

AGUA FRIA

WATERCOURSE MASTER PLAN

El Mirage Landfill Site Summary of Status Review

Prepared for



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December 2001

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Flood Control District of MC Library
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El Mirage Landfill Site Summary of Status Review

Prepared for

**Flood Control District of
Maricopa County**

As Part of The
**Agua Fria River Watercourse
Master Plan Study**

June 2001

Prepared by



**Kimley-Horn
and Associates, Inc.**

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El Mirage Landfill Site Summary of Status Review

Introduction

At the request of the Flood Control District of Maricopa County (FCD), Kimley-Horn and Associates, Inc. (KHA) conducted a preliminary evaluation of the current status of the El Mirage Landfill. The landfill is located within the municipal boundaries of the City of El Mirage, Maricopa County, Arizona, adjacent to the west bank of the Agua Fria River channel at the US 60 (Grand Avenue) crossing (See Figure 1).

The purpose of the review was to establish, based on existing readily available data, the approximate location and extent of operation, regulatory status, operational history, and closure status of the landfill. The results contained here are preliminary and should not be considered a complete or final determination as to the status of the El Mirage Landfill.

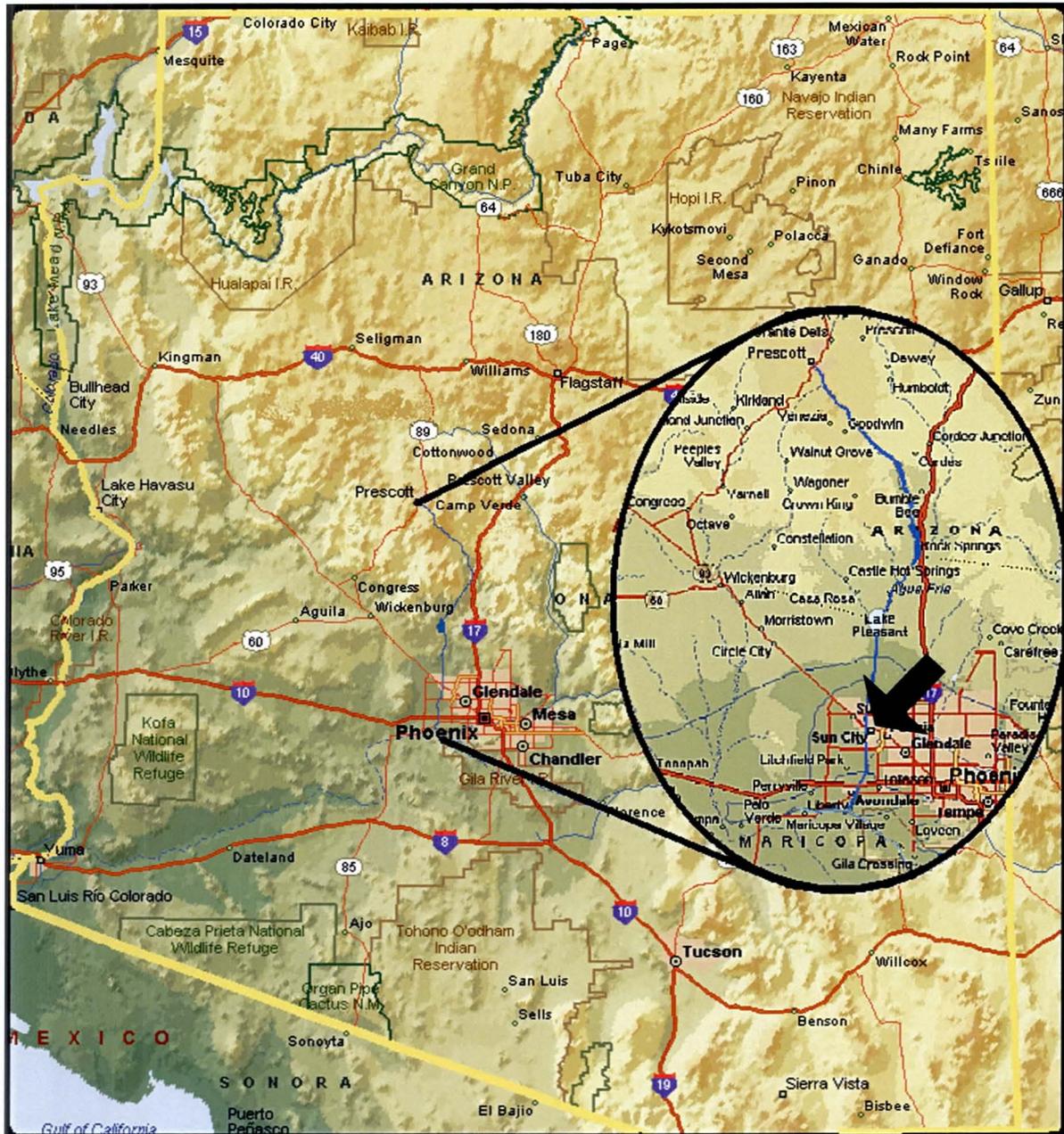
The report includes a brief description of the methodology used for the review of the data pertaining to the landfill. It also provides an abbreviated chronology of the regulatory and operational issues regarding the landfill from the early 1970s until recent actions based on a limited review of readily available records. The Discussion Section of the report summarizes the results of the data review and field reconnaissance and the Summary and Recommendations Section provides some conclusions and recommendations. The Appendices contain photographic documentation from the site reconnaissance and selected excerpts from the Arizona Department of Environmental Quality (ADEQ) record review.

Methodology

This preliminary review was limited to a review of existing readily available records and documentation regarding the El Mirage Landfill site. The Arizona Department of Environmental Quality (ADEQ) has records for the site dating from the early 1970s. While the records are extensive, the data is incomplete and is not completely cataloged. Apparently there are pending or recently concluded legal actions against the site and its owners, and some information may be in other offices or otherwise missing. While KHA staff conducted a diligent review, the volume of material, disarray, and incomplete nature of the files prevented a complete record review.

The data review was conducted to better understand the following issues. The Discussion Section of this report summarizes the findings for each of these issues.

- Identification, location, and description of landfill site
- ADEQ records and regulatory status of landfill site
- Extent of landfill operation
- Type of waste accepted at the landfill
- Extent of previous flood damage at the site
- Status of landfill closure plan implementation
- Evidence of groundwater contamination



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FIGURE 1
Location Map

WEST VALLEY RECREATION CORRIDOR

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EL MIRAGE LANDFILL REVIEW



Kimley-Horn
and Associates, Inc.

The following records were reviewed:

- Historical aerial photography (1960s to present) at Noble Science Library and in ADEQ files
- On-line ADEQ hazardous and solid waste databases
- ADEQ file archives, reviewed at the ADEQ offices
- Interviews with ADEQ case workers

Site visits were conducted in April and July 2001 in an attempt to verify or confirm information relating to the monitoring wells, extent of site closure, and the general condition of the site. The field review did not include sampling, excavation, or other intrusive evaluation, but was limited to a pedestrian reconnaissance of the site.

The evaluation resulted in a series of comments regarding the El Mirage Landfill, which are included in the final section of this report. Also included are a series of recommendations for consideration as possible further action. The comments and recommendations are based on the preliminary review of the existing data and are therefore subject to revision, as additional information becomes available. Further, legal counsel should be contacted prior to initiating action based on the comments or recommendations.

Discussion

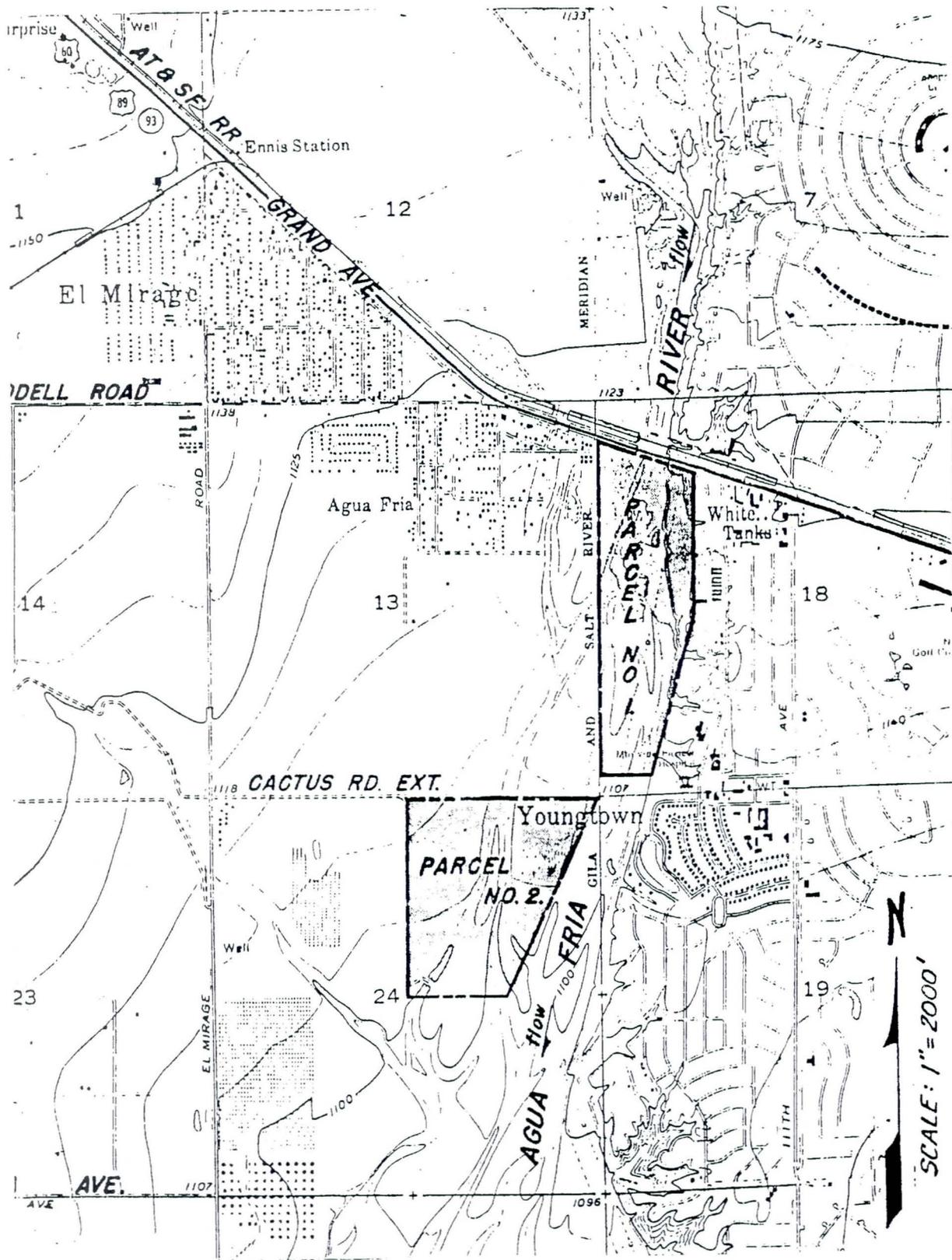
Identification, Location, and Site Description

The landfill is referenced in the ADEQ closed landfill database as the El Mirage Landfill. The records indicate the landfill site was owned by Mucho Dinero, Inc., 1555 E. Flamingo Road, Las Vegas, NV 89119-5258. Locally, the landfill is known by several names including the El Mirage Industrial Landfill, the El Mirage Sanitary Landfill, Grand Avenue Landfill and the Boyce Dump. According to the ADEQ records, the landfill operator/owner was Ken Boyce, 11141 N. 115th Avenue, El Mirage, Arizona 85335. The records also indicate several other companies and individuals with some level of responsibility/involvement, including:

- Estate of Mr. Kenneth Boyce,
- Mr. John Knight,
- Alice Boyce (wife of Ken Boyce),
- Jim Laros (listed as landfill Operational Manager),
- MRC Land and Development, and
- Research Refuse Corporation d.b.a. El Mirage Landfill.

There are also numerous attorney and consulting companies listed as providing services to the landfill operation.

The landfill site is located in the southwest quadrant of the intersection of the Agua Fria River channel and US 60 (Grand Avenue). The landfill cell is located on an approximately 105 acre parcel that includes the western bank and a portion of the river channel. The parcel (noted as Parcel 1) is in the western one-half of Section 18, Township 3 north, Range 1 east (Gila and Salt River Meridian). The records indicate that a second parcel, south of the first in the northeastern quarter of Section 24, Township 3 north, Range 1 west (GSRM) was also included in the initial landfill plan (See Figure 2).



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Figure 2
 Site Location

The actual landfill footprint is located in the western portion of Parcel 1 and forms the western bank of the river channel. This aboveground cell is approximately fifty feet high, 600 feet wide and 2500 feet long. The cell progressively narrows from its widest point near Grand Avenue (Highway 60) to its terminus in the south. The facility included a maintenance and operations yard in the northwestern corner of the property (See Figure 3).

Phase I of the landfill was started in the northern most portion of Parcel 1 (in an abandoned 10 acre aggregate pit) and Phase II continued to the south in Parcel 1. The refuse material was dumped in lifts at the base of the previous slope, wetted with an enzyme saturate water and compacted by the weight of the next haul truck and onsite earthmoving equipment. Each completed cell measured approximately 26 feet long, by 50 feet wide and four to six feet deep. The cells started in the northwest perimeter and moved progressively south and east. The exposed face of the cell was to be covered daily with two feet of earth material. Most of the cover material was excavated from the Agua Fria River channel.

With the exception of the filling of an aggregate pit, which is reported to be 10 to 15 feet below grade, the available records indicate that the majority of the accumulated waste is above channel grade. The facility accepted non-hazardous waste material (See Types of Waste Accepted section below) from approximately 1973 until the late 1980s. Reportedly, the site did not accept liquid waste. The material was primarily from surrounding municipalities, starting with approximately two trucks per day from El Mirage in 1973, to approximately 47 trucks per day in 1979. The site stopped taking high volumes of municipal refuse in 1988, but continued to take construction debris for use as flood protection material.

Currently, the site is abandoned and onsite signage indicates that the parcel is for sale. The office and maintenance buildings have been removed, although the concrete pads remain. Several unimproved roads provide access to the east and west side of the landfill and the area has numerous off road vehicle (ORV) trails (See Appendix A, Photographs 1 to 3). The landfill is covered with a layer of soil and cobble material with minimal vegetation (See Photographs 4 and 5). The relatively steep sides of the landfill exhibit moderate rill erosion (See Photographs 6 and 7). One area in the northwest quadrant has landfill material exposed in what appears to be an old road cut (See Photograph 8).

Additional details of the field reconnaissance are contained in each of the following sections.

ADEQ Records and Regulatory Status

ADEQ office files list the site as El Mirage with file numbers 26624-1 through 18. The landfill was licensed in 1973 under the authority of the Maricopa County Department of Health, Division of Environmental Health. In 1979, the Arizona State Health Department, Department of Sanitation assumed landfill oversight responsibility from the Division of Environmental Health. The Department of Sanitation required additional documentation from the operator as a condition of continuation of the landfill operation. Most of the ADEQ records pertain to the post Maricopa County Department of Health period from approximately 1979 to the more recent past.

The site went through a series of notices and violations with the various regulatory agencies that continued through the site's operational history. In 1980 and continuing until 1984, when the City of El Mirage entered a settlement agreement with the landfill operators, numerous charges of non-compliance were filed. The City of El Mirage contended the site was in violation of floodplain use regulations, City zoning regulations, and considered the site a public and private nuisance.

After the settlement agreement with the City, the landfill continued to operate at the site until the early 1990s. During this period additional, regulatory, and legal action was waged regarding the proper operation of the landfill, the inappropriate location of the facility, the potential threats, and violations of special conditions of the operating agreement. The landfill ceased operation and implemented all or parts of a closure plan under an 11 June 1990 ADEQ Water Quality Assurance Revolving Fund (WQARF)



1996 Aerial Photograph
Scale is approximate at 1 inch to 800 feet

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Figure 3
Aerial Photography

Consent Order. The Consent Order established responsibility for closure and maintenance of the site until property sale with the landfill operators.

The following table presents a chronology of some of the more significant regulatory and legal issues surrounding the El Mirage Landfill. Where indicated, the referenced document is included in Appendix B of this report. Some of the issues noted are covered in more detail in upcoming sections of this report.

EL MIRAGE LANDFILL REGULATORY COMPLIANCE RECORD SUMMARY

Year	Issue
1973	The Town of El Mirage granted an I-2 Zoning Variance and a Special Use Permit to Kenneth and Alice Boyce to open the El Mirage Landfill at its current location. (See Appendix B, Deconcini McDonald Brammer & Lacy P.C. letter to Maricopa County Flood Control District). Additionally, a June 1973 letter to the Bureau of Health Engineering notes compacted fill material within the channel as an operational violation. The letter also indicates that some of the operation has extended into Youngstown (the boundary between the two towns is the center of the channel and south).
June 1973	Maricopa County Department of Health issues a landfill permit to Kenneth Boyce and R. J. Collet for the El Mirage Sanitary Landfill. Mr. John Knight, noted as the land owner would also use the site for sand and gravel extraction.
1979	Maricopa County Department of Health Service Engineering Report indicates that the El Mirage Sanitary Landfill has several violations including no channel construction, no riprap, operations extending too far to the north, and several access and fence issues. In addition, allegations of disposal of material into channel (allegations repeated in 1980).
February and June 1980	Inspection Report of El Mirage Landfill during February 16-20, 1980 flood on Agua Fria River. Inspection report notes large loss of material and cover. Inspection notes sever erosion along southern boundary and debris trail of "several hundred yards". Stipulation and Consent Order between ADHS and El Mirage for landfill operator to provide flood protection, operator will be allowed to continue operation with compliance to stipulations in June 1990 order.
October 1980	ADHS/EPA classify site as Open Dump. El Mirage Industrial Landfill Operational Report and Flood Study prepared and submitted (See Appendix B).
June 1981	FEMA letter agrees that at current elevation, landfill is above 100 year water elevation and technically placement of material is not within floodway, but expresses concern for public health and safety given type of facility.
1980 to 1983	City of El Mirage and Landfill Operator exchange legal opinions regarding floodplain use permits and zoning violations
March – April 1983	ADHS Inter Office Memorandum documenting complaints against El Mirage Landfill for odor, failure to adequately cover material face, and improper road. Several additional inspections (within several days) identified same or similar issues.
July 1983	Arizona Attorney General letter detailing requirements for submittal of proposed expansion plans for El Mirage Landfill.
November 1983	ADHS Inter Office Memorandum recommends Cease and Desist Order and suggests that unless City of El Mirage issues floodplain use permit the landfill should be closed (with proper closure plan).
January 1984	Agreement between ADHS, AG, and El Mirage Landfill to provide flood protection. Operating plan and closure plan for Parcel 1. Parcel 2 expansion plan to be submitted and approved by ADHS prior to activity at Parcel 2.
September 1984	Agreement between City of El Mirage and Landfill Operator to settle outstanding litigation and identify 5 potential new sites for landfill. City to fund acquisition of new property. Existing operation to continue until suitable new site is operational. Current operator to enter agreement with City to operate "new" facility with percentage payment to City.
October 1986	Letter from attorney to Maricopa County Flood Control District detailing history of El Mirage Landfill operation and explaining continual renewal of 90 day use permits by City of El Mirage.
May 1987	Letter from US EPA regarding potential violations of Sections 303, 401, or 404 of the Clean Water Act and requesting that the landfill prepare and submit a Discharge Assessment for the site.
January 1989	Agreement between Landfill Operator and City of El Mirage for landfill closure within one year of agreement and cessation of operations upon signature of agreement. City to cooperate for permits at alternative site. The agreement also certifies that no hazardous materials were accepted at Parcel 1 or Parcel 2.
July 1989	ADEQ letter to El Mirage Industrial Landfill providing notice that operator is to be held liable for potential release of hazardous material from landfill that could be an imminent or substantial danger to the public health.
October 1989	Soil gas testing of landfill site identifies contamination. Closure Plan prepared by Water Resources Associates for closure and post closure maintenance of El Mirage Landfill. (See Appendix B). Plan includes groundwater monitoring, drainage control and landfill cap, and methane gas monitoring system.
May 1990	ADEQ Consent Order detaining bond requirements and closure/monitoring requirements.

While the ADEQ record notes several instances of improper documentation of solid waste materials, no record of allegations of the landfill accepting non-approved material was identified. However, with the pre-licensure activity and the alleged documentation lapses, it is possible that non-approved material was deposited in the landfill.

There are several additional documents in the record including questions regarding the proper implementation of the closure plan, ongoing groundwater sampling and analysis, and a 1999 request for WQARF assistance for a potential buyer of an adjacent parcel. While it appears that the landfill operation was in substantial compliance with the latest consent order, questions regarding the adequacy of the flood protection and potential groundwater contamination remain.

Extent of Landfill Operation

ADEQ records locate the El Mirage Landfill in the northwest quarter of the southwest quarter of Section 18 of Township 3 north and Range 1 east, (NW1/4, SW1/4, Section 18, T3N, R1E) with an additional parcel in the northwest quarter of Section 24 (West ½, NW1/4, Section 24 T3N R1E). The site is located on the El Mirage, Arizona-Maricopa County 7.5 minute United States Geologic Survey (USGS) quadrangle in the southwestern quadrant of the intersection of US 60 (Grand Avenue) and the Agua Fria River channel. The review of current aerial photography located a site in approximately the same location (southwest quadrant of the Agua Fria/US 60 Grand Avenue Crossing) as described in the ADEQ records. The aerial signature of the landfill appears to be confined to the northern most of the two parcels, (Parcel 1 – See Figure 2 and Figure 4) noted in the ownership record.

The review of historical aerials at the Arizona State University Noble Science Library noted activity indicative of a “landfill operation” along the western channel bank of the Agua Fria River, from approximately the late 1970s until the early 1990s. This activity includes aboveground stockpiling of soil and related earthmoving, several small buildings along the northern boundary, and truck traffic on and off the site. The sequence of activity is similar to ongoing site processing of solid waste material and the later photography clearly shows an ever-increasing aboveground stockpile. An aerial photograph of the landfill operation in 1985 illustrates the approximate extent of the aboveground cell and the amount of material being removed from the river channel (See Figure 4).

Aerial photography from the late 1960s notes a disturbed area with several small depressional areas in the same general location as the above documented activity. The activity noted is consistent with aggregate removal operations elsewhere in the area, but could also be indicative of otherwise undocumented landfill operations. The location of this disturbance extends into the western portion of the channel and to the south, outside of the current landfill footprint. While the photography establishes that some level of activity occurred at the site during this period (1960s), the extent and purpose can not be verified. It is possible that solid waste material or other unidentified material was deposited in this area.

There is also confusion relating to the below grade extent of the operation. The 1973 Maricopa County Department of Health Services landfill permit application described a trench seal landfill operation with depths of 30 feet (it is unclear if the depth referenced landfill material thickness or below grade elevation). Later, documentation in the ADEQ records suggest that the landfill may have extended 10 to 15 feet below the channel bottom elevation, particularly in the northern portion of the site. A 1973 ADHS memorandum notes compacted fill within the Agua Fria channel. Drill logs from the installation of monitoring wells, in or near the suspected below grade area in the northern portion of the site, noted debris to a depth of approximately seven feet below existing surface elevations. The remainder of the well log indicates alluvial material until groundwater is encountered.

↑
NORTH



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Figure 4
Historical Aerial
Photography

The current above ground footprint of the landfill appears to mimic the estimated northern and western extent of the operation (based on estimates from the historical aerial photography). The eastern boundary of the landfill, now forming the west bank of the Agua Fria River channel, is reportedly 50 to 75 feet east of its original approved location. The 1980 Operational Report suggests that an error in field staking or site surveying resulted in the toe of the slope encroaching into the original river channel.

While post license activity appears to have been confined to the currently visible footprint, early unregulated activity may have occurred to the east and south of the existing footprint. Historical aerial photography suggests some excavation activity to the east of the existing above ground footprint, that may indicate pre-1960 disposal of material. Furthermore, the same photography indicates activity on the parcel immediately south of the existing footprint that may be related to early landfill operations.

It should be noted that the historical aerial photography shows a less defined Agua Fria River channel with significantly more braiding than is noted in the present channel. The historical aerials include the railroad bridge, which has apparently constricted the main channel, but also shows visual evidence of truncated and remnant channels near the landfill location. The 1960 photography suggests that at one point, a secondary channel may have existed along the western boundary of the current landfill site.

Type of Waste Accepted at the Landfill

The original permit application for the landfill required that materials were to be 95% household waste, comprised of 30% garbage, up to 70% vegetation, and 5% commercial waste, consisting of wood, glass, stone, metal, masonry, tires, and ashes. The site was not permitted to take any dead animals, septage, petroleum products, or other industrial or chemical wastes. The review of the records did not identify record of the landfill being cited for receiving non-permitted materials. There is one instance of illegal dumping at the site, which was reported to ADEQ by the operator. The illegal material was contained and removed without contamination. However, the existing data record does not provide a complete documentation of post-licensure activity and does not address the pre-regulated activity at the site.

The historical aerial review identified onsite activity including potential dumping from the early 1960s. This activity continues, with different areas and varying extent, until the existing landfill footprint begins to take shape in the mid 1970's. The review of the historical aerial photography did not reveal indications of drums or other visible evidence of non-permitted material. No records of the type of material that may have been dumped in that timeframe were identified. The review of ADEQ files and limited discussions with ADEQ personnel did not identify evidence to suggest that non-permitted material was accepted.

Groundwater constituents normally associated with industrial solvents have been noted in nearby monitoring well samples (See Groundwater Contamination Section). Soil vapor analysis, conducted in 1989, identified some VOC constituents in soil samples along the northern portion of the site. The landfill is located in an area with a history of industrial activity and with other areas of documented volatile organic compound (VOC) contamination. The source of these constituents has not been verified and it is possible that they have migrated from a source other than the buried debris in the landfill. While the identification of these contaminants in soil vapor and groundwater samples is troublesome, it is not an absolute indication that the landfill site contains such compounds.

Status of Closure Plan Implementation

ADEQ records clearly establish that an engineered closure plan was required (1985 closure agreement, 1987 Attorney General lawsuit, and 1990 ADEQ Consent Decree). The records document that hydrologic and channel hydraulic evaluations were conducted for the channel and that a bank protection plan for the landfill was developed. A Closure Plan was prepared and submitted to ADEQ Hazardous and Solid Waste Section in October 1989 (See Appendix B).

The record review did not locate definitive documentation of the implementation or completion of the closure plan. The available records are incomplete and in some instances contradict earlier records. Some records indicate that closure activity was initiated. Photographs from 1981 illustrate a toe trench along an unidentified portion of the perimeter of the landfill awaiting installation of rip rap (it should be noted that this is the same timeframe when allegations of operation within the Agua Fria channel were made). Inspection Reports from 1985, noting the excavation of a toe trench, also suggest that the operator has begun, or is continuing the required rip rap protection. However, later records requesting exploratory excavation to confirm closure activity seem to suggest that some doubt existed about the proper completion of closure plans. No reports of the results of the exploratory excavation or verification of completion of the noted trenching were identified.

There are questions raised in the inspection reports and other documents regarding the proper implementation of the flood protection required in the closure plan. The questions include whether the deposit material was properly compacted (the landfill was cited as an open dump and had several complaints of odor and exposed refuse). There is uncertainty as to whether the side slope armor and other flood protection was properly engineered and installed. Additionally, there is uncertainty regarding the alleged in-channel dumping, whether methane gas collection was required, and whether the final top cap was properly implemented. No record of the final status of these issues was identified in the record review.

The site reconnaissance identified a constructed earth channel in the Agua Fria River channel that is apparently the channel noted in the El Mirage Industrial Landfill Report and subsequent documents. The channel is designed to direct flows away from both banks and to compensate for lost flow capacity when the landfill encroached into the channel. Photographs 9 to 11 illustrate the excavated channel (See Appendix A).

The site reconnaissance confirmed that the channel side of the landfill contained a layer of concrete rubble. The concrete rubble does not appear to be engineered material and does not appear to have been properly placed. There are noticeable gaps between large pieces of the material and several areas appear relatively unstable. The toe depth of the rubble has not been verified and several areas appear to be resting at channel grade. Portions of the toe of the rubble lined slope have developed woody vegetation growth, which might help stabilize the slope. The field reconnaissance identified concrete pipe material that may be asbestos containing material (ACM). This material was noted in the southern portion of the landfill and the extent of its distribution is not known. The slope armoring is illustrated in Photographs 12 to 16 of Appendix A.

The top and sides of the landfill are capped with a layer of soil and stone, but numerous moderate sized erosion fissures were noted along the slopes (Photographs 17 and 18). The top of the landfill exhibits isolated areas of apparent subsidence and subsequent ponding of water (Photographs 19 and 20). Onsite runoff appears to flow off the steep side slopes and collect in the access roads along each side of the landfill. The water then flows to numerous low points in the rubble layer, and flows down the face of the river channel. Several areas exhibit surface erosion behind the rubble material, where surface runoff has formed gullies in the landfill side

slopes (See photographs 21 and 22). No evidence of controlled seep drainage or leachate collection drainage was noted during the field reconnaissance.

Extent of Flood Damage

Flooding in the river channel in 1978 and 1980 damaged the El Mirage landfill. The ADEQ records include aerial photography indicating significant damage to the landfill during these flow events. The photography shows exposed trash material along the eroded edge of the landfill. ADEQ records also include documentation of earthmoving equipment repairing the edge of the landfill. However, the photographic documentation does not provide the level of detail necessary to evaluate the design or implementation of the repair.

Several ADEQ sources suggest that much of the material from the landfill was carried downstream out of the area. The 1990 flood event resulted in significant erosion and material was reportedly scattered down channel for "several 100 yards". There is speculation that material deposited within the Agua Fria channel was eroded and transported downstream during the flow events. The ADEQ record documents complaints of downstream debris but does not detail the extent or composition of the debris.

Potential Ground Water or Surface Water Contamination

The subsurface material in the landfill area is primarily alluvial with layers of gravel, cobble, and clay. The clay soil in the area can be graded and compacted to form a relatively impervious surface cap. Ground water depths vary from 200 to 300 feet in depth. Numerous wells in the area, along with other land use activity, have influenced ground water depths.

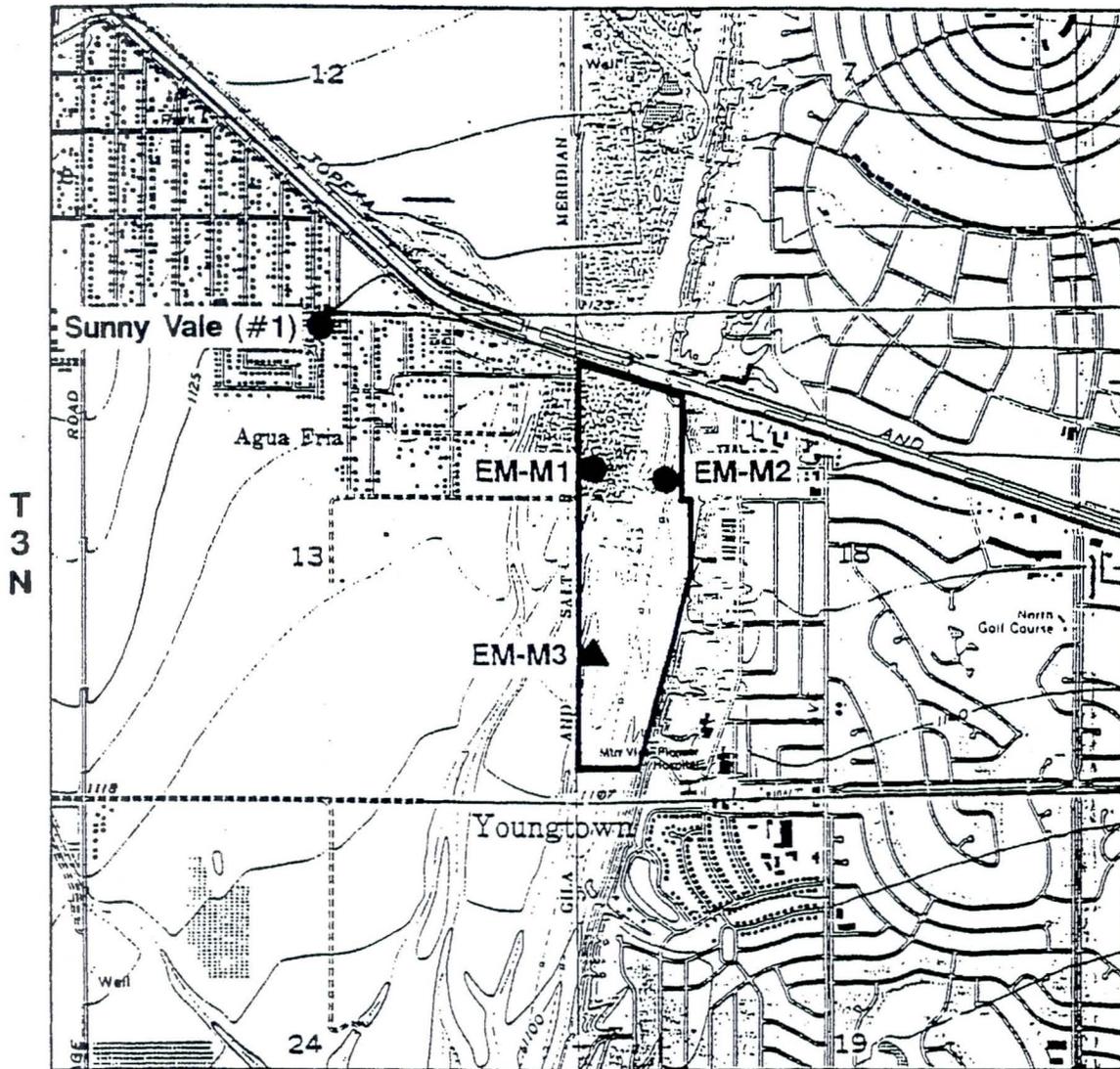
The historical aerial review did not identify evidence of the installation of a landfill liner or leachate collection system. ADEQ records do not indicate the installation or operation of a liner or collection system. There is no record of soil compaction of underlying material prior to placing the landfill material. The field reconnaissance did not note visual evidence of a collection or lining system. It appears that the landfill material rest directly on uncompacted alluvial valley fill material. Surface runoff and precipitation infiltration through the landfill cells may occur which could result in direct discharge to the area groundwater.

The site closure plan required groundwater monitoring. The ADEQ record indicates numerous monitoring wells in the general area of the landfill (See Figure 5). Some of the wells are no longer active and the location of some is uncertain. Information regarding subsurface flow direction and depth of the groundwater is incomplete. Larger production withdrawal wells in the general vicinity may be influencing groundwater patterns.

Currently, ADEQ maintains and samples at least two monitoring wells along the northern end of the landfill. These two wells were identified during the field reconnaissance. Water samples have been collected from these two wells and others in the landfill area and analyzed periodically since the 1980s. Analysis has resulted in the identification of 12 volatile organic compounds (VOC) in the groundwater. Two of the compounds, tetrachloroethene and dichlorodifluoromethane, have exceeded state drinking water standards on at least one occasion.

Water quality analysis from the two wells in March 2000 identified several volatile organic compounds above the detect levels. None of the constituents identified in the March 2000 samples exceeded state water quality standards. A brief description of each constituent is included as "Attachment A" of this memorandum. It should be noted that the constituents identified in the ground water sample analysis are also associated with industrial solvents and other industrial activities. The area surrounding the landfill has a history of industrial activity and there are several records of VOC contamination from industrial solvents.

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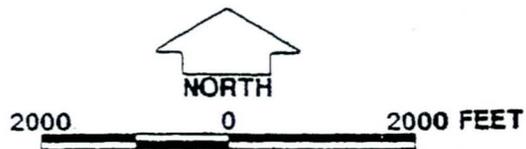


BASE MAP : USGS 7.5 Minute Quadangle - El Mirage, Az.

LEGEND

-  El Mirage Industrial Landfill Property Boundary
-  Well Location
-  Proposed Well Location

Map Credit:
Water Resources, Inc.



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Figure 5
Ground Water
Monitoring Wells

ADEQ is concerned that the VOCs identified are those that would result from a landfill generating methane gas (the most recent records available indicate that the landfill has been tested for methane formation with negative results). Vapor analysis conducted in 1989 identified concentrations of PCE, Freon compounds, and other constituents in soil samples from the northern portion of the site. Based on the results ADEQ has recommended that semi-annual sampling and analysis of the monitoring wells continue. There was no information regarding the continued testing for potential methane gas formation. No evidence of the methane gas monitoring wells noted in the closure report were found during the field reconnaissance.

The area immediately to the southwest of the western boundary of the El Mirage Landfill is under development with single-family residential housing, and the area immediately west has evidence of recent field surveying work. These areas are in the immediate path of potential VOC plume migration and methane gas formation.

The surface water runoff from the landfill is collected along two dirt roadways that traverse the east and west flanks of the aboveground cell. The runoff then discharges from random points to either the Agua Fria River channel on the east side, or a collection swale along the west side of the landfill. The west side collection swale may be a portion of a remnant sub-channel of the Agua Fria River (See photograph 23). The collection swale ultimately discharges to the Agua Fria River channel to the south of the landfill property.

Portions of the side slopes of the landfill exhibit moderate rill erosion and several one to two feet deep gullies have formed in the capping material (See Appendix A and Photographs 6 and 7). The armored side slopes leading to the river also exhibit areas where surface discharge has undercut areas behind the riprap when flowing to the channel (See photograph 24). The western slopes exhibit less erosion. A single-family residential development is under construction to the southwest of the landfill facility and the area to the immediate west appears to be field staked for possible construction. These areas appear to be utilizing the El Mirage Landfill swale as a discharge for site drainage and have constructed some detention facility along the swale (See photographs 25 and 26).

Comments and Recommendations

This document was prepared for the Flood Control District of Maricopa County and is for their sole use. Use of this document by third parties will be at the sole risk of those parties. The evaluation is based on a limited records search and a field reconnaissance of the subject property. The review did not include exploratory probes, sampling, or analysis.

This review of the status of the EL Mirage Landfill identified many gaps in the available data record. The incomplete data and the preliminary nature of this review preclude specific conclusions and/or recommendations. The following are some general comments relating to the results of the review and are followed by some general recommendations. Both the comments and the general recommendations should be treated as tentative information, subject to revision as additional information is obtained. Further, this information should not be construed as legal advice and legal counsel should be consulted prior to any further activity.

Comments

- It may be that the resolution of the El Mirage Landfill issues are not within the mission of the Maricopa County Flood Control District and should be resolved by the identified owners and involved agencies.
- The Flood Control District should be aware that channel activity such as channel lining, erosion protection or bank stabilization on either bank, levee construction, or other activities in the vicinity of the landfill may result in changes to flow patterns in the channel. These changes in flow patterns could adversely affect the stability of the El Mirage Landfill. Therefore, any activity in this area should be carefully designed and documented to reduce the possibility of real or perceived affects on the El Mirage Landfill. Further, channel excavation could expose previously covered portions of the landfill material.
- Responsibility for the current and future management of the El Mirage Landfill site does not appear to be completely resolved. The level of responsibility for future management of the landfill should be determined prior to further action.
- The exact footprint of the historic extent of the landfill operation can not be determined with the documentation reviewed. The historical aerial photography indicates some early (1960's) activity within the current landfill footprint and immediately to the south and east (within the channel) of the current footprint. The activity appears to be excavation or stockpiling and may or may not include disposal of solid waste material. Post-licensure activity appears to have been confined to the existing footprint, although it may have extended into the Agua Fria channel.
- While the exact depth of the landfill operation has not been determined, the records indicate that the landfill may have been operated below the Agua Fria River channel bottom elevation. Several notations of excavation as deep as 10 feet below the channel are noted in the records. It seems reasonable to assume that at some point in the life of the landfill, operations extended below the grade of the Agua Fria River channel. The uncertainty regarding the extent of the operation will affect any plans to isolate or protect the landfill.
- It is unlikely that the landfill is lined or otherwise isolated from groundwater. Natural soils within the landfill are most likely alluvial and are relatively pervious. The El Mirage Landfill does not appear to have a leachate collection system or a landfill liner and there is no documentation of proper compaction or covering of the trash layers. Therefore, it is likely that the landfill does discharge to the groundwater. The area's arid conditions may reduce the amount and effect of this discharge.

- The documented VOC plume may or may not be from the landfill operation. There is no documentation of solvent disposal at the landfill. However, there are gaps in the available record and the pre-licensure phase of the landfill is not documented. The surrounding area has documented records of VOC contamination from other sources. The source of the VOC plume can not be determined based on the reviewed information.
- Available records indicate that testing at the landfill site did not verify methane formation, although the contaminants identified in the 1989 soil testing can be an indication of such formation. The closure plan requires the installation of methane gas monitor wells along the western boundary of the landfill, but does not indicate whether they were installed. The field reconnaissance did not locate methane gas monitoring wells. Development activity continues along the western boundary of the landfill.
- A significant, but undocumented, amount of the landfill material was eroded and transported downstream in early flood events. It is unclear as to whether the flood events removed sub-surface material in or adjacent to the channel. Based on this review, there appears to be a potential for buried landfill debris in the Agua Fria River channel adjacent to the El Mirage Landfill site.
- It is also unclear as to whether the landfill closure or flood repair damage was adequately designed or implemented. Inadequately designed or implemented erosion/flood protection on the landfill banks could affect channel activities. The surface runoff system for the landfill does not appear to be designed as per the discussion in the final closure plan.
- The field review identified suspect asbestos containing material (ACM). The material is a concrete based pipe, that was noted in the southern portion of the site. The extent of the distribution of potential ACM is not known, but it is possible that the material is interspersed throughout the bank armoring.
- The existing bank armoring may not be adequate to protect the cell slopes from erosion during channel flow events. Field reconnaissance noted gaps in the armoring, badly placed and inadequately sorted material, and areas of infiltration and erosion.

General Recommendations

If the Flood Control District chooses to participate in activity that might affect the El Mirage Landfill, the following issues will require further evaluation. Legal counsel should be consulted prior to initiation of additional activity.

- A better understanding of the adequacy of the design of the closure plan and if the closure plan was properly completed is important to evaluating the stability of the landfill. Several issues in the inspection reports suggest that there was concern regarding the closure plan implementation. To the extent practical, the notations on the inspection reports should be researched and resolved. If practical, participants in the implementation of the final closure should be identified and questioned for insight into the final operations at the site
- Determination of status of additional development in the area. Specifically, but not limited to, potential development immediately southwest and west of the landfill site. The data records note a proposed methane monitoring/collection (?) system that may have been ordered for the area to the west of the landfill. Further, the western portion of the landfill operation should be investigated to assure that residential development is adequately isolated from potential contamination. The developing area to the southwest of the landfill appears to be utilizing the surface runoff ditch of the western side of the landfill for their surface water discharge. This may or may not pose a hazard to the landfill base or to the landfill drainage system.

- Conduct additional coordination with ADEQ/ADWR to clarify responsibilities and roles for further activity regarding the El Mirage Landfill. This coordination could include the development of an agreement as to responsible parties and an understanding of what level of evaluation and stabilization techniques might be accepted. Complete cleanup of any site is difficult, a pre-activity agreement as to the expectations and responsibilities of the various participants might reduce further/additional litigation. This agreement should be developed prior to any invasive activity at the landfill site.
- Prepare a groundwater-monitoring program that will attempt to verify the general groundwater flow patterns in the area and predict the direction and extent of the VOC plume. This program may include the installation of additional monitoring wells (to triangulate the site and adjacent contributing areas). The monitoring program should also include the development of recommendations for action necessary to minimize the potential of additional migration of the contamination plume.
- Conduct a more complete site review of the condition of the landfill site. The review should include visible inspection and photographic documentation of the landfill cap, banks, and armoring. The site review should include the ADEQ/ADWR or other applicable agencies and parties. It might include potential core sampling of the river channel, the landfill cell, and the armored banks to evaluate the sub-surface conditions. A more complete evaluation of the suspect ACM should be conducted with sampling and analysis of the pipe material. An attempt should be made to determine the amount and possible distribution of the ACM. Review of landfill customer records may reveal the approximate timing and therefore, distribution of the material. A pre-inspection agreement should be developed (as described above) prior to sub-surface sampling or ground disturbance on or adjacent to the landfill.
- Verify, to the extent practical, the “final footprint” of the landfill on Parcel 1 and verify that Parcel 2 was not utilized for refuse disposal. Soil borings may be required to verify the extent of the landfill operation.

ATTACHMENT A

Groundwater Sample Constituent Description

Tetrachloroethene

Chemical Abstract Service (CAS) Number: 127-18-4

Synonyms: tetrachloroethylene, perchloroethylene, PCE, PERC, Perchlor

Chemical Formula: C₂Cl₄

Description: clear colorless liquid with a chloroform-like odor

Target Organs: eyes, skin, respiratory system, liver, kidneys, central nervous system

Routes of Exposure: inhalation (primary route), skin absorption, ingestion, skin and/or eye contact

EPA Drinking Water Maximum Contaminant Level (MCL): 0.005 mg/L

Uses:

- Textile industry for processing, finishing, sizing
- Component of aerosol dry-cleaning products
- Intermediate in the synthesis of fluorocarbons
- Solvent for fats, greases, waxes, rubbers, gums
- Removal of caffeine from coffee
- Metal degreasing
- Veterinary medicine as anthelmintic
- Fumigant for insects and rodent

Carcinogenicity:

- National Toxicology Program (NTP) Cancer Classification: reasonably anticipated to be a carcinogen
- International Agency for Research on Cancer (IARC) Classification: possible human carcinogen (Group 2B)
- U.S. Environmental Protection Agency (EPA) Weight of Evidence Classification: EPA's Science Advisory Board recommended C-B2 (C = possible human carcinogen; B2 = probable human carcinogen); however EPA has not adopted this weight of evidence classification

Major Release Mechanisms:

- Vaporization losses from dry cleaning and industrial metal cleaning
- Wastewater – particularly from metal finishing, laundries, aluminum forming, organic chemical/plastics manufacturing, municipal treatment plants
- Water pollution from tetrachloroethylene leaching from vinyl liners in asbestos cement water pipelines and during chlorination water treatment, where it can be formed in small quantities.

Additional Information:

- In some groundwater, undergoes reductive dechlorination catalyzed by anaerobic bacteria that yields vinyl chloride
- Some of the highest outdoor air levels have been associated with waste disposal sites
- Expected to exhibit low to medium mobility in soil, therefore may leach slowly into the groundwater

Dichlorodifluoromethane

CAS Number: 75-71-8

Synonyms: F-12, Freon 12, Algorfrene Type 2

Chemical Formula: CCl₂F₂

Description: colorless gas with ether-like odor

Target Organs: peripheral nervous system, cardiovascular system

Routes of Exposure: inhalation (primary route), skin and/or eye contact (liquid→frostbite)

EPA Drinking Water Maximum Contaminant Level (MCL): NA (not included in National Primary Drinking Water Standards, National Secondary Drinking Water Standards, or in the Unregulated Contaminant Monitoring Rule)

Carcinogenicity: Not classified by the NTP; has not undergone complete evaluation for human carcinogenic potential.

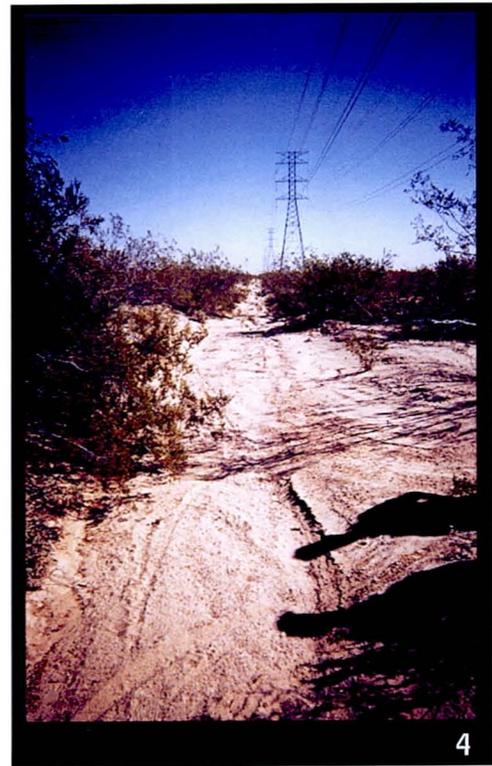
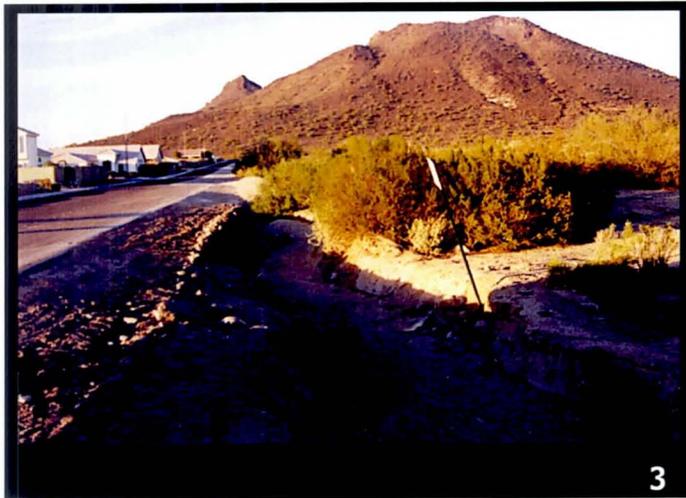
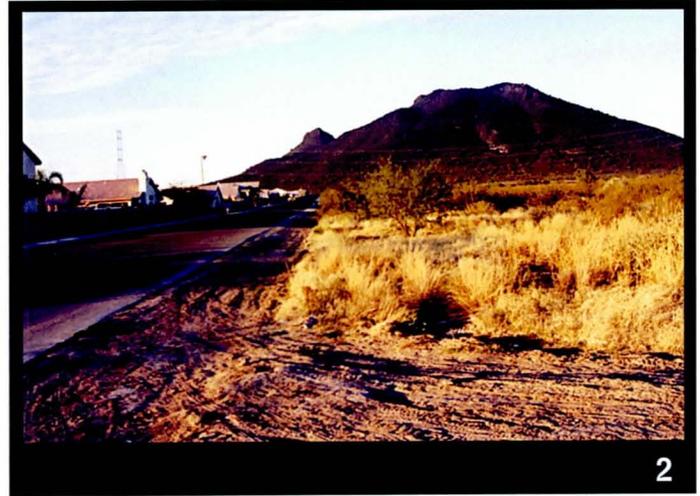
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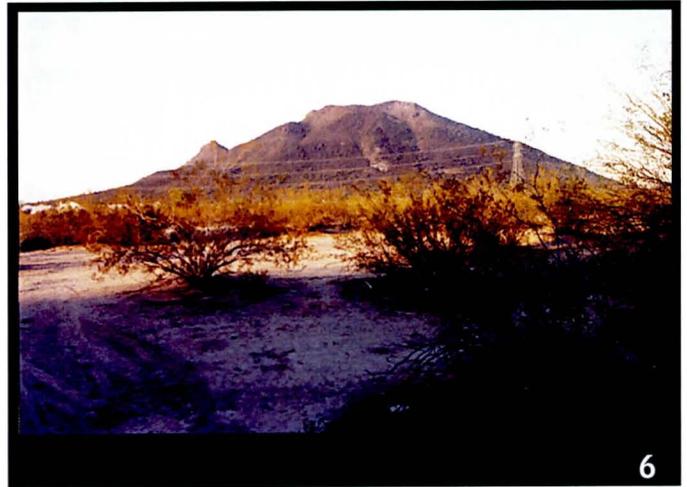
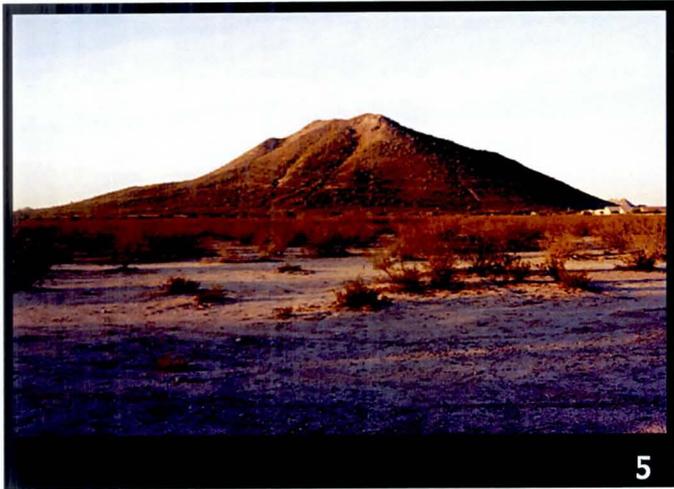
- Refrigerant
- Aerosol propellant
- Rocket propellant
- Foaming agent
- Plastics

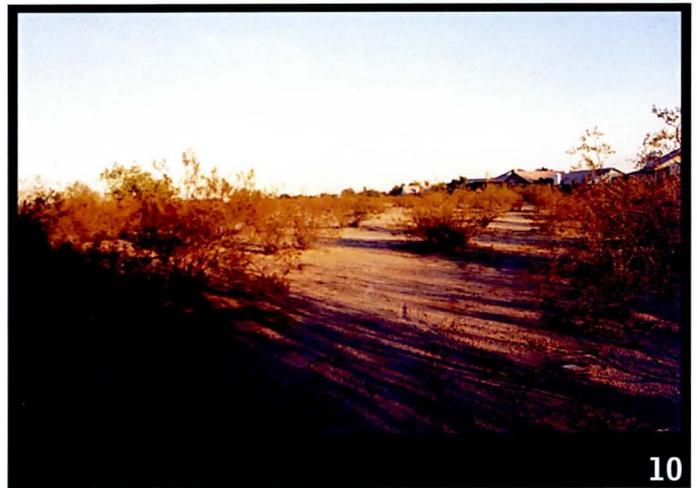
Additional Information:

- Suggested disposal by incineration in a special high temperature (>2000° F) chemical incinerator facility
- Ranked as one of the most hazardous compounds (worst 10%) to ecosystems
- Drinking water information removed from EPA Integrated Risk Information System (IRIS) on or before April 01, 1997

Appendix A Site Photography







Appendix B ADEQ - Record Documents

Presented Chronologically

<u>Document</u>	<u>Date</u>
Parcel I and Parcel II Legal Descriptions	No Date
El Mirage Industrial Landfill Operational and Flood Study Report -	October 1980
Attorney General/ DeConcini Letter RE: El Mirage Landfill Expansion -	July 1983
Notice of Disposal Form Attachment C	January 1984
Arizona Department of Health Services/DeConcini letter	June 1984
DeConcini/Maricopa County Flood Control District Letter	October 1986
ADEQ /Refuse Research Corporation letter	July 1989
Closure Plan/Post Closure Maintenance Plan Water Resources Assoc. Inc	October 1989
ADEQ Inter Office Memo/Consent Order	June 1990