FIFTH FIVE-YEAR REVIEW REPORT FOR NINETEENTH AVENUE LANDFILL SUPERFUND SITE MARICOPA COUNTY, ARIZONA

PREPARED BY

U. S. Army Corps of Engineers
Seattle District

FOR

U.S. Environmental Protection Agency

Region IX

Approved by:

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Executive Summary

This is the fifth Five-Year Review of the Nineteenth Avenue Landfill Superfund Site (Site) located in the City of Phoenix (City), Maricopa County, Arizona. The purpose of this Five-Year Review is to review information to determine if the remedy is, and will continue to be, protective of human health and the environment.

The Site is a closed landfill that occupies approximately 213 acres in an industrial area of Phoenix, Arizona, and is owned by the City. There has been only one operable unit established for the entire remedy. The Site is comprised of two disposal cells, Cells A and A-1, separated by the Salt River. Wastes disposed at the Site (operated from 1957 to 1979) were predominately municipal refuse, with some solid and liquid industrial wastes. In February 1979, the Arizona Department of Health Services issued a cease and desist order to the City to close the landfill. The U.S. Environmental Protection Agency (EPA) placed the Site on the Superfund National Priorities List in September 1983.

EPA issued the Record of Decision in 1989. The purpose of the remedy was to achieve refuse washout control, surface water and sediment quality protection, groundwater quality protection, and landfill gas migration control. The selected remedy was designed to contain the landfill wastes on-site, through capping the landfill and collection and flaring of landfill generated gases, and to provide necessary monitoring to protect human health and the environment.

The specific remedy components include the following:

- Levees would be placed along both the north and south banks of the Salt River at the landfill site to provide flood protection.
- The river channel would be widened.
- A soil cap would be placed over the landfill so that rainwater does not seep into the landfill material.
- A secure fence would be erected around the landfill boundary.
- Ambient air quality, methane gas, and groundwater would be monitored.
- A contingency plan would be implemented should groundwater quality standards be exceeded at the landfill boundary.
- Methane gas would be collected and treated in a manner that eliminates any risk of explosion.

In December 1995, an Explanation of Significant Difference (ESD) #1 was signed by EPA, which modified the remedy by changing the lining material used in the perimeter drainage channels at the Site.

EPA approved the City's construction completion report and its documentation that the remedy was operational and functional in September 1998. Several enhancements were made to the landfill gas collection system after methane migration control issues were identified in the first Five-Year Review in 2000.

In October 2003, ESD #2 was signed, modifying the remedy by updating the maximum contaminant levels for specific constituents in groundwater, and adding the Arizona Ambient Air Quality Guidelines for volatile organic compounds as performance standards for ambient air quality monitoring at the Site. In June 2006, ESD #3 was signed, modifying the remedy to require institutional controls, including a Declaration of Environmental Use Restriction (DEUR). In July 2006, the DEUR was recorded to prevent incompatible land use. In September 2006, EPA deleted the Site from the National Priorities List, having determined that all appropriate response actions were completed and the Site posed no significant threat to public health or the environment. Operation, monitoring and maintenance activities, and Five-Year Reviews continue to ensure protection of human health and the environment.

In October 2012, an amendment to the 2006 DEUR was recorded, incorporating a Landfill Maintenance Contingency Plan as a component of the Engineering Control Plan. It allowed an intentional breach of the engineered protective cap if needed to perform emergency repair or maintenance activities of the landfill gas extraction system.

In July 2015, EPA signed ESD #4, which included two changes: (1) allow the current flare treatment system for Cell A-1 to be replaced with an improved carbon adsorption system to contain and remove landfill gas contaminants; and (2) document that a DEUR was placed in the Site's chain of title in 2006, and that an amendment to the DEUR was recorded in 2012.

Based on the review of relevant documents and data, site inspections, and interviews since the fourth Five-Year Review, the remedy is functioning as intended by the Record of Decision. There have been no changes in the Site's physical conditions that would affect the remedy's protectiveness. Due to declining landfill gas concentrations, a new carbon adsorption system was installed in Cell A-1 to replace the existing flare station in October 2015. All requirements in the DEUR are being met and were verified during the Site visit. There is no information that calls into question the remedy's protectiveness.

The remedy at the Nineteenth Avenue Landfill Superfund Site is protective of human health and the environment. There are no environmental exposure pathways that result in unacceptable risks. The engineered and institutional controls selected in the decision documents are properly operated, monitored, and maintained, and the land use at the Site allows for the integrity of the remedy to continue. Levees protect the Site from 100-year floods, the landfill cap prevents surface water from entering the refuse (which reduces the potential for leachate to reach groundwater aquifers), and monitoring continues to document that methane gas is controlled and groundwater concentrations are at levels that do not require implementation of the Groundwater Contingency Plan.

Contents

List of Figures

List of Tables

List of Abbreviations

ADEQ	Arizona Department of Environmental Quality
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
City	City of Phoenix
DEUR	Declaration of Environmental Use Restriction
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Difference
FYR	Five Year Review
MCLs	Maximum Contaminant Levels
mg/L	milligrams per liter
O&M	Operation and Maintenance
RAP	Remedial Action Plan
ROD	Record of Decision
µg/L	micrograms per liter

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of the reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (40 CFR Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the fifth FYR for the Nineteenth Avenue Landfill Superfund Site (Site) located in the City of Phoenix (City), Maricopa County, Arizona. The triggering action for this statutory review is the September 28, 2015, signing of the previous FYR. The FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

The Nineteenth Avenue Landfill Superfund Site FYR was led by Nadia Hollan Burke, EPA Remedial Project Manager, and Cynthia Wetmore, EPA Environmental Engineer. Participants included: Deborah Johnston, Project Manager, Matthew Masten, Environmental Engineer, and Sara Benovic, Hydrogeologist, for the U.S. Army Corps of Engineers. The review began on October 30, 2019.

1.1. Background

The 213-acre Site is geographically located in an industrial area of Phoenix, Maricopa County, Arizona just southeast of the intersection of Lower Buckeye Road and 19th Avenue. The Site is separated into two parts by the Salt River (Figure 1). Approximately 200-acres of the Site are located north of the Salt River and are referred to as Cell A. The remaining 13-acre portion, referred to as Cell A-1, is located south of the Salt River (Figure 2).

Beginning in the late 1950s, pits were excavated to produce sand and gravel. The State permitted a City-operated landfill from 1957 through 1979. During this time, the pits were backfilled predominately with municipal refuse from the Phoenix area. Approximately nine million cubic yards of municipal refuse, solid and liquid industrial wastes, medical wastes, and materials containing low levels of radioactivity were deposited in the landfill. The average depth of the waste is 30 to 35 feet; however, portions of the southern third of Cell A have wastes buried deeper than 50 feet and refuse in Cell A-1 is only 10 to 20 feet thick next to the Salt River.

As a result of intermittent flooding from the Salt River since the mid-1960's and erosion of landfill refuse in 1978 and 1979, the landfill was closed by a cease and desist order in February 1979 by the Arizona Department of Health Services. EPA placed the Site on the National Priorities List in September 1983. Appendix B provides the key site response activities since the initial refuse washout event.

1.2. Physical Characteristics

The population within the zip codes around the Site (85007, 85009, 85003) is approximately 69,500 people. The nearest residence is 1/3 mile from the Site. The section of the Salt River that bisects the Site is designated the Rio Salado Habitat Restoration Area. A recreational trail (Overbank Trail) is located on both the south and north sides of the Salt River adjacent to the landfill. The surrounding areas continue to be used for light industrial purposes.

The City's water supply comes primarily from the Salt River Project, which brings water by canal and pipeline from the Salt and Verde Rivers, and the Central Arizona Project, which transports Colorado River water. A small amount of water also comes from groundwater wells (2% of total supply from 20 different groundwater wells).

Table 1. Five-Year Review Summary Form for the Nineteenth Avenue Landfill Superfund Site

SITE IDENTIFICATION		
Site Name: Nineteenth Avenue Landfill		
EPA ID: AZ D980496780		
Region: 9	**State:** AZ	**City/County:** Phoenix/Maricopa
SITE STATUS		
NPL Status: Deleted		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Nadia Hollan Burke		
Author affiliation: EPA R9		
Review period: October 2019 through June 2020		
Date of site inspection: 2/12/2020		
Type of review: Statutory		
Review number: 5		
Triggering action date: September 28, 2015		
Due date ***(five years after triggering action date):*** September 28, 2020		

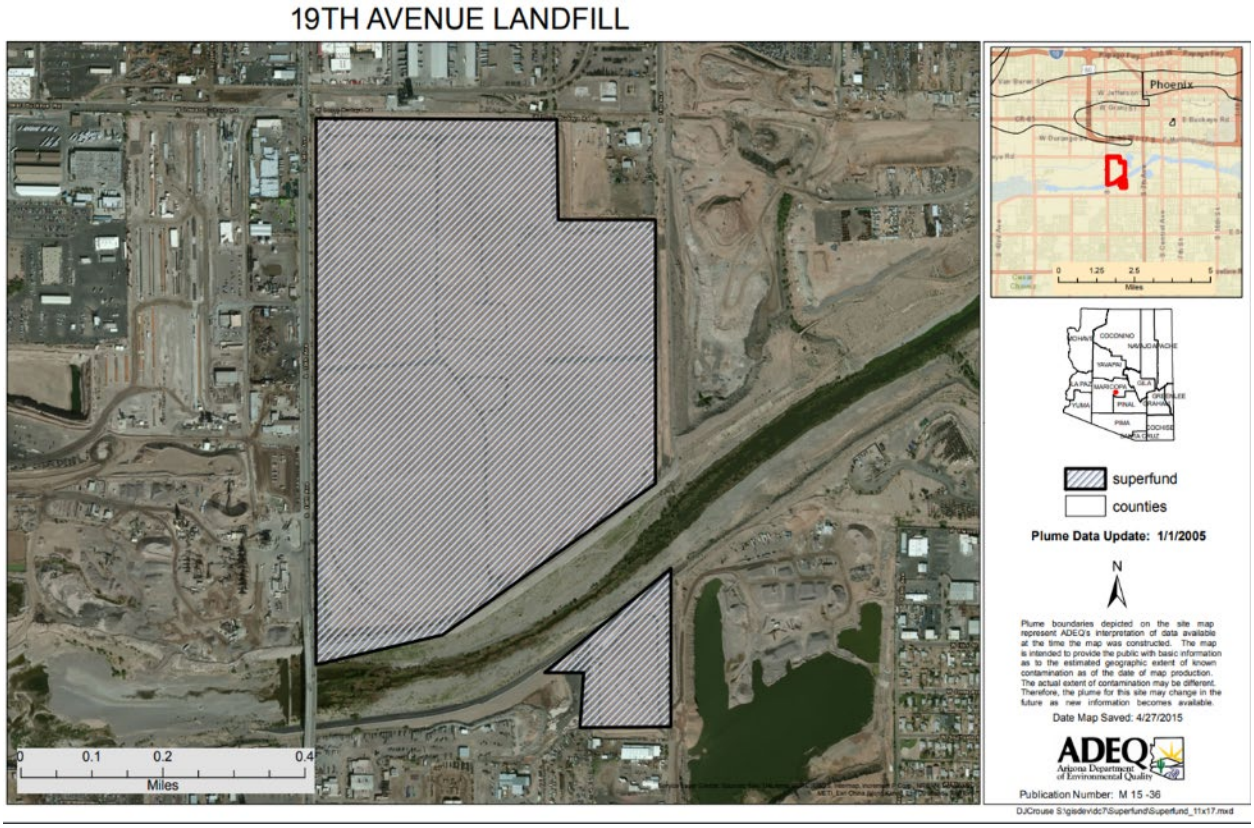


Figure 1. Location Map for the Nineteenth Avenue Landfill Superfund Site

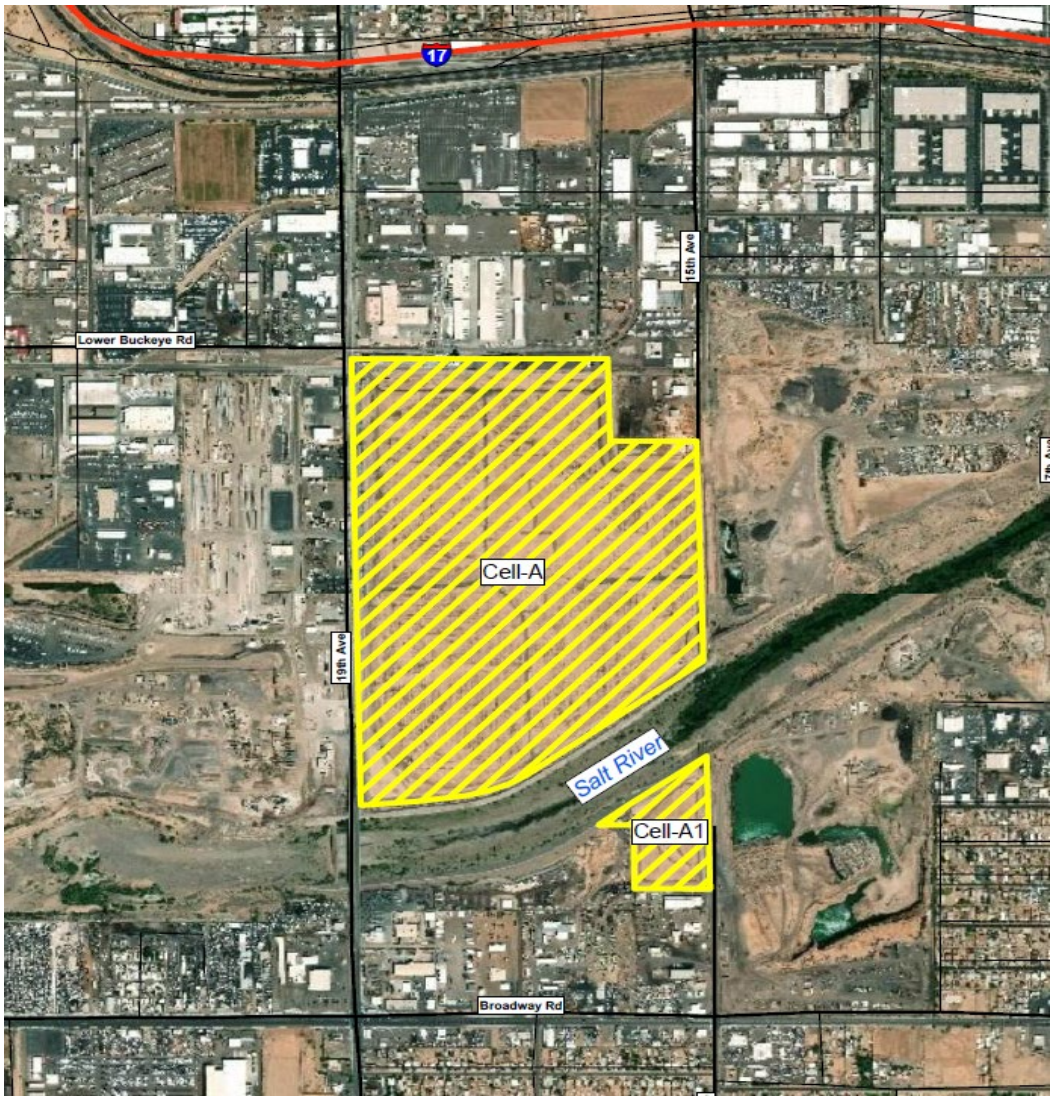


Figure 2. Detailed Map of the Nineteenth Avenue Landfill Superfund Site

1.3. Hydrology

The Site is situated in the southeastern portion of the west sub-basin of the Salt River Basin in central Arizona. The landfill is underlain by alluvial materials deposited within the region's structurally depressed basins. These materials can be divided into five different units that extend 350 feet below ground surface (bgs). There is a 15-foot surface layer composed of silty sand. Beneath this layer, there are approximately 100 feet of cobbles and coarse gravels. The next three units below this layer are divisions within the Upper Alluvial Unit (See Figure 3.)

The alluvial materials beneath the Site can transmit a relatively large amount of water because they are generally coarse grained. The transmissivity of the materials between a depth of approximately 100 and 150 feet is estimated to be 190,000 gallons per day per foot. The transmissivity of the cobble and gravel deposits above 100 feet is probably even greater.

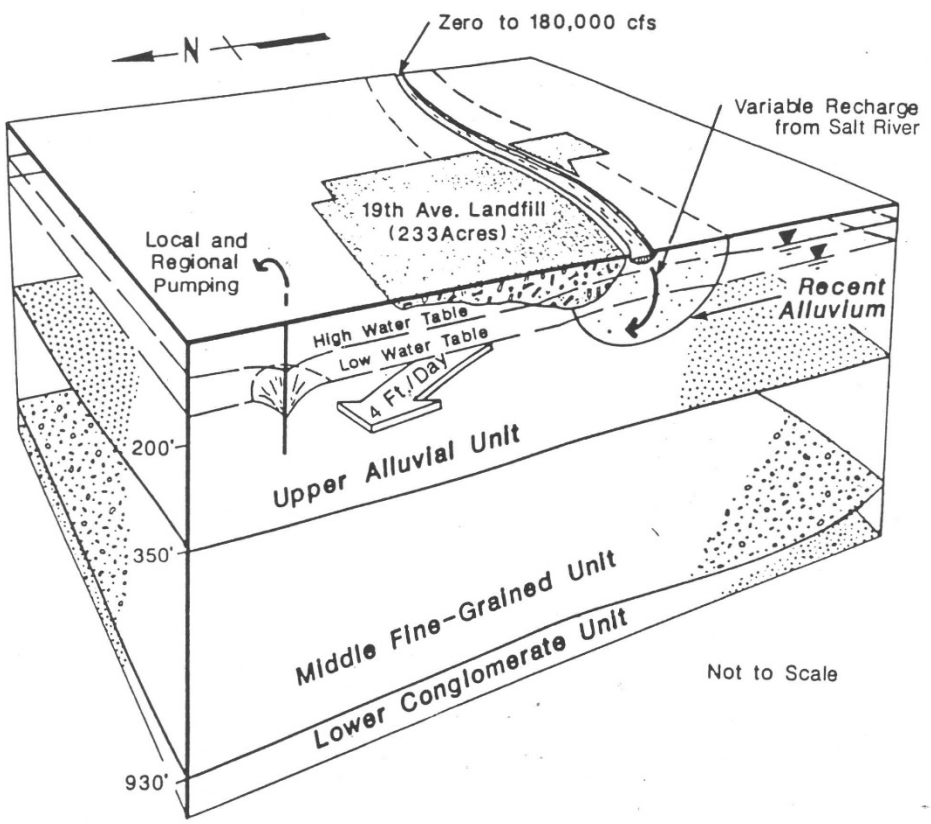


Figure 3. Hydrogeologic Conceptual Diagram

The direction of groundwater flow beneath the landfill is predominantly from the southeast to the northwest at the rate of 1 to 8 feet per day. Depth to groundwater ranged between 20 to 40 feet bgs near the river, and 60 to 80 feet bgs north of the site at the time of the Record of Decision. During periods of flow in the Salt River, the groundwater table rose and historically was in contact with the landfill refuse. Overall, the depth to groundwater is lower than compared to the previous FYR. Groundwater depths in 2015 were generally below 80 feet bgs and generally below 85 feet in 2016. Depth to groundwater in monitoring wells in 2017 and 2018 exceeded 95 feet bgs which is beyond the deepest depth of refuse (max 50 feet).

The nearest industrial water supply well is approximately 0.5 miles to the west of the Site and all the wells downgradient of the Site (bound by Interstate 17 to the north of the Site) are City monitoring wells. There is one upgradient industrial domestic well located southwest of Cell A-1, adjacent to the Salt River. The closest irrigation well is located approximately one mile directly west of the Site (cross gradient).

The groundwater hydraulics at the landfill are influenced by irrigation wells and industrial wells and occasionally by recharge from surface water. The use of agricultural irrigation wells west of the landfill is limited almost exclusively to the 6-month summer growing season. Groundwater flow gradients, and therefore flow rates, increase during the summer because of seasonal groundwater withdrawals. These withdrawals create drawdown in the aquifer and induce steeper flow gradients.

The river channel is mostly dry in the vicinity of the landfill because river flows are controlled by a system of upstream water conservation dams. During controlled releases or flood flows, water levels fluctuate 20 to 30 feet over a period of months. Flows in the Salt River recharge the groundwater at an average rate of approximately 1-

foot per day. The higher water tables resulting from the recharge of surface water are gradually reduced at an average rate of about four feet of head per year by regional agricultural well withdrawals. When flows occur in the Salt River (it is usually dry), a groundwater mound develops beneath the river due to recharge. Due to groundwater mounding, groundwater levels in shallow wells indicate a local reversal in flow direction in Cell A-1 (flows to the south and southeast); however, this does not affect the regional flow direction to the northwest. Surface water flow in the Salt River and 15th Avenue storm drain adjacent to the landfill have been observed to influence the groundwater levels in monitoring wells at the landfill.

Before the channelization of the Salt River was completed in March 1996 as a part of the remedy, portions of the landfill were within the estimated 100-year flood plain of the Salt River. The 100-year floodplain covered approximately 50 percent of Cell A-1 and 30 percent of Cell A; however, these areas are now outside the current Federal Emergency Management Agency 100-year floodplain (Map 04013C2230L dated 16 October 2013). The landfill area has been designated as being a 0.2 percent annual chance of flood hazard while the Salt River is a regulatory floodway adjacent to the Site and characterized as an area with reduced flood risk due to levees.

2. Remedial Actions Summary

2.1. Basis for Taking Action

The basis for taking action was due to the periodic inundation of the landfill by flood waters from the Salt River and washout of refuse potentially containing hazardous wastes, pollutants, or contaminants. The City completed a remedial investigation/feasibility study in 1998. The primary contaminants of concern in the Site's soil/refuse were volatile organic contaminants such as toluene and xylenes. Various metals, volatile organic contaminants, and radioisotopes were detected in groundwater in excess of their respective maximum contaminant levels (MCLs). Ambient air emissions from methane and volatile organic contaminants were found to be within general background levels.

2.2. Remedy Selection

In 1998, the EPA delegated the lead remedial oversight responsibility of the Site to the Arizona Department of Environmental Quality (ADEQ), formerly the Arizona Department of Health Services. The City completed a Remedial Action Plan under State oversight on June 12, 1989. ADEQ approved of Remedial Action Plan in a Letter of Determination. EPA issued the Record of Decision (ROD), dated September 29, 1989 based on the Remedial Action Plan.

The selected remedy for the landfill cells that border the Salt River, Cell A and Cell A-1, included containing landfill wastes onsite by constructing a soil cap and surface drainage structures over the landfill, as well as soil-cement levees along the river at the landfill boundary; widening the river channel; collecting and flaring landfill generated gases; institutional controls and access restrictions; and air and ground water monitoring. A contingency groundwater treatment plan will be implemented if current groundwater quality standards are exceeded at the landfill boundary.

Specifically, the remedy includes:

1) Refuse Washout Control
    a. Goal – Prevent erosion and overtopping of the landfill during a 100-year flood, thereby eliminating the risk of refuse washing out of the landfill and preventing impacts to surface water and sediment quality in the Salt River.
    b. Components – Refuse washout will be controlled from a 100-year flood by the construction of seated levees with bank protection for both Cell A and Cell A-1; a subsurface grade control structure will be constructed across the river channel; the storm drain outfall channel will be piped and backfilled; and the river channel between Cell A and Cell A-1 will be widened.
2) Surface Water and Sediment Quality Protection
    a. Goal – Prevent surface water infiltration into the landfill and the transport of landfill material in surface water runoff, thereby eliminating the possible impact of the landfill on surface water and sediment quality, reducing leachate generation in the landfill, and reducing localized air emissions from cracks or holes in the existing landfill cover.
    b. Components – Surface water quality impacts will be controlled by installing a single-layer soil cap over both cells; providing positive drainage for both cells via surface grading and perimeter ditches; placing fences around both cells; and relocating A & B Silica Sand and All Chevy Auto Parts.
3) Groundwater Quality Protection
    a. Goal – Ensure that future potential groundwater degradation does not pose a risk to public health, welfare, or the environment.
    b. Components – The City will continue to deliver an adequate supply of drinking water from the City distribution system to the residences and businesses in the landfill's vicinity. A Groundwater Quality Monitoring Plan will be implemented. If groundwater quality conditions exceed applicable water standards, a response action would be required as outlined in the Groundwater Contingency Plan. If a remedial response is trigged, EPA's Safe Drinking Water Act MCLs, the Arizona Department of Health Service State Action Level, and the 10^{-6} excess cancer risk level will be considered as potential Applicable or Relevant and Appropriate Requirements (ARARs).

        EPA defined a groundwater exceedance as follows:
        i. The average of three consecutive quarterly samples from a single well exceeds a constituent's current groundwater quality standard,[1] or a single sample exceeds three times the current groundwater standard; and
        ii. A follow-up sample confirms that either of the exceedance conditions described above has occurred. The follow-up sample will be collected within 15 calendar days of receipt of the results which indicated the apparent exceedance condition. The initiation of confirmatory sampling will start a monthly schedule of sampling at the affected well(s) for the exceeding constituent(s). If a follow-up sample does not confirm the exceedance, quarterly sampling may resume after three months of monthly sampling.
4) Landfill Gas Migration Control
    a. Goal – Prevent off-site migration of landfill gas, thereby eliminating the risk of explosions from methane accumulation.

[1] Defined as the constituent's current MCL, Proposed MCL (or an Action level where an MCL has not been established or an MCL Proposed

b. Components – Subsurface gas migration will be controlled by improving and expanding the gas collection and combustion system for both cells; single-layer soil caps over both cells; and monitoring subsurface methane concentrations.

EPA and ADEQ modified the remedy by signing the following four Explanation of Significant Differences (ESDs).

- ESD #1 allowed the City to use a flexible lining system for the perimeter drainage channel (December 1995).
- ESD #2 added the Arizona Ambient Air Quality Guidelines for volatile organic compounds as performance standards for ambient air quality monitoring at the Site (October 2003), and documented that some of the MCLs had changed or had been promulgated since the ROD and that those MCLs should be updated in the Groundwater Quality Monitoring Plan.
- ESD #3 required that institutional controls be established for the Site, including the use of Declaration of Environmental Use Restriction (DEUR) (June 2006).
- ESD #4 modified the remedy by allowing the City to treat the landfill gas in Cell A-1 by carbon treatment rather than flaring and documented that the City recorded a DEUR on the Site in 2006 and recorded a DEUR Amendment in 2012 (July 2015.)

2.3. Remedy Implementation

The City started the erosion and drainage tasks in 1995 and completed the remainder of the remedy by 1997, which included: landfill landscaping; installation of the Armorflex™ channel, a sedimentation pond lining system, and a gas collection system; the construction of a compacted clay-soil cap with surface drainage structures channeling precipitation away from the cap; construction of the soil-cement levees along the landfill cells that border the Salt River to prevent erosion and overtopping from the Salt River flood flows; placement of a subsurface pipe with backfill that prevents erosional undercutting along the east boundary of the landfill; and channel widening and fence placement.

A Preliminary Close-Out Report documenting construction completion was signed by EPA and ADEQ in February 1998, and a Remedial Action Completion report prepared by the City documenting that the remedy was operational and functional was approved in September 1998.

The City recorded a DEUR in July 2006, which included both engineering and institutional controls for the property (Table 2). The DEUR describes the known contamination at the Site, the engineering controls that must be maintained, and the institutional controls required of the City and any and all future owners. The DEUR controls the use and access to the landfill property, while the Arizona Department of Water Resources restricts groundwater well site location, construction, and uses that could impact the remedy. Currently, the City provides drinking water to this area and will continue to do so in the future. The Engineering Control Plan from the Remedial Action Plan is referenced in the DEUR and describes the engineering controls on the property (a drainage and levee system, a capping system, an erosion and drainage system, a landfill gas extraction system, and fencing).

Table 2. Summary of Planned and/or Implemented Institutional Controls

Media, engineered controls, and areas	Institutional Controls Needed	Institutional Controls Called for in the Decision Documents	Impacted Parcel(s)	Institutional Control Objective	Title Instrument Implemented and Date
Groundwater	Yes	Yes	Entire site	Minimize GW impacts due to flood flows, surface runoff, etc. through monitoring	DEUR 2006
Methane Gas Control	Yes	Yes	Entire site	Reduce explosion potential	DEUR 2006
Engineering Control Perimeter Site Fencing	Yes	Yes	Entire site	Eliminate trespassers	DEUR 2006
Restrict types of Future Use	Yes	Yes	Entire site	Land used for non-residential only	DEUR 2006

In July 2006, EPA and ADEQ signed the Final Close-Out Report documenting that the City had successfully completed all required remedial actions, including implementation of the institutional controls, and eligibility for Site Completion. In September 2006, the EPA issued a Final Notice of Deletion for the landfill in the Federal Register.

2.4. Operation and Maintenance (O&M)

The purpose of the Landfill Operation and Maintenance Program is to establish compliance measures for the landfill engineering controls to assure that: (1) surface water does not infiltrate through the landfill, and (2) the Site is secure from unauthorized entrance.

In 2012, an Amendment to the DEUR incorporated a Maintenance Contingency Plan to streamline landfill gas extraction system maintenance and to allow the cap to be breached if necessary, to make emergency repairs. The City completed an Updated Operation and Maintenance Manual (2014) to be consistent with the requirements of the 2006 DEUR and the 2012 DEUR Amendment. The 2014 City Operation and Maintenance Update provided specific details on required inspection and monitoring, removed extraneous information, documents, and requirements not included in the DEUR, and incorporated operational changes implemented since the original manual was issued. It also includes five engineering control monitoring aspects. The City Solid Waste Disposal Management Division or its designated representative conducts an inspection of the landfill components at least once per year.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2015 FYR for the Nineteenth Avenue Landfill stated the following:

> *"The remedy at the Nineteenth Avenue Landfill Superfund Site is protective of human health and the environment. Currently, there are no environmental exposure pathways that result in unacceptable risks, and none are expected as long as the engineered and institutional controls selected in the decision documents continue to be properly operated, monitored, and maintained, and the land use at the Site allows for the integrity of the remedy to continue."*

The 2015 FYR had no issues which could affect the protectiveness of the remedy.

3.2. Work Completed at the Site During this Five-Year Review Period

During this FYR period, the City continued routine maintenance activities, monitoring of groundwater and methane gas and annual inspections of the Site. The results are documented in quarterly, semi-annual, and Annual Reports.

Maintenance activities included repair of eroded areas, irrigation systems, fencing, and wells, probes, the gas control system, and rodent control. Areas that were identified in need of attention during inspections were repaired prior to the subsequent inspection visits. The main issue of concern during the review period was related to excavation activities at the neighboring property resulting in a deep vertical cut along the property line. The security fencing collapsed into the excavation on the neighboring property in 2015 posing a significant safety issue. The fencing issue was repaired by the 2016 site visit.

During the 2019 site visit, minor erosional issues were noted but are not believed to represent an imminent or serious risk to the integrity and functionality of the existing engineering controls during average storm events for the Site. However, the existing erosion/washout areas provide preferential flow paths and will increase the likelihood of infiltration barrier layer erosion if a future severe storm event occurs. It is expected the City will complete repairs to address the erosional issues prior to the next Annual DEUR inspection.

Groundwater monitoring was performed quarterly for the majority of the FYR period. However, two wells are often sampled monthly to obtain additional data to determine if the contingency plan needs to be triggered. In September 2019, the City was authorized by ADEQ to reduce the groundwater monitoring sampling frequency from quarterly to semi-annual.

Landfill gas monitoring is performed monthly. All readings were below five percent methane by volume for this FYR period except for one occurrence during the first quarter of 2019. Due to declining landfill gas concentrations, a new carbon adsorption system was installed in Cell A-1 to replace the existing flare station in October 2015. The City renewed its air quality permit (Maricopa County Air Quality Permit #010048) on May 25, 2016 with an expiration date of August 31, 2021.

4. Five-Year Review Process

4.1. Community Notification, Involvement and Site Interviews

A public notice was made available by newspaper postings in the *Arizona Business Gazette* on January 2, 2020, and the *La Voz* on January 24, 2020. The notices stated that there was a five-year review and invited the public to submit any comments to the EPA (Included in Appendix F.) The notices were also published to ADEQ's web page: https://axdeq.gov/notices/public-notice-seeking-input-cleanup-work-19th-avenue-landfill-superfund-site-phoenix. The results of the review and the report will be made available at ADEQ's web page: https://azdeq.gov/19th-avenue-landfill-site-history and EPA's web page at: www.epa.gov/superfund/nineteenthave. An information repository containing the Site's Administrative Record (i.e., a required set of key site-related documents and reports) is located at:

ADEQ Records Management Center
1110 West Washington Street
Phoenix, AZ 85007

and

EPA Region IX
Records Center
Mail Stop: R09-SEMD-CSCEB-CES
75 Hawthorne Street
San Francisco, CA 94105

During the FYR process, two interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The results of the interviews are presented in Appendix G and summarized below.

Ms. Lisa Kowalczyk, ADEQ's Project Manager for the Site since September 2019, found that O&M of the Site's institutional and engineering controls are satisfactory and that the City's O&M activities are in accordance with relevant legal requirements. Additionally, Ms. Kowalczyk found that the cap is functioning as expected; that the cap continues to contain waste and prevent infiltration; that the change from quarterly to semi-annual groundwater monitoring in 2019 was approved by ADEQ in accordance with the decision documents and duly enacted by the City upon its receipt of ADEQ's verbal and written approval; and that the remedy's effectiveness was not impacted due to the change in groundwater monitoring frequency.

Ms. Kowalczyk further found that the City is adequately controlling explosive gas (methane) at the Nineteenth Avenue Landfill by operating a flare system and monitoring an extensive gas monitoring probe network, which is similar to other solid waste landfills of its age within the state of Arizona. Unlike other solid waste landfills within Arizona, however, which rely on quarterly gas probe system sampling or on monthly sampling focused on certain potential areas of concern, the Nineteenth Avenue Landfill is required to sample the entirety of its landfill gas probe system each month. Consequently, the City has requested a reduction in methane monitoring sampling frequency from monthly to quarterly, while keeping the same methane exceedance conditions, in accordance with 40 CFR 258.23. ADEQ agrees that an optimization of the methane monitoring program (whether a Site wide reduction to quarterly monitoring or a mix of quarterly monitoring and focused monthly monitoring of certain probes) is appropriate.

Mr. Doug Sawyer, the City's Engineering Supervisor, indicated that the remedy is functioning as expected. Periodic inspections ensure that the monitoring equipment is functioning and that physical components of the remedy (fencing, extraction system) are repaired in a timely manner. He noted that decreasing groundwater levels have caused the existing groundwater sampling pumps (electric submersible pumps) to be exposed to air and then re-submerged, thereby accelerating rusting of the exposed metal parts. He recommends proposing a switch to low-flow bladder pumps that operate on compressed air and have fewer moving parts.

Mr. Sawyer also noted that as methane gas production decreases, the City will need to replace the landfill gas collection and control system with another control technology more suitable to the lower methane content. The City is in the process of requesting a reduction in the monthly gas monitoring to a quarterly basis. Mr. Sawyer indicated that this request is supported by the fact that only 3 of the 136 probes are susceptible to gas migration, which only occurs after a rain event. The proposed reduction would continue monthly monitoring at those 3 probes and reduce the monitoring to quarterly in the remainder of the probes. The City is considering asking EPA and ADEQ to manage the landfill under EPA's CERCLA authority as a closed municipal solid waste site. Mr. Sawyer believes the basis for the City's request was the assumption that the site had taken hazardous wastes. However, years of monitoring have not demonstrated hazardous waste disposal characteristic in either the groundwater or landfill gas monitoring results.

4.2. Data Review

The results of a data review of the groundwater quality and methane monitoring results in the FYR period are provided in Appendix C and summarized below.

The City conducted quarterly groundwater sampling and groundwater depth measurements at 18 monitoring wells, which comprise the current monitoring network (See Figure 4.) As stated in the remedy contingency plan, if the average of three consecutive quarterly samples of a constituent in any downgradient well exceeds the groundwater standards and a follow-up groundwater sample confirms the exceedance , then the contingency plan must be implemented. As such, a running three quarter average of groundwater contaminant concentrations above the current groundwater standard was evaluated for this FYR. Most one-time exceedances were occasional heavy metals that occurred in downgradient wells (DM-4, DM-7S, DM-7D, I-3, and I-4). In addition, DM-8S and DM-8D are the only upgradient wells with a three-quarter average exceedance.

Exceedances of sulfate, arsenic, thallium, nickel, chromium, and gross alpha were reported during this FYR period in one or more of the downgradient wells. Most of the exceedances were reported in wells I-3 and I-4 on the western property boundary. Of the five downgradient wells with exceedances, I-3 and I-4 were the most frequently reported. The upgradient exceedances in DM-8S and DM-8D were for arsenic and were reported in the first quarter of 2015. Mann-Kendall trends indicate increasing concentrations of arsenic in Cell A-1 at upgradient well I-6. The exceedances of arsenic in many of the monitoring wells are most likely attributed to existing soil conditions and are extensively discussed in the Third FYR.

Sulfate exceedances were only noted in downgradient well DM-7S. It was not found to exceed the criteria in the landfill boundary wells suggesting that a source other than the landfill may be responsible for the exceedances.

Thallium exceedances were noted only from wells I-3 and I-4 (predominately well I-3). Thallium concentrations in well I-4 may be increasing with a maximum detection of 0.004 mg/L during the May 2017 sampling event.

Gross alpha was reported only from downgradient well DM-7D in 2015 and 2016. It has not been recorded since.

Nickel exceedances were only reported from well I-3.

Chromium exceedances were only reported for well DM-4 in 2016.

Trend analysis indicates these periodic exceedances of sulfate, thallium, nickel, chromium, and gross alpha are not increasing and do not show a correlation between the landfill constituents and constituents in the downgradient wells (if it is in the boundary wells, it is not in the downgradient wells and vice versa). As such, the implementation of the groundwater contingency plan has not been necessary. Additionally, the groundwater at the landfill is not a drinking water source. Therefore, these periodic exceedances do not pose a risk to human health or the environment.

Methane concentrations at the landfill boundary should be less than 5 percent by volume in air. Based on the review of available quarterly and semi-annual reports, there was one exceedance of methane during this FYR period, which occurred during the first quarter of 2019 at probe LG19A18D (probe located in trash) with a concentration of 7.5 percent methane. Data from April to September 2019 at this probe had methane concentrations of 0 percent. The ARAR for the landfill gas accumulation is a limit of 5 percent on the concentration of methane (the lower explosive limit) in the subsurface at the boundary of the landfill and less than 1.25 percent methane in buildings. The single exceedance of 5 percent does not represent an on-going human health or environmental exposure pathway since the methane did not continue to exceed the limit. Additionally, due to declining landfill gas concentrations, a new carbon adsorption system was installed in Cell A-1 to replace the existing flare station in October 2015.

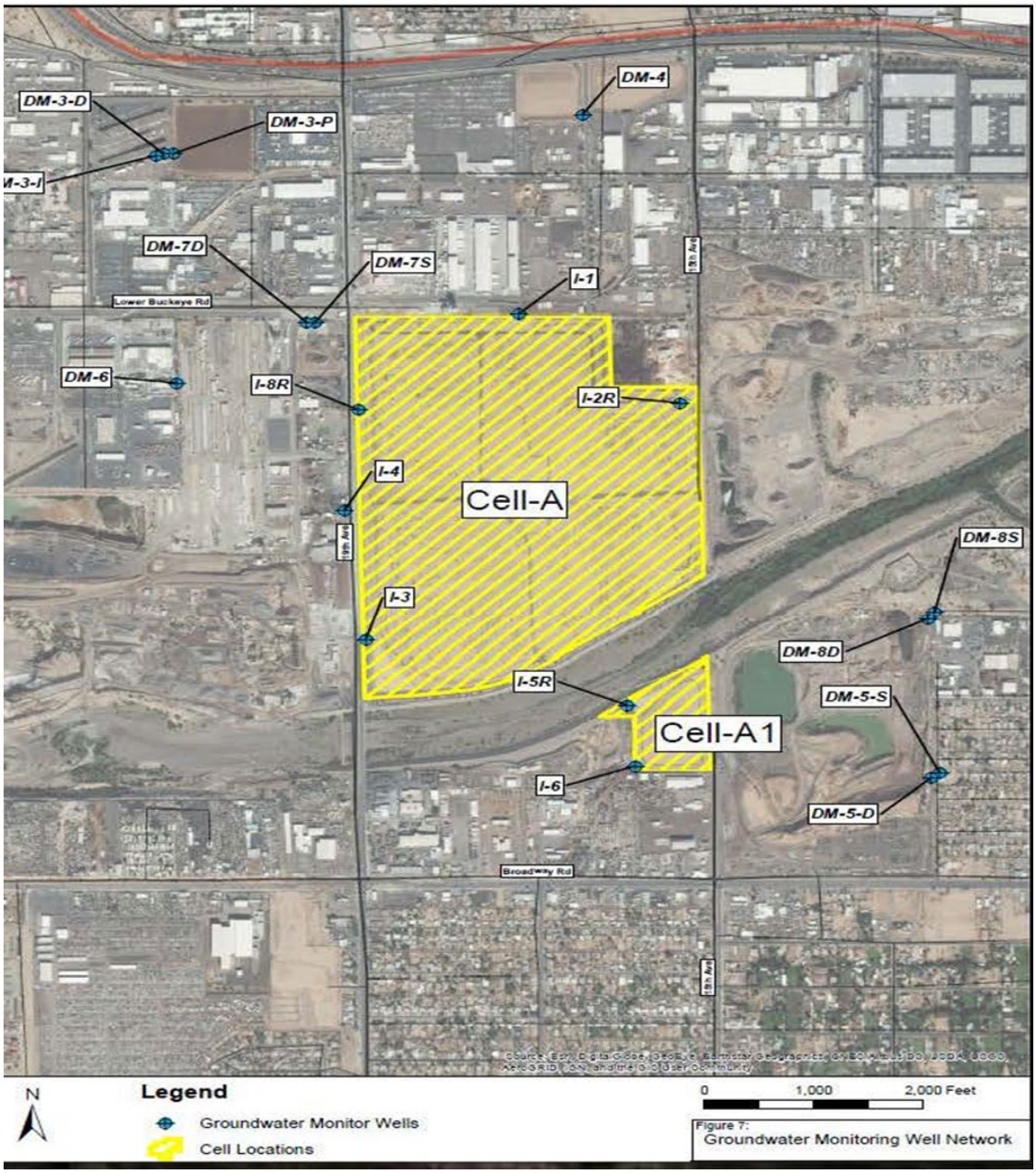


Figure 4. Groundwater Monitoring Wells

4.3. Site Inspection

The inspection of the Site was conducted on February 12, 2020 (See Appendix H.) In attendance were Matthew Masten, U.S. Army Corps of Engineers, Env. Engineer; Doug Sawyer, the City's Project Manager; Michael Bouchard, Chris Fine, Jon Birch, Ariel LeBarron, and Jessica Yates all from the City; Nadia Hollan Burke, Remedial Project Manager, EPA; and Karin Harker and Lisa Kowalczyk from the Federal Projects Unit, ADEQ. The purpose of the inspection was to assess the protectiveness of the remedy.

The City indicated that a new geographic information system, which is being used to track and visualize methane emissions from the Site, was installed during the five-year review period. Other changes during the review period included the removal of the flare from Cell A-1 installation of a carbon adsorption system, and upgrades to the methane collection system. The flare was replaced in the last five years. The current burner stack was moved from a different City site at 19th Ave and Greenway Road, where it was no longer needed. The stack is approximately 10 years old and appeared to be in good working order. An operator is on the Site daily, Mon-Fri, and the system has an alarm to notify appropriate personnel of any shut down. The flare system appeared to be in good shape and functioning correctly.

The C-line of the methane extraction system was upgraded in 2019. Representative valve boxes were opened and samplers were inspected. These all appeared to be in good condition and functioning normally.

The landfill cap was noted to be well vegetated, with erosion control wattles in place where necessary. No erosion concerns were noted on the landfill cap, inspectors are on site weekly, and maintenance crews repair any erosion issues.

The east perimeter of the landfill was inspected and the City's Project Manager indicated that, although there had been issues with the adjoining property owner (construction debris recyclers) over excavating along the property line a few years ago, this problem was fixed and is no longer an issue.

The east side above-grade methane collection system, southeast retention basin, surface water channel, and storm water intakes were all inspected. All appeared to be in good working order and well maintained.

The Cell A-1 carbon adsorption system was inspected. This system replaced the Cell A-1 flare that was in place during the previous FYR inspection. Three granular activated carbon vessels were installed to replace the flare, due to lower methane emissions in this cell. The system emissions are sampled weekly. Carbon changeouts occur approximately every 6-8 months. The Cell A-1 granular activated carbon system was found to be in good working order.

All components of the Site's remedial action appear to be in good condition and are currently operating as intended. All systems and wells were found to be secured and free from vandalism. No indication of trespassing was observed.

5. Technical Assessment

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

According to the review of relevant documents and data, site inspections, and interviews, the remedy is functioning as intended by the EPA ROD, and the ESDs. The landfill cover system has been effective in containing the waste and contaminants and preventing leaching of contaminants into the groundwater. During the February 12, 2020 site visit, the landfill cap was observed to be well vegetated with erosion control wattles in

place where necessary. No erosion concerns were identified on the landfill cap. Mr. Sawyer (City of Phoenix) stated that inspectors are on-site weekly, and maintenance crews repair any erosion issues.

The constructed levees with bank protection prevent refuse washout during a 100-year flood event and are inspected by on-site personnel. Construction and implementation of the landfill gas mitigation system prevents off-site migration of landfill gas thereby eliminating the risk of explosions that could result from the accumulation of methane gas. Performance of the groundwater monitoring program ensures that future potential groundwater degradation does not pose a risk to public health, welfare, or the environment.

The City performs adequate monitoring, inspections, and O&M at the Site to ensure compliance with procedural requirements and the protection of human health and the environment. A DEUR with engineering and institutional controls was recorded for the Site on July 19, 2006. (See Appendix E.) The DEUR describes the known contamination at the Site, the engineering controls that must be maintained, and the institutional controls required of the City and any future owners. The City has submitted to ADEQ Annual Inspection Reports, as required by the DEUR. The City has provided appropriate security measures at the Site and has been routinely submitting monitoring reports to ADEQ.

The exceedances of arsenic in many of the monitoring wells are most likely attributed to existing soil conditions and are extensively discussed in the Third FYR. These exceedances do not pose a risk to human health or the environment as drinking water is not provided from the groundwater at the landfill. Exceedances of sulfate, arsenic, thallium, nickel, chromium, and gross alpha were reported during this FYR period in one or more of the downgradient wells. Sulfate exceedances were only noted in downgradient well DM-7S. It was not found to exceed the criteria in the landfill boundary wells suggesting that a source other than the landfill may be responsible for the exceedances. Gross alpha was reported only from downgradient well DM-7D in 2015 and 2016. It has not been recorded since. Trend analysis indicates these exceedances are not increasing and do not show a correlation between the landfill groundwater constituents and groundwater constituents in the downgradient wells (if it is in the boundary wells, it is not in the downgradient wells and vice versa).

The ARAR for the landfill gas accumulation is a limit of 5 percent on the concentration of methane (the lower explosive limit) in the subsurface at the boundary of the landfill and less than 1.25 percent methane in buildings. Since the methane concentration was not measured in an enclosed space (requirement of ROD), the single exceedance of 5 percent does not represent a human health or environmental exposure pathway.

Air emissions from the flare stations meet the requirements of the Maricopa County Air Permit.

5.2. Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of Remedy Selection Still Valid?

There have been no changes to the ARARs in the FYR period affecting the protectiveness of the remedy. (See Appendix D.) There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy as noted during the 2019 site visit. The City is in compliance with the requirements of the air permit. There are no known complete exposure pathways to contaminants from the Site as the landfill cap is in operating condition and the perimeter fencing is intact. Engineering controls are in place and well maintained. Institutional controls (monitoring of groundwater and methane emissions) are in place that prevent/prohibit human incursion onto the Site either through the prevention of installation of drinking water wells or public access to the landfill cap. Monitoring results for groundwater contamination and landfill gas emissions are showing no trend or a decreasing trend over time.

5.3. Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

No additional information (including climate change impacts) has been identified that would call into question the protectiveness of the remedy. A Government Accountability Office (GAO) report published in October 2019 titled *SUPERFUND, EPA Should Take Additional Actions to Manage Risk from Climate Change* identifies the Site as having a potentially increased risk for flooding at the one percent level. Federal Emergency Management Agency (FEMA) flood hazard map includes the Site in the 0.2 percent of flood risk. (The GAO report averages over a larger area than Site boundary while the FEMA map is location specific.) The GAO report indicates the Site is at a high wildfire hazard potential. A review of the most current aerial photographs suggest that there is no fuel source for a wildfire within ¼ mile of the Site. The landfill itself is capped with grasses; this does not indicate an increased risk from existing conditions. Therefore, no additional risks to the Site would result from climate change as the levees are built to the 100-year flood and landscaping at the Site is frequently inspected to ensure that reduced fuel loads are maintained.

The east perimeter of the landfill was inspected during the site visit on February 12, 2020. Mr. Sawyer (City of Phoenix) indicated that there had been issues with the adjoining property owner (construction debris recyclers) over excavating along the property line a few years ago, but this problem was fixed and is no longer an issue.

6. Issues/Recommendations

There are no issues or recommendations that affect the protectiveness of the remedy.

Although there are no issues that affect protectiveness, there were follow-up items identified that may improve the monitoring program. The 1989 ROD states the following in regard to protecting groundwater and implementing the contingency plan:

> *Monitoring groundwater quality and implementing a contingency plan if ground-water quality conditions deteriorate due to future contaminant releases from the landfill. The objective of the contingency plan is to ensure that potential ground-water degradation does not to pose a risk to public health, welfare, or the environment in the future.*

Appendix B of the ROD describes the process for implementing the contingency plan and provides an explanation of events which would trigger the plan. It is recommended that the agencies and the City of Phoenix implement a strategy to ensure the guidance provided in the contingency plan is adhered to, and that follow-up sampling occurs immediately following the exceedances instead of sampling in the next monitoring cycle.

7. Protectiveness Statement

Table 3. Protectiveness Statement

Sitewide Protectiveness Statement
Protectiveness Determination: Protective
Protectiveness Statement: The remedy at the Nineteenth Avenue Landfill Superfund Site is protective of human health and the environment. There are no environmental exposure pathways that result in unacceptable risks. The engineered and institutional controls selected in the decision documents are properly operated, monitored, and maintained, and the land use at the Site allows for the integrity of the remedy to continue. Levees protect the Site from the 100-year floods, the landfill cap functions to prevent surface water from entering the refuse which reduces the potential for leachate to reach groundwater aquifers, and monitoring continues to document that no groundwater or methane gas concentrations are at levels that result in the implementation of the monitoring Contingency Plan.

8. Next Review

The next five-year review report for the Nineteenth Avenue Landfill Superfund Site is required five years from the completion date of this review.

Appendix A: List of Documents Reviewed

Arizona Department of Environmental Quality. December 1995. *Explanation of Significant Difference #1, 19th Avenue Landfill.*

Arizona Department of Environmental Quality. September 2003. *19th Avenue Landfill Explanation of Significant Differences.*

Arizona Department of Environmental Quality. April 2006. *19th Avenue Landfill Explanation of Significant Difference #3.*

Arizona Department of Environmental Quality. September 2010. *Third Five-Year Review Report for 19th Avenue Landfill Superfund Site.*

Arizona Department of Environmental Quality. 25 September 2019 Letter. *19th Avenue Landfill Notice of Intent to Modify Groundwater Sampling Frequency from Quarterly to Semi-Annual, Modify the 1992 Consent Decree and Present Explanation of Significant Difference for the Record of Decision*.

City of Phoenix. 20 July 2006. *Declaration of Environmental Use Restriction For Property With Engineering and Institutional Controls.*

City of Phoenix. 30 April 2015. *19th Avenue Landfill Quarterly Progress Report, First Quarter 2015*.

City of Phoenix. 30 July 2015. *19th Avenue Landfill Quarterly Progress Report, Second Quarter 2015*.

City of Phoenix. 30 October 2015. *19th Avenue Landfill Quarterly Progress Report, Third Quarter 2015*.

City of Phoenix. 29 January 2016. *19th Avenue Landfill Quarterly Progress Report, Fourth Quarter 2015*.

City of Phoenix. 29 April 2016. *19th Avenue Landfill Quarterly Progress Report, First Quarter 2016*.

City of Phoenix. 29 July 2016. *19th Avenue Landfill Quarterly Progress Report, Second Quarter 2016*.

City of Phoenix. 9 December 2016. *19th Avenue Landfill Quarterly Progress Report, Third Quarter 2016*.

City of Phoenix. 30 January 2017. *19th Avenue Landfill Quarterly Progress Report, Fourth Quarter 2016*.

City of Phoenix. 28 April 2017. *19th Avenue Landfill Quarterly Progress Report, First Quarter 2017*.

City of Phoenix. 28 July 2017. *19th Avenue Landfill Quarterly Progress Report, Second Quarter 2017*.

City of Phoenix. 30 October 2017. *19th Avenue Landfill Quarterly Progress Report, Third Quarter 2017*.

City of Phoenix. 30 January 2018. *19th Avenue Landfill Quarterly Progress Report, Fourth Quarter 2017*.

City of Phoenix. 30 April 2018. *19th Avenue Landfill Quarterly Progress Report, First Quarter 2018*.

City of Phoenix. 30 July 2018. *19th Avenue Landfill Quarterly Progress Report, Second Quarter 2018*.

City of Phoenix. 30 October 2018. *19th Avenue Landfill Quarterly Progress Report, Third Quarter 2018*.

City of Phoenix Public Works Department. 15 November 2019. *2nd Semi-Annual Groundwater and Gas Monitoring Report*.

City of Phoenix Public Works Department. 22 January 2020. *Follow-Up Groundwater Analytical Results*.

City of Phoenix zip code population. https://statisticalatlas.com/zip/85003/Overview#nav-map/neighborhood

FEMA Flood Map Service Center accessed 15 January 2020 https://msc.fema.gov/portal/search?AddressQuery=19th%20Ave%20landfill%20Phoenix%20Arizona#searchresultsanchor

Government Accountability Office. 2019. *Superfund EPA Should Take Additional Actions to Manage Risks from Climate Change* GAO-20-73.

Registry of Wells in Arizona https://gisweb3.azwater.gov/WellReg accessed 14 February 2020

Tetra Tech. 3 April 2019. *2018 Annual Declaration of Environmental Use Restriction Inspection for the City Of Phoenix 19th Avenue Landfill*.

Tetra Tech. 17 May 2019. *19th Avenue Landfill Quarterly Progress Report, First Quarter 2019*.

United States Army Corps of Engineers. 28 September 2015. *Fourth Five-Year Review Report for Nineteenth Avenue Landfill Superfund Site, Maricopa County, Arizona*.

United States Environmental Protection Agency. 8 September 1983. *40 CFR Part 300, Amendment to National Oil and Hazardous Substance Contingency Plan; National Priorities List.*

United States Environmental Protection Agency. 29 September 1989. *EPA SUPERFUND Record of Decision, Nineteenth Avenue Landfill, EPA ID: AZD980496780. OU 01. Phoenix, Arizona*.

United States Environmental Protection Agency. 25 September 2006. *40 CFR Part 300, National Oil and Hazardous Substance Contingency Plan; National Priorities List Update; Notice of deletion of the Nineteenth (19th) Avenue Landfill Superfund Site from the National Priorities List.*

United States Environmental Protection Agency. June 2015. *Explanation of Significant Difference #4, 19th Avenue Landfill, Phoenix, Arizona*.

Appendix B: Site Chronology

Discovery of problem or contamination (flooding event washed refuse into river)	May 1978
Pre-National Priorities List responses	February 1979
Landfill closed by a cease and desist order issued by Arizona Department of Health Services	February 1979
Consent Order agreed to by City of Phoenix (City) and Arizona Department of Health Services	June 1979, amended Dec 1979
Site listed by the EPA	September 1983
Remedial Investigation/Feasibility Study completed by the City	June 1988
Lead oversight responsibility assigned to ADEQ by EPA	1988
Remedial Action Plan completed by the City	June 1989
Letter of Determination signed by ADEQ approved remedial action plan	21 September 1989
Record of Decision (ROD) signed by EPA approved ADEQ's Letter of Determination	29 September 1989
Remedial Design started by the City	October 1990 completed September 1997
Consent Decree signed by ADEQ and the City	18 June 1992
Explanation of Significant Difference (ESD) #1 signed by agencies	December 1995
Remedial design completed by City	May 1995
Remedy construction completed by City	December 1996
Preliminary Close-Out Report signed by ADEQ and EPA	February 1998
Remedial Action Report completed by City	September 1998
First FYR Report approved by ADEQ and EPA	September 2000·
Supplemental First FYR Report completed by ADEQ	July 2001
ESD #2 signed by ADEQ and EPA	September 2003
Second FYR Report approved by ADEQ and EPA	September 2005
Screening Level Ecological Risk Assessment completed by EPA	March 2006
ESD #3 signed by ADEQ and EPA	June 2006
Declaration of Environmental Use Restriction recorded (DEUR) by the City	July 2006
Final Close-out Report signed by ADEQ and EPA	July 2006
Nineteenth Ave Landfill delisted by EPA	September 25, 2006
Third FYR Report approved by ADEQ and EPA	September 2010
DEUR amended	November 2012
ESD #4 signed by ADEQ and EPA	July 2015
Fourth FYR Report approved by EPA	September 2015
Carbon adsorption system was installed in Cell A-1	October 2015
City GW monitoring reduced to semi-annually	25 September 2019

Appendix C: Data Review

Groundwater

The hydrogeologic data review for this FYR included compliance groundwater monitoring data, groundwater level data and landfill gas data. In 1987, a total of 7 off-site wells DM-series wells were installed: a DM-3 cluster series (DM-3D, DM-3I, DM-3P) located northwest and downgradient of Cell A; DM-4 (located due north and downgradient or cross-gradient of Cell A); DM-5D and DM-5S (located southeast and upgradient of both landfill cells); and DM-6 (located northwest and downgradient of Cell A). The well casing for these DM wells is 6" PVC, the well depth ranges from 164 to 370 feet, and the screen intervals are all 40 feet in length. Three small diameter wells designated River North, River South and Jackrabbit area were installed and located along the banks of the Salt River. Subsequently, during construction of the final remedy, these wells were abandoned. In 1992, 4 additional off-site multi-depth wells were added to the DM-series: DM-7D and DM-7S (located just northwest and directly downgradient of Cell A); and DM-8D and D-8S (located northeast of Cell A-1, upgradient), for a total of 11 DM-series wells. The well casing for these additional DM wells is 6" PVC, the well depths range from 99 to 179 feet, and the screen intervals are 15 feet in the deeper (D) wells and 40 feet in the shallower (S) wells. In 1996, 3 additional I-series monitor wells (I-2R, I-5R, I-8R) were added along other border areas in Cells A and A-1 for a total of seven I-series boundary wells. The well casing for these additional I-series wells is 4" PVC, the well depth ranges from 101 to 115 feet, and the screen intervals are 40 to 50 feet. Late in 1996 well River North-R was installed along the Salt River in the southeast corner of Cell A to a depth of 95 feet with a screen interval of 35 feet. In particular, groundwater monitor wells I-3 and I-4, the two wells that most often have exceedances of current groundwater quality standards, have screen intervals of 54 feet and 69 feet, respectively. These two wells are boundary wells completed to a depth of 100 feet below ground surface (bgs) and102 feet bgs, respectively.

Groundwater flow directions for this FYR period reflect historical trends, with the predominant flow from the southeast to the northwest (See Figure C-2.) The detections of all chemicals are most likely residual concentrations and not due to the groundwater contacting the bottom of the landfill refuse, therefore, a mechanism to transport contamination off site does not exist. Groundwater levels for the entire Phoenix metropolitan area have lowered the water table throughout the region for several years and this is reflected in the water levels beneath the site. At the time the ROD was issued for the Site, groundwater levels were high enough to encounter or saturate landfill debris. Currently, depth to groundwater is approximately 70 to 100 feet bgs in on-site wells.

The Site contains 18 monitoring wells installed in the Upper Alluvial unit as shown on Figure C-1. During the period leading up to the 2020 FYR, the City conducted quarterly groundwater sampling and depth to groundwater measurements which comprises the current monitoring network. The quarterly samples were submitted for analysis to an Arizona Department of Health Services certified laboratory that uses state-approved analytical methods. The City prepared and submitted quarterly reports to the agencies during this review period until 2019, then Tetra Tech began to produce the quarterly, and subsequent semi-annual reports.

Groundwater data results from the three-quarter averages that exceed the groundwater water quality standards were evaluated for this FYR (See Table C-1.) All quarterly reports from this FYR period were reviewed as well as the 2019 semi-annual report, which covered the second and third quarters of 2019. Most groundwater exceedances occurred in downgradient wells; only two upgradient wells (DM-8S and DM-8D) had three quarter exceedances for arsenic, which occurred during the first quarter event in 2015. Trends for arsenic and nickel are shown in Figures C-4, C-5 and C-6.

Landfill boundary wells I-3 and I-4 (downgradient of I-3) had arsenic concentrations ranging from 0.039 mg/L in 2015 to 0.015 mg/L in 2019 and 0.063 mg/L in 2016 to 0.015 mg/L in 2019 respectively. Downgradient well DM-3D had concentrations of arsenic ranging from 0.0044 mg/L in 2019 to 0.0079 mg/L in 2015 suggesting that the

arsenic exceedances observed in the boundary wells are not migrating to the downgradient wells. Upgradient wells DM-8S and DM-8D located outside the landfill had arsenic concentrations of 0.0112 mg/L and 0.0108 mg/L respectively in 2015. Based on approval from ADEQ in 2014, the City is no longer required to conduct monthly monitoring or provide an exceedance report for arsenic concentrations at wells I-3 or I-4. Data from 1986 to 1987 found arsenic concentrations at wells I-3 and I-4 ranging from 0 to 0.040 mg/L and 0.003 to 0.047 mg/L respectively. The current groundwater quality standard for arsenic is 0.01 mg/L. Transient increased arsenic (and iron) concentrations at wells I-3 and I-4 have clearly been associated with changes in water levels. However, arsenic concentration maxima in those wells are in response to new all-time low water levels. The data indicates that arsenic concentrations have varied little since 1986 and do not show an increasing trend at the landfill boundary overall and do show a presence at upgradient wells located outside the landfill boundaries (See Figure C-4.)

Downgradient well DM-7D (outside landfill boundary) had exceedances of gross alpha of 19.53 pCi/L and 19.93 pCi/L in 2016 and 2015 respectively. In 1986, upgradient well I-5 had gross alpha concentrations of 15 pCi/L suggesting that gross alpha is ubiquitous in the soils in the landfill vicinity. No exceedances of gross alpha have occurred since 2016 therefore, not affecting human health or the environment.

Thallium exceedances were found in landfill boundary wells I-3 and I-4 (See Figure C-6.) Thallium concentrations ranged from 0.0028 mg/L in 2018 to 0.002 mg/L in 2019 in I-3. Thallium concentrations ranged from 0.0016 mg/L in 2015 to 0.004 mg/L in 2019 in well I-4. Upgradient well I-6 had concentrations of thallium of 0.0012 mg/L in 2015, 2016, and 2017 suggesting soils near the landfill may contain thallium. The standard for thallium is 0.002 mg/L. While concentrations exceed the current groundwater standards in the boundary wells, and since drinking water will continued to be provided by the City of Phoenix, the remedy is protective of human health and the environment.

Nickel was observed in boundary wells I-3 and I-4 and in upgradient well I-6. Concentrations of nickel in well I-3 ranged from 0.12 mg/L in 2015 to 0.17 mg/L in 2017. Concentrations of nickel in well I-4 ranged from 0.039 mg/L in 2019 to 0.0079 mg/L in 2015. Concentrations of nickel in well I-6 ranged from 0.01 mg/L in 2018 to 0.014 mg/L in 2019. Data from 1986 to 1987 found nickel concentrations at wells I-3 and I-4 ranging from 0.03 mg/L to 0.05 mg/L and 0.09 to 0.03 mg/L respectively. Well I-6 concentrations ranged from 0.03 mg/L to 0.068 mg/L. The standard for nickel is 0.1 mg/L. Nickel concentrations exceed the current groundwater standards 3 times during this FYR and does not show an increasing trend. Since nickel concentrations are not found in downgradient wells but is found in the upgradient well suggests that nickel is not migrating beyond the landfill boundary and not affecting human health and the environment.

Occasional and transient detections of chromium, sulfate and gross alpha were the only other constituents which exceeded the current groundwater standards for the three-quarter averages, all in downgradient wells. Gross alpha is a common, naturally occurring contaminant in Arizona's alluvial aquifers composed of eroded granite and no migration pattern from the landfill site is documented by the data (detections of gross alpha at varied depths and locations appear to indicate that the gross alpha is pervasive in groundwater in the area of the landfill.). As early as the late 1990s, gross alpha was detected in upgradient well DM-5S. A trend analysis was not carried out on these intermittently detected constituents. Sulfate has been detected in well DM-7S at concentrations exceeding the current groundwater standards for the averaged three-event periods over the past year (See Table C-1.) This well is located downgradient of the landfill and is the only well that had levels of sulfate which exceeded the averaged standard. The detection of sulfate may warrant further investigation by the agencies should the detections continue to be present at increased concentrations.

The following information is from the April 14, 2004, ADEQ Technical Memorandum from their hydrologist.

> Reducing conditions clearly exist in the vadose zone beneath the landfill cap as evidenced by the amount of methane gas being collected by the extraction system at the Site. Seasonal lowering of the water table causes an influx of methane gas and associated reducing conditions downward into the expanding vadose zone and relatively thick capillary fringe to the water table. The water table is now at least 30 feet below the lowest refuse zone (small area where the pits were excavated to 50 feet bgs). Arsenic concentrations increase when the vadose zone expands downward and the water table moves farther from the base of the landfill refuse deposits due to a declining water table. This suggests mobilization of naturally occurring arsenic in the soils upon exposure to reducing conditions in the vadose zone rather than increasing contribution from a landfill source. If the source of the arsenic was associated with the landfill refuse, arsenic concentrations would be expected to increase with rising water levels in the vadose zone. Drops in the water table exposing aquifer sediment for the first time to reducing vadose zone conditions beneath the landfill appear to be related to increases in arsenic concentration at wells I-3 and I-4, both located at the downgradient edge of the landfill.

Surface Water and Sediment

No surface water bodies are located within the landfill cells; however, the Salt River bisects the Site. Stormwater runoff is directed to the perimeter drainage channels and into retention basins. From the basins, it is released into the Salt River. No surface water or sediment monitoring is conducted in the adjacent Salt River because the landfill was properly closed in accordance with the State's stormwater runoff requirements.

Landfill Gas

As a means of controlling subsurface migration of landfill gases to off-site locations, the City installed a gas extraction and treatment (flaring) system which is monitored on a monthly basis (See Figure C-3.) There are a total of 177 methane gas extraction wells in the network; 141 extraction wells are located within Cell A and the remaining 36 are located within Cell A-1. Due to declining landfill gas concentrations, a new carbon adsorption system was installed in Cell A-1 to replace the existing flare station in October 2015.

The City performs landfill gas monitoring on a monthly basis. The system included 43 dual-depth monitoring probes at Cell A, 11 dual-depth probes at Cell A-1, eight probes in the Salt River channel and five triple-depth probes on the south bank of the Salt River. After rain or flow events, the Salt River channel probes cannot be sampled if there is water present; these probes are sampled when they are in dry conditions.

Based on the review of available quarterly and semi-annual reports, there was one exceedance of methane during this FYR period, which occurred during the first quarter of 2019 at probe LG19A18D (probe located in trash) with a concentration of 7.5 percent methane. Data from April to September 2019 at this probe had methane concentrations of 0. The ARAR for the landfill gas accumulation is a limit of 5 percent on the concentration of methane (the lower explosive limit) in the subsurface at the boundary of the landfill and less than 1.25 percent methane in buildings. Since the methane concentration was not measured in an enclosed space (requirement of ROD), the single exceedance of 5 percent does not represent a human health or environmental exposure pathway.

Table C-4. Three Quarter Event Rolling Average Results[1] for all Current Groundwater Standards Exceedances

Year	Event	Well ID	Constituent	Average Result (mg/L)	Current Groundwater Standards(mg/L)
2019	2nd Semi-Annual	DM-7S	Sulfate	**1,490**	400
		I-3	Arsenic	**0.0183**	0.01
		I-3	Thallium	**0.0022**	0.002
		I-4	Arsenic	**0.0011**	0.01
		I-4	Thallium	**0.0029**	0.002
2019	1st Quarter	DM-7S	Sulfate	**1,490**	400
		I-3	Arsenic	**0.017**	0.01
		I-3	Thallium	**0.0024**	0.002
2018	4th Quarter	DM-7S	Sulfate	**2,400**	400
		I-3	Arsenic	**0.015**	0.01
		I-3	Nickel	**0.12**	0.1
		I-3	Thallium	**0.0028**	0.002
2017	4th Quarter	I-3	Arsenic	**0.015**	0.01
		I-4	Arsenic	**0.014**	0.01
2017	3rd Quarter	I-3	Arsenic	**0.0263**	0.01
		I-3	Nickel	**0.108**	0.1
		I-3	Thallium	**0.0026**	0.002
		I-4	Arsenic	**0.0257**	0.01
		I-4	Thallium	**0.0023**	0.002
2017	2nd Quarter	I-3	Arsenic	**0.0183**	0.01
		I-4	Arsenic	**0.019**	0.01
2017	1st Quarter	I-3	Arsenic	**0.034**	0.01
		I-3	Thallium	**0.0021**	0.002
		I-4	Arsenic	**0.035**	0.01
		I-4	Thallium	**0.0022**	0.002
2016	4th Quarter	I-3	Arsenic	**0.032**	0.01
		I-4	Arsenic	**0.063**	0.01
2016	3rd Quarter	I-3	Arsenic	**0.016**	0.01
		I-4	Arsenic	**0.038**	0.01
		DM-4	Chromium	**0.0767**	0.05
2016	2nd Quarter	I-3	Arsenic	**0.029**	0.01
		I-4	Arsenic	**0.0557**	0.01
		DM-4	Chromium	**0.075**	0.05
		DM-7D	Gross Alpha	**19.5333**	15
2016	1st Quarter	I-3	Arsenic	**0.0303**	0.01
		I-4	Arsenic	**0.0533**	0.01
		DM-7D	Gross Alpha	**18.7333**	15
2015	4th Quarter	I-3	Arsenic	**0.0323**	0.01
		I-4	Arsenic	**0.047**	0.01

Year	Event	Well ID	Constituent	Average Result (mg/L)	Current Groundwater Standards(mg/L)
		DM-7D	Gross Alpha	**19.9333**	15
2015	3rd Quarter	I-3	Arsenic	**0.0307**	0.01
		I-4	Arsenic	**0.0467**	0.01
2015	2nd Quarter	I-3	Arsenic	**0.0247**	0.01
		I-3	Thallium	0.002	0.002
		I-4	Arsenic	**0.0427**	0.01
2015	1st Quarter	I-3	Arsenic	**0.0297**	0.01
		I-3	Nickel	**0.1133**	0.1
		I-3	Thallium	**0.0021**	0.002
		I-4	Arsenic	**0.0507**	0.01
		DM-7S	Sulfate	**840**	400
		DM-8S	Arsenic	**0.0112**	0.01
		DM-8D	Arsenic	**0.0108**	0.01

1 – "Rolling" averages refer to an average over a 3-event period; i.e. the three most recent events are averaged; **BOLD** are exceedances of current groundwater standards.

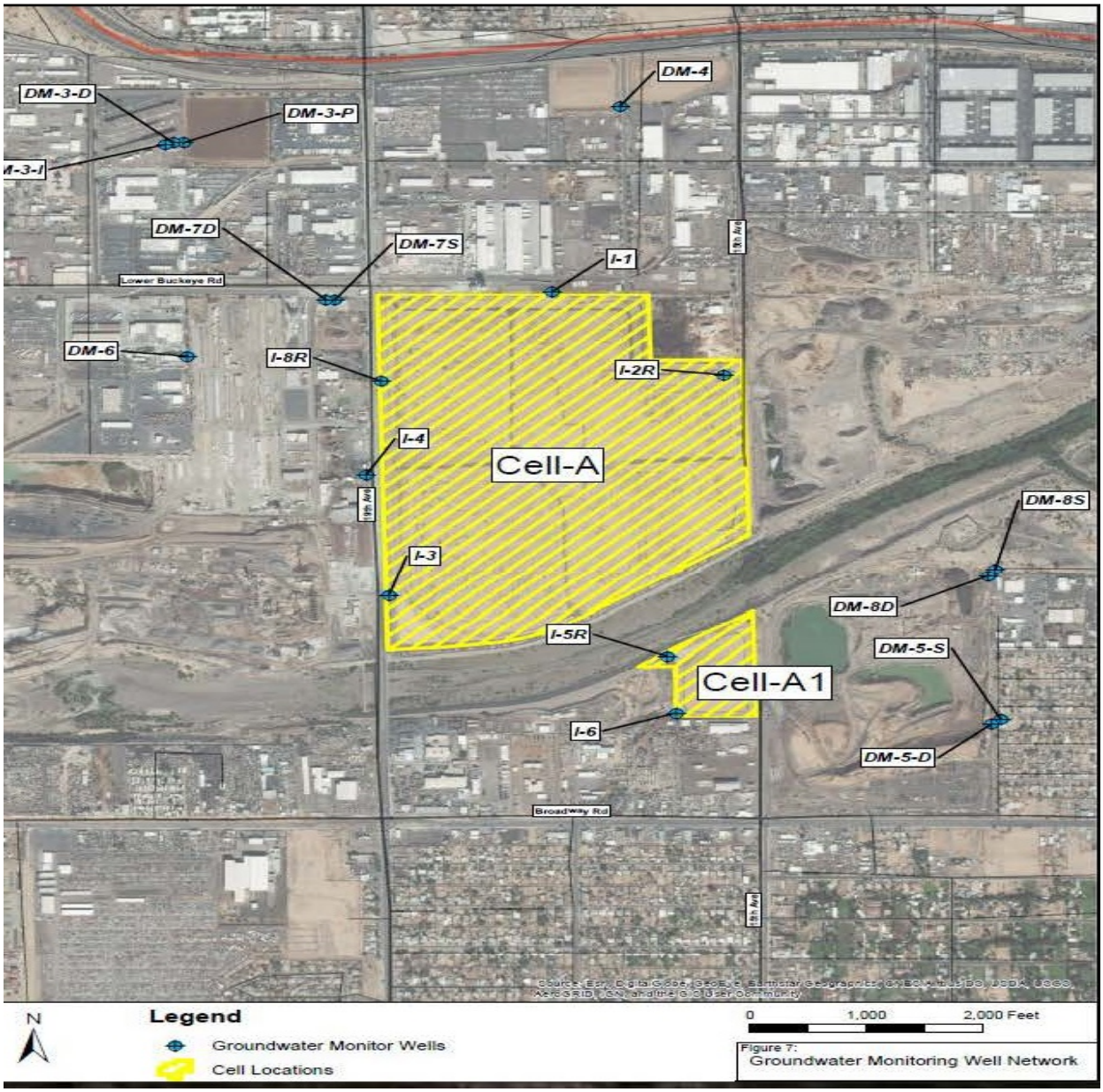


Figure C-5. Groundwater Monitoring Wells for the Nineteenth Avenue Landfill Superfund Site

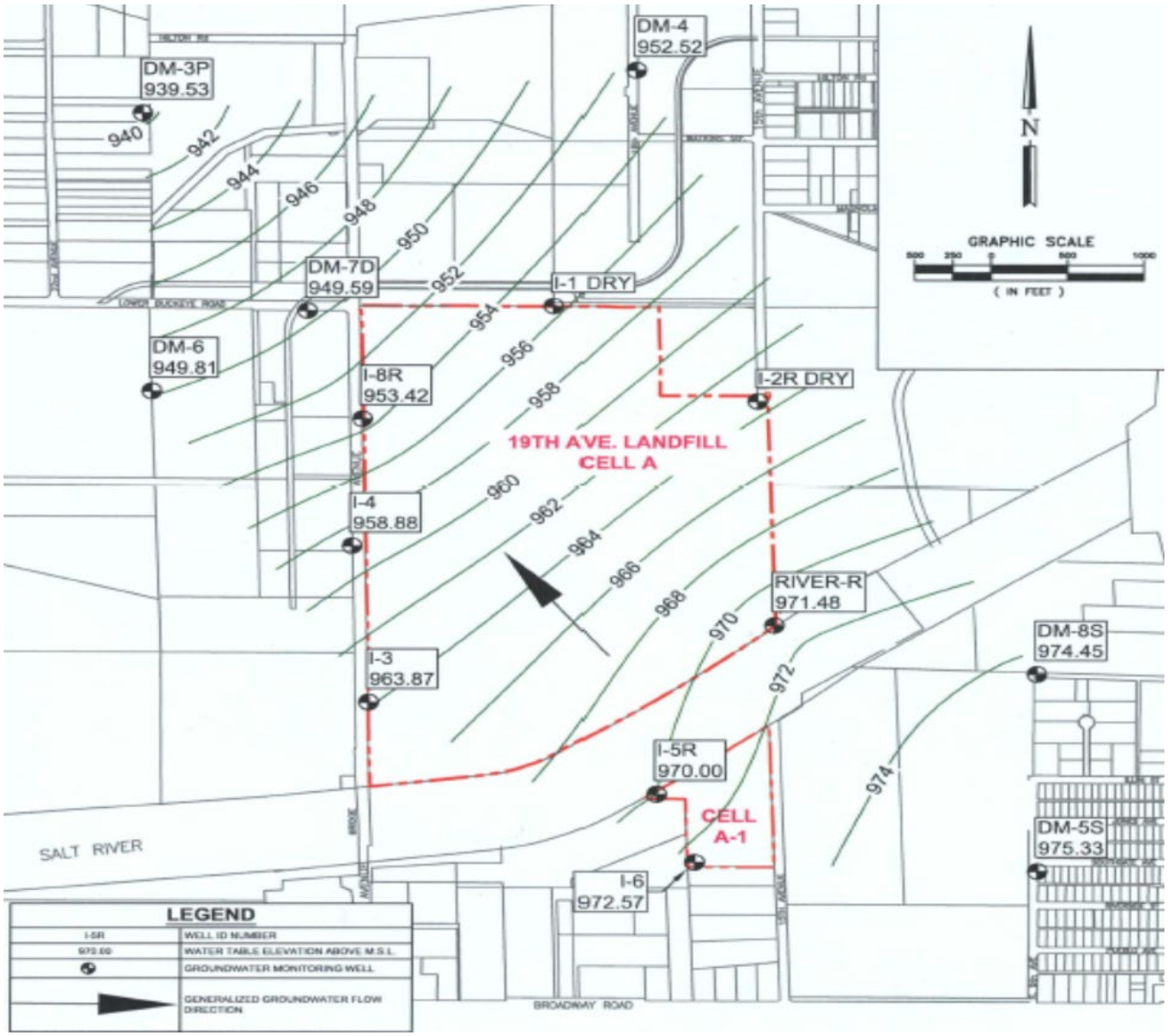


Figure C-6. Groundwater Elevation Map Third Quarter 2019

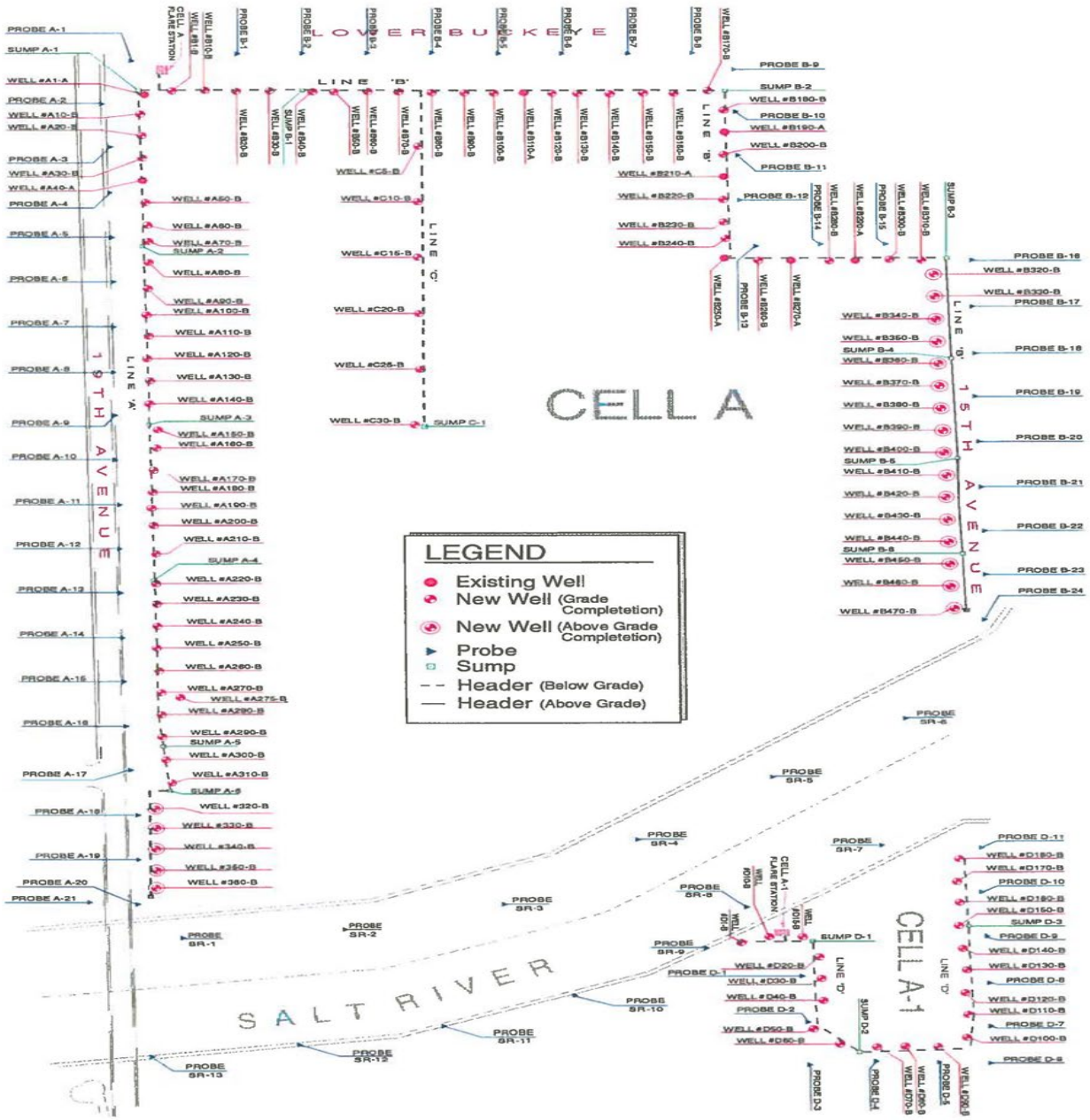
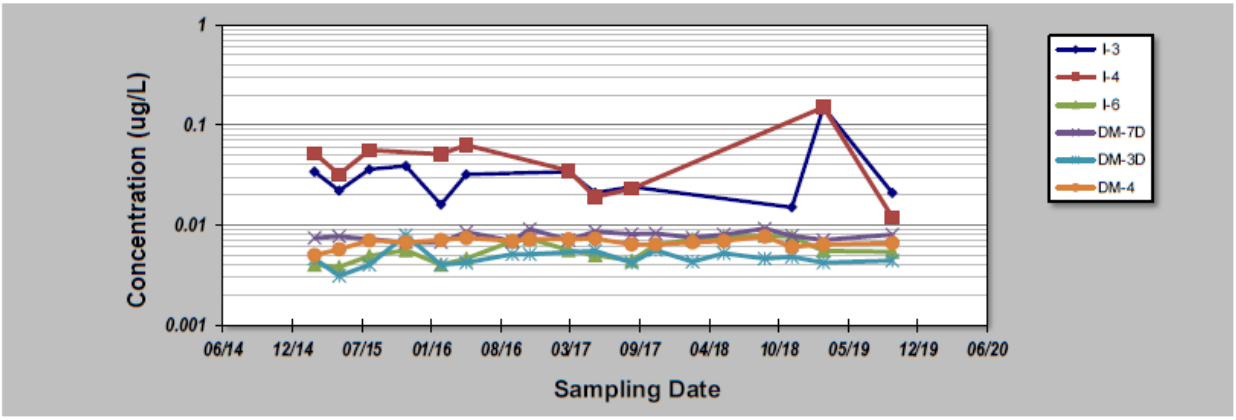


Figure C-7. Landfill Gas Extraction System Features

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 4-Feb-20
Facility Name: 19th Avenue Landfill
Conducted By: S. Benovic
Job ID:
Constituent: Arsenic
Concentration Units: mg/L

Sampling Point ID:	I-3	I-4	I-6	DM-7D	DM-3D	DM-4	
Sampling Event	Sampling Date	ARSENIC CONCENTRATION (mg/L)					
1	1-Mar-15	0.034	0.052	0.004	0.0074	0.0046	0.005
2	11-May-15	0.022	0.032	0.0038	0.0077	0.0031	0.0057
3	6-Aug-15	0.036	0.056	0.0049	0 .0077	0.004	0.007
4	19-Nov-15	0.039	0 053	0.0056	0.0067	0.0079	0.0067
5	28-Feb-16	0.016	0.051	0.004	0.0067	0.004	0.0071
6	11-May-16	0.032	0.063	0.0046	0.0085	0.0042	0.0074
7	21-Sep-16			0.0069	0.0069	0.0051	0.0069
8	9-Nov-16			0.0073	0.0091	0.0051	0.0072
9	1-Mar-17	0.034	0.035	0.0056	0.0071	0.0 034	0.0072
10	17-May-17	0.021	0.019	0.005	0.0086	0.0055	0.0073
11	30-Aug-17	0.024	0.023	0.0044	0.0081	0.0042	0.0064
12	7-Nov-17			0.0063	0.0082	0.0056	0.0064
13	21-Feb-18			0.0072	0.0075	0.0043	0.0067
14	22-May-18			0.0077	0.008	0.0052	0.0069
15	17-Sep-18			0.0078	0.0092	0.0046	0.0077
16	4-Dec-18	0.015		0.0076	0.0078	0.0048	0.006
17	5-Mar-19	0.15	0.15	0.0055	0.0071	0.0042	0.0064
18	19-Sep-19	0.021	0.012	0.0054	0.008	0.0044	0.0066
19							
20							
Coefficient of Variation:		0.99	0.80	0.24	0.10	0.22	0.10
Mann-Kendall Statistic (S):		-12	-11	67	27	20	5
Confidence Factor:		77.0%	81.0%	99.5%	85.6%	78.0%	55.9%
Concentration Trend:		Stable	Stable	Increasing	No Trend	No Trend	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

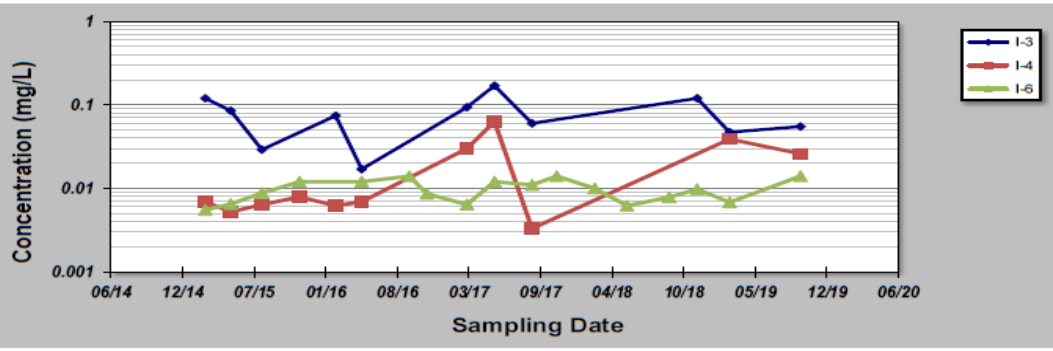
Error in graph, unit should be mg/L. Also note current groundwater standard for arsenic is 0.01 mg/L.)

Figure C-8. Quarterly Groundwater Arsenic Trends for Selected Wells

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	5-Feb-20	Job ID:	
Facility Name:	19th Avenue Landfill	Constituent:	Nickel
Conducted By:	S. Benovic	Concentration Units:	mg/L

Sampling Point ID:	I-3	I-4	I-6				
Sampling Event	Sampling Date	NICKEL CONCENTRATION (mg/L)						
1	1-Mar-15	0.12	0.0069	0.0055				
2	11-May-15	0.085	0.0052	0.0065				
3	6-Aug-15	0.029	0.0064	0.0088				
4	19-Nov-15	0 .019	0.0079	0.012				
5	28-Feb-16	0.074	0.0062	0 .01				
6	11-May-16	0.017	0.0069	0.012				
7	21-Sep-16			0.014				
8	9-Nov-16			0.0086				
9	1-Mar-17	0.094	0.03	0.0064				
10	17-May-17	0.17	0.063	0.012				
11	30-Aug-17	0.06	0.0033	0.011				
12	7-Nov-17			0.014				
13	21-Feb-18			0.01				
14	22-May-18			0.0062				
15	17-Sep-18			0.0078				
16	4-Dec-18	0.12		0.0098				
17	5-Mar-19	0.047	0.039	0.0068				
18	19-Sep-19	0.055	0.026	0.014				
19								
20								
Coefficient of Variation:		0.57	1.05	0.30				
Mann-Kendall Statistic (S):		-6	18	12				
Confidence Factor:		64.8%	90.5%	67.2%				
Concentration Trend:		Stable	Prob. Increasing	No Trend				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

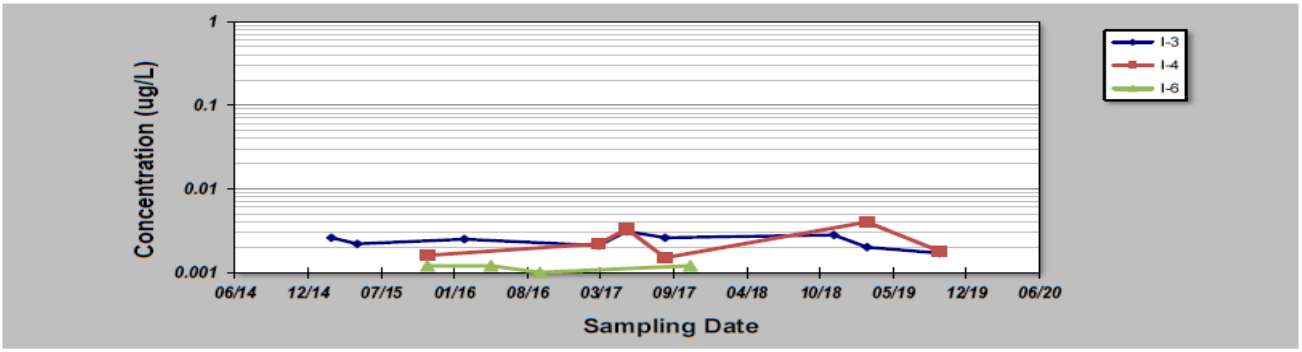
Note: current groundwater standard for nickel is 0.1 mg/L.

Figure C-9. Quarterly Groundwater Nickel Trends for Selected Wells

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	4-Feb-20	Job ID:	
Facility Name:	19th Avenue Landfill	Constituent:	Thallium
Conducted By:	S. Benovic	Concentration Units:	mg/L

Sampling Point ID:	I-3	I-4	I-6				
Sampling Event	Sampling Date	THALLIUM CONCENTRATION (mg/L)						
1	1-Mar-15	0.0026	0	0				
2	11-May-15	0.0022	0	0				
3	6-Aug-15	0	0	0				
4	19-Nov-15	0	0.0016	0.0012				
5	28-Feb-16	0.0025	0	0 .0011				
6	11-May-16	0	0	0.0012				
7	21-Sep-16			0.001				
8	9-Nov-16			0				
9	1-Mar-17	0.0021	0.0022	0				
10	17-May-17	0.0031	0.0033	0				
11	30-Aug-17	0.0026	0.0015	0				
12	7-Nov-17			0.0012				
13	21-Feb-18			0				
14	22-May-18			0				
15	17-Sep-18			0				
16	4-Dec-18	0.0028		0				
17	5-Mar-19	0.002	0.004	0				
18	19-Sep-19	0.0017	0.0018	0				
19								
20								
Coefficient of Variation:		0.64	1.11	1.87				
Mann-Kendall Statistic (S):		4	29	-21				
Confidence Factor:		58.0%	98.7%	79.2%				
Concentration Trend:		No Trend	Increasing	No Trend				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

Error in graph, unit should be mg/L. Also note current groundwater standard for thallium is 0.002 mg/L.

Figure C-10. Quarterly Groundwater Thallium Trends for Selected Wells

Appendix D: ARAR Assessment

Section 121 (d)(2)(A) of CERCLA requires that remedial actions must meet Federal standards, requirements, criteria, or limitations that are determined to be legally Applicable or Relevant and Appropriate Requirements (ARARs). ARARs are those standards, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. An important factor to note is that once the ROD has been signed, all ARARs identified for the remedy become established (frozen) and cannot be changed or modified unless new or modified requirements or standards call into question the protectiveness of the selected remedy. The ARARs that were established for the site in the ROD and subsequent ESDs for the remedy include:

- Surface water protection ARARs – Designation of protected use for the Salt River (Arizona Administrative Code R18-11-107).
- Groundwater protection ARARs – EPA Safe Drinking Water Act MCLs, Arizona Water Quality Standards 18 Arizona Administrative Code 11 Supplement 16-4, Article 4 (2016) aquifer water quality standards, and ADEQ Human Health-Based Guidance Levels for Contaminants in Drinking Water.
- Air emissions limitation ARARs – Maricopa County Air Control Permit (1996), and Resource Conservation and Recovery Act Proposed Rule on Methane Emissions for Landfills (1988).
- Air Preservation/Protection ARARs – Arizona Ambient Air Quality Standards (1980).
- Soil Exposure Protection ARARs – Because the implemented remedial action to address soil Contamination within the landfill was a containment remedy (i.e., capping), soil exposure protection ARARs were not established.

Federal and State laws and regulations that have been promulgated or changed in the FYR period are described in Table D-1. There have been no revisions to laws or regulations that affect the protectiveness of the remedy.

Table D-5. Summary of ARAR Changes for the Site

Requirement and Citation	Recent Amendment Date	Document	Effect on Protectiveness	Description
EPA Clean Air Act (CAA) (40 CFR Part 60 Subpart Cc and WWW CAA Section 111(d) and Section 60.25(b)	29 August 2019	ROD	Changes do not affect protectiveness.	Arizona is required to submit a State Plan on Emissions at Existing Municipal Solid Waste Landfills and provides emission guidelines. Maricopa County by 29 August 2019
CAA Section 111(d) 40 CFR Part 60,61, and 63 Arizona Revised Statutes Title 49, Chapter 3, Article 2,Section 49-480	10 July 2017	ROD	Changes do not affect protectiveness.	EPA delegation of approval of the MCAQD Section 111(c), 111(d) Plan to implement the emission guidelines and compliance times for MSW landfill. Air permit issued for operation of the flare systems and provides specific emission allowances.

Appendix E: Institutional Control Assessment

On June 29, 2006, ADEQ and the EPA signed ESD #3 requiring a DEUR on the property to ensure long-term Operation and Maintenance of the remedy with institutional controls and to ensure compatibility with the remedy of future land uses (includes Engineering Control Plan). On July 19, 2006, the City recorded a DEUR with engineering and institutional controls for the property. The DEUR states that *"the City/Property Owner shall not conduct or permit any excavation or construction activities on the Property, nor create or permit surface impoundments, infiltration units, or any other soil disturbance or other activity on or adjacent to the Property that may impair the integrity of any engineering control without the express written approval of ADEQ obtained in advance of any such activity."*

The DEUR also describes the contamination known to be present at the Site, the engineering controls that must be maintained, and the institutional controls required of the City and any and all future owners of the Site.

The specific institutional controls mechanisms identified were the DEUR and the existing Arizona Department of Water Resources requirements. The institutional controls are: the City shall restrict use of the property to non-residential use, the City shall continue conducting groundwater monitoring of the wells in accordance with the Consent Decree and Agreement, and the City shall implement the groundwater contingency plan (as described in the Consent Decree and Agreement) if necessary.

The DEUR controls the use and access to the landfill property and the Arizona Department of Water Resources restricts groundwater well site location, construction, and use that could impact the remedy. During the site visit on February 12, 2020, the access controlling fencing was inspected and found to be in good repair. In addition, during the site visit, no indication of vandalism or illegal access was noted. Residential use of the property is specifically prohibited. The Engineering Control Plan of the DEUR, describes the five engineering controls on the property: a drainage and levee system, a capping system, an erosion and drainage system, a landfill gas extraction system, and fencing. During the site inspection, all engineering controls were functioning as designed and were in compliance with the DEUR.

Appendix F. Press Notice

The following notice was published by the Arizona Business Gazette January 2, 2020.

EPA SEEKS PUBLIC INPUT ON CLEANUP WORK AT 19TH AVENUE LANDFILL SUPERFUND SITE, PHOENIX, ARIZONA

The U.S. Environmental Protection Agency (EPA) and the Arizona Department of Environmental Quality (ADEQ) started the fifth Five-Year Review (FYR) of the cleanup plans (or "remedies") at the Nineteenth Avenue Landfill Superfund site. The purpose of this FYR is to evaluate whether the cleanups plans are working as they were designed and that they still protect human health and the environment. According to the Superfund law, EPA is required to review a site remedy every five years if a cleanup takes more than five years to complete or if hazardous waste remains on-site. In the case of 19th Avenue, waste remains on-site as part of the remedy.

Background
The 213-acre site is in an industrial area of Phoenix, Arizona, at the southeast corner of 19th Avenue and Lower Buckeye Road. Site contamination came from former sand and gravel mining and later landfill operations for municipal refuse and various solid and liquid industrial wastes. The landfill operated until it was closed in 1979. The site was listed on the EPA National Priorities List (NPL), or "Superfund list," in 1983 and was deleted from the NPL in 2006 when cleanup goals had been met. The NPL is a list of the most hazardous toxic waste sites in the country. The last FYR was completed in 2015 and the next one will be conducted 2025. ADEQ is the lead agency overseeing the long-term operation and maintenance of the Superfund remedies being conducted by the City of Phoenix (the city.)

Cleanup Remedies in Place
The city constructed the remedy in 1996. The remedy includes safely containing contaminated materials and soils within the boundaries of the closed Nineteenth Avenue Landfill. It also includes putting a cap over the landfill wastes to limit water from entering the site. Finally, the remedy collected, flared and monitored methane gas from the landfill so the gas wouldn't move off-site. In addition, the city continues to monitor groundwater underlying the site.

What is Included in a Five-Year Review?
The last Five-Year Review, done in 2015, found the cleanup remedies were working as intended and were protective of human health and the environment. The 2020 Five-Year Review will include the following:

- an inspection of the site and cleanup technologies;
- a review of data and maintenance records; and
- a review to see if any new laws or requirements have been put in place since the last Five-Year Review.

EPA and ADEQ Would Like to Hear from You!
We invite the community to learn more about the site and welcome your input about how you think the site remedies are working. If you would like to discuss the site or need more information, please contact either of the site project managers below before February 28, 2020:

- Lisa Kowalczyk, ADEQ, 602-771-3976, kowalczyk.lisa@azdeq.gov
- Nadia Hollan Burke, EPA, 415-972-3187 or toll free 800-231-3075, burke.nadiahollan@epa.gov

Site Information Repository
Visit ADEQ's web page at https://azdeq.gov/superfund/19th-avenue-landfill or EPA's web page at www.epa.gov/superfund/nineteenthave for more site information. An information repository that contains the site's Administrative Record (i.e., a required set of key site-related documents and reports) is located at:

ADEQ Records Management Center
1110 West Washington Street
Phoenix, AZ 85007
602-771-4380
Record Viewing: Tuesday-Thursday from 8:30am to 4:00pm

The Five-Year Review report will be completed no later than September 30, 2020. EPA will post a copy of the report on the site webpages and send a copy to the site information repository listed above.

CNS-3324813#

The following notice was published in La Voz (lavozarizona.com) on January 24, 2020.

EPA BUSCA LA OPINIÓN DEL PÚBLICO SOBRE EL TRABAJO DE LIMPIEZA EN EL SITIO DE SUPERFUND EN EL RELLENO SANITARIO DE 19TH AVENUE, PHOENIX, ARIZONA

La Agencia de Protección Ambiental de los Estados Unidos (EPA) y el Departamento de Calidad Ambiental de Arizona (ADEQ) comenzaron la Revisión de Cinco Años (FYR) de los planes de limpieza (o "remedios") en el sitio Superfund en el relleno sanitario de Nineteenth Avenue. El propósito de esta FYR es evaluar si los planes de limpieza están funcionando como fueron diseñados y que todavía protegen la salud humana y el medio ambiente. De acuerdo con la ley de Superfund, la EPA está obligada a revisar el remedio del sitio cada cinco años y si una limpieza toma más de Cinco Años para completarse o si los desechos peligrosos permanecen en el sitio. En el caso de 19th Avenue, los residuos permanecen en el sitio como parte del remedio.

Antecedentes
El sitio de 213 acres está en un área industrial de Phoenix, Arizona, en la esquina sureste de 19th Avenue y Lower Buckeye Road. La contaminación del sitio proviene de la antigua operacion de minería de arena y grava y de las operaciones de relleno sanitario para desechos municipales y diversos desechos industriales sólidos y líquidos. El relleno sanitario funcionó hasta su cierre en 1979. El sitio fue incluido en la Lista de Prioridades Nacionales (NPL) de la EPA, o "lista Superfund", en 1983 y fue eliminado de la NPL en 2006 cuando cumplieron los objetivos de limpieza. NPL es una lista de los sitios de desechos tóxicos más peligrosos del país. La última FYR se completó en 2015 y la próxima se llevará a cabo en 2025. ADEQ es la agencia principal que supervisa la operación y el mantenimiento a largo plazo de los remedios de Superfund que está llevando a cabo la ciudad de Phoenix (la ciudad).

Remedios de limpieza en el lugar
La ciudad construyó el remedio en 1996. El remedio incluye contener de forma segura materiales y suelos contaminados dentro de los límites del relleno sanitario cerrado de Nineteenth Avenue. También incluye poner una tapa sobre los desechos del relleno sanitario para limitar la entrada de agua al sitio. Finalmente, el remedio recolectó, quemó y monitoreó el gas metano del relleno sanitario para que el gas no se moviera fuera del sitio. Además, la ciudad continúa monitoreando las aguas subterráneas de bajo del sitio.

¿Qué se incluye en una Revisión de Cinco Años?
La última Revisión de Cinco Años, realizada en 2015, encontró que los remedios de limpieza funcionaban según lo previsto y que protegían la salud humana y el medio ambiente. La Revisión de Cinco Años de 2020 incluirá lo siguiente:

- una inspección del sitio y de las tecnologías de limpieza;
- una revisión de los datos y registros de mantenimiento; y
- una revisión para ver si se han establecido nuevas leyes o requisitos desde la última Revisión de Cinco Años.

¡EPA y ADEQ les gustaría saber de usted!
Invitamos a la comunidad a que aprenda más sobre el sitio y agradecemos sus comentarios sobre su opinión sobre cómo crees que los remedios estén funcionando. Si desea hablar sobre el sitio o necesita más información, por favor comuníquese con uno de los gerentes de proyecto antes del 28 de febrero de 2020:

- Lisa Kowalczyk, ADEQ, 602-771-3976, kowalczyk.lisa@azdeq.gov
- Nadia Hollan Burke, EPA, 415-972-3187 o llame gratis al 800-231-3075, burke.nadiahollan@epa.gov

Repositorio de información del sitio
Visite la página web de ADEQ en https://azdeq.gov/superfund/19th-avenue-landfill o la página web de la EPA en www.epa.gov/superfund/nineteenthave para más información sobre el sitio. Un repositorio de información contiene el Registro Administrativo del sitio (*es decir*, un conjunto requerido de documentos e informes clave relacionados con el sitio) se encuentra en:

ADEQ Records Management Center
1110 West Washington Street
Phoenix, AZ 85007
602-771-4380
Visualización de registros: martes a jueves de 8:30 a. m. a 4:00 p. m.

El informe del Revisión de Cinco Años se completará a más tardar el 30 de septiembre de 2020. La EPA publicará una copia del informe en las páginas web del sitio y enviará una copia al repositorio de información del sitio que se indica arriba.

Appendix G: Interview Forms

Five-Year Review Interview Record			
Site:	19th Avenue Landfill	**EPA ID No:**	AZ D980496780

Interview Type: *By email, following in-person meeting during site visit*
Location of Visit: Phoenix, Arizona
Date: February 12, 2020
Time: 1 pm to 4 pm

Interviewers

Name	Title	Organization

Interviewees

Name	Organization	Title	Telephone	Email
Lisa Kowalczyk	ADEQ	Project Manager	602-771-3976	Kowalczyk.Lisa@azdeq.gov

Summary of Conversation

1) What is your overall impression of the project?

As the current project manager for the site since September 2019, the operation and maintenance of site institutional and engineering controls appear to be satisfactory. I have found the City of Phoenix's O&M activities to be adequately conducted in accordance with relevant legal (Record of Decision (ROD), Declaration of Environmental Use Restrictions (DEUR), etc.) requirements.

2) Is the remedy functioning as expected? How well is the remedy performing?

Cap with drainage structures – Functioning as expected. No physical condition changes at the Site, therefore cap continues to contain waste and prevent infiltration.

Declaration of Restricted Use (DEUR) – No use of property incompatible with the acceptable land use specified in the 2006 DEUR has occurred since the last 5-Year Review in 2015, to ADEQ's knowledge. Institutional and engineering controls are sufficiently maintained by City of Phoenix pursuant to this document.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

No groundwater exceedances have been identified by the City of Phoenix, nor submitted to ADEQ, that required the implementation of the contingency plan.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

The City of Phoenix maintains the Salt River Drainage and Levee System (SRDLS), the landfill capping system, the landfill erosion and drainage control system, and site security controls through annual and post-storm event inspections. During the course of routine on-site work (e.g. methane sampling events), the City may have the opportunity to monitor and rectify clearly visible issues at a more frequent rate than annually/following severe storm events.

The City of Phoenix actively monitors landfill gas at the site. They have invested the resources to develop a novel approach to electronically storing and visualizing landfill gas data. Automatic monitoring information is used in operational decisions for the flare system located at the site. Landfill gas (methane) sampling events currently occur monthly and run roughly 2 days.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.

Change from quarterly to semi-annual groundwater monitoring occurred in 2019, with approval by ADEQ of change in groundwater sampling frequency in accordance with the decision documents and enacted by the City of Phoenix upon receiving verbal and written approval from ADEQ. No impact to effectiveness of remedy due to this change in groundwater monitoring frequency.

6) What are the annual operating costs for your organization's involvement with the site?

ADEQ does not conduct operational activities at the site, only oversight.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.

For specific details relating to costs, please confer with the City of Phoenix. ADEQ does not conduct operational activities at the site so will not be able to provide further details on unexpected costs relating to O&M.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Reduction in groundwater sampling from quarterly to semi-annually. Changes to groundwater sampling program are estimated to amount to approximately $50,000 in cost savings annually.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

No.

10) Do you have any comments, suggestions, or recommendations regarding the project?

The City of Phoenix is adequately controlling explosive gas (methane) at the 19th Avenue Landfill by operating a flare system and monitoring an extensive gas monitoring probe network, which is similar to other solid waste landfills of its age within the state of Arizona. However, unlike other solid waste landfills within Arizona, the 19th Avenue Landfill is required to sample the entirety of their landfill gas probe system monthly, instead of quarterly or only focusing monthly sampling on certain potential areas of concern. The City of Phoenix has requested a reduction in methane monitoring sampling frequency from monthly to quarterly, whilst keeping the same methane exceedance conditions, in accordance with 40 CFR 258.23. ADEQ agrees that an optimization of the methane monitoring program (whether a site wide reduction to quarterly monitoring or a mix of quarterly monitoring and focused monthly monitoring of certain probes) is appropriate.

Additional Site-Specific Questions

[If needed]

Five-Year Review Interview Record				
Site:19th Ave LF			**EPA ID No:**	

Interview Type: *[e.g. Visit, Teleconference, etc.]*
Location of Visit:
Date:
Time:

Interviewers

Name	Title	Organization

Interviewees

Name	Organization	Title	Telephone	Email
Doug Sawyer	City of Phoenix	Engineering Supervisor	602-534-1157	doug.sawyer@phoenix.gov

Summary of Conversation

1) What is your overall impression of the project? The landfill stopped receiving wastes after flooding almost 40 years ago. As part of a Consent Decree with the State and USEPA, the City constructed an engineered final cover, on-site stormwater drainage protection, channelized the Salt River adjacent to the landfill, constructed grade control in the channel, installed site security fencing, installed a ground water monitoring network, and constructed the landfill gas collection and control system (GCCS) consisting of extraction wells, flare and carbon absorption system. We monitor the site on a regular basis and perform repairs and maintenance as necessary to protect the environment and human health of our citizens and neighbors.

Now almost 40 years after the last waste was received, the landfill gas quality (as measured by percent methane and non-methanogenic organic compounds) and quantity (as measured by landfill gas flow rate in standard cubic feet per minute-scfm) continues to decline. To accommodate the decrease in gas flow rate, the City replaced the original gas flare with a smaller or lower capacity flare and anticipates a future date when this smaller flare will not be a viable control feature. We also replace the small flare in Cell A-1 with a carbon absorption system (CAS).

Since installing the groundwater monitoring system, the City has encountered some maintenance issues with sampling pumps. The groundwater monitoring system consists of monitoring wells and uses dedicated electric submersible pumps. However, electric pump/motors are designed to be operated on a regular basis instead of the periodic basis associated with environmental monitoring. In addition, the seasonal water level fluctuations are causing pumps to be exposed to air and then re-submerged that results in accelerated rusting of the exposed metal. As a result, the City has experienced on-going maintenance issues and failures of the pumps and/or motors. The failures occur and the lead time to remove and replace the defective pump impacts the regular collection of the groundwater samples. The City proposes to replace electric pumps/motors with "low-flow bladder pumps" that operate on compressed air and contain a limited number of moving parts and no bearings, motors or impellers that can malfunction. The bladder pumps were specifically designed to collect quality groundwater samples for environment compliance purposes. Another advantage of bladder pumps is that they require less well purging and disturbance of the local groundwater.

2) Is the remedy functioning as expected? How well is the remedy performing? The remedy is functioning as expected. The landfill GCCS is performing as expected and controlling the migration of gas and extracting it as expected. We continue to perform periodic inspections of the constructed controls (for example; on-site stormwater drainage protection, channelized the Salt River adjacent to the landfill, constructed grade control in the channel, installed site security fencing, installed a ground water monitoring network, and constructed the landfill gas collection and control system (GCCS). We expect the landfill gas (LFG) will continue to decline in quality and quantity as the solid waste continues to decompose due to non-methanogenic microbial action. At some point in the not-to-distant future, the City will need to replace with GCCS with another control technology more suitable to the lower methane content.

The site security (fencing) is periodically damaged due to vehicles that crash into the gates at 19th Ave and 15th Ave (on the north side). Anecdotal evidence suggests these vehicular incursions are due to drivers operating person vehicles under the influence and who may not be familiar or impaired to the point they are unaware of the "dead end "roadways. The repair to the gates typically costs $2000 and this occurs several times each year.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing? The data shows that the methane quality and quantity continue to decline as expected. The flow rate at the GCCS Flare station is averaging approximately 200 scfm and methane content is approximately 17%. The original flare station (circa 1996) was

designed with a capacity of 1500 scfm. In 2016, that flare stack was removed and replaced with a 600 scfm stack to accommodate the decrease in LFG flow.

The groundwater monitoring system has shown results consistent with an arid-climate, closed landfill located in a shallow groundwater regime. As the phreatic surface responds to fluctuations in rainfall/surface water recharge in the Salt River Basin, we have periodic exceedances of some heavy metals (e.g. thallium, arsenic and nickel), inorganics (nitrates, sulfates) and an occasional low-level detection of a VOC. The exceedances are not believed to be related to landfill releases, but due to the interaction of surface water flow in the Salt River and sediments in the constantly fluctuating vadose zone. In accordance with the Consent Decree, the City performs monthly sampling of those wells with an exceedance until the well returns to constituent levels stipulated in the Consent Decree.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities. Yes, there is a continuous O&M presence at the 19th Ave LF. We have Solid Waste Inspectors and a Maintenance Team that inspect/monitor the engineered cap, storm water drainage features, site security and LFG GCCS. In addition, we use a third party to sample groundwater on a regular basis and another to monitor and repair the GCCS Flare Unit as needed. We use a combination of internal City of Phoenix staff and third party to complete repairs and replacement of items as needed.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts. There have been no significant changes in the O&M requirements or maintenance schedules in the last 5 years. The sampling routine for groundwater has not changed, but the frequency has been changed by the ADEQ from quarterly to semi-annual groundwater monitoring.

6) What are the annual operating costs for your organization's involvement with the site? The O&M for the City of Phoenix at the 19th Ave LF is roughly $300,000 for the third party GCCS monitoring, $60,000 for third party groundwater monitoring labor, $50,000 in groundwater laboratory analysis, $200,000 for internal labor/equipment and repairs and $50,000 for third party agency reporting and coordination. The total is approximately $660,000/year.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details. There have been no unexpected O&M difficulties in the last 5 years. There are the periodic repairs to the site security gates due to impaired drivers, but nothing that would impact the overall operation and function of the site engineered improvement or controls. With declining LFG quality and quantity, the City will need to investigate alternative control strategies/technologies for handling the LFG. These alternatives may include intermittent operation of the flare system, a carbon absorption system and solar powered "mini-flares" at each well head.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency. In 2019, the City and the ADEQ agreed to reduce the groundwater sampling frequency from quarterly to semi-annual. The reduction in monitoring frequency was based on the number of years since waste was deposited in the 19th Ave Landfill (approximately 40 years ago) and the constituents found in the groundwater. The reduction in GW monitoring frequency will save the City approximately $60,000/year.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy? The City is not aware of changes in the Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedies in place.

10) Do you have any comments, suggestions, or recommendations regarding the project? There are 2 areas of the remedy monitoring that the City requests changed and another that regarding the Consent Decree.

The first suggestion or request is the remedy associated with the frequency of landfill gas (LFG) monitoring at the property boundary. In Consent Decree under **Section VIII Work To Be Performed; 4. Methane Gas Control and Ambient Air Quality Protection; B. Continue to monitor on a monthly basis landfill gas migration, utilizing the existing the gas monitoring probes at the perimeters of Cells A and A-1.** The City continues to perform this monthly monitoring. The 19th Ave LF has 136 LFG perimeter probes. Based on almost 26 years of continuous monitoring and reporting, the City has had very few perimeter exceedances. We find that only 3 of the 136 probes are susceptible to gas migration and those only occur after rain events that result in ponding of the retention basins or condensate in the collection system. In Subtitle D, the USEPA promulgated monitoring for explosive gas in landfills. In 40CFR Part 258.23 Explosive Gases Control provides for a minimum monitoring frequency of **quarterly** LFG gas based on site characteristics, control systems, locations, etc... Outside of the occasional perimeter probe exceedance, the LFG GCCS system installed and monitored by the City is effective in extracting and limiting the migration of LFG past the landfill boundaries. Based on the installation and maintenance of the control technology, the City respectfully requests that we modify the LFG perimeter probe monitoring from monthly to quarterly basis. Further the City would continue monthly monitoring of those probes that are susceptible to weather related occurrences and/or system upsets.

The second suggestion or request is the remedy associated with monitoring of groundwater after an exceedance is detected in the routine monitoring. **Section VIII Work To Be Performed; 3. Groundwater Quality Protection and Section XII Contingency Plan** specify the actions to be taken when a when a down-gradient groundwater sample is collected, and a

contaminant of concern exceeds the numeric values listed in the Remedial Action Plan (RAP). The remedy is based on ADEQ guidance documents from circa 1988 and 1989. Since the Consent Decree was prepared, the theory and practice of groundwater monitoring for landfills has advanced. Dr. Gibbons published a book entitled: Statistical Methods for Groundwater Monitoring (1994). Based on his and other's work, the analysis of groundwater monitoring results has progressed and since the Consent Decree was approved in the early 1990's. The City requests the flexibility to modify and update the collection of samples, analysis of results and definition of an exceedance based on a better understanding of groundwater monitoring and theory. For instance, the City would like to replace existing electric submersible well pumps with newer "low-flow bladder pumps". The bladder pumps are more dependable and require less purging of monitoring wells. Another possible modification would be to use a statistical analysis of groundwater laboratory results as opposed to a strict numeric value referenced in the Consent Decree. Based on almost 26 years of groundwater data, the City has found that the groundwater quality is subject to fluctuations in the depth of the water table, surface water flows in the adjacent Salt River channel, and spatial/temporal variations. To this point, the USEPA has approved the use of a number of statistical programs to analyze groundwater sampling results from solid waste facilities. These statistical programs include DUMPstat and Sanitas Statistical Software that the City uses at it other closed landfill sites as well as the operational SR85 Landfill. The City requests the flexibility to begin these discussions with the ADEQ and USEPA.

The third suggestion is related to the mechanism used to "manage" the 19th Ave Landfill. The City, State and USEPA listed the 19th Ave site on the National Priorities List (NPL) in 1983. The assumption was that the site had taken hazardous wastes and was therefore suitable as a "Superfund" site under CERCLA. Since that time, this closed and remedied site has not exhibited hazardous waste disposal characteristics in either the groundwater or landfill gas monitoring results. The City would like to enter discussions about the appropriateness of managing this site in the Federal Programs Unit and suggest that the site may be adequately managed as a closed municipal solid waste site administered by the ADEQ Solid Waste Unit.

Additional Site-Specific Questions

[If needed]

Appendix H: Site Inspection Report and Photos

Trip Report
Nineteenth Avenue Landfill

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1. INTRODUCTION

a. Date of Visit: 12 February 2020

b. Location: Phoenix, AZ

c. Purpose: A site visit was conducted to visually inspect and document the conditions of the remedy, the site, and the surrounding area for inclusion into the Five-Year Review Report.

d. Participants:

Matthew Masten	US Army Corps of Engineers, Env. Engineer	602-230-6873
Doug Sawyer	Project Manager, City of Phoenix	602-534-1157
Michael Bouchard	City of Phoenix	
Chris Fine	City of Phoenix	
Jon Birch	City of Phoenix	
Ariel LeBarron	City of Phoenix	
Jessica Yates	City of Phoenix	
Nadia Hollan Burke	Remedial Project Manager, EPA	415-972-3187
Karin Harker	Federal Projects Unit, ADEQ	602-771-0361
Lisa Kowalczyk	Federal Projects Unit, ADEQ	602-771-3976

2. SUMMARY

A site visit to the Nineteenth Avenue Landfill Superfund Site was conducted on 12 February 2020. The inspection included visual observation of overall site conditions and inspection of various components of the remedy. The participants received an overview of the site and the remedial history. The inspection evaluated the landfill caps, the landfill gas collection system, the flare station, carbon treatment system, as well as representative groundwater monitoring wells, methane probes, and several representative gas extraction wells.

3. DISCUSSION

On 12 February, Mr. Masten arrived at the City of Phoenix Solid Waste Management offices at 1300 hrs. Ms. Burke, Ms. Kowalczyk and Ms. Harker also met at the offices. The City of Phoenix team, led by Mr. Sawyer presented an overview of the Nineteenth Ave site, highlighting changes from the past five years. Of note was the new GIS system which is being used to track and visualize methane emissions from the site. Other major changes include the removal of the flare from Cell A-1, installation of a carbon adsorption system and upgrades to the methane collection system. After the presentation, the team proceeded to tour the Nineteenth Avenue Landfill site.

The weather was partly sunny, calm, and approximately 60 degrees Fahrenheit. The participants first toured the Cell A Gas Flare, where Mr. Sawyer and Mr. Fine gave an overview and history of the project and site. Mr. Fine detailed the changes to the flare. The flare has been replaced in the last five years, the current burner stack was moved from a different City of Phoenix site at 19th Ave and Greenway Road,

where it was no longer needed. The stack is approximately 10 years old and appeared to be in good working order. An operator is on the site daily, Mon-Fri, and the system has an alarm to notify appropriate personnel of any shut down. The computer control system has been upgraded in the last few years. A new primary compressor has been installed, and an older backup is present. It was stated that power quality can be an issue, the PLC has line conditioners. The condensation tank is sampled annually but does not have to be emptied often. An O&M manual, Health and Safety plans, and permits were all in place. The flare system appeared to be in good shape and functioning correctly.

The team proceeded to inspect the landfill, beginning with the C-line of the methane extraction system. This line was upgraded in 2019. Representative valve boxes were opened and samplers were inspected. Methane extraction well head C25B was inspected. These all appeared to be in good condition and functioning normally. The landfill cap was noted to be well vegetated, with erosion control wattles in place where necessary. No erosion concerns were noted on the landfill cap. Mr. Sawyer stated that inspectors are on site weekly, and maintenance crews repair any erosion issues.

The southern perimeter of the landfill along the levee was inspected next. Drainage channels on the landfill perimeter were clear of major debris and sediment and appeared to be maintained regularly. The methane well heads in the levee were in good condition, with some damage to valve box covers, likely due to vehicle traffic. The cemented soil on the levee was noted to be in good shape. Minor erosion was noted at the southwest corner of the site atop the levee. The City of Phoenix stated that they are monitoring this issue and will infill with concrete. The City was asked about the flapper gates to the Salt River drainage and noted that there have been no issues with vandalism since the last five-year review.

The east perimeter of the landfill was inspected next. Mr. Sawyer indicated that there had been issues with the adjoining property owner (construction debris recyclers) over excavating along the property line a few years ago, but this problem was fixed and is no longer an issue. The east side above-grade methane collection system, southeast retention basin, surface water channel, and storm water intakes were all inspected. All appeared to be in good working order and well maintained.

The 15th Ave gate to the landfill has been replaced, as it was reportedly crashed into by a vehicle. Fill dirt is now mounded on the interior of the gate to further prevent any potential intrusion through this gate. The condensate pump vaults were checked and appeared to be in good condition and functioning normally. The northwest drainage channel and monitoring wells along the channel were inspected and appeared to be well maintained and in good working order. All monitoring wells had caps in place and were secured. The landfill cap was noted to be in good shape overall. Mr. Sawyer stated that City of Phoenix maintenance crews handle what they can at the Nineteenth Ave site, and several contracts are in place to handle any larger jobs.

The team arrived at the Cell A-1 Site at 1530 hrs. Some minor erosion rivulets were observed near the edge of the cap, this damage did not appear to affect the protectiveness of the remedy. The cap was noted to be in good overall shape. The retention basin and inlet for discharge to the Salt River drainage was inspected and found to be in good condition.

The Cell A-1 carbon adsorption system was inspected next. This system has replaced the Cell A-1 flare that was in place during the previous five-year review inspection. Three granular activated carbon (GAC) vessels were installed to replace the flare, due to lower methane emissions in this cell. The system emissions are sampled weekly. Carbon change outs occur approximately every 6-8 months. Construction fencing has been installed on the shade structure to act as netting to keep birds away, but birds continue to be a problem. The Cell A-1 GAC system was found to be in good working order.

The team returned to the City of Phoenix Solid Waste Management Facility offices and Mr. Masten departed the site at 1630 hrs.

All components of the remedial action for the Nineteenth Avenue Landfill site appear to be in good condition and are currently operating as intended. All systems and wells were found to be well secured and free from vandalism. No indication of trespassing was noted.

Matthew Masten, P.E.
Environmental Engineer
CESPL-TESS

Site Photos

Photo 1 Cell A flare and blower

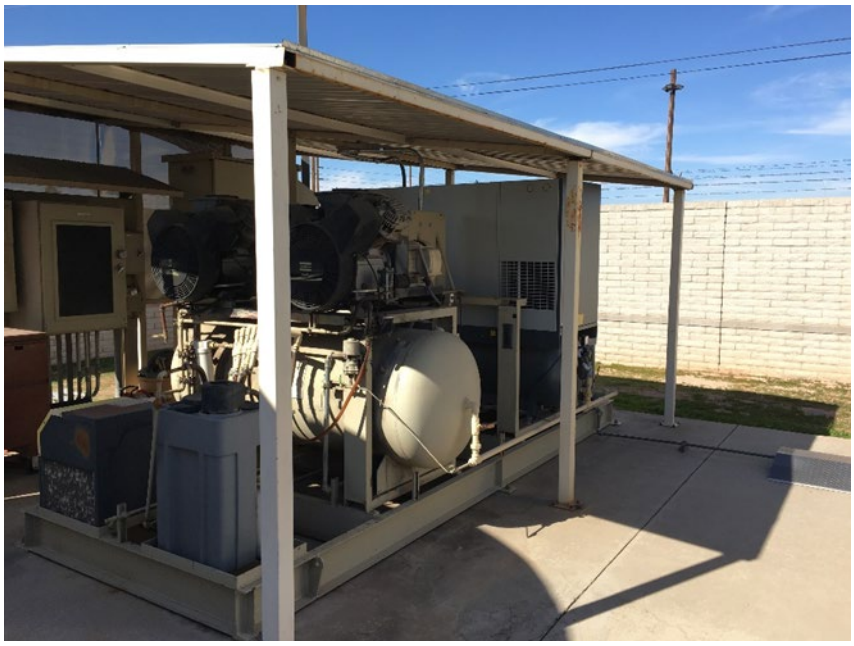

Photo 2 Cell A flare, redundant air compressors (new model on the right)

Photo 3 Cell A Flare control panel

Photo 4 Cell A Flare condensation tank

Photo 5 Flare stack mount, showing previous stack location

Photo 6 Overview of landfill cap, showing C-line of methane extraction system, facing south

Photo 7 Well head C25B

Photo 8 Straw wattles in place on cap, looking north

Photo 9 View atop levee, facing west

Photo 10 Gas collection well vaults in levee

Photo 11 Minor erosion, southwest corner of Cell A, on top of levee

Photo 12 Cell A southwest retention basin

Photo 13 East side methane collection system

Photo 14 Surface water channel

Photo 15 Storm drainage inlet, east side of landfill

Photo 16 Cell A west drainage channel

Photo Cell A-1 retention basin

Photo 18 Cell A-1 GAC system

Photo 19 Cell A-1 GAC system

Photo 20 Cell A-1 GAC system control panel

Photo 21 Cell A-1 cap overview

Photo 22 Cell A-1 drainage channel, northeast corner