JULY 30, 2021

2020 ANNUAL PERFORMANCE MONITORING AND SITE-WIDE STATUS REPORT

REVISION 1.0

APACHE POWDER SUPERFUND SITE
COCHISE COUNTY, ARIZONA

PREPARED FOR:

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Prepared for
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Apache Powder Superfund Site Project Executive Abstract

Document Title: *2020 Annual Performance Monitoring and Site-Wide Status Report, Revision 1.0, Apache Powder Superfund Site, Cochise County, Arizona* **Submitting Party:** Apache Nitrogen Products, Inc. **Final Document:** _X_ Yes _ No	**Date of Document:** 7/30/2021 **Author of Document:** Hargis + Associates, Inc.
Priority Status: _X_ High	**Is this time critical:** ___X Yes __ No
Action Required from Receiving Agency: __ Information Only _X_ Review and Input __ Other / Explain:	**Type of Document:** __ Draft _X Report __ Letter __ Memo __ Other / Explain:
What does this information pertain to? _X_ Remedial Design, Remedial Action [RD/RA] _X_ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) _X_ Performance monitoring plans (PMPs) and Operation and Maintenance (O&M) plans __ Interim Measures __ Other / Explain:	**Is this a Regulatory Requirement?** _X_ Yes __ No **If no, why is the document needed?**
Requirement associated with Regulatory Vehicle ANPI is required to submit an Annual Report in compliance with Appendix 2 of the 1994 Unilateral Administrative Order (UAO) for Remedial Design, Remedial Action [RD/RA] and Other Response Actions, Docket 95-07.	**Other Justification/s:** __ Permit _X_ Other / Explain: NONE

Brief summary of attached document:

This revised report documents work performed during Calendar Year 2020 in fulfillment of the above-referenced Scope of Work for the CERCLA Record of Decision and associated amendment and Explanation of Significant Differences. The status of all identified media components is reported and recommendations for work moving forward are presented. This represents Revision 1.0 of the initial report submitted on March 31, 2021.

Recommendations:

Recommendations regarding changes in the performance monitoring strategy of the groundwater remedy are presented. Status of Institutional Controls are updated and the P-03 Decommissioning completion is summarized.

How is this information related to the Final Remedy or Regulatory Requirements?

This submittal is required for compliance under CERCLA with the UAO and pursuant to the USEPA approved PMP and O&M Plans.

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COCHISE COUNTY, ARIZONA

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ACRONYMS AND ABBREVIATIONS

3D	3-dimensional
AAC	Arizona Administrative Code
AAWQS	Arizona Aquifer Water Quality Standards
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADWR	Arizona Department of Water Resources
ADWSP	Alternate Domestic Water Supply Plan
AFCEE	U.S. Air Force Center for Engineering and the Environment
ammonia-N	ammonia as nitrogen
amsl	above mean sea level
ANA	aerobic nitrification area
ANPI	Apache Nitrogen Products, Inc.
BAS	BAS Groundwater Consulting
bls	below land surface
bmp	below measuring point
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
COCs	chemicals of concern
COD	chemical oxygen demand
COP	Community Outreach Plan
CSM	conceptual site model
CY	calendar year
DCP	design confirmation piezometer
DEUR	Declaration of Environmental Use Restriction
DNT	dinitrotoluene
DO	dissolved oxygen
EC	electrical conductivity
EFF-L	primary discharge location for NARS wetland
ESD	Explanation of Significant Differences

ACRONYMS AND ABBREVIATIONS (continued)

EPA	U.S. Environmental Protection Agency
ET	evapotranspiration
FDA	final denitrification area
ft/ft	feet per foot
FYR	five-year review report
GIS	geographic information system
gpm	gallons per minute
GWSI	Groundwater Site Inventory
H+A	Hargis + Associates, Inc.
HBGL	Health-Based Guidance Level
HGI	hydroGEOPHYSICS
ICs	institutional controls
ISM	incremental sampling methodology
Kd	soil adsorption coefficient
LCU	laterally confining unit
LR	linear regression
MCA	Molinos Creek Sub-Aquifer
MCL	Maximum Contaminant Level
mg/l	milligrams per liter
MK	Mann-Kendall
MNA	monitored natural attenuation
msl	mean sea level
NARS	Northern Area Remediation System
NG	nitroglycerin
nitrate-N	nitrate as nitrogen
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
O&M	operation and maintenance
ORP	oxidation-reduction potential
PDA	primary denitrification area

ACRONYMS AND ABBREVIATIONS (continued)

pH	hydrogen ion potential
PMP	Performance Monitoring Plan
PZ-A	Perched Zone A (in area of formerly-active evaporation ponds)
PZ-B	Perched Zone B (formerly referred to as MCA)
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI	remedial investigation
RPD	relative percent difference
RPM	Remedial Project Manager
ROD	Record of Decision
SCIPEE	Source Control Plan/Engineering Evaluation
SEW	shallow aquifer extraction well
the Site	Apache Powder Superfund Site located in Cochise County, Arizona
SRL	Arizona Soil Remediation Level (Title 18, Chapter 7)
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TNT	trinitrotoluene
TOC	total organic carbon
TSS	total suspended solids
µg/l	micrograms per liter
UAO	Unilateral Administrative Order
USGS	United States Geological Survey
VOC	volatile organic compound

2020 ANNUAL PERFORMANCE MONITORING AND SITE-WIDE STATUS REPORT
APACHE POWDER SUPERFUND SITE
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REVISION 1.0

1.0 INTRODUCTION

This revised document reports on the annual performance of ongoing groundwater remedial actions as well as the status of other media remedial components at the Apache Powder Superfund Site (the Site) in Cochise County, Arizona, as of the end of Calendar Year 2020 ([CY 2020] Figure 1). The Site remedial actions are being performed pursuant to a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) order under the oversight of the U.S. Environmental Protection Agency ([EPA], 1994b, 2009c). Performance monitoring of ongoing remedial actions is performed according to the respective performance monitoring plans (PMPs) and Operation and Maintenance (O&M) plans approved by the EPA (Hargis + Associates, Inc. [H+A], 2007a, 2007b, 2008b, 2009a, 2012b, 2021b).

The document is Revision 1.0 of the *2020 Annual Performance Monitoring and Site-Wide Status Report.* The initial report was submitted to the EPA on March 31, 2021 (H+A, 2021c). This document contains revisions incorporated based on comments provided by the EPA and ADEQ in letters dated June 3, 2021 and May 26, 2021, respectively (EPA, 2021c; ADEQ, 2021). Appendix I includes a Response to Comments (RTC) table that addresses the agencies comments and the corresponding corrections made to the text and tables as part of Revision 1.0.

1.1 SITE DESCRIPTION

The Site comprises an area of approximately nine square miles of mixed industrial and rural properties located in Cochise County, approximately seven miles southeast of the town of Benson, Arizona (Figure 1). The Apache Nitrogen Products, Inc. (ANPI) property comprises approximately 1,600 acres of land, located in a portion of Section 31, Township 17 South

(T.17 S.), Range 21 East (R.21 E.), a portion of Section 12, Township 18 South, Range 20 East and portions of Section 6, 7, and 8 in Township 18 South, Range 21 East (Figure 1).

Most of the upland areas of the Site can be described geomorphologically as “badlands terrain”. Badlands are characterized by a hummocky topography, dissected by fine ephemeral drainages. Softer sedimentary rocks and clay-rich soils have been extensively eroded by wind and water processes. In appearance, badlands are characterized by steep slopes, minimal vegetation, lack of a substantial regolith, and high drainage density (Parsons and Abrahams, 2009). Lowland areas found in the floodplain areas along the San Pedro River are riparian. Rural homesteads surround the ANPI property, some of which are farms and livestock properties, while others are primarily residential.

With the inclusion of recent property acquisitions, the new property boundary is displayed on Site maps within this report (Figure 1). The northern area nitrate as nitrogen (nitrate-N) plume within the shallow alluvial aquifer along the west side of the San Pedro River is now approximately 73 percent beneath the ANPI property boundary which includes railroad right-of-way. The total plume area is approximately 65 acres and approximately 47 acres is now within ANPI property. This represents a 10 percent increase since 2019, predominantly due to the reduction in the overall extent of the plume in the northwest region near SEW-01. ANPI has expanded its ownership of properties adjacent to the plant. The updated ANPI property boundary is displayed on Figure 1 (H+A, 2020i, & 2020g).

1.2 REPORTING

Remedy performance is evaluated by means of ongoing performance monitoring and operations and maintenance (O&M) programs. Weekly, monthly, quarterly, and annual reports are prepared and transmitted to the respective regulatory agencies. This annual report includes a summary of the data collected for the various active remedies, evaluation of data trends, discussion of performance and effectiveness of remedy, summary of the quality assurance/quality control of the sampling analysis activities, and recommendations for modifications to the monitoring schedule focusing on the CY 2020.

Performance monitoring plans have been prepared for the respective ongoing Site remedy components. These comprise four separate documents titled:

- *Southern Area Performance Monitoring Plan, Revision 2.0* [Southern Area PMP] (H+A, 2007b),
- *Soils Engineering Control Plan* [Soils O&M Plan] (H+A, 2008b) *Performance Monitoring Plan for Monitored Natural Attenuation of Shallow Aquifer Groundwater in the Northern Area of the Apache Superfund Site, Revision 1.0*, [Northern Area PMP] (H+A, 2009a), and
- *Operation and Maintenance Plan, Northern Area Remediation System, Revision No. 4.0* (H+A,2012b)

1.3 REMEDY COMPONENTS

The Site media (or remedy) components that are currently being monitored for remedy performance include the Southern Area Perched System Perched Zone A (PZ-A; area of formerly-active evaporation ponds 1A, 1B, 2A, 3A, 3B, Pond 7 and the Dynagel Pond), the Southern Area Perched System Perched Zone B (PZ-B; formerly referred to as the Molinos Creek Sub-Aquifer [MCA]), and the formerly-active evaporation ponds in the Southern Area of the Site. Media Component 8, Legacy Soils Area, was recently added by the Explanation of Significant Differences (ESD) #4 (EPA, 2017a). This component was added to address the cleanup of potential soil contamination that may be uncovered during the demolition of legacy structures and buildings from historical manufacturing processes. ANPI started its demolition project in 2012, which was completed by 2019 (H+A, 2019p). In the Northern Area shallow aquifer groundwater is also an ongoing component of the remedy. These media components are listed in Table 1.

Prior to 2016, remedial actions for the Southern Area media components included the perched groundwater both beneath the formerly-active evaporation pond areas and in the MCA and decommissioning of ANPI's formerly-active evaporation ponds. Suppling bottled drinking water to potentially affected properties that relied on shallow aquifer groundwater for domestic consumption was instituted in the early 1990s. Discharge from PZ-A to PZ-B ceased after all formerly-active evaporation ponds stopped receiving industrial wastewater discharges in 1995. The remedy for the Southern Area also included the institutional control (ICs) for the Site and monitored natural attenuation (MNA). These measures were implemented pursuant to the 2005 Amended Record of Decision (ROD) (EPA, 2005) (Figure 2). Subsequently, native soil covers were emplaced over the formerly-active evaporation Ponds in December 2007 (H+A, 2008a). A Declaration of Environmental Use Restriction (DEUR) for Property with Engineering Control and Non-Residential Restriction was recorded in Cochise County in 2008, according to an approved plan (Arizona Department of Environmental Quality [ADEQ], 2008 and H+A, 2008b). Requisite ICs were, and continue to be, implemented per the ROD Amendment (EPA, 2005).

After a study of the Southern Area perched zone pursuant to recommendations in the third five-year review (FYR) (EPA, 2012), ANPI updated its Conceptual Site Model (CSM) for the Southern Area (H+A, 2017d). The MCA was determined to be a second area of perched groundwater and renamed Perched Zone B (PZ-B), whereas the original perched zone was renamed Perched Zone A (PZ-A). Both PZ-A and PZ-B are experiencing declining water levels and have been determined to be hydraulically isolated from each other and from the shallow alluvial aquifer along the San Pedro River in the Southern Area.

Based on the new CSM, EPA modified its Media Component 1 called out in the 1994 ROD from “Perched Groundwater”, which included only the groundwater beneath the formerly-active evaporation ponds, to the “Southern Area Perched System.” Therefore, Media Component 1 now includes both PZ-A (the groundwater beneath the formerly active evaporation ponds) and PZ-B (Tables 1 and 2). In addition, the revised CSM report documented the attempts to use *in situ* methods to supplement MNA within the PZ-B footprint. However, the *in-situ* methods were unsuccessful due to the lack of a sufficiently extensive body of water in PZ-B and poor hydraulic communication across the sedimentary strata. Due to the lack of hydraulic connection between PZ-B and the shallow aquifer, including the lack of hydraulic flow through PZ-B, and poor yield indicating a lack of a potable water supply, PZ-B was determined to be a fully isolated perched zone similar to PZ-A. As a result, in July 2017, EPA signed an ESD #4 eliminating MNA as a component of the remedy for the Southern Area perched system. Further, pumping and evaporation of PZ-A perched water, which had been performed since 2002, was deemed unnecessary since the previously established ICs and long-term groundwater monitoring were considered sufficient for this isolated groundwater body (EPA, 2017c).

EPA’s ESD #4 added media component 8, Legacy Soils Area, to the Southern Area. Demolition of on-site historical structures deemed to be unnecessary for future manufacturing has commenced in 2012 and was completed in 2019 in the ANPI operations area (H+A, 2019p). The

Legacy Soils Area component was added to cover the cleanup of potential soils contamination that may be uncovered during this demolition work.

The groundwater remedy for the Northern Area still comprises both an active pump-and-treat component known as the Northern Area Remediation System (NARS) and an MNA component. Nitrate-contaminated groundwater is extracted by shallow aquifer extraction wells (SEW-01 and SEW-02) and treated in a wetlands treatment system to remove (denitrify) the nitrate-N (Figure 2). North of the extraction well SEW-01 and SEW-02 capture envelope, nitrate-N is reduced within the aquifer through various mechanisms of natural attenuation (EPA, 2008).

In 1997 extraction well SEW-01 was installed and operated for five years prior to its implementation as the key component in the NARS full-scale treatment. The far distal end of the plume downgradient of the SEW-01 extraction well capture zone has undergone natural attenuation and has been below site-specific cleanup standards since 2013. A Remedial Investigation was conducted, and a Northern Area Groundwater Model was developed in 2005. The model was used to define the extent of the capture zone associated with pumping extraction well SEW-01. The model was further used to project the rate of clean-up of the far northern portion of the shallow aquifer under natural attenuation. This analysis supported the field-based evidence of a highly heterogenous shallow aquifer system (highly variable hydraulic conductivity [K] values, ranging from 50 to 1,000 feet per day). After time, the model projections proved to be consistent with the field data.

In an effort to increase mass extraction and treatment of nitrates within the NARS capture zone, an additional extraction well (TW-01 since renamed SEW-02) was incorporated into the NARS (H+A, 2018b). Pilot testing of extraction well SEW-02 began in late 2017. During pilot testing, extraction rates were deemed to be inefficient, hence the well was redeveloped in October 2017. Subsequent testing indicated the well would sustain yields of approximately 35-45 gallons per minute (gpm). With EPA approval, extraction well SEW-02 began full-scale operation in July 2018. This additional NARS extraction well resulted in a nearly doubling of the extraction and treatment of nitrate mass as compared to 2017.

In light of potential concerns regarding capture of San Pedro River subflow due to pumping at extraction well SEW-02, five piezometers were installed along the western bank of the San Pedro

River in 2018 (H+A, 2019b). These were monitored routinely throughout 2020. Water level data, water quality data and groundwater modeling results all indicate that pumping at SEW-02 is not impacted San Pedro River subflow.

Pilot testing of PB-5A (SEW-03) was conducted in December 2019 and indicated the well would sustain yields of approximately 10 gpm. The results of the December pilot test are presented in "Results of Pilot Extraction Testing at Northern Area Shallow Aquifer Test Well PB-5A" dated January 31, 2020 (H+A, 2020c).

As discussed above, ICs have been implemented at the Site to prevent access to contaminated soils and groundwater. Other ICs have been implemented to provide surveillance measures to ensure that the remedy remained protective of human health (Table 2). More detailed information concerning ICs is provided in Section 6.0.

1.4 OTHER ACTIONS

A summary of all demolition activities conducted between 2012 and 2016 was prepared and previously submitted to EPA (H+A, 2017a). A final report summarizing all demolition activities between 2012 through 2019 entitled *Final Comprehensive Summary Report for the Legacy Soils Area* (Legacy Soils Report) was submitted to EPA on December 9, 2019 (H+A, 2019p). EPA approval of the Legacy Soils Report was provided in a letter dated August 28, 2020 (EPA, 2020f). Additional discussion on the status of the Legacy Soils Report and the associated P-03 Tank decommissioning is provided in Section 9.0.

1.5 PROJECT ORGANIZATION

An organization chart showing responsibilities for implementing performance monitoring and O&M activities at the Site has been prepared (Figure 3). The organization chart indicates the respective roles of government agencies and contractors involved with the project. The primary governmental agencies include EPA and ADEQ. The responsible party is ANPI. ANPI is supported by its consultant, contractors, and laboratories.

1.6 SITE REMEDIATION STANDARDS

EPA has selected remediation standards for the cleanup of groundwater at the Site. The chemicals of concern (COCs) identified for groundwater are nitrate-N and perchlorate. Perchlorate is limited to PZ-A and PZ-B in the Southern Area, whereas nitrate-N is the only COC for Northern Area groundwater. The EPA selected the Maximum Contaminant Level (MCL) for drinking water of 10 milligrams per liter (mg/l) as the Site cleanup standard for nitrate-N (EPA, 1994a). The Arizona Department of Health Services (ADHS) Health-Based Guidance Level (HBGL) for drinking water of 14 micrograms per liter (µg/l) was selected for perchlorate in Site groundwater (EPA, 2005). The COCs for the formerly-active evaporation ponds are antimony, arsenic, and beryllium which remain in concentrations above the Arizona residential Soil Remediation Levels (SRLs) (EPA, 2000; ADEQ, 2009; Arizona Administrative Code [AAC] Title 18). The ROD-selected remedy permitted leaving contaminated sediments in place beneath a native soil cover (cap) (EPA, 2005). For demolition activities, the soil was cleaned up to meet the standards for Arizona residential SRLs.

2.0 SOUTHERN AREA

The Southern Area of the Site includes most of the historical and current ANPI manufacturing areas and the immediately-surrounding areas along the San Pedro River and upland. This is the area drained by ephemeral washes designated as Wash 5 and Wash 6 (Figure 2). This area incorporates principally PZ-A and PZ-B, MW-24, the Southern Area Shallow Aquifer, and formerly-active evaporation ponds.

It is important to understand the hydrologic relationship between PZ-B and PZ-A, which is situated to the west of PZ-B and underlying the formerly-active evaporation ponds. The hydrogeologic conceptualization of PZ-B features an essentially stagnant alluvial system that was created mostly by artificial recharge of industrial wastewater. PZ-B is isolated hydraulically from the laterally-adjacent, shallow alluvial aquifer system along the San Pedro River to the east. This lateral isolation occurs as a result of fine-grained, overbank deposits that separate the San Pedro system from the coarse-grained alluvium in PZ-B (H+A, 2003a). The fine-grained sediments that result in this lateral isolation are referred to as the Laterally-Confining Unit (LCU). Underlying and forming the base of PZ-B as well as the base of the shallow alluvial aquifer along the San Pedro River is a clay unit of the St. David Formation. The St. David clay is the upper unit of the St. David Formation and comprises a hard, red-brown clay stratum 200 or more feet thick at the Site.

Much of the groundwater in PZ-B is present as a result of seepage from PZ-A. PZ-A was created as a result of groundwater mounding due to leakage from ANPI's formerly-active unlined evaporation ponds. Due to the subsurface topography, the elevation of PZ-A groundwater is notably higher than both that of PZ-B and the shallow aquifer. The hydrogeology of PZ-A was first interpreted during the Site Remedial Investigation (RI) and later studied by Deane (Deane, 2000). Specifically, Deane's interpretation was largely based on the paleogeomorphology of the St. David clay surface, which he identified as a paleodrainage system. As such, paleochannels were "etched" into the underlying clay surface. These, now buried, paleochannels serve to both collect water that infiltrated historically through the formerly-active evaporation pond bottoms and also direct drainage away from the PZ-A groundwater mound. Deane identified such paleofeatures in the field on the basis of both exploratory drilling and seismic reflection surveys. Historically, under sufficient hydraulic mounding of PZ-A groundwater in terrace deposit sediments overlying the clay (informally referred to as the Granite Wash unit), water seeped eastward from PZ-A into PZ-B. Presently the volume and water level elevations of PZ-A groundwater are insufficient to sustain lateral flow into PZ-B (H+A, 2017d). This is confirmed in the field by measurements within a, roughly north-south, line of perched zone monitor wells constructed across the edge of PZ-B (MW-29, MW-30, MW-31, and MW-32). This field evidence confirms the elimination of PZ-A as a source for PZ-B, despite persistence of small remnants of PZ-A water at the piezometer P-01 and P-03 locations (Figure 4).

2.1 SOUTHERN AREA REMEDY

Voluntary pumping and evaporation of water was being conducted since 2002 at the original perched zone (PZ-A) and MNA was the EPA remedy of the MCA (PZ-B) prior to ESD #4 (EPA, 2017a). The EPA determined that the dewatering pilot program at PZ-A was no longer necessary based on the documentation of the hydraulic isolation of PZ-A and PZ-B from each other and the shallow aquifer groundwater along with a lack of a potable water supply in PZ-A and PZ-B (EPA, 2017c). ESD #4 also abandoned MNA as a remedy for PZ-B, while retaining long-term groundwater monitoring and ICs as the remedy for the Southern Area (EPA, 2017a).

With respect to the shallow alluvial aquifer along the San Pedro River, the COCs found in PZ-A and PZ-B are not present, presumably as a result of the hydraulic isolation afforded by the LCU. Nevertheless, long-term groundwater monitoring and ICs remain in effect as preventive measures.

During CY 2020, groundwater samples were collected from PZ-A monitor wells, PZ-B monitor wells, and Southern Area shallow alluvial aquifer monitor wells in accordance with an approved schedule as outlined in the Southern Area PMP (H+A, 2007b) (Table 3). The results of PMP quarterly monitoring have been provided in separate quarterly reports to EPA. The November 2020 quarterly report result figures are included in this annual report in Appendix B (H+A, 2021a).

2.2 PERCHED ZONE A GROUNDWATER

As discussed earlier, the PZ-A groundwater underlies ANPI's primary operations area, which is in the southern portion of the ANPI property and in the vicinity of the formerly-active evaporation ponds (Ponds 1A, 1B, 2A, 2B, 3A, and 3B) (Figures 2 and 5). These ponds received process wastewaters from 1971 until approximately February 1995. When the brine concentrator facility was brought online in 1995, ANPI eliminated all former discharges of process wastewater to the ponds.

PZ-A groundwater is present in this area within underlying alluvial materials overlying the erosional surface of the St. David clay under unconfined conditions. It is important to note that the quality of water discharged to ponds varied significantly over the years. Additionally, the rate of evaporation and hence concentration of dissolved solids in the infiltrating wastewaters varied seasonally. First, the quality of the water in ANPI's waste stream compared with the quality of PZ-A groundwater indicates that the PZ-A generally had a much a higher concentration of dissolved solids. This was suggested by a Source Control Plan/Engineering Evaluation (SCIPEE) study contracted by ANPI, which involved sampling of various waste streams in the plant (H+A, 1990; Malcolm Pirnie, 1991). In turn, this suggests that evaporation of water detained in the ponds played a significant role in concentrating dissolved solids including the COCs, nitrate-N and perchlorate.

By 1995, many process improvements had been implemented by ANPI, such that the quality of wastewater discharged to the formerly-active evaporation ponds had greatly improved. In fact, the last volume of water discharged to the ponds was actually fresh makeup water produced from ANPI production well ANP-4. This water had been used to pressure test the 1.2-million-gallon surge tank associated with the new brine concentrator facility constructed in the mid-1990s. The fresh water remained in the ponds for some time. Thus, it is believed that a significant percentage of this fresh water infiltrated into PZ-A, creating a lens over the older, more contaminated water, and thereby resulting in vertical stratification of water quality. As such, the concentration of dissolved solids increased with increasing depth. Such vertical stratification has been reported by multiple authors (e.g., Schmidt, 1977; Parker, et al., 1983).

Ongoing quarterly monitoring of water levels in PZ-A piezometers and monitor wells confirms both cessation of lateral seepage into PZ-B and the shrinkage of the areal extent and volume of PZ-A. Presently, remnants of PZ-A perched groundwater are only present at the P-01 and P-03 locations. Groundwater levels and COC concentrations at these locations fluctuate, potentially due to local recharge as well as the intermittent groundwater extraction at P-03 conducted from 2002 to 2018. Historical water levels measured at PZ-A monitor well MW-29, situated at the edge of PZ-B, indicate that seepage from the perched zone into the PZ-B has not occurred since late 2003 (Figures 4 and A-6).

PZ-A comprises part of the Southern Area performance monitoring network (Figure 6). As discussed earlier, PZ-A represents a potential source area for PZ-B because of historical discharges of nitrate-N and perchlorate-bearing groundwater to this area. The goal of PZ-A performance monitoring is primarily to verify that these discharges do not resume. In addition to performance monitoring, ICs provide another level of protection in association with the Southern Area remedy. For example, as a provision of the DEUR, groundwater resource development in this area of the ANPI property is precluded. Section 6.0 provides further details on ICs.

During CY 2020, performance monitoring was performed quarterly in PZ-A (Table 3) (H+A, 2019e, 2019j, 2019p, 2020b). The monitoring included quarterly measurements of water level elevations and collection of water quality samples. The PZ-A performance monitoring network includes piezometers P-01, P-03, P-10 and perched monitor wells MW-29, MW-30, MW-31, and MW-32 (Figure 6). While historically other monitor wells and piezometers were used to characterize groundwater conditions across the PZ-A, the dissipation of PZ-A water has obviated the need to continue monitoring at these sites. Perched zone piezometers P-02, P-04, P-05, P-06, P-07, P-08, P-09, P-11, and monitor wells MW-02, MW-03, MW-04 and MW-07 are dry and no longer monitored (Figure 4). PZ-A piezometer P-10 and perched monitor wells MW-29, MW-30, MW-31, and MW-32 are monitored annually for water level elevation to confirm that communication between PZ-A and PZ-B has not resumed (Figure 4). The P-10 and MW-29 locations are believed to represent a paleochannel on the surface of the St. David clay and are therefore monitored to assess potential seepage from PZ-A into PZ-B (Deane, 2000).

2.2.1 Water Level

During CY 2020, water level elevations were measured quarterly in PZ-A piezometers P-01, P-03, and P-10, and MW-29 through MW-32. PZ-A piezometers P-01 and P-03 were the only monitoring locations where groundwater depths were sufficient to measure during each monitoring event (Table 4; Figure 4). The water levels at piezometers P-01 and P-03 remained fairly consistently throughout 2020. The water level in November 2020 in PZ-A piezometer P-01 declined from the First Quarter 2020, whereas the water level in piezometer P-03 increased since the First Quarter 2020 (H+A, 2021a) (Appendix A, Figures A-1 and A-2). Extraction from piezometer P-03 was discontinued in 2017 per discussions with the EPA (Table 6). Occasional water level increases at piezometers P-01 and P-03 are believed to be attributed to natural and/or artificial recharge such as the increased local precipitation in 2014, 2016, and 2019 (Table 18). Natural recharge occurs from infiltration of precipitation and/or overland runoff, particularly where water may be detained at the surface, while artificial recharge might occur from water line leaks, irrigation, or other water handling practices. Despite short term fluctuations in water level measurements within PZ-A, the decline in water levels is an overall long-term trend. However, the overall long-term declining water levels in PZ-A are attributed to coupling both the cessation of wastewater discharges to the formerly-active evaporation ponds in 1995 and the declines caused by pumping from the recently de-activated pilot dewatering program. PZ-A monitor wells MW-29, MW-30, MW-31 and MW-32 remained dry in 2020, confirming that seepage from PZ-A into PZ-B was not occurring.

The saturated thickness of PZ-A ranged from approximately to 4.69 feet at perched zone A piezometer P-01 and from approximately 8.48 to 9.12 feet at piezometer P-03 during CY 2020 (Table 5; Figure 4). Water level elevation was measured at approximately 3,666.45 feet above mean sea level (msl) at piezometer P-01 in November 2020 (Table 4; Figure 4). Groundwater perching is present in PZ-A due to differences in the elevation of the underlying perching unit (St. David clay) (Figure 7). The surface of the St. David clay is the low permeability unit upon which the perched groundwater rests. To the east, the clay forms the base of the shallow alluvial aquifer along the San Pedro River. It further serves to confine the deep regional aquifer 200 or more feet below the land surface. In the geologic past, this unit was subjected to subaerial erosion, which resulted in uneven depressions or pockets on the clay surface, and thus created areas that collect groundwater. These were described as geomorphic paleofeatures by Deane (2000). These perched pockets of groundwater occur at different elevations due to the different elevations of the clay unit. Despite the differences in elevation, there is no hydraulic connection that would facilitate lateral groundwater movement (Figure 7).

2.2.2 Perched Zone A Dewatering

In 2002, operation of a pilot extraction/treatment system was initiated. This system provided for additional source control for the PZ-B and further accelerated PZ-A dewatering. The dewatering operation initially involved the pumping of groundwater from PZ-A piezometer P-03 using a submersible pump (H+A, 2002a). Extracted PZ-A groundwater was discharged into lined pools and allowed to evaporate. The pools were replaced with lined, steel stock tanks in 2009. Operation of the dewatering has continued since 2002. In April 2008, the submersible pump failed and was removed from piezometer P-03. In its place, a wind-powered air-lifting device was installed. Not long after installation, that system failed and groundwater could no longer be extracted. The dewatering system remained inoperative through the remainder of 2008, with the exception of occasional groundwater withdrawals using a small submersible pump powered by a portable generator. In 2009, pumping was resumed. On May 9, 2010, a solar powered submersible pump was installed for groundwater extraction at piezometer P-03. As discussed earlier, the pilot dewatering program at P-03 was ended in 2017 per a determination of the Fourth FYR, and ESD #4 (EPA, 2017a and b). During previous years quarterly PMP sampling rounds the pump is run at an estimated two gallons a minute until three borehole volumes were purged. The purged volume from the periodic purging events represents the total volume discharged from piezometer P-03 per year. This information was reported in the ANPI Monthly and Quarterly Performance Reports. Since the system was initially installed in 2002, an estimated 108,378 gallons have been removed (Table 6).

2.2.3 Water Quality

Groundwater samples were collected from PZ-A piezometer P-03 during 2020 quarterly groundwater monitoring. Nitrate-N detections in samples collected from the PZ-A piezometer P-03 increased from an estimated concentration of 6,000 mg/l in February 2020 to 7,500 mg/l in November 2020 (Table 7; Figure A-2). Perchlorate detections in samples collected from the PZ-A piezometer P-03 decreased from 519 µg/l in February to an estimated concentration of 488 µg/l in November during 2020 (H+A, 2021a, 2020b) (Table 7; Figure A-2).

PZ-A piezometer P-01 was also monitored quarterly during 2020. Nitrate-N detections in samples collected from the PZ-A piezometer P-01 decreased from an estimated concentration of 50 mg/l in February 2020, to less than the cleanup standard in November 2020 (Table 7; Figure A-1). All perchlorate concentrations were less than the cleanup standard (H+A, 2020f, 2020h 2020k) (Table 7; Figure A-1). Last sampled in early 2017, nitrate-N in monitor wells MW-03 and MW-04 were at concentrations greater than the cleanup standard. Perchlorate was above the cleanup standard only in monitor well MW-03. Per EPA approval, monitoring of fluoride and ammonia as nitrogen (ammonia-N) was discontinued in the perched zone in 2009 (EPA, 2009a).

2.2.4 Perched Zone A Status

Current data are consistent with the current conceptual understanding of the PZ-A hydrogeology. Source control measures initiated in 1995 have been effective in reducing the extent of the perched zone and have eliminated the transport of PZ-A groundwater into the PZ-B (Figure 6). Perched zone monitoring and IC measures confirm that there are no potential receptors and no new sources for perched groundwater. PZ-A piezometer P-03 is the only location in PZ-A where nitrate-N and perchlorate consistently persist in concentrations greatly exceeding the cleanup standards. Increasing trends in COC concentrations have been observed and are expected to continue at perched piezometer P-03. This phenomenon is explained by the vertical stratification of groundwater quality in the perched zone as discussed in Section 2.2. As aforementioned, the pilot dewatering program at piezometer P-03 was discontinued per EPA's decision.

2.3 PERCHED ZONE B

Groundwater-bearing alluvium referred to as the PZ-B is isolated from the shallow aquifer along the San Pedro River to the east due to hydraulic isolation associated with the LCU. The PZ-B is believed to be an area that historically was created largely as a result of artificial recharge from the unlined formerly active evaporation ponds in the southern portion of the ANPI plant. Prior to the construction of the evaporation ponds in 1971, the industrial wastewater stream was mostly routed offsite via unlined ditches leading to Wash 6 (Figure 6). Infiltration of these discharge waters as well as storm water runoff began to accumulate within the alluvial sediments in the PZ-B. Thus, it is likely that PZ-A began to develop even before the operation of the formerly-active evaporation ponds due to leakage from these unlined wastewater conveyances and general non-point discharges. Depending on the volume of the mound that accreted from this ongoing process of infiltration, seepage from PZ-A into PZ-B is also believed to have contributed to the aforementioned artificial recharge. Presently, hydrographic data indicate that groundwater levels in PZ-B are declining, presumably owing to a lack of such sources of artificial recharge and concurrent losses via other mechanisms (Appendix A). Based on the flatness of the hydraulic gradient across PZ-B, there appears to be little, if any, lateral groundwater movement. This is an important realization because it provides further evidence of hydraulic isolation between the PZ-B and shallow aquifer.

No less than 45 percent of the footprint of PZ-B is believed to underlie property owned by ANPI. This estimate could be conservative based on limited distribution of monitor wells to the east. Moreover, groundwater-bearing sediments probably do not occupy the entire footprint as outlined. Further refinement is limited due to the inability to obtain permission to construct wells on the private properties. It is known, however, from records and conversations that adjacent property owners do not extract shallow groundwater. ICs, such as surveillance of new or petitioned well drilling activities and community outreach, provide further control over potential exposures to contaminated groundwater. Surveillance includes observing any changes in land use and annual updating of the site-wide well inventory. Well inventory updates are completed and reported as an Appendix G in the Annual Report. The ADEQ performs an ongoing review of notices of intent (NOIs) for proposed new wells near the PZ-B. Section 6.0 provides further details on ICs.

The PZ-B comprises part of the Southern Area performance monitoring network (Figure 6). Performance monitoring in this perched zone was performed annually in CY 2020. Monitor wells located in the PZ-B include MW-15, MW-21, MW-23, MW-39, and MW-47 (Figure 6). Groundwater samples were collected from the PZ-B monitor wells MW-21, MW-23, MW-39 and MW-47 annually during 2020 when sufficient water was present (Table 7).

2.3.1 PZ-B Water Levels

Water level elevations in PZ-B monitor wells MW-21, MW-23, MW-39, and MW-47 increased from August 2019 to August 2020 (Table 4; Appendix A). PZ-B monitor well MW-15 was dry during third quarter monitoring and therefore was not sampled according to the proposed schedule (H+A, 2019o). PZ-A monitor wells MW-29, MW-30, MW-31, and MW-32 were sounded for groundwater during 2020, and never had measurable groundwater present. These wells are situated along the PZ-A/PZ-B boundary. Monitor well MW-29 has been dry since late 2003 confirming the absence of seepage between PZ-A and PZ-B (Table 4).

Water level elevations at monitor wells MW-21, MW-23, MW-39, and MW-47 in the PZ-B increased between annual measurements taken in August 2019 and August 2020. In general, water levels were on a declining trend in perched zone B after the most recent rise in 2016 (Figures A-7 through A-13).

Water level elevations ranged from approximately 3,598.77 feet msl at perched zone B well MW-39 to approximately 3,599.58 feet msl at perched zone B well MW-23 in 2020 (Table 4). As aforementioned, differences in elevation are typical of groundwater perching due to differences in the elevation of the St. David clay (Figure 7).

2.3.2 PZ-B Water Quality

Nitrate-N detections in groundwater quality samples collected in PZ-B monitor wells ranged from 1.5 mg/l at monitor well MW-47 in August 2020 to an estimated concentration of 4,500 mg/l at monitor well MW-21 in August 2020 (H+A, 2020k) (Table 7; Appendices A and B).

Perchlorate detections in groundwater samples collected in the PZ-B ranged from less than 3.2 µg/l at monitor well MW-23 in August 2020 to 321 µg/l at monitor well MW-21 in August 2020 (H+A, 2020k) (Figures A-7 through A-13).

Per the EPA's approval of the 2018 performance monitoring schedule, nitrate-N and perchlorate analyses are no longer performed quarterly in the PZ-B well network. The monitoring frequency is an annual event conducted in the month of August per the 2020 performance monitoring schedule (Table 3).

2.3.3 PZ-B Remedial Status

Water level monitoring indicates a decreasing trend in water level elevations in the PZ-B. While most of the water levels in PZ-B wells exhibited a slight increase in 2015 through 2016, water levels declined in 2017 and 2018 and were near pre-2015 elevations in 2019. Water levels in PZ-B wells have increased in 2020 (Figures A-7 through A-13).

The data collected in PZ-B and PZ-A together generally support the revised Southern Area conceptualization. It is anticipated that COC concentrations detected at MW-21 may continue to increase, as a result of the same vertical stratification phenomena described for PZ-A in Section 2.2, unless significant natural recharge is occurring. Additionally, groundwater level declines are expected to continue as a result of various factors such as transpiration losses and lateral and downward infiltration of PZ-B groundwater into adjacent dry soils along the margins of the PZ-B. Finally, it is apparent that natural attenuation is not a major process for reduction of nitrate-N or perchlorate as originally conceptualized. Although studies indicated the presence of the requisite microflora, there is a deficiency of the necessary nutrients to support efficient reduction of the COC oxyanions.

During 2020, ICs were effective and no changes in land use were observed. Section 6.0 provides further details of ICs.

2.3.4 Conceptual Site Model Revision

After a study of the Southern Area perched zone pursuant to recommendations in the third FYR (EPA, 2012), ANPI updated the CSM for the Southern Area (H+A, 2017d). As a result, it was decided that the MCA was effectively a second perched zone. The original perched zone is now referred to as PZ-A and the MCA has been renamed PZ-B. PZ-A and PZ-B are experiencing declining water levels and have been determined to be hydraulically isolated from each other and from the shallow alluvial aquifer along the San Pedro River in the Southern Area. Based on the field work done in the Southern Area, EPA modified Media Component 1 from “Perched Groundwater”, which included only the groundwater beneath the formerly-active evaporation ponds, to the “Southern Area Perched System”, which includes both PZ-A and PZ-B (Tables 1 and 2). In addition, the revised CSM report documented the attempts to use *in situ* methods to supplement MNA within the PZ-B footprint (H+A, 2017d). The *in-situ* denitrification and dechlorination was determined unfeasible due to the lack of an extensive body of water in PZ-B and the poor hydraulic communication in the sedimentary strata. Moreover, PZ-B, by virtue of the LCU was shown to be hydraulically isolated from the shallow alluvial aquifer along the San

Pedro River to the east. The poor yield from the perched system and lack of a potable water supply in PZ-A and PZ-B indicated that there was low potential for future groundwater resource development. Accordingly, EPA abandoned MNA as a remedy for the PZ-B but kept the previously established ICs in place along with long-term monitoring for the Southern Area Perched System (EPA, 2017a). Pumping and evaporation of perched water from PZ-A was also discontinued at the end of 2017, because the previously established ICs and long-term groundwater monitoring were deemed sufficient for this isolated groundwater body (EPA, 2017c).

2.4 MW-24 AREA

ANPI constructed monitor wells MW-22, MW-14, and MW-24 (E-W) along a roughly east-west transect in the northernmost portion of the Southern Area (Figure 6). This configuration was designed to investigate the nature of the anomalous water levels in the monitor well MW-24 area as well as a potential flow path from south to north, as suggested by Deane (2000). Specifically, the water level in monitor well MW-24 is significantly lower than that measured in monitor wells MW-14 and MW-22. Additionally, nitrate-N and perchlorate were present in monitor well MW-24 and sporadically present in the two wells to the east (post 1997). Initially, it was postulated that there was a paleochannel extending from PZ-B to the monitor well MW-24 area (Deane, 2000). However, subsequent exploratory drilling showed that such a through-running feature was not present, and that the MW-24 area is essentially isolated and surrounded by the fine-grained sediments of the LCU (H+A, 2017d).

The hydrogeological characterization work in the Southern Area that resulted in the reclassification of the MCA into PZ-B also resulted in separating monitor well MW-24 from PZ-B into its own area (H+A, 2017d). The last sample collected from monitor well MW-24 was in December 2015 when the nitrate-N concentration was 0.88 mg/l (Figure A-14). The nitrate-N concentration in groundwater were below the cleanup standard in 2000.

2.4.1 Water Level

Water level elevations were not measured in monitor well MW-24 in CY 2020 as it was removed from the 2019 performance monitoring schedule per EPA approval. The last measured water level in monitor well MW-24 was in August 2018 at 3,599.95 ft msl (Figure A-14). Historically, monitor well MW-24 exhibits the same wider seasonal water level fluctuations as the wells in the PZ-B versus MW-14 and MW-22, the hydrographs of which are more typical of other wells in the Southern Area shallow alluvial aquifer along the San Pedro River. This may result from the relative hydraulic isolation as is also the case for PZ-B.

2.4.2 Water Quality

Groundwater samples were collected annually for nitrate-N and perchlorate from MW-24 prior to the inoperable pump status. Monitor well MW-24 has historically been below the standard for nitrate-N, with one exception of 11 mg/L reported in 1999. Periodic detections above the perchlorate standard, with the last detection in exceedance of the limit reported in 2002, have been observed at this well. Monitor wells MW-14 and MW-22 have exhibited the reverse trend, with higher concentrations of nitrate-N, periodically exceeding the standard, while historically remaining below the perchlorate standard. During 2012 to 2015, the concentrations of nitrate-N and perchlorate remained stable from 0.88 to 1.1 mg/l and from 1.3 to 2.8 µg/l, respectively. As aforementioned, MW-24 was removed from the performance monitoring network in 2018.

2.5 SOUTHERN AREA SHALLOW AQUIFER

The lithology of the shallow aquifer primarily consists of gravel, sand, and silt sediments. These unconsolidated sediments generally range between 40 and 100 feet in thickness, but locally may be as much as 150 feet thick. Locally, the aquifer may yield as much as 2,000 gpm to properly constructed wells. Depths to groundwater in the shallow aquifer generally range from 20 to 80 feet below land surface (bls), depending upon surface topography. In certain locations along the San Pedro River, the water level in the shallow aquifer may be at or near the river bottom. Movement of shallow aquifer groundwater is generally northward, and typically groundwater is under semi-confined conditions in the vicinity of the Site. As discussed earlier, the shallow (or San Pedro) aquifer is hydraulically isolated from the PZ-B owing to an intervening, low hydraulic conductivity unit referred to as the LCU. It is apparent from the areal distribution of sediments that there is no hydraulic connection between PZ-B and the shallow alluvial aquifer. This is based on the various lithologic borings across the LCU as well as the direction of the hydraulic gradient across the LCU, which is westward from the shallow aquifer toward the PZ-B.

2.5.1 Regional Aquifer

Groundwater also occurs in the lower portion of the St. David Formation and the underlying older sedimentary rocks. These lithologic units comprise a single, confined hydrostratigraphic unit, referred to as the regional or deep aquifer. The upper unit of the deep aquifer consists of clayey and silty gravel beds near the mountains and clay, silt, and sandy silt, with interbeds of gypsum in the central part of the Basin. Near the Site, the upper unit of the deep aquifer is encountered at depths ranging from approximately 300 to 400 feet bls. The upper unit of the deep aquifer ranges from 300 to 800 feet in thickness. The lower unit of the deep aquifer is composed of older sedimentary rocks including lenses of gravel, sandstone, and siltstone. Gypsiferous silt lacustrine sediments may also be present (Roeske and Werrell, 1973). The lower unit of the deep aquifer is encountered at depths below 600 feet bls at the Site, and ranges in thickness from several tens of feet, near the edge of the valley, to more than 1,000 feet beneath the San Pedro River (H+A, 1990). Water in the regional aquifer in the St. David area is under artesian pressure, and in most areas, the elevation of its potentiometric surface is higher than the water table in the shallow aquifer, thereby indicating an upward vertical gradient. In lower elevations near the central part of the San Pedro Valley, wells tapping the regional aquifer may be artesian flowing, although depressurization has occurred as a result of increasing development and associated groundwater exploitation.

The performance monitoring network in the Southern Area of the shallow aquifer includes monitor wells MW-01, MW-06, MW-14, MW-22, MW-25, and MW-33 (Table 3; Figure 6). Monitor wells MW-06 and MW-01 are considered to be situated upgradient from the Site, and therefore monitor background conditions in the shallow aquifer.

ICs for the Southern Area of the shallow aquifer include surveillance and community outreach to assure that no groundwater resource development occurs within areas where the shallow aquifer may be contaminated. Surveillance also includes observing any changes in land use and updating the well inventory to query for new well permits filed near the Site. Section 6.0 provides further details on ICs.

2.5.2 Shallow Aquifer Water Levels

Shallow aquifer water level elevations in shallow aquifer monitor wells in the Southern Area were monitored in an annual event in August, per the 2020 Performance Monitoring Schedule (Table 3; Figures A-15 through A-20). Water level elevations in the Southern Area ranged from 3,597.92 feet above msl in August 2020 in shallow aquifer monitor well MW-25 to 3,625.92 feet above msl in February 2020 in monitor well MW-06 (H+A, 2020f, 2020h, 2020k, 2021a) (Table 4).

The apparent hydraulic gradients estimated for February 2020 within the Southern Area shallow aquifer groundwater were approximately 0.003 feet per foot (ft/ft) calculated between the locations of monitor wells MW-06 and MW-01, and approximately 0.004 calculated between monitor wells MW-22 and MW-33 in August 2020 (H+A, 2020f, 2020k) (Table 4). This is consistent with the gradients historically calculated between these wells and are in contrast to the essentially flat hydraulic gradients for PZ-B wells and reflect a more typical groundwater flow system.

Water level elevations in shallow aquifer monitor wells in the Southern Area showed typical seasonal fluctuations. Historically, water level elevations observed in the Southern Area shallow aquifer wells in proximity of the San Pedro River typically increase during the summer monsoon season due to increased runoff in the river and infiltration. In 2020, the monsoon season was abnormally dry. Water level elevations in each Southern Area well (MW-01, MW-06, MW-14, MW-22, MW-25 and MW-33) decreased from February to August 2020 (Figures A-15 through A-20). In addition to recharge during seasonal rainfall-runoff, groundwater levels are affected by seasonal pumping cycles from nearby residential and agricultural use, which typically are higher in the warmer seasons.

2.5.3 Water Quality

Groundwater samples were collected from upgradient Southern Area shallow aquifer monitoring wells MW-01, MW-06, MW-14, MW-22 and MW-33 in August 2020. Water quality is not monitored at monitor well MW-25, however this well would be monitored contingent upon results from monitor well MW-33. In addition, monitor well MW-22 is no longer sampled in accordance with the 2020 performance monitoring schedule (Table 3).

Nitrate-N was not detected in Southern Area shallow aquifer monitoring wells during 2020, (H+A, 2020f, 2020h, 2020k, 2021a) (Table 7). Perchlorate was not detected in Southern Area shallow aquifer monitoring wells MW-01, MW-06, MW-14, MW-22 and MW-33 during 2020 (Table 7; Figure 6).

2.5.4 Southern Area Shallow Aquifer Status

Data collected during 2020 support the current conceptualization of the shallow aquifer in the Southern Area and its relationship to the PZ-B. The LCU provides hydraulic separation between the PZ-B and shallow aquifer. Nitrate-N was not detected at sentinel wells, upgradient wells and buffer zone wells in 2020. Perchlorate was not detected at Southern Area shallow aquifer monitor wells in 2020. Historically, nitrate-N has been detected at several locations in the shallow aquifer. Nitrate-N concentrations exceeding the cleanup standard of 10 mg/l have not been detected in the Southern Area shallow alluvial aquifer since 1991, and since 1999, detected concentrations have remained less than 3 mg/l. Historically, perchlorate has not been detected in the shallow aquifer with the following exceptions; an original sample in MW-14 in February 2017 (0.7 µg/l), a field duplicate in monitor well MW-22 in February 2017 (0.67 µg/l) and a split sample in monitor well MW-22 in February 2008 (4.4 µg/l).

ICs were effective and no important changes in land use were observed during 2020.

3.0 NORTHERN AREA

The Northern Area is the portion of the shallow aquifer into which the Wash 1, 2, 3, and 4 watersheds drain. The Northern Area extends from the vicinity of shallow aquifer monitor well MW-13 north toward shallow aquifer private well D(17-20)25bad (Figure 8). Within this area, the shallow aquifer boundary widens to the east of the San Pedro River and incorporates large tracts of farmland in St. David, across the San Pedro River. Moving further downgradient, the aquifer then narrows to the north of Dragoon Wash. Generally, groundwater flow is to the north-northwest paralleling the course of the San Pedro River. Further information about the regional aquifer is provided in the first paragraph in Section 2.5.1.

Nitrate-N is the only COC in the Northern Area. The San Pedro River itself forms the eastern boundary of the nitrate-N plume (as defined by concentrations exceeding the 10 mg/l MCL) (Figure 2). The nitrate-N plume is believed to have resulted from historical discharges of plant wastewaters and runoff originating within Wash 4, 5, and 6 watersheds, based on the primary locations of ANPI's industrial operations (Table 7; Figure 2). Both groundwater and surface water transport mechanisms are believed to control the dynamics of the nitrate-N plume.

Two separate remedies are operating in the Northern Area, the NARS and the Northern Area MNA. The NARS is an active remedy that captures nitrate-N groundwater via extraction well SEW-01 and the more recently installed SEW-02 (operational as of July 2018). The extraction wells route recovered groundwater into the NARS treatment wetland for denitrification. The treated water is then discharged back into Wash 3, where it infiltrates back into the shallow aquifer. Extraction well SEW-01 creates a definable capture envelope within the shallow aquifer. Extraction well SEW-02 was added to the NARS to accelerate attainment of remedy standards by extraction of contaminated groundwater upgradient from extraction well SEW-01. A third extraction well located upgradient of SEW-02, identified in this report as monitor well PB-5A (SEW-03), will be operating as part of the NARS in 2021 using common infrastructure as SEW-02 for transport to the wetland ponds for treatment. Where the shallow aquifer extends northward of SEW-01 the remedy is based on MNA. These areas are discussed separately in this section.

The NARS is located in the northwest section of the ANPI property (Figure 9). The MNA performance network in the Northern Area comprises a management zone, buffer zone, sentinel well, and upgradient zone (Table 3; Figure 8) (H+A, 2009a). Performance monitoring is performed in the Northern Area to evaluate the NARS and MNA performance pursuant to the Northern Area PMP and the NARS operations and maintenance manual (H+A, 2007a, 2009a). Monitoring of the NARS is performed in both weekly and monthly rounds, while shallow aquifer groundwater monitoring occurred on a quarterly basis during CY 2020 (Table 3; Appendix C).

The regional (deep) aquifer is the primary aquifer used for domestic purposes throughout the St. David area (H+A, 2009b). Several private wells tap the shallow aquifer for irrigation purposes. A limited number of residences are relying on shallow aquifer water for domestic purposes; however, these are located outside of the area of contamination. Three private well owners, D(17-20)36aad1(Jacobs), D(18-21)06bcb (Jones), and D(17-20)36ddc (Morales), in the study area are currently using the shallow aquifer for domestic usage. Currently groundwater at each of these private wells is below the cleanup standard for nitrate-N (Table 7).

ICs for the Northern Area include community outreach, surveillance, and an Alternate Domestic Water Supply Plan (ADWSP), which provided household water to residents that relied solely on affected shallow aquifer wells. Section 6.0 provides further details on ICs. Remedial actions addressing nitrate-N contamination in the Northern Area comprise both an active component based on pump-and-treat technology and a passive remedy based on natural attenuation.

3.1 NORTHERN AREA REMEDIATION SYSTEM PERFORMANCE

By means of the NARS, nitrate-N in extracted groundwater is reduced in the wetland by means of biological denitrification. The goal of this system is to reduce the nitrate-N in the groundwater to concentrations less than the cleanup standard of 10 mg/l as specified in the ROD (EPA, 1994). NARS monitoring is performed to assist operational decisions regarding wetland operation and to verify that the treated effluent discharge meets Arizona Aquifer Water Quality Standards (AAWQS). Construction of the NARS was completed in 1997, but began full-scale operations in 2005 after the wetland flora were fully established. The recent expansion of the NARS includes the area immediately upgradient of SEW-01 by way of extraction well SEW-02 (operational in July

2018) and the new addition of the third extraction well PB-5A (SEW-03) to the south of SEW-02, anticipated to be operational by the second quarter of 2021.

The NARS consists of four subsystems including extraction, delivery, treatment, and return systems. The extraction system includes extraction wells SEW-01 and SEW-02, which pump nitrate-bearing groundwater from the shallow aquifer (Figure 9). The delivery system conveys water withdrawn from extraction wells to the treatment system via approximately 9,300 feet of above- and below-grade pipe. The treatment system consists of a 4.3-acre constructed wetland, comprising five separate treatment cells. The first three treatment cells denitrify the groundwater extracted from SEW-01 and SEW-02. Fundamentally, in the anoxic conditions artificially-created and maintained in the bottoms of the wetland ponds, bacteria utilize oxygen on the nitrate radical for their metabolic processes, thereby liberating free nitrogen to the atmosphere. Additional nitrate removal is realized as a result of nutrient uptake by cattails (*Typha latifolia*) cultivated in the wetland ponds. The fourth treatment cell is designed to oxidize any ammonia residuals originating in the influent water. This is accomplished through an oxidation process created as a result of oxygen liberation from photosynthesis. The fifth treatment cell relies on the same denitrification processes to remove any residual nitrate-N. Treated water is returned via approximately 2,900 feet of above- and below-grade piping. This piping conveys the treated effluent to a return location in Wash 3, where it mostly recharges back into the shallow aquifer or otherwise flows into the San Pedro River (Figures 9 and 10).

In December 2020, ANPI conducted wetland area vegetation removal and modification of wetland collection piping to prepare for the addition of groundwater from extraction well SEW-03 into the NARS routine operation (H+A, 2021b). On December 3 through 4, 2020, vegetation removal was conducted in areas of proposed changes to the wetland collection piping system. Most of the vegetation trimmed or removed was mesquite and tamarisk trees/brush and buffel grass. The removed or trimmed vegetation was placed into several rolloff bins and disposed offsite.

During the period December 8 through 11, 2020, ANPI contractors installed new piping and header system for pond PDA-C such that SEW-01 water can be routed to both ponds PDA-S and PDA-C. A new header system was installed in pond PDA-S to evenly distributed flow from SEW- along the east side of the pond. This work was done in accordance with that described in the change plan (ANPI, 2020c). The new piping and header at PDA-C consisted of approximately

350 feet of piping, three valved discharge points, and a valve for routing inflow to ponds PDA-S and/or PDA-C. The new piping and header at PDA-S for SEW-02 inflow consisted of approximately 150 feet of piping and three valved discharge points along the west side of the pond. The new headers are depicted on Figure 10.

3.1.1 NARS Operations and Maintenance

Proper operation of the NARS requires maintenance of the groundwater extraction system, and groundwater treatment system (wetland), and confirmation that treated effluent return system components are working properly and efficiently. By regularly inspecting and maintaining each system component and keeping accurate maintenance records, problems can often be discovered and corrected before a serious malfunction or system upset occurs. NARS maintenance also consists of conducting equipment inspections, repairing or replacing damaged equipment or equipment parts, and exercising good housekeeping. Equipment maintenance is performed according to recommendations of the respective manufacturers. These are compiled in Appendix C of the NARS O&M manual (H+A, 2007a, 2012b). The NARS O&M manual also includes guidelines for pest control and abatement. These guidelines provide the operator with procedures for monitoring and implementing control of harmful pests, such as caterpillars or invasive plants. Information regarding amendment loading and monitoring procedures is also presented in the O&M manual, in addition to specifications for ranges of normal operating parameters, routine operation duties, and reporting forms (H+A, 2007a, 2012b).

The following sections describe various routine and non-routine O&M actions performed during 2019.

3.1.1.1 Maintenance and Repairs

During CY 2020, routine maintenance was conducted included cleaning out the hydraulic distribution piping, outlet structures, and outlet structure gratings, which became clogged with plant debris. Periodic maintenance was performed to remove sediment that filled treatment cell inlet open trays. This typically occurs mainly at the final denitrification area (FDA), where the bank slope meets the inlet tray (Figure 10).

To account for the temperature-dependent rate of denitrification, the pumping regimen at extraction well SEW-01 and SEW-02 must be adjusted seasonally. The rationale of adjusting the pumping time of SEW-01 and SEW-02 is that at lower temperatures denitrification is limited, therefore, as a precautionary measure to allow a longer residence time for treatment in the wetland cells, the pumping time at the extraction wells is reduced in the winter months and then increased again as temperature increases in the warmer months. Therefore, extraction well SEW-02 was turned off for fourteen weeks in the winter months (January – March) of 2020, following the cold weather protocol to reduce mass loading in the wetlands, as described in the O&M Manual (H+A, 2012b). Nitrate-N concentration within pond effluent remains under nitrate-N MCL of 10 mg/l. Extraction well SEW-01 operated for 362 days in 2020. Extraction well SEW-02 remained running for 267 days in 2020. The three days that SEW-01 was offline was caused by damage to the line due to flooding on September 9, 2020. The line was repaired and operational again on September 11, 2020. The other noteworthy repair conducted on SEW-01 was the replacement of the timer on July 13 due to a button malfunction on the old model. The new replacement timer for SEW-01 is the same model as the timer on SEW-02.

In late 2020, preparations for the startup of extraction well SEW-03 were underway as part of the NARS treatment optimization effort. This included the incorporation of extraction well SEW-03 into the NARS pumping regime and operations and maintenance protocols to reduce mass loading in the winter months. Details regarding the intended pumping regime for extraction wells are presented in the *Revised Start-Up of Extraction Well SEW-03 and Changes to NARS Wetland Operation Technical Memorandum* dated May 4, 2021 and discussed in Sections 7.2.1 and 10.2.1 herein (H+A, 2021b, 2021d).

3.1.1.2 Emergent Plant Monitoring

Monitoring of cattail vitality is performed during the growing season. During 2020, monitoring of emergent plants indicated acceptable vitality based on their healthy green coloration; large, well developed catkins; and an area coverage over approximately 90 percent of pond surfaces. Typically, the cattails in Pond PDA-S green-up earlier than in the other primary denitrification area (PDAs) and FDA. This is attributed to the comparatively warmer influent water temperatures into PDA-S in early spring. Water surfaces in the downstream ponds are exposed to atmospheric temperatures that are typically cooler than the relatively constant temperature of the influent from extraction wells SEW-01 and SEW-02.

3.1.1.3 Invasive Species Control

Routine measures to control invasion of insect and plant pests were performed in 2020. *Simyra henrici* (*Sh*), commonly known as cattail caterpillars, were not observed in the treatment cells in 2020.

Mosquito monitoring was also performed routinely. Mosquitoes were not observed in significant numbers during inspections conducted in 2020. It is believed that mosquito populations are largely in balance due to predatory species of birds and bats.

Non-wetland plants were observed in and around the treatment cells during 2020. Invasive plant removal was performed at the treatment wetland to remove Tamarisk (*Tamarisk chinensis*), commonly known as salt cedar, and also tumbleweed (*Salsola tragus*). The tamarisk and tumbleweeds were removed.

3.1.1.4 Ecological Monitoring

During 2020, active controls for invasive animal species were not required. The wetlands are well-populated with a variety of avian species. Some of the species observed include sharp-shinned hawk, red-tailed hawk, mourning dove, common raven, northern rough-winged swallow, tree swallow, marsh wren, ruby-crowned kinglet, chipping sparrow, Brewer’s sparrow, vesper sparrow, black-throated sparrow, white-crowned sparrow and yellow-headed blackbird. A number of reptiles and mammalian species have also been observed. Frogs, rattlesnakes, javelina, bats, and coyote were noted most often. Ecological monitoring is performed primarily to assess whether wildlife activity is causing damage to the treatment cells. In the past, when treatment cell water levels were low, javelina were noted entering the treatment cells to dig up cattail roots. This created conditions vulnerable to bank erosion.

3.1.1.5 Amendment Loading

During 2020, molasses was dosed into the wetland as a carbon amendment to support dissolved oxygen (DO) suppression in the water column and to sustain the proper dissolved organic carbon concentration. The total volume of molasses added from January through December 2020 was approximately 7,100 gallons all added at Pond PDA-S (Table 8; Figure 11). Personnel checked the area surrounding the wetland to assure that excessive molasses loading had not created offensive odors from hydrogen sulfide off-gassing. Such odors were not detected to any significant degree, and when detected, the odors were limited to the immediate wetland area.

During 2020, it was determined that phosphorus supplements (in the form of B-52) were not needed based on cattail vitality. Phosphorus is believed to recycle into the water column in the winter when plants senesce; therefore, the nutrient is utilized by plants only during the growing season. Molasses may also be providing an added source of available phosphorus within this system.

3.2 WATER LEVEL AND SYSTEM MONITORING

Hydrologic conditions in the wetland are monitored to ensure proper hydraulic routing through the wetland. Hydraulic routing is affected by treatment cell water levels, preferred flow pathways through the treatment cells, and influent and effluent volume and rate. Visual observation provides the basis for determining potential short-circuiting of the intended flow path through the cells.

3.2.1 Influent Monitoring

The rate and volume of extracted groundwater delivered to the treatment wetland is monitored on a weekly basis as part of O&M and monitoring activities. Two parameters are measured weekly: totalized flow volume (in gallons), and instantaneous flow in gallons per minute (Figure 12). Table 10 summarizes the totalized flow volume measured at SEW-01, SEW-02 and PB-5A (SEW-03) during 2020. Figure 13 provides a graphic depiction of the cumulative pumpage history at extraction wells SEW-01, SEW-02 and PB-5A (SEW-03) through December 2020. Extraction wells SEW-01 and SEW-02 pumpage time was variable from January to December of 2020. Extraction well SEW-02 generally pumped an average of four to eight hours per day, while extraction well SEW-01 pumped an average of four to eight hours per day in the colder months and eight to twelve hours per day in the warmer months. The highest daily pumping durations occurred in July and August of 2020 (Figure 12).

During CY 2020, the instantaneous flow rate at extraction wells SEW-01 and SEW-02 were maintained at approximately 185 to 190 gpm and at 45 gpm, respectively (Table 10). The volume of groundwater extracted from the shallow aquifer via SEW-01 and SEW-02 during the 2020 reporting period was 33,768,770 and 3,685,579 respectively, for a total of 37,454,349 gallons. During 2020 well PB-5A (SEW-03) was not extracting (Table 10). It is estimated that a total volume of 965,435,782 gallons has been removed since pumping of extraction well SEW-01 commenced in 1997 (Figure 13). According to vendor specifications, the precision of the flow meters at extraction wells SEW-01 and SEW-02 is typically ± 2 percent of the actual flow. The flowmeter installed at PB-5A (SEW-03) prior to the 2019 pilot testing mechanically failed, after which manual readings were reported for the remainder of the test. The uncertainty due to flow measurement during 2020 was approximately ± 668,900 gallons, and during the entire operational history of the NARS, from 1997 to the present, uncertainty is approximately ± 19,300,000 gallons.

Water levels are measured quarterly in extraction wells SEW-01 and SEW-02 as part of O&M and performance monitoring. A hydrograph presenting water level elevations at SEW-01 and SEW-02 are provided (Figure D-1).

The last static water level measurement at SEW-01 was measured in March 2008, when the pumping was temporarily shut down for servicing. The apparent difference between the pumping and static water levels measured at that time was approximately eight feet. However, the static water level was possibly still affected by residual drawdown from pumping. Static water level measured in SEW-02 was 3,587.51 ft above msl in February 2020 (Figure D-1).

3.2.2 Effluent Monitoring

In accordance with normal operation, discharge to the primary location in Wash 3 was continuous during CY 2020 (Figure 9). The average effluent flow rate estimated at the Parshall flume was 70 gpm (Table 10). The 2020 annual volume of treated water discharged from the primary location into Wash 3 was approximately 31,700,327 gallons (Table 10). No complaints concerning discharge odors were received from neighbors in CY 2020. The monitoring location for detecting discharge odors is located at Apache Powder Road and Wash 3 (Figure 9).

3.2.3 Water Budget

A water budget facilitates evaluation of operational performance of the wetland system. Monitoring inflow and outflow volumes allows the operator to determine mass removal rates of nitrate-N, identify if leakage is occurring, and estimate a recharge volume of treated water. The water budget is one of the components that help guide the operation of the wetland; however, long-term operation of the NARS is guided by monitoring water levels, water quality, adjustments to inflow, carbon loading, and biological parameters (Kadlec & Knight, 1996, H+A, 2012b).

Water budget for the NARS is calculated based on the best available data for the system inputs *(I)* and outputs *(O)*. The resulting equation is:

$$I - O = \Delta S \pm \varepsilon$$

Where ΔS = change in storage and ε = total error in measurement and/or estimation.

Input data included data collected from the SEW-01 and SEW-02 flow meters and precipitation data collected on site. The surface area of the treatment cells was used to calculate the precipitation volume based on the ANPI rain gauge. The remaining watershed was not included because the soils at the wetland consist of high-permeability, sandy and gravelly soils that generally infiltrate a large percentage of the rainfall. Once these soils reach saturation, a percentage of runoff is diverted along the road, or along the open distribution piping. Vegetation also acts to intercept smaller amounts of precipitation. In the past, erosion has occurred only in response to extremely heavy precipitation and mainly near the wetland shed, near the FDA inlet tray, and near the influent piping (Figure 10). Thus, based on these assumptions, CY 2020 input to the system from precipitation, SEW-01 and SEW-02 was estimated to be approximately 38,401,113 gallons (Table 9).

Output from the system includes evapotranspiration (ET) losses, evaporation losses from open water areas, and discharge at the Parshall flume. ET is a combination of evaporation and transpiration. Evaporation accounts for water losses from soil and water, and transpiration is water loss from photosynthesis by emergent flora. Evaporation measurements were collected by means of an atmometer (ET gage™ Model A) located near the wetland storage shed. The monthly ET rate was multiplied by a factor of 1.5 during the growing season, specifically for the months June, July and August, to account for transpiration from cattails. These data were compared to estimated rates for reference crop ET and pan/lake evaporation rates. A referenced pan evaporation rate of 93 inches per year was used for the open water area (Sellers and Hill, 1974) (Table 9). During October 2007, a sonic flow meter was installed at the Parshall flume to provide a method to measure totalized discharge. However, this instrument performed inconsistently in 2007, 2008, and most of 2009. During that time, discharge estimates were calculated from the rate of outflow as measured weekly from the Parshall flume. During 2020, the Parshall flume effluent totalizer was malfunctioning from February through April (readings were off by a factor of 10). After a few attempts at fixing the totalizer, ANPI replaced the existing meter with a new one of the same model on July 9, 2020. Effluent totals were estimated for this time period (Table 10). Output from the system was calculated to be approximately 42,667,072 gallons in 2020. Of this amount, an estimated 31,700,327 gallons were discharged (Table 9).

Uncertainties to the water budget calculations, in addition to measurement uncertainties for the output, include changes in storage and infiltration losses into underlying, adjacent soils, as well as estimation of ET rates. Input errors include rainfall, runoff and percent error with the SEW-01 and SEW-02 totalizers. Based on these calculations, the difference between input volume produced at extraction wells SEW-01 and SEW-02 and the outflow volume estimated at the Parshall flume is approximately 4,256,959 gallons with a surplus of the input being discharged (Table 9). However, this level of apparent gain is probably due to uncertainties/errors in the various component measurements. The Parshall flume totalizer had mechanical difficulties and had stopped measuring flow intermittently throughout 2020, resulting in estimated flow volumes using the average volume of the previous readings when the totalizer had been functioning properly. Weeks with estimated volumes likely contributed to the overestimation of total output in 2020.

3.2.4 Treatment Cell Water Level Monitoring

Water levels were measured weekly in the primary denitrification area (PDA), aerobic nitrification area (ANA), and FDA treatment cells (Appendix D). A table presenting treatment cell water levels is included (Table D-1). Every effort was made to operate treatment cells at maximum operating depths from January through December 2020 (Table D-1). This goal was intended to maximize residence times through the wetland.

3.2.5 Design Confirmation Piezometer

A design confirmation piezometer (DCP), DCP-12, was installed below the toe of the FDA (Figure 9). The primary purpose of this piezometer was to monitor for potential leakage across the clay cutoff wall installed within the FDA berm and intended to minimize leakage out of the pond. During initial filling of the FDA in 1997, water seeped through the cutoff wall and appeared in the piezometer. This leakage was believed to be due to the temporary desiccation of the clay materials in the cutoff wall between the time of construction and the filling of the wetland. In the subsurface, infiltrating waters leaked through the desiccation cracks and migrated toward the piezometer. At the same time during continued operation of the FDA, subsurface water was rewetting, swelling the clay, and healing over the desiccation cracks, thus restoring the functionality of the clay cutoff wall. Since 1997, water levels in piezometer DCP-12 have remained relatively static. This seems to indicate that the water in the vicinity of the piezometer must be resting within a depression in the Saint David clay, which underlies the alluvial sediments associated with Wash 3. The water level elevation at DCP-12 ranged from approximately 3,668.00 feet above msl in August 2020 to 3,670.32 feet above msl in February 2020, with an average depth to water of 21.07 feet below measuring point (bmp) and an average saturated screened interval of approximately 3.83 feet during 2020 (Table 11). The slight fluctuations in the hydrographic data may be in part due to local recharge effects along Wash 3 and/or ET due to phreatophytes.

3.2.6 Monitor Well MW-10

Monitor well MW-10 is located in the Wash 3 alluvium, downstream from the primary discharge location (Figure 9). From the time it was installed in 1990 until wetland discharge was initiated at the primary Wash 3 location in May 2005, monitor well MW-10 remained dry. Water level elevations at monitor well MW-10 ranged from approximately 3,617.90 feet above msl in January and in September through November 2020 to 3,618.77 feet above msl in August 2020 with an average depth to water of 15.78 feet bmp during 2020 (Table 11). The average saturated screened interval at monitor well MW-10 in CY 2020 was approximately 3.02 feet.

3.3 NARS WATER QUALITY MONITORING

Monitoring influent and effluent water at the NARS provides the essential basis for evaluating wetland operational and performance efficiency. Nitrate-N is monitored at these and other key locations weekly using a field probe. Monthly samples are also collected and transmitted to an Arizona-licensed laboratory for nitrate-N analysis by EPA Method 300.0 and ammonia-N analysis by Standard Method SM4500-NH3 B, C. Other parameters are monitored monthly, quarterly, and annually according to an approved schedule (Tables C-1 through C-4). These parameters are used for evaluation of potential operational issues and therefore provide possible information of trends that may be leading to an upset condition. In 2020, water quality monitoring was performed at extraction wells SEW-01 and SEW-02, within wetland treatment cells, at the wetland effluent discharge location, at monitor well MW-10, and piezometer DCP-12 as part of the O&M monitoring program.

3.3.1 Influent /Effluent Water Quality

Water quality samples were collected at shallow aquifer extraction wells SEW-01 and SEW-02 and analyzed for nitrate-N on a monthly basis; total phosphorus and ammonia-N on a quarterly basis; and bicarbonate, calcium, chloride, fluoride, orthophosphate, potassium, magnesium, sodium, sulfate, and total dissolved solids (TDS) on an annual basis, as outlined in the extraction well monitoring schedule (Tables 12, 13 and Table C-1). Field parameters hydrogen ion potential (pH), electrical conductivity (EC), and temperature were monitored monthly at the extraction wells. Field nitrate is monitored weekly (Table E-1).

Water quality samples were collected at the primary discharge location (EFF-L) and analyzed for nitrate-N and ammonia-N on a monthly basis; TDS, total phosphorus, and total suspended solids (TSS) on a quarterly basis; and bicarbonate, chloride, fluoride, sulfate, orthophosphate, potassium, magnesium, calcium, and sodium on an annual basis, as outlined in the effluent monitoring schedule (Tables 12 and 13; Table C-3). Field parameters pH, EC, and temperature were monitored monthly at the primary discharge location (Table E-1). Field nitrate is monitored weekly (Table E-1).

Nitrate-N concentrations ranged from an annual low concentration of 32 mg/l in November to 46 mg/l in January 2020 in water quality samples collected monthly from extraction well SEW-01 and from an annual low estimated concentration of 160 mg/l in January to an annual maximum concentration of 290 mg/l in August and October 2020 from extraction well SEW-02 (Table 12; Figure D-3). The 2020 average nitrate-N concentration in SEW-01 and SEW-02 was 37 mg/l and 249 mg/l respectively. At the end of the reporting period, the total estimated mass of nitrate-N removed from the shallow aquifer since pumping commenced in 1997 was 768,100 pounds. The total estimated mass of nitrate-N removed from January through December 2020 was approximately 17,741 pounds (Figure 14).

Nitrate-N concentrations in wetland effluent were less than the ROD cleanup standard of 10 mg/l. Nitrate-N concentrations were less than 0.5 mg/l in 2020 in water quality samples collected monthly at the primary discharge location EFF-L, with the exception of the following: 1) the January sample result with an estimated concentration of 6.6 mg/l; 2) an original and field duplicate sample collected in February, both with concentrations of 4.6 mg/l; and 3) the October sample with a concentration of 1.6 mg/l (Table 12; Figure D-6).

Ammonia-N concentrations collected from quarterly samples in extraction well SEW-01 ranged from 3.5 mg/l in May, with a split sample result of 5.0 mg/l, to 5.2 mg/l in February 2020. Ammonia-N concentrations collected from quarterly samples in extraction well SEW-02 ranged from 11 mg/l in May and August to 17 mg/l in November 2020 (Table 12). Ammonia-N concentrations in wetland effluent water samples collected monthly from EFF-L were less than 0.5 mg/l for 2020 with the exception of samples collected in November and December with a concentration of 1.1 mg/l and 1.0 mg/l, respectively (Table 12).

The concentration of nitrate-N in groundwater sampled at extraction well SEW-01 is higher than the concentration of nearby monitor wells MW-08, MW-17, MW-18 and MW-19, which are located along the aquifer boundary and in the “backwater” area of the extraction well. Monitor wells MW-17 and MW-18 are essentially co-located, but represent different sampling depths at the same location. These wells are believed to be along the northern edge of the extraction well SEW-01 capture envelope.

3.3.1.1 Effluent Field Nitrate

Field monitored nitrate-N concentrations ranged from 0.47 mg/l to 7.58 mg/l in effluent discharge (Table E-1). Field nitrate-N was compared to analytical laboratory results and the relative percent difference (RPD) was calculated (Table E-2). If the analytical result from the lab and the nitrate field probe was 1 mg/l or less, the RPD was not calculated. The data suggest that the field probe results are, on average, slightly higher than the laboratory results (Table E-2). The reasons for the fairly consistent offset between the probe and lab data are uncertain. Initial thoughts are that there may be some degree of denitrification occurring in transit to the laboratory. However, the critical operational decisions pending on the sampling results are such that it would be preferable to base the decision on falsely higher analytical results than falsely lower results. Thus, the present method of operation is conservative. Additionally, it is possible that the field probe may be the more representative value because it is taken soon after the time of sample collection, whereas laboratory analyses have a holding time of up to 48 hours. During this time denitrification may be occurring.

3.3.2 Treatment Cells Water Quality

Water quality samples were collected monthly from the PDA, ANA, and FDA treatment cells and analyzed for nitrate-N and ammonia-N as part of normal operation of the NARS (Table 12; Figures D-3 through D-5). In addition, samples were also collected for chemical oxygen demand (COD), total phosphorus, total Kjedahl nitrogen (TKN), and total organic carbon (TOC) (Tables 14 and 15).

Nitrate-N concentrations detected in original water samples ranged from less than 0.5 mg/l to 20 mg/l at ANA, FDA, and PDA-N and at PDA-C to an estimated 68 mg/l at PDA-S (Table 12; Figures D-3 through D-5). The 2020 average nitrate-N concentrations were 29.00 mg/l at

PDA-S, 16.83 mg/l at PDA-C, 7.72 mg/l at PDA-N, 3.37 mg/l at ANA, and 1.38 mg/l at FDA, calculated from monthly detections from original samples. During 2020, denitrification performance was consistent in the PDA and FDA treatment cells.

It was believed that historically increasing trends in nitrate-N concentration of the effluent resulted from falling air temperatures at the site when approaching freezing conditions. Colder temperatures suppress denitrification processes in the treatment cells. In December 2020 pumping was reduced to 4 to 6 hours per day for both SEW-01 and SEW-02, with the exception of the shutdown of SEW-02 from the week of December 10 through the week of April 9 due to slow denitrification in the wetlands causing nitrate-N concentrations to be elevated throughout the ponds. Reducing the influent mass loading, as recommended in the cold weather operations protocol of the O&M Manual, was successful at keeping nitrate-N from exceeding 10 mg/l in the effluent (H+A, 2012). This regimen decreased the nitrate loading into the wetland and increased the residence time through the treatment cells. No increases in nitrate-N concentrations in the effluent were observed near the discharge limit of 10 mg/l in CY 2020.

Water quality sampling for ammonia-N was performed monthly. The 2020 average ammonia-N concentrations were 8.87 mg/l at PDA-S, 0.90 mg/l at PDA-C, 0.44 mg/l at PDA-N, 0.47 at ANA and 0.39 mg/l at FDA, calculated from monthly detections. These concentrations of ammonia-N are favorable in terms of potential issues related to reconversion of ammonia to nitrate.

Water quality sampling for COD was performed quarterly in 2020, according to the treatment cell monitoring schedule (Table 15, Appendix C). COD concentrations in samples ranged from less than 60 mg/l at PDA-C in November 2020 to 820 mg/l in February 2020 at PDA-S (Table 15). The critical COD value for denitrification is 40-60 mg/l (HSU, 2002). It is suspected that the COD values have increased as more detrital material has accumulated and decomposed in the treatment cells.

Water quality sampling for TOC was performed quarterly in 2020. TOC concentrations detected in samples ranged from 23 mg/l in November 2020 at PDA-N to 330 mg/l at PDA-S in November 2020 (Table 15). TOC concentrations in CY 2020 were generally higher than CY 2019 concentrations. The volume of molasses added in CY 2020 was slightly less than that added in CY 2019, at 7,100 gallons in 2020 as compared to 11,450 gallons in 2019. The decrease in molasses addition did not appear to affect TOC concentrations based on the results from both 2019 and 2020. On the contrary, TOC increased on average from 2019 to 2020 while molasses addition decreased.

Water quality sampling for TKN was performed in August 2020. TKN concentrations detected in original water samples ranged from 0.61 mg/l at FDA to 1.0 mg/l at ANA (Table 14). All other ponds had TKN results were less than 0.50 mg/l.

Water quality sampling for phosphorus was performed quarterly in CY 2020. Total phosphorus concentrations detected in samples ranged from less than 0.1 mg/l at PDA-S, PDA-C, PDA-N, FDA, and ANA in November 2020, to 0.40 mg/l at PDA-S in May 2018 (Table 15). During the growing season, phosphorus concentrations are typically low due to uptake from cattails. Once cattails enter their senescent phase, concentrations detected in water samples should increase. The November 2020 results were less than 0.10 mg/l (Table 15). Phosphorus supplements (in the form of B-52) were not added in 2020.

Selected water quality parameters were evaluated from water samples collected monthly from the wetland treatment cells with field meters during the period from January through December 2020. NARS parameters included dissolved oxygen (DO), pH, EC, nitrate-N, and temperature (Tables E-1 and E-3). Field nitrate-N was compared to analytical laboratory results and the RPD was calculated (Table E-2). Field parameters showed little fluctuations during CY 2020 with the exception of January and February when concentrations of nitrate-N were elevated throughout the ponds. Dissolved oxygen was detected at concentrations less than 5 mg/l in all treatment cells during CY 2020 with the exception of treatment cell ANA in January 2020 with maximum concentration of 5.2 mg/l, respectively (Table E-3). In general, the measurements at the ANA were at higher concentrations than at the other treatment cells. Because the ANA treatment cell is designed to be aerobic, higher DO at ANA is not an issue. Suppression of DO concentrations in other cells is a favorable condition for the denitrification process. During CY 2020, EC did not increase as treatment water moved through subsequent treatment cells as was observed during the establishment phase of the wetland when dissolved solids concentrated and stressed the wetland plants. The pH remained within an optimal range for denitrification during CY 2020. Molasses was loaded into cell PDA-S to suppress DO concentrations thereby facilitating the denitrification process (Table 8).

3.3.3 Design Confirmation Piezometer Water Quality

Water samples were collected from piezometer DCP-12 during the February, May, August and November 2020 quarterly groundwater activities (H+A, 2020f, 2020h, 2020k, 2021a). These samples were analyzed for nitrate-N (Table 12). The nitrate-N concentration in original water samples collected at piezometer DCP-12 ranged between 8.6 mg/l in November 2020 to 150 mg/l in May 2020 (H+A, 2021a, 2020h) (Figure D-7). Sampling of this piezometer is performed using a bailer to manually extract three borehole volumes before sampling occurs. During the past few years, the piezometer has typically gone dry before purging the requisite three borehole volumes (approximately eight to ten gallons). This may help to explain the occasional increase in nitrate-N concentrations in the samples. Specifically, and as discussed earlier, there may be some level of local recharge. At the same time, there may also be vertical stratification in the water at that location such that more concentrated water is situated at the bottom of the piezometer. This concentrated water is probably reflective of water that was leaked during the initial filling of the wetland, considering the nitrate-N concentrations are much higher than any waters that have been in the FDA in recent years.

3.3.4 Monitor Well MW-10 Water Quality

Water samples were collected from monitor well MW-10 during the February, August, and November 2020 quarterly groundwater activities (H+A, 2020f, 2020k, 2021a). These samples were analyzed for nitrate-N and ammonia-N (Table 12). Ammonia-N concentrations in original samples collected at monitor well MW-10 were less than 0.5 mg/l for February, August and November 2020 (H+A, 2020f, 2020k, 2021a) (Table 12). Nitrate-N concentrations in water samples were less than 0.5 mg/l for May, August, and November and detected at 5.8 mg/l in February 2020 (H+A, 2020f, 2020h, 2020k, 2021a) (Table 12; Figure D-7). Water quality at monitor well MW-10 is used to monitor the quality of water recharging to the shallow aquifer to determine if compliance with the AAWQS of 10 mg/l for nitrate-N is being met (AAC, Title 18, Chapter 11). Ammonia-N is monitored to evaluate if nitrate-N conversion is occurring through oxidation because ammonia-N inhibits denitrification.

3.3.5 NARS Remediation Status

The NARS remedy was effective during CY 2020 in that a large mass of nitrate-N was removed from the shallow aquifer. The treatment cells provided the essential conditions for denitrification to occur. During CY 2020, nitrate-N concentrations remained at less than 0.5 mg/l in original effluent samples with the exception of January and February with an estimated concentration of 1.1 mg/l and 1.0 mg/l, respectively (Table 12). The NARS was effective in capturing and treating contaminated groundwater, based on decreasing nitrate-N concentrations north of the extraction well SEW-01 capture envelope. In addition, the NARS has effectively treated contaminated water extracted from both SEW-01 and SEW-02 since pumping commenced in this extraction well in July 2018.

Highlights through CY 2020 include removal of 37,454,349 gallons of contaminated groundwater; removal of an estimated 19,210 pounds of nitrate-N mass; operations of the SEW-01 and SEW-02 extraction wells for 362 days and 267 days respectively; continuous discharge of treated effluent to the primary discharge location; and non-detections of ammonia-N concentrations and non-detections of nitrate-N except for January 2020 when 5.8 mg/l was detected at Wash 3 monitor well MW-10 (Table 12). Nitrate-N concentrations ranged between 32 mg/l and an estimated value of 46 mg/l in original water quality samples collected monthly from extraction well SEW-01 and from an estimated value of 160 mg/l to 300 mg/l in 2020 from SEW-02 (Table 12; Figure D-3). The highest historical nitrate-N concentrations detected at extraction well SEW-01 were sampled in the late 2003, early 2004 time period (Figure D-6). At that time, concentrations were approximately 390 mg/l.

3.4 Northern Area Groundwater

The Northern Area groundwater monitoring activities were performed according to the schedule outlined in the Northern Area PMP (H+A, 2009a). Groundwater samples were collected from Northern Area shallow aquifer monitor wells and shallow aquifer private wells in accordance with an approved schedule to evaluate performance of the NARS and MNA (Table 3). The shallow aquifer monitor wells in the network include MW-08, MW-11, MW-13, MW-17 through MW-20, MW-34, MW-35, MW-36, MW-38, MW-40, MW-41A, MW-41B, MW-42, and MW-45 (Figure 8). In 2018, Monitor wells MW-20, MW-38, MW-40, MW-41A, MW-41B and MW-42 were reduced from semi-annual to biennial monitoring for water quality and water level measurements per approval by the EPA. As such, these wells were not sampled in 2020 and are scheduled to be sampled next in August 2021 (Table 3). The remaining NARS Northern Area wells are monitored for water levels and water quality quarterly, with the exception of semi-annual sampling at MW-13, MW-17 and MW-18 and annual sampling at MW-11 (Table 3). Additionally, transducers have been installed in select Northern Area monitoring wells for near continuous water level monitoring. During the CY 2018, eight shallow wells were installed in the northern area for the purpose of remedy acceleration (H+A, 2019b, 2019c). They are identified as monitor wells PB-2A, PB-4, PB-5A, PB-7 and piezometers NAP-1 through NAP-5.

Shallow aquifer private wells have also been incorporated into the Northern Area performance monitoring network. In August 2020 biennial private wells D(17-20)36aad1, D(17-20)36caa, D(17-20)36caa2, D(17-20)36cdb, D(17-20)36ddc, D(18-20)01aad and D(17-20)25bad were monitored with water quality sampling. In 2020 monitoring of the Jones well (private well D(18-21)06bcb) in the Northern Area was monitored on a quarterly basis because of the potential impact to the capture zone in the vicinity of this well during extraction at SEW-02. Because the well is a private well located just north of the capture zone envelope of extraction well SEW-01, it will continue to be monitored quarterly.

3.4.1 Northern Area Water levels

Water levels were measured quarterly and water level contour maps were prepared to evaluate groundwater flow dynamics in the Northern Area of the shallow aquifer (H+A, 2021a) (Appendix B). Water level monitoring is essential in the determination of possible shifts in flow direction, which could cause migration of nitrate-N to areas where it previously had not been present. The general pattern of groundwater flow in the Northern Area shallow aquifer is sub-parallel to the course of the San Pedro River, which flows north to northwest.

Static water level elevations in the Northern Area shallow aquifer around and upgradient of the NARS ranged from approximately 3,568.17 feet above msl in monitor well MW-19 in November 2020, to approximately 3,596.09 feet above msl in monitor well MW-13 in February 2020 (Table 4). A localized depression in the shallow aquifer near monitor wells MW-08, MW-17, MW-18, and MW-19 has developed as a result of long-term pumping at NARS extraction well SEW-01 (Figure B-3). Water level elevations in the Northern Area shallow aquifer wells in the MNA management zone were not measured per the 2020 monitoring schedule. Private well D(18-21)06bcb was scheduled to be monitored quarterly. During 2020 this well was unable to be measured in February, May, August and November due to lack of an access port. However, a groundwater sample was obtained (H+A, 2020f, 2020h, 2020k, 2021a).

Water level elevations in shallow aquifer monitor wells feature typical seasonal fluctuations. These effects include increases due to winter recharge and decreases due to pumping increases and ET losses during the summer. In previous years, water levels in shallow aquifer wells not influenced by extraction well SEW-01 pumping increased slightly during summer monsoon. This seasonal influence was not observed in the August 2020 water levels; however, the monitoring was conducted in early August near the middle of the monsoon season (Table 4; Figures A-41 through A-47). The monsoon precipitation for CY 2020 at 3.59 inches totaled for the months of June through September was below the average precipitation of 7.86 inches at the National Oceanic and Atmospheric Administration (NOAA) Benson 6E station totaled for the same months (Table 18).

MNA Northern area monitor wells were not measured in 2020 due to the change to the monitoring frequency to biennially per EPA approval (EPA, 2020d). The apparent horizontal hydraulic gradient was last calculated in February 2019 within the Northern Area shallow aquifer, at approximately 0.003 ft/ft, between monitor wells MW-40 and MW-41B (H+A, 2019e). The measured gradient was consistent with the November 2018 result (H+A, 2019e).

3.4.2 Northern Area Water Quality

Water quality sampling for nitrate-N contamination was performed on a quarterly, semi-annual, annual or biennial basis according to an approved schedule (Table 3). Time series water quality graphs for nitrate-N concentrations were prepared to examine trends (Appendix A).

Nitrate-N concentrations, detected in shallow aquifer groundwater samples collected from upgradient monitor wells around and upgradient of the NARS, ranged from less than 0.5 mg/l at monitor well MW-34 in August and November of CY 2020 to an estimated at 990 mg/l at monitor well PB-5A (SEW-03) in May 2020 (H+A, 2020f, 2020h, 2020k, 2021a) (Table 7). Nitrate-N was detected at concentrations greater than 10 mg/l in samples collected from upgradient Northern

Area monitor wells MW-08, MW-13, MW-17, MW-18, MW-19, MW-35, MW-36, and MW-45, PB-2A, PB-5A (SEW-03), and PB-7 during CY 2020 (Table 7; Figures A-21, A-23 through A-26, A-28, A-29, A-30, A-32, A-34 and A-35). Depth discrete samples in wells that are not equipped with dedicated pumps were sampled using Hydrasleeves™. These were set at the same depth intervals as sampled in 2019. The vertical nitrate-N concentration gradient reported in monitor wells PB-2A, PB-4 and PB-7 were consistent with those detected from 2019, but with an increased concentration with depth within the water column observed at the PB-4 and PB-7 and absent at the northern-most well PB-2A (Table 7; Appendix A-32, A-33, A-35). During 2020, nitrate-N concentrations decreased in wells MW-13, MW-17, and MW-18, remained the same in wells MW-08, MW-19, MW-34, MW-35, MW-36 and PB-7, and increased in wells MW-11, MW-45, PB-2A, PB-4 (the deep sample collected at 65 ft bls), and PB-5A (SEW-03). It is important to understand that these high concentrations of nitrate-N in upgradient monitor wells in the Northern Area are not comparable to the low background concentrations seen in the upgradient monitor wells in the Southern Area. The Southern Area upgradient monitor wells were well upgradient of the location where historical discharges from the site occurred. Additionally, agricultural activities and domestic sewage discharged to septic systems which may contribute to nitrate concentrations in the shallow aquifer are common in the Northern Area. For this reason, shallow aquifer private wells have been incorporated into the monitoring network. Those land uses may also add to the nitrate-N background in groundwater. In contrast, upgradient from the Northern Area MNA area, the NARS is operative as an active component of the remedy. Therefore, the high nitrate-N concentrations detected in monitor wells are controlled by the capture of extraction well SEW-01 and SEW-02 (Figures 8 and B-6).

MNA management zone wells MW-41A and MW-42 were not sampled in 2020 per the monitoring schedule. These wells were sampled in 2019 and both contained less than 10 mg/l (H+A, 2019o, 2020b) (Table 7). Management zone well D(18-21)06bcb is located just north of the SEW-01 extent of capture zone as determined from particle tracking and water level monitoring data, and is largely managed by the pumping rate at SEW-01 (H+A, 2005b). Nitrate-N concentrations in well D(18-21)06bcb ranged from 2.0 mg/l in August 2020 to an estimated concentration of 4.3 mg/l in November 2020 (H+A, 2020k, 2021a). The average nitrate-N concentration detected in well D(18-21)06bcb has decreased between 2019 and 2020. At this location, the concentrations of nitrate-N in the well might be expected to fluctuate if agricultural pumping were sufficiently intense. In addition, the NARS piezometers NAP-1 through NAP-5 were not sampled in 2020.

MNA parameters had been collected on an annual basis at MNA management zone monitor wells MW-38, MW-40, MW-41B, MW-42, and D(17-20)25bad through 2016. Samples had been analyzed for alkalinity, dissolved manganese, dissolved iron, and sulfate by an approved laboratory, and DO, oxidation-reduction potential (ORP), and TDS. The nitrate-N concentrations in groundwater in these wells have been below the cleanup standard since May 2013. The EPA agreed during the May 17, 2017, annual meeting that these analyses were no longer needed to track MNA parameter monitoring.

3.4.3 Northern Area Shallow Aquifer Status

The shallow aquifer in the Northern Area showed decreasing concentrations of nitrate-N across the MNA network monitor wells, so much so that the nitrate-N plume extent has decreased closer to the extraction well (Figure 2). Private well D(18-21)06bcb nitrate-N concentrations had increased from 2018 through 2019 to an estimated maximum concentration of 11 mg/l. Since 2019, concentrations of nitrate-N in downgradient private well D(18-21)06bcb have declined to a maximum concentration of 4.3 mg/l detected in November 2020. A notable difference in the defined area of the plume is in the vicinity this private well D(18-21)06bcb, MW-17, and MW-18, upgradient from SEW-01. This portion of the plume has receded towards SEW-01 significantly, as concentrations declined below 10 mg/l in MW-17 and MW-18 in August 2020, and nitrate-N in the private well continued to decline throughout 2020.

The installation of well PB-5A (SEW-03) in 2019 and subsequent sampling for nitrate-N showed concentrations ranging from 470 mg/L to 530 mg/L collected during pumping events in June and December 2019. Vertical profile results exhibited a wider range of nitrate concentrations at depth in this well in 2019, as discussed in detail in the 2019 Annual Performance Monitoring and Site-Wide Report (H+A, 2020e). In 2020, concentrations of nitrate-N ranged from and estimated concentration of 870 mg/l in May 2020 to an estimated concentration of 1,600 mg/l in November 2020 from original samples. Nitrate-N concentrations have sequentially increased between February and November 2020 (Table 7). In addition to the nitrate-N concentrations measured at PB-5A, the higher nitrate-N concentrations at wells PB-4 and PB-7 (over 100 mg/L) have better defined the axis of the downgradient plume.

In the area around and upgradient of the NARS, nitrate-N concentrations at shallow aquifer monitor wells MW-19 and MW-34 indicated little fluctuation during CY 2020. Monitor well MW-19 concentrations ranged from 3.5 to an estimated 12 mg/l, and MW-34 concentrations were below 0.5 mg/l in August and November 2020 with low level detections up to 1.2 mg/l in May 2020. Concentrations at monitor well MW-35 and MW-17 ranged from 50 to 97 mg/l and from 16 to 26 mg/l in CY 2020, respectively. Monitor wells PB-4 and PB-7 exhibited an increase in nitrate-N concentrations only in the deepest sample collected within the well screen (65 ft bls and 60 ft bls, respectively). Nitrate-N increasing with depth is consistent with the vertical profile observed at these new wells since depth discrete sampling began in 2018 (H+A, 2020ee). This is consistent with water level patterns and flow line analyses expected along the aquifer boundary which in places is quite irregular. Nitrate-N concentrations at monitor well MW-08 remained steady in 2020. This monitor well is within the capture zone of extraction well SEW-01.

ICs were effective during CY 2020. The well inventory was updated and no additional domestic wells were identified as within or reasonably close to (within 0.7 miles) the nitrate-N plume. One new irrigation supply well drilled in 2020 was identified within 0.7 miles of the nitrate-N plume, however this well is not considered to be at-risk due to irrigation use. Details on the CY 2020 well inventory are in Section 6.1. Currently, bottled water is supplied to one well owner, D(18-21)06bcb. This residence is located just north of SEW-01. Currently the nitrate-N concentration is below 10 mg/l, as it has been since 2013 with the exception of one estimated result of 11 mg/l in August 2019. This private well will be monitored quarterly in CY 2021 to verify that nitrate-N concentrations remain below 10 mg/l, particularly during potential changes in the extraction well SEW-01 pumping regimen associated with pumping upgradient at extraction well SEW-02. Details on ICs are provided in Section 6.0.

Private well D(18-20)01aad (McRae) was recommended for removal from the monitoring list in 2020 (H+A, 2020e). This well is not accessible and the owner has not been responsive to ANPI's requests to access this well for sampling. This well was last sampled in May 2013, and nitrate-N was reported at 5.3 mg/L. This well has not been reported to exceed 10 mg/L since May 2007, when the nitrate-N concentration was 14 mg/L. EPA and ADEQ requested this well not be removed from the monitoring plan and recommended additional attempts be made by ANPI, and if necessary ADEQ, if the resident is not receptive (EPA, 2020d, ADEQ 2020). This well is scheduled to be sampled next in August 2021 (Table 16).

3.5 OVERVIEW OF NORTHERN AREA SHALLOW ALLUVIAL AQUIFER

For the purposes of this report and for various practical reasons, the shallow aquifer is referenced in terms of a Southern Area and Northern Area. This division was based on:

- The position of tributary watersheds that enter the San Pedro River, with the Southern Area drained primarily by Wash 6, and the Northern Area by Washes 1, 2, 3, 4, and 5.
- The types of COCs present, with both nitrate-N and perchlorate present in the Southern Area, and only nitrate-N present in the Northern Area.
- The presence of perched groundwater systems in the Southern Area as a result of historical plant operational activities.
- A mound-like protrusion of the aquifer boundary extending along the western aquifer boundary just to the south of Wash 5.
- Differences in the remedies operating in these respective areas.

In the Southern Area, based on a determination of low risk to human health and for contaminant migration, a program of long-term monitoring is in place according to the EPA's 2017 ESD. For the Northern Area, two separate remedies are operating, a pump-and-treat remedy known as the NARS established pursuant to EPA's 1994 ROD, and a larger area, which is under MNA as a result of EPA's 2008 ESD approving MNA in the Northern Area (EPA, 2008).

The Northern Area of the shallow alluvial aquifer within the ANPI Superfund Site occurs within the heterogeneous alluvial strata along the San Pedro River (Figure 8). Groundwater flows across the area in a general southeast to northwest direction, roughly parallel to the course of the river. Historically, intermittent flow along this reach is facilitated by groundwater-surface water exchanges, wherein the river is alternately a gaining and a losing stream, owing to River location and flow conditions. These conditions were confirmed via a detailed wellpoint survey conducted during low-flow conditions in the river (H+A, 2003). Recent modeling conducted on groundwater water elevations and streamflow data collected since 2018 indicates that San Pedro River is predominantly a losing stream, although some reaches likely still exhibit seasonal periods of gain (H+A, 2020i). There has been a notable decline in surface flows and precipitation events over the past decade which has contributed to a reduction in measurable streamflow within the San Pedro

River and a downward trend in water level elevation within the shallow aquifer during the historic period of record (Appendix A, A-21 through A-55).

The aquifer is present within a diverse lithologic assemblage ranging from silty clays to sands and gravels. These units comprise both Holocene alluvial materials, associated with the San Pedro River, and older, reworked materials of the St. David Formation as described by Gray (Gray, 1965 and 1967). The general stratigraphic section of the St. David Formation comprises strata of Pliocene to Pleistocene age. Notably, Gray has described a lower clay unit as predominantly red clays and mudstones to depths of 2,600 feet above mean sea level (amsl) near St. David (Gray, 1967). At the Site, this unit has been referred to as the "St. David clay," and is considered the base of the shallow alluvial aquifer. The St. David clay also forms a confining unit for underlying artesian aquifers in the St. David Formation. Generally, these artesian aquifers are present at considerable depths (>200-750 feet) below the clay surface and are commonly exploited for public, agricultural, and domestic water supplies.

In examining the stratigraphy of the St. David Formation, coarser units ("stringers") are commonly noted among the fine-grained units (Gray, 1965, 1967). Such stringers have been commonly observed in the materials that form the western boundary of the shallow aquifer. Depending on the elevations of historical water levels, contaminated groundwater can saturate such materials and become trapped if groundwater levels recede, particularly if they are underlain by finer-grained materials. Such perching has been commonly observed in the Southern Area of the Site.

Incision by drainages (ephemeral washes) coming off the upland area west of the boundary into the alluvium are evident. In particular, such incisions are noted in the areas where Washes 1 and 2, Wash 4, and Wash 5 debouch onto the alluvial plain. The initial remedial investigation required the construction of monitor wells at each of these locations. And in the early days of the investigation, some of the highest concentrations of nitrate-N were detected in groundwater sampled from these wells along the alluvial margin. It is evident that these areas are not in the primary pathway of groundwater flow, which is predominantly to the east along the San Pedro River. Hence, without sufficient recharge, nitrate-N that entered into these areas did not readily advect out.

As stated earlier, the lower clay unit of the St. David Formation is considered the base of the shallow alluvial aquifer for the purposes of this investigation. The configuration of the surface of this clay base was interpreted from resistivity and induced polarization surveys performed in 2018 (hydroGEOPHYSICS, Inc. [HGI], 2018). The interpretation indicates trough-like structure or a basin sloping roughly towards the position of the present San Pedro River and plunging towards the northwest. Generally, the St. David clay is encountered at a maximum depth under the river axis.

Not only is the clay horizon important from a hydrostratigraphic standpoint, but it also represents a confining unit for the deep artesian aquifers within the St. David Formation. As stated earlier, these artesian aquifers are important as a local water supply, so it is important that downward migration from the contaminated portions of the shallow alluvial aquifer is not occurring. Thus, it is important that the clay acts as a confining unit for the artesian aquifers and that the hydraulic gradient within the artesian aquifers is upward. In many places the potentiometric surface is present above the water table of the shallow aquifer. Insofar as vertical groundwater movement between the shallow and artesian aquifers, an upward recharge effect is suspected due to the combined effect of the upward hydraulic gradient and the lack of proper annular seals in many older deep aquifer wells.

As for the extent of the Northern Area of the Shallow Aquifer at the Site, an extension of the western boundary of the shallow aquifer was designated as the boundary between the Northern and Southern Areas (Figure 8). The basis for this designation was discussed earlier in this section. The northern extent of the shallow alluvial aquifer extends along the San Pedro River. Stratigraphic heterogeneities in the subsurface, and their implications for contaminant transport and the operational history of the Site are addressed in detail in previous annual reports (H+A, 2020e, 2019d).

3.5.1 CSM for the Northern Area Shallow Aquifer

Elements of the CSM for the Northern Area of the shallow alluvial aquifer along the San Pedro River and their implications for numerical modeling have been detailed in the *2019 Annual Performance Monitoring and Site-Wide Status Report* (H+A, 2020e). Primarily it is believed that preferred pathways probably exist closest to the San Pedro River, where the sediments are thickest, groundwater-surface water exchange is present, and the sediments are coarser.

In 2019 hydrogeologic cross-sections were prepared of the NARS portion of the Northern Area of the shallow alluvial aquifer to further refine the CSM using the new data collected from the 2018 and 2019 exploratory drilling. The cross-sections were developed on the basis of lithologic logs from both prior and recent exploration, and represent data recorded from a variety of boring and logging methods. The recent drilling programs were performed using continuous coring methods and are therefore believed to be more reliable than the earlier drilling by conventional rotary methods. The position of these cross-sections is shown on Figure 15. Examination of cross-sections A-A′, B-B′ and C-C′ easily demonstrate the degree of heterogeneity in the system on the western side of the San Pedro River (Figures 16, 17 and 18, respectively).

BAS Groundwater Consulting (BAS) prepared a 3-dimensional (3D) geologic model using the lithologic logs from boreholes drilled in the Northern Area *Apache Powder Superfund Site Northern Area Groundwater Model Technical Memorandum* (H+A, 2020e). Consistent with the existing CSM and geologic setting observed at the Site, the 3D geologic model is highly heterogeneous, consisting of several discontinuous lenses of sand, silt, and clay. The model results match closely with the conceptual cross sections (Figures 16 through 18). This was exhibited during the annual meeting with the EPA on June 18, 2019. The 3D geologic model was used as the foundation of the groundwater flow model described below. Modeling details and associated figures are provided in the GW Model TM in the *2019 Annual Performance Monitoring and Site-Wide Status Report (H+A, 2020e).*

Following the completion of the 3D geologic model, a numerical groundwater flow model of the Northern Area was created by BAS using the United States Geological Survey (USGS) MODFLOW-USG software (USGS, 2017). The MODFLOW grid was intersected with the LeapFrog™ model.

A summary of key findings and implications for the CSM were provided in the *2019 Annual Report*. In general, the findings were congruent with the pre-existing CSM and serves to strengthen the existing model. The model demonstrated the efficacy of the NARS as evidenced by the reduction of nitrate-N concentrations at nearly all locations over the modeling period. Extraction well SEW-01 plays a crucial role in capture of nitrate-N throughput is clearly illustrated in the model.

The model indicates that by maintaining the same pumping regimen at extraction well SEW-01, nitrate-N should remain below 10 mg/l in the downgradient private well D(18-21)06bcb(Jones).

Based on examination of hydrochemical data, it is inferred that the water pumped from extraction well SEW-02 is not being drawn from the subflow region of the San Pedro River. Further presentation of the hydrographic information since the startup of pumping at extraction well SEW-02 is presented in Appendix E. In addition, groundwater monitoring results did not show that recharge to groundwater from the river and tributaries will increase from the additional pumping under simulated scenarios However, they do indicate that the additional simulated pumping will impact the availability of shallow groundwater adjacent to the river for vegetation. Lower water levels caused a decrease in ET with increased pumping at SEW-02, as predicted by the model. Although lower water levels resulted in less ET, vegetation may seek out water in saturated sediments along the river instead. This result could have an impact on streamflow and subflow (H+A, 2020e).

In comment letters dated May 21 and June 9, 2020 ADEQ and the EPA, respectively, provided feedback on the model, suggesting alternate approaches to the model could have been taken. In the Annual meeting on June 17, 2020, instead of requiring additional modeling simulations, the Agencies and ANPI agreed to collect additional data during operation and optimization of the NARS and revisit the groundwater model as appropriate (EPA, 2020d, ADEQ 2020).

3.6 NORTHERN AREA REMEDIATION SYSTEM

The Northern Area Remediation System (NARS) was designed and is being operated by ANPI per EPA direction set forth in the 1994 ROD. The system comprises and extraction wellfield that conveys water to a constructed treatment wetland for denitrification. Upon treatment to the ROD-specified 10 mg/l standard for nitrate-N, the treated water is returned to the aquifer via infiltration within Wash 3, a tributary to the San Pedro River (Figure 9).

While performance with regard to the remedial activities in both the Southern Area and in the MNA portion of the Northern Area is essentially in a static/maintenance status, recent efforts have been directed towards the acceleration of NARS performance in an effort to attain the remedial action goals sooner than has been projected. This program has been undertaken in light of:

- Geophysical surveys and exploratory drilling in the Northern Area providing further hydrostratigraphic information on optimal locations for emplacement of additional extraction wells.
- Further denitrification capacity potentially available in the NARS treatment wetland.
- Acquisition of additional parcels of land in the Northern Area by ANPI.
- Successful pilot testing of a new extraction well (SEW-02) in the Northern Area.

As mentioned earlier, during July and August 2018, ANPI completed a geophysical survey along five roughly southwest-northeast transects in the Northern Area (HGI, 2018). The survey included both electrical resistivity and induced polarization methods in an effort to help define subsurface features with a goal of assisting in the siting of locations for potential new exploratory borings and extraction wells.

Based on the survey results, six locations were selected for exploratory drilling. Drilling was performed beginning in November 2018, during which time four potential extraction wells and five exploratory borings were drilled. The results are summarized in the report dated March 27, 2019, entitled Results of Additional Characterization Drilling and Extraction Well Construction in Northern Area (H+A, 2019c).

The resulting information led to consideration of a supplemental drilling program to address certain data gaps. The proposed workplan for this exploratory phase was submitted to EPA for approval on January 3, 2019 with approval for the work plan issued in a January 28, 2019 correspondence from USEPA to ANPI. This drilling was performed in February 2019. Upon completion of this exploration, the locations were surveyed for position and elevation control. From that information stratigraphic cross-sections were interpreted (Figures 15 through 18). Details regarding the events that led up to the incorporation of extraction well SEW-02 (TW-01) are summarized in previous annual reports (H+A, 2019d, 2020e).

Efforts to accelerate attainment of remedy standards have focused on optimal extraction of contaminated groundwater within positions upgradient from extraction well SEW-01. This effort began in July 2018 with pumping at extraction well SEW-02. Aggressive pumping at that location resulted in nearly doubling the rate of nitrate-N mass extraction from the shallow aquifer. This has resulted from a combination of the decrease in influent concentrations to extraction well SEW-01 and the capture of higher nitrate-N concentrations at extraction well SEW-02. This effort to accelerate the remedial goals achievement continue with the proposed addition of a third extraction well, SEW-03, anticipated to operate as part of the NARS in late March/early April (H+A, 2021b).

Based on concerns raised regarding the potential for capture of San Pedro River subflow due to more rigorous pumping in the Northern Area, during the proposed pilot testing of SEW-02, in June 2018 five piezometers (NAP-01 through NAP-05) were constructed along the western bank of the San Pedro River (Figure 8). These piezometers were monitored throughout 2020 using downhole pressure transducers. Borings were drilled to depths of 22 to 40 feet bls and screened across intervals where first water was encountered. These piezometers enable monitoring of water levels and water quality along the San Pedro River in the subflow region. Generally, water level responses in the piezometers indicate changes in response to surface flow effects and potentially bank storage in the San Pedro River. Specifically, surface water/groundwater interactions are apparent. The water level in piezometer NAP-4 exhibits slight fluctuations in response to pumping cycles at extraction well SEW-02, whereas the fluctuations at nearby monitor well MW-45 are quite pronounced (H+A, 2020e).

Of the exploratory borings drilled in 2018 and 2019 to assist with identifying potential extraction wells, PB-5A (SEW-03) was proposed as an additional extraction well for the Northern Area based on initial sampling and analysis of groundwater. Following approval of the revised work plan, ANPI conducted a pilot testing program at PB-5A (SEW-03) in December 2019 (H+A, 2019e, 2019k, EPA, 2019e). PB-5A (SEW-03) was equipped with a stainless steel, three-inch diameter, submersible electric pump, supplied with gasoline-powered electric generator power during the pilot test. A two-inch diameter plastic flex piping was installed to connect PB-5A (SEW-03) discharge piping to the four-inch diameter flex pipeline near extraction well SEW-02 (Figure 9). The December 2019 test of PB-5A (SEW-03) indicated the potential to pump at a sustained rate of 10 gpm. Nitrate-N concentration of measured during the test ranged between 470 and 510 mg/l (H+A, 2020c). The results of the December pilot test are presented in “Results of Pilot Extraction Testing at Northern Area Shallow Aquifer Test Well PB-5A” dated January 31, 2020 (H+A, 2020c).

4.0 SAN PEDRO RIVER

The San Pedro River is the primary hydrologic feature within the basin and is interactive with the shallow aquifer. The interactions are controlled largely by hydrostratigraphic and geomorphic factors. For example, lithologic logging in the vicinity of monitor well MW-35 indicates semi-confinement by a fine-grained stratum in the vicinity of monitor well MW-35, however, moving eastward toward the river, this stratum does not appear to be present in outcrop, likely owing to historic downcutting along the river meander. Accordingly, throughout the study area, the San Pedro River has alternated between gaining and losing reaches (Figure 19). Groundwater-surface water interactions are particularly evident during baseflow conditions. In addition, ephemeral tributaries entering the San Pedro River from the west, probably contribute some degree of recharge to the shallow aquifer during periods of intense runoff. Detailed investigations of the groundwater-surface water interactions along the San Pedro River have been performed as part of the Site RIs (H+A, 2003c). Additionally, similar investigations have been performed by other investigators upstream and downstream from the site (Black and Veatch, 1988). The groundwater flow model was also used to simulate the effects pumping in the shallow aquifer may have on the San Pedro River baseflow, if any. As previously discussed, the simulations show that additional pumping in the shallow aquifer does not negatively impact the San Pedro River directly. However, it does have the potential of reducing ET and availability of groundwater for plant-life (H+A, 2020i). Data collected since 2018 indicates that San Pedro River is predominantly a losing stream. Past studies have indicated that some reaches have exhibited seasonal periods of gain (H+A, 2003c, 2020i). There has been a notable decline in surface flows and precipitation events over the past decade which has contributed to a reduction in measurable streamflow within the San Pedro River and a downward trend in water level elevation within the shallow aquifer during the historic period of record (Appendix A, A-21 through A-55).

The 10 mg/l surface water quality standard for the San Pedro River along the Curtiss Reach was reassigned by ADEQ in December 2008 to match the criteria for designated use under full-body contact and partial body contact of 3,733 mg/l for nitrate-N (ADEQ, 2016). Surface water sampling has never indicated an exceedance of that standard.

Measurement and sampling along the San Pedro River are contingent on flow conditions. Water quality monitoring in the San Pedro River is opportunistic due to the intermittent nature of its flow. As discussed above, reaches of the stream have flowed intermittently due to groundwater discharge, however most reaches are ephemeral during most of the year. During more extreme runoff events, the stream can flow bank-to-bank or occasionally overbank throughout the Site. During CY 2020, the five surface water stations of the site were monitored for flow: SW-03, SW-04, SW-12, SW-13 and SW-14 (Figure B-1). Surface water flow was detected during two quarterly events, February and May 2020, and water quality and surface water discharge rates were monitored at the four flowing surface water monitoring stations at those times (Table 7 and Figure 20).

4.1 DISCHARGE

San Pedro River surface water discharge conditions during the 2020 monitoring period were predominantly dry (Table 17). Surface water flow was measured at the four flowing stations in February 2020, SW-03, SW-04, SW-12 and SW-14 and in May 2020. Surface flow was absent at the station SW-13 in 2020. Surface water discharge ranged from an estimated 0.01 cubic feet per second (cfs) at surface water locations SW-03, SW-04, SW-12, and SW-14 in May to 3.72 cfs at surface water location SW-03 in February 2020 (Figure 20).

4.2 SAN PEDRO RIVER WATER QUALITY

During 2020, surface water quality samples were scheduled for collection at the five monitoring stations along the San Pedro River (Figure B-1). Surface water samples collected from monitoring stations SW-03, SW-04, SW-12 and SW-14 are analyzed for nitrate-N (Table 7). Surface water samples collected at SW-14 are also analyzed for perchlorate because it is situated near the Southern Area. The SW-03/04 reach has historically recorded the highest nitrate-N concentrations (Figure 8).

Nitrate-N concentrations in samples collected from San Pedro River surface water stations were detected in samples collected from SW-03, SW-04 and SW-14 in February at concentrations of 1.8 mg/l, 0.74 mg/l and 0.34 mg/l, respectively. Nitrate-N was also detected in May in samples collected from locations SW-03 and SW-04 at 3.5 mg/l and 3.3 mg/l, respectively. These concentrations are within the historical range for these sample locations (Table 7; Figures A-51 through A-55).

5.0 INACTIVE AND FORMERLY ACTIVE PONDS

The remedy for the Inactive and Formerly Active ponds on ANPI property involved the emplacement of a native soil cover over the footprint of the former ponds (Figure 5). Ponds 1A, 1B, 2A, 2B, 3A, and 3B all were situated overlying PZ-A. ICs are used to further prevent potential for exposures to pond soils containing COCs greater than SRLs. The ICs are intended to be protective of groundwater users and those that might be subject to direct exposure to contaminants within the ponds. This remedy was selected in the 2005 EPA-amended ROD (EPA, 2005). Pursuant to the August 22, 2008 DEUR, an annual pond inspection was performed during December 2020 (ADEQ, 2008). The full inspection report is included in an Appendix to this report (H+A, 2020a) (Appendix F). The DEUR was recorded in Cochise County on July 28, 2008, and subsequently approved by ADEQ on August 22, 2008 (ADEQ, 2008). The DEUR restricts the use of the property to non-residential, restricts the use of contaminated groundwater beneath the ANPI property, and provides details on institutional and engineering controls for maintaining pond covers.

There were no pond cover maintenance and restoration activities performed during CY 2020. Inspection results for 2020 did not result in immediate corrective actions. However, several findings during the annual inspection in December 2020 will require action prior to the summer rains in July. Details of the pond locations requiring maintenance and current photographs showing the conditions of the pond covers as of the annual inspection are provided (Appendix F).

5.1 PONDS STATUS

Pond cover inspections were performed in accordance with the “Soil Engineering Control Plan”. Quarterly pond inspections were performed by ANPI throughout CY 2020 and in response to extreme weather events and according to the O&M manual (H+A, 2008b, 2012b).

At the end of 2020, the Pond covers were generally in good condition. During the annual 2020 inspection, erosion control devices showed signs of deterioration at Ponds 1A, 1B, 2A, 2B, 3A, 3B, and Dynagel, however, native vegetation has re-established across the majority of the ponds and therefore repair is either optional or not considered necessary Erosion channels greater than two inches deep were not observed during the 2020 pond inspection. Overall, the pond covers continue to provide effective containment of contaminated soils. ICs including the signage and fencing ensure a further degree of protectiveness.

6.0 INSTITUTIONAL CONTROLS

ICs for groundwater have been imposed pursuant to an amendment to the ROD (EPA, 2005). The ICs required by the ROD amendment and the DEUR for the ponds included Site access restriction, community education and outreach, and well inventory for the purpose of determining potential exposure risk. In addition, ANPI implemented a revised ADWSP and a Community Outreach Plan (COP) (ANPI, 2007 and H+A, 2009b).

6.1 WELL INVENTORY

The primary purposes of the well inventory are to identify shallow aquifer wells in the vicinity of the ANPI study area and track well development and construction as it may relate to potential human exposure pathways associated with contaminated groundwater associated with the Site. The well inventory comprises an assemblage of well information managed in both electronic and hardcopy formats. The electronic media are stored within Microsoft Access Database and a Geographic Information System (GIS) based on ArcView 10.1 architecture. Data sources for the well inventory include the Arizona Department of Water Resources (ADWR) Wells 55 database, Groundwater Site Inventory (GWSI) database, and field data collected by ANPI. The well inventory is updated annually, once ADWR completes their revised database. The complete CY 2020 well inventory update is provided (Appendix G).

Based on the August 2020 nitrate-N plume, no additional domestic wells were identified within 0.7 miles of the nitrate-N plume. In total, five new registration records were added to the database between CY 2018 and CY 2020.

The well inventory within the proximity of the site continues to be a useful tool for evaluating potential receptors for contaminated shallow groundwater. Previously, the broader geographic area of the inventory appears to be providing little useful information so the detailed extent of the well inventory report has been used since 2015. Future inventory reports will limit the area of study to the area labeled “Detailed Extent of Well Inventory” as shown on Figure 1 of Appendix G, based on discussions with EPA.

In addition to this annual well inventory, ADWR reviews NOI files for proposed domestic water supply wells close to the ANPI facility to determine if they are within the DEUR or one mile of the Site plume (Figure 22). If the well location is within these limits, the ADWR forwards the NOI to ADEQ for consultation on well impact pursuant to R12-15-1302. At the same time, ADWR sends a courtesy copy to the EPA Remedial Project Manager (RPM). After consultation with ADEQ, ADWR decides whether to issue the permit, to require a hydrological study from the applicant or to deny the permit.

6.2 COMMUNITY OUTREACH

The Community Outreach Plan (COP) was prepared in 2007 (ANPI, 2007). The COP specifies outreach activities designed to inform the community in the vicinity of the Site of ongoing remediation activities as well as other information that may be useful in understanding plant operations. Activities associated with the COP may include mailings to nearby residents to communicate remediation status, maps showing the extent of contamination, and community meetings to provide updates on the Superfund project. ANPI also maintains a website at URL http://www.apachenitrogen.com. This website is another component of the outreach program. The Benson Library also contains a repository of information on the Apache Superfund Site for public viewing.

The following information was reported by ANPI's Community Outreach Coordinator:

"ANPI has a strong commitment to the communities in Cochise County and to key State and National groups that participate in the mining and agricultural industries. The following are a few specific functions, activities, and areas of support ANPI provides support to, and/or participates in."

- Apache Community Advisory Council – In 2014, ANPI saw the need for and the benefit of developing a council of area citizens to serve as a community relations resource for Benson, St. David, and Cochise County. The Council, composed of a dozen recruited business leaders, educators, retirees, and thought leaders, is kept informed of company initiatives, plans, issues, donations, and other pertinent organizational information at a grassroots level. ANPI utilizes the members as a barometer regarding local sentiment, concerns, or issues, allowing the company to notify and educate the public proactively about ongoing activities and opportunities for improving our trustworthiness, reputation, and standing in the community. The Council currently includes, among others, the Superintendent of Benson Unified School District, the Director of the Southeastern Arizona

Economic Development Group, a local Pastor and two local business owners, as well as the past President of the Benson Chamber of Commerce, the Director of Cochise County Emergency Services, and three former Mayors of Benson. The group meets quarterly at the offices of ANPI for updates and exchanges of information.

- Other Local Clubs/Organizations - ANPI personnel from all levels of the company are active in civic groups, kids' programs, etc. Following are some of those activities. Benson Rotary Club, Benson Clean & Beautiful Board of Directors, coaching in Little League baseball and adult softball teams, Benson Chamber of Commerce Board, Cochise County Local Emergency Planning Committee (LEPC), and St. David Heritage & Cultural Arts Society.

- Community Functions Support – ANPI participates in numerous local community events, including St. David Pioneer Days, Benson Butterfield Stage Days, Benson Community Heath Fair, St. David Broadway & Beyond, the 4th of July & Christmas parades, and the County Science Fair.

- Apache Good Neighbor Program – ANPI has established a program for neighbors or interested parties to sign up to receive occasional mail flyers from the company providing updates for ongoing or upcoming plant activities, projects, or functions.

- Donations and Contributions - ANPI provides tens of thousands of dollars annually to support local financial needs, including six scholarships for Benson and St. David students, sponsorships for fundraising efforts such as Meals on Wheels, Community Food Bank, VFW and American Legion Golf events, News in Education program for area schools, Benson Butterfield Rodeo, Friends of Kartchner Caverns 5k, Benson Museum, Benson Shop with a Cop, 4th of July fireworks, and numerous others.

- State & National Support – ANPI supports several State and National Trade groups who are involved in the mining and agricultural industries, including AMIGOS, ANNA (Ammonium Nitrate & Nitric Acid) Conference, and The Fertilizer Institute.

"Apache has had a long history and heritage in the San Pedro River Valley, and it is very important to us to present and maintain a positive and open relationship with our neighbors and surrounding communities. Our efforts have been well received, and we are pleased to continue with them, always seeking continuous improvements."

6.3 ALTERNATE DOMESTIC WATER SUPPLY PLAN

The ADWSP describes measures taken to address the contamination of domestic wells that were contaminated as a result of historical discharge of nitrate. This included construction of replacement wells drilled into the deep aquifer at eight residences and the identification of procedures for newly-identified at risk domestic supply wells (H+A, 2009b). The ADWSP applies only to residences where the sole water supply is from the shallow aquifer.

The procedures involve contacting the well owner and determining whether the well is used for domestic consumption or some other purpose. If the nitrate-N concentration is above 10 mg/l and the well is used for domestic purposes, a confirmation sample is collected. If the sample analysis indicates a concentration of nitrate-N greater than 10 mg/l, delivery of bottled water is immediately provided to the well owner. The private well is then monitored on a quarterly basis. If the nitrate-N is less than 10 mg/l, quarterly monitoring continues until EPA approves a reduction to either semi-annually or annually. Then the well is monitored for an additional two years (H+A, 2009b). When the nitrate-N concentrations in the domestic well are less than 10 mg/l for four consecutive quarters, bottled water deliveries are discontinued. During CY 2020, no new shallow aquifer wells were identified for monitoring and bottled water. Only one private well owner, D(18-21)06bcb, currently receives bottled water. According to samples collected in 2020, private well D(18-21)06bcb nitrate-N concentrations were below 10 mg/l (Table 7). Nitrate-N concentrations at D(18-21)06bcb have been below the goal of 10 mg/l since November 2012, with the exception of an estimated concentration of 11 mg/l in August 2020.

6.4 DEUR AND FENCING

As previously stated, a DEUR was filed in 2008. The DEUR binds to the property deed and restricts the land use of the area where the native soil covers were constructed over the formerly-active evaporation ponds. The DEUR also provides a declaration, which outlines requirements for an engineering control plan for native soil covers and ICs for the ANPI property. Perimeter fencing was inspected quarterly during the pond cover inspections. Fencing was determined to be in general good condition and did not require repairs in 2020. Fencing around ANPI property restricts Site access, thereby affording a safety buffer for the general public as well as for security. In 2008, additional 10-foot barbed wire fencing was installed around ANPI operations area. Pond 7 and Dynagel are within the barbed fenced area and the formerly-active evaporation ponds are within the property fencing. Appendix F presents the results of the annual pond cover inspection. Attachment A in Appendix F provides a copy of the DEUR.

Media Component 8, Legacy Soils Area, expands the ICs. This component was added by EPA in its ESD #4 (EPA, 2017a). The Legacy Soils Area covers the operations area where ANPI has been demolishing historical structures since 2012 (H+A, 2017a, 2019p). The cleanup standards for Component 8 soils are based on the ADEQ's non-residential SRLs (Table 19).

6.5 DESCRIPTION OF PREVIOUS WASTE DISPOSAL

Previous remedial actions at ANPI include the collection, transportation, treatment, and disposal of waste materials and contaminated media associated with the Waste Storage Area (Media Component 4), Wash 3 Area (Media Component 5), and other locations outside of Wash 3 containing dinitrotoluene (DNT) waste (Media Component 7) (H+A, 2001 and 2002b). Previous actions also include removal of trinitrotoluene (TNT) from a TNT-contaminated area, which predated ANPI operations. Waste materials associated with media components 4, 5, and 7 were disposed in various disposal facilities including Beatty, Nevada; Huachuca City, and La Paz landfills in Arizona; and Ensco, Safety Kleen, and East Carbon Development Corp. in Utah. A remedial action implementation report for the TNT-contaminated area was submitted to EPA in July 2002 (H+A, 2002c). Remedial actions included removal of TNT material by conducting a pretreatment onsite burn and then shipment of residual materials to a disposal facility. A total of six burns were conducted onsite and the residual material from the burns, equating to 870 tons, were sent to Beatty Landfill for disposal.

ANPI has been demolishing legacy structures and buildings from historical manufacturing processes since 2012. In 2017 a report was issued that documented all work through the end of 2016 (H+A, 2017a). In December 2019, the *Final Comprehensive Summary Report for the Legacy Soils Area* (Legacy Soils Report) providing details on all waste removal and disposal events conducted throughout the demolition activities since 2012 was submitted to the EPA (H+A, 2019p). The EPA approved the Legacy Soils Report in a letter dated August 28, 2020 (EPA, 2020f). Chronological waste disposal activities are detailed in the Legacy Soils Report (2019p). Per the EPA email dated February 23, 2021 the official "Remedial Action Report" authored by EPA is being finalized with Regional Counsel, which will close out the Legacy Soils Area (EPA, 2021a).

7.0 REMEDY EVALUATION

Water level and water quality trending was used for the evaluation of the performance of the groundwater remedy. The following sections discuss the metrics associated with these tools.

7.1 SOUTHERN AREA REMEDIAL PERFORMANCE EVALUATION

After a study of the Southern Area perched zone pursuant to recommendations in the third FYR (EPA, 2012), ANPI updated the CSM for the Southern Area (H+A, 2017d). The MCA was determined to be a second perched zone. The original perched zone was now referred to as PZ-A and the MCA was referred to as PZ-B. PZ-A and PZ-B are experiencing declining water levels and were determined to be hydraulically isolated from each other and from the shallow alluvial aquifer along the San Pedro River to the east in the Southern Area. Accordingly, based on the field work done in the Southern Area, EPA modified Media Component 1 from “Perched Groundwater”, which included only the groundwater beneath the formerly-active evaporation ponds, to the “Southern Area Perched System”, which includes both PZ-A (the groundwater beneath the formerly-active evaporation ponds) and PZ-B (Tables 1 and 2).

In addition, the revised CSM report documented the attempts to use *in situ* methods to supplement MNA within the PZ-B footprint (H+A, 2017d). The *in-situ* methods were not feasible due to the lack of an extensive body of water in PZ-B and the poor hydraulic conditions in the sedimentary materials. Due to lack of hydraulic connection to the shallow aquifer and poor potential for water resource development from the perched system, in the July 2017 ESD #4, EPA modified the MNA remedy for the PZ-B, but kept the previously established ICs in place along with long-term monitoring for the Southern Area Perched System (EPA, 2017a). Pumping and evaporation of perched water from PZ-A was also discontinued at the end of 2017 because the previously established ICs and long-term groundwater monitoring were deemed sufficient for this isolated groundwater body (EPA, 2017c).

Overall, the PZ-A and PZ-B groundwater areal extent is shrinking and water levels have declined. PZ-A perimeter monitoring confirmed that groundwater seepage from the PZ-A into PZ-B has not occurred since 2003.

Water level elevations across PZ-A and PZ-B have declined overall since 1995 (Figures A-1 through A-13). However, water level elevations increased between 2014 and 2016 in some piezometers and wells such as P-01 (Figure A-1), P-03 (Figure A-2), MW-21 (Figure A-8), and MW-23 (Figure A-9) due to increased precipitation. At the same time the nitrate-N concentrations decreased in these wells. The decrease in concentrations is believed to indicate that precipitation infiltration introduces a higher quality of water than the ambient water in the perched zones. Moreover, the infiltration does not appear to leach contaminants from the overlying vadose zone.

Further evaluation of monitoring data was conducted using the MAROS software. MAROS software was developed on behalf of the U.S. Air Force Center for Engineering and the Environment (AFCEE) and is used as a data management tool to improve long-term groundwater monitoring programs (GSI, 2012). The MAROS software was applied to Site monitoring data from 2012 to 2017 to calculate Mann-Kendall (MK) statistics and perform linear regression (LR) analyses. In the *2017 Annual Performance Monitoring and Site-Wide Status Report* data representing piezometer P-03 in PZ-A was selected for analysis and in PZ-B, monitor wells MW-21, MW-23, MW-39, MW-43 and MW-47 (H+A, 2018c). The overall results of the MK analysis indicated that half of the wells are experiencing decreasing nitrate-N and perchlorate trends (P-03, MW-39, and MW-43). Likewise, the LR analysis provides a further basis for characterizing the data trend. The overall results indicated that the majority of wells were experiencing decreasing nitrate-N and perchlorate trends (H+A, 2018c; Table 19; P-03, MW-21, MW-23 and MW-39).

7.2 NORTHERN AREA REMEDIATION EVALUATION

Water quality data indicate that MNA and the NARS in the Northern Area is operating properly and successfully. Nitrate-N concentrations are decreasing in the SEW-01 capture envelope. In addition, the MNA management area located north of the capture envelope has met the cleanup standards. On July 13, 2018, SEW-02 began pumping to acquire baseline parameters, followed by continual operation starting July 16, 2018. Extraction upgradient of the SEW-01 capture zone has proven acceleration of remedial efforts by the nitrate-N concentrations extracted (nearly double) from the shallow aquifer and treated through the treatment ponds. This has resulted from a combination of the decrease in influent concentrations to extraction well SEW-01 and the capture of higher nitrate-N concentrations at extraction well SEW-02. As previously discussed, it is anticipated that, with the strategic incorporation of PB-5A (SEW-03) into the remedy network, attainment of the remedial standards can be achieved sooner.

7.2.1 NARS Evaluation

Extraction well SEW-01 operated for 362 days in 2020. Extraction well SEW-02 operated for 267 days in 2020. Discharge to the primary lower location in Wash 3 was continuous during CY 2020. It is estimated that 19,210 pounds of nitrate-N was removed from the shallow aquifer in 2020. Per discussions with the EPA and agencies in the March 10, 2021 meeting regarding the draft March 1, 2021 *Start-Up of Extraction Well SEW-03 and Changes to NARS Wetland Operation Technical Memorandum*, the addition of PB-5A (SEW-03) to the NARS will commence in March 2021 (H+A, 2021b). In total, mass loading of approximately 6,000 lbs/mo (72,000 lbs/yr) into the wetlands will be targeted during the initial start-up of SEW-03. This represents a greater than three-fold increase in nitrate-N treatment as compared to nitrate-N removal in 2020 and exceeds the annual mass removal observed in the wetlands since it became fully operational in 2005. 2020 Nitrate-N concentrations ranged between 32 mg/l and an estimated value of 46 mg/l in original water quality samples collected monthly from extraction well SEW-01 and from an estimated value of 160 mg/l to 300 mg/l in 2020 from SEW-02 (Table 12). The highest nitrate-N concentrations at SEW-01 were observed in the late 2003, early 2004 time period (Figure D-6). During that time, concentrations were as high as 390 mg/l.

On an annual basis, remedial optimization progress will be evaluated to determine if the remedy acceleration is accomplishing the overall goal to increase the treatment of nitrate-N at the site and reduce the size of the nitrate-N groundwater plume, containing it on ANPI property. In 2021 the addition of the new extraction well SEW-03 should be given adequate operational time to evaluate the effectiveness of pumping in combination with extraction well SEW-02. In the event the mass removal via groundwater extraction plateaus in the future, analysis tools including, but not limited to, the 2019 groundwater flow model to simulate various pumping scenarios using future data may be employed to optimize the existing well network.

7.2.2 Northern Area MNA Evaluation

The monitoring of nitrate-N in the Northern Area MNA management zone indicates that all areas are meeting the cleanup standard. This is believed to be largely due to the capture of high nitrate-N concentrations in groundwater by the NARS extraction well SEW-01, thereby stemming plume migration to the north. Further evaluation of nitrate-N trending in selected Northern Area wells performed in 2017 indicated that the majority of the wells are experiencing decreasing nitrate-N trends (D(17-20)36aad1, D(17-20)36caa, D(17-20)36caa2, D(18-21)06bcb, MW-40, MW-41B and MW-42). Nitrate-N was indicated to be decreasing in MW-41B and stable in MW-41A (H+A, 2018c).

7.3 INACTIVE AND FORMERLY ACTIVE PONDS REMEDIATION EVALUATION

At the end of CY 2020, the pond covers were in overall good condition (Appendix F). Pond inspections were performed throughout CY 2020 according to the O&M manual (H+A, 2008b, 2010a).

8.0 QUALITY ASSURANCE/ QUALITY CONTROL

The quality of the data collected during the 2020 quarterly performance monitoring, monthly NARS, and building demolition activities were evaluated using data assessment procedures as specified in the Quality Assurance Project Plan (QAPP) and QAPP addendum (H+A, 2010a and 2013). Data assessment procedures are used to identify data that do not meet data quality objectives. Data assessment procedures included, but were not limited to, review of holding times; preservation methods; chain-of-custody documentation; field and rinsate blank results; matrix spike and matrix spike duplicate results; field duplicate and split sample comparison results; reporting detection limits; and data trending. Data assessment is a means of identifying deficiencies in laboratory or in field procedures. Such deficiencies increase the risk of failure to attain data quality objectives. Accordingly, assessment assists in the identification of appropriate corrective actions and/or the type of data qualification that should be applied (H+A, 2010a and 2013). A CY 2020 data assessment and validation summary is provided in Appendix H.

9.0 PIEZOMETER P-03 DECOMMISIONING

One component of the groundwater remedy in the southern portion of the ANPI site was the operation of a piezometer P-03 Pilot/Extraction System. This system involved the extraction and evaporation treatment of contaminated perched groundwater in the same area as the former unlined evaporation ponds (PZ-A).

Starting in 2002, contaminated groundwater was extracted from piezometer P-03 and discharged into lined, above-ground pools and allowed to evaporate. In 2009, the pools were replaced with lined, steel stock tanks. In 2017, per a recommendation presented in ESD #4 (EPA, 2017a) and the Fourth Five Year Report (EPA, 2017c), the operation of this system was terminated. From its installation in 2002 until its termination, it is estimated that a total volume of 108,378 gallons were removed (H+A, 2019m).

9.1 P-03 SCOPING AND TANK SAMPLING WORK PLAN

On July 26, 2018, personnel from H+A visited the site to observe site conditions. Both 2,300-gallon stock tanks were lined with a heavy plastic and contained light to dark orange liquid with a yellow orange precipitate on the sides and bottom of the tanks. The western and eastern tanks contained liquids and solids approximately one foot and three feet in depth, respectively. The combined volume of contents was approximately 2,350 gallons. A work plan, for the characterization of the tanks for disposal, was provided to the EPA on September 17, 2018, (H+A, 2018e) and approved on September 20, 2018 (EPA, 2018).

9.2 P-03 TANK SAMPLING

On October 3, 2018, H+A personnel collected samples from the stock tanks for the purpose of disposal characterization. Liquid and solid samples were analyzed for: nitrate (nitrate-N); cyanide (reactivity-CN); sulfate (reactivity-sulfate); corrosivity (pH); volatile organic chemicals (VOCs) – toxicity characteristic leaching procedure (TCLP); fluoride; perchlorate; Resource Conservation and Recovery Act (RCRA) 8-metals & strontium (totals). Additionally, liquid samples were analyzed for ammonia (ammonia-N) and RCRA 8-metals TCLP. Solid samples were also analyzed for ignitability (H+A, 2018g). The analytical results indicated that the liquids and solids were not hazardous wastes by characteristic. The report provided recommendations for decommissioning, disposal, recycling, and confirmatory soil sampling. The results of the characterization were presented in a report dated December 7, 2018 (H+A, 2018g).

9.3 P-03 DECOMMISSIONING PLANNING

On October 9, 2019, a plan for the dismantling and disposal of the P-03 pilot project infrastructure and associated waste materials was submitted to EPA (H+A, 2019m). The objectives of the plan included:

- Dismantling of all infrastructure associated with the P-03 system.
- Stabilization of residual waste liquid and solid materials.
- Transport of all waste materials to a licensed disposal facility and waste metals to a recycling facility.
- Removal of contaminated soil.
- Post-soil removal soil sampling and analysis for verification of clean-up according to the ESD #4.

The plan was approved by the agencies on October 16, 2019 (EPA, 2019f). The plan called for residual liquid and sludge to be removed from the tanks and mixed with soil to produce a waste that would be more stable for transportation to the receiving facility. That material would then be transferred to roll-off bins. If characterized as non-hazardous, this would be transported by Goodman Enterprises to the US Ecology facility in Beatty, Nevada. The empty metal tanks would be removed separately and transported to SA Recycling facility in Tucson, Arizona. After removal of the tanks, confirmatory sampling of soils underneath the tanks would be performed. Prior to these activities, an approximate 12-inch-high berm would be constructed from stockpiled native soil around the perimeter of both tanks to create containment in case of spillage (H+A, 2019m).

9.4 P-03 DECOMMISSIONING

On November 25, 2019, ANPI initiated decommissioning activities. Soil berms were constructed around the two storage tanks to contain potential releases. Tank liquids and solids were removed by backhoe, placed on the ground, mixed with native soil, and then placed in roll-off bins. The empty tanks were placed outside of the berm areas onto Visqueen plastic. The upper 6-inches of soils underlying the tank footprints and one-foot perimeter were stockpiled within the bermed area and covered with Visqueen plastic.

ADEQ personnel present as observers noted that the activities deviated from the work plan.

> *"The deviation called for the contents of the tanks both solids and liquids to be placed in an area on the ground (unlined hole dug within the bermed area) where a backhoe would mix the contents with soil and place into lined roll-offs for transport." (ADEQ, 2019b).*

Subsequently, EPA requested ANPI to prepare a sampling and analysis plan to expand the sampling to include areas where decommissioning activities were conducted.

9.5 P-03 SOIL CONFIRMATION

On February 17, 2020, ANPI provided EPA a soil confirmation sampling plan (H+A, 2020d), which EPA approved on February 26, 2020 (EPA, 2020b). On April 29, 2020, soil confirmation sampling was conducted at the storage tanks. The sampling and analysis were conducted in accordance with the Sampling Plan. Soil samples were collected utilizing Incremental Sampling Methodology (ISM) from four decision units (IRTC, 2012). Soil samples were submitted the laboratory for preparation by ISM procedures and for analysis of certain analytes using the following methods:

- Fluoride/Nitrate-N (EPA Method 9056A)
- Perchlorate (EPA Method 314.0)
- Corrosivity (pH) (SW846 9045)
- Metals, including strontium (EPA Method 6010)
- Ammonia-N (EPA Method 4500-NH3)

All soil confirmation sample results were below screening levels. The results of the confirmation soil sampling were summarized in the report. (H+A, 2020g).

9.6 P-03 RESIDUALS DISPOSAL

On May 5, 2020, ANPI requested EPA approval for recycling the two storage tanks. In the letter, ANPI confirmed that (1) the tanks were empty, and (2) the residual fluids from cleaning the tanks were added to the contents of the tanks in the roll-off, and would not be sent to the scrap metal recycler (ANPI, 2020a). EPA approved the recycling on May 13, 2020 (EPA 2020c), and in June 2020 the tanks were transported by Goodman Enterprises to SA Recycling in Tucson, Arizona. The tanks weights were measured at 8.5 tons.

On August 18, 2020, ANPI requested EPA approval for off-site disposal of the excavated soils (ANPI, 2020b). The soils were stored in four roll-off bins and a single small pile (approximately three cubic yards) near the P-03 site. A portion of the small pile was added into each of the roll-off bins to maximize shipping weights. The remaining pile was shipped separately in a fifth roll-off bin. In August, EPA approved disposal of perchlorates in soil material generated (EPA, 2020e). Between September 14 and October 28, 2020, a total of 59.2 tons of soil were transported by Goodman Enterprises to US Ecology landfill in Beatty, Nevada for disposal. The soils were shipped under manifest with the description of "Perchlorates in Soil, Non-Hazardous Solid Waste". In November 2020, the Decommissioning and Disposal Summary report for P-03 was issued (H+A, 2020j, ANPI 2020d). EPA approval of the report is pending.

10.0 RECOMMENDATIONS

ANPI is recommending the following for consideration by EPA. Revisions to the monitoring schedule will be implemented upon EPA approval. Proposed changes to the monitoring schedule were determined based on evaluation of data collected during CY 2020 from existing and recently installed wells, historical data, and the updated CSM as discussed in the 2019 Annual Report. The proposed CY 2021 monitoring schedule is given in Table 16. Recommendations specific to each portion of the Site are presented in the following sections of this chapter.

10.1 SOUTHERN AREA GROUNDWATER RECOMMENDATIONS

EPA-approved reductions in monitoring for the Southern Area Groundwater in 2020 included reduced monitoring frequencies from quarterly to biennial for several wells. These wells were not monitored in 2020 and are scheduled to be monitoring next in August 2021 (Table 3; H+A, 2020i). Consideration of further reduction in the monitoring schedule in the Southern Area will be evaluated in the 2021 Annual Report after additional data have been collected and reviewed. Therefore, no changes are proposed to the groundwater sampling and water level measurement frequency for PZ-A, PZ-B and the southern area wells at this time (Table 16). It is believed that the existing program will continue to offer continued protection of human health and the environment.

10.2 NORTHERN AREA GROUNDWATER RECOMMENDATIONS

With regard to the Northern Area groundwater, the following recommendations are offered for EPAs consideration. It is believed that this proposed program will continue to provide protection of human health and the environment, along with sufficient frequency of data collection in the Northern Area.

10.2.1 NARS WETLAND AREA

For the past 20 years, ANPI has been sampling sediments in the NARS wetland on five-year intervals to determine whether potential ecologically impactful concentration of metals have been accumulating. This investigation was initially recommended by a consultant to EPA, who was concerned with a situation in Kesterson, California (Weiser, 2018). At that location, within a wildlife refuge, selenium transported by agricultural runoff, had accumulated in a reservoir. Exposure to selenium subsequently resulted in developmental defects in avian and fish species.

Accordingly, in 1997 it was recommended by EPA that ANPI conduct periodic sampling of pond sediments and additional analyses of the groundwater entering and existing the ponds. Based on the acquisition of data over the past 20 years, it is apparent that impactful concentrations of metals are not accumulating in wetland sediments. Inputs to the system from groundwater and/or surface water runoff have not changed since wetland startup. So, it cannot be concluded that there is any potential ecological impact from wetland operation.

The NARS treatment cell sediment sampling collected in CY 2016 (conducted every five years) showed only a few instances where the 2016 concentrations were higher than their respective baseline concentrations detected in 1997 (H+A, 2017b). This reflects measurements made over a 20-year period of wetland operation. In all instances where constituent concentrations have increased, the change has been relatively slight, less than a factor of two. Furthermore, selenium was below the laboratory reporting limit in all treatment cells in each sampling event. After these results were evaluated at the time of the 2016 Annual Monitoring Report, ANPI recommended that sediment sampling be discontinued. EPA approved this request on May 23, 2017 and the sediment sampling has been discontinued as of April 2018 (H+A, 2019d).

In addition to the sediment sampling conducted at the treatment cells every five years, the same analytical suite was analyzed for water samples collected from the extraction wells, DCP-12 and the effluent sampling locations in (Table 16, Appendix C). This 5-year sampling event is currently scheduled for November 2021, moved from September 2021 in the 2020 monitoring schedule, for the following analytes:

- Effluent and Extraction Wells analyzed for aluminum, barium, beryllium, cadmium, chromium, copper, iron, manganese, silver, thallium, and zinc by EPA Method 200.7. They will also be analyzed for antimony, arsenic, lead, and selenium by EPA method 200.8 and mercury by EPA method 245.1.

- DCP-12 analyzed for barium, beryllium, chromium, lead, and thallium by EPA method 200.7 and mercury by EPA Method 245.1.

Due to the discontinuance of the treatment cell sediment sampling, the purpose of these analyses in influent source water and effluent water is likewise no longer necessary. Therefore, ANPI requests this 5-year sampling event be removed from the extraction wells, DCP-12 and the Effluent in the 2021 schedule (Table 16).

Sampling at extraction wells SEW-01 and SEW-02 is proposed to continue in accordance with 2021 schedule, including monthly nitrate-N samples, quarterly ammonia samples and water levels, annual metals and perchlorate samples, and weekly field nitrate-N measurements, total phosphorus and major ion samples (Table 16).

PB-5A (SEW-03) is included on the monitoring schedule under the quarterly sampling event for other Northern Area monitoring wells. This well was monitored in January 2021 as a monitor well, due to its non-operational status. Once PB-5A (SEW-03) begins operation as part of the NARS, this well will transition into the scheduling protocol established for the other NARS extraction wells and pursuant to the EPA-approved February 2021 *Northern Area Shallow Aquifer Remedy Acceleration StartUp Testing Work Plan for SEW-03* (Startup Work Plan) (ANPI, 2021). The extraction well SEW-3 start-up period will occur during 2021, which will include ongoing optimization of nitrate-N removal and the generation of periodic status reports that compile the collected water level and sampling data for review.

As proposed in the draft March 1, 2021 *Start-Up of Extraction Well SEW-03 and Changes to NARS Wetland Operation Technical Memorandum* weekly NARS monitoring events and nitrate-N field measurements will increase to three times per week for the first month following the initial start-up of SEW-03. In addition, three triggers are identified in the technical memorandum that induce three weekly monitoring events until the criteria for the trigger is resolved (H+A, 2021b). A baseline water level and water quality analysis is anticipated to be performed in March at select wells prior to the start-up of the new extraction well SEW-03. Specifics of plan implementation are presently undergoing further discussion with EPA (EPA, 2021b).

Once extraction at the new extraction well SEW-03 commences, system optimization evaluations will be conducted as new data are generated with an objective of maximizing nitrate mass removal and maintaining plume capture. These evaluations will provide a basis for the effect of seasonalities on system operation. Evaluations will be conducted quarterly by ANPI consultants, H+A and Dr. Robert A. Gearheart and the project team, which includes ANPI, and the regulatory team. The quarterly evaluations will coincide with the Performance Monitoring Plan (PMP) schedule, which are generally conducted in February, May, August and November. Observations from the PMP events will be considered during the respective quarterly evaluation and aid in the formulation of recommendations. Decisions regarding operational adjustments will be based on consensus by the project team as part of the ongoing adaptive site management optimization process, as described in the work plan (ANPI, 2021, H+A, 2021b).

Vertical profiling results from Northern Area monitor wells PB-4 and PB-7 continued to exhibit an increasing concentration trend with depth. This was also observed in depth discrete sampling in 2019 at these wells and in well PB-5A (SEW-03) prior to installing the dedicated pump (H+A, 2020e). In 2019, the highest magnitude change in nitrate-N concentration was observed at well PB-5A (SEW-03). The magnitude of the vertical concentration gradient decreases gradually downgradient at monitor well PB-4, and further downgradient at monitor well PB-7. Monitor well PB-2A is the farthest downgradient well that was vertically profiled and does not exhibit a vertical concentration gradient throughout the saturated zone. Monitor well PB-2A nitrate-N concentrations have remained consistent with depth since depth discrete sampling first began in 2019. Depth discrete sampling in monitor wells PB-4 and PB-7 will continue through 2021, and as long as a vertical concentration gradient is observed, however depth discrete sampling at PB-2A is no longer necessary. Enough data have been collected from PB-2A to confirm that a vertical gradient is not influencing results in this well. ANPI proposes only one sample be collected within the mid-point of the screen in 2021.

It is believed that this program will offer continued protection of human health and the environment.

10.2.2 Northern Area MNA

Data collected over the past several years have demonstrated that the Northern Area outside of the NARS capture envelope has cleaned up according to model projections. Presently, the network of monitor wells indicate that groundwater sampled at all locations is below the cleanup standard and has been below the cleanup standard since mid-2013. It was discussed during the

May 17, 2017 annual meeting that MNA parameter sampling may no longer be needed. The following recommendations are offered for EPA consideration.

It is believed that 2020 performance monitoring frequency proposed for the MNA Management Zone PMP and Long-Term Site-Wide Plan offers continued protection of human health and the environment and provide information relative to groundwater flow and gradients throughout the study area.

10.3 SUMMARY OF RECOMMENDATIONS FOR EPA CONSIDERATION

The following is a bulleted summary of all program changes for EPA's consideration (Table 16):

- The 5-year sampling event for collection of groundwater and effluent samples from the NARS extraction wells, DCP-12 and Effluent is proposed for removal.

- One single sample be collected within the mid-point of the screen from monitor well PB-2A. Depth discrete samples (from three depth intervals consistent with 2019 and 2020 data collection) will be continued at monitor wells PB-4 and PB-7.

- Continued pump and treatment of extracted groundwater from SEW-01 and SEW-02.

- Addition of extraction well SEW-03 into the NARS monitoring schedule once operation has commenced in late March/early April. Monthly sampling and monitoring events in select Northern Area wells will be conducted for a minimum of three months in accordance with the *Northern Area Shallow Aquifer Remedy Acceleration StartUp Testing Work Plan for SEW-03, Final, Apache Powder Superfund Site, Cochise County*, *Arizona* dated February 10, with the following exceptions; monitor well MW-46 and piezometers NAP-4 and NAP-5 are not recommended for water quality sampling. Monitor well MW-46 was drilled to near the western boundary of the shallow aquifer. Due to access constraints the well was not optimally placed and is not considered to be representative of the main part of the aquifer, and instead represents shallower hydrostratigraphy. This well in not part of the current PMP well network for this reason. The piezometers are intended to monitor groundwater surface water interaction adjacent to the San Pedro River. They are screened in the shallowest portion of the shallow aquifer and have not had detectable levels of nitrate-N since installation in 2018. Sampling for water quality is not recommended for these wells, however water level measurements during monthly monitoring events will be continued. Quarterly evaluations to monitor progress and optimization of the wetland with all three extraction wells operational will be performed in accordance with the *Revised Start-Up of Extraction Well SEW-03 and Changes to NARS Wetland Operation Technical Memorandum. Apache Powder Superfund Site, Cochise County, Arizona,* dated May 5, 2021.

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TABLES

TABLE 1

SITE REMEDIES

MEDIA COMPONENT	LOCATION	REMEDY
Formerly Active Ponds / Southern Area Perched System-Perched Zone A	Southern Area	Native soil cover and institutional controls
Southern Area Perched System-Perched Zone B (formerly Molinos Creek Sub-Aquifer)	Southern Area	Institutional controls and long-term groundwater monitoring
Shallow Aquifer Groundwater	Northern Area	Northern Area Remediation System (NARS) and MNA
Legacy Soils Area (investigative activities not yet completed)	Southern Area	Cleanup to non-residential standards and institutional controls

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______, 2000. Letter from Ms. Andria Benner, EPA, to Ms. Kerstin Alter, ANPI, re: "Explanation of Significant Difference (ESD) #2". September 29, 2000.

______, 2005 Amendment to the *Apache Powder Superfund Site, Record of Decision.* September 30, 2005.

______, 2008 Letter from John Lucey of EPA to Pamela Beilke of ANPI. Re: "EPA Explanation of Significant Differences approving MNA in the Northern Area". July 31, 2008.

______, 2017c. Five-Year Review Report, Fourth Five-Year Report For Apache Powder Superfund Site, Cochise County, Arizona. September 2017.

TABLE 2

SITE INSTITUTIONAL CONTROLS

MEDIA COMPNENT	LOCATION	INSTITUTIONAL CONTROL
Southern Area Perched System-Perched Zone A	Southern Area	DEUR*, Fencing (access restriction)
Southern Area Perched System-Perched Zone B (formerly Molinos Creek Sub-Aquifer)	Southern Area	DEUR*, Well Inventory, Community Outreach
Formerly Active Ponds	Southern Area	DEUR*, Fencing, Signage, Community Outreach
Legacy Soils Area (investigative activities not yet completed)	Southern Area	Fencing, Community Outreach, possible DEUR
Shallow Aquifer Groundwater	Northern Area	Well Inventory, Community Outreach, Alternate Domestic Water Supply Plan

References:

U.S. Environmental Protection Agency (EPA), 1994. Record of Decision, Apache Powder Company, EPA ID AZD008399263, OU01, Saint David, Arizona. EPA/ROD/R09-94-120. September 30, 1994.

______, 1997. Letter from Ms. Andria Benner, EPA, to Ms. Kerstin Alter, ANPI, re: “Explanation of Significant Difference (ESD)”. April 22, 1997.

______, 2000. Letter from Ms. Andria Benner, EPA, to Ms. Kerstin Alter, ANPI, re: “Explanation of Significant Difference (ESD) #2”. September 29, 2000.

______, 2005 Amendment to the *Apache Powder Superfund Site, Record of Decision.* September 30, 2005.

______, 2008 Letter from John Lucey of EPA to Pamela Beilke of ANPI. Re: “EPA Explanation of Significant Differences approving MNA in the Northern Area”. July 31, 2008.

______, 2017c. Five-Year Review Report, Fourth Five-Year Report For Apache Powder Superfund Site, Cochise County, Arizona. September 2017.

TABLE 3

2020 PERFORMANCE MONITORING SCHEDULE
FOR GROUNDWATER, SOIL, AND NARS REMEDIES

SITE ID	WELL OWNER	PROPOSED MONITORING FREQUENCY/PARAMETERS				WATER LEVELS	COMMENTS
		NITRATE-N	AMMONIA	METALS(1)	ClO4		
MONITORING WELLS (NORTHERN AREA) *[Northern Area PMP and Long-Term Site-Wide Plan]*							
MW-08	ANPI	Q				Q	
MW-11	ANPI	A - Aug				Q	
MW-13	ANPI	S - Feb/Aug				Q	
MW-17	ANPI	S - Feb/Aug				Q	
MW-18	ANPI	S - Feb/Aug				Q	
MW-19	ANPI	Q				Q	
MW-34	ANPI	Q				Q	
MW-35	ANPI	Q				Q	
MW-36	ANPI	Q				Q	
MW-45	ANPI	Q				Q	
PB-2A	ANPI	Q				Q	
PB-4	ANPI	Q				Q	
PB-5A	ANPI	Q				Q	
PB-7	ANPI	Q				Q	
PIEZOMETERS (NORTHERN AREA) *[Northern Area PMP]*							
NAP-1	ANPI					Q	Water level monitoring via transducers with quarterly downloads and static water level measurements
NAP-2	ANPI					Q	
NAP-3	ANPI					Q	
NAP-4	ANPI					Q	
NAP-5	ANPI					Q	
MNA MANAGEMENT ZONE (NORTHERN AREA) *[Northern Area PMP and Long-Term Site-Wide Plan]*							
MW-20	ANPI	B - Aug 2021				B - Aug 2021	Access limited by owner availability
MW-38	ANPI	B - Aug 2021				B - Aug 2021	Access limited by owner availability
MW-41A	ANPI	B - Aug 2021				B - Aug 2021	Access limited by owner availability
MW-41B	ANPI	B - Aug 2021				B - Aug 2021	Access limited by owner availability
MW-42	ANPI	B - Aug 2021				B - Aug 2021	
D(17-20)36aad1	Jacobs	B - Aug 2021				B - Aug 2021	
D(17-20)36caa2	Hyder	B - Aug 2021				B - Aug 2021	
D(17-20)36caa	Gaynor	B - Aug 2021				B - Aug 2021	
D(17-20)36cdb	Woolever	B - Aug 2021				B - Aug 2021	Access limited by owner availability

TABLE 3

2020 PERFORMANCE MONITORING SCHEDULE
FOR GROUNDWATER, SOIL, AND NARS REMEDIES

SITE ID	WELL OWNER	PROPOSED MONITORING FREQUENCY/PARAMETERS				WATER LEVELS	COMMENTS
		NITRATE-N	AMMONIA	METALS[(1)]	ClO4		
MNA MANAGEMENT ZONE (NORTHERN AREA) [*Northern Area PMP and Long-Term Site-Wide Plan] - CONT'D*							
D(17-20)36ddc	Morales	B - Aug 2021				B - Aug 2021	
D(18-20)01aad	McRae	B - Aug 2021				B - Aug 2021	
D(18-21)06bcb	Jones	Q				Q	
D(17-20)36aad3	Acuna					B - Aug 2021	Water level only
D(17-20)36cad1	McCann					B - Aug 2021	Water level only
D(17-20)36dad	Ohlde					B - Aug 2021	Water level only
D(18-21)06ada	White					B - Aug 2021	Water level only
D(18-21)06bab	Alexander					B - Aug 2021	Water level only
D(18-21)06bcc2	Wooten					B - Aug 2021	Water level only
D(18-21)08bab	Tenopir					B - Aug 2021	Water level only
SENTINEL WELLS (NORTHERN AREA) [*Northern Area PMP]*							
MW-40	ANPI	B - Aug 2021				B - Aug 2021	Access limited by owner availability
MNA BUFFER ZONE WELLS (NORTHERN AREA) *[Northern Area PMP]*							
D(17-20)25bad	Spears	B - Aug 2021				NM	Access limited by owner availability
NORTHERN AREA REMEDIATION SYSTEM [*NARS O&M]*							
SEW-01	ANPI	M	Q	Sep-2021	A - Sep	Q	Weekly nitrate-N with field methods. Additional parameters include total phosphorus (Q), major ions (A)
SEW-02	ANPI	M	Q	Sep-2021	A - Sep	Q	Weekly nitrate-N with field methods. Additional parameters include total phosphorus (Q), major ions (A)
MW-10	ANPI	Q	Q			Weekly	
DCP-12	ANPI	Q		Feb-2021		Q	
TREATMENT CELLS (surface water)	ANPI	M	M			Weekly	Weekly nitrate-N with field methods. Additional parameters include total phosphorus, chemical oxygen demand, and total organic carbon (Q), total kjeldahl nitrogen, organic nitrate (A).
EFFLUENT	ANPI	M	M	Sep-2021			Additional parameters include total phosphorus, total kjeldahl nitrogen, organic nitrogen, total dissolved solids, and total suspended solids (Q). Major ions (A)

TABLE 3

2020 PERFORMANCE MONITORING SCHEDULE
FOR GROUNDWATER, SOIL, AND NARS REMEDIES

SITE ID	WELL OWNER	PROPOSED MONITORING FREQUENCY/PARAMETERS				WATER LEVELS	COMMENTS
		NITRATE-N	AMMONIA	METALS[1]	ClO4		
NATIVE POND COVERS *[Soils Engineering Control Plan]*							
POND 1	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
POND 2	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
POND 3	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
POND 7	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
DYNAGEL	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
SAN PEDRO RIVER SURFACE WATER MONITORING STATIONS (NORTHERN AREA) *[Northern Area PMP]*							
SW-03	NA	Q				Q	If flow is present
SW-04	NA	Q				Q	If flow is present
SW-13	NA	Q				Q	If flow is present
SW-14	NA	Q			Q	Q	If flow is present
PERCHED ZONE A (SOUTHERN AREA) *[Southern Area PMP]*							
P-01	ANPI	Q			Q	Q	
P-03	ANPI	Q			Q	Q	
P-10	ANPI					B - Aug 2021	Water level only
MW-29	ANPI					B - Aug 2021	Water level only
MW-30	ANPI					B - Aug 2021	Water level only
MW-31	ANPI					B - Aug 2021	Water level only
MW-32	ANPI					B - Aug 2021	Water level only
PERCHED ZONE B (SOUTHERN AREA) *[Southern Area PMP]*							
MW-15	ANPI	B - Aug 2021			B - Aug 2021	B - Aug 2021	If sufficient water exists to sample
MW-21	ANPI	A - Aug			A - Aug	A - Aug	Ammonia-N analysis discontinued in 2020
MW-23	ANPI	A - Aug			A - Aug	A - Aug	Ammonia-N analysis discontinued in 2020
MW-39	ANPI	A - Aug			A - Aug	A - Aug	Ammonia-N analysis discontinued in 2020
MW-47	ANPI	A - Aug			A - Aug	A - Aug	Ammonia-N analysis discontinued in 2020
UPGRADIENT WELLS (SOUTHERN AREA) *[Southern Area PMP]*							
MW-01	ANPI	A - Aug			A - Aug	S - Feb/Aug	Access limited by owner availability
MW-06	ANPI	A - Aug			A - Aug	S - Feb/Aug	

TABLE 3

2020 PERFORMANCE MONITORING SCHEDULE
FOR GROUNDWATER, SOIL, AND NARS REMEDIES

SITE ID	WELL OWNER	PROPOSED MONITORING FREQUENCY/PARAMETERS				WATER LEVELS	COMMENTS
		NITRATE-N	AMMONIA	METALS[1]	ClO4		
MONITOR WELLS (SOUTHERN AREA) *[Southern Area PMP]*							
MW-14	ANPI	A - Aug			A - Aug	S - Feb/Aug	
MW-22	ANPI					S - Feb/Aug	Water level only
MW-25	ANPI	C			C	S - Feb/Aug	
MW-33	ANPI	A - Aug			A - Aug	S - Feb/Aug	
SAN PEDRO RIVER SURFACE WATER MONITORING STATIONS (SOUTHERN AREA) *[Southern Area PMP]*							
SW-12	NA	Q				Q	If flow is present; Access limited by owner availability

ABBREVIATIONS/ACRONYMS:

A = Annually
ANPI = Apache Nitrogen Products, Inc.
B = Biennial (occurs every two years)
ClO_4 = Perchlorate
C = Contingent on MW-33 results
H+A = Hargis + Associates, Inc.
M = Monthly
NARS = Northern Area Remediation System
NM = Not measured
O&M = Operation and maintenance
PMP = Performance Monitoring Plan
Q = Quarterly
S = Semi-Annually

NOTES:

Standard Field Parameters - Temp (^{o}C), pH, Electrical Conductivity (µS/cm) are collected every time a well is sampled.

(1) = Metals List every 5 years:
SEW-01 and Effluent: aluminum, antimony, arsenic, barium, beryllium, cadmium, total chromium, copper, iron, lead, managanese, mercury, selenium, silver, thallium and zinc.
DCP-12: barium, beryllium, total chromium, lead, mercury and thallium.
Treatment Cells Sediment: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, zinc; calcium, magnesium, sodium, potassium, orthophosphate, chloride, fluoride, sulfate, alkalinity, pH; total nitrogen by calculation, total organic carbon, total phosphorus, ammonia-nitrogen, nitrate-nitrogen, total kjedahl nitrogen.

TABLE 4

WATER LEVEL ELEVATION

IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
PERCHED ZONE A PIEZOMETERS				
P-01	2/3/2020	3688.93	22.01	3666.92
P-01	5/18/2020		22.22	3666.71
P-01	8/10/2020		22.68	3666.25
P-01	11/9/2020		22.48	3666.45
P-03	2/3/2020	3674.45	36.94	3637.51
P-03	5/18/2020		36.34	3638.11
P-03	8/10/2020		36.36	3638.09
P-03	11/9/2020		36.30	3638.15
P-10	2/3/2020	3669.12	DRY	---
PERCHED ZONE A MONITOR WELLS				
MW-29	2/3/2020	3664.91	DRY	---
MW-30	2/3/2020	3664.28	DRY	---
MW-31	2/3/2020	3662.58	DRY	---
MW-32	2/3/2020	3659.37	DRY	---
PERCHED ZONE B MONITOR WELLS				
MW-21	8/10/2020	3662.87	63.80	3599.07
MW-23	8/10/2020	3660.66	61.08	3599.58
MW-39	8/10/2020	3649.14	50.37	3598.77
MW-47	8/10/2020	3652.63	53.16	3599.47
SOUTHERN AREA SHALLOW AQUIFER MONITOR WELLS				
MW-01	2/5/2020	3631.00	18.34	3612.66
MW-01	8/13/2020		UTM	---
MW-06	2/3/2020	3648.44	22.52	3625.92
MW-06	8/10/2020		23.57	3624.87
MW-14	2/3/2020	3623.59	14.49	3609.10
MW-14	8/10/2020		16.12	3607.47
MW-22	2/3/2020	3624.96	16.20	3608.76
MW-22	8/10/2020		17.65	3607.31
MW-25	2/3/2020	3621.01	21.06	3599.95
MW-25	8/10/2020		23.09	3597.92
MW-33	2/3/2020	3623.69	18.82	3604.87
MW-33	8/10/2020		20.89	3602.80
NORTHERN AREA SHALLOW AQUIFER MONITOR WELLS				
MW-08	2/3/2020	3640.00	65.17	3574.83
MW-08	5/18/2020		63.15	3576.85
MW-08	8/10/2020		68.67	3571.33
MW-08	11/9/2020		71.71	3568.29
MW-11	2/3/2020	3617.46	25.29	3592.16
MW-11	5/18/2020		25.62	3591.83
MW-11	8/10/2020		28.64	3588.81
MW-11	11/9/2020		29.83	3587.62

TABLE 4

WATER LEVEL ELEVATION

IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
MW-13	2/3/2020	3623.89	27.80	3596.09
MW-13	5/18/2020		28.03	3595.86
MW-13	8/10/2020		31.12	3592.77
MW-13	11/9/2020		32.55	3591.34
MW-17	2/5/2020	3625.92	50.60	3575.32
MW-17	5/18/2020		49.09	3576.83
MW-17	8/10/2020		55.26	3570.66
MW-17	11/9/2020		UTM	---
MW-18	2/5/2020	3625.90	52.22	3573.68
MW-18	5/18/2020		50.76	3575.14
MW-18	8/10/2020		56.94	3568.96
MW-18	11/9/2020		UTM	---
MW-19	2/3/2020	3642.16	67.81	3574.35
MW-19	5/18/2020		65.47	3576.69
MW-19	8/10/2020		70.70	3571.46
MW-19	11/9/2020		73.99	3568.17
MW-34	2/3/2020	3615.60	25.30	3590.30
MW-34	5/18/2020		25.46	3590.14
MW-34	8/10/2020		28.24	3587.36
MW-34	11/9/2020		29.32	3586.28
MW-35	2/3/2020	3597.83	10.16	3587.67
MW-35	5/18/2020		10.08	3587.75
MW-35	8/10/2020		12.50	3585.33
MW-35	11/9/2020		13.52	3584.31
MW-36	2/3/2020	3611.05	22.62	3588.43
MW-36	5/18/2020		22.82	3588.23
MW-36	8/10/2020		25.36	3585.69
MW-36	11/9/2020		26.45	3584.60
MW-45	2/3/2020	3613.06	24.46	3588.60
MW-45	5/18/2020		25.82	3587.24
MW-45	8/10/2020		27.43	3585.63
MW-45	11/9/2020		28.56	3584.50
PB-2A	2/3/2020	3594.98	13.40	3581.58
PB-2A	5/18/2020		13.62	3581.36
PB-2A	8/10/2020		19.88	3575.10
PB-2A	11/9/2020		21.66	3573.32
PB-4	2/3/2020	3600.98	12.93	3588.05
PB-4	5/18/2020		12.98	3588.00
PB-4	8/10/2020		15.42	3585.56
PB-4	11/9/2020		16.55	3584.43
PB-5A	2/3/2020	3621.15	30.68	3590.47
PB-5A	5/18/2020		30.40	3590.75
PB-5A	8/10/2020		33.33	3587.82
PB-5A	11/9/2020		34.39	3586.76

TABLE 4

WATER LEVEL ELEVATION

IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
PB-7	2/3/2020	3597.23	9.51	3587.72
PB-7	5/18/2020		9.50	3587.73
PB-7	8/10/2020		11.84	3585.39
PB-7	11/9/2020		12.91	3584.32
NORTHERN AREA SHALLOW AQUIFER PIEZOMETERS				
NAP-1	2/3/2020	3596.42	8.71	3587.71
NAP-1	5/18/2020		8.68	3587.74
NAP-1	8/10/2020		10.96	3585.46
NAP-1	11/9/2020		UTM	---
NAP-2	2/3/2020	3596.15	8.19	3587.96
NAP-2	5/18/2020		8.18	3587.97
NAP-2	8/10/2020		10.36	3585.79
NAP-2	11/9/2020		UTM	---
NAP-3	2/3/2020	3598.52	9.44	3589.08
NAP-3	5/18/2020		9.50	3589.02
NAP-3	8/10/2020		12.54	3585.98
NAP-3	11/9/2020		13.68	3584.84
NAP-4	2/3/2020	3599.91	10.16	3589.75
NAP-4	5/18/2020		10.23	3589.68
NAP-4	8/10/2020		13.16	3586.75
NAP-4	11/9/2020		14.33	3585.58
NAP-5	2/3/2020	3599.30	8.58	3590.72
NAP-5	5/18/2020		UTM	---
NAP-5	8/10/2020		11.63	3587.67
NAP-5	11/9/2020		12.67	3586.63
NARS SHALLOW AQUIFER EXTRACTION WELLS				
SEW-01	2/3/2020	3623.63	55.60, P	3568.03
	5/20/2020		54.05, P	3513.98
	8/10/2020		60.18, P	3563.45
	11/9/2020		62.80, P	3560.83
SEW-02	2/3/2020	3613.23	25.72	3587.51
	5/18/2020		62.20, P	3551.03
	8/10/2020		62.21, P	3551.02
	11/9/2020		59.19, P	3554.04
NARS SHALLOW AQUIFER MONITOR WELLS				
DCP-12	2/3/2020	3690.10	19.78	3670.32
	5/18/2020		21.05	3669.05
	8/10/2020		21.94	3668.16
	11/9/2020		21.32	3668.78
MW-10	2/3/2020	3634.00	15.41	3618.59
	5/18/2020		15.46	3618.54
	8/10/2020		15.23	3618.77
	11/9/2020		15.31	3618.69

TABLE 4

WATER LEVEL ELEVATION

IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
NORTHERN AREA SHALLOW AQUIFER PRIVATE WELLS				
D(18-21)06bcb (Jones)	2/5/2020	3612.80	UTM	---
D(18-21)06bcb (Jones)	5/20/2020		UTM	---
D(18-21)06bcb (Jones)	8/11/2020		UTM	---
D(18-21)06bcb (Jones)	11/9/2020		UTM	---

NOTES and ABBREVIATIONS:

feet msl = feet above mean sea level
feet bmp = feet below measuring point
NM = not measured
P = pumping
PWL = pumping water level
RP = recently pumped
UTM = unable to measure

TABLE 5

SATURATED THICKNESS OF PERCHED ZONE A

IDENTIFIER	DATE MEASURED	WATER LEVEL ELEVATION (feet msl)	ELEVATION OF SCREEN BOTTOM (feet msl)	SATURATED THICKNESS OF PERCHED ZONE (feet)
P-01	2/19/2019	3666.77	3662.23	4.54
	5/6/2019	3666.77		4.54
	8/2/2019	3665.91		3.68
	11/4/2019	3666.90		4.67
	2/3/2020	3666.92		4.69
	5/18/2020	3666.71		4.48
	8/10/2020	3666.25		4.02
	11/9/2020	3666.45		4.22
P-03	2/19/2019	3637.54	3629.03	8.51
	5/6/2019	3637.95		8.92
	8/2/2019	3637.65		8.62
	11/4/2019	3637.40		8.37
	2/3/2020	3637.51		8.48
	5/18/2020	3638.11		9.08
	8/10/2020	3638.09		9.06
	11/9/2020	3638.15		9.12
P-10	2/19/2019	DRY	3622.78	0.00
	5/6/2019	DRY		0.00
	8/2/2019	DRY		0.00
	11/4/2019	DRY		0.00
	2/3/2020	DRY		0.00

ABBREVIATIONS/ACRONYMS:

feet msl = feet above mean sea level

TABLE 6

PERCHED ZONE A PIEZOMETER P-03
EXTRACTION/TREATMENT PERFORMANCE

Year	Total Pumped (gal)	NO_3-N Mass Removed (lbs)	ClO_4 Mass Removed (lbs)
12/30/2002	3,524	62	0.01
12/30/2003	14,739	289	0.07
12/30/2004	11,513	243	0.05
12/30/2005	12,587	363	0.05
12/30/2006	10,073	315	0.05
12/30/2007	6,991	280	0.03
12/30/2008	2,887	122	0.01
12/30/2009	9,795	571	0.05
12/30/2010	4,764	290	0.02
12/30/2011	6,049	427	0.02
12/30/2012	4,286	337	0.02
12/30/2013	5,271	522	0.03
12/30/2014	8,143	758	0.03
12/30/2015	2,793	243	0.01
12/30/2016	666	35	0.002
12/30/2017	4,298	199	0.013
TOTAL	108,378	5,056	0.48

ABBREVIATIONS/ACRONYMS:

ClO_4 = perchlorate
gal = gallons
lbs = pounds
NO_3-N = nitrate-Nitrogen

NOTES:

Totalized values were collected at the P-03 flow meter.

TABLE 7

GROUNDWATER QUALITY DATA (NITRATE-N AND PERCHLORATE)

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
PERCHED ZONE A PIEZOMETERS				
P-01	2/21/2019	7.1	<50	ORG
	5/8/2019	120E	5.8	ORG
	8/7/2019	21E	5.9	ORG
	11/6/2019	4.2	<4.0E	ORG
	11/6/2019	3.7	<1.0	SPT
	2/5/2020	51E	4.37	FD
	2/5/2020	50E	4.11	ORG
	5/20/2020	23E	<4.0	FD
	5/20/2020	22E	<4.0	ORG
	8/13/2020	20	6.12	ORG
	11/11/2020	7.6	<4.0	ORG
P-03	2/20/2019	6300	590	FD
	2/20/2019	6100	560	ORG
	5/7/2019	6500	540E	ORG
	5/7/2019	6500	530	SPT
	8/5/2019	6500	620	ORG
	11/5/2019	6600	583	ORG
	2/4/2020	6000E	519	ORG
	5/19/2020	5700	476	ORG
	5/19/2020	6800	550	SPT
	8/11/2020	5500	509	ORG
	11/11/2020	7500	488	ORG
PERCHED ZONE B MONITOR WELLS				
MW-21	8/5/2019	3700	280	ORG
	8/13/2020	4500E	321	ORG
MW-23	8/5/2019	9.9	2.7	ORG
	8/5/2019	9.4	3.2	SPT
	8/13/2020	18	<4.0	ORG
MW-39	8/5/2019	21	32	FD
	8/5/2019	22	33	ORG
	8/13/2020	19	31.3	ORG
MW-47	8/5/2019	2.3	5	ORG
	8/12/2020	1.5	<4.0	ORG

TABLE 7

GROUNDWATER QUALITY DATA
(NITRATE-N AND PERCHLORATE)

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
SOUTHERN AREA SHALLOW AQUIFER MONITOR WELLS				
MW-01	8/7/2019	<0.50	<1.0	ORG
MW-06	8/5/2019	<0.50	<1.0	ORG
	8/5/2019	0.12	<1.0	SPT
	8/12/2020	<0.50	<4.0	ORG
MW-14	8/5/2019	0.51	<1.0	ORG
	8/13/2020	<0.50	<4.0	FD
	8/13/2020	<0.50	<4.0	ORG
MW-33	8/5/2019	<0.50	<1.0	ORG
	8/13/2020	<0.50	<4.0	ORG
NARS SHALLOW AQUIFER MONITOR WELLS				
MW-08	2/20/2019	24	---	ORG
	5/7/2019	27	---	ORG
	8/6/2019	24	---	FD
	8/6/2019	24	---	ORG
	11/6/2019	25	---	ORG
	2/5/2020	26	---	ORG
	2/5/2020	28	---	SPT
	5/20/2020	23	---	FD
	5/20/2020	23	---	ORG
	8/12/2020	30	---	ORG
	11/10/2020	27	---	ORG
MW-11	8/6/2019	1.2	---	ORG
	8/12/2020	3.2	---	ORG
	8/12/2020	3.5	---	SPT
MW-13	2/20/2019	24	---	FD
	2/20/2019	24	---	ORG
	8/5/2019	30	---	ORG
	8/5/2019	29	---	SPT
	2/5/2020	19E	---	ORG
	8/13/2020	16	---	ORG

TABLE 7

GROUNDWATER QUALITY DATA (NITRATE-N AND PERCHLORATE)

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
NARS SHALLOW AQUIFER MONITOR WELLS				
MW-17	2/20/2019	26E	---	ORG
	8/6/2019	16E	---	ORG
	2/5/2020	12E	---	ORG
	8/13/2020	3.5	---	FD
	8/13/2020	3.5	---	ORG
MW-18	2/20/2019	33E	---	ORG
	8/6/2019	29E	---	ORG
	2/5/2020	25E	---	ORG
	8/13/2020	6.9	---	ORG
MW-19	2/20/2019	12	---	ORG
	5/7/2019	16	---	ORG
	5/7/2019	15	---	SPT
	8/6/2019	13	---	ORG
	11/6/2019	12	---	ORG
	2/5/2020	12	---	ORG
	5/20/2020	18	---	ORG
	8/12/2020	17	---	ORG
	11/10/2020	13	---	FD
	11/10/2020	13	---	ORG
MW-34	2/21/2019	<0.50	---	ORG
	5/7/2019	<0.50	---	ORG
	8/6/2019	<0.50	---	FD
	8/6/2019	<0.50	---	ORG
	11/5/2019	<0.50	---	ORG
	2/4/2020	0.93	---	ORG
	5/19/2020	1.2	---	ORG
	8/12/2020	<0.50	---	ORG
	8/12/2020	0.30	---	SPT
	11/10/2020	<0.50	---	ORG
MW-35	2/21/2019	62	---	ORG
	5/8/2019	76E	---	ORG
	8/6/2019	72	---	ORG
	11/5/2019	65	---	ORG
	2/4/2020	97	---	ORG
	5/19/2020	50	---	ORG
	5/19/2020	52	---	SPT
	8/12/2020	57	---	ORG
	11/10/2020	62	---	FD
	11/10/2020	62	---	ORG

TABLE 7

GROUNDWATER QUALITY DATA
(NITRATE-N AND PERCHLORATE)

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
NARS SHALLOW AQUIFER MONITOR WELLS				
MW-36	2/21/2019	110	---	ORG
	2/21/2019	130	---	SPT
	5/8/2019	87E	---	FD
	5/8/2019	90E	---	ORG
	8/6/2019	83	---	ORG
	11/5/2019	76E	---	FD
	11/5/2019	74E	---	ORG
	2/4/2020	170	---	ORG
	5/19/2020	100	---	ORG
	8/12/2020	86	---	ORG
	11/10/2020	95	---	ORG
	11/10/2020	100	---	SPT
MW-45	2/21/2019	140E	---	ORG
	2/21/2019	170	---	SPT
	5/8/2019	200E	---	ORG
	8/5/2019	210	---	ORG
	11/5/2019	180	---	ORG
	2/4/2020	170	---	ORG
	5/19/2020	240	---	ORG
	8/11/2020	230	---	FD
	8/11/2020	240	---	ORG
	11/10/2020	260	---	ORG
NORTHERN AREA MNA MANAGEMENT ZONE SHALLOW AQUIFER MONITOR WELLS				
PB-2A	5/8/2019	36E	---	ORG
	8/6/2019	56	---	ORG
	11/5/2019	53E	---	ORG
PB-2A (80' Depth)	2/4/2020	50E	---	FD
	2/4/2020	49E	---	ORG
	5/19/2020	49	---	ORG
	8/11/2020	55	---	ORG
	11/10/2020	81	---	ORG
PB-2A (90' Depth)	2/4/2020	49E	---	FD
	2/4/2020	48E	---	ORG
	5/19/2020	42	---	ORG
	8/11/2020	54	---	ORG
	11/10/2020	81	---	ORG

TABLE 7

GROUNDWATER QUALITY DATA
(NITRATE-N AND PERCHLORATE)

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
PB-2A (100' Depth)	2/4/2020	46E	---	FD
	2/4/2020	50E	---	ORG
	5/19/2020	42	---	ORG
	8/11/2020	52	---	FD
	8/11/2020	54	---	ORG
	11/10/2020	83	---	ORG
PB-4	5/8/2019	60E	---	ORG
	8/6/2019	44	---	ORG
	11/5/2019	41E	---	ORG
PB-4 (45' Depth)	2/4/2020	42E	---	ORG
	5/19/2020	42	---	ORG
	8/12/2020	51	---	ORG
	11/10/2020	48	---	ORG
PB-4 (55' Depth)	2/4/2020	44E	---	ORG
	5/19/2020	41	---	ORG
	8/12/2020	49E	---	ORG
	11/10/2020	49	---	FD
	11/10/2020	50	---	ORG
PB-4 (65' Depth)	2/4/2020	43E	---	ORG
	5/19/2020	42	---	ORG
	8/12/2020	130E	---	ORG
	8/12/2020	85	---	SPT
	11/10/2020	150E	---	ORG
PB-5A (SEW-03)	5/8/2019	170E	---	ORG
	11/5/2019	300E	---	ORG
	2/4/2020	870E	---	ORG
	5/19/2020	950E	---	ORG
	8/12/2020	990E	---	ORG
	11/10/2020	1600E	---	ORG
	11/10/2020	1300	---	SPT
PB-7	5/8/2019	31E	---	ORG
	8/6/2019	37	---	ORG
	11/5/2019	14E	---	ORG

TABLE 7

GROUNDWATER QUALITY DATA
(NITRATE-N AND PERCHLORATE)

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
PB-7 (40' Depth)	2/4/2020	17E	---	ORG
	5/19/2020	25	---	ORG
	8/11/2020	27	---	ORG
	11/10/2020	27	---	ORG
PB-7 (50' Depth)	2/4/2020	18E	---	ORG
	5/19/2020	30	---	ORG
	8/11/2020	32	---	ORG
	11/10/2020	27	---	ORG
PB-7 (60' Depth)	2/4/2020	38E	---	ORG
	5/19/2020	110E	---	ORG
	5/19/2020	81	---	SPT
	8/11/2020	38	---	ORG
	11/10/2020	64E	---	ORG
	11/10/2020	110E	---	SPT
NORTHERN AREA MNA MANAGEMENT ZONE SHALLOW AQUIFER MONITOR WELLS				
MW-41A	11/6/2019	<0.50	---	FD
	11/6/2019	<0.50	---	ORG
MW-41B	11/6/2019	3.1	---	ORG
MW-42	8/6/2019	5.9	---	ORG
NORTHERN AREA MANAGEMENT ZONE SHALLOW AQUIFER PIEZOMETERS				
NAP-4	2/21/2019	<0.50	---	ORG
NORTHERN AREA MNA MANAGEMENT ZONE SHALLOW AQUIFER PRIVATE WELLS				
D(17-20)36aad1 (Jacobs)	8/7/2019	0.96	---	FD
	8/7/2019	0.96	---	ORG
D(17-20)36caa (Gaynor)	8/7/2019	<0.50	---	ORG
	8/7/2019	0.17	---	SPT
D(17-20)36caa2(Hyder)	8/7/2019	1.7	---	ORG
	8/7/2019	1.8	---	SPT
D(17-20)36ddc (Morales)	8/7/2019	1.5	---	ORG

TABLE 7

GROUNDWATER QUALITY DATA (NITRATE-N AND PERCHLORATE)

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
D(18-21)06bcb (Jones)	2/20/2019	5.3	---	ORG
	5/7/2019	4.7	---	ORG
	8/7/2019	10E	---	FD
	8/7/2019	11E	---	ORG
	11/6/2019	5.1	---	ORG
	2/5/2020	4.2	---	ORG
	5/20/2020	2.1	---	FD
	5/20/2020	2.1	---	REG
	8/11/2020	2.0	---	ORG
	11/11/2020	4.3	---	ORG
SURFACE WATER				
SW-03	2/21/2019	<0.50	---	ORG
	2/5/2020	1.8	---	ORG
	5/20/2020	3.5	---	ORG
SW-04	2/21/2019	<0.50	---	ORG
	2/5/2020	0.74	---	ORG
	5/20/2020	3.3	---	ORG
SW-12	2/20/2019	<0.50	---	ORG
	5/8/2019	<0.50E	---	ORG
	2/5/2020	<0.50	---	ORG
	5/20/2020	<0.50	---	ORG
SW-14	2/21/2019	<0.50	<1.0	ORG
	5/7/2019	<0.50	<1.0	FD
	5/7/2019	<0.50	<5.0	ORG
	2/5/2020	<0.50	<4.0	ORG
	2/5/2020	0.34	<1.0	SPT
	5/20/2020	<0.50	<4.0	ORG

ABBREVIATIONS/ACRONYMS:

(<)= Not detected, numerical value is less than the method detection limit.
-- = not analyzed
µg/l = micrograms per liter
E = Estimated
FD = field duplicate
mg/l = milligrams per liter
ORG = original sample
SPT = Split sample

TABLE 8

AMENDMENT ADDITIONS LOG
JANUARY 2020 THROUGH DECEMBER 2020
(MOLASSES, SODIUM TRIPOLYPHOSPHATE)

TREATMENT CELLS	DATE	MOLASSES (Liquid Form) (gal)	B-52 Sodium Tripolyphosphate (lbs)
PDA-S	1/3/2020	900	0
	1/10/2020	0	0
	1/17/2020	0	0
	1/24/2020	1,200	0
	1/31/2020	0	0
	2/7/2020	0	0
	2/14/2020	0	0
	2/21/2020	0	0
	2/28/2020	0	0
	3/6/2020	0	0
	3/13/2020	0	0
	3/20/2020	0	0
	3/27/2020	0	0
	4/3/2020	0	0
	4/10/2020	0	0
	4/17/2020	0	0
	4/24/2020	0	0
	5/1/2020	0	0
	5/8/2020	0	0
	5/15/2020	0	0
	5/22/2020	0	0
	5/29/2020	0	0
	6/5/2020	0	0
	6/12/2020	0	0
	6/19/2020	0	0
	6/26/2020	0	0
	7/3/2020	0	0
	7/10/2020	0	0
	7/17/2020	0	0
	7/24/2020	0	0
	7/31/2020	0	0
	8/7/2020	0	0
	8/14/2020	0	0
	8/21/2020	0	0
	8/28/2020	0	0
	9/4/2020	0	0
	9/11/2020	0	0
	9/18/2020	0	0

TABLE 8

AMENDMENT ADDITIONS LOG
JANUARY 2020 THROUGH DECEMBER 2020
(MOLASSES, SODIUM TRIPOLYPHOSPHATE)

TREATMENT CELLS	DATE	MOLASSES (Liquid Form) (gal)	B-52 Sodium Tripolyphosphate (lbs)
PDA-S (cont'd)	9/25/2020	0	0
	10/2/2020	0	0
	10/9/2020	1,200	0
	10/16/2020	0	0
	10/23/2020	1,200	0
	10/30/2020	1,000	0
	11/6/2020	0	0
	11/12/2020	800	0
	11/20/2020	0	0
	11/27/2020	0	0
	12/4/2020	800	0
	12/11/2020	0	0
	12/18/2020	0	0
	12/23/2020	0	0
	12/31/2021	0	0
TOTAL (PDA-S)		**7,100**	**0**
PDA-C	1/3/2020	0	0
	1/10/2020	0	0
	1/17/2020	0	0
	1/24/2020	0	0
	1/31/2020	0	0
	2/7/2020	0	0
	2/14/2020	0	0
	2/21/2020	0	0
	2/28/2020	0	0
	3/6/2020	0	0
	3/13/2020	0	0
	3/20/2020	0	0
	3/27/2020	0	0
	4/3/2020	0	0
	4/10/2020	0	0
	4/17/2020	0	0
	4/24/2020	0	0
	5/1/2020	0	0
	5/8/2020	0	0
	5/15/2020	0	0
	5/22/2020	0	0

TABLE 8

AMENDMENT ADDITIONS LOG
JANUARY 2020 THROUGH DECEMBER 2020
(MOLASSES, SODIUM TRIPOLYPHOSPHATE)

TREATMENT CELLS	DATE	MOLASSES (Liquid Form) (gal)	B-52 Sodium Tripolyphosphate (lbs)
PDA-C (cont'd)	5/29/2020	0	0
	6/5/2020	0	0
	6/12/2020	0	0
	6/19/2020	0	0
	6/26/2020	0	0
	7/3/2020	0	0
	7/10/2020	0	0
	7/17/2020	0	0
	7/24/2020	0	0
	7/31/2020	0	0
	8/7/2020	0	0
	8/14/2020	0	0
	8/21/2020	0	0
	8/28/2020	0	0
	9/4/2020	0	0
	9/11/2020	0	0
	9/18/2020	0	0
	9/25/2020	0	0
	10/2/2020	0	0
	10/9/2020	0	0
	10/16/2020	0	0
	10/23/2020	0	0
	10/30/2020	0	0
	11/6/2020	0	0
	11/12/2020	0	0
	11/20/2020	0	0
	11/27/2020	0	0
	12/4/2020	0	0
	12/11/2020	0	0
	12/18/2020	0	0
	12/23/2020	0	0
	12/31/2021	0	0
TOTAL (PDA-C)		**0**	**0**

TABLE 8

AMENDMENT ADDITIONS LOG
JANUARY 2020 THROUGH DECEMBER 2020
(MOLASSES, SODIUM TRIPOLYPHOSPHATE)

TREATMENT CELLS	DATE	MOLASSES (Liquid Form) (gal)	B-52 Sodium Tripolyphosphate (lbs)
PDA-N	1/3/2020	0	0
	1/10/2020	0	0
	1/17/2020	0	0
	1/24/2020	0	0
	1/31/2020	0	0
	2/7/2020	0	0
	2/14/2020	0	0
	2/21/2020	0	0
	2/28/2020	0	0
	3/6/2020	0	0
	3/13/2020	0	0
	3/20/2020	0	0
	3/27/2020	0	0
	4/10/2020	0	0
	4/17/2020	0	0
	4/24/2020	0	0
	5/1/2020	0	0
	5/8/2020	0	0
	5/15/2020	0	0
	5/22/2020	0	0
	5/29/2020	0	0
	6/5/2020	0	0
	6/12/2020	0	0
	6/19/2020	0	0
	6/26/2020	0	0
	7/3/2020	0	0
	7/10/2020	0	0
	7/17/2020	0	0
	7/24/2020	0	0
	7/31/2020	0	0
	8/7/2020	0	0
	8/14/2020	0	0
	8/21/2020	0	0
	8/28/2020	0	0
	9/4/2020	0	0
	9/11/2020	0	0
	9/18/2020	0	0
	9/25/2020	0	0
	10/2/2020	0	0

TABLE 8

AMENDMENT ADDITIONS LOG
JANUARY 2020 THROUGH DECEMBER 2020
(MOLASSES, SODIUM TRIPOLYPHOSPHATE)

TREATMENT CELLS	DATE	MOLASSES (Liquid Form) (gal)	B-52 Sodium Tripolyphosphate (lbs)
PDA-N (cont'd)	10/9/2020	0	0
	10/16/2020	0	0
	10/23/2020	0	0
	10/30/2020	0	0
	11/6/2020	0	0
	11/12/2020	0	0
	11/20/2020	0	0
	11/27/2020	0	0
	12/4/2020	0	0
	12/11/2020	0	0
	12/18/2020	0	0
	12/23/2020	0	0
	12/31/2020	0	0
TOTAL (PDA-N)		**0**	**0**
FDA	1/3/2020	0	0
	1/10/2020	0	0
	1/17/2020	0	0
	1/24/2020	0	0
	1/31/2020	0	0
	2/7/2020	0	0
	2/14/2020	0	0
	2/21/2020	0	0
	2/28/2020	0	0
	3/6/2020	0	0
	3/13/2020	0	0
	3/20/2020	0	0
	3/27/2020	0	0
	4/3/2020	0	0
	4/10/2020	0	0
	4/17/2020	0	0
	4/24/2020	0	0
	5/1/2020	0	0
	5/8/2020	0	0
	5/15/2020	0	0
	5/22/2020	0	0
	5/29/2020	0	0
	6/5/2020	0	0

TABLE 8

AMENDMENT ADDITIONS LOG
JANUARY 2020 THROUGH DECEMBER 2020
(MOLASSES, SODIUM TRIPOLYPHOSPHATE)

TREATMENT CELLS	DATE	MOLASSES (Liquid Form) (gal)	B-52 Sodium Tripolyphosphate (lbs)
FDA (cont'd)	6/12/2020	0	0
	6/19/2020	0	0
	6/26/2020	0	0
	7/3/2020	0	0
	7/10/2020	0	0
	7/17/2020	0	0
	7/24/2020	0	0
	7/31/2020	0	0
	8/7/2020	0	0
	8/14/2020	0	0
	8/21/2020	0	0
	8/28/2020	0	0
	9/4/2020	0	0
	9/11/2020	0	0
	9/18/2020	0	0
	9/25/2020	0	0
	10/2/2020	0	0
	10/9/2020	0	0
	10/16/2020	0	0
	10/23/2020	0	0
	10/30/2020	0	0
	11/6/2020	0	0
	11/12/2020	0	0
	11/20/2020	0	0
	11/27/2020	0	0
	12/4/2020	0	0
	12/11/2020	0	0
	12/18/2020	0	0
	12/23/2020	0	0
	12/31/2020	0	0
TOTAL (FDA)		**0**	**0**
ANA	1/3/2020	0	0
	1/10/2020	0	0
	1/17/2020	0	0
	1/24/2020	0	0
	1/31/2020	0	0
	2/7/2020	0	0

TABLE 8

AMENDMENT ADDITIONS LOG
JANUARY 2020 THROUGH DECEMBER 2020
(MOLASSES, SODIUM TRIPOLYPHOSPHATE)

TREATMENT CELLS	DATE	MOLASSES (Liquid Form) (gal)	B-52 Sodium Tripolyphosphate (lbs)
ANA (cont'd)	2/14/2020	0	0
	2/21/2020	0	0
	2/28/2020	0	0
	3/6/2020	0	0
	3/13/2020	0	0
	3/20/2020	0	0
	3/27/2020	0	0
	4/3/2020	0	0
	4/10/2020	0	0
	4/17/2020	0	0
	4/24/2020	0	0
	5/1/2020	0	0
	5/8/2020	0	0
	5/15/2020	0	0
	5/22/2020	0	0
	5/29/2020	0	0
	6/5/2020	0	0
	6/12/2020	0	0
	6/19/2020	0	0
	6/26/2020	0	0
	7/3/2020	0	0
	7/10/2020	0	0
	7/17/2020	0	0
	7/24/2020	0	0
	7/31/2020	0	0
	8/7/2020	0	0
	8/14/2020	0	0
	8/21/2020	0	0
	8/28/2020	0	0
	9/4/2020	0	0
	9/11/2020	0	0
	9/18/2020	0	0
	9/25/2020	0	0
	10/2/2020	0	0
	10/9/2020	0	0
	10/16/2020	0	0
	10/23/2020	0	0
	10/30/2020	0	0
	11/6/2020	0	0

TABLE 8

AMENDMENT ADDITIONS LOG
JANUARY 2020 THROUGH DECEMBER 2020
(MOLASSES, SODIUM TRIPOLYPHOSPHATE)

TREATMENT CELLS	DATE	MOLASSES (Liquid Form) (gal)	B-52 Sodium Tripolyphosphate (lbs)
ANA (cont'd)	11/12/2020	0	0
	11/20/2020	0	0
	11/27/2020	0	0
	12/4/2020	0	0
	12/11/2020	0	0
	12/18/2020	0	0
	12/23/2020	0	0
	12/31/2020	0	0
TOTAL (ANA)		**0**	**0**

ABBREVIATIONS/ACRONYMS:

gal = gallons
lbs = pounds

TABLE 9

NORTHERN AREA REMEDIATION SYSTEM WETLAND

WATER BUDGET

INPUTS	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
SEW-01 [a]	gal	22,241,215	25,018,950	23,313,210	22,322,350	32,491,750	50,356,930	52,953,830	56,738,430	62,257,020	76,113,710	69,325,856	71,215,764	55,074,470	47,351,910	46,730,760	44,483,260	33,669,034	32,236,898	29,601,550	24,905,500	33,768,770
SEW-02 [a]	gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4,905,555	8,539,718	3,685,579
PB-5A [a]	gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	144,100	--
Precip [b]	in	15	14	7	8	9	7.9	12.7	13	13	6	10	9	9	10	14	17	12	7	16	15	8
Precip	ft	1.2	1.2	0.6	0.6	0.8	0.7	1.1	1.1	1.1	0.5	0.9	0.8	0.7	0.8	1.2	1.4	1.0	0.6	1.3	1.3	0.7
Precip Vol	gal	1,777,722	1,680,951	833,905	909,171	1,123,023	940,233	1,511,303	1,600,906	1,585,374	663,062	1,223,379	1,133,776	1,050,146	1,168,422	1,715,597	2,009,495	1,433,647	836,294	1,911,529	1,792,058	955,764
INPUT TOTAL	gal	**24,018,937**	**26,699,901**	**24,147,115**	**23,231,521**	**33,614,773**	**51,297,163**	**54,465,133**	**58,339,336**	**63,842,394**	**76,776,772**	**70,549,235**	**72,349,540**	**56,124,616**	**48,520,332**	**48,446,357**	**46,492,755**	**35,102,681**	**33,073,192**	**36,418,634**	**35,381,376**	**38,410,113**
OUTPUTS	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ET RATE [c]	ft	7.5	7.5	7.5	7.5	7.5	8.6	7.3	7.7	7.8	8.1	7.0	7.6	7.0	7.0	7.0	5.0	7.0	7.8	7.9	7.5	7.6
ET	gal	8,088,722	8,088,722	8,088,722	8,088,722	8,088,722	9,275,068	7,905,378	8,304,422	8,412,271	8,735,820	7,549,474	8,175,002	7,549,474	7,549,474	7,549,474	5,392,482	7,549,474	8,412,271	8,520,121	8,088,722	8,196,572
Evap Rate [d]	ft	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Evap	gal	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173	2,770,173
Discharge [e,f,g]	gal	0	4,151,520	163,900	4,423,680	20,750,400	32,760,000	44,042,400	47,753,280	44,915,717	51,131,146	52,699,680	61,903,720	37,518,380	32,804,310	26,619,260	27,951,113	22,385,536	24,173,394	32,633,072	31,636,709	31,700,327
OUTPUT TOTAL	**gal**	**10,858,896**	**15,010,416**	**11,022,796**	**15,282,576**	**31,609,296**	**44,805,241**	**54,717,951**	**58,827,875**	**56,098,161**	**62,637,139**	**63,019,327**	**72,848,895**	**47,838,027**	**43,123,957**	**36,938,907**	**36,113,768**	**32,705,183**	**35,355,838**	**43,923,366**	**42,495,605**	**42,667,072**
	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Input - Output *	**gal**	**13,160,041**	**11,689,485**	**13,124,319**	**7,948,945**	**2,005,478**	**6,491,922**	**-252,819**	**-488,539**	**7,744,233**	**14,139,632**	**7,529,907**	**-499,356**	**8,286,589**	**5,396,375**	**11,507,450**	**10,378,987**	**2,397,497**	**-2,282,646**	**-7,504,732**	**-7,114,228**	**-4,256,959**

ABBREVIATIONS/ACRONYMS:

ET = evapotranspiration
evap = evaporation
ft = feet
gal = gallons
in = inches
Precip = precipatation
SEW = shallow aquifer extraction well

NOTES:

* = Uncertainty unaccounted for changes in storage, infiltration losses, and measurement error.
[a] = Measured from SEW wells' flow meter.
[b] = Measured from ANP weather station.
[c] = Measured from wetland atmometer.
[d] = Estimated from referenced pan evaporation Arizona climate 1931-1972, U of A Press, 1974.
[e] = Estimated from measurements at the Parshall flume until totalizer installed in October 2007.
[f] = The Parshall Flume totalizer was out of service for approximately 2 months in 2012, 2015 and 2016. The total for each year is estimated.
[g] = The Parshall Flume totalizer was offline and/or malfunctioning from January to July 2020. The totalizer was repaired January 10, 2021. The total for this year is estimated.

TABLE 10
INFLUENT AND EFFLUENT
MEASUREMENTS

DATE RECORDED	INFLUENT						EFFLUENT	
	SEW-01		SEW-02		PB-5A (SEW-03)		PARSHALL FLUME	
	TOTALIZED FLOW (gallons)	FLOW (GPM)	TOTALIZED FLOW (gallons)	FLOW (GPM)	TOTALIZED FLOW (gallons)	FLOW (GPM)	TOTALIZED FLOW (gallons)	FLOW (GPM)
1/3/2020	274175572	185	13547994	45	--	--	456430561	NL
1/10/2020	274710352	185	13641994	0	--	--	456767838	NL
1/16/2020	275115982	185	13641994	0	--	--	457105115	NL
1/24/2020	275698782	0[a]	13641994	0	--	--	457442392	NL
1/31/2020	276258552	190	13641994	0	--	--	457779669	NL
2/7/2020	276675152	185	13641994	0	--	--	458271598	126.17*
2/14/2020	277033732	185	13641994	0	--	--	458450352	17.27*
2/20/2020	277287052	0[a]	13641994	0	--	--	458569855	13.03*
2/28/2020	277715632	185	13641994	0	--	--	458755546	14.31*
3/6/2020	278092092	185	13641994	0	--	--	458985546	20.14*
3/13/2020	278447142	185	13641994	0	--	--	459215546	28.17*
3/20/2020	278833182	190	13641994	0	--	--	459454509	36.1*
3/27/2020	279353862	190	13641994	0	--	--	459724863	30.84*
4/1/2020	279873682	190	13641994	0	--	--	460065341	52.51*
4/9/2020	280583902	190	13641994	0	--	--	460654861	65.38*
4/16/2020	281262962	190	13647830	45	--	--	461200959	63.11*
4/23/2020	282002222	0[a]	13723195	0[a]	--	--	461841488	41.52*
5/1/2020	282682592	190	13806988	45	--	--	462449711	75.27*
5/8/2020	283372002	190	13890109	45	--	--	462895964	53.22*
5/15/2020	284036272	190	13967386	45	--	--	463296338	49.5*
5/22/2020	284712792	190	14048976	45	--	--	463497624	38.92*
5/29/2020	285447512	190	14131837	45	--	--	463797624	40*
6/5/2020	286078112	190	14211605	45	--	--	464097624	40*
6/12/2020	286767672	190	14291353	45	--	--	464397624	40*
6/18/2020	287430292	190	14379475	45	--	--	464777624	40*
6/26/2020	288675152	190	14510954	45	--	--	465157624	40*
7/2/2020	289081772	190	14575833	45	--	--	465417624	26*
7/10/2020	290505922	190	14693259	45	--	--	465917624	833.7
7/17/2020	290952112	190	14774789	45	--	--	466421186	8.76
7/24/2020	291635922	190	14902763	45	--	--	467600818	94.79
7/31/2020	292422182	190	15060640	45	--	--	469208145	105.06
8/7/2020	293225392	190	15203039	45	--	--	470393322	82.01
8/14/2020	294091282	190	15370446	45	--	--	471289355	41.63
8/21/2020	294843222	190	15511148	45	--	--	471931165	60.31
8/28/2020	295591372	190	15650587	45	--	--	472756241	156.89
9/4/2020	296408142	190	15715476	45	--	--	473624814	25.59
9/11/2020	296773872	0[a]	15783410	0[a]	--	--	474259743	20.48
9/18/2020	297508132	190	15864702	45	--	--	474425615	3.12
9/25/2020	298301842	190	15977694	45	--	--	475025245	53.97
10/2/2020	299104762	190	16089136	45	--	--	475762992	79.28
10/9/2020	299933692	190	16155232	45	--	--	476519457	77.48
10/16/2020	300611542	190	16255482	45	--	--	477171155	60.49
10/23/2020	301280392	190	16344754	45	--	--	478192116	94.68

TABLE 10
INFLUENT AND EFFLUENT
MEASUREMENTS

DATE RECORDED	INFLUENT						EFFLUENT	
	SEW-01		SEW-02		PB-5A (SEW-03)		PARSHALL FLUME	
	TOTALIZED FLOW (gallons)	FLOW (GPM)	TOTALIZED FLOW (gallons)	FLOW (GPM)	TOTALIZED FLOW (gallons)	FLOW (GPM)	TOTALIZED FLOW (gallons)	FLOW (GPM)
10/30/2020	301930822	190	16437369	45	--	--	479068553	111.45
11/5/2020	302508512	190	16525578	45	--	--	479587230	88.14
11/12/2020	303193162	190	16629991	45	--	--	480745636	62.93
11/20/2020	303911282	190	16721432	45	--	--	481952672	57.56
11/25/2020	304384522	190	16789122	45	--	--	482657077	56.74
12/4/2020	305218042	190	16907613	45	--	--	484138436	73.44
12/10/2020	305597782	0[a]	16952010	0[a]	--	--	484963813	68.16
12/17/2020	306134092	190	16985739	45	--	--	485488469	59.32
12/23/2020	306638312	190	17051588	45	--	--	486394697	92.99
12/31/2020	307383712	190	17130852	45	--	--	487793611	103.7

Total Effluent volume January through December 2020 = 31,700,327 gallons
Average Effluent flow rate January through December 2020 = 70 gpm*
SEW-01 volume extracted January through December 2020 = 33,768,770 gallons
SEW-02 volume extracted January through December 2020 = 3,685,579 gallons
Total Influent volume January through December 2020 = 37,454,349 gallons
Average Influent flow rate January through December 2020 = 264 gpm

ABBREVIATIONS/ACRONYMS:

GPM = Gallons per minute measured at the Flowmeters and/or Parshall Flume.
NL= Meter down. Added an average of Parshall flume readings from 4/18/19-5/10/19 of 337,277.
SEW = Shallow Aquifer Extraction Well

NOTES:

* = Meter malfunction. Instant flow rate and totalizer estimated. Estimated totals were not used to calculate the 2020 Average Effluent flow rate.
-- = Extraction well not pumping per NARS O&M Schedule.
[a] = Reading was recording outside of daily pumping hours.

TABLE 11

WATER LEVEL DATA
(WELLS)

IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
SHALLOW AQUIFER MONITOR WELL				
MW-10	1/3/2020	3634.00	16.10	3617.90
	1/10/2020		16.10	3617.90
	1/16/2020		16.10	3617.90
	1/24/2020		16.10	3617.90
	1/31/2020		16.01	3617.99
	2/3/2020		15.41	3618.59
	2/7/2020		15.90	3618.10
	2/14/2020		15.80	3618.20
	2/20/2020		15.50	3618.50
	2/28/2020		15.51	3618.49
	3/6/2020		15.51	3618.49
	3/13/2020		15.51	3618.49
	3/20/2020		15.61	3618.39
	3/27/2020		15.61	3618.39
	4/1/2020		15.61	3618.39
	4/9/2020		15.61	3618.39
	4/16/2020		15.61	3618.39
	4/23/2020		15.61	3618.39
	5/1/2020		15.61	3618.39
	5/8/2020		15.61	3618.39
	5/15/2020		15.61	3618.39
	5/18/2020		15.46	3618.54
	5/22/2020		15.61	3618.39
	5/29/2020		15.61	3618.39
	6/5/2020		15.61	3618.39
	6/12/2020		15.61	3618.39
	6/18/2020		15.61	3618.39
	6/26/2020		15.61	3618.39
	7/2/2020		15.61	3618.39
	7/10/2020		15.61	3618.39
	7/17/2020		15.61	3618.39
	7/24/2020		15.61	3618.39
	7/31/2020		15.61	3618.39
	8/7/2020		15.61	3618.39
	8/10/2020		15.23	3618.77
	8/14/2020		16.05	3617.95
	8/21/2020		16.05	3617.95
	8/28/2020		16.05	3617.95
	9/4/2020		16.05	3617.95
	9/11/2020		16.10	3617.90
	9/18/2020		16.10	3617.90
	9/25/2020		16.10	3617.90
	10/2/2020		16.10	3617.90
	10/9/2020		16.10	3617.90

TABLE 11

WATER LEVEL DATA
(WELLS)

IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
MW-10 (cont'd)	10/16/2020		16.10	3617.90
	10/23/2020		16.10	3617.90
	10/30/2020		16.10	3617.90
	11/5/2020		16.10	3617.90
	11/9/2020		15.31	3618.69
	11/12/2020		15.85	3618.15
	11/20/2020		15.85	3618.15
	11/25/2020		15.85	3618.15
	12/4/2020		15.85	3618.15
	12/10/2020		15.85	3618.15
	12/17/2020		15.85	3618.15
	12/23/2020		15.85	3618.15
EXTRACTION WELLS				
SEW-01	2/3/2020	3623.63	55.60	3568.03
	5/20/2020		54.05	3569.58
	8/10/2020		60.18	3563.45
	11/10/2020		62.80	3560.83
SEW-02	2/3/2020	3613.23	25.72	3587.51
	5/18/2020		62.20	3551.03
	8/10/2020		62.21	3551.02
	11/9/2020		59.19	3554.04
DESIGN CONFIRMATION PIEZOMETER				
DCP-12	1/31/2020	3690.10	21.21	3668.89
	2/3/2020		19.78	3670.32
	3/20/2020		20.11	3669.99
	5/1/2020		20.25	3669.85
	5/18/2020		21.05	3669.05
	5/29/2020		21.45	3668.65
	6/18/2020		20.75	3669.35
	7/24/2020		20.55	3669.55
	8/10/2020		21.94	3668.16
	8/21/2020		22.10	3668.00
	9/25/2020		21.35	3668.75
	11/9/2020		21.32	3668.78
	11/20/2020		21.55	3668.55
	12/17/2020		21.60	3668.50

ABBREVIATIONS/ACRONYMS:

bmp = below measuring point
msl = mean sea level
UTM = unable to measure

TABLE 12

WATER QUALITY DATA
(NITRATE-N AND AMMONIA-N)

IDENTIFIER	SAMPLE DATE	LAB	NITRATE-N (mg/l)	AMMONIA-N (mg/l)	SAMPLE TYPE
TREATMENT CELLS					
ANA	1/28/2020	TURN	16E	<0.50	FD
	1/28/2020	TURN	14E	<0.50	ORG
	2/11/2020	TURN	14E	<0.50	ORG
	3/17/2020	TURN	0.93	<0.50	ORG
	4/28/2020	TURN	1.9E	<0.50	ORG
	5/26/2020	TURN	<0.50	<0.50	ORG
	6/16/2020	TURN	<0.50	<0.50	ORG
	7/20/2020	TURN	<0.50	1.4	FD
	7/20/2020	TURN	<0.50	0.94	ORG
	8/18/2020	TURN	2.6	<0.50	ORG
	9/22/2020	TURN	<0.50	<0.50	ORG
	9/22/2020	TAA	<0.050	0.90	SPT
	10/20/2020	TURN	10	<0.50	ORG
	11/17/2020	TURN	<0.50	1.6	ORG
	12/15/2020	TURN	<0.50	1.1	ORG
FDA	1/28/2020	TURN	7.7E	<0.50	ORG
	2/11/2020	TURN	5.4	<0.50	ORG
	3/17/2020	TURN	<0.50	<0.50	ORG
	4/28/2020	TURN	<0.50	<0.50	ORG
	5/26/2020	TURN	<0.50	<0.50	ORG
	6/16/2020	TURN	<0.50	<0.50	ORG
	7/20/2020	TURN	<0.50	<0.50	ORG
	8/18/2020	TURN	<0.50	<0.50	ORG
	9/22/2020	TURN	<0.50	<0.50	ORG
	10/20/2020	TURN	1.3	<0.50	FD
	10/20/2020	TURN	1.2	<0.50	ORG
	10/20/2020	TAA	1.4	<0.50	SPT
	11/17/2020	TURN	<0.50	1.1	ORG
	12/15/2020	TURN	<0.50	1.1	ORG
PDA-C	1/28/2020	TURN	20E	<0.50	ORG
	2/11/2020	TURN	20E	0.76	ORG
	3/17/2020	TURN	15	2.5	ORG
	4/28/2020	TURN	13	1.8	ORG
	4/28/2020	TAA	14	2.9	SPT
	5/26/2020	TURN	13	<0.50	FD
	5/26/2020	TURN	13	<0.50	ORG
	6/16/2020	TURN	22E	<0.50	ORG
	7/20/2020	TURN	21E	<0.50	ORG

TABLE 12

WATER QUALITY DATA
(NITRATE-N AND AMMONIA-N)

IDENTIFIER	SAMPLE DATE	LAB	NITRATE-N (mg/l)	AMMONIA-N (mg/l)	SAMPLE TYPE
PDA-C (cont'd)	8/18/2020	TURN	46	<0.50	ORG
	9/22/2020	TURN	27	<0.50	ORG
	10/20/2020	TURN	8.3	0.96	ORG
	11/17/2020	TURN	3.4	2.3	ORG
	12/15/2020	TURN	8.0	0.99	ORG
	12/15/2020	TAA	8.7	0.82	SPT
TREATMENT CELLS					
PDA-N	1/28/2020	TURN	17E	<0.50	ORG
	2/11/2020	TURN	16E	<0.50	ORG
	3/17/2020	TURN	<0.50	<0.50	ORG
	4/28/2020	TURN	5.8	<0.50	ORG
	5/26/2020	TURN	3.3	<0.50	ORG
	6/16/2020	TURN	7.7	<0.50	ORG
	6/16/2020	TAA	8.3	<0.50	SPT
	7/20/2020	TURN	7.6	<0.50	ORG
	8/18/2020	TURN	20	<0.50	ORG
	9/22/2020	TURN	11	<0.50	ORG
	10/20/2020	TURN	10	0.78	ORG
	11/17/2020	TURN	<0.50	1.7	FD
	11/17/2020	TURN	<0.50	1.7	ORG
	12/15/2020	TURN	0.63	0.56	ORG
PDA-S	1/28/2020	TURN	<0.50E	11	ORG
	2/11/2020	TURN	<0.50	13	ORG
	3/17/2020	TURN	<0.50E	14	FD
	3/17/2020	TURN	<0.50E	14	ORG
	4/28/2020	TURN	23	3.0	ORG
	5/26/2020	TURN	45	<0.50	ORG
	6/16/2020	TURN	50E	<0.50	ORG
	7/20/2020	TURN	68E	<0.50	ORG
	7/20/2020	TAA	71E	<0.50E	SPT
	8/18/2020	TURN	84	<0.50	ORG
	9/22/2020	TURN	68	<0.50	ORG
	10/20/2020	TURN	<0.50	14	ORG
	11/17/2020	TURN	4.7	3.2	ORG
	11/17/2020	TAA	5.1	4.2	SPT
	12/15/2020	TURN	16	3.9	ORG
SHALLOW AQUIFER MONITOR WELL					
MW-10	2/5/2020	TURN	5.8	<0.50	ORG
	8/11/2020	TURN	<0.50	<0.50	ORG
	11/11/2020	TURN	<0.50	<0.50	ORG

TABLE 12

WATER QUALITY DATA
(NITRATE-N AND AMMONIA-N)

IDENTIFIER	SAMPLE DATE	LAB	NITRATE-N (mg/l)	AMMONIA-N (mg/l)	SAMPLE TYPE
EXTRACTION WELLS					
SEW-01	1/28/2020	TURN	46E	---	ORG
	1/28/2020	TAA	51E	---	SPT
	2/11/2020	TURN	45	5.2	ORG
	3/17/2020	TURN	41	---	ORG
	4/28/2020	TURN	34	---	FD
	4/28/2020	TURN	34	---	ORG
	5/26/2020	TURN	32	3.5	ORG
	5/26/2020	TAA	36	5.0	SPT
	6/16/2020	TURN	35	---	ORG
	7/20/2020	TURN	40	---	ORG
	8/18/2020	TURN	36	4.1	FD
	8/18/2020	TURN	33	3.8	ORG
	9/22/2020	TURN	36	---	ORG
	10/20/2020	TURN	33	---	ORG
	11/17/2020	TURN	32	3.9	ORG
	12/15/2020	TURN	34	---	ORG
SEW-02	1/28/2020	TURN	160E	---	ORG
	2/11/2020	TURN	170	12	ORG
	3/17/2020	TURN	180	---	ORG
	4/28/2020	TURN	240	---	ORG
	5/26/2020	TURN	250	11	ORG
	6/16/2020	TURN	260	---	ORG
	7/20/2020	TURN	270	---	ORG
	8/18/2020	TURN	290	11	ORG
	8/18/2020	TAA	300	12	SPT
	9/22/2020	TURN	290	---	ORG
	10/20/2020	TURN	290	---	ORG
	11/17/2020	TURN	280	17	ORG
	12/15/2020	TURN	270	---	FD
	12/15/2020	TURN	240	---	ORG
EFFLUENT					
EFF-L	1/28/2020	TURN	6.6E	<0.50	ORG
	2/11/2020	TURN	4.6	<0.50	FD
	2/11/2020	TURN	4.6	<0.50	ORG
	3/17/2020	TURN	<0.50	<0.50	ORG
	4/28/2020	TURN	<0.50	<0.50	ORG
	5/26/2020	TURN	<0.50	<0.50	ORG

TABLE 12

WATER QUALITY DATA
(NITRATE-N AND AMMONIA-N)

IDENTIFIER	SAMPLE DATE	LAB	NITRATE-N (mg/l)	AMMONIA-N (mg/l)	SAMPLE TYPE
EFF-L (cont'd)	6/16/2020	TURN	<0.50	<0.50	ORG
	7/20/2020	TURN	<0.50	<0.50	ORG
	8/18/2020	TURN	<0.50	<0.50	ORG
	8/18/2020	TAA	<0.050	<0.50	SPT
	9/22/2020	TURN	<0.50	<0.50	ORG
	10/20/2020	TURN	1.6	<0.50	ORG
	11/17/2020	TURN	<0.50	1.1	ORG
	12/15/2020	TURN	<0.50	1.0	ORG
DESIGN CONFIRMATION PIEZOMETER					
DCP-12	2/5/2020	TURN	12E	---	FD
	2/5/2020	TURN	13E	---	ORG
	8/11/2020	TURN	16	---	ORG
	11/11/2020	TURN	8.6	---	ORG
BLANKS					
Field Blank	1/28/2020	TURN	<0.50E	<0.50	FB
	2/11/2020	TURN	<0.50	<0.50	FB
	3/17/2020	TURN	<0.50E	<0.50	FB
	4/28/2020	TURN	0.58	<0.50	FB
	5/26/2020	TURN	<0.50	<0.50	FB
	6/16/2020	TURN	<0.50	---	FB
	7/20/2020	TURN	<0.50	---	FB
	8/18/2020	TURN	<0.50	<0.50	FB
	9/22/2020	TURN	0.53	<0.50	FB
	12/15/2020	TURN	<0.50	<0.50	FB

ABBREVIATIONS/ACRONYMS:

(<) = Not detected, numerical value is less than the method detection limit.
-- = not analyzed
E = Estimated
FB = Field Blank sample
FD = Field Duplicate sample
mg/l = milligrams per liter
ORG = original sample
SPT = Split sample
TAA = Test America Analytical Laboratories, Inc.
TURN = Turner Laboratories, Inc.

TABLE 13

WATER QUALITY DATA
NORMAL OPERATION ADDITIONAL ANALYTES
INFLUENT AND EFFLUENT

SAMPLE DATE	LAB	ANALYTES	SEW-01	EFF-L	UNITS	SAMPLE TYPE
8/18/2020	TURN	bicarbonate	270	570	mg/l	ORG
		carbonate	< 2.0	< 2.0	mg/l	ORG
		chloride	19	8.4	mg/l	ORG
		fluoride	1.9	2.7	mg/l	ORG
		sulfate	270	370E	mg/l	ORG
		ortho-phosphate	< 0.50E	< 0.50	mg/l	ORG
		phosphorus	< 0.10	< 0.10	mg/l	ORG
		potassium	5.6	5.6	mg/l	ORG
		magnesium	23	44	mg/l	ORG
		calcium	130	170	mg/l	ORG
		sodium	100	180	mg/l	ORG
		total dissolved solids	890	1,200	mg/l	ORG
		total suspended solids	NA	< 10	mg/l	ORG

ABBREVIATIONS/ACRONYMS:

mg/l = milligrams per liter
NA = not analyzed
ORG = original sample
TURN = Turner Laboratories, Inc., Tucson, AZ

NOTES:

(<) = Not detected, numerical value is less than the method detection limit.

TABLE 14

WATER QUALITY DATA
NORMAL OPERATION (NITROGEN SPECIES)

IDENTIFIER	SAMPLE DATE	LAB	Total Kjeldahl Nitrogen (TKN) (mg/l)	ORGANIC NITROGEN (mg/l)	SAMPLE TYPE
TREATMENT CELLS					
PDA-S	8/18/2020	TURN	<0.50	0.0	ORG
PDA-C	8/18/2020	TURN	<0.50	0.0	ORG
PDA-N	8/18/2020	TURN	<0.50	0.0	ORG
ANA	8/18/2020	TURN	1.0	1.0	ORG
FDA	8/18/2020	TURN	0.61	0.61	ORG

ABBREVIATIONS/ACRONYMS:

mg/l = milligrams per liter
ORG = original sample
TURN = Turner Laboratories, Inc., Tucson, AZ

NOTES:

(<) = Not detected, numerical value is less than the method detection limit.

TABLE 15

WATER QUALITY DATA
NORMAL OPERATION (NUTRIENTS)

IDENTIFIER	SAMPLE DATE	LAB	CHEMICAL OXYGEN DEMAND (mg/l)	TOTAL ORGANIC CARBON (mg/l)	TOTAL PHOSPHORUS (mg/l)	SAMPLE TYPE
TREATMENT CELLS						
ANA	2/11/2020	TURN	27	11	<0.10	ORG
	5/26/2020	TURN	40E	8.3	<0.10	ORG
	8/18/2020	TURN	35	13	<0.10	ORG
	11/17/2020	TURN	140	49	<0.10	ORG
FDA	2/11/2020	TURN	23	11	<0.10	ORG
	5/26/2020	TURN	29E	9.0	<0.10	ORG
	8/18/2020	TURN	53	13	<0.10	ORG
	11/17/2020	TURN	82	27	<0.10	ORG
PDA-C	2/11/2020	TURN	41	15	<0.10	ORG
	5/26/2020	TURN	20	4.3	<0.10	FD
	5/26/2020	TURN	<20E	4.9	<0.10	ORG
	8/18/2020	TURN	27	5.0	<0.10	ORG
	11/17/2020	TURN	60	23	<0.10	ORG
PDA-N	2/11/2020	TURN	<20	9.8	<0.10	ORG
	5/26/2020	TURN	38E	6.1	<0.10	ORG
	8/18/2020	TURN	24	15	<0.10	ORG
	11/17/2020	TURN	94	42	<0.10	FD
	11/17/2020	TURN	94	35	<0.10	ORG
PDA-S	2/11/2020	TURN	820	250	<0.10	ORG
	5/26/2020	TURN	39E	32	0.32E	ORG
	8/18/2020	TURN	23	10	<0.10	ORG
	11/17/2020	ETAMP	250	73E	0.24	SPT
	11/17/2020	TURN	330	85	<0.10	ORG

ABBREVIATIONS/ACRONYMS:

(<) = Not detected, numerical value is less than the method detection limit.
E = Estimated
FD = field duplicate sample
mg/l = milligrams per liter
ORG = original sample
SPT = Split sample
TURN = Turner Laboratories, Inc.
ETAMP = Eurofins Laboratories, Inc., Phoenix, Arizona

TABLE 16

2021 PERFORMANCE MONITORING SCHEDULE
FOR GROUNDWATER, SOIL, AND NARS REMEDIES

SITE ID	WELL OWNER	PROPOSED MONITORING FREQUENCY/PARAMETERS				WATER LEVELS	COMMENTS
		NITRATE-N	AMMONIA	METALS[1]	ClO4		
MONITORING WELLS (NORTHERN AREA) *[Northern Area PMP and Long-Term Site-Wide Plan]*							
MW-08	ANPI	Q				Q	
MW-11	ANPI	A - Aug				Q	
MW-13	ANPI	S - Feb/Aug				Q	
MW-17	ANPI	S - Feb/Aug				Q	
MW-18	ANPI	S - Feb/Aug				Q	
MW-19	ANPI	Q				Q	
MW-34	ANPI	Q				Q	
MW-35	ANPI	Q				Q	
MW-36	ANPI	Q				Q	
MW-45	ANPI	Q				Q	
PB-2A	ANPI	Q				Q	
PB-4	ANPI	Q				Q	
PB-5A	ANPI	Q				Q	Move to NARS O&M Schedule commencing extraction
PB-7	ANPI	Q				Q	
PIEZOMETERS (NORTHERN AREA) *[Northern Area PMP]*							
NAP-1	ANPI					Q	Water level monitoring via transducers with quarterly downloads and static water level measurements
NAP-2	ANPI					Q	
NAP-3	ANPI					Q	
NAP-4	ANPI					Q	
NAP-5	ANPI					Q	
MNA MANAGEMENT ZONE (NORTHERN AREA) *[Northern Area PMP and Long-Term Site-Wide Plan]*							
MW-20	ANPI	B - Aug 2021				B - Aug 2021	Access limited by owner availability
MW-38	ANPI	B - Aug 2021				B - Aug 2021	
MW-41A	ANPI	B - Aug 2021				B - Aug 2021	
MW-41B	ANPI	B - Aug 2021				B - Aug 2021	
MW-42	ANPI	B - Aug 2021				B - Aug 2021	
D(17-20)36aad1	Jacobs	B - Aug 2021				B - Aug 2021	

TABLE 16

2021 PERFORMANCE MONITORING SCHEDULE
FOR GROUNDWATER, SOIL, AND NARS REMEDIES

SITE ID	WELL OWNER	PROPOSED MONITORING FREQUENCY/PARAMETERS				WATER LEVELS	COMMENTS
		NITRATE-N	AMMONIA	METALS(1)	ClO4		
MNA MANAGEMENT ZONE (NORTHERN AREA) *[Northern Area PMP and Long-Term Site-Wide Plan] - CONT'D*							
D(17-20)36caa2	Hyder	B - Aug 2021				B - Aug 2021	
D(17-20)36caa	Gaynor	B - Aug 2021				B - Aug 2021	
D(17-20)36cdb	Woolever	B - Aug 2021				B - Aug 2021	
D(17-20)36ddc	Morales	B - Aug 2021				B - Aug 2021	
D(18-20)01aad	McRae	B - Aug 2021				B - Aug 2021	
D(18-21)06bcb	Jones	Q				Q	
D(17-20)36aad3	Acuna					B - Aug 2021	
D(17-20)36cad1	McCann					B - Aug 2021	
D(17-20)36dad	Ohlde					B - Aug 2021	
D(18-21)06ada	White					B - Aug 2021	
D(18-21)06bab	Alexander					B - Aug 2021	
D(18-21)06bcc2	Wooten					B - Aug 2021	
D(18-21)08bab	Tenopir					B - Aug 2021	
SENTINEL WELLS (NORTHERN AREA) *[Northern Area PMP]*							
MW-40	ANPI	B - Aug 2021				B - Aug 2021	Access limited by owner availability
MNA BUFFER ZONE WELLS (NORTHERN AREA) *[Northern Area PMP]*							
D(17-20)25bad	Spears	B - Aug 2021				NM	Access limited by owner availability
NORTHERN AREA REMEDIATION SYSTEM *[NARS O&M]*							
SEW-01	ANPI	M	Q	Nov-2021	A - Sep	Q	Weekly nitrate-N with field methods. Additional parameters include total phosphorus (Q), major ions (A). Changed 5-yr metals sampling date from Sep-2021.
SEW-02	ANPI	M	Q	Nov-2021	A - Sep	Q	Weekly nitrate-N with field methods. Additional parameters include total phosphorus (Q), major ions (A). Changed 5-yr metals sampling date from Sep-2021.
SEW-03	ANPI	M	Q	Nov-2021	A - Sep	Q	Weekly nitrate-N with field methods. Additional parameters include total phosphorus (Q), major ions (A). Changed 5-yr metals sampling date from Sep-2021.
MW-10	ANPI	Q	Q			Weekly	
DCP-12	ANPI	Q		Nov-2021		Q	Changed metals sampling date from Feb-2021
TREATMENT CELLS (surface water)	ANPI	M	M			Weekly	Weekly nitrate-N with field methods. Additional parameters include total phosphorus, chemical oxygen demand, and total organic carbon (Q), total kjeldahl nitrogen, organic nitrate (A).

TABLE 16

2021 PERFORMANCE MONITORING SCHEDULE
FOR GROUNDWATER, SOIL, AND NARS REMEDIES

SITE ID	WELL OWNER	PROPOSED MONITORING FREQUENCY/PARAMETERS				WATER LEVELS	COMMENTS
		NITRATE-N	AMMONIA	METALS[(1)]	ClO4		
EFFLUENT	ANPI	M	M	Nov-2021			Additional parameters include total phosphorus, total kjeldahl nitrogen, organic nitrogen, total dissolved solids, and total suspended solids (Q). Major ions (A). Changed metals sampling date from Sep-2021
NATIVE POND COVERS *[Soils Engineering Control Plan]*							
POND 1	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
POND 2	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
POND 3	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
POND 7	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
DYNAGEL	ANPI	ANPI performs quarterly inspections and after heavy rainfall, H+A performs annual inspection.					
SAN PEDRO RIVER SURFACE WATER MONITORING STATIONS (NORTHERN AREA) *[Northern Area PMP]*							
SW-03	NA	Q				Q	If flow is present
SW-04	NA	Q				Q	If flow is present
SW-13	NA	Q				Q	If flow is present
SW-14	NA	Q			Q	Q	If flow is present
PERCHED ZONE A (SOUTHERN AREA) *[Southern Area PMP]*							
P-01	ANPI	Q			Q	Q	
P-03	ANPI	Q			Q	Q	
P-10	ANPI					B - Aug 2021	Water level only
MW-29	ANPI					B - Aug 2021	Water level only
MW-30	ANPI					B - Aug 2021	Water level only
MW-31	ANPI					B - Aug 2021	Water level only
MW-32	ANPI					B - Aug 2021	Water level only
PERCHED ZONE B (SOUTHERN AREA) *[Southern Area PMP]*							
MW-15	ANPI	B - Aug 2021			B - Aug 2021	B - Aug 2021	If sufficient water exists to sample
MW-21	ANPI	A - Aug			A - Aug	A - Aug	
MW-23	ANPI	A - Aug			A - Aug	A - Aug	
MW-39	ANPI	A - Aug			A - Aug	A - Aug	
MW-47	ANPI	A - Aug			A - Aug	A - Aug	

TABLE 16

2021 PERFORMANCE MONITORING SCHEDULE
FOR GROUNDWATER, SOIL, AND NARS REMEDIES

SITE ID	WELL OWNER	PROPOSED MONITORING FREQUENCY/PARAMETERS				WATER LEVELS	COMMENTS
		NITRATE-N	AMMONIA	METALS[1]	ClO4		
UPGRADIENT WELLS (SOUTHERN AREA) *[Southern Area PMP]*							
MW-01	ANPI	A - Aug			A - Aug	S - Feb/Aug	Access limited by owner availability
MW-06	ANPI	A - Aug			A - Aug	S - Feb/Aug	
MONITOR WELLS (SOUTHERN AREA) *[Southern Area PMP]*							
MW-14	ANPI	A - Aug			A - Aug	S - Feb/Aug	
MW-22	ANPI					S - Feb/Aug	Water level only
MW-25	ANPI	C			C	S - Feb/Aug	
MW-33	ANPI	A - Aug			A - Aug	S - Feb/Aug	
SAN PEDRO RIVER SURFACE WATER MONITORING STATIONS (SOUTHERN AREA) *[Southern Area PMP]*							
SW-12	NA	Q				Q	If flow is present; Access limited by owner availability

ABBREVIATIONS/ACRONYMS:

A = Annually
ANPI = Apache Nitrogen Products, Inc.
B = Biennial (occurs every two years)
ClO_4 = Perchlorate
C = Contingent on MW-33 results
H+A = Hargis + Associates, Inc.
M = Monthly
NARS = Northern Area Remediation System
NM = Not measured
O&M = Operation and maintenance
PMP = Performance Monitoring Plan
Q = Quarterly
S = Semi-Annually

NOTES:

Wells and/or sampling events proposed for a change in monitoring schedule from the formerly approved 2020 schedule.

Standard Field Parameters - Temp (°C), pH, Electrical Conductivity (µS/cm) are collected every time a well is sampled.

(1) = Metals List every 5 years:
SEW-01 and Effluent: aluminum, antimony, arsenic, barium, beryllium, cadmium, total chromium, copper, iron, lead, managanese, mercury, selenium, silver, thallium and zinc.
DCP-12: barium, beryllium, total chromium, lead, mercury and thallium.
Treatment Cells Sediment: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, zinc; calcium, magnesium, sodium, potassium, orthophosphate, chloride, fluoride, sulfate, alkalinity, pH; total nitrogen by calculation, total organic carbon, total phosphorus, ammonia-nitrogen, nitrate-nitrogen, total kjedahl nitrogen.

TABLE 17
2020 SURFACE WATER STATION QUARTERLY DISCHARGE MEASUREMENTS

PMP Quarterly Sampling Event	Surface Water Station SW-03 Discharge (cfs)	Surface Water Station SW-04 Discharge (cfs)	Surface Water Station SW-12 Discharge (cfs)	Surface Water Station SW-13 Discharge (cfs)	Surface Water Station SW-14 Discharge (cfs)
February	3.72	3.17	3.43	NF	2.66
May	0.01	0.01	0.01	NF	0.01
August	NF	NF	NF	NF	NF
November	NF	NF	NA	NF	NF

ABBREVIATIONS/ACRONYMS:

cfs = cubic feet per second
E = Estimated due to equipment malfunction.
NF = No flow within the San Pedro River.
PMP = Performance Monitoring Plan

TABLE 18

ANNUAL PRECIPITATION [1]
BENSON, ARIZONA

	PRECIPITATION (INCHES)	
PRECIPITATION (RAIN SEASON)	TOMBSTONE[2] (028619)	BENSON 6 SE[2] (020683)
1979	8.07	9.64
1980	10.95	9.39
1981	10.90	9.66
1982	17.96	17.28
1983	16.79	17.94
1984	23.01	19.82
1985	13.73	14.32
1986	17.35	17.64
1987	13.50	11.31
1988	16.06	17.39
1989	9.01	11.63
1990	17.24	14.27
1991	15.31	19.45
1992	18.09	15.69
1993	7.67	13.61
1994	18.46	14.28
1995	8.79	10.09
1996	14.06	8.19
1997	14.98	14.65
1998	8.07	8.51
1999	14.22	14.47
2000	22.51	16.72
2001	9.00	11.79
2002	10.55	8.08
2003	14.92	9.91
2004	9.45	7.92
2005	5.19	5.66
2006	10.94	14.82
2007	10.83	6.23
2008	20.06	8.26
2009	12.40	4.19
2010	10.01	9.58
2011	14.00	8.17
2012	14.04	7.08
2013	10.12	9.51
2014	26.13	16.37

TABLE 18

ANNUAL PRECIPITATION [1]
BENSON, ARIZONA

	PRECIPITATION (INCHES)	
PRECIPITATION (RAIN SEASON)	TOMBSTONE[2] (028619)	BENSON 6 SE[2] (020683)
2015	10.84	12.21
2016	15.83	11.64
2017	10.36	7.80
2018	16.45	16.53
2019	15.11	20.57
2020	7.22[3]	5.63[3]
Average:	13.73	12.25

NOTES:

(1) Annual Precipitation calculated as a rainfall year season from June to the following May.

(2) Stations: Tombstone, Arizona (028619) Period of Record: 07/1/1893 to 02/28/2020.

Apache Powder Company, Arizona (020309) Period of Record: 07/01/1923 to 04/30/1990.

Benson 6 SE, Arizona (020683) Period of Record: 05/01/1990 to 02/28/2020.

(3) Contains data from June 1, 2020 through February 28, 2021.

HARGIS + ASSOCIATES, INC.

TABLE 19
APACHE POWDER SUPERFUND SITE - SOIL CLEANUP STANDARDS

Chemical of Potential Concern (COPC)	. . . Milligrams per Kilogram . . .		
	Arizona SRL Residential[1]	Arizona SRL Non-Residential[2]	Proposed Cleanup Standard
INORGANICS			
ASBESTOS	NS	NS	Refer to Footnote [3]
NITRATE AS NITROGEN	NS	NS	100,000[4]
PERCHLORATE	55	720	720
EXPLOSIVES (NITROAROMATICS AND NITRAMINES)			
1,3-DINITROBENZENE	6.1	62	62
1,3,5-TRINITROBENZENE	1,800	18,000	18,000
2-NITROTOLUENE	0.93	22	22
2,4-DINITROTOLUENE	120	1,200	1,200
2,6-DINITROTOLUENE	61	620	620
2,4,6-TRINITROTOLUENE	18	310	310
3-NITROTOLUENE	730	1,000	1,000
4-NITROTOLUENE	13	300	300
HMX	3,100	31,000	31,000
NITROBENZENE	20	100	100
NITROGLYCERIN	39	1,200	1,200
PETN	NS	NS	570[5]
RDX	5.0	160	160
TETRYL	NS	NS	2,300[6]
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)			
BENZO[A]ANTHRACENE	0.69	21	21
BENZO[A]PYRENE	0.069	2.1	2.1
BENZO[B]FLUORANTHENE	0.69	21	21
CARBAZOLE	27	860	860
CHRYSENE	68	2,000	2,000
DIBENZO(A,H)ANTHRACENE	0.69	2.1	2.1
DIBENZOFURAN	140	140	140
FLUORANTHENE	2,300	22,000	22,000
FLUORENE	2,700	26,000	26,000
INDENO(1,2,3-CD)PYRENE	1	21	21
NAPHTHALENE	56	190	190
PENTACHLOROPHENOL	3.2	90	90
PYRENE	2,300	29,000	29,000

HARGIS + ASSOCIATES, INC.

TABLE 19
APACHE POWDER SUPERFUND SITE - SOIL CLEANUP STANDARDS

Chemical of Potential Concern (COPC)	. . . Milligrams per Kilogram . . .		
	Arizona SRL Residential[1]	Arizona SRL Non-Residential[2]	Proposed Cleanup Standard
TOTAL HYDROCARBONS (TPHs)			
TOTAL FUEL HYDROCARBONS (C10-C32)	4,100[7]	18,000[7]	18,000[7]
DIESEL RANGE ORGANICS (C10-C22)	4,100[7]	18,000[7]	18,000[7]
OIL RANGE ORGANICS (C22-C32)	4,100[7]	18,000[7]	18,000[7]
METALS			
ANTIMONY	31	410	410
ARSENIC	10	10	Refer to Footnote[8]
BARIUM	15,000	170,000	170,000
BERYLLIUM	150	1,900	1,900
CHROMIUM, TOTAL	NS	NS	4,500[9]
LEAD	400	800	800
MANGANESE	3,300	32,000	32,000
MISCELLANEOUS INORGANICS			
VANADIUM	78	1,000	1,000
VANADIUM PENTOXIDE	78	1,000	1,000

ABBREVIATIONS AND ACRONYMS:

EPA= U.S. Environmental Protection Agency
NS = No specified Arizona SRL
SRL= Soil Remediation Level

FOOTNOTES:

EPA selected cleanup standards are based on the 2009 Arizona Administrative Code (AAC) Title 18; Ch. 7 Appendix A non-residential Arizona Soil Remediation Levels (SRL), except where noted in footnotes below:

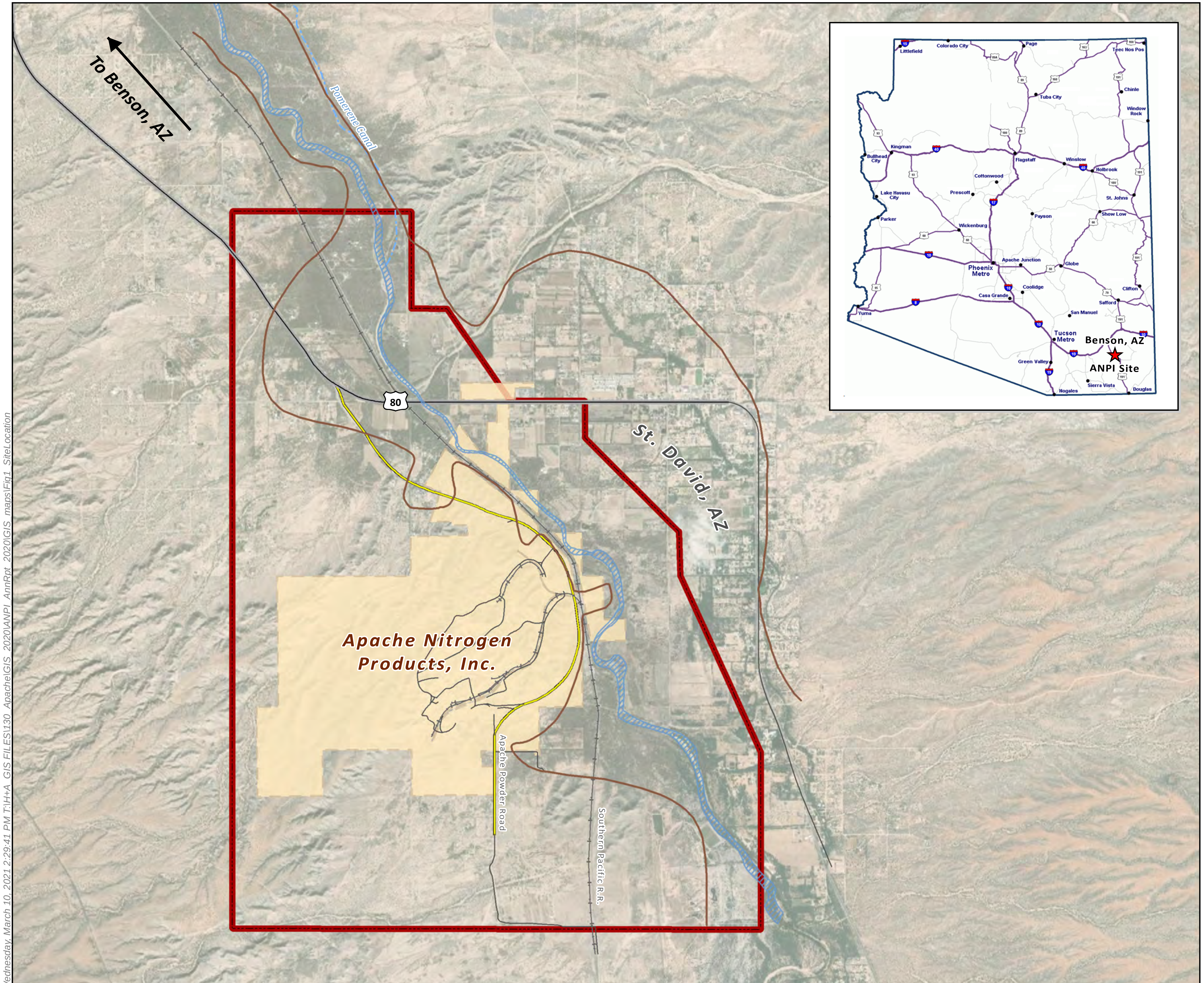
[1] = Residential - 2009 Arizona Administrative Code (AAC) Title 18; Ch. 7, Appendix A Residential SRLs, March 31, 2009.
[2] = Non-Residential - 2009 Arizona Administrative Code (AAC) Title 18; Ch. 7, Appendix A Non-Residential SRLs, March 31, 2009.
[3] = Asbestos - Cleanup Standard: (1) Step 1-Look for visual evidence; (2) Step 2-Clean up to non-visual to a minimum depth of 1 foot below ground surface (bgs).
[4] = Nitrate as Nitrogen - 2000 EPA Superfund Explanation of Significant Differences: Apache Powder Co. EPA ID: AZD008399263 OU 01 St. David, AZ Table 2 - Comparison of Potential Cleanup Levels and EPA Selected Cleanup Standards for Contaminated Soils and Waste Materials, EPA Selected Cleanup Standard ESD #2 09/29/2000..
[5] = PETN - 2017 EPA Region IX Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1) Industrial Soil, June 2017.
[6] = Tetryl - 2017 EPA Region IX Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1) Industrial Soil, June 2017.

TABLE 19
APACHE POWDER SUPERFUND SITE - SOIL CLEANUP STANDARDS

FOOTNOTES (con'td):

[7] = Total Fuel Hydrocarbons - 2009 Arizona Administrative Code (AAC) Title 18; Ch. 7, Appendix B 1997 Soil Remediation Levels (SRLs), March 31, 2009.
[8] = Arsenic - Site-specific soil background concentrations were calculated according to the methodology specified in AAC R18-7-204, using concentrations of all background soil samples collected during the remedial investigation (i.e., SS-01 through -04, S-1, and S-2). Applying the rule, the 95% upper confidence level of the mean concentrations yielded concentrations of 24.58 mg/kg for surficial soils; 17.00 mg/kg for granite wash sediments; and 36.29 mg/kg for St. David clay. This methodology is consistent with EPA Guidance 9285.708I.
[9] =Total Chromium - 2009 Arizona Administrative Code (AAC) Title 18; Ch. 7, Appendix B 1997 Soil Remediation Levels (SRLs), March 31, 2009.

FIGURES



EXPLANATION

- Study Area Boundary
- ANPI Property Boundary
- San Pedro River
- Shallow Aquifer Boundary
- Railroad
- U.S. 80
- Apache Powder Road
- Streets & Dirt Roads

N

0 2,500 5,000 10,000

Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

APACHE NITROGEN PRODUCTS, INC.
SITE LOCATION

HARGIS + ASSOCIATES, INC.
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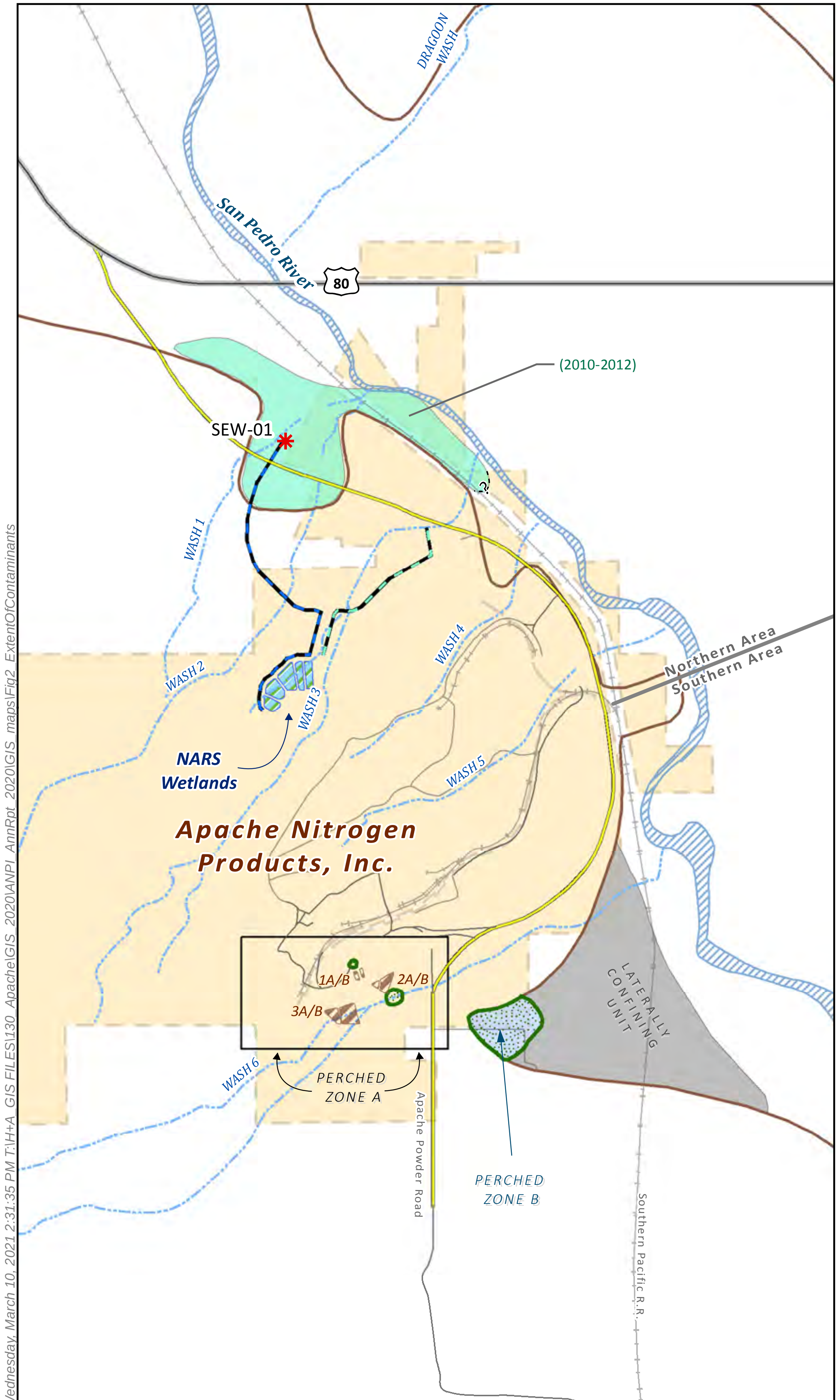
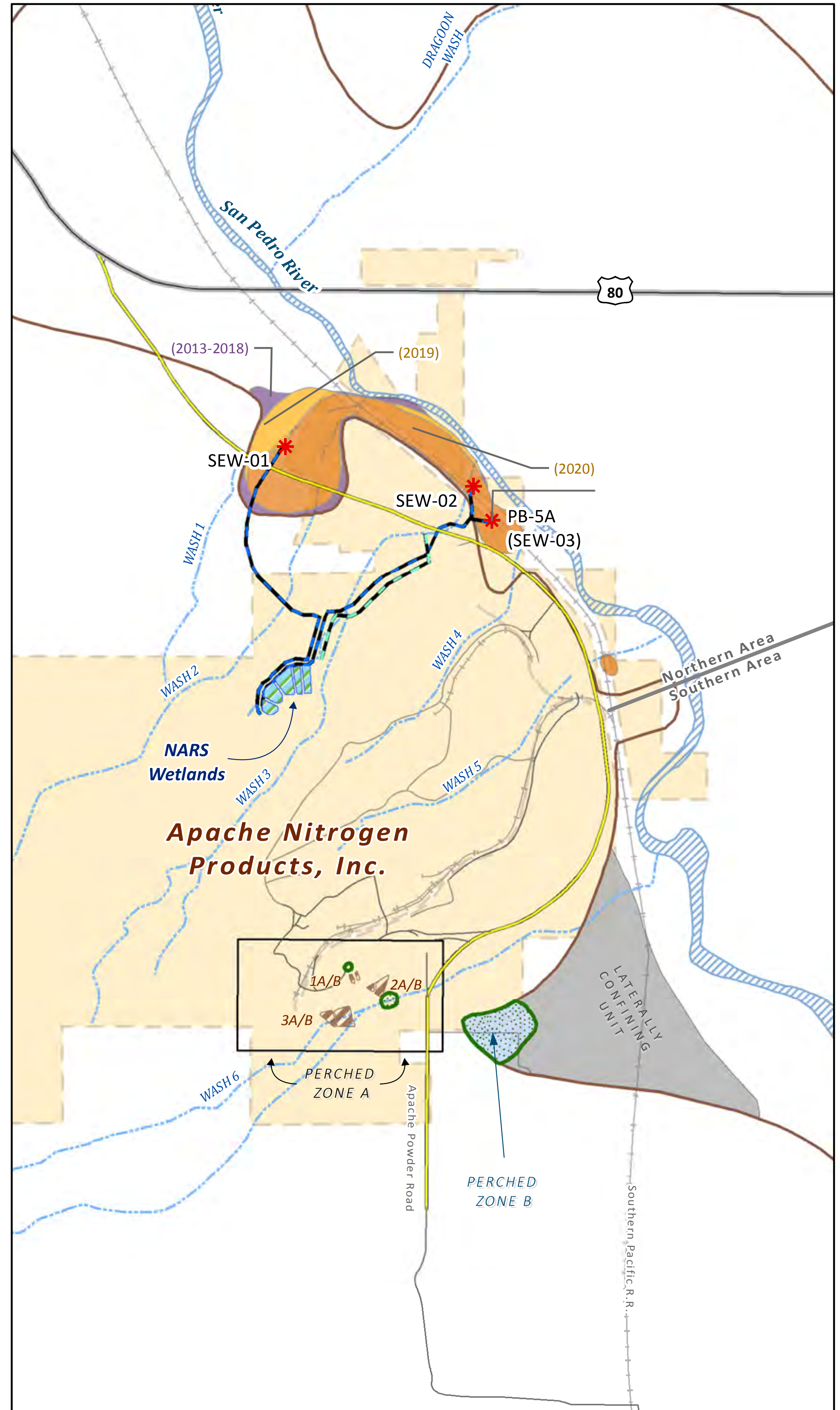
FIGURE 1

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | Fig1_SiteLocation | Rev.0

Wednesday, March 10, 2021 2:29:41 PM T:\H+A_GIS FILES\130_Apache\GIS_2020ANPI_AnnRpt_2020\GIS_maps\Fig1_SiteLocation



YEARS 2010-2012



YEARS 2013-2020

EXPLANATION

- Shallow Aquifer Extraction Well
- Apache Powder
- Shallow Aquifer
- Formerly Active Ponds (1A, 1B, 2A, 2B, 3A, 3B)
- Extent of Nitrate-N Concentrations Above the Clean-Up Standard of 10 mg/l in 2010-2012 (Queried Where Uncertain)
- Extent of Nitrate-N Concentrations Above the Clean-Up Standard of 10 mg/l in 2020
- Extent of Nitrate-N Concentrations Above the Clean-Up Standard of 10 mg/l in 2019
- Extent of Nitrate-N Concentrations Above the Clean-Up Standard of 10 mg/l in 2013 - 2018
- Extent of Elevated Perchlorate and Nitrate Concentrations in Southern Area

N

0 1,250 2,500 5,000
Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

APPROXIMATE EXTENT OF NITRATE-N AND PERCHLORATE CONTAMINATION FROM 2010-2020

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03/2021

FIGURE 2

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | Fig2_ExtentOfContaminants | Rev.0

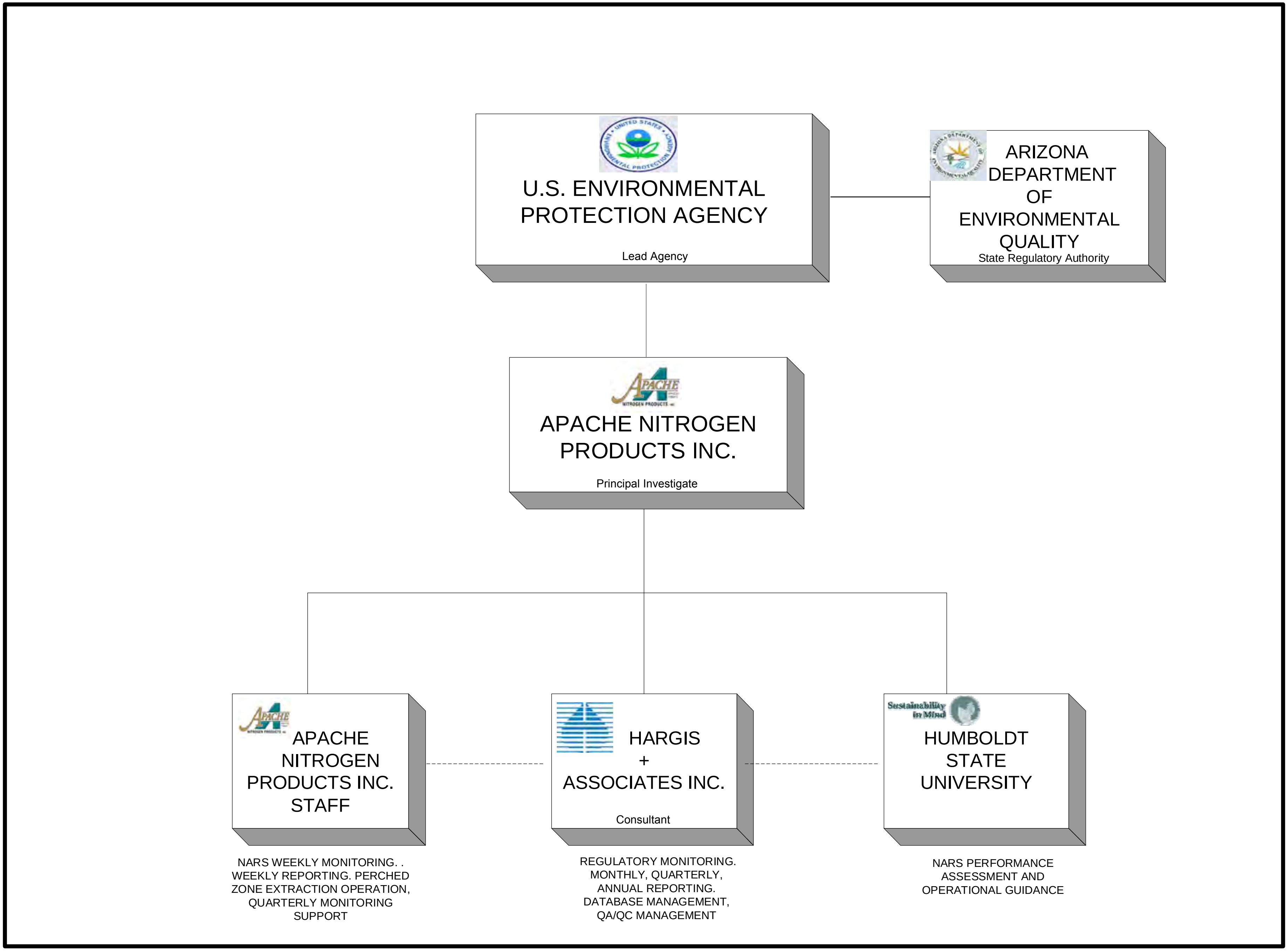

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FIGURE 3. ORGANIZATIONAL CHART,
APACHE POWDER SUPERFUND SITE

EXPLANATION

- Perched Zone A Monitor
- Perched Zone A
- Shallow Aquifer Monitor
- 4.22 — Saturated Thickness of Perched Zone (In Feet), November 2020
- (9.08) — Saturated Thickness of Perched Zone (In Feet), February 1995
- Perched Zone B
- Approximate Surface Outcrop of St. David Clay
- Maximum Lateral Extent of Perched Zone A Saturated Sediments, November 2018
- Maximum Lateral Extent of Perched Zone A Saturated Sediments, February 1995

Notes and Abbreviations

NM = Not Measured
NP = Not Present During 1995
* = Last measured in May 2018

APACHE NITROGEN PRODUCTS, INC.
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CHANGE IN AREAL EXTENT AND SATURATED THICKNESS OF PERCHED GROUNDWATER FEBRUARY 1995 TO NOVEMBER 2020

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FIGURE 4

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | Fig4_ExtentOfSatThickness | Rev.0

EXPLANATION

- Ponds with Native Soil Covers
- ANPI Property Boundary

N

0 200 400 800
Feet

APACHE NITROGEN PRODUCTS, INC.
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LOCATION OF PONDS (NATIVE SOIL COVERS)

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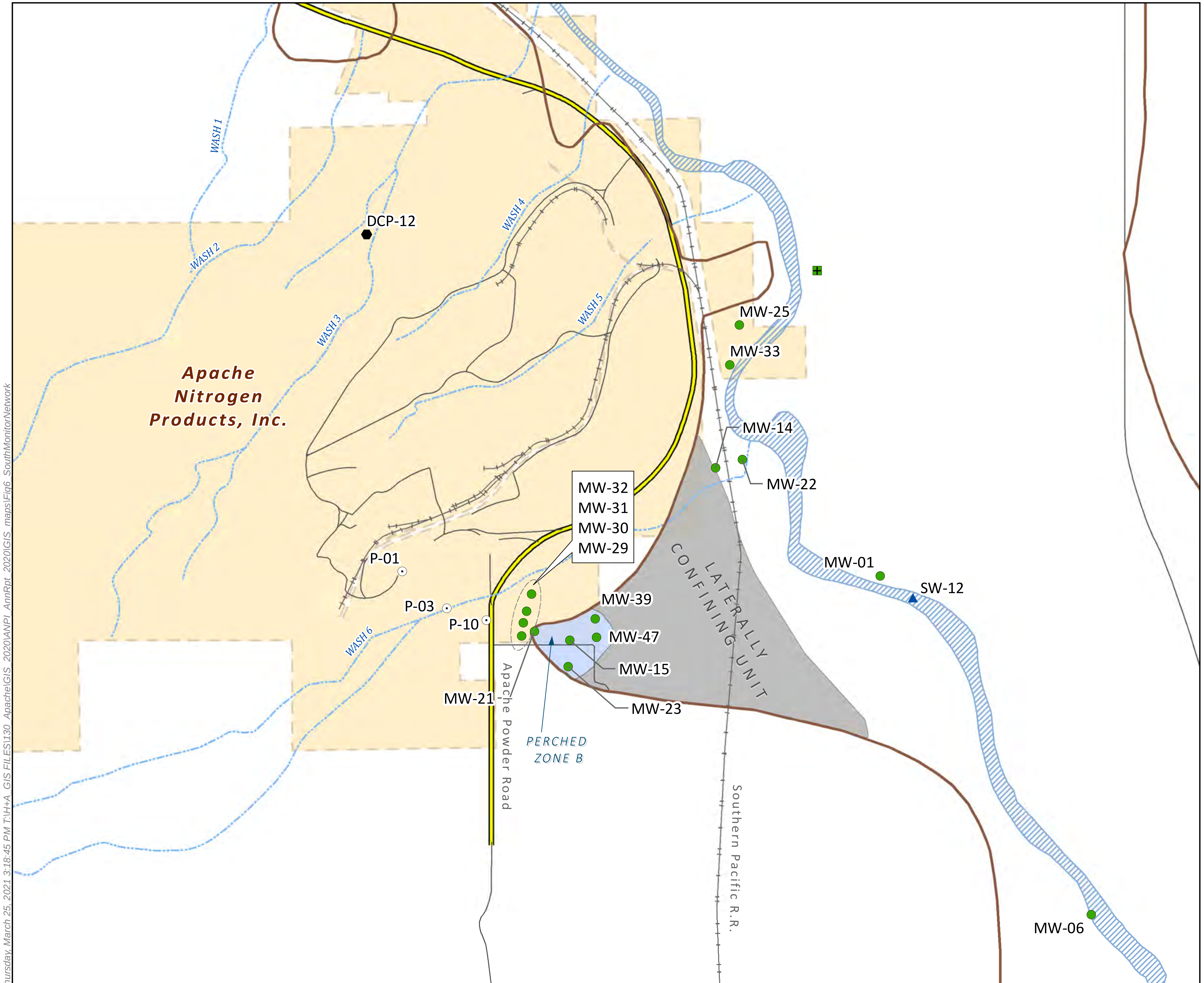
FIGURE 5

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | Fig5_PondLocations | Rev.0

Monday, February 22, 2021 9:09:58 AM T:\H+A_GIS FILES\130_Apache\GIS_2020\ANPI_AnnRpt_2020\GIS_maps\Fig5_PondLocations



EXPLANATION

- Shallow Aquifer Monitor Well
- Shallow Aquifer Private Well
- Design Confirmation Piezometer
- Surface Monitoring Station
- Perched Zone Piezometer
- Apache Powder
- Shallow Aquifer
- Wash
- San Pedro
- ANPI Property
- Perched Zone

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

2020 SOUTHERN AREA PERFORMANCE MONITORING NETWORK

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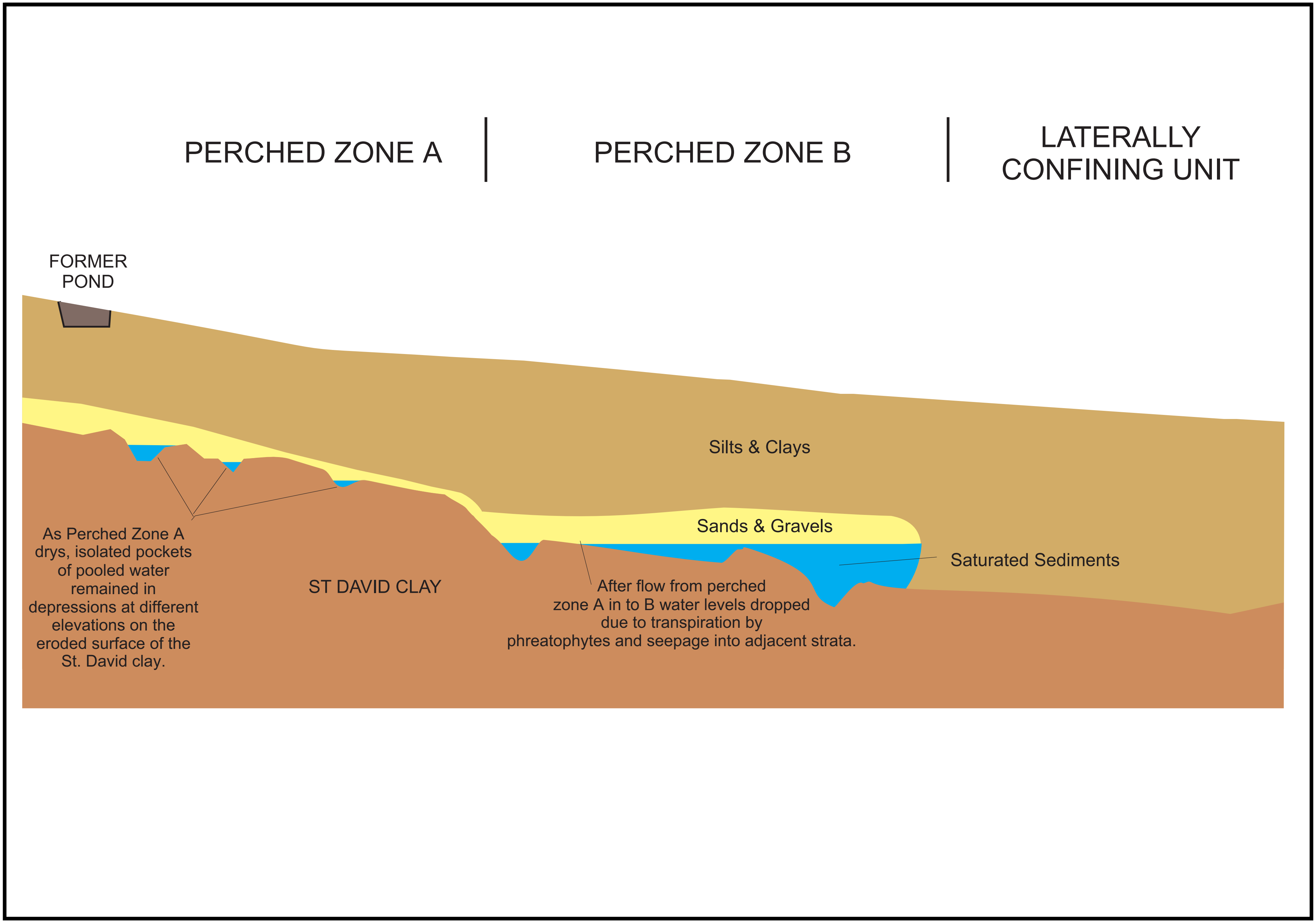
03/2021

FIGURE 6

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 Fig6_SouthMonitorNetwork Rev.0



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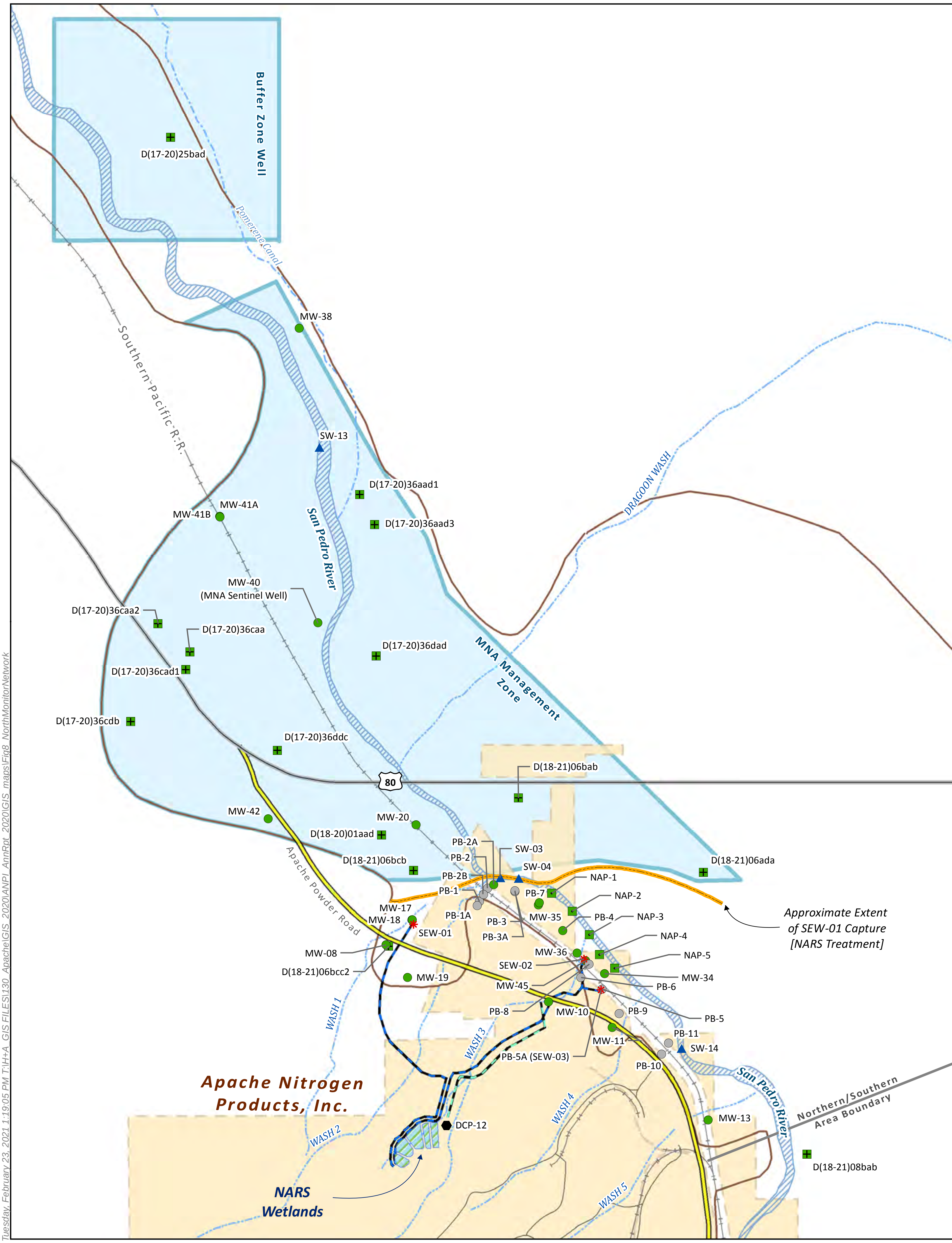
Hydrogeology/Engineering

FIGURE 7. CROSS-SECTIONAL CONCEPTUALIZATION OF GROUNDWATER PERCHING AND ISOLATION IN DEPRESSIONS IN PERCHED ZONE A AND PERCHED ZONE B



EXPLANATION

- Shallow Aquifer Monitor Well
- Shallow Aquifer Extraction Well
- Shallow Aquifer Piezometer
- Design Confirmation Piezometer
- Shallow Aquifer Private Well
- Surface Monitoring Station
- Soil Boring (Abandoned)
- Collection System Piping
- Treatment Effluent Return System
- Shallow Aquifer Boundary
- Wash
- San Pedro River
- ANPI Property Boundary
- MNA Management Zone (2012)

N

0 500 1,000 2,000

Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

2020 NORTHERN AREA PERFORMANCE MONITORING NETWORK

HARGIS + ASSOCIATES, INC.
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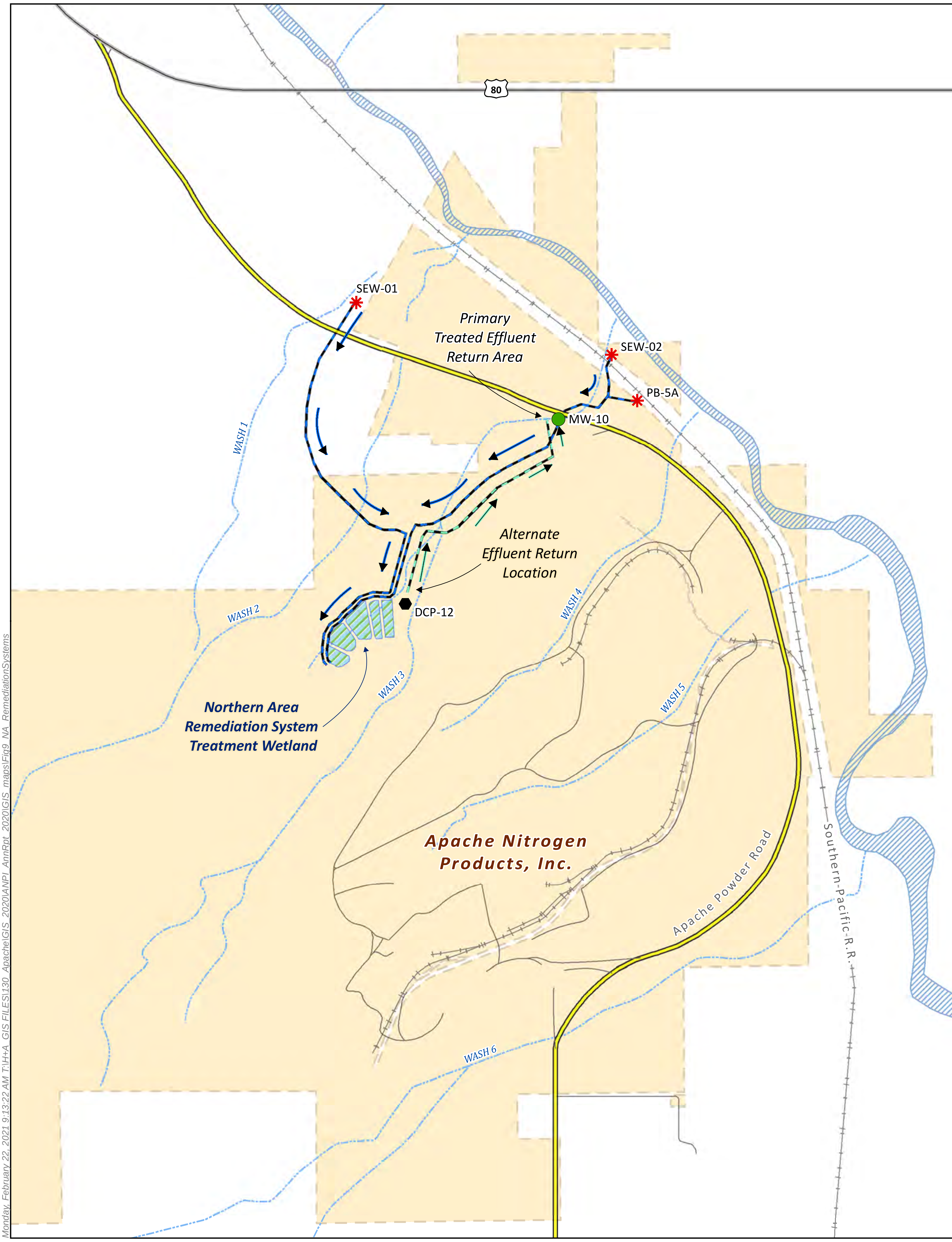
03/2021

FIGURE 8

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | Fig8_NorthMonitorNetwork | Rev.0



Monday, February 22, 2021 9:13:22 AM T:\H+A GIS FILES\130 Apache\GIS 2020\ANPI AnnRpt 2020\GIS maps\Fig9 NA RemediationSystems

EXPLANATION

- Shallow Aquifer Monitor Well
- Shallow Aquifer Extraction Well
- Design Confirmation Piezometer
- Collection System Piping
- Treatment Effluent Return System
- Collection System Flow Direction
- Effluent Return System Flow Direction
- Apache Powder Road
- Wash
- San Pedro River
- ANPI Property Boundary

N

0 500 1,000 2,000
Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

NORTHERN AREA REMEDIATION SYSTEMS PLOT PLAN

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FIGURE 9

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | Fig9_NA_RemediationSystems | Rev.0

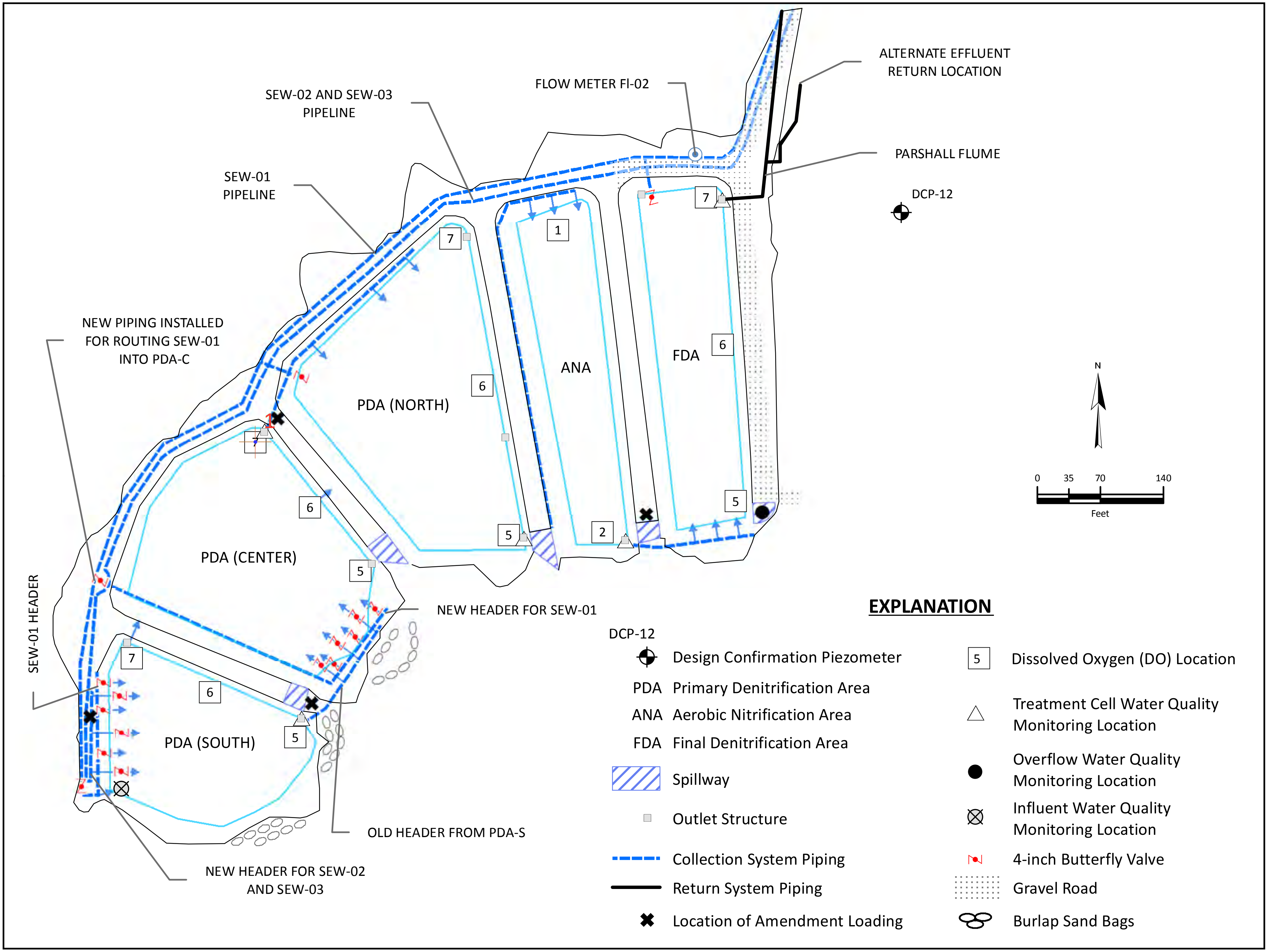

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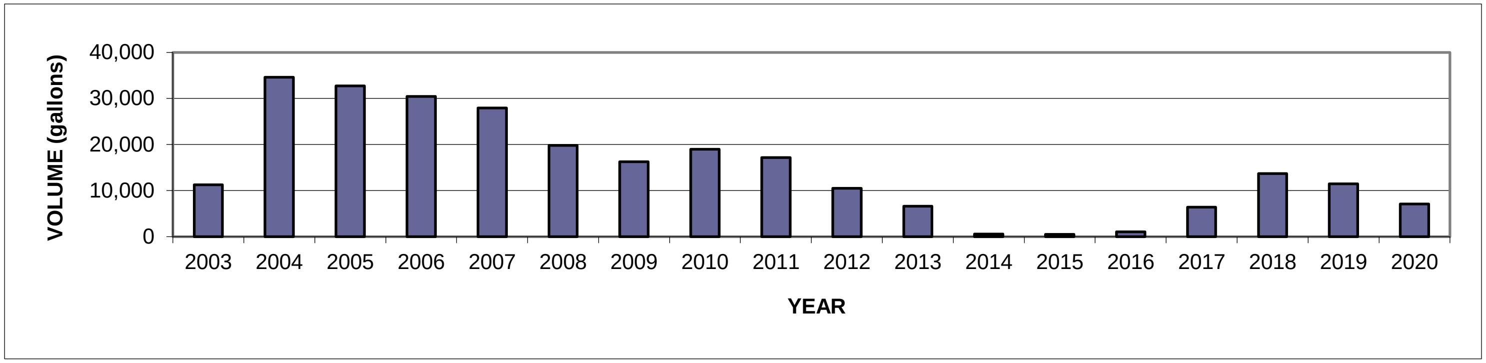
FIGURE 10. NORTHERN AREA REMEDIATION SYSTEM TREATMENT WETLAND



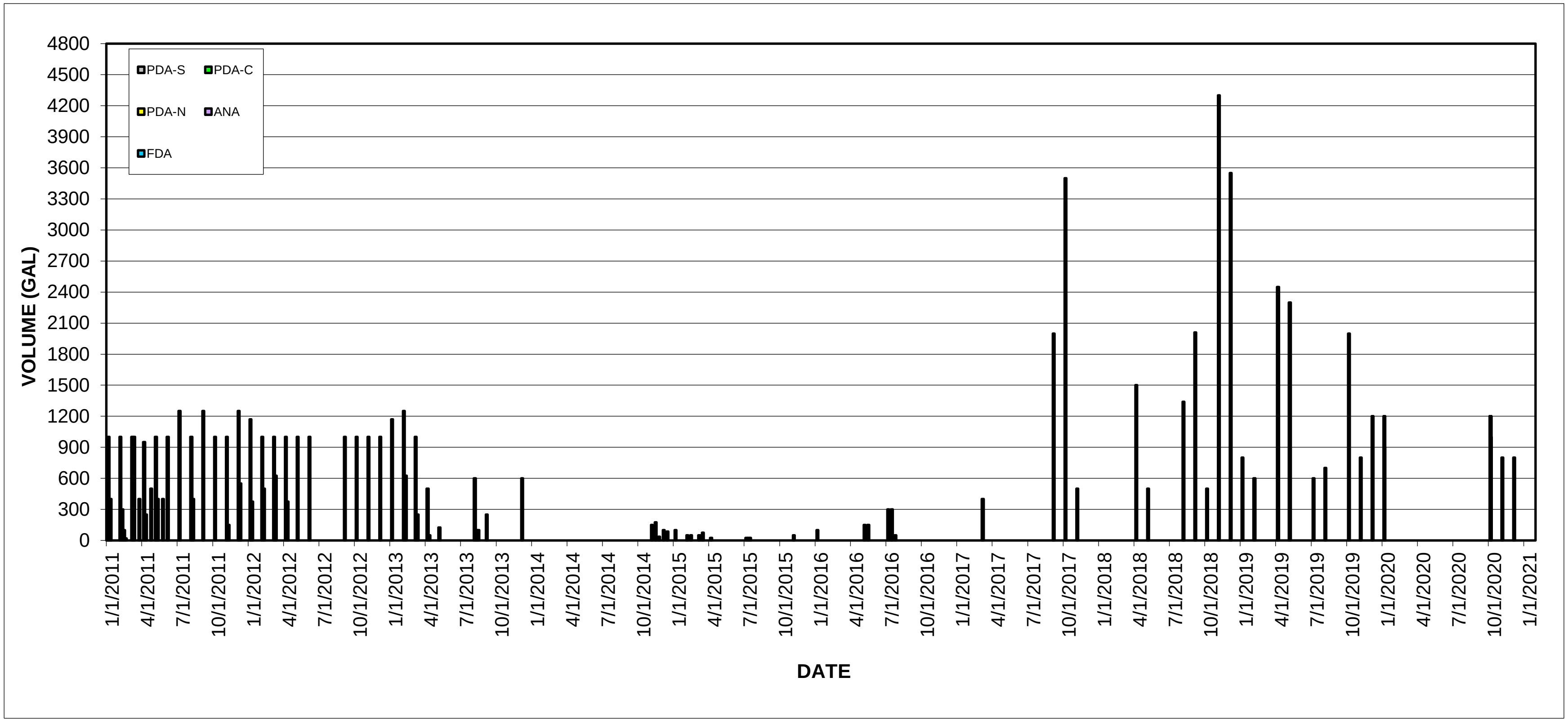


FIGURE 11 MONTHLY MOLASSES VOLUME AND ANNUAL VOLUME AT TREATMENT CELLS
PDA-S, PDA-C, PDA-N, ANA, AND FDA

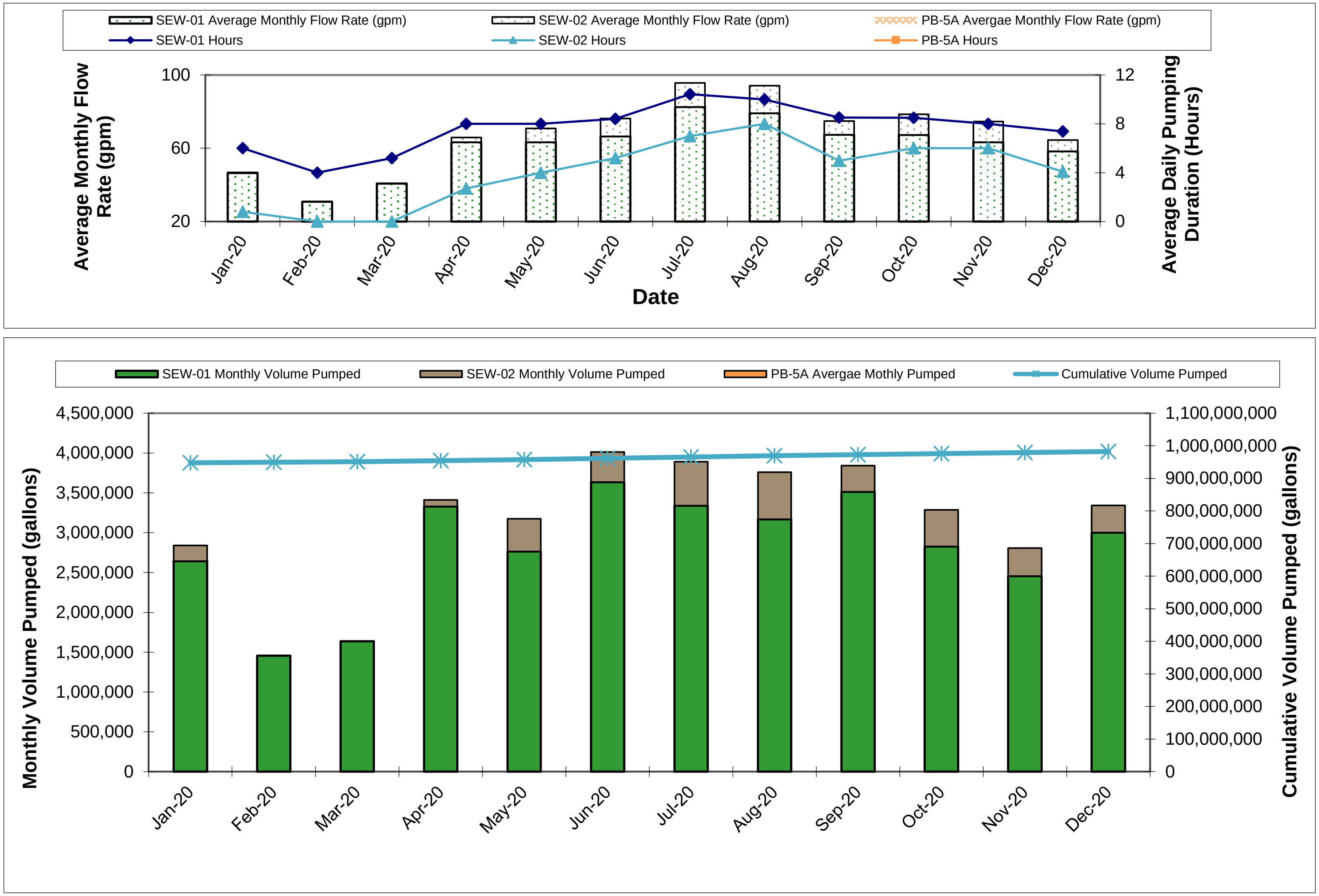


FIGURE 12. 2020 EXTRACTION WELL SEW-01, SEW-02, AND PB-5A PERFORMANCE

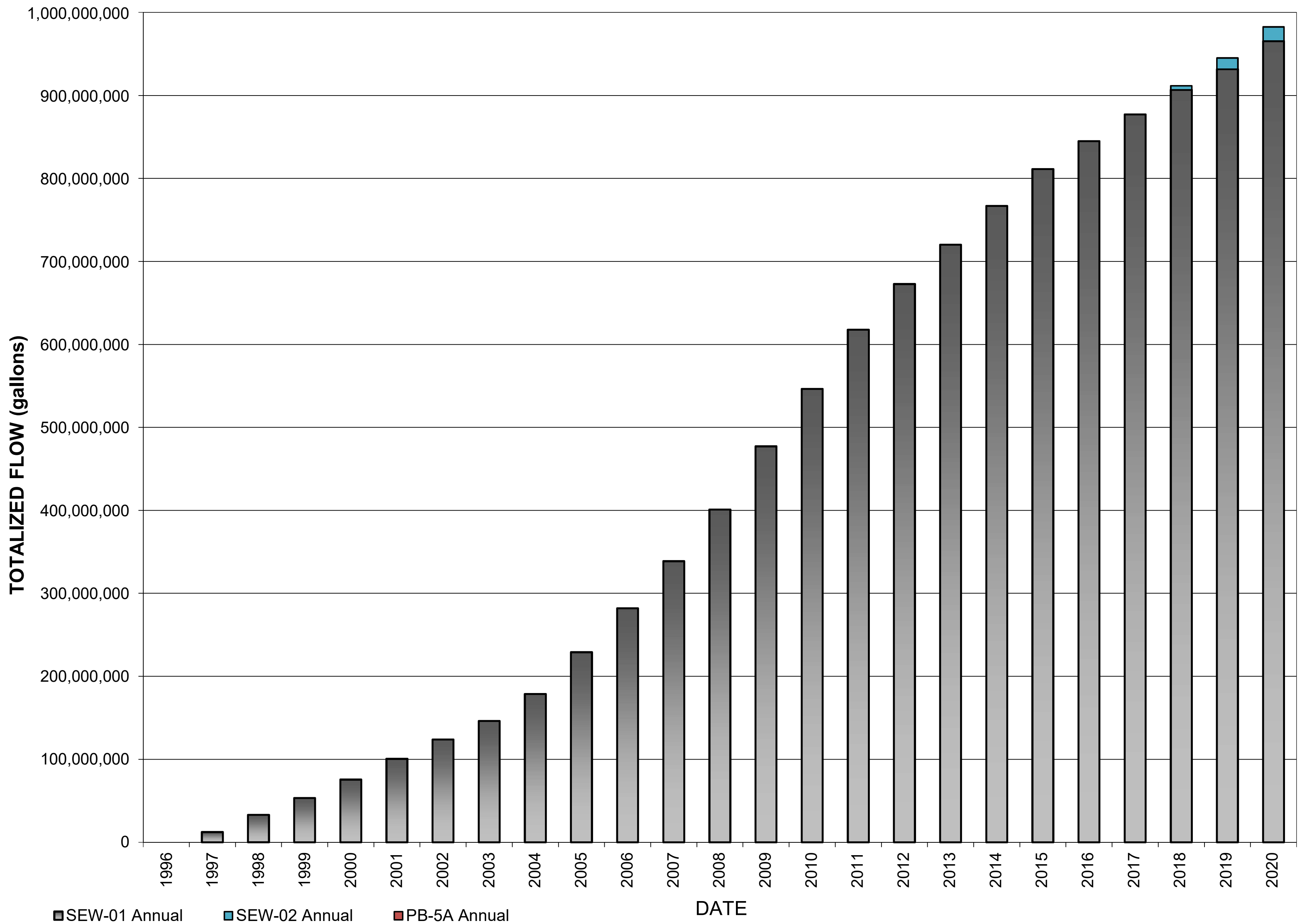


FIGURE 13. CUMULATIVE EXTRACTION WELL PUMPAGE

HARGIS + ASSOCIATES, INC.

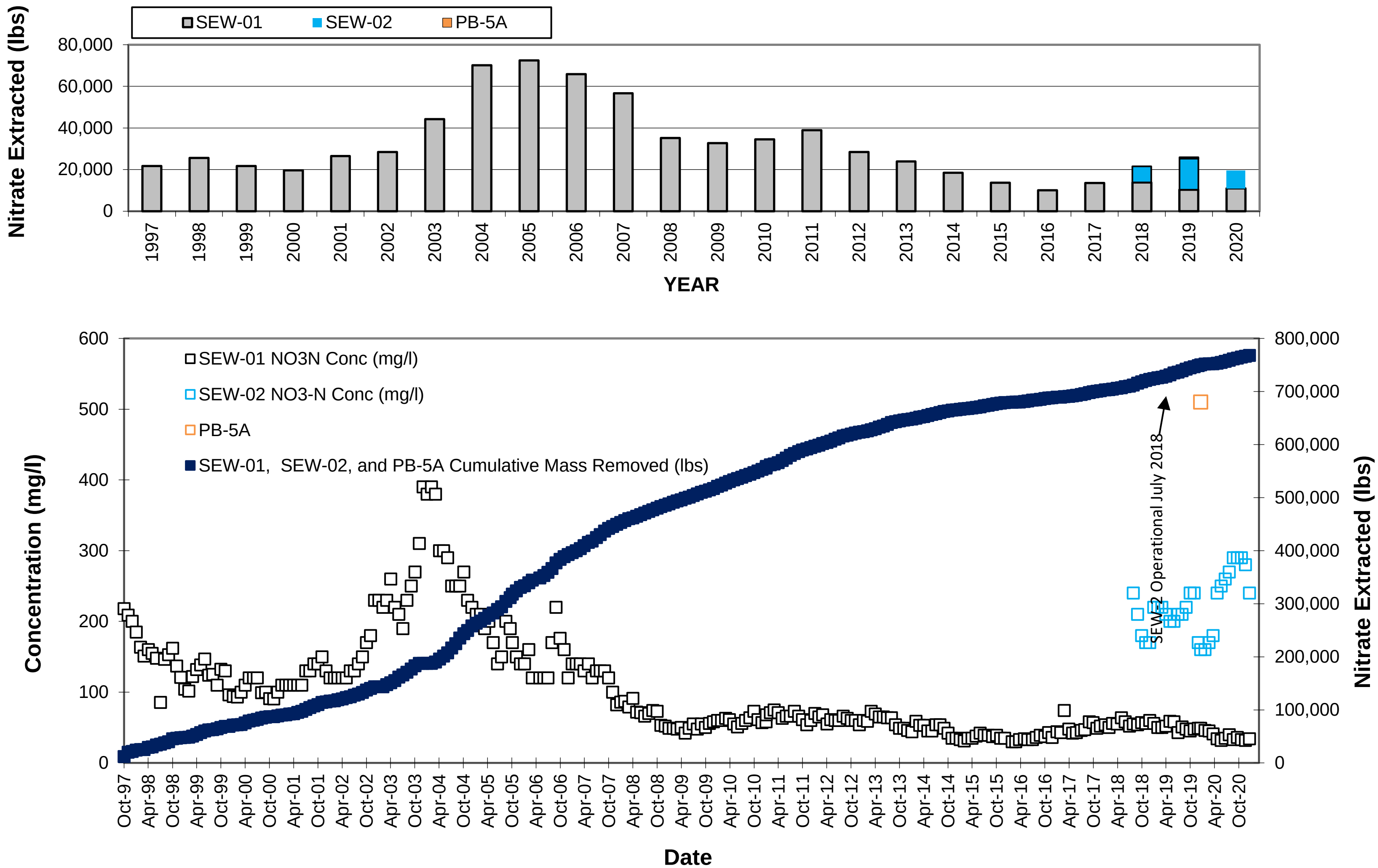
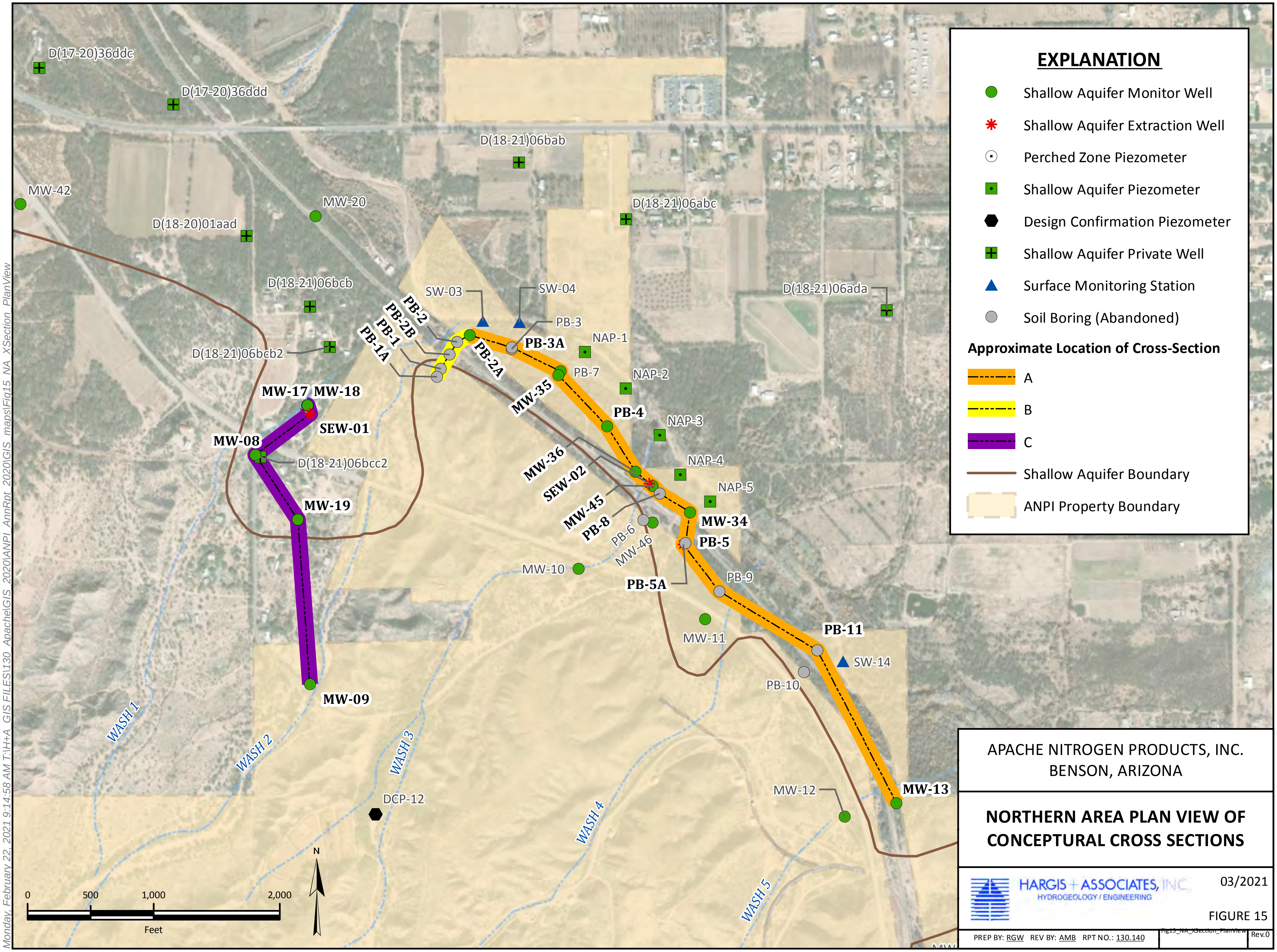


FIGURE 14. CUMULATIVE SHALLOW AQUIFER EXTRACTION WELLS' NITRATE-N REMOVAL



APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

NORTHERN AREA PLAN VIEW OF CONCEPTUAL CROSS SECTIONS

HARGIS + ASSOCIATES, INC.
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FIGURE 15

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 Fig15_NA_XSection_PlanView Rev.0

Monday, February 22, 2021 9:14:58 AM T:\H+A_GIS FILES\130_ApacheIGIS_2020\ANPI_AnnRpt_2020\GIS_maps\Fig15_NA_XSection_PlanView

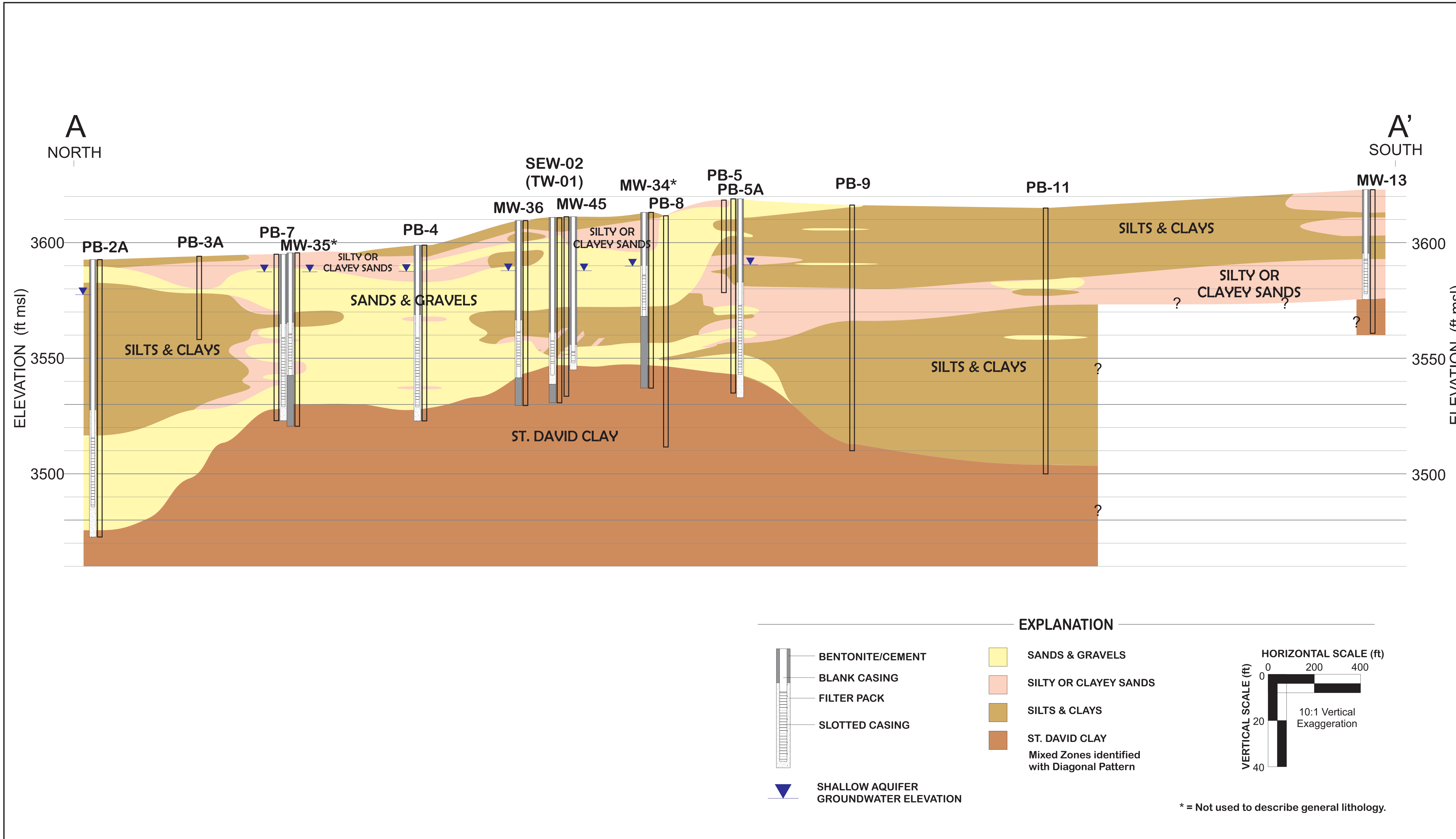

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FIGURE 1 6: NORTHERN AREA CONCEPTUAL CROSS SECTION A - A'

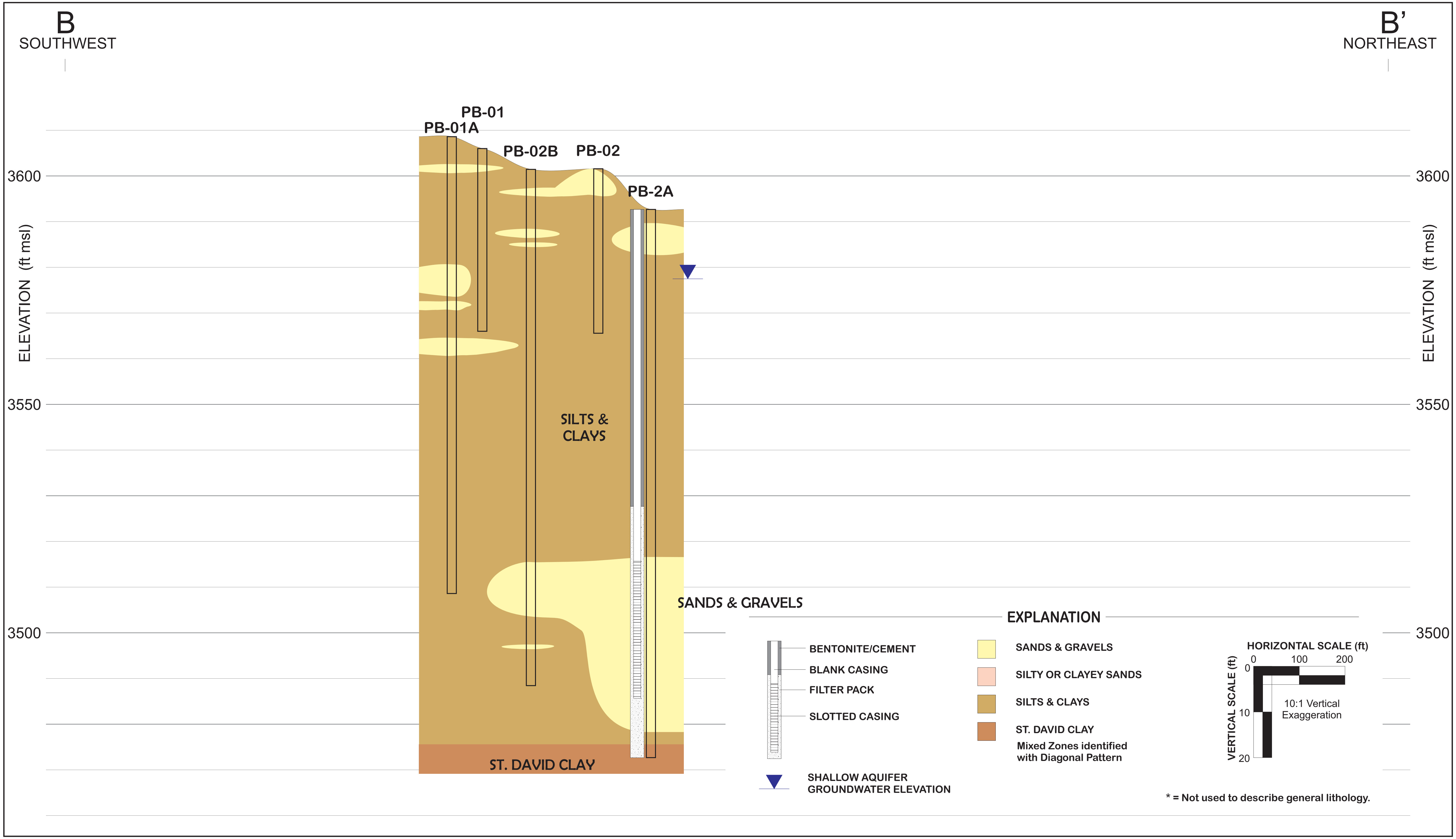

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FIGURE 1 7: NORTHERN AREA CONCEPTUAL CROSS SECTION B - B'

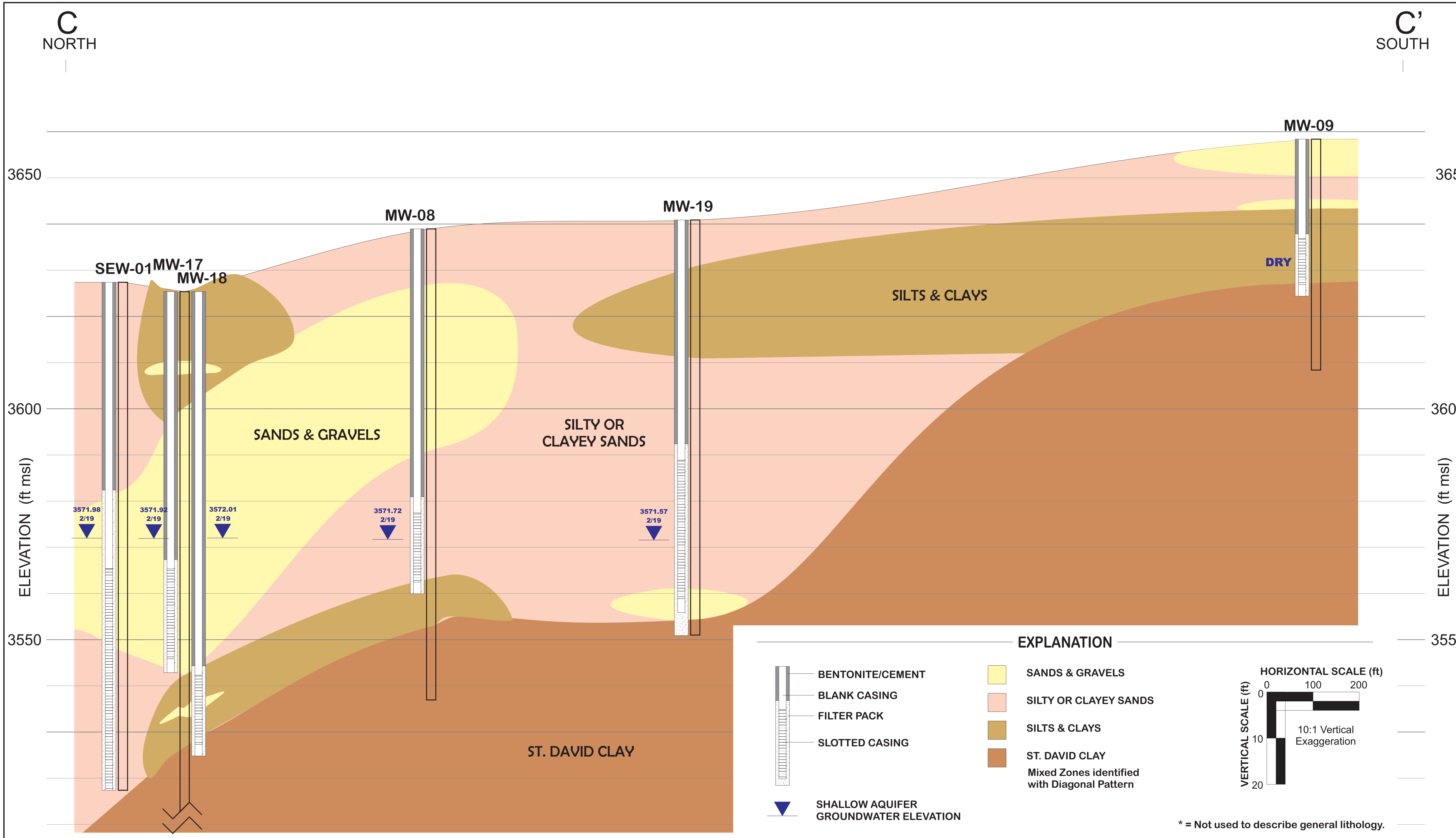

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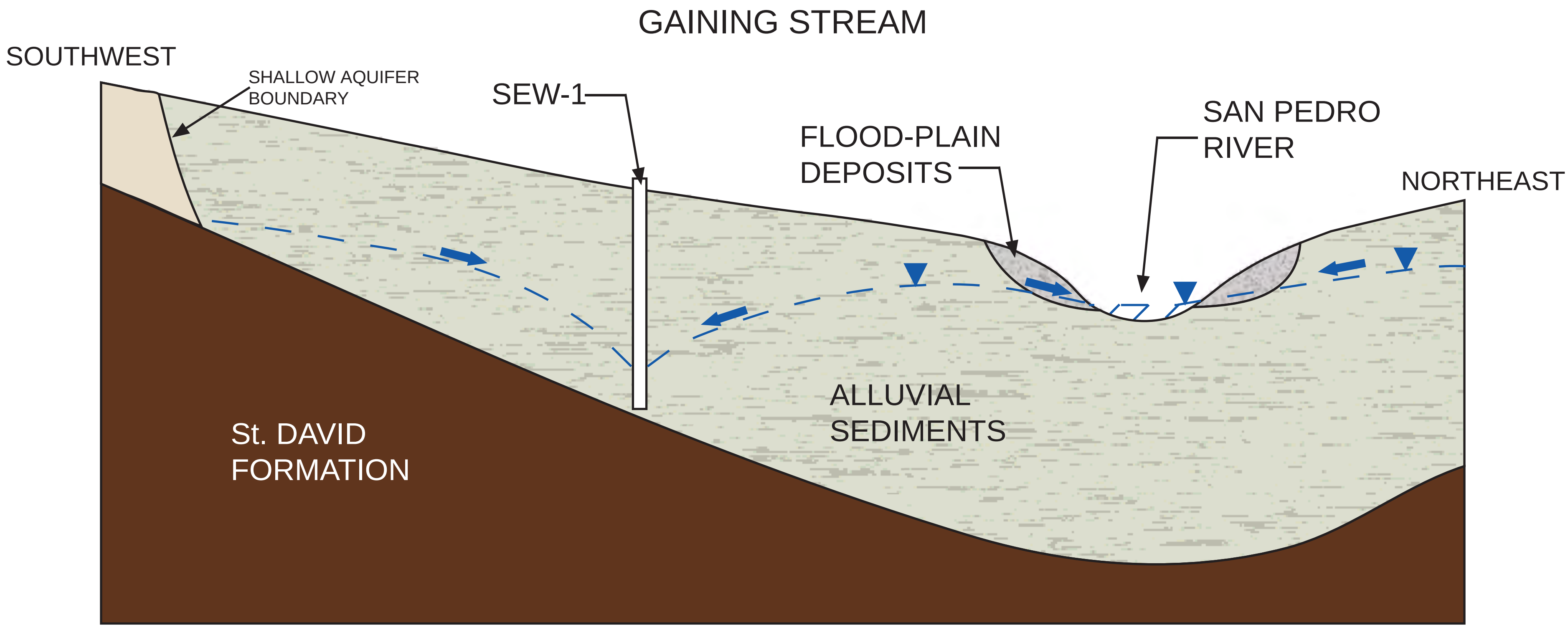
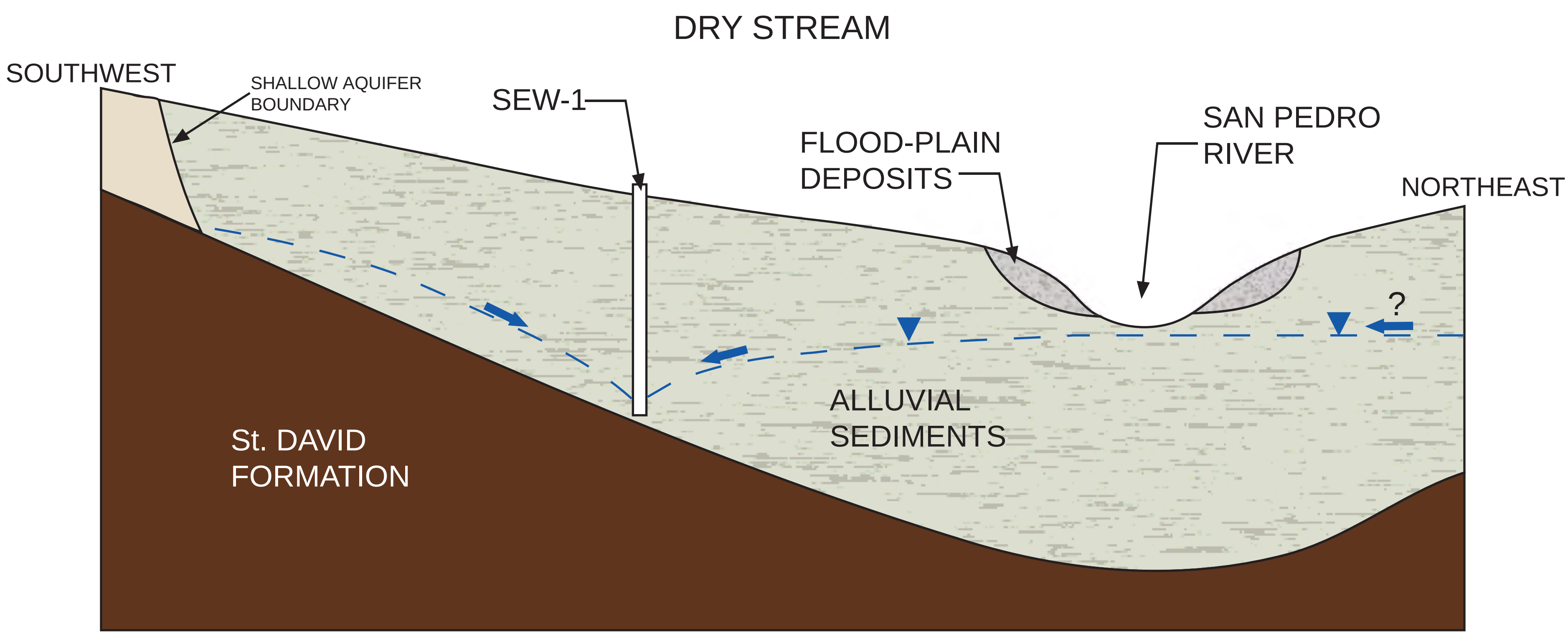
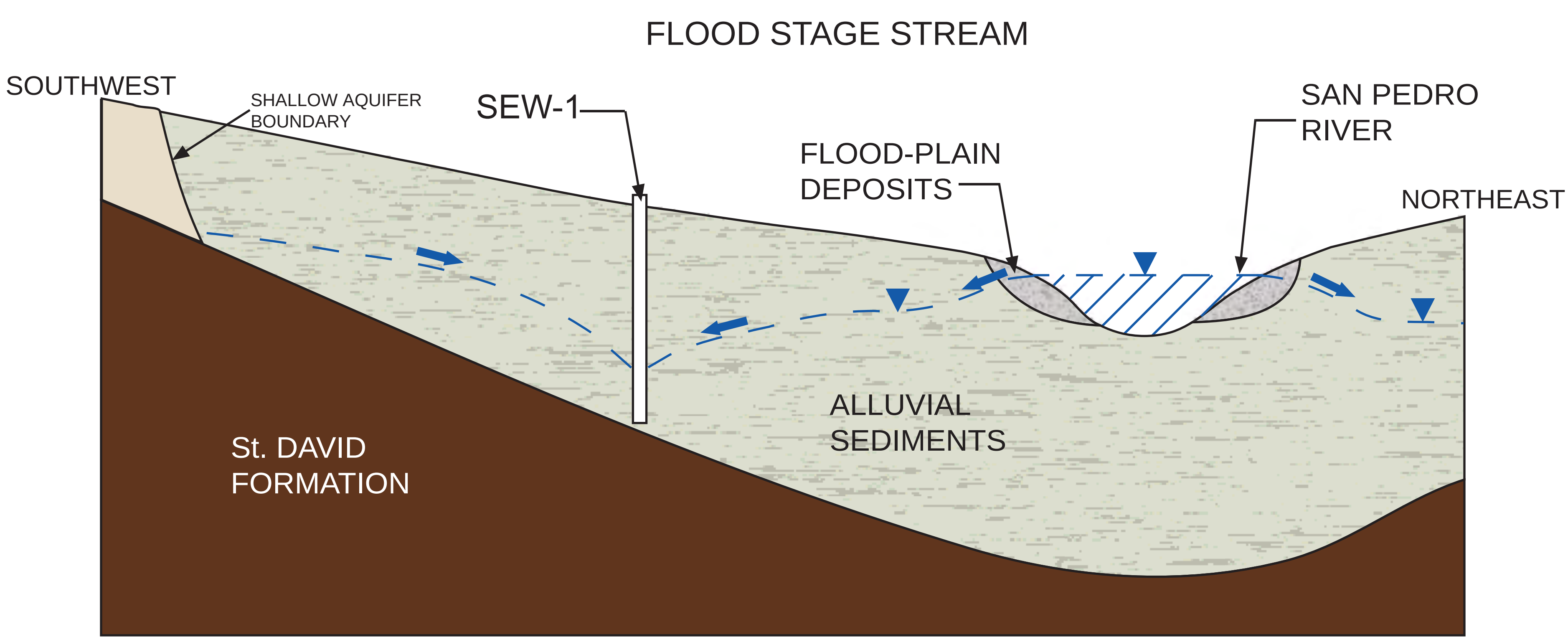
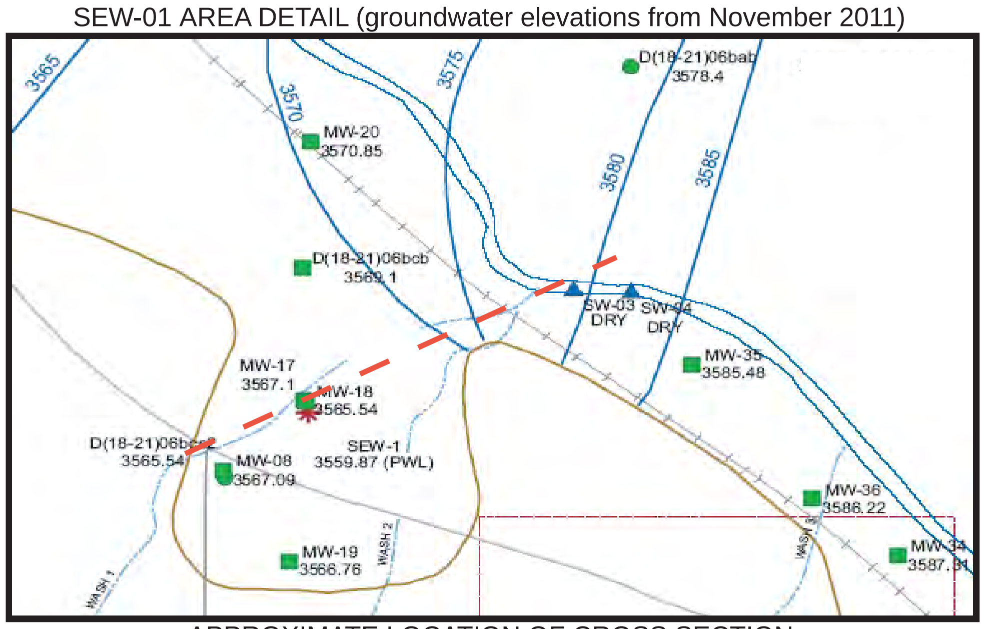
FIGURE 1 8: NORTHERN AREA CONCEPTUAL CROSS SECTION C - C'







SEW-01 AREA DETAIL (groundwater elevations from November 2011)



APPROXIMATE LOCATION OF CROSS SECTION

- Aprroximate level of water table
- Approximate groundwater flow direction
- Approximate cross section location

SCHEMATIC ONLY: NOT TO SCALE

APACHE NITROGEN PRODUCTS INC
BENSON, ARIZONA

SCENARIOS OF SAN PEDRO RIVER STAGES AND RESULTING GROUNDWATER FLOW DIRECTIONS

HARGIS + ASSOCIATES, INC

06/26/2012

FIGURE 19

PREP BY DAT REV BY BAM RPT NO 130.124 Schematic SEW-1 to River.ai

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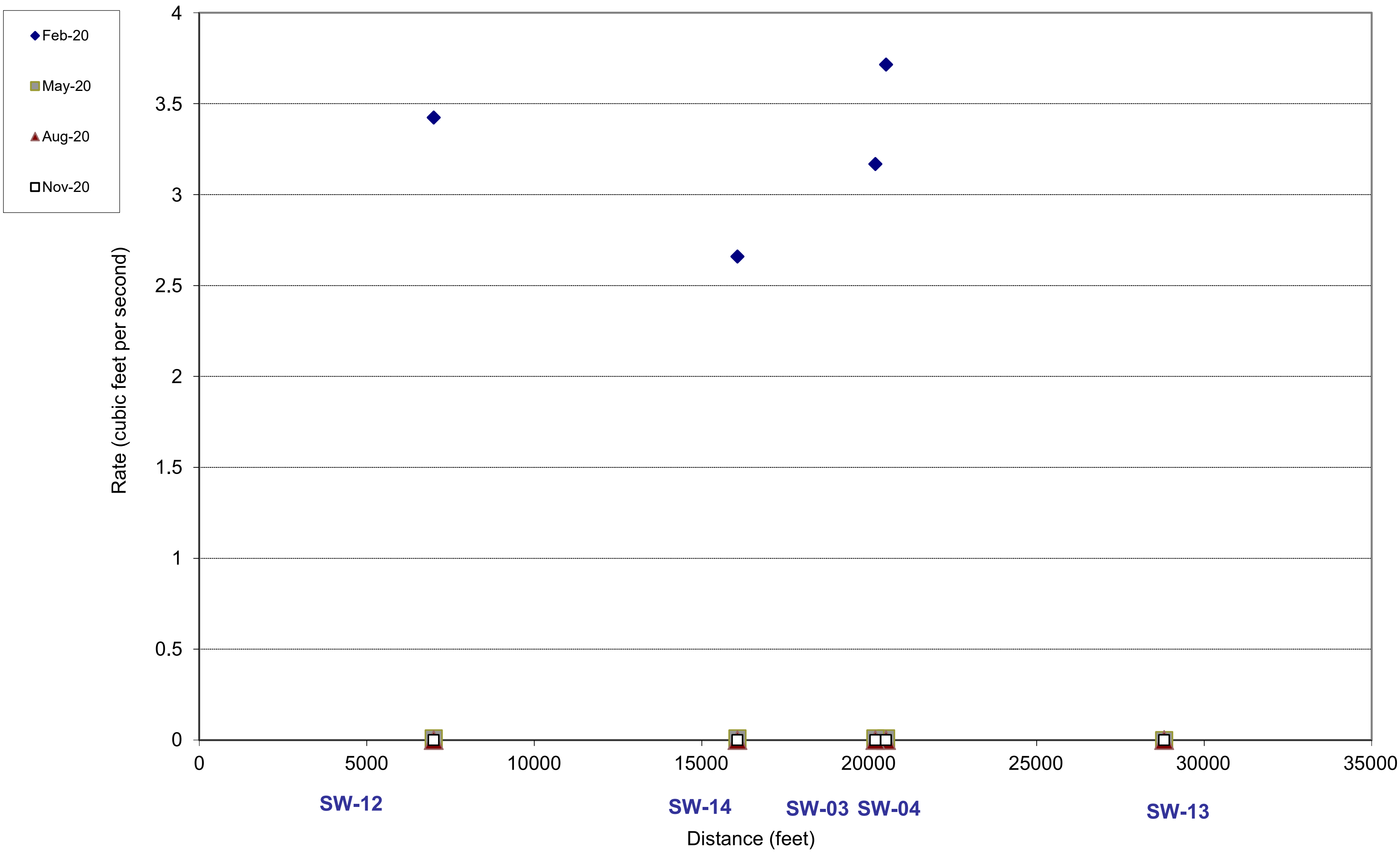

FIGURE 20. 2020 SURFACE WATER DISCHARGE AT SURFACE WATER MONITORING LOCATIONS SW-12, SW-14, SW-03, SW-04, AND SW-13

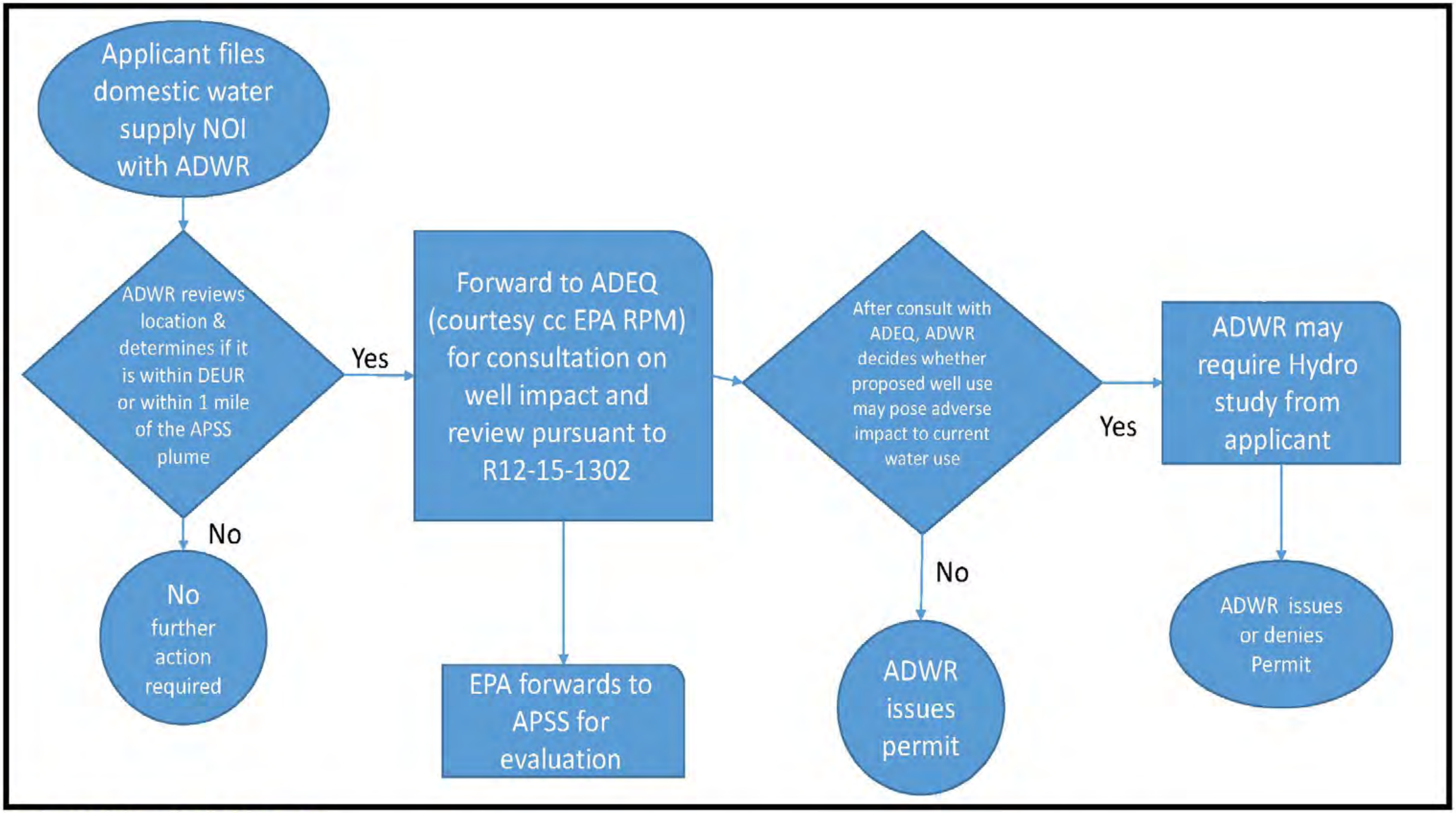

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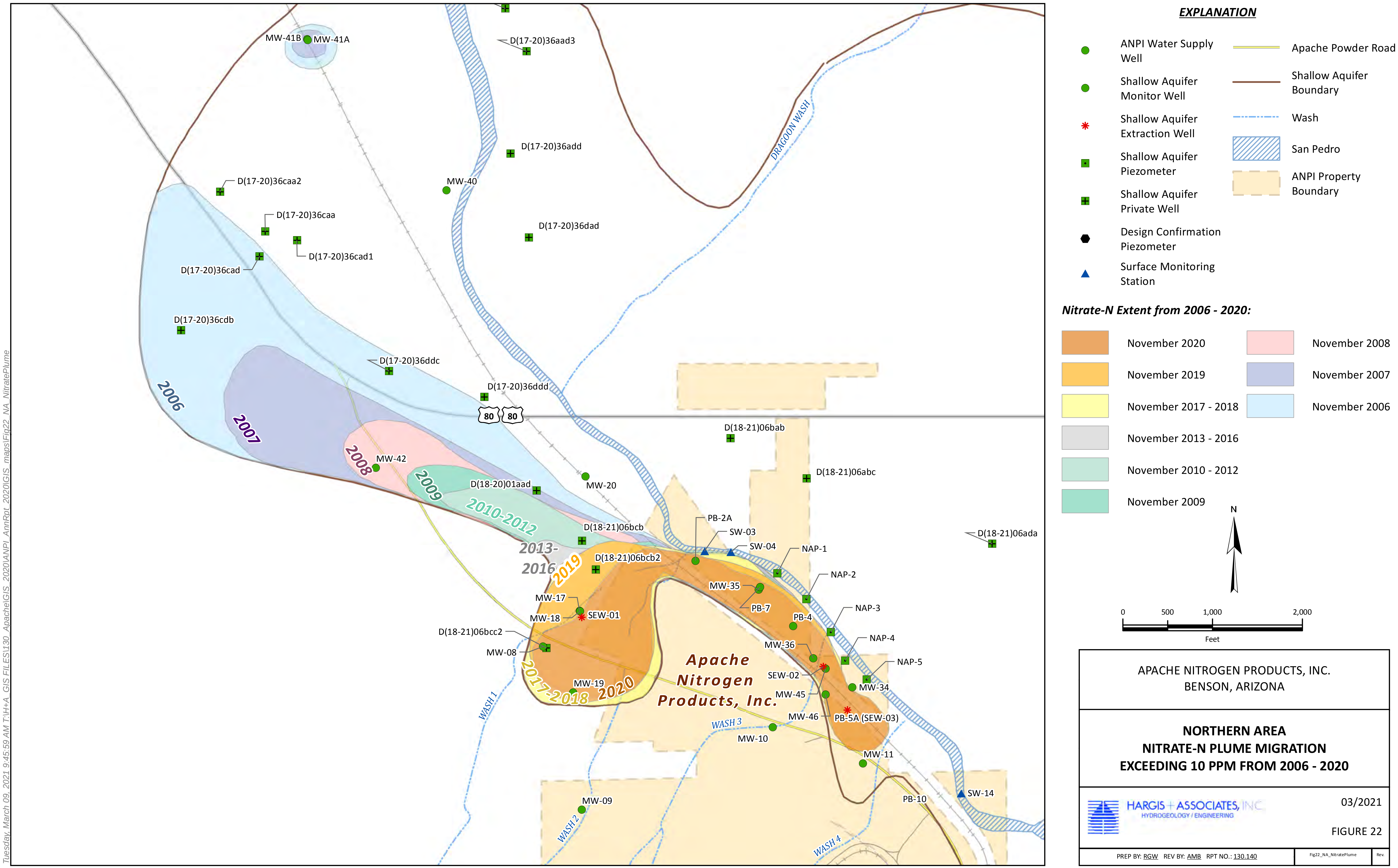
FIGURE 21. NOI PROCESS FOR APACHE POWDER SUPERFUND SITE



APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

NORTHERN AREA
NITRATE-N PLUME MIGRATION
EXCEEDING 10 PPM FROM 2006 - 2020

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FIGURE 22

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | Fig22_NA_NitratePlume | Rev.

Tuesday, March 09, 2021 9:45:59 AM T:\H+A_GIS FILES\130_Apache\GIS_2020\ANPI_AnnRpt_2020\GIS_maps\Fig22_NA_NitratePlume

APPENDIX A

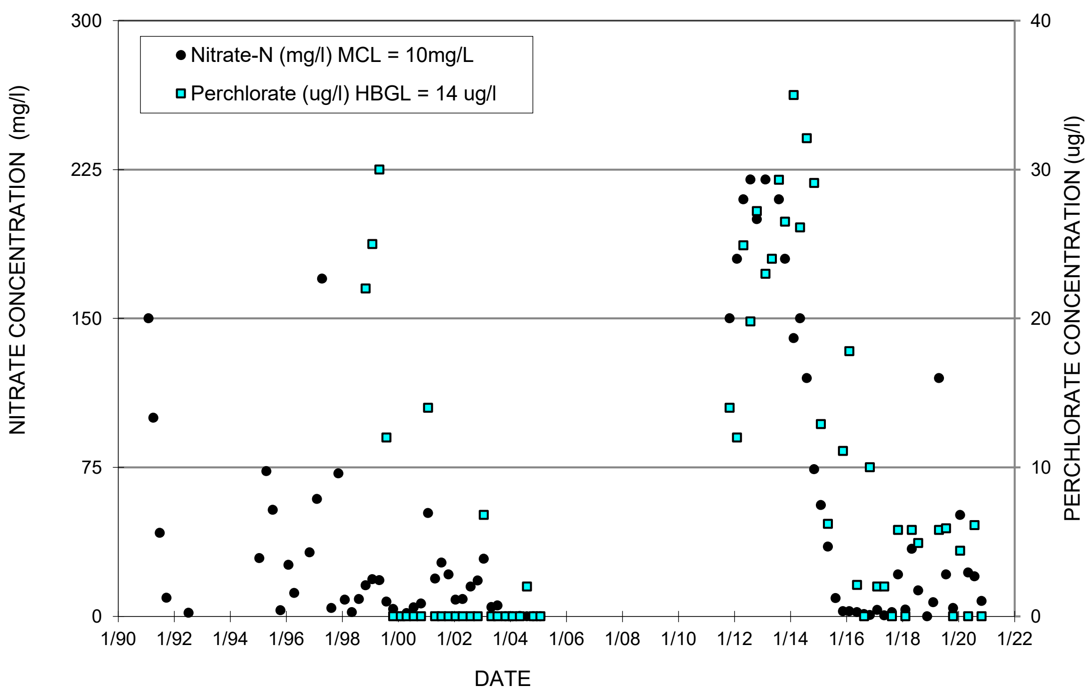
WATER LEVEL AND WATER QUALITY HYDROGRAPHS

APPENDIX A

WATER LEVEL AND WATER QUALITY HYDROGRAPHS

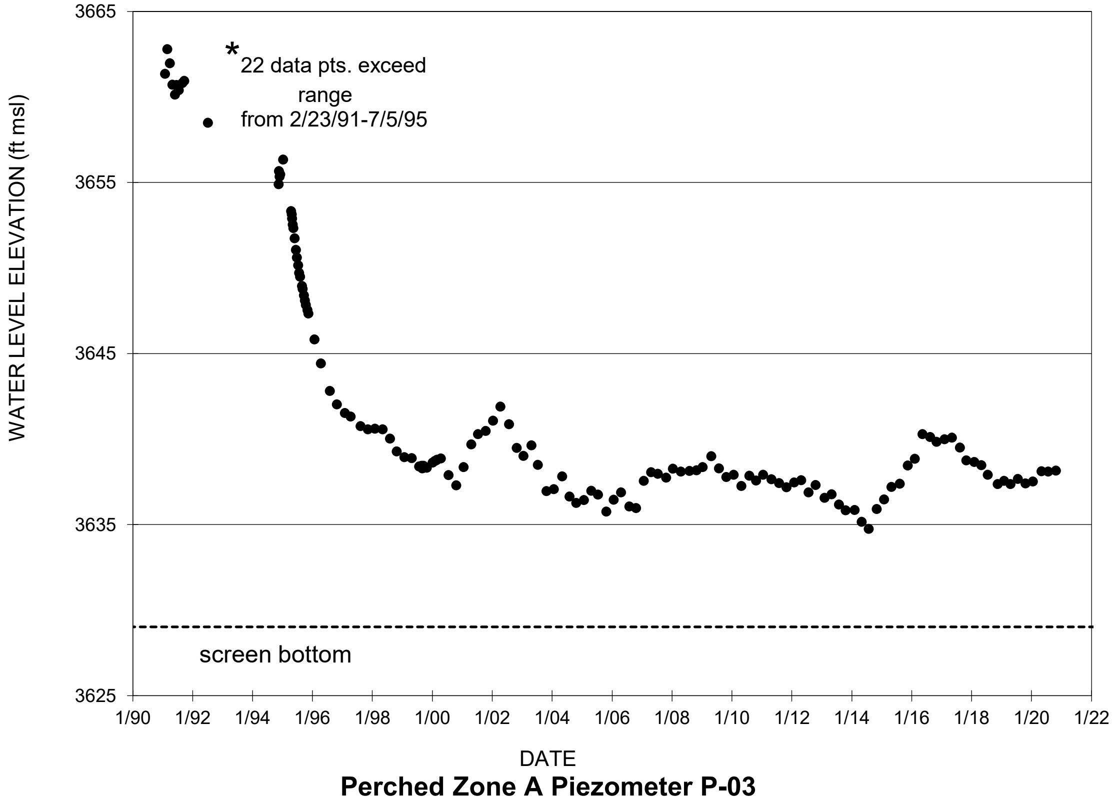
TABLE OF CONTENTS

Perched Zone A Piezometer P-01



Perched Zone A Piezometer P-01

FIGURE A-1. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE A PIEZOMETER P-01



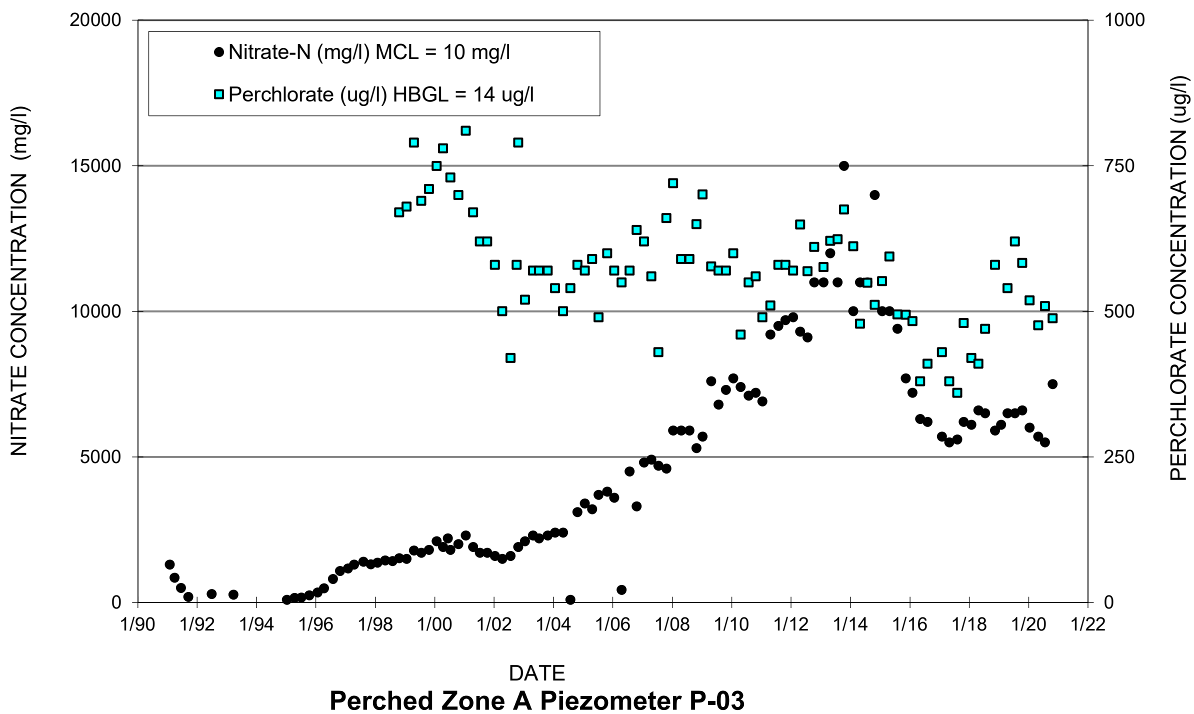
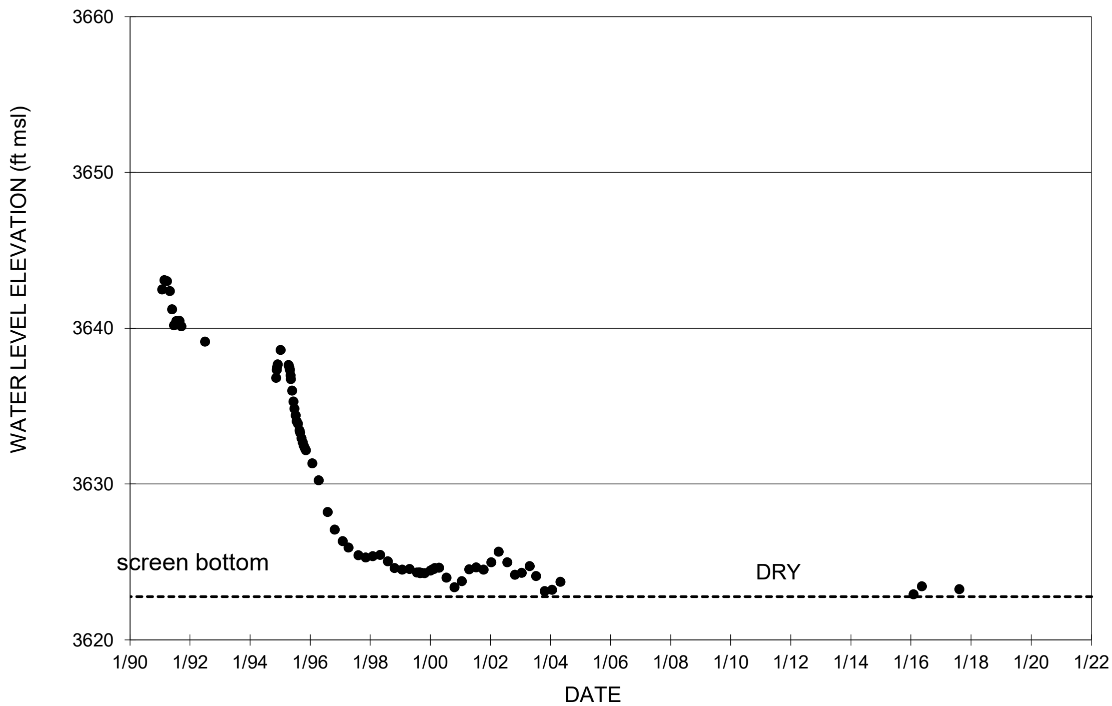
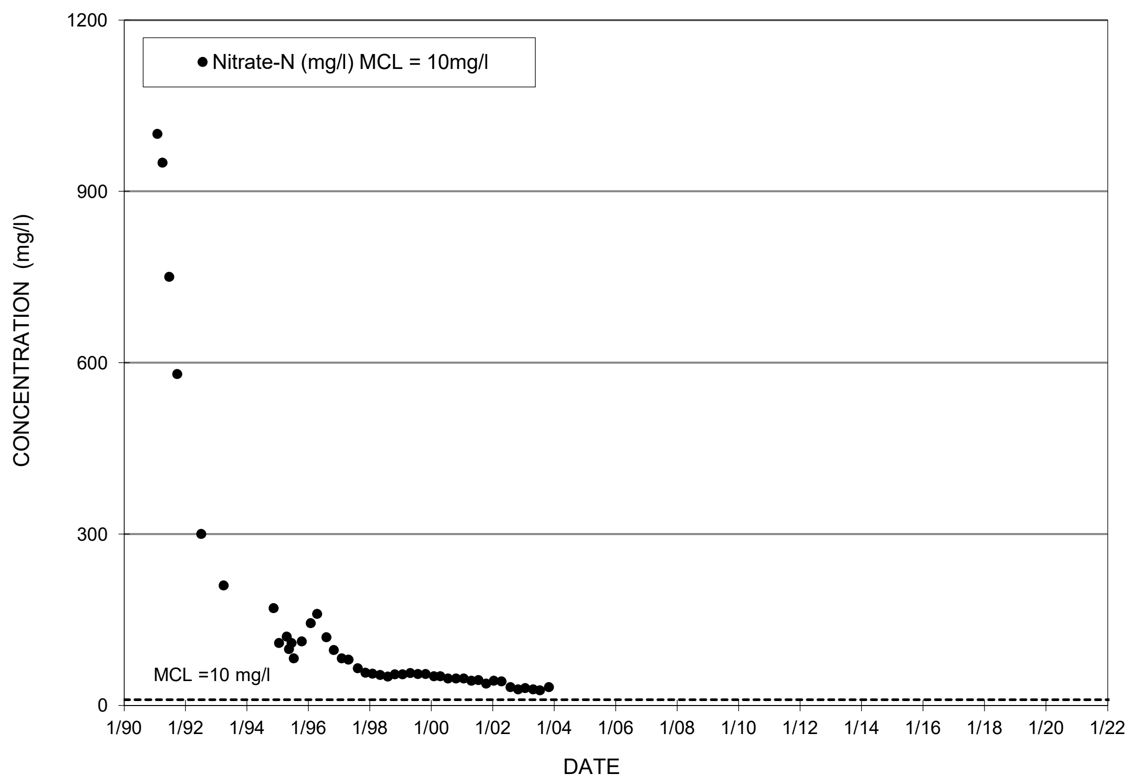


FIGURE A-2. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE A PIEZOMETER P-03



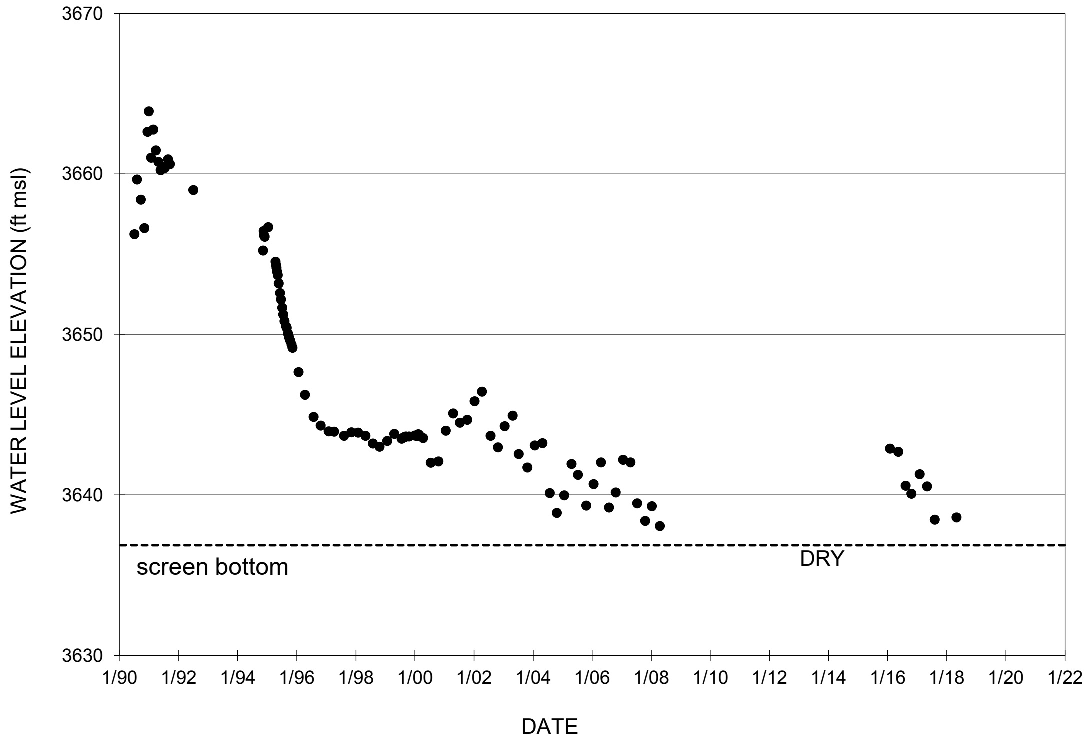
Perched Zone A Piezometer P-10



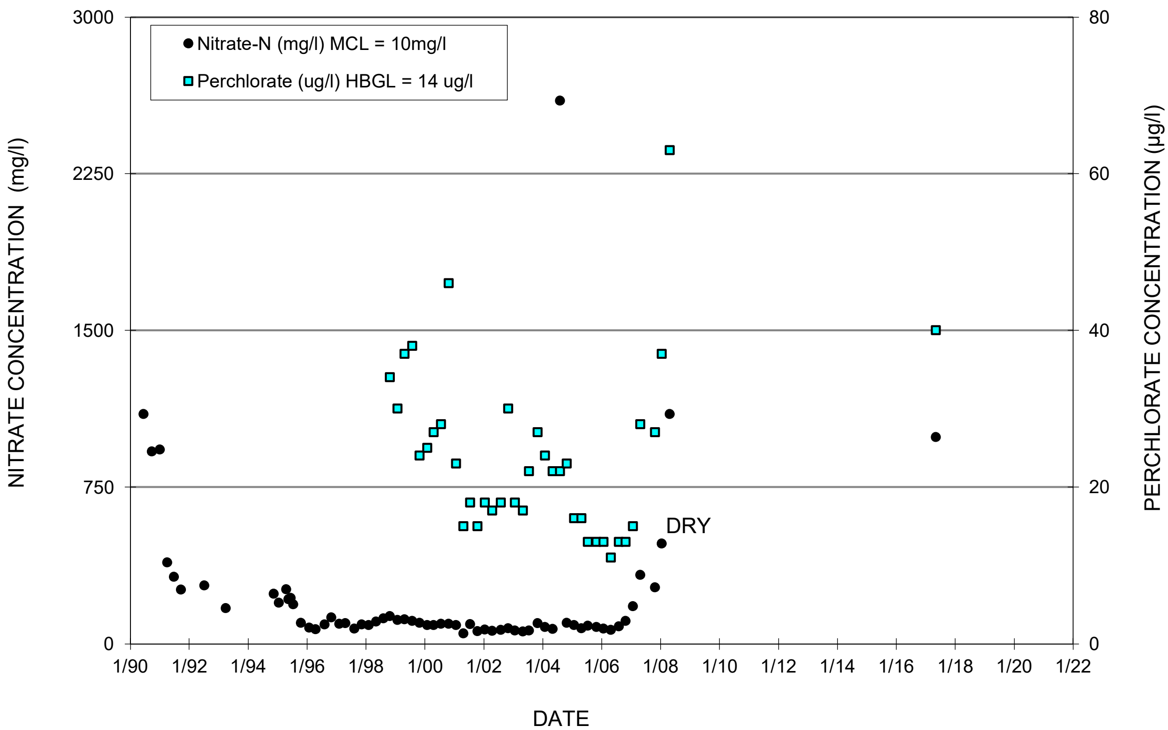
Perched Zone A Piezometer P-10

FIGURE A-3. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE A PIEZOMETER P-10

HARGIS + ASSOCIATES, INC.



Perched Zone A Monitor Well MW-03



Perched Zone A Monitor Well MW-03

FIGURE A-4. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE A MONITOR WELL MW-03

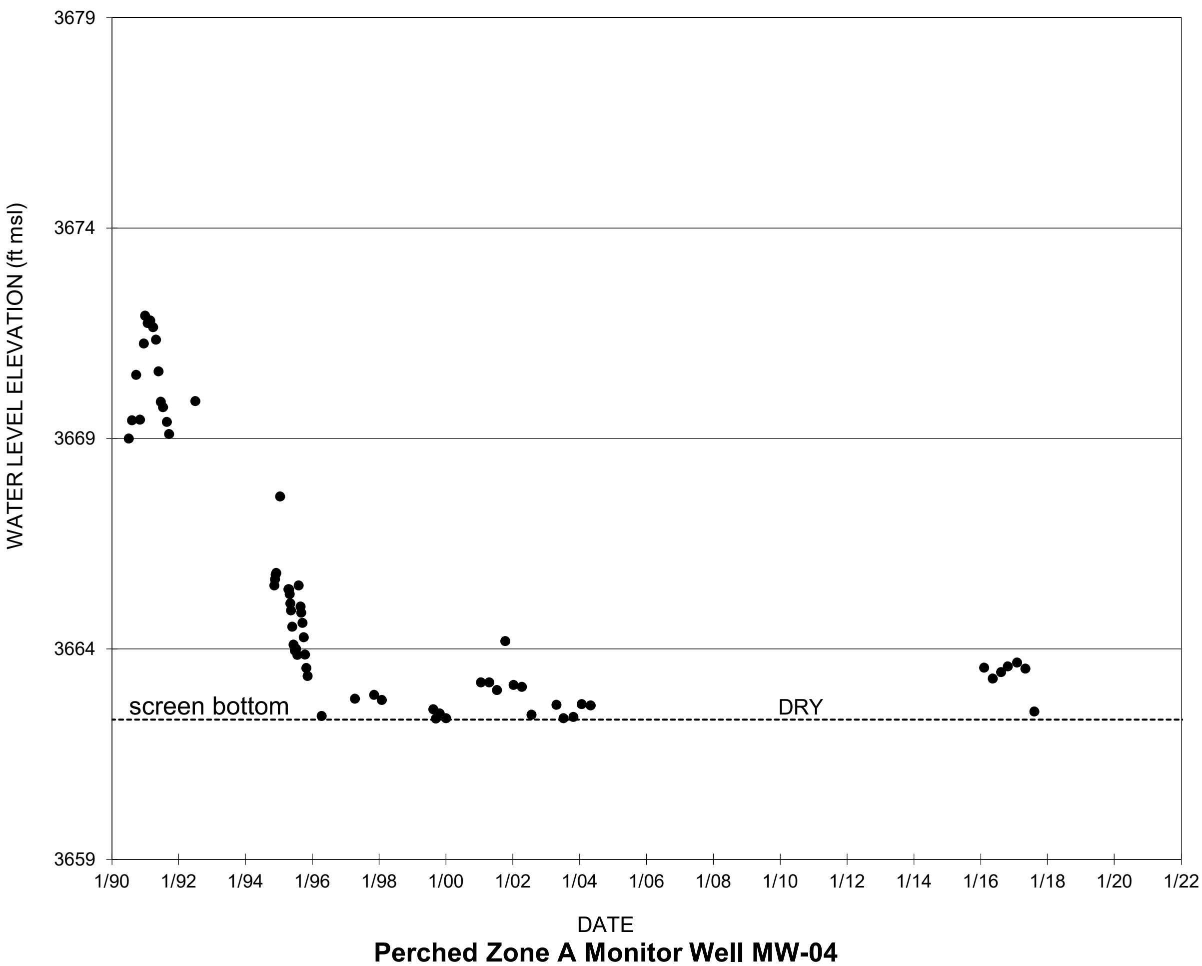
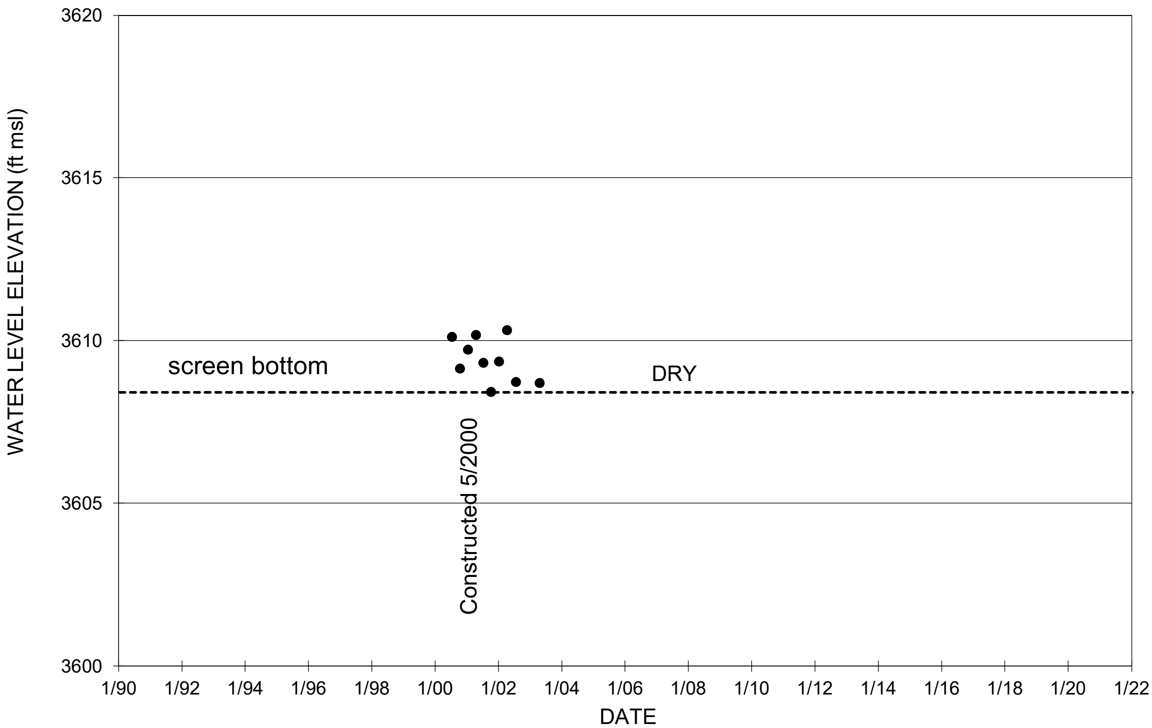
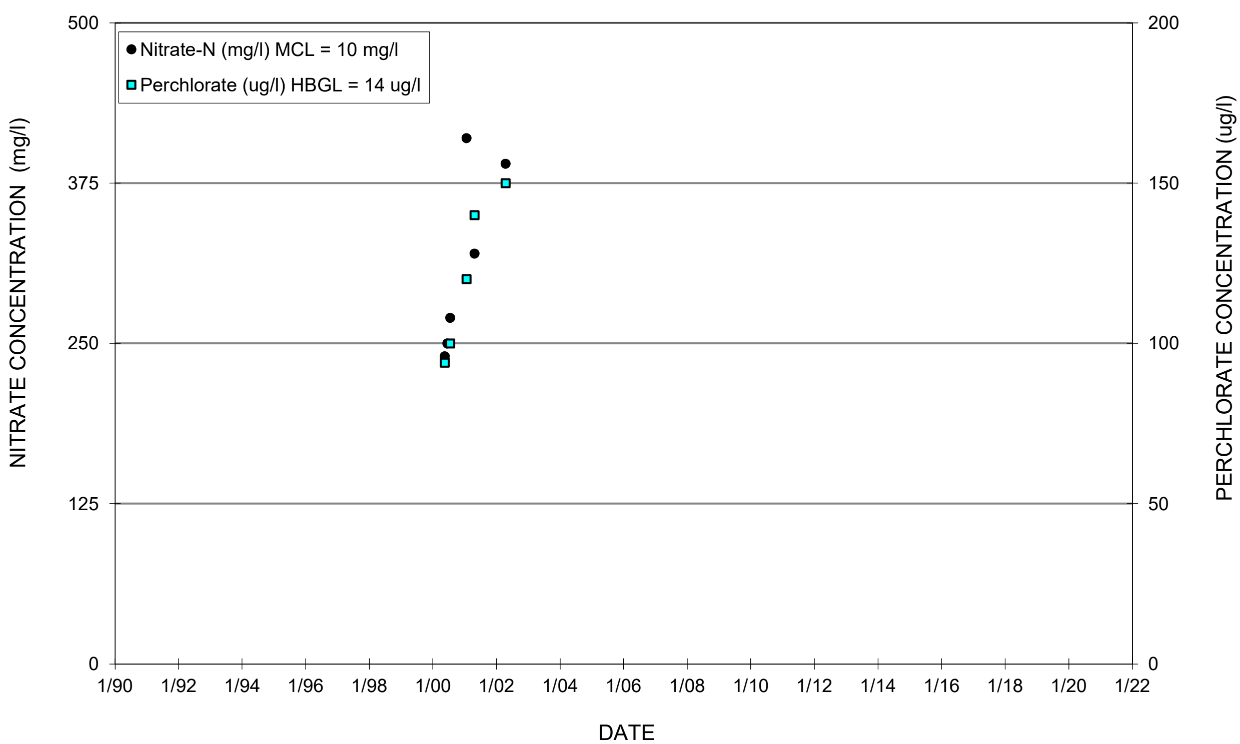


FIGURE A-5. WATER LEVEL HYDROGRAPH FOR PERCHED ZONE A MONITOR WELL MW-04

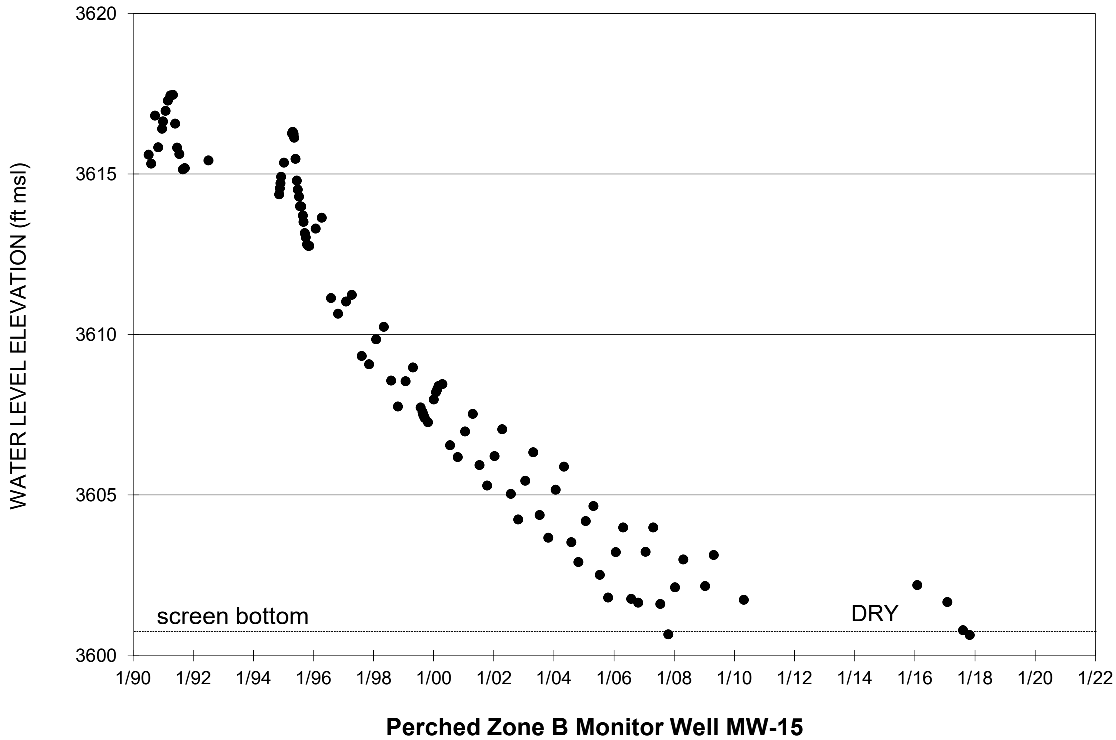


Perched Zone A Monitor Well MW-29



Perched Zone A Monitor Well MW-29

FIGURE A-6. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE A MONITOR WELL MW-29



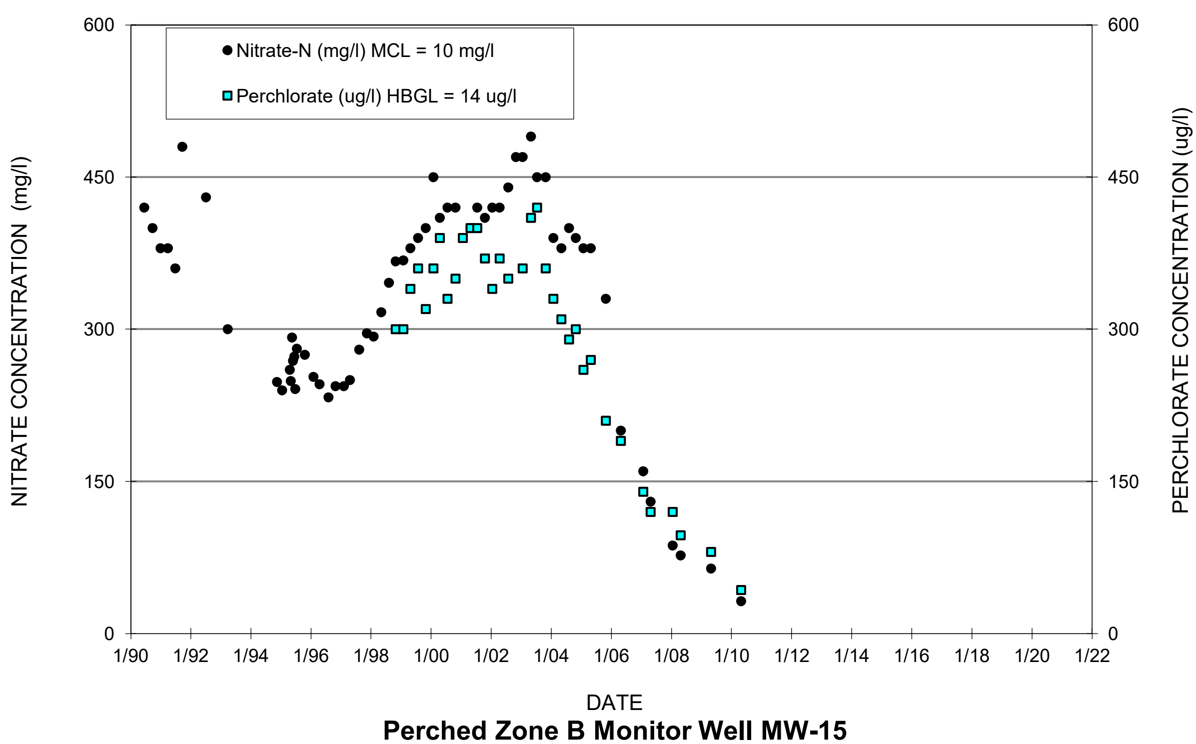
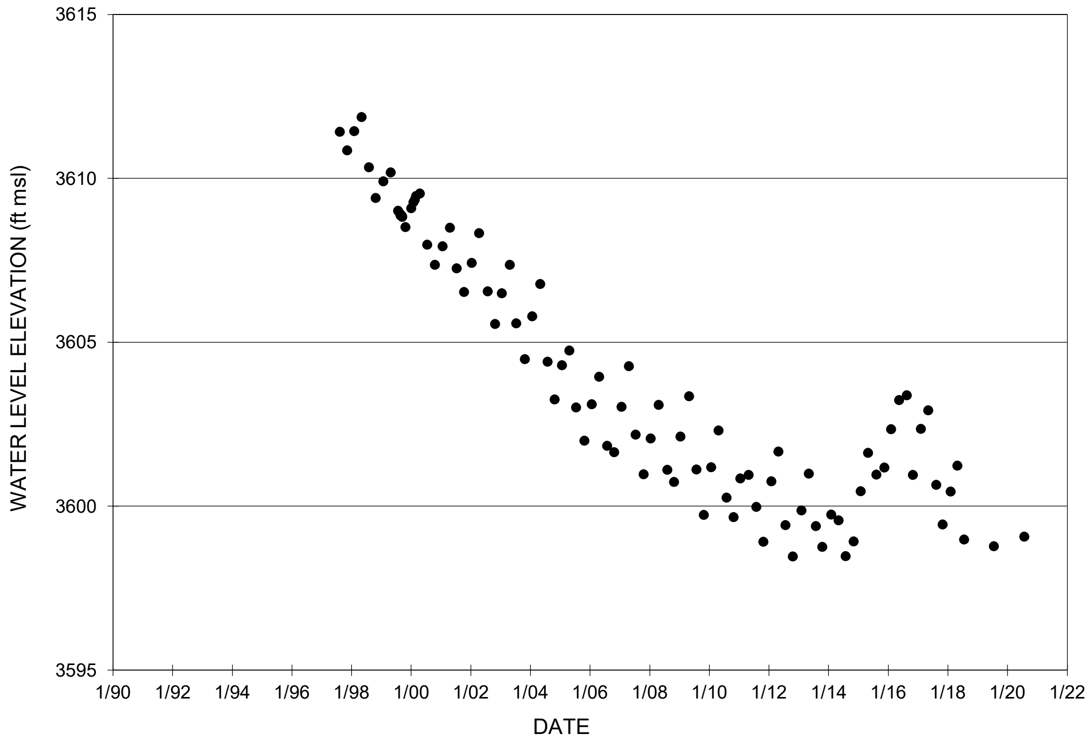
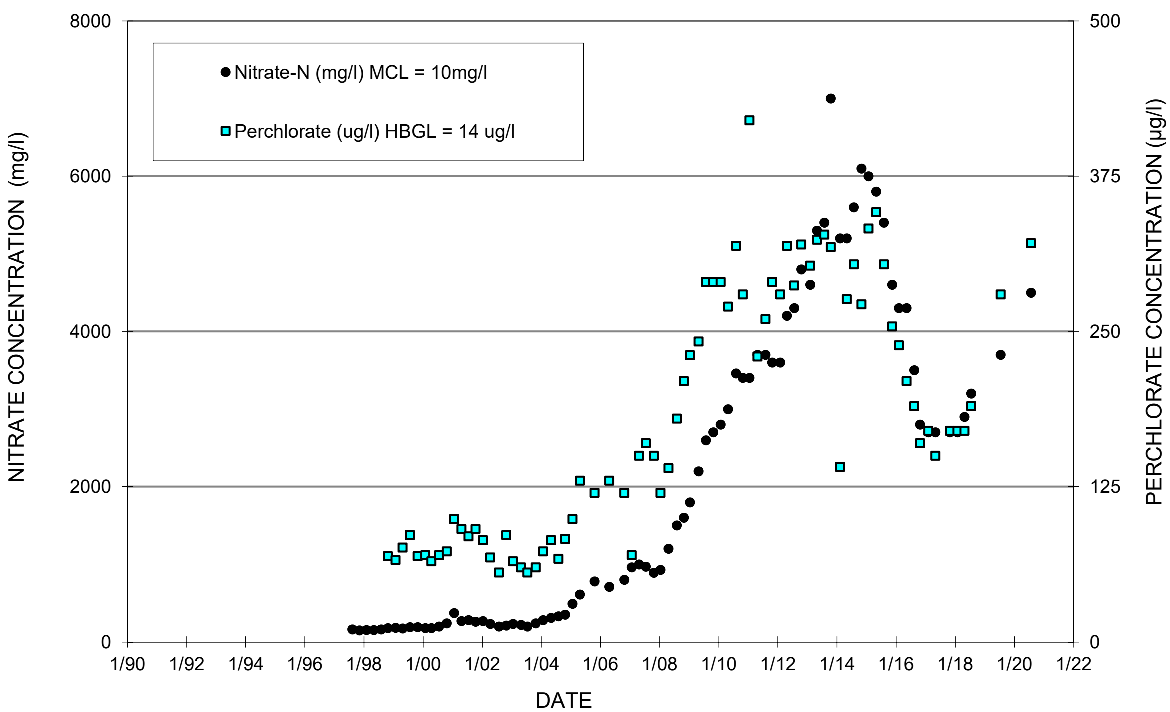


FIGURE A-7. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE B MONITOR WELL MW-15

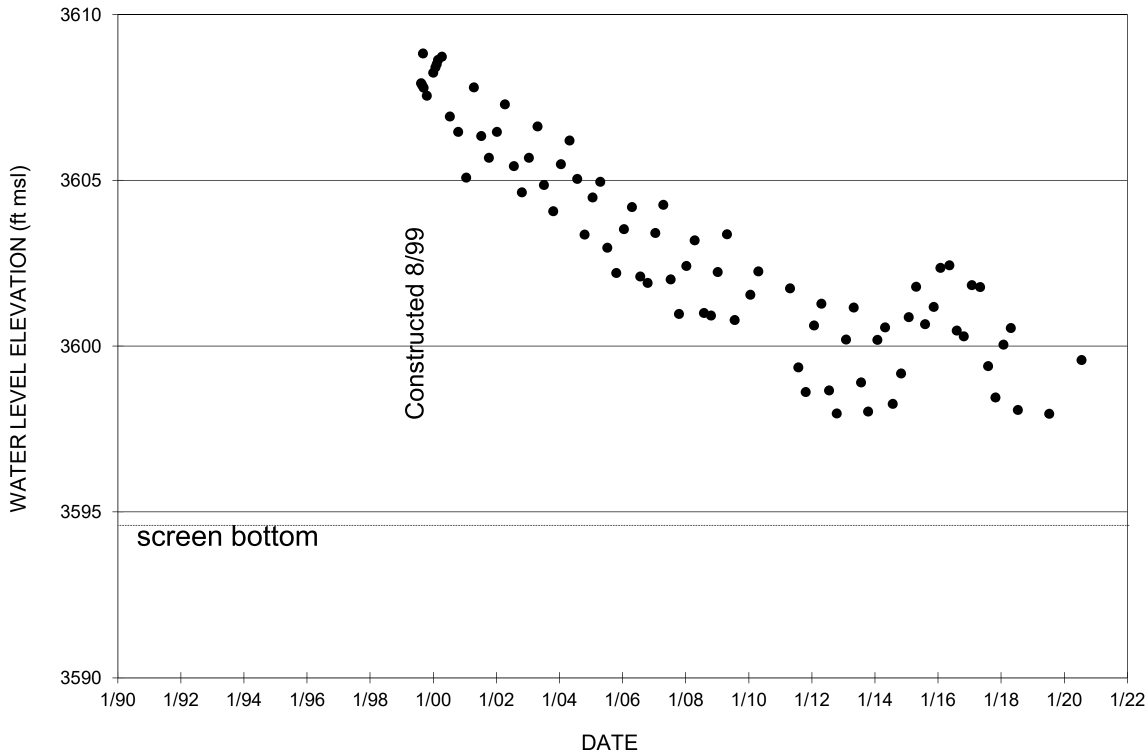


Perched Zone B Monitor Well MW-21

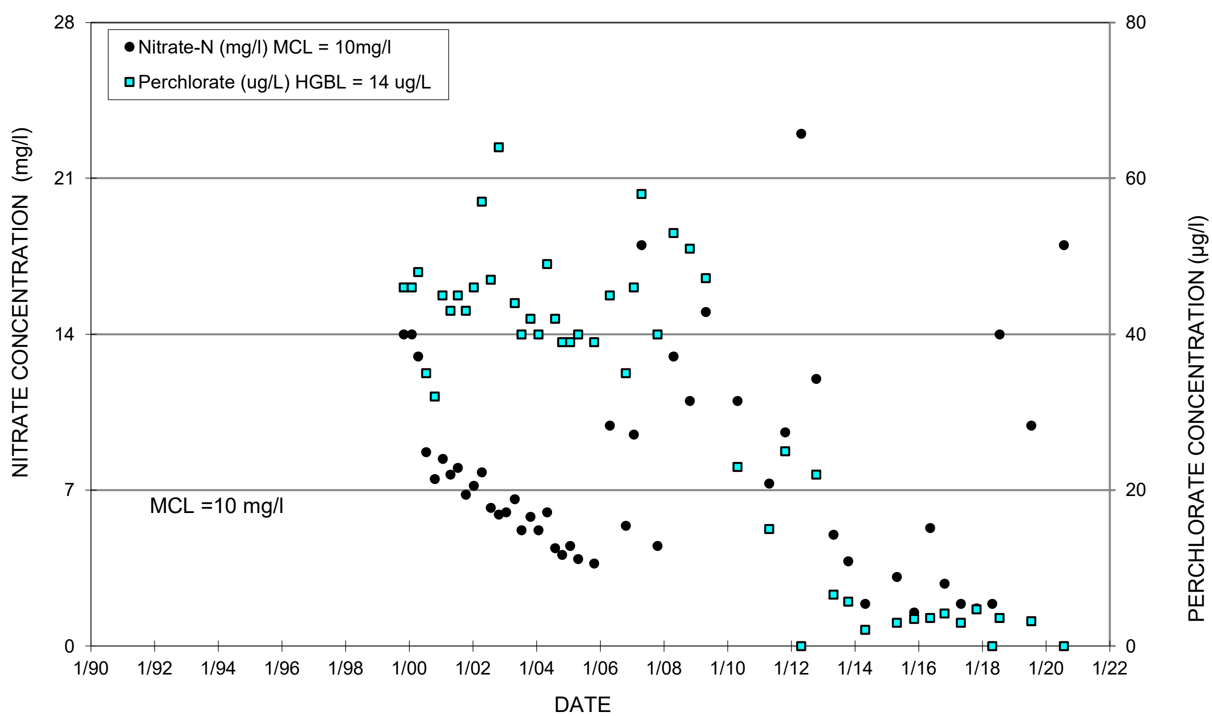


Perched Zone B Monitor Well MW-21

FIGURE A-8. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE B MONITOR WELL MW-21

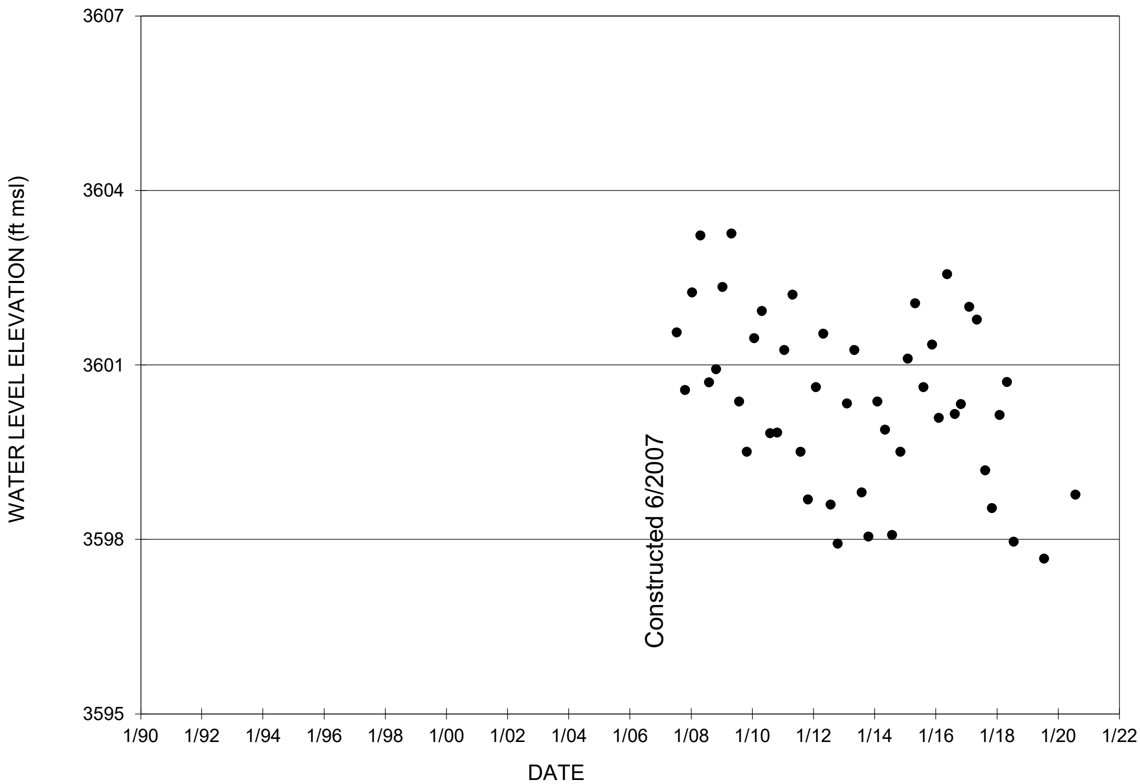


Perched Zone B Monitor Well MW-23

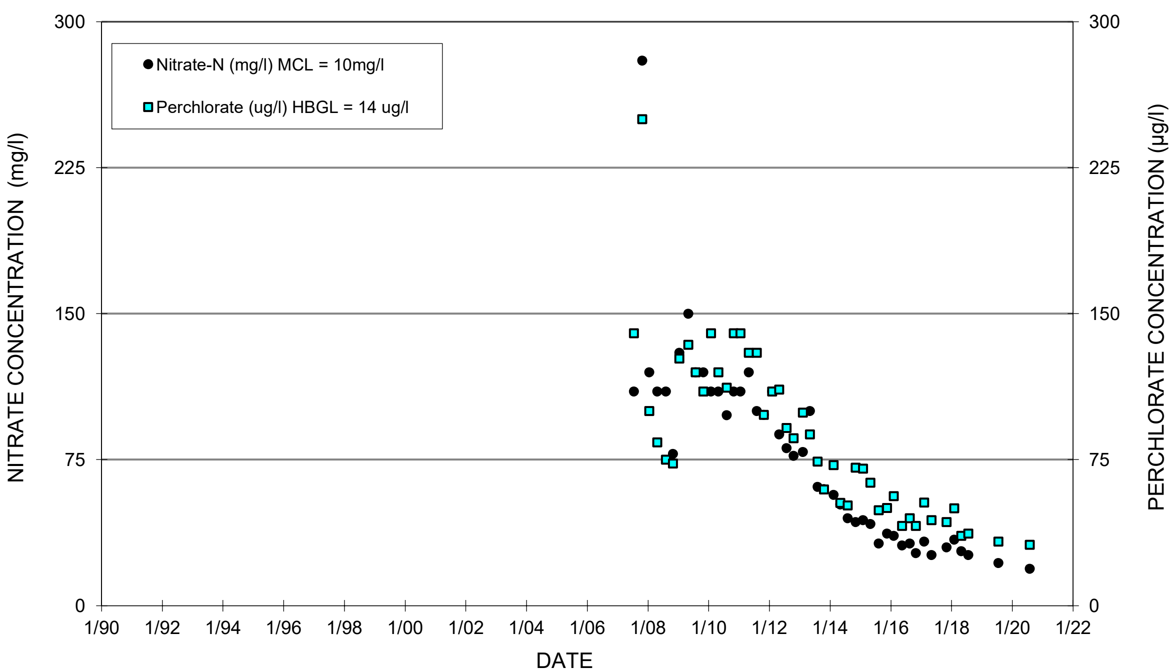


Perched Zone B Monitor Well MW-23

FIGURE A-9. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE B MONITOR WELL MW-23



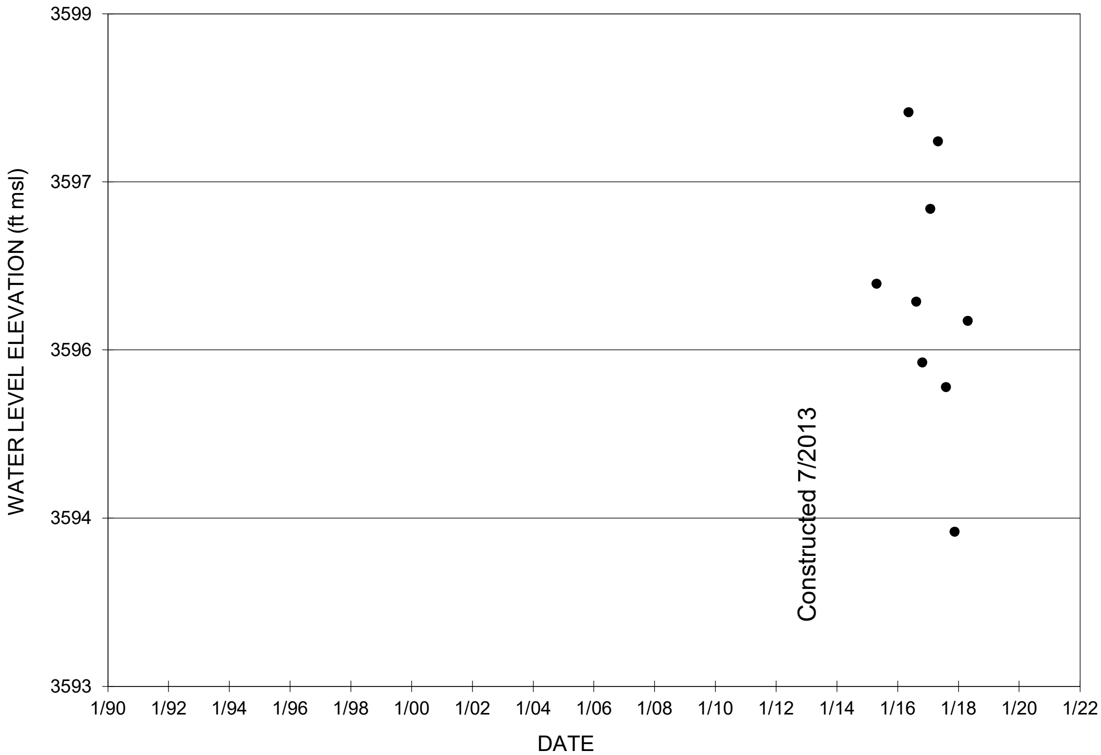
Perched Zone B Monitor Well MW-39



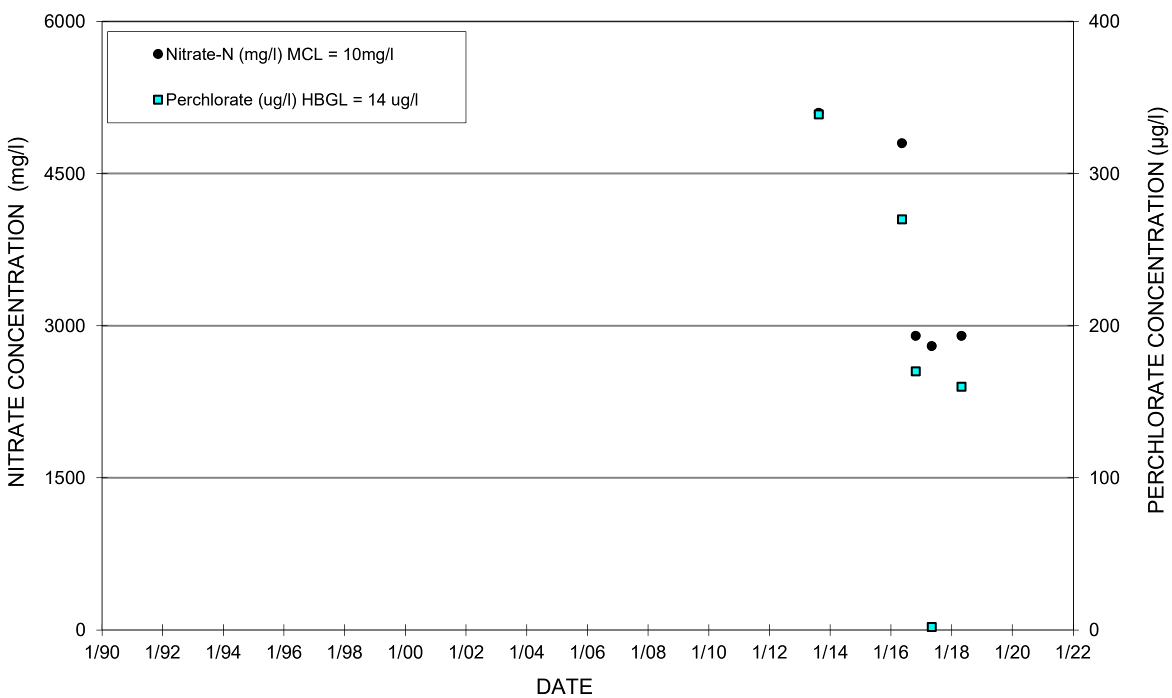
Perched Zone B Monitor Well MW-39

FIGURE A-10. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE B MONITOR WELL MW-39

HARGIS + ASSOCIATES, INC.

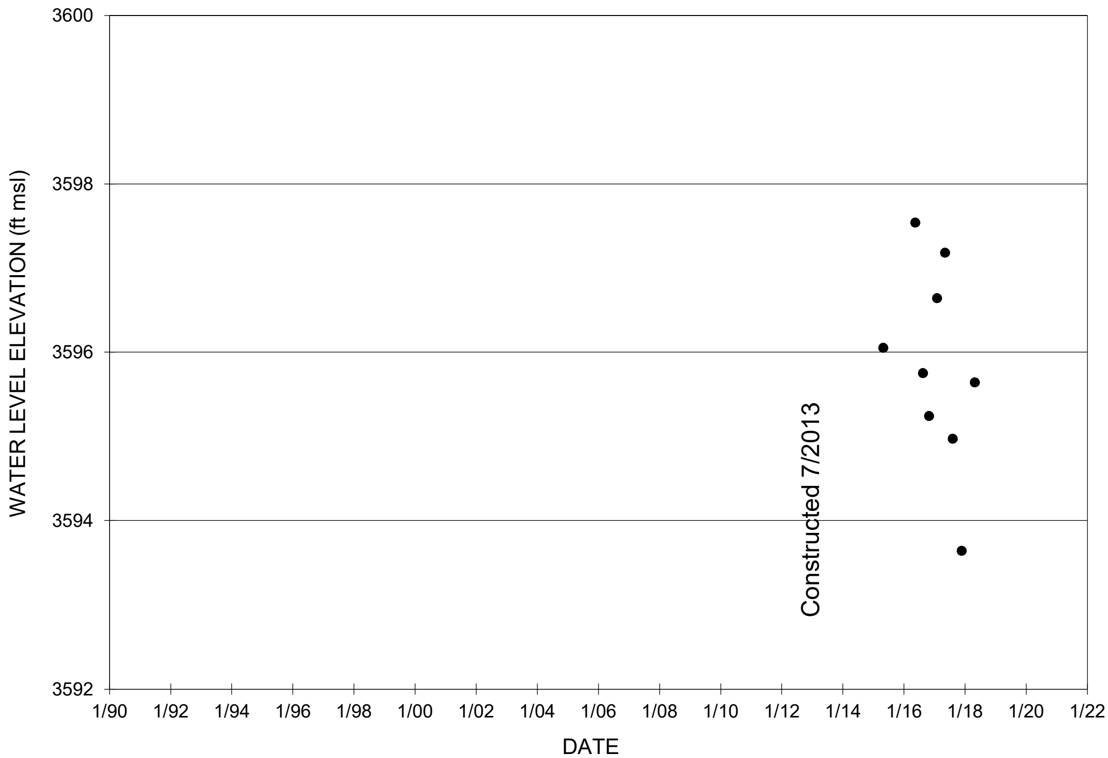


Perched Zone B Monitor Well MW-43

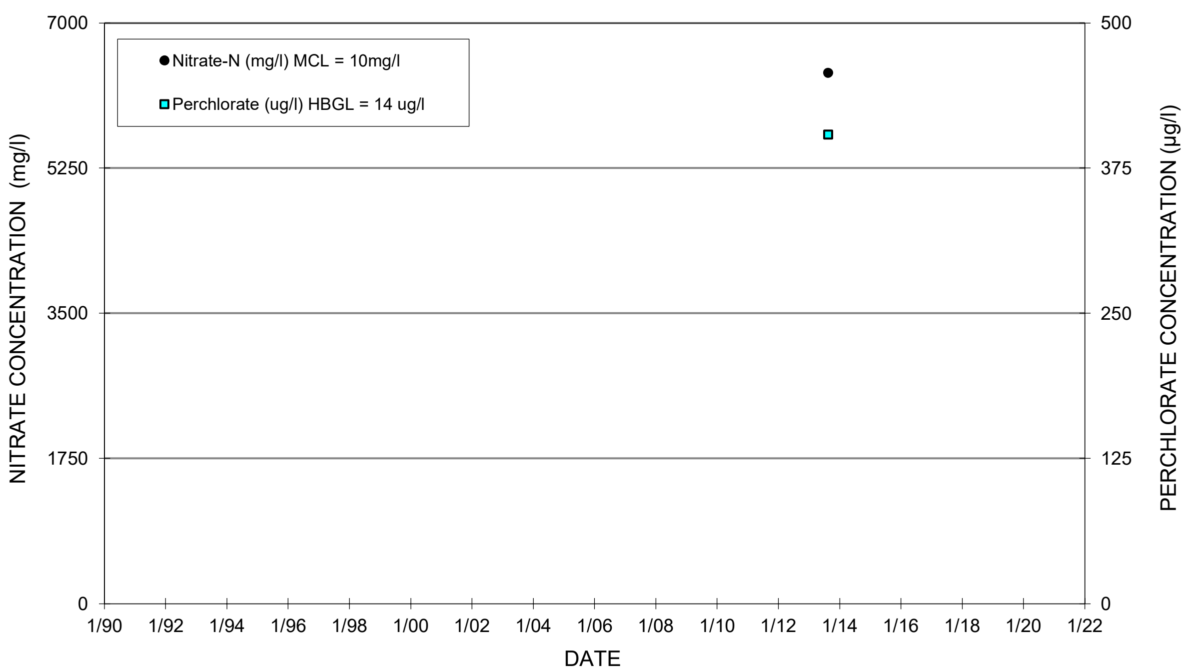


Perched Zone B Monitor Well MW-43

FIGURE A-11. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE B MONITOR WELL MW-43



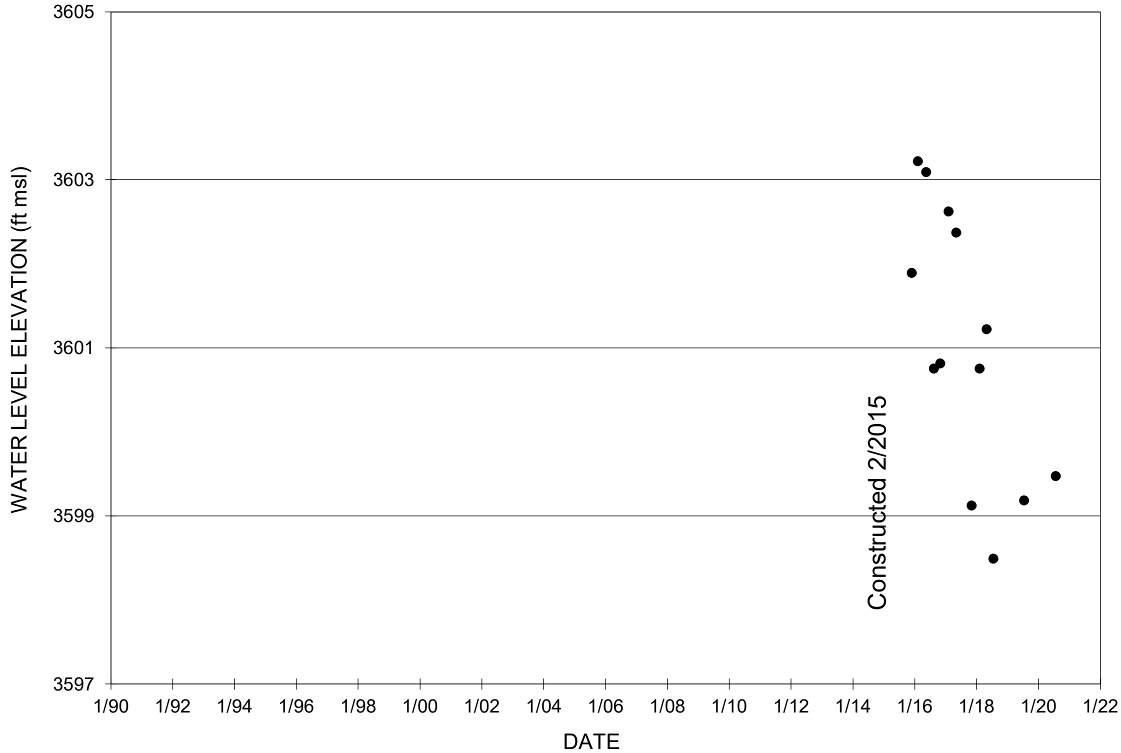
Perched Zone B Monitor Well MW-44



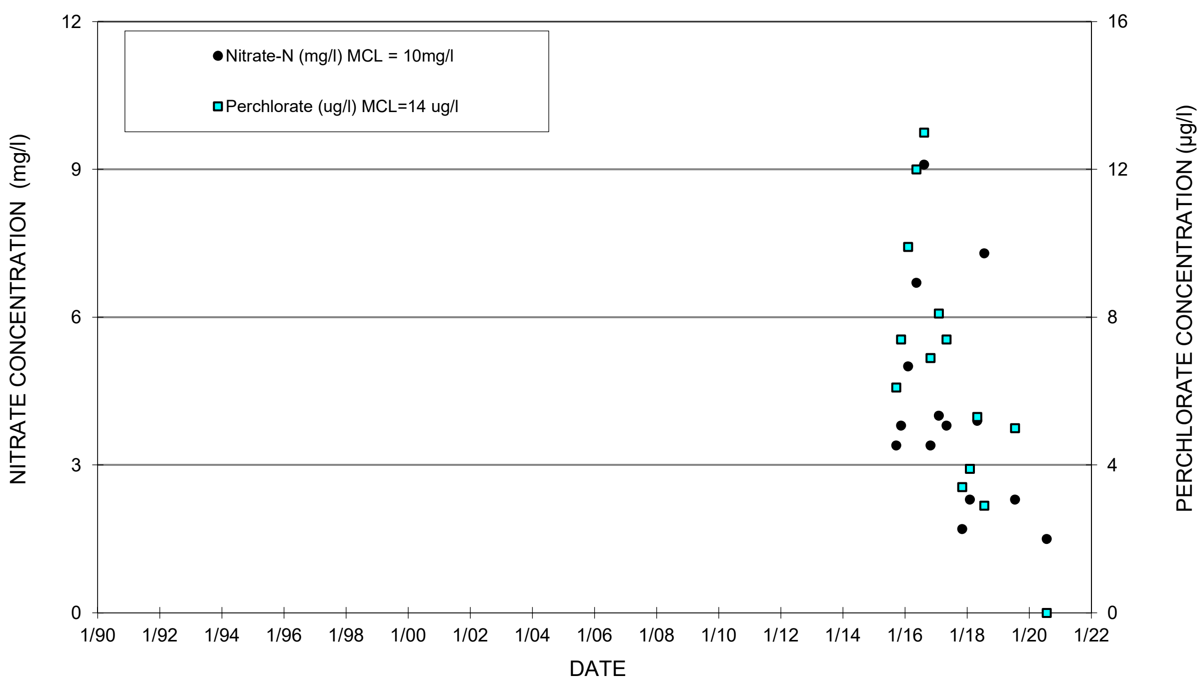
Perched Zone B Monitor Well MW-44

FIGURE A-12. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE B MONITOR WELL MW-44

HARGIS + ASSOCIATES, INC.

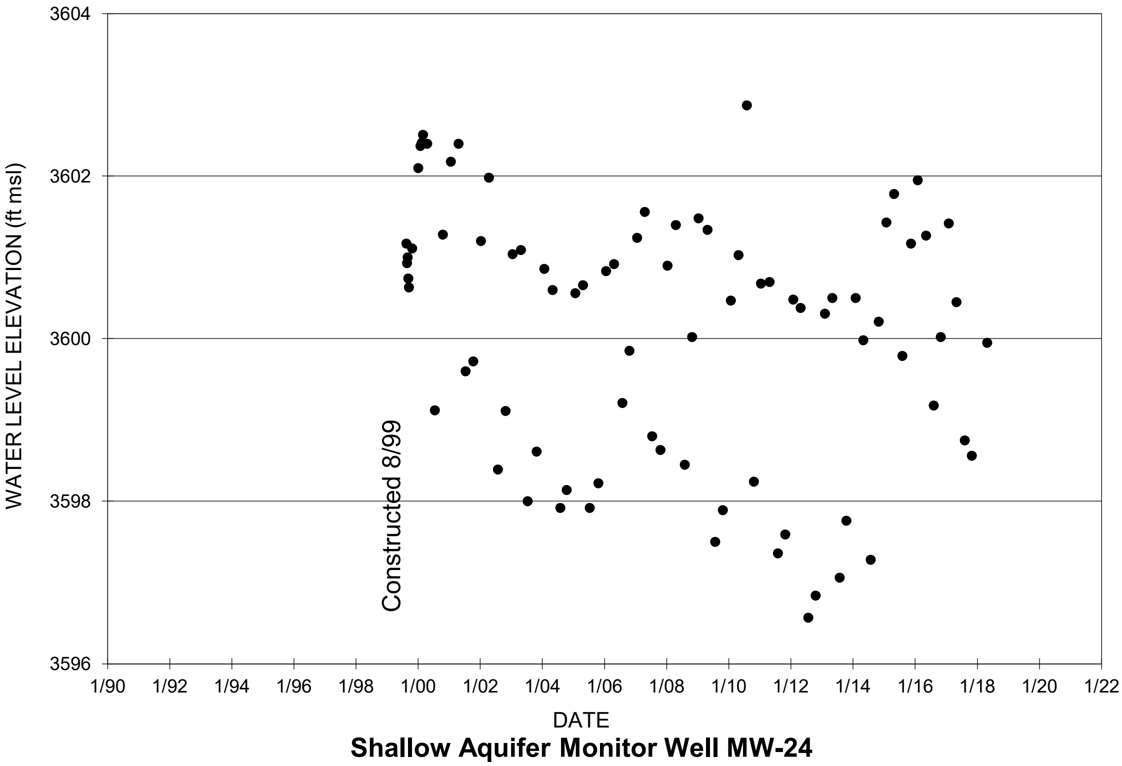


Perched Zone B Monitor Well MW-47



Perched Zone B Monitor Well MW-47

FIGURE A-13. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR PERCHED ZONE B MONITOR WELL MW-47



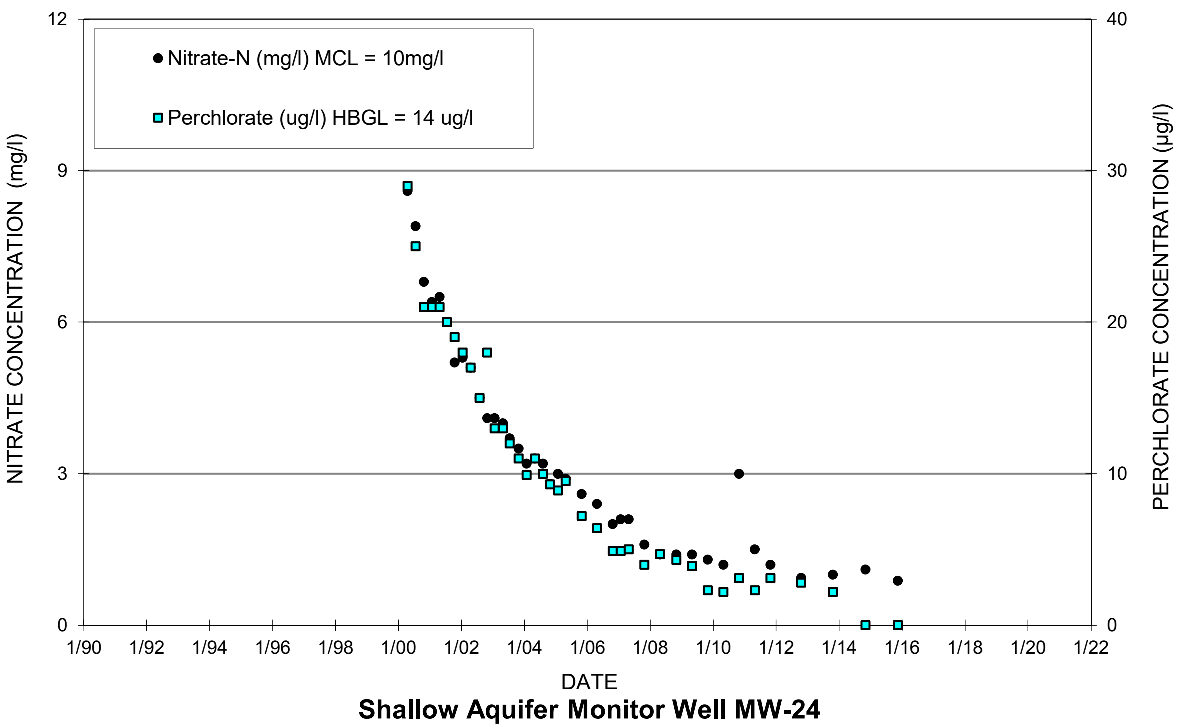
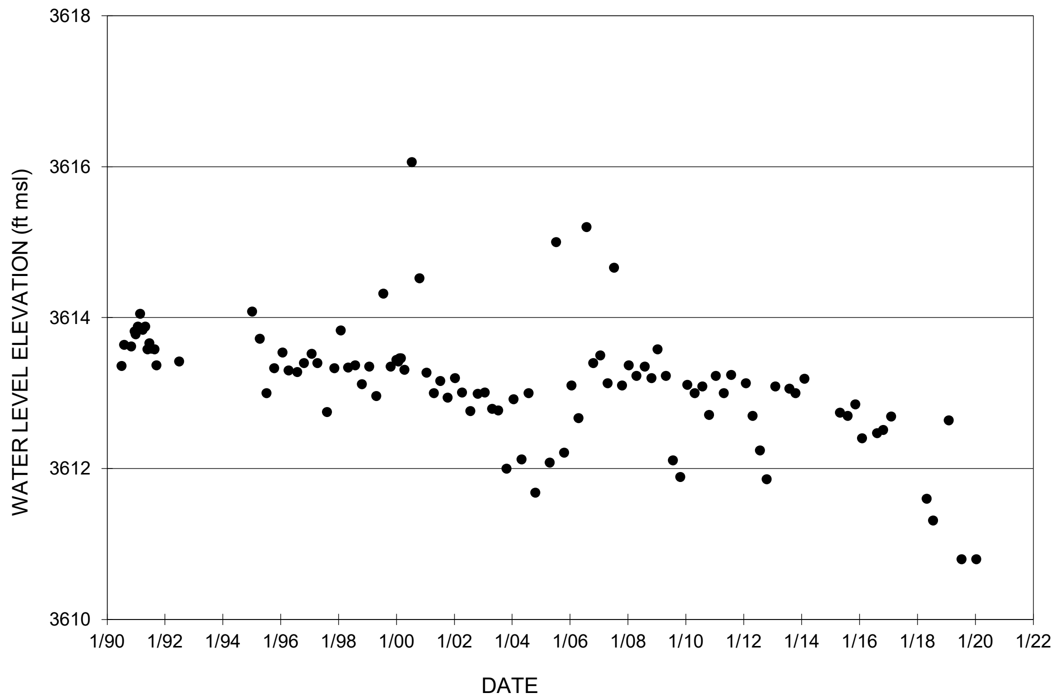
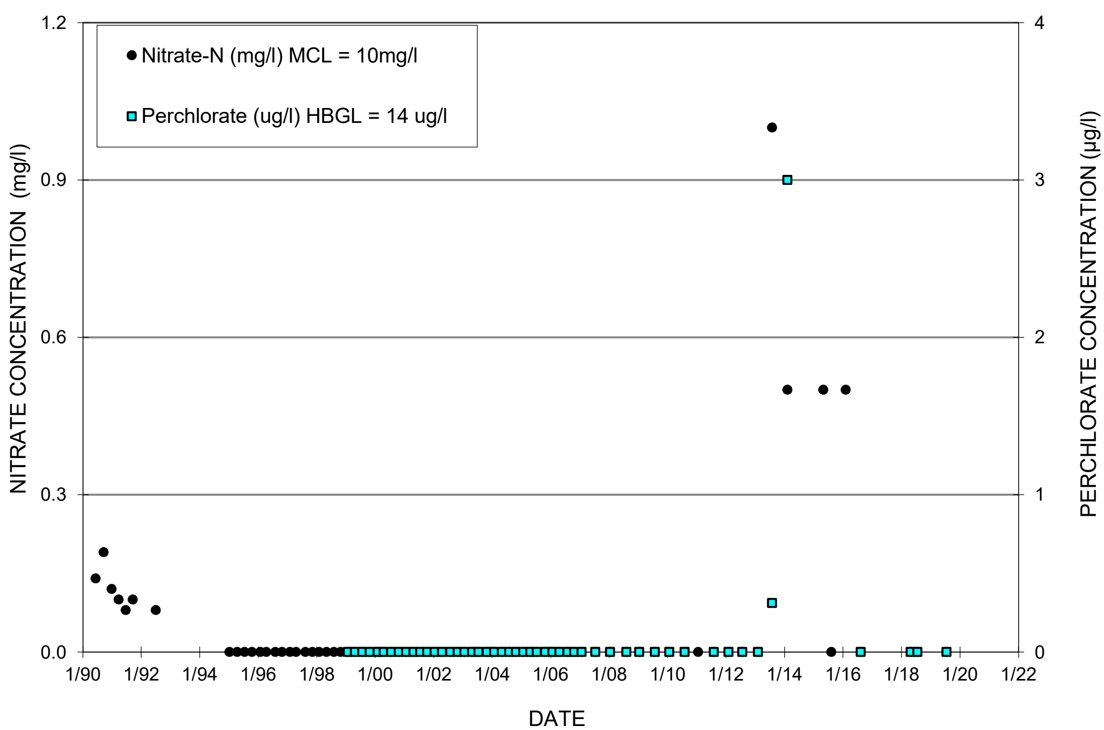


FIGURE A-14. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SOUTHERN AREA UPGRADIENT MONITOR WELL MW-24

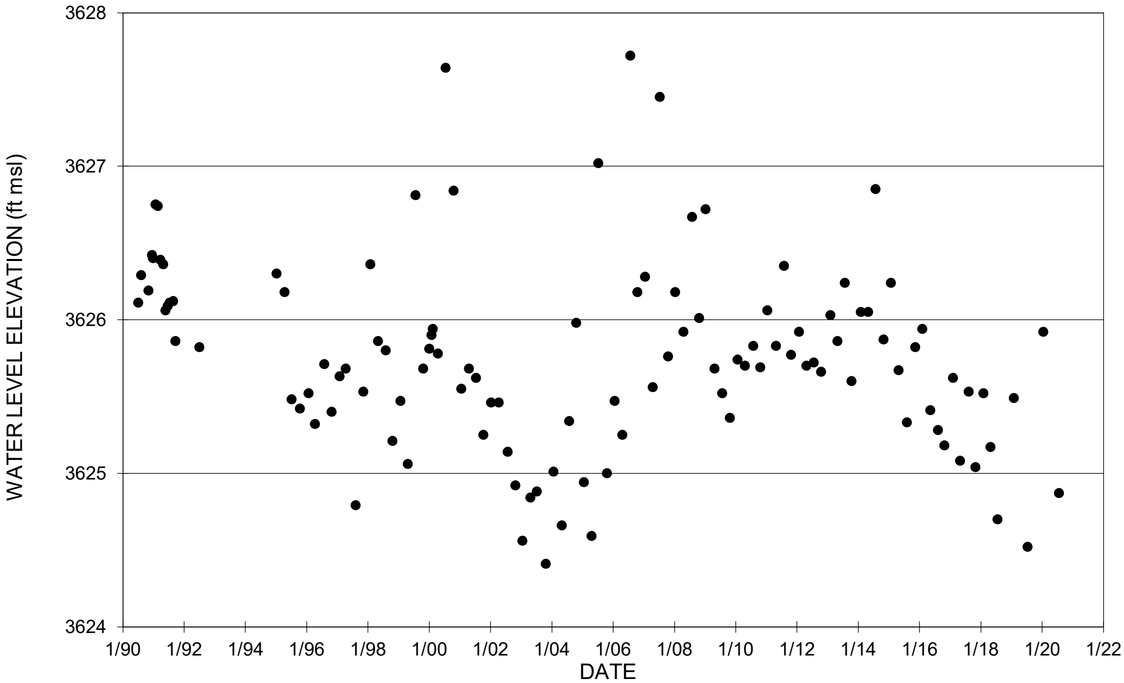


Shallow Aquifer Monitor Well MW-01

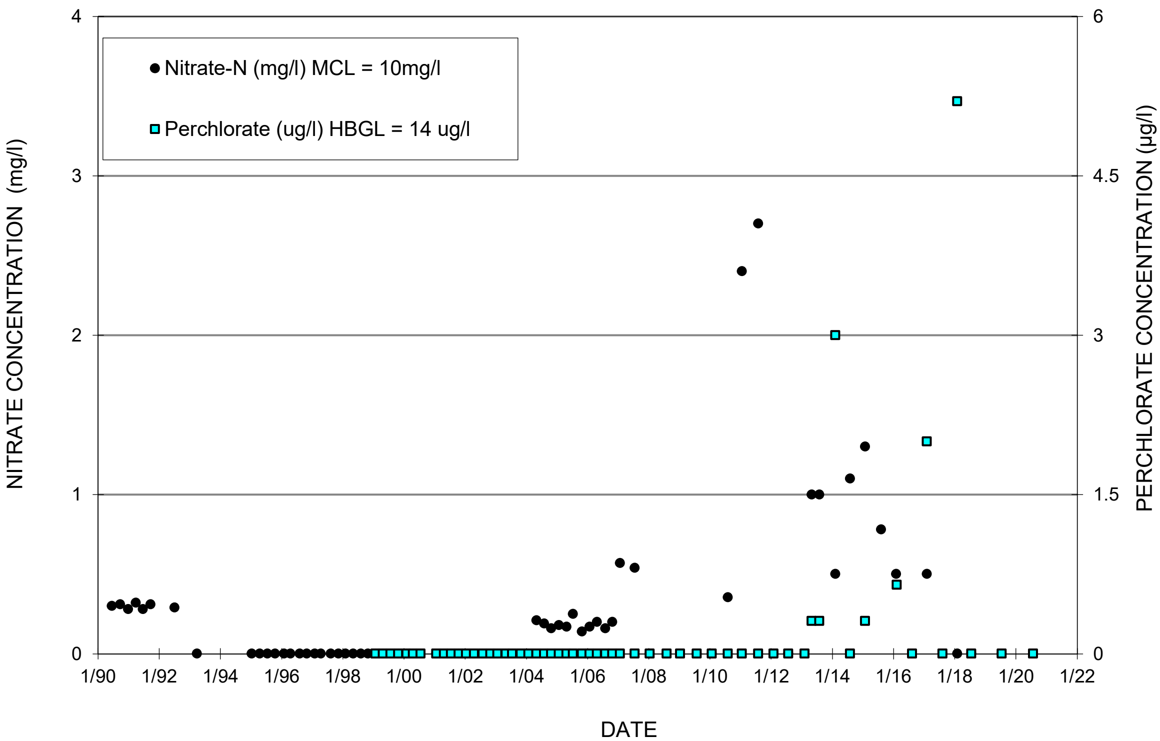


Shallow Aquifer Monitor Well MW-01

FIGURE A-15. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SOUTHERN AREA UPGRADIENT MONITOR WELL MW-01

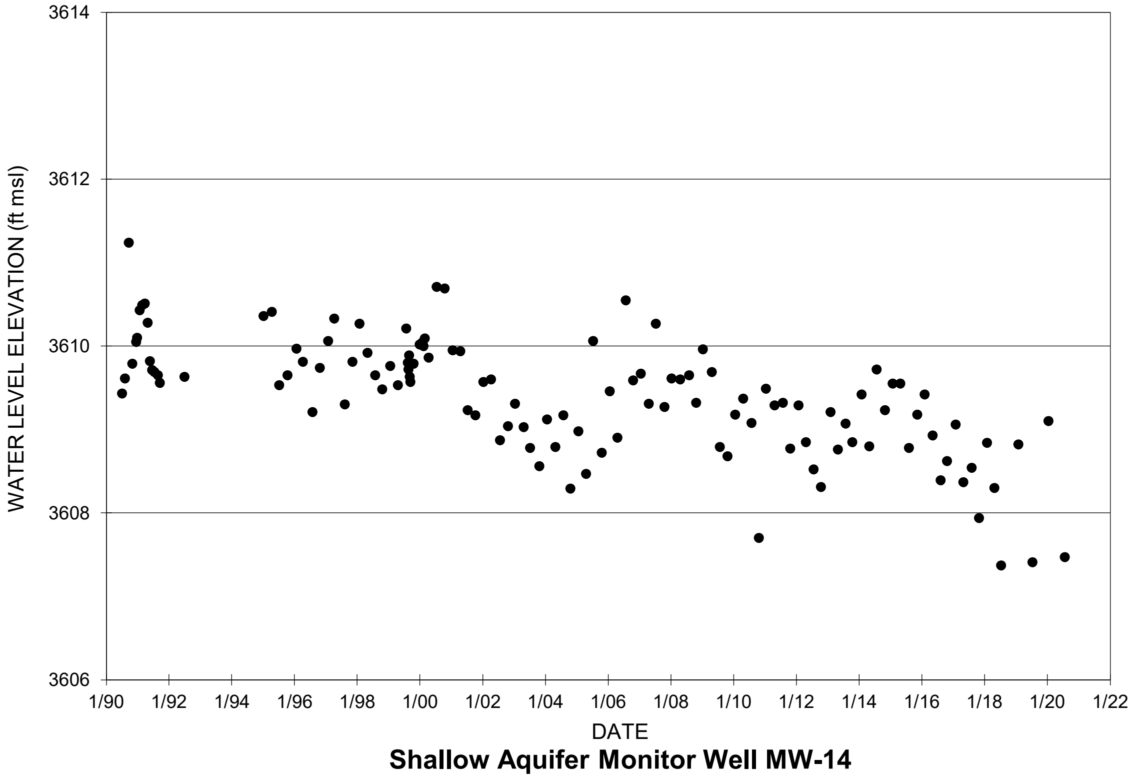


Shallow Aquifer Monitor Well MW-06



Shallow Aquifer Monitor Well MW-06

FIGURE A-16. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SOUTHERN AREA UPGRADIENT MONITOR WELL MW-06



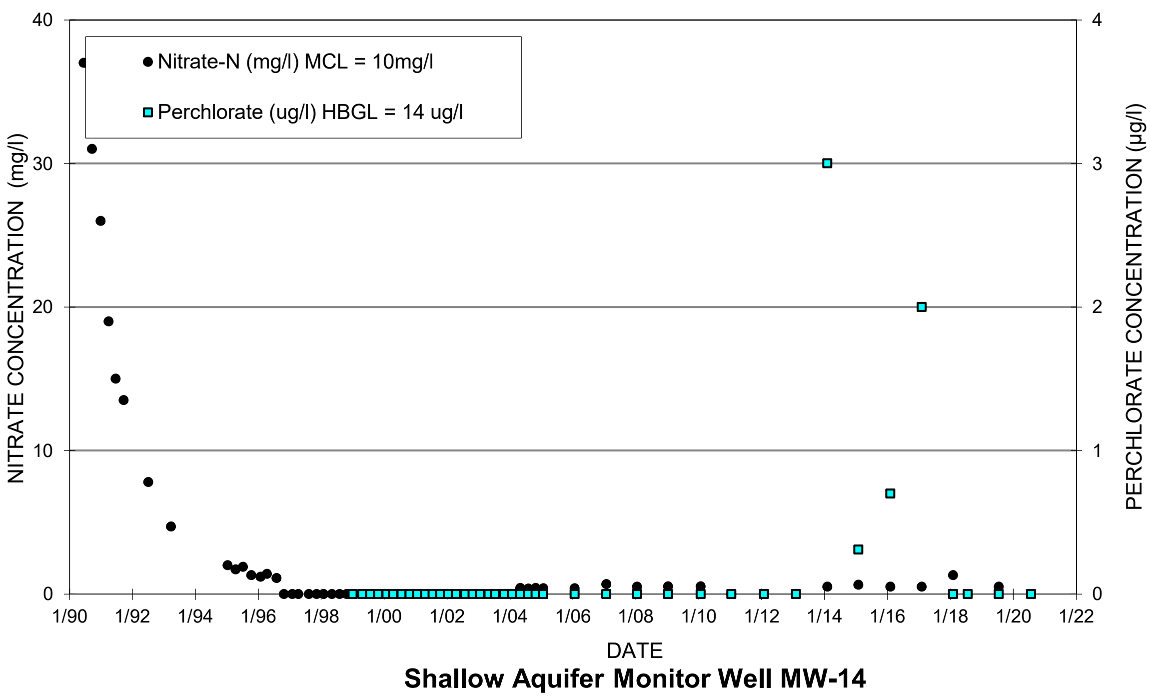
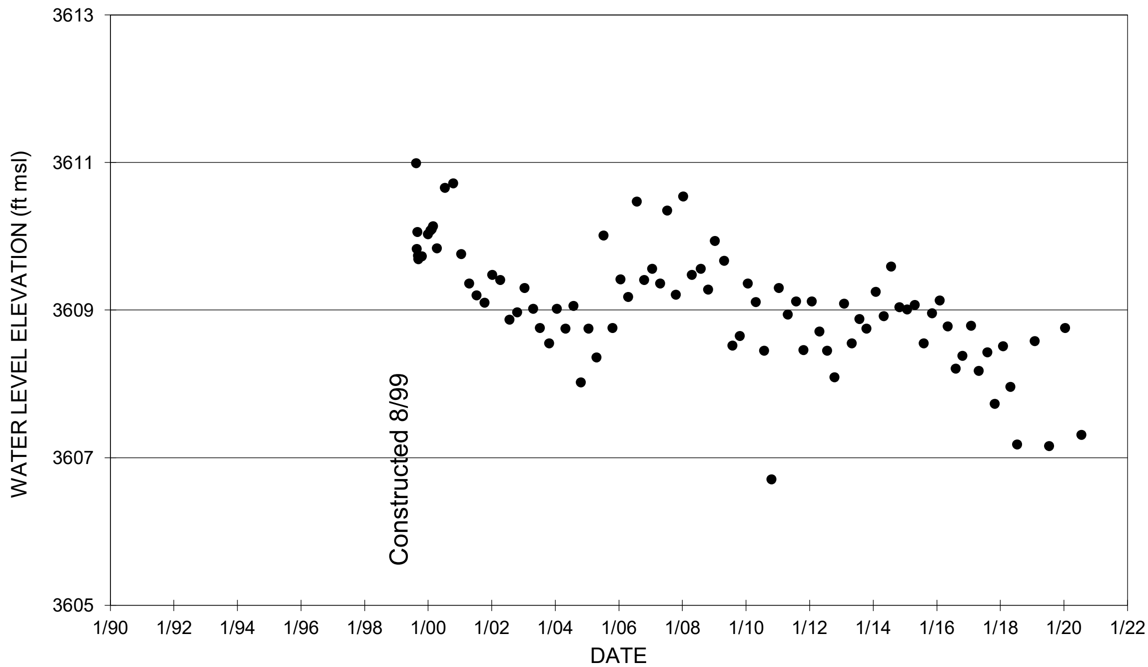
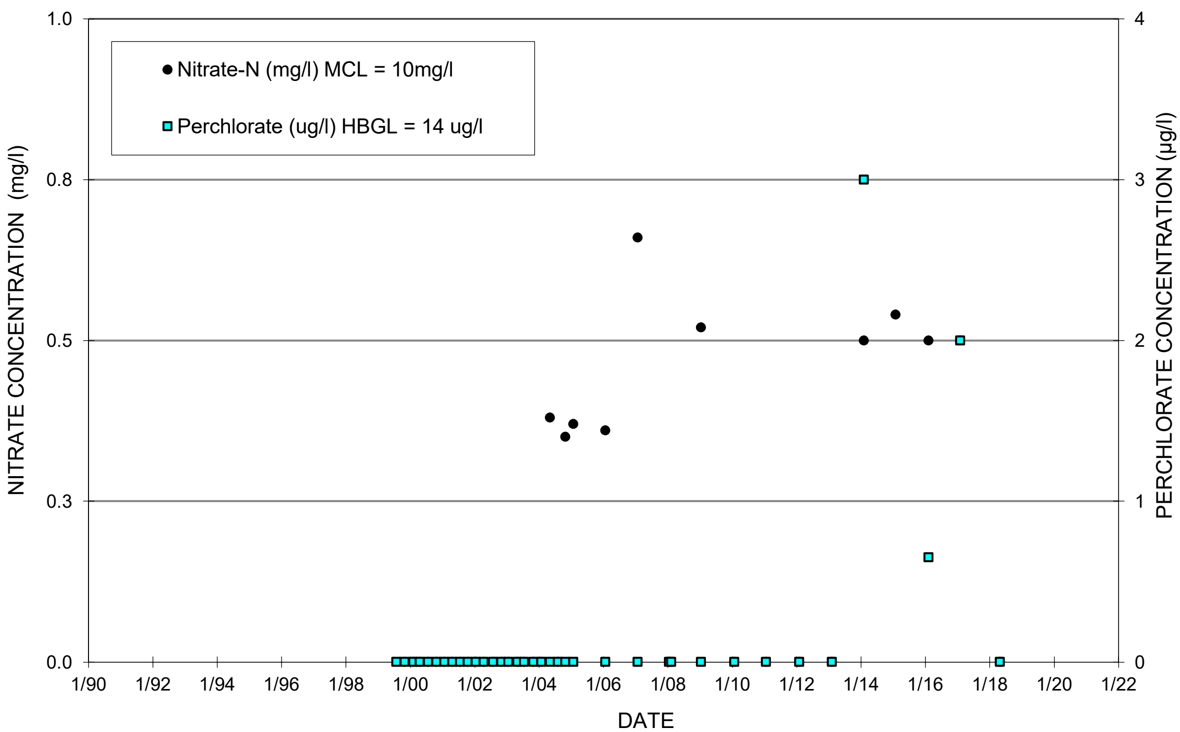


FIGURE A-17. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SOUTHERN AREA SENTINEL MONITOR WELL MW-14

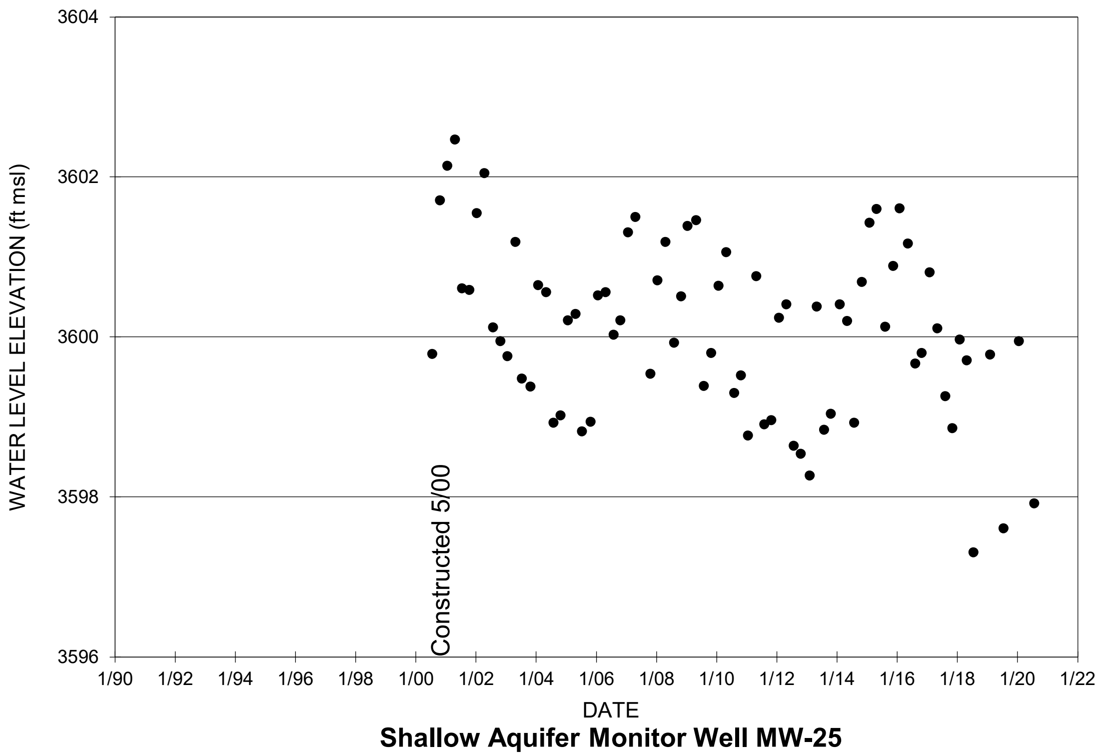


Shallow Aquifer Monitor Well MW-22



Shallow Aquifer Monitor Well MW-22

FIGURE A-18. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SOUTHERN AREA SENTINEL MONITOR WELL MW-22



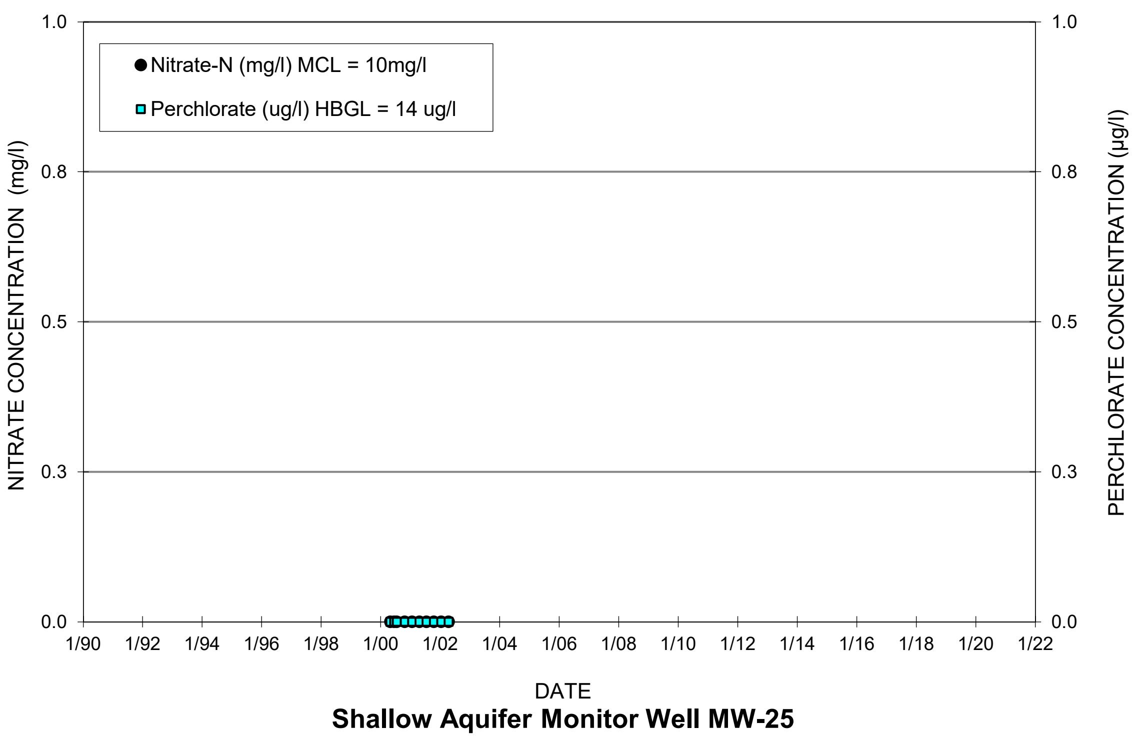
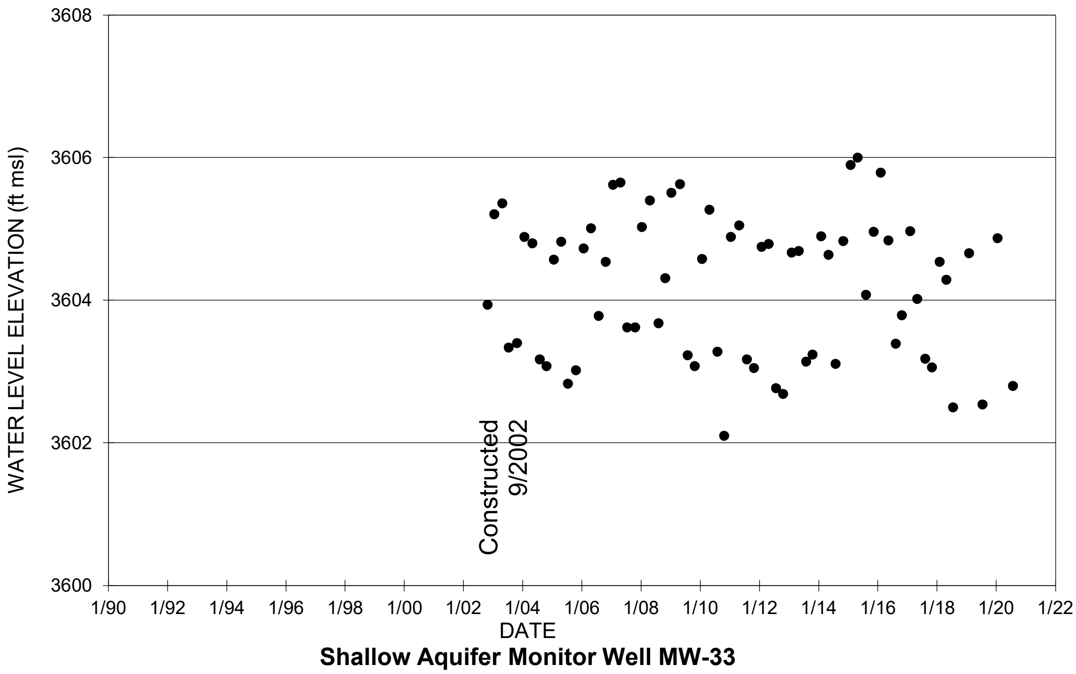


FIGURE A-19. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SOUTHERN AREA BUFFER ZONE MONITOR WELL MW-25



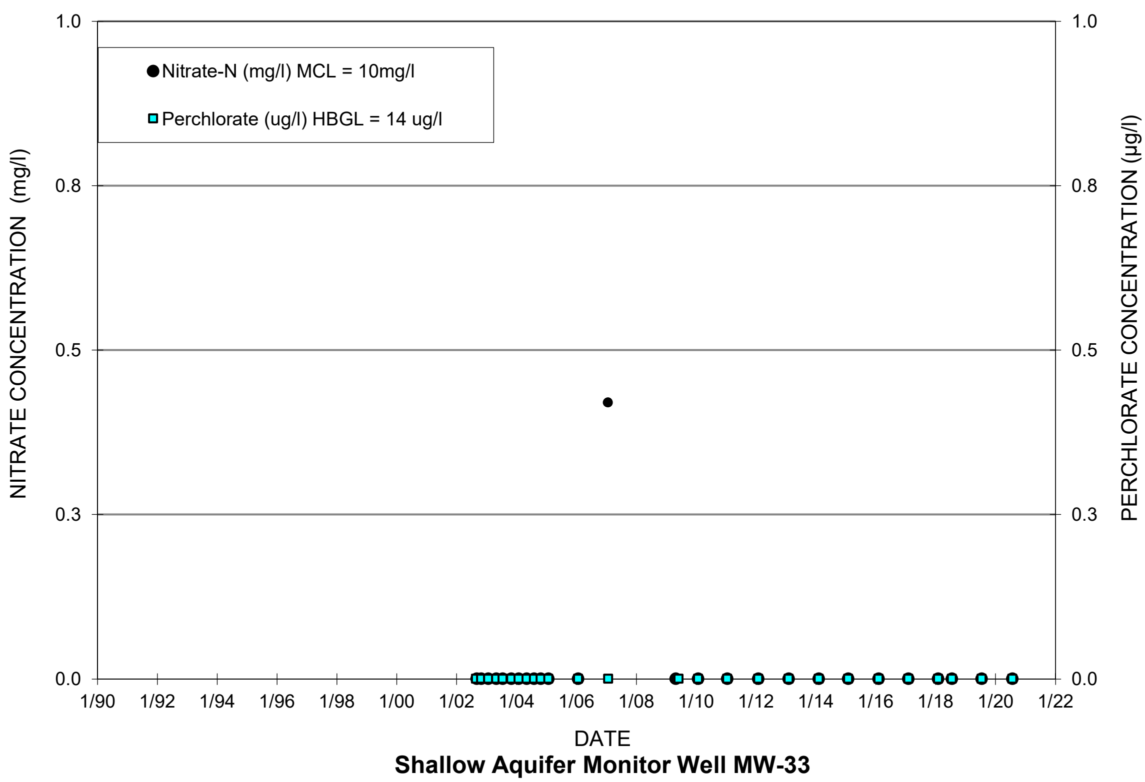
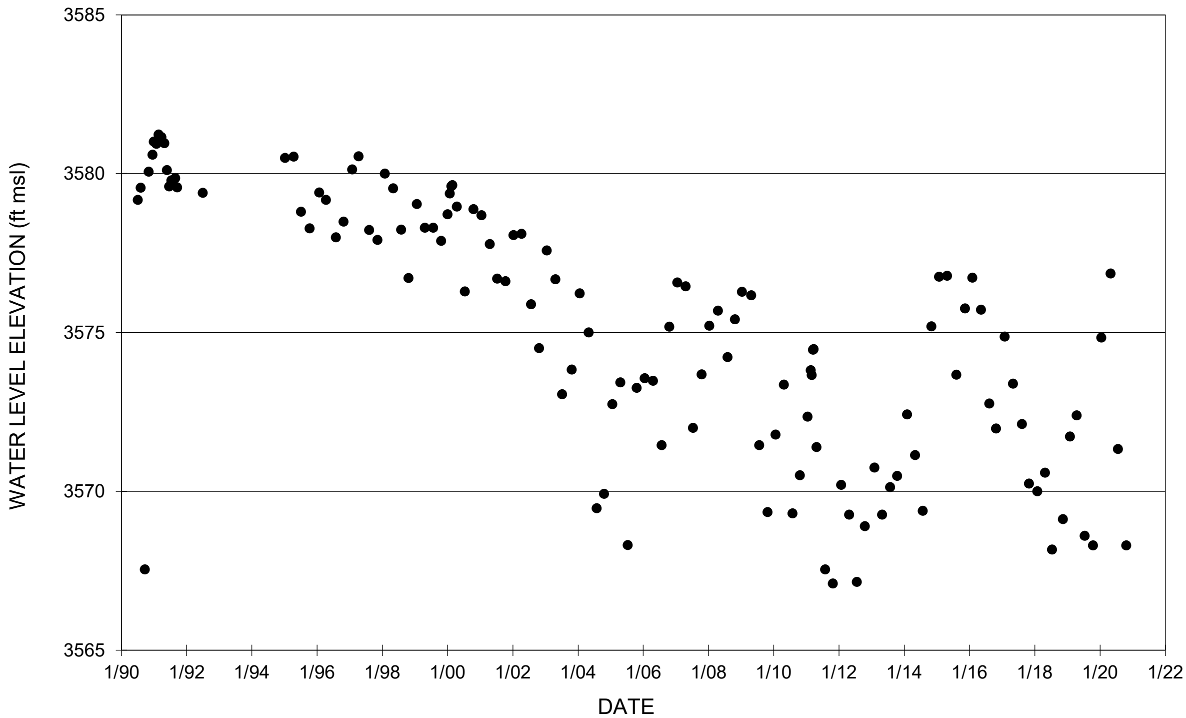
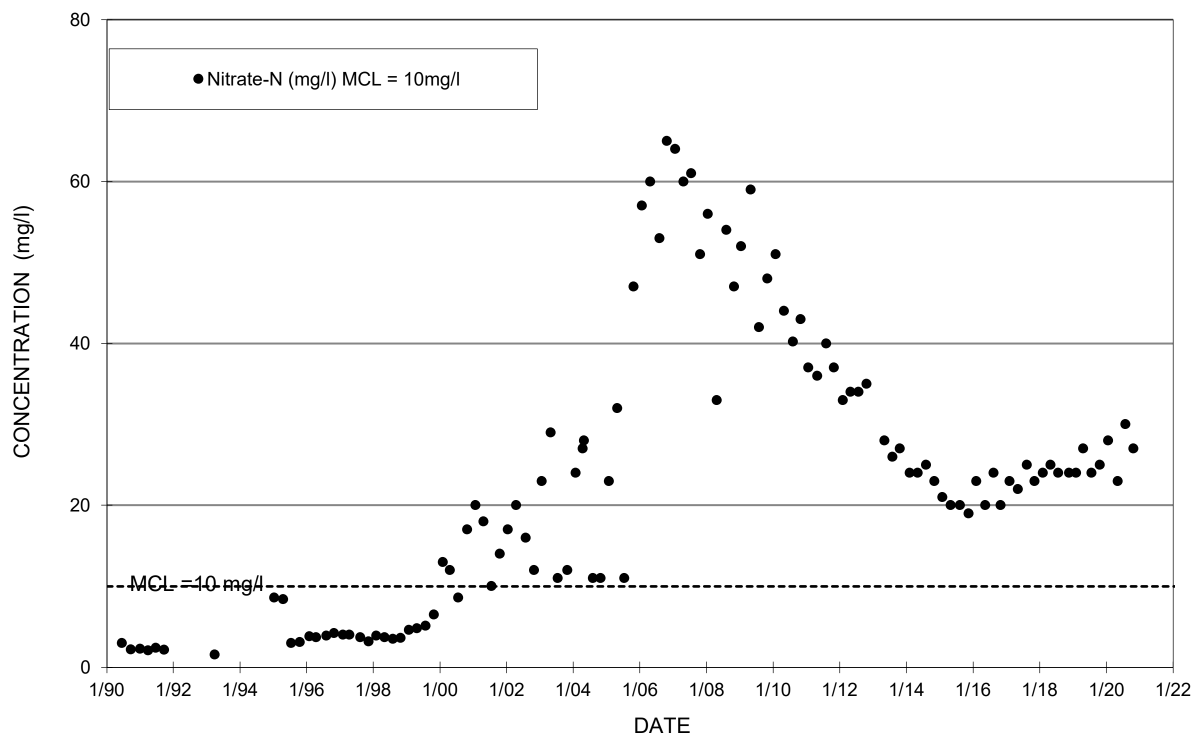


FIGURE A-20 WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SOUTHERN AREA BUFFER ZONE MONITOR WELL MW-33

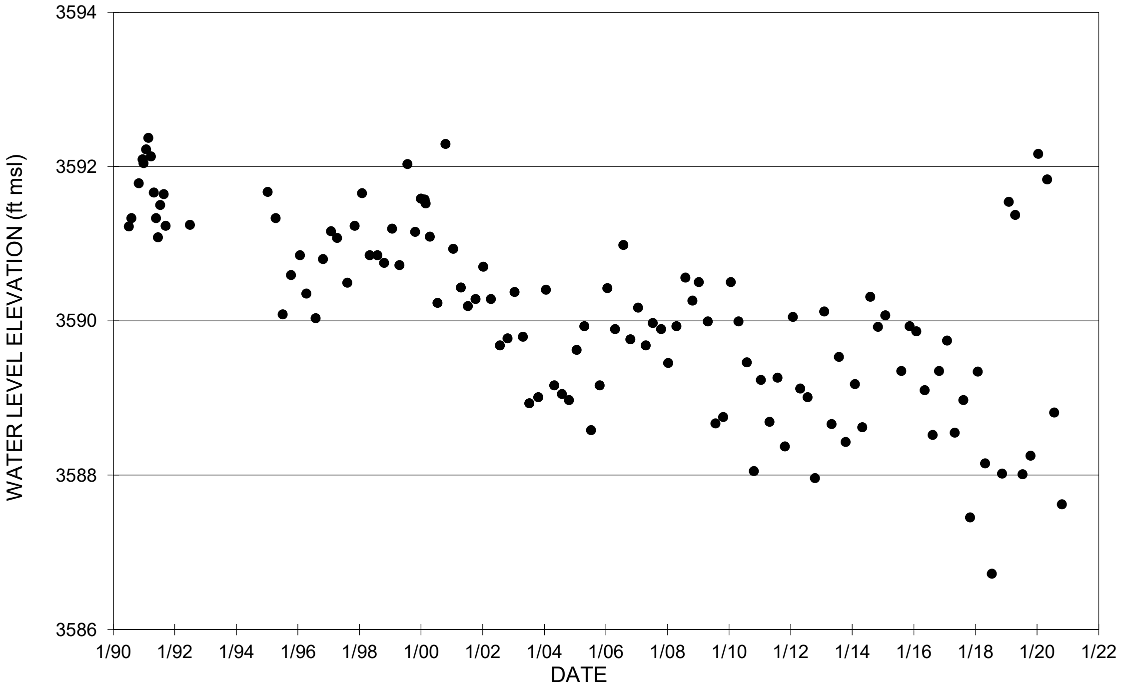


Shallow Aquifer Monitor Well MW-08

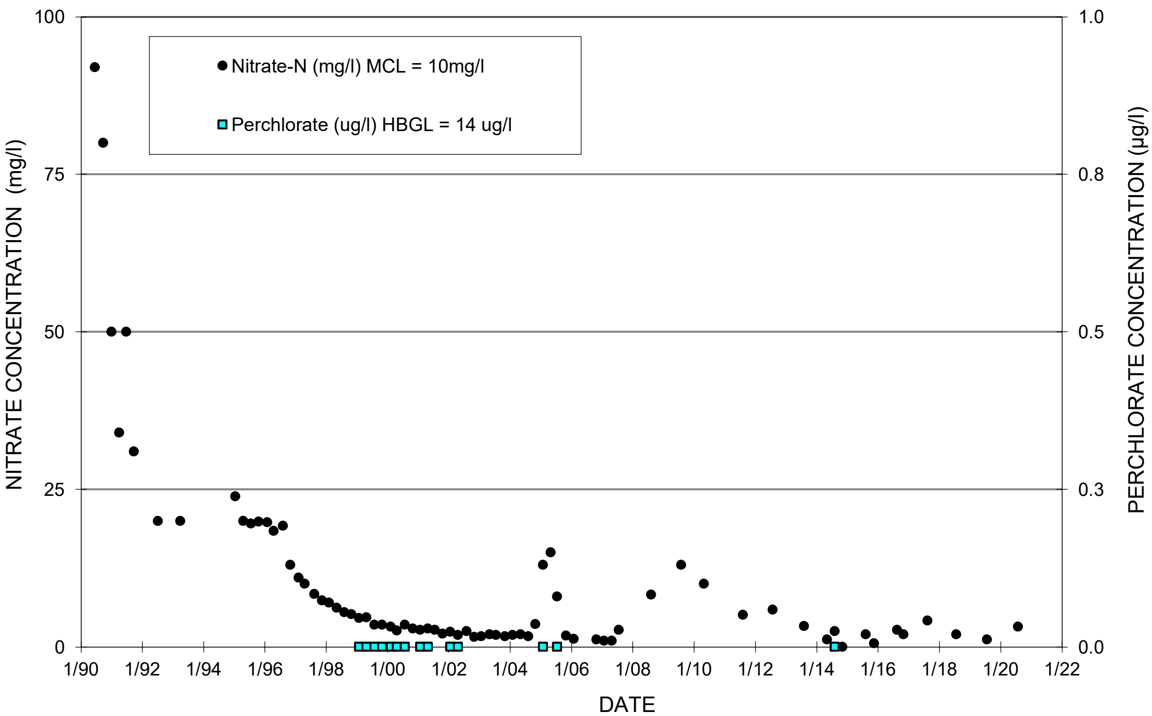


Shallow Aquifer Monitor Well MW-08

FIGURE A-21. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-08



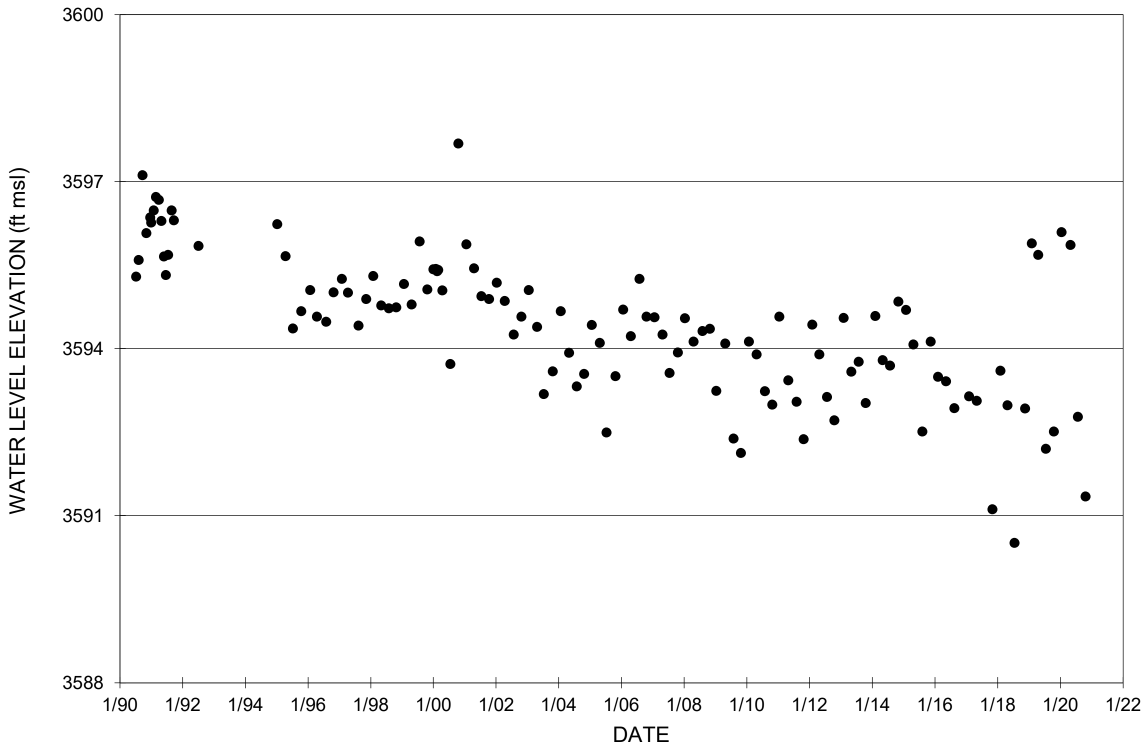
Shallow Aquifer Monitor Well MW-11



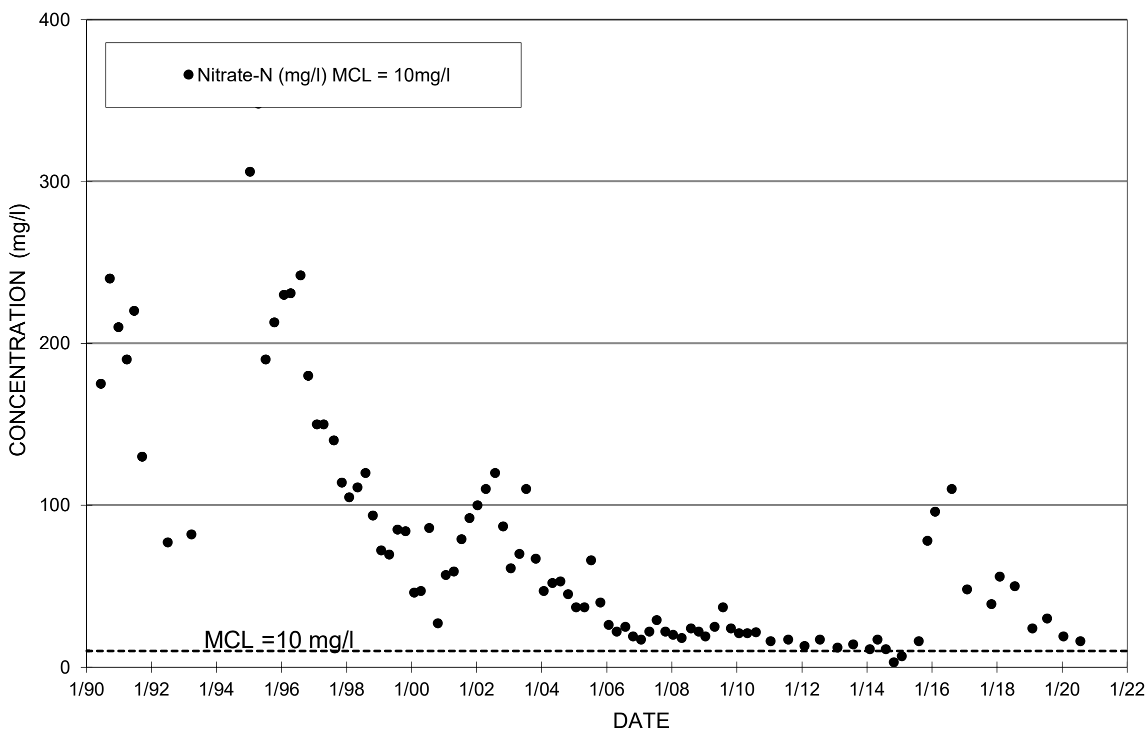
Shallow Aquifer Monitor Well MW-11

FIGURE A-22. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-11

HARGIS + ASSOCIATES, INC.

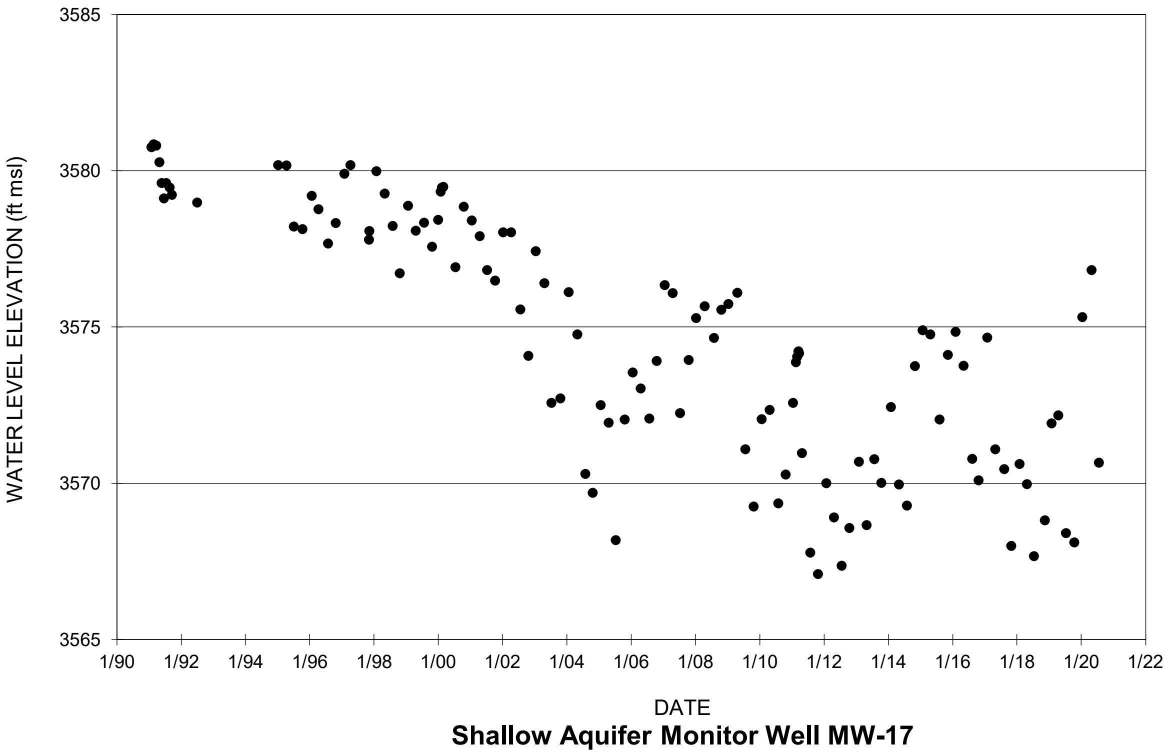


Shallow Aquifer Monitor Well MW-13



Shallow Aquifer Monitor Well MW-13

FIGURE A-23. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-13



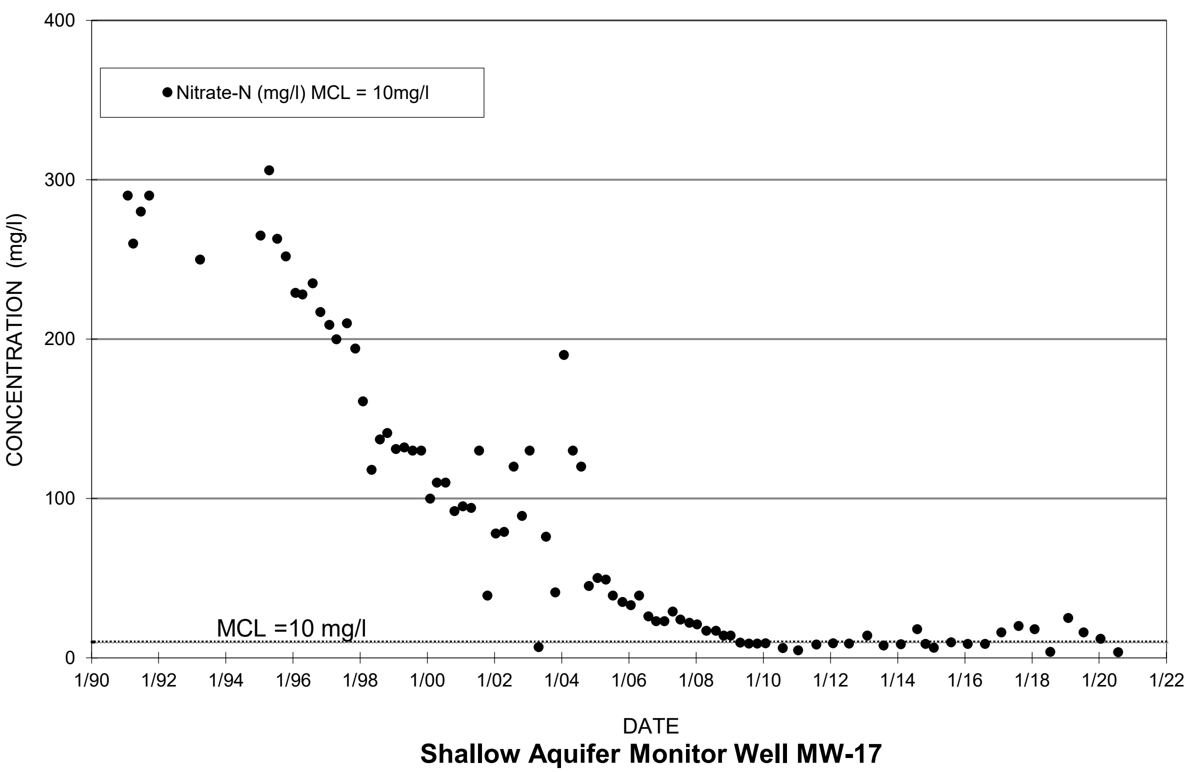
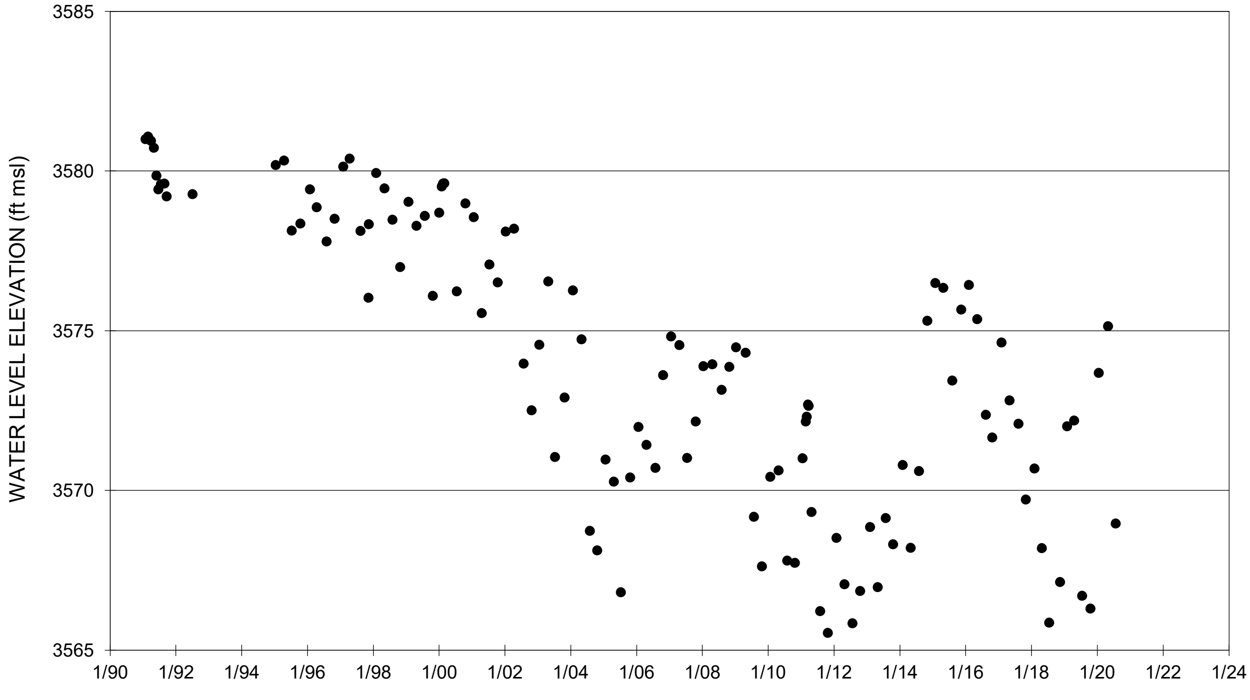
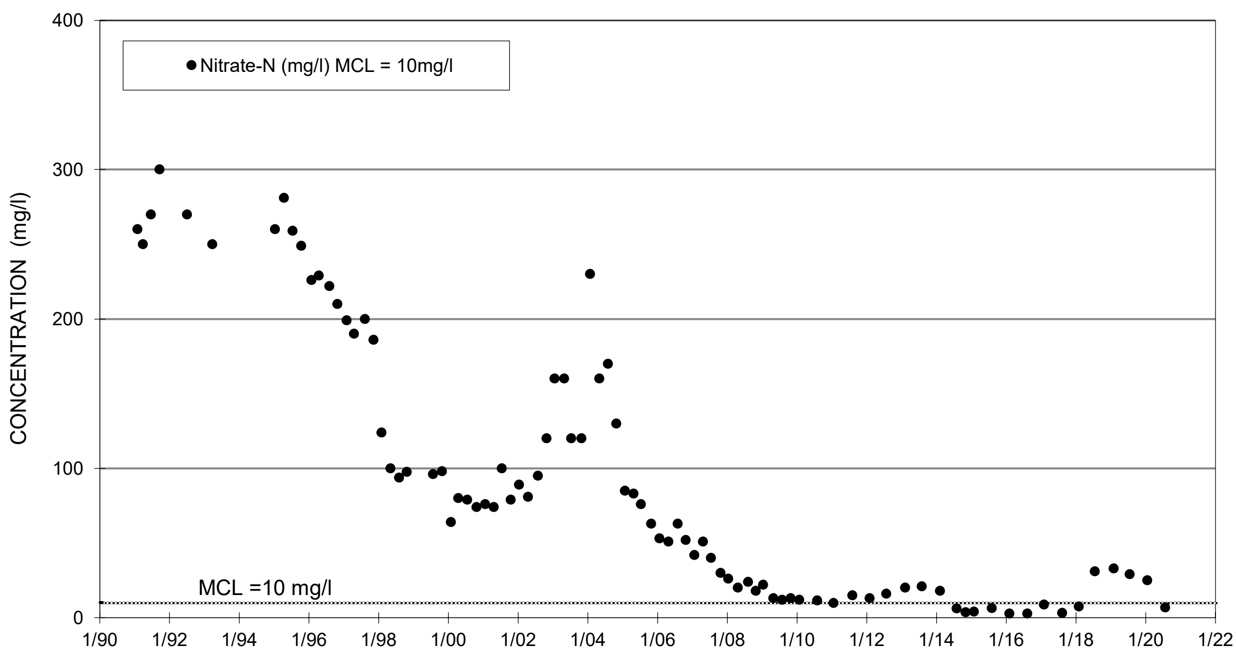


FIGURE A-24. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-17

HARGIS + ASSOCIATES, INC.



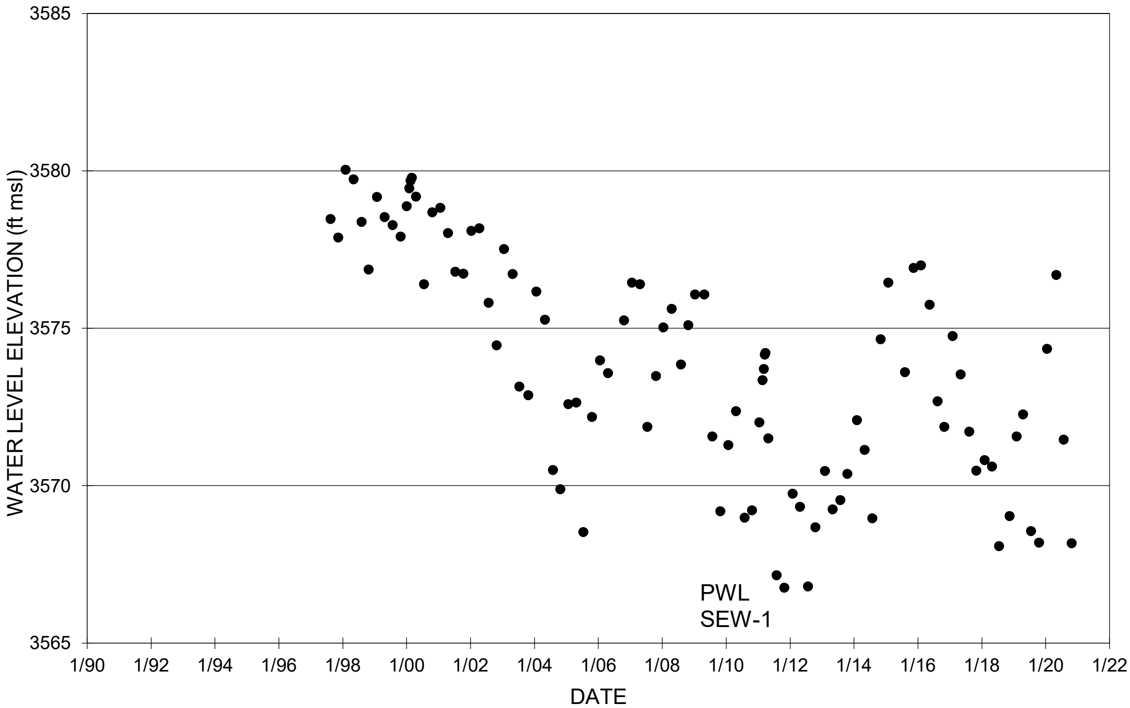
Shallow Aquifer Monitor Well MW-18



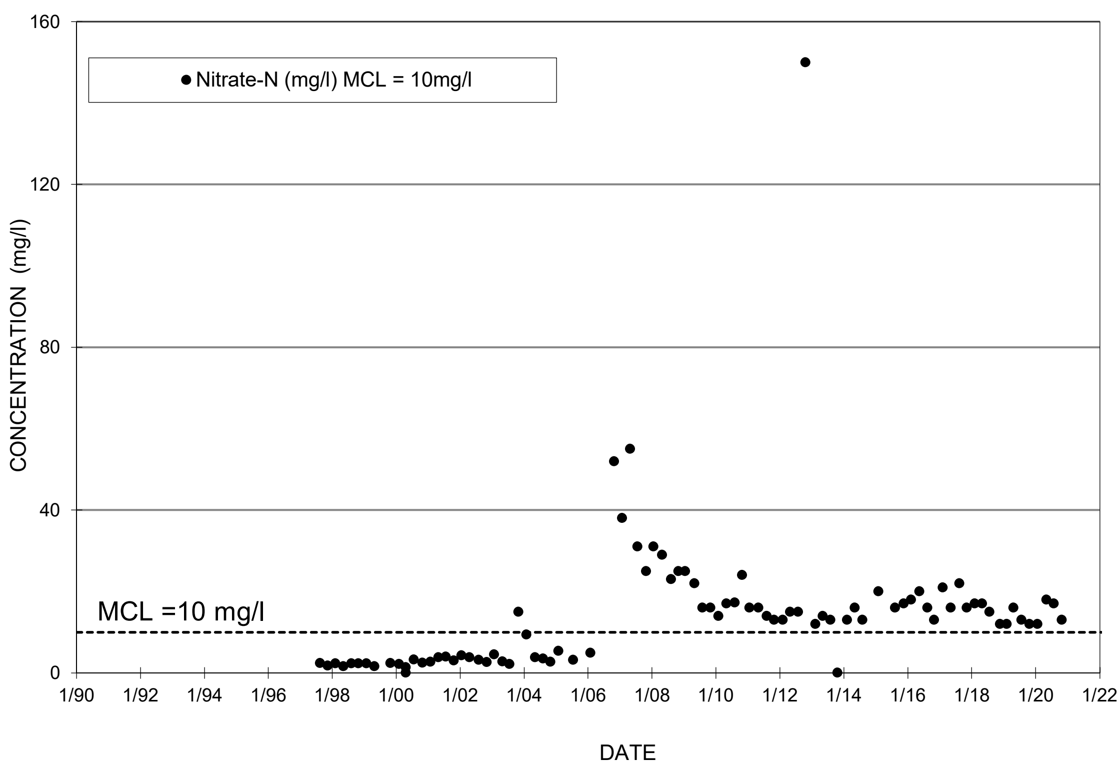
Shallow Aquifer Monitor Well MW-18

FIGURE A-25. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-18

HARGIS + ASSOCIATES, INC.

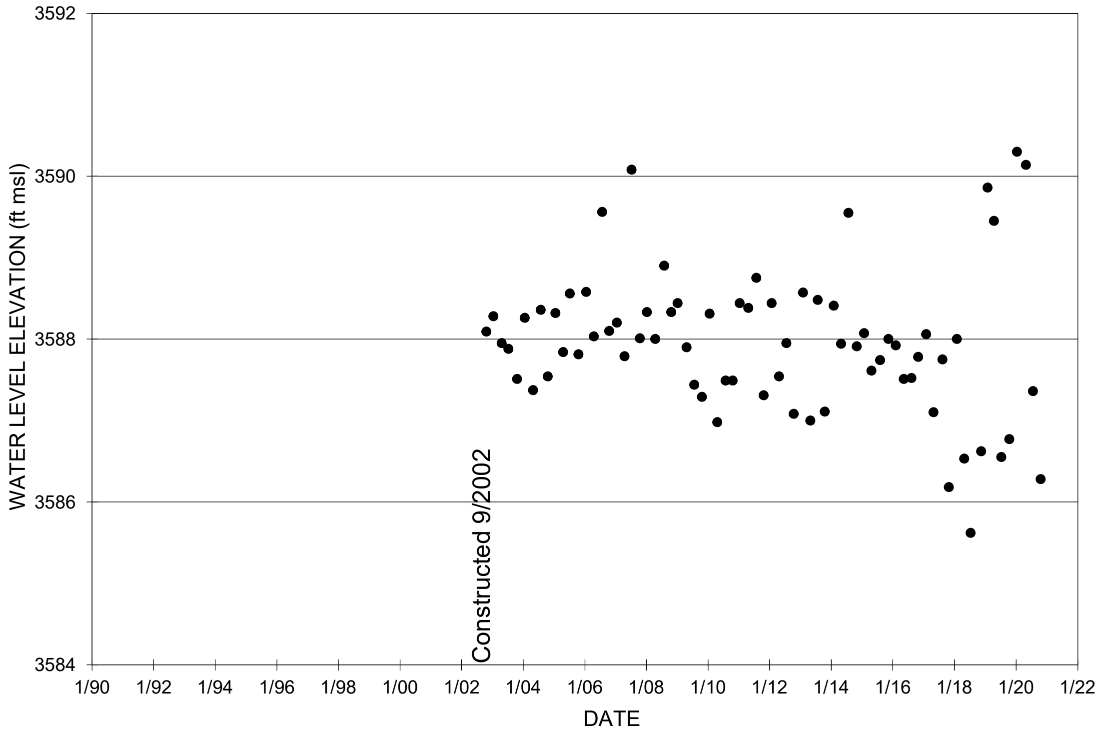


Shallow Aquifer Monitor Well MW-19

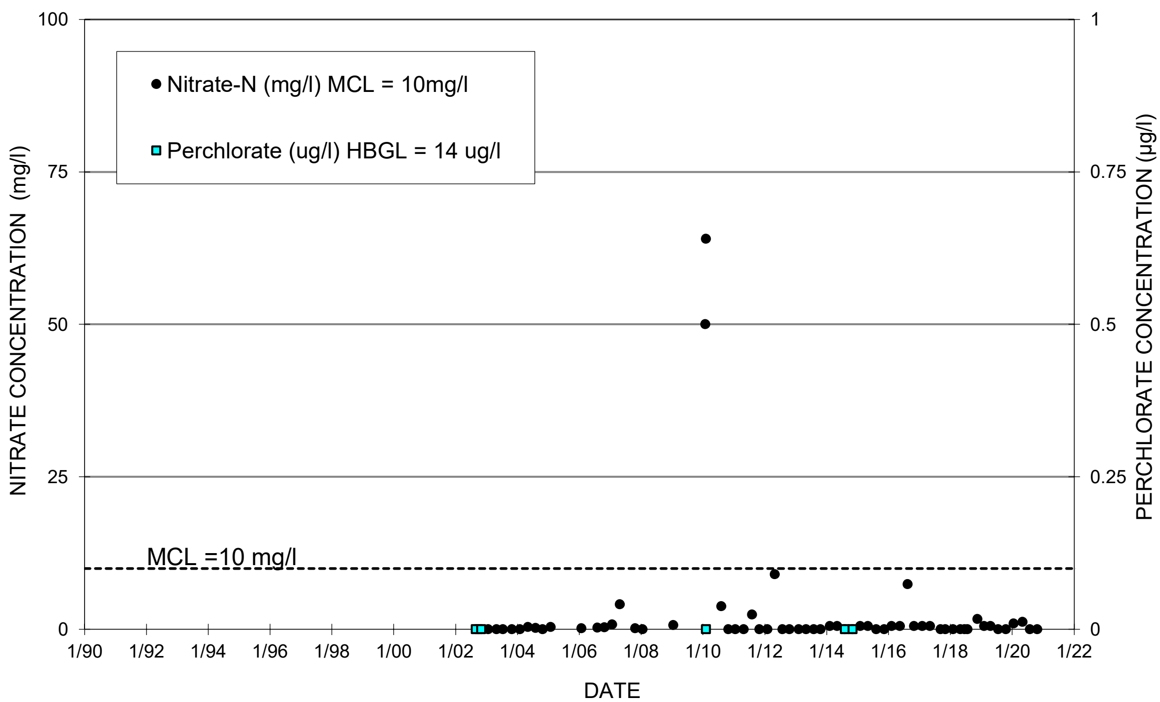


Shallow Aquifer Monitor Well MW-19

FIGURE A-26. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-19

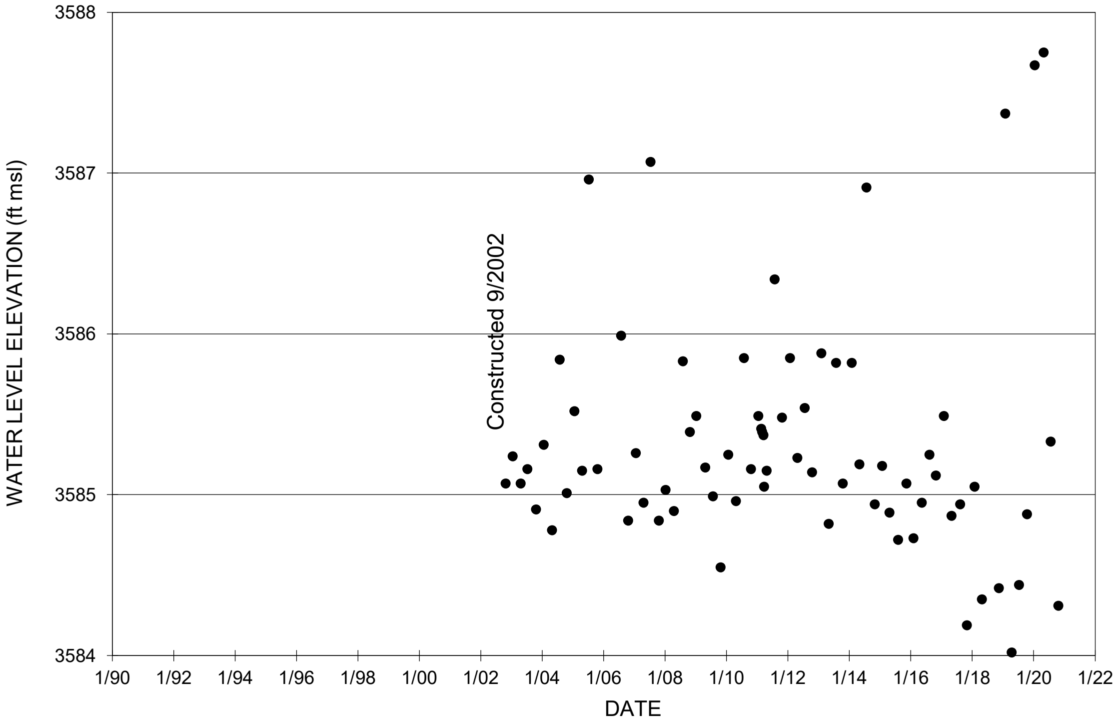


Shallow Aquifer Monitor Well MW-34

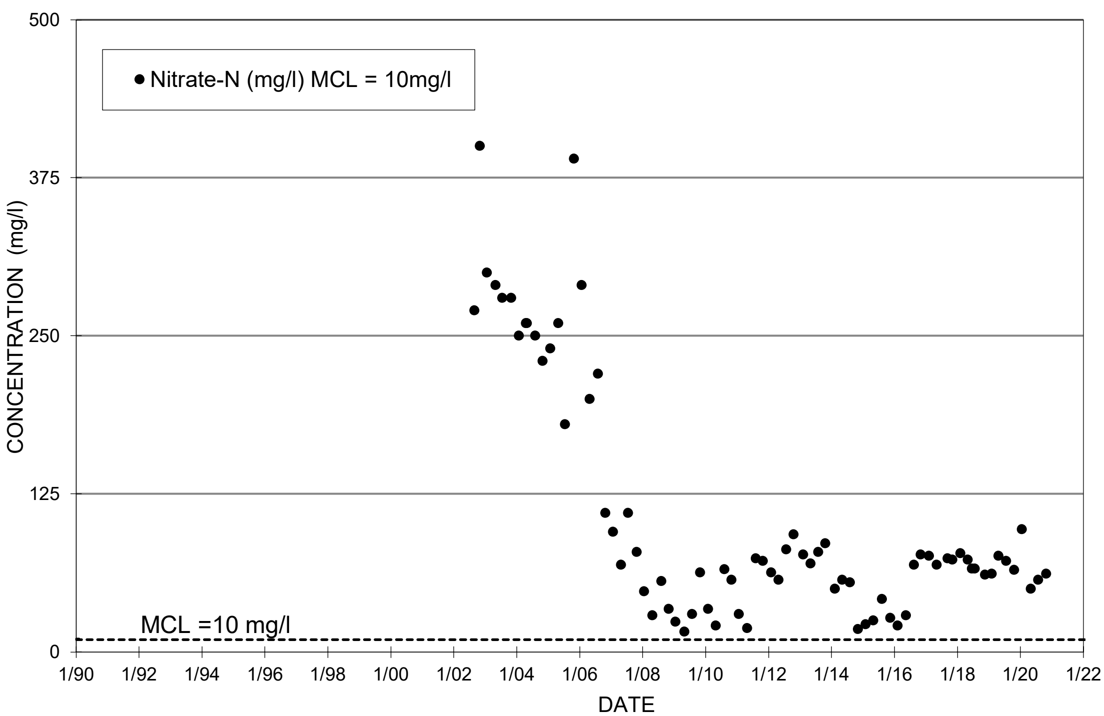


Shallow Aquifer Monitor Well MW-34

FIGURE A-27. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-34

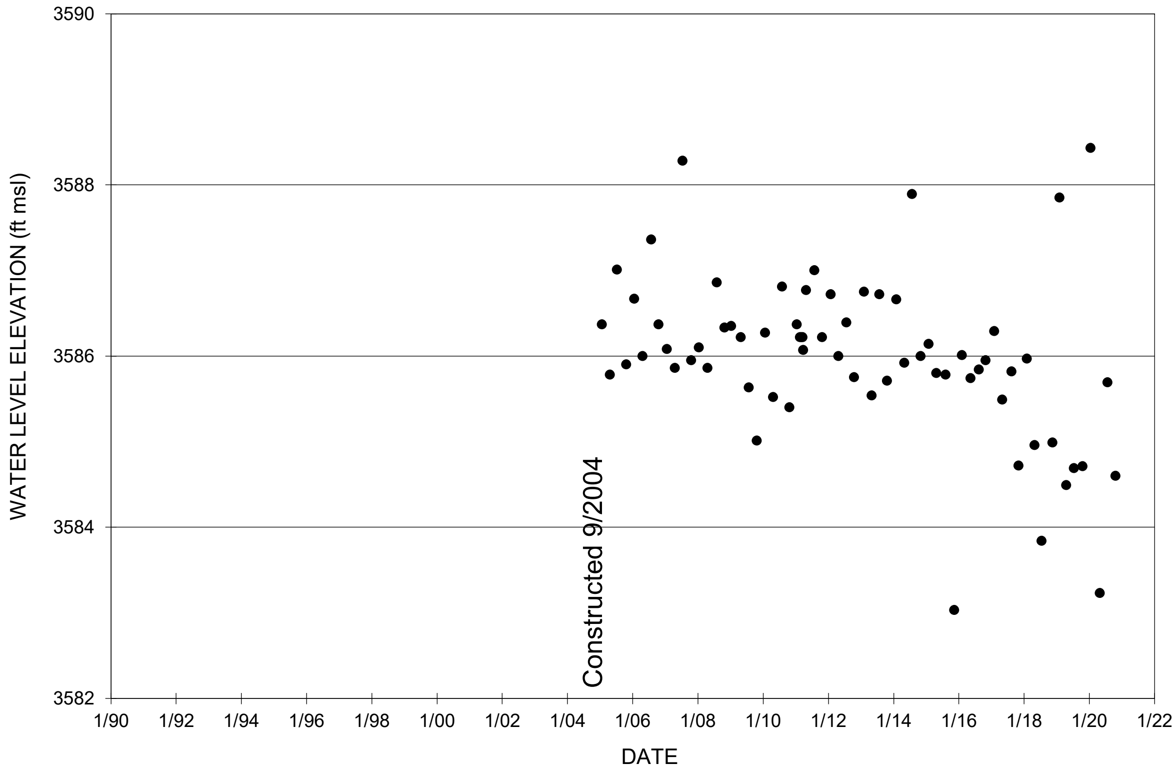


Shallow Aquifer Monitor Well MW-35

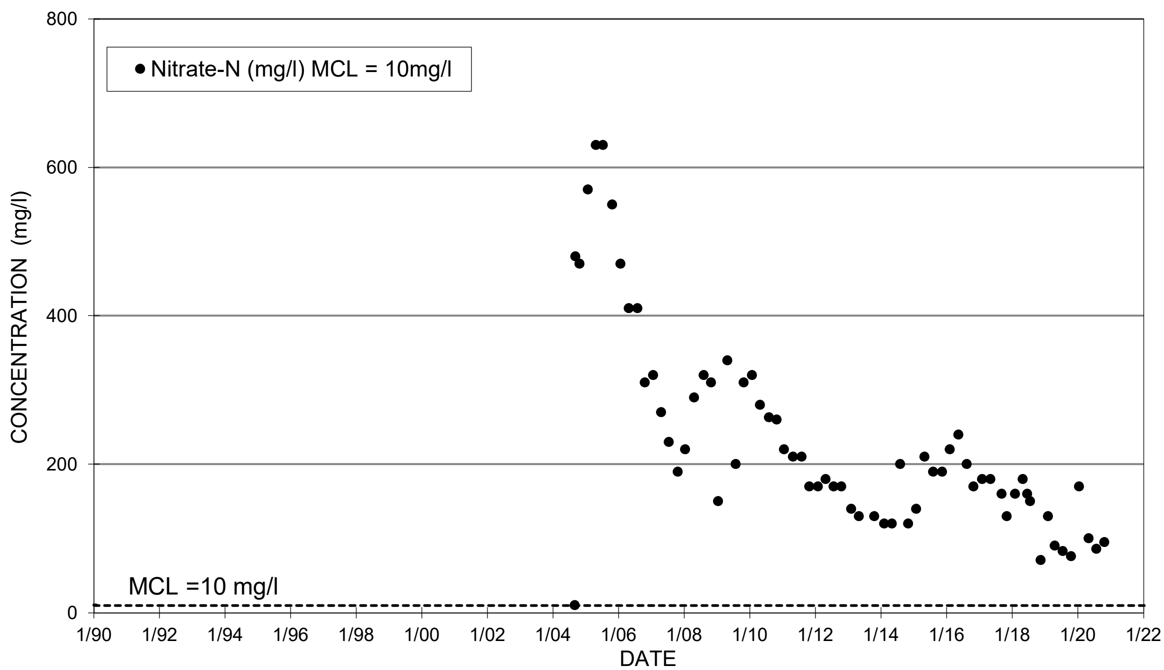


Shallow Aquifer Monitor Well MW-35

FIGURE A-28. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-35



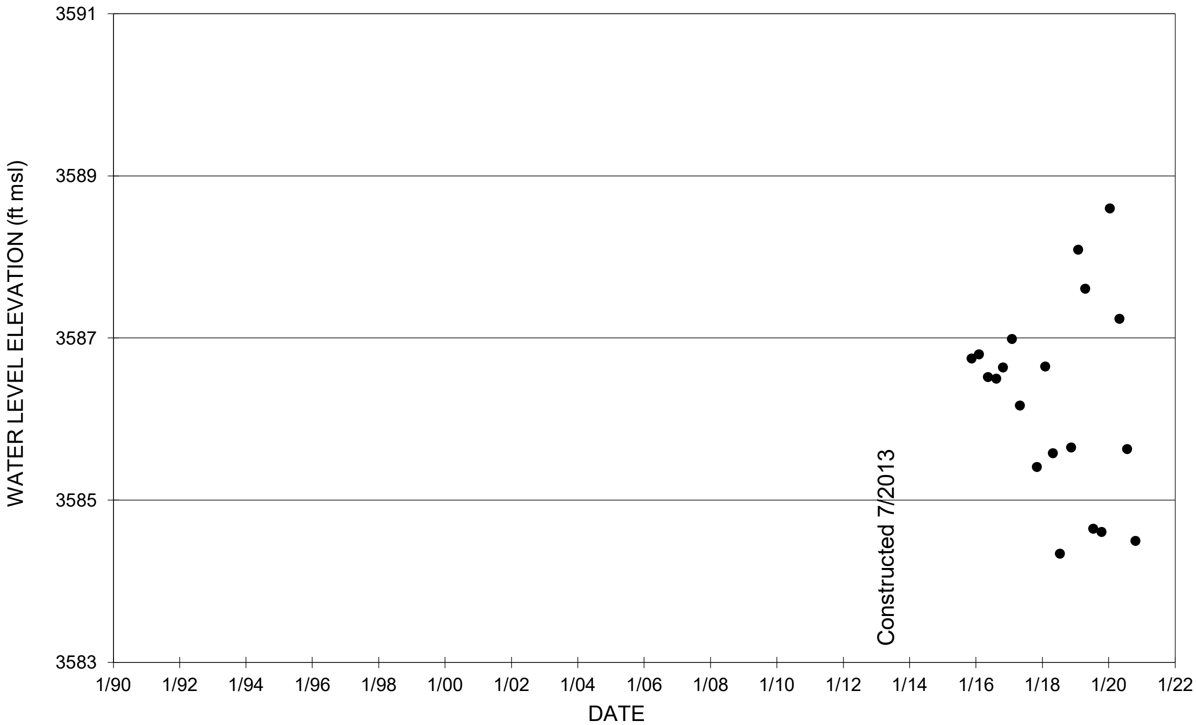
Shallow Aquifer Monitor Well MW-36



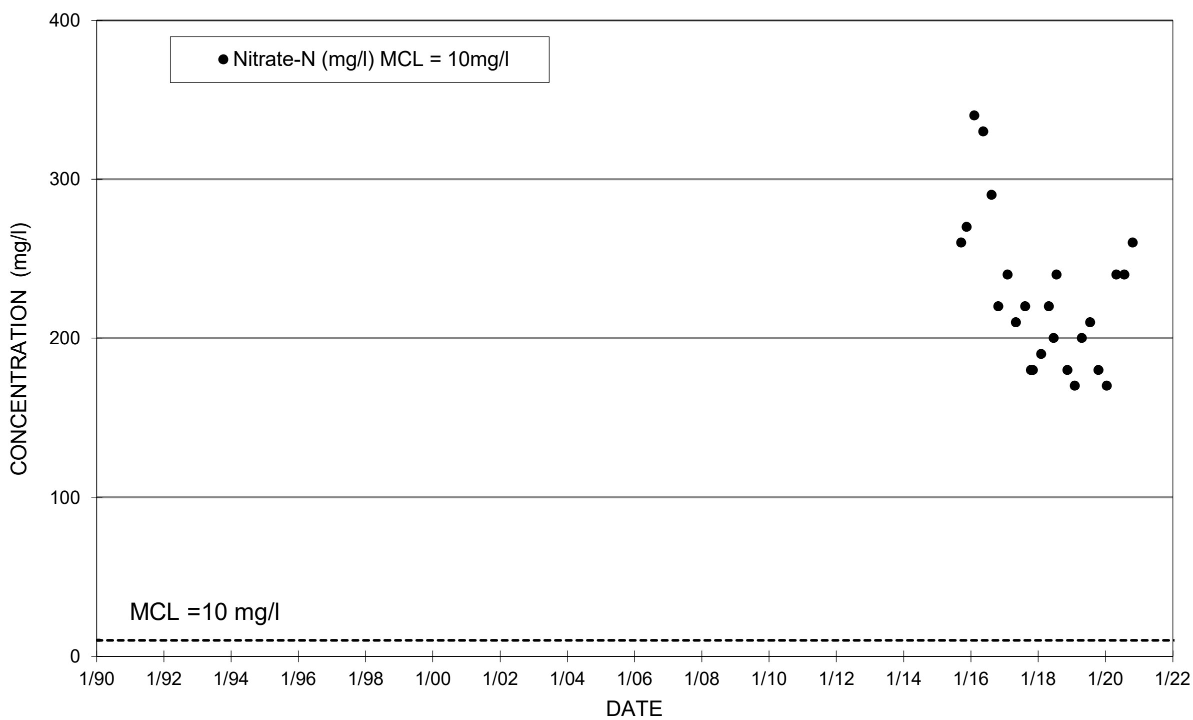
Shallow Aquifer Monitor Well MW-36

FIGURE A-29. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-36

HARGIS + ASSOCIATES, INC.

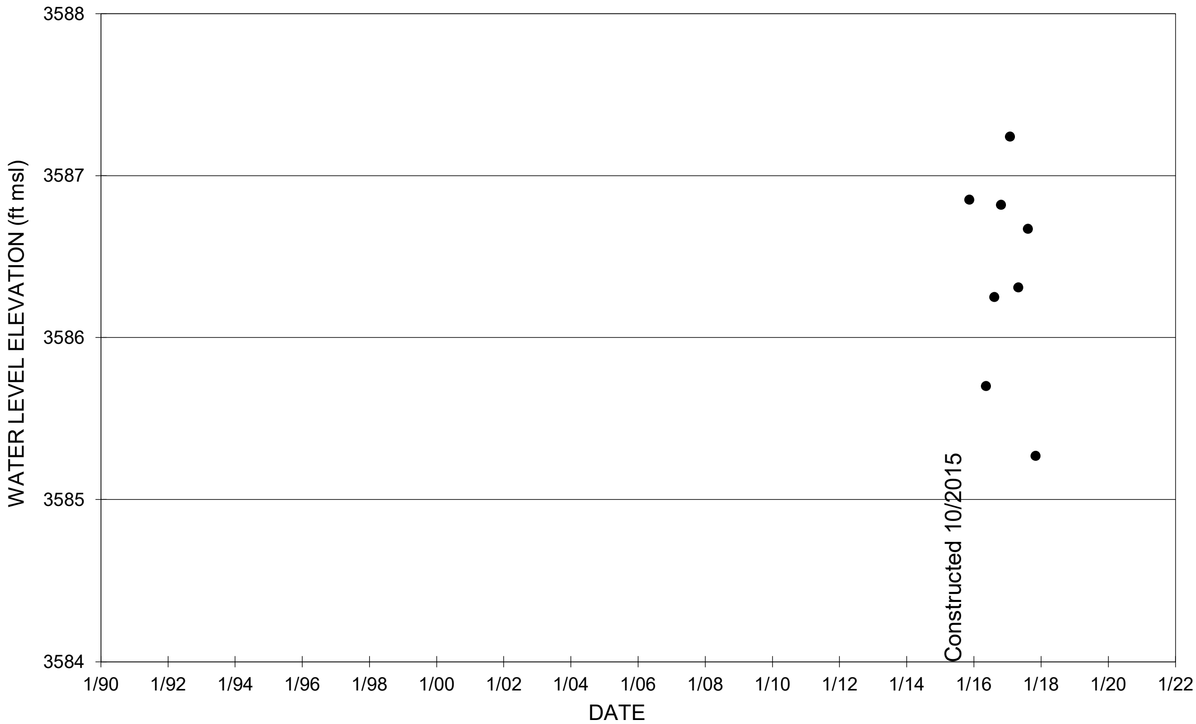


Shallow Aquifer Monitor Well MW-45

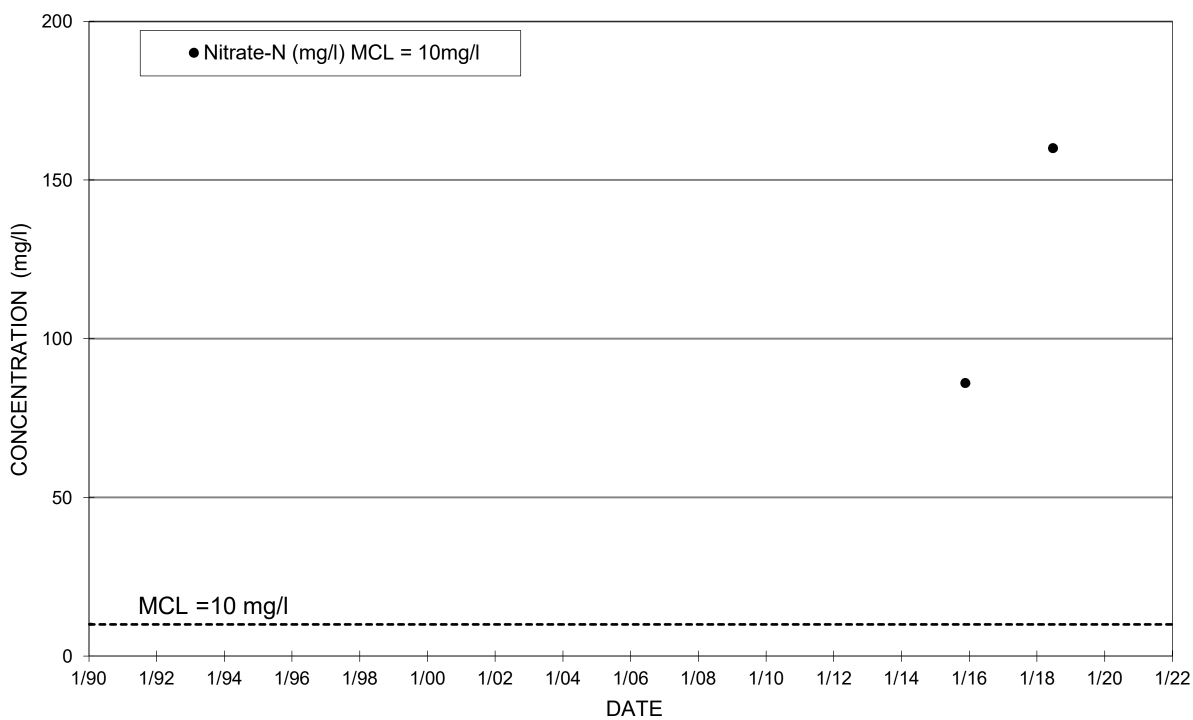


Shallow Aquifer Monitor Well MW-45

FIGURE A-30. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-45

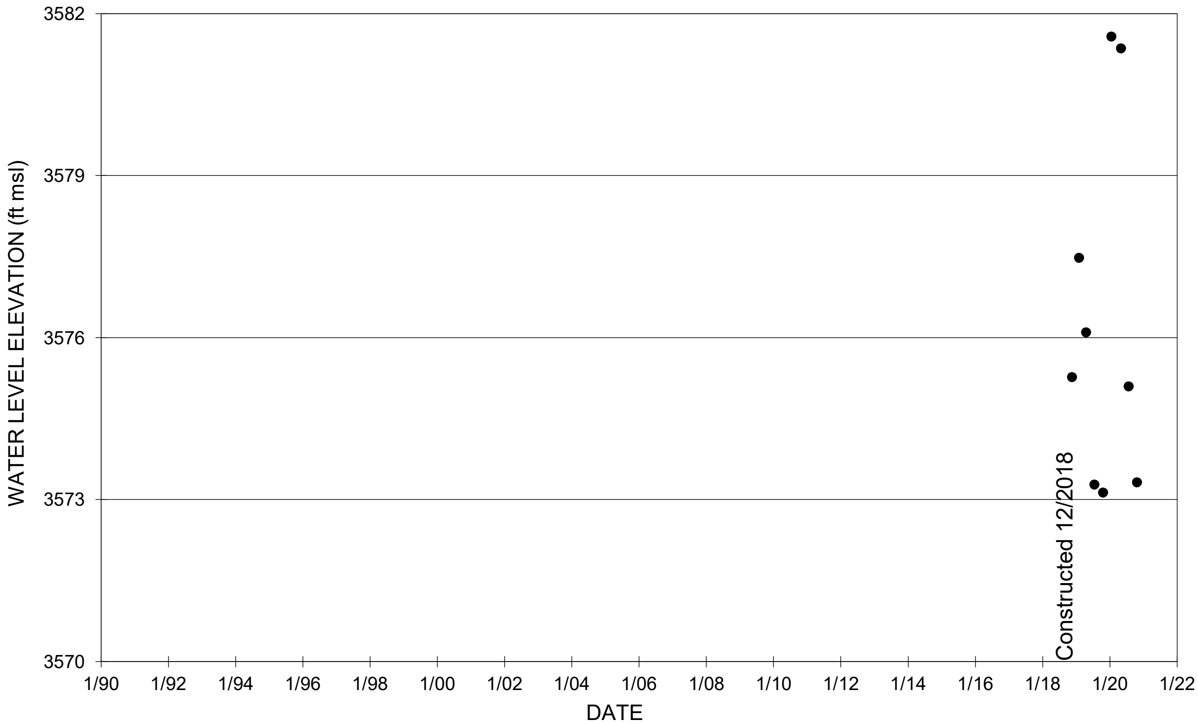


Shallow Aquifer Monitor Well MW-46

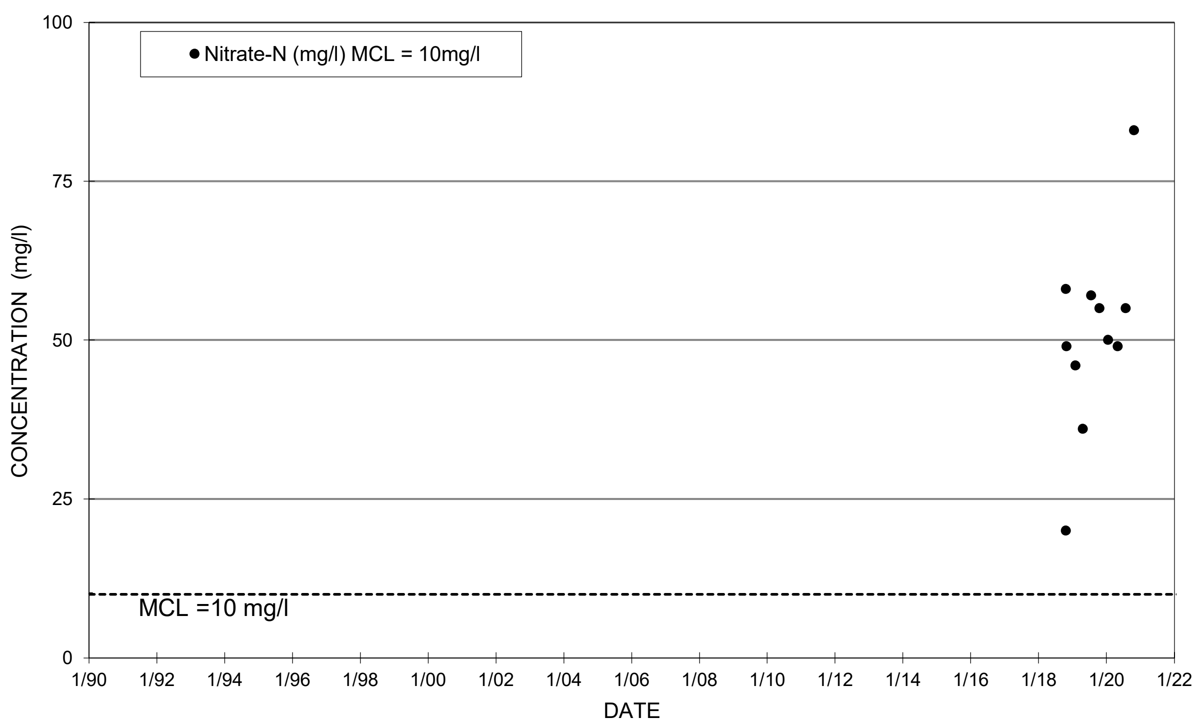


Shallow Aquifer Monitor Well MW-46

FIGURE A-31. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL MW-46

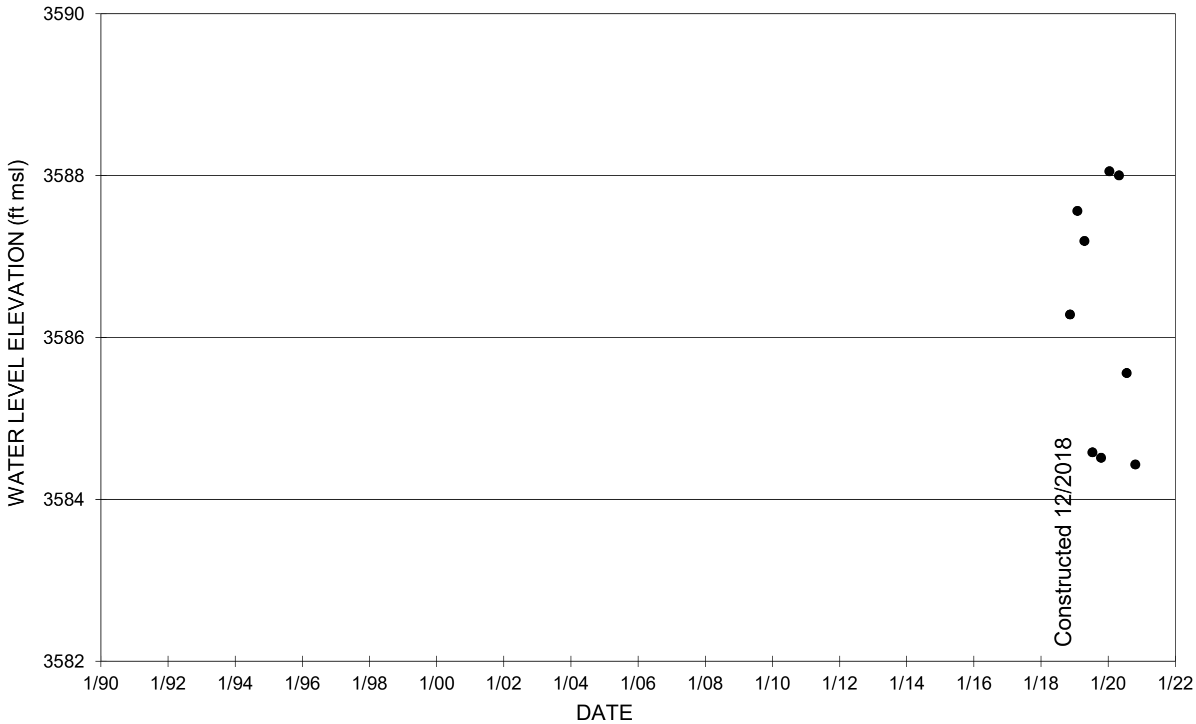


Shallow Aquifer Monitor Well PB-2A

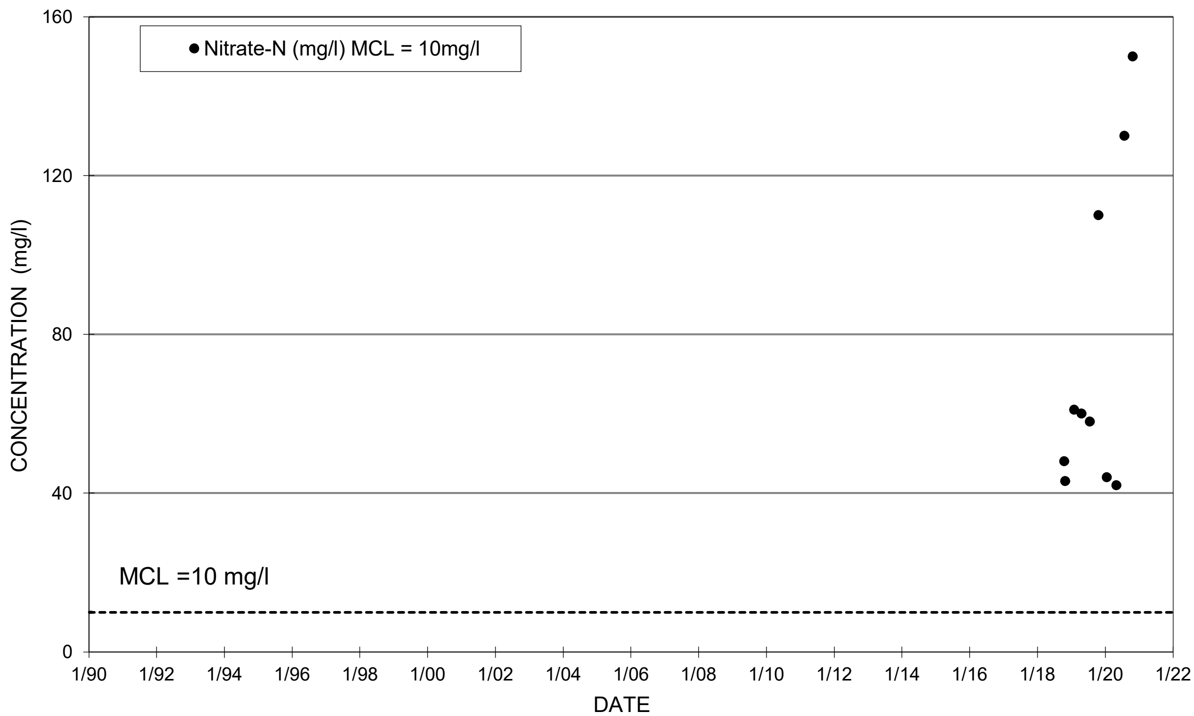


Shallow Aquifer Monitor Well PB-2A

FIGURE A-32. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL PB-2A

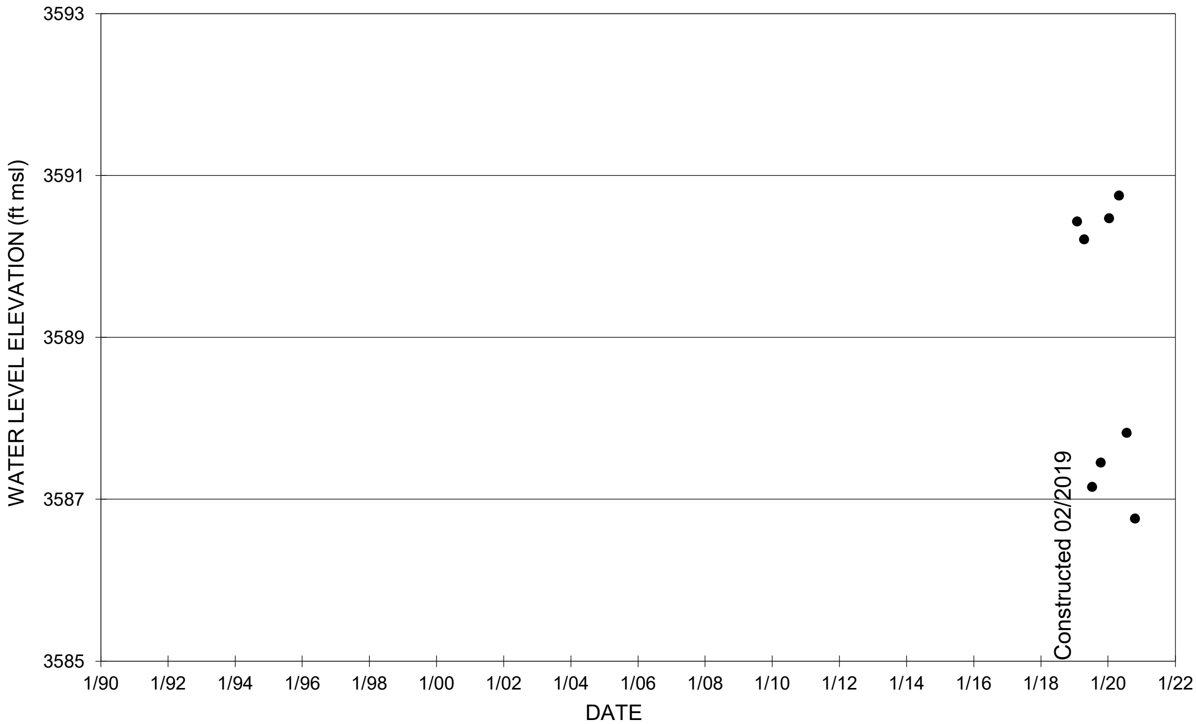


Shallow Aquifer Monitor Well PB-4

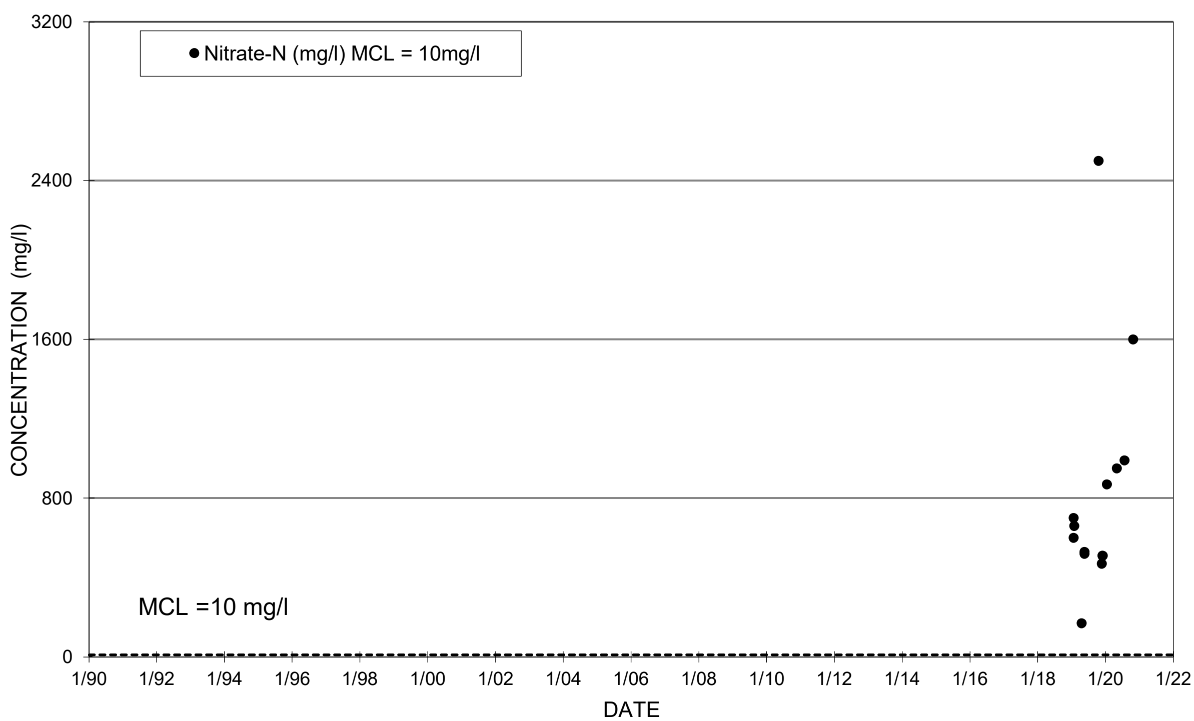


Shallow Aquifer Monitor Well PB-4

FIGURE A-33. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL PB-4

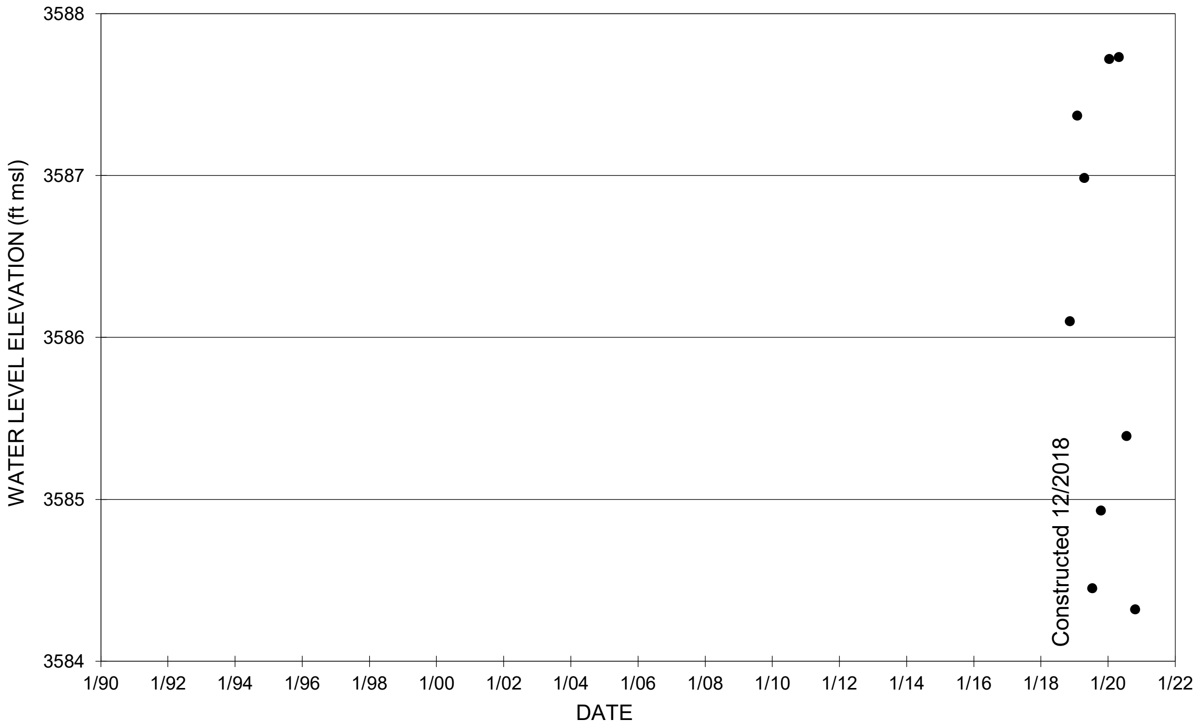


Shallow Aquifer Monitor Well PB-5A

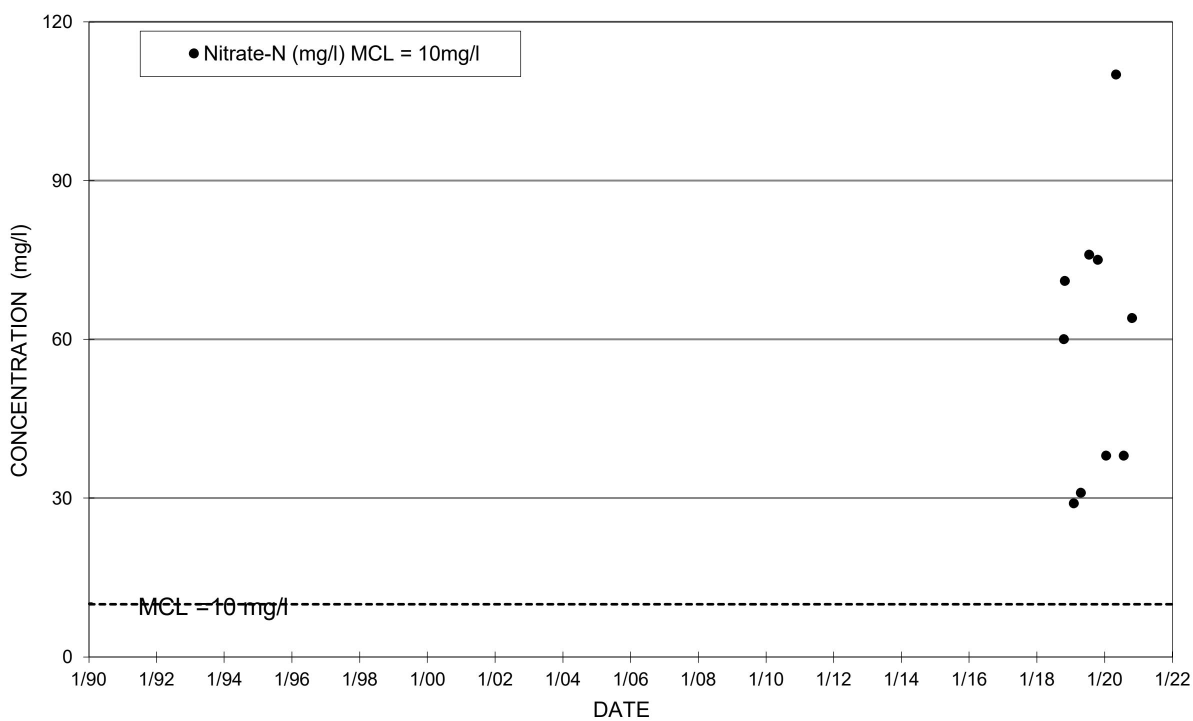


Shallow Aquifer Monitor Well PB-5A

FIGURE A-34. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL PB-5A

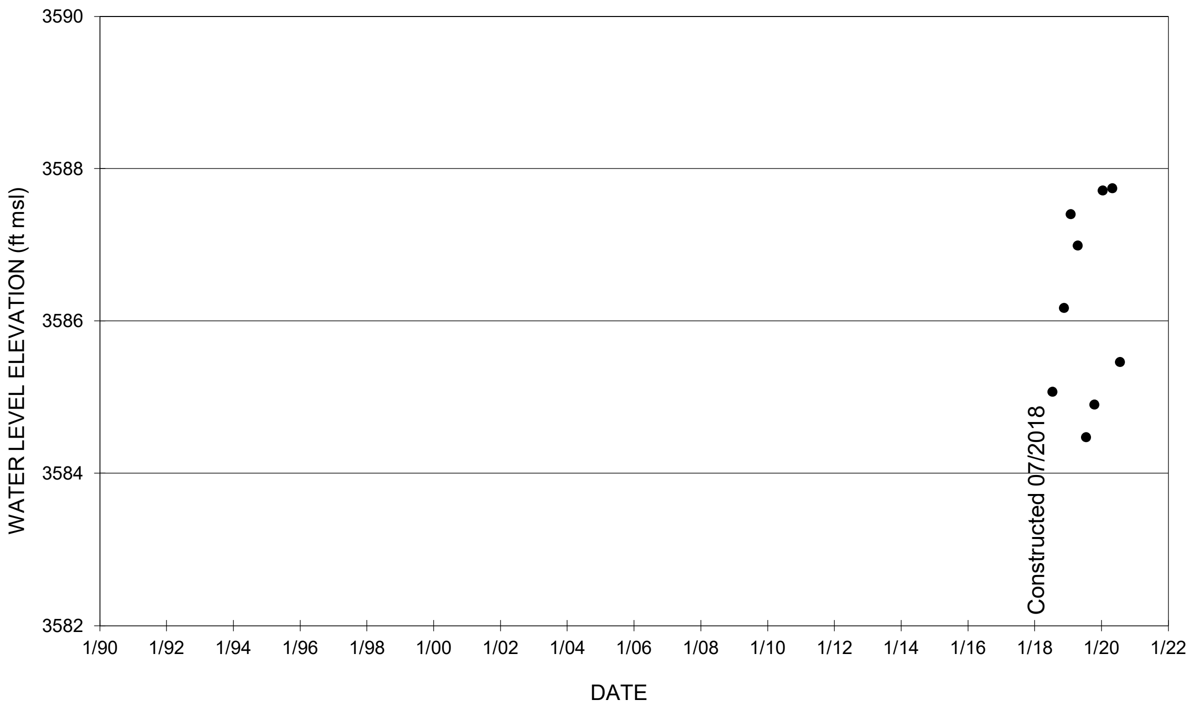


Shallow Aquifer Monitor Well PB-7

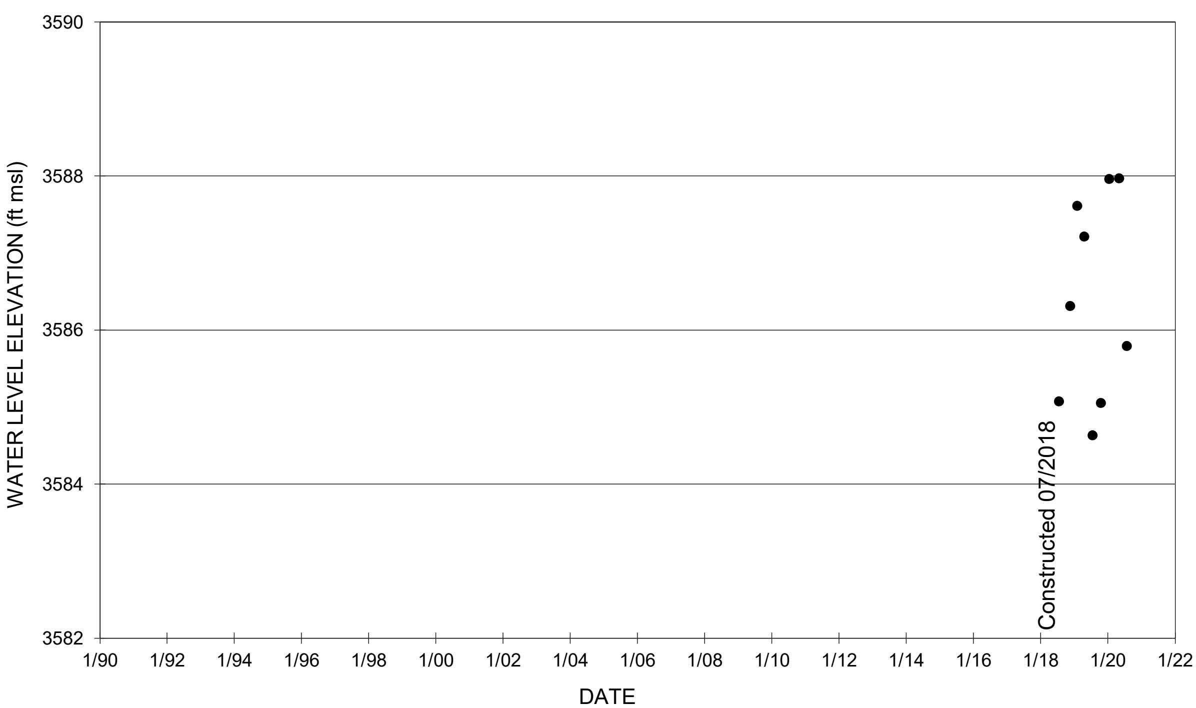


Shallow Aquifer Monitor Well PB-7

FIGURE A-35. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER MONITOR WELL PB-7



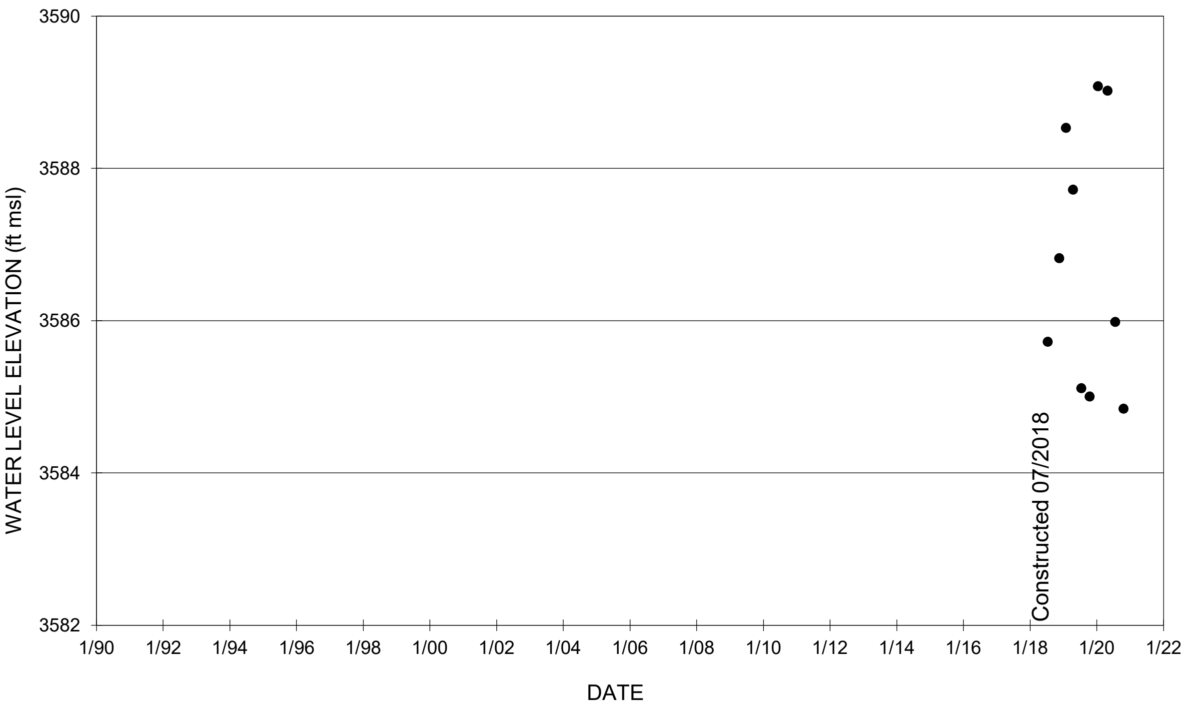
Shallow Aquifer Piezometer NAP-1



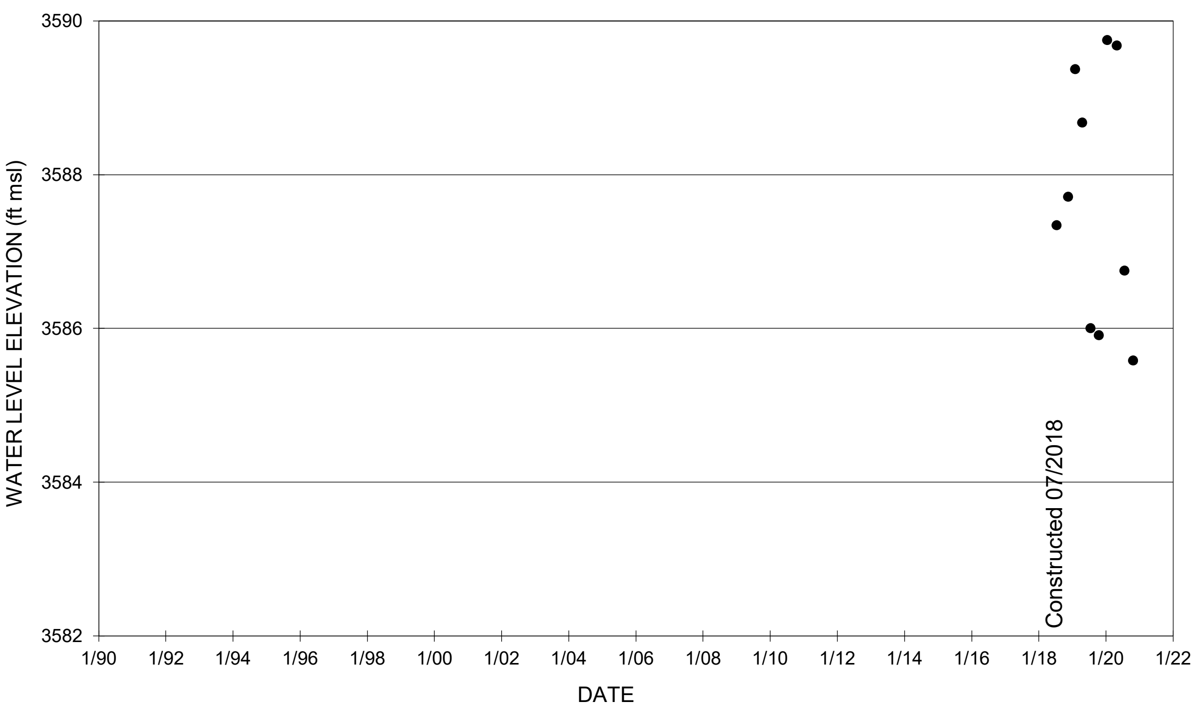
Shallow Aquifer Piezometer NAP-2

FIGURE A-36. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA SHALLOW AQUIFER PIEZOMETERS NAP-1 AND NAP-2

HARGIS + ASSOCIATES, INC.



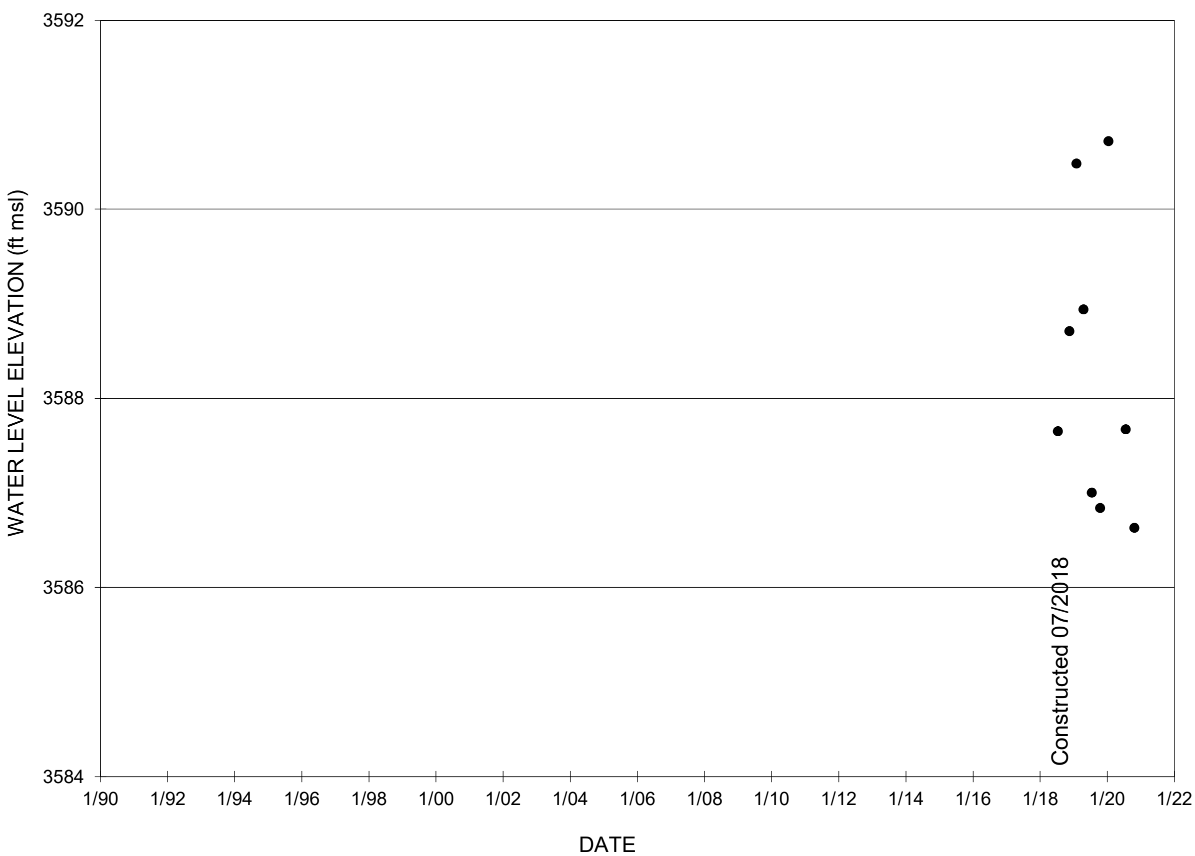
Shallow Aquifer Piezometer NAP-3



Shallow Aquifer Piezometer NAP-4

FIGURE A-37. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA SHALLOW AQUIFER PIEZOMETERS NAP-3 AND NAP-4

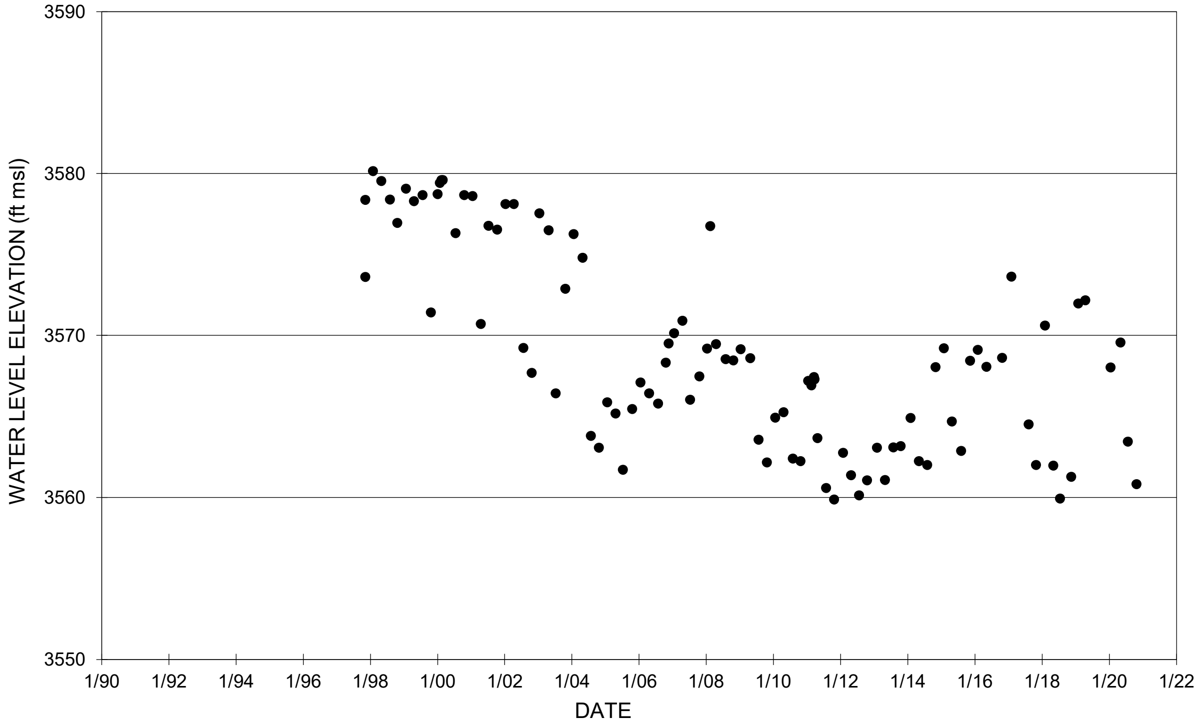
HARGIS + ASSOCIATES, INC.



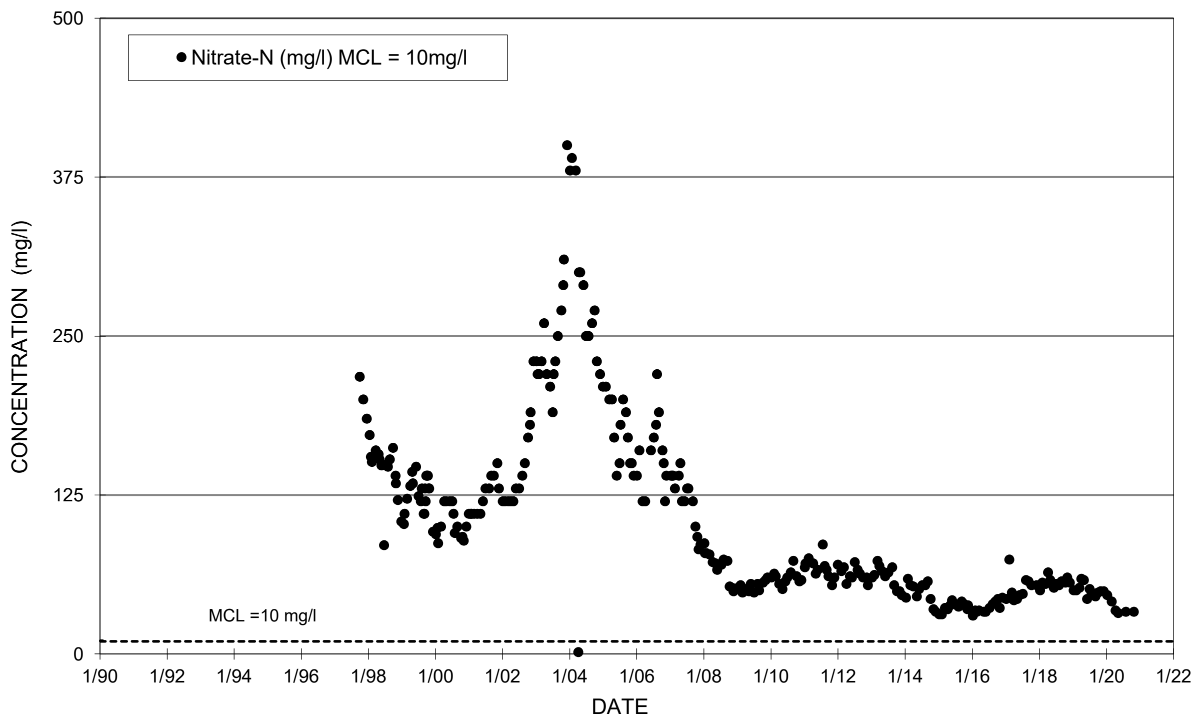
Shallow Aquifer Piezometer NAP-5

FIGURE A-38. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA SHALLOW AQUIFER PIEZOMETER NAP-5

HARGIS + ASSOCIATES, INC.

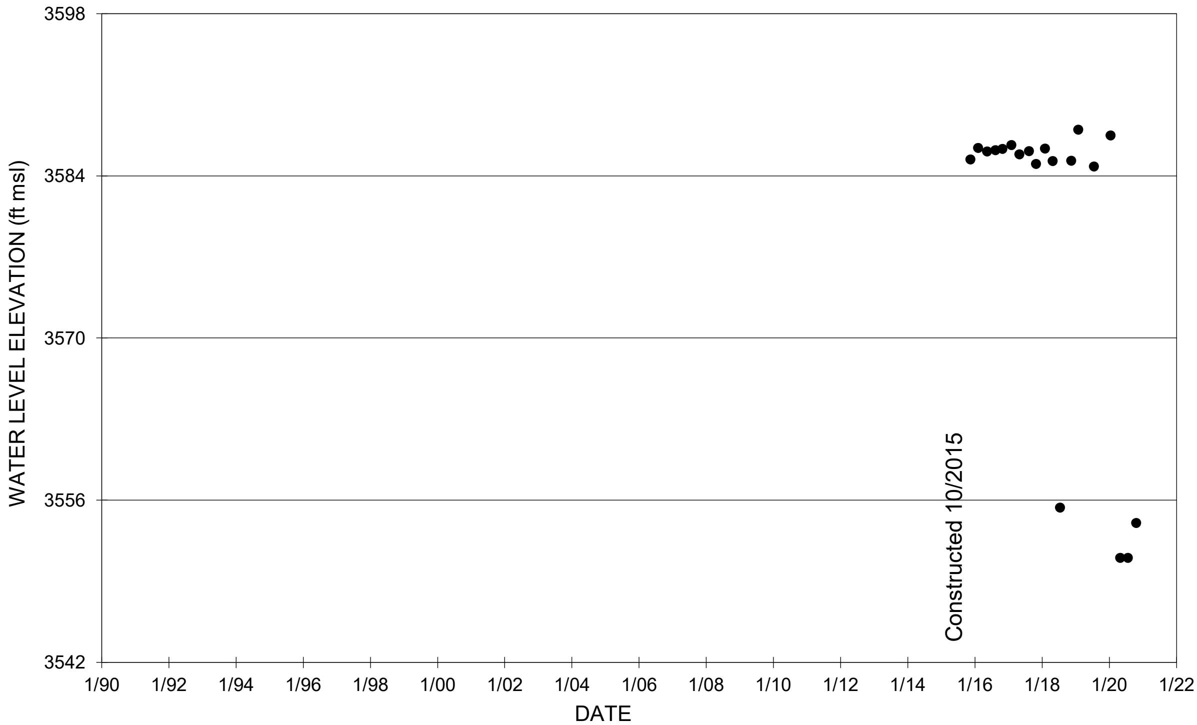


Shallow Aquifer Test Well SEW-01

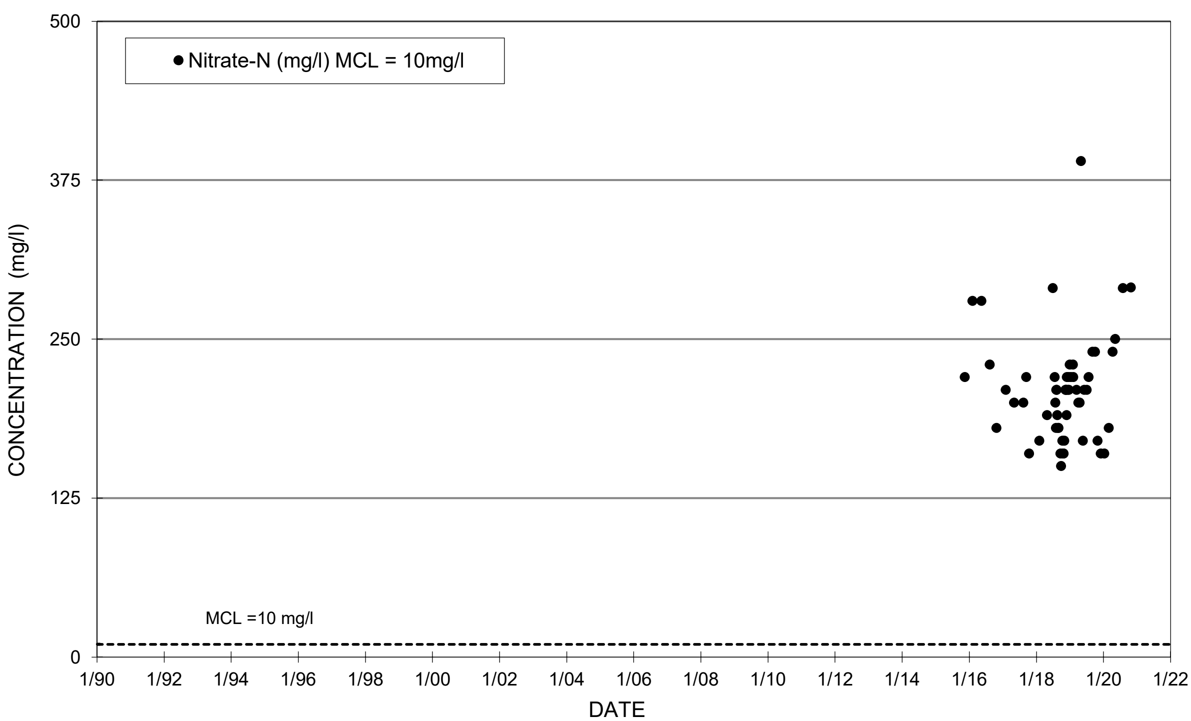


Shallow Aquifer Test Well SEW-01

FIGURE A-39. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER EXTRACTION WELL SEW-01



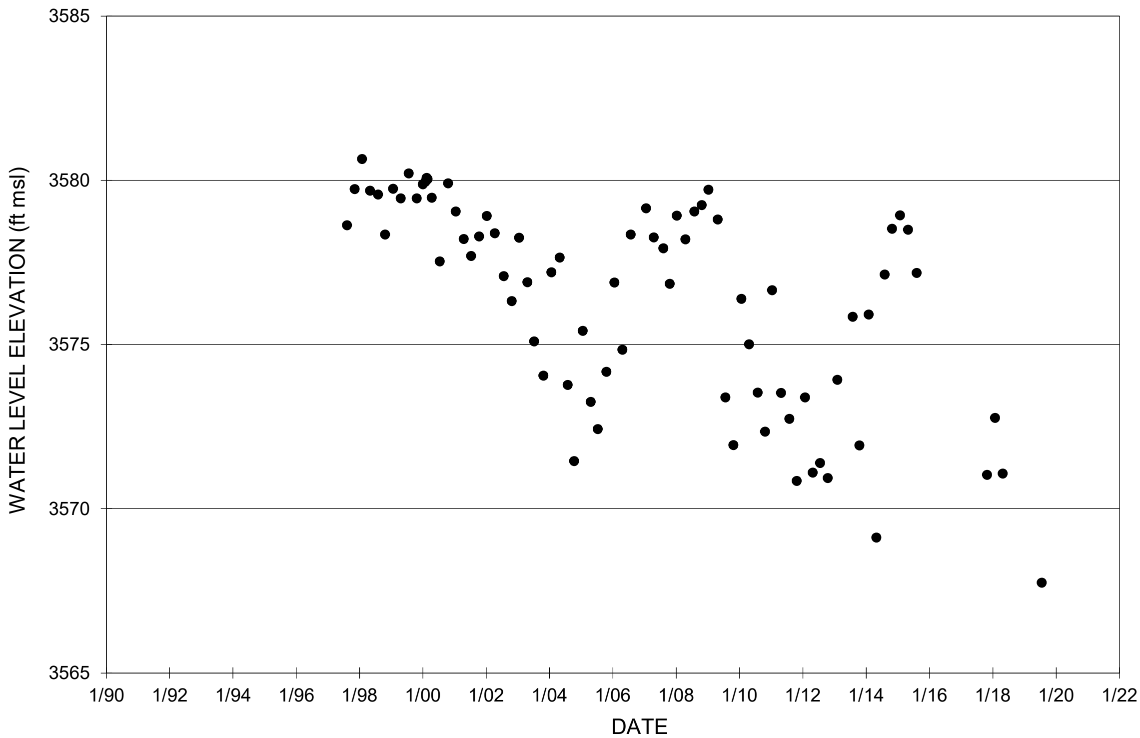
Shallow Aquifer Test Well SEW-02



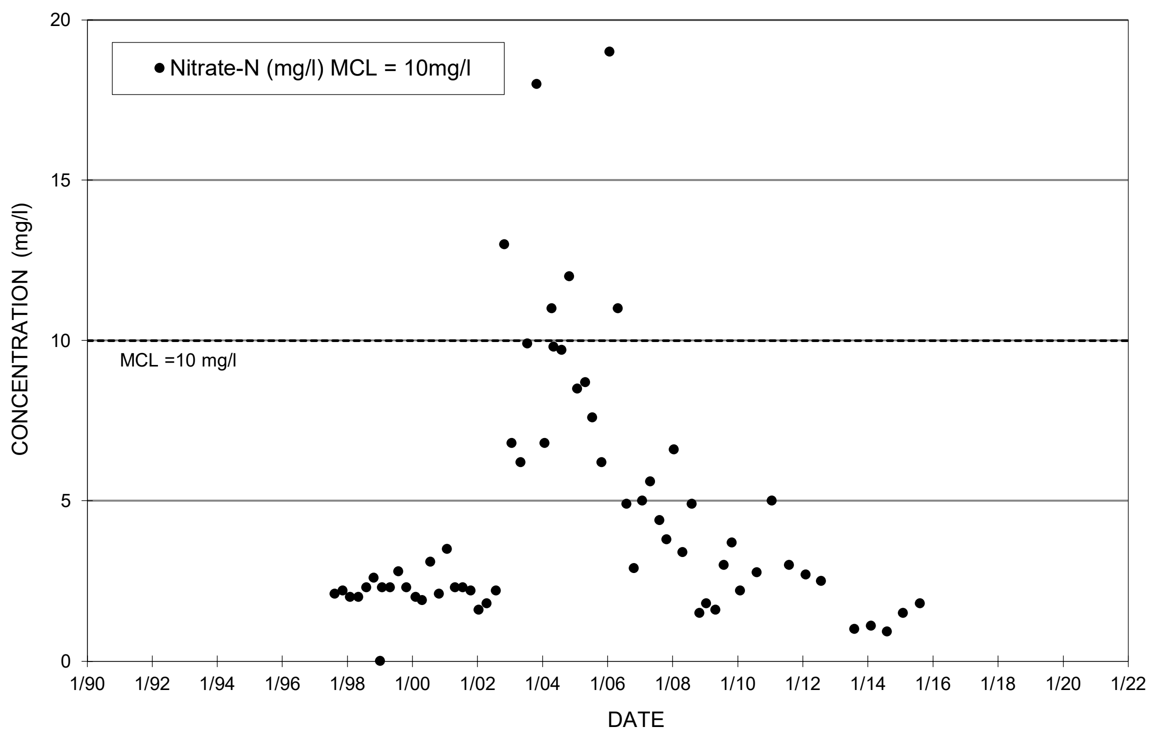
Shallow Aquifer Test Well SEW-02

FIGURE A-40. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR SHALLOW AQUIFER EXTRACTION WELL SEW-02

HARGIS + ASSOCIATES, INC.

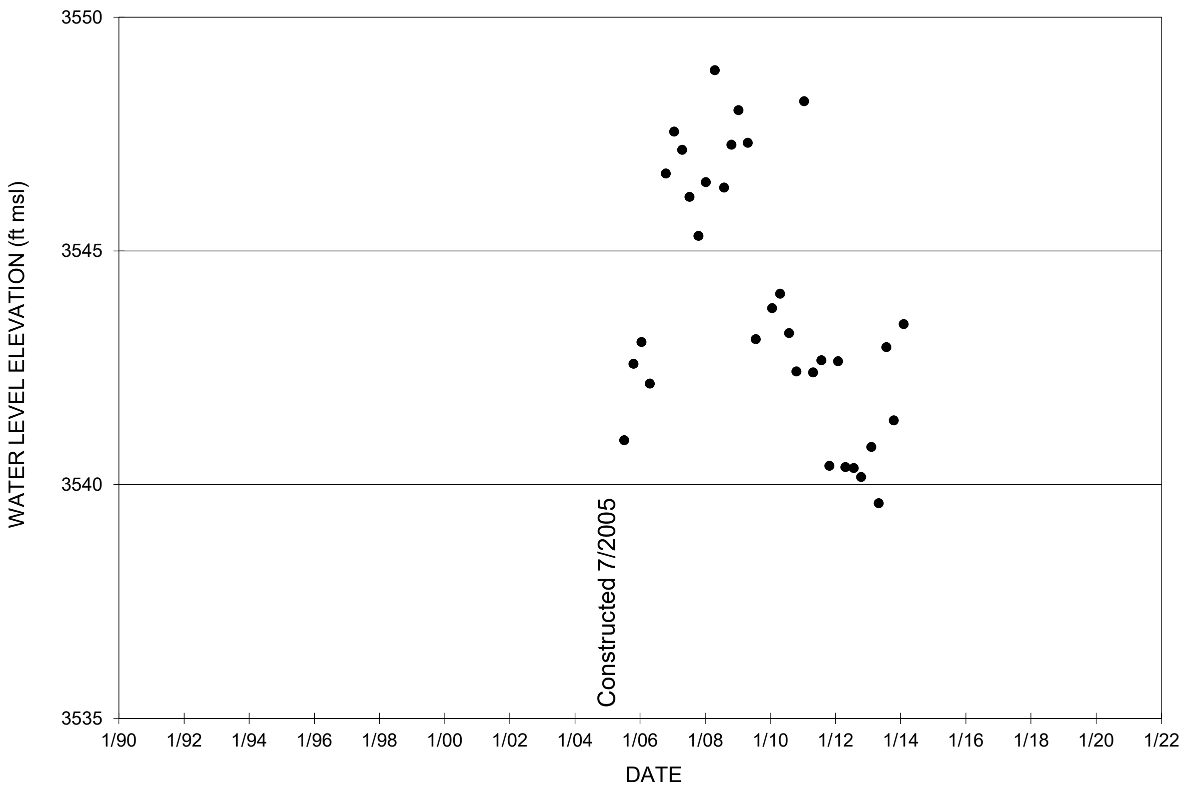


Shallow Aquifer Monitor Well MW-20

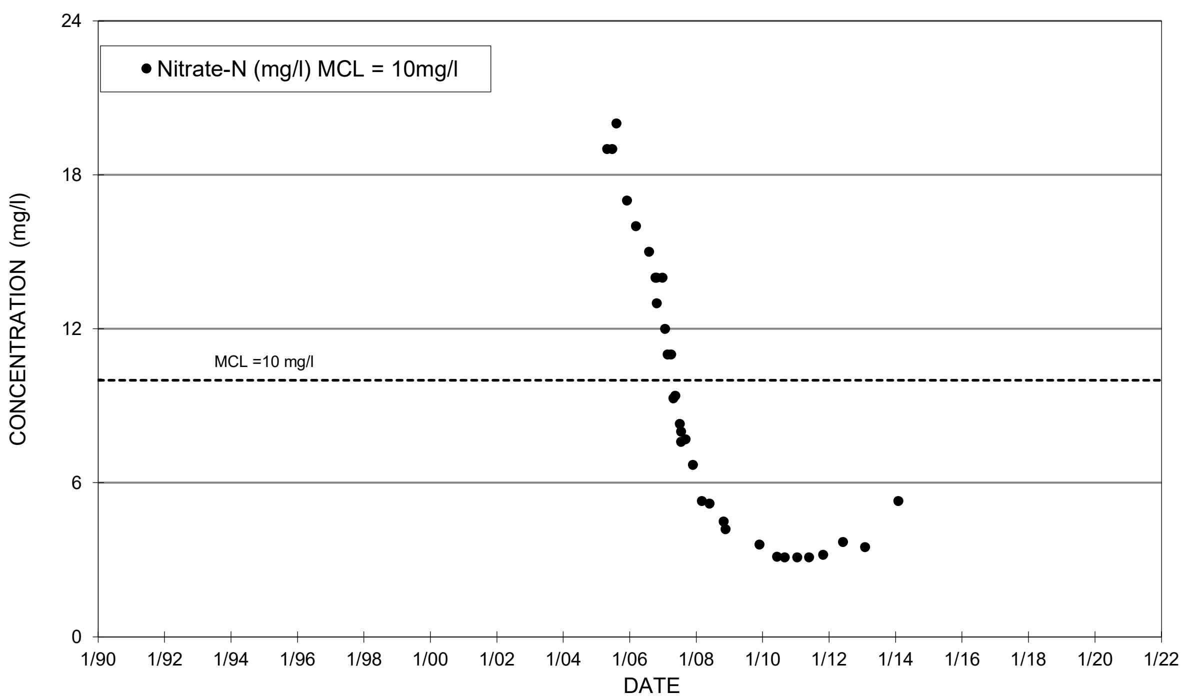


Shallow Aquifer Monitor Well MW-20

FIGURE A-41. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE MONITOR WELL MW-20

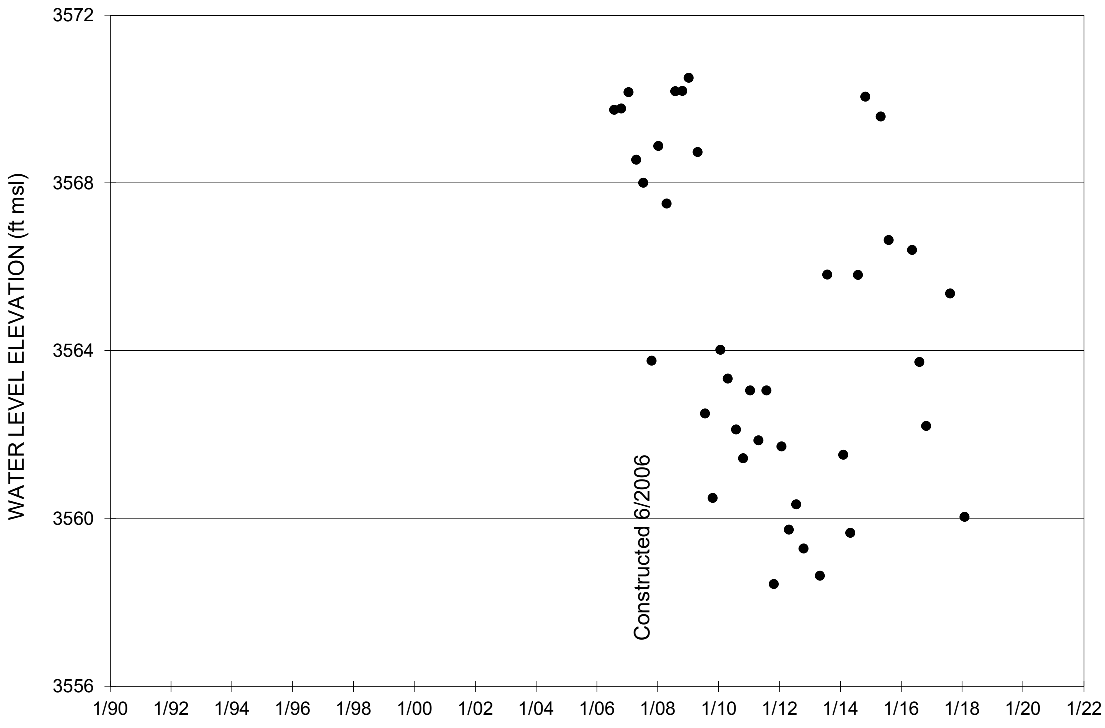


Shallow Aquifer Monitor Well MW-38

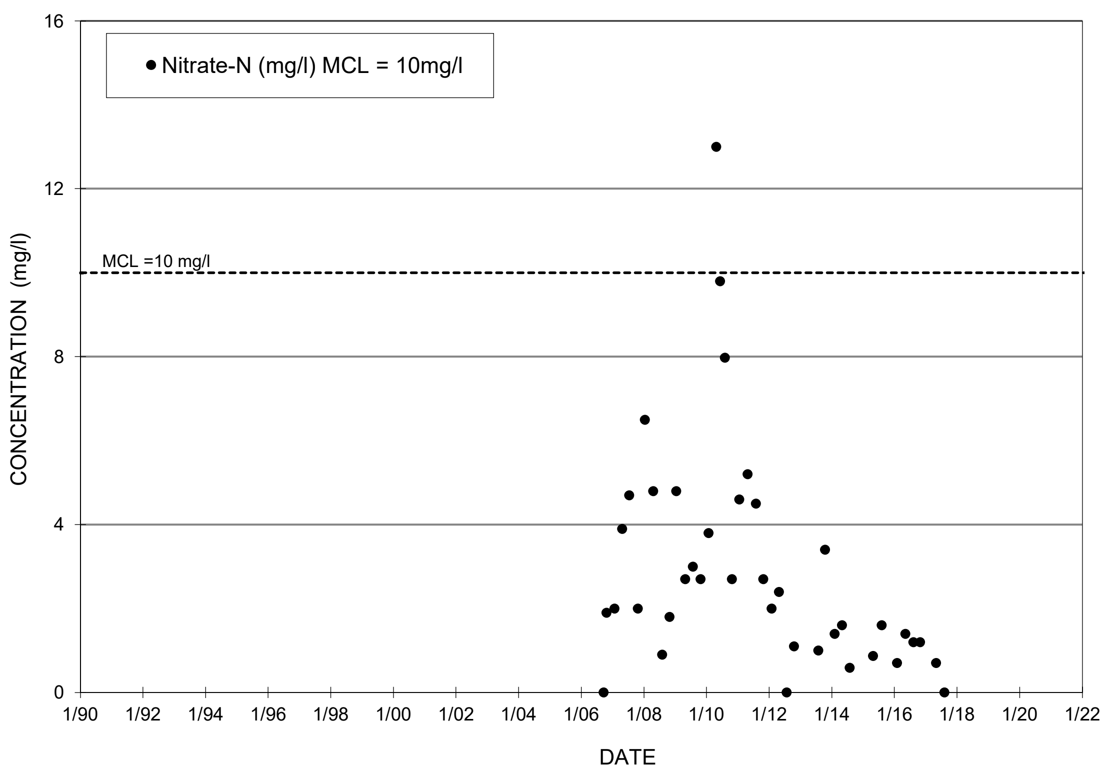


Shallow Aquifer Monitor Well MW-38

FIGURE A-42. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE MONITOR WELL MW-38

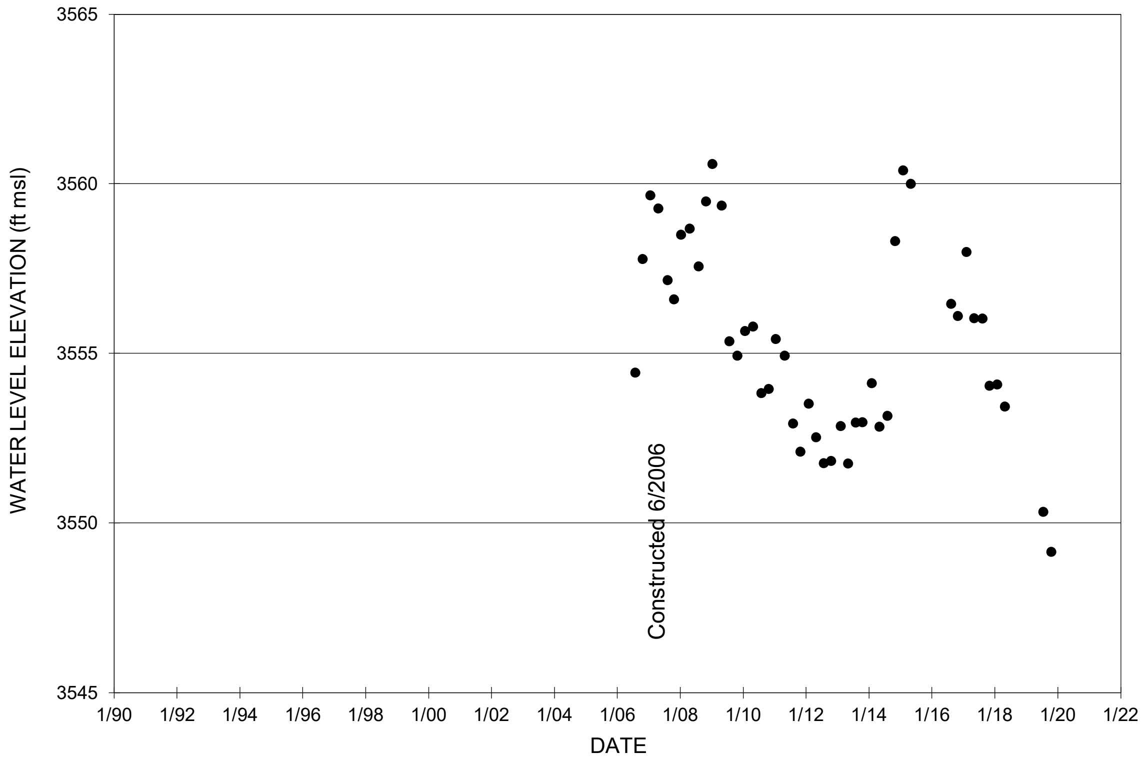


Shallow Aquifer Monitor Well MW-40

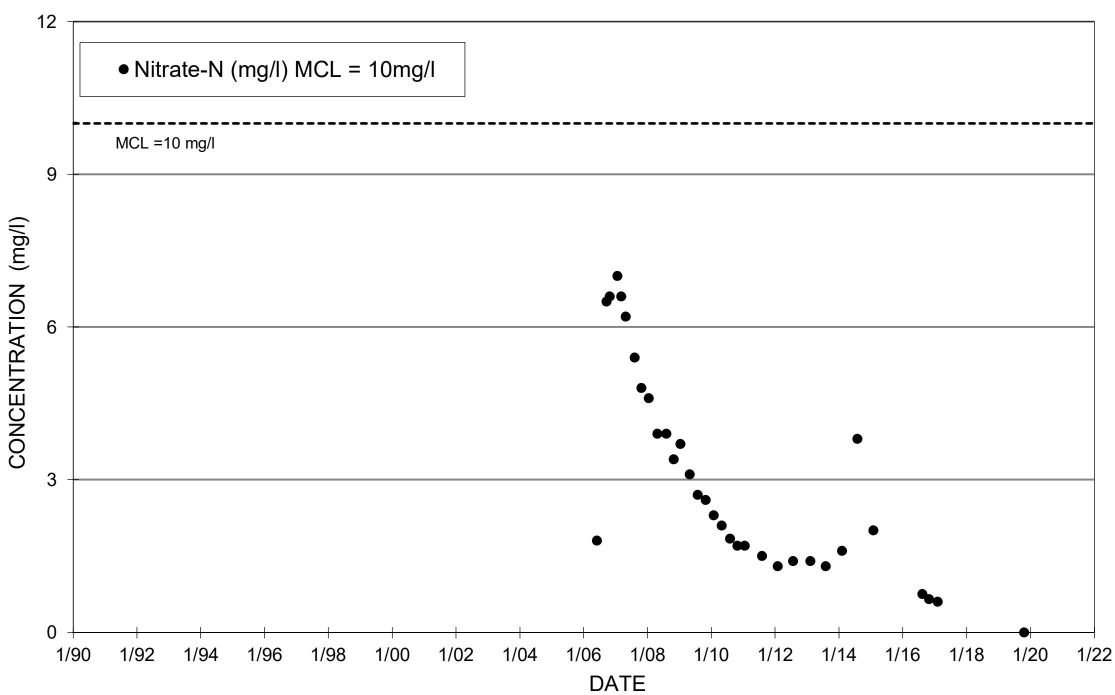


Shallow Aquifer Monitor Well MW-40

FIGURE A-43. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA SENTINEL MONITOR WELL MW-40

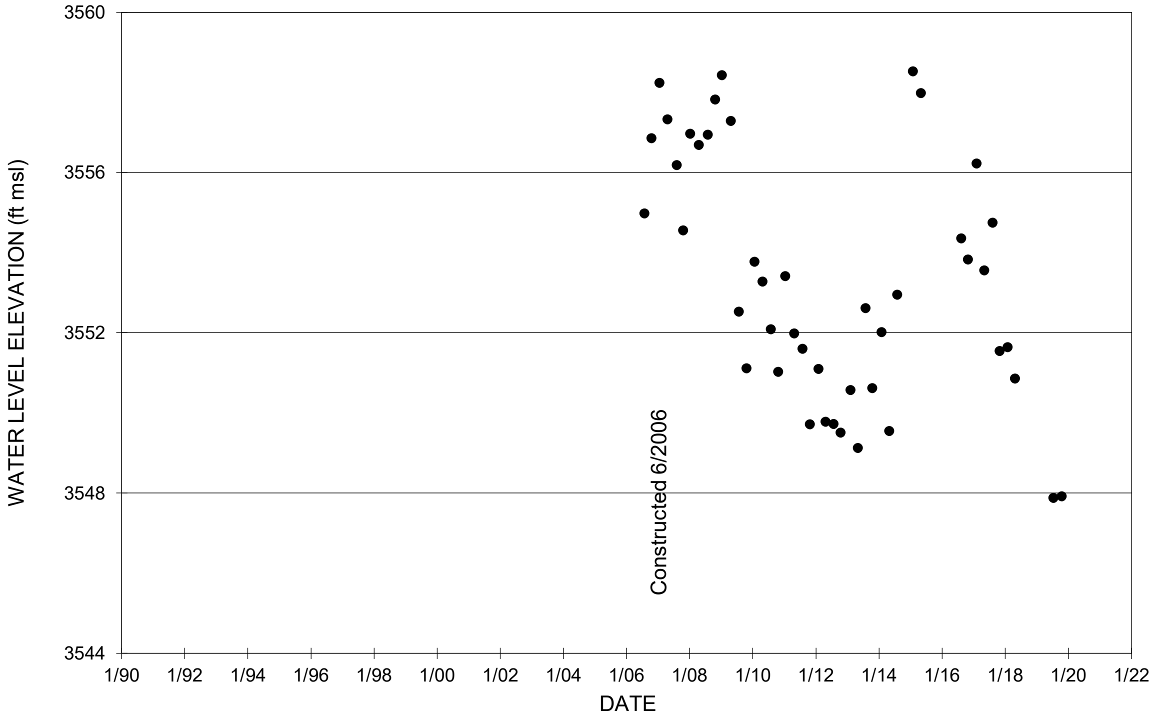


Shallow Aquifer Monitor Well MW-41A

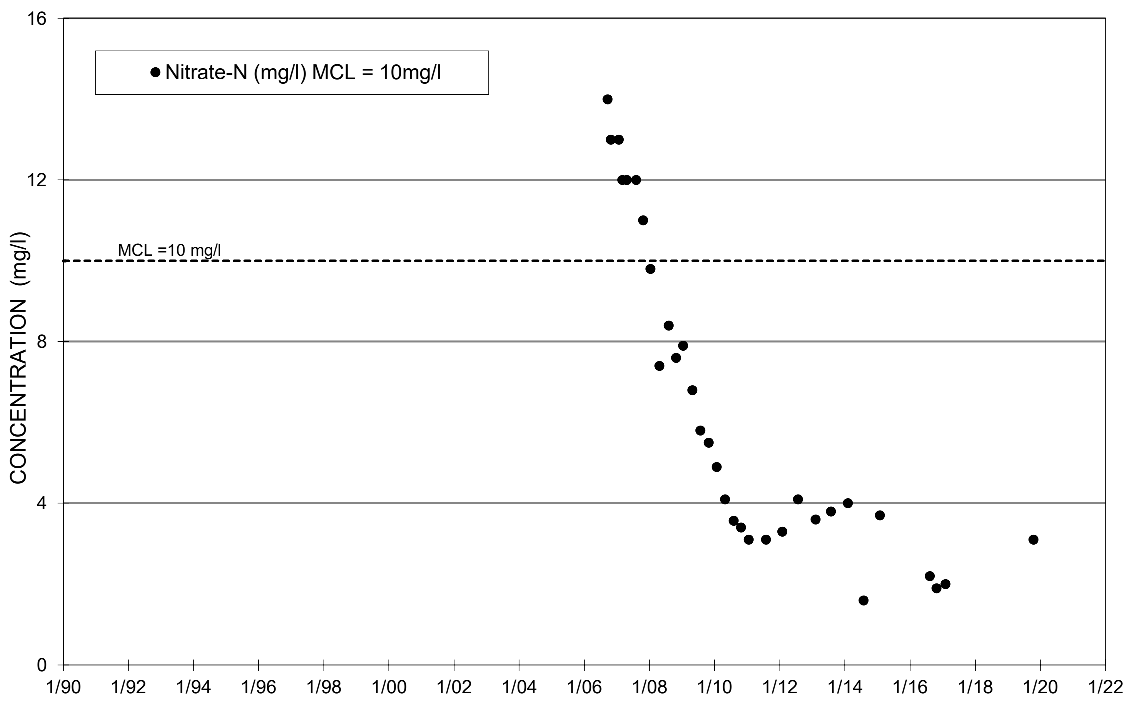


Shallow Aquifer Monitor Well MW-41A

FIGURE A-44. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE MONITOR WELL MW-41A



Shallow Aquifer Monitor Well MW-41B



Shallow Aquifer Monitor Well MW-41B

FIGURE A-45. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE MONITOR WELL MW-41B

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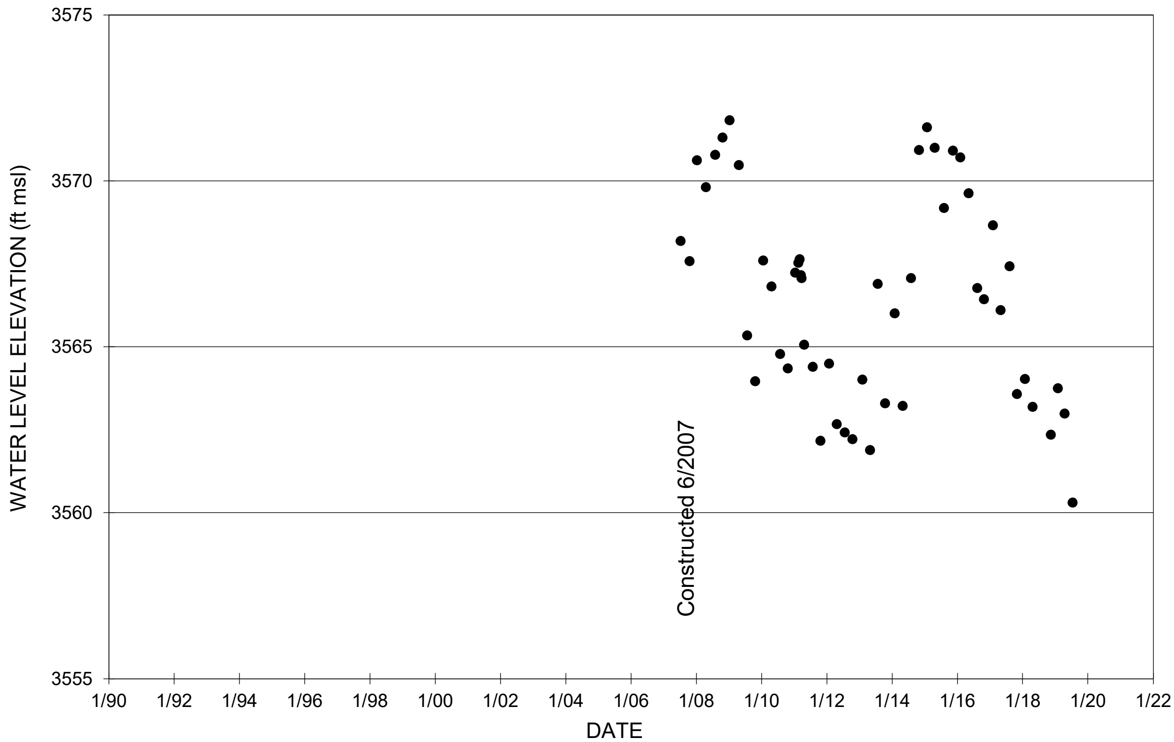
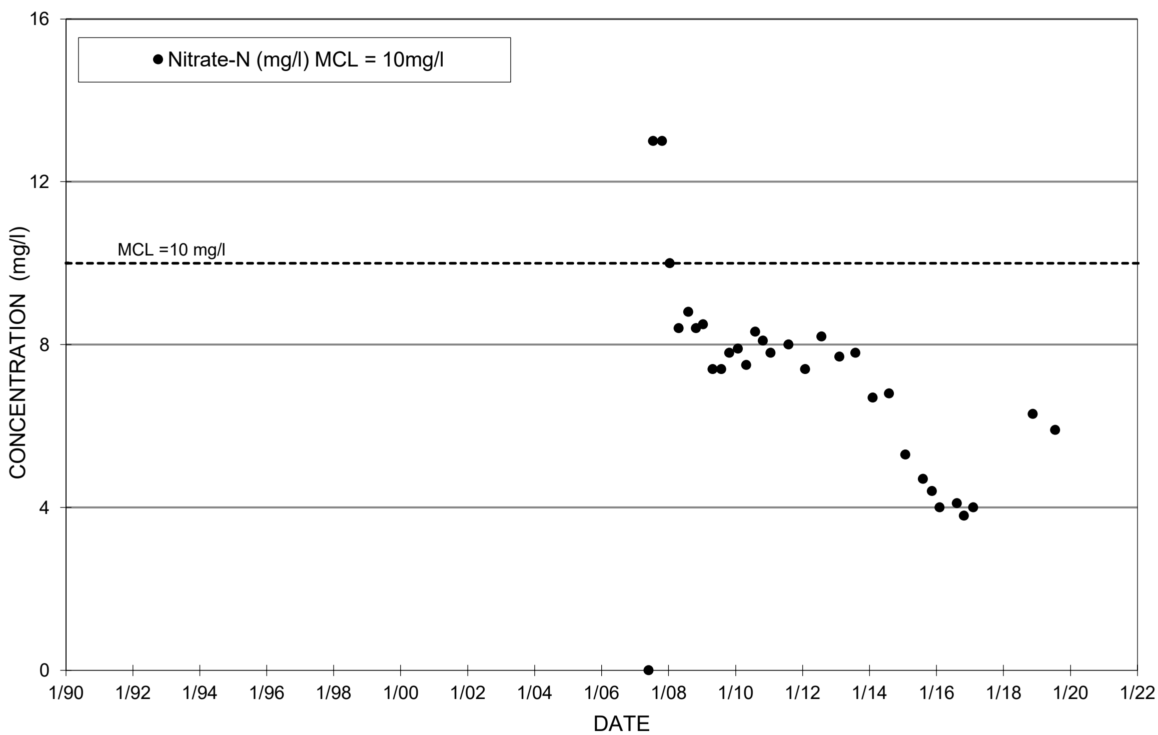
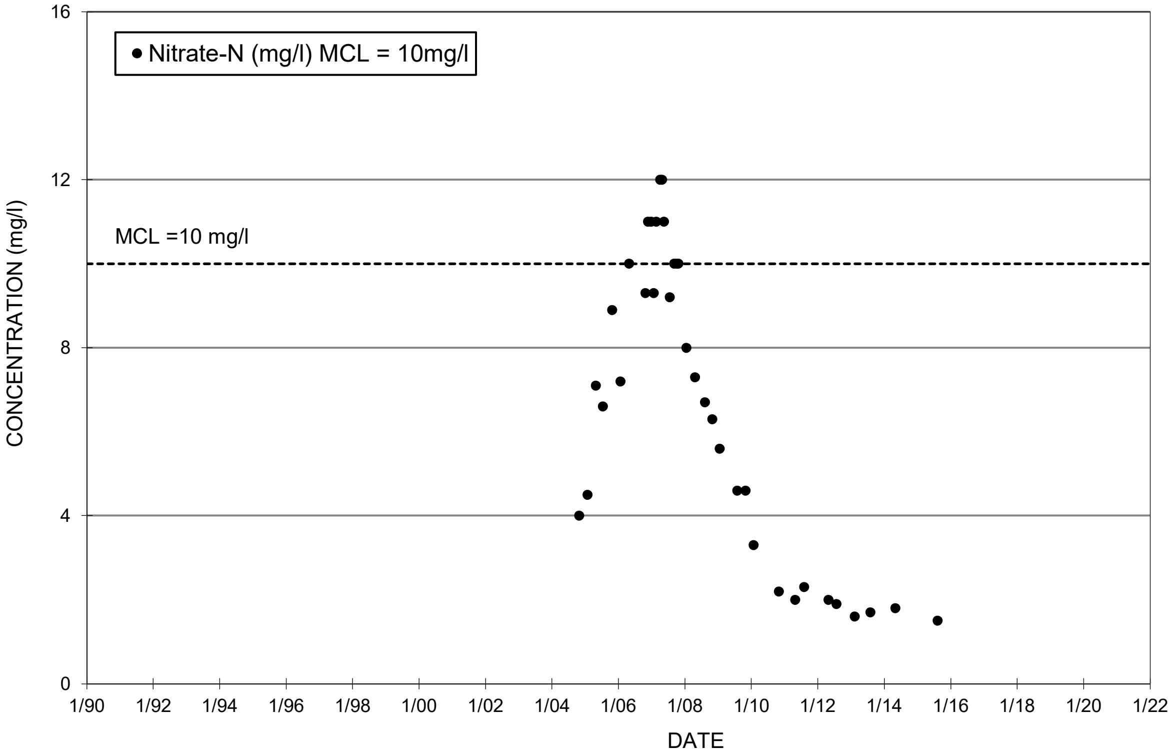


Shallow Aquifer Monitor Well MW-42

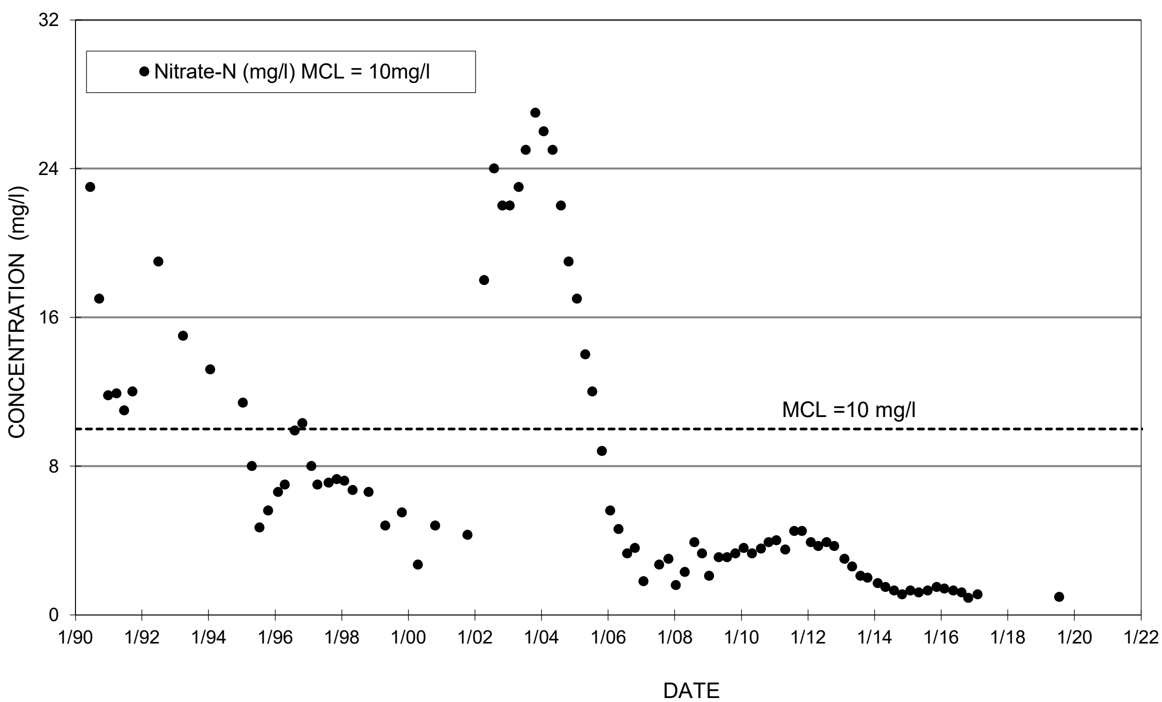


Shallow Aquifer Monitor Well MW-42

FIGURE A-46. WATER LEVEL AND WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE MONITOR WELL MW-42

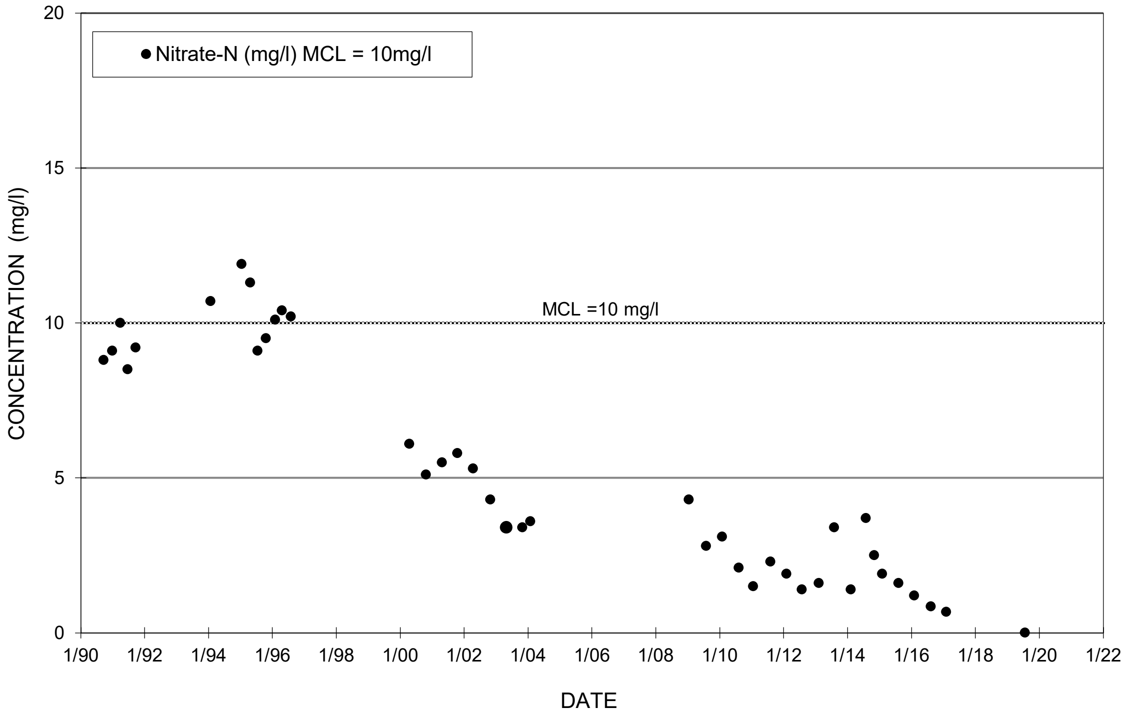


Shallow Aquifer Private Well D(17-20)36bad

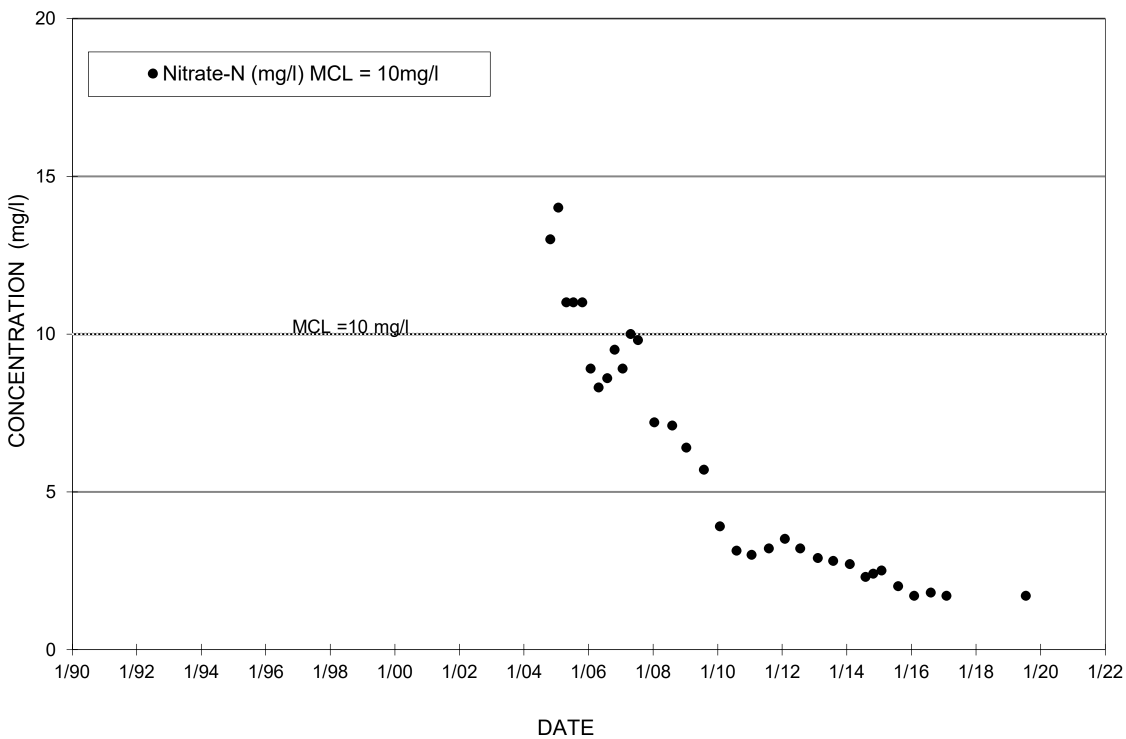


Shallow Aquifer Private Well D(17-20)36aad1

FIGURE A-47. WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE PRIVATE WELLS D(17-20)25bad AND D(17-20)36aad1

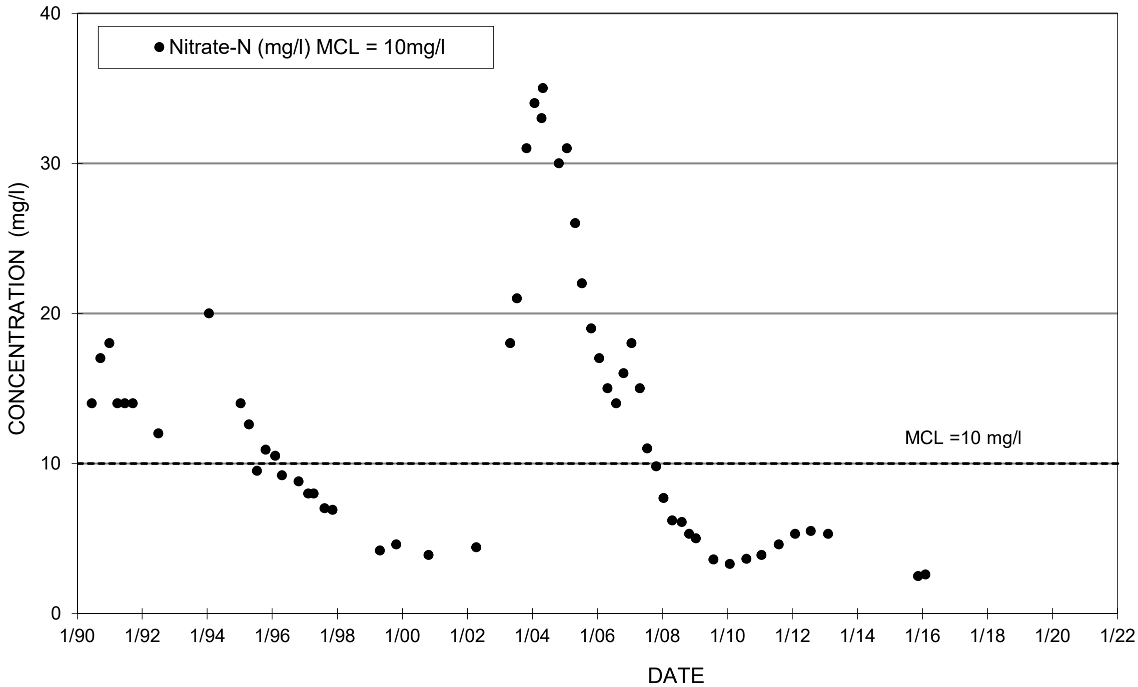


Shallow Aquifer Private Well D(17-20)36caa

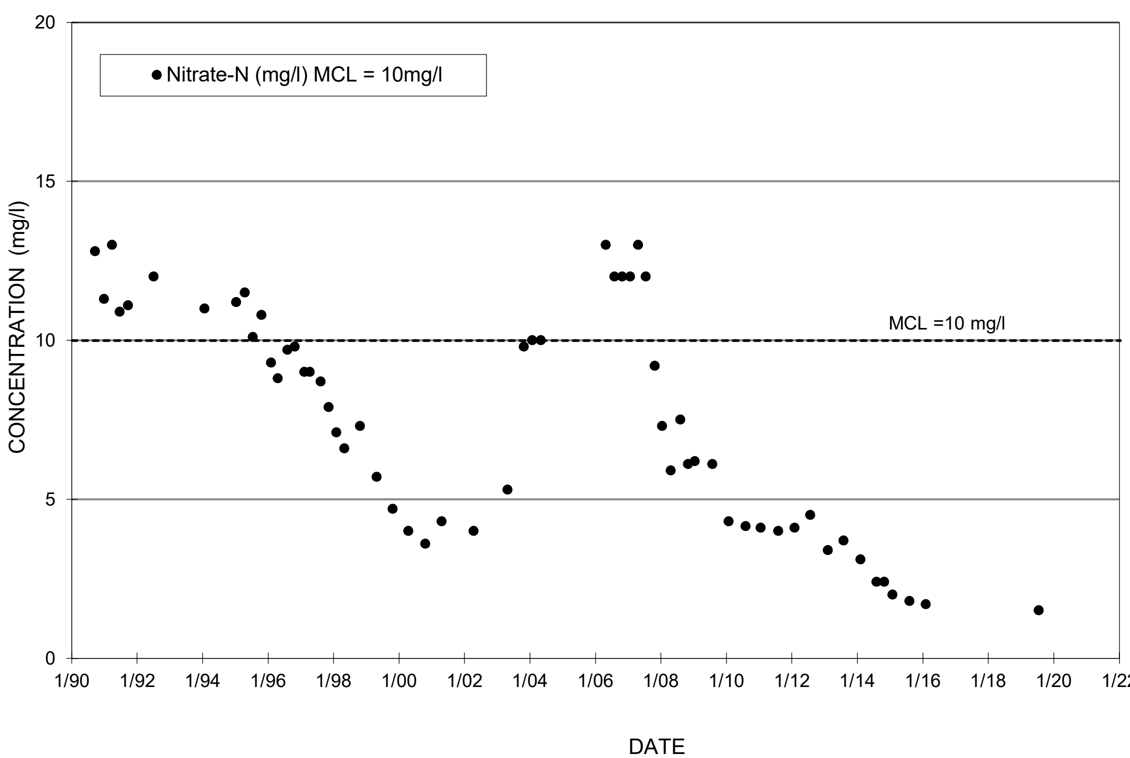


Shallow Aquifer Private Well D(17-20)36caa2

FIGURE A-48. WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE PRIVATE WELLS D(17-20)36caa AND D(17-20)36caa2



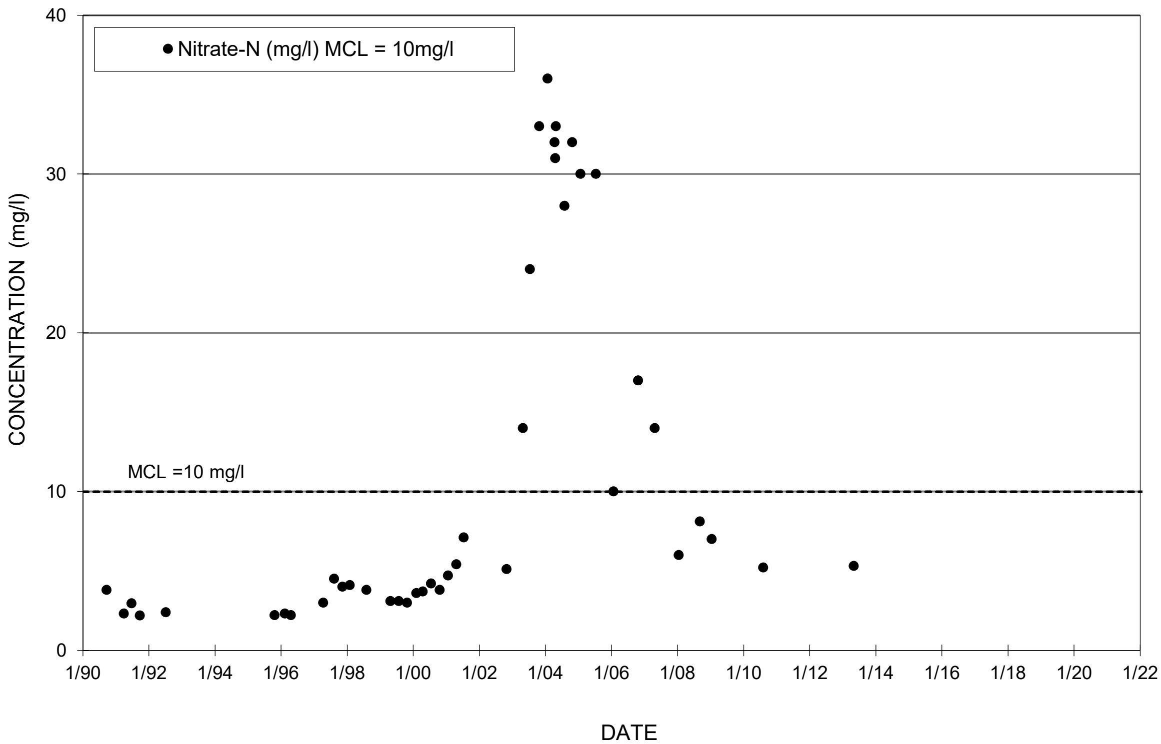
Shallow Aquifer Private Well D(17-20)36cdb



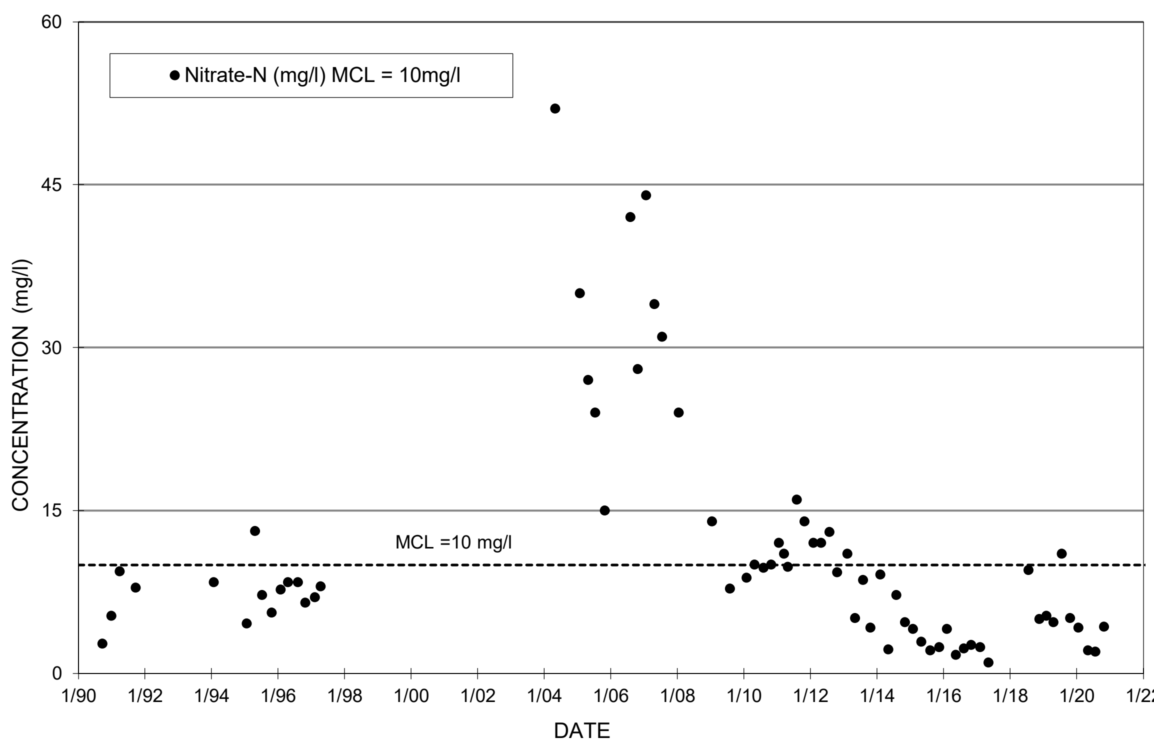
Shallow Aquifer Private Well D(17-20)36ddc

FIGURE A-49. WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE PRIVATE WELLS D(17-20)36cdb AND D(17-20)36ddc

HARGIS + ASSOCIATES, INC.



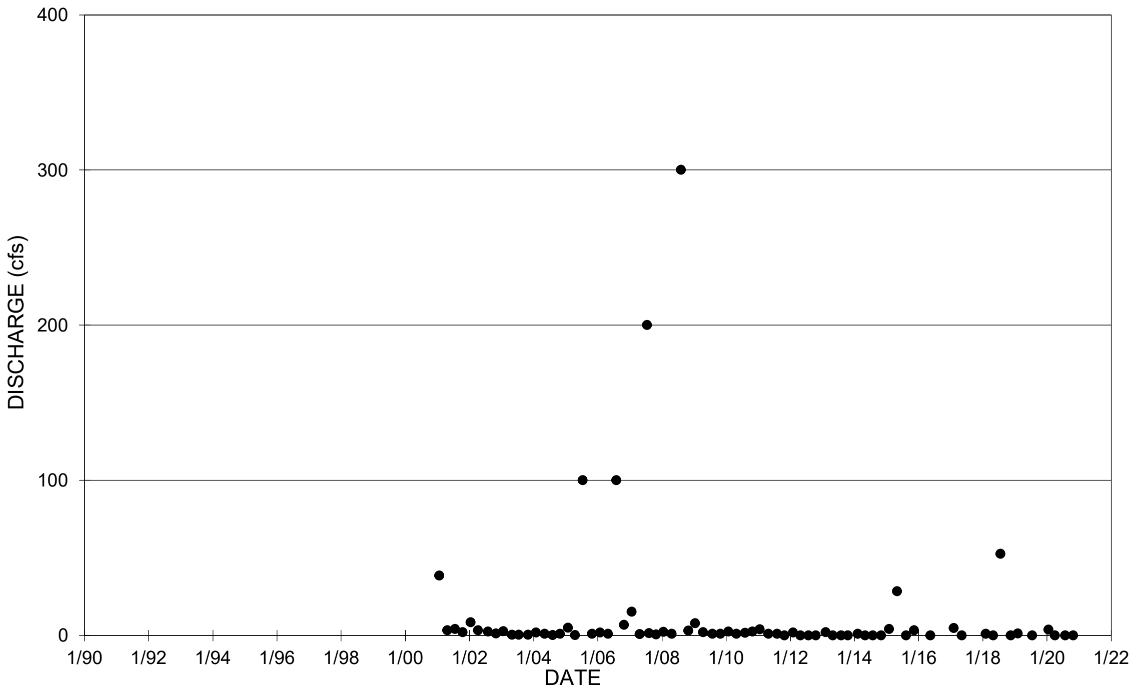
Shallow Aquifer Private Well D(18-20)01aad



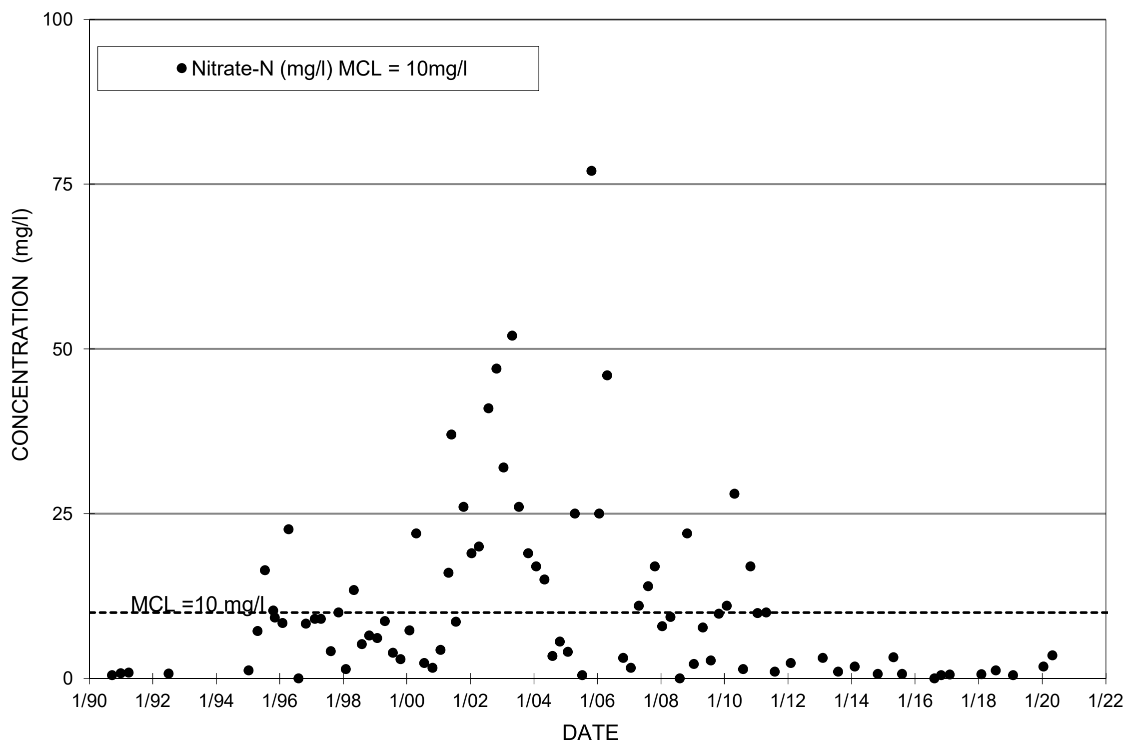
Shallow Aquifer Private Well D(18-21)06bcb

FIGURE A-50. WATER QUALITY HYDROGRAPHS FOR NORTHERN AREA MANAGEMENT ZONE PRIVATE WELLS D(18-20)01aad AND D(18-21)06bcb

HARGIS + ASSOCIATES, INC.



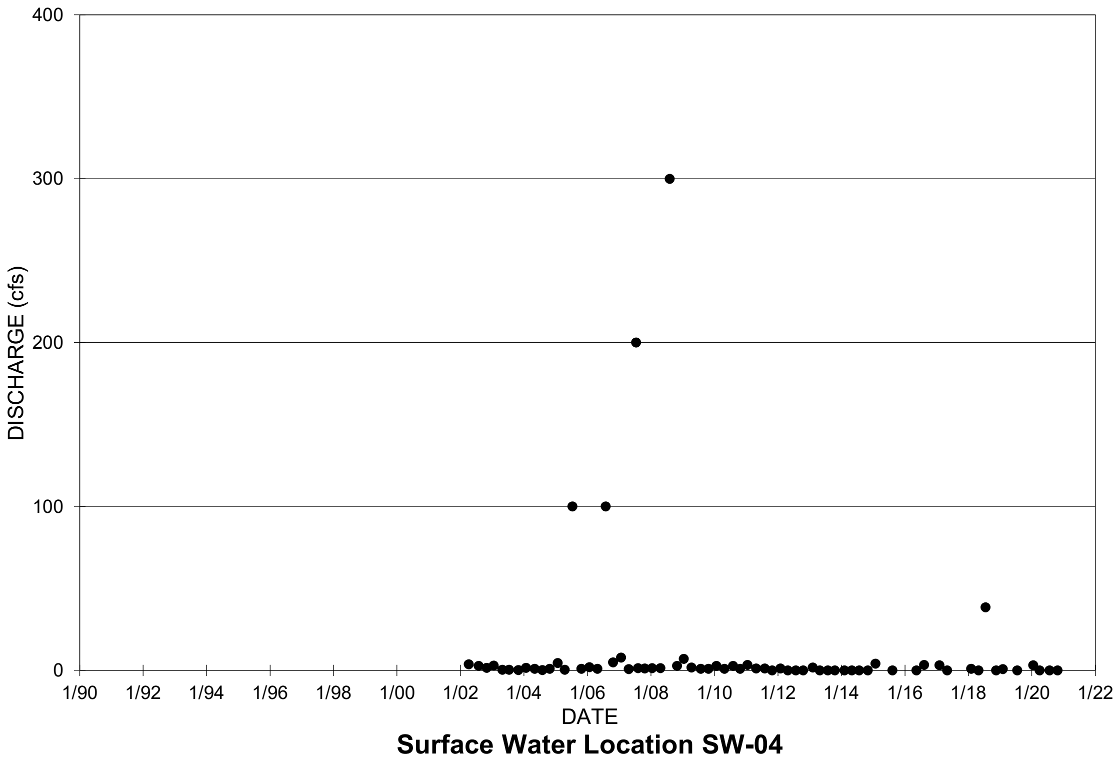
Surface Water Location SW-03



Surface Water Location SW-03

FIGURE A-51. SURFACE FLOW AND WATER QUALITY HYDROGRAPHS FOR SURFACE WATER LOCATION SW-03

HARGIS + ASSOCIATES, INC.



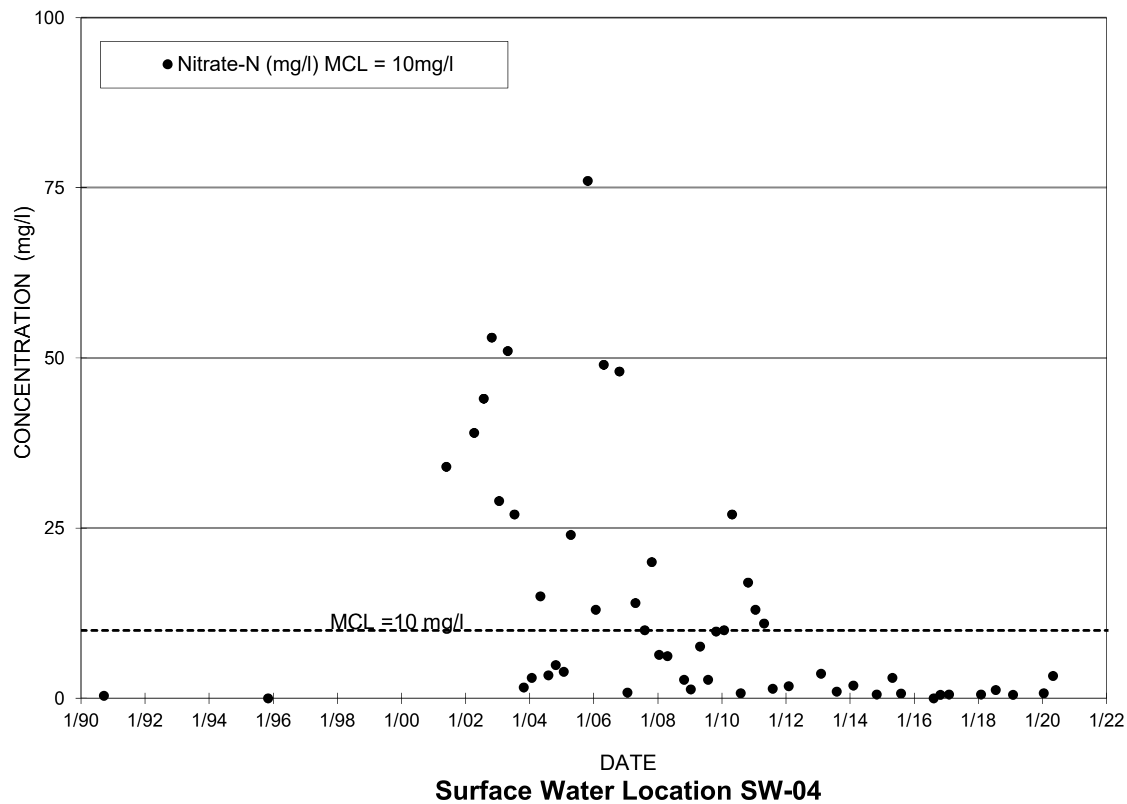
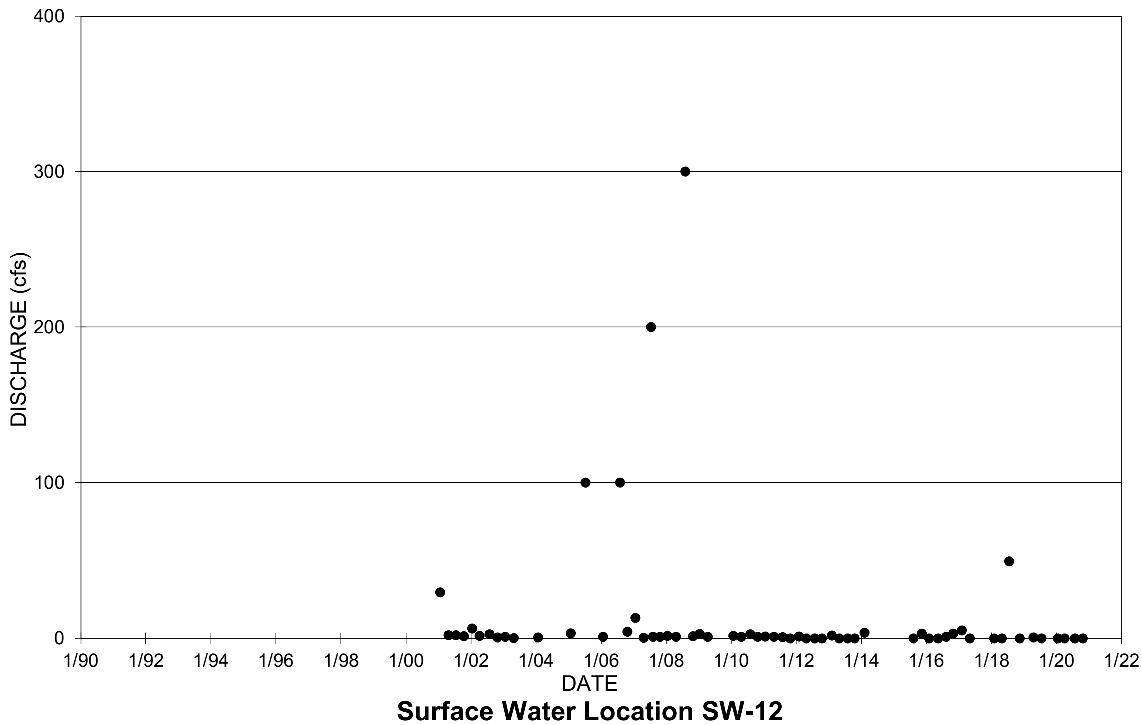


FIGURE A-52. SURFACE FLOW AND WATER QUALITY HYDROGRAPHS FOR SURFACE WATER LOCATION SW-04

HARGIS + ASSOCIATES, INC.



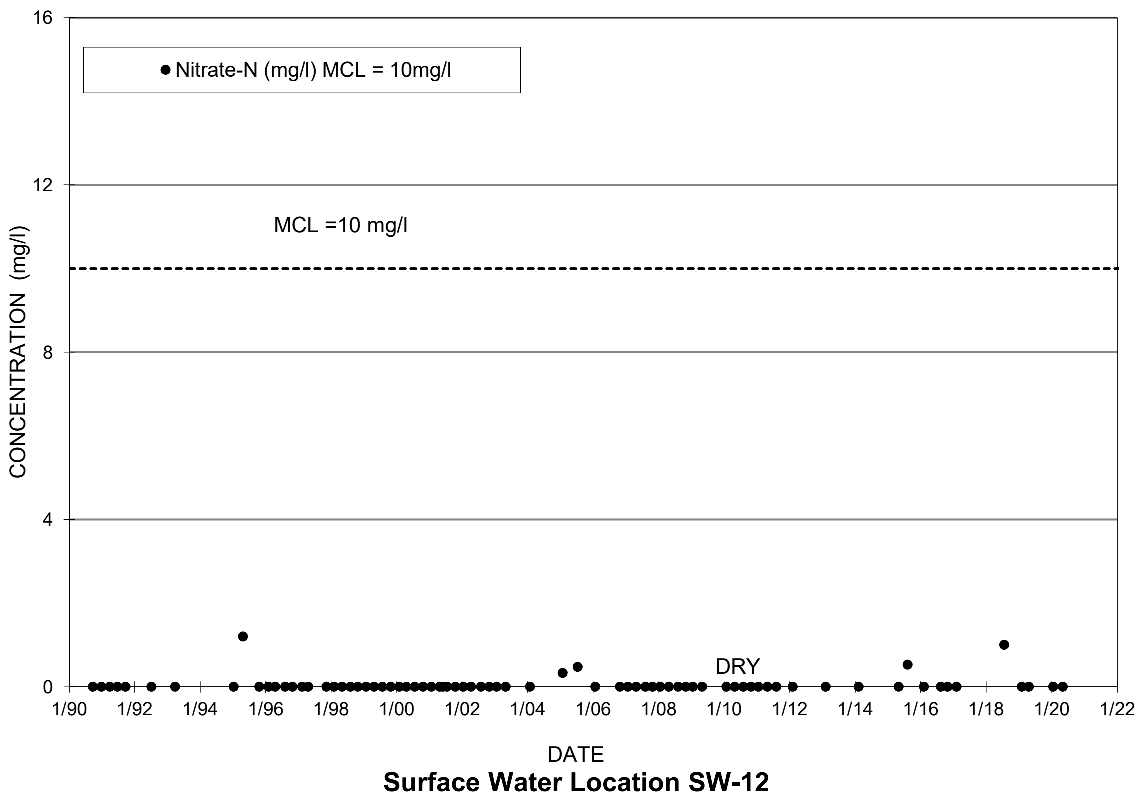
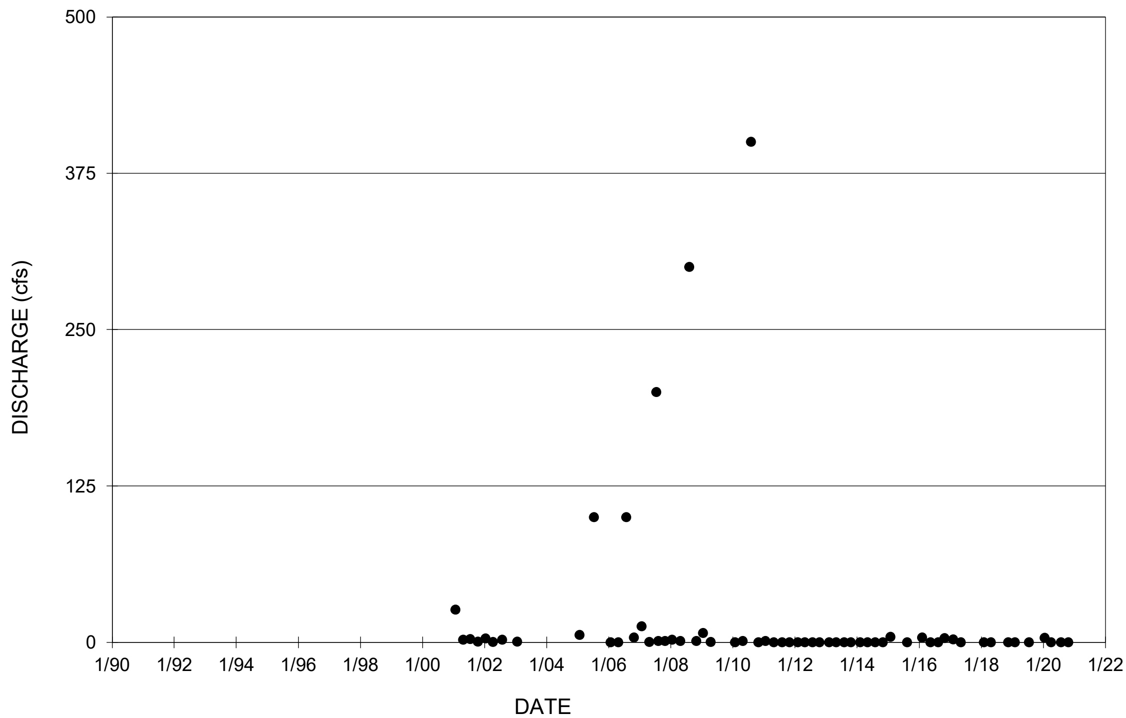
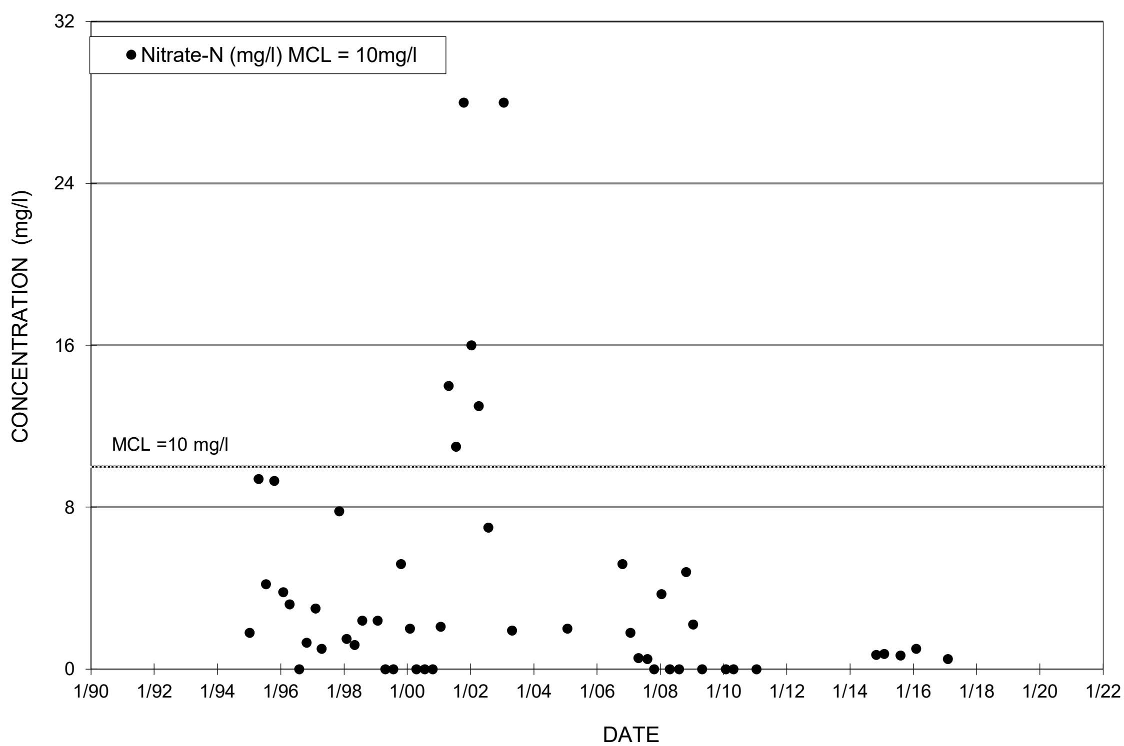


FIGURE A-53. SURFACE FLOW AND WATER QUALITY HYDROGRAPHS FOR SURFACE WATER LOCATION SW-12

HARGIS + ASSOCIATES, INC.



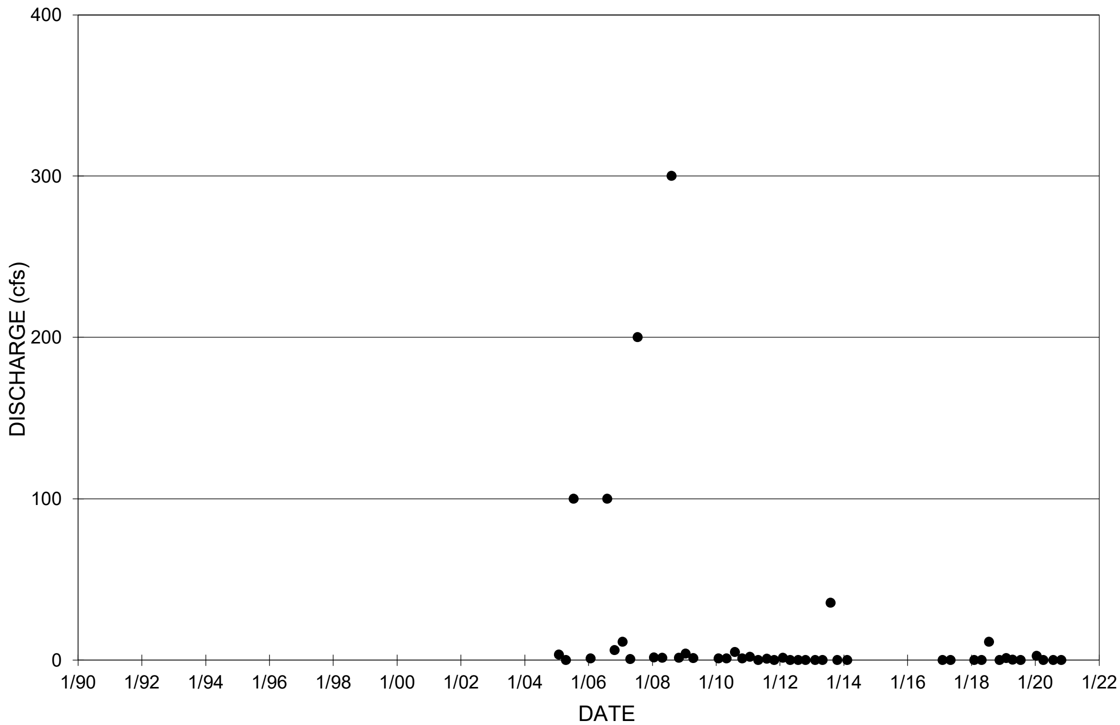
Surface Water Location SW-13



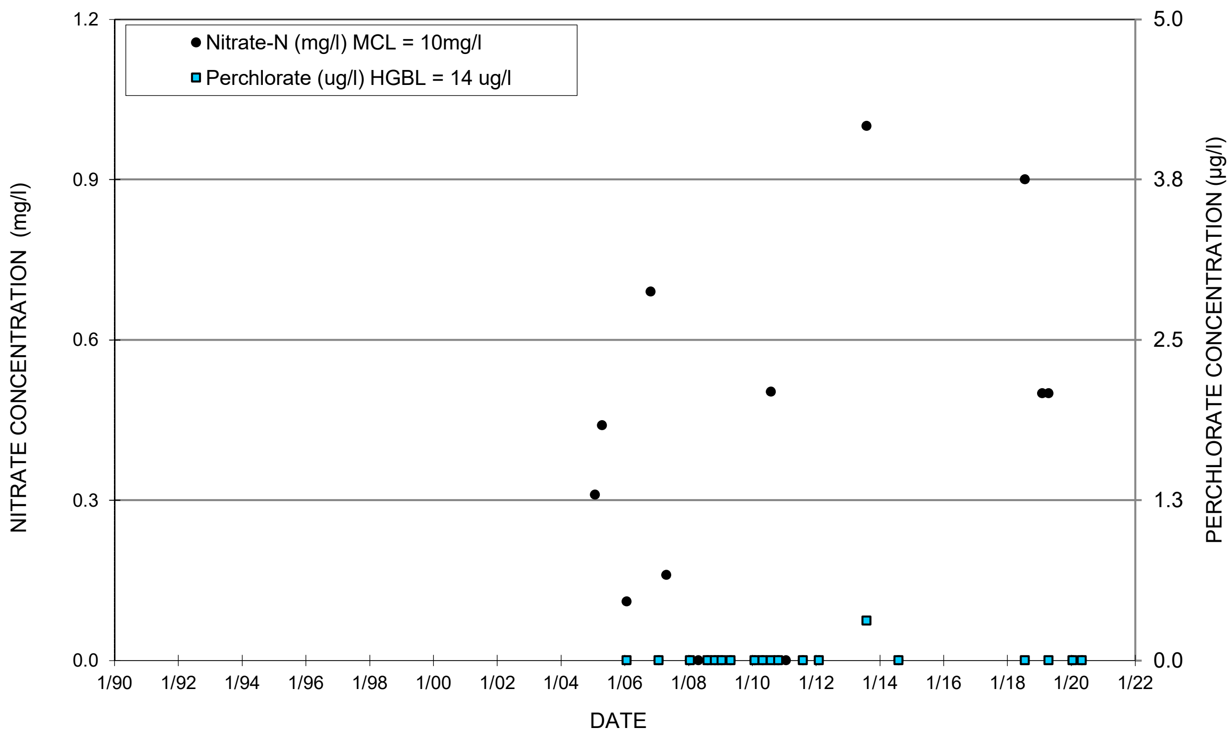
Surface Water Location SW-13

FIGURE A-54. SURFACE FLOW AND WATER QUALITY HYDROGRAPHS FOR SURFACE WATER LOCATION SW-13

HARGIS + ASSOCIATES, INC.



Surface Water Location SW-14

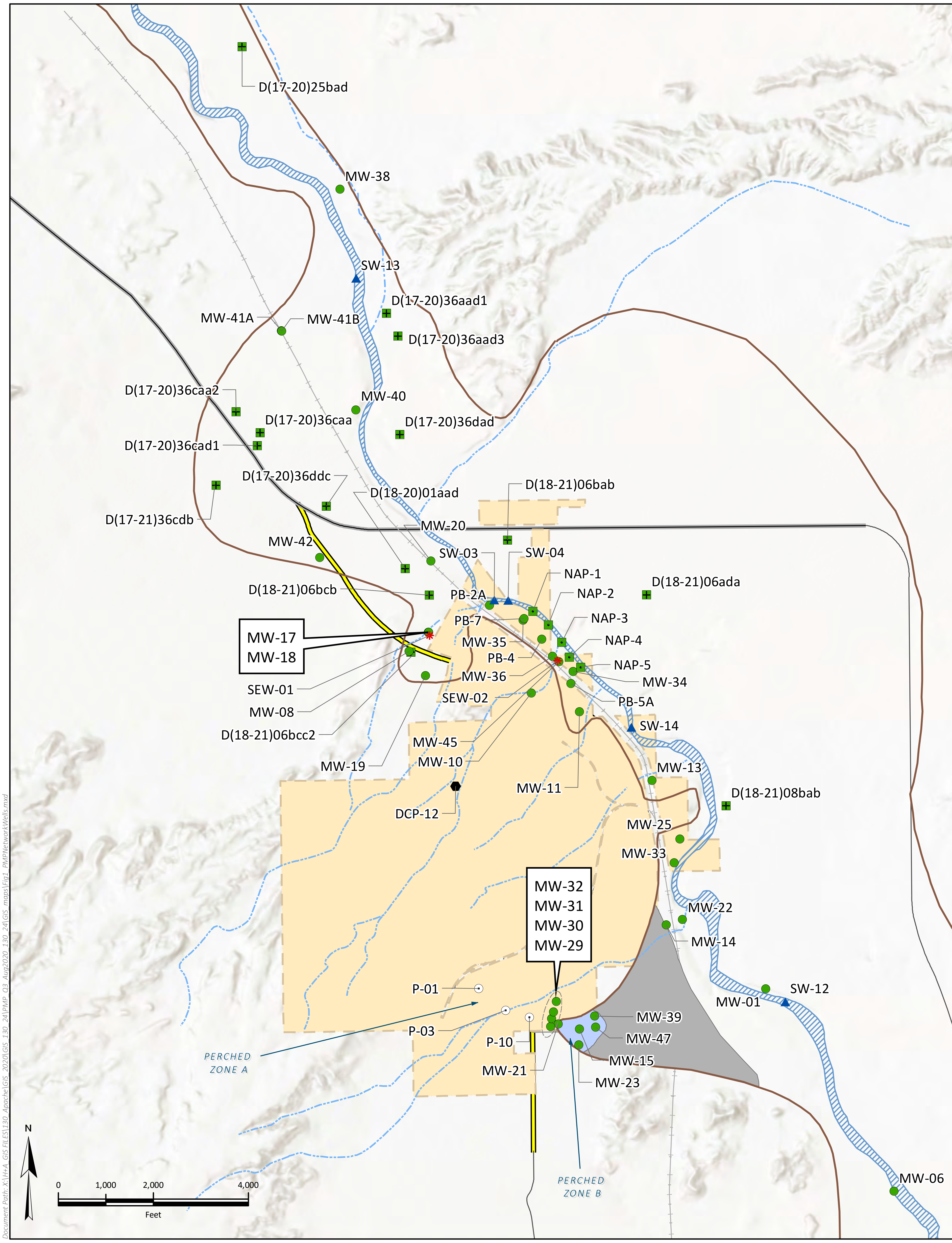


Surface Water Location SW-14

FIGURE A-55. SURFACE FLOW AND WATER QUALITY HYDROGRAPHS FOR SURFACE WATER LOCATION SW-14

APPENDIX B

PERCHED ZONE AND SHALLOW AQUIFER WATER LEVEL AND WATER QUALITY FIGURES, NOVEMBER 2020



EXPLANATION

Well Network

MW-36	Shallow Aquifer Monitor Well
SEW-01	Shallow Aquifer Extraction Well
D(18-21)06bcb	Shallow Aquifer Private Well
PB-4	Shallow Aquifer Piezometer
P-01	Perched Zone Piezometer
DCP-12	Design Confirmation Piezometer
SW-14	Surface Monitoring Station

Other Features

- Apache Powder Road
- Shallow Aquifer Boundary
- Ephemeral Stream
- San Pedro River
- ANPI Property Boundary
- Laterally Confining Unit
- Perched Zone B

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APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

PERFORMANCE MONITORING NETWORK WELLS

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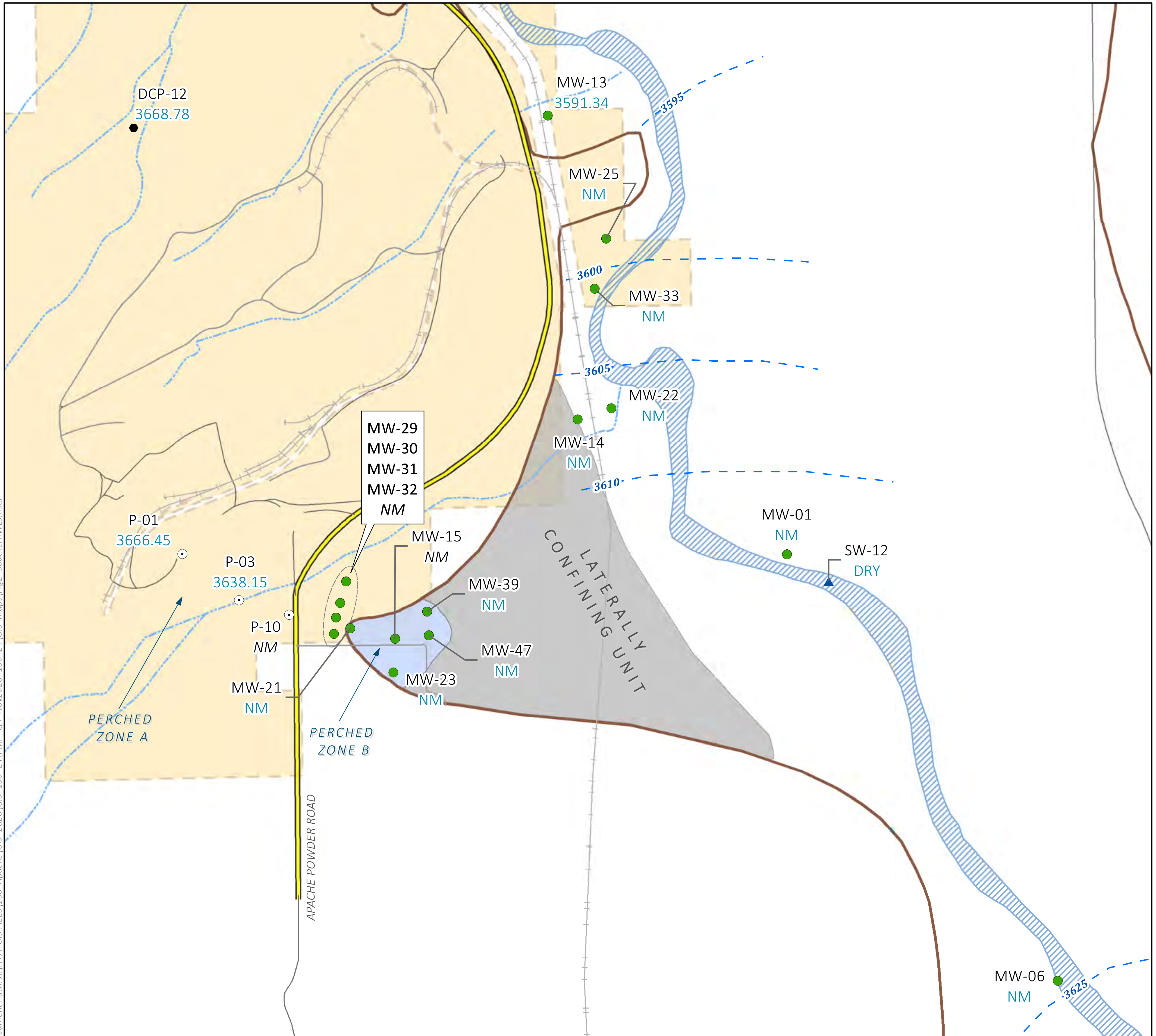
FIGURE 1

PREP BY: RAS REV BY: JSD RPT NO.: 130.24 Fig1_PMPNetworkWells Rev.



EXPLANATION

MW-25 NM	●	Shallow Aquifer Monitor Well and Water Level Elevation in ft, msl
P-03 3638.15	⊙	Perched Zone Piezometer and Water Level Elevation in ft, msl
DCP-12 3668.78	⬢	Design Confirmation Piezometer and Water Level Elevation in ft, msl
SW-12 DRY	▲	Surface Monitoring Station (Approximate Flow Rate in cfs)

- 3600 — Approximate Line of Equal Water Elevation in ft, msl
- Apache Powder
- Shallow Aquifer
- Ephemeral
- San Pedro
- Laterally Confining
- Perched Zone
- Apache Nitrogen

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Abbreviations

PWL - Pumping Water Level
NM - Not Measured
UTM - Unable To Measure
ft, msl - feet above mean sea level
cfs - cubic feet per second

0 1,000 2,000 4,000
Feet

N

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

WATER LEVEL ELEVATIONS IN THE SOUTHERN AREA SHALLOW AQUIFER NOVEMBER 2020

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FIGURE 2

PREP BY: RAS REV BY: JSD RPT NO.: 130.24 Fig2_SouthernWLs Rev. 3

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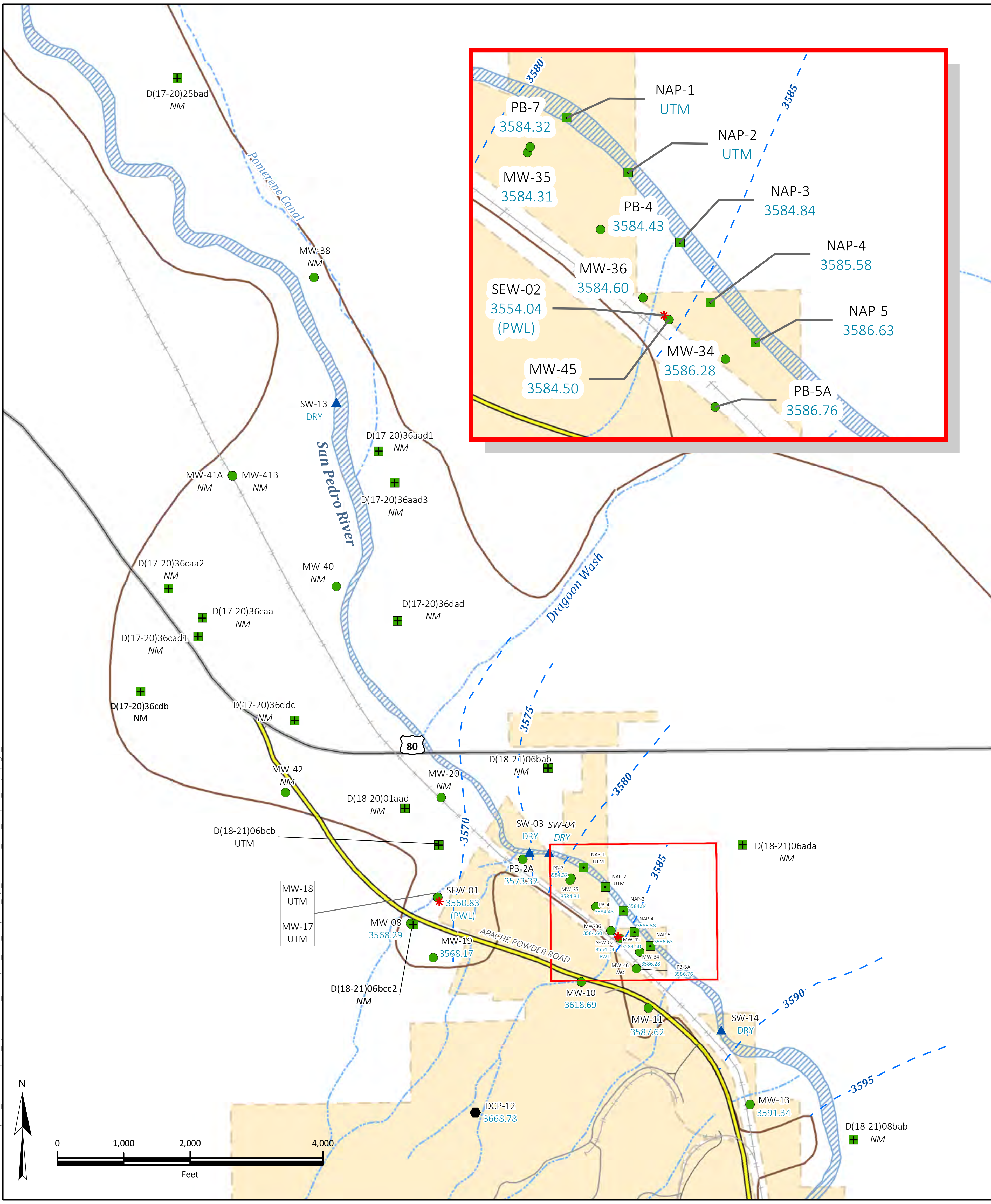

EXPLANATION

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Well Network

- MW-13 3591.34 — Shallow Aquifer Monitor Well and Water Level Elevation in ft, msl
- SEW-01 3560.83 — Shallow Aquifer Extraction Well and Water Level Elevation in ft, msl
- DCP-12 3668.78 — Design Confirmation Piezometer and Water Level Elevation in ft, msl
- NAP-1 UTM — Northern Area Piezometer and Water Level Elevation in ft, msl
- D(18-21)06bcb UTM — Northern Area Private Well and Water Level Elevation in ft, msl
- SW-14 DRY — Surface Monitoring Station (Approximate Flow Rate in cfs)

Other Features

- 3595 — Approximate Line of Equal Water Elevation in ft, msl (Dashed Where Uncertain)
- Apache Powder Road
- Shallow Aquifer Boundary
- Ephemeral Stream
- San Pedro River
- Apache Nitrogen Property

Abbreviations

PWL - Pumping Water Level
NM - Not Measured
UTM - Unable To Measure
ft, msl - feet above mean sea level
cfs - cubic feet per second

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

WATER LEVEL ELEVATIONS IN THE NORTHERN AREA SHALLOW AQUIFER NOVEMBER 2020

HARGIS + ASSOCIATES, INC.
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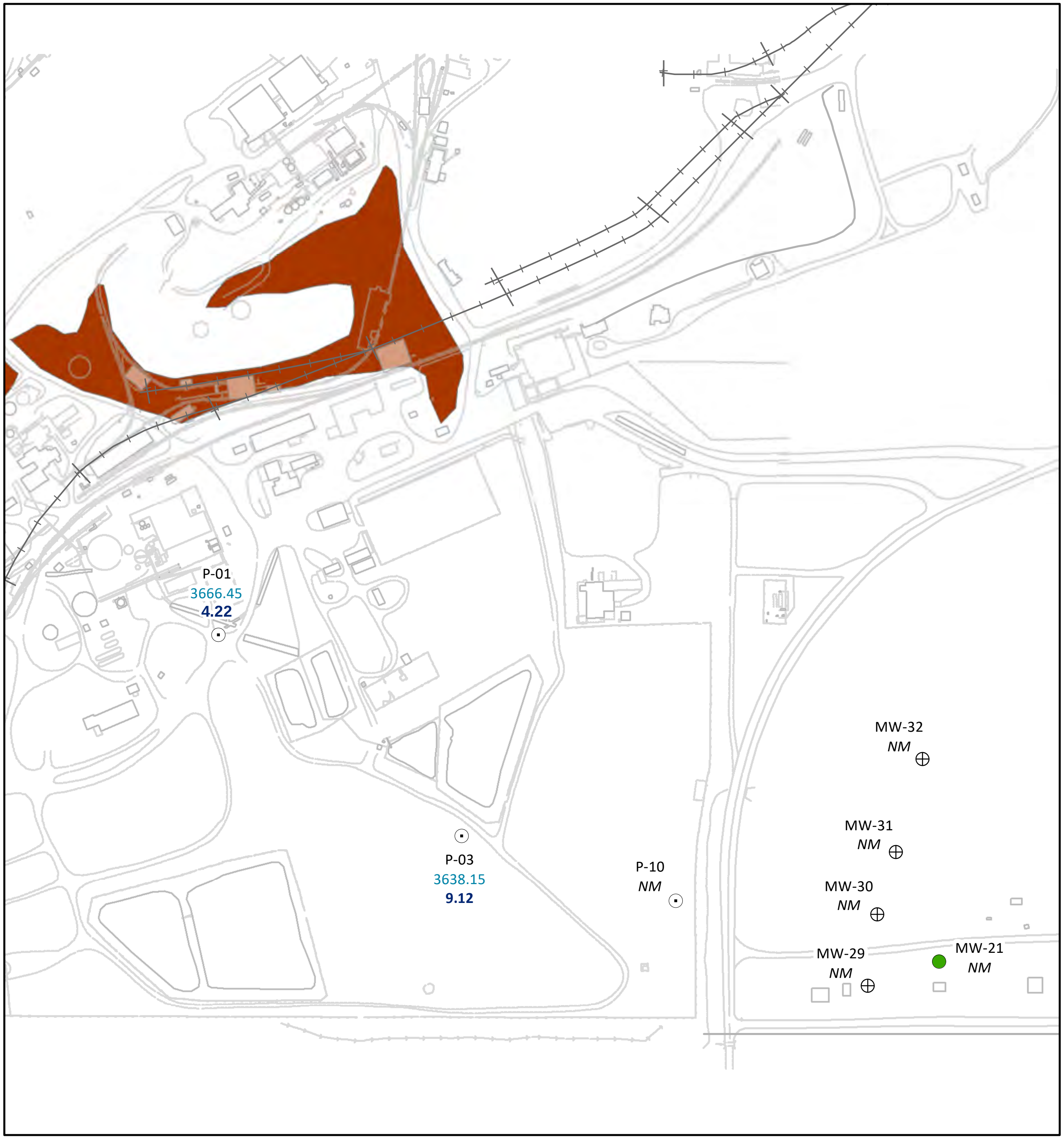
FIGURE 3

PREP BY: RAS REV BY: JSD RPT NO.: 130.24 Fig3_NorthWLs Rev. 2



EXPLANATION

Well

P-03 3638.15 **9.12** — Perched Zone A Piezometer, Elevation of Perched Groundwater in ft, msl, and Measured Saturated Thickness in ft

MW-31 *NM* — Perched Zone A Monitor Well

MW-21 NM — Perched Zone B Monitor Well

Other Features

Approximate Surface Outcrop of St. David Clay

Abbreviations

NM - *Not Measured*

ft, msl - *feet above mean sea level*

N

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0 175 350 700

Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

WATER LEVEL ELEVATIONS AND SATURATED THICKNESS IN PERCHED GROUNDWATER ZONES A AND B, NOVEMBER 2020

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FIGURE 4

PREP BY: RAS REV BY: JSD RPT NO.: 130.24 | Fig4_PerchedWL | Rev.2

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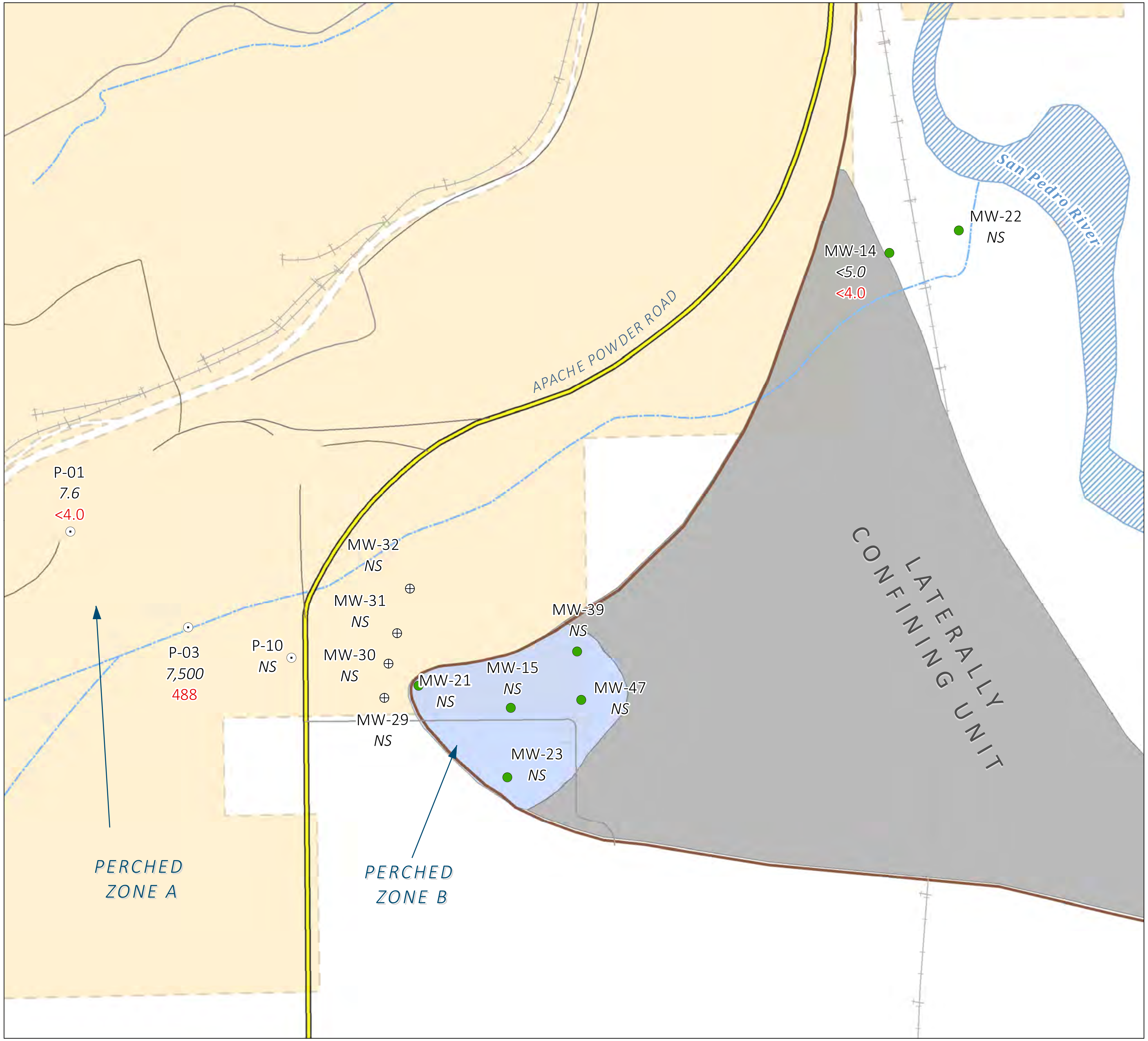

EXPLANATION

Well Network

P-01 ***7.6*** <4.0	⊙	Perched Zone A Piezometer with Nitrate-Nitrogen Concentration in Milligrams per Liter, Perchlorate Concentration in Micrograms per Liter
MW-30 *NS*	⊕	Perched Zone A Monitor Well with Nitrate-Nitrogen Concentration in Milligrams per Liter, Perchlorate Concentration in Micrograms per Liter
MW-21 *NS*	●	Perched Zone B Monitor Well with Nitrate-Nitrogen Concentration in Milligrams per Liter, Perchlorate Concentration in Micrograms per Liter

Other Features

- Apache Powder Road
- Shallow Aquifer Boundary
- Ephemeral Stream
- San Pedro River
- Perched Zone B
- Apache Nitrogen Property

Abbreviations

NS - Not Sampled

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APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

NITRATE-N AND PERCHLORATE IN SOUTHERN AREA PERCHED ZONES A AND B GROUNDWATER, NOVEMBER 2020

HARGIS + ASSOCIATES, INC.
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FIGURE 5

PREP BY: RAS REV BY: JSD RPT NO.: 130.24 Fig5_SouthNitrate Rev. 2

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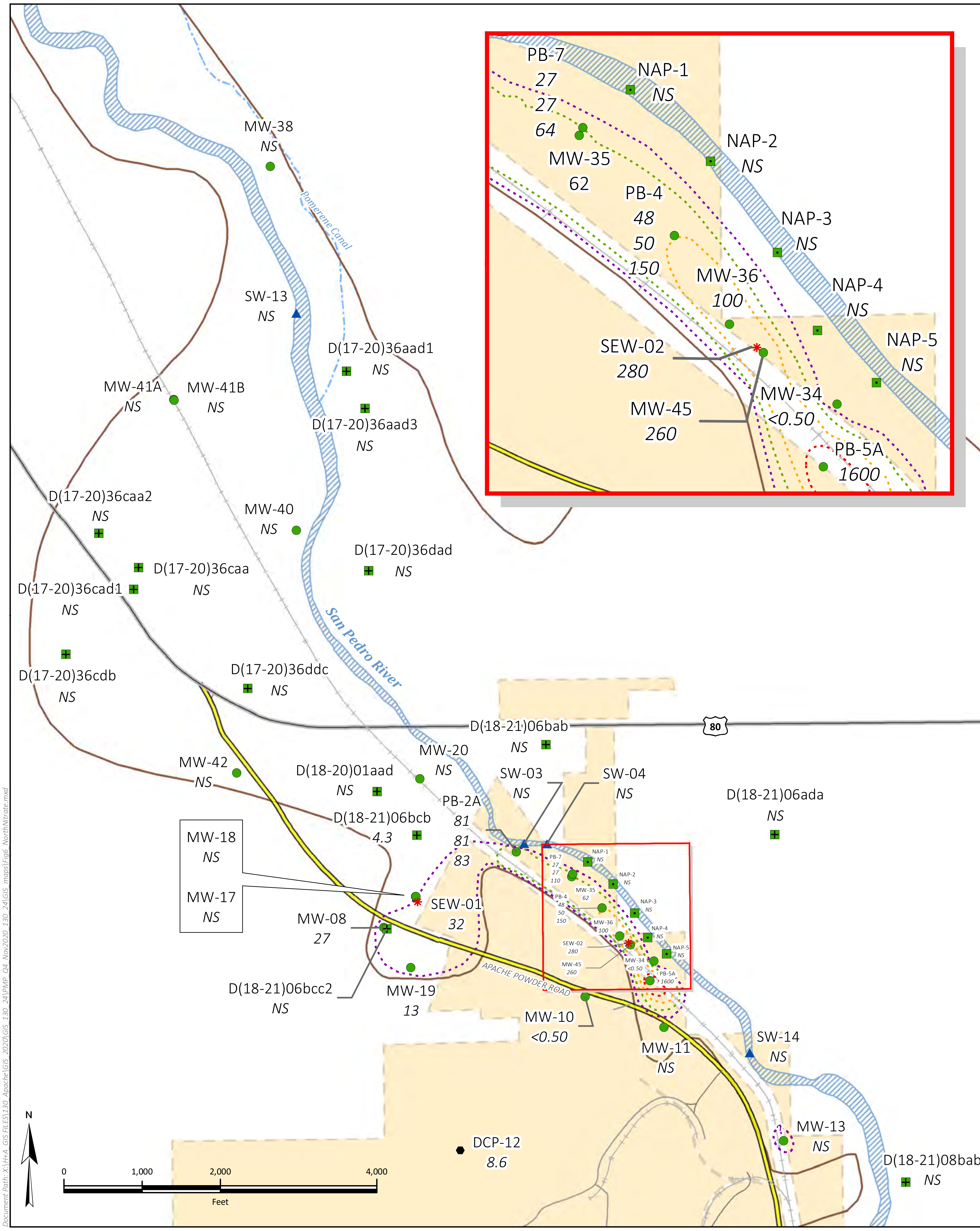

EXPLANATION

Well

PB-4 48 50 150	Shallow Aquifer Monitor Well and Nitrate-Nitrogen Concentration in mg/L in Bailed Samples from Upper, Middle, and Lower Part of Perforated Interval (Depths Provided in Table 4)
SEW-01 32	Shallow Aquifer Extraction Well and Nitrate-Nitrogen Concentration in mg/L
DCP-12 8.6	Design Confirmation Piezometer and Nitrate-Nitrogen Concentration in mg/L
NAP-1 NS	Northern Area Piezometer and Nitrate-Nitrogen Concentration in mg/L
D(18-21)06BCB 4.3	Northern Area Private Well and Nitrate-Nitrogen Concentration in mg/L
SW-14 NS	Surface Monitoring Station and Nitrate-Nitrogen Concentration in mg/L

Approximate Limit of Shallow Aquifer Groundwater with Nitrate-Nitrogen:

- >10 milligrams per
- >50 milligrams per
- >100 milligrams per
- >500 milligrams per

Other Features

- Apache Powder Road
- Shallow Aquifer Boundary
- San Pedro River
- Apache Nitrogen Property

Abbreviations

NS - Not Sampled
mg/L - milligrams per liter
? - Uncertain

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

NITRATE-NITROGEN IN SHALLOW AQUIFER GROUNDWATER & SURFACE WATER NORTHERN AREA, NOVEMBER 2020

HARGIS + ASSOCIATES, INC.
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FIGURE 6

PREP BY: RAS REV BY: JSD RPT NO.: 130.24 Fig6_NorthNitrate Rev. 2

APPENDIX C

NARS MONITORING SCHEDULES

TABLE C-1
EXTRACTION WELL MONITORING SCHEDULE

Analyte or Parameter to be Monitored[a]	Monitoring Frequency Normal Operation Period	Comment
METALS		
aluminum	every 5 years	November 2021; September 2026
antimony	every 5 years	November 2021; September 2026
arsenic	every 5 years	November 2021; September 2026
barium	every 5 years	November 2021; September 2026
beryllium	every 5 years	November 2021; September 2026
cadmium	every 5 years	November 2021; September 2026
chromium (total)	every 5 years	November 2021; September 2026
copper	every 5 years	November 2021; September 2026
lead	every 5 years	November 2021; September 2026
iron	every 5 years	November 2021; September 2026
manganese	every 5 years	November 2021; September 2026
mercury	every 5 years	November 2021; September 2026
selenium	every 5 years	November 2021; September 2026
silver	every 5 years	November 2021; September 2026
thallium	every 5 years	November 2021; September 2026
zinc	every 5 years	November 2021; September 2026
NITROGEN SPECIES / NUTRIENTS		
nitrate-N	weekly	weekly monitoring may be performed utilizing field methods and verified monthly by lab
ammonia-N	quarterly	
total phosphorus	quarterly	

TABLE C-1
EXTRACTION WELL MONITORING SCHEDULE

Analyte or Parameter to be Monitored[a]	Monitoring Frequency Normal Operation Period	Comment
MAJOR IONS		
bicarbonate	annual	
calcium	annual	
carbonate		
chloride	annual	
fluoride	annual	
magnesium	annual	
orthophosphate	annual	
potassium	annual	
sodium	annual	
sulfate	annual	
TDS	annual	
MISCELLANEOUS		
perchlorate	annual	
FIELD PARAMETERS		
pH	monthly	
temperature	monthly	
EC	monthly	
FLOW RATE	weekly	
WATER LEVELS	quarterly	

ABBREVIATIONS/ACRONYMS:

EC = specific conductance
nitrate-N = nitrate-Nitrogen
pH = hydrogen ion potential
TDS = total dissolved solids

NOTES:

[a] = Extraction well water quality analysis may be performed utilizing field methods / instrumentation where possible.

TABLE C-2
TREATMENT CELL MONITORING SCHEDULE

Analyte or Parameter to be Monitored [a]	Monitoring Frequency Normal Operation Period	Comment
NITROGEN SPECIES / NUTRIENTS		
ammonia-N	monthly	
TKN	annual	
organic nitrogen	annual	
nitrate-N	weekly	weekly monitoring may be performed utilizing field methods and verified monthly by lab
total phosphorus	quarterly	
MISCELLANEOUS		
COD	quarterly	
TOC	quarterly	
FIELD PARAMETERS		
DO	monthly	more frequently if needed
pH	monthly	more frequently if needed
EC	monthly	more frequently if needed
temperature	monthly	more frequently if needed
WATER LEVELS	weekly	

ABBREVIATIONS/ACRONYMS:

COD = chemical oxygen demand
DO = dissolved oxygen
EC = specific conductance
nitrate-N = nitrate-Nitrogen
ph = hydrogen ion potential

TABLE C-3
WETLAND EFFLUENT MONITORING SCHEDULE

Analyte or Parameter to be Monitored[a]	Monitoring Frequency	Comment
	Normal Operation Period	
METALS		
aluminum	every 5 years	November 2021; September 2026
antimony	every 5 years	November 2021; September 2026
arsenic	every 5 years	November 2021; September 2026
barium	every 5 years	November 2021; September 2026
beryllium	every 5 years	November 2021; September 2026
cadmium	every 5 years	November 2021; September 2026
chromium (total)	every 5 years	November 2021; September 2026
copper	every 5 years	November 2021; September 2026
lead	every 5 years	November 2021; September 2026
iron	every 5 years	November 2021; September 2026
manganese	every 5 years	November 2021; September 2026
mercury	every 5 years	November 2021; September 2026
selenium	every 5 years	November 2021; September 2026
silver	every 5 years	November 2021; September 2026
thallium	every 5 years	November 2021; September 2026
zinc	every 5 years	November 2021; September 2026
NITROGEN SPECIES / NUTRIENTS		
nitrate-N	weekly	weekly monitoring may be performed utilizing field methods and verified monthly by lab
ammonia-N	weekly	
organic nitrogen	annual	
TKN	annual	
total phosphorus	quarterly	

TABLE C-3
WETLAND EFFLUENT MONITORING SCHEDULE

Analyte or Parameter to be Monitored[a]	Monitoring Frequency	Comment
	Normal Operation Period	
MAJOR IONS		
bicarbonate	annual	
calcium	annual	
carbonate		
chloride	annual	
fluoride	annual	
magnesium	annual	
orthophosphate	annual	
potassium	annual	
sodium	annual	
sulfate	annual	
MISCELLANEOUS		
TSS	quarterly	
TDS	quarterly	
FIELD PARAMETERS		
pH	monthly	more frequently if needed
temperature	monthly	more frequently if needed
dissolved oxygen	monthly	more frequently if needed
EC	monthly	more frequently if needed
FLOW RATE	weekly	Daily monitoring only following adjustments in flow rate, then weekly

ABBREVIATIONS/ACRONYMS:

EC = specific conductance
nitrate-N = nitrate-Nitrogen
pH = hydrogen ion potential
TDS = total dissolved solids
TKN = total kjeldahl nitrogen
TSS = total suspended solids

NOTES:

[a] = Effluent water quality analysis may be performed utilizing field methods / instrumentation where possible.

TABLE C-4
MONITOR WELL MONITORING SCHEDULE

Analyte or Parameter to be Monitored[a]	Monitoring Frequency Normal Operation Period	Comment
Design Confirmation Piezometer DCP-12		
METALS		
barium	every 5 years	November 2021; September 2026
beryllium	every 5 years	November 2021; September 2026
chromium (total)	every 5 years	November 2021; September 2026
lead	every 5 years	November 2021; September 2026
mercury	every 5 years	November 2021; September 2026
thallium	every 5 years	November 2021; September 2026
NITROGEN SPECIES / NUTRIENTS		
nitrate-N	quarterly	quarterly monitoring performed by laboratory[b]
FIELD PARAMETERS		
pH	quarterly	
temperature	quarterly	
EC	quarterly	
WATER LEVELS	monthly	
Monitor Well MW-10		
NITROGEN SPECIES / NUTRIENTS		
nitrate-N	quarterly	quarterly monitoring performed by laboratory[b]
ammonia-N	quarterly	quarterly monitoring performed by laboratory[b]
FIELD PARAMETERS		
pH	quarterly	more frequently if needed
temperature	quarterly	more frequently if needed
EC	quarterly	more frequently if needed
WATER LEVELS	weekly	

TABLE C-4
MONITOR WELL MONITORING SCHEDULE

ABBREVIATIONS/ACRONYMS:

EC = specific conductance
nitrate-N = nitrate-Nitrogen
pH = hydrogen ion potential

NOTES:

a = Monitor Well water quality analysis may be performed utilizing field methods / instrumentation where possible.
b = More frequent monitoring will be required at DCP-12 if treatment cell overflow occurs. More frequent monitoring will be required at MW-10 if AWQS standard is exceeded.

TABLE C-5
TREATMENT CELL SOIL MONITORING SCHEDULE

Analyte or Parameter to be Monitored	Monitoring Frequency Normal Operation Period	Comment
METALS		
aluminum	every 5 years	November 2021; September 2026
antimony	every 5 years	November 2021; September 2026
arsenic	every 5 years	November 2021; September 2026
barium	every 5 years	November 2021; September 2026
beryllium	every 5 years	November 2021; September 2026
cadmium	every 5 years	November 2021; September 2026
chromium	every 5 years	November 2021; September 2026
copper	every 5 years	November 2021; September 2026
lead	every 5 years	November 2021; September 2026
iron	every 5 years	November 2021; September 2026
manganese	every 5 years	November 2021; September 2026
nickel	every 5 years	November 2021; September 2026
mercury	every 5 years	November 2021; September 2026
selenium	every 5 years	November 2021; September 2026
silver	every 5 years	November 2021; September 2026
thallium	every 5 years	November 2021; September 2026
zinc	every 5 years	November 2021; September 2026
NITROGEN SPECIES / NUTRIENTS		
nitrate-N	every 5 years	November 2021; September 2026
ammonia-N	every 5 years	November 2021; September 2026
TKN	every 5 years	November 2021; September 2026
total nitrogen (calculation)	every 5 years	November 2021; September 2026
total organic carbon	every 5 years	November 2021; September 2026
total phosphorus	every 5 years	November 2021; September 2026

TABLE C-5
TREATMENT CELL SOIL MONITORING SCHEDULE

Analyte or Parameter to be Monitored	Monitoring Frequency Normal Operation Period	Comment
MAJOR IONS		
bicarbonate	every 5 years	November 2021; September 2026
calcium	every 5 years	November 2021; September 2026
carbonate	every 5 years	November 2021; September 2026
chloride	every 5 years	November 2021; September 2026
fluoride	every 5 years	November 2021; September 2026
magnesium	every 5 years	November 2021; September 2026
orthophosphate	every 5 years	November 2021; September 2026
pH	every 5 years	November 2021; September 2026
potassium	every 5 years	November 2021; September 2026
sodium	every 5 years	November 2021; September 2026
sulfate	every 5 years	November 2021; September 2026

ABBREVIATIONS/ACRONYMS:

nitrate-N = nitrate-Nitrogen
pH = hydrogen ion potential
TKN = total kjeldahl nitrogen

APPENDIX D

NARS WATER LEVEL AND WATER QUALITY HYDROGRAPHS

APPENDIX D

TABLE

TABLE D-1

WATER LEVEL DATA
(TREATMENT CELLS)

IDENTIFIER	DATE MEASURED	WATER DEPTH (feet)
ANA	1/3/2020	4.75
	1/10/2020	4.75
	1/16/2020	4.75
	1/24/2020	4.75
	1/31/2020	4.75
	2/7/2020	4.75
	2/14/2020	4.75
	2/20/2020	4.75
	2/28/2020	4.75
	3/6/2020	4.75
	3/13/2020	4.75
	3/20/2020	4.75
	3/27/2020	4.75
	4/1/2020	4.75
	4/9/2020	4.75
	4/16/2020	4.75
	4/23/2020	4.75
	5/1/2020	4.75
	5/8/2020	4.75
	5/15/2020	4.75
	5/22/2020	4.75
	5/29/2020	4.75
	6/5/2020	4.75
	6/12/2020	4.75
	6/18/2020	4.75
	6/26/2020	4.75
	7/2/2020	4.75
	7/10/2020	4.75
	7/17/2020	4.75
	7/24/2020	4.75
	7/31/2020	4.75
	8/7/2020	4.75
	8/14/2020	4.75
	8/21/2020	4.75
	8/28/2020	4.75
	9/4/2020	4.75
	9/11/2020	4.75
	9/18/2020	4.75
	9/25/2020	4.75
	10/2/2020	4.75
	10/9/2020	4.75
	10/16/2020	4.75
	10/23/2020	4.75

TABLE D-1

WATER LEVEL DATA
(TREATMENT CELLS)

IDENTIFIER	DATE MEASURED	WATER DEPTH (feet)
ANA	10/30/2020	4.75
	11/5/2020	4.75
	11/12/2020	4.75
	11/20/2020	4.75
	11/25/2020	4.75
	12/4/2020	4.75
	12/10/2020	4.75
	12/17/2020	4.75
	12/23/2020	4.75
	12/31/2020	4.75
FDA	1/3/2020	2.20
	1/10/2020	2.20
	1/16/2020	2.20
	1/24/2020	2.20
	1/31/2020	2.20
	2/7/2020	2.20
	2/14/2020	2.20
	2/20/2020	2.20
	2/28/2020	2.20
	3/6/2020	2.20
	3/13/2020	2.20
	3/20/2020	2.20
	3/27/2020	2.20
	4/1/2020	2.20
	4/9/2020	2.20
	4/16/2020	2.20
	4/23/2020	2.20
	5/1/2020	2.20
	5/8/2020	2.20
	5/15/2020	2.20
	5/22/2020	2.20
	5/29/2020	2.20
	6/5/2020	2.20
	6/12/2020	2.20
	6/18/2020	2.20
	6/26/2020	2.20
	7/2/2020	2.20
	7/10/2020	2.20
	7/17/2020	2.20
	7/24/2020	2.20
	7/31/2020	2.20
	8/7/2020	2.20
	8/14/2020	2.20
	8/21/2020	2.20

TABLE D-1

WATER LEVEL DATA
(TREATMENT CELLS)

IDENTIFIER	DATE MEASURED	WATER DEPTH (feet)
FDA	8/28/2020	2.20
	9/4/2020	2.20
	9/11/2020	2.20
	9/18/2020	2.20
	9/25/2020	2.20
	10/2/2020	2.20
	10/9/2020	2.20
	10/16/2020	2.20
	10/23/2020	2.20
	10/30/2020	2.20
	11/5/2020	2.20
	11/12/2020	2.20
	11/20/2020	2.20
	11/25/2020	2.20
	12/4/2020	2.20
	12/10/2020	2.20
	12/17/2020	2.20
	12/23/2020	2.20
	12/31/2020	2.20
PDA-C	1/3/2020	3.00
	1/10/2020	3.00
	1/16/2020	3.00
	1/24/2020	3.00
	1/31/2020	3.00
	2/7/2020	3.00
	2/14/2020	3.00
	2/20/2020	3.00
	2/28/2020	3.00
	3/6/2020	3.00
	3/13/2020	3.00
	3/20/2020	3.00
	3/27/2020	3.00
	4/1/2020	3.00
	4/9/2020	3.00
	4/16/2020	3.00
	4/23/2020	3.00
	5/1/2020	3.00
	5/8/2020	3.00
	5/15/2020	3.00
	5/22/2020	3.00

TABLE D-1

WATER LEVEL DATA
(TREATMENT CELLS)

IDENTIFIER	DATE MEASURED	WATER DEPTH (feet)
PDA-C	5/29/2020	3.00
	6/5/2020	3.00
	6/12/2020	3.00
	6/18/2020	3.00
	6/26/2020	3.00
	7/2/2020	3.00
	7/10/2020	3.00
	7/17/2020	3.00
	7/24/2020	3.00
	7/31/2020	3.00
	8/7/2020	3.00
	8/14/2020	3.00
	8/21/2020	3.00
	8/28/2020	3.00
	9/4/2020	3.00
	9/11/2020	3.00
	9/18/2020	3.00
	9/25/2020	3.00
	10/2/2020	3.00
	10/9/2020	3.00
	10/16/2020	3.00
	10/23/2020	3.00
	10/30/2020	3.00
	11/5/2020	3.00
	11/12/2020	3.00
	11/20/2020	3.00
	11/25/2020	3.00
	12/4/2020	3.00
	12/10/2020	3.00
	12/17/2020	3.00
	12/23/2020	3.00
	12/31/2020	3.00
PDA-N	1/3/2020	2.20
	1/10/2020	2.20
	1/16/2020	2.20
	1/24/2020	2.20
	1/31/2020	2.20
	2/7/2020	2.20
	2/14/2020	2.20
	2/20/2020	2.20

TABLE D-1

WATER LEVEL DATA
(TREATMENT CELLS)

IDENTIFIER	DATE MEASURED	WATER DEPTH (feet)
PDA-N	2/28/2020	2.20
	3/6/2020	2.20
	3/13/2020	2.20
	3/20/2020	2.20
	3/27/2020	2.20
	4/1/2020	2.20
	4/9/2020	2.20
	4/16/2020	2.20
	4/23/2020	2.20
	5/1/2020	2.20
	5/8/2020	2.20
	5/15/2020	2.20
	5/22/2020	2.20
	5/29/2020	2.20
	6/5/2020	2.20
	6/12/2020	2.20
	6/18/2020	2.20
	6/26/2020	2.20
	7/2/2020	2.20
	7/10/2020	2.20
	7/17/2020	2.20
	7/24/2020	2.20
	7/31/2020	2.20
	8/7/2020	2.20
	8/14/2020	2.20
	8/21/2020	2.20
	8/28/2020	2.20
	9/4/2020	2.20
	9/11/2020	2.20
	9/18/2020	2.20
	9/25/2020	2.20
	10/2/2020	2.20
	10/9/2020	2.20
	10/16/2020	2.20
	10/23/2020	2.20
	10/30/2020	2.20
	11/5/2020	2.20
	11/12/2020	2.20
	11/20/2020	2.20
	11/25/2020	2.20
	12/4/2020	2.20

TABLE D-1

WATER LEVEL DATA
(TREATMENT CELLS)

IDENTIFIER	DATE MEASURED	WATER DEPTH (feet)
PDA-N	12/10/2020	2.20
	12/17/2020	2.20
	12/23/2020	2.20
	12/31/2020	2.20
PDA-S	1/3/2020	2.50
	1/10/2020	2.50
	1/16/2020	2.50
	1/24/2020	2.50
	1/31/2020	2.50
	2/7/2020	2.50
	2/14/2020	2.50
	2/20/2020	2.50
	2/28/2020	2.50
	3/6/2020	2.50
	3/13/2020	2.50
	3/20/2020	2.50
	3/27/2020	2.50
	4/1/2020	2.50
	4/9/2020	2.50
	4/16/2020	2.50
	4/23/2020	2.50
	5/1/2020	2.50
	5/8/2020	2.50
	5/15/2020	2.50
	5/22/2020	2.50
	5/29/2020	2.50
	6/5/2020	2.50
	6/12/2020	2.50
	6/18/2020	2.50
	6/26/2020	2.50
	7/2/2020	2.50
	7/10/2020	2.50
	7/17/2020	2.50
	7/24/2020	2.50
	7/31/2020	2.50
	8/7/2020	2.50
	8/14/2020	2.50
	8/21/2020	2.50
	8/28/2020	2.50
	9/4/2020	2.50

TABLE D-1

WATER LEVEL DATA
(TREATMENT CELLS)

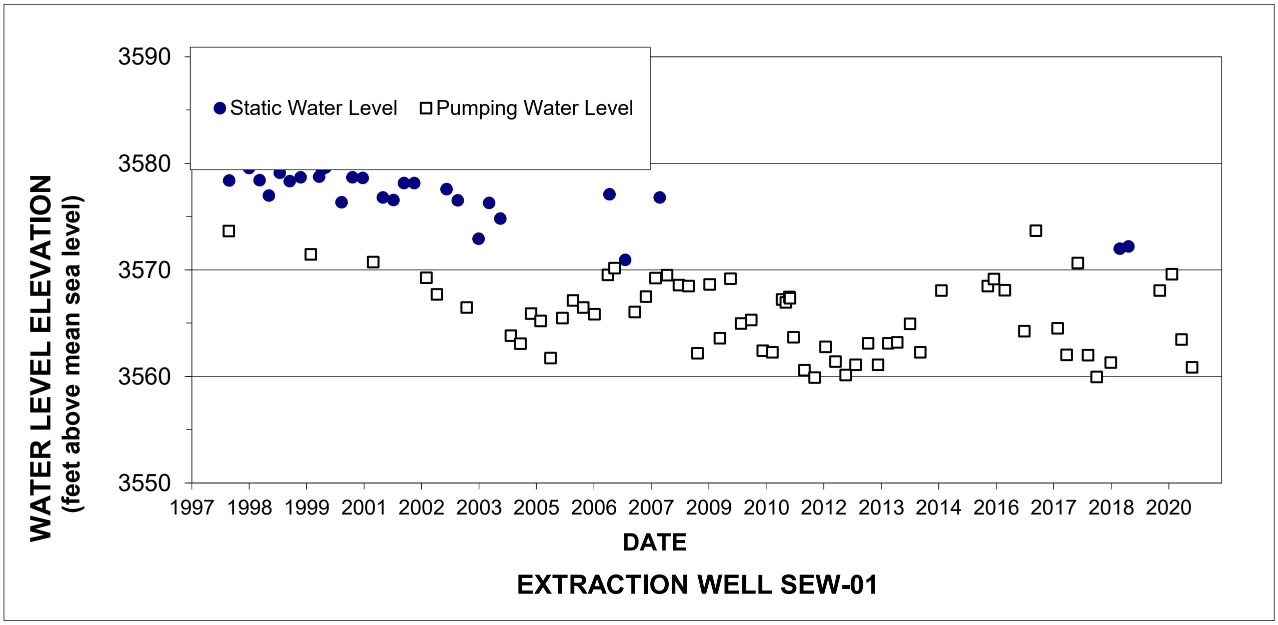
IDENTIFIER	DATE MEASURED	WATER DEPTH (feet)
PDA-S	9/11/2020	2.50
	9/18/2020	2.50
	9/25/2020	2.50
	10/2/2020	2.50
	10/9/2020	2.50
	10/16/2020	2.50
	10/23/2020	2.50
	10/30/2020	2.50
	11/5/2020	2.50
	11/12/2020	2.50
	11/20/2020	2.50
	11/25/2020	2.50
	12/4/2020	2.50
	12/10/2020	2.50
	12/17/2020	2.50
	12/23/2020	2.50
	12/31/2020	2.50

NOTES and ABBREVIATIONS:

1. Water depths are measured with staff gauges located in outlet structures.

APPENDIX D

FIGURES



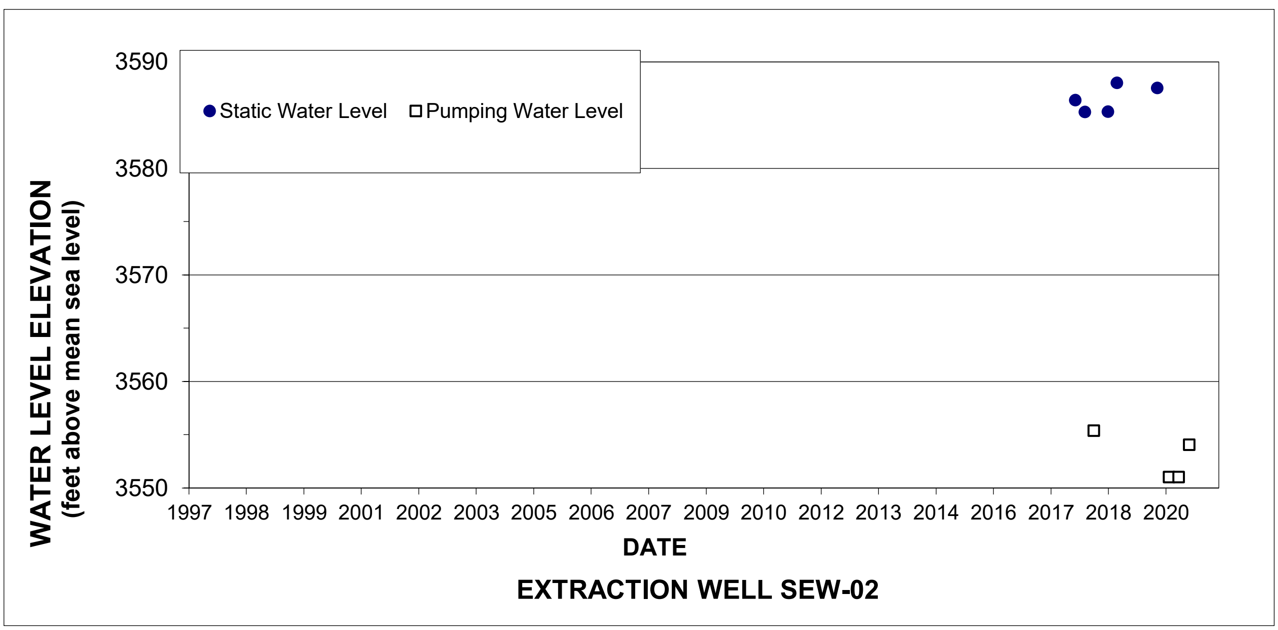
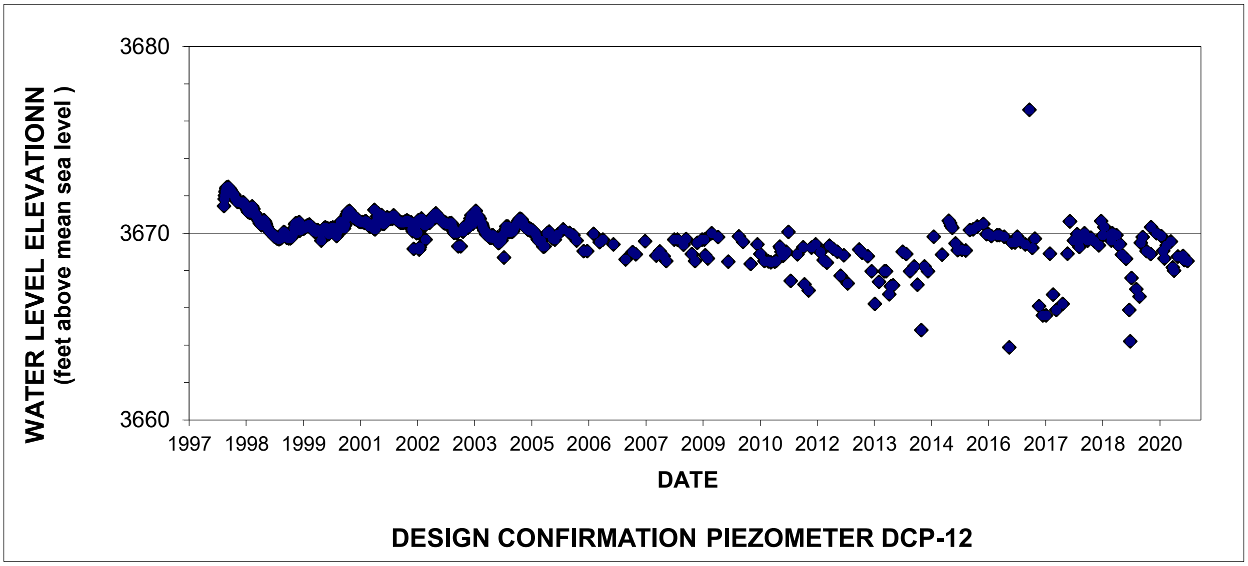


FIGURE D-1. WATER LEVEL HYDROGRAPHS FOR EXTRACTION WELL SEW-01 AND EXTRACTION WELL SEW-02



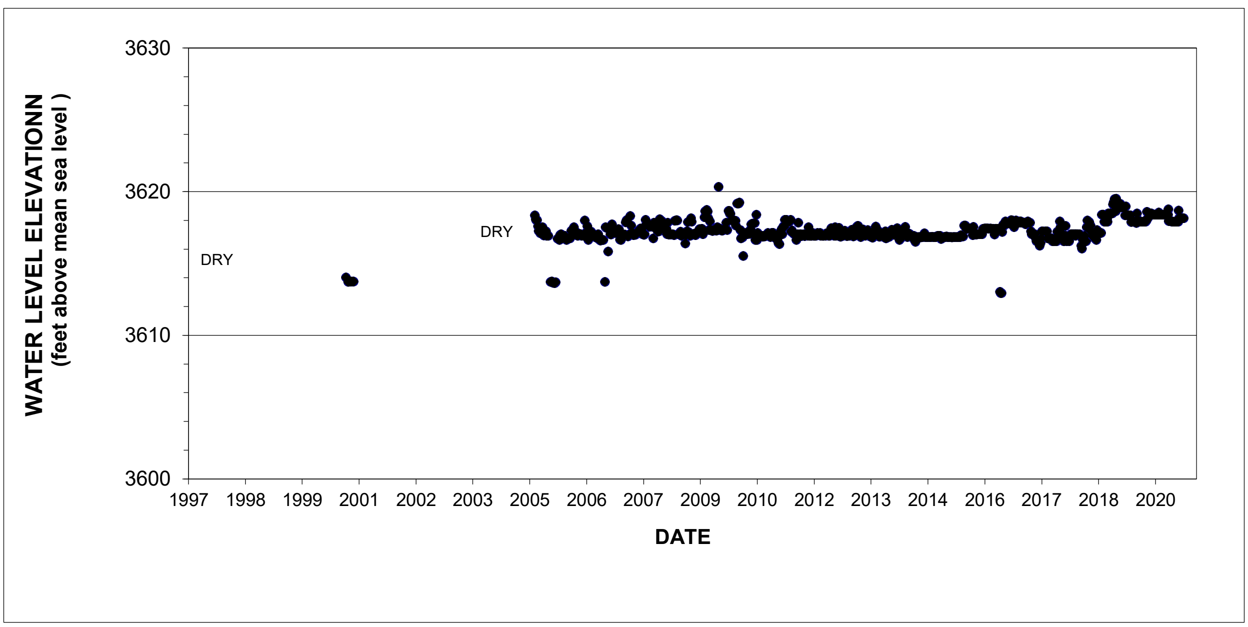
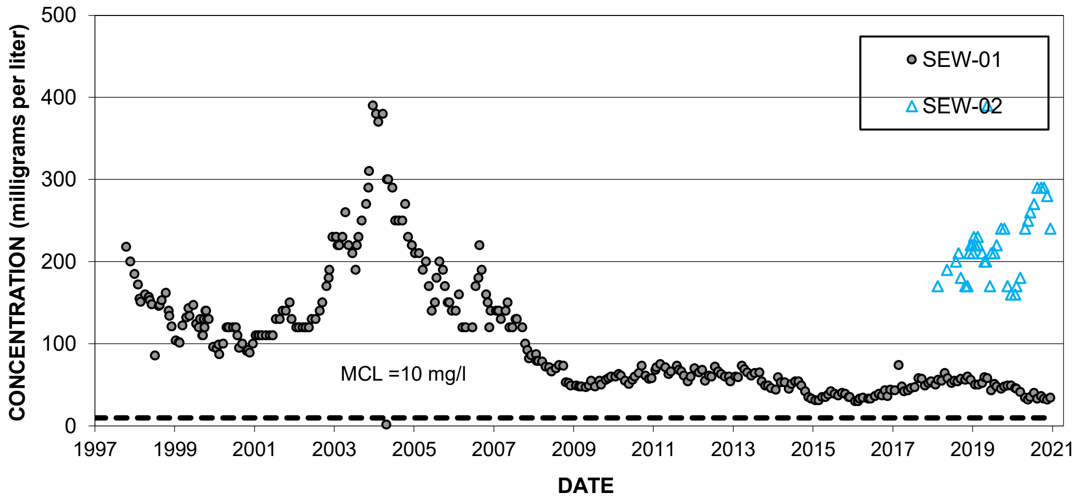
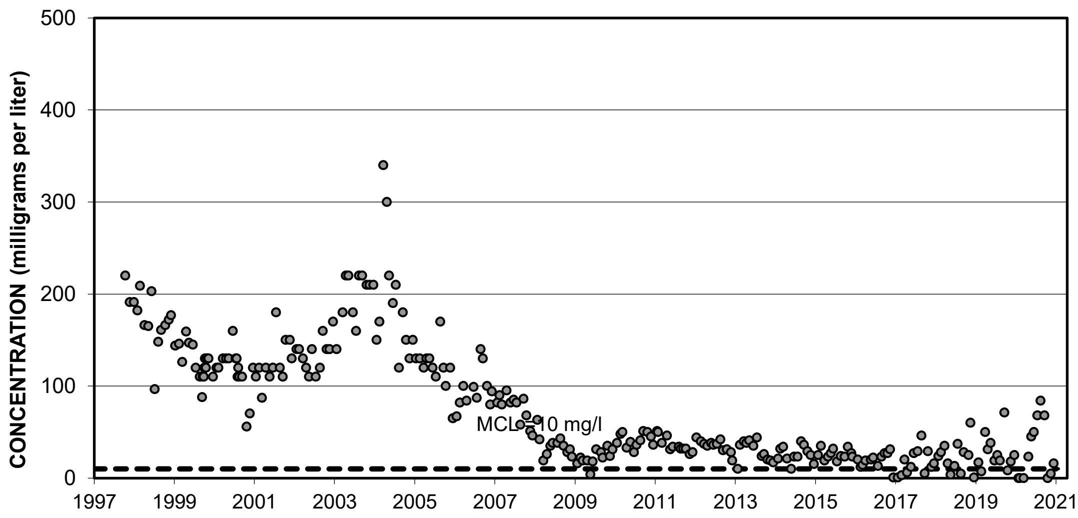


FIGURE D-2. WATER LEVEL HYDROGRAPHS FOR DESIGN CONFIRMATION PIEZOMETER DCP-12 AND MONITOR WELL MW-10



EXTRACTION WELLS SEW-01 AND SEW-02



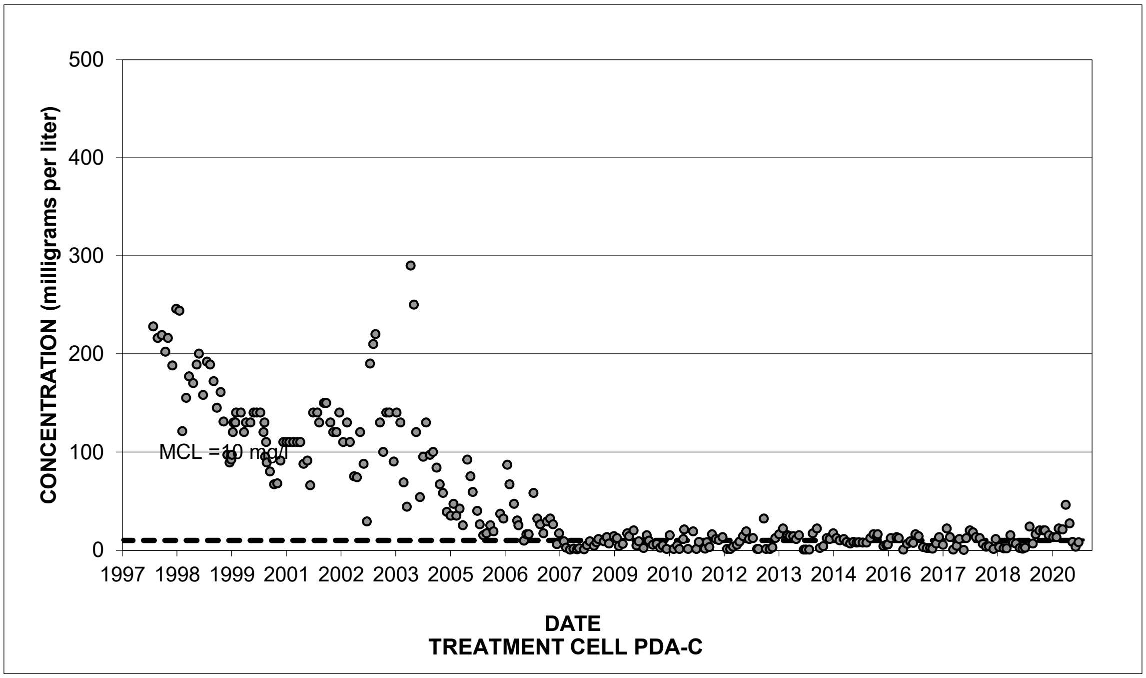
TREATMENT CELL PDA-S

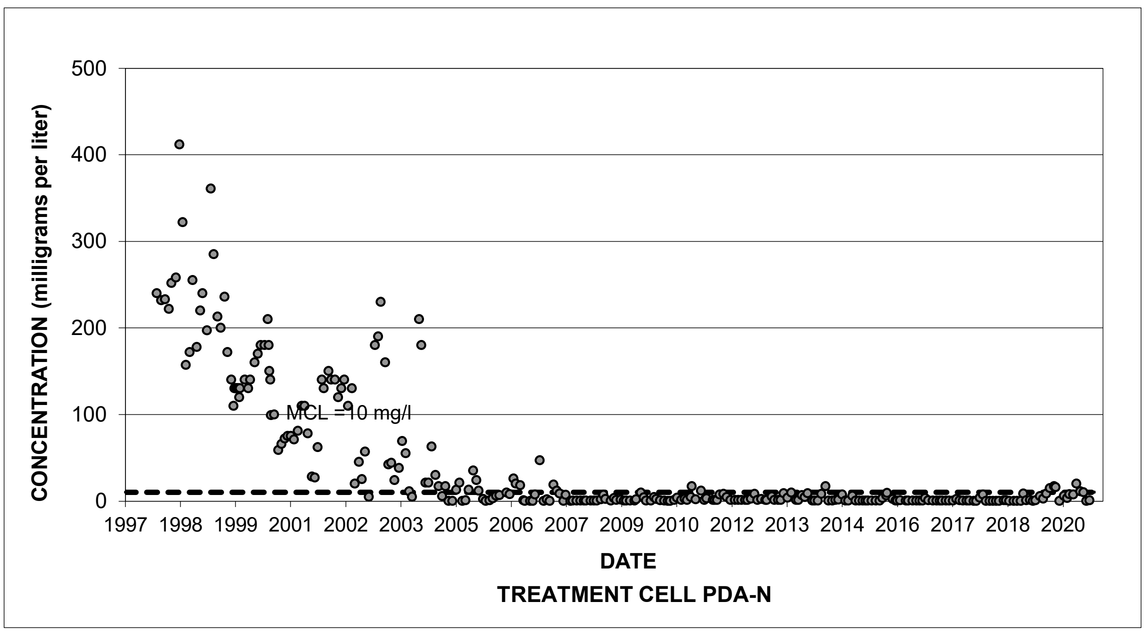
Notes:

MCL = Federal Maximum Contaminant Level

NO_3-N = Nitrate as Nitrogen

FIGURE D-3. WATER QUALITY HYDROGRAPHS FOR NO3-N IN NARS EXTRACTION WELL SEW-1 AND TREATMENT CELL PDA-S



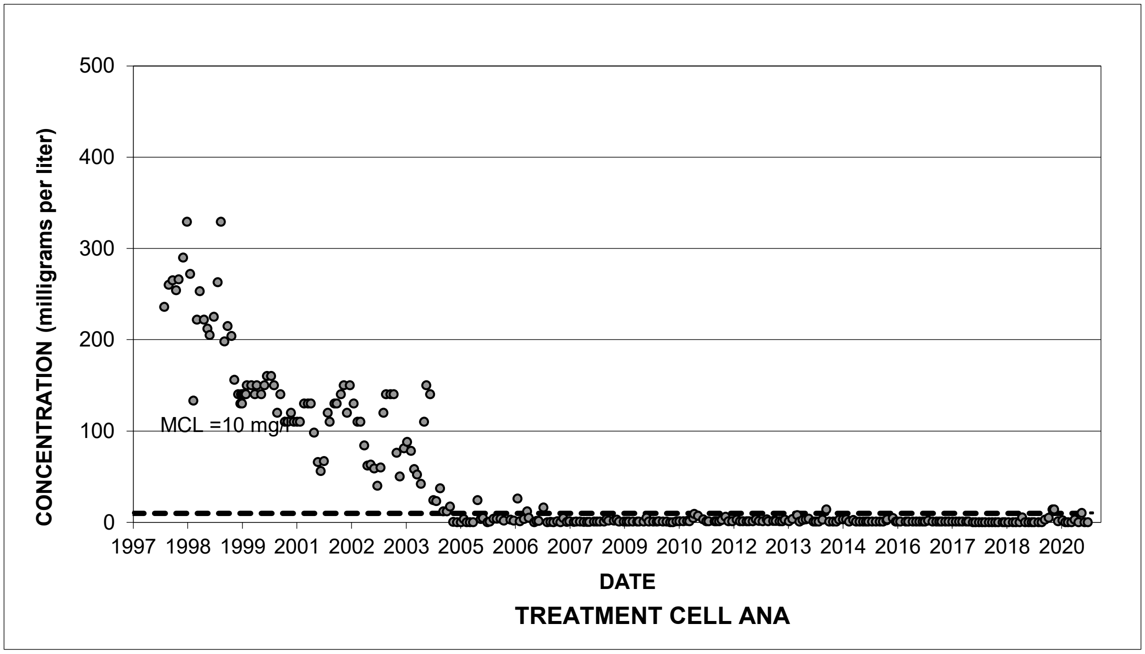


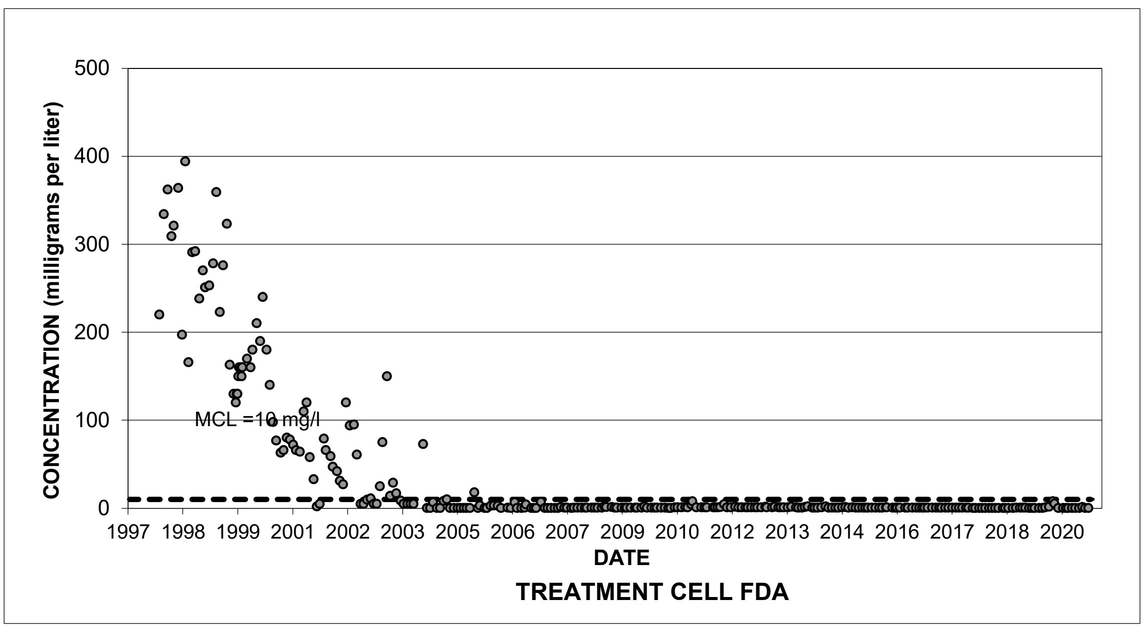
Notes:

MCL = Federal Maximum Contaminant Level

NO_3-N = Nitrate as Nitrogen

FIGURE D-4. WATER QUALITY HYDROGRAPHS FOR NO3-N IN NARS TREATMENT CELLS PDA-C AND PDA-N



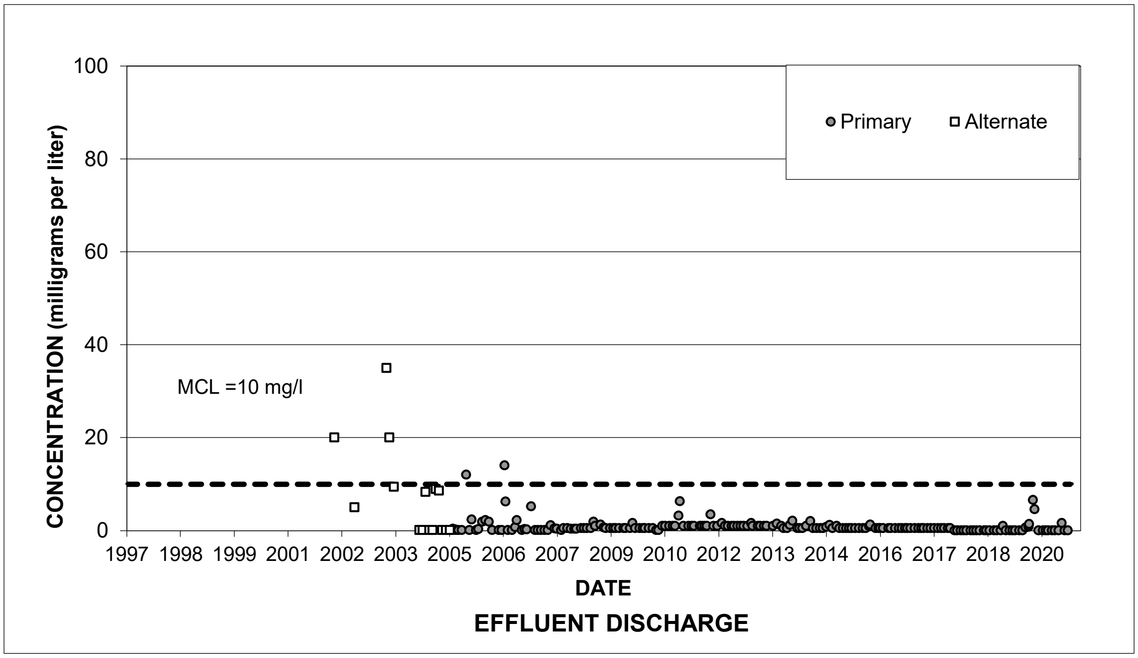


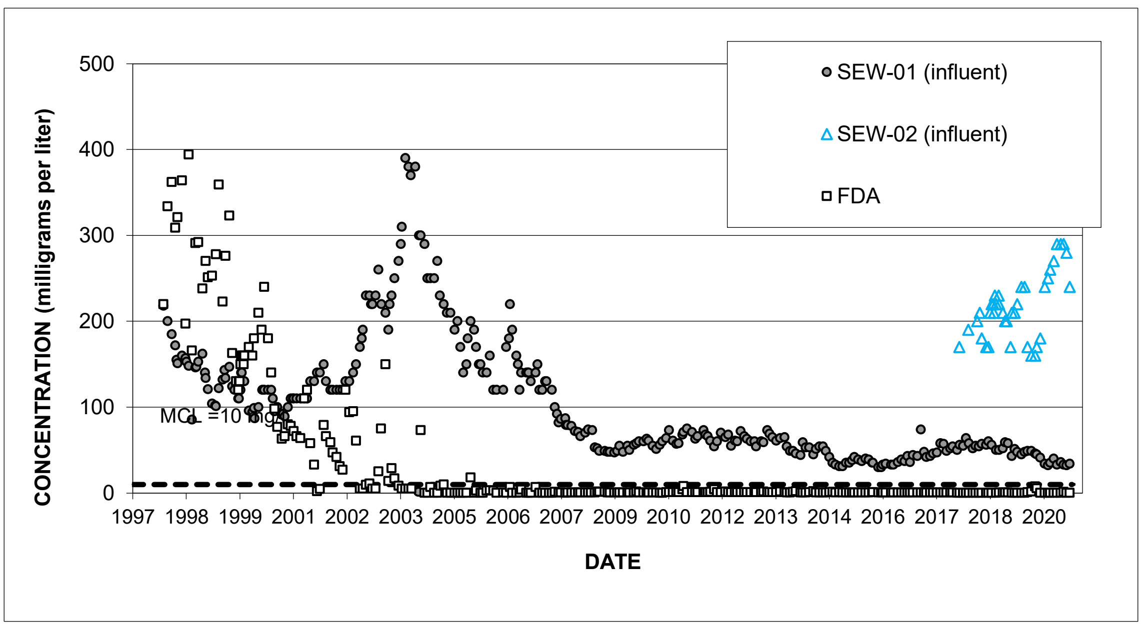
Notes:

MCL = Federal Maximum Contaminant Level

NO_3-N = Nitrate as Nitrogen

FIGURE D-5. WATER QUALITY HYDROGRAPHS FOR NO3-N IN NARS TEATMENT CELLS ANA AND FDA



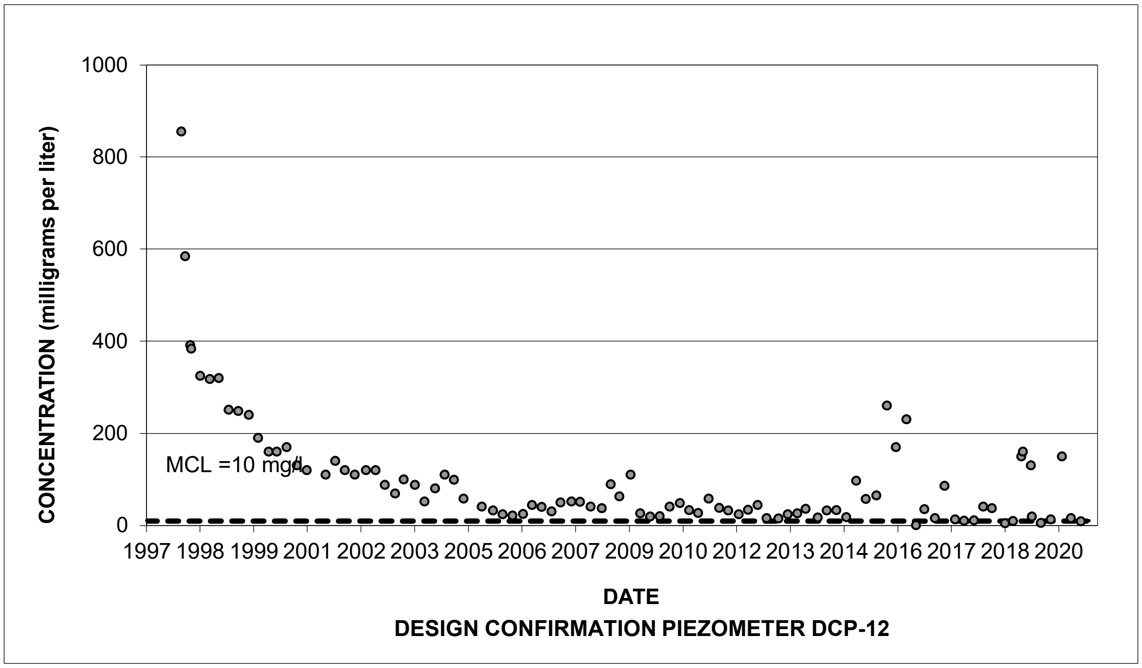


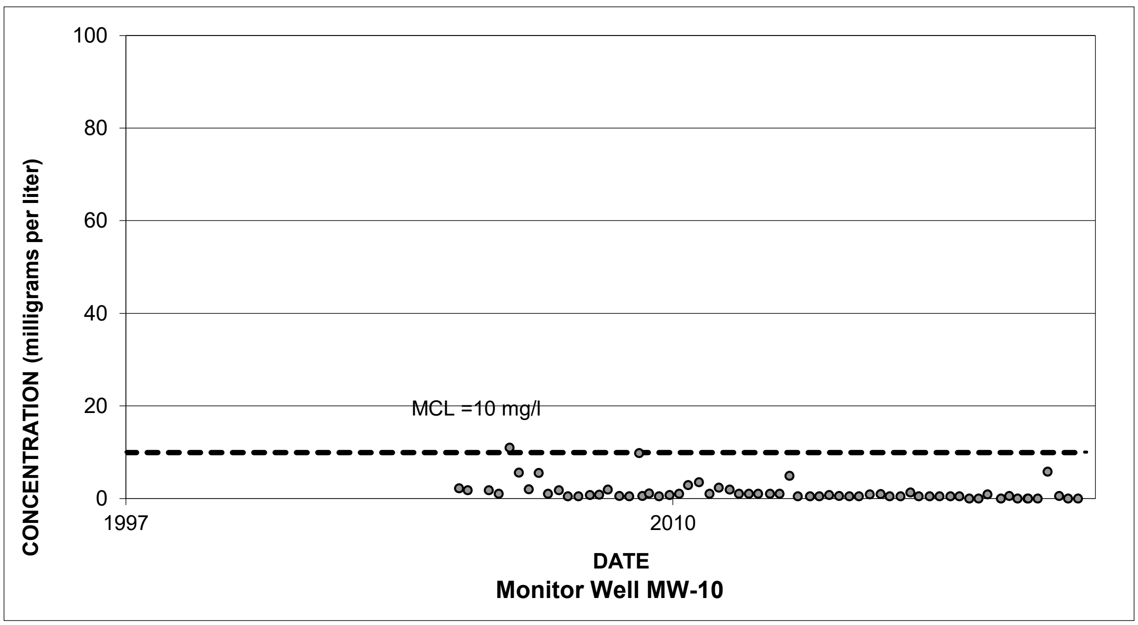
Notes:

MCL = Federal Maximum Contaminant Level

NO_3-N = Nitrate as Nitrogen

FIGURE D-6. WATER QUALITY HYDROGRAPHS FOR NO3-N AT NARS EFFLUENT AND INFLUENT





Notes:

MCL = Federal Maximum Contaminant Level

NO_3-N = Nitrate as Nitrogen

FIGURE D-7. WATER QUALITY HYDROGRAPHS FOR NO3-N IN DESIGN CONFIRMATION PIEZOMETER AND MW-10

APPENDIX E

NARS FIELD DATA

APPENDIX E

TABLES

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
TREATMENT CELLS						
ANA	1/3/2020	---	---	3.6	10.08	ORG
	1/10/2020	---	---	4.7	11.57	ORG
	1/16/2020	---	---	5.7	10.95	ORG
	1/24/2020	---	---	5.9	12.23	ORG
	1/28/2020	7.54	1.053	6.2	10.11	ORG
	1/31/2020	---	---	5.6	9.71	ORG
	2/7/2020	---	---	3.8	15.25	ORG
	2/11/2020	7.38	1.004	6.5	19.28	ORG
	2/14/2020	---	---	7.5	16.99	ORG
	2/20/2020	---	---	6.9	12.03	ORG
	2/28/2020	---	---	6.3	7.02	ORG
	3/6/2020	---	---	9.7	4.78	ORG
	3/13/2020	---	---	11.6	1.92	ORG
	3/17/2020	7.53	1.008	10.2	0.76	ORG
	3/20/2020	---	---	8.8	0.43	ORG
	3/27/2020	---	---	10.9	0.18	ORG
	4/1/2020	---	---	12.3	0.36	ORG
	4/9/2020	---	---	12.5	0.71	ORG
	4/16/2020	---	---	11	0.43	ORG
	4/23/2020			12.1	0.77	ORG
	4/28/2020	7.34	1.072	14.8	2.11	ORG
	5/1/2020	---	---	14.6	1.01	ORG
	5/8/2020	---	---	16.1	0.71	ORG
	5/15/2020	---	---	15.0	0.72	ORG
	5/22/2020	---	---	14.4	0.69	ORG
	5/26/2020	7.10	1.125	14.2	0.38	ORG
	5/29/2020	---	---	18.5	0.45	ORG
	6/5/2020	---	---	18.7	0.71	ORG
	6/12/2020	---	---	17.8	0.45	ORG
	6/16/2020	7.45	1.3	19.5	1.32	ORG
	6/18/2020	---	---	17.7	0.51	ORG
	6/26/2020	---	---	18.1	1.84	ORG
	7/2/2020	---	---	19.9	0.45	ORG
	7/10/2020	---	---	21.4	10.54	ORG
	7/17/2020	---	---	21.9	1.08	ORG
	7/20/2020	7.36	1.515	21.2	2.64	ORG
	7/24/2020	---	---	21.1	1.52	ORG
	7/31/2020	---	---	22.3	1.01	ORG
	8/7/2020	---	---	21.6	0.78	ORG
	8/14/2020			22.4	0.94	ORG
	8/18/2020	7.34	3.649	21.0	4.49	ORG
	8/21/2020	---	---	21.6	0.65	ORG
	8/28/2020	---	---	20.7	6.98	ORG
	9/4/2020	---	---	20.7	7.51	ORG
	9/11/2020	---	---	18.4	1.66	ORG
	9/18/2020	---	---	19.0	0.69	ORG
	9/22/2020	7.34	1.477	17.5	1.17	ORG
	9/25/2020	---	---	17.7	0.71	ORG
	10/2/2020	---	---	15.8	1.19	ORG
	10/9/2020	---	---	15.2	5.10	ORG
	10/16/2020	---	---	14.6	8.75	ORG
	10/20/2020	7.28	1.495	13.3	9.59	ORG
	10/23/2020	---	---	14.5	2.67	ORG
	10/30/2020	---	---	11.1	0.88	ORG
	11/5/2020	---	---	12.0	0.99	ORG
	11/12/2020	---	---	9.9	1.69	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
TREATMENT CELLS						
ANA	11/17/2020	7.35	1.246	8.7	2.32	ORG
	11/20/2020	---	---	10.5	1.98	ORG
	11/25/2020	---	---	9.1	0.92	ORG
	12/4/2020	---	---	4.2	0.85	ORG
	12/10/2020	---	---	6.3	0.93	ORG
	12/15/2020	7.55	1.043	7.2	1.21	ORG
	12/17/2020		---	5.1	0.62	ORG
	12/23/2020	---	---	4.6	0.74	ORG
	12/31/2020	---	---	3.6	5.86	ORG
FDA	1/3/2020	---	---	4.1	4.35	ORG
	1/10/2020	---	---	5.3	5.22	ORG
	1/16/2020	---	---	4.8	5.54	ORG
	1/24/2020	---	---	6.7	7.11	ORG
	1/28/2020	7.28	1.127	6.6	5.29	ORG
	1/31/2020	---	---	6.1	5.35	ORG
	2/7/2020	---	---	5.6	6.18	ORG
	2/11/2020	7.1	1.08	6.1	7.68	ORG
	2/14/2020	---	---	10	6.44	ORG
	2/20/2020	---	---	7.3	3.76	ORG
	2/28/2020	---	---	7.8	1.67	ORG
	3/6/2020	---	---	9.5	1.42	ORG
	3/13/2020	---	---	11.5	0.86	ORG
	3/17/2020	7.2	1.175	10.3	0.52	ORG
	3/20/2020	---	---	8.5	0.66	ORG
	3/27/2020	---	---	10.5	0.2	ORG
	4/1/2020	---	---	11.1	0.48	ORG
	4/9/2020	---	---	11.3	0.59	ORG
	4/16/2020	---	---	10	0.47	ORG
	4/23/2020	---	---	11.3	0.85	ORG
	4/28/2020	7.28	1.145	15.8	1.18	ORG
	5/1/2020	---	---	13.7	0.86	ORG
	5/8/2020	---	---	15.3	0.93	ORG
	5/15/2020	---	---	14.5	1.01	ORG
	5/22/2020	---	---	13.7	0.82	ORG
	5/26/2020	6.82	1.197	12.5	0.66	ORG
	5/29/2020	---	---	14.8	0.41	ORG
	6/5/2020	---	---	15.2	0.54	ORG
	6/12/2020	---	---	16.8	0.31	ORG
	6/16/2020	7.30	1.332	16.6	0.45	ORG
	6/18/2020	---	---	16.2	0.37	ORG
	6/26/2020	---	---	16.9	0.79	ORG
	7/2/2020	---	---	17.9	0.47	ORG
	7/10/2020	---	---	20.9	6.05	ORG
	7/17/2020	---	---	19.6	0.45	ORG
	7/20/2020	6.81	1.661	18.5	0.59	ORG
	7/24/2020	---	---	19.9	0.85	ORG
	7/31/2020	---	---	20.3	0.49	ORG
	8/7/2020	---	---	19.6	0.44	ORG
	8/14/2020	---	---	20.5	0.84	ORG
	8/18/2020	7.08	3.575	18.6	1.76	ORG
	8/21/2020	---	---	20.1	0.55	ORG
	8/28/2020	---	---	18.6	1.07	ORG
	9/4/2020	---	---	18.8	1.08	ORG
	9/11/2020	---	---	17.4	1.54	ORG
	9/18/2020	---	---	19.6	1.16	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
TREATMENT CELLS						
FDA	9/22/2020	7.35	1.442	15.7	0.86	ORG
	9/25/2020	---	---	16.6	0.73	ORG
	10/2/2020	---	---	13.8	0.53	ORG
	10/9/2020	---	---	14.2	0.58	ORG
	10/16/2020	---	---	14.8	1.33	ORG
	10/20/2020	7.24	1.486	12.4	1.73	ORG
	10/23/2020	---	---	13.5	1.01	ORG
	10/30/2020	---	---	10.5	1.39	ORG
	11/5/2020	---	---	12.2	0.62	ORG
	11/12/2020	---	---	9.7	1.18	ORG
	11/17/2020	7.31	1.240	8.5	1.11	ORG
	11/20/2020	---	---	10.5	0.73	ORG
	11/25/2020	---	---	9.6	0.61	ORG
	12/4/2020	---	---	3.4	0.89	ORG
	12/10/2020	---	---	7.7	0.72	ORG
	12/15/2020	7.48	1.190	6.1	1.13	ORG
	12/17/2020	---	---	6.3	1.38	ORG
	12/23/2020	---	---	5.5	0.46	ORG
	12/31/2020	---	---	3.6	2.02	ORG
PDA-C	1/3/2020	---	---	7.9	15.85	ORG
	1/10/2020	---	---	8.3	18.58	ORG
	1/16/2020	---	---	7.9	17.19	ORG
	1/24/2020	---	---	8.9	18.13	ORG
	1/28/2020	7.34	1.084	9.3	19.08	ORG
	1/31/2020	---	---	9.3	14.09	ORG
	2/7/2020	---	---	8.3	23.52	ORG
	2/11/2020	7.11	1.009	8.6	28.8	ORG
	2/14/2020	---	---	9.2	24.68	ORG
	2/20/2020	---	---	8.2	20.77	ORG
	2/28/2020	---	---	8.7	14.61	ORG
	3/6/2020	---	---	10.1	11.91	ORG
	3/13/2020	---	---	11.7	0.68	ORG
	3/17/2020	6.95	1.075	11	11.51	ORG
	3/20/2020	---	---	10.3	10.03	ORG
	3/27/2020	---	---	11.2	6.29	ORG
	4/1/2020	---	---	12.5	15.01	ORG
	4/9/2020	---	---	14.6	15.92	ORG
	4/16/2020	---	---	11.5	10.05	ORG
	4/23/2020	---	---	14.5	20.78	ORG
	4/28/2020	7.04	1.102	14.7	15.31	ORG
	5/1/2020	---	---	14.3	8.32	ORG
	5/8/2020	---	---	15.3	8.04	ORG
	5/15/2020	---	---	15.3	8.86	ORG
	5/22/2020	---	---	14.8	9.95	ORG
	5/26/2020	6.90	1.216	14.5	9.27	ORG
	5/29/2020	---	---	16.0	8.43	ORG
	6/5/2020	---	---	16.2	7.89	ORG
	6/12/2020	---	---	20.3	7.25	ORG
	6/16/2020	7.20	1.365	18.0	20.25	ORG
	6/18/2020	---	---	17.5	12.70	ORG
	6/26/2020	---	---	17.9	24.83	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
TREATMENT CELLS						
PDA-C	7/2/2020	---	---	18.7	20.18	ORG
	7/10/2020	---	---	20.6	24.37	ORG
	7/17/2020	---	---	20.6	15.51	ORG
	7/20/2020	6.94	1.559	20.1	11.07	ORG
	7/24/2020	---	---	20.5	13.21	ORG
	7/31/2020	---	---	20.7	16.01	ORG
	8/7/2020	---	---	20.9	20.16	ORG
	8/14/2020	---	---	21.2	19.32	ORG
	8/18/2020	7.10	3.671	20.3	27.92	ORG
	8/21/2020	---	---	20.9	8.98	ORG
	8/28/2020	---	---	20.4	35.82	ORG
	9/4/2020	---	---	20.4	35.71	ORG
	9/11/2020	---	---	19.2	25.02	ORG
	9/18/2020	---	---	18.8	14.79	ORG
	9/22/2020	7.19	1.410	18.1	28.52	ORG
	9/25/2020	---	---	18.2	23.03	ORG
	10/2/2020	---	---	16.3	32.31	ORG
	10/9/2020	---	---	16.2	33.07	ORG
	10/16/2020	---	---	15.7	9.67	ORG
	10/20/2020	7.23	1.622	15.0	11.04	ORG
	10/23/2020	---	---	15.4	7.16	ORG
	10/30/2020	---	---	12.5	4.31	ORG
	11/5/2020	---	---	13.7	4.09	ORG
	11/12/2020	---	---	11.8	5.82	ORG
	11/17/2020	7.21	1.230	11.3	8.66	ORG
	11/20/2020	---	---	12.0	8.23	ORG
	11/25/2020	---	---	11.4	4.49	ORG
	12/4/2020	---	---	8.1	4.83	ORG
	12/10/2020	---	---	9.0	5.50	ORG
	12/15/2020	7.37	1.113	7.5	8.13	ORG
	12/17/2020	---	---	7.7	8.52	ORG
	12/23/2020	---	---	6.7	10.07	ORG
	12/31/2020	---	---	6.7	25.60	ORG
PDA-N	1/3/2020	---	---	4.2	13.81	ORG
	1/10/2020	---	---	5.5	14.48	ORG
	1/16/2020	---	---	5.3	13.24	ORG
	1/24/2020	---	---	5.8	15.01	ORG
	1/28/2020	7.63	1.021	6.2	14.85	ORG
	1/31/2020	---	---	6.0	12.15	ORG
	2/7/2020	---	---	4.6	18.60	ORG
	2/11/2020	7.39	0.958	5.9	22.42	ORG
	2/14/2020	---	---	7	19.54	ORG
	2/20/2020	---	---	6	13.31	ORG
	2/28/2020	---	---	6.1	6.75	ORG
	3/6/2020	---	---	8.7	3.17	ORG
	3/13/2020	---	---	9.8	0.66	ORG
	3/17/2020	7.43	0.945	8.9	0.51	ORG
	3/20/2020	---	---	7.8	0.5	ORG
	3/27/2020	---	---	9.4	0.22	ORG
	4/1/2020	---	---	10.3	0.93	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
TREATMENT CELLS						
PDA-N	4/9/2020	---	---	11.6	4.24	ORG
	4/16/2020	---	---	9.2	4.01	ORG
	4/23/2020	---	---	10.2	5.25	ORG
	4/28/2020	7.33	1.027	13.0	7.26	ORG
	5/1/2020	---	---	13.0	3.41	ORG
	5/8/2020	---	---	14.0	2.23	ORG
	5/15/2020	---	---	13.4	2.42	ORG
	5/22/2020	---	---	12.7	2.72	ORG
	5/26/2020	7.16	1.103	12.0	2.08	ORG
	5/29/2020	---	---	14.6	1.59	ORG
	6/5/2020	---	---	14.8	2.01	ORG
	6/12/2020	---	---	16.0	1.27	ORG
	6/16/2020	7.46	1.324	16.9	6.78	ORG
	6/18/2020	---	---	15.5	4.28	ORG
	6/26/2020	---	---	16.3	18.51	ORG
	7/2/2020	---	---	17.0	5.96	ORG
	7/10/2020	---	---	20.1	21.61	ORG
	7/17/2020	---	---	19.5	4.85	ORG
	7/20/2020	7.11	1.653	18.7	4.69	ORG
	7/24/2020	---	---	19.7	7.20	ORG
	7/31/2020	---	---	20.3	6.19	ORG
	8/7/2020	---	---	20.1	8.23	ORG
	8/14/2020	---	---	20.6	8.71	ORG
	8/18/2020	7.37	3.706	18.9	17.44	ORG
	8/21/2020	---	---	20.3	4.94	ORG
	8/28/2020	---	---	19.2	21.88	ORG
	9/4/2020	---	---	19.3	20.71	ORG
	9/11/2020	---	---	17.5	9.45	ORG
	9/18/2020	---	---	17.4	4.53	ORG
	9/22/2020	7.45	1.487	16.8	10.04	ORG
	9/25/2020	---	---	16.6	9.04	ORG
	10/2/2020	---	---	14.4	17.03	ORG
	10/9/2020	---	---	14.2	20.03	ORG
	10/16/2020	---	---	14.0	11.49	ORG
	10/20/2020	7.46	1.547	12.6	12.41	ORG
	10/23/2020	---	---	13.5	4.83	ORG
	10/30/2020	---	---	9.7	0.99	ORG
	11/5/2020	---	---	12.4	2.14	ORG
	11/12/2020	---	---	9.8	1.96	ORG
	11/17/2020	7.45	1.212	9.2	2.76	ORG
	11/20/2020	---	---	10.4	2.45	ORG
	11/25/2020	---	---	9.4	0.88	ORG
	12/4/2020	---	---	5.0	1.32	ORG
	12/10/2020	---	---	7.2	0.83	ORG
	12/15/2020	7.53	1.074	5.1	1.58	ORG
	12/17/2020	---	---	5.2	1.05	ORG
	12/23/2020	---	---	4.4	2.43	ORG
	12/31/2020	---	---	4.1	11.88	ORG
PDA-S	1/3/2020	---	---	10.2	17.34	ORG
	1/10/2020	---	---	10.7	15.73	ORG
	1/16/2020	---	---	10.5	7.43	ORG
	1/24/2020	---	---	10.8	2.56	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
TREATMENT CELLS						
PDA-S	1/28/2020	6.39	1.487	11.6	2.26	ORG
	1/31/2020	---	---	10.3	6.51	ORG
	2/7/2020	---	---	9.6	3.92	ORG
	2/11/2020	6.29	1.355	11.3	3.01	ORG
	2/14/2020	---	---	11.5	14.19	ORG
	2/20/2020	---	---	10.2	2.88	ORG
	2/28/2020	---	---	10.8	2.09	ORG
	3/6/2020	---	---	12.2	1.65	ORG
	3/13/2020	---	---	13.4	1.17	ORG
	3/17/2020	6.72	1.151	13	1.61	ORG
	3/20/2020	---	---	12.6	1.85	ORG
	3/27/2020	---	---	13.9	0.75	ORG
	4/1/2020	---	---	14.9	6.15	ORG
	4/9/2020	---	---	16.1	2.11	ORG
	4/16/2020	---	---	14.7	1.47	ORG
	4/23/2020	---	---	16.8	23.3	ORG
	4/28/2020	7.02	1.352	18.0	35.02	ORG
	5/1/2020	---	---	17.9	17.96	ORG
	5/8/2020	---	---	18.6	21.74	ORG
	5/15/2020	---	---	18.6	34.10	ORG
	5/22/2020	---	---	18.5	39.01	ORG
	5/26/2020	6.83	1.532	18.8	35.25	ORG
	5/29/2020	---	---	19.2	28.76	ORG
	6/5/2020	---	---	19.4	23.22	ORG
	6/12/2020	---	---	21.6	24.08	ORG
	6/16/2020	7.11	1.554	20.8	50.07	ORG
	6/18/2020	---	---	20.6	32.29	ORG
	6/26/2020	---	---	20.1	38.60	ORG
	7/2/2020	---	---	20.7	40.31	ORG
	7/10/2020	---	---	21.6	33.17	ORG
	7/17/2020	---	---	22.0	40.67	ORG
	7/20/2020	6.83	1.764	21.9	41.61	ORG
	7/24/2020	---	---	21.6	51.57	ORG
	7/31/2020	---	---	22.3	42.17	ORG
	8/7/2020	---	---	22.3	55.28	ORG
	8/14/2020	---	---	22.4	49.96	ORG
	8/18/2020	6.82	3.965	22.0	57.80	ORG
	8/21/2020	---	---	22.1	21.13	ORG
	8/28/2020	---	---	21.8	64.35	ORG
	9/4/2020	---	---	21.5	31.42	ORG
	9/11/2020	---	---	21.0	100.45	ORG
	9/18/2020	---	---	19.8	45.47	ORG
	9/22/2020	6.97	1.578	20.1	80.32	ORG
	9/25/2020	---	---	20.4	57.51	ORG
	10/2/2020	---	---	19.1	64.92	ORG
	10/9/2020	---	---	19.0	18.39	ORG
	10/16/2020	---	---	18.8	6.27	ORG
	10/20/2020	6.07	1.794	18.6	9.18	ORG
	10/23/2020	---	---	18.6	10.11	ORG
	10/30/2020	---	---	16.3	5.75	ORG
	11/5/2020	---	---	17.0	19.22	ORG
	11/12/2020	---	---	14.6	8.31	ORG
	11/17/2020	6.71	1.475	14.6	6.29	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
EXTRACTION WELLS						
PDA-S	11/20/2020	---	---	15.5	7.25	ORG
	11/25/2020	---	---	14.1	13.30	ORG
	12/4/2020	---	---	11.3	1.19	ORG
	12/10/2020	---	---	12.2	8.56	ORG
	12/15/2020	6.98	1.231	11.5	16.82	ORG
	12/17/2020	---	---	11.8	14.81	ORG
	12/23/2020	---	---	11.1	1.57	ORG
	12/31/2020	---	---	12.7	48.32	ORG
SEW-01	1/3/2020	---	---	---	44.44	ORG
	1/10/2020	---	---	---	48.28	ORG
	1/16/2020	---	---	---	40.21	ORG
	1/24/2020	---	---	---	44.31	ORG
	1/28/2020	7.47	1.247	16.8	44.54	ORG
	1/31/2020	---	---	---	41.68	ORG
	2/7/2020	---	---	---	47.88	ORG
	2/11/2020	7.34	1.239	18.2	50.26	ORG
	2/14/2020	---	---	---	49.86	ORG
	2/20/2020	---	---	---	47.58	ORG
	2/28/2020	---	---	---	41.01	ORG
	3/6/2020	---	---	---	36.61	ORG
	3/13/2020	---	---	---	39.92	ORG
	3/17/2020	7.21	1.376	19.6	38.91	ORG
	3/20/2020	---	---	---	39.5	ORG
	3/27/2020	---	---	---	33.36	ORG
	4/1/2020	---	---	---	29.64	ORG
	4/9/2020	---	---	---	41.33	ORG
	4/16/2020	---	---	---	38.02	ORG
	4/23/2020	---	---	---	33.9	ORG
	4/28/2020	7.05	1.213	20.5	52.71	ORG
	5/1/2020	---	---	---	31.39	ORG
	5/8/2020	---	---	---	32.23	ORG
	5/15/2020	---	---	---	33.11	ORG
	5/22/2020	---	---	---	34.51	ORG
	5/26/2020	7.41	1.277	21.2	25.92	ORG
	5/29/2020	---	---	---	28.28	ORG
	6/5/2020	---	---	---	26.13	ORG
	6/12/2020	---	---	---	25.53	ORG
	6/16/2020	7.49	1.317	21.8	45.33	ORG
	6/18/2020	---	---	---	27.81	ORG
	6/26/2020	---	---	---	31.86	ORG
	7/2/2020	---	---	---	32.79	ORG
	7/10/2020	---	---	---	28.33	ORG
	7/17/2020	---	---	---	30.49	ORG
	7/20/2020	7.49	1.369	21.8	27.04	ORG
	7/24/2020	---	---	---	29.47	ORG
	7/31/2020	---	---	---	26.15	ORG
	8/7/2020	---	---	---	28.75	ORG
	8/14/2020	---	---	---	32.09	ORG
	8/18/2020	7.81	3.023	20.5	21.93	ORG
	8/21/2020	---	---	---	23.22	ORG
	8/28/2020	---	---	---	34.77	ORG
	9/4/2020	---	---	---	34.74	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
EXTRACTION WELLS						
SEW-01	9/11/2020	---	---	---	36.77	ORG
	9/18/2020	---	---	---	30.49	ORG
	9/22/2020	7.65	1.334	20.9	31.84	ORG
	9/25/2020	---	---	---	29.54	ORG
	10/2/2020	---	---	---	38.55	ORG
	10/9/2020	---	---	---	35.92	ORG
	10/16/2020	---	---	---	29.91	ORG
	10/20/2020	7.32	1.404	20.5	37.12	ORG
	10/23/2020	---	---	---	32.01	ORG
	10/30/2020	---	---	---	31.23	ORG
	11/5/2020	---	---	---	33.03	ORG
	11/12/2020	---	---	---	33.08	ORG
	11/17/2020	7.28	1.288	20.0	33.58	ORG
	11/20/2020	---	---	---	34.22	ORG
	11/25/2020	---	---	---	28.73	ORG
	12/4/2020	---	---	---	29.55	ORG
	12/10/2020	---	---	---	30.07	ORG
	12/15/2020	7.59	1.297	17.6	31.21	ORG
	12/17/2020	---	---	---	32.80	ORG
	12/23/2020	---	---	---	33.64	ORG
	12/31/2020	---	---	---	38.56	ORG
SEW-02	1/3/2020	---	---	---	245.96	ORG
	1/10/2020	---	---	---	228.62	ORG
	1/16/2020	---	---	---	209.32	ORG
	1/24/2020	---	---	---	202.00	ORG
	1/28/2020	6.90	2.130	18.5	220.04	ORG
	1/31/2020	---	---	---	161.48	ORG
	2/7/2020	---	---	---	184.12	ORG
	2/11/2020	6.71	2.144	18.7	184.8	ORG
	2/14/2020	---	---	---	206.68	ORG
	2/20/2020	---	---	---	185.76	ORG
	2/28/2020	---	---	---	142.88	ORG
	3/6/2020	---	---	---	176.32	ORG
	3/13/2020	---	---	---	172.88	ORG
	3/17/2020	6.94	2.241	19.3	184.61	ORG
	3/20/2020	---	---	---	154.88	ORG
	3/27/2020	---	---	---	155.32	ORG
	4/1/2020	---	---	---	156.84	ORG
	4/9/2020	---	---	---	172.84	ORG
	4/16/2020	---	---	---	260.76	ORG
	4/23/2020	---	---	---	259.24	ORG
	4/28/2020	6.68	1.910	21.3	254.53	ORG
	5/1/2020	---	---	---	255.80	ORG
	5/8/2020	---	---	---	250.19	ORG
	5/15/2020	---	---	---	262.98	ORG
	5/22/2020	---	---	---	250.37	ORG
	5/26/2020	6.90	3.070	20.8	248.22	ORG
	5/29/2020	---	---	---	249.51	ORG
	6/5/2020	---	---	---	242.12	ORG
	6/12/2020	---	---	---	237.51	ORG
	6/16/2020	6.98	2.802	20.7	255.31	ORG
	6/18/2020	---	---	---	244.02	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
EXTRACTION WELLS						
SEW-02	6/26/2020				251.34	ORG
	7/2/2020	---	---	---	250.51	ORG
	7/10/2020	---	---	---	242.13	ORG
	7/17/2020	---	---	---	220.08	ORG
	7/20/2020	6.86	2.813	20.7	225.73	ORG
	7/24/2020	---	---	---	241.17	ORG
	7/31/2020	---	---	---	258.93	ORG
	8/7/2020	---	---	---	268.24	ORG
	8/14/2020	---	---	---	255.01	ORG
	8/18/2020	7.04	6.509	20.2	227.26	ORG
	8/21/2020	---	---	---	235.11	ORG
	8/28/2020	---	---	---	261.71	ORG
	9/4/2020	---	---	---	242.19	ORG
	9/11/2020	---	---	---	245.72	ORG
	9/18/2020	---	---	---	249.22	ORG
	9/22/2020	6.85	2.802	19.9	287.55	ORG
	9/25/2020	---	---	---	271.31	ORG
	10/2/2020	---	---	---	280.12	ORG
	10/9/2020	---	---	---	268.55	ORG
	10/16/2020	---	---	---	286.17	ORG
	10/20/2020	6.88	2.994	20.1	291.14	ORG
	10/23/2020	---	---	---	277.15	ORG
	10/30/2020	---	---	---	241.93	ORG
	11/5/2020	---	---	---	295.17	ORG
	11/12/2020	---	---	---	290.56	ORG
	11/17/2020	6.74	2.957	20.4	292.13	ORG
	11/20/2020	---	---	---	295.66	ORG
	11/25/2020	---	---	---	290.15	ORG
	12/4/2020	---	---	---	285.32	ORG
	12/10/2020	---	---	---	287.32	ORG
	12/15/2020	7.01	2.856	18.7	228.72	ORG
	12/17/2020	---	---	---	246.98	ORG
	12/23/2020	---	---	---	260.17	ORG
	12/31/2020	---	---	---	>300	ORG
EFFLUENT						
EFF-L	1/3/2020	---	---	---	2.31	ORG
	1/10/2020	---	---	---	5.17	ORG
	1/16/2020	---	---	---	5.13	ORG
	1/24/2020	---	---	---	7.58	ORG
	1/28/2020	7.58	1.203	8.9	7.32	ORG
	1/31/2020	---	---	---	5.54	ORG
	2/7/2020	---	---	---	6.05	ORG
	2/11/2020	7.19	1.13	7.5	6.14	ORG
	2/14/2020	---	---	---	7.19	ORG
	2/20/2020	---	---	---	4.99	ORG
	2/28/2020	---	---	---	1.23	ORG
	3/6/2020	---	---	---	1.11	ORG
	3/13/2020	---	---	---	0.81	ORG
	3/17/2020	7.21	1.105	13.6	0.64	ORG
	3/20/2020	---	---	---	0.88	ORG
	3/27/2020	---	---	---	0.57	ORG
	4/1/2020	---	---	---	0.77	ORG

TABLE E-1

SUMMARY OF FIELD WATER QUALITY
JANUARY THROUGH DECEMBER 2020

IDENTIFIER	SAMPLE DATE	HYDROGEN ION POTENTIAL (pH Units)	ELECTRICAL CONDUCTIVITY (mS/cm)	TEMPERATURE (C)	NITRATE-N (mg/l)	SAMPLE TYPE
EFFLUENT						
EFF-L	4/9/2020	---	---	---	1.17	ORG
	4/16/2020	---	---	---	0.68	ORG
	4/23/2020	---	---	---	0.89	ORG
	4/28/2020	7.14	1.168	16.5	1.02	ORG
	5/1/2020	---	---	---	0.91	ORG
	5/8/2020	---	---	---	0.96	ORG
	5/15/2020	---	---	---	0.88	ORG
	5/22/2020	---	---	---	0.84	ORG
	5/26/2020	7.27	1.292	16.2	0.52	ORG
	5/29/2020	---	---	---	0.79	ORG
	6/5/2020	---	---	---	0.75	ORG
	6/12/2020	---	---	---	0.47	ORG
	6/16/2020	7.50	1.422	20.4	0.55	ORG
	6/18/2020	---	---	---	0.53	ORG
	6/26/2020	---	---	---	0.83	ORG
	7/2/2020	---	---	---	0.55	ORG
	7/10/2020	---	---	---	3.12	ORG
	7/17/2020	---	---	---	0.73	ORG
	7/20/2020	7.59	1.526	24.3	0.86	ORG
	7/24/2020	---	---	---	0.72	ORG
	7/31/2020	---	---	---	0.67	ORG
	8/7/2020	---	---	---	0.67	ORG
	8/14/2020	---	---	---	0.97	ORG
	8/18/2020	7.48	3.762	20.5	2.19	ORG
	8/21/2020	---	---	---	0.71	ORG
	8/28/2020	---	---	---	0.89	ORG
	9/4/2020	---	---	---	1.12	ORG
	9/11/2020	---	---	---	1.21	ORG
	9/18/2020	---	---	---	0.81	ORG
	9/22/2020	7.53	1.535	18.5	0.95	ORG
	9/25/2020	---	---	---	0.69	ORG
	10/2/2020	---	---	---	0.88	ORG
	10/9/2020	---	---	---	0.75	ORG
	10/16/2020	---	---	---	1.17	ORG
	10/20/2020	7.52	1.567	14.9	1.53	ORG
	10/23/2020	---	---	---	1.11	ORG
	10/30/2020	---	---	---	0.89	ORG
	11/5/2020	---	---	---	0.65	ORG
	11/12/2020	---	---	---	1.21	ORG
	11/17/2020	7.48	1.269	9.6	0.85	ORG
	11/20/2020	---	---	---	0.85	ORG
	11/25/2020	---	---	---	0.77	ORG
	12/4/2020	---	---	---	0.74	ORG
	12/10/2020	---	---	---	0.83	ORG
	12/15/2020	7.66	1.225	8.2	1.67	ORG
	12/17/2020	---	---	---	0.77	ORG
	12/23/2020	---	---	---	0.66	ORG
	12/31/2020	---	---	---	2.48	ORG

ABBREVIATIONS/ACRONYMS:

--- = not analyzed
C = Centigrade
mg/l = ıilligrams per liter
ms/cm = emens per centimeter
NO3-N = Nitrate-Nitrogen
ORG = original sample
pH = Hydrogen ion potential

NOTES:

Field data collected with a YSI Pro Multimeter.

TABLE E-2
DATA COMPARISON TABLE
(Nitrate as Nitrogen)
(mg/l)

IDENTIFIER	SAMPLE DATE	LAB	ANP	RPD (%)
PDA-S	1/28/2020	<0.50E	2.26	NC
	2/11/2020	<0.50	3.01	NC
	3/17/2020	<0.50E	1.61	NC
	4/28/2020	23	35.02	41
	5/26/2020	45	35.25	24
	6/16/2020	50E	50.07	0
	7/20/2020	68E	41.61	48
	8/18/2020	84	57.8	37
	9/22/2020	68	80.32	17
	10/20/2020	<0.50	9.18	NC
	11/17/2020	4.7	6.29	29
	12/15/2020	16	16.82	5
PDA-C	1/28/2020	20E	19.08	5
	2/11/2020	20E	28.8	36
	3/17/2020	15.00	11.51	26
	4/28/2020	13.00	15.31	16
	5/26/2020	13.00	9.27	33
	6/16/2020	22E	20.25	8
	7/20/2020	21E	11.07	56
	8/18/2020	46.00	27.92	49
	9/22/2020	27.00	28.52	5
	10/20/2020	8.30	11.04	28
	11/17/2020	3.40	8.66	87
	12/15/2020	8.00	8.13	2
PDA-N	1/28/2020	17E	14.85	14
	2/11/2020	16E	22.42	33
	3/17/2020	<0.50	0.51	NC
	4/28/2020	5.8	7.26	22
	5/26/2020	3.3	2.08	45
	6/16/2020	7.7	6.78	13
	7/20/2020	7.6	4.69	47
	8/18/2020	20	17.44	14
	9/22/2020	11	10.04	9
	10/20/2020	10	12.41	22
	11/17/2020	<0.50	2.76	NC
	12/15/2020	0.63	1.58	86

TABLE E-2
DATA COMPARISON TABLE
(Nitrate as Nitrogen)
(mg/l)

IDENTIFIER	SAMPLE DATE	LAB	ANP	RPD (%)
ANA	1/28/2020	14E	10.11	32
	2/11/2020	14E	19.28	32
	3/17/2020	0.93	0.76	20
	4/28/2020	1.9E	2.11	10
	5/26/2020	<0.50	0.38	NC
	6/16/2020	<0.50	1.32	NC
	7/20/2020	<0.50	2.64	NC
	8/18/2020	2.6	4.49	53
	9/22/2020	<0.50	1.17	NC
	10/20/2020	10	9.59	4
	11/17/2020	<0.50	2.32	NC
	12/15/2020	<0.50	1.21	NC
FDA	1/28/2020	7.7E	5.29	37
	2/11/2020	5.4	7.68	35
	3/17/2020	<0.50	0.52	NC
	4/28/2020	<0.50	1.18	NC
	5/26/2020	<0.50	0.66	NC
	6/16/2020	<0.50	0.45	NC
	7/20/2020	<0.50	0.59	NC
	8/18/2020	<0.50	1.76	NC
	9/22/2020	<0.50	0.86	NC
	10/20/2020	1.2	1.73	36
	11/17/2020	<0.50	1.11	NC
	12/15/2020	<0.50	1.13	NC
EXTRACTION WELLS				
SEW-01	1/28/2020	46E	44.54	3
	2/11/2020	45	50.26	11
	3/17/2020	41	38.91	5
	4/28/2020	34	52.71	43
	5/26/2020	32	25.92	21
	6/16/2020	35	45.33	26
	7/20/2020	40	27.04	39
	8/18/2020	33	21.93	40
	9/22/2020	36	31.84	12
	10/20/2020	33	37.12	12
	11/17/2020	32	33.58	5
	12/15/2020	34	31.21	9

TABLE E-2
DATA COMPARISON TABLE
(Nitrate as Nitrogen)
(mg/l)

IDENTIFIER	SAMPLE DATE	LAB	ANP	RPD (%)
SEW-02	1/28/2020	160E	220.04	32
	2/11/2020	170	184.8	8
	3/17/2020	180	184.61	3
	4/28/2020	240	254.53	6
	5/26/2020	250	248.22	1
	6/16/2020	260	255.31	2
	7/20/2020	270	225.73	18
	8/18/2020	290	227.26	24
	9/22/2020	290	287.55	1
	10/20/2020	290	291.14	0
	11/17/2020	280	292.13	4
	12/15/2020	240	228.72	5
EFFLUENT				
EFF-L	1/28/2020	6.6E	7.32	10
	2/11/2020	4.6	6.14	29
	3/17/2020	<0.50	0.64	NC
	4/28/2020	<0.50	1.02	NC
	5/26/2020	<0.50	0.52	NC
	6/16/2020	<0.50	0.55	NC
	7/20/2020	<0.50	0.86	NC
	8/18/2020	<0.50E	2.19	NC
	9/22/2020	<0.50	0.95	NC
	10/20/2020	1.6	1.53	4
	11/17/2020	<0.50	0.85	NC
	12/15/2020	<0.50	1.67	NC

ABBREVIATIONS/ACRONYMS:

mg/l = milligrams per liter
NA = Resuts not available
NC = Not calculated; lab or probe results less than 0.5 mg/l.
RPD = Relative percent difference

TABLE E-3

FIELD WATER QUALITY DATA
(DISSOLVED OXYGEN)
(mg/l)

IDENTIFIER	SAMPLE DATE	LOCATION 5	LOCATION 6	LOCATION 7
TREATMENT CELLS				
PDA-S				
	1/28/2020	2.5	2.7	2.9
	2/11/2020	1.2	1.5	1.7
	3/17/2020	2.7	3.1	3.5
	4/28/2020	2.9	3.0	3.2
	5/26/2020	0.9	1.5	1.8
	6/16/2020	1.1	1.8	1.5
	7/20/2020	0.8	1.2	1.4
	8/18/2020	0.8	1.1	1.2
	9/22/2020	1.4	1.4	1.7
	10/20/2020	1.2	1.9	2.2
	11/17/2020	1.1	1.9	1.7
	12/15/2020	1.7	1.8	2.2
PDA-C				
	1/28/2020	3.1	3.9	4.3
	2/11/2020	3.9	3.5	3.1
	3/17/2020	2.7	2.3	2.3
	4/28/2020	2.5	2.6	2.7
	5/26/2020	3.1	2.5	1.6
	6/16/2020	2.5	2.1	1.9
	7/20/2020	1.4	1.2	1.1
	8/18/2020	UTM	1.7	1.2
	9/22/2020	1.7	1.4	1.1
	10/20/2020	2.2	1.8	1.1
	11/17/2020	2.5	1.9	1.2
	12/15/2020	1.1	1.9	1.6
PDA-N				
	1/28/2020	3.9	3.8	3.2
	2/11/2020	4.2	4.7	4.9
	3/17/2020	2.2	2.7	3.1
	4/28/2020	2.2	2.5	3.3
	5/26/2020	1.9	2.5	3.9
	6/16/2020	1.8	2.7	3.5
	7/20/2020	1.5	1.7	1.9
	8/18/2020	1.1	1.7	1.5
	9/22/2020	1.2	1.5	1.8
	10/20/2020	1.7	2.5	2.7
	11/17/2020	1.4	1.8	2.5
	12/15/2020	1.7	1.9	1.2

TABLE E-3

FIELD WATER QUALITY DATA
(DISSOLVED OXYGEN)
(mg/l)

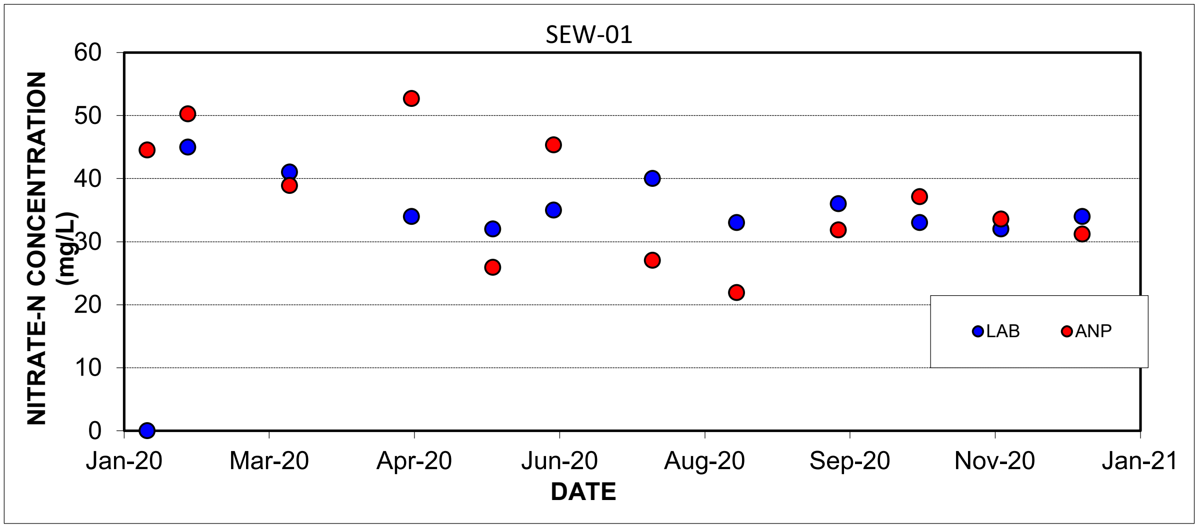
IDENTIFIER	SAMPLE DATE	LOCATION		
		5	6	7
FDA				
	1/28/2020	2.7	3.2	3.6
	2/11/2020	1.9	2.7	2.5
	3/17/2020	2.9	3.1	2.5
	4/28/2020	2.7	3.5	2.7
	5/26/2020	3.9	2.1	1.6
	6/16/2020	3.2	2.3	1.8
	7/20/2020	1.7	1.8	1.2
	8/18/2020	1.5	1.4	1.2
	9/22/2020	2.1	1.8	1.3
	10/20/2020	2.2	2.1	1.9
	11/17/2020	2.2	1.9	1.4
	12/15/2020	1.3	1.7	1.5
IDENTIFIER	SAMPLE DATE	LOCATION		
		1	2	
ANA				
	1/28/2020	5.2	4.7	
	2/11/2020	4.7	3.6	
	3/17/2020	4.2	3.7	
	4/28/2020	4.5	4.1	
	5/26/2020	4.7	3.8	
	6/16/2020	5.1	3.9	
	7/20/2020	2.2	1.7	
	8/18/2020	2.7	2.2	
	9/22/2020	3.9	3.5	
	10/20/2020	3.9	4.1	
	11/17/2020	3.7	2.6	
	12/15/2020	2.1	1.9	

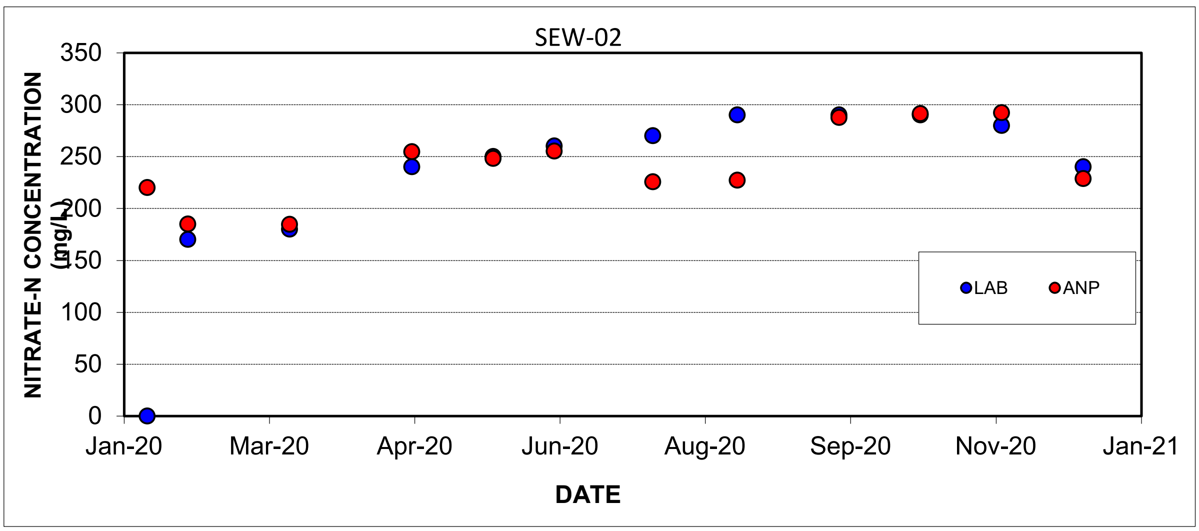
ABBREVIATIONS/ACRONYMS:
mg/l = milligrams per liter

NOTES:
See Figure 10 for sampling locations.

APPENDIX E

FIGURE





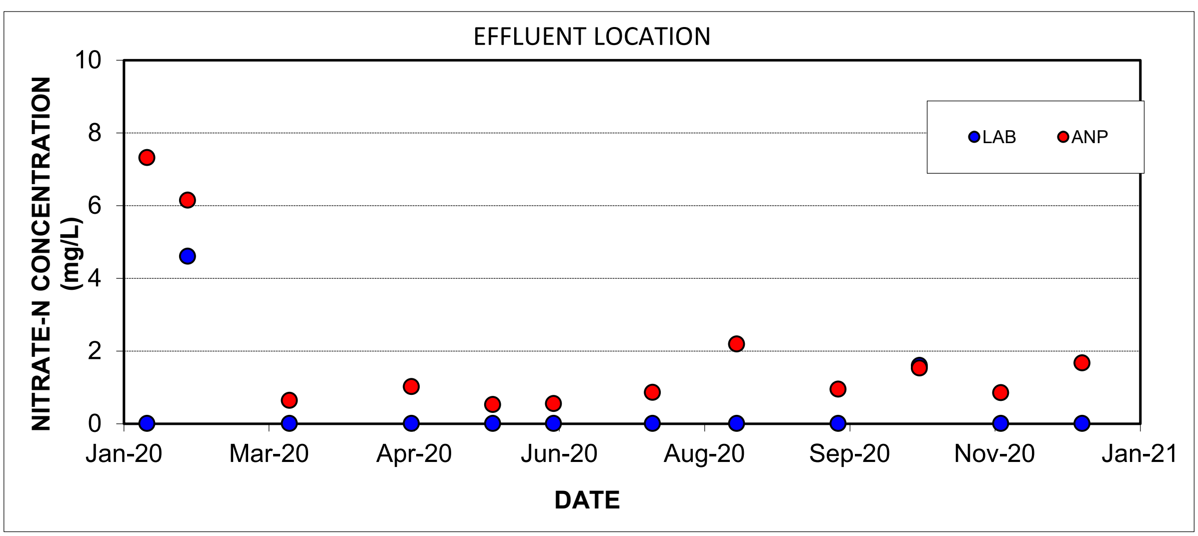


FIGURE E-1. Nitrate-N Concentrations for SEWs and EFF-L Lab Data vs YSI Pro Field Meter

APPENDIX F

RESULTS OF 2020 ANNUAL POND COVER INSPECTION REPORT

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY • ENGINEERING

7400 North Oracle Road, Suite 202
Tucson, AZ 85704
Phone: 520.881.7300
Fax: 520.529.2141

February 1, 2021

VIA EMAIL AND FEDERAL EXPRESS

Ms. Gwenn Ziegler
DEUR Program Coordinator
1110 W. Washington Street
Phoenix, AZ 85007

Re: Results of the 2020 Annual Pond Cover Inspection
Apache Nitrogen Products, Inc., Cochise County, Arizona

Dear Ms. Zeigler:

Pursuant to the August 22, 2008 Arizona Department of Environmental Quality (ADEQ) Declaration of Environmental Use Restriction for Property with Engineering Control and Non-Residential Restriction (DEUR), Hargis + Associates, Inc. (H+A), on behalf of its client, Apache Nitrogen Products, Inc. (ANPI), is submitting this annual inspection report for the above-referenced property (Figure 1). As required by the terms of the DEUR, this report:

- Describes the status of the institutional controls and the condition of the engineering controls for the pond areas;
- States the nature and cost of maintenance activities performed on engineering controls during the 2020 calendar year;
- Includes photographs depicting the condition of the engineering controls; and
- Describes the status of the financial assurance mechanism and certifies that the financial assurance mechanism is being maintained.

The main text of the DEUR is provided (Attachment 1).

Native soil covers (pond covers) were installed over Ponds 1A and 1B (1A/1B), Ponds 2A and 2B (2A/2B), Ponds 3A and 3B (3A/3B), Pond 7, and the Dynagel Pond (Figure 2) in accordance with the April 22, 2008, *Remedial Action Implementation Report for Pond Soils and Sediments* (H+A, 2008). A single pond cover was installed at each of the five pond locations, 1A/1B, 2A/2B, 3A/3B, 7, and the Dynagel Pond. Therefore, for the purposes of this report, Ponds 1A/1B, Ponds 2A/2B, and Ponds 3A/3B are referred to as Pond 1, Pond 2, and Pond 3, respectively (Figure 3).

Other Offices:
Mesa, AZ
Folsom, CA
San Diego, CA

Institutional and Engineering Controls

Pursuant to the terms of the DEUR, institutional controls are in place to limit the use of the ANPI property to non-residential use and prohibit the excavation or other disturbance of the pond covers. The institutional controls also prohibit the installation of shallow aquifer wells on the ANPI property except for wells used for remediation and/or monitoring of the shallow aquifer.

Engineering controls include the five native soil pond covers, erosion control devices at each pond cover, perimeter fencing, native vegetation, and warning signs around the ponds. In accordance with the April 22, 2008 *Remedial Action Implementation Report for Pond Soils and Sediments* (H+A, 2008), quarterly maintenance requirements for the engineering controls include:

- Inspecting erosion control devices installed on the pond covers for damage or wear;
- Inspecting surface and side slopes of the pond covers for development of erosional channels;
- Repairing or replacing damaged erosion control devices until native vegetation has re-established;
- Replacing damaged, missing, or illegible warning signs;
- Filling in and compacting erosional channels greater than two inches deep; and
- Repairing any damage to the facility perimeter fence.

Quarterly inspections of engineering and institutional controls were performed by ANPI in March 2020 (First Quarter), June 2020 (Second Quarter), and September 2020 (Third Quarter). An annual inspection was performed by H+A in December 2020.

On March 27, 2020, the following findings were documented:

- Erosion control devices at Ponds 1, 2, 3, 7, and Dynagel were noted as being in good condition.
- With respect to erosion channels, Ponds 1, 2, 3, 7, and Dynagel were in good condition.
- Warning signs were in place and in good condition at Ponds 1, 2, 3, 7 and Dynagel.
- The property perimeter fence was noted as being in good condition.

On June 26, 2020, the following findings were documented:

- Erosion control devices at Ponds 1, 2, 3, 7, and Dynagel were noted as being in good condition.
- With respect to erosion channels, Ponds 1, 2, 3, 7, and Dynagel were in good condition.
- Warning signs were in place and in good condition at Ponds 1, 2, 3, 7 and Dynagel.
- The property perimeter fence was noted as being in good condition.

On September 9, 2020, the following findings were documented:

- Erosion control devices at Ponds 1, 2, 3, 7, and Dynagel were noted as being in good condition.
- With respect to erosion channels, Ponds 1, 2, 3, 7, and Dynagel were in good condition.
- Warning signs were in place and in good condition at Ponds 1, 2, 3, 7 and Dynagel.
- The property perimeter fence was noted as being in good condition.

During the December 21, 2020 annual inspection conducted by H+A, the following findings were documented:

- Per DEUR Declaration G.1, the erosion control devices will be maintained until native vegetation re-establishes. The original engineering controls were installed December 2007 and the site exhibits 12 years of vegetation growth. Native vegetation was observed re-establishing at the erosion control devices at the time of the 2020 inspection, and included grasses, mesquite, and cactus. The native vegetation appears to be aiding in the production of natural soil cover and thereby replacing the erosion control devices with natural soil cover. Increased native vegetation was observed re-establishing at all the pond covers. As time passes, the need for erosion control devices will continue to decline.
- The Pond 1 cover was generally in good condition with the following comments/exceptions:
  - Erosion control devices showed signs of deterioration, however, native vegetation has re-established across the majority of the pond. Repair of the erosion control devices is considered optional.
  - No erosion channels greater than two inches deep were observed.
  - Signage is visible from all angles.
- The Pond 2 cover was generally in good condition with the following comments/exceptions:
  - Erosion control devices showed signs of deterioration, however, native vegetation has re-established across the majority of the pond. Repair of the erosion control devices is considered optional.
  - No erosion channels greater than two inches deep were observed.
  - Signage is visible from all angles.
- The Pond 3 cover was generally in good condition with the following comments/exceptions:
  - Erosion control devices showed signs of deterioration, however, native vegetation has re-established across the majority of the pond. Repair of the erosion control devices is not necessary.
  - No erosion channels greater than two inches deep were observed.
  - Signage is visible from all angles.
- The Pond 7 cover was generally in good condition with the following comments/exceptions:
  - Erosion control devices were noted as being in good condition.
  - No erosion channels greater than two inches deep were observed.
  - Signage is visible from all angles.
- The Dynagel Pond cover was generally in good condition with the following exceptions:
  - Erosion control devices showed signs of deterioration, however, native vegetation has re-established across the majority of the pond. Repair of the erosion control devices is not necessary.
  - No erosion channels greater than two inches deep were observed.
  - Signage is visible from all angles.

- Property perimeter chain-link fence in close proximity to the ponds was inspected and found to be in good condition. The complete property perimeter chain-link fence was not inspected.
- ANPI provided 1st, 2nd and 3rd quarter pond inspection reports.

On December 21, 2020, ANPI was provided a list of action items based on the inspection results described above and anticipates completion of the items by the next quarterly inspection (tentatively scheduled for March 2021).

Restoration Costs

ANPI completed all repairs identified during the 2020 quarterly inspections. The total cost for repairs was approximately $5,244, which included $0 in materials, approximately $4,500 in subcontractor labor, and approximately $744 for ANPI labor.

Photographs of Engineering Controls

Photographs of the pond covers and engineering controls taken during the December 2020 annual inspection are provided (Attachment 2).

Financial Assurance

ANPI has provided financial assurance using a Certificate of Deposit naming ADEQ as the Beneficiary. ANPI may not withdraw any portion of the principal without the written consent of the Director of ADEQ.

References

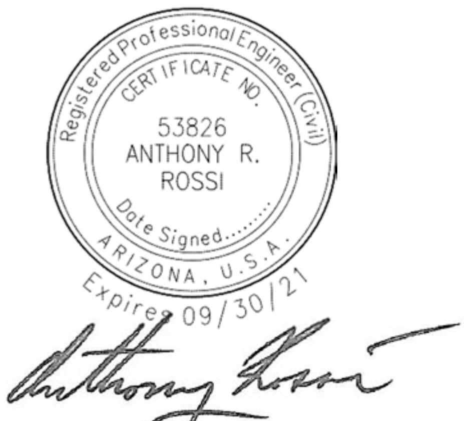
H+A, 2008. *Remedial Action Implementation Report for Pond Soils and Sediments (CERCLA Media Component 3 and Formerly Active Ponds), Revision 1.0, Apache Powder Superfund Site, Cochise County, Arizona.* April 22, 2008.

HARGIS+ASSOCIATES, INC.

Please contact me if you have questions or need additional information.

Sincerely,

HARGIS + ASSOCIATES, INC.



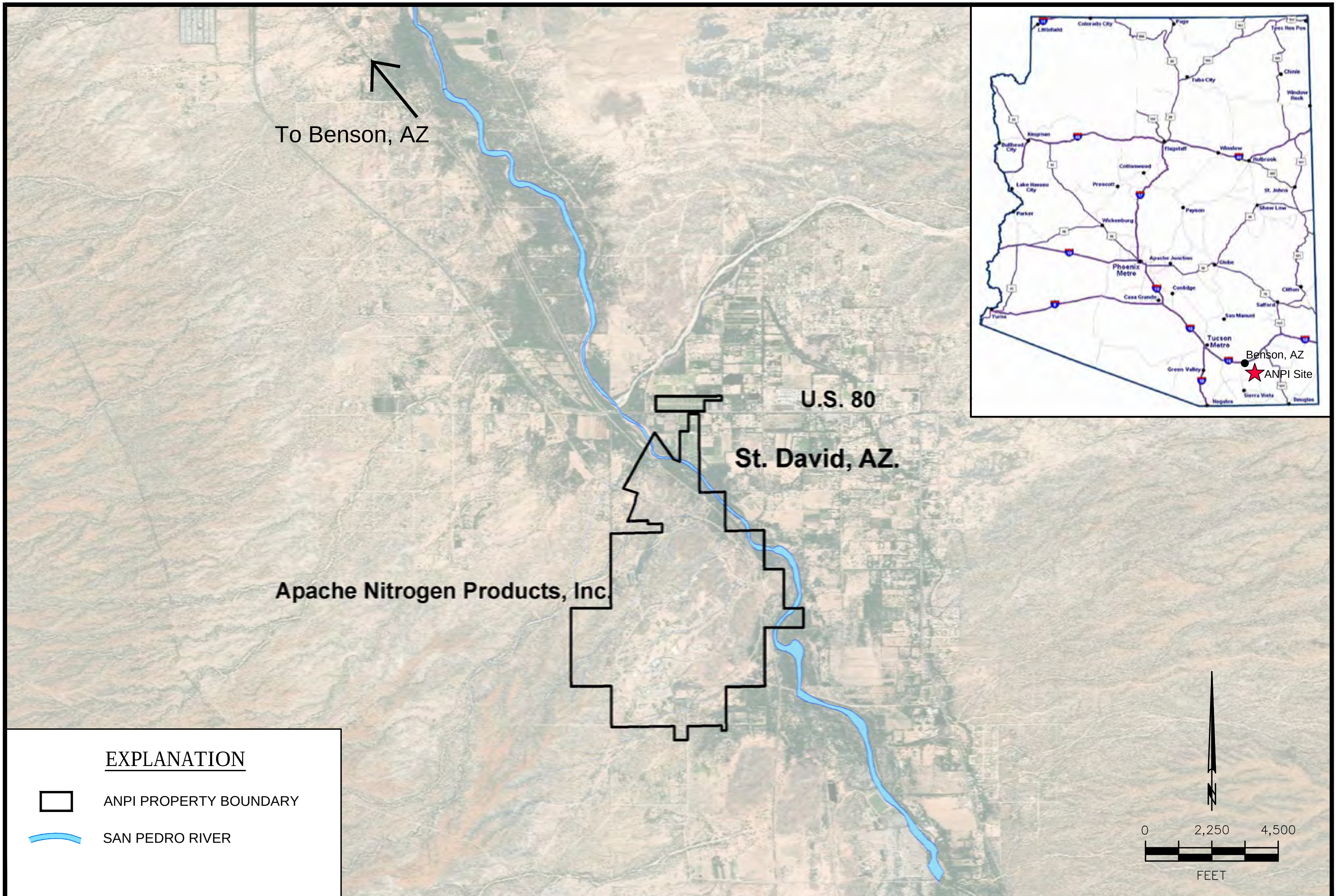
Anthony Rossi, PE
Engineering Manager

TRR/jak

Attachments:	Figure 1	Site Location
	Figure 2	Location of Covered Ponds
	Figure 3	Location of Covered and Former Ponds
	Attachment 1	Declaration of Environmental Use Restriction For Property with Engineering Control and Non-Residential Restriction, dated 9/4/08
	Attachment 2	2020 Photographic Documentation

cc: Patrick Kelly, EPA (Email only)
Jerry Helton, ADEQ (Email only)
TJ Raica, Environmental Director, ANPI (Email only)
Jeff Bauer, Environmental Specialist, ANPI (Email only)
Brian Ford, ANPI (Email only)

FIGURES



1/19 | RPT NO.130.139 | 410-10020 | A

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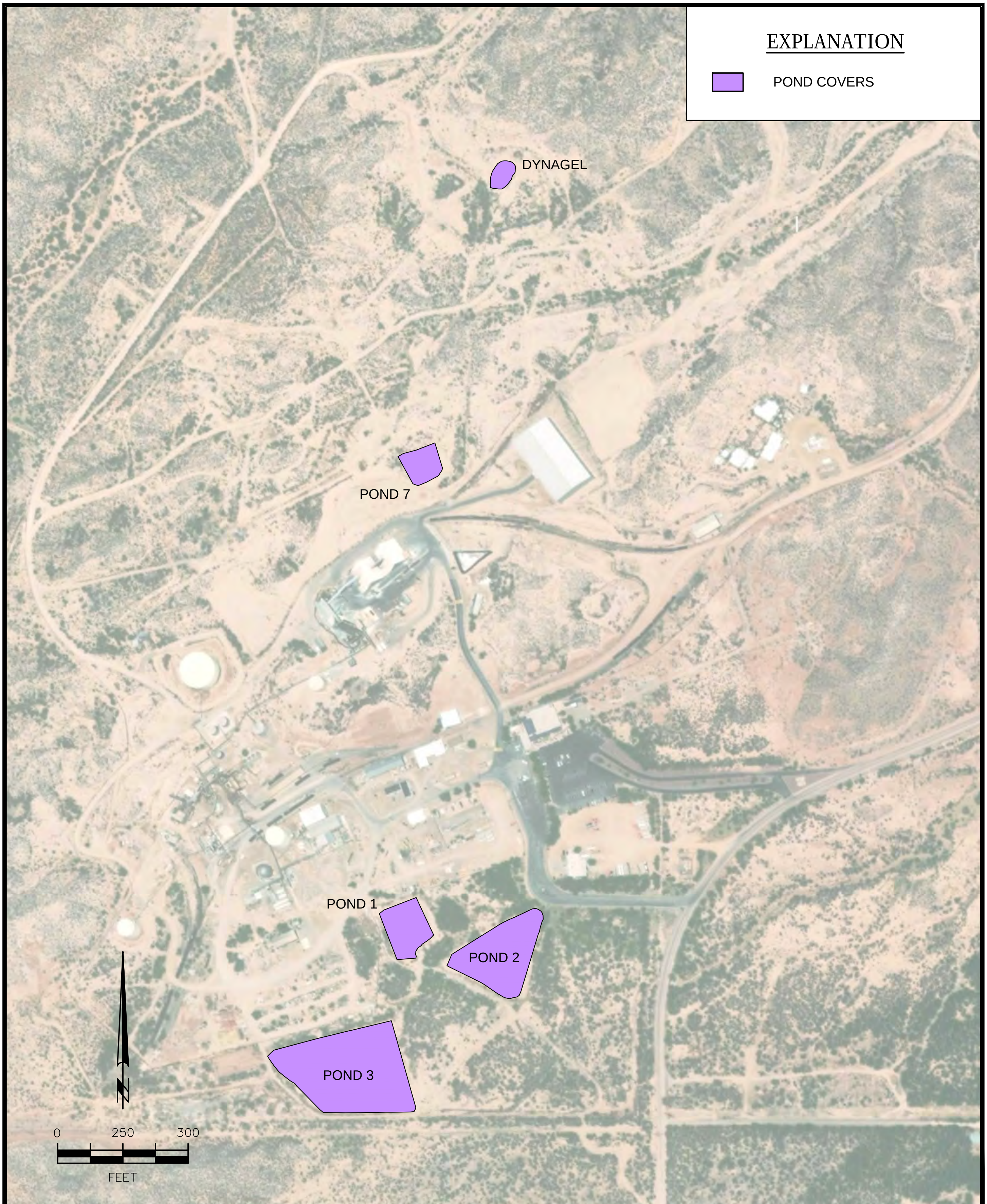
Hydrogeology/Engineering

FIGURE 1.
SITE LOCATION
APACHE NITROGEN PRODUCTS, INC., COCHISE COUNTY, ARIZONA

Jan 03, 2019 - 3:10pm ESS - T:\2018\100-199\Apache\Hydrogeology\H+A Basemaps\410-10020.dwg



Jan 22, 2020 - 2:24pm ESS - T:\2020\100-199\130 Apache\Hydrogeology\H+A Basemaps\410-10205.dwg

1/20 | RPT NO.130.131 | 410-10205 | A

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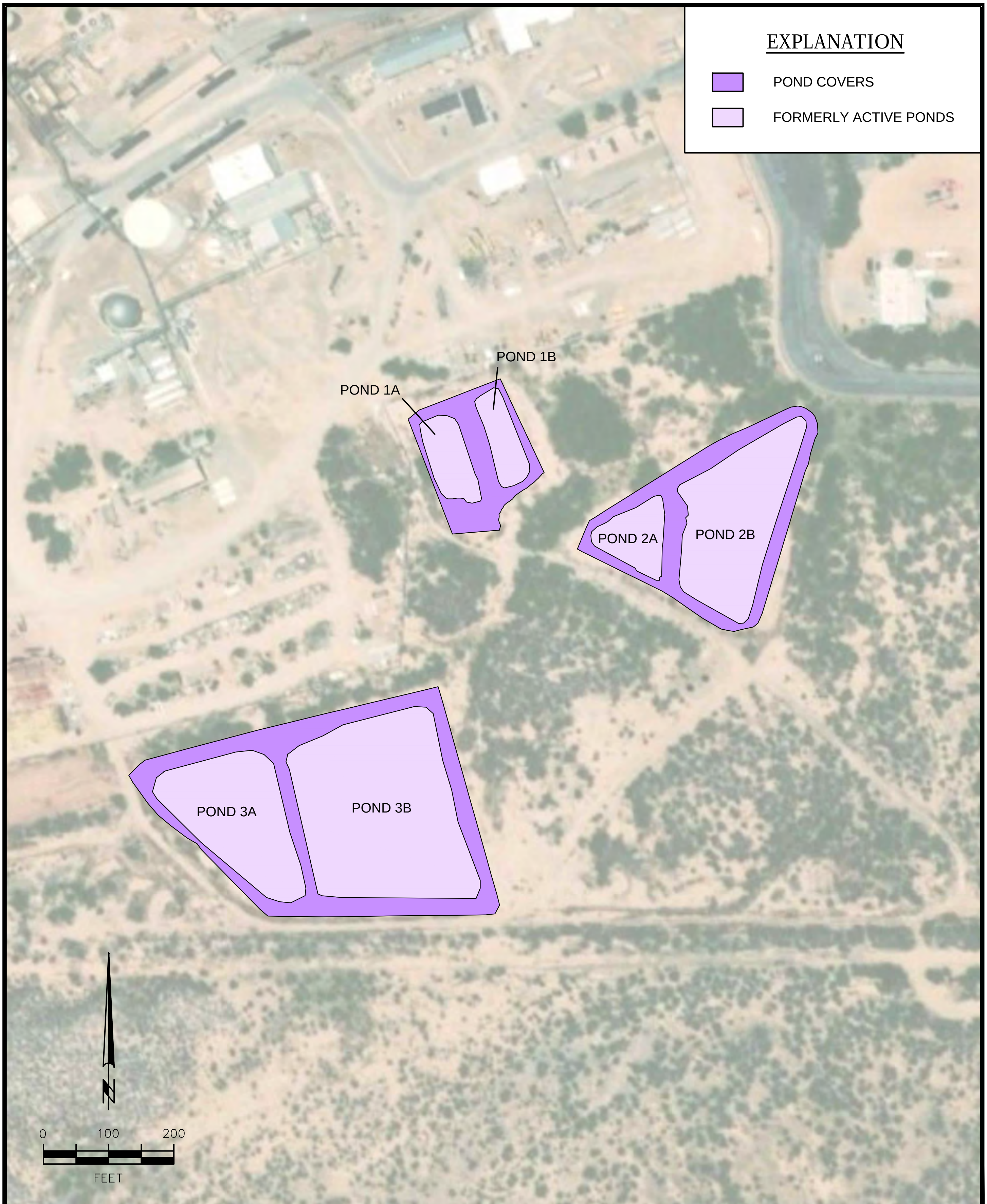
Hydrogeology/Engineering

FIGURE 2.
LOCATION OF COVERED PONDS
APACHE NITROGEN PRODUCTS, INC., COCHISE COUNTY, AZ



Jan 03, 2019 - 3:03pm ESS - T:\2018\100-199\Apache\Hydrogeology\H+A Basemaps\410-10021.dwg

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Hydrogeology/Engineering

FIGURE 3.
LOCATION OF COVERED AND FORMER PONDS
APACHE NITROGEN PRODUCTS, INC.

ATTACHMENT 1

DECLARATION OF ENVIRONMENTAL USE RESTRICTION FOR PROPERTY WITH ENGINEERING CONTROL AND NON-RESIDENTIAL RESTRICTION

2008-23984
Page 1 of 40
Requested By: APACHE NITROGEN PRODUCTS
Christine Rhodes - Recorder
Cochise County, AZ
09-04-2008 01:19 PM Recording Fee $45.00

When recorded, return to:

Apache Nitrogen Products, Inc.
P.O. Box 700
Benson, AZ 85602

DECLARATION OF ENVIRONMENTAL USE RESTRICTION FOR PROPERTY WITH ENGINEERING CONTROL AND NON-RESIDENTIAL RESTRICTION

Superfund
Apache Nitrogen Products, Inc.
P.O. Box 700
Benson, AZ 85602

This Declaration of Environmental Use Restriction ("Declaration"), when recorded, is a covenant that runs with and burdens the Property, binds all owners and owners' heirs, successors and assigns, and inures to the benefit of the Arizona Department of Environmental Quality ("Department") and the State of Arizona.

This Declaration is executed and recorded by Apache Nitrogen Products, Inc., an Arizona Corporation.

DECLARATION

Owner covenants and agrees as follows:

A. Presence of Contamination. Environmental contaminants are present on a portion of real property located at 1436 S Apache Powder Road, St David, Arizona ("Property").

B. Warranty of Title. Owner is the only owner of, and holds equitable and legal title to, the Property and has authority to execute and record this Declaration.

C. Legal Description. Owner's deed setting forth the legal description of the Property at which the contamination is located is attached and marked "Exhibit 1." A legal description of the portion of the Property subject to this Declaration is attached and marked as "Exhibit 2."

The Property tax number is 121-01-005.

D. Maps. The location of the Property identified in "Exhibit 1" is depicted on a map attached and marked as "Exhibit 3"; the portion of the Property subject to this Declaration is depicted on a map attached and marked as "Exhibit 4."

E. Completion of Remediation. The date that remediation, remedial action, corrective action or response action was completed: April 2008. (Reference Remedial Action Implementation Plan & Engineering Control Plan)

F. Environmental Contaminant Information. Soil contaminants subject to this DEUR are listed in Exhibit 5. A site-specific statistical risk evaluation was conducted by ADEQ in 2004. This risk evaluation focused on the pond soils Contaminants of Concern (COCs) Beryllium (Be), Antimony (Sb), and Arsenic (As) in Ponds 1A, 1B, 2A, 2B, 3A, 3B, 7, and Dynagel. The concentrations of Be found in Ponds 2B, 3B, and 7 were only slightly greater than the residential SRL of 1.4 mg/kg, but below the non-residential SRL of 11 mg/kg. Therefore, the Be residuals were well below the threshold considered for ADEQ's risk evaluation. The concentrations of Sb at Dynagel pond, and for As at Ponds 1A, 1B, 2A, 2B, 3A, 3B, 7, and Dynagel were evaluated statistically. The analysis for Sb yielded a 95 percent UCL lower than the residential SRL for Sb; therefore, no additional risk-based evaluation for Sb was deemed necessary. The 95 percent UCL for As concentrations at all of the ponds except 2B and 3B exceeded the site-specific background concentration of 19.2 mg/kg; the respective residential and non-residential SRLs of 10 mg/kg; and the residential and non-residential health-based protection levels of 0.4 mg/kg and 1.6 mg/kg. Pond 2B contained one sample with a concentration of As greater than the background concentration while Pond 3B contained none.

COCs in the shallow groundwater at the site include nitrate and perchlorate, both of which are being remediated using a combination of active pump-and-treat (with constructed wetlands) and monitored natural attenuation. This DEUR also restricts the use of the contaminated aquifer beneath Apache's property.

G. Engineering/Institutional Control Statements. Because Owner is using an engineering control and an institutional control to satisfy the requirements of A.R.S. §§ 49-152 or 49-158, Owner agrees to the following:

1. The institutional controls limit the use of the Property to non-residential use as defined in A.R.S. § 49-151 where natural persons are not reasonably expected to be in frequent contact with the soil. These institutional controls prohibit excavation or other disturbance of the soil cover. The institutional controls also prohibit the installation of shallow aquifer wells on the Property except for wells used in the remediation and/or monitoring of the shallow aquifer.

The engineering controls consist of the following:

- The 2 foot native soil cover sides have a minimum 2 horizontal to 1 vertical slope.
- The surface of the covers were graded to promote surface runoff and sloped to approximate the slope of the surrounding native topography.
- Erosion control devices were installed and will be maintained until native vegetation re-establishes.
- Perimeter fence around the property.
- Signs around the perimeter of the ponds warning people not to enter.

2. The engineering controls were constructed in December 2007.

3. The maintenance requirements of the institutional controls are that Owner assures that the restricted area not be subject to residential use as defined in by A.R.S. § 49-151. The quarterly maintenance requirements of the engineering controls are:

- Inspect erosion control measures installed on the cover for damage or wear
- Inspect surface and side slopes of cover for development of erosional channels
- Repair or replace damaged erosion control measures
- Replace damaged, missing, or illegible warning signs
- Fill in and compact erosional channels greater than 2 inches deep
- Repair any damage to facility perimeter fence

The maintenance requirements for the engineering controls are specified in the Engineering Control Plan (Appendix A) document dated April 2008. Owner agrees to maintain the specified maintenance requirements and implement the procedures outlined in the document.

4. In order to protect the public health and the environment, the engineering controls and the institutional controls must remain in place because contaminant levels exceed residential soil standards, and because of the requirement to eliminate the potential for human exposure to contaminants of concern (COCs) present at concentrations that could pose a threat to human health and prevent migration.

5. If any person desires to cancel or modify the engineering controls or institutional controls in the future, the person shall obtain the Department's prior written approval. Any modification of the engineering or institutional controls without the Department's prior written approval is void and a violation of this Declaration.

6. Owner hereby grants to the Department and its representatives, authorized agents, attorneys, investigators, consultants, advisors, and contractors the right of access to the Property at all reasonable times to verify that the engineering controls and institutional controls are being maintained. The Department's right of access is continuing and runs with the land. If access to the Property is restricted, Owner shall have any barrier to entry opened or removed at the Department's request.

7. Owner shall incorporate the terms of this Declaration into any lease, license or other agreement that is signed by Owner and that grants a right with respect to the Property. The incorporation may be in full or by reference.

8. Owner agrees to provide a copy of the Engineering Control Plan document dated April 2008 to the subsequent purchaser of the property. Additional copies can be obtained through the Arizona Department of Environmental Quality (ADEQ), Waste Program Division, Site Assessment Unit.

H. Engineering Control Plans/Financial Assurance. The engineering control plans and financial assurance mechanism prescribed by A.R.S. § 49-152.01 are as follows:

The Engineering Control Plan submitted to ADEQ documents inspection and maintenance that will be performed to ensure the integrity of the closed ponds. In addition to quarterly inspections, monitoring of the native soil cover and physical components of the institutional controls will be performed monthly to ensure their long-term competency and to identify maintenance requirements. If necessary, future surveys will be performed to verify pond cover surface elevations. Permanent survey monuments installed near each pond cover will serve as benchmarks for future surveys.

Apache Nitrogen Products, Inc. has provided financial assurance using a Certificate of Deposit naming the Arizona Department of Environmental Quality as the Beneficiary (Appendix B).

I. Periodic Inspections and Reports. Because ANPI has elected to use an engineering control and institutional control to satisfy the requirements of A.R.S. §§ 49-152 or 49-158, ANPI shall maintain the controls to ensure that they continue to protect public health and the environment, and shall inspect the engineering control at least once each calendar year or more in accordance with the Engineering Control Plan Document dated April 2008. Within thirty days after the annual inspection to be conducted in December, ANPI shall submit to the Department a written report that:

1. Describes the condition of the engineering controls and the status of the institutional controls;

2. States the nature and cost of all restoration made to the engineering controls during the calendar year;

3. Includes current photographs of the engineering controls; and

4. Describes the status of the financial assurance mechanism prescribed by A.R.S. § 49-152.01, and a certification that the financial assurance mechanism is being maintained.

The inspection report shall be submitted to the DEUR Program Coordinator at the following address: 1110 W. Washington Street, Phoenix, Arizona 85007.

J. Additional Information. More detailed information on the remediation is maintained and available at the Department of Environmental Quality, located at 1110 W. Washington Street, Phoenix, Arizona 85007.

K. Release of this Declaration. Request for the release of this Declaration pursuant to A.R.S. §§ 49-152(D) or 49-158(L) may be filed by owners holding all equitable and legal title to the Property or having legal authority to file the request. The release portion of the fee specified in R18-7-604 was paid for this Declaration. If Owner elected, pursuant to R18-7-605, not to pay the release portion with the original fee, a release will not be granted until the Department receives payment of the release portion of the fee specified in R18-7-604, which is in effect at the time of the release request.

L. Sale or Transfer of the Property. At least five working days before the sale or other transfer of title to or an interest in the property or any portion of the property, the Owner and buyer or transferee shall provide written notice and written commitment as required by A.R.S. §49-152.01(C).

M. Failure to Comply. If Owner fails to comply with this declaration or to implement the Engineering Control Plan document dated April 2008, the Department shall give Owner written notice by certified mail of the failure. If Owner fails to take the action specified in the Department's notice, the Department may issue an order pursuant to A.R.S. §§ 49-152.02 and 49-158(I) and take any other action allowed by law.

N. Related Rules. If this Declaration is being used to comply with R18-12-263.01(B)(4)(d), the remaining information required by that rule is attached as Exhibits: *NA*.

Pamela J. Beilke, Director of Compliance & Quality
Owner *[state full name]*

Pamela J Beilke
[signature]

Apache Nitrogen Products, Inc.
P.O. Box 700
Benson, AZ 85602
[current address of Owner]

This Declaration of Environmental Use Restriction was subscribed and sworn before me this 25 day of July, 2008 by:
Pamela J. Beilke, Director of Compliance + Quality
[state full name and legal status of each Owner]

[signature]

KAREN T SMITH
NOTARY PUBLIC -- ARIZONA
COCHISE COUNTY
My Commission Expires
May 31, 2012

Notary Public
My commission expires: May 31, 2012

This Declaration of Environmental Use Restriction is approved this 22nd day of August, 2008 by the Arizona Department of Environmental Quality.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY, an agency of the State of Arizona,

by: [signature]

[signature of the Department's authorized agent]

Name Amanda Stone
[print name of the authorized agent]

Its Director, Waste Programs Division
[state person's official title]

This Declaration of Environmental Use Restriction was subscribed and sworn to before me this 22nd day of August, 2008 by:

Amanda E. Stone, Dir. WPD
[state full name and title of Department's agent]

[signature]
Notary Public

OFFICIAL SEAL
FELICIA M. KRZYWICKI
NOTARY PUBLIC - State of Arizona
MARICOPA COUNTY
My Comm. Expires Jan. 19, 2009

My commission expires: Jan 19, 2009

ATTACHMENT 2

2020 PHOTOGRAPH DOCUMENTATION

Pond 1
12/21/2020

Pond 1
12/21/2020

Pond 1
12/21/2020

Pond 1
12/21/2020

Pond 2
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Pond 7
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Pond 7
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Dynagel Pond
12/21/2020

Dynagel Pond
12/21/2020

Dynagel Pond
12/21/2020

Dynagel Pond
12/21/2020

APPENDIX G

2020 WELL INVENTORY UPDATE

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY • ENGINEERING

7400 N. Oracle Rd.
Suite 202
Tucson, AZ 85704
Phone: 520.881.7300
Fax: 520.529.2141

VIA FEDERAL EXPRESS

March 31, 2021

Mr. Patrick Kelly
Remedial Project Manager
US EPA, Region 9
Superfund Division SFD-8-1
75 Hawthorne Street
San Francisco, CA 94105

Re: 2020 Well Inventory Update, Apache Powder Superfund Site, Cochise County, Arizona

Dear Mr. Kelly:

As directed by the U.S. Environmental Protection Agency[1] (EPA), Apache Nitrogen Products, Inc. (ANPI) has completed its 2020 well inventory update. The well inventory area surrounds the Apache Powder Superfund Site and comprises an area of approximately 386 square miles. The primary purposes of the well inventory are to (1) identify shallow aquifer wells in the vicinity of the ANPI study area, and (2) track well development and construction as it may relate to human exposure pathways associated with contaminated groundwater associated with the Apache Powder Superfund Site.

The well inventory comprises an assemblage of well information managed in both electronic and hardcopy formats. The electronic media are stored within Microsoft Access Database and a Geographic Information System (GIS) based on ArcView 10 architecture. The hardcopy media consist of records contained within the Arizona Department of Water Resources' (ADWR) Imaged Records. ADWR's Imaged Records consist of scanned documents and correspondence between the well owner and ADWR. The following paragraphs describe the well inventory.

[1] EPA, 2005. Amendment to Record of Decision Apache Powder Superfund Site Benson, Arizona. September 2005.

Other Offices:
Mesa, AZ
San Diego, CA
Tucson, AZ

INPUT DATA

Data sources for the well inventory include the ADWR Wells 55 Registry database, Groundwater Site Inventory (GWSI) database, and field data collected by ANPI.

The ADWR Wells 55 database contains a large number of records, including registry IDs that have no associated imaged record. The database is not site-verified. It also includes all Notices of Intent to Drill (NOI) filed with ADWR. In addition to actual, completed water wells, NOIs may represent exploratory borings, dry wells that were never completed as water wells, foundation borings, denied or cancelled NOIs, etc. Additionally, property owners sometimes file NOIs, but do not actually drill the petitioned well. On the other hand, occasionally NOIs are filed with and accepted by ADWR and the well is actually completed, but the well driller does not file a well driller report with ADWR. ANPI routinely receives and reviews NOIs provided by Arizona Department of Environmental Water Quality (ADEQ). These NOIs are those that represent wells within a specified distance from the shallow aquifer which ADEQ review was requested as a matter of assuring against human exposure by plume avoidance or against aquifer cross-contamination via special construction design.

The GWSI database is site-verified, but it is not nearly as comprehensive as the Wells 55 database. GWSI data was used to supplement Wells 55 data in the ANPI well inventory and to verify that a well does exist.

Field data collected by ANPI, such as the 1990 Site Survey including a private well survey and quarterly groundwater monitoring knowledge, was used to correct known mistakes within the ADWR Wells 55 database or to verify the existence of a well. Additionally, reconnaissance is ongoing. ANPI personnel continuously monitor drilling activities within the area.

WELL LOCATION METHOD

ADWR's method of well location is to position the well within the center of the smallest division of the reported location. As a result, the cadastral location of wells reported in the Wells 55 database is not exact. For example, if the location in the driller's report is given as Township/Range/Section/160 Acres/40 acres/10 acres, its accuracy is assumed to be precise to within ten acres and its location is plotted in the center of that ten-acre area. Often, locations are not reported to within ten acres. Thus, a map produced from well locations taken from the Wells 55 database often produces a grid-like configuration. In fact, a well with only the Township/Range/Section information could be mislocated by as much as 0.7 miles.

METHODOLOGY

An area including the Apache Powder Superfund Site study area as defined at the outset of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation was initially selected to assure inclusion of all potentially relevant records. This area was considerably larger than the actual extent of the study area as well as the affected portions of the shallow aquifer because it is intended to have a substantial buffer. More recently, EPA agreed that it would be appropriate to reduce the size of the area in consideration of the shrinking of the contaminant plume.[2]

ADWR's well data set was therefore "clipped" to include a more focused area and incorporates the ANPI study area, the affected areas of the shallow aquifer, and a buffer zone. This area is oriented roughly parallel to the course of the San Pedro River and is referred to as the "detailed" extent (Figure 1). All wells within this zone are included in both the electronic and hardcopy components of the well inventory. In addition to the hardcopy media, any wells within the detailed extent area having an available ADWR Imaged Record were hyperlinked to the corresponding well record. This provision facilitates viewing of further information for selected wells in the GIS.

Further descriptive information was added to the database as a means of identifying relevant information for each well within the inventory. This descriptive information includes the following categories:

- Aquifer
- Conf_aqui
- Conf_loc
- Comments
- Drill_log
- Loc_update
- Location

These categories are described in the following sections.

"Aquifer" defines the "water-bearing zone" tapped by the well. The "water-bearing zones" include the shallow aquifer, deep, or other aquifer. In some instances, the wells may be classified as dry and in others, as unknown. If the well depth was reported as less than 200 feet, the well was assumed to be tapping the shallow aquifer, initially. Further scrutiny of the well log, location, depth-to-water, etc. as reported in the Imaged Record or as ascertained from field knowledge was then made to verify shallow aquifer assignment. If the well depth was reported as greater than 200 feet, the well was assumed to be tapping the deep aquifer. In some cases, generally ones with field knowledge, the well was classified as "other" referring to wells in the ANPI perched zone or the design confirmation piezometer, monitoring the ANPI Northern Area Remediation System. If the well was described as "artesian" or "flowing" in the water well report, but well depth was not reported, its category was assigned as "unknown," because in technical terms, artesian simply means that the water level in the well is above a confining unit. This condition has been observed to exist both in the shallow and deep aquifers according to location and geologic conditions. If the well drilling did not encounter water, the well was classified as "dry."

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[2] See EPA comment letter and 2014 Annual Performance Monitoring and Site-Wide Status Report-Apache Powder Superfund Site dated April 1, 2015.

The **Conf_aqui** category contains information concerning a well's existence and history. For instance, if a well was verified by ANPI or by GWSI, it is so identified. It is also indicated if ADWR's Imaged Record only has an existing well registration, NOI, or if it contains a well driller's report among other things.

The **Conf_loc** category declares the actual confidence in the existence of a particular well. It is largely contingent on information reported in the **conf_aqui** category. One of five well groupings was assigned: "well not evaluated," "confirmed well," "unconfirmed well," "aborted/cancelled well," or "abandoned well." Most wells outside the detailed extent were assigned to "well not evaluated" grouping. Wells that have been site verified by either ANPI or the GWSI database, have a well driller report, or have an existing well registration were assigned to the "confirmed well" grouping. Wells that only have a NOI, or there is no Imaged Record, were assigned to the "unconfirmed well" grouping. Any well with an NOI denial or cancellation were assigned to the "aborted/cancelled well" grouping. Finally, wells with a Notice of Abandonment or known ANPI exploratory boreholes were assigned to the "abandoned wells" grouping.

The **Comments** category is for adding notes, specifically if a category originally filled out by ADWR was changed based on additional or new information.

The **Drill_log** category indicates whether a driller's report is available for the particular well. The column simply indicates "yes," "no," or "unknown." This provision facilitates searches for wells located within a certain area that have additional information available in the form of the driller's report.

The **Loc_update** category indicates whether a well location has been updated by ANPI. The column simply indicates "yes" or "no." In 2006, ANPI acquired an extensive set of Cochise County assessor maps. The assessor maps, imaged records, and field knowledge combined allowed for many shallow well locations within the detailed extent to be updated manually.

The **Location** category indicates which general area the well can be located, the study area, the northern area, the eastern area, or the northeastern area.

WELLS POTENTIALLY AT RISK

As stated earlier, the well inventory was designed with the intent to identify shallow aquifer wells within the vicinity of the ANPI study area that may be within the extent of the nitrate-nitrogen (nitrate-N) plume. After each well update, GIS is used to "filter" out deep or unknown wells within the detailed extent area. A determination of "wells potentially at risk" is based on an overlay of the extent of the limits of nitrate-N in concentrations exceeding ten milligrams per liter (10 mg/l) within the shallow aquifer, based on the most current sampling and analysis from quarterly monitoring rounds outlined in performance monitoring plans and the 2020 annual report.[3,4,5]

If any of the new, confirmed shallow wells are within, or reasonably close to, the extent of the plume, the well owners are notified. "Reasonably close to" is defined as a buffer zone of 0.7 miles from the extent of the nitrate-N plume. This buffer was chosen on the basis of maximum error associated with ADWR's convention of assuming the well is located at the center of the smallest areal division reported. Specifically, if only the Township, Range, and Section are reported, the distance from the center of the section to the corner is 0.7 miles. Note that the November 2020 nitrate-N map contains a small hot spot at the location of ANPI monitor well MW-13. This hot spot is not considered to be part of the continuous plume to the north and as such was not used to calculate the buffer extent.

RESULTS OF THE 2020 WELL INVENTORY UPDATE

The current well inventory is based on January 19, 2021 Wells 55 download from the ADWR within the reduced survey area. Based on the update, the inventory consists of 1,171 ADWR registration numbers within the detailed extent (Figure 2). Within this area, 260 registration numbers are associated with confirmed shallow wells (Figure 3), 492 are associated with confirmed deep wells (Figure 4), 23 are associated with confirmed other aquifer wells. The remaining registration numbers are classified as unknown, boreholes, aborted/cancelled, or abandoned wells.

Based on the November 2020 nitrate-N plume, the inventory identified no new wells as being considered at risk (Figure 5).

Five additional registration records associated with non-ANPI owners were added to the database between 2019 and 2020. Four of the additional registration records were associated with wells. One registration record (55-924047) was associated with Arizona Department of Transportation geotechnical borings that were abandoned after drilling.

Of the four remaining registration records:

- One registration record (55-233495) was an NOI filing for a non-exempt well for commercial use that was authorized by ADWR in December 2020 but had not yet been drilled as the end of 2020.

- Two of the registration records are categorized as deep wells based on total depth and/or review of driller's logs:

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[3] H+A, 2007. *Southern Area Performance Monitoring Plan Revision 2.0.* September 19, 2007.

[4] H+A, 2009. *Performance Monitoring Plan for Monitored Natural Attenuation of Shallow Aquifer Groundwater in The Northern Area of the Apache Powder Superfund Site Revision 1.0.* February 12, 2009.

[5] H+A, 2021. *2020 Annual Performance Monitoring and Site-Wide Status Report Apache Powder Superfund Site.*

- Well 55-231999 is an exempt well that was completed in April 2020 to a total depth of 555 feet.
- Well 55-232774 is a non-exempt well that was completed in November 2020 to a total depth of 360 feet.

- One of the registration records (55-231763) is categorized as a shallow well based on total depth and review of the driller's log. This well is a non-exempt irrigation supply well and was completed in June 2020. This well is not considered to be an at-risk well due to irrigation use.

The nitrate-N plume was delineated based on analysis of groundwater samples collected during the November 2020 quarterly performance monitoring round. The plume was used to evaluate shallow wells completely within the plume and within 0.7 miles of the plume perimeter. Comparison of the plume footprint in November 2020 to the footprint based on November 2019 data results in approximately the same extent. A total of 107 shallow wells were confirmed within this area (Figure 6; Table 1).

Thirty of the 107 shallow wells belong to either ANPI or are within the ANPI performance monitoring network. A significant number of the remaining wells are located east of the San Pedro River and south of the Dragoon Wash (aka Gila Wash). Due to the groundwater flow pattern from the St. David Area, it is believed that this area is at minimal risk from the nitrate-N plume. The owners of the remaining wells have been contacted by ANPI to determine the operational status of the wells and the type of groundwater usage.

INVENTORY UPDATES

The well inventory is updated on an annual basis. This update involves acquiring data from the latest ADWR Wells 55 GIS Shapefile file by downloading it from ADWR's URL site (https://tinyurl.com/rhrg63e). Next, a query is run for to identify registration numbers not currently in the inventory database. Based on this query, ADWR on-line PDF records are collected. Every annual update also reevaluates the Imaged Records of the previous year's wells at potential risk to check for ownership updates, abandonment, etc. A new search for wells at potential risk using the most current nitrate-N plume is performed on the confirmed shallow wells. Any new wells at potential risk are reported along with any updates to wells on previous year's potential risk list in the annual letter report.

Approximately every five years, a more extensive update is performed. Five-year updates are timed to coincide with EPA's Five-Year Review. This update was during last year's inventory and is scheduled next during calendar year 2022. This activity involves updates of the Imaged Records for wells already within the inventory, as appropriate, reviewing Imaged Records for all wells, and organizing hardcopies of all new and updated wells. ADWR's Imaged Records are periodically updated with new ownership, abandonment data, availability of driller's logs, etc.

The enclosed portable hard drive contains the well inventory database along with the image folder (1.2 GB in size). The included "readme" file provides instructions for the well inventory and how to link to the imaged records. The inventory database file has several queries included with it.

These queries include: shallow, confirmed wells; deep, confirmed wells; other, confirmed wells; unconfirmed wells; aborted/cancelled wells; and abandoned wells.

Please contact me if there are any questions concerning this report.

Sincerely,

HARGIS + ASSOCIATES, INC.

LEO S. LEONHART, PHD, RG
Principal Hydrogeologist/Senior Technical Director

Enclosures: Table 1
Figures 1 through 6

cc w/encl: PMP Distribution

TABLE

TABLE 1
ANPI 2020 WELL INVENTORY
SHALLOW WELLS WITHIN 0.7 MILES OF THE NITRATE-N PLUME

REGISTRY ID	CADASTRAL LOCATION	WELL DEPTH	INSTALLED	COMMENTS	Owner	DRILLER REPORT AVAILABLE IN IMAGED RECORDS	LOCATION
085222	D(18-21)06BAA	75	10/20/1980		MAYBERRY, JIM,	YES	NA - E
204298	D(18-21)06DBB	68	9/25/2004	ANP MW-36	APACHE NITROGEN PRODUCTS INC	YES	NA
206932	D(18-21)06AAB	121	7/8/2005		ERNEST & MARLA PESQUEIRA	YES	NA - E
215849	D(17-20)36DCC	133	7/16/2007	ANP MW-42	APACHE NITROGEN PRODUCTS INC	NO	NA
218794	D(18-21)06ABB	140	4/20/2009	Well location is East of SPR south of U.S. 80.	DAMON TREJO	YES	NA - E
220063	D(17-21)31DDA				DAVID DAUGHERTY	NO	NA - E
231763	D(18-21)06BAA	120	6/4/2020	Irrigation Well	ALEXANDER INVESTMENT TRUST	YES	NA - E
501649	D(17-20)36DDD	125	6/24/1982	CGMP Private Well	VENICE J HIGGINBOTHAM, TRUSTEE	YES	NA
503019	D(18-21)05CAD	130	6/30/1982		PB & SD KARTCHNER	YES	NA - E
503534	D(17-20)36DDC	125	8/16/1982	CGMP Private Well	SCOTT,J	YES	NA
513537	D(18-21)06ADA	240	3/26/1986	CGMP Private Well	WHITE, EULAS,E	YES	NA - E
528008	D(18-21)07AAA	53			APACHE POWDER CO,		NA
528009	D(18-21)07CDC	62	5/11/1990	ANP MW-13	APACHE POWDER CO,	YES	NA
528018	D(18-21)06BCC	102	5/6/1990	ANP MW-08	APACHE POWDER CO,	YES	NA
528020	D(18-21)06CCB	50	5/7/1990	ANP MW-09 - DRY	APACHE POWDER CO,		NA
528021	D(18-21)06DBC	40	5/5/1990	ANP MW-10	APACHE POWDER CO,	YES	NA
528022	D(18-21)06DBD	62	5/8/1990	ANP MW-11	APACHE POWDER CO,	YES	NA
530043	D(18-21)06BBD	120	7/17/1991	ANP evaluated property owner for a deep replacement well was found to have a deep well (see 55-530042).	MITCHELL, HUGH,A	YES	NA
530522	D(18-21)06BCD	140	2/11/1991	ANP MW-17	APACHE NITROGEN PROD,	YES	NA
530523	D(18-21)06BCD	140	2/10/1991	ANP MW-18	APACHE NITROGEN PROD,	YES	NA
562198	D(18-21)07BBA	25	5/16/1997	ANP DCP-12	APACHE NITROGEN PRODUCTS INC	YES	NA
562927	D(18-21)06CBB	85	7/2/1997	ANP MW-19	APACHE NITROGEN PROD,	NO	NA
562928	D(18-21)06BBD	100	7/10/1997	ANP MW-20	APACHE NITROGEN PROD,	NO	NA
562930	D(18-21)06BCC	110	7/10/1997	ANP SEW-01	APACHE NITROGEN PROD,	YES	NA
576951	D(18-21)06ABA	120	12/18/1999		JEFFERY A. THOMAS[1]	YES	NA - E
577270	D(18-21)06BCB	128	12/27/1999	CGMP Private Well	THOMAS S HAYMORE	YES	NA
579872	D(18-21)08BBC	130	6/15/2000	ANP MW-26	APACHE NITROGEN PRODUCTS, INC.	YES	SA
579874	D(18-21)08BBC	160	6/15/2000	ANP MW-25	APACHE NITROGEN PRODUCTS, INC.	YES	SA
579877	D(18-21)08BBC	130	6/15/2000	ANP MW-27	APACHE NITROGEN PRODUCTS, INC.	YES	SA
594007	D(18-21)06DBD	45	9/11/2002	ANP MW-34	APACHE NITROGEN PRODUCTS INC	YES	NA
594008	D(18-21)06BDA	54	9/17/2002	ANP MW-35	APACHE NITROGEN PRODUCTS INC	YES	NA
594574	D(17-21)31DDD	140	3/4/2003		ANDREW MAYBERRY	YES	NA - E
594823	D(17-21)31DCC	155			JERRY & RUTH BRIMHALL	YES	NA - E
596097	D(18-21)06ABA	118			DAMON TREJO	YES	NA - E
605933	D(18-21)05CAA	150	4/1/1956		DRIGGS, T	NO	NA - E
605934	D(18-21)05CA*	100	4/1/1956		DRIGGS, T	NO	NA - E
606590	D(18-20)01AAA	138	6/20/1980	CGMP Private Well	LORIN P MCRAE	YES	NA
607625	D(18-21)06AD*	80	9/30/1962	; Well owner has other shallow well in CGMP	WHITE,E E	NO	NA - E
607854	D(17-21)31DDA	80	8/1/1939		GOODMAN,D R	NO	NA - E
607856	D(18-21)06AAA	60			JUDD,J V	NO	NA - E
607860	D(17-21)31DCA	132	2/2/1950		JERRY & RUTH BRIMHALL	NO	NA - E
608770	D(18-20)01DCC				BRUCE J HANCOCK	NO	NA
609235	D(18-21)06DAC	108	3/31/1977		SCOTT THACKER	NO	NA - E
609236	D(18-21)05CBB	115	1/1/1958		SCOTT THACKER	NO	NA - E
609244	D(18-21)05CBB				SCOTT THACKER	NO	NA - E
609573	D(17-21)31DDD	125	8/1/1964		ALARCON,R	NO	NA - E
610200	D(17-21)31DDC	140			FENN,G L	NO	NA - E
610372	D(18-21)08BAB	110	7/6/1964		TENOPIR, F	NO	SA - E
611921	D(18-21)05CA*	110	6/1/1976		KARTCHNER, P	NO	NA - E
612814	D(18-21)06ABB	100	1/1/1929		MAYBERRY,R	NO	NA - E
612815	D(18-21)06ABB				COCHISE COUNTY INVESTMENTS, LLC	NO	NA - E
613372	D(17-21)31DDD				BOWMAN,G B	NO	NA - E
618510	D(18-21)06AD*				CLINTON & BEVERLY HEPNER	NO	NA - E
619450	D(18-21)06ACA	104	10/4/1976	Included in 1990 Inventory	COCHISE COUNTY INVESTMENTS, LLC	NO	NA - E
620712	D(18-21)06B**	100	1/1/1977	CGMP Private Well	KEMPTON,G J	NO	NA
620713	D(18-21)06B**	40	1/1/1931	Kempton/Jones Well not in CGMP	KEMPTON,G J	NO	NA
620728	D(17-21)31DDC	150			SANDVE,P A	NO	NA - E
623460	D(17-21)31DDB	135	5/1/1970		DALE H. ALLRED	NO	NA - E
623461	D(17-21)31DDB	235	6/1/1970		JAROD & LAURA CHRONISTER[1]	NO	NA - E
625379	D(18-21)05BC*	160	1/1/1970		NEIL & APRIL GINTZ	NO	NA - E
625380	D(18-21)05BC*	200	1/1/1969		BRANCH & ROSS,	NO	NA - E
625744	D(18-21)05CA*	120			KARTCHNER, P	NO	NA - E
627686	D(18-21)06ABB	105	1/1/1929		COCHISE COUNTY INVESTMENTS, LLC	NO	NA - E
627698	D(18-21)06BAA	105	1/1/1954		MAYBERRY,E J	NO	NA - E
627699	D(18-21)06ABB	60	1/1/1951		COCHISE COUNTY INVESTMENTS, LLC	NO	NA - E
627700	D(18-21)06BAA	105	1/1/1980		MAYBERRY,E J	NO	NA - E
628448	D(17-21)31DCC				COCHISE COUNTY INVESTMENTS, LLC	NO	NA - E
628450	D(17-21)31DCB				COCHISE COUNTY INVESTMENTS, LLC	NO	NA - E
628464	D(18-21)06AD*	100			JASON & CHRISTY POSEGATE	NO	NA - E
631237	D(17-21)31CC*	200	4/1/1949		SIMEON AND JOSHUA R. COLEMAN	NO	NA - E - ND
631238	D(17-21)31CC*	200	4/1/1949		CHILDS,F	NO	NA - E - ND
631239	D(17-21)31CC*	200			RILEY, ROBERT,A	NO	NA - E - ND
631240	D(17-21)31CC*	200			CAMERON J. AND KAMERAN P. JUDD[1]	NO	NA - E - ND
631273	D(18-21)06BAA	95	6/6/1962		ALEXANDER,J W	NO	NA - E
631274	D(18-21)06BAA	30	12/31/1927		ALEXANDER, JAMES & B,	NO	NA - E
631275	D(18-21)06BAB	50	1/1/1925	CGMP Private Well	ALEXANDER,J W	NO	NA - E
631276	D(18-21)06BAA	50	6/1/1942		ALEXANDER,J W	NO	NA - E
631775	D(18-21)06AAB	125	12/31/1936		BRYCE, DANIEL,V	NO	NA - E
631777	D(18-21)06AAB	100	11/23/1977		BRYCE, DANIEL,V	NO	NA - E
631778	D(18-21)06ADB	100	11/23/1977		TREJO,A J	NO	NA - E
631795	D(17-21)31CBD	36	<1930		RILEY, ROBERT,A	NO	NA - E - ND
631796	D(17-21)31CCC	24	1/1/1930		RILEY, ROBERT,A	NO	NA - E - ND
631797	D(17-21)31CBD		<1930		RUSSELL & SHEILA HUNTER	NO	NA - E - ND
637271	D(18-21)06AD*				JASON & CRISTRY POSEGATE	NO	NA - E
641700	D(17-21)31DD*	100	12/7/1974		MERRILL,G E	NO	NA - E
642472	D(18-21)05B00*				PYLANT,G E	NO	NA - E
645416	D(18-21)06AAB	110	5/2/1976		ROBERT EDWARD BURG	NO	NA - E
647038	D(18-21)06AD*	80			JASON & CHRISTY POSEGATE	NO	NA - E
647428	D(18-21)05BBC	125	3/1/1965		MORTENSON,D O	NO	NA - E
647579	D(18-21)06AAA	100	9/1/1980		SMITH,G L	NO	NA - E
648981	D(18-21)06AA*				SMITH,D S	NO	NA - E
648982	D(18-21)06AA*	80			ALBERT ZYWAR	NO	NA - E

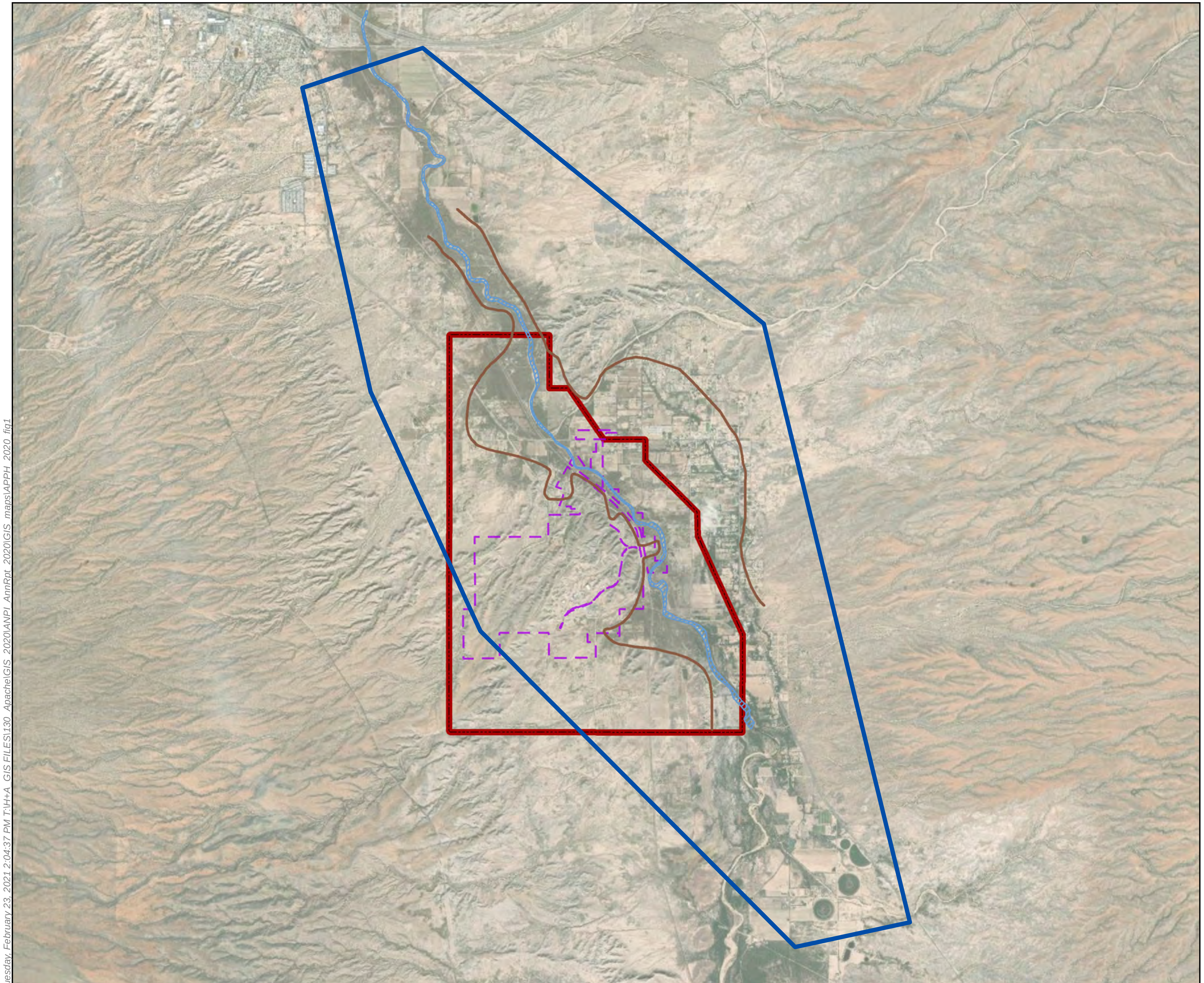
TABLE 1
ANPI 2020 WELL INVENTORY
SHALLOW WELLS WITHIN 0.7 MILES OF THE NITRATE-N PLUME

REGISTRY ID	CADASTRAL LOCATION	WELL DEPTH	INSTALLED	COMMENTS	Owner	DRILLER REPORT AVAILABLE IN IMAGED RECORDS	LOCATION
648983	D(18-21)06AA*				SMITH,D S	NO	NA - E
649691	D(18-21)06BCC	120		Carnes shallow well	CARNES,P L	NO	NA
806011	D(18-21)06BCB	100	12/31/1971	CGMP Private Well	WOOTEN, RANDAL,	NO	NA
918671	D(18-21)06DBB	80	9/28/2015	ANP SEW-02	APACHE NITROGEN PRODUCTS INC	YES	NA
918673	D(18-21)06DBB	75	9/30/2015	ANP MW-45	APACHE NITROGEN PRODUCTS INC	YES	NA
918674	D(18-21)06DBB	60	9/25/2015	ANP MW-46	APACHE NITROGEN PRODUCTS INC	YES	NA
921793	D(18-21)06BDA	22	6/18/2018	ANP NAP-1	APACHE NITROGEN PRODUCTS, INC.	YES	NA
921794	D(18-21)06ACB	22	6/19/2018	ANP NAP-2	APACHE NITROGEN PRODUCTS, INC.	YES	NA
921795	D(18-21)06ACC	22	6/19/2018	ANP NAP-3	APACHE NITROGEN PRODUCTS, INC.	YES	NA
921796	D(18-21)06ACD	22	6/20/2018	ANP NAP-4	APACHE NITROGEN PRODUCTS, INC.	YES	NA
921797	D(18-21)06DBA	22	6/20/2018	ANP NAP-5	APACHE NITROGEN PRODUCTS, INC.	YES	NA
922340	D(18-21)06BDB	107	11/21/2018	ANP PB-2A	APACHE NITROGEN PRODUCTS, INC.	YES	NA
922342	D(18-21)06BDA	66	11/21/2018	ANP PB-7	APACHE NITROGEN PRODUCTS, INC.	YES	NA
922343	D(18-21)06ACD	70	11/20/2018	ANP PB-4	APACHE NITROGEN PRODUCTS, INC.	YES	NA
922710	D(17-21)31CCC	150	3/15/2010	Monitor Well B-05A	ARIZONA DEPARTMENT OF TRANSPORTATION	YES	NA - E - ND

ABBREVIATIONS
NA = Northern Area
NA-E = Northern Area east of the San Pedro River, South of Dragoon Wash
NA-E-ND = Northern Area east of the San Pedro River, North of Dragoon Wash
SA = Southern Area
SA-E = Southern Area east of the San Pedro River

Footnotes:
* = Locational information to nearest 10 acre not available from Arizona Department of Water Resources (ADWR)
[1] = Change in ownership in 2020

FIGURES



EXPLANATION

- Study Area Boundary
- Detailed Extent of Well Inventory
- ANPI Property Boundary
- Shallow Aquifer Boundary
- San Pedro River

N

0 2,500 5,000 10,000

Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

DETAILED EXTENT OF WELL INVENTORY

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY / ENGINEERING

03/2021

FIGURE 1

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | APPH_2020_fig1 | Rev.0

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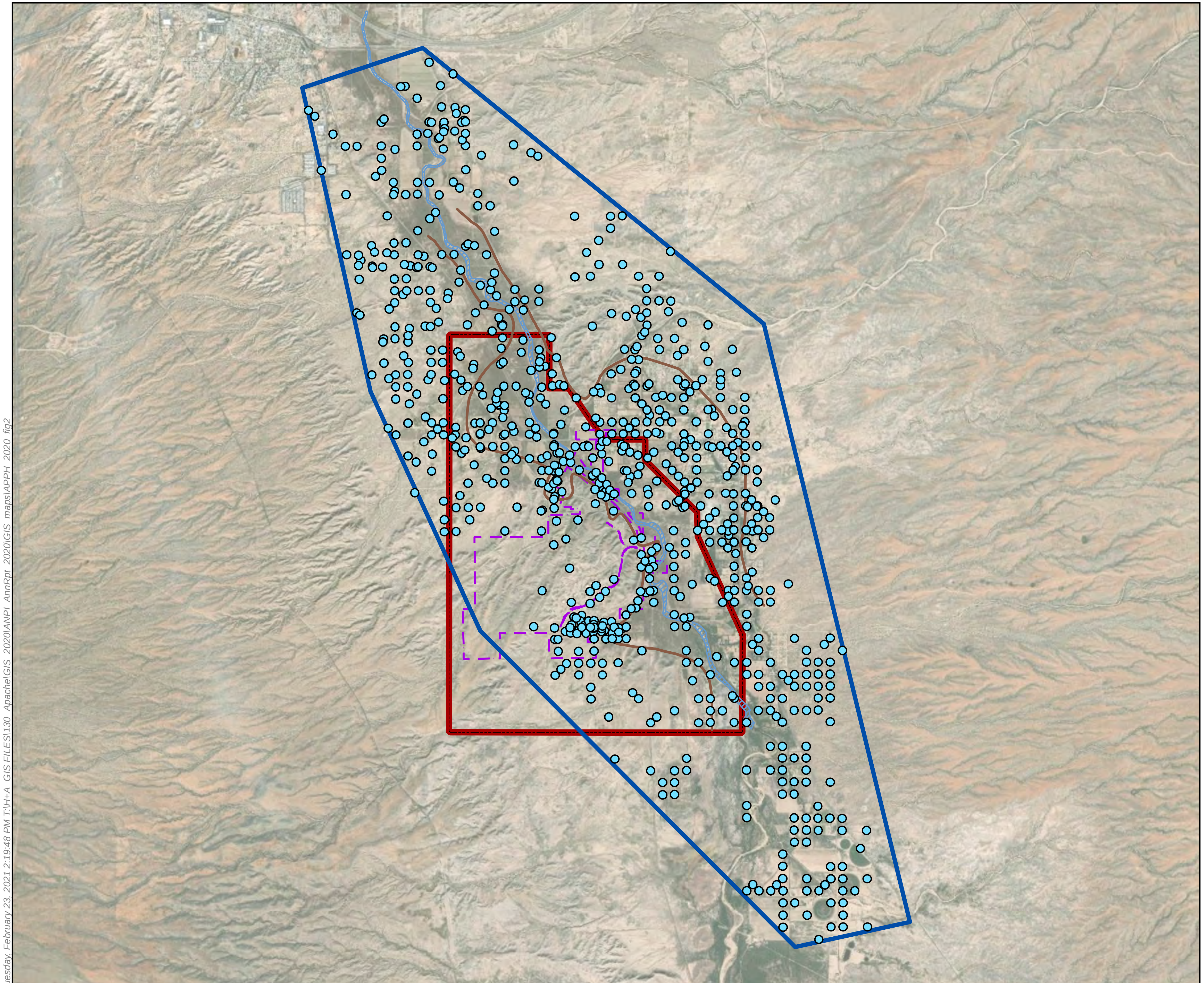

EXPLANATION

- Well Location
- Study Area Boundary
- Detailed Extent of Well Inventory
- ANPI Property Boundary
- Shallow Aquifer Boundary
- San Pedro River

N

0 2,500 5,000 10,000

Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

2020 WELLS WITHIN THE DETAILED EXTENT

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY / ENGINEERING

03/20201

FIGURE 2

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | APPH_2020_fig2 | Rev.0

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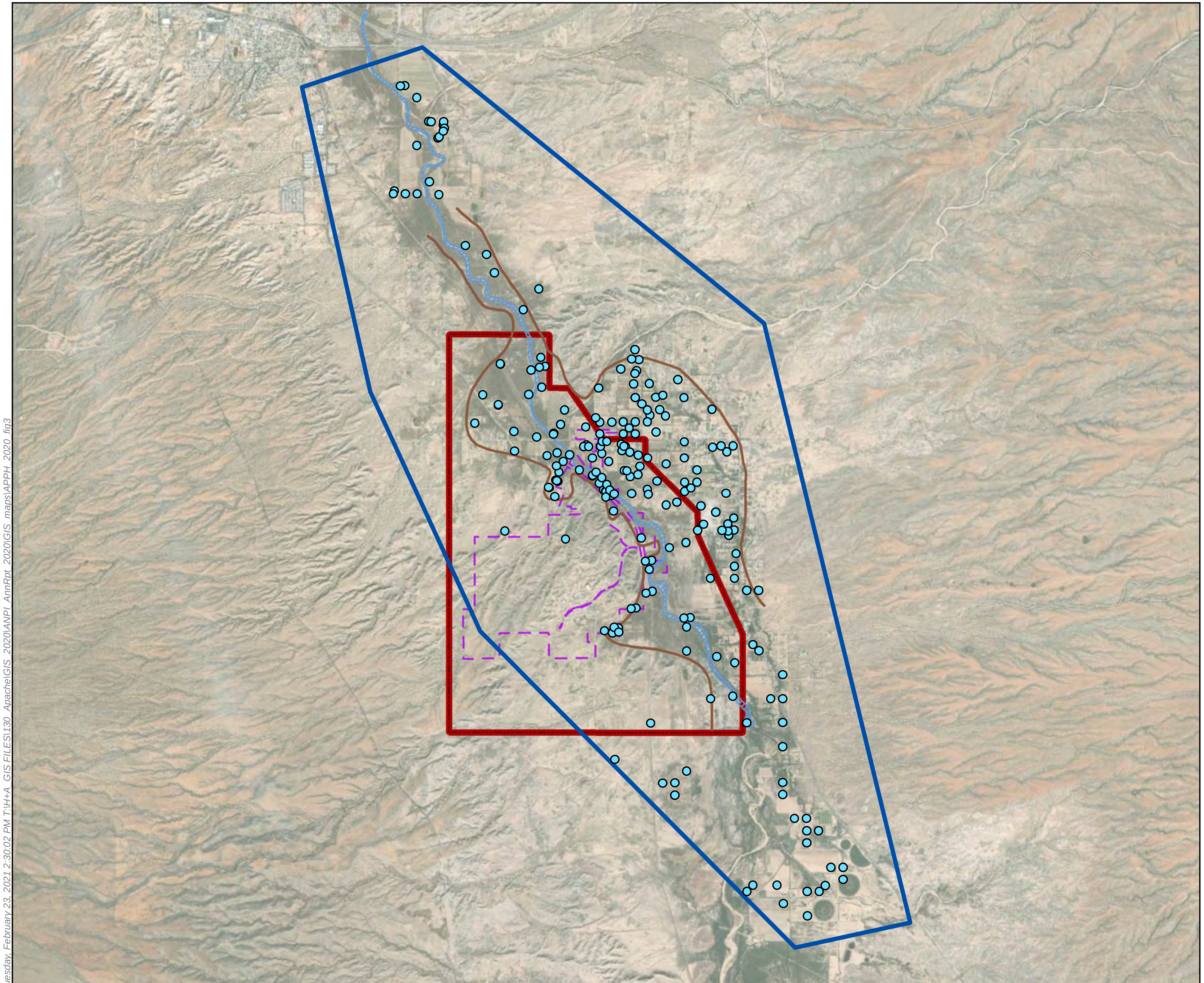


EXPLANATION

- Confirmed Shallow Well Location
- Study Area Boundary
- Detailed Extent of Well Inventory
- ANPI Property Boundary
- Shallow Aquifer Boundary
- San Pedro River

N

0 2,500 5,000 10,000

Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

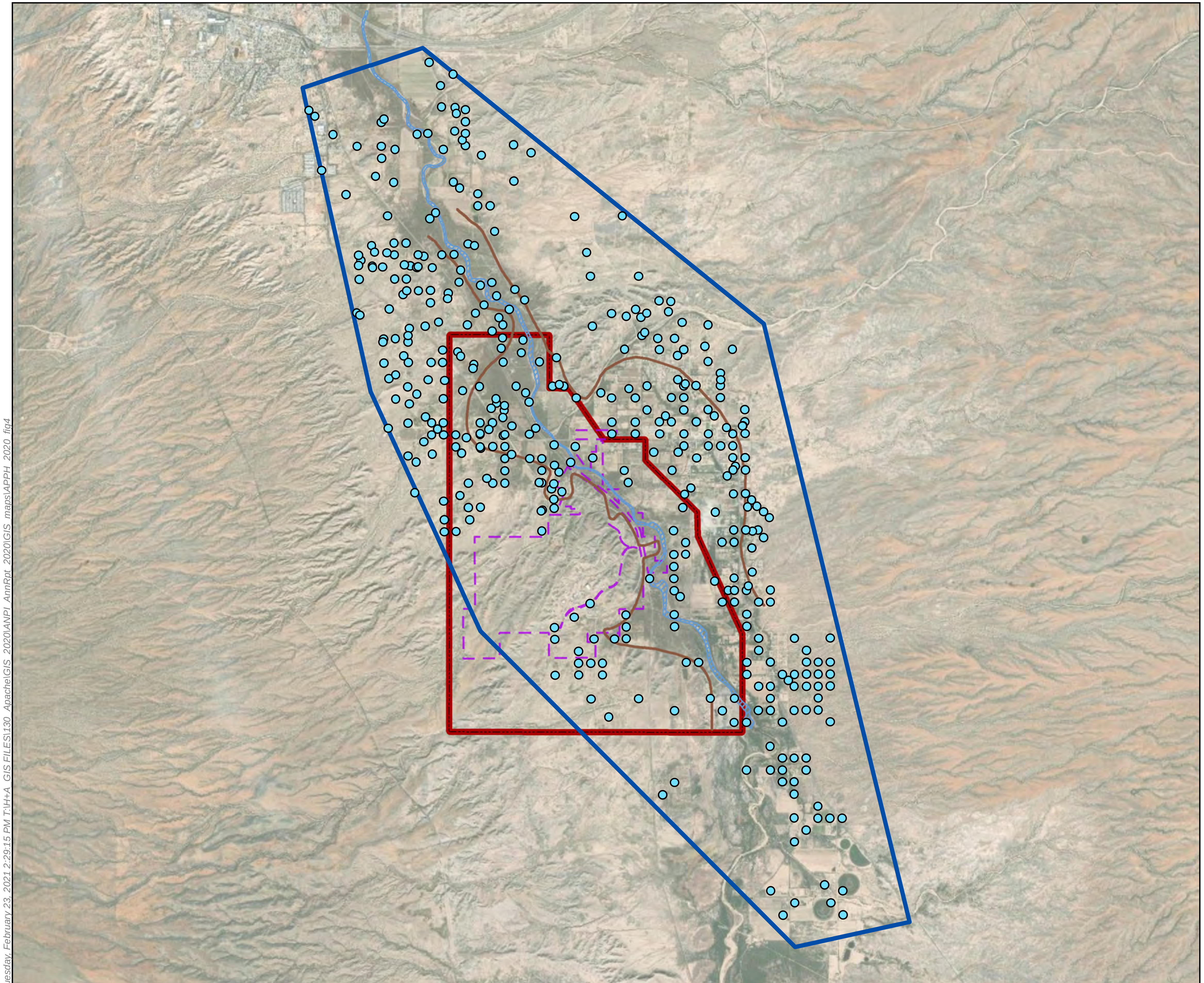
CONFIRMED SHALLOW WELLS WITHIN THE DETAILED EXTENT

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY / ENGINEERING

03/2021

FIGURE 3

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | APPH_2020_fig3 | Rev.0



EXPLANATION

- Confirmed Deep Well Location
- Study Area Boundary
- Detailed Extent of Well Inventory
- ANPI Property Boundary
- Shallow Aquifer Boundary
- San Pedro River

N

0 2,500 5,000 10,000
Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

CONFIRMED DEEP WELLS
WITHIN THE DETAILED EXTENT

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY / ENGINEERING

03/2021

FIGURE 4

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | APPH_2020_fig4 | Rev.0

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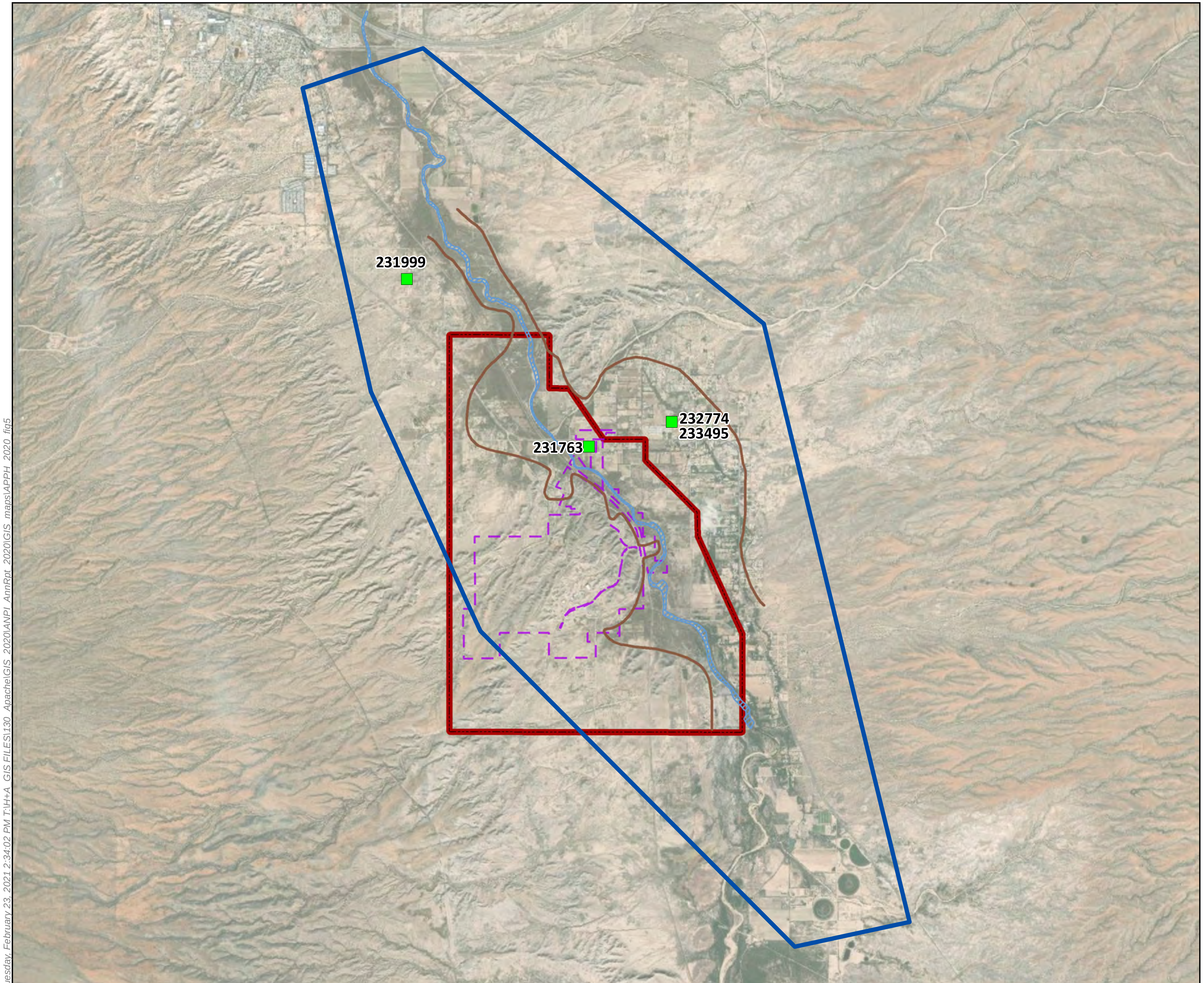


EXPLANATION

- 2020 Inventory New Wells
- Study Area Boundary
- Detailed Extent of Well Inventory
- ANPI Property Boundary
- Shallow Aquifer Boundary
- San Pedro River

N

0 2,500 5,000 10,000
Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

2020 WELL INVENTORY UPDATE
WELLS IDENTIFIED IN THE
INVENTORY EXTENT

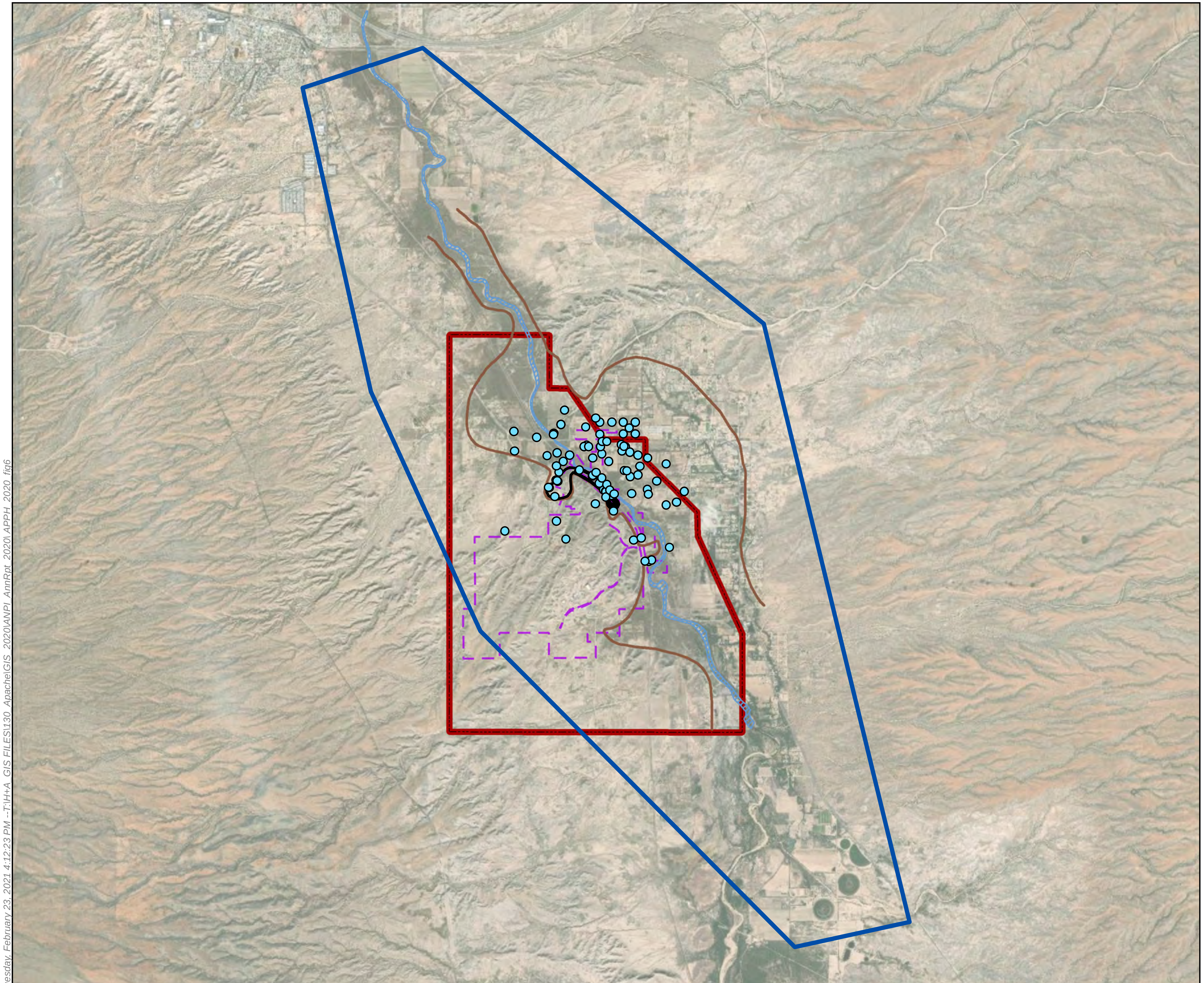
HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY / ENGINEERING

03/2021

FIGURE 5

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | APPH_2020_fig5 | Rev.0

Tuesday, February 23, 2021 2:34:02 PM T:\H+A GIS FILES\130 Apache\GIS 2020\ANPI AnnRpt 2020\GIS maps\APPH 2020 fig5



EXPLANATION

Shallow well location within 0.7 miles of NO3 plume November 2020

Approximate Limit of Nitrate-Nitrogen Exceeding 10 miligrams per liter

Study Area Boundary

Detailed Extent of Well Inventory

ANPI Property Boundary

Shallow Aquifer Boundary

San Pedro River

N

0 2,500 5,000 10,000

Feet

APACHE NITROGEN PRODUCTS, INC.
BENSON, ARIZONA

SHALLOW WELLS WITHIN 0.7 MILES OF THE NOVEMBER 2020 NITRATE-N PLUME

HARGIS + ASSOCIATES, INC
HYDROGEOLOGY / ENGINEERING

03/2021

FIGURE 6

PREP BY: RGW REV BY: AMB RPT NO.: 130.140 | APPH_2020_fig6 | Rev.0

APPENDIX H

DATA ASSESSMENT AND VALIDATION SUMMARY
2020 ANNUAL SUMMARY

APPENDIX H

DATA ASSESSMENT AND VALIDATION SUMMARY
2020 ANNUAL SUMMARY

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TABLES

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ATTACHMENTS

Attachment

ACRONYMS AND ABBREVIATIONS

%	Percent
ADEQ	Arizona Department of Environmental Quality
Ammonia-N	Ammonia as Nitrogen
ANPI	Apache Nitrogen Products, Inc.
E	Estimated
EPA	U.S. Environmental Protection Agency
ETAMP	Eurofins TestAmerica Phoenix Arizona
H+A	Hargis + Associates, Inc.
HU	Unusable
LCS	Laboratory Control Sample
LDC	Laboratory Data Consultants, Inc.
MNA	Monitored Natural Attenuation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NARS	Northern Area Remediation System
Nitrate-N	Nitrate as Nitrogen
O&M	Operations and Maintenance
pH	hydrogen ion potential
PMP	Performance Monitoring Plan
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
SOPs	Standard Operating Procedures
Turner	Turner Laboratories, Inc., Tucson Arizona

APPENDIX H

DATA ASSESSMENT AND VALIDATION SUMMARY
2020 ANNUAL SUMMARY

1.0 INTRODUCTION

A laboratory and field data quality assurance/quality control (QA/QC) program has been established to ensure the reliability and validity of data gathered as part of the performance monitoring of groundwater remedies. The QA/QC program ensures that representative, consistent, defensible, and valid water quality and water level data is collected. To achieve these objectives, the QA/QC program is a comprehensive program from the planning stage to the reporting of the data.

Water quality data for samples collected at the Apache Nitrogen Products, Inc. (ANPI) Superfund site are extensively reviewed to ensure that quality control criteria have been met in accordance with standard operating procedures (SOPs) outlined in the following supporting documents:

- *Operation and Maintenance (O&M) Plan Northern Area Remediation System (NARS), Revision 3.0* (Hargis + Associates, Inc. [H+A,] 2007a);
- *Southern Area Performance Monitoring Plan (PMP)*, Revision 2.0 (H+A, 2007b);
- *Long-Term Site-Wide Performance Monitoring and O&M of Remedies, Revision 1.0* (H+A, 2009a);
- *PMP for Monitored Natural Attenuation (MNA) of Shallow Aquifer Groundwater in the Northern Area, Revision 1.0* (H+A, 2009b); and
- *Quality Assurance Project Plan (QAPP) Performance Monitoring and O&M of Remedies, Revision 1.0* (H+A, 2010).

QA/QC SOPs are implemented to ensure that the water and soil quality data obtained can be used to support decisions on site assessment and remedial actions. QA/QC SOPs, such as data assessment and validation, are specified in the quality assurance project plan QAPP (H+A, 2010). As required by the QAPP, SOPs assess the precision, accuracy, and completeness of field and laboratory data. Field data are reviewed to evaluate their completeness and correctness. Field duplicate results are used to evaluate the precision of the sampling technique. Field and equipment blank results are reviewed to verify that sample collection, handling, and transport processes did not affect the quality of the samples. Data generated by the laboratory for analysis of laboratory spike samples and internal laboratory duplicates are evaluated to determine laboratory accuracy and precision.

The following sections provide the 2020 data assessment summary for the monthly, quarterly and annual NARS and quarterly PMP activities.

2.0 NORTHERN AREA REMEDIATION SYSTEM

NARS water quality samples were collected in accordance with the QAPP and O&M Plan (H+A, 2010 and 2007a). The January through December 2020 NARS analytical data have been extensively reviewed to ensure that QA/QC criteria have been met. Monthly NARS water quality samples were collected from extraction wells SEW-01 and SEW-02, primary effluent location (Effluent), and treatment cells ANA, FDA, PDA-C, PDA-N, and PDA-S. Monthly, samples collected at these locations were analyzed for nitrate as nitrogen (nitrate-N) and all locations except SEW-01 and SEW-02 were also analyzed for ammonia as nitrogen (ammonia-N) (Table 12). Quarterly, all locations were also analyzed for total phosphorus. In addition to total phosphorus Effluent samples were analyzed for total dissolved solids and total suspended solids and the treatment cell samples were analyzed for chemical oxygen demand, total organic carbon quarterly. Annually the Effluent, SEW-01 and SEW-02 samples were analyzed for alkalinity as bicarbonate, carbonate, and hydroxide along with calcium, magnesium, potassium, sodium, fluoride, chloride, orthophosphate, and sulfate. The effluent was also analyzed for total Kjeldahl nitrogen and organic nitrogen while SEW-01 and SEW-02 were analyzed for perchlorate on an annual basis. The treatment cells were analyzed for TKN and organic nitrogen annually (Tables 13 and 14).

Water quality samples from the design confirmation piezometer DCP-12 and monitor well MW-10 were collected on a quarterly basis. The quarterly DCP-12 and monitor well MW-10 samples were analyzed for nitrate-N and samples collected at monitor well MW-10 were also analyzed for ammonia-N (Table 12).

From January to December 2020, 459 laboratory analyses were performed for treatment cells, Effluent, SEW-01, SEW-02, DCP-12, and monitor well MW-10. The 459 laboratory analyses included 320 originals, 43 field duplicates, 59 splits, and 37 field blanks. See Table H-1 for the number and type of NARS analyses performed in 2020. Original water quality samples, field duplicates, and field blanks were submitted for analysis to Turner Laboratories, Inc. (Turner) of Tucson, Arizona. Split samples were submitted for analysis to Eurofins TestAmerica Laboratories (ETAMP) of Phoenix, Arizona.

In addition to the above listed laboratory analyses, 1,241 field analyses for the treatment cells, SEW-01, SEW-02, and Effluent were performed for electrical conductivity, hydrogen ion potential (pH), temperature, dissolved oxygen, and nitrate-N (Appendix E and Table H-1). Field parameters were measured using the YSI Professional Plus direct-reading instrument for electrical conductivity, pH, and temperature, dissolved oxygen, and nitrate-N.

2.1 DATA ASSESSMENT

The NARS water quality data was evaluated using assessment procedures as specified in the QAPP (H+A, 2010). Level II data assessment procedures were performed on 100 percent of the 2020 sampling analytical data. NARS data derived from water quality samples collected from January through December 2020, were assessed by H+A including the evaluation of the following:

- Sample holding times;
- Analytical methods and data reporting;
- Field blanks and laboratory reagent blanks;
- Laboratory control sample (LCS) recovery
- Matrix spike (MS) recovery;
- Matrix spike duplicate (MSD) analysis;
- Field duplicate analysis;
- Split sample analysis; and
- Data trending.

SOPs were used to assess data reported by the analytical laboratory and to assign H+A data qualifiers (H+A, 2010). The H+A data qualifiers were developed in order to differentiate data qualified by H+A from data qualified by the U.S. Environmental Protection Agency (EPA) (H+A, 2010) and the Arizona Department of Environmental Quality (ADEQ) (ADEQ, 2012). Data qualifiers are entered into the project database and have been tabulated with the analytical results (Tables 12 through 15).

2.2 DATA VALIDATION

Validation of NARS water quality data was performed according to EPA Level IV guidelines by Laboratory Data Consultants (LDC) of Carlsbad, California. The analyses were validated using the following documents, as applicable to each method: 1) USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2017 (EPA, 2017a), and 2) the QAPP (H+A, 2010). Validation is the comprehensive assessment of the raw data including the evaluation of the following:

- Sample holding times;
- Analytical methods and data reporting;
- Ion chromatograph performance;
- Initial and continuing instrument calibrations;
- Field blanks;
- Laboratory reagent blanks;
- Laboratory control samples;
- MS recovery and MSD analysis; and
- Compound identification and compound quantitation.

Data validation was performed on the 2020 water quality data after data assessment issues were addressed. The QAPP requires a minimum of 20 percent of the original samples to be validated on an annual basis. In 2019 EPA approved changing the requirement for data validation to 10 percent of the original samples (EPA, 2019). Approximately 30 percent of the original data for NARS water quality samples collected from January through December 2020 were validated by LDC (i.e., 97 of the 320 total analyses were validated by LDC). Please note that blank samples were not included when determining the number of samples requiring data validation. Validation in excess of 10 percent was performed in order to include all parameters analyzed.

2.3 DATA ASSESSMENT AND VALIDATION RESULTS

Instances where 2020 NARS water quality data failed to meet data quality objectives and acceptance criteria established in the QAPP and EPA Level IV guidelines are summarized in Table H-2. Of the 459 data points, 41 data points were qualified as estimated, “E”. No data points were qualified as unusable, “HU” (Table H-2). All other NARS analytical results met data quality objectives and acceptance criteria.

3.0 GROUNDWATER PERFORMANCE MONITORING

PMP groundwater quality samples were collected in accordance with the SOPs outlined in the Southern Area PMP, PMP for MNA of Shallow Aquifer Groundwater in the Northern Area, and QAPP (H+A, 2007b, 2009b, and 2010). The PMP analytical data, collected quarterly from January through December 2020, have been reviewed to ensure that QA/QC criteria have been met. Water quality data have been reviewed in accordance with SOPs outlined in the QAPP (H+A, 2010). These SOPs are implemented to ensure that the groundwater water quality data obtained can be used to support decisions regarding site assessment and remedial actions. Specifically, SOPs for data assessment and validation are specified in the QAPP.

In accordance with the PMPs, the 2020 groundwater water quality samples were collected on a quarterly basis (i.e., February, May, August, and December). The groundwater quality samples were collected from the PMP groundwater well monitoring network, perched zone piezometers, and surface water locations and were analyzed for nitrate-N and perchlorate (Table 7) as required by the sample schedule (Table 3).

From January through December 2020, 161 analyses were performed for groundwater performance monitoring which included 116 originals, 17 field duplicates, 17 splits and 11 field blanks. See Table H-3 for the number and type of PMP analyses performed in 2020. Original groundwater quality samples, field duplicates, and field blanks were submitted for analysis to Turner of Tucson, Arizona. Split samples were submitted for analysis to ETAMP of Phoenix, Arizona.

3.1 DATA ASSESSMENT

The PMP groundwater quality data was evaluated using assessment procedures as specified in the QAPP (H+A, 2010). Level II data assessment procedures were performed on 100 percent of the 2020 sampling analytical data. Procedures used to assess the 2020 quarterly groundwater quality data included evaluation of the following:

- Sample holding times;
- Analytical methods and data reporting;

- Field blanks, trip blanks, and laboratory reagent blanks;
- LCS recovery
- MS recovery;
- MSD analysis;
- Field duplicate analysis;
- Split sample analysis; and
- Data trending.

SOPs were used to assess laboratory data and to assign H+A data qualifiers in accordance with the QAPP (H+A, 2010). The H+A data qualifiers were developed in order to differentiate data qualified by H+A from data qualified by the EPA and ADEQ (ADEQ, 2012). Data qualifiers are entered into the project database.

3.2 DATA VALIDATION

Validation of PMP groundwater quality data was performed according to EPA Level IV guidelines by LDC of Carlsbad, California. The analyses were validated using the following documents, as applicable to each method: 1) USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2017 (EPA, 2017a), and 2) the QAPP (H+A, 2010). Validation is the comprehensive assessment of the raw data including the evaluation of the following:

- Sample holding times;
- Analytical methods and data reporting;
- Ion chromatograph performance;
- Initial and continuing instrument calibrations;
- Field blanks;
- Laboratory reagent blanks;
- Laboratory control samples;

- MS recovery and MSD analysis; and
- Compound identification and compound quantitation.

Data validation was performed on the 2020 PMP groundwater quality data after data assessment issues were addressed. The QAPP requires a minimum of 20 percent of the original data to be validated on an annual basis. In 2019, EPA approved changing the requirement for data validation to 10 percent of the original samples (EPA, 2019). In 2020, approximately 17 percent of the data for PMP groundwater quality samples collected quarterly from January through December 2020 was validated by LDC (i.e., 20 of the 115 total analyses were validated). Please note that blank samples were not included when determining the number of samples requiring data validation.

3.3 DATA ASSESSMENT AND VALIDATION RESULTS

Instances where 2020 PMP groundwater quality data failed to meet data quality objectives and acceptance criteria established in the QAPP and EPA Level IV guidelines are summarized in Table H-4. Of the 161 data points, 31 data points were qualified as estimated, “E”. No data points were qualified as unusable, “HU” (Table H-4). All other PMP analytical results met data quality objectives and acceptance criteria.

4.0 LABORATORY AUDITS

As per QAPP requirements (H+A, 2010), on-site laboratory audits of the laboratories are to be performed on a biennial basis. Virtual audits were performed in 2020 due to Covid-19 restrictions. Laboratory audits of Turner and ETAMP were performed in 2020 by Laboratory Data Consultants (LDC). The LDC audits focused on QA systems and data generated for the Apache Powder Superfund Project. The virtual audit of Turner Laboratories was performed by LDC on December 9, 2020, and the virtual audit of Eurofins TestAmerica was performed December 16, 2020. The LDC report for the Apache Superfund laboratory audits is provided in Attachment H-1. In summary, the laboratories were assessed as having adequate capability and quality systems to support the Apache Superfund Project.

5.0 FINDINGS AND CORRECTIVE ACTIONS

The QA Manager documents any findings and corrective action requirements that ensue from the review of laboratory reports and field documents. Corrective action/comments on variations such as missing data, and chain-of-custody record errors are recorded and the results of the review and corresponding corrective action requests are documented. Instances where 2020 laboratory data failed to meet data quality objectives and acceptance criteria established in the QAPP and EPA Level IV guidelines are summarized in Tables H-2 and H-4. A summary of 2020 laboratory and field quality control findings and corrective actions is provided in Table H-5.

6.0 CONCLUSION

All 2020 analytical results met data quality objectives and acceptance criteria with the following exceptions:

- Of the 459 NARS water quality data points, 40 data points were qualified as estimated, “E”. No samples were qualified as unusable, “HU” (Table H-2).
- Of the 161 PMP water quality data points, 31 data points were qualified as estimated, “E”. No samples were qualified as unusable, “HU”. (Table H-4).

7.0 REFERENCES CITED

Arizona Department of Environmental Quality (ADEQ 2012) Arizona Data Qualifiers Revision 4.0 September 5, 2012.

Hargis + Associates, Inc. (H+A, 2007a). Operation and Maintenance Plan Northern Area Remediation System, Revision 3.0, of the Apache Powder Superfund Site, Cochise County, Arizona. Prepared for Apache Nitrogen Products, Inc., Benson, Arizona. March 9, 2007.

_____, 2007b. Southern Area Performance Monitoring Plan, Revision 2.0, of the Apache Powder Superfund Site, Cochise County, Arizona. Prepared for Apache Nitrogen Products, Inc., Benson, Arizona. September 5, 2007.

_____, 2009a. Long-Term Site-Wide Performance Monitoring and Operations and Maintenance of Remedies, Revision 1.0, Apache Powder Superfund Site, Benson, Arizona. Prepared for Apache Nitrogen Products, Inc., Benson, Arizona. February 12, 2009.

_____, 2009b. Performance Monitoring Plan for Monitored Natural Attenuation of Shallow Aquifer Groundwater in the Northern Area, Revision 1.0, of the Apache Powder Superfund Site, Cochise County, Arizona. Prepared for Apache Nitrogen Products, Inc., Benson, Arizona. February 12, 2009.

_____, 2010. Quality Assurance Project Plan Performance Monitoring and Operation and Maintenance of Remedies, Revision 1.0, of the Apache Powder Superfund Site, Cochise County, Arizona. Prepared for Apache Nitrogen Products, Inc., Benson, Arizona. June 14, 2010.

U.S. Environmental Protection Agency (EPA 2017a), USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review. January 2017.

_____, 2017b. USEPA Contract Laboratory Program National Functional Guidelines for Organic Superfund Methods Data Review. January 2017.

_____, 2019. EPA Comments on 2018 Annual Performance Monitoring and Site-Wide Status Report, dated March 29, 2019 - Apache Powder Superfund Site. June 5, 2018 (sic).

APPENDIX H

TABLES

TABLE H-1

2020 NORTHERN AREA REMEDIATION SYSTEM
TOTAL NUMBER OF ANALYSES PERFORMED

LABORATORY		
No. of Analyses	Analyte	
7	Ca	Calcium
7	Cl	Chloride
4	ClO4	Perchlorate
6	CO3	Carbonate Alkalinity
25	COD	Chemical Oxygen Demand
7	F	Fluoride
6	HCO3	Bicarbonate Alkalinity
7	K	Potassium
7	Mg	Magnesium
8	N	Calculated Nitrogen
7	Na	Sodium
110	NH3-N	Ammonia - Nitrogen
136	NO3-N	Nitrate - Nitrogen
6	OH	Hydroxide, Alkalinity
7	OP	Orthophosphate
2	PALK	Phenolphthalein, Alkalinity
43	P	Phosphorus (Total)
7	SO4	Sulfate
6	TALK	Total Alkalinity
11	TDS	Total Dissolved Solids
8	TKN	Total Kjeldahl Nitrogen
25	TOC	Total Organic Carbon
7	TSS	Total Suspended Solids
459	Total Laboratory Analyses	

TABLE H-1

2020 NORTHERN AREA REMEDIATION SYSTEM
TOTAL NUMBER OF ANALYSES PERFORMED

FIELD		
No. of Analyses	Analyte	
168	DO	Dissolved Oxygen
96	EC	Electrical Conductivity
520	NO3-N	Nitrate – Nitrogen
96	pH	pH
361	TEMP	Temperature
1,241	Total Field Measurements	

TABLE H-2

2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
SEW-1-S	1/28/2020	550-136942-01	NO3-N	14797-55-8		51	mg/L	E	H2	SPT	EW	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
ANA	1/28/2020	20A0369-02	NO3-N	14797-55-8		14	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
ANA-D	1/28/2020	20A0369-03	NO3-N	14797-55-8		16	mg/L	E	H2	FD	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-N	1/28/2020	20A0369-04	NO3-N	14797-55-8		17	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-C	1/28/2020	20A0369-06	NO3-N	14797-55-8		20	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-S	1/28/2020	20A0369-07	NO3-N	14797-55-8	<	0.5	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-C	1/28/2020	20A0369-06	NO3-N	14797-55-8		20	mg/L	E	M2	ORG	TC	MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
FDA	1/28/2020	20A0369-01	NO3-N	14797-55-8		7.7	mg/L	E	--	ORG	TC	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
ANA	1/28/2020	20A0369-02	NO3-N	14797-55-8		14	mg/L	E	--	ORG	TC	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
ANA-D	1/28/2020	20A0369-03	NO3-N	14797-55-8		16	mg/L	E	--	FD	TC	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
PDA-N	1/28/2020	20A0369-04	NO3-N	14797-55-8		17	mg/L	E	--	ORG	TC	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
PDA-NB	1/28/2020	20A0369-05	NO3-N	14797-55-8	<	0.5	mg/L	E	--	ORG	--	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations

TABLE H-2

2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
PDA-C	1/28/2020	20A0369-06	NO3-N	14797-55-8		20	mg/L	E	--	ORG	TC	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
PDA-S	1/28/2020	20A0369-07	NO3-N	14797-55-8	<	0.5	mg/L	E	--	ORG	TC	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
SEW-1	1/28/2020	20A0369-08	NO3-N	14797-55-8		46	mg/L	E	--	ORG	EW	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
SEW-2	1/28/2020	20A0369-09	NO3-N	14797-55-8		160	mg/L	E	--	ORG	EW	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
EFF-L	1/28/2020	20A0369-10	NO3-N	14797-55-8		6.6	mg/L	E	--	ORG	EF	Batch MS/MSD %R below laboratory criteria, See Acronyms/Abbreviations
DCP-12	2/5/2020	20B0210-02	NO3-N	14797-55-8		13	mg/L	E	H2	ORG	DCP	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
DCP-12-D	2/5/2020	20B0210-03	NO3-N	14797-55-8		12	mg/L	E	H2	FD	DCP	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
ANA	2/11/2020	20B0343-02	NO3-N	14797-55-8		14	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-N	2/11/2020	20B0343-04	NO3-N	14797-55-8		16	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-C	2/11/2020	20B0343-05	NO3-N	14797-55-8		20	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
EFF-L	2/11/2020	20B0343-07	TDS	10-33-3		1100	mg/L	E	C4	ORG	EF	Confirmatory analysis was past holding time, See Acronyms/ Abbreviations
EFF-L-D	2/11/2020	20B0343-08	TDS	10-33-3		0	mg/L	E	C4	FD	EF	Confirmatory analysis was past holding time, See Acronyms/ Abbreviations

TABLE H-2

2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
ANA	2/11/2020	20B0343-02	NO3-N	14797-55-8		14	mg/L	None, sample conc. >5X conc. in CCB	B3	ORG	TC	NO3-N detected in the CCB at a conc. of 0.246 mg/L, See Acronyms/ Abbreviations
PDA-N	2/11/2020	20B0343-04	NO3-N	14797-55-8		16	mg/L	None, sample conc. >5X conc. in CCB	B3	ORG	TC	NO3-N detected in the CCB at a conc. of 0.246 mg/L, See Acronyms/ Abbreviations
PDA-C	2/11/2020	20B0343-05	NO3-N	14797-55-8		20	mg/L	None, sample conc. >5X conc. in CCB	B3	ORG	TC	NO3-N detected in the CCB at a conc. of 0.246 mg/L, See Acronyms/ Abbreviations
PDA-CB	3/17/2020	20C0465-05	NO3-N	14797-55-8	<	0.5	mg/L	E	H2	FB	TC	Confirmatory analysis was past holding time, See Acronyms/ Abbreviations
PDA-S	3/17/2020	20C0465-06	NO3-N	14797-55-8		14	mg/L	E	H2	ORG	TC	Confirmatory analysis was past holding time, See Acronyms/ Abbreviations
PDA-SD	3/17/2020	20C0465-07	NO3-N	14797-55-8		14	mg/L	E	H2	FD	TC	Confirmatory analysis was past holding time, See Acronyms/ Abbreviations
FDA-B	4/28/2020	20D0608-09	NO3-N	14797-55-8		0.58	mg/L	--	--	FB	--	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
SEW-1	4/28/2020	20D0608-01	NO3-N	14797-55-8		34	mg/L	None, sample conc. >5X conc. in FB	--	ORG	EW	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
SEW-2	4/28/2020	20D0608-02	NO3-N	14797-55-8		240	mg/L	None, sample conc. >5X conc. in FB	--	ORG	EW	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
SEW-1-D	4/28/2020	20D0608-03	NO3-N	14797-55-8		34	mg/L	None, sample conc. >5X conc. in FB	--	FD	EW	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
PDA-S	4/28/2020	20D0608-04	NO3-N	14797-55-8		23	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
PDA-C	4/28/2020	20D0608-05	NO3-N	14797-55-8		13	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations

TABLE H-2

2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
PDA-N	4/28/2020	20D0608-06	NO3-N	14797-55-8		5.8	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
ANA	4/28/2020	20D0608-07	NO3-N	14797-55-8		1.9	mg/L	E	--	ORG	TC	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
FDA	4/28/2020	20D0608-08	NO3-N	14797-55-8	<	0.5	mg/L	None, sample conc. <0.50	--	ORG	TC	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
EFF-L	4/28/2020	20D0608-10	NO3-N	14797-55-8	<	0.5	mg/L	None, sample conc. <0.50	--	ORG	EF	NO3-N detected in assoc. FB at conc. of 0.58 mg/L, See Acronyms/Abbreviations
DCP-12	5/20/2020	20E0436-02	NO3-N	14797-55-8		150	mg/L	E	H2	ORG	EW	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-S-B	5/26/1930	20E0524-07	Total-P	7723-14-0		0.24	mg/L	--	--	FB	--	Total-P detected in FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
FDA	5/26/1930	20E0524-01	Total-P	7723-14-0	<	0.1	mg/L	None, sample conc. <0.10	--	ORG	TC	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
ANA	5/26/1930	20E0524-02	Total-P	7723-14-0	<	0.1	mg/L	None, sample conc. <0.10	--	ORG	TC	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
PDA-N	5/26/1930	20E0524-03	Total-P	7723-14-0	<	0.1	mg/L	None, sample conc. <0.10	--	ORG	TC	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
PDA-C	5/26/1930	20E0524-04	Total-P	7723-14-0	<	0.1	mg/L	None, sample conc. <0.10	--	ORG	TC	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
PDA-C-D	5/26/1930	20E0524-05	Total-P	7723-14-0	<	0.1	mg/L	None, sample conc. <0.10	--	FD	TC	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
PDA-S	5/26/1930	20E0524-06	Total-P	7723-14-0		0.32	mg/L	E	--	ORG	TC	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations

TABLE H-2

2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
EFF-L	5/26/1930	20E0524-08	Total-P	7723-14-0	<	0.1	mg/L	None, sample conc. <0.10	--	ORG	EF	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
SEW-01	5/26/1930	20E0524-09	Total-P	7723-14-0	<	0.1	mg/L	None, sample conc. <0.10	--	ORG	EW	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
SEW-02	5/26/1930	20E0524-10	Total-P	7723-14-0	<	0.1	mg/L	None, sample conc. <0.10	--	ORG	EW	Total-P detected in assoc. FB at conc. of 0.24 mg/L, See Acronyms/Abbreviations
PDA-S-B	5/26/1930	20E0524-07	TOC	7440-44-0		0.56	mg/L	--	--	FB	--	TOC detected in FB at conc. of 0.56 mg/L, See Acronyms/Abbreviations
FDA	5/26/1930	20E0524-01	TOC	7440-44-0		9	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	TOC detected in assoc. FB at conc. of 0.56 mg/L, See Acronyms/Abbreviations
ANA	5/26/1930	20E0524-02	TOC	7440-44-0		8.3	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	TOC detected in assoc. FB at conc. of 0.56 mg/L, See Acronyms/Abbreviations
PDA-N	5/26/1930	20E0524-03	TOC	7440-44-0		6.1	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	TOC detected in assoc. FB at conc. of 0.56 mg/L, See Acronyms/Abbreviations
PDA-C	5/26/1930	20E0524-04	TOC	7440-44-0		4.9	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	TOC detected in assoc. FB at conc. of 0.56 mg/L, See Acronyms/Abbreviations
PDA-C-D	5/26/1930	20E0524-05	TOC	7440-44-0		4.3	mg/L	None, sample conc. >5X conc. in FB	--	FD	TC	TOC detected in assoc. FB at conc. of 0.56 mg/L, See Acronyms/Abbreviations
PDA-S	5/26/1930	20E0524-06	TOC	7440-44-0		32	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	TOC detected in assoc. FB at conc. of 0.56 mg/L, See Acronyms/Abbreviations
PDA-S-B	5/26/1930	20E0524-07	COD	NA		29	mg/L	--	--	FB	--	TOC detected in FB at conc. of 29 mg/L, See Acronyms/Abbreviations
FDA	5/26/1930	20E0524-01	COD	NA		29	mg/L	E	--	ORG	TC	COD detected in assoc. FB at conc. of 29 mg/L, See Acronyms/Abbreviations

TABLE H-2

2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
ANA	5/26/1930	20E0524-02	COD	NA		40	mg/L	E	--	ORG	TC	COD detected in assoc. FB at conc. of 29 mg/L, See Acronyms/Abbreviations
PDA-N	5/26/1930	20E0524-03	COD	NA		38	mg/L	E	--	ORG	TC	COD detected in assoc. FB at conc. of 29 mg/L, See Acronyms/Abbreviations
PDA-C	5/26/1930	20E0524-04	COD	NA	<	20	mg/L	None, sample conc. <20	--	ORG	TC	COD detected in assoc. FB at conc. of 29 mg/L, See Acronyms/Abbreviations
PDA-C-D	5/26/1930	20E0524-05	COD	NA		20	mg/L	E	--	FD	TC	COD detected in assoc. FB at conc. of 29 mg/L, See Acronyms/Abbreviations
PDA-S	5/26/1930	20E0524-06	COD	NA		39	mg/L	E	--	ORG	TC	COD detected in assoc. FB at conc. of 29 mg/L, See Acronyms/Abbreviations
SEW-1-S	5/26/1930	550-142655-1	NO3-N	14797-55-8		36	mg/L	None	M3	SPT	EW	Sample analyte concentration is disproportionate to spike concentration, See abbreviations/acronyms
PDA-C	6/16/2020	20F0845-04	NO3-N	14797-55-8		22	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-S	6/16/2020	20F0845-04	NO3-N	14797-55-8		50	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
PDA-S-S	7/20/2020	550-145570-01	NO3-N	14797-55-8		71	mg/L	E	--	SPT	TC	Sample cooler temp 18.3oC at time of receipt by lab. Received >8 hours after sampling, See Acronyms/Abbreviations
PDA-S-S	7/20/2020	550-145570-01	NH3-N	7664-41-7	<	0.5	mg/L	E	--	SPT	TC	Sample cooler temp 18.3oC at time of receipt by lab. Received >8 hours after sampling, See Acronyms/Abbreviations
PDA-S	7/20/2020	20G0539-04	NO3-N	14797-55-8		68	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations

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2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
PDA-C	7/20/2020	20G0539-05	NO3-N	14797-55-8		21	mg/L	E	H2	ORG	TC	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
SEW-01	8/18/2020	20H0517-01	Ortho P	--	<	0.5	mg/L	E	H2	ORG	EW	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
SEW-01-D	8/18/2020	20H0517-02	Ortho P	--	<	0.5	mg/L	E	H2	FD	EW	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
SEW-01	8/18/2020	20H0517-01	Ortho P	--	<	0.5	mg/L	None, sample ND	L5	ORG	EW	LCS/LCSD %R > acceptance criteria, See Acronyms/Abbreviations
SEW-01-D	8/18/2020	20H0517-02	Ortho P	--	<	0.5	mg/L	None, sample ND	L5	FD	EW	LCS/LCSD %R > acceptance criteria, See Acronyms/Abbreviations
SEW-02	8/18/2020	20H0517-03	Ortho P	--	<	5	mg/L	E	H2	ORG	SM/EW	Required analysis at dilution performed past HT, See Acronyms/Abbreviations
SEW-02	8/18/2020	20H0517-03	Ortho P	--	<	5	mg/L	None, sample ND	L5	ORG	SM/EW	LCS/LCSD %R > acceptance criteria, See Acronyms/Abbreviations
EFF-L	8/18/2020	20H0517-09	Ortho P	--	<	0.5	mg/L	None, sample ND	L5	ORG	EF	LCS/LCSD %R > acceptance criteria, See Acronyms/Abbreviations
EFF-L-B	8/18/2020	20H0517-09	Ortho P	--	<	0.5	mg/L	None, sample ND	L5	FB	EF	LCS/LCSD %R > acceptance criteria, See Acronyms/Abbreviations
EFF-L	8/18/2020	20H0517-09	Ca	7440-70-2		170	mg/L	None	M3	ORG	EF	Sample analyte conc is disproportionate to spike conc, See abbreviations/acronyms
EFF-L	8/18/2020	20H0517-09	Na	7440-23-5		180	mg/L	None	M3	ORG	EF	Sample analyte conc is disproportionate to spike conc, See abbreviations/acronyms
EFF-L	8/18/2020	20H0517-09	SO4	14808-79-8		370	mg/L	E	M2	ORG	EF	MS/MSD %R below criteria, See abbreviations/acronyms
SEW-02-S	8/18/2020	550-147470-1	NO3-N	14797-55-8		300	mg/L	None	M3	SPT	SM/EW	Sample analyte conc is disproportionate to spike conc, See abbreviations/acronyms

TABLE H-2

2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
SEW-02-S	8/18/2020	550-147470-1	Ca	7440-70-2		400	mg/L	None	M3	SPT	SM/EW	Sample analyte conc is disproportionate to spike conc, See abbreviations/acronyms
SEW-02-S	8/18/2020	550-147470-1	Na	7440-23-5		120	mg/L	None	M3	SPT	SM/EW	Sample analyte conc is disproportionate to spike conc, See abbreviations/acronyms
EFF-L-S	8/18/2020	550-147470-2	Ca	7440-70-2		180	mg/L	None	M3	SPT	SM/EW	Sample analyte conc is disproportionate to spike conc, See abbreviations/acronyms
EFF-L-S	8/18/2020	550-147470-2	Na	7440-23-5		170	mg/L	None	M3	SPT	SM/EW	Sample analyte conc is disproportionate to spike conc, See abbreviations/acronyms
PDA-CB	9/22/2020	20I0566-05	NO3-N	14797-55-8		0.53	mg/L	None	--	FB	--	NO3-N detected in FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations
FDA	9/22/2020	20I0566-01	NO3-N	14797-55-8	<	0.5	mg/L	None, NO3-N not detected	--	ORG	TC	NO3-N detected in associated FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations
ANA	9/22/2020	20I0566-02	NO3-N	14797-55-8	<	0.5	mg/L	None, NO3-N not detected	--	ORG	TC	NO3-N detected in associated FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations
PDA-N	9/22/2020	20I0566-03	NO3-N	14797-55-8		11	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	NO3-N detected in associated FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations
PDA-C	9/22/2020	20I0566-04	NO3-N	14797-55-8		27	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	NO3-N detected in associated FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations
PDA-S	9/22/2020	20I0566-06	NO3-N	14797-55-8		68	mg/L	None, sample conc. >5X conc. in FB	--	ORG	TC	NO3-N detected in associated FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations
SEW-1	9/22/2020	20I0566-07	NO3-N	14797-55-8		36	mg/L	None, sample conc. >5X conc. in FB	--	ORG	EW	NO3-N detected in associated FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations
SEW-2	9/22/2020	20I0566-08	NO3-N	14797-55-8		290	mg/L	None, sample conc. >5X conc. in FB	--	ORG	SM/EW	NO3-N detected in associated FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations

TABLE H-2

2020 NORTHERN AREA REMEDIATION MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Lab ID	Analyte	CAS Number	Value Flag	Lab Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Comments
EFF-L	9/22/2020	20I0566-09	NO3-N	14797-55-8	<	0.5	mg/L	None, NO3-N not detected	--	ORG	EF	NO3-N detected in associated FB at conc. of 0.53 mg/L, See Acronyms/Abbreviations
PDA-S-S	11/27/2020	550-153193-1	TOC	7440-44-0		73	mg/L	E	M2	SPT	TC	TOC MSD %R below criteria, See Acronyms/Abbreviations

TABLE H-2

2020 NORTHERN AREA REMEDIATION SYSTEM
DATA QUALIFIERS SUMMARY

Abbreviations/Acronyms:

<	=	Less Than
>	=	Greater Than
%R	=	% Recovery
ADHS	=	Arizona Department of Health Services
Ca	=	Calcium
CAS	=	Chemical Abstracts Service
COD	=	Chemical Oxygen Demand
Conc.	=	Concentration
DCP	=	Design confirmation piezometer
E	=	Estimated
EF	=	ARS Wetland primary discharge location
EW	=	Shallow Aquifer Extraction Well
FB	=	Field Blank
FD	=	Field Duplicate
HA	=	Hargis + Associates, Inc.
mg/L	=	Milligrams per Liter
MS/MSD	=	Matrix Spike/Matrix Spike Duplicate
Na	=	Sodium
ND	=	Non-detect
NH3-N	=	Ammonia-Nitrogen
NO3-N	=	Nitrate - Nitrogen
ORG	=	Original
Ortho P	=	Dissolved Ortho-Phosphorus
QA	=	Quality Assurance
QC	=	Quality Control
SM	=	ShallowMonitor Well
SO4	=	Sulfate
SPT	=	Split
TC	=	Treatment Cell
TOC	=	Total Organic Carbon
Total-P	=	Total Phosphorus

Notes:

B3	=	Target analyte detected in calibration blank at or above the method reporting limit.
C4	=	Confirmatory analysis was past holding time
H2	=	Hold Time: Initial analysis within holding time; Reanalysis for the required dilution was past holding time.
L5	=	The associated blank spike recovery was above laboratory/method acceptance limits. This analyte was not detected in the sample.
M2	=	Matrix spike recovery was low, the associated blank spike recovery was acceptable.
M3	=	Matrix Spike: Matrix spike recovery value was unusable; the analyte concentration in the sample is disproportionate to the spike level.

TABLE H-3

2020 PERFORMANCE MONITORING PLAN
TOTAL NUMBER OF ANALYSES PERFORMED

LABORATORY		
No. of Analyses	Analyte	
27	ClO4	Perchlorate
134	NO3-N	Nitrate – Nitrogen
161	Total Laboratory Analyses	

TABLE H-4

2020 PERFORMANCE MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Laboratory ID	Parameter	CAS Number	Value Flag	Laboratory Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Qualifier Comments
P-03	2/4/2020	20B0152-01	NO3-N	14797-55-8		6000	mg/L	E	H2	ORG	PP	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-2A-80	2/4/2020	20B0152-07	NO3-N	14797-55-8		49	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-2A-90	2/4/2020	20B0152-08	NO3-N	14797-55-8		48	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-2A-100	2/4/2020	20B0152-09	NO3-N	14797-55-8		50	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-2A-80-D	2/4/2020	20B0152-10	NO3-N	14797-55-8		50	mg/L	E	H2	FD	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-2A-90-D	2/4/2020	20B0152-11	NO3-N	14797-55-8		49	mg/L	E	H2	FD	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-2A-100-D	2/4/2020	20B0152-12	NO3-N	14797-55-8		46	mg/L	E	H2	FD	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-4-45	2/4/2020	20B0152-13	NO3-N	14797-55-8		42	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms

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2020 PERFORMANCE MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Laboratory ID	Parameter	CAS Number	Value Flag	Laboratory Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Qualifier Comments
PB-4-55	2/4/2020	20B0152-14	NO3-N	14797-55-8		44	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-4-65	2/4/2020	20B0152-15	NO3-N	14797-55-8		43	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-5A	2/4/2020	20B0152-16	NO3-N	14797-55-8		870	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-7-40	2/4/2020	20B0152-17	NO3-N	14797-55-8		17	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-7-50	2/4/2020	20B0152-18	NO3-N	14797-55-8		18	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-7-60	2/4/2020	20B0152-19	NO3-N	14797-55-8		38	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
P-01	2/5/2020	20B0212-01	NO3-N	14797-55-8		50	mg/L	E	H2	ORG	PP	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
P-01-D	2/5/2020	20B0212-02	NO3-N	14797-55-8		51	mg/L	E	H2	FD	PP	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms

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2020 PERFORMANCE MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Laboratory ID	Parameter	CAS Number	Value Flag	Laboratory Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Qualifier Comments
MW-13	2/5/2020	20B0212-05	NO3-N	14797-55-8		19	mg/L	E	H2	ORG	SM	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
MW-17	2/5/2020	20B0212-07	NO3-N	14797-55-8		12	mg/L	E	H2	ORG	SM	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
MW-18	2/5/2020	20B0212-08	NO3-N	14797-55-8		25	mg/L	E	H2	ORG	SM	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-5A	5/19/2020	20E0412-13	NO3-N	14797-55-8		950	mg/L	E	H2	ORG	BH	Required dilution of sample analyzed after holding time expiration, See
PB-7-60	5/19/2020	20E0412-16	NO3-N	14797-55-8		110	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
P-03	5/19/2020	20E0412-01	ClO4	14797-73-0		0.476	mg/L	None	M3	ORG	PP	Sample analyte concentration is disproportionate to spike concentration; See Acronyms / Abbreviations
P-01	5/20/2020	20E0435-01	NO3-N	14797-55-8		22	mg/L	E	H2	ORG	PP	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
P-01-D	5/20/2020	20E0435-01	NO3-N	14797-55-8		23	mg/L	E	H2	FD	PP	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms

TABLE H-4

2020 PERFORMANCE MONITORING PLAN
DATA QUALIFIERS SUMMARY

Location ID	Date Collected	Laboratory ID	Parameter	CAS Number	Value Flag	Laboratory Result	Units	HA Qualifier	ADHS Code	QA Code	Group	Qualifier Comments
PB-4-55	8/12/2020	20H0411-07	NO3-N	14797-55-8		49	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-4-65	8/12/2020	20H0411-08	NO3-N	14797-55-8		130	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-5A	8/12/2020	20H0411-09	NO3-N	14797-55-8		660	mg/L	E	H2	ORG	BH	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
MW-21	8/13/2020	20H0428-10	NO3-N	14797-55-8		4500	mg/L	E	H2	ORG	SM	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-4-65	11/10/2020	20K0302-01	NO3-N	14797-55-8		150	mg/L	E	H2	ORG	NAX	Required dilution of sample analyzed after holding time expiration, See Abbreviations/Acronyms
PB-5A	11/10/2020	20K0302-01	NO3-N	14797-55-8		1600	mg/L	E	M2	ORG	NAX	MS/MSD %R below criteria, See abbreviations/acronyms. Note only this sample qualified, other MS/MSD results using project samples in this report were acceptable.
PB-7-60	11/10/2020	20K0302-01	NO3-N	14797-55-8		64	mg/L	E	--	ORG	NAX	Split sample RPD >30%
PB-7-60-S	11/10/2020	550-152788-2	NO3-N	14797-55-8		110	mg/L	E	--	SPT	NAX	Split sample RPD >30%

TABLE H-4

2020 PERFORMANCE MONITORING PLAN
DATA QUALIFIERS SUMMARY

ABBREVIATIONS/ACRONYMS:

>	=	Greater Than
% R	=	Percent Recovery
ADHS	=	Arizona Department of Health Services
BH	=	Bore Hole
CAS	=	Chemical Abstracts Service
ClO4	=	Perchlorate
Conc.	=	Concentration
E	=	Estimated
FD	=	Field Duplicate
H2	=	Hold Time: Initial analysis within holding time; Reanalysis for the required dilution was past holding time.
HA	=	Hargis + Associates, Inc.
M2	=	Matrix spike recovery was low; the associated LCS/LCSD was acceptable.
M3	=	Matrix Spike: The spike recovery value is unusable, the analyte concentration in the sample is disproportionate to the spike level; the associated blank spike recovery was acceptable.
mg/L	=	Milligrams per Liter
MS/MSD	=	Matrix Spike/Matrix Spike Dupliate
NAX	=	Northern Area extraction wells
NO3-N	=	Nitrate-Nitrogen
ORG	=	Original
PP	=	Perched Zone Piezometer
QA	=	Quality Assurance
SM	=	Shallow Monitor Well
SP	=	Shallow Private Well
SPT	=	Split

TABLE H-5

2020 QUALITY CONTROL FINDINGS AND CORRECTIVE ACTIONS SUMMARY

DATE	SITE PROGRAM	ISSUE TYPE	FINDINGS	CORRECTIVE ACTIONS
1/28/2020	NARS	Field	550-136942-01 Sample ID incorrect on COC	Lab contacted to correct ID to SEW-1-S
1/28/2020	NARS	Laboratory	20A0369-02 (ANA) and 20A0369-10 (EFF-L) NO3-N results not within historical trend and greater than the concentrations of the influent samples	Lab contacted to verify results for all samples. While others are close to limits of historical trend or just outside, they are not in line with recent samples. Results confirmed for ANA. Lab determined NO3-N result for EFF-L incorrectly had a 10X dilution factor added to the result.
1/28/2020	NARS	Field	20A0369 sample temperature >6.0 °C at receipt.	20A0369 sample temperature 13.7 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.
2/5/2020	NARS	Field	20B0210 sample temperature >6.0 °C at receipt.	20B0210 sample temperature 9.5 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.
2/5/2020	PMP	Field	20B0212 sample temperature >6.0 °C at receipt.	20B0212 sample temperature 9.7 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.
2/11/2020	NARS	Laboratory	20B0243-08 (EFF-L-D) is a FD with TDS conc. ND. 20B0243-07 (EFF-L), the original sample, has a TDS conc. of 1100 mg/L which is in line with historical trend.	Laboratory contacted. Samples reanalyzed and FD result is acceptable. Reanalysis past hold time expiration reported.
3/17/2020	NARS	Field	20C0465 sample temperature >6.0 °C at receipt.	20C0465 sample temperature 6.9 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.
4/28/2020	NARS	Laboratory	550-141430-1 sample ID PDA-C-5, COC lists ID as PD-C-S.	Lab notified of error and revised report received.
4/28/2020	NARS	Field	20D0608 sample temperature >6.0 °C at receipt.	20D0608 cooler temperature 10.1 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.
5/19/2020	PMP	Laboratory	550-142392-01 (P-03-S) NO3-N concentration below historical range.	Laboratory was contacted to confirm result. Upon review found dilution factor incorrect. Revise report issued, split results acceptable.
5/20/2020	NARS	Field	20E0436 - Sample date listed on COC incorrectly listed as 2/5/20	Lab used correct sample date which was listed on sample containers.
5/20/2020	NARS	Laboratory	20E0436 – Ammonia reported below the RL	Lab contacted; report revised to report result to RL.
5/26/2020	NARS	Laboratory	20E0524 – TSS reported below the RL	Lab contacted; report revised to report result to RL.
6/16/2020	NARS	Field	20F0485 sample temperature >6.0 °C at receipt	20F0485 cooler temperature 7.8 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.
7/20/2020	NARS	Laboratory	550-145570-1 sample ID PDA-5-5, COC lists ID as PD-S-S.	Lab notified of error and sample ID corrected.
7/20/2020	NARS	Field	550-145570 sample cooler temperature >6.0 °C at receipt.	550-145579 cooler temperature 18.3 °C at receipt. Field personnel notified of excursion and instructed to add more ice. Data qualified.
7/20/2020	NARS	Field	20G0539 sample cooler temperature >6.0 °C at receipt.	20G0539 cooler temperature 11.6 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.

TABLE H-5

2020 QUALITY CONTROL FINDINGS AND CORRECTIVE ACTIONS SUMMARY

DATE	SITE PROGRAM	ISSUE TYPE	FINDINGS	CORRECTIVE ACTIONS
8/11/2020	NARS	Laboratory	20H0366-01 NH3-N result reported to MDL.	Lab contacted and report revised to evaluate result to RL.
8/12/2020	PMP	Laboratory	20H0411 Several sample IDs listed incorrectly by the laboratory.	Laboratory was contacted to correct sample IDs.
8/12/2020	PMP	Field	550-147136 Chain of custody lists sample date as 8/11/20, containers list 8/12/20	H+A contacted by laboratory, sample date of 8/12/ confirmed.
8/18/2020	NARS	Field	20H0517-10 (EFF-L-B) Alkalinity analysis not possible due to sample pH.	Sample pH measured at ≈4.5 which is too low to perform alkalinity analysis. Laboratory confirmed correct sample container and did not indicate the presence of preservative. Field personnel did not note anything unusual when collected FB. Sample Alkalinity results within historical ranges, no impact to data.
9/22/2020	NARS	Field	20I0566 sample cooler temperature >6.0 °C at receipt.	20I0566 cooler temperature 14.3 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.
9/22/2020	NARS	Field	550-149619-1 Sample ID listed as ANA on COC.	550-149619 revised COC sent to lab listing ID as ANA-S
10/20/2020	NARS	Field	550-151440 NH3-N sample container preserved with HNO3.	Lab split off portion of unpreserved NO3-N bottle and preserved with H2SO4.
10/20/2020	NARS	Field	20J0490 - sample cooler temperature >6.0 °C at receipt.	20J0490 cooler temperature 11.9 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.
11/10/2020	PMP	Field	550-152788-1 COC - sample MW-36-S missing sample time.	Laboratory used the sample time listed on the containers. Field personnel reminded to include all required information on COC.
11/10/2020	PMP	Field	550-152788-2 COC - sample PB-5A-S sample ID listed incorrectly.	Revised COC listing correct sample ID submitted to the laboratory.
11/10/2020	PMP	Laboratory	550-152788-1 / -2 Sample PB-5A-S was listed on a separate COC and required Level IV DVP. Lab logged in with other samples submitted in shipment and did not log in for Level IV.	Laboratory contacted. Sample PF-5A-S deleted from ffo-152788-1 and logged in as separated sample delivery group 550-152788-2. Level IV DVP added.
12/15/2020	NARS	Laboratory	550-154841 – sample ID logged in as PDA-C5, COC lists PDA-CS.	Laboratory notified of error and it was corrected.
12/15/2020	NARS	Field	20L0453 - sample cooler temperature >6.0 °C at receipt.	20L0453 cooler temperature 6.9 °C at receipt. Samples delivered via short transit time to lab, not allowing enough time to cool samples. No action required.

Note: All qualified laboratory data are listed in Tables H-2 and H-4

TABLE H-5

2020 QUALITY CONTROL FINDINGS AND CORRECTIVE ACTIONS SUMMARY

ABBREVIATIONS/ACRONYMS:

≈	=	Approximately
°C	=	Degrees Celsius
COC	=	Chain-of-Custody
COD	=	Chemical Oxygen Demand
Conc.	=	Concentration
DVP	=	Data Validation Package
FD	=	Field Duplicate
HNO3	=	Nitric Acid
H2SO4	=	Sulfuric Acid
MDL	=	Method Detection Limit
mg/L	=	Milligrams per Liter
MS/MSD	=	Matrix Spike/Matrix Spike Duplicate
NARS	=	Northern Area Remediation System
ND	=	Non-detect
NH3-N	=	Ammonia Nitrogen
NO3-N	=	Nitrate as Nitrogen
NR	=	Not Reported
PMP	=	Performance Monitoring Plan
RL	=	Reporting Limit
TDS	=	Total Dissolved Solids
TSS	=	Total Suspended Solids

ATTACHMENT H-1

2020 VIRTUAL ON-SITE LABORATORY AUDIT FOR THE APACHE NITROGEN SUPERFUND PROJECT

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Phone: (760) 827-1100

Hargis + Associates, Inc.
Stapley Center
1640 South Stapley Drive, Suite 209
Mesa, AZ 85204
Attn: Ms. Mary Tyer

February 2, 2021

Subject: 2020 Virtual On-site Laboratory Assessments in Support of the Apache Powder Superfund Project

Dear Ms. Tyer,

Per your request, Laboratory Data Consultants, Inc. (LDC) has performed laboratory assessments of the laboratories listed below. The assessments focused on QA systems and data generated for the Apache Powder Superfund project.

The laboratories assessed were:

Turner Laboratories, Inc.
445 N. Coyote Drive, Suite 104
Tucson, AZ 85745

Eurofins TestAmerica
4625 E. Cotton Center Blvd, Suite 189
Phoenix, AZ 85040

Virtual on-site assessments were conducted on December 9 (Turner Laboratories) and December 16, 2020 (Eurofins TestAmerica) in lieu of physical on-site assessments due to Covid-19 restrictions.

This report includes the following sections:

Turner Laboratories, Inc.
- 1-A) LDC Laboratory Assessment Report
- 1-B) Laboratory Corrective Action Response
- 1-C) Summary of Laboratory Assessment

Eurofins TestAmerica – Phoenix
- 2-A) LDC Laboratory Assessment Report
- 2-B) Laboratory Corrective Action Response
- 2-C) LDC Summary of Laboratory Assessment

As discussed in Sections 1-C and 2-C, Turner Laboratories and Eurofins TestAmerica-Phoenix performed acceptable corrective action to the findings identified in the respective assessment reports and each laboratory is capable of performing analytical testing for the Apache Powder Superfund project. Final closure is contingent upon full execution of each respective corrective action plan.

Please contact me at (760) 827-1100 if you have any questions.

Sincerely,

Scott Denzer
Principal Chemist

Technical Report for:

2020 Laboratory Assessments for the Apache Powder Superfund Project

Prepared for:

Hargis + Associates, Inc
Stapley Center
1640 South Stapley Drive, Suite 209
Mesa, AZ 85204

Prepared by:

Laboratory Data Consultants, Inc.
2701 Loker Ave. West, Suite 220
Carlsbad, CA 92010

February 2, 2021

Table of Contents

Section No.

Section 1-A

Turner Laboratories, Inc.

LDC Laboratory Assessment Report

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760/827-1100 Fax: 760/827-1099

December 11, 2020

Turner Laboratories, Inc.
2445 N. Coyote Drive
Tuscon, AZ 85745
Attn: Ms. Elizabeth Kasik

Subject: 2020 Apache Powder Laboratory Audit Report of Turner Laboratories, Inc. in Tuscon, AZ

Dear Ms. Kasik,

The attached report provides results of the laboratory audit of Turner Laboratories, Inc. located in Tuscon, Arizona. Laboratory Data Consultants, Inc. (LDC) conducted the audit on behalf of Hargis + Associates, Inc.. The report includes information pertaining to the review of laboratory preliminary documentation, proficiency testing (PT) information and an on-site audit performed on December 9, 2020.

Turner Laboratories has until January 12, 2021 (30 calendar days excluding holidays) to submit a corrective action plan (CAP) addressing the deficiencies identified in this report. For each finding, your response should include a discussion of the scope and approach for planned corrective actions along with scheduled completion dates for each item not completed at the time the CAP is submitted. The plan of action must provide sufficient detail to determine if the approach is technically reasonable.

Your CAP should be directed to my attention at the letterhead address. I would like to express my appreciation to you and other members of the staff who were helpful and candid during the on-site visit. Should you have any questions or wish to discuss audit deficiencies or proposed corrective action, please contact me at (760) 827-1100.

Sincerely,

Scott Denzer
Principal Chemist

Report for:

Apache Powder Superfund Project
2020 Laboratory Audit

Prepared for:

Hargis + Associates, Inc.
7400 N. Oracle Road, Suite 202
Tucson, AZ 85705
Attn: Ms. Mary Tyer

Laboratory:

Turner Laboratories, Inc.
2445 North Canyon Drive
Tucson, AZ 85745

Prepared by:

Laboratory Data Consultants, Inc.
2701 Loker Ave. West, Suite 220
Carlsbad, CA 92010

December 11, 2020

1.0 Introduction

As requested by Hargis + Associates, Inc. (Hargis), Laboratory Data Consultants, Inc. (LDC) conducted an audit of Turner Laboratories, Inc. (Turner Laboratories) located in Tuscon, AZ. The audit process includes four primary phases: 1) Review of laboratory preliminary documentation; 2) Proficiency Testing (PT) review; 3) On-site audit; and 4) Corrective action. The on-site audit was conducted as a virtual audit due to Covid-19 restrictions.

2.0 General Information

The audit was initiated by Hargis and executed by Mr. Scott Denzer of LDC as part of the overall Quality Assurance program for the Apache Powder Superfund project. The audit was structured as a general evaluation of the laboratory's quality systems and capacity to support the project.

Turner Laboratories has been providing residential, commercial and government clients with routine environmental analytical services since it was founded in 1984. The laboratory has the capacity, capabilities and support systems to deliver analytical data for small and mid-size projects.

Turner Laboratories maintains licensing through Arizona Department of Health Services. The laboratory occupies approximately 8,400 square feet. The laboratory currently operates with approximately 14 full-time personnel. Normal business hours are 8:00am to 5:00pm Monday through Friday however extended hours occur on an add-needed basis for sample receiving and operations.

3.0 Laboratory Preliminary Documentation Review

A review of laboratory supplied documentation was conducted prior to and as part of the on-site audit. Documentation included the laboratory's Quality Assurance Plan (QAP), selected standard operating procedures (SOPs), method detection limits (MDL) studies, and proficiency test (PT) sample results. An Organizational Chart, a master list of SOPs and a master list of major analytical instrumentation were included in the QAM and reviewed during the document review process.

4.0 Licensing and Proficiency Test (PT) Review

Turner Laboratories has been licensed by the State of Arizona Department of Health Services (AZ DHS) environmental laboratory licensing program. The laboratory is currently licensed by AZ DHS through March 24, 2021 (License #AZ0066). In addition, Turner Laboratories participates in externally administered proficiency testing programs.

All results of the most recent PT samples were within acceptance limits.

5.0 On-Site Audit

The following information is presented in association with the virtual on-site audit performed by LDC of Turner Laboratories on December 9, 2020.

5.1 On-Site Audit

The audit was initiated by Hargis and executed by Mr. Scott Denzer of LDC. The on-site audit was structured as a general evaluation of the laboratory's quality systems and capacity to support the Apache Powder Superfund project and was conducted as a virtual audit due to Covid-19 restrictions.

The objective of the audit of Turner Laboratories was to determine whether the laboratory's quality assurance (QA) program and Quality Control (QC) practices meet the method requirements and are consistent with the QAP, applicable SOPs, State licensing requirements, and good laboratory practices.

The following analytical methods (along with appropriate sample preparation procedures) were evaluated during the audit process:

Matrix	Analytical Method	Analyte
Water	EPA 300.0	Nitrate
	SM 4500-NH3 B,C	Nitrogen, Ammonia as N

5.2 Evaluation Criteria

The virtual on-site audit was performed in accordance with the protocols presented in the analytical methods and in accordance with applicable AZ DHS quality control requirements. The EPA's Test Methods for Evaluating Solid Waste SW846, Turner Laboratories' QAP and laboratory SOPs were also used as performance standards.

5.3 Description

The assessor began the virtual audit by holding an orientation meeting with the Laboratory Director and the Project Manager of the company during which the elements of the laboratory audit program were described.

Following a description of the scope and schedule for the audit, the assessor adjourned the opening meeting and initiated their review of laboratory operations. The virtual on-site audit of Turner Laboratories focused on items related to quality systems and aspects of routine laboratory operations, including:

- Organization and Personnel
- Safety and Facilities
- Sample Management
- Quality Control (QC) Practices
- Record Keeping and Traceability
- Ethics and Technical Training
- Laboratory Licensing
- Sample and Standard Preparation
- Report Generation
- Specific Analytical Methods
- Data Management and Storage
- Laboratory Information Management System
- Waste Management

The adequacy of the laboratory's QA program was assessed. The facility, instrumentation, documentation, and support practices were reviewed. The assessor interviewed the Technical Director, the Project Manager, supervisors, analysts, technicians, and support personnel.

At the conclusion of the virtual audit, the assessor conducted an audit debrief with the Laboratory Director and the Project Manager. During the briefing the assessor presented a verbal review of the overall deficiencies and observations identified during the course of the audit. The deficiencies and observations are presented in Sections 6.0 and 7.0 of this report.

Laboratory personnel asked questions as needed throughout the audit.

6.0 Deficiencies

During the course of the audit the assessor noted policies, practices, documents, or records that did not comply with evaluation criteria identified in Section 5.2. In addition, the assessor paid special attention to items previously identified as deficiencies to ensure laboratory corrective actions had remained in place.

Table 1 presents a cumulative summary of deficiencies. It is requested that the laboratory provide their response in the "Laboratory Corrective Action Plan (CAP)" column of Table 1 as a means of facilitating the corrective action process. A copy of Table 1 has been provided as a Microsoft Word file in order to facilitate the process.

7.0 Observations

This section presents general observations, which reflect on the capabilities and capacity of the laboratory. Response from the laboratory is not required.

The laboratory's facility provides ample space for production analytical work and support activities, with appropriate segregation of functional areas.

Based on interviews and a review of available training documents, the laboratory's staff is qualified to perform the analyses requested by Hargis.

A laboratory information management system (LIMS) is used in all sections of the laboratory. The LIMS is within the laboratory and has a user authentication system that limits access for each user to privileges specific to their role in the laboratory. The laboratory has contracted staff to maintain the LIMS and ensure routine backup and offsite storage of files.

8.0 Conclusions

Turner Laboratories has the staff, facilities, and equipment necessary to provide Hargis with environmental analytical services on the Apache Powder Superfund project. In general, the laboratory quality control samples, sample identification and batch records are adequate to meet project requirements, and staff members are qualified for their positions. The laboratory will need to adequately address the findings of this report for complete approval.

Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 9, 2020
Turner Laboratories, Inc.

Ref #	Department	Finding	Response	Documentation	Status	Follow-up Date
1	QA (QAP)	The Table of Contents in the Laboratory's Quality Assurance Plan (QAP), Revision #30 includes references to Appendix A and Appendix B however documents associated with these appendices were not identified as such.				
2	QA (QAP)	The Table of Contents in the QAP references Appendix F however the contents of this appendix (List of Turner Laboratories' Policies) do not appear in the QAP.				
3	QA (QAP)	The last paragraph of Section 5.3 in the QAP discusses sample disposal practices and includes a reference to Section 4.4, however Section 4.4 discusses document retention and disposal rather than sample disposal.				
4	Health and Safety	The Health and Safety Manual did not include a signature page indicating the revision number and date prepared. The document should include approval signatures along with date(s) of signing and treated as a controlled document.				
5	QA (Internal Audits)	Internal system audits are conducted following receipt of proficiency test (PT) results as indicated in Section 2 of Turner Laboratories Policy No. 6. However the internal audits are currently limited to an evaluation of PT results and a root cause analysis of outliers. All items in Policy #6 should be reviewed during the internal audit including work area inspection items in Section 2.B of the policy.				
6	QA (Training)	Ethics training and manual integration training are performed and documented as part of the new employee training. Ethics training should be performed on an annual basis and attendance records maintained. It is recommended the annual training include a reminder of the laboratory's manual integration policies.				
7	QA (MDL Study)	In the nitrate spike data associated with the EPA Method 300.0 MDL study, a 32% recovery was reported for QC Batch 2006210 prepared and analyzed on 6/16/2020 however the spike amount was 0.5mg/l and the result was 0.63mgl.				
8	QA (MDL Study)	In the nitrate spike data associated with the EPA Method 300.0 MDL study, results were reported with significant figures varying between one and three.				

Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 9, 2020
Turner Laboratories, Inc.

Ref #	Department	Finding	Response	Documentation	Status	Follow-up Date
9	QA (MDL Study)	Since the MDL study for nitrate by EPA 300.0 is determined using data from multiple instruments, the auditor recommends associating the Instrument ID with blank and spike results on the MDL Study summary form. This information helps ensure a sufficient amount of data is incorporated into the study from each instrument.				
10	QA (MDL Study)	The MDL study for ammonia by SM 45000-NH_3 B,C utilized data from blanks analyzed between January 2017 and September 2020 however it only utilized spike data analyzed between January 2018 and July 2018. The MDL study must be verified once every 13 months using data from the last 24 months.				
11	Sample Receiving	There are two sample receiving rooms (North and South) and two sample refrigerators (North and South) located in the North receiving room. There was confusion about the identities of the rooms and refrigerators during the audit, therefore the auditor recommends they be re-identified.				
12	Sample Receiving	Section 4.1.5 of SOP SC-1, Revision #8 (Sample Receiving) indicates "The temperature of a representative sample or the temperature blank is taken …" but does not clarify what constitutes a representative sample and where in the cooler the sample should be taken from.				
13	Wet Chem (Nitrate by EPA 300.0)	Section 7.2.1 of SOP INORG-03, Revision #21 (analysis of nitrate by EPA Method 300.0) discusses initial setup of the Dionex IC System however the instrument setup conditions (e.g. loop size, flow rate, operating pressure range, etc) were not specified.				
14	Wet Chem (Nitrate by EPA 300.0)	Section 7.2.2.11 of SOP INORG-03 discusses the evaluation of QC samples however since Sections 8.4 and 8.5 of the SOP contain a much more detailed discussion of the evaluation and corrective action, the auditor recommends simply referencing these sections.				
15	Wet Chem (Nitrate by EPA 300.0)	Sections 8.3.5 and 8.3.6 of SOP INORG-03 do not indicate the need to filter the Method Blank and LCS/LCSD as is required for samples in Sections 7.1.1.1 and 7.2.3.1. The Method Blank and LCS/LCSD should be handled in the same manner as samples.				

Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 9, 2020
Turner Laboratories, Inc.

Ref #	Department	Finding	Response	Documentation	Status	Follow-up Date
16	Wet Chem (Nitrate by EPA 300.0)	The auditor recommends including a reference to the manual integration SOP (SOP ADM-3) within Section 8.6 of the SOP INORG-03.				
17	Wet Chem (Nitrate by EPA 300.0)	Section 9.3 of SOP INORG-03 indicates an MDL Study is performed every six months as is stated in Section 9.2.4 of EPA Method 300.0, however the laboratory is currently verifying MDLs on an annual basis which is consistent with the EPA Method Update Rule. The auditor recommends the QA Officer discuss the frequency requirement with a State accreditation officer either before or during the next on-site audit.	Observation. No response required.	N/A	N/A	N/A
18	QA	It was indicated that all thermometers had recently been verified however the old labels, including previous correction factors, had not been replaced.				

Section 1-B

Turner Laboratories, Inc.

Laboratory Corrective Action Response

From:	Elizabeth Kasik
To:	Scott Denzer
Cc:	Kevin Brim; MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Mike McGovern
Subject:	RE: Lab Audit for Hargis - Apache Powder Superfund Site Project
Date:	Friday, January 15, 2021 10:24:34 AM
Attachments:	Ethics Training Form.pdf

Hi Scott,

Please find the completed training form attached.

Thank you,
Elizabeth

Elizabeth C Kasik
Laboratory Director

Turner Laboratories Inc
2445 North Coyote Drive
Suite 104
Tucson, AZ 85745
Office: 520-882-5880
Cell: 602-524-7249
ekasik@turnerlabs.com

TURNER LABORATORIES INC.

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Friday, January 15, 2021 6:17 AM
To: Elizabeth Kasik <ekasik@turnerlabs.com>
Cc: Kevin Brim <kbrim@turnerlabs.com>; MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com; Mike McGovern <mmcgovern@turnerlabs.com>
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Good morning Elizabeth,

Thanks for the detailed corrective action plan and supportive documentation. I've completed a review and have one follow-up question. There were two people who had not signed the Annual Ethics Training Form on January 8, 2021: Marissa Huff and Ruben Rivera. Did they receive training on another day? If so, could you please supply the signed acknowledgment form.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
DATA VALIDATION, ADR, CUSTOM SOFTWARE AND DATABASE MANAGEMENT

Email: sdenzer@lab-data.com
Web: http://www.lab-data.com

Laboratory Data Consultants, Inc.
2701 Loker Ave. West, Suite 220
Carlsbad, CA 92010
760.827.1130 (Direct), 760.827.1100 (Main)

From: Elizabeth Kasik [mailto:ekasik@turnerlabs.com]
Sent: Friday, January 8, 2021 12:42 PM
To: Scott Denzer
Cc: Kevin Brim; MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Mike McGovern
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Good Afternoon All,

Please find attached Turner's response to the Apache Superfund Audit. Please note that all corrective actions and documentation have been completed with the exception of the finding regarding internal auditing. This will be completed upon the receipt of the next round of PT results. Please let me know if you have any questions or need any additional information regarding the response.

Thank you,
Elizabeth

Elizabeth C Kasik
Laboratory Director

Turner Laboratories Inc
2445 North Coyote Drive
Suite 104

Tucson, AZ 85745
Office: 520-882-5880
Cell: 602-524-7249
ekasik@turnerlabs.com

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Friday, December 11, 2020 12:20 PM
To: Elizabeth Kasik <ekasik@turnerlabs.com>
Cc: Kevin Brim <kbrim@turnerlabs.com>; MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Elizabeth,

Attached is the laboratory assessment report resulting from LDC's on-site assessment two days ago for the Hargis + Associates' Apache Powder Superfund project. Also attached is a MS Word template of the findings to assist with providing corrective action responses.

Once corrective action responses are received, LDC will review the responses and provide a final report and recommendation to Hargis.

Feel free to contact me if you have any questions. I appreciate your help in adapting to the needs of a virtual audit and apologize for keeping you on your feet throughout the day. You certainly made the audit flow smoothly.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
DATA VALIDATION, ADR, CUSTOM SOFTWARE AND DATABASE MANAGEMENT

Email: sdenzer@lab-data.com
Web: http://www.lab-data.com

Laboratory Data Consultants, Inc.
2701 Loker Ave. West, Suite 220
Carlsbad, CA 92010
760.827.1130 (Direct), 760.827.1100 (Main)

From: Scott Denzer
Sent: Tuesday, November 24, 2020 7:14 AM
To: Elizabeth Kasik
Cc: Kevin Brim; MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Good morning Elizabeth,

Tomorrow morning works well. I'll try reaching you between 9-9:30am your time.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
DATA VALIDATION, ADR, CUSTOM SOFTWARE AND DATABASE MANAGEMENT

Email: sdenzer@lab-data.com
Web: http://www.lab-data.com

Laboratory Data Consultants, Inc.
2701 Loker Ave. West, Suite 220
Carlsbad, CA 92010
760.827.1130 (Direct), 760.827.1100 (Main)

From: Elizabeth Kasik [mailto:ekasik@turnerlabs.com]
Sent: Tuesday, November 24, 2020 7:07 AM
To: Scott Denzer
Cc: Kevin Brim; MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Good Morning Scott,

My schedule is pretty open tomorrow and most of next week. Please let me know what works best for you.

Thank you,
Elizabeth

Elizabeth C Kasik
Laboratory Director

Turner Laboratories Inc
2445 North Coyote Drive
Suite 104
Tucson, AZ 85745
Office: 520-882-5880
Cell: 602-524-7249
ekasik@turnerlabs.com

TURNER LABORATORIES INC.

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Tuesday, November 24, 2020 6:48 AM
To: Elizabeth Kasik <ekasik@turnerlabs.com>
Cc: Kevin Brim <kbrim@turnerlabs.com>; MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Elizabeth,

Thanks for the quick follow up. Let me know when it's best to reach you and we'll discuss how we'll handle the virtual on-site aspect of the audit.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
DATA VALIDATION, ADR, CUSTOM SOFTWARE AND DATABASE MANAGEMENT

Email: sdenzer@lab-data.com
Web: http://www.lab-data.com

Laboratory Data Consultants, Inc.
2701 Loker Ave. West, Suite 220
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be confidential and/or privileged. If the reader of this message is not the intended recipient or the employee or agent responsible to deliver it to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have inadvertently received this communication, please notify the sender immediately.

From: Elizabeth Kasik [mailto:ekasik@turnerlabs.com]
Sent: Monday, November 23, 2020 12:44 PM
To: Scott Denzer; Kevin Brim
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Scott,

Please find the requested documentation attached. Please let me know if there is anything else that you need.

Thank you and have a great day,
Elizabeth

Elizabeth C Kasik
Laboratory Director

Turner Laboratories Inc
2445 North Coyote Drive
Suite 104
Tucson, AZ 85745
Office: 520-882-5880
Cell: 602-524-7249
ekasik@turnerlabs.com

TURNER
LABORATORIES INC.

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Friday, November 6, 2020 6:13 AM
To: Elizabeth Kasik <ekasik@turnerlabs.com>; Kevin Brim <kbrim@turnerlabs.com>
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Elizabeth and Kevin,

th

In preparation for the Dec 9 virtual audit, please forward the following documents to me by close of business Wednesday , Nov 25. If the files are too large to email, let me know and I'll send you a link to use or you can post them to LDC Advantage.

1) Laboratory Quality Assurance Manual
2) SOPs for EPA Method 300 and SM4500-NH_3 B,C
3) SOP for Sample Receiving/Login
4) The past two sets of Proficiency Test results for the Nitrate-N by Method 300 and NH_3-N by SM4500-NH_3 B,C
5) Organization Chart (if not included in the QA Manual)
6) Current accreditation certificate (if not included in the QA Manual)

As in the past I'd like to interview staff who routinely handle the project samples although I'll also briefly interview group/section supervisors.

Attached is a draft agenda. We can adjust as necessary during the onset of the audit. As mentioned, I'll be in touch to discuss logistics of the virtual software/platform.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
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Carlsbad, CA 92010
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From: Scott Denzer
Sent: Wednesday, November 4, 2020 7:50 AM
To: Elizabeth Kasik; Kevin Brim
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Elizabeth,

th

That's great. Let's plan on Wednesday, December 9 .   I'm sure you've been through other virtual audits this year but as mentioned I'll be in touch over the coming few days to discuss logistics and to request documentation.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
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From: Elizabeth Kasik [mailto:ekasik@turnerlabs.com]
Sent: Wednesday, November 4, 2020 7:44 AM
To: Scott Denzer; Kevin Brim
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Scott,

Hope that you are doing well also! Either Wednesday the 9th or Thursday the 10th would work well for us that week. Please let me know which you would prefer or if another date would be better for you. We're pretty flexible that week.

Thanks so much,
Elizabeth

Elizabeth C Kasik
Laboratory Director

Turner Laboratories Inc
2445 North Coyote Drive
Suite 104
Tucson, AZ 85745

Office: 520-882-5880
Cell: 602-524-7249
ekasik@turnerlabs.com

TURNER LABORATORIES INC.

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Wednesday, November 4, 2020 8:18 AM
To: Kevin Brim <kbrim@turnerlabs.com>; Elizabeth Kasik <ekasik@turnerlabs.com>
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com
Subject: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Kevin and Elizabeth,

I hope you're staying safe and doing well!

Laboratory Data Consultants (LDC) has been asked by Mary Tyer with Hargis+Associates to perform a routine laboratory audit of Turner Laboratories in support of the Apache Powder Superfund Project.

This will be a single-day virtual systems and performance audit and will focus on the following analyses:

Analytical Method	Analyte	Matrix
EPA 300.0	Nitrate-N	Water
SM 4500-NH_3 B, C	Ammonia Nitrogen (NH_3-N)	Water

We'd like to perform the audit the week of Dec 7-11. Would Wednesday, Thursday or Friday of that week work for you and other staff involved in the audit?

Once we confirm an audit date, I'll be in touch to discuss logistics of the virtual audit, request documentation and coordinate the agenda.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants

DATA VALIDATION, ADR, CUSTOM SOFTWARE AND DATABASE MANAGEMENT

Email: sdenzer@lab-data.com
Web: http://www.lab-data.com

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Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 9, 2020
Turner Laboratories, Inc.

Ref #	Department	Finding	Response	Documentation	Status	Follow-up Date
1	QA (QAP)	The Table of Contents in the Laboratory's Quality Assurance Plan (QAP), Revision #30 includes references to Appendix A and Appendix B however documents associated with these appendices were not identified as such.	The Quality Assurance Plan has been updated with coversheets for these sections to indicate the Appendix that they represent.	Revised QAP		
2	QA (QAP)	The Table of Contents in the QAP references Appendix F however the contents of this appendix (List of Turner Laboratories' Policies) do not appear in the QAP.	The Quality Assurance Plan has been updated to include Appendix F	Revised QAP		
3	QA (QAP)	The last paragraph of Section 5.3 in the QAP discusses sample disposal practices and includes a reference to Section 4.4, however Section 4.4 discusses document retention and disposal rather than sample disposal.	This reference has been removed from the Quality Assurance Plan.	Revised QAP		
4	Health and Safety	The Health and Safety Manual did not include a signature page indicating the revision number and date prepared. The document should include approval signatures along with date(s) of signing and treated as a controlled document.	The Health & Safety has been updated and revised to include signatures.	Revised Health & Safety Manual		
5	QA (Internal Audits)	Internal system audits are conducted following receipt of proficiency test (PT) results as indicated in Section 2 of Turner Laboratories Policy No. 6. However the internal audits are currently limited to an evaluation of PT results and a root cause analysis of outliers. All items in Policy #6 should be reviewed during the internal audit including work area inspection items in Section 2.B of the policy.	The Laboratory Director will complete an audit according to Policy #6 upon the receipt of the next round of PT samples. A formal write-up will be done at this time. The next PT will e completed in the March-April timeframe.			
6	QA (Training)	Ethics training and manual integration training are performed and documented as part of the new employee training. Ethics training should be performed on an annual basis and attendance records maintained. It is recommended the annual training include a reminder of the laboratory's manual integration policies.	An annual refresher training was performed for all staff on 01/08/2021	Training form		
7	QA (MDL Study)	In the nitrate spike data associated with the EPA Method 300.0 MDL study, a 32% recovery was reported for QC Batch 2006210 prepared and analyzed on 6/16/2020 however the spike amount was 0.5mg/l and the result was 0.63mgl.	The data was taken directly from LIMS and was not a calculation done on the spreadsheet. The Batch in question was not used, and the incorrect spike ID was entered into the system. Thus, making the recovery look as if it were outside of specifications even though it was not. The spreadsheet has been updated to calculate the recoveries	Revised Nitrate MDL		

Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 9, 2020
Turner Laboratories, Inc.

Ref #	Department	Finding	Response	Documentation	Status	Follow-up Date
			by formula rather than directly from LIMs			
8	QA (MDL Study)	In the nitrate spike data associated with the EPA Method 300.0 MDL study, results were reported with significant figures varying between one and three.	All data has been re-formatted to be three significant figures.	Revised Nitrate MDL		
9	QA (MDL Study)	Since the MDL study for nitrate by EPA 300.0 is determined using data from multiple instruments, the auditor recommends associating the Instrument ID with blank and spike results on the MDL Study summary form. This information helps ensure a sufficient amount of data is incorporated into the study from each instrument.	The MDL has been revised to show the instrument ID for the data that was collected.	Revised Nitrate MDL		
10	QA (MDL Study)	The MDL study for ammonia by SM 45000-NH_3 B,C utilized data from blanks analyzed between January 2017 and September 2020 however it only utilized spike data analyzed between January 2018 and July 2018. The MDL study must be verified once every 13 months using data from the last 24 months.	Upon investigating this finding, I found that there was a period of time where the MRL check was performed, but not entered into Element. The analyst is not including the MRL check in Element. Also, a more complete data set has been used to calculate a new MDL.	Revised Ammonia MDL		
11	Sample Receiving	There are two sample receiving rooms (North and South) and two sample refrigerators (North and South) located in the North receiving room. There was confusion about the identities of the rooms and refrigerators during the audit, therefore the auditor recommends they be re-identified.	The identifications for these thermometers and refrigerators have been clarified.	Temperature logs and thermometer labels		
12	Sample Receiving	Section 4.1.5 of SOP SC-1, Revision #8 (Sample Receiving) indicates "The temperature of a representative sample or the temperature blank is taken …" but does not clarify what constitutes a representative sample and where in the cooler the sample should be taken from.	Section 4.1.5. has been revised to specify a location in the cooler.	Revised SOP SC-1		
13	Wet Chem (Nitrate by EPA 300.0)	Section 7.2.1 of SOP INORG-03, Revision #21 (analysis of nitrate by EPA Method 300.0) discusses initial setup of the Dionex IC System however the instrument setup conditions (e.g. loop size, flow rate, operating pressure range, etc) were not specified.	This information has been added to the SOP.	Revised SOP INORG-03		
14	Wet Chem (Nitrate by EPA 300.0)	Section 7.2.2.11 of SOP INORG-03 discusses the evaluation of QC samples however since Sections 8.4 and 8.5 of the SOP contain a much more detailed discussion of the evaluation and corrective action, the auditor	This section of the SOP has been revised.	Revised SOP INORG-03		

Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 9, 2020
Turner Laboratories, Inc.

Ref #	Department	Finding	Response	Documentation	Status	Follow-up Date
		recommends simply referencing these sections.				
15	Wet Chem (Nitrate by EPA 300.0)	Sections 8.3.5 and 8.3.6 of SOP INORG-03 do not indicate the need to filter the Method Blank and LCS/LCSD as is required for samples in Sections 7.1.1.1 and 7.2.3.1. The Method Blank and LCS/LCSD should be handled in the same manner as samples.	All samples, QC and standards are filtered through the filter that is included in the cap of the IC vial. The additional filter step is to ensure that particles that would clog the filter cap have been removed. We will verify the cleanliness of each batch of filters by filtering lab water and assessing as a blank. In addition we will also filter an LCS/LCSD with each lot to ensure that the filer is not adversely affecting analyte recovery.	Revised SOP INORG-03 and filter log		
16	Wet Chem (Nitrate by EPA 300.0)	The auditor recommends including a reference to the manual integration SOP (SOP ADM-3) within Section 8.6 of the SOP INORG-03.	The SOP has been revised to include this reference.	Revised SOP INORG-03		
17	Wet Chem (Nitrate by EPA 300.0)	Section 9.3 of SOP INORG-03 indicates an MDL Study is performed every six months as is stated in Section 9.2.4 of EPA Method 300.0, however the laboratory is currently verifying MDLs on an annual basis which is consistent with the EPA Method Update Rule. The auditor recommends the QA Officer discuss the frequency requirement with a State accreditation officer either before or during the next on-site audit.	Observation. No response required.	N/A	N/A	N/A
18	QA	It was indicated that all thermometers had recently been verified however the old labels, including previous correction factors, had not been replaced.	All labels and logs are now up to date	Example labels		

Section 1-C

Turner Laboratories, Inc.

LDC Summary of Laboratory Assessment

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Phone: (760) 827-1100

January 19, 2021

Turner Laboratories, Inc.
2445 North Coyote Drive, Suite 104
Tucson, AZ 85745
Attn: Ms. Elizabeth Kasik

Subject: **Summary of 2020 Laboratory Assessment of Turner Laboratories, Inc. in Tuscson, AZ for the Apache Powder Superfund Project**

Dear Ms. Kasik,

Laboratory Data Consultants, Inc. (LDC) has reviewed your corrective action responses and documentation provided in emails dated January 8 and January 15, 2021 to the Laboratory Assessment Report issued by LDC on December 11, 2020. The Laboratory Assessment Report was issued following a virtual on-site assessment on December 9, 2020 which was intended as a general assessment of the laboratory's quality systems and capacity to support the Hargis + Associates Apache Powder Superfund Project.

This letter presents the outcome of the assessment.

- **Preliminary Documentation Review:** A review of laboratory supplied documentation was conducted prior to and during the virtual on-site assessment. Documentation included the laboratory's quality assurance (QA) manual, selected standard operating procedures (SOPs), and the Laboratory's organizational chart. The QA Manual included a list of major analytical equipment/instrumentation as well as a list of laboratory certifications and accreditations. Documentation review was based on requirements specified in the published analytical methods, AZ DEQ requirements and good laboratory practices. Following this review, LDC proceeded with other phases of the lab assessment, including a virtual on-site laboratory audit.

- **Proficiency Test (PT) Samples:** Turner Laboratories participates in external certification and PT programs, including the State of Arizona's Office of Licensure and Certification. PT results for the methods and analytes of interest were acceptable.

- **Onsite Audit:** LDC conducted a virtual on-site audit of Turner Laboratories in Tucson, AZ on December 9, 2020. A virtual on-site audit was performed in lieu of a physical on-site audit due to Covid-19 restrictions. Deficiencies identified during the audit, and those identified during the preliminary documentation review are presented in the Laboratory Assessment Report dated December 11, 2020.

- **Corrective Actions:** Turner Laboratories provided LDC with responses on January 8 to the deficiencies noted in the Laboratory Assessment Report. When applicable, documentation was submitted by the laboratory indicating the required updates were performed on items identified in the Laboratory Assessment Report. The corrective action plan and schedule were reviewed and considered acceptable.

LDC will be submitting this summary as part of a final report to Hargis+Associates.

Should you have any questions or wish to discuss the laboratory assessment, please contact me at (760) 827-1100.

Sincerely,

Scott Denzer
Principal Chemist

Section 2-A

Eurofins TestAmerica-Phoenix

LDC Laboratory Assessment Report

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760/827-1100 Fax: 760/827-1099

December 22, 2020

Eurofins TestAmerica, Phoenix
4625 East Cotton Center Boulevard, Suite 189
Phoenix, AZ 85040
Attn: Ms. Ann Doerr

Subject: 2020 Apache Powder Laboratory Audit Report of Eurofins TestAmerica in Phoenix, AZ

Dear Ms. Doerr,

The attached report provides results of the laboratory audit of Eurofins TestAmerica located in Phoenix, Arizona. Laboratory Data Consultants, Inc. (LDC) conducted the audit on behalf of Hargis + Associates, Inc.. The report includes information pertaining to the review of laboratory preliminary documentation, proficiency testing (PT) information and an on-site audit performed on December 16, 2020.

Eurofins TestAmerica has until January 25, 2021 (30 calendar days excluding holidays) to submit a corrective action plan (CAP) addressing the deficiencies identified in this report. For each finding, your response should include a discussion of the scope and approach for planned corrective actions along with scheduled completion dates for each item not completed at the time the CAP is submitted. The plan of action must provide sufficient detail to determine if the approach is technically reasonable.

Your CAP should be directed to my attention at the letterhead address. I would like to express my appreciation to you and other members of the staff who were helpful and candid during the on-site visit. Should you have any questions or wish to discuss audit deficiencies or proposed corrective action, please contact me at (760) 827-1100.

Sincerely,

Scott Denzer
Principal Chemist

Report for:

Apache Powder Superfund Project
2020 Laboratory Audit

Prepared for:

Hargis + Associates, Inc.
7400 N. Oracle Road, Suite 202
Tucson, AZ 85705
Attn: Ms. Mary Tyer

Laboratory:

Eurofins TestAmerica, Phoenix
4625 East Cotton Center Boulevard, Suite 189
Phoenix, AZ 85040

Prepared by:

Laboratory Data Consultants, Inc.
2701 Loker Ave. West, Suite 220
Carlsbad, CA 92010

December 22, 2020

1.0 Introduction

As requested by Hargis + Associates, Inc. (Hargis), Laboratory Data Consultants, Inc. (LDC) conducted an audit of Eurofins TestAmerica (Eurofins-TA, Phoenix) located in Phoenix, AZ. The audit process includes four primary phases: 1) Review of laboratory preliminary documentation; 2) Proficiency Testing (PT) review; 3) On-site audit; and 4) Corrective action. The on-site audit was conducted as a virtual audit due to Covid-19 restrictions.

2.0 General Information

The audit was initiated by Hargis and executed by Mr. Scott Denzer of LDC as part of the overall Quality Assurance program for the Apache Powder Superfund project. The audit was structured as a general evaluation of the laboratory's quality systems and capacity to support the project.

Eurofins-TA, Phoenix provides commercial and government clients with routine environmental analytical. The laboratory has the capacity, capabilities and support systems to deliver analytical data for small and mid-size projects.

Eurofins-TA, Phoenix maintains licensing through Arizona Department of Health Services. The laboratory occupies approximately 24,000 square feet. The laboratory currently operates with approximately 43 full-time personnel. Normal business hours are 8:00am to 5:00pm Monday through Friday however extended hours occur on an add-needed basis for sample receiving and operations.

3.0 Laboratory Preliminary Documentation Review

A review of laboratory supplied documentation was conducted prior to and as part of the on-site audit. Documentation included the laboratory's Quality Assurance Manual (QAM), selected standard operating procedures (SOPs), method detection limits (MDL) studies, and proficiency test (PT) sample results. An Organizational Chart, a master list of methods performed by the laboratory and a master list of major analytical instrumentation were included in the QAM and reviewed during the document review process.

4.0 Licensing and Proficiency Test (PT) Review

Eurofins-TA, Phoenix has been licensed by the State of Arizona Department of Health Services (AZ DHS) environmental laboratory licensing program. The laboratory is currently licensed by AZ DHS through June 10, 2021 (License #AZ0728). In addition, Eurofins-TA, Phoenix participates in externally administered proficiency testing programs.

All results of the most recent PT samples were within acceptance limits.

5.0 On-Site Audit

The following information is presented in association with the virtual on-site audit performed by LDC of Eurofins-TA, Phoenix on December 16, 2020.

5.1 On-Site Audit

The audit was initiated by Hargis and executed by Mr. Scott Denzer of LDC. The on-site audit was structured as a general evaluation of the laboratory's quality systems and capacity to support the Apache Powder Superfund project and was conducted as a virtual audit due to Covid-19 restrictions.

The objective of the audit of Eurofins-TA, Phoenix was to determine whether the laboratory's quality assurance (QA) program and Quality Control (QC) practices meet the method requirements and are consistent with the QAM, applicable SOPs, State licensing requirements, and good laboratory practices.

The following analytical methods (along with appropriate sample preparation procedures) were evaluated during the audit process:

Matrix	Analytical Method	Analyte
Water	EPA 300.0	Nitrate as N
	SM 4500-NH3 D	Nitrogen, Ammonia as N

5.2 Evaluation Criteria

The virtual on-site audit was performed in accordance with the protocols presented in the analytical methods and in accordance with applicable AZ DHS quality control requirements. The EPA's Test Methods for Evaluating Solid Waste SW846, Eurofins-TA, Phoenix's QAM and laboratory SOPs were also used as performance standards.

5.3 Description

The assessor began the virtual audit by holding an orientation meeting with the Laboratory Director, the QA Manager and the Wet Chemistry Manager during which the elements of the laboratory audit program were described.

Following a description of the scope and schedule for the audit, the assessor adjourned the opening meeting and initiated their review of laboratory operations. The virtual on-site audit of Eurofins-TA, Phoenix focused on items related to quality systems and aspects of routine laboratory operations, including:

- Organization and Personnel
- Safety and Facilities
- Sample Management
- Quality Control (QC) Practices
- Record Keeping and Traceability
- Ethics and Technical Training
- Laboratory Licensing
- Sample and Standard Preparation
- Report Generation
- Specific Analytical Methods
- Data Management and Storage
- Laboratory Information Management System
- Waste Management

The adequacy of the laboratory's QA program was assessed. The facility, instrumentation, documentation, and support practices were reviewed. The assessor interviewed the QA Manager, the Project Manager, supervisors, analysts, technicians, and support personnel.

At the conclusion of the virtual audit, the assessor conducted an audit debrief with the Laboratory Director and the QA Manager. During the briefing the assessor presented a verbal review of the overall deficiencies and observations identified during the course of the audit. The deficiencies and observations are presented in Sections 6.0 and 7.0 of this report.

Laboratory personnel asked questions as needed throughout the audit.

6.0 Deficiencies

During the course of the audit the assessor noted policies, practices, documents, or records that did not comply with evaluation criteria identified in Section 5.2. In addition, the assessor paid special attention to items previously identified as deficiencies to ensure laboratory corrective actions had remained in place.

Table 1 presents a cumulative summary of deficiencies. It is requested that the laboratory provide their response in the "Laboratory Corrective Action Plan (CAP)" column of Table 1 as a means of facilitating the corrective action process. A copy of Table 1 has been provided as a Microsoft Word file in order to facilitate the process.

7.0 Observations

This section presents general observations, which reflect on the capabilities and capacity of the laboratory. Response from the laboratory is not required.

The laboratory's facility provides ample space for production analytical work and support activities, with appropriate segregation of functional areas.

Based on interviews and a review of available training documents, the laboratory's staff is qualified to perform the analyses requested by Hargis.

A laboratory information management system (LIMS) is used in all sections of the laboratory. The LIMS is within the laboratory and has a user authentication system that limits access for each user to privileges specific to their role in the laboratory. The laboratory has contracted staff to maintain the LIMS and ensure routine backup and offsite storage of files.

8.0 Conclusions

Eurofins-TA, Phoenix has the staff, facilities, and equipment necessary to provide Hargis with environmental analytical services on the Apache Powder Superfund project. In general, the laboratory quality control samples, sample identification and batch records are adequate to meet project requirements, and staff members are qualified for their positions. The laboratory will need to adequately address the findings of this report for complete approval.

Ref #	Department	Finding	Response	Documentation (Attachment #)	Status	Projected Completion Date
1	QA (QAM)	Section 3.4.1 of the Quality Assurance Manual (QAM) indicates the manual is reviewed annually by senior laboratory management. The current version has an effective date of December 4, 2019 however the QA Manager indicated it's in the process of being reviewed.				
2	QA (QAM)	A list of methods currently performed by the laboratory is included as Appendix 4 in the QAM however the Appendix is not identified in the list of Appendices on Page 12.				
3	QA (SOP)	The first attachment in the SOP for SM4500-NH_3 D (SOP No. PE-WET-015, Rev 5) was not identified as Attachment 1.				
4	QA (SOP)	Section 10.3.2.8 of the SOP for SM4500-NH_3 D includes multiple references to Attachment 2. It appears the references should be to Attachment 1.				
5	QA (SOP)	Section 10.3.3.8 of the SOP for SM4500-NH_3 D includes multiple references to Attachment 3. It appears the references should be to Attachment 2.				
6	QA (SOP)	Section 6.1 of the SOP for EPA 300.0 (SOP No. PE-WET-002, Rev 7) does not identify Dionex as the instrument and column vendor nor does it identify which instrument is IC3, IC 6 and IC 8 (the instrument identifiers used throughout the remainder of the SOP).				
7	QA (SOP)	The header for the table in Section 10.2.4 II of the SOP for EPA 300.0 references Standard 9. It appears the reference should be to Standard 8.				
8	QA (SOP)	Section 11.5 of the SOP for EPA 300.0 identifies the calculation to be performed when NO_3 is to be reported as N. Since the standard being used for the analysis is NO_3 as N, the calculation does not need to be performed.				
9	QA (SOP)	Section 11.6.1 of the SOP for EPA 300.0 indicates total NO_3 as N is the sum of NO_2 as N and NO_3 as N. The sum of the two values should be "Total Nitrate-Nitrite as N".				

Ref #	Department	Finding	Response	Documentation (Attachment #)	Status	Projected Completion Date
10	QA (SOP)	Section 12.1.2 of the SOP for EPA 300.0 indicates "For methods that do not specify the LOQ/MRL, the default limits of 50-150% may be used." This appears to be an erroneous Section within the discussion of the method detection limit study (Section 12.1).				
11	QA (Corrective Action)	The laboratory's Incident Corrective Action Tracking (ICAT) database was properly used to document a failing proficiency test (PT) sample for ammonia by SM 4500-NH_3 D in March 2020 as well as the resulting investigation that was performed. However, the ICAT was not updated to indicate a successful repeat PT was performed.				
12	QA (Ethics Training)	It was indicated ethics training is currently performed twice per year however documentation is retained by Corporate Human Resources. The records should be readily accessible to the QA Manager so they can be monitored to ensure all staff have completed the annual training.				
13	Sample Receiving	Sample receiving staff verify samples for SM4500-NH_3 D have been properly preserved by dipping a pH strip directly into the sample rather than by checking the pH of an aliquot of the sample.				
14	Wet Chemistry (SM4500-NH_3 D)	Wet Chemistry staff verify samples for SM4500-NH_3 D have been properly preserved by dipping a pH strip directly into the sample rather than by checking the pH of an aliquot of the sample.				
15	Wet Chemistry (EPA 300.0)	Prior to the analysis for nitrate, Wet Chemistry staff use a test strip to screen for high levels of nitrate. The test is performed by dipping the test strip directly into the sample rather than by dipping it into an aliquot of the sample.				
16	Wet Chemistry (EPA 300.0)	Section 12.3.2 of the EPA 300.0 indicates MDL studies are performed as part of an analyst's initial demonstration of capability (IDOC) however it was stated that MDL studies are performed per method rather than per individual analyst.				

Section 2-B

Eurofins TestAmerica-Phoenix

Laboratory Corrective Action Response

From:	Genco, Tony
To:	Scott Denzer; Doerr, Ann H.
Cc:	MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Stimson, Stephanie; Stanfield, Dona; Maycock, Lisa
Subject:	RE: Lab Audit for Hargis - Apache Powder Superfund Site Project
Date:	Friday, January 29, 2021 4:52:24 PM
Attachments:	Eurofins-TA Phoenix_CorrectiveActionPlanTemplate_2020_122220_response.docx

Good afternoon Scott. Please see the attached response and let us know if you have any additional questions. I do owe you some follow up items that I'll be sure to send on once complete.

Have a great weekend,

Tony Genco
Quality Assurance Manager

Eurofins TestAmerica
4625 E. Cotton Center Blvd., Ste. 189
Phoenix, AZ 85040
USA

Phone: 602-659-7704 direct
602-437-3340 main
E-mail: Tony.Genco@eurofinset.com

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Thursday, January 28, 2021 12:46 PM
To: Doerr, Ann H. <Ann.Doerr@Eurofinset.com>
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com; Stimson, Stephanie <Stephanie.Stimson@Eurofinset.com>; Stanfield, Dona <Dona.Stanfield@Eurofinset.com>; Genco, Tony <tony.genco@eurofinset.com>; Maycock, Lisa <Lisa.Maycock@Eurofinset.com>
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

EXTERNAL EMAIL*

Hi Ann, Tony,

For the one item that's pending please indicate the projected completion date. You'll then need to complete the item by that date and forward documentation demonstrating completion.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
DATA VALIDATION, ADR, CUSTOM SOFTWARE AND DATABASE MANAGEMENT

Email: sdenzer@lab-data.com
Web: http://www.lab-data.com

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2701 Loker Ave. West, Suite 220
Carlsbad, CA 92010
760.827.1130 (Direct), 760.827.1100 (Main)

From: Doerr, Ann H. [mailto:Ann.Doerr@Eurofinset.com]
Sent: Thursday, January 28, 2021 11:39 AM
To: Scott Denzer
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Stimson, Stephanie; Stanfield, Dona; Genco, Tony; Maycock, Lisa
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Scott,

We have one item pending, so we can write up that it will be done in X days.

Also, I have transferred to another position in TestAmerica. Tony Genco has assumed the role of QA Manager for Phoenix. I have copied him on this email.

Ann Doerr

Phone: 602-659-7679
Cell 480-209-5482

E-mail: Ann.Doerr@eurofinset.com

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Thursday, January 28, 2021 12:36 PM
To: Doerr, Ann H. <Ann.Doerr@Eurofinset.com>
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com; Stimson, Stephanie <Stephanie.Stimson@Eurofinset.com>; Stanfield, Dona <Dona.Stanfield@Eurofinset.com>
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

EXTERNAL EMAIL*

Hi Ann,

I'm following up on the corrective action plan (CAP) that was due this past Monday for the December 16th audit. Please forward the CAP to me by close of business tomorrow so I can finalize a report for Hargis+Associates early next week.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

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From: Scott Denzer
Sent: Tuesday, December 22, 2020 11:53 AM
To: Doerr, Ann H.
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Stimson, Stephanie; Stanfield, Dona
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Ann,

Attached is the laboratory assessment report resulting from LDC's on-site audit last Wednesday for the Hargis + Associates' Apache Powder Superfund project. Also attached is a MS Word template of the findings to assist with providing corrective action responses.

Once corrective action responses are received, LDC will review the responses and provide a final report and recommendation to Hargis.

Feel free to contact me if you have any questions. I appreciate your help in adapting to the needs of a virtual audit and apologize for keeping you on your feet throughout the day. You certainly made the audit flow smoothly.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

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From: Scott Denzer
Sent: Wednesday, December 9, 2020 3:21 PM
To: Doerr, Ann H.
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Stimson, Stephanie; Stanfield, Dona
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Ann,

You should have received an email providing access to the technical support folder in LDC Advantage. You can drop the files in the "View/Submit Lab Files" folder of LDC Technical Support. I'll send you instructions shortly for submitting files.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

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Web: http://www.lab-data.com

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Carlsbad, CA 92010
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From: Doerr, Ann H. [mailto:Ann.Doerr@Eurofinset.com]
Sent: Wednesday, December 9, 2020 1:49 PM
To: Scott Denzer
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Stimson, Stephanie; Stanfield, Dona
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Scott,

Can you send me the link to post to your site.

Thanks

Ann Doerr

Phone: 602-659-7679

E-mail: Ann.Doerr@eurofinset.com

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Tuesday, November 24, 2020 8:59 AM
To: Doerr, Ann H. <Ann.Doerr@Eurofinset.com>
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com; Stimson, Stephanie <Stephanie.Stimson@Eurofinset.com>; Stanfield, Dona <Dona.Stanfield@Eurofinset.com>
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

EXTERNAL EMAIL*

Good morning Ann,

In preparation for the Dec 16th virtual audit, please forward the following documents to me by close of business Friday , Dec 11. If the files are too large to email, let me know and I'll send you a link you can use to post the files to our secure LDC Advantage site.

1) Laboratory Quality Assurance Manual
2) SOPs for EPA Method 300 and SM4500-NH_3 D

3) SOP for Sample Receiving/Login
4) The past two sets of Proficiency Test results for the Nitrate-N by Method 300 and NH_3-N by SM4500-NH_3 D
5) Organization Chart (if not included in the QA Manual)
6) Current accreditation certificate (if not included in the QA Manual)
7) The most recent MDL studies for methods/analytes in Item 4 above

As in the past I'd like to interview staff who routinely handle the project samples although I'll also briefly interview group/section supervisors.

Attached is a draft agenda. We can adjust as necessary during the onset of the audit. As mentioned, I'll be in touch to discuss logistics of the virtual software/platform.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

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Carlsbad, CA 92010
760.827.1130 (Direct), 760.827.1100 (Main)

From: Scott Denzer
Sent: Monday, November 16, 2020 5:05 AM
To: Doerr, Ann H.
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Stimson, Stephanie; Stanfield, Dona
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Ann,

December 16th works well.

You've likely been through other virtual audits this year but I'll be in touch over the coming days to discuss logistics and request documentation.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

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Web: http://www.lab-data.com

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From: Doerr, Ann H. [mailto:Ann.Doerr@Eurofinset.com]
Sent: Saturday, November 14, 2020 7:33 AM
To: Scott Denzer
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com; Stimson, Stephanie; Stanfield, Dona
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Scott. How about Wednesday 12/16/2020?

Ann Doerr

Phone: 602-659-7679

E-mail: Ann.Doerr@eurofinset.com

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Monday, November 9, 2020 6:04 AM
To: Doerr, Ann H. <Ann.Doerr@Eurofinset.com>
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

EXTERNAL EMAIL*

Hi Ann,

I'm not sure if your lab director or dept manager had a chance to check their schedules, however something came up during the week of Nov 30-Dec 4. Could we fit it in during the week of Dec 14-18 instead?

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

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Web: http://www.lab-data.com

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Carlsbad, CA 92010
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From: Scott Denzer
Sent: Wednesday, November 4, 2020 9:59 AM
To: Doerr, Ann H.
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

Hi Ann,

No problem. A virtual audit provides a bit more flexibility; therefore I'm happy to work with your team on schedule as needed.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
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Web: http://www.lab-data.com

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Carlsbad, CA 92010
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From: Doerr, Ann H. [mailto:Ann.Doerr@Eurofinset.com]
Sent: Wednesday, November 4, 2020 9:26 AM
To: Scott Denzer
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com); abeam@hargis.com
Subject: RE: Lab Audit for Hargis - Apache Powder Superfund Site Project

HI Scott,

It has been awhile! I forwarded your request to our lab director and dept. manager. Our lab director is out today but should return tomorrow. Once she returns we can set a date.

Thanks,

Ann Doerr

Phone: 602-659-7679

E-mail: Ann.Doerr@eurofinset.com

From: Scott Denzer <sdenzer@lab-data.com>
Sent: Wednesday, November 4, 2020 8:18 AM
To: Doerr, Ann H. <Ann.Doerr@Eurofinset.com>
Cc: MTyer@Hargis.com; Leo Leonhart (LLeonhart@hargis.com) <LLeonhart@hargis.com>; abeam@hargis.com
Subject: Lab Audit for Hargis - Apache Powder Superfund Site Project

EXTERNAL EMAIL*

Hi Ann,

I hope you're doing well; it's been a few years since I last saw you!

Laboratory Data Consultants (LDC) has been asked by Mary Tyer with Hargis+Associates to perform a routine laboratory audit of Eurofins TestAmerica-Phoenix in support of the Apache Powder Superfund Project.

This will be a single-day virtual systems and performance audit and will focus on the following analyses:

Analytical Method	Analyte	Matrix
EPA 300.0	Nitrate-N	Water
SM 4500-NH_3 D	Ammonia Nitrogen (NH_3-N)	Water

We'd like to perform the audit the week of Nov 30 – Dec 4. Would Wednesday, Thursday or Friday of that week work for you and other staff involved in the audit?

Once we confirm an audit date, I'll be in touch to discuss logistics of the virtual audit, request documentation and coordinate the agenda.

Thanks,
Scott

Scott Denzer
Director of Operations/Principal Chemist

Laboratory Data Consultants
DATA VALIDATION, ADR, CUSTOM SOFTWARE AND DATABASE MANAGEMENT

Email: sdenzer@lab-data.com
Web: http://www.lab-data.com

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Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 16, 2020
Eurofins-TA, Phoenix

Ref #	Department	Finding	Response	Documentation (Attachment #)	Status	Projected Comp Date
1	QA (QAM)	Section 3.4.1 of the Quality Assurance Manual (QAM) indicates the manual is reviewed annually by senior laboratory management. The current version has an effective date of December 4, 2019 however the QA Manager indicated it's in the process of being reviewed.	There was a delay in reviewing the QA Manual as the QA Manager (Ann Doerr) was furloughed 1 day per week for several months due to Covid. Manual is currently under review by current QA Manager		Review in process	3/1/21
2	QA (QAM)	A list of methods currently performed by the laboratory is included as Appendix 4 in the QAM however the Appendix is not identified in the list of Appendices on Page 12.	QA Manual was reviewed most recently in December 2019 left an error in the list of appendices in the table of contents. Appendix 4 appeared in all versions of the QAM dating back to 2010 but was missing from the table of contents from 2014 onward. The list of methods will be included in the List of Appendices in the next update.		The QA Manual is currently in revision.	3/1/21
3	QA (SOP)	The first attachment in the SOP for SM4500-NH_3 D (SOP No. PE-WET-015, Rev 5) was not identified as Attachment 1.	In a recent document review, an obsolete attachment to SOP "PE-WET-015 R.5 SM 4500-NH3D Ammonia" was removed from use. This was recorded in the revision history dated September 8, 2015 and Attachment 1 (Data Review Checklist) was archived. However, two additional attachments remained in use. The text of the SOP left the references to Attachment 2 (Timetable Template Report) and Attachment 3 intact. These references were not changed in the most recent document reviews in 2018, 2019 and 2020.		The now unnamed attachment will be named Attachment 1 during the next revision. An SOP change form has been initiated.	Completed
4	QA (SOP)	Section 10.3.2.8 of the SOP for SM4500-NH_3 D includes multiple references to Attachment 2. It appears the references should be to Attachment 1.	In a recent document review by TA Phoenix QA, an obsolete attachment to SOP "PE-WET-015 R.5 SM 4500-NH3D Ammonia" was removed from use. This was recorded in the revision history dated September 8, 2015 and		During the next revision of the SOP Section 10.3.2.8 will revised to reference Attachment 1 instead of Attachment 2. An SOP change form has been created to reflect this	Completed

Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 16, 2020
Eurofins-TA, Phoenix

Ref #	Department	Finding	Response	Documentation (Attachment #)	Status	Projected Comp Date
			Attachment 1 (Data Review Checklist) was archived. However, two additional attachments remained in use. The text of the SOP left the references to Attachment 2 (Timetable Template Report) and Attachment 3 intact. These references were not changed in the most recent document reviews in 2018, 2019 and 2020.		requirement.	
5	QA (SOP)	Section 10.3.3.8 of the SOP for SM4500-NH_3 D includes multiple references to Attachment 3. It appears the references should be to Attachment 2.	In a recent document review by TA Phoenix QA, an obsolete attachment to SOP "PE-WET-015 R.5 SM 4500-NH3D Ammonia" was removed from use. This was recorded in the revision history dated September 8, 2015 and Attachment 1 (Data Review Checklist) was archived. However, two additional attachments remained in use. The text of the SOP left the references to Attachment 2 (Timetable Template Report) and Attachment 3 intact. These references were not changed in the most recent document reviews in 2018, 2019 and 2020.		During the next revision of the SOP Section 10.3.3.8 will revised to reference the correct attachment. A Document Change Form has been created to reflect this requirement.	Completed
6	QA (SOP)	Section 6.1 of the SOP for EPA 300.0 (SOP No. PE-WET-002, Rev 7) does not identify Dionex as the instrument and column vendor nor does it identify which instrument is IC3, IC 6 and IC 8 (the instrument identifiers used throughout the remainder of the SOP).	SOP templates require a list of all required equipment and lab ware including for analytical equipment the size and type of instrument. SOP for EPA 300.0 was reviewed most recently in March 2020 and the current version identifies the model of the ion chromatography system but not Dionex as the manufacturer or the identifiers used internally in the lab (IC3, IC6, IC8)		During the next revision of the SOP, section 6.1 will be revised to include the manufacturer and also list the lab ID with the appropriate model. A document change form has been created to reflect this requirement.	Completed
7	QA (SOP)	The header for the table in Section 10.2.4 II of the SOP for EPA 300.0 references Standard 9. It appears the reference should be to Standard 8.	SOP for EPA 300.0 was reviewed most recently in March 2020 and lack of oversight during review left an error in the Section 10.2.4 table header. The		Next revision of Section 10.2.4.11 of the SOP will be revised to reflect the current standard that is to be used for	Completed

Table 1
Hargis + Associates, Inc.: Apache Powder Superfund Project
Laboratory Audit, December 16, 2020
Eurofins-TA, Phoenix

Ref #	Department	Finding	Response	Documentation (Attachment #)	Status	Projected Comp Date
			column header in Section 10.2.3 is correctly titled "Standard 9 (Intermediate Standard) (mL)" but the header in Section 10.2.4 should reference "Standard 8."		preparing intermediate standards. A document change form has been created to reflect this requirement.	
8	QA (SOP)	Section 11.5 of the SOP for EPA 300.0 identifies the calculation to be performed when NO_3 is to be reported as N. Since the standard being used for the analysis is NO_3 as N, the calculation does not need to be performed.	Upon review of the calculations, it appears to be unnecessary as the standard is already reporting NO3 as N.		Section 11.5 will be removed from the SOP as it is unnecessary. A document change form has been created to reflect this requirement.	Completed
9	QA (SOP)	Section 11.6.1 of the SOP for EPA 300.0 indicates total NO_3 as N is the sum of NO_2 as N and NO_3 as N. The sum of the two values should be “Total Nitrate-Nitrite as N”.	The SOP does indicates that Total NO3 is the sum of NO2 as N and NO3 as N which is incorrect		Section 11.6.1 will be revised to state that "Total Nitrate-Nitrite as N is the sum of total Nitrate as N and total Nitrite as N". A document change form has been created to reflect this requirement	Completed
10	QA (SOP)	Section 12.1.2 of the SOP for EPA 300.0 indicates “For methods that do not specify the LOQ/MRL, the default limits of 50-150% may be used.” This appears to be an erroneous Section within the discussion of the method detection limit study (Section 12.1).	After reviewing the SOP, it was determined the requirement for a low level CCV (50-150%) required by for drinking water samples is addressed in section 9.1. This requirement does not belong in the section on MDL studies		During the next revision of the SOP, section 12.1.2 will be removed. A document change form has been created to reflect this requirement.	Completed
11	QA (Corrective Action)	The laboratory’s Incident Corrective Action Tracking (ICAT) database was properly used to document a failing proficiency test (PT) sample for ammonia by SM 4500-NH_3 D in March 2020 as well as the resulting investigation that was performed. However, the ICAT was not updated to indicate a successful repeat PT was performed.	A review of SOP PE-QAD-021 R Proficiency Testing Program Section 10.13 indicates that if a remedial PT has been performed that a subsequent successful PT will be documented in iCAT.		When remedial PTs are performed, the results will be entered into iCAT into the Corrective Action for the original failed PT. the WP0220 CAR was amended to include the remedial PTs that were performed from the Phenova WP0420 study.	Completed
12	QA (Ethics Training)	It was indicated ethics training is currently performed twice per year however documentation is retained by Corporate Human Resources. The records should be readily accessible to the QA Manager so they can be monitored to ensure all staff have completed the annual training.	There was some confusion on which department (QA vs. HR) was handling the signing of the Ethics Statement with the recent acquisition of TestAmerica by Eurofins		Corporate QA was contacted and it has been determined that the local lab will retain the signed Ethics Statement. Employees are required to sign	Completed

Ref #	Department	Finding	Response	Documentation (Attachment #)	Status	Projected Comp Date
					the Ethics Statement upon hire and on an annual basis. In Jan and Feb of 2021, there will be a labwide training on Data Integrity. At this training all employees will sign the Ethics Statement. A followup will be conducted by 2/15/2021 to ensure all employees have completed this requirement.	
13	Sample Receiving	Sample receiving staff verify samples for SM4500-NH_3 D have been properly preserved by dipping a pH strip directly into the sample rather than by checking the pH of an aliquot of the sample.	Going forward, the pH will be checked by utilizing a transfer pipet to draw a small portion of sample and dropping a few drops of the sample onto the strip over a garbage can.		In effect.	Completed
14	Wet Chemistry (SM4500-NH_3 D)	Wet Chemistry staff verify samples for SM4500-NH_3 D have been properly preserved by dipping a pH strip directly into the sample rather than by checking the pH of an aliquot of the sample.	Going forward, the pH will be checked by utilizing a transfer pipet to draw a small portion of sample and dropping a few drops of the sample onto the strip over a garbage can.		In effect.	Completed
15	Wet Chemistry (EPA 300.0)	Prior to the analysis for nitrate, Wet Chemistry staff use a test strip to screen for high levels of nitrate. The test is performed by dipping the test strip directly into the sample rather than by dipping it into an aliquot of the sample.	Going forward, a transfer pipette will be utilized to draw a small portion of the sample out of the sample bottle and place drops onto the test strip for quick analysis		In effect.	Completed
16	Wet Chemistry (EPA 300.0)	Section 12.3.2 of the EPA 300.0 indicates MDL studies are performed as part of an analyst's initial demonstration of capability (IDOC) however it was stated that MDL studies are performed per method rather than per individual analyst.	It was found that the IDOC using the MDL study is indeed in the SOP for 300.0 Anions and Standard Methods. Going forward, all analysts training to run anions on the IC instruments for 300.0 will be running an MDL study during their training phase.		In effect.	Completed

Section 2-C

Eurofins TestAmerica-Phoenix

LDC Summary of Laboratory Assessment

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Phone: (760) 827-1100

February 1, 2021

Eurofins TestAmerica - Phoenix
4625 E Cotton Center Blvd, Suite 189
Phoenix, AZ 85040
Attn: Mr. Tony Genco

Subject: **Summary of 2020 Laboratory Assessment of Eurofins TestAmerica Laboratory in Phoenix, AZ for the Apache Powder Superfund Project**

Dear Mr. Genco,

Laboratory Data Consultants, Inc. (LDC) has reviewed your corrective action responses provided in an email dated January 29, 2021 to the Laboratory Assessment Report issued by LDC on December 22, 2020. The Laboratory Assessment Report was issued following a virtual on-site assessment on December 16, 2020 which was intended as a general assessment of the laboratory's quality systems and capacity to support the Hargis + Associates Apache Powder Superfund Project.

This letter presents the outcome of the assessment.

- **Preliminary Documentation Review:** A review of laboratory supplied documentation was conducted prior to and during the virtual on-site assessment. Documentation included the laboratory's quality assurance (QA) manual, selected standard operating procedures (SOPs), and the Laboratory's organizational chart. The QA Manual included a list of major analytical equipment/instrumentation as well as a list of laboratory certifications and accreditations. Documentation review was based on requirements specified in the published analytical methods, AZ DEQ requirements and good laboratory practices. Following this review, LDC proceeded with other phases of the lab assessment, including a virtual on-site laboratory audit.

- **Proficiency Test (PT) Samples:** Eurofins TestAmerica-Phoenix Laboratory participates in external certification and PT programs, including the State of Arizona's Office of Licensure and Certification. PT results for the methods and analytes of interest were acceptable with the exception of the Ammonia as Nitrogen (by SM 4500-NH_3 D) result in WP0220. A subsequent PT for Ammonia as Nitrogen using the same method was analyzed as part of WP0820 and the result was acceptable.

- **Onsite Audit:** LDC conducted a virtual on-site audit of the Eurofins TestAmerica Laboratory in Phoenix, AZ on December 16, 2020. A virtual on-site audit was performed in lieu of a physical on-site audit due to Covid-19 restrictions. Deficiencies identified during the audit, and those identified during the preliminary documentation review are presented in the Laboratory Assessment Report dated December 22, 2020.

- **Corrective Actions:** Eurofins TestAmerica-Phoenix provided LDC with responses on January 29, 2021 to the deficiencies noted in the Laboratory Assessment Report. The corrective action plan and schedule were reviewed and considered acceptable however final acceptance is contingent upon the receipt of documentation demonstrating completion of Corrective Action Plan Items 1, 2 and 12.

LDC will be submitting this summary as part of a final report to Hargis+Associates.

Should you have any questions or wish to discuss the laboratory assessment, please contact me at (760) 827-1100.

Sincerely,

Scott Denzer
Principal Chemist

APPENDIX I

RESPONSE TO COMMENTS –
RESPONSE TO EPA COMMENTS DATED JUNE 3, 2021 AND ADEQ COMMENTS DATED MAY 26, 2021 ON THE *2020 ANNUAL PERFORMANCE MONITORING AND SITE-WIDE STATUS REPORT* APACHE POWDER SUPERFUND SITE, COCHISE COUNTY, ARIZONA

RESPONSE TO EPA COMMENTS DATED JUNE 3, 2021 AND ADEQ COMMENTS DATED MAY 26, 2021 ON THE *2020 ANNUAL PERFORMANCE MONITORING AND SITE-WIDE STATUS REPORT* – APACHE POWDER SUPERFUND SITE, COCHISE COUNTY, ARIZONA

Comment Number	Applicable Section of Report	Comment	Requested Action	Response
EPA COMMENTS				
1	Section 1.2 p. 3	After conclusion of the optimization period, the 2012 Northern Area Remediation System (NARS) Operation and Maintenance (O&M) Plan, Revision 4 ["NARS O&M Plan"] should be updated to incorporate (or include as attachments) information associated with the additions of extraction wells SEW-2 and SEW-3 and associated sampling program and updates to the wetlands construction.	Include a statement that acknowledges the need to update the NARS O&M Plan to incorporate the latest information.	Accepted change. This has been included in Revision 1.0
2	Section 1.3 Top of page 6	Investigation activities performed during 2018/2019 were not included, leaving a gap in historical continuity inconsistent with the historical detail included throughout the report.	Include summary text for the 2018/2019 investigation activities that led to the installation of boring PB5A/extraction well SEW-3.	Accepted change. This has been included in Revision 1.0
3	Section 3.1.1.1, p. 28	Given the recent agreement to operate extraction wells SEW-2 and SEW-3 to optimize nitrates removal, this decision should be documented in the annual report.	Even though the agreement to modify winter operation of SEW-2 and SEW-3 occurred during 2021, it would be beneficial for continuity and documentation purposes to include a summary discussion in the 2020 annual report, as discussions around winter operations and optimization were well underway in late 2020. This should include referencing the March 1, 2021 Draft Tech Memo titled, "Startup of Extraction Well SEW-03 and Changes to NARS Wetland Operation" that discusses optimization of winter operation, agreement to operate of SEW-2 and	Discussion of the plan to operate SEW-03 is in Sections 7.2.1 and 10.2.1, with reference to the March 1 Draft Tech Memo. Text is added to pg 28 to reference these sections and to detail the anticipated pumping regime in winter 2021.

RESPONSE TO EPA COMMENTS DATED JUNE 3, 2021 AND ADEQ COMMENTS DATED MAY 26, 2021 ON THE *2020 ANNUAL PERFORMANCE MONITORING AND SITE-WIDE STATUS REPORT* – APACHE POWDER SUPERFUND SITE, COCHISE COUNTY, ARIZONA

Comment Number	Applicable Section of Report	Comment	Requested Action	Response
			SEW-3 during the winter of 2021 (i.e., continuous operation of SEW-3 and 6 hours per day for SEW-2), continued evaluation of nitrates mass loading to the wetlands, and re-adjustment of daily pumping duration if a short-term exceedance of the nitrates discharge criteria is exceeded.	
4	Section 3.4.2, p. 43	EPA does not believe that the text meant to reference use of passive diffusion bags to sample for nitrate.	If appropriate, change the method of nitrate sampling to Hydrasleeves™ or appropriate sampling method.	Hydrasleeves™ were used. Corrected in text.
5	Section 3.6, p. 52, 3rd paragraph	The text incorrectly states that the field work was performed in February 2020 instead of 2019.	Correct field work date to "February 2019". For the second sentence, also add ", with approval for the work plan issued in a January 28, 2019 correspondence from USEPA to ANPI" at the end after "January 3, 2019."	The date error in the text is associated with the workplan submittal. January 3, 2020 was changed to January 3, 2019. The drilling was performed in February 2019, as the text states. Added "with approval for the work plan issued in a January 28, 2019 correspondence from USEPA to ANPI"
6	Section 10.2.1, p. 75. 3rd paragraph	The text states that new extraction well SEW-3 will be incorporated into the current extraction well sampling protocol and does not acknowledge the more frequent startup sampling protocol and water level measurements described in the February 2021 work plan titled, "Northern Area Shallow Aquifer Remedy Acceleration: Startup Testing for SEW-3 ("SEW-3 Startup Plan").	The text should be revised to reference the sampling protocol described in the "Northern Area Shallow Aquifer Remedy Acceleration: Startup Testing for SEW3" for extraction well SEW-3 instead of the "NARS O&M Plan". It should also mention that the extraction well SEW-3 start-up period will occur during 2021, which will include ongoing optimization of nitrates removal and the generation of	Text is updated to include the SEW-03 Start-up monitoring plan.

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			periodic status reports that compiles the collected water level and sampling data for review. This updated information for the startup of extraction well SEW-3 is included in Section 10.3 but should also be included here.	
7	Section 10.3, p. 77, 4th bullet	Monitoring well MW-46 that is proposed for elimination from the sampling program is considered to be an important well because of its location at the edge of the geologic plume boundary and proximity to Wash 3 (but upgradient).	EPA would like to discuss the elimination of well MW-46 during the upcoming annual meeting call and potential replacement if of limited value as currently constructed.	The elimination of MW-46 was discussed during the Annual Meeting on 6/7/21. It was determined that this well is not of value for the current monitoring of SEW-03 Startup. Further consideration for potentially relocating this well will be evaluated in the 3-month data evaluation of the SEW-03 Start-up.
8	Section 10.3, p. 77	The annual report does not include any recommendation bullets regarding the long-term Northern Area remedy optimization strategy, including commitments regarding the recent start-up of extraction well SEW-3. EPA believes that it's important to document the intent of the optimization effort for future reference.	EPA would like to discuss the current status of the extraction well SEW-3 data collection compared to the requirements of the "SEW-3 Startup Plan" during the annual meeting call, as well as the methodology that will be used to evaluate capture influence and a schedule for the initial tech memo submission for review and discussion.	The schedule for the initial tech memo submission was discussed in the Annual Meeting. An extension until August 11, 2021 was requested by ANPI on July 23, 2021.
		EPA would also like to include a long-term remedy optimization strategy bullet that would incorporate the evaluation of the Northern Area remedy progress on an annual basis, which could include the following potential needs: a. additional assessment activities to identify a potential source(s) of continuing nitrates mass flux sources		A bullet has been added to Section 7.2.1 NARS Evaluation to discuss the long term remedy optimization strategy.

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		(assuming insufficient decreases in the nitrate concentrations measured at extraction wells SEW-2 and SEW-3 during operations, and/or significant rebound at the conclusion of the optimization period [inferred here is a rebound test]); b. additional monitoring wells to improve the conceptual site model (CSM); and/or c. current remedy enhancements or consideration of more aggressive treatment technologies (in the event an upgradient "source area" is identified in the future).		
ADEQ COMMENTS				
GENERAL COMMENTS				
1		The subject report provides a good overview of monitoring results for calendar year 2020.		Acknowledged.
2		There are several sections of the report that describe activities that occurred prior to 2021. Please consider removing these sections in future reports.		Noted.
SPECIFIC COMMENTS				
3	Page 2, section 1.1, first paragraph.	The second sentence states that 73 percent of the plume is on ANPI property while the fourth sentence adds the railroad as a boundary and still quotes 73 percent. Does the railroad change the calculation?		Railroad ROWs are ANPI-owned property. The calculations presented in the text include this land. The text has been revised to eliminate the redundancy and only state the percentage once for clarity.

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4	Page 11, top paragraph.	The second sentence refers to a localized lens created by leaking pipes or overly-aggressive irrigation. This seems like speculation. Is it needed?		"unless a localized lens is created by piping leaks or overly-aggressive landscape irrigation" has been removed in Revision 1.0.
5	Page 11, first paragraph, last sentence.	It seems like this sentence should also refer to Figure A-6, which shows that MW-29 has been dry since 2003.		Added reference to Figure A-6.
6	Page 12, second paragraph, first sentence.	It isn't clear that the reference to Figure 7 is needed because the text refers to specific wells that aren't shown on the figure.		The reference to Figure 7 is removed from the first and second sentence in the second paragraph and moved to the third sentence.
7	Page 13, Section 2.2.2.	This is an example of text that describes activities that were completed prior to 2020. Consider removing this text from next year's report or move it to an appendix of historical activities.		Section 2.2.2. will be removed in future reports.
8	Page 14, first full paragraph, last two sentences.	This refers to sampling in 2017 and can be removed from future reports.		This discussion will be removed in future reports.
9	Page 15, first full paragraph, first sentence.	Is the 45 percent value shown on a figure?		Figure 6 depicts the ANPI boundary with PZ-B superimposed. The percent value is not provided on the Figure.
10	Page 15, last sentence.	Consider removing because it refers to sampling done in 2018.		Sentence removed in Revision 1.0
11	Page 16, third paragraph.	The values differ by less than one foot which isn't consistent with the "significant differences in elevation" referred to in the second sentence.		Removed "significant"

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12	Page 17, second paragraph.	Consider deleting this paragraph.		Removed in Revision 1.0
13	Page 18, section 2.3.4.	Consider deleting this section, it generally repeats information provided earlier.		Will consider deleting Section 2.3.4 in future reports.
14	Page 19, section 2.4.	Consider deleting this section.		Will consider deleting Section 2.4 in future reports.
15	Page 31, section 3.2.2, second sentence and third sentences.	Please check for consistency: 31,700,327 gallons / 365 days/yr / 24 hrs/day / 60 min/hr = 60 gpm (not 75 gpm).		This calculation as presented in Table 10 utilizes the reported weekly Parshall flume instant flow, consistent with past reports, and is not meant to provide an average flow rate (annualized to 60 gpm). Instantaneous flow exiting the ponds varies. During 2020 the Parshall flume meter was malfunctioning from February to July, in which time instant flow rate was estimated. While these estimated values may have biased the results, the flow rate using only the reported data when the totalizer was functioning in 2020 is also higher than the annualized average of 60 gpm. The text in Revision 1.0 has been revised to report the average of weekly readings without the use of the estimated values when the meter was down. This average is 70 gpm and has been updated in Table 10 and noted by an asterisk with further explanation.

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16	Page 37, last sentence.	The paragraph generally describes reduced pumping as the weather cools off. What does the "No increases in nitrate…" refer to?		In Revision 1.0 the text will be revised to state "No increases in nitrate-N concentrations in the effluent were observed near the discharge limit of 10 mg/l in CY 2020."
17	Page 34, section 3.4.2, last full paragraph.	Consider deleting this paragraph because it refers to discontinued activities.		Section 3.4.2 is on Page 43 and the last full paragraph contains details on 2020 activities. It's unclear what text this comment refers to and therefore the text will be retained in Revision 1.0.
18	Page 45 last paragraph, second to last sentence.	This sentence is confusing because it combines several concepts: mass and concentration, poor circulation, and aquifer heterogeneities. Either expand and clarify or delete this text.		The following sentence was removed in Revision 1.0 "Although nitrate-N in MW-17 declined during 2020, the mass in the vicinity of MW-35, and the increase in nitrate-N with depth in PB-7 and PB-4 is attributed to upgradient high concentrations that are lingering due to poor circulation and/or aquifer heterogeneities."
19	Page 46, first full paragraph, third sentence.	There is reference to a new irrigation well. Where is it located and might pumping from it influence flow direction?		This is registered well 55-231763 and is located to the northeast of the plume boundary, north of the San Pedro River. Figure 5 in Appendix G displays the location of this well. This well is registered to the same property owner as well D(18-21)06BAB that is scheduled for monitoring (water level only) in August 2021. Attempts will be made prior to the August PMP to contact the owner and request to collect a water level measurement in the new well D(18-21)06BAA and determine operational frequency and rate,

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				following which potential influence will be evaluated if this new well indicates an increase in yield on the property rather than a replacement of the former well
20	Page 46, first full paragraph.	Reference to the concentration of 11 milligrams per liter (mg/L) in a private well. This measurement is the first time that the nitrate concentration has exceeded 10 (mg/L) in 8 years. It might be prudent to resample the well to confirm the result.		The sample date of August 2020 was incorrect and has been changed to August 2019 in Revision 1.0. Table 7 results for this well were correct (see Response to Comment 22). Concentrations in this private well have remained below 10 mg/l during each quarterly sampling event since August 2019.
21	Page 49, section 3.5, second paragraph.	The sentence beginning "The eastern and western boundaries…" is incomplete.		This sentence was removed in Revision 1.0
22	Page 62, section 6.3, last sentence of first full paragraph.	The text indicates that the nitrate concentration in well D(18-21)06bcb was 11 mg/L in August 2020. Table 7 shows that value was measured in August 2019. Please check		Table 7 data has been verified. The text has been revised (see response to comment #20).