

Five-Year Review Report

Second Five-Year Report

For

Apache Powder Superfund Site

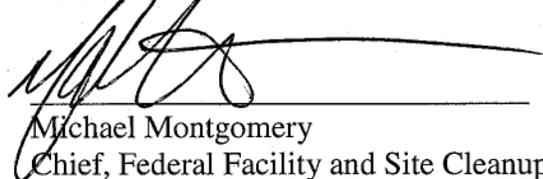
Cochise County, Arizona

September 2007

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Date:



9/25/07

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List of Acronyms

ADEQ	Arizona Department of Environmental Quality	MCL	Maximum Contaminant Level
		μ/L	micrograms per liter
ADHS	Arizona Department of Health Services	mg/kg	milligrams per kilogram
		mg/L	milligrams per liter
ADWR	Arizona Department of Water Resources	MNA	monitored natural attenuation
		NARS	Northern Area Remediation System
ANP	Apache Nitrogen Products, Inc.	NPL	National Priorities List
ARARs	Applicable or Relevant and Appropriate Requirements	O&M	operation and maintenance
		OBOD	Open Burn/Open Detonation
CD	Consent Decree	ppb	parts per billion
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	RCRA	Resource Conservation and Recovery Act
		RI	Remedial Investigation
CFR	Code of Federal Regulations	ROD	Record of Decision
COC	chemicals of concern	SLERA	Screening-Level Ecological Risk Assessment
DNT	dinitrotoluene	SRL	soil remediation level
EPA	United States Environmental Protection Agency	TBC	to be considered
		TNT	trinitrotoluene
ESD	Explanation of Significant Differences	TOSA	Temporary On-site Storage Area
FS	Feasibility Study	UAO	Unilateral Administrative Order
LCU	laterally-confining unit		
MCA	Molinos Creek sub-Aquifer	UXO	unexploded ordnance

Executive Summary

This report documents the second five-year review (2nd FYR) of the Apache Powder Superfund Site (the Site) in Cochise County, Arizona. The first five-year review (FYR) was completed in September 2002 and triggered by the 1997 construction of the Northern Area Remediation System (NARS). The remedy for the Site includes capping of contaminated soils and sediments on site, institutional controls, monitored natural attenuation of contaminated groundwater in the Southern Area of the Site, and pump and treatment of contaminated groundwater in constructed wetlands in the Northern Area of the Site.

EPA concludes in this second FYR that the remedy is protective in the short term for both groundwater and soils because there is no evidence that there is current exposure. However, in order for the remedy to remain protective in the long-term, Institutional Controls (ICs) must be put in place restricting access to the contaminated shallow aquifer for drinking water purposes and restricting access to pond soils on-site where residual contamination has been capped.

The remedies completed to date were constructed in accordance with the requirements of the Record of Decision (ROD) and subsequent amendments and Explanation of Significant Differences (ESDs) and are functioning as designed. ANP is operating and maintaining the remedies appropriately. No construction or operation and maintenance (O&M) deficiencies were noted that currently impact the protectiveness of the remedy.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from WasteLAN): Apache Powder Superfund Site		
EPA ID (from WasteLAN): AZD008399263		
Region: IX	State: AZ	City/County: Benson/Cochise
SITE STATUS		
NPL status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
Remediation status (choose all that apply): <input checked="" type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input checked="" type="checkbox"/> Complete		
Multiple OUs?: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Construction completion date: NA	
Has site been put into reuse? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
REVIEW STATUS		
Lead agency: <input checked="" type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency _____		
Author name: USACE HTRW CX and U.S. EPA, Region 9		
Author title:	Author affiliation: USACE HTRW CX	
Review period:** September 2002 to September 2007		
Date(s) of site inspection: 02 / 26 / 2007		
Type of review:	(Statutory)	
	<input checked="" type="checkbox"/> Post-SARA <input type="checkbox"/> Pre-SARA <input type="checkbox"/> NPL-Removal only	
	<input type="checkbox"/> Non-NPL Remedial Action Site <input type="checkbox"/> NPL State/Tribe-lead	
	<input type="checkbox"/> Regional Discretion	
Review number: <input type="checkbox"/> 1 (first) <input checked="" type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____		
Triggering action:		
<input type="checkbox"/> Actual RA Onsite Construction at OU # _____	<input type="checkbox"/> Actual RA Start at OU# _____	
<input type="checkbox"/> Construction Completion	<input checked="" type="checkbox"/> Previous Five-Year Review Report	
<input type="checkbox"/> Other (specify)		
Triggering action date (from WasteLAN): 09 / 30 / 2002		
Due date (five years after triggering action date): 09 / 30 / 2007		

* [For this site Operating Units are identified as Media Components]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

1. Long-term ICs have not been implemented yet for the groundwater or soils remedies.
2. The groundwater model for the Northern Area needs to be updated with new data.

Recommendations and Follow-up Actions:

1. To implement groundwater ICs, the Alternate Domestic Water Supply Plan needs to be updated to outline procedures for responding to discovery of any contaminated shallow aquifer drinking water supply wells. A corresponding Community Outreach Plan needs to be prepared to describe procedures for notifying the community about changing groundwater conditions as the cleanup proceeds. A Declaration of Environmental Use Restriction (DEUR) or equivalent restriction needs to be placed on the ANP property for drinking water use of the shallow aquifer.
1. To implement soils ICs, a DEUR needs to be placed on the ponds capped in 2007 which contain residual contamination above cleanup levels.
2. In the Northern Area, sufficient data needs to be collected from the recently installed monitoring wells and the new data needs to be incorporated into an updated groundwater model.

Protectiveness Statement:

All immediate threats at the Site have been addressed. The remedy is protective in the short term for both groundwater and soils because exposure pathways that could result in unacceptable risks are being controlled. In order for the remedy to remain protective in the long-term, Institutional Controls (ICs) must be put in place restricting access to the contaminated shallow aquifer for drinking water purposes and restricting access to pond soils on-site where residual contamination has been capped.

Other Comments:

The Site is well maintained and effectively operated.

1.0 Introduction

EPA has conducted a five year review of the remedial actions implemented at the Apache Powder Superfund Site (Site), in Cochise County, Arizona. To assist EPA, the U.S. Army Corps of Engineers (USACE) prepared a detailed Technical Analysis, Remedy Operation and Status, 2002 – 2007, to support this second Five Year Review Report. The purpose of this second review is to determine whether the remedy at the Site is protective of human health and the environment. The methods, findings, and conclusions of this review and the first review are documented in the Five-Year Review Reports. This review also identifies issues, if any, found during the review, and recommend actions to address these issues.

This review is required by Federal statute. EPA is preparing this second Five-Year Review report pursuant to CERCLA Section 121(c), as amended, and the National Contingency Plan (NCP). CERCLA Section 121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section (104) or (106) of this title, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Agency interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR Section 300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action.

This review has been completed because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unrestricted use and unlimited exposure. The triggering action for this review was the prior five year review completed in September 2002.

The review was completed during the period of February through August 2007. It covers eight areas of concern that have been identified at the Site: seven media components and one area where a removal action was taken. This Report documents the results of the review.

2.0 Site Chronology

Table 2-1 provides a chronology of events at the Site

Table 2-1: Chronology of Site Events	
Event	Date
Apache Powder Company (APC) began manufacturing industrial chemicals and explosives at the Site	1922
APC discharged facility wastewater to dry washes that discharged into San Pedro River	1922 to 1971
Dye Carbonics operated a carbon dioxide plant at the Site	1973 to 1979
APC discharged facility wastewater into unlined evaporation ponds	1971 to 1995
Arizona Department of Health Services (ADHS) identified the Site as a potential problem	1979
EPA proposed listing of Site on National Priorities List (NPL)	1986
Preliminary investigation performed; San Pedro River hot-spot identified	1987
EPA issued special Notice Letter to APC notifying it of its liability and offering the opportunity to conduct a remedial investigation/feasibility study (RI/FS)	1988
EPA issued a UAO for RI/FS	1989
ANP supplied bottled water to residents with nitrate-contaminated wells	1989
EPA listed Site on NPL	1990
EPA assumed federal lead for Site cleanup	1993
EPA directed ANP to remove approximately 262 drums containing DNT and approximately 60 cubic yards of DNT-contaminated soils from Wash 3, where they were stored in a temporary on-site storage area (TOSA)	1993
ANP completed draft RI/FS Report	1994

Table 2-1: Chronology of Site Events	
Event	Date
EPA assumed federal lead to complete FS	June 1994
ADEQ and ANP signed State Consent Decree (CD) to bring ANP into compliance with state air regulations, Resource Conservation and Recovery Act (RCRA) hazardous waste requirements, and aquifer protection permit (APP) requirements	June 1994
Record of Decision (ROD) signed by EPA	September 1994
ANP constructed eight deep aquifer replacement wells for households using bottled water	October 1994
State CD became effective	November 1994
EPA issued Unilateral Administrative Order (UAO) for cleanup of groundwater and soils	December 1994
ANP agreed to implement EPA RD/RA UAO and assumed lead	January 1995
ANP began start-up testing of brine concentrator for treatment of process wastewater	February - March 1995
Full scale start-up of brine concentrator to treat wastewater	April 1995
EPA signed Explanation of Significant Differences (ESD) #1	1996
ANP constructed Northern Area Remediation System (NARS)	1997
State CD closed OBOD Area	March 1997
ANP discovered TNT-Contaminated Area	August 1997
Perchlorate investigation completed; ANP detected perchlorate in perched and shallow aquifer groundwater and shallow soils.	November 1998
NARS in establishment phase	1998 to 2001
ANP completed a Unexploded ordnance (UXO) survey of TNT-Contaminated Area	February 1999

Table 2-1: Chronology of Site Events

Event	Date
EPA issued a Time-critical Removal Action Memorandum for removal of TNT-contaminated soils under the UAO sections for 'Other Response Actions' and 'Endangerment and Emergency Response'	November 1999
ANP conducted TNT preburn	December 1999
ANP remediated Media Components 4 (White Waste Materials and Drum Storage Area), 5 (Wash 3 Area), and 7 (Drums located outside Wash 3 Area); contaminated soils are removed from these areas and the TNT-Contaminated Area	January 2000 to June 2000
ANP completed Removal Action Implementation Report issued for TNT-contaminated Area and Remedial Implementation Report for Media Components 4, 5, and 7	August 2000
EPA issued ESD #2	September 2000
ANP prepared Remediation Implementation Report for Media Component 3 (Inactive Ponds 4A, 4B, 5A, 5B, 6A, 6B, 7, 8, and Dynagel Pond)	February 2001
ANP conducted San Pedro River water quality follow-up sampling	October 2001
ANP commenced NARS start-up testing for the season	June 2002
EPA conducted follow-up San Pedro water quality sampling	July 2002
ANP conducted an investigation to further characterize the lateral confining unit (LCU) in the Southern Area shallow aquifer and the source of the nitrate hot-spot in the San Pedro River in the Northern Area	September 2002
EPA completed first Five-Year Review Report	September 2002
EPA approved NARS discharge treatability study plan	November 2002
ANP completed Characterization of Groundwater Systems in Southern Area Report	June 2003
ANP completed Applicability of Monitored Natural Attenuation (MNA) Report	July 2003

Table 2-1: Chronology of Site Events	
Event	Date
ANP completed Supplemental Feasibility Study for Media Component 2B (Southern Area Groundwater)	August 2003
ANP completed Summary of Soil Analytical Data Report	February 2004
ADEQ completed risk assessment evaluations for selected inactive and formerly active ponds on the Site that are no longer in use, but contained residual concentrations of certain metals (arsenic and beryllium) at levels exceeding the SRLs	August 2004
ANP completed Screening Level Ecological Risk Assessment (SLERA)	November 2004
ANP completed Supplemental Feasibility Study Report for Pond Soils and Sediments	April 2005
EPA signed ROD Amendment	September 2005
ANP completed a RD/RA Work Plan for Pond Soils and Sediments (CERCLA Media Components 3 and Formerly Active Ponds)	February 2006
ANP completed Comprehensive Northern Area Characterization Workplan	August 2006
ANP completed Southern Area Remedial Design Workplan to install groundwater monitoring network for MNA remedy	September 2006
ANP completed Southern Area Characterization Report	March 2007
ANP completed Southern Area Performance Monitoring Plan	August 2007
ANP completed re-grading and capping of ponds with residual soils contamination	August 2007

3.0 Site Background

The Apache Powder Superfund Site encompasses an area of approximately 9 square miles located in Cochise County, approximately 7 miles southeast of Benson, Arizona. The Apache Nitrogen Products facility property comprises approximately 1,000 acres of land. There are privately owned residences located north of the ANP property, with the nearest residence less than a quarter mile from the facility. Approximately 1,100 people depend on wells for drinking water within three miles of the ANP facility. The San Pedro River flows north-northwest along the eastern portion of the Site from the southeast corner of the ANP property. This river is a significant riparian region. The study area referred to herein extends approximately 0.5 mile east to over 3 miles northwest beyond ANP property boundaries.

Major land uses within the vicinity of the industrial site include low-density residential, and agricultural. An estimated 150-200 people live in the study area. There is the potential for future population increase in the St. David/Benson community. The primary undeveloped landscape consists of high desert chaparral, mesquite bosques, and riparian cottonwood stands that line the primary drainages including the San Pedro River.

3.1 Physical Characteristics

Two aquifers are identified in the subsurface of the study area, a shallow, near-surface aquifer contaminated by nitrate, and a much deeper, uncontaminated aquifer. The two aquifers are separated by the thick, relatively impermeable Saint David Formation. Detailed hydrogeologic and physical descriptions of the Site, including the Site regional hydrogeology and geology, drainage, climate, land and resource use can be found in the Technical Analysis, Remedy Operation and Status, 2002 – 2007, prepared by the U.S. Army Corps of Engineers.

The deep aquifer is a source of process water for ANP operations. Three production wells currently supply water for ANP. A fourth production well, ANP-2, was abandoned in 1999. The deep aquifer is also the source of drinking water for all the private domestic drinking water wells located on property over the contaminated shallow aquifer or within a conservative buffer zone of it. The Arizona Department of Water Resources coordinates closely with Arizona Department of Environmental Quality and EPA to make sure that all new drinking water supply wells in the vicinity of the contaminated plume are installed in the deep aquifer with adequate construction methods to prevent any potential cross-contamination between the two aquifers.

3.2 History of Contamination

Apache Powder Company, now known as Apache Nitrogen Products, Inc. (ANP), commenced operations in 1922. Explosives were manufactured at the ANP facility and wastewater was discharged to unlined ponds and tributary washes. ANP disposal activities are the source of the nitrate contamination in the shallow aquifer underneath the ANP property in the Southern Area, in the Northern Area adjacent to and immediately downgradient of the ANP property, and in the San Pedro River. No nitrate contamination has been found in the deep aquifer lying beneath a thick aquitard under the shallow aquifer. In 1998, perchlorate was discovered in the groundwater in the Southern Area in the perched zone and in the adjacent shallow aquifer.

3.3 Initial Response

In response to the discovery of nitrate-contamination in the shallow aquifer during the 1987 Preliminary Investigation of the Site, ANP provided bottled water to eight households whose drinking water supply wells were removed from service in 1989. ANP replaced these contaminated wells with deep aquifer wells in 1994.

In 1990, ANP was placed on the NPL. In June 1992, EPA and ADEQ agreed to split each agency's respective roles to ensure that the clean-up activities performed by ANP were comprehensive and duplicative requirements were not imposed by the agencies. ADEQ assumed responsibility for ANP's compliance with State requirements for aquifer protection, air quality, and hazardous waste management under RCRA. EPA, in turn, assumed responsibility for overseeing ANP's cleanup of historical contamination at the Site. The discussion in this FYR focuses on the activities overseen by EPA. During the 1990s, investigations were conducted of various areas with soils contamination at the Site. Initially, three areas of soils contamination were identified and several other areas were later discovered. In 1999-2000, most areas with soils contamination were cleaned up. Contaminated soils located in drums or in surface soils were excavated and removed for treatment and disposal. The soils in one area contaminated with TNT were pretreated on site (by burning) and subsequently shipped off-site for final disposal.

Of the ponds that received discharges of wastewater from the plant operations, ANP is currently re-grading and capping all the ponds with residual levels of contamination above EPA's selected cleanup standards. Some of these ponds were classified as "inactive" ponds and are being remediated under EPA's CERCLA UAO. Other ponds which were still in use in the early 1990s at the time of the ROD are classified as "active" ponds and are being remediated under the State CD.

3.4 Basis for Taking Action

Hazardous substances and pollutants or contaminants released at the Site by media component include:

Perched Groundwater: Arsenic, Fluoride, Nitrate and Perchlorate

Shallow Aquifer Groundwater: Nitrate and Perchlorate in Southern Area; Nitrate only in Northern Area

San Pedro River Surface Water: Nitrate only

Inactive Pond Soils: Antimony, Arsenic, Barium, Beryllium, Chromium, Lead, Manganese, and Nitrate

White Waste Area: Nitrate and Arsenic

Drum Storage Area: Vanadium Pentoxide, Cooling Tower Ceramic Packing Material (later determined non-hazardous)

Wash 3 Area (excluding Open Burn Open Dump (OBOD) Area: 2,4-Dinitrotoluene (DNT), 2,6 DNT, Lead and Paraffins (present as a result of DNT decomposition; later determined non-hazardous

Stained Soil Areas: DNT, Paraffins (later determined non-hazardous)

DNT Drums Located Outside of Wash 3 Area: 2,4-DNT, 2,6-DNT

Trinitrotoluene (TNT)-Contaminated Area: TNT, 2,4-DNT, 2,6-DNT, and 1,3,5-Trinitrobenzene

4.0 Remedial Actions

The September 1994 Record of Decision (ROD) for the Site originally identified five media components:

- Media Component 1: Perched Groundwater Aquifer
- Media Component 2: Shallow Groundwater Aquifer (later subdivided to Northern and Southern Areas)
- Media Component 3: Inactive Ponds
- Media Component 4: White Waste and Drum Storage Area
- Media Component 5: Wash 3 Area (Excluding the Open Burn/Open Detonation Area)

Subsequently, the following additional areas of concern were discovered at the Site:

- Media Component 7: Other Drums located outside of Wash 3 Area
- Removal Action: Tri-nitrotoluene (TNT) Contaminated Area

Media Component 6 is not discussed in either the first or second review because it does not identify a specific area of concern, but instead required additional investigative groundwater studies.

The ROD required implementation of following remedial actions:

- Use of a brine concentrator to treat plant process wastewater for total dissolved solids, including nitrate, fluoride, and arsenic.
- Extraction of nitrate contaminated shallow ground water and the construction of a wetlands system (using biological treatment) to treat the water.
- On-site containment (capping) of contaminated soils in the "Inactive Ponds."
- Excavation and off-site treatment and disposal of contaminated soils (arsenic and dinitrotoluene [DNT]) from the White Waste Material and Drum Storage Area.

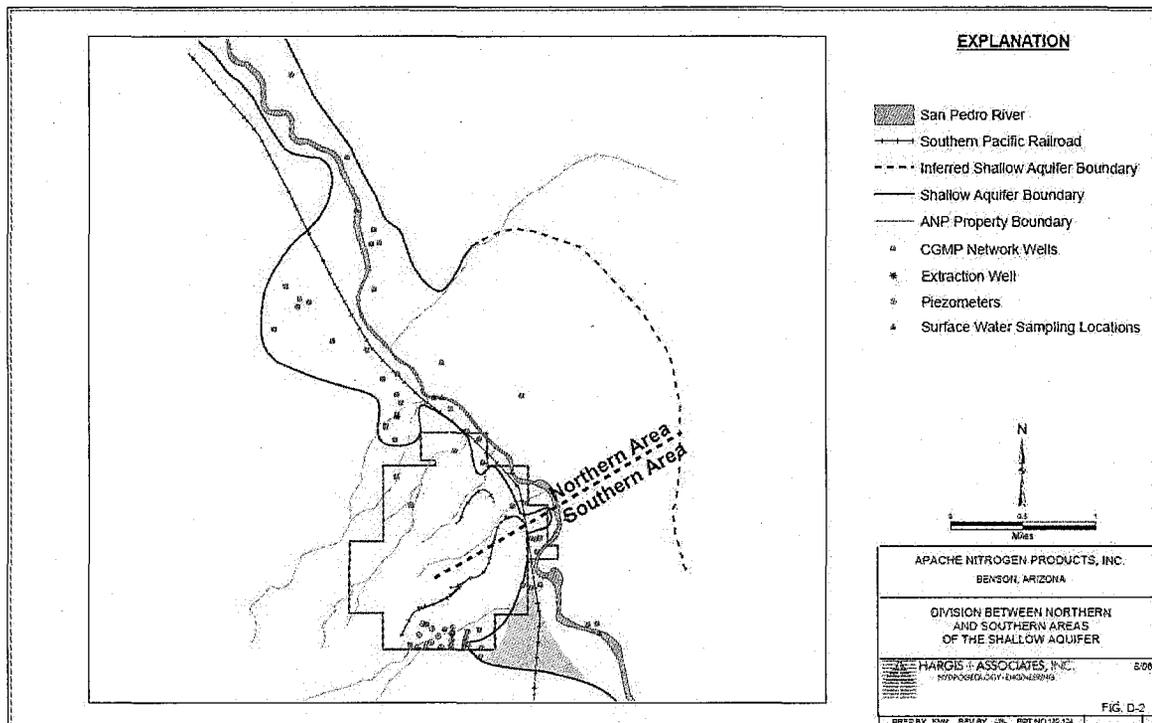
- Excavation and off-site treatment and disposal of the lead- and DNT- contaminated soils from the Wash 3 Area.

In 1996, EPA signed Explanation of Significant Difference (ESD) #1 which divided the Site remedy for the shallow aquifer groundwater contamination into two areas: a Northern Area and a Southern Area. This ESD allowed treatment of the shallow aquifer in separate areas and allowed for other design modifications to the wetlands system.

In 2000, EPA signed ESD #2 which established cleanup standards for metals that were not included in the 1994 ROD. This second ESD allowed “No Further Action” for soils media components where hazardous substances were not detected or where levels of contaminants did not exceed cleanup standards. ESD #2 also established an additional Media Component #7 - Other Drums because of the discovery of additional drums outside of Wash 3.

In 2005, EPA signed a ROD Amendment which changed the remedy for the cleanup of Southern Area Groundwater from the use of constructed wetlands to monitored natural attenuation (MNA). It also specified the institutional controls (ICs) needed and indicated that future use would be non-residential. A Declaration of Environmental Use Restriction (DEUR) is planned for the ANP facility for the ponds with residual soils contamination. A DEUR or equivalent regulatory restriction is also required by the ROD Amendment to prevent use of the contaminated shallow aquifer groundwater underneath the ANP facility.

The Remedial Action Objectives (RAOs) for the Site were identified in the 1994 Feasibility Study (FS) and referenced in the 1994 ROD.



4.1 Remedy Implementation

Alternative Water Supply

The RI/FS indicated that nitrate had impacted the shallow aquifer. Eight private wells on private properties located adjacent to the ANP facility exceeded drinking water standards for nitrate. To protect public health, at EPA's direction, ANP prepared an Alternate Domestic Water Supply Plan and in 1994 replaced the eight contaminated shallow aquifer drinking water wells with deep aquifer wells. Water quality sampling of the replacement wells over the first 2 years following installation indicated exceedances of the arsenic and fluoride MCLs in one well. However, the fluoride and arsenic in the deep aquifer are naturally occurring, based on analytical data from the shallow aquifer near the replacement well and because of evidence of a strong upward hydraulic gradient in the deep wells. As a good will gesture, ANP installed point-of-use reverse osmosis (RO) water treatment systems on the kitchen taps of the three households served by the well. Residents are responsible for the operation and maintenance (O&M) of these RO systems. Water quality samples were collected from the three RO units in 1995 and 1996 and analyzed for fluoride and arsenic. No MCLs were exceeded. A detailed discussion of the well replacements and the results of the sampling and RO filter installation are in the first FYR.

To determine if the remedy continued to be protective, in March and April 2006, EPA sampled the eight deep aquifer replacement wells. The data results are included in the technical memorandum *Water Quality Sampling and Analysis of Deep Aquifer Replacement Domestic Wells* (CH2M Hill). All nitrate concentrations were below the maximum contaminant level (MCL) for drinking water of 10 parts per million (ppm). Perchlorate was not detected in any of the deep aquifer replacement wells and has never been detected in the deep aquifer in the vicinity of the ANP facility. Arsenic concentrations were similar to those observed in the previous sampling (i.e. between the former MCL of 50 parts per billion (ppb) and the revised MCL of 10 ppb). As discussed above, arsenic occurs naturally at these concentrations in the deep aquifer. Arsenic in the deep aquifer replacement wells is not considered a release from the Site and is not considered further in this FYR. Additionally, ANP provides bottled water to two shallow aquifer well owners who retained connections to the shallow aquifer wells for agricultural purposes. Information gathered by ANP indicates that the water from the wells is not being used for drinking water purposes.

Media Component 1: Perched Groundwater Zone

Media Component 1 comprises the perched groundwater zone underlying the south end of the ANP property in the vicinity of the evaporation ponds, known as the Formerly Active Ponds. The 1994 ROD identified this perched groundwater to be impacted with nitrate, arsenic, and fluoride as a result of seepage of wastewater from the ponds. The remedy selected for this area was extraction of the perched groundwater and treatment by the brine concentrator. As described in detail in the first FYR Report, in April 1995, ANP ceased discharge of process wastewaters to the evaporation ponds. As a result, the perched zone was dewatering rapidly. Instead of treatment in the brine concentrator, the 1996 ESD #1 allowed treatment of the perched groundwater in a wetlands system. However, in 1997 when perchlorate was discovered in the Southern Area perched groundwater zone and the adjacent shallow aquifer, EPA required ANP

to conduct additional characterization and investigation activities in the perched system and adjacent shallow aquifer and re-evaluate remedy alternatives for this area.

Remedial design investigations throughout 1999 and 2000 identified the Apache Wash paleochannel as the pathway for the discharge of the perched zone to the adjacent southern shallow aquifer. Studies conducted by ANP identified a lateral confining (LCU) unit which separates the perched zone from the shallow aquifer of alluvium associated with the San Pedro River (Hargis 2006). It was identified by the use of seismic studies, and a series of exploratory boreholes designed to determine the LCU's extent and characteristics. The LCU is believed to be a paleo-feature representing either lateral overbank deposits from the ancestral Molinos Creek and San Pedro River, or a buried erosional remnant of the St. David Formation. In either case, its contrasting hydraulic properties with the adjacent alluvium provide hydraulic separation between two regions of groundwater flow within the shallow aquifer informally named the 'Molinos Creek sub-Aquifer' or 'MCA' and the San Pedro Aquifer. At one time, it was believed that groundwater could be exchanged between the MCA and SAN PEDRO AQUIFER via slow seepage through the LCU. However, with the construction of monitor well MW-33 and with continued monitoring of groundwater levels and various water quality parameters, it was determined any exchange of water between the two units is unlikely (Hargis 2006).

The original perched zone is now almost completely dewatered because of minimal recharge to the perched groundwater. Because the perched zone has largely been dewatered, the potential of contaminant migration to the shallow aquifer is minimized. Most of the residual groundwater in the perched zone has either been extracted by ANP or has migrated into and is now isolated in the MCA. Recent investigations now indicate that the MCA is split into a southern and northern lobe by the LCU. The source of water for each lobe appears to be different. The Southern lobe appears to have been fed by Wash 6 and the Northern lobe by the perched zone underneath the evaporation ponds. Both lobes in the MCA have been dewatering since ANP stopped discharging water into the ponds and washes.

Media Component 2: Shallow Aquifer Groundwater

The 1994 ROD prescribed extraction of shallow groundwater, followed by treatment through constructed wetlands. Subsequent to the ROD, the shallow aquifer groundwater was divided into two areas, the Northern and Southern Areas. The Northern Area is generally located north of the ANP property in the vicinity of shallow aquifer monitor wells MW-17 and MW-18. The Southern Area is located in the southeast portion of the ANP property in the vicinity of shallow aquifer monitor well MW-15.

After the discovery of perchlorate in the perched zone and the adjacent shallow aquifer in 1998, additional studies were conducted to investigate the extent of perchlorate contamination and migration from these areas into the adjacent MCA and the San Pedro River. These investigations (Hargis) found the following:

- Natural conditions have worked to contain and hydraulically isolate contamination in Southern Area.

- MNA is an effective remedy for both nitrate and perchlorate, and nitrate and perchlorate-reducing bacteria were found to be present in the Southern Area.
- Natural processes are expected to achieve remedial objectives in a reasonable time, with modeling simulations indicating that it will take 29 years or less for contaminant concentrations to reach EPA's cleanup standards.
- Perchlorate was not detected in the San Pedro River and had not migrated beyond the Southern Area perched zone and adjacent MCA.

In accordance with these findings, the ROD was amended in 2005 as follows:

- Changed the remedy for the cleanup of Southern Area Groundwater (contaminated with nitrate and perchlorate) from pump and treat with constructed wetlands treatment to monitored natural attenuation and continue the use of institutional controls.
- Selected a groundwater cleanup standard for perchlorate.

The Amended ROD also identified two locations for discharge of the treated wetlands effluent: a primary location where the effluent was to be discharged when nitrate concentrations were below the discharge limit of 10 ppm; and a secondary location where the wetlands effluent could be discharged if above the discharge limit. The ROD Amendment documented the limitation of the discharges of treated effluent at the primary discharge location to 10 ppm nitrate or below at all times and allowed discharge of the effluent at the secondary discharge location up to 20 percent of the time. The ROD Amendment also exempted the discharges of e-coli in the effluent from meeting total counts of coliform because the e-coli were not a result of humans but from the use and visitation of wildlife to the wetlands.

Northern Area Shallow Aquifer Remedy (2A)

The shallow extraction well #1 (SEW-1) and wetlands treatment system known as the Northern Area Remediation System (NARS) was constructed in 1997 to remediate nitrate-N-contaminated shallow aquifer groundwater in the Northern Area. The NARS is located in the northwest area of the ANP property boundary. Details of the NARS system, including activities conducted during the establishment, limited-scale startup, and full-scale startup, are included in the first FYR (Section 4.3.2).

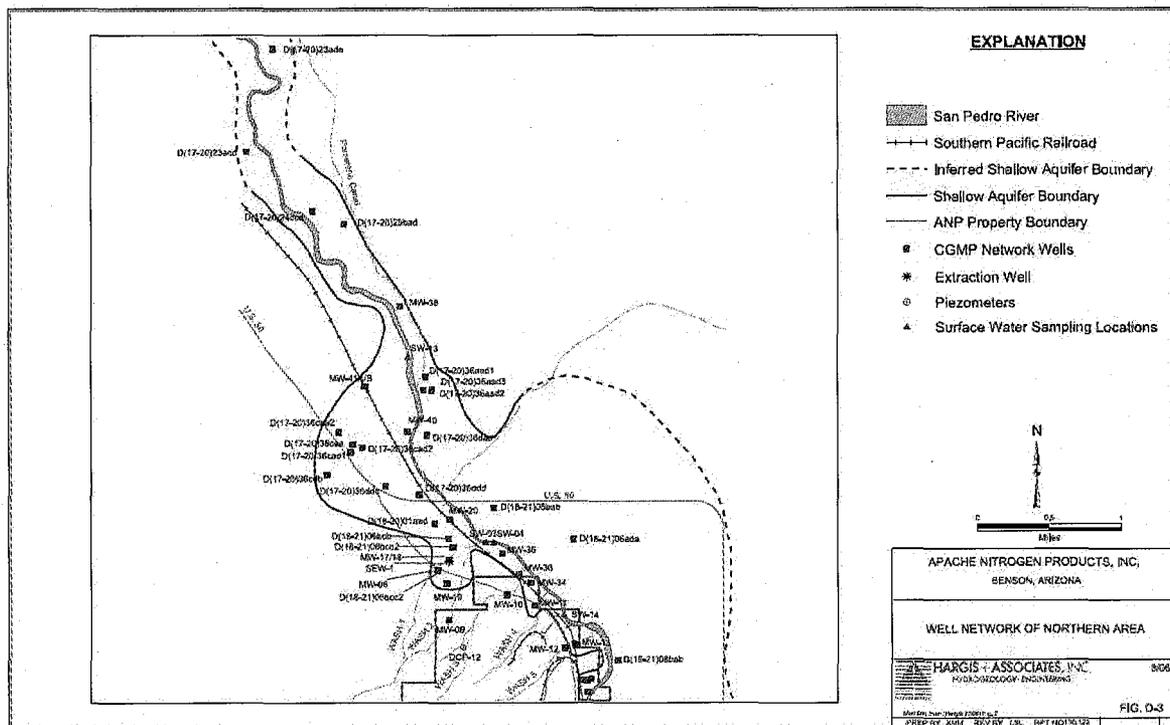
The establishment phase was originally estimated at 2 years. However, due to a number of unforeseen events, the first establishment phase included the time period from September 1997 through June 2001. There was a limited-scale startup from June 2001 to November 2001 that ended when the wetland vegetation (cat tails) entered winter dormancy. Additional establishment phases were performed in 2002, 2003, and 2004, with limited start-up phases in the fall of each year. Limited start-up phases allowed effluent discharges to the secondary discharge location.

In May 2005, sufficient data had been compiled indicating that the NARS was reliably treating nitrate down to the nitrate cleanup standard and full-scale startup and operation began in June 2005. When full scale start up began the NARS-treated effluent began to be discharged at the primary discharge location in Wash 3, in close proximity to the shallow aquifer and the San

Pedro River. The average effluent discharge since June 2005 has been below 5 ppm nitrate >80% of the time, and below 10 ppm nitrate >95% of the time. Nitrate concentrations in the wetlands influent decreased over 2005 and stabilized in 2006 in the 140-180 ppm range.

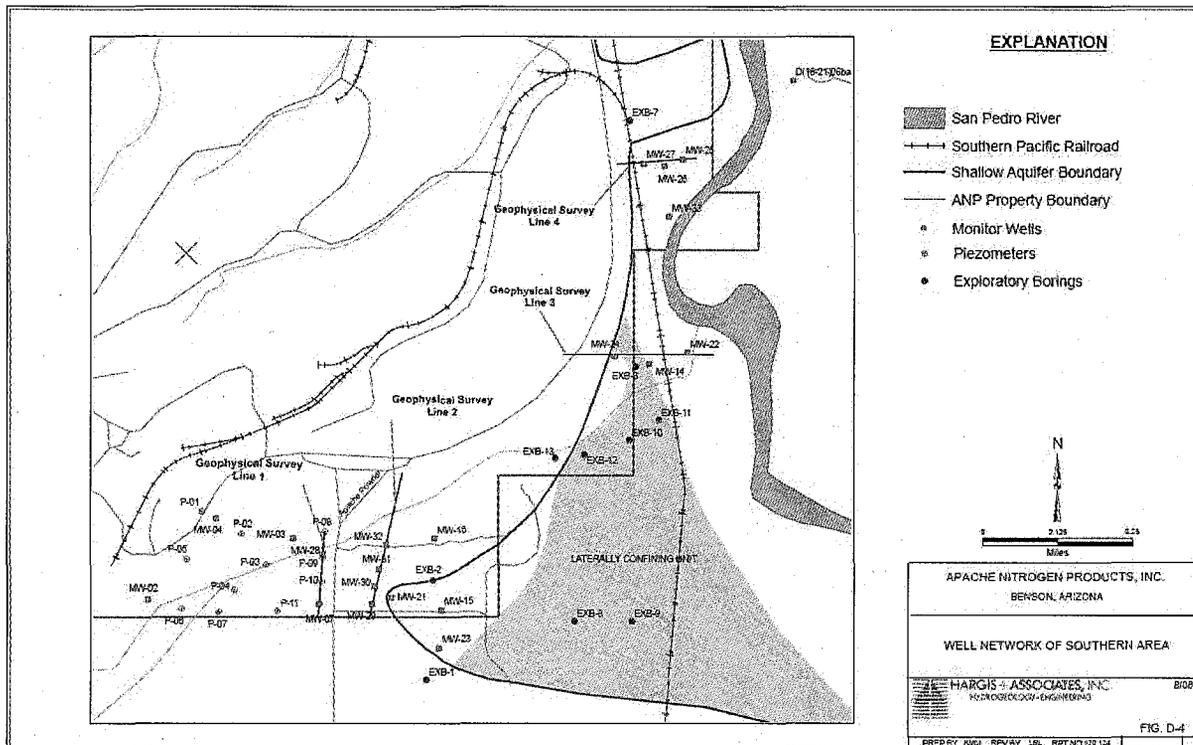
It does not appear that the single extraction well SEW-1 will capture the entire nitrate plume that exceeds 10 parts per million (ppm). There is a relatively low concentration portion of the plume that has migrated downgradient and beyond the capture zone of SEW-1. Results of groundwater monitoring do not indicate a risk to drinking water receptors. That portion of the plume is being monitored and evaluated for monitored natural attenuation.

In 2005 the EPA in response to community comments on the ROD Amendment, conducted additional investigative studies in the Northern Area. In January 2006, EPA hired outside experts to complete a hydrogeologic evaluation of whether pumping of the extraction well SEW-1 was causing potential leakage between the deep and shallow aquifers via old or poorly constructed wells. The experts concluded in their September 2006 report "Assessment of Hydrologic Conditions near the Apache Powder Superfund Site, Benson Arizona" (USACE, 2006) that SEW-1 is not causing leakage between the two aquifers. However, they recommended the collection of some additional data to further validate these findings. During November and December 2006, water quality data and temperature data were collected from SEW-1 and nearby wells. At the time of temperature data collection in December 2006, several deep wells that had previously ceased to flow to the surface, were found to again have natural water levels that were above the ground surface. Also, SEW-1 was shutdown for two weeks in December 2006 and early January 2007 to test whether there was evidence of any hydraulic connection between aquifers. The results of this data collection effort confirmed that the two aquifers are separate and pumping of SEW-1 is not influencing water levels in nearby private deep aquifer wells.



Southern Area Shallow Aquifer Remedy (2B)

ANP is proceeding to implement monitored natural attenuation (MNA) in the Southern Area as required by the 2005 ROD Amendment. During 2006 and early 2007, ANP conducted various field activities in the Southern Area to further characterize the Southern Area, in particular the MCA, to design and locate wells for the MNA monitoring network. In Summer 2006, when a borehole was drilled to install a monitoring well in the Southern area, no groundwater was found. This location had previously been thought to be part of a hydraulically separate aquifer named the Molinos Creek Sub-Aquifer (MCA). In December 2006, 10 additional exploratory boreholes were installed in the Southern Area to further refine the extent of contaminated groundwater in the MCA. Water quality samples were also collected from these boreholes. The results indicated that water levels and nitrate and perchlorate concentrations were continuing to drop in the MCA; and the lateral boundaries of the MCA are much smaller than originally thought. Most recently, in 2007, nitrate and perchlorate concentrations in monitoring well MW-24, the northern most monitoring point in the MCA, have dropped to below EPA's cleanup standards. These findings further confirm the hydraulic isolation of the MCA groundwater from the shallow aquifer associated with the San Pedro River. These findings also indicate that the MCA may have been created "artificially" by the discharge of ANP's plant washdown waters to washes and unlined evaporation ponds. Now, 10 years after ANP installed the brine concentrator to treat these process wastewaters and ceased these discharges, the MCA appears to be drying up. With the dropping water levels and lower contaminant concentrations in the MCA, the MNA remedy for the Southern Area may achieve the selected cleanup standards in less time than originally estimated.



Media Component 3: Inactive Ponds

Media Component 3 includes nine unlined ponds at the ANP site that have been classified as “inactive.” This includes Ponds 4A, 4B, 5A, 5B, 6A, 7, 8, and the Dynagel Pond. Only the Dynagel Pond and Pond 7 are under EPA oversight; therefore, only these ponds were evaluated in this FYR. The status of the Formerly Active Ponds 4A, 4B, 5A, 5B, 6A, and 8, which are being remediated under the State Consent Decree.

The 1994 ROD remedy required capping the inactive ponds with clay caps. It also required implementation of institutional controls so that future use of the Site was compatible with the remedial goals and the integrity of the clay caps was maintained. Because of the 1994 ROD requirements to cap the inactive ponds, at the time, EPA did not establish soils cleanup levels for nitrate and the metals detected in the inactive ponds soils. Later soils sampling conducted after the ROD indicated that many of the inactive ponds were not contaminated and did not require capping. To correct this, ESD #2 established the following:

- Modified soil clean-up remedies to “No Further Action” for selected soil media components where hazardous substances were not detected or levels of contamination did not exceed EPA selected clean-up standards. This allowed ANP not to cap any pond which did not exceed standards.
- Cleanup standards for compounds or COCs that had been discovered since the ROD or for which the ROD did not establish clean-up standards.

The clean-up standards set forth by ESD #2 included standards for the metals identified in Pond 7 and the Dynagel Pond.

The characterization of the sediments and soils in the ponds was performed during three different events: the preliminary investigation, RI, and Remedial Design investigation. The details of the results of these investigations are included in Section 4.4.2 in the first FYR report and *Remedial Action Implementation Report for Media Component 3 (Inactive Ponds) (Hargis)*. The data for Pond 7 and the Dynagel Pond from the combined investigations indicated that one or more soil samples from Pond 7 and the Dynagel Pond contained arsenic, antimony, and beryllium above the State of Arizona residential soil remediation levels (SRLs). Pond 7 had one sample with an exceedance of the lead SRL, which (combined with the other results) was deemed an outlier; therefore, lead was not carried forward as a potential COC.

In 2004, ADEQ conducted a site-specific statistical risk evaluation of metals in certain ponds on the Site (ADEQ, 2004). This risk evaluation focused on the COCs beryllium, antimony, and arsenic. The risk evaluation was based on a toxic threshold for beryllium of 150 mg/kg in accordance with current EPA Region IX PRGs and recent evaluations by ADEQ (ADEQ, 2004). The concentrations of beryllium found in Ponds 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 beryllium residuals were well below the threshold considered for the risk evaluation. In addition, the beryllium SRL was officially raised as of March 2007 to 150 mg/kg. The concentrations of arsenic and antimony were statistically evaluated to determine the 95 percent UCL for antimony at Dynagel Pond and for arsenic at Pond 7 and the Dynagel Pond. The analysis for antimony

yielded a 95 percent UCL lower than the residential SRL for antimony; therefore, no additional risk-based evaluation was deemed necessary.

The 95 percent UCL for arsenic concentrations at Pond 7 and the Dynagel Pond exceeded the background concentration of 19.2 mg/kg, the 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, respectively. ADEQ's risk evaluation concluded that the concentrations of arsenic remaining in the soils/sediments of Ponds 7 and Dynagel posed a potential risk to human health. It was further concluded that the risk could be abated by construction of a native soil cover and institutional controls such as a Declaration of Environmental Use Restriction (DEUR) to ensure that the cover is maintained.

Work on Pond 7 and the Dynagel Pond, as described by the Work Plan prepared in 2006 (Hargis, 2006), is planned for 2007-8.

Media Components 4, 5, 7, and TNT-Contaminated Area

The remedies for Media Component 4 – White Waste and Drum Storage Area, Media Component 5, Media Component 7, and the TNT-Contaminated Area, which involved sampling, excavation and off-site disposal, were all completed before or within the time period of the first FYR. The reader is referred to the first FYR for details. No further action or operation and maintenance were required for any of the actions once completed. The first FYR found the remedies protective for all the media. Details of the remedy implementation are included in the first FYR report. The evaluation of these Media Components in this FYR found that the remedies remained protective.

Status of Cleanup Activities Under State Consent Decree

In the early 1990s, cleanup of areas of the Site where ANP's plant operations were still underway were included under a separate State Consent Decree with ANP. The status of these activities is described in the USACE Analysis, but compliance with the Consent Decree is outside of EPA's oversight.

4.2 Operation and Maintenance

Alternative Water Supply

At the time of the 2005 ROD Amendment, a nearby private property owner raised concerns that the deep aquifer replacement wells could be causing potential loss of capacity in other deep aquifer wells under artesian pressure due to poor construction. As a result, EPA directed its contractor, CH2M Hill, to evaluate the construction methodology of all the replacement wells. The results of this study indicated that all the replacement wells were constructed properly and to an engineering standard of higher quality than that required by the State agencies. All wells were determined to be of good quality and functioning as designed. No O&M issues were identified.

Media Component 2: Shallow Aquifer Groundwater

Northern Area Shallow Aquifer Remedy (2A)

The activities required for O&M of full-scale operation of the NARS include:

- Inspect components of system, and conduct service and maintenance
- Monitor and collect extraction well and treatment cell hydrologic data, including influent and effluent flow rates and water levels
- Assess aquatic vegetation health and density
- Add supplemental carbon in the form of molasses (if needed) to the denitrifying cells
- Record and report operational data
- Discharge water from the last treatment cell to the primary effluent discharge location or secondary location (if necessary due to treatment upset conditions)
- Perform field and laboratory water quality monitoring

Through June of 2006 the total mass of nitrate-N removed from the shallow aquifer since pumping commenced in 1997 is estimated to be approximately 360,000 pounds. A total of 255,639,230 gallons have been extracted by SEW-1 since pumping commenced in 1997. Operational costs for the NARS over the FYR time period are included in Table 4-1 (ANP, 2007a).

<u>Year</u>	<u>Costs (thousands \$)</u>
2002	158
2003	147
2004	144
2005	121
2006	151
2007 (estimated)	93

Groundwater sampling of the monitoring wells and private water supply wells, as well as the surface water of the San Pedro River, is being performed by the ANP contractor, Hargis and Associates. O&M costs for monitoring (costs include the costs for monitoring the Southern Area shallow and perched aquifers and the San Pedro River surface water) are included in Table 4-2 (ANP, 2007b).

Table 4-2: Combined Monitoring Costs for the Northern and Southern Area Groundwater

<u>Year</u>	<u>Costs (thousands \$)</u>
2002	106
2003	88
2004	99
2005	139
2006	135

Southern Area Shallow Aquifer Remedy (2B)

Because the remedy for the Southern Area is MNA, no active treatment requiring O&M of a treatment system is being conducted. The only O&M occurring is the monitoring of the groundwater for water level and nitrate and perchlorate concentrations. Costs for the monitoring over the FYR time period are included in Table 4-2 of the USACE 5-Year Review Analysis.

Media Component 3: Inactive Ponds

The re-grading and capping of Pond 7 and the Dynagel Pond were completed in August 2007. No O&M costs have yet been incurred. O&M of the native soil cap will begin soon, now that construction is complete.

Media Components 4, 5, 7, and TNT-Contaminated Area

The remedial actions for these media components required excavation and off-site disposal of all contaminated materials with concentrations exceeding EPA's selected soils cleanup levels. Therefore, no waste remains on-site requiring O&M for these media components.

5.0 Progress Since the Last Review

This is the second five-year review for the Apache Superfund Site. The following section contains conclusions and recommendations made in Chapter 7 of the first FYR.

5.1 Current Status of Issues and Recommendations from First FYR

Groundwater and Surface Water Issues and Recommendations

1. The Carnes and Wooten shallow aquifer wells, previously used for monitoring and sampling points in the groundwater program, should either be repaired for continued use as monitoring wells or properly abandoned according to ADWR regulations depending on their usefulness as part of the monitoring network program.

Response: No action has been taken by ANP to repair or abandon these wells because these shallow aquifer wells are private wells and not the property of ANP. Although the wells are

in a state of disrepair, they are not being used for drinking water purposes and they pose no risk to the Site remedy.

2. Replacement deep aquifer drinking water supply wells have not been sampled since 1996. These wells should be re-sampled to ensure that the remedy is remaining protective.

Response: Water quality sampling was conducted during March and April of 2006. ANP sampled the eight deep aquifer replacement wells that were installed in 1994. The test results indicated that nitrate concentrations were below the drinking water standard (MCL) of 10 ppm. Perchlorate was not detected in any of the deep aquifer replacement wells. Arsenic levels were similar to those observed in the previous sampling, and exceeded EPA's recently revised drinking water standard for arsenic of 10 ppb. Arsenic in these wells is not considered a release from the Site. Regardless, ANP has provided these households with elevated arsenic concentrations reverse osmosis filters for the water provided by the deep aquifer replacement wells. Additional information is available in the technical memorandum Water Quality Sampling and Analysis of Deep Aquifer Replacement Domestic Wells (CH2M Hill).

3. Proceed with lithologic subsurface investigation of LCU to determine potential feasibility of MNA as a remedial action alternative.

Response: Additional field investigations were conducted in the Southern Area to further characterize the LCU (lateral confining unit to the east of the MCA) to better document whether it formed a hydraulic barrier. The results indicated that the LCU was less permeable than originally believed. Minimal or no hydraulic connection was observed between the Southern Area shallow aquifer along the San Pedro River and the MCA across the LCU. The studies concluded that natural conditions within the MCA (the St. David clay outcropping to the west and the LCU to the east) hydraulically isolated and contained the nitrate and perchlorate contaminated groundwater in the Southern Area within the perched zone and adjacent MCA. EPA's 2005 ROD amendment selected MNA for the Southern Area remedy based in part on the results of these studies.

4. Proceed with additional hydrogeologic characterization near the San Pedro River hot-spot to identify the source of river contamination.

Response: To further characterize the source of the hot-spot near the San Pedro River, in August 2006, ANP prepared a Comprehensive Northern Area Characterization Work Plan. The plan proposed installing monitor wells MW-40, MW-41A and MW-41B, based on the results of previously installed exploratory borings. After installation of these wells, ANP proposed installing two additional monitor wells: (1) MW-42 to be located downgradient from SEW-1 near the lateral margin of the shallow aquifer (to provide long-term monitoring data to evaluate plume capture by SEW-1 and nitrate attenuation downgradient); and (2) MW-43 to be located across the perennial gaining reach of the San Pedro River from the ANP property, just north of surface monitoring stations SW-3 and SW-4 (to determine if nitrate contamination could be migrating across the San Pedro to the east side and then migrating towards the northeast). Data from these additional well locations will help

characterize potential pathways of nitrate released from the hot-spot and refine the extent of the SEW-1 capture zone. Monitor well MW-42 was installed in early July. A property access agreement is still being negotiated for the MW-43 location. Data from these new locations will be incorporated into an updated groundwater model.

5. Because EPA's Records Center and the Benson Library repository rely on paper documents for the administrative record, not electronic files, at a minimum, the Annual Groundwater Monitoring Report, should include historic data tables, including long-term data trends and data compilation, for data comparison.

Response: Regarding the first point, at the time of the first FYR, the Benson Library repository relied on paper documents for the administrative record and EPA's Records Center to lesser extent. However, in the intervening years, the Benson Library now receives information electronically on CD-ROM discs and most data in EPA's repository is managed electronically. Regarding the second point of providing copies of the Annual Groundwater Monitoring Report to the Benson Library, this Report has not been provided on a regular basis and EPA will take measures to ensure it is provided to the Benson Library in the future. EPA will also work with ANP to ensure that the annual report includes historic data tables, including long-term data trends and data compilation, for data comparison.

6. Concentrations of contaminants displayed on site-wide figures included in the Comprehensive Groundwater Monitoring Reports should reflect all monitoring points sampled during that sampling period for comprehensive visual analyses.

Response: Errors continue to be found in some figures included in the Comprehensive Groundwater Monitoring Reports submitted by ANP. For example, the May 2006 report had wells missing from some maps, some maps with no groundwater flow lines and, in other instances, wells shown on a map with no explanation if they were not sampled. In the future, EPA will provide more feedback to ANP when text or figures in such Reports need to be corrected.

7. Graphs included in groundwater monitoring reports should be drawn to a scale that is appropriate for the data being represented, which is sometimes not the case, thus making data interpretation more difficult. Specifically, this applies for the concentration graphs for P-01, P-02, and MW-08.

Response: Hydrographs relating to water levels are now drawn by ANP's contractors to a uniform scale that is appropriate.

Soils Issues and Recommendations

8. Proceed with completion of the SLERA. It is recommended that this report contain a comprehensive Site map(s) showing all impacted and formerly-impacted areas. The current Access database should be linked to available GIS-compatible mapping tools/software.

Response: ANP completed the SLERA (Screening Level Ecological Risk Assessment and Preliminary Baseline Ecological Risk Assessment Report) in November 2004. The report included a comprehensive Site map(s) showing all impacted and formerly impacted areas. Neither EPA nor ANP proceeded to link the SLERA data results to a GIS mapping system due to limited need to analyze the soils data further at this GIS level of detail.

9. Proceed with completion of the Ecological Risk Assessment with regards to areas governed under the state CD.

Response: The SLERA prepared by ANP included an evaluation of the formerly active ponds, and other operational areas of the Site included in the State's CD.

10. Based on the results of the Ecological Risk Assessment it is recommended that evaluations and/or investigations proceed to determine remedial actions necessary for all ponds not yet addressed.

Response: Based on the results of the 2004 SLERA and other studies, in April 2005, ANP completed a *Supplemental Feasibility Study Report for Pond Soils and Sediments* which evaluated the remedial alternatives for all ponds at the Site, both the "inactive" ponds (Media Component 3) and the "formerly active" ponds under the State CD. Because soils data collected in the intervening years since the 1994 ROD indicated that several ponds previously thought to be contaminated may not be contaminated (i.e., contaminant concentrations were below EPA's selected cleanup levels, the Arizona SRLs, or the SRL for a particular contaminant had changed), ANP requested that ADEQ complete a risk evaluation on several ponds. ADEQ's risk evaluation concluded that the arsenic concentrations remaining in the soils/sediments of Ponds 1A, 1B, 2A, 3A, 7, and Dynagel posed a potential risk to human health. ADEQ further concluded that the risk could be "abated" by implementing either of the following two actions: (1) remove the contaminated "hot spots" from the ponds and then recalculate the risk; or (2) prevent direct contact by use of native soil cover and place a Declaration of Environmental Use Restriction (DEUR) on the ponds to ensure the cover is maintained. When EPA completed the ROD Amendment for the Site in September 2005, ADEQ's recommendations and risk assessment findings were taken into consideration. In February 2006, ANP completed a RD/RA Workplan for Pond Soils and Sediments, which again addressed all the ponds collectively. A consistent remedy (a native soil cap) is currently being constructed by ANP on all the ponds with residual soil contamination above EPA's selected soils cleanup levels.

11. Currently existing documentation relative to a comprehensive evaluation of areas under the jurisdiction of the EPA UAO versus the State's CD is minimal. EPA has required ANP to conduct an ecological risk-screening of all known areas of soil contamination on the facility, regardless of agency jurisdiction and to prepare a comprehensive evaluation report. A continuation of this coordination is recommended.

Response: As discussed above, comprehensive investigation, evaluation and remedy selection has been conducted on all the ponds, the known remaining areas of soils contamination at the ANP facility. ANP completed a comprehensive Supplemental FS,

followed by an RD/RA Workplan, and is now constructing a consistent remedy for all the ponds.

NARS Issues and Recommendations

12. Efforts should be intensified to monitor wetland status and to try to achieve full-scale startup status during the summer of 2003. This will be enhanced by weekly reporting of wetland characteristics such as sampling results, total volume of influent and effluent, carbon additions, O & M activities conducted, and any other wetlands related activities.

Response: Start-up efforts were intensified in 2003, including numerous experiments with carbon additions to the wetlands, to enhance denitrification of the wetlands. By March 2005, the NARS transitioned into full-scale operations with effluent discharge still occurring at the secondary discharge location. In June 2005, the treated effluent discharge reached consistent nitrate concentrations at or below 5 ppm and the discharge area was moved to the primary location in Wash 3 near the San Pedro River (Hargis 2006).

13. The O&M report should also evaluate: estimates of amount of contaminant removal, the hydraulic influence of pumping at SEW-1, water balance estimates, and analytical results for all discharge parameters (i.e., nitrate-N, coliform).

Response: The current O & M Reports evaluate the amount of contaminant removal, water balance estimates, and analytical results for all discharge parameters (nitrate, coliform, electrical conductivity, total dissolved solids, chemical oxygen demand, hydrogen oxygen demand, and temperature). The hydraulic influence of pumping of SEW-1 has been measured through water levels and flow amounts. Monitoring also occurs in MW-10 in Wash 3 to monitor infiltration of the treated effluent into the shallow aquifer near the San Pedro River and in a design piezometer DCP-12 adjacent to the last treatment pond to monitor for potential seepage from the last wetlands treatment cell.

14. Submit updated O&M Plan for EPA approval.

Response: ANP submitted an updated O&M Plan to EPA for approval in March 2007.

15. Evaluate and report on the effectiveness of control measures to prevent treatment cell bank erosion following the high intensity rainfall events.

Response: Only one area remains (the south wall of the last treatment wetlands cell, which has potential bank erosion.) During the intervening years since construction of the wetlands in 1997, ANP has continued to monitor and respond to any evidence of cell bank erosion.

6.0 Five-Year Review Process

6.1 Administrative Components, Community Notification, Document Review

EPA Region 9 published an announcement in the San Pedro Valley News - Sun newspaper on February 14, 2007 that a second FYR was underway. Public input was sought through survey forms provided to local residents and technical survey forms sent to ANP, ANP's Contractor, and USACE personnel familiar with the site. Discussions were held with the ANP NARS manager, the EPA RPM, and the State of Arizona project manager. A site inspection also was conducted. A copy of this completed report and an updated fact sheet are available through the EPA Region 9 Superfund Record Center located in San Francisco and from the information repository. EPA will also announce completion of this second FYR Review in the San Pedro Valley News - Sun after it has been approved.

6.2 Data Review

Extensive analysis of groundwater and surface water trends was conducted by USACE during its evaluation and the findings are summarized in the Technical Analysis, remedy Operation and Status, 2002- 2007.. Details of these water level and water quality trend analyses can be found in that document.

In summary, wells in the Southern Area predominantly display a decreasing trend in nitrate and perchlorate concentrations over the time of this five-year review (2002 to present). The wells also have declining water levels. One well (MW-21) shows nitrate and perchlorate concentrations that remained relatively constant over the time period 2002-2004 but have increased since 2004. The nitrate concentrations have increased from 35 ppm to 80 ppm and perchlorate concentrations from 80 parts per billion (ppb) to 130 ppb. The reason for the recently increased nitrate and perchlorate concentrations in monitoring well MW-21 is unclear, but is likely related to dewatering of the MCA and declining water levels. This appears to have a concentrating effect in this well. Also, the time over which the increasing trend in MW-21 has occurred is relatively short, making it difficult to establish the accuracy or cause of the trend. Because the Southern Area Groundwater is isolated from the San Pedro River and there are no private water supply wells in the aquifer, there is low potential for exposure to the contamination. Therefore, further monitoring of the nitrate and perchlorate concentrations is recommended along with water levels to possibly establish trends.

In the northern area, the majority of the surface water, monitoring and private wells that have been sampled show decreasing nitrate concentrations since full-scale NARS operation began in 2005. The farthest downgradient wells network consist of private wells (D(17-20)25bad), (D(17-20)24ccd), (D(17-20)23acd), and (D(17-20)23ada). Nitrate concentrations in two of these far downgradient wells increased over the 2004-2006 time frame, with one well reaching the nitrate MCL (D(17-20)25bad), and one nearing the MCL (D(17-20)24ccd). Two of the wells were stable; D(17-20)23acd at approximately 7 mg/L, and the farthest of the downgradient monitoring well, D(17-20)23ada at concentrations below 0.6 mg/L, which is likely indicative of background levels. Due to the relatively short period of record for these wells, continued monitoring is recommended to further evaluate long-term trends and the efficacy of the NARS. It is evident

that a portion of the nitrate plume is beyond the capture zone of SEW-1. However, these areas do not have shallow drinking water wells.

Surface water sampling locations SW-03 and SW-04 are within a perennial reach of the San Pedro River where surface flow is sustained by shallow aquifer groundwater discharging to the surface. Nitrate concentrations in the surface water are highly variable, and inversely proportional to river flow levels changing in response to precipitation events. At low river flows (i.e. at base flow, not reflecting precipitation events), surface water quality is more indicative of the quality of the discharging groundwater.

No data were collected over the FYR time period for soils media components, except sampling of the soil for the native soil caps.

6.3 Recommended Changes to Monitoring Programs

The following changes to the monitoring program are recommended:

- Monitoring of the San Pedro River surface water locations SW-03 and SW-04 on the basis of river discharge level and/or precipitation level, particularly at low river discharge levels. Presently, the River is being monitored on a quarterly basis regardless of instantaneous discharge level.
- Establishment of a contingency monitoring program for DCP-12 based on discharge to the alternative discharge location. The ROD Amendment allows for the alternative discharge location to be used up to 20% of the time (80% of the time to the primary discharge location) if nitrate discharge concentrations are above 10 mg/L. It is recommended that if discharges with nitrate concentrations significantly above 10 mg/L are discharged to the alternative discharge location for a period of time greater than 5 days within any month (20% of the month), that DCP-12, near the alternative discharge location, be sampled for nitrate concentration. This allows monitoring of any increases in nitrate concentration in the aquifer that may result from the increased nitrate concentrations in the discharge.
- Periodic monitoring of both ammonia and nitrate is recommended at the influent location and the discharge location after the groundwater is treated through the Wetlands area. Ammonia monitoring is recommended because of its potential to convert to nitrate under oxidizing conditions, which may occur during its transport after treatment point to the discharge point. In addition, evaluation of and possible substitution of another monitoring well for MW-10 is recommended as the NARS contingency monitoring point for changes to the aquifer from discharge at the primary discharge location. No data was collected over the FYR time period because MW-10 was dry at all times when attempts were made to sample the well.

6.4 Site Inspection

The USACE site visit was performed at the ANP site on February 26, 2007. The brine concentrator, the NARS system, including the wetlands, the extraction well, and the wetlands

discharge locations, and selected locations of the Northern Area and Southern Area monitoring and private water supply network were visited. Discussions about the history of both the activities overseen by EPA and the State were also held with EPA and State regulators, ANP personnel, and the ANP contractor, Hargis and Associates, who were also present during the site visit. Details of the site visit are included in the Site Visit Report and Site Visit Checklist in the USACE Analysis.

6.5 Community Interviews

The USACE team mailed site survey forms supplied by EPA to eight private parties. Generally, the private parties were satisfied with the remedial actions taken with the exception of one party, who has previously expressed concerns to EPA. These previously identified concerns regarding diminishing pressure and water supply from the deep aquifer under artesian pressure were investigated by EPA and its contractors over a several year period and the concerns were determined to be unrelated to the remedial actions conducted at the site.

In addition to the public survey forms, technical assessment survey forms were e-mailed to various technical professionals familiar with the Site. Completed survey forms indicated the respondents thought the remedy was performing adequately and as envisioned in the ROD.

The results of the public survey and the technical assessment survey forms are included in the USACE Analysis.

7.0 Technical Assessment

7.1 Question A: Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended. SEW-1 is extracting groundwater from the area of high nitrate concentrations in the Northern Area. Since full-scale operation of the NARS was achieved in June 2005, the wetlands treatment is operating as intended by treating effluent to levels that are consistently below the discharge criteria specified in the ROD and ROD Amendment.

The concentrations in the SARS groundwater are predominantly displaying a decreasing trend of nitrate and perchlorate over the time of this five-year review with the exception of one monitoring well which recently has shown an increasing trend. Continued monitoring of this monitoring well, as required as part of the remedy, will determine the cause. It is anticipated that the remedy will achieve the RAOs within the anticipated timeframe.

Cessation of wastewater recharge and ongoing extraction of groundwater from the perched aquifer has resulted in decreased water levels in the aquifer. With continued dewatering, it is expected that the perched zone will become completely dry and contaminants immobile in the near future. The water level and nitrate and perchlorate concentrations and total mass in the adjacent MCA of the shallow aquifer in the Southern area also continue to decrease.

The 1994 ROD identified the need for ICs to limit exposure to contaminants and prevent disturbance of the soil caps. The ROD also called for ICs to prohibit the use of the shallow aquifer groundwater for drinking purposes. A soils DEUR is planned for the ANP property this year, but is not yet in place. Access to the ANP facility is restricted by existing perimeter fencing surrounding the entire 1,000 acre property. There is a guarded entrance gate and sign-in shack for any business or facility visitors who need to access the operations area of the facility. The perimeter and outlying areas of the facility are patrolled regularly by facility personnel.

Ongoing education and outreach inform nearby residents and property owners of the extent of the contaminated shallow aquifer groundwater plume. EPA has distributed Fact Sheets showing updated maps of the contaminated plume in July 2005, June 2006, and October 2006 and most recently in February 2007. ANP continues to conduct its own outreach efforts. ANP has been directed by EPA to submit by September 2007 a Community Outreach Plan to formally document its education and outreach activities. ANP is also required to submit an Alternate Domestic Water Supply Plan by September 2007. An updated Well Inventory is required in 2007.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of remedy selection still valid?

There have been no changes in the ARARs that should affect the protectiveness of the remedy and there have been no changes in standards or To Be Considered (TBCs) for the Site. The ARARs are considered to be health protective and reasonable in evaluating risk for this site.

There have been no changes in the toxicity factors or other contaminant characteristics that could affect the protectiveness of the remedy.

There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy; however, the 1992 Apache Powder risk assessment was conducted prior to implementation of current guidance for human health and ecological risk assessments. While several changes were identified, the outcome of the risk characterization is the same.

Substantial progress has been achieved toward meeting the RAOs since implementation of the remedy.

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No information has come to light that could call into question the protectiveness of the remedy.

7.4 Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the remedy is functioning as intended by the ROD and ROD Amendment. There have been no changes in the ARARs that would affect the protectiveness of the remedy. The assumptions used in determining exposure pathways are considered to be health protective and reasonable in evaluating risk for this site. There have been no changes in the toxicity factors or other contaminant characteristics that could affect the protectiveness of the remedy and there has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

8.0 Issues

Issues for the Apache Powder Superfund Site are presented in the following Table.

	Issue	Affects Current Protectiveness (Y/N)?	Affects Future Protectiveness (Y/N)?	Responsible Entity	Completion Date
1.	Long-term ICs have not been implemented yet for the groundwater or soils remedies.	N	Y	ANP	1/08
2.	The groundwater model for the Northern Area needs to be updated with new data.	N	N	ANP	1/08

9.0 Recommendations and Follow-Up Actions

Long-Term Institutional Controls need to be implemented. A groundwater DEUR is planned to restrict use of shallow aquifer wells for drinking water purposes on the ANP property. A second soils DEUR is planned to restrict access to ponds where residual soil contamination was left in place and capped with native soils caps. A Community Outreach Plan is planned to formally document ANP's education and outreach activities. ANP is also required to submit an Alternate Domestic Water Supply Plan by September 2007 and an updated Well Inventory is required by December 2007.

The Northern Area Groundwater Model will also be updated once sufficient new data is obtained from recently installed monitoring wells. Because the results of the NARS may not be fully apparent after only two years of full-scale operation, continued long-term monitoring is needed. The revised model should be used to simulate pumping scenarios that are designed to optimize contaminant plume capture at SEW-1 and minimize impact to the surface water and riparian habitat of the San Pedro River.

The portion of the nitrate plume that has migrated beyond the capture zone of extraction well SEW-1 is being evaluated. This portion of the plume is low concentration and it does not threaten drinking water wells in the area. This area of the plume continues to be properly monitored for water levels and nitrate concentration. It is recommended that the portion of the plume that is down-gradient of the SEW-1 extraction well capture zone be assessed for applicability and feasibility of monitored natural attenuation.

10.0 Protectiveness Statement

EPA concludes in this second FYR that the remedy is protective in the short term for both groundwater and soils because exposure pathways that could result in unacceptable risks are being controlled. However, in order for the remedy to remain protective in the long-term, Institutional Controls (ICs) must be put in place restricting access to the contaminated shallow aquifer for drinking water purposes and restricting access to pond soils on-site where residual contamination has been capped. The final construction of the remedies for Media Components 1 (Perched Zone), 2 (Shallow Aquifer Groundwater in Northern and Southern Area) and 3 (Inactive Ponds) are still underway.

Construction has been completed on the remedies for Media Components 4, 5, 7 and the TNT-Contaminated Area. The remedies were constructed in accordance with the requirements of the Record of Decision (ROD) and subsequent amendments and Explanation of Significant Differences (ESDs) and are functioning as designed. ANP is operating and maintaining the remedies appropriately. No construction or operation and maintenance (O&M) deficiencies were noted that currently impact the protectiveness of the remedy. The remedies for these media components were found to be protective in the first FYR and remain protective in this second FYR.

11.0 Next Review

The next FYR for the Apache Site is required by September 2012. EPA recommends that only Media Components 1, 2A and 2B, and 3 be evaluated in the next FYR. Media Components 4, 5, 7, and the TNT-Contaminated Area have been cleaned up and no contamination remains on the Site in these areas above EPA's cleanup levels and no use restrictions were required for these areas.