided in Appendix C. In comparison to November 2020 gauging, groundwater levels increased by an average of approximately 0.2 foot in the northern area and central area. In the southern area, average groundwater levels increased by approximately 0.4 foot in the regional aquifer while average groundwater levels in the perched aquifer were essentially stable with a decrease in groundwater elevation of approximately 0.1 foot.

At the time the Stage 2 Abatement Plan was written in 2013, groundwater flow direction in the northern portion was to the east-southeast. Over time, the groundwater flow direction has shifted. During the most recent gauging event, groundwater flow direction at the north and south ends of the northern area were still to the east-southeast, but groundwater in the center of the northern area was flowing to the east. The groundwater flow direction in the central and southern areas remains unchanged from 2013. In the central area, groundwater flow direction was generally to the southeast. Flow in the southern area regional aquifer was to the southeast and flow in the southern perched aquifer was to the south-southwest.

The hydraulic gradient across the Dairies in the regional aquifer was approximately 0.001 ft/ft and the hydraulic gradient in the perched aquifer in the southern area was approximately 0.007 ft/ft.

3.2 Groundwater Field Parameters

Field parameters from the most recent monitoring event including specific conductance, pH, temperature, ORP, and dissolved oxygen were recorded on the sampling field forms

(Appendix A) and are summarized in Table 2. Specific conductance, dissolved oxygen, and ORP trends for select wells are presented in Appendix D. Though dissolved oxygen and ORP measurements from wells containing a dedicated pump were recorded, these measurements are not considered representative of aquifer conditions.

3.3 Groundwater Nitrate, Chloride, and TDS Analytical Results

3.3.1 Abatement Plan Well Results

Groundwater analyte concentrations were below the 10 milligram per liter (mg/L) NMWQCC standard for nitrate as nitrogen in 11 of the 25 AP monitoring wells sampled. The remaining 14 AP wells had nitrate concentrations at or above the standard: DAD-01, DAD-07, DAD-08, DAD-09, DAD-11 (vertical delineation), DAD-12 (vertical delineation), DAD-13, DAD-14, DAD-15, DAD-19 (vertical delineation), DAD-20, DAD-21, DAD-22, and DAD-23.

Nitrate concentrations decreased or remained the same in AP wells DAD-03, DAD-04, DAD-05, DAD-07, DAD-10, DAD-11 (vertical delineation), DAD-12 (vertical delineation), DAD-13, DAD-14, DAD-16, DAD-18 (vertical delineation), DAD-19 (vertical delineation), DAD-21, DAD-23, and DAD-26 compared to the December 2020 sampling event. During this sampling event, nitrate concentrations in the AP wells ranged from 110 mg/L in well DAD-21 located at Del Oro Dairy to <1.0 mg/L (the laboratory reporting limit [RL]) in wells DAD-03, DAD-05, and DAD-16.

Both chloride and TDS concentrations exceeded their respective NMWQCC standard in all AP wells sampled, with the exception of well DAD-17 located at the southern end of the central area. In well DAD-17, chloride was below the 250 mg/L standard with a concentration of 96 mg/L and TDS was below the standard of 1,000 mg/L at a concentration of 634 mg/L. The highest chloride and TDS concentrations in the AP wells were obtained from well DAD-08 located in the central area, where respective concentrations were 1,800 mg/L and 4,880 mg/L.

Table 4 and Figures 6 through 9 present the analytical results for AP monitoring wells. Analytical laboratory reports are provided in Appendix B. Nitrate, chloride, and TDS concentration trends for select AP wells are presented by area in Appendix E.

3.3.2 Abatement Plan and Discharge Permit Well Results by Area

DP groundwater analytical results are presented in Table 5. Nitrate, chloride, and TDS concentration trends for the DP wells by area are presented in Appendix F. Analytical data for all sampled DP wells are also presented in Figures 6 through 9. Analytical laboratory reports are included in Appendix B. Discussions of upgradient/downgradient conditions reflect current groundwater flow directions discussed in section 3.1. The following discussions summarize the results by area at the Dairies.

Northern Portion

Northern Application Area upgradient well 86/340-01 (located to the north) has been below the

nitrate standard since February 2018; between April 2011 and November 2017, concentrations in this well were consistently above the nitrate standard. The Northern Land Application Area well 70/86/340-01 was below the nitrate standard for the first time since 2015 with a concentration of 9.8 mg/L. The nitrate concentration in downgradient AP well DAD-02 (located to the south) has been below the NMWQCC standard of 10 mg/L since March 2019. Downgradient Dominguez 2 wells 42-10, 42-11, and 42-12 (located to the east) also remain below the nitrate standard, with a maximum detection of 2.1 mg/L in well 42-10. Downgradient AP wells DAD-01 and DAD-13 (located to the east), had detections of nitrate above the standard at concentrations of 18 mg/L and 15 mg/L, respectively. The highest nitrate concentration in the northern portion was observed in Dominguez Dairy 2 well 42-06 with a concentration of 230 mg/L.

Chloride concentrations were at or above the 250 mg/L standard in wells sampled within the northern portion of the Dairies with the exceptions of Northern Land Application Area well 86/340-01 (240 mg/L) and AP well DAD-02 (240 mg/L). Well 86/340-01 is furthest northern well and DAD-02 is furthest southern well within the northern area. TDS concentrations were above the 1,000 mg/L standard in all wells sampled within the northern portion of the Dairies. The highest concentrations of chloride and TDS were observed at Northern Land Application area well 70-03 with concentrations of 1,700 mg/L and 4,600 mg/L, respectively.

Central Portion

The highest nitrate concentration in the central portion was 62 mg/L, observed in Big Sky Dairy well 833-07. The upgradient extent of the central portion nitrate plume is defined by Buena Vista Dairy II well 74-03, where nitrate was not detected above the laboratory RL. Former McAnally Enterprises well MW-4 and AP well DAD-17 define the downgradient extent of the plume with nitrate concentrations of 1.5 mg/L and 1.3 mg/L, respectively. Historically, the eastern cross-gradient extent of the plume was defined by AP wells DAD-07 and DAD-15. For this sampling event, the nitrate concentrations in AP wells DAD-07 and DAD-15 were 17 mg/L and 18 mg/L, respectively. The western extent is defined by AP wells DAD-04 and DAD-16; nitrate concentrations remain below standards in these wells.

Chloride and TDS concentrations were above standards in wells within the central portion of the Dairies with the exception of AP well DAD-17, where chloride and TDS concentrations were 96 mg/L and 634 mg/L, respectively. The highest chloride concentration was observed at AP well DAD-08 at 1,800 mg/L. AP well DAD-08 is located east of Sunset Dairy, adjacent to an irrigation well that is no longer in use. Concentrations of chloride have been decreasing since 2013/2014. The highest TDS concentration was observed at Buena Vista Dairy well 74-02 at a concentration of 9,470 mg/L.

Southern Portion – Regional and Perched Aquifers

Wells completed in the regional aquifer in the southern portion of the dairies include AP well DAD-10 and Del Oro Dairy wells 692-05 through 692-09 (Figure 8). All of the sampled wells in the regional aquifer were below the NMWQCC standard for nitrate except for Del Oro well 692-05, which had a concentration of 17 mg/L. Chloride concentrations were above the NMWQCC standard and ranged from 390 mg/L in Del Oro wells 692-06 and 692-09 to 540

mg/L in Del Oro Dairy well 692-07. TDS concentrations were above the NMWQCC standard and ranged from 1,350 mg/L in Del Oro Dairy well 692-08 to 1,640 mg/L in Del Oro Dairy well 692-07.

Perched aquifer wells in the southern portion of DAD that are sampled include wells 692-02, 629-04, DAD-09, DAD-20, DAD-21, DAD-22, and DAD-26 (Figure 9). A suspected water line leak may be impacting these wells.

Nitrate was above the standard in all sampled monitoring wells in the perched aquifer with the exception of Del Oro Dairy well 692-02; the nitrate concentration in this well has remained below the standard since May 2019. The maximum nitrate concentration of 110 mg/L was observed in AP well DAD-21. Chloride concentrations ranged from 270 mg/L in Del Oro Dairy well 692-02 to 980 mg/L in AP well DAD-21. TDS in the perched aquifer ranged from below the standard in Del Oro Dairy well 692-02 (877 mg/L) to above the standard in AP well DAD-21 (3,440 mg/L).

3.3.3 Irrigation/Supply Well Results

Groundwater analytical results for the sampled irrigation/supply wells are presented in Table 6. Analytical results are included in Figures 6, 7, and 8. Analytical laboratory reports are provided in Appendix B.

Nitrate concentrations were above the NMWQCC standard for nitrate in 2 of the 12 irrigation/supply well sample locations. Irrigation/supply wells LRG-00953 (Bright Star Dairy) and LRG-00591-S (Dominguez Dairy) both had nitrate concentrations above the standard with concentrations of 14 mg/L and 27 mg/L, respectively, and are located in the northern area.

All irrigation/supply wells were above the NMWQCC standard for chloride and TDS. Chloride concentrations ranged from 350 mg/L at Sunset/Desert Land Dairy well LRG-3348-B to 1,200 mg/L at Dominguez Dairy well LRG-00591-S. TDS concentrations ranged from 1,290 mg/L at Del Oro Dairy well LRG-5820/LRG-5820-S/LRG-5820-S-2 to 3,430 mg/L at Dominguez Dairy well LRG-00591-S. Both chloride and TDS concentration ranges are generally similar to the concentrations observed in discharge plan and abatement plan monitoring wells, further indicating that chloride and TDS concentrations observed are above standards regionally.

4.0 TREND ANALYSIS

Trend analysis can indicate whether concentrations of constituents such as nitrate, chloride and TDS are stable, increasing or decreasing at a particular well (Gilbert 1987). Analytical data collected from AP and DP wells were analyzed using the Mann-Kendall test. The analysis for the northern and central areas is presented in the Five-Year Evaluation and Quarterly Monitoring Report (EA 2020). Analysis for the southern portion is presented in this report. The trend analysis is based on analytical data collected from November/December 2015 through the current quarter. Concentration trend graphs for nitrate, chloride, and TDS are found in

Appendices E and F. The statistical trend analysis is provided in Appendix G. Table 7 provides a summary of the trend analysis for the AP and DP wells.

Statistical trend analysis for the southern portion was completed on all wells within the regional and perched aquifers. Of the 13 wells analyzed in the southern portion of the Dairies, six had decreasing or stable concentrations of nitrate, chloride, and TDS.

Within the regional aquifer, stable or decreasing nitrate trends were observed in 692-07, 692-08, and DAD-10. Chloride trends were decreasing or stable in all regional wells. TDS concentrations were stable or decreasing in Del Oro well 692-06 and AP well DAD-10.

In the perched aquifer, statistical trend analysis indicated five of the seven wells had stable or decreasing trends for all analytes. Abatement wells DAD-20 and DAD-21 had increasing trends for nitrate and TDS; nitrate was above the standard in both wells. Chloride was stable in both of those wells.

5.0 FIRST ORDER DECAY RATE

First order nitrate decay rates were calculated for wells where nitrate was detected above the standard and nitrate concentrations were exhibiting decreasing trends according to the Mann-Kendall trend analysis. The 1st order decay rates for monitored natural attenuation were calculated using an excel spreadsheet developed by the Utah Leaking Underground Storage Tank program, and is based on EPA's Ground Water Issue paper EPA/540/S-02/500, "Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies," by Newell, Rifai, Wilson, Connor, Aziz and Suarez, November 2002. The analysis for the northern and central areas is presented in the Five-Year Evaluation and Quarterly Monitoring Report (EA 2020). Analysis for the southern portion is presented in this report. Decay rate spreadsheets are presented in Appendix H.

Decay rates were calculated for two southern area monitoring wells in the perched aquifer. The nitrate decay rate for AP wells DAD-22 and DAD-26 were calculated as 0.1557 years^{-1} to 0.3335 years^{-1}, respectively. The rate corresponds to an average estimated half-life of 3.3 years and an average estimated 4.7 years' cleanup time. Note that this well was likely impacted by a nearby municipal water line release and that calculated decay rates may not be predictive of future trends. A summary of the results of the decay rate analysis is presented in Table 8.

6.0 GEOSTATISTICS

A geostatistical analysis was completed to estimate analyte distribution and calculate contaminant plume area. Nitrate plumes were defined as areas where concentrations exceed the NMWQCC nitrate standard of 10 mg/L. As in the Five-Year Review (EA 2020), chloride and TDS plumes were defined as areas exceeding the 2016 calculated background concentration to provide a consistent baseline from initiation of abatement for comparison of year over year changes.

Interpolation by kriging was applied to nitrate, chloride, and TDS concentrations from the February/March 2021 sampling event unless otherwise noted. Buena Vista Dairy well 126-09 contained insufficient water for sampling and as a result, November 2020 data were used. Dominguez well 624-09 had nitrate, chloride, and TDS concentrations significantly higher than historical results and were not used in modeling. Additionally, vertical delineation models were excluded from the data set. In locations where plume edges were not defined by the model, isopleth lines were manually drawn using professional judgment. TDS in the southern portions of the regional aquifer was not modeled because concentrations were below regional background levels.

Table 9 provides the calculated areas of plumes in the north, central, and south portions for 2016 through 2021. Distributions of contaminants modeled from 2021 data are displayed in Figures 10 through 20. Note that the contaminant plume geometries were statistically modeled, and as a result, concentration intervals may be offset from measured concentrations at individual monitoring locations.

The following is a discussion of the trend analysis for each portion of the Dairy:

- Northern portion - The total size of the nitrate, chloride, and TDS plumes decreased by over 60% between 2016 and 2021. Though the overall size of the nitrate plume decreased substantially, the highest concentration portion of the plume expanded in the vicinity of Dominguez Dairy 2 well 42-06.

- Central portion - The nitrate and chloride plumes decreased in size relative to the 2016 baseline. The size of the TDS plume has increased between 2016 and 2021.

- Southern portion (perched aquifer) – Nitrate and chloride plumes increased in total size between 2016 and 2021; the TDS plume size has decreased since 2016. Because of the distribution of contamination and monitoring wells, the modeled plume geometries in the perched aquifer required manual interpretation for large areas and are therefore limited in their ability to offer accurate comparisons from year to year. Additionally, plume configuration and size may be impacted by a nearby municipal water line leak.

- Southern portion (regional aquifer) – The chloride and TDS plume sizes decreased or were stable between 2016 and 2021. TDS has not been detected above existing conditions. The nitrate plume size increased from 0.2 acres in 2016 to 22.3 acres in 2021.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The groundwater monitoring event included the gauging of all accessible DP and AP wells and sampling of 25 AP wells and the DP wells that were accessible and contained sufficient water to sample. Based on the data collected, the following conclusions and recommendations are presented:

- The depth to groundwater at the site ranged from 11.58 to 132.50 ft btoc.

- Generally, groundwater levels increased relative to last quarter in the northern, central and southern portions of the regional aquifer. Groundwater elevations were generally stable relative to last quarter in the southern perched aquifer.

- During the most recent groundwater monitoring event, groundwater flow direction at the north and south ends of the northern area were to the east-southeast; however, groundwater in the center of the northern area was flowing to the east.

- Flow in the central and southern area regional aquifer was to the southeast and flow in the southern perched aquifer was to the south-southwest.

- Hydraulic gradient in the regional aquifer was 0.001 ft/ft.

- The perched aquifer at Del Oro Dairy has a groundwater flow direction toward the southwest. The hydraulic gradient in the perched aquifer was approximately 0.007 ft/ft.

- Nitrate was below the NMWQCC standard of 10 mg/L in 11 of the 25 groundwater samples collected from the AP wells.

- Chloride was above the NMWQCC standard of 250 mg/L in all AP monitoring wells sampled, except for well DAD-17, which had a chloride concentration of 96 mg/L.

- TDS was above the NMWQCC standard of 1,000 mg/L in all monitoring wells sampled, except for well DAD-17, which had a TDS concentration of 634 mg/L.

- Chloride and TDS remain near or above NMWQCC standards in wells upgradient of the northern, central, and southern portions of the plume at the Dairies. Chloride and TDS are regionally elevated above standards and not necessarily attributed to the Dairies.

- Trend analysis indicates that 6 of the 13 wells analyzed in the southern portion had decreasing or stable trends for nitrate, chloride, and TDS.

- The nitrate decay rates for southern perched aquifer AP wells DAD-22 and DAD-26 were calculated as 0.1557 $years^{-1}$ and 0.3732 $years^{-1}$, respectively. The rate corresponds to an average estimated half-life of 3.3 years and an estimated 4.7 years' cleanup time. Note that this well was likely impacted by a nearby municipal water line release and that calculated decay rates may not be predictive of future trends.

- The total size of the northern area nitrate, chloride, and TDS plumes decreased by over 60% between 2016 and 2021.

- The central area nitrate and chloride plumes decreased in size relative to the 2016 baseline, while the size of the TDS plume increased.

- In the regional aquifer of the southern portion, chloride and TDS plumes decreased in size or were stable between 2016 and 2021; the size of the nitrate plume increased.

- In the perched aquifer of the southern portion, nitrate and chloride plume size increased and TDS plume size decreased between 2016 and 2021.

- The nitrate plume is no longer defined in the perched aquifer at Del Oro Dairy. A modified Abatement Plan proposal to address this has been submitted to NMED.

- When the Stage 2 Abatement Plan modification is approved, DAD-06 will be redeveloped to remove the silt that is in the bottom of the well so that groundwater can be collected for analysis.

- Elevated water levels and anomalous concentrations of nitrate, chloride, and TDS in the southern perched aquifer is likely the result of a municipal water line release.

Conclusions related to statistical trend analysis and decay rates for the northern and central areas are presented in the Five-Year Review (EA 2020).

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DECAY RATE CALCULATIONS