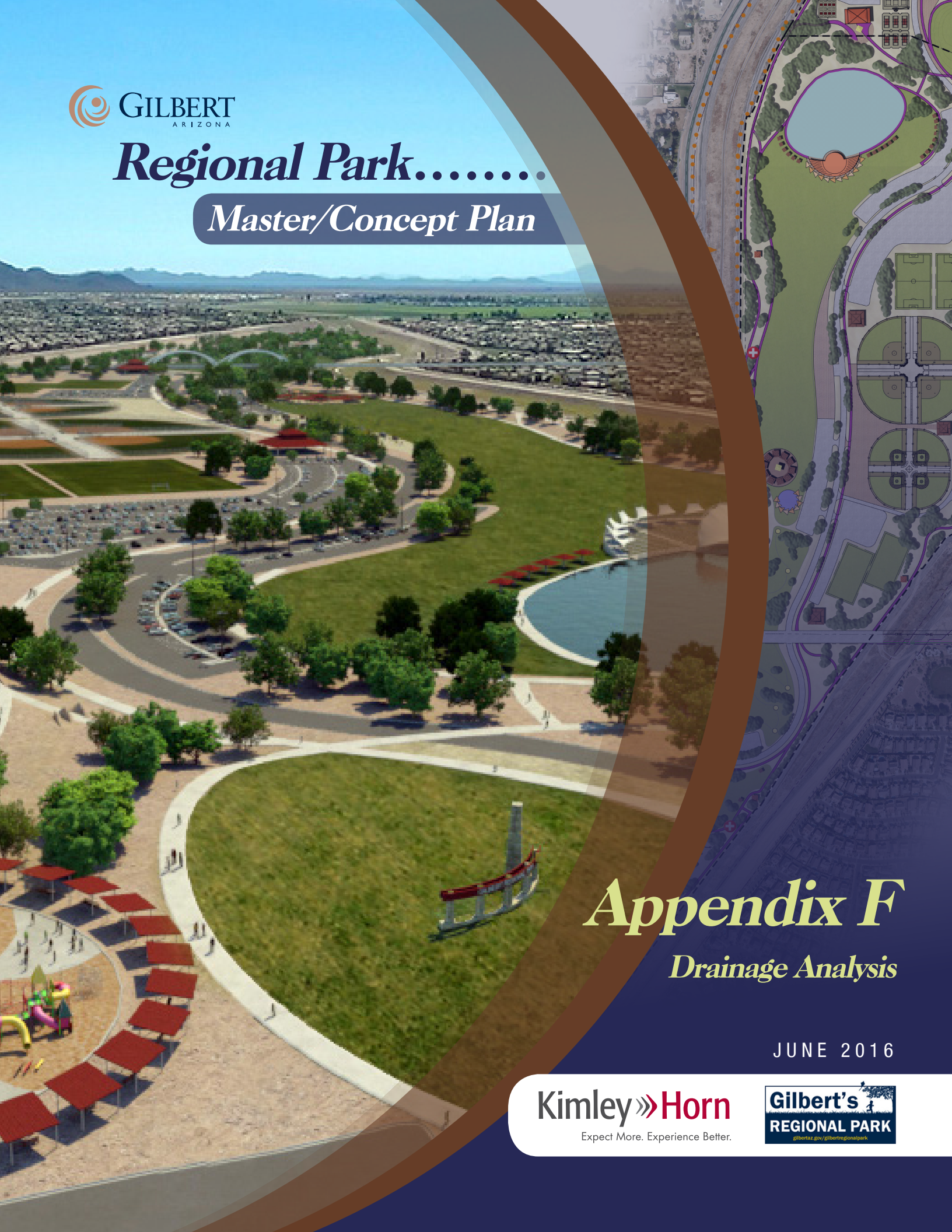
GILBERT
ARIZONA

Regional Park.....

Master/Concept Plan



Appendix F

Drainage Analysis

JUNE 2016

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Contents

Figures

Tables

Appendix

1.0 INTRODUCTION

1.1 PURPOSE

This report documents the drainage requirements and basin storage for the Chandler Heights Basin based on the recommended concept plan. The proposed 272-acre regional park facility is located at the southwest corner of the intersection of Queen Creek Road/Higley Road in Gilbert, Arizona. The site will include various sport, playground, and other park-related uses and is assumed to be built out by 2027.

1.2 CHANDLER HEIGHTS BASIN HISTORY

The Chandler Heights Basin was designed to attenuate runoff from the east valley prior to entry into the East Maricopa Floodway (EMF). The EMF was built in the 1980s by the Natural Resources Conservation Service. It extends from Brown Road in Mesa south to the Gila River in Pinal County and is a regional outfall for the area providing 27 miles of channel conveyance before discharging into the Gila River. Major washes that contribute to the EMF are the Powerline Floodway, which drains the Powerline, Vineyard and Rittenhouse Road Flood Retarding Structures, Queen Creek Wash and Sonoqui Wash. The EMF flows south along the western boundary of the Chandler Heights Basin, while the Queen Creek Wash and Sonoqui Wash confluence at the basin. The EMF does not have capacity to convey runoff from the 370 square mile watershed, so the Chandler Heights Basin was designed to attenuate flows to the EMF. Figure 1 shows the watershed area map.

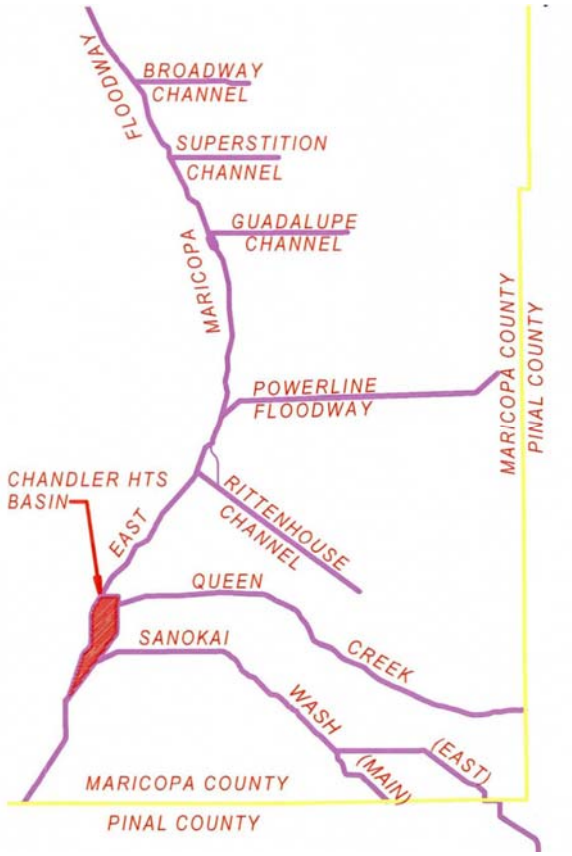


Figure 1 Watershed Area Map

The Gilbert Regional Park Master / Concept Plan includes a full topographic survey of the entire Chandler Heights basin area and surrounding EMF, Queen Creek and Sonoqui Wash. The survey was completed in January of 2016 utilizing the North American Datum 1983 (NAD83) for horizontal control and the North American Vertical Datum of 1988 (NAVD88).

The proposed development, a 272-acre regional park facility, is located at the southwest corner of the intersection of Queen Creek Road/Higley Road in Gilbert, Arizona. The project location is shown in **Figure 2**.

Major streets adjacent to the development include Higley Road, Queen Creek Road, Greenfield Road and Chandler Heights Road. The recommended vision concept plan is illustrated in **Figure 3**. The site opportunities and constraints map can be found in **Figure 4.**

1.3 INTERGOVERNMENTAL AGREEMENT WITH DISTRICT

The Town of Gilbert has entered into an Intergovernmental Agreement (IGA) with the District. As the park amenities are developed it will be imperative to keep the provisions of the IGA at the fore front. The goal of the IGA is to provide the Town access to and use of the basin for recreational use. The IGA provides the Town of Gilbert with a no cost, non-exclusive Recreational Use Easement over the easement area identified within Exhibit A of the IGA. The uses identified include: construction, maintenance and operation of parks, landscaping, fencing, signage, lighting and other compatible recreational uses and related appurtenant facilities or improvements for the use and enjoyment of the general public. Construction of recreational amenities or improvements shall be at no cost to the District and require approval from the District prior to start of construction. The requirement of the IGA is that first and foremost the basin must function as a flood control facility.

> *"Flood control remains the primary purpose of the basin and Gilbert's uses may not materially reduce, diminish or alter the flood control features of the basin or the capturing, storing and conveying flood and storm water." -2015 IGA*

The following are requirements have been identified by the IGA:

- All Recreation Amenities to or within the Easement Area shall require a FCDMC Right of Way Permit prior to start of construction.
- The Town shall be responsible for design, all permits and inspections, utility relocations, construction, construction management, operation and maintenance and all costs associated with modifying the contouring and grading of the Easement Area for permitted uses.
- The Town shall be responsible for the removal of graffiti, trash and debris, weed and dust control within the Easement Area. Maintaining repairing, correcting any damage to and replacing project flood control features within the Easement Area that may become damaged from permitted uses.
- Provide an operation and maintenance plan for all operation and maintenance activities for the review and approval of the District.
- Final inspection of the recreational amenities with the District shall be required of the Town once construction is completed.
- District shall be allowed unrestricted access to the Easement Area including for the purpose of sediment removal, structural repair and replacement of flood control features and periodic inspections, as the District deems necessary.
- The District shall be responsible for sediment removal, structural repair and replacement of flood control features and for periodic inspections of flood control features. The District shall not be responsible for any damages to flood control facilities from recreational amenity use.
- The IGA requires that the Town have a Flood Response Plan in place for the basin once design phases move forward.

1.4 TOPOGRAPHIC SURVEY

The Gilbert New Regional Park Master Plan included a full topographic survey of the entire Chandler Heights basin area and surrounding EMF, Queen Creek and Sonoqui Wash. The survey was completed in January of 2016 utilizing the North American Datum 1983 (NAD83) for horizontal control and the North American Vertical Datum of 1988 (NAVD88).

The EMF CHB Predesign Study utilized the North American Datum 1983 (NAD83) for horizontal control and the North American Vertical Datum 1929 (NAVD29) for vertical control.

An equation between the two vertical datums has been provided based on the Benchmark provided below.

The Elevation for the point listed below in NAVD-29 is 1295.24 or -2.37' from NGVD88 to NAVD-29.

The following benchmark and basis of bearing was utilized for the January 2016 topographical survey.

BENCHMARK:

N.G.S. PID "BBBH42" BEING A BRASS CAP FLUSH, LYING NORTHEASTERLY OF THE INTERSECTION OF QUEEN CREEK AND 158TH STREET ALIGNMENTS, HAVING AN ELEVATION OF 1297.61' (NAVD-88)

BASIS OF BEARING:

BEARINGS SHOWN HEREON ARE BASED UPON U.S. STATE PLANE NAD83 COORDINATE SYSTEM ARIZONA STATE PLANE COORDINATE ZONE CENTRAL, DETERMINED BY GPS OBSERVATIONS.

Figure 2. Vicinity Map

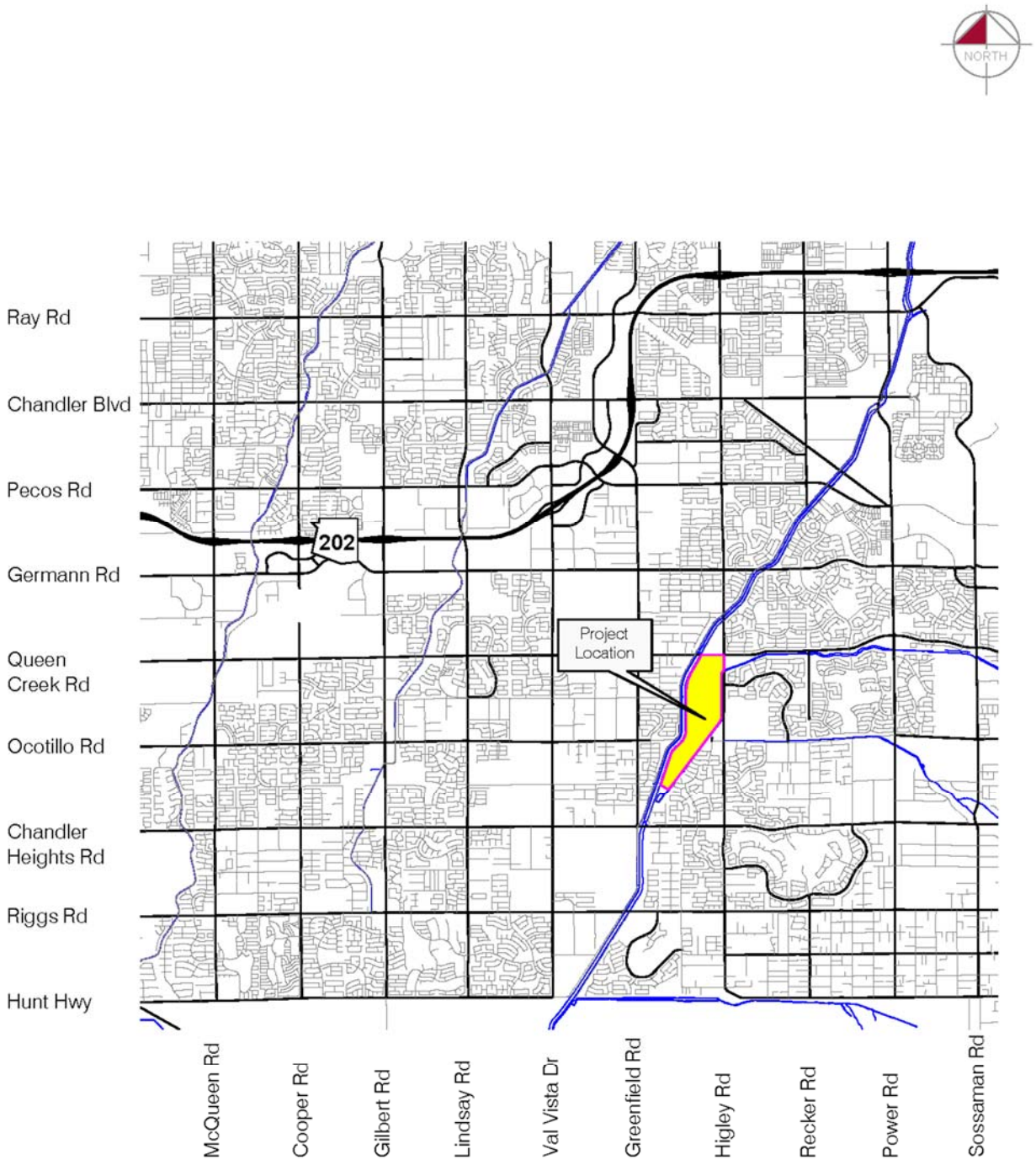
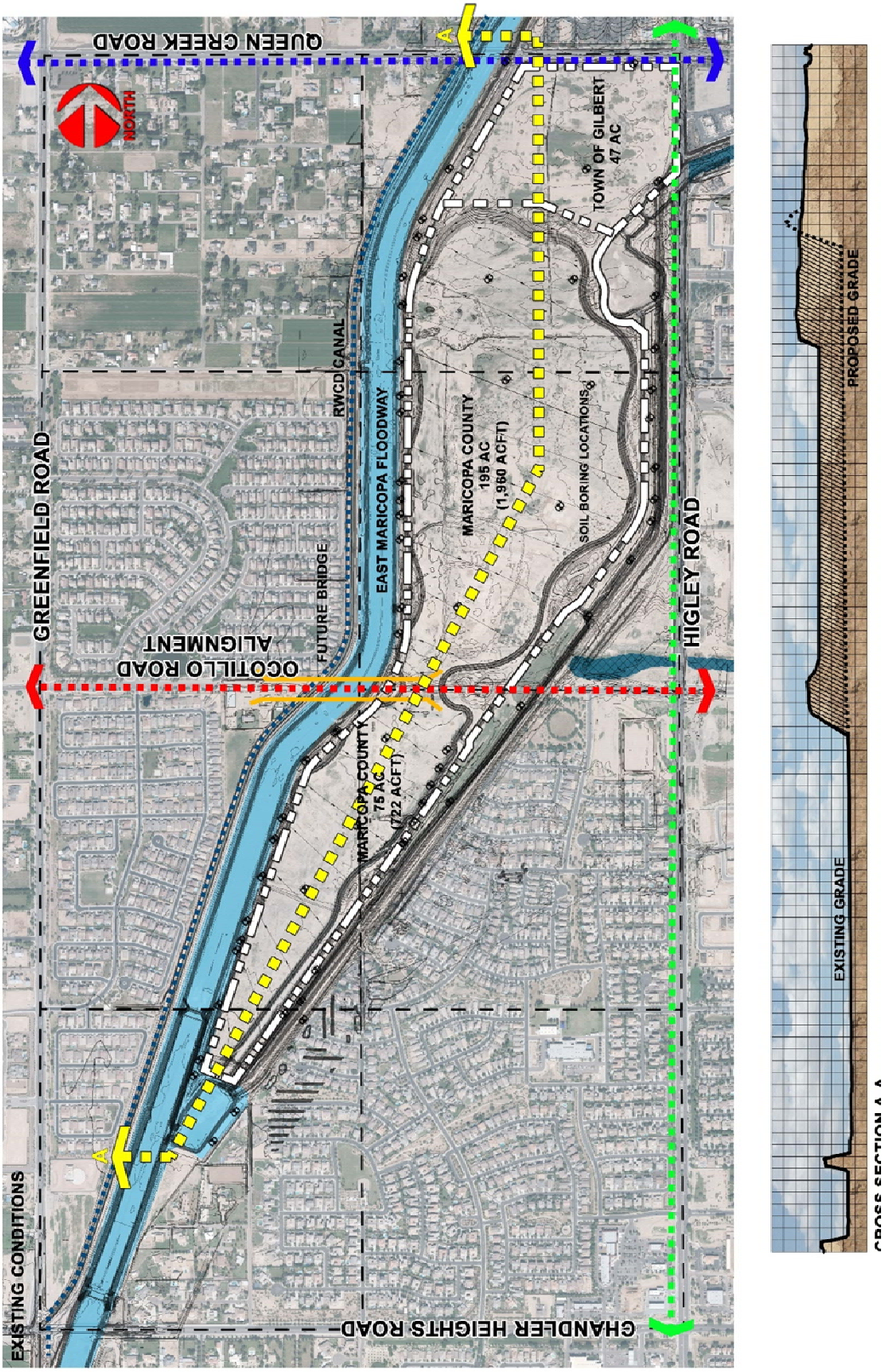


Figure 3. Site Plan

Figure 4. Opportunities & Constraints Map



2.0 PREVIOUS STUDIES

2.1 INTITIAL EAST MARICOPA FLOODWAY CAPACITY STUDIES

The Flood Control District of Maricopa County (FCDMC), completed three initial studies involving the East Maricopa Floodway:

1. East Maricopa Floodway Capacity Assessment Study (Howard Needles Tammen & Bergendoff, 1999)
2. East Maricopa Floodway Capacity Mitigation Study Report (Huitt-Zollars, 2000)
3. East Maricopa Floodway Capacity Mitigation and Multi-Use Corridor Study (Collins-Pina, 2000)

The EMF capacity study by HNTB evaluated the conveyance capacity of the entire EMF for existing and future 100 year discharge as well as the original EMF design discharge developed by the Soil Conservation Service (SCS) which has since been re-named as the *Natural Resources Conservation Service (NRCS)*. The study also provided the conveyance capacity of the EMF under bank full conditions and determined capacity deficiencies within the floodway.

The EMF Capacity Mitigation Study by Huitt-Zollars evaluated alternatives to add a series of detention basins along the EMF to provide additional capacity for the restricted channel. The study also developed and updated the hydrology models for the EMF based on future watershed conditions. These models served as the basis for design for the EMF Capacity Mitigation and Multi-Use Corridor Study by Collins-Pina in 2000.

The study evaluated alternatives and recommended the construction of two detention basins to improve the capacity of the EMF, Rittenhouse Basin (SWC of Power Road and E. Williams Field Road) and Chandler Heights Basin (SWC of Queen Creek Road and Higley Road).

CHANDLER HEIGHTS BASIN

The FCDMC contracted with Kirkham Michael in 2001 to provide engineering and design services for the design of Chandler Heights Basin and Rittenhouse Basin. The first step in the design process was the Predesign Study which evaluated six design alternatives for the Chandler Heights Basin. The alternatives were dependent on the following design objectives:

- Minimize the volume of the basins
- Optimize the confluence of Queen Creek, Sonoqui Wash and Rittenhouse Channel to minimize the volume of the basins
- Provide for multi-use opportunities for the basin to include recharge, recreation, and mitigation
- Maximize the basin configuration to use a gravity outlet
- Balance basin volume versus channel capacity
- Minimize Operations and Maintenance for sediment removal

The Town of Gilbert was a stakeholder during the East Maricopa Floodway Chandler Heights / Rittenhouse Basin Predesign Study completed in January of 2002 which included both the Chandler Heights Basin and the Rittenhouse Basin drainage facilities. The Town expressed interest for both basins to provide options for future multi-use and recreational facilities. The District is a strong proponent of implementing drainage solutions that provide multi-use opportunities while maintaining the primary function of the drainage facility.

A Phase 1 Environmental Site Assessment for the Chandler Heights Basin was completed by URS in January of 2002. This report can be found in the appendix of this report.

ADDITIONAL PREVIOUS STUDIES & CONSTRUCTION DOCUMENTS

- **East Maricopa Floodway Chandler Heights Basin Design Predesign Study** was completed in January 2002 by Kirkham Michael and funded by FCDMC.
- **Phase 1 Environmental Site Assessment for the Chandler Heights Basin** was completed by URS in January 2002 and funded by FCDMC.
- **Geotechnical Evaluation East Maricopa Floodway (EMF) & Chandler Heights Detention Basin** was completed in October 2002 by Ninyo & Moore and funded by FCDMC.
- **Hydrology / Hydraulic Report for Rittenhouse and Chandler Heights Detention Basins** was completed in October 2003 by Kirkham Michael and funded by FCDMC.
- **Construction Phasing for Rittenhouse and Chandler Heights Detention Basins** was completed in February 2004 by Kirkham Michael and funded by FCDMC.
- **Design Calculations & Analysis Notebook for Rittenhouse and Chandler Heights Detention Basins** was completed in March 2004 by Kirkham Michael and funded by FCDMC.
- **Construction Documents for Chandler Heights Detention Basin** was completed in March 2004 by Kirkham Michael and funded by the FCDMC.

DESIGN CRITERIA

The Chandler Heights Basin design criteria as developed by the FCDMC as part of the East Maricopa Floodway Chandler Heights / Rittenhouse Basin Predesign Study completed in January of 2002, utilizes the 100-yr 24-hr future watershed conditions as the design hydrology for the Chandler Heights Basin. The design hydrology also includes the upstream Rittenhouse Basin as this has a direct effect on the Chandler Heights Basin sizing and EMF capacity.

Freeboard

The FCDMC does not have specific design criteria for detention basin freeboard requirements. The pre-design study identified the use of the Arizona Department of Transportation (ADOT) policy which outlines detention storage if feasible to be below the grade surrounding the basin site and provide one foot of freeboard.

Basin Drawdown Requirements

Maricopa County requires detention basins to be drained within 36 hours after the rainfall event to minimize standing water.

Basin Slopes

The maximum slope for all side slopes shall be 4:1 (H:V) as per the geotechnical investigation report recommendations.

Flow Rates at the basin weir:

- Total Flow (Q) in the Queen Creek Channel is 5,536 cfs
- The Q that by-passes the weir is 2,312 cfs
- The Q over the weir is 3,225 cfs

CHANDLER HEIGHTS BASIN PREFERRED CONCEPT

The East Maricopa Floodway Chandler Heights Basin Design Predesign Study recommended the sideweir concept design solution. This concept utilizes a single sideweir after the confluence of Queen Creek and Sonoqui Wash to allow flow to bypass and continue past the sideweir and the detention basin, through the sedimentation basin and discharge into the EMF through a concrete box culvert outlet. The weir elevation and length is set to allow for the bypass of the excess flow to be diverted into detention storage. This alternative includes improvements to the Queen Creek Channel to contain the 100 year event with freeboard along the east side of the Chandler Heights basin frontage. The sideweir diverts flow from Queen Creek / Sonoqui Wash channel in the detention basin. The frequency storm has been estimated to by-pass the basin to spill over the weir to be between the 5 yr and 10 yr event. Flows in the channel below the sideweir will be conveyed into the sedimentation basin, and then discharge into the EMF. The basin floor elevation is tied to the EMF channel floor elevation as the District wanted to utilize gravity flow in lieu of the use of mechanical pumps.

CURRENT STATUS

The basin was designed to meet the criteria of the Flood Control District of Maricopa County (District) for the 100-year, 24-hour storm event. It was also designed with the end in mind – future conditions full build-out through 2020 was assumed in the hydrologic modeling, and the basin geometry was laid out to provide opportunities for multiple use and recreational amenities. The entire basin has been designed, and the first two phases have been constructed. Phase 1 included the outlet, improvements to the EMF and the lower portion of the basin south of the Ocotillo alignment. Phase 2 included the Queen Creek Channel with drop structures, sideweir from the Queen Creek Channel into the Chandler Heights Basin and the remaining portion of the basin south of Ocotillo. The basin has been fully functional since Phase 2 was constructed, but without the total volume needed to attenuate the ultimate runoff. Phase 3 is designed but not completed and includes the excavation of the final design volume to complete the northern section of the basin. Phase 4 is planned to be construction of landscaping and irrigation for the basin.

<u>Chandler Heights Detention Basin Flood Control District of Maricopa County Final Design– Construction Phase Schedules</u>

- C028 – Construct the improvements in the EMF, the outlet, spillway, and lower portion of the basin (completed).
- C029 – Construct the improvements in Queen Creek Channel and the sideweir (completed)
- C030 – Construct the remainder of the basin
- C031 - Install all landscaping and irrigation

2.2 CHANDLER HEIGHTS DESIGN BASIN STORAGE

The Hydrology / Hydraulics Report for the Chandler Heights and Rittenhouse Basin design completed by Kirkham Michael in October of 2003 provided the following Stage Storage Chart for Chandler Heights Basin. Table 1 provides the design stage storage for the Chandler Heights Basin.

Table 1 Chandler Heights Basin Design Stage Storage

Basin Elevation (ft)	Area (acres)	Cumulative Storage Volume (acre-ft)
1296	0	0
1297	19	9
1298	53	45
1299	58	101
1300	125	192
1301	174	342
1302	175	516
1303	177	693
1304	179	871
1305	181	1050
1306	182	1232
1307	184	1415
1308	186	1600
1309	187	1786

The 225 acre basin has a bottom elevation of 1296 and a minimum top basin elevation of 1309. This allows for over two feet of freeboard at the peak basin water surface elevation (1306.5 during the 100 year, 24 hour event. The peak basin water surface elevation occurs at 1306.5 for Max Storage volume of 1325 acre ft.

The Kirkham Michael EMF CHB Predesign Study utilized the North American Datum 1983 (NAD83) for horizontal control and the North American Vertical Datum 1929 (NAVD29) for vertical control.

3.0 GILBERT REGIONAL PARK RECOMMENDED CONCEPT

3.1 BASIN STORAGE PROVIDE FOR RECOMMENDED CONCEPT PLAN

The following basin Stage Storage Chart in Table 2 has been provided based on the recommended concept plan.

Table 2 Concept Basin Stage Storage

Basin Elevation (ft)	Area (acres)	Cumulative Storage Volume (acre-ft)
1298	0	0
1299	17	6
1300	41	34
1301	68	87
1302	115	178
1303	151	310
1304	178	474
1305	180	653
1306	182	834
1307	184	1016
1308	186	1201
1309	188	1388
1310	190	1576
1311	192	1767

The 225 acre basin has a bottom elevation of 1298 and a minimum top basin elevation of 1311. This allows for over two feet of freeboard at the peak basin water surface elevation (1308.6 during the 100 year, 24 hour event. The peak basin water surface elevation occurs at 1308.6 for Max Storage volume of 1325 acre ft.

As noted in the Topographical Survey section the topographical survey completed in January of 2016 utilized the North American Datum 1983 (NAD83) for horizontal control and the North American Vertical Datum of 1988 (NAVD88). Since the previous study utilized the North American Vertical Datum 1929 (NAVD29) for vertical control. An equation between the two vertical datum locations requires a difference of -2.37 feet from the NGVD88 (previous study) to the NAVD-29 (current topo).

The maximum design elevation around the Chandler Height Basin embankment is 1309 feet, except at the emergency spillway and the lateral weir where the elevation is 1307 feet. The bottom of the basin is set at 1298 feet and the water surface elevation at the lateral weir during peak flow is 1308.6 feet.

APPENDIX A

CHANDLER HEIGHTS BASIN PHASE 1 ENVIRONMENTAL REPORT

URS

REPORT
PHASE I ENVIRONMENTAL SITE ASSESSMENT
CHANDLER HEIGHTS DETENTION BASIN
MARICOPA COUNTY, ARIZONA

Prepared For
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

URS Job No. E1-15448010.55
February 26, 2002

URS

February 26, 2002

Ms. Theresa Pinto
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009-6399

Re: Report
Phase I Environmental Site Assessment
Chandler Heights Detention Basin
In Maricopa County, Arizona
for Flood Control District of Maricopa County
URS Job No. E1-15448010.55

Dear Ms. Pinto:

Pursuant to your request, URS has completed the Phase I Environmental Site Assessment for the above-referenced property. The attached report summarizes the findings of this assessment.

We are pleased to be of service to the Flood Control District of Maricopa County. Should you have any questions or if we may be of some additional service, please contact URS at (602) 371-1100.

Sincerely,

URS

Marianne Burrus
Project Environmental Scientist

Robert J. Petrisko
Environmental Assessment Manager
Due Diligence

RJP/tc

URS Corporation
7720 North 16th Street, Suite 100
Phoenix, AZ 85020
Tel: 602.371.1100
Fax: 602.371.1615

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

URS was retained by the Flood Control District of Maricopa County (FCDMC) to conduct a Phase I Environmental Site Assessment (ESA) on the Chandler Heights Detention Basin project located near Gilbert in Maricopa County, Arizona (the "site" or the "subject property"). This Phase I ESA was conducted in accordance with URS' revised proposal to the Flood Control, dated November 13, 2001. This Phase I ESA was conducted to review past and current land use practices at the site and on adjacent properties at the time of our site reconnaissance and is consistent with the methods and procedures described in the American Society for Testing and Materials (ASTM) "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process" (Standard Designation E 1527-00), published in September 2000. The Phase I ESA objectives, scope, and limitations are presented in the following sections.

1.1 PURPOSE AND SCOPE OF WORK

The Phase I ESA was performed in accordance with ASTM Standard E 1527-00. This assessment was conducted to identify recognized environmental conditions associated with the subject property. ASTM defines recognized environmental conditions as the presence or likely presence of hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release into structures, ground, groundwater, or surface water on the subject property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimis conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

The environmental assessment was accomplished by, and limited to, a reconnaissance of the site, a review of publicly available records, a review of pertinent documentation presently and readily available from FCDMC and/or through URS' standard resources, and interviews with knowledgeable individuals. The site vicinity is defined as the neighboring properties and facilities within an approximate distance of ¼ mile of the site, the nature of which may adversely affect or have affected environmental conditions at the site due to the presence and/or release of hazardous substances or petroleum products to the environment. The report is intended for the exclusive use of the FCDMC. URS' scope of services for the environmental site assessment included the following elements:

- Historical review of the current and past uses of the subject property.

- Review of pertinent, available documents and maps regarding local geologic and hydrogeologic conditions.

- Review and interpretation of available historical aerial photographs of the site and surrounding area to allow inference regarding historical site development.

- Review and interpretation of available archival topographic maps, historical land use maps (such as Sanborn Fire Insurance maps) of the site and the area within ¼ mile of the subject property for information regarding historical site land use that could have involved the manufacture, generation, use, storage and/or disposal of hazardous substances.

- A site reconnaissance to assess evidence of current and/or past use or storage of toxic or hazardous material; on-site ponds, landfills, drywells, waste streams or other disposal units; visible soil contamination; aboveground or underground storage tanks; electrical transformers containing polychlorinated biphenyls (PCBs); and drums, barrels and other storage containers.

- Visual observations of adjacent properties from the site to assess their potential to adversely impact the subject property.

- Inquiries by telephone or writing to applicable municipal, county, and state regulatory agencies for information regarding environmental permits, environmental violations or incidents and/or status of enforcement actions at the subject property. Agency contacts included the Arizona Department of Environmental Quality (ADEQ), Arizona Department of Water Resources (ADWR), Maricopa County Health Department, and the local Fire Department.

- Review of the following state and Federal agency lists and databases of known or potential hazardous waste sites and sites currently under investigation for potential environmental violations. Although the regulatory database search distances were extended to include the subject property and surrounding areas, only the distances listed below were evaluated as required by ASTM. The following databases were reviewed:

Type of Database	Description of Database	Radius Searched
NPL	The National Priorities List (NPL) identifies uncontrolled or abandoned hazardous waste sites. To appear on the NPL, sites must have met or surpassed a predetermined hazard ranking system score, been chosen as a state's top priority site, pose a significant health or environmental threat, or be a site where the EPA has determined that remedial action is more cost-effective than removal action.	1 mile
CERCLIS	The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database identifies hazardous waste sites that require investigation and possible remedial action to mitigate potential negative impacts on human health or the environment.	0.5 mile
RCRA TSDs	Resource Conservation and Recovery Act (RCRA) treatment, storage, or disposal (TSD) sites.	1 mile
CORRACTS	RCRA TSD facilities ordered to implement corrective actions.	1 mile
RCRA Generators	RCRA-regulated hazardous waste generator notifiers list; both Large and Small Quantity Generators are included in this list.	Target property and adjoining
ERNS	EPA's Emergency Response Notification System (ERNS) list contains reported spill records of oil and hazardous substances.	Target property
SPL/WQARF	State Equivalent Priority List / Water Quality Assurance Revolving Fund.	1 mile
SHWS	State Hazardous Waste Sites Listing.	1 mile
SWLF	State inventory of solid waste disposal and landfill sites.	0.5 mile
LUST	List of information pertaining to all reported leaking underground storage tanks.	0.5 mile
UST	State underground storage tank sites listing.	Target property and adjoining
Drywells	State drywell registration list.	Target property

- Preparation of this report to present the findings and conclusions.

It was not in our scope and we did not assess structural, mechanical, electrical systems, environmental regulatory compliance, or worker health and safety issues. Sampling and analysis for radon, lead-based paint, water, soil, or other environmental media were not included in our scope of services.

1.2 LIMITING CONDITIONS

During our site visits, a small portion of the subject property was not accessible due to realignment activities being conducted on Ocotillo Road (see Figures 2 and 3). Consequently, URS observed this area from outside the construction zone. No other conditions were encountered that would limit URS' ability to make appropriate conclusions regarding the environmental integrity of the subject property.

1.3 LIMITATIONS OF THE PHASE I ESA

The Phase I ESA was prepared in accordance with the scope of work described in URS' proposal to the FCDMC, dated November 13, 2001. The work conducted by URS is limited to the services agreed to in the proposal and no other services beyond those explicitly stated should be inferred or are implied.

The conclusions presented in this report are professional opinions based solely upon URS' visual observations of the site and the immediate site vicinity, and upon URS' interpretations of the readily available historical information, conversations with personnel knowledgeable about the site, and other readily available information, as referenced in the report. These conclusions are intended exclusively for the purpose stated herein, at the site indicated, and for the project indicated.

The information provided by URS is for the exclusive use of the FCDMC. The scope of services performed during this investigation may not be appropriate for other users, and any use or re-use of this document, or the findings, conclusions, or recommendations presented herein is at the sole risk of said user.

This study was not intended to be a definitive investigation of possible contamination at the subject property. The purpose and scope of this investigation was to determine if there is reason to suspect the possibility of contamination at the site.

This report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings of this assessment. Opinions and recommendations presented in this report apply to site conditions and features as they existed at the time of URS' site visit, and those reasonably foreseeable. They cannot necessarily apply to conditions and features of which URS is unaware and has not had the opportunity to evaluate.

2.0 SITE DESCRIPTION

Information concerning the subject property presented in the following subsections is based on a review of readily available published information and site reconnaissances conducted by URS personnel on December 26, 2001 and January 8, 2002.

2.1 PHYSICAL LOCATION AND DESCRIPTION OF PROPERTY

The Chandler Heights Detention Basin project consists of fourteen contiguous parcels totaling approximately 325 acres of primarily vacant graded and former agricultural land. The subject

property is located in Sections 15 and 2 (Township 2 South, Range 6 East) of the Gila and Salt River Base Meridian.

The entire "site" is more specifically bounded by the East Maricopa Floodway on the west, Queen Creek Road on the north, Queen Creek wash and Higley Road on the east, and Chandler Heights Road on the south, and lies just west of Gilbert, Arizona on Maricopa County land (see Figure 1).

2.2 ENVIRONMENTAL SETTING

Environmental characteristics including topography, geology, and hydrogeology were evaluated based on site observations, published literature, and maps.

2.2.1 Topography

According to URS' review of United States Department of the Interior Geological Survey, Higley, Arizona 7.5 minute topographic quadrangle map, 1956, photorevised 1981 and Chandler Heights, Arizona 7.5 minute topographic quadrangle map, 1956, photorevised 1973, the general direction of surface-water flow in the area of the subject property is west. According to these topographic maps, the subject property is relatively flat with an elevation of approximately 1300 feet above mean sea level.

2.2.2 Geology

The Chandler Heights Detention basin is situated within the Basin and Range Physiographic Province of Arizona. The Basin and Range Physiographic Province is characterized by broad alluvium-filled basins separated by north-northwest trending block-faulted mountain ranges. This structural trend is the result of northwest-southeast faults formed by extensional tectonism during the Tertiary. Mountain blocks uplifted during tectonic activity were accompanied by extensive erosion that filled the intermontane valleys with alluvium. Extensional faulting also resulted in large-scale volcanism that produced extensive basalt and tuff deposits that eroded and contributed alluvium to the basin fill.

The subject property is more specifically located in the Salt River Valley, a broad alluvial basin within the Basin and Range Physiographic Province. The basin is almost completely surrounded by mountains composed primarily of granitic, metamorphic, and volcanic rocks and minor amounts of consolidated sedimentary rocks. The valley floor is underlain by unconsolidated to semi-consolidated basin-fill sediments. In the eastern part of the Salt River Valley area, sedimentary deposits form the main water-bearing units and consist mainly of unconsolidated and weakly consolidated clay, silt,

sand, and gravel. The main water-bearing unit ranges in thickness from a few tens of feet near the mountains to more than 1,200 feet in the central part of the area (Cooley, M.E., 1973; map showing distribution and estimated thickness of alluvial deposits in the Phoenix area Arizona: U.S. Geological Survey Miscellaneous Investigations Series Map I-845-C). Crystalline rocks, which consist mainly of schist, gneiss, granite, and felsic to mafic volcanic rocks, are present in the mountains that border the main water-bearing units. Well-cemented conglomerate and sandstone may also be present in places (Lancy, R.L.; Ross, P.P.; and Littin, G.R., April 1978; maps showing Ground-Water Conditions in the Eastern Part of the Salt River Valley).

2.2.3 Soils

URS reviewed readily available reference material providing soil types for the subject property. According to the U.S. Department of Agriculture Soil Conservation Service, the subject property consists of several different soil types. However, the most prominent appear to be Gilman loam. This soil type is defined as deep, well-drained soils that occur on flood plains and alluvial fans of large streams. They are typically used for irrigated crops, range, recreation, and wildlife. Irrigated areas include cotton, alfalfa, sorghum, wheat, citrus, and vegetables. The soil has a slight erosion hazard with a moderate permeability and a slow water runoff.

2.2.4 Hydrology

According to B.A. Hammett and R.L. Herther's *Maps Showing Groundwater Conditions in the Phoenix Active Management Area, Maricopa, Pinal and Yavapai Counties, Arizona - 1992,* the depth to groundwater in the area of the subject property is approximately 270 feet below ground surface (bgs). The general direction of groundwater flow in the vicinity of the subject property is north-northwest away from the Santan Mountains.

According to Flood Insurance Rate Map Nos. 04013C2670 G and 04013C3035 G, dated July 19, 2001, published by the Federal Emergency Management Agency (FEMA), the subject property is not located within the boundaries of a 100-year floodplain.

3.0 SITE RECONNAISSANCE

URS' site reconnaissance was conducted to observe existing operations and environmental conditions, including: chemical storage and disposal areas, evidence of stressed vegetation, disturbed topography, soil and surficial staining, evidence of underground/aboveground storage tanks, and the presence of PCB-containing equipment.

3.1 GENERAL CONDITIONS

Ms. Marianne Burrus of URS conducted the site reconnaissance on December 26, 2001 and January 8, 2002. The subject property currently consists of approximately 325 acres of land bounded by the East Maricopa Floodway on the west, Queen Creek Road on the north, Queen Creek wash and Higley Road on the east, and Chandler Heights Road on the south (see Figure 1).

For the purpose of this report, the subject property was divided into two sections: the northern portion and southern portion. Specifically, the northern portion is the area of the subject property north of the Ocotillo Road realignment and the southern portion is south of the realignment area (see Figures 2 and 3). The portion of the subject property involved in the realignment of Ocotillo Road was not accessible during our site visit. Consequently, URS observed this area from outside the construction zone. At the time of our site reconnaissance, heavy equipment was in the process of excavating, mounding, and removing large areas of soil (see Site Photograph 1). According to Theresa Pinto of the FCDMC, the activities observed were being conducted to install sewer and reclaimed water lines along the road realignment.

Northern Portion

This portion of the subject property was primarily vacant graded land with a large area covered with desert vegetation (i.e. shrubs and small trees). The Queen Creek wash and an adjacent dirt road form the eastern boundary of this section of the subject property. Several areas of debris were observed along the wash embankment. The interior area of the northern portion of the subject property was mostly graded land that has been extensively used by off-road recreational vehicles. A construction staging area with a fenced area was observed along the western border. No current structures or evidence of past structures were observed in the northern portion of the subject property.

Southern Portion

This portion of the subject property was primarily former agricultural land. Two concrete-lined irrigation ditches and one dirt road were observed in the northern half of this portion. In addition, several areas of debris were observed in this area. Two sediment retention basins were observed in the southern-most portion of the subject property. No current structures or evidence of past structures were observed in the southern portion of the subject property.

3.1.1 Hazardous Substances and Wastes

Although no evidence of chemical use, storage, or disposal was observed on the subject property at the time of our site reconnaissance, URS observed approximately six 5-gallon plastic buckets and one 55-gallon drum within the scattered debris located along the Queen Creek wash embankment (see Site Photographs 2 and 3). All of the containers appeared to be empty with no evidence of staining.

3.1.2 Polychlorinated Biphenyl (PCB) Containing Equipment

No potential PCB-containing equipment (i.e. transformers) was observed on the subject property at the time of our site reconnaissance.

3.1.3 Solid Waste

Solid waste does not appear to be currently generated on the subject property. However, URS observed several areas of dumping within the subject property.

Northern Portion

The following debris was observed along the embankment of Queen Creek wash in the northeast portion of the subject property:

- a large area (approximately 20 x 30 feet) of crushed concrete and mounded dirt (see Site Photograph 4);
- construction debris and household garbage, including pipes, concrete, paper products, plastic, and wood;
- approximately 40 used automobile tires (see Site Photograph 5);
- several discarded appliances, including a stove;
- one automobile body; and
- several 5-gallon plastic buckets (see Section 3.1.1, for further discussion).

URS also observed several discarded automobile shells located in the central section of the subject property (see Site Photograph 6). In addition, URS observed two piles of dirt and several piles of rocks and gravel located within an area that appears to be used for construction staging in the

northwest portion of the subject property (see Site Photographs 7 and 8). A chain-linked fence surrounds a portion of this area. A placard on the fence indicates that the area is owned and used by the FCDMC.

Southern Portion

Several areas of debris were observed in the southern portion of the subject property. Specifically, two large areas were observed in the mid-section along the embankment of the Queen Creek wash. The debris piles included mounded soil, tires, wood, concrete slabs, asphalt remnants, paper debris, scrap metal, rubber tubing, and one empty 55-gallon drum (see Site Photographs 9, 10, and 11). Although a large intact concrete pad was observed along the embankment, the pad appeared to be discarded and not associated with an on-site structure or water well (see Site Photograph 12). URS also observed approximately 10 used tires in and around the concrete-lined irrigation ditches located just south of the Ocotillo Road realignment area (see Site Photograph 13).

3.1.4 Water Wells

No water wells were observed on the subject property at the time of our site reconnaissance. However, according to the Arizona Department of Water Resources (ADWR), the following four water wells are located within the cadastral location which includes the subject property.

Cadastral Location	Registration Number	Well Owner	Well Type
D(2-6)15 AAD	55-576962	Leonard Shane and RWCD (two owners listed)	Geotechnical
D(2-6)22 ABD	55-576963	RWCD	Geotechnical
D(2-6)22 BA0	55-623411	AA Freeman	Non-exempt
D(2-6)22 BDD	55-609478	Therese Mao	Non-exempt
RWCD – Roosevelt Water Conservation District			

URS did observe one well outside the boundaries of the subject property but at the cadastral location of D(2-6)22 BDD. None of the other wells listed above were observed either on or off-site.

3.1.5 Drinking Water and Wastewater

Drinking water is not currently provided to the subject property. Based on our site observations, no wastewater is currently generated on the subject property.

3.1.6 Stormwater Drainage and Drywells

Topographic relief in the area of the subject property is relatively flat, therefore, stormwater would most likely pool in low-lying areas for most of the subject property with the following exceptions.

Northern Portion

Stormwater accumulated in the northeast corner of the site would most likely flow into the Queen Creek wash. However, due to the earthen embankment along most of the wash it is unlikely that stormwater from most of the northern portion subject property would flow into the wash.

Southern Portion

Stormwater accumulated in the southern-most portion of the subject property would enter one of the two retention basins (see Site Photographs 14 and 15). The two basins are a combination of dirt, rock, and concrete-lined. According to Mr. Stears of the FCDMC, both basins are designed to trap sediment. No drains, staining, or debris were observed in either retention basin. In addition, two concrete-lined irrigation ditches were observed just south of the Ocotillo Road realignment. As described in Section 3.1.3, several discarded tires were observed in the ditches.

Drywells are typically constructed on commercially-developed properties to collect rainwater surface runoff, and therefore, have the potential to introduce contaminants into the subsurface. URS observed no drywells, nor would we expect to find any evidence of drywells on the subject property during our site reconnaissance.

3.1.7 Pits, Ponds and Lagoons

No pits, ponds, or lagoons were observed on the subject property at the time of our site reconnaissance. However, Queen Creek wash is located along the northeastern boundary of the subject property. In addition, two retention basins and two concrete-lined irrigation ditches were observed within the southern portion of the subject property (see Section 3.1.6, for further discussion).

3.1.8 Other Physical Evidence of Contamination

Other than the dumping described in Section 3.1.3, no evidence of contamination, such as soil staining, or distressed vegetation, was observed within the boundaries of the subject property during our site reconnaissance.

4.0 ADJOINING AND SURROUNDING LAND USE

URS performed a visual review of readily visible areas of adjacent properties. The following description of the current uses of adjoining and surrounding properties is based on URS' observations on the dates of our site visits.

4.1 CURRENT USES OF ADJOINING PROPERTIES

A visual assessment of adjacent properties was performed in the general vicinity (within approximately ¼-mile) of the site, to the extent they were visible from the subject property, along public rights-of-way, and accessible adjacent properties. However, URS did not physically inspect adjacent properties. In general, surrounding properties consist of agricultural land, farm/dairy sites, residential areas, and native desert land.

Northern Portion

Properties observed adjacent to the northern portion of the subject property are as follows:

To the north	-	beyond Queen Creek Road; dairy farm and residential areas
To the south	-	subject property
To the east	-	Higley Road and vacant graded land
To the west	-	beyond East Maricopa Floodway; Roosevelt Canal, agricultural land, and residential homes

Southern Portion

Properties observed adjacent to the southern portion of the subject property are as follows:

To the north	-	subject property
To the south	-	beyond Chandler Heights Road; agricultural land and residential homes
To the east	-	Shamrock Farms and new residential development
To the west	-	beyond East Maricopa Floodway; Roosevelt Canal, farm, and agricultural land

No evidence of environmental impairment of the subject property associated with chemical use, storage, or disposal on adjacent properties, if any, was observed during our site reconnaissance.

5.0 HISTORICAL INFORMATION

Information regarding past site land use of the subject property and properties within the site vicinity was obtained by reviewing historical aerial photographs, topographic maps, and conducting personal interviews. These documents were reviewed to obtain information regarding historical land use that

could have involved the manufacture, generation, use, storage and/or disposal of hazardous substances on the subject property.

5.1 AERIAL PHOTOGRAPHS

URS reviewed readily available aerial photographs of the subject property at Landiscor Aerial Information, Inc. and Rupp Photography, Inc. Aerial photographs included 1949, 1954, 1955, 1958, and 1962 through 2000. In general, the area of the proposed Chandler Heights Detention Basin has been agricultural or vacant land since the late 1940s. Evidence of impoundments, pesticide storage/mixing sheds, or crop dusting air strips were not visible on site in any of the reviewed aerial photographs. No structures were observed within the boundaries of the subject property on any of the aerial photographs reviewed. The sedimentation pond currently located in the southern portion of the subject property appeared to be constructed in the late 1980s.

The Roosevelt Canal located along the western border of the subject property was visible in all photographs reviewed. The surrounding properties appeared to be primarily residential, agricultural, dairy, or vacant land in all of the aerial photographs reviewed. Most of the development in the area appeared to begin in the mid-1980s.

5.2 HISTORICAL FIRE INSURANCE MAPS

Due to the location of the subject property outside the metropolitan-Phoenix area, historical fire insurance maps were not available for the subject property area.

5.3 TOPOGRAPHIC MAPS

URS reviewed the following USGS maps for the subject property: Chandler Heights, Arizona 7.5 minute topographic quadrangle map, 1956, photorevised 1973 and Higley, Arizona 7.5 minute topographic quadrangle map, 1956, photorevised 1981. According to our review of the maps, the Roosevelt Canal and associated levee were present west of the subject property in the earliest edition of both maps. The levee currently bordering the eastside of the subject property was also depicted in the earliest editions of both maps. Two unimproved roads were depicted in both maps. One road is shown trending north-south in the southern portion of the subject property. One small structure is depicted in the 1956 edition of the map at the end of the second unimproved road located in the northern half of the site, along the eastern border. However, no evidence of a structure was observed during our site reconnaissance or within the 1950's aerial photograph reviewed.

5.4 CITY DIRECTORIES

Based on our review of aerial photographs, the subject property has historically been vacant since the 1940s. Consequently, historical city directories were deemed unnecessary for review.

5.5 CHAIN OF TITLE REPORT

URS was not requested to obtain Chain-of-Title information by the FCDMC nor was it provided for our review.

5.6 INTERVIEWS

URS conducted a series of interviews to obtain information regarding current and historical land use that could have involved the manufacture, generation, use, storage, and/or disposal of hazardous substances or wastes on the subject property. The following information was obtained from interviews with Mr. Paul Stears and Mr. John Palmieri of the FCDMC.

Although most of the subject property has been owned by the FCDMC for greater than 5 years, a portion of the subject property south of the Ocotillo Road realignment was recently purchased from Shamrock Farms in 1999. The northeast corner of the subject property has been used in recent years by FCDMC as a soil storage and processing area. Soil excavated during the construction of the East Maricopa Floodway was deposited in this area and has been used for various projects by the FCDMC. No water wells are located within the boundaries of the subject property. No structures have historically been located on the subject property.

6.0 REVIEW OF AGENCY INFORMATION

Federal and state governments have developed legislation within the past 15 years relating to environmental issues. As a result of this legislation, regulations that govern the storage, handling, control and disposal of hazardous materials have been promulgated. Numerous agencies collect and disseminate information for use in evaluating potential environmental problems. URS maintains an in-house library of current ADEQ and U.S. Environmental Protection Agency (EPA) regulatory lists.

URS reviewed information gathered from several environmental databases through Environmental Data Resources, Inc. (EDR) to evaluate whether activities on or near the subject property have the potential to create a Recognized Environmental Condition on the subject property. EDR reviews databases compiled by federal, state, and local governmental agencies. The complete list of databases reviewed by EDR is provided in EDR's report, which is included as Appendix A of this report.

It should be noted that this information is reported as URS received it from EDR, which, in turn, reports information as it is provided in various government databases. It is not possible for either URS or EDR to verify the accuracy or completeness of information contained in these databases. However, the use of and reliance on this information is a generally accepted practice in the conduct of environmental due diligence. The following EPA and ADEQ documents and lists were reviewed in accordance with ASTM E 1527-00.

6.1 FEDERAL REGULATORY AGENCY DATABASES

U.S. EPA National Priorities List (NPL)

The NPL is an EPA database of uncontrolled or abandoned hazardous waste sites identified for priority remedial actions under the Superfund Program. To be included on the NPL a site must meet or surpass a predetermined hazard ranking systems score, must be chosen as a state's top-priority site, or must meet all three of the following criteria: 1) the United States Department of Health and Human Services issues a health advisory recommending that people be removed from the site to avoid exposure; 2) the EPA determines that the site represents a significant threat; and 3) the EPA determines that remedial action is more cost-effective than removal action.

According to the EDR database, dated July 26, 2001, neither the subject property nor facilities located within 1 mile of the subject property were listed as an NPL site.

U.S. EPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) List

The EPA's CERCLIS List identifies facilities which are subject to investigation by the EPA concerning possible contamination to the environment. Three categories of sites are included on the Federal CERCLIS inventory. These are: 1) sites which may be potentially hazardous and require preliminary investigation; 2) sites which have been investigated and, based on the results, remedial action or no further investigation is planned under the Federal Superfund Program; and/or 3) final and proposed National Priorities List (II) sites which have been investigated and the EPA determined the sites may represent a long-term threat to public health or the environment. Inclusion on the list does not mean that the facility is contaminated, causing contamination, or in violation of state or federal statutes or regulations.

According to the reviewed document, dated July 12, 2001, neither the subject property nor facilities located within ½-mile of the subject property were listed as CERCLIS sites.

U.S. EPA RCRA CORRACTS TSD Facilities List

Under RCRA, the EPA compiles a database of facilities that are involved in the generation, transportation, storage, or disposal (TSD) of hazardous materials. This database lists RCRA facilities that are undergoing "corrective action". A "corrective action order" is issued pursuant to RCRA Section 3008 (h) when there has been a release of hazardous waste or constituents into the environment from a RCRA TSD facility. The RCRA TSDs are facilities that treat, store and/or dispose of hazardous waste. Corrective actions may be required beyond the facility's boundary and can be required regardless of when the release occurred, even if it predates RCRA.

According to the CORRACTS database, dated September 20, 2001, neither the subject property nor facilities located within 1 mile of the subject property were listed.

U.S. EPA RCRA Non-CORRACTS TSD Facilities List

The EPA's Resource Conservation and Recovery Information System (RCRIS) identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRIS Treatment, Storage, Disposal (TSD) Facilities List is a compilation by EPA of reporting facilities that generate, transport, store, treat, or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) but are not undergoing any "corrective action".

According to the database reviewed, dated June 21, 2000, neither the subject property nor facilities located within 1 mile of the subject property were listed.

U.S. EPA RCRA Generators or Notifiers List

The EPA's Resource Conservation and Recovery Act (RCRA) Program identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRA Facilities List is a compilation by EPA of reporting facilities that generate hazardous waste. RCRA Large Quantity Generators are facilities which generate at least 1,000 kilograms per month (kg/mo) of non-acutely hazardous waste (or 1 kg/mo of acutely hazardous waste). Small Quantity Generators are facilities which generate less than 1,000 kg/mo of non-acutely hazardous waste.

According to the database reviewed, dated June 21, 2000, neither the subject property nor adjacent facilities were listed.

U.S. EPA Emergency Response Notification System (ERNS) List

The ERNS List is a list compiled by the EPA of spills of potentially hazardous substances called in to the Coast Guard and other spill response centers across the U.S. Spill notifications included on this list have not necessarily been confirmed by EPA.

According to the ERNS database, dated August 8, 2000, no hazardous material incidents have been reported for the subject property.

6.2 STATE REGULATORY AGENCY DATABASES

Arizona Department of Environmental Quality - Superfund Program List and WQARF Project Areas

A Water Quality Assurance Revolving Fund (WQARF) area, which is also referred to as a state Superfund area, is a region designated by the ADEQ for further investigation regarding environmental concerns. This designation is typically based on known areas of groundwater contamination, or past or present land uses which have been known to use and discharge chemicals that can contaminate groundwater.

According to the Superfund Program and WQARF lists, dated October 2000 and May 1999, respectively, the subject property is not located within the geographic boundaries of a currently designated WQARF area. In addition, there are no WQARF sites located within a one-mile radius of the subject property.

Arizona Department of Environmental Quality - Arizona CERCLA Information Data System (ACIDS)

The Arizona CERCLIS Information Data System (ACIDS) List has been used by the ADEQ Superfund Programs Section (SPS) for the past decade in tracking WQARF sites and portions of sites, potential WQARF sites, referrals, and other cases of interest to the SPS. As of March 13, 2000, there were approximately 1,500 entries on the ACIDS list. While some of the cases on this list are relevant to Arizona's Superfund Program, others are not and their inclusion may be misleading. For this reason, the SPS has elected to archive the ACIDS list, and no longer distribute it. In its stead, the ACIDS List has been replaced by the Arizona Superfund Programs List (SPL). This list is more representative of the sites and potential sites within the jurisdiction of the ADEQ SPS. According to ADEQ, the listing of properties on the ACIDS list is not an indication of liability or potential

liability. Many of the properties on this list have no present involvement in WQARF or federal Superfund.

According to the EDR database report, dated January 3, 2000, neither the subject property nor facilities located within 1 mile of the subject property were listed on the ACIDS list.

Arizona Department of Environmental Quality - Directory of Arizona Active and Inactive Solid Waste Facilities

The Directory of Arizona Active and Inactive Solid Waste Facilities list is provided by the ADEQ and is a compilation of solid waste facilities currently in operation.

According to the solid waste database reviewed, dated June 1999, neither the subject property nor facilities located within ½-mile of the subject property were listed.

Arizona Department of Environmental Quality - Directory of Arizona Closed Solid Waste Facilities

The Directory of Arizona Closed Solid Waste Facilities list is provided by the ADEQ and is a compilation of closed solid waste facilities.

According to the solid waste database reviewed, dated June 1999, neither the subject property nor facilities located within ½-mile of the subject property were listed.

Arizona Department of Environmental Quality - Leaking Underground Storage Tank (LUST) List

The LUST list is a compilation of sites with confirmed leaking underground storage tanks that have been reported to the ADEQ. This list was reviewed for reported LUSTs located on the subject property.

According to the ADEQ LUST list, dated November 8, 2001, neither the subject property nor facilities located within ½-mile of the subject property were listed.

Arizona Department of Environmental Quality - Registered Underground Storage Tank (UST) List

The state of Arizona requires that owners of most underground storage tanks (USTs) register their USTs with ADEQ. URS reviewed ADEQ's Underground Storage Tank Registration list for registered USTs located on the subject property.

According to the UST database, dated January 3, 2000, the subject property is not listed as having registered USTs. However, one UST facility is identified adjacent to the subject property.

Wayne Freeman Farm
16235 East Ocotillo Road
Chandler, Arizona 85249
(located adjacent to the west, across the floodway, and hydrologically crossgradient of the subject property)
(3 registered USTs; Status: Removed; no LUSTs reported)

Arizona Department of Environmental Quality – Drywell Registration Database

Drywells are constructed to collect rainwater surface runoff, and therefore, have the potential to introduce contaminants into the subsurface. EDR reviewed ADEQ's Drywell Registration Database for drywells registered to the subject property.

According to the reviewed database, dated October 1, 2001, no drywells are registered to an address corresponding to the subject property.

6.3 REGULATORY AGENCY CONTACT

During the performance of an environmental assessment, federal, state and local regulatory agencies having jurisdiction over the subject property are contacted to determine the following information: the status of relevant environmental permits; whether there have been any violations, or other similar correspondence from such agencies; whether any corrective action or remediation is planned, currently taking place, or has been completed at the subject property; whether there have been any reported violations or complaints that the subject property is not in compliance with environmental laws, regulations, or standards, and whether the subject property is under investigation for such non-compliance; whether the subject property is listed on any of the regulatory databases; and whether there is any other pertinent documentation on file with such regulatory agencies regarding the subject property or surrounding sites of concern.

URS contacted the State of Arizona Fire Marshall, the ADEQ, ADWR, and the Maricopa County Health Department regarding environmental-related records for the subject property. The subject property has been historically vacant or agricultural, therefore, no street address corresponds to the site. Because the fire and health department files are by address, no information was available. However, based on our review of historical information (i.e. aerial photographs, topographic maps and interviews) it is unlikely that past activities conducted on the subject property would alter the conclusions and recommendations of this report.

ADEQ reported that they have no records for the subject property and ADWR has provided us the well registration list, which is summarized in Section 3.1.4 of this report.

7.0 CONCLUSIONS

URS conducted a Phase I Environmental Site Assessment on the Chandler Heights Detention Basin located near Gilbert in Maricopa County, Arizona. This study was conducted to evaluate the potential for a Recognized Environmental Condition to exist on the subject property from onsite or offsite activities. Any exceptions to, or deletions from, this practice are described in Sections 1.2 and 1.3 of this report. This assessment was conducted to evaluate the potential for a Recognized Environmental Condition to exist on the subject property from onsite or offsite activities. This assessment has revealed the following Recognized Environmental Conditions in connection with the subject property.

7.1 HISTORICAL RECOGNIZED ENVIRONMENTAL CONDITIONS

According to the ASTM E-1527 standards published in September 2000, a Historical Recognized Environmental Condition is defined as an environmental condition which in the past would have been a recognized environmental condition, but which may or may not be considered a recognized environmental condition currently. That is, if a past release of any hazardous substances or petroleum products has occurred in connection with the property and has been remediated, with such remediation accepted by the responsible regulatory agency, the condition is considered a historical recognized environmental condition.

Based on a review of regulatory information and applicable documentation, no historical Recognized Environmental Conditions were identified at the subject property.

7.2 CURRENT ONSITE RECOGNIZED ENVIRONMENTAL CONDITIONS

Based on our site reconnaissance and a review of regulatory information, no onsite Recognized Environmental Conditions have been identified that would environmentally impact the subject property.

7.3 CURRENT OFFSITE RECOGNIZED ENVIRONMENTAL CONDITIONS

Based on our site reconnaissance and review of regulatory information, no offsite Recognized Environmental Conditions have been identified that would environmentally impact the subject property.

7.4 OTHER ENVIRONMENTAL CONSIDERATIONS

Based on our site reconnaissance, the following other environmental considerations have been identified on the subject property.

- Because most of the subject property has historically been used as agricultural land, pesticide/herbicide residuals may likely be present in soils. Soil Remediation Levels (SRLs) for various chemicals (including pesticides and herbicides) have been developed by the ADEQ rule-making process. However, the Department emphasizes that lawfully applied contaminants are outside of its statutory authority and are not affected by this rule if property use does not change. Based on the intended construction of the detention basin, FCDMC may wish to evaluate pesticide/herbicide residuals in the soil, if any. However, the information evaluated for this Phase I ESA, concerning agricultural use of the subject property, did not indicate an excessive amount of pesticide and/or herbicide use (i.e., evidence of impoundments, mixing sheds, or crop dusting air strips).

8.0 RECOMMENDATIONS

Although no Recognized Environmental Conditions were noted, based on the conclusions discussed above, the following recommendation is provided for the subject property.

- If FCDMC wishes to evaluate pesticide/herbicide residuals in agricultural soil of the subject property, URS recommends sampling and laboratory analysis of surficial soils.

9.0 REFERENCES

Arizona Department of Water Resources (ADWR) Registered Wells database, dated March 2, 2001.

ASTM, 2000. American Society for Testing and Materials (ASTM). Standard E 1527-00, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,* September 2000.

Arizona Department of Environmental Quality (ADEQ), Active Remedial Projects Sites within the Metropolitan Phoenix Area Map, May 1999.

Aerial Photographs, Landiscor Aerial Information, Inc., Phoenix, Arizona.

Aerial Photographs, Rupp Aerial Photography, Inc., Phoenix, Arizona.

Environmental Data Resources, Inc., EDR-Radius Map with Geocheck, Inquiry Number: 0712230.1r, dated December 7, 2001.

Federal Emergency Management Agency Flood Insurance Rate Maps Nos. 04013C2670-G and 04013C3035-G (dated July 19, 2001).

Hartman, George W., United States Department of Agriculture, Soil Conservation Service, Soil Survey of Maricopa County, Arizona, Central Part, September 1977.

Lancy, R.L; Ross, P.P.; and Littin, G.R.; maps showing Ground-Water Conditions in the Eastern Part of the Salt River Valley, April 1978.

Laney, R.L. and M.E. Hahn, Hydrogeology of the Eastern Part of the Salt River Valley Area, Maricopa and Pinal Counties, Arizona, U.S. Geological Survey OFR 86-4147, 1986.

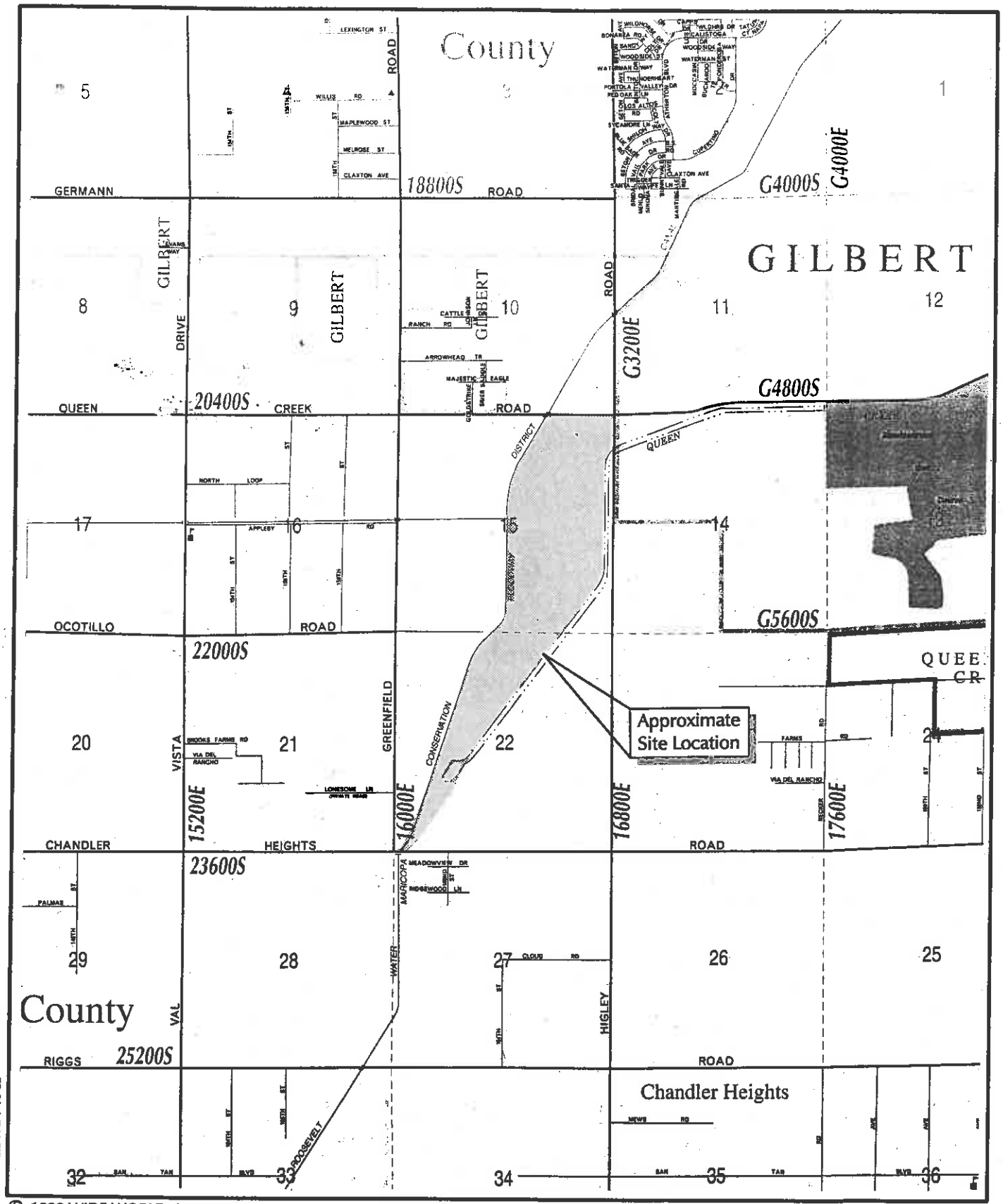
Reynolds, S., Geologic Map of Arizona, Arizona Geological Survey, Map 26, 1988.

U.S, Department of Agriculture, Soil Survey, Eastern Maricopa and Northern Pinal Counties Area, Arizona, November 1974.

U.S.G.S., Chandler Heights, Arizona Quadrangle, 7.5 minute series topographic map, 1956 (photorevised 1973).

U.S.G.S., Higley Arizona Quadrangle, 7.5 minute series topographic map, 1956 (photorevised 1981).

FIGURES



Vicinity Map

Figure 1

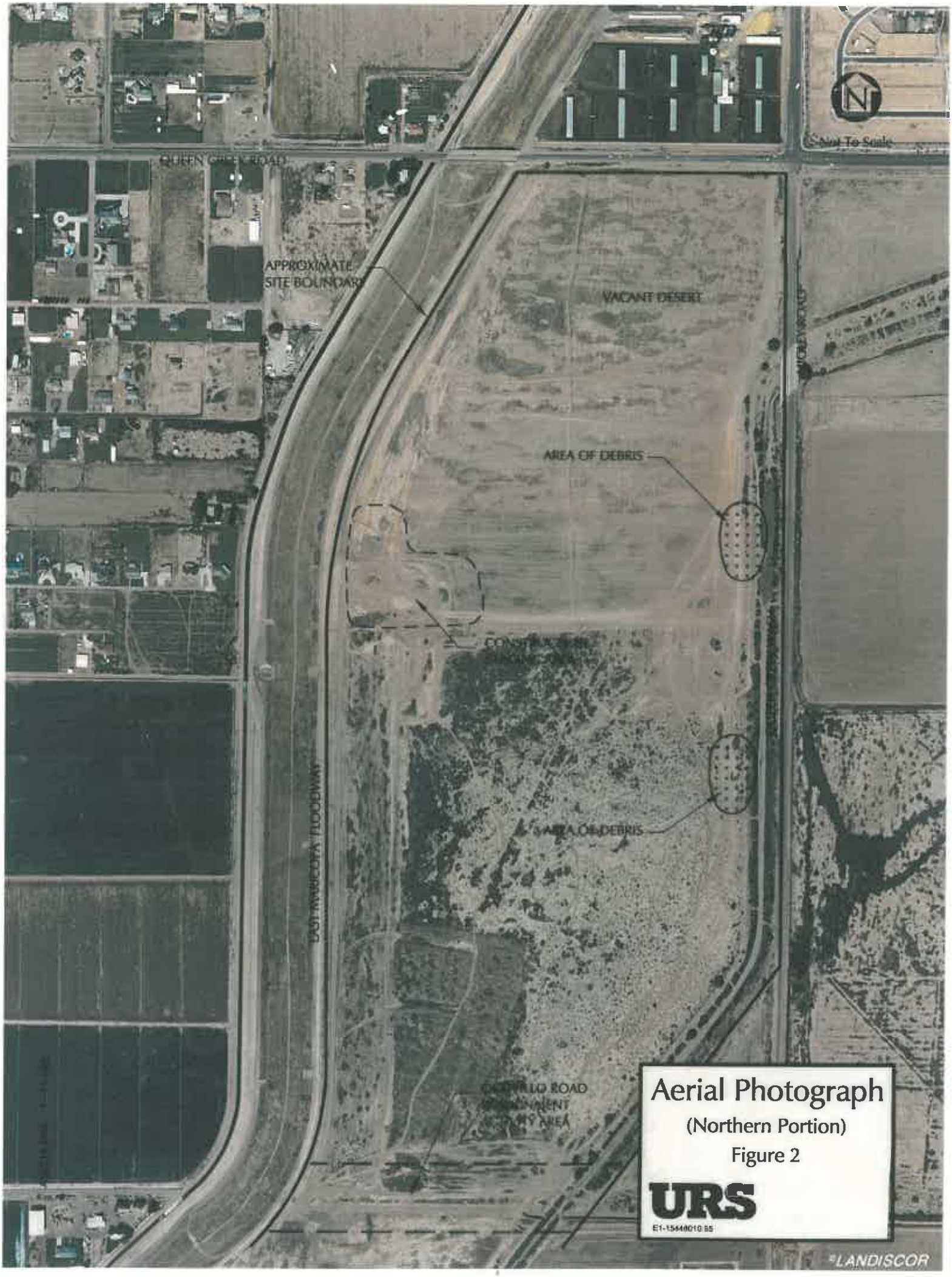
0 1

Scale in Miles

A15212.DWG 1-10-02

URS

E1-15448010.55



Aerial Photograph

(Northern Portion)

Figure 2

URS

E1-15448010.55

Aerial Photograph

(Southern Portion)

Figure 3

URS

E1-154480010.55

Photograph 1 – Ocotillo Road realignment area

Photograph 2 – Empty buckets (along the Queen Creek wash embankment)

Photograph 3 – Empty 55-gallon drum (along Queen Creek wash embankment)

Photograph 4 – Construction debris (along Queen Creek wash embankment)

Photograph 5 – Discarded used tires (along Queen Creek wash embankment)

Photograph 6 – Discarded automobile shell

Photograph 7 – Construction staging area

Photograph 8 – Construction staging area

Photograph 9 – Debris pile (southern portion of site)

Photograph 10 - Debris pile (southern portion of site)

Photograph 11 - Debris pile (southern portion of site)

Photograph 12 – Concrete pad and debris (along Queen Creek wash embankment)

Photograph 13 – Concrete-lined irrigation ditch with discarded tires

Photograph 14 - South retention basin (located in the southern portion)

Photograph 15 – North retention basin (located in the southern portion)

APPENDIX A

EDR REGULATORY DATABASE

The EDR Radius Map
with GeoCheck®

Chandler Heights Detention Basin
Greenfield Rd/Queen Creek Rd
Chandler, AZ 85236

Inquiry Number: 0712230.1r

December 07, 2001

Environmental Data Resources, Inc.

***The* Source For Environmental Risk Management Data**

3530 Post Road
Southport, Connecticut 06490

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The report meets the government records search requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-00. Search distances are per ASTM standard or custom distances requested by the user.

TARGET PROPERTY INFORMATION

ADDRESS

GREENFIELD RD/QUEEN CREEK RD
CHANDLER, AZ 85236

COORDINATES

Latitude (North):	33.249100 - 33° 14' 56.8"
Longitude (West):	111.726700 - 111° 43' 36.1"
Universal Tranverse Mercator:	Zone 12
UTM X (Meters):	432303.9
UTM Y (Meters):	3678946.2

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	2433111-B6 CHANDLER HEIGHTS, AZ
Source:	USGS 7.5 min quad index

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the ASTM E 1527-00 search radius around the target property for the following databases:

FEDERAL ASTM STANDARD

NPL ..... National Priority List
Proposed NPL ..... Proposed National Priority List Sites
CERCLIS ..... Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP ..... CERCLIS No Further Remedial Action Planned
CORRACTS ..... Corrective Action Report
RCRIS-TSD ..... Resource Conservation and Recovery Information System
RCRIS-LQG ..... Resource Conservation and Recovery Information System
RCRIS-SQG ..... Resource Conservation and Recovery Information System
ERNS ..... Emergency Response Notification System

STATE ASTM STANDARD

SPL ..... Superfund Program List
SHWS ..... ZipAcids List
SWF/LF ..... Directory of Solid Waste Facilities
LUST ..... Leaking Underground Storage Tank Listing

AZ WQARF..... Water Quality Assurance Revolving Fund Sites

FEDERAL ASTM SUPPLEMENTAL

CONSENT..... Superfund (CERCLA) Consent Decrees
ROD..... Records Of Decision
Delisted NPL..... National Priority List Deletions
FINDS..... Facility Index System/Facility Identification Initiative Program Summary Report
HMIRS..... Hazardous Materials Information Reporting System
MLTS..... Material Licensing Tracking System
MINES..... Mines Master Index File
NPL Liens..... Federal Superfund Liens
PADS..... PCB Activity Database System
RAATS..... RCRA Administrative Action Tracking System
TRIS..... Toxic Chemical Release Inventory System
TSCA..... Toxic Substances Control Act
FTTS..... FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

STATE OR LOCAL ASTM SUPPLEMENTAL

AST..... List of Aboveground Storage Tanks
AZ Spills..... Hazardous Material Logbook
AZ DOD..... Department of Defense Sites
WWFAC..... Waste Water Treatment Facilities
Aquifer..... Waste Water Treatment Facilities
Dry Wells..... Drywell Registration
AZ AIRS..... Arizona Airs Database

EDR PROPRIETARY DATABASES

Coal Gas..... Former Manufactured Gas (Coal Gas) Sites

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified.

Elevations have been determined from the USGS 1 degree Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. EDR's definition of a site with an elevation equal to the target property includes a tolerance of +/- 10 feet. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property (by more than 10 feet). Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STATE ASTM STANDARD

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Environmental Quality's Arizona UST-DMS Facility and Tank Data Listing by City database.

A review of the UST list, as provided by EDR, and dated 01/03/2000 has revealed that there is 1 UST

site within approximately 0.75 miles of the target property.

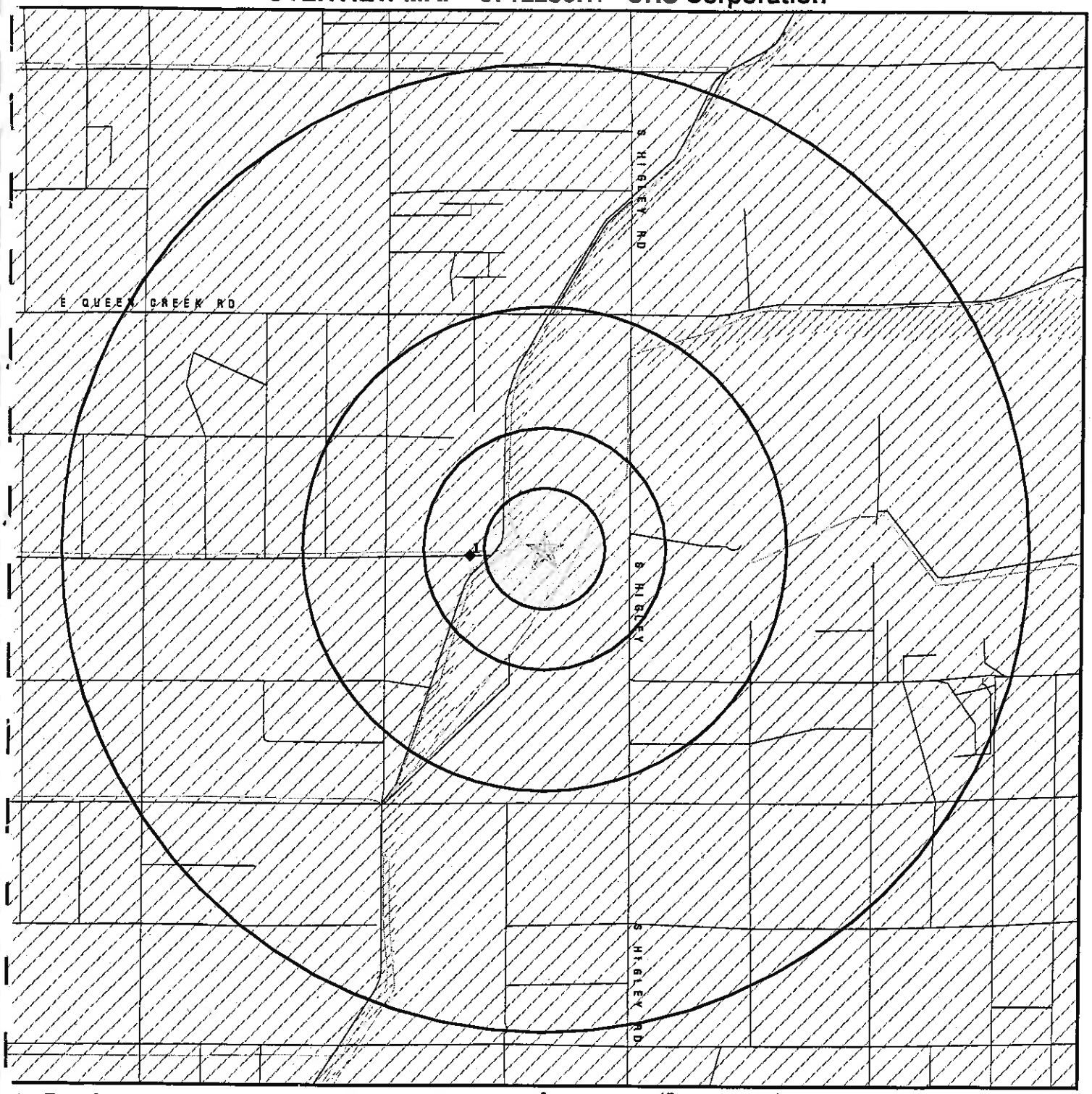
Lower Elevation	Address	Dist / Dir	Map ID	Page
WAYNE FREEMAN FARM	16235 E OCOTILLO RD	1/4 - 1/2 W	1	6

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
SPRECKLES MONTERREY HOME	SHWS
GREAT WESTERN SILICON	RCRIS-SQG, SHWS, FINDS, WWFAC, Dry Wells, CERC-NFRAP
WILBER ELLIS PESTICIDE DUMP	SHWS
SAN TAN DUSTERS	AZ Spills, WWFAC
CHANDLER, CITY OF	AZ Spills, WWFAC
PROPERTY RESERVE, INC.	Aquifer, WWFAC
#10 WELL	UST

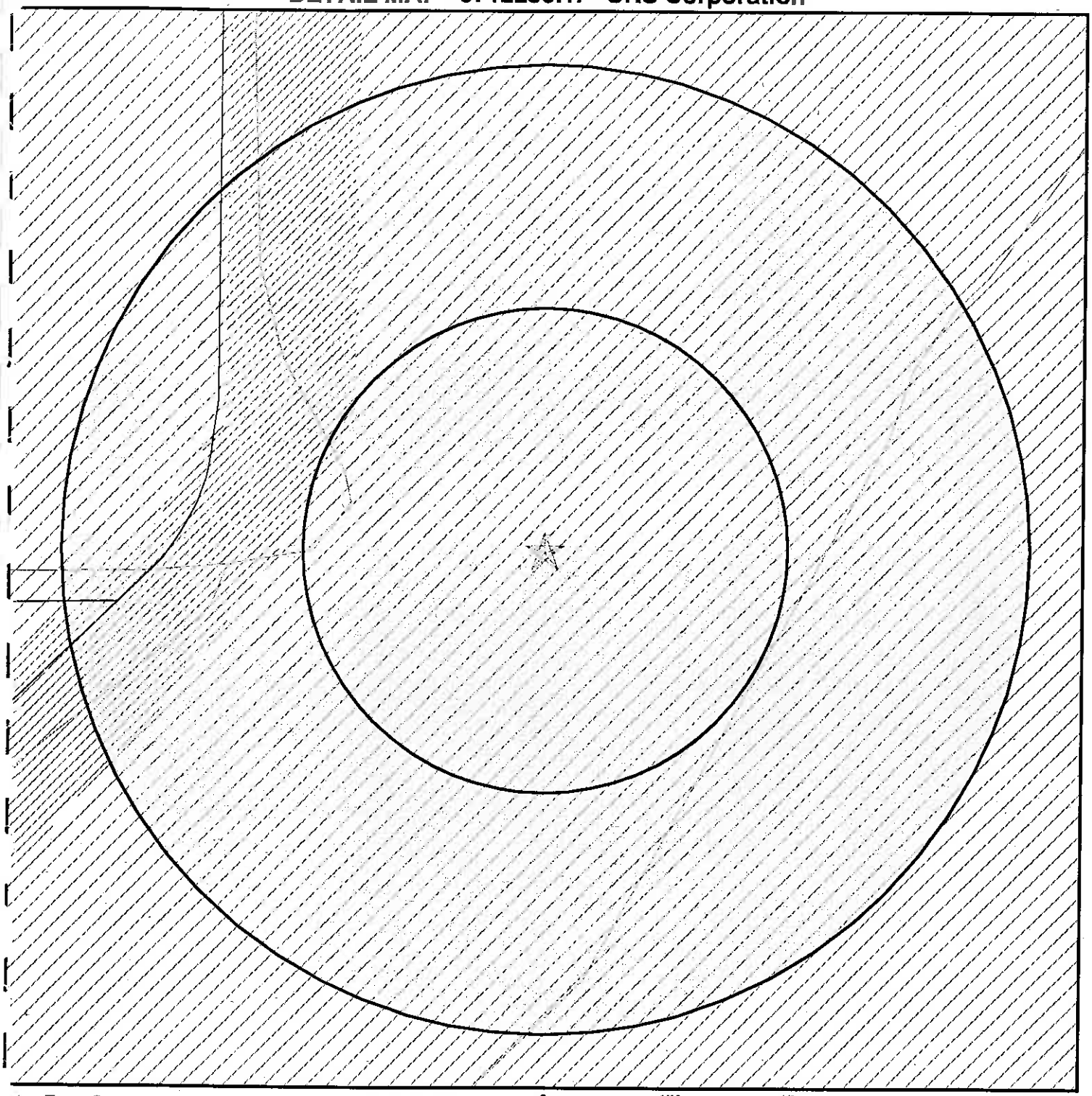
OVERVIEW MAP - 0712230.1r - URS Corporation



- ☆ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- Coal Gasification Sites (if requested)
- National Priority List Sites
- Landfill Sites
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Dept. of Defense Sites
- Water Quality Assurance Revolving Fund Areas

TARGET PROPERTY:	Chandler Heights Detention Basin	CUSTOMER:	URS Corporation
ADDRESS:	Greenfield Rd/Queen Creek Rd	CONTACT:	Marianne Burrus
CITY/STATE/ZIP:	Chandler AZ 85236	INQUIRY #:	0712230.1r
LAT/LONG:	33.2491 / 111.7267	DATE:	December 07, 2001 6:27 pm

DETAIL MAP - 0712230.1r - URS Corporation



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Coal Gasification Sites (if requested)
- Sensitive Receptors
- National Priority List Sites
- Landfill Sites
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Dept. of Defense Sites
- Water Quality Assurance Revolving Fund Areas

TARGET PROPERTY:	Chandler Heights Detention Basin	CUSTOMER:	URS Corporation
ADDRESS:	Greenfield Rd/Queen Creek Rd	CONTACT:	Marianne Burrus
CITY/STATE/ZIP:	Chandler AZ 85236	INQUIRY #:	0712230.1r
LAT/LONG:	33.2491 / 111.7267	DATE:	December 07, 2001 6:28 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FEDERAL ASTM STANDARD								
NPL		1.500	0	0	0	0	0	0
Proposed NPL		1.500	0	0	0	0	0	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		0.750	0	0	0	0	NR	0
CORRACTS		1.500	0	0	0	0	0	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		0.750	0	0	0	0	NR	0
RCRIS Sm. Quan. Gen.		0.750	0	0	0	0	NR	0
ERNS		0.500	0	0	0	NR	NR	0
STATE ASTM STANDARD								
SPL		1.000	0	0	0	0	NR	0
State Haz. Waste		1.500	0	0	0	0	0	0
State Landfill		1.000	0	0	0	0	NR	0
LUST		1.000	0	0	0	0	NR	0
UST		0.750	0	0	1	0	NR	1
AZ WQARF		1.500	0	0	0	0	0	0
FEDERAL ASTM SUPPLEMENTAL								
CONSENT		1.000	0	0	0	0	NR	0
ROD		1.000	0	0	0	0	NR	0
Delisted NPL		1.000	0	0	0	0	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
MINES		0.250	0	0	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
FTTS		TP	NR	NR	NR	NR	NR	0
STATE OR LOCAL ASTM SUPPLEMENTAL								
AST		TP	NR	NR	NR	NR	NR	0
AZ Spills		TP	NR	NR	NR	NR	NR	0
AZ DOD		0.500	0	0	0	NR	NR	0
WWFAC		0.500	0	0	0	NR	NR	0
Aquifer		TP	NR	NR	NR	NR	NR	0
Dry Wells		TP	NR	NR	NR	NR	NR	0
AZ AIRS		TP	NR	NR	NR	NR	NR	0
EDR PROPRIETARY DATABASES								
Coal Gas		1.000	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
AQUIFLOW - see EDR Physical Setting Source Addendum								

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

Coal Gas Site Search: No site was found in a search of Real Property Scan's ENVIROHAZ database.

1
West
1/4-1/2
1633
Lower

WAYNE FREEMAN FARM
16235 E OCOTILLO RD
CHANDLER, AZ 85249

UST **U001625823**
N/A

UST:

Facility ID:	0-002179	Tank ID:	1
Owner:	Wayne Freeman	Owner ID:	3807
Owner Contact:	1420 N Center St Mesa, AZ 85201		
Status:	Removed	Product:	Gasoline
Capacity:	1000	Age:	Not reported
Pipe Type:	Not reported	Tank Id:	1
Material Type:	Asphalt-coated or Bare Steel		
Multiple Selection Tank Release:	Not reported		
Pipe Release Information:	Not reported		
Type of Pipe Information:	Galvanized Steel		

Facility ID:	0-002179	Tank ID:	2
Owner:	Wayne Freeman	Owner ID:	3807
Owner Contact:	1420 N Center St Mesa, AZ 85201		
Status:	Removed	Product:	Gasoline
Capacity:	1000	Age:	Not reported
Pipe Type:	Not reported	Tank Id:	2
Material Type:	Asphalt-coated or Bare Steel		
Multiple Selection Tank Release:	Not reported		
Pipe Release Information:	Not reported		
Type of Pipe Information:	Galvanized Steel		

Facility ID:	0-002179	Tank ID:	3
Owner:	Wayne Freeman	Owner ID:	3807
Owner Contact:	1420 N Center St Mesa, AZ 85201		
Status:	Removed	Product:	Diesel
Capacity:	1000	Age:	Not reported
Pipe Type:	Not reported	Tank Id:	3
Material Type:	Asphalt-coated or Bare Steel		
Multiple Selection Tank Release:	Not reported		
Pipe Release Information:	Not reported		
Type of Pipe Information:	Galvanized Steel		

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)	Facility ID
CHANDLER	S100887617	SAN TAN DUSTERS	CHANDLER AIRPORT		AZ Spills, WWFAC	85-104
CHANDLER	S103277388	CHANDLER, CITY OF	SW CORNER RAY RD / ARIZONA A		AZ Spills, WWFAC	89-297
CHANDLER	S103931932	SPRECKLES MONTERREY HOME	NW CORNER OF MC QUEEN / RIGG		SHWS	
CHANDLER	S102789579	PROPERTY RESERVE, INC.	OCOTILLO RD BETWN ALMAS /		Aquifer, WWFAC	P102771
CHANDLER	1000158739	GREAT WESTERN SILICON	11515 E RIGGS RD	85249	RCRIS-SQG, SHWS, FINDS, WWFAC Dry Wells, CERC-NFRAP	AZD077536183
HIGLEY	U001628683	#10 WELL	SAN TAN RD & 164TH ST	85236	UST	0-007965
SUN LAKES	S103392014	WILBER ELLIS PESTICIDE DUMP	SE OF CHANDLER HEIGHTS RD. /	85249	SHWS	

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Elapsed ASTM days: Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

FEDERAL ASTM STANDARD RECORDS

NPL: National Priority List
Source: EPA
Telephone: N/A
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/26/01
Date Made Active at EDR: 08/28/01
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 08/06/01
Elapsed ASTM days: 22
Date of Last EDR Contact: 11/05/01

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 6
Telephone: 214-655-6659

EPA Region 8
Telephone: 303-312-6774

Proposed NPL: Proposed National Priority List Sites
Source: EPA
Telephone: N/A

Date of Government Version: 07/26/01
Date Made Active at EDR: 08/28/01
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 08/06/01
Elapsed ASTM days: 22
Date of Last EDR Contact: 11/05/01

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-413-0223
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 07/12/01
Date Made Active at EDR: 10/16/01
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 09/24/01
Elapsed ASTM days: 22
Date of Last EDR Contact: 09/24/01

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Source: EPA
Telephone: 703-413-0223
As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

Date of Government Version: 07/12/01
Date Made Active at EDR: 10/16/01
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 09/24/01
Elapsed ASTM days: 22
Date of Last EDR Contact: 09/24/01

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 09/20/01
Date Made Active at EDR: 10/30/01
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 09/24/01
Elapsed ASTM days: 36
Date of Last EDR Contact: 09/11/01

RCRIS: Resource Conservation and Recovery Information System
Source: EPA/NTIS
Telephone: 800-424-9346
Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

Date of Government Version: 06/21/00
Date Made Active at EDR: 07/31/00
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 07/10/00
Elapsed ASTM days: 21
Date of Last EDR Contact: 11/07/01

ERNS: Emergency Response Notification System
Source: EPA/NTIS
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 08/08/00
Date Made Active at EDR: 09/06/00
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 08/11/00
Elapsed ASTM days: 26
Date of Last EDR Contact: 10/25/01

FEDERAL ASTM SUPPLEMENTAL RECORDS

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/99
Database Release Frequency: Biennially

Date of Last EDR Contact: 09/18/01
Date of Next Scheduled EDR Contact: 12/17/01

CONSENT: Superfund (CERCLA) Consent Decrees
Source: EPA Regional Offices
Telephone: Varies
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: N/A
Database Release Frequency: Varies

Date of Last EDR Contact: N/A
Date of Next Scheduled EDR Contact: N/A

ROD: Records Of Decision
Source: NTIS
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 09/30/00
Database Release Frequency: Annually

Date of Last EDR Contact: 10/09/01
Date of Next Scheduled EDR Contact: 01/07/02

DELISTED NPL: National Priority List Deletions
Source: EPA
Telephone: N/A
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/26/01
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 11/05/01
Date of Next Scheduled EDR Contact: 02/04/02

FINDS: Facility Index System/Facility Identification Initiative Program Summary Report
Source: EPA
Telephone: N/A
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/13/01
Database Release Frequency: Quarterly

Date of Last EDR Contact: 10/08/01
Date of Next Scheduled EDR Contact: 01/07/02

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4526
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 05/31/01
Database Release Frequency: Annually

Date of Last EDR Contact: 10/22/01
Date of Next Scheduled EDR Contact: 01/21/02

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 05/29/01
Database Release Frequency: Quarterly

Date of Last EDR Contact: 10/08/01
Date of Next Scheduled EDR Contact: 01/07/02

MINES: Mines Master Index File
Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959

Date of Government Version: 08/24/01
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 10/01/01
Date of Next Scheduled EDR Contact: 12/31/01

NPL LIENS: Federal Superfund Liens
Source: EPA
Telephone: 205-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner receives notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/91
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 11/19/01
Date of Next Scheduled EDR Contact: 02/18/02

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-260-3936
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 09/30/01
Database Release Frequency: Annually

Date of Last EDR Contact: 11/13/01
Date of Next Scheduled EDR Contact: 02/12/02

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/95
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 09/13/01
Date of Next Scheduled EDR Contact: 12/10/01

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-260-1531
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/99
Database Release Frequency: Annually

Date of Last EDR Contact: 09/24/01
Date of Next Scheduled EDR Contact: 12/24/01

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-1444
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/98
Database Release Frequency: Every 4 Years

Date of Last EDR Contact: 10/24/01
Date of Next Scheduled EDR Contact: 01/21/02

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-564-2501
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/19/01
Database Release Frequency: Quarterly

Date of Last EDR Contact: 09/25/01
Date of Next Scheduled EDR Contact: 12/24/01

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA
Telephone: 202-564-2501

Date of Government Version: 07/19/01
Database Release Frequency: Quarterly

Date of Last EDR Contact: 09/25/01
Date of Next Scheduled EDR Contact: 12/24/01

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STATE OF ARIZONA ASTM STANDARD RECORDS

SPL: Superfund Program List
Source: Dept. of Environmental Quality
Telephone: 602-207-4360
The list is representative of the sites and potential sites within the jurisdiction of the Superfund Program Section. It is comprised of the following elements: 1) Water Quality Assurance Revolving Fund Registry Sites; 2) Potential WQARF Registry sites; 3) NPL sites; and 4) Department of Defense sites requiring SPS oversight.

Date of Government Version: 10/23/00
Date Made Active at EDR: 01/03/01
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 12/04/00
Elapsed ASTM days: 30
Date of Last EDR Contact: 12/04/01

SHWS: ZipAcids List
Source: Department of Environmental Quality
Telephone: 602-207-2202
The ACIDS list consists of more than 750 locations subject to investigation under the State Water Quality Assurance Revolving Fund (WQARF) and Federal CERCLA programs. The list is no longer updated by the state.

Date of Government Version: 01/03/00
Date Made Active at EDR: 05/16/00
Database Release Frequency: No Update Planned

Date of Data Arrival at EDR: 04/11/00
Elapsed ASTM days: 35
Date of Last EDR Contact: 10/22/01

SWF/LF: Directory of Solid Waste Facilities
Source: Department of Environmental Quality
Telephone: 602-207-4132
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 11/01/00
Date Made Active at EDR: 02/01/01
Database Release Frequency: Annually

Date of Data Arrival at EDR: 01/02/01
Elapsed ASTM days: 30
Date of Last EDR Contact: 11/05/01

LUST: Leaking Underground Storage Tank Listing
Source: Department of Environmental Quality
Telephone: 602-207-4345
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 11/08/01
Date Made Active at EDR: 11/27/01
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 11/13/01
Elapsed ASTM days: 14
Date of Last EDR Contact: 11/07/01

UST: Underground Storage Tank Listing
Source: Department of Environmental Quality
Telephone: 602-207-4345
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 01/03/00
Date Made Active at EDR: 03/17/00
Database Release Frequency: Annually

Date of Data Arrival at EDR: 02/14/00
Elapsed ASTM days: 32
Date of Last EDR Contact: 11/07/01

WQARF: Water Quality Assurance Revolving Fund Sites
Source: Department of Environmental Quality
Telephone: 602-207-2202
Sites which may have an actual or potential impact upon the waters of the state, cause by hazardous substances. The WQARF program provides matching funds to political subdivisions and other state agencies for clean-up activities.

Date of Government Version: 06/12/01
Date Made Active at EDR: 09/24/01
Database Release Frequency: Annually

Date of Data Arrival at EDR: 06/26/01
Elapsed ASTM days: 90
Date of Last EDR Contact: 09/28/01

STATE OF ARIZONA ASTM SUPPLEMENTAL RECORDS

AST: List of Aboveground Storage Tanks
Source: Dept. of Building & Fire Safety
Telephone: 602-255-4964
Aboveground storage tanks that the Dept. of Building & Fire Safety have permitted.

Date of Government Version: 12/31/00
Database Release Frequency: Annually

Date of Last EDR Contact: 10/16/01
Date of Next Scheduled EDR Contact: 01/14/02

SPILLS: Hazardous Material Logbook
Source: Department of Environmental Quality
Telephone: 602-207-2202
ADEQ Emergency Response Unit. The ADEQ Emergency Response Unit documents chemical spills and incidents which are referred to the Unit. The logbook information for 1984-1986 consists of handwritten entries of the date, incident number and name of facility if known. Current logbooks are computerized and can be sorted by date, incident number, name, city (zip codes are not included), county, chemical and quantity.

Date of Government Version: 06/30/00
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 10/19/01
Date of Next Scheduled EDR Contact: 12/31/01

DOD: Department of Defense Sites
Source: Department of Environmental Quality
Telephone: 602-207-2202
These sites are federal facilities that are either being assessed for potential contamination, or have active remediation taking place on them.

Date of Government Version: 06/12/01
Database Release Frequency: Annually

Date of Last EDR Contact: 09/28/01
Date of Next Scheduled EDR Contact: 12/24/01

WWFAC: Waste Water Treatment Facilities
Source: Department of Environmental Quality
Telephone: 602-207-4623
Statewide list of waste water treatment facilities.

Date of Government Version: 12/12/00
Database Release Frequency: Varies

Date of Last EDR Contact: 11/26/01
Date of Next Scheduled EDR Contact: 02/25/02

AQUIFER: Waste Water Treatment Facilities
Source: Department of Environmental Quality
Telephone: 602-207-4623
Waste Water Treatment Facilities with APP (Aquifer Protection Permits.)

Date of Government Version: 05/01/01
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 11/02/01
Date of Next Scheduled EDR Contact: 01/28/02

DRY WELLS: Drywell Registration
Source: Department of Environmental Quality
Telephone: 602-207-2202
A drywell is a bored, drilled, or driven shaft or hole whose depth is greater than its width and is designed and constructed specifically for the disposal of storm water.

Date of Government Version: 10/01/01
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 10/09/01
Date of Next Scheduled EDR Contact: 12/24/01

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AZ AIRS: Arizona Airs Database
Source: Department of Environmental Quality
Telephone: 602-207-2344
Arizona major (has the potential to emit over 100 tons of criteria pollutant) and minor (below 100 tons) sources.

Date of Government Version: 08/07/01
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 11/07/01
Date of Next Scheduled EDR Contact: 02/04/02

EDR PROPRIETARY DATABASES

Former Manufactured Gas (Coal Gas) Sites: The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. ©Copyright 1993 Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

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The information contained in this report has predominantly been obtained from publicly available sources produced by entities other than Real Property Scan. While reasonable steps have been taken to insure the accuracy of this report, Real Property Scan does not guarantee the accuracy of this report. Any liability on the part of Real Property Scan is strictly limited to a refund of the amount paid. No claim is made for the actual existence of toxins at any site. This report does not constitute a legal opinion.

HISTORICAL AND OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Oil/Gas Pipelines/Electrical Transmission Lines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines and electrical transmission lines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 1999 from the U.S. Fish and Wildlife Service.

GEOCHECK®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CHANDLER HEIGHTS DETENTION BASIN
GREENFIELD RD/QUEEN CREEK RD
CHANDLER, AZ 85236

TARGET PROPERTY COORDINATES

Latitude (North):	33.249100 - 33° 14' 56.8"
Longitude (West):	111.726700 - 111° 43' 36.1"
Universal Tranverse Mercator:	Zone 12
UTM X (Meters):	432303.9
UTM Y (Meters):	3678946.2

EDR's GeoCheck Physical Setting Source Addendum has been developed to assist the environmental professional with the collection of physical setting source information in accordance with ASTM 1527-00, Section 7.2.3. Section 7.2.3 requires that a current USGS 7.5 Minute Topographic Map (or equivalent, such as the USGS Digital Elevation Model) be reviewed. It also requires that one or more additional physical setting sources be sought when (1) conditions have been identified in which hazardous substances or petroleum products are likely to migrate to or from the property, and (2) more information than is provided in the current USGS 7.5 Minute Topographic Map (or equivalent) is generally obtained, pursuant to local good commercial or customary practice, to assess the impact of migration of recognized environmental conditions in connection with the property. Such additional physical setting sources generally include information about the topographic, hydrologic, hydrogeologic, and geologic characteristics of a site, and wells in the area.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata. EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

USGS TOPOGRAPHIC MAP ASSOCIATED WITH THIS SITE

Target Property: 2433111-B6 CHANDLER HEIGHTS, AZ
Source: USGS 7.5 min quad index

GENERAL TOPOGRAPHIC GRADIENT AT TARGET PROPERTY

Target Property: General WNW

Source: General Topographic Gradient has been determined from the USGS 1 Degree Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
MARICOPA, AZ	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 04013C3075F / CWPP

Additional Panels in search area: 04013C2690F / CWPP
04013C2670F / CWPP
04013C3035F / CWPP

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
NOT AVAILABLE	Not Available

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Site-Specific Hydrogeological Data*:
Search Radius: 2.0 miles
Status: Not found

AQUIFLOW®

Search Radius: 2.000 Miles.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era: Cenozoic
System: Quaternary
Series: Quaternary
Code: Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Component Name: MOHALL

Soil Surface Texture: loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel: HIGH

Depth to Bedrock Min: > 60 inches

Depth to Bedrock Max: > 60 inches

Soil Layer Information

	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	10 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 2.00 Min: 0.60	Max: 8.40 Min: 7.90
2	10 inches	27 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COURSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand.	Max: 0.60 Min: 0.20	Max: 8.40 Min: 7.90
3	27 inches	37 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 2.00 Min: 0.60	Max: 8.40 Min: 7.90

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
4	37 inches	60 inches	gravelly - sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COURSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 2.00 Min: 0.60	Max: 8.40 Min: 7.90

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures: gravelly - fine sandy loam
sandy loam

Surficial Soil Types: gravelly - fine sandy loam
sandy loam

Shallow Soil Types: sandy loam

Deeper Soil Types: sandy clay loam

ADDITIONAL ENVIRONMENTAL RECORD SOURCES

According to ASTM E 1527-00, Section 7.2.2, "one or more additional state or local sources of environmental records may be checked, in the discretion of the environmental professional, to enhance and supplement federal and state sources... Factors to consider in determining which local or additional state records, if any, should be checked include (1) whether they are reasonably ascertainable, (2) whether they are sufficiently useful, accurate, and complete in light of the objective of the records review (see 7.1.1), and (3) whether they are obtained, pursuant to local, good commercial or customary practice." One of the record sources listed in Section 7.2.2 is water well information. Water well information can be used to assist the environmental professional in assessing sources that may impact groundwater flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A1	331455111434801	1/8 - 1/4 Mile West
C7	331430111440501	1/2 - 1 Mile SW
C8	331430111440601	1/2 - 1 Mile SW
D10	331517111441801	1/2 - 1 Mile WNW
14	331408111434401	1/2 - 1 Mile South
15	331524111424501	1/2 - 1 Mile NE
D17	331518111442701	1/2 - 1 Mile WNW
19	331535111441501	1/2 - 1 Mile NW

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

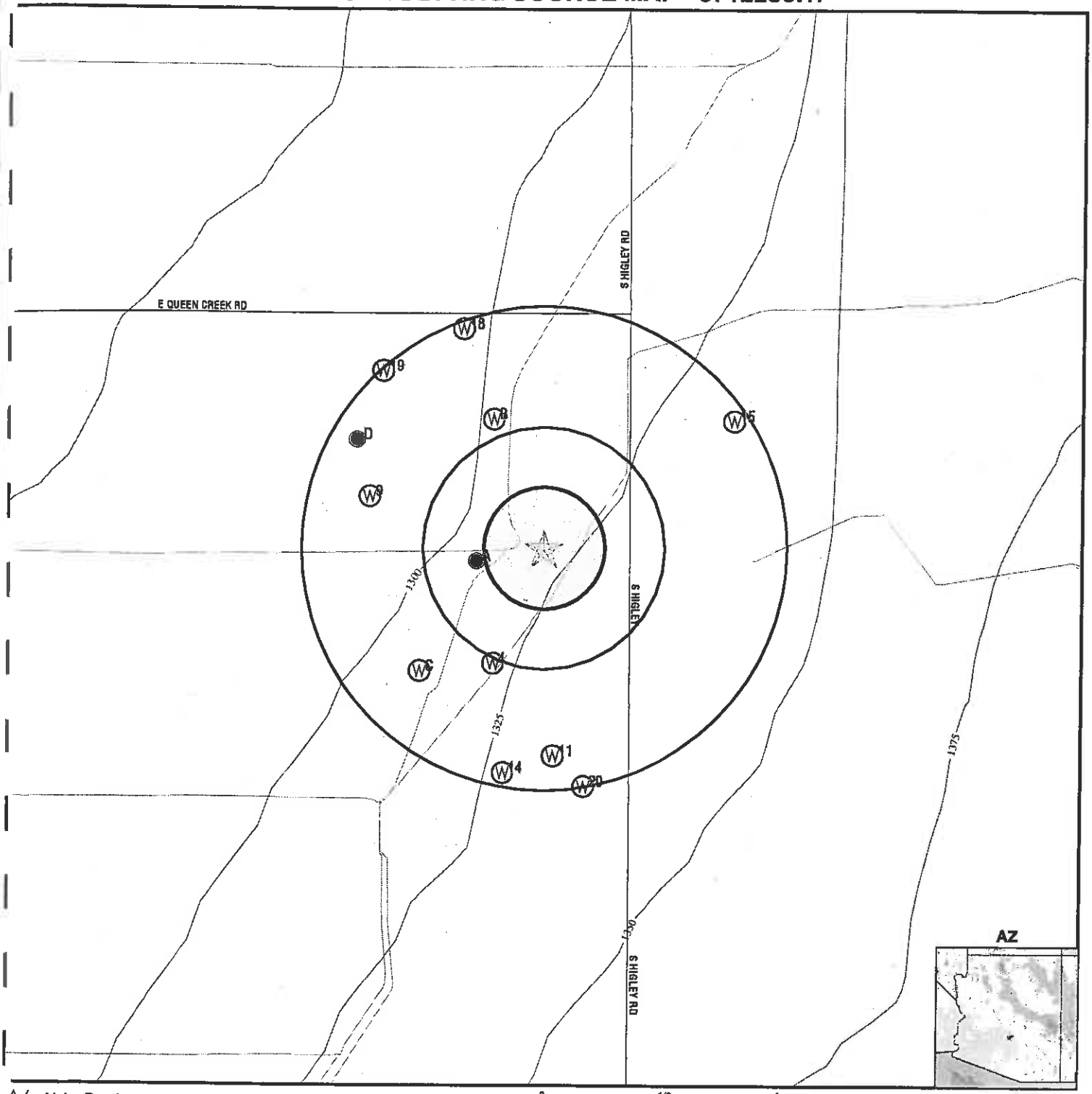
MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A2	623411	1/4 - 1/2 Mile WSW
A3	639965	1/4 - 1/2 Mile West
4	609478	1/2 - 1 Mile SSW
B5	620533	1/2 - 1 Mile NNW
B6	640452	1/2 - 1 Mile NNW
9	505458	1/2 - 1 Mile WNW
11	603553	1/2 - 1 Mile South
D12	626948	1/2 - 1 Mile NW
D13	626947	1/2 - 1 Mile NW
D16	620534	1/2 - 1 Mile WNW
18	633972	1/2 - 1 Mile NNW
20	529563	1/2 - 1 Mile South

PHYSICAL SETTING SOURCE MAP - 0712230.1r



- Major Roads
- Contour Lines
- Water Wells
- Public Water Supply Wells
- Groundwater Flow Direction
- Indeterminate Groundwater Flow at Location
- Groundwater Flow Varies at Location
- Cluster of Multiple Icons
- Earthquake epicenter, Richter 5 or greater
- Closest Hydrogeological Data

TARGET PROPERTY:	Chandler Heights Detention Basin	CUSTOMER:	URS Corporation
ADDRESS:	Greenfield Rd/Queen Creek Rd	CONTACT:	Marianne Burrus
CITY/STATE/ZIP:	Chandler AZ 85236	INQUIRY #:	0712230.1r
LAT/LONG:	33.2491 / 111.7267	DATE:	December 07, 2001 6:28 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

	Database	EDR ID Number
A1		
West	**FED USGS**	**331455111434801**
1/8 - 1/4 Mile		
Lower		

BASIC WELL DATA

Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1951	County:	Maricopa
Altitude:	1310.00 ft.	State:	Arizona
Well Depth:	770.00 ft.	Topographic Setting:	Valley flat
Depth to Water Table:	Not Reported	Prim. Use of Site:	Withdrawal of water
Date Measured:	Not Reported	Prim. Use of Water:	Irrigation

A2			
WSW	**AZ WELLS**	**623411**	
1/4 - 1/2 Mile			
Lower			

Registration Num:	623411	Map ID:	A2
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	22
1/4 Section:	B	1/4,1/4 Section:	A
1/4,1/4,1/4 Section:	Not Reported	Location Accuracy:	Unverified
File Type:	Registered Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Not In AMA or INA Sub-Basin
Well Type:	Non Exempt Well (Old) (pump capacity > 35 gpm or irrigates > 2 acres) If no pump equipment is noted as installed on 'Intent to Drill' form, it is entered as a Non - Exempt well		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Private	Owner:	Not Reported
Water Use	Irrigation	Well Use	Water Production
Drill Permit Issued:	Jun 11, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	No
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	FREEMAN, A A		
In Care of:	Not Reported 1412 N CENTER ST MESA,AZ 85201		
Well Depth (Ft):	778	Casing Diameter (In):	20
Casing Depth (Ft):	Not Reported	Casing Finish:	Not Reported
Pump Capacity (GPM):	2000	Water Level (Ft):	350
Well Completed:	Not Reported	Acres Irrigated:	195.0000
Pump Capacity Test:	2000 (GMP)	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	0
Pump Power Type:	Not Reported		
Point of Use 1:	WX 22 020 S 060 E	Point of Use 2:	NX SW 21 020 S 060 E

A3		
West	**AZ WELLS**	**639965**
1/4 - 1/2 Mile		
Lower		

Registration Num:	639965	Map ID:	A3
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	15
1/4 Section:	C	1/4,1/4 Section:	D
1/4,1/4,1/4 Section:	C	Location Accuracy:	Unverified
File Type:	Late Registration		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Not In AMA or INA Sub-Basin
Well Type:	Exempt Well (Old) (pump capacity < 35 gpm or irrigates < 2 acres)		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Private	Owner:	Not Reported
Water Use	Stock	Well Use	Water Production
Drill Permit Issued:	Jun 17, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	No
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	BEALS, A R		
In Care of:	Not Reported 760 W 8TH ST MESA,AZ 85201		
Well Depth (Ft):	Not Reported	Casing Diameter (In):	8
Casing Depth (Ft):	Not Reported	Casing Finish:	Not Reported
Pump Capacity (GPM):	Not Reported	Water Level (Ft):	Not Reported
Well Completed:	Not Reported	Acres Irrigated:	0.00
Pump Capacity Test:	Not Reported	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	Not Reported
Pump Power Type:	Not Reported		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

4
SSW
1/2 - 1 Mile
Higher

AZ WELLS **609478**

Registration Num:	609478	Map ID:	4
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	22
1/4 Section:	B	1/4,1/4 Section:	D
1/4,1/4,1/4 Section:	D	Location Accuracy:	Unverified
File Type:	Registered Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Not In AMA or INA Sub-Basin
Well Type:	Non Exempt Well (Old) (pump capacity > 35 gpm or irrigates > 2 acres) If no pump equipment is noted as installed on 'Intent to Drill' form, it is entered as a Non - Exempt well		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Private	Owner:	Not Reported
Water Use	Irrigation	Well Use	Water Production

Drill Permit Issued:	May 27, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	Yes
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	MAO, THERESE		
In Care of:	Not Reported 5536 E SOLANO DR PARADISE VALLEY,AZ 85253		
Well Depth (Ft):	1400	Casing Diameter (In):	16
Casing Depth (Ft):	Not Reported	Casing Finish:	Not Reported
Pump Capacity (GPM):	1000	Water Level (Ft):	0
Well Completed:	Oct , 1970	Acres Irrigated:	150.0000
Pump Capacity Test:	1000 (GMP)	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	0
Pump Power Type:	Not Reported		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

B5
NNW
1/2 - 1 Mile
Lower

AZ WELLS **620533**

Registration Num:	620533	Map ID:	B5
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	15
1/4 Section:	B	1/4,1/4 Section:	D
1/4,1/4,1/4 Section:	D	Location Accuracy:	Unverified
File Type:	Registered Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Not In AMA or INA Sub-Basin
Well Type:	Non Exempt Well (Old) (pump capacity > 35 gpm or irrigates > 2 acres) If no pump equipment is noted as installed on 'Intent to Drill' form, it is entered as a Non - Exempt well		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Water Ditrict	Owner:	Not Reported
Water Use	Irrigation	Well Use	Water Production
Drill Permit Issued:	Jun 14, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	No
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	ROOSEVELT WTR DIST		
In Care of:	Not Reported PO BOX 168 HIGLEY,AZ 85236		
Well Depth (Ft):	1000	Casing Diameter (In):	20
Casing Depth (Ft):	Not Reported	Casing Finish:	Steel - Perforated Slotted Caseing
Pump Capacity (GPM):	165	Water Level (Ft):	301
Well Completed:	Dec 18, 1961	Acres Irrigated:	39400.0000
Pump Capacity Test:	165 (GMP)	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	0
Pump Power Type:	Not Reported		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

	Database	EDR ID Number
B6 **NNW** **1/2 - 1 Mile** **Lower**	**AZ WELLS**	**640452**

Registration Num:	640452	Map ID:	B6
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	15
1/4 Section:	B	1/4,1/4 Section:	D
1/4,1/4,1/4 Section:	D	Location Accuracy:	Unverified
File Type:	Late Registration		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	East Salt River Valley - Phoenix AMA
Well Type:	Exempt Well (Old) (pump capacity < 35 gpm or irrigates < 2 acres)		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Private	Owner:	Not Reported
Water Use	Domestic	Well Use	Water Production
Drill Permit Issued:	Jul 13, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	Yes
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	BROWN, GLEN LEON		
In Care of:	Not Reported 2429 S ROGERS MESA,AZ 85202		
Well Depth (Ft):	400	Casing Diameter (In):	Not Reported
Casing Depth (Ft):	Not Reported	Casing Finish:	Steel - Perforated Slotted Caseing
Pump Capacity (GPM):	30	Water Level (Ft):	284
Well Completed:	Mar 01, 1974	Acres Irrigated:	0.00
Pump Capacity Test:	30 (GMP)	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	Not Reported
Pump Power Type:	Not Reported		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

C7
SW
1/2 - 1 Mile
Lower

FED USGS **331430111440501**

BASIC WELL DATA

Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1944	County:	Maricopa
Altitude:	1310.00 ft.	State:	Arizona
Well Depth:	900.00 ft.	Topographic Setting:	Not Reported
Depth to Water Table:	249.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	10201953	Prim. Use of Water:	Irrigation

C8
SW
1/2 - 1 Mile
Lower

FED USGS **331430111440601**

GEOCHECK®- PHYSICAL SETTING SOURCE MAP FINDINGS

BASIC WELL DATA

Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1970	County:	Maricopa
Altitude:	1311.00 ft.	State:	Arizona
Well Depth:	1400.00 ft.	Topographic Setting:	Not Reported
Depth to Water Table:	384.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	03011971	Prim. Use of Water:	Irrigation

9
WNW
1/2 - 1 Mile
Lower

AZ WELLS **505458**

Registration Num:	505458	Map ID:	9
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	16
1/4 Section:	D	1/4,1/4 Section:	D
1/4,1/4,1/4 Section:	A	Location Accuracy:	Unverified
File Type:	New Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Hassayampa - Phoeinx AMA
Well Type:	Exempt Well (Old) (pump capacity < 35 gpm or irrigates < 2 acres)		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Private	Owner:	Not Reported
Water Use	Domestic	Well Use	Water Production
Drill Permit Issued:	May 24, 1983	Registration Num:	003
Intended Pump Cap.:	2 (GPM)	Change in Owner:	Yes
Drillers Log Status:	Completed (when Well Drillers Completion Report is entered)		
Completion Report Stat:	Completed (when Well Drillers Completion Report is entered)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	WEST, PATRICIA CAROL		
In Care of:	Not Reported 21648 S GREENFIELD CHANDLER,AZ 85249		
Well Depth (Ft):	580	Casing Diameter (In):	6
Casing Depth (Ft):	Not Reported	Casing Finish:	Steel - Perforated Slotted Caseing
Pump Capacity (GPM):	12	Water Level (Ft):	260
Well Completed:	May 29, 1983	Acres Irrigated:	0.00
Pump Capacity Test:	12 (GMP)	Yield Method:	Not Reported
Pump Type:	Submersible	Drawdown (Ft):	Not Reported
Pump Power Type:	Electric Motor 1 -> 5 HP		
Point of Use 1:	NE SE SE 16 020 S 060 E	Point of Use 2:	Not Reported

---

D10
WNW
1/2 - 1 Mile
Lower

FED USGS **331517111441801**

BASIC WELL DATA

Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	Not Reported	County:	Maricopa
Altitude:	1306.00 ft.	State:	Arizona
Well Depth:	Not Reported	Topographic Setting:	Not Reported
Depth to Water Table:	101.00 ft.	Prim. Use of Site:	Destroyed
Date Measured:	10011939	Prim. Use of Water:	Unused

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

	Database	EDR ID Number
11 **South** **1/2 - 1 Mile** **Higher**	**AZ WELLS**	**603553**

Registration Num:	603553	Map ID:	11
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	22
1/4 Section:	D	1/4,1/4 Section:	C
1/4,1/4,1/4 Section:	A	Location Accuracy:	Unverified
File Type:	Registered Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	East Salt River Valley - Phoenix AMA
Well Type:	Non Exempt Well (Old) (pump capacity > 35 gpm or irrigates > 2 acres) If no pump equipment is noted as installed on 'Intent to Drill' form, it is entered as a Non - Exempt well		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Corporation	Owner:	Not Reported
Water Use	Stock	Well Use	Water Production
Drill Permit Issued:	Mar 16, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	400 (GPM)	Change in Owner:	No
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	SHAMROCK FARMS CO		
In Care of:	SEE 59-502580 16516 E CHNADLER HGH CHANDLER,AZ 85249		
Well Depth (Ft):	1600	Casing Diameter (In):	20
Casing Depth (Ft):	Not Reported	Casing Finish:	Steel - Perforated Slotted Caseing
Pump Capacity (GPM):	400	Water Level (Ft):	450
Well Completed:	Mar 15, 1967	Acres Irrigated:	0.00
Pump Capacity Test:	400 (GMP)	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	0
Pump Power Type:	Not Reported		
Point of Use 1:	NE SW SE 22 020 S 060 E	Point of Use 2:	Not Reported

D12 **NW** **1/2 - 1 Mile** **Lower**		**AZ WELLS**	**626948**

Registration Num:	626948	Map ID:	D12
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	16
1/4 Section:	A	1/4,1/4 Section:	D
1/4,1/4,1/4 Section:	D	Location Accuracy:	Unverified
File Type:	Registered Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Not In AMA or INA Sub-Basin
Well Type:	Non Exempt Well (Old) (pump capacity > 35 gpm or irrigates > 2 acres) If no pump equipment is noted as installed on 'Intent to Drill' form, it is entered as a Non - Exempt well		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Corporation	Owner:	Not Reported
Water Use	Domestic	Well Use	Water Production

Drill Permit Issued:	Jun 10, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	No
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	TANKERSLEY WTR CO, J		
In Care of:	Not Reported PO BOX 420 HIGLEY,AZ 85236		
Well Depth (Ft):	1500	Casing Diameter (In):	20
Casing Depth (Ft):	Not Reported	Casing Finish:	Steel - Perforated Slotted Caseing
Pump Capacity (GPM):	165	Water Level (Ft):	325
Well Completed:	Apr 10, 1962	Acres Irrigated:	0.00
Pump Capacity Test:	165 (GMP)	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	Not Reported
Pump Power Type:	Not Reported		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

D13
NW
1/2 - 1 Mile
Lower

AZ WELLS 626947

Registration Num:	626947	Map ID:	D13
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	16
1/4 Section:	A	1/4,1/4 Section:	D
1/4,1/4,1/4 Section:	D	Location Accuracy:	Unverified
File Type:	Registered Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Not In AMA or INA Sub-Basin
Well Type:	Non Exempt Well (Old) (pump capacity > 35 gpm or irrigates > 2 acres) If no pump equipment is noted as installed on 'Intent to Drill' form, it is entered as a Non - Exempt well		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Corporation	Owner:	Not Reported
Water Use	Domestic	Well Use	Water Production
Drill Permit Issued:	Jun 10, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	No
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	TANKERSLEY WTR CO, J		
In Care of:	Not Reported PO BOX 420 HIGLEY,AZ 85236		
Well Depth (Ft):	Not Reported	Casing Diameter (In):	20
Casing Depth (Ft):	Not Reported	Casing Finish:	Other
Pump Capacity (GPM):	Not Reported	Water Level (Ft):	325
Well Completed:	Not Reported	Acres Irrigated:	0.00
Pump Capacity Test:	Not Reported	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	Not Reported
Pump Power Type:	Not Reported		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

	Database	EDR ID Number
14 **South** **1/2 - 1 Mile** **Higher**	**FED USGS**	**331408111434401**

BASIC WELL DATA

Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	Not Reported	County:	Maricopa
Altitude:	1317.00 ft.	State:	Arizona
Well Depth:	735.00 ft.	Topographic Setting:	Valley flat
Depth to Water Table:	Not Reported	Prim. Use of Site:	Withdrawal of water
Date Measured:	Not Reported	Prim. Use of Water:	Irrigation

---

15 **NE** **1/2 - 1 Mile** **Higher**	**FED USGS**	**331524111424501**

BASIC WELL DATA

Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	Not Reported	County:	Maricopa
Altitude:	Not Reported	State:	Arizona
Well Depth:	420.00 ft.	Topographic Setting:	Not Reported
Depth to Water Table:	Not Reported	Prim. Use of Site:	Not Reported
Date Measured:	Not Reported	Prim. Use of Water:	Not Reported

D16 **WNW** **1/2 - 1 Mile** **Lower**	**AZ WELLS**	**620534**

Registration Num:	620534	Map ID:	D16
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	16
1/4 Section:	D	1/4,1/4 Section:	A
1/4,1/4,1/4 Section:	B	Location Accuracy:	Unverified
File Type:	Registered Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Not In AMA or INA Sub-Basin
Well Type:	Non Exempt Well (Old) (pump capacity > 35 gpm or irrigates > 2 acres) If no pump equipment is noted as installed on 'Intent to Drill' form, it is entered as a Non - Exempt well		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Water Ditrict	Owner:	Not Reported
Water Use	Irrigation	Well Use	Water Production

Drill Permit Issued:	Jun 14, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	No
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	ROOSEVELT WTR DIST		
In Care of:	Not Reported PO BOX 168 HIGLEY,AZ 85236		
Well Depth (Ft):	750	Casing Diameter (In):	20
Casing Depth (Ft):	Not Reported	Casing Finish:	Steel - Perforated Slotted Caseing
Pump Capacity (GPM):	126	Water Level (Ft):	305
Well Completed:	May 24, 1947	Acres Irrigated:	39400.0000
Pump Capacity Test:	126 (GMP)	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	0
Pump Power Type:	Not Reported		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

D17
WNW
1/2 - 1 Mile
Lower

FED USGS **331518111442701**

BASIC WELL DATA

Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	Not Reported	County:	Maricopa
Altitude:	1302.00 ft.	State:	Arizona
Well Depth:	750.00 ft.	Topographic Setting:	Not Reported
Depth to Water Table:	127.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	05011947	Prim. Use of Water:	Irrigation

18
NNW
1/2 - 1 Mile
Lower

AZ WELLS **633972**

Registration Num:	633972	Map ID:	18
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	15
1/4 Section:	B	1/4,1/4 Section:	A
1/4,1/4,1/4 Section:	B	Location Accuracy:	Unverified
File Type:	Registered Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	Not In AMA or INA Sub-Basin
Well Type:	Exempt Well (Old) (pump capacity < 35 gpm or irrigates < 2 acres)		
River Watershed:	La Paz	County:	Maricopa
Owner Type:	Private	Owner:	Not Reported
Water Use	Domestic	Well Use	Water Production

Drill Permit Issued:	May 27, 1982	Registration Num:	Not Reported
Intended Pump Cap.:	Not Reported	Change in Owner:	No
Drillers Log Status:	Registration of Existing Wells or Late Registration forms entered)		
Completion Report Stat:	No Completion Report is needed (Example: abandoned exploation wells)		
Poor Quality Prmt Num:	Not Reported	Poor Qual Prmt Status:	Not Reported
Owner:	WITTER, D L		
In Care of:	Not Reported		
	BOX 83		
	HIGLEY,AZ 85236		
Well Depth (Ft):	450	Casing Diameter (In):	6
Casing Depth (Ft):	Not Reported	Casing Finish:	Steel - Perforated Slotted Caseing
Pump Capacity (GPM):	5	Water Level (Ft):	430
Well Completed:	Not Reported	Acres Irrigated:	0.00
Pump Capacity Test:	5 (GMP)	Yield Method:	Not Reported
Pump Type:	Not Reported	Drawdown (Ft):	Not Reported
Pump Power Type:	Not Reported		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

19
NW
1/2 - 1 Mile
Lower

FED USGS **331535111441501**

BASIC WELL DATA

Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	Not Reported	County:	Maricopa
Altitude:	Not Reported	State:	Arizona
Well Depth:	610.00 ft.	Topographic Setting:	Not Reported
Depth to Water Table:	142.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	07011948	Prim. Use of Water:	Irrigation

20
South
1/2 - 1 Mile
Higher

AZ WELLS **529563**

Registration Num:	529563	Map ID:	20
CADASTRAL LOCATION OF WELL:			
State Quadrant:	D	Township:	02
1/2 Township:	-	Range:	06
1/2 Range:	Not Reported	Section:	22
1/4 Section:	D	1/4,1/4 Section:	D
1/4,1/4,1/4 Section:	C	Location Accuracy:	Verified
File Type:	New Wells		
AMA or INA Basin:	Phoenix AMA	AMA/INA Sub-Basin:	East Salt River Valley - Phoenix AMA
Well Type:	Non Exempt Well (Old) (pump capacity > 35 gpm or irrigates > 2 acres)		
	If no pump equipment is noted as installed on 'Intent to Drill' form, it is entered as a Non - Exempt well		
River Watershed:	Upper Gila River	County:	Maricopa
Owner Type:	Private	Owner:	Not Reported
Water Use	Industrial	Well Use	Water Production

GEOCHECK®- PHYSICAL SETTING SOURCE MAP FINDINGS

Drill Permit Issued:	Oct 01, 1990	Registration Num:	007
Intended Pump Cap.:	400 (GPM)	Change in Owner:	No
Drillers Log Status:	Completed (when Well Drillers Completion Report is entered)		
Completion Report Stat:	Completed (when Well Drillers Completion Report is entered)		
Poor Quality Prmt Num:	T529563	Poor Qual Prmt Status:	59-502580
Owner:	SHAMROCK FARMS CO		
In Care of:	R J WHITEHURST 16516 E CHANDLER HTS CHANDLER,AZ 85249		
Well Depth (Ft):	815	Casing Diameter (In):	12
Casing Depth (Ft):	Not Reported	Casing Finish:	Steel - Perforated Slotted Caseing
Pump Capacity (GPM):	600	Water Level (Ft):	286
Well Completed:	Oct 15, 1990	Acres Irrigated:	0.00
Pump Capacity Test:	600 (GMP)	Yield Method:	Meter
Pump Type:	Submersible	Drawdown (Ft):	50
Pump Power Type:	Electric Motor 15 -> 100 HP		
Point of Use 1:	Not Reported	Point of Use 2:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Federal EPA Radon Zone for MARICOPA County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Zip Code: 85236

Number of sites tested: 2

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	1.200 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 1999 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the national Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

ADDITIONAL ENVIRONMENTAL RECORD SOURCES

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: In November 1971 the United States Geological Survey (USGS) implemented a national water resource information tracking system. This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on more than 900,000 wells, springs, and other sources of groundwater.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STATE RECORDS

Arizona Well Registration Database
Source: Department of Water Resources
Telephone: 602-542-1586
Contains information provided to ADWR's Operations Division by well drillers and/or owners.

RADON

Area Radon Information: The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones: Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

APPENDIX B

CHANDLER HEIGHT BASIN ARCHEOLOGICAL INVENTORY REPORT

THE CHANDLER HEIGHTS DETENTION BASIN ARCHEOLOGICAL INVENTORY PROJECT OF EASTERN MARICOPA COUNTY, ARIZONA

James B. Rodgers

Contract Archeological Series 01-8
Scientific Archeological Services

THE CHANDLER HEIGHTS DETENTION BASIN ARCHEOLOGICAL INVENTORY PROJECT OF EASTERN MARICOPA COUNTY, ARIZONA

Arizona State Antiquities Act Permit 2001-10BL

Maricopa County Flood Control District Contract No. 2001C022

Work Assignment No. 2

Prepared and Submitted by:

James B. Rodgers
Scientific Archeological Services
2542 W. Monterey Way
Phoenix, Arizona 85017

Prepared for and Submitted to:

Theresa M. Pinto
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

January 16, 2002

Contract Archeological Series 01-8

ABSTRACT

Under contract with the Flood Control District of Maricopa County, the project sponsor, Scientific Archeological Services has just completed an archeological inventory of a proposed floodwater detention basin in eastern Maricopa County, Arizona. The entirety of the resulting Chandler Heights Detention Basin inventory area is either privately owned or County land, but the planned development there is expected to require the issuance of a Clean Water Act Section 404 Permit from the U.S. Army Corps of Engineers. Overall, therefore, it will formally constitute a Federal undertaking.

The CHDB archeological inventory area occupies 384.40 acres of unincorporated land situated immediately southwest of Gilbert, Arizona, west of the town of Queen Creek, and just northeast of Chandler, Arizona. More specifically, it is bounded by the Roosevelt Water Conservation District Canal on the west, Queen Creek Road on the north, Queen Creek drainage on the east, and Chandler Heights Road on the south. The contiguous USGS 7.5' quadrangle maps of Higley (AZ U:10 SW) and Chandler Heights (AZ U:14 NW), Arizona, locate it in Sec 15 and both the W2 and the NE4 of Sec 22 in T2S, R6E (G&SRB&M).

Two major types of archeological compliance research were completed by SAS during this inventory study. First, archival research included various literature searches and different site record checks. It reveals the former presence of two project sites (AZ U:10:15 ASU and AZ U:10:16 ASU), before they were subsequently destroyed through a series of archeological mitigation work by ASU. Second, two kinds of field surveys were undertaken during December 11-14, 2001: 1) a reconnasisance was made of the 71.70 acres comprising the modern East Maricopa Floodway and an existing FCD sedimentation basin, and 2) an intensive (100%) survey was made of the remaining 312.70 acres that form the project proper. The latter was accomplished by walking 136 linear transects that varied greatly in length (500-2,200 ft) but were never more than 65.6 feet wide. It results in the documentation of two most relevant facts: 1) absolutely no archeological sites but 13 loci of isolated artifacts were found and fully recorded during the SAS fieldwork, and 2) only about 84.04 acres (21.8%) of the entire project area presently exist in an undisturbed natural condition.

MANAGEMENT RECOMMENDATION

Neither of the two archival sites exist any longer, and the 13 isolated artifact loci include only 3 late historic trash dumps, which produced 375 artifacts, and 10 extremely sparse prehistoric loci containing 5 lithic artifacts and 9 sherds. None of those loci even begin to qualify for either State or National Register nomination. Thus, the proposed development will have no effect upon any prehistoric or historic cultural resource property. The Flood Control District should therefore be provided with all appropriate agency authorization for its planned construction of the Chandler Heights Detention Basin southwest of Gilbert, Arizona.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The explicit purpose of this technical management report is to record the nature, methodologies, results, and recommendations of a recent archeological inventory that Scientific Archeological Services (SAS) has recently completed of the Chandler Heights Detention Basin of eastern Maricopa County, Arizona (Figure 1). For clarity sake, SAS considers an archeological inventory to be a listing, description, and evaluation of all prehistoric and historic resources that could be adversely impacted by a city, county, state, or federal undertaking, with undertaking here being defined as any project or activity that could alter the character, condition, or integrity of a significant prehistoric or historic property.

A comprehensive description of the Chandler Heights Detention Basin (CHDB) construction project has already been prepared by the Flood Control District of Maricopa County (Flood Control District or FCD) and included in the project scope of work. Basically, however, it is a proposed floodwater development that is intended to increase the current stormwater capabilities of the East Maricopa Floodway, discussed later, and is to be accomplished by constructing an off-line detention basin between the cities of Gilbert and Chandler, Arizona. Importantly, such construction will necessarily have to impact part of the earthen levee that now parallels the western bank of the Queen Creek drainage, which is an official waterway of the United States, or Federal, government. Prior to building the Chandler Heights Detention Basin, therefore, the Flood Control District will need to formally obtain a Clean Water Act Section 404 Permit from the U.S. Army Corps of Engineers (USACE or Corps). Accordingly, the overall CHDB development will constitute a true Federal undertaking.

The Flood Control District remains the sole sponsor of this archeological inventory project. On September 14, 2001, it requested SAS to prepare a cost estimate for undertaking this particular investigation. That estimate was provided on September 28, 2001, and it was officially accepted on October 12, 2001, when the Flood Control District issued SAS its formal notice to proceed. Since then, all responsibilities of the resulting contract project have been completed according to several explicit provisions of four primary documents: 1) the general project scope of work (Flood Control District of Maricopa County 2001), 2) an on-call SAS archeological contract with Maricopa County (FCD No. 2001C022), 3) Work Assignment No. 2 of that contract, and 4) an unnumbered, non-collection, archeological repository agreement, which was negotiated between SAS and the Arizona State Museum (ASM) on December 11, 2000. Stipulations of all four governing documents are based on a host of requirements that are specified in different pieces of archeological legislation and corresponding procedural guidelines, all of which are cited shortly.

Mr. Paul Stears has been the FCD manager for this project, and Theresa M. Pinto, FCD environmental services planner, has ably assisted him throughout its entirety. The friendly competence of both individuals is greatly appreciated by SAS, for, among several other

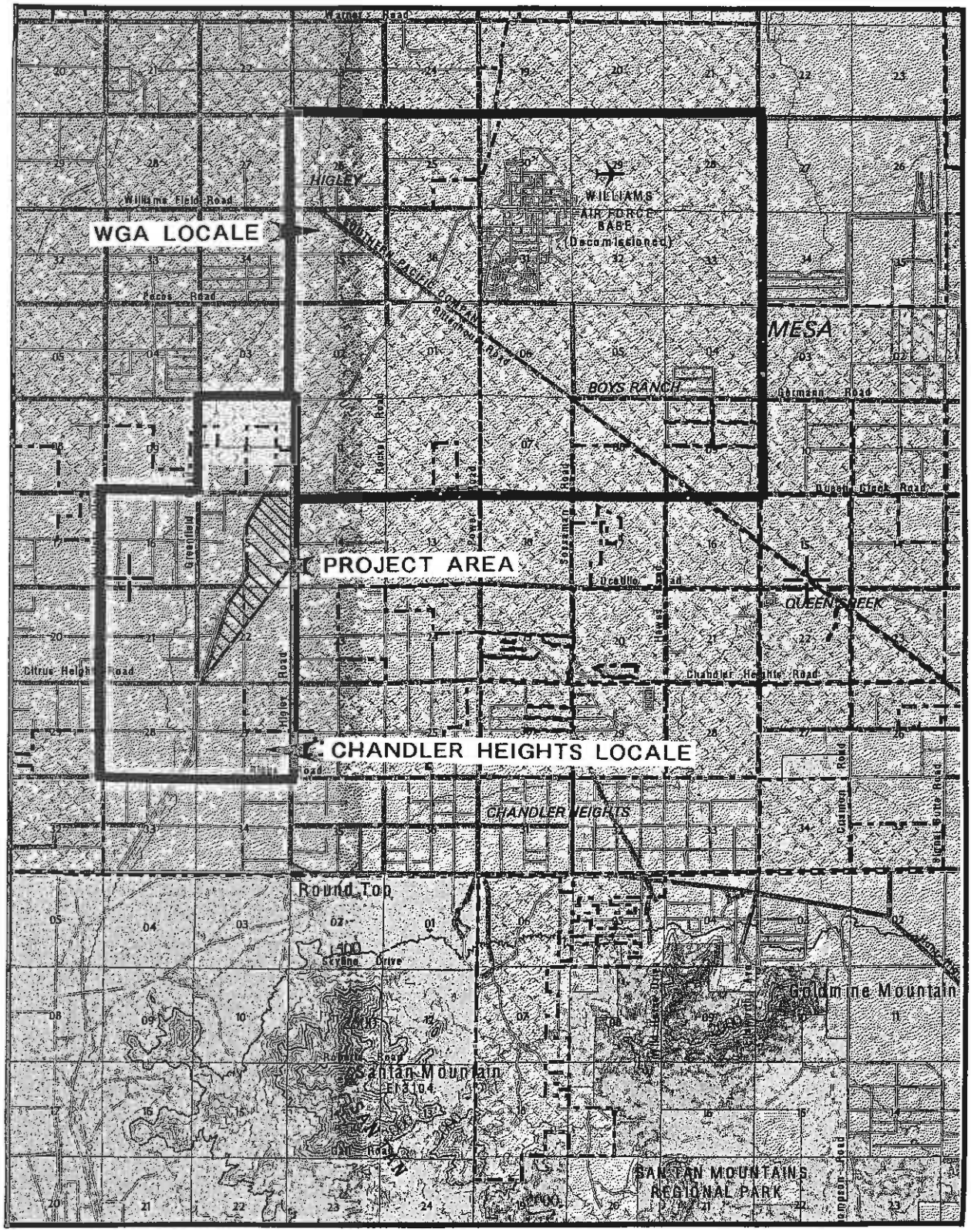


Figure 1. General location of the Chandler Heights Detention Basin archeological inventory area. (based on the Mesa West quadrangle sheet of the 2001 land ownership map of the Arizona State land Department)

things, it has resulted in the successful accomplishment of six major administrative tasks: 1) the preparation of the project scope of work, 2) the expeditious handling of the project work assignment, 3) the provision of different project resource materials, 4) the regular maintenance of all necessary project communication, 5) the review and acceptance of this final project report, and 6) the coordination of certain interagency communication.

Three important kinds of project resource materials were provided to SAS by the Flood Control District. The first one, of course, consisted of the project scope of work (Flood Control District of Maricopa County 2001). The second one was a large-scale (1" = 1000') engineering map showing different vertical and horizontal specifications of the Chandler Heights Detention Basin. The third one was the most valuable and, hereafter, is referred to as the CHDB, or project, Aerial Base Map. Dated December 30, 2000, it is a large-scale (1" = 500'), black-and-white aerial photograph that had been carefully prepared by the Geographic Information System (GIS) Branch of the Flood Control District. Its primary value rests in the fact that it clearly shows all project boundaries, various kinds of modern disturbances within those boundaries, and the location of several natural and artificial features situated inside and immediately outside of them.

As its principal investigator, the author administered all aspects of this archeological project for SAS and was responsible for supervising or actually conducting all of the archival research activities of this inventory. In addition, he and archeologist Dennis J. Grebe completed the project field survey on December 11, 12, 13, and 14, 2001. The varied fiscal, laboratory analysis, and technical support activities of SAS were, as usual, very competently provided during this entire project by both Carol A. Rodgers, SAS laboratory director, and Michelle L. Howe, SAS project clerk.

Finally, three professionals who are totally unaffiliated with SAS and the Flood Control District provided miscellaneous assistance throughout this project. As one of the research technicians for the Archeology Division there, Teresa M. Serrano interacted with SAS and performed certain project specific repository responsibilities for the Arizona State Museum, which is located on campus at the University of Arizona in Tucson, Arizona. Sharon F. Urban, ASM public archeologist, conducted the numerous tasks required of a normal ASM site records check. Finally, SAS archival research activities at the Anthropology Department Archives at Arizona State University (ASU) were greatly facilitated by the cheerful aid of archivist Alex B. Symcox.

LEGISLATIVE BACKGROUND

The impetus of this Chandler Heights Detention Basin archeological inventory project is a prerequisite of both Federal archeological law and the implicit cultural resource compliance policy

of the Flood Control District of Maricopa County. The latter strives to be consistent with, among others, a) the National Historic Preservation Act of 1966, b) the Arizona Antiquities Act of 1960 (Arizona Revised Statute [A.R.S.] Section [§] 41-841 et seq.), and c) the State Historic Preservation Act of 1982 (A.R.S. § 41-861 et seq.). The principal concern of all three laws is the realistic protection of all important resources that might otherwise be impacted or totally destroyed during certain governmental undertakings.

The 1966 National Historic Preservation Act, or Public Law 89-665, expanded the role of the National Register of Historic Places (National Register) and established the Advisory Council on Historic Preservation (Advisory Council). The National Register is an official listing of cultural resources formally determined to be significant in American history, architecture, archeology, or culture. The criteria for National Register eligibility are essentially the same as those of the Arizona Register of Historic Places (Arizona Register). They were developed in 1976 by the National Park Service (1999) and are included in 36 CFR 60. The Advisory Council has been authorized to coordinate all national historic preservation activities, and its archeological compliance procedures were recently updated, on May 18, 1999, in 36 CFR 800 (Advisory Council on Historic Preservation 1999). Other guidelines and technical advice for undertaking a variety of preservation activities have also been developed by both the National Park Service (1983) and, importantly, the U.S. Army Corps of Engineers (1999).

The Arizona Antiquities Act established the Arizona State Museum as the prime archeological permitting agency in Arizona (State), and the various mandatory procedures for complying with the provisions of archeological contract permits have been recently updated by the Arizona Board of Regents (1991) and the Arizona State Museum (1994). Later, the State Historic Preservation Act clarified some of the major responsibilities of the State Historic Preservation Officer (SHPO). Among others, those responsibilities require the SHPO to a) advise, assist and monitor Federal, state and other municipal agencies as they seek to perform their historic preservation duties and b) ensure that prehistoric and historic properties are effectively considered during all levels of project planning and development. The variability and minimal quantities of archeological materials necessary for designating prehistoric or historic sites per se have been established by the Arizona State Museum (1993; Fish 1994).

PROJECT OBJECTIVE AND GOALS

Given the nature, location, and legal jurisdiction of the proposed undertaking, the primary purpose of this CHDB inventory study has been to assist the Flood Control District of Maricopa County, the State Historic Preservation Officer, the Arizona State Museum, and the U.S. Army Corps of Engineers with their respective compliance responsibilities of the above legislation and corresponding

compliance guidelines. Thus, this overall project objective could have required SAS to achieve any or all of the following eight project goals:

1. Represent the FCD during all interagency meetings held in conjunction with this particular archeological study.

2. Define the nature and area of potential adverse effect of the proposed undertaking.

3. Identify all prehistoric and historic resources that could be affected by it.

4. Report the occurrence of all Indian burial remains and funerary objects encountered during the project survey.

5. Evaluate the potential archeological significance of all encountered prehistoric and historic project resources.

6. Assess the nature of effects that the project undertaking might have upon all significant cultural resources.

7. Recommend realistic alternative measures for alleviating, or mitigating, all adverse effects of the proposed undertaking.

8. Document all relevant information pertaining to the nature, activities, results, and recommendations of this archeological study.

ENVIRONMENTAL SETTING

Figure 1 was based on the Mesa West quadrangle sheet of the "Arizona Surface Management Responsibility Map," which the Arizona State Land Department last updated on February 10, 2001. It should thus have served several useful purposes. Primarily, though, it has indicated that the CHDB project area contains no lands of either the state of Arizona (State), the U.S. Bureau of Land Management (BLM), or any reservation of Native Americans. However, the eastern project boundary does coincide with a western part of the Queen Creek drainage, or Queen Creek Wash (Figure 2), which is an official United States waterway and, thus, is regulated by the U.S. Army Corps of Engineers.

Figure 1 has also provided a geographic view of the general area surrounding the CHDB project area. Accordingly, this latter area occurs in eastern Maricopa County and is situated northwest of the rural agricultural community of Chandler Heights, northeast of the city of Chandler, Arizona, west of the unincorporated town of Queen Creek, and immediately southwest of both SAS's Williams Gateway Airport (WGA) Locale (Rodgers 2001a:8) and the city of Gilbert, Arizona. Further, it occurs northwest of the northern Santan Mountain part of the Santan Mountains range, about 10 miles

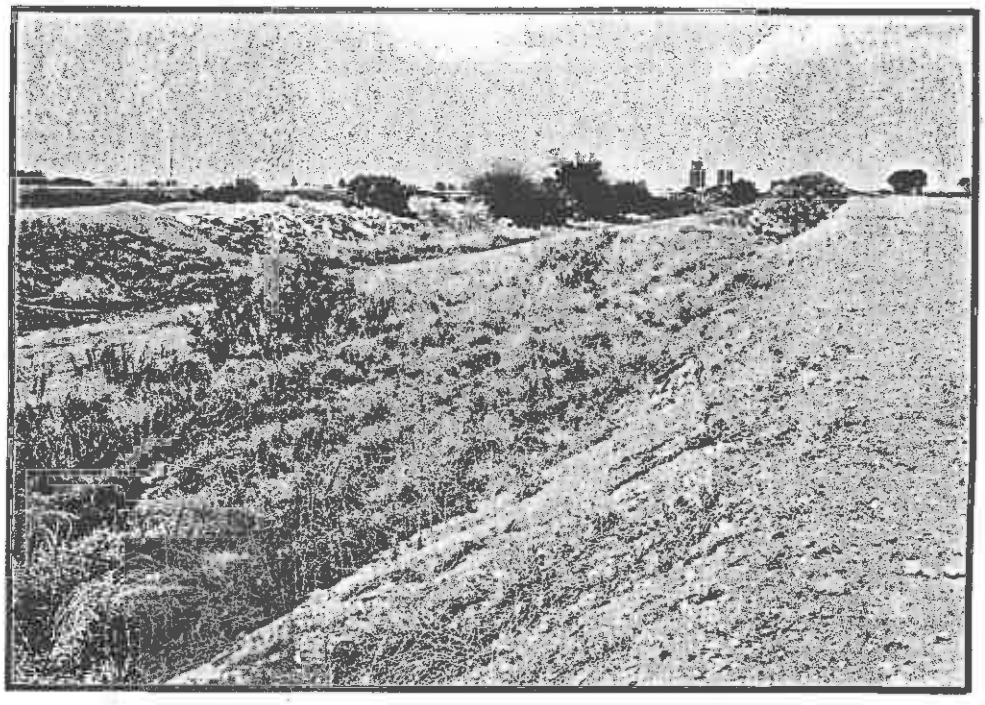


Figure 2. Queen Creek Wash, looking north along Higley Road.

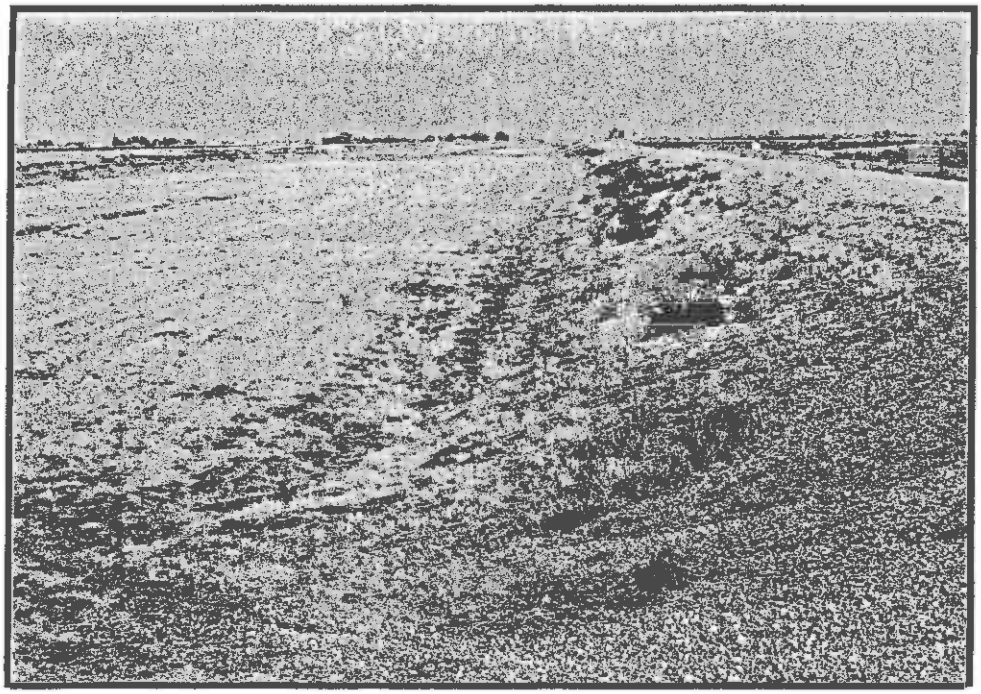


Figure 3. East Maricopa Floodway, looking north from just north of Chandler Heights Road.

north of the Gila River, nearly 8.5 miles south of the Superstition Freeway (a local segment of U.S. Highway 60), and only 2.0 miles north of the coincidental alignment of Maricopa and Pinal counties, which is also a northern boundary of the Gila River Indian Reservation (GRIR).

The CHDB project area is also located in the northern part of an arbitrarily defined archeological research locality that SAS (Rodgers 2001b:5-6) has previously designated as the Chandler Heights Locale. As slightly expanded here, this locality is irregular in shape. Encompassing 9.0 square miles, it extends 2.0 miles eastward from Val Vista Drive to Higley Road and 5.0 miles southward from Germann Road to Hunt Highway. Two important linear waterworks exist within this locale, and both are water diversion channels that parallel each other as they flow in a general southwesterly direction. The first and western one is the Roosevelt Water Conservation District (RWCD) Canal or, more popularly, the Roosevelt Canal. The second one is the East Maricopa Floodway (EMF): an existing flood control facility of the Maricopa County Flood Control District that was originally designed and built by the U.S. Soil Conservation Service, presently the U.S. Natural Resources Conservation Service (NRCS). Significantly, it was then named the Roosevelt Water Conservation District Floodway.

Environmentally, the Chandler Heights Locale is situated within a southern part of the alluvial mouth, or delta, of Queen Creek Wash. Significant, too, is the fact that this Queen Creek drainage is a tributary of neither the Salt nor the Gila rivers, and even its intermittent flow has recently been blocked by construction of Whitlow Ranch Dam. Historically, this drainage originated north of Picket Post Mountain, which is located near Superior in northeastern Pinal County. It then flowed generally westward, passing just south of the Superstition Mountains and north of Florence Junction, and it eventually debouches north of Santan Mountain. Sonoqui Wash enters Queen Creek near the intersection of Higley Road and Ocotillo Road. It originates along the northern slopes of Goldmine Mountain, which is located east of Santan Mountain, and then flows generally westward.

Péwé (1978:1) reports that the Queen Creek delta region constitutes only one in a series of individual troughs that, collectively, comprise the larger and much more complex Phoenix Basin, an integral topographic and structural component of the Sonoran Desert section of the Basin and Range Physiographic Province (Fenneman 1946). In general, it is characterized as a vast desert plain of deep unconsolidated Quaternary sediments and widely scattered buttes, hills, and low mountains (Kamilli and Richard 1998). The numerous soils of the Queen Creek delta region have been intensively examined, thoroughly studied, carefully described, and actually mapped by the NRCS (Adams 1974).

Provisionally, at least, SAS interprets the above edaphic, geologic, and geomorphologic data as suggesting that the Chandler Heights Locale consists of only two major environmental zones: 1) the Queen Creek floodplain and 2) a geologically older alluvial

fan. Both zones typically contain sediments of the Quaternary period and both slope generally westward. The various soils there support indigenous fauna of the Sonoran Biotic province (Dice 1939) and indigenous flora of the Lower Colorado subdivision of the Sonoran Desertscrub (Brown 1973; Lowe 1964).

Figure 4 is a composite map that is based on two contiguous 7.5' quadrangle maps that the U.S. Geological Survey (USGS) first prepared in 1956. The northern of the two is titled Higley, Arizona, and was photorevised in 1981. The southern one is of Chandler Heights, Arizona, and was photorevised in 1973. These same two maps have been designated by the ASM as AZ U:10 SW and AZ U:14 NW. Throughout this report they are simply referred to as the project quad maps. They are especially valuable for indicating that the CHDB project area is irregular plan and that its nearly level, natural surface originally descended gradually westward from about 1,319 feet to only 1,310 feet above sea level. In reference to the Gila and Salt River Baseline and Meridian (G&SRB&M), this project area is located totally within Section (Sec) 15 and the western one-half (W2) and the northeastern one-quarter (NE4) of Sec 22 in Township 2 South and Range 6 East (T2S,R6E).

Additionally, Figure 4 has provided a detailed glimpse of the roughly 8.5-square-mile area that immediately surrounds the actual CHDB project area. Throughout the remainder of this report, this particular area is referred to as the general project vicinity. Figure 4 thus illustrates that the CHDB project area is immediately bounded by Queen Creek Road on the north, Higley Road on the east, Chandler Heights Road on the south, and the RWCD Canal on the west. Ocotillo Road occurs midway between Queen Creek and Chandler Heights roads, Greenfield Road occurs 1.0 mile west of Higley Road, and Riggs Road occurs 1.0 miles south of Chandler Heights Road. Parenthetically, Queen Creek Road was formerly known as Santan Road, Chandler Heights Road was originally termed Citrus Heights Road, Ocotillo Road was once known as Rittenhouse Road, and Riggs Road originated as Superstition Road.

Figure 5 is based on the previously defined CHDB Aerial Base Map and is included here to provide the most detailed view of the concerned archeological inventory area. In overview, this area is composed of five contiguous parcels that are simply designated Parcel A through E. Parcels A, B, and C comprise a total of 77.35 acres that are owned by Maricopa County (County). Parcel A is the largest of the three and coincides with the section of the East Maricopa Floodway occurring immediately east of the RWCD Canal and between Queen Creek Road and Chandler Heights Road. Flowing about 2.1 miles southwestward and measuring about 240 feet wide, it alone occupies 62.2 acres. Parcel B occurs just east of the EMF and just north of undeveloped Appleby Road. It is presently a County equipment and materials maintenance yard that, measuring a maximum of 630 feet long and 500 feet wide, includes 5.65 acres. Situated much farther south, Parcel C is located immediately east of the EMF and just northeast of the intesection of Greenfield Road and Chandler Heights Road. This recent construction area now functions as a small (9.50 ac) sedimentation basin of the Flood Control District.

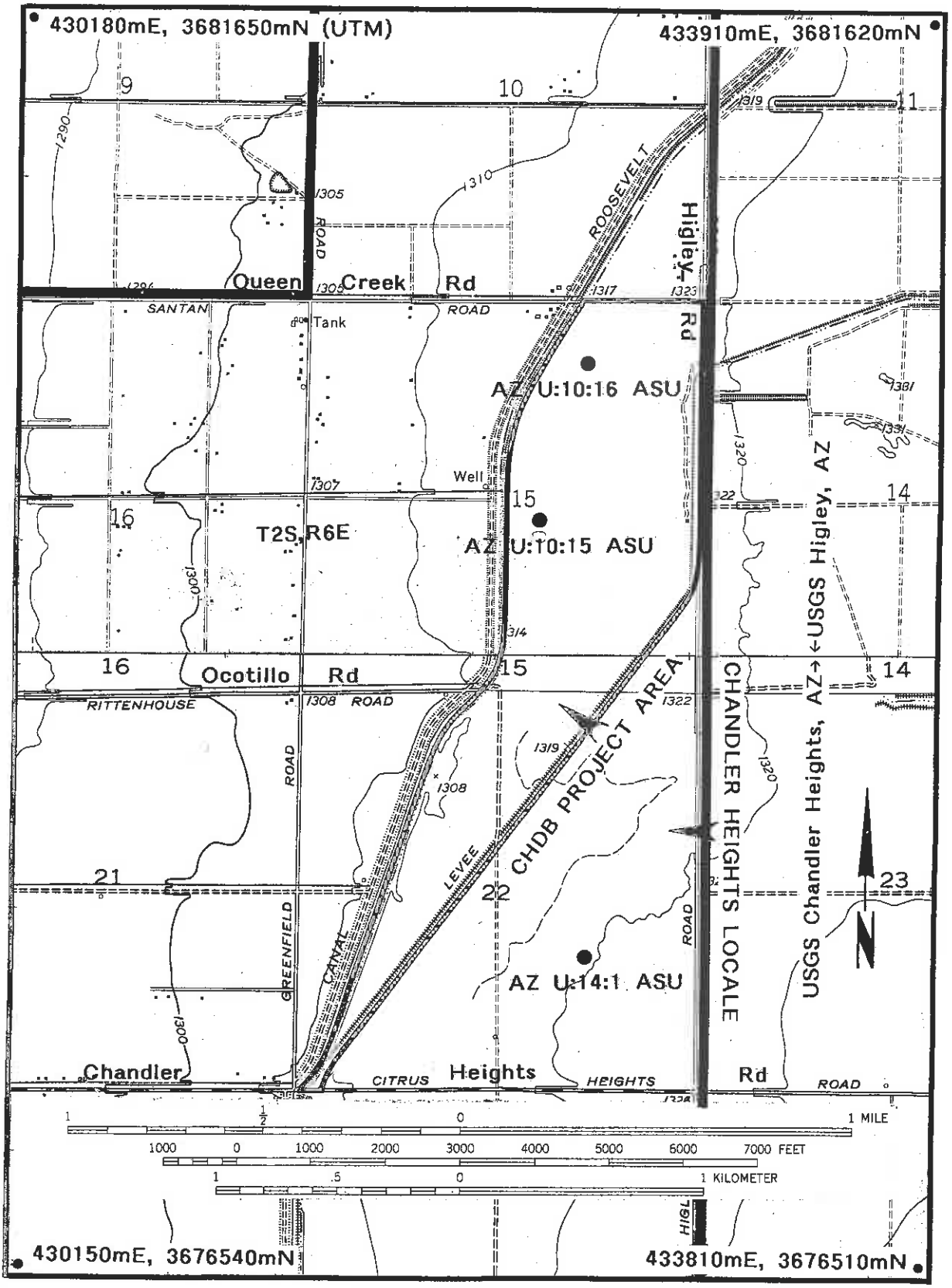


Figure 4. Detailed location of the CHDB archeological inventory area in the Chandler Heights Locale. (Based on the USGS 7.5' quadrangle maps of Higley and Chandler Heights, Arizona)

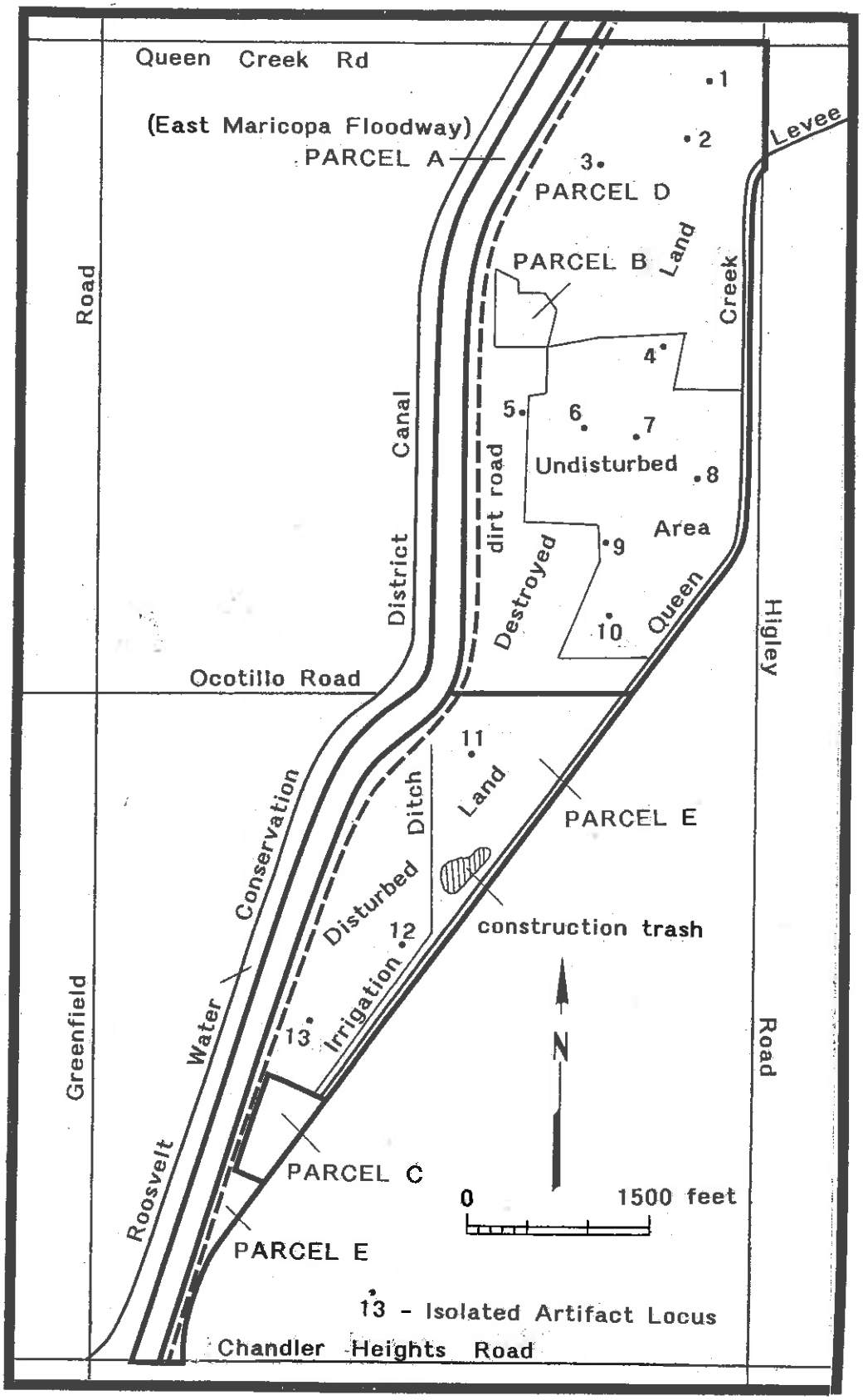


Figure 5. Detailed plan of the five contiguous parcels comprising the CHDB archeological inventory area.

Parcels D and E form the project area proper and consist entirely of private property. Parcel D is, by far, the larger one and includes the remaining 220.15 acres occurring east of the EMF, south of Queen Creek Road, west of Higley Road and Queen Creek Wash, and north of undeveloped Ocotillo Road. Parcel E includes the 86.9 acres situated immediately south of Parcel D, west of Queen Creek Wash, north of Chandler Heights Road, and east of the EMF.

Field observations by SAS strongly suggest that all five of the above project parcels probably coincide with parts of only one of the two environmental zones that characterize the surrounding Chandler Heights Locale. More specifically, Parcels A, B, C, D, and E are all believed to have once formed a western part of the Queen Creek floodplain. Confirmation of this hypothesis is presently precluded, however, by the fact that most of the present project area has been disturbed or totally destroyed by several land altering activities (Figure 6 and 7), all of which are discussed later. At any rate, archival data (Adams 1974: Sheet 30, 33, 34) indicate that the five major soils of this area include a Mohall loam, Mohall sandy loam, Estrella loam, Gilman fine sandy loam, and especially a Gilman loam. Having nearly level surfaces, all five soils typically slope less than one percent and have been formed in mixed alluvium that has been derived from both basic and acidic igneous rocks.

Quite understandably, therefore, only one part of the project area was found to exist in a natural state. That single "undisturbed area" consists of about 84.04 acres, and Figure 5 has accurately delimited its boundary within the greater southern part of Parcel D. Gilman loam is the exclusive soil there, and, currently, it primarily supports an indigenous floral community that is dominated by creosote bushes (*Larrea tridentata*) and different annual grasses but also contains some scattered mesquite trees (*Prosopis velutina*), miscellaneous weeds, and even a few isolated large bushes of crucifixion thorn (*Castela emoryi*) (Figure 8). Otherwise, major project vegetation exists only along Queen Creek Wash itself. Relevant plants there are definitely not limited to a variable mixture of, for example, mesquite, yellow paloverde (*Cercidium microphyllum*), and desert willow (*Chilopsis linearis*) trees, tomatillo (*Lycium andersonii*), desert broom (*Baccharis sarothroides*), numerous weeds, and salt cedar (*Tamarix pentandra*) shrubs.

Correspondingly, faunal species were relatively rare across the CHDB project area. Other than the occurrence of numerous unidentified lizards, in fact, avifauna were most common and were easily identified as mourning dove (*Zenaidura macroura*), several juvenile red-tailed hawks (*Buteo jamaicensis*), and one roadrunner (*Geococcyx californianus*). Mammals were extremely scarce, with only one jackrabbit (*Lepus californicus*) having been seen across the project area proper and a few cottontail rabbits (*Sylvilagus audubonii*) actually observed along Queen Creek Wash.

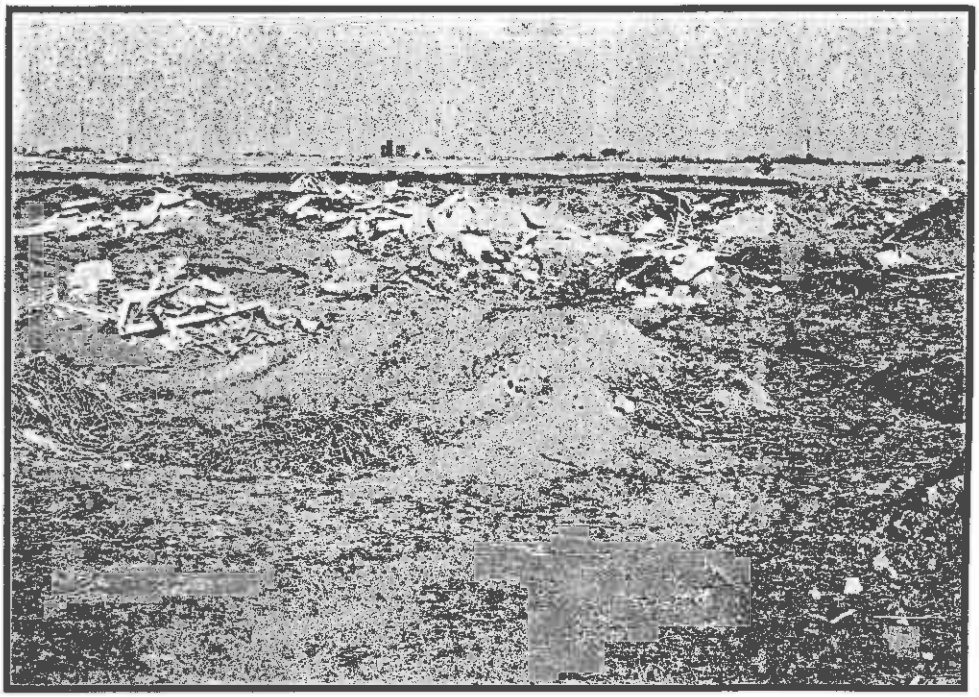


Figure 6. Modern dump of construction trash located in the northern part of project Parcel D.

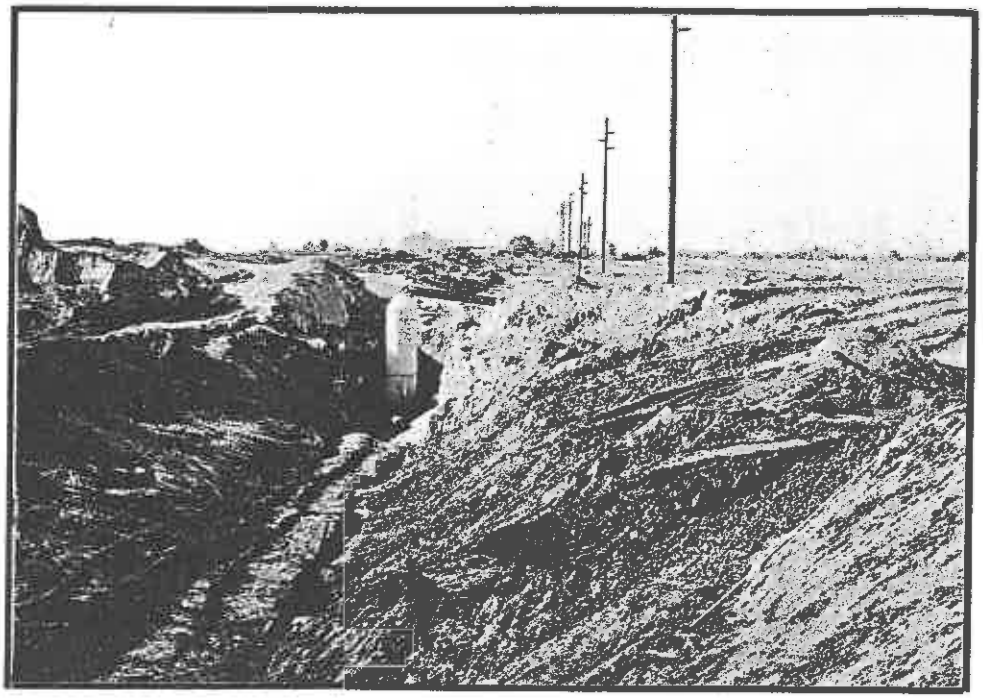


Figure 7. Large underground pipeline being completed along the co-incidental boundary of project Parcels D and E, looking westward.

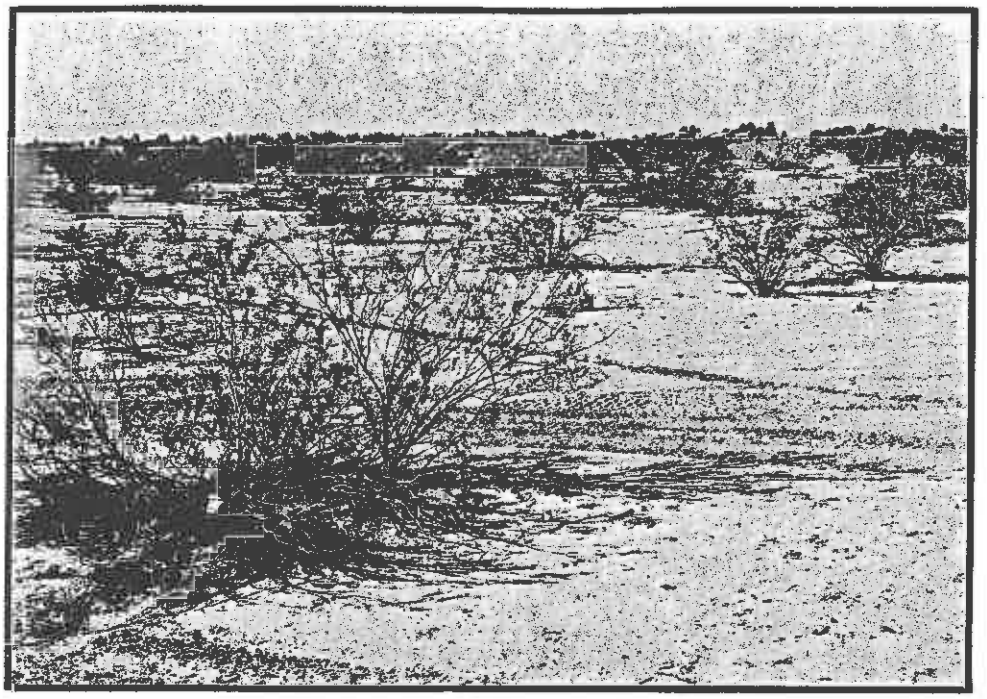


Figure 8. Undisturbed creosote community of project Parcel D.

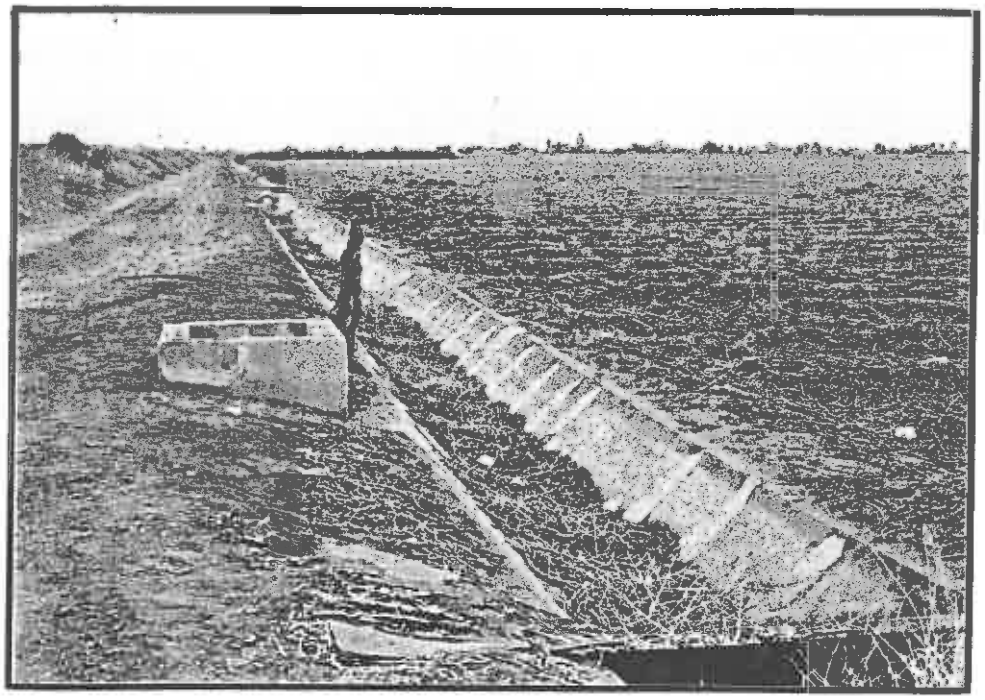


Figure 9. Detail of modern irrigation ditch and adjacent water inlet box in the central part of project Parcel E, looking southwestward.

PROJECT METHODOLOGIES

The eight different explicit goals of this archeological study have all been accomplished by successfully completing numerous minor tasks and several major activities that were undertaken during five concurrent or immediately successive phases. Major responsibilities of those phases correspondingly included much project administration, archival research, fieldwork, laboratory analysis, and reporting. Relevant aspects of each phase, as well as their results, have already been documented by the project director in his Summary Project Journal (SAS Form 210). The three most critical phases involved various archival research, fieldwork, and laboratory analysis activities and, thus, major procedural aspects of each one are elaborated here.

Unless stated otherwise, SAS performed all of its project activities according to the professional standards, recommendations, and procedural guidelines that have been established by not only the Arizona Board of Regents (1991), the Arizona State Museum (1994, 1999), and the State Historic Preservation Office (1999), but the national archeological community (McGimsey and Davis 1977) and also certain Federal agencies: in particular, the National Park Service (1983), the Advisory Council on Historic Preservation (1999), and, of course, the U.S. Army Corps of Engineers (1999). In addition, the significance of all project resources were to have been evaluated according to their individual potential for being eligible for nomination to the National Register of Historic Places. Again, the eligibility criteria of this Register were originally established by the National Park Service (1999), in 1976, and are presented in 36 CFR 60.

Archival Research Phase

Scientific Archeological Services completed two principal types of archival research during this CHDB archeological investigation: a comprehensive literature search and a thorough records check. The primary purpose of the literature search was to obtain published information pertaining to both the local environment and its documented archeological record. In contrast, different record checks were conducted in order to locate and evaluate various sources of unpublished data (e.g., maps, site files, photographs, records, etc.) concerning all previous cultural resource projects and all prehistoric and historic sites previously located and recorded in or near the defined project area.

This first critical phase actually began on September 27, 2001. Later, on November 2, 2001, SAS formally requested the Arizona State Museum to provide all relevant information that it then possessed concerning all prior research projects and all resulting archeological sites occurring in the northern part of the recently expanded Chandler Heights Locale. For clarification, this locality now includes all nine square miles occupying Sec 10, 15, 16, 21, 22, 27, 28, 33, and 34 of T2S,R6E. All activities of the

requested ASM site records check were performed, or directly supervised, by Sharon F. Urban, ASM public archeologist, and all of them of them had been completed as of November 23, 2001.

The author later completed other site record checks at the Public Records Room of the Arizona State Office of the U.S. Bureau of Land Management, the reference library of the Arizona State Preservation Office, and the Anthropology Department Archives at ASU. Literature searches were undertaken throughout the entire course of this inventory at the following research facilities of the greater Phoenix metropolitan area: 1) the Flood Control District of Maricopa County, 2) Scientific Archeological Services, 3) the Arizona Room of Phoenix's Burton Barr Central Library, 4) the Heard Museum Library and Archives, 5) the ASU Anthropology Department Archives, and 6) the Natural Resources Conservation Service.

Fieldwork Phase

In marked contrast to a reconnaissance, or incomplete, survey, an intensive survey, is the only type of field examination that suitably fulfills the professional requirements of an archeological inventory. McGimsey and Davis (1977:113), for example, has specifically considered it to be "a comprehensive and extended physical examination of a study area for the purpose of obtaining reliable data on all cultural resources and associated environmental variables." In paraphrase, the National Park Service (1983:44739) similarly considers such a survey to be a systematic examination of an area in order to gather cultural resource information that is appropriate and sufficient for evaluating their archeological significance.

According to its standard operating procedures, SAS conscientiously strove to intensively survey the entirety (100%) of all potential archeological surfaces existing within the defined CHDB project area. That survey was undertaken and completed by the author and archeologist Dennis J. Grebe during December 11-14, 2001. It resulted in the walking of 136 individual transects, or 68 crew swaths, which were simply pairs of parallel, individual transects that were walked by the two-man field crew. Those transects varied from 500 feet to 2,200 feet long. Otherwise, though, they were always contiguous, linear alignments, and none of them was ever any more than 20 m (65.6 ft) wide. Further, the resulting 68 crew swaths shared several identical characteristics: 1) each one was assigned a consecutive numerical designation (No. 1-68), 2) each was carefully plotted on the Project Aerial Base Map, 3) all but two of them were oriented along a true east-west axis, and, whenever necessary, 4) the leading edge of each one was intermittently marked with flagging tape, which was subsequently removed while walking its return, or reverse, transect.

The accurate location, orientation and spacing of all crew swaths were all very easily maintained through the rather regular SAS use of: 1) a tripoded Brunton pocket transit, properly adjusted to read bearings consistently in reference to true north, 2) a one

hundred meter tape, 3) an SAS field copy of the two previously defined project quadrangle maps, and, most importantly, 4) an original version of the CHDB Aerial Base Map. Once again, that base map was a large-scale (1" = 500') aerial photograph that clearly delineated all relevant project boundaries and accurately illustrated the location of several pertinent natural and man-made features occurring inside and immediately outside of those boundaries.

According to provisions of the governing SAS-ASM curatorial agreement, only exceptionally rare or significant artifacts were to have been collected or removed from the field. During their survey, however, the two field archeologists were prepared and properly equipped to designate, measure, photograph, and record several categories of surface cultural resources. In decreasing size and order of potential significance, those resources could have included: 1) prehistoric or historic archeological sites, as differentiated below, 2) intrasite components, 3) intracomponent features, and 4) isolated artifact loci. All meaningful field data were to have been entered into the single project journal (SAS Form 210) and, whenever critical to do so, all observed plants and animals were suppose to have been identified and appropriately listed using a Biotic Resource Variability Sheet (SAS Form 303). Those identifications were to have been greatly facilitated by using the descriptions and taxonomic classifications provided by Lowe (1964) and Epple (1995).

To eliminate any possible confusion later, SAS generally considers an archeological site to include any geographic space that was utilized by man, and the different minimal criteria for actually defining a site per se have already been established by the ASM (Fish 1994). Further, all noncontemporary cultural resources of Arizona can be assigned to either of three gross time periods, or chronological eras: the prehistoric, the protohistoric, and the historic. Regionally speaking, prehistoric sites normally predate A.D. 1450, protohistoric sites usually date between circa A.D. 1450 and 1534, and historic sites most often span the interval between 1534 and 1951, the beginning of contemporary, or modern, times. Also, the historic era in Arizona is commonly divided into the Spanish (1534-1821), Mexican (1821-1848), and Anglo-American (1848-1951), or simply American, periods. Finally, the Spanish period is sometimes subdivided into earlier Spanish Exploration (1534-1690) and later Spanish Colonial (1690-1821) times; whereas the Anglo-American period has been subdivided into the Pre-Territorial (1848-1863), Territorial (1863-1912), and Statehood (1912-1951) phases.

An official ASM designation was to have been assigned to every newly found prehistoric or historic site of this project, as well as to any previously recorded archival project site that still exists but had not yet received such a designation from the ASM. All appropriate ASM site records were to be filled out for every new site, of course, with standard procedures for doing so having already been formulated by the Arizona State Museum (1993). While no extensive mapping was expected to occur, further site documentation was to be achieved by photographing all important environmental, prehistoric, and historic archeological features.

Finally, SAS considers an isolated artifact locus (IAL) as a non-site archeological manifestation that is most commonly represented by a single prehistoric or historic specimen or a sparse and spatially distinct locus of such specimens that are known or believed to predate 1951. As such, an IAL of SAS is similar to, but yet significantly different from, other entities that are variously defined by other research institutions as, for example, isolated finds or isolated occurrences. A large area, or associated group, of isolated artifact loci is further considered to form a field of isolated artifacts or, simply, an "isolate field."

The recording of isolated artifact loci is currently a specific requirement of neither Maricopa County, the State, nor the U.S. Army Corps of Engineers. Nonetheless, basic descriptive data from each IAL of this CHDB inventory project were to have been obtained using SAS Form 315. That Isolated Artifactual Locus Data Sheet considers several kinds of administrative, provenience, environmental, and strictly archeological variables, or analytic observations. It also recognizes the existence of three mutually exclusive types of IALs: single, double, and multiple; depending upon the quantity of artifacts observed and recorded at each one. For greater ease in referencing, all IALs of this inventory were also to have received consecutive numerical designations, and their accurate locations were to have been carefully plotted on the Project Aerial Base Map. The cursory field analysis of every isolated artifact, or isolate, was to consider, among other things, its functional or typological classification, condition, and measurement. Finally, all prehistoric isolates were to have been identified and classified according to common Southwestern archeological terms and definitions.

Laboratory Analysis Phase

Due to the non-collection limitation of this archeological inventory, no major artifact analyses were expected to occur during this particular investigation. Thus, most of the laboratory analysis time was spent analyzing and interpreting the different field and archival research data. The remainder of that time was used to finalize the project journal and process all project maps, archeological data sheets, records, etc. for their eventual curation by the Arizona State Museum. The SAS procedures for accomplishing such curatorial processing responsibilities are the same as those officially formulated by the ASM (Young 1988).

ARCHIVAL RESEARCH RESULTS

No single overview presently exists concerning both the history and the prehistory of the entire Queen Creek delta region. Much archeological research has been undertaken within the Williams Gateway Airport and Chandler Heights archeological research locales, however, and the results of three particular SAS projects (Rodgers 1997, 2001a, 2001b) there are most heavily relied upon here for the following discussion.

Accordingly, the general archeological record of the Queen Creek delta may someday prove to have begun more than 11,500 years ago. Presently, though, the Chandler Heights Locale itself is not known conclusively to contain any sites of either early Paleo-Indian (>10,000-8000 B.C.) peoples or the succeeding Archaic Indians (7500-200 B.C.). Also interesting is the fact that ruins of the later Hohokam Indians are, quite surprisingly, relatively rare across this particular locale.

Hohokam designates the predominant prehistoric culture of all southern Arizona (Haury 1976; Gumerman and Haury 1979; McGuire and Schiffer 1982; Gumerman 1991), and the Hohokam Indians are generally believed to be the ancestors of both the modern *Akimel O'odham* ("river people") and the *Tohono O'odham* ("desert people"), formerly known respectively as the Pima and Papago. Characteristically, the Hohokam were agriculturalists who employed intricate systems of both canal irrigation and floodwater farming. Their cultivated foods were heavily supplemented, though, by the hunting of game, possible horticulture, and the collecting, gathering and processing of numerous native plant foods. Much Hohokam rock art was produced, whenever possible, and cremation was the typical, albeit not the exclusive, pattern of human burial. Quite understandably, Hohokam architecture varied greatly through time, with domestic habitations not being limited to subsurface pithouses; semisubterranean, masonry-footed, and adobe-walled structures, and large compounds built of adobe and rock. Public, or monumental, architecture of the Hohokam includes large ballcourts and raised platform mounds, both of which may have been associated, at least indirectly, with certain unknown religious activities. Several types of interfamily settlements have thus been recognized and, from smaller to larger, have been defined as farmsteads, hamlets, and villages. The Hohokam were very skilled artisans and produced a great quantity and variety of utilitarian and ceremonial items that were fashioned from bone, clay, stone, and both local and marine shell.

The chronology of the Hohokam culture is presently a critical issue of much professional debate (Dean 1991). Traditionally, at least, it is most commonly divided into four main periods (i.e., Pioneer, Colonial, Sedentary, and Classic) and a series of nine sequent phases. The Pioneer is one of the two most controversial periods, and may date A.D. 300-800 and include the Vahki, Estrella, Sweetwater, and Snaketown phases. The Colonial period is better known and consists of the Gila Butte (A.D. 800-900) and Santa Cruz (A.D. 900-1000) phases. The A.D. 1000-1200 Sedentary period coincides with the Sacaton phase. The final Classic period is composed of the Soho (A.D. 1200-1300) and Civano (A.D. 1300-1450).

Parenthetically, two other cultural phase assignments should, perhaps, be introduced here, too, even though neither one of them has yet received full acceptance and use by the professional archeological community. The first one, or "Red Mountain," was originally proffered by Morris (1969) as a transitional phase occurring between the cultural development of the Archaic and Hohokam Indians. Much later, Sires (1984) advanced the "Polvorón" phase to account for the final expression of the Hohokam Classic period, at

least as it is believed by some to have taken place in parts of northwestern Pinal County.

Only three prehistoric sites are presently known to exist within the Chandler Heights Locale, and all three are believed to have been first recorded during a 1963-65 reconnaissance survey that ASU undertook according to provisions of National Science Foundation Grant No. GS-237. Unfortunately, though, no detailed desciption of either site was ever provided by Ruppé (1966) in his final survey report. Original information pertaining to all three sites is therefore limited to unpublished field data (Ives and Opfenring 1964) that continue to be curated at the ASU Anthropology Department Archives.

The three concerned prehistoric archival sites have been officially designated as AZ U:10:15 ASU, AZ U:10:16 ASU, and AZ U:14:1 ASU. Figure 4 has already indicated that the first two sites occur inside the USGS 7.5' quadrangle of Higley, Arizona; the third one similarly occurs in the 7.5' quadrangle of Chandler Heights, Arizona. More precisely, AZ U:14:1 ASU was initially recorded as occurring just northwest of the intersection of Higley Road and Chandler Heights Road, a general area that has since been totally destroyed by rural agricultural development. Archeologically, AZ U:14:1 ASU, AZ U:10:15 ASU, and AZ U:10:16 ASU are all Hohokam sites. However, AZ U:14:1 ASU is presently known to have been only a relatively small (300 feet square) and very shallow scatter of mainly undiagnostic lithic artifacts and pottery sherds. The few decorated ceramics there suggested that it was used sometime during the transition of the Santa Cruz and Sacaton phases, or perhaps A.D. 950-1050.

The two remaining archival sites are much more important, for both were originally located in an area that has since been defined herein as Parcel D of the present CHDB inventory area. Both sites were later encountered during a 1974-75 reconnaissance survey and were then recorded by ASU (Rodgers 1975:7) as occurring outside and no closer than 60 m from the eastern boundary of the RWCD Floodway Project. Measuring less than 80 m in diameter, both sites were considered to be sparse artifact scatters, and neither one possessed any surface architectural features. While AZ U:10:15 ASU was tentatively assigned to the late Colonial-Sedentary period transition of circa A.D. 1000, AZ U:10:16 ASU was believed to date mainly to late Sacaton times of, perhaps, A.D. 1100-1200.

In December 1975, ASU revisited both AZ U:10:15 and 16 ASU, for both sites were situated within one of 13 tracts at which the former U.S. Soil Conservation Service planned to dispose of spoil obtained from the adjacent RWCD Floodway, or modern East Maricopa Floodway. As reported by Rosenberg (1976:3, 5), AZ U:10:15 ASU measured 50 m in diameter, was located adjacent to a large natural mound, and was considered a possible habitation or seasonal food collecting site. Arizona U:10:16 ASU occurred farther north, along a gravel ridge, and was thought tohave possibly been a Hohokam habitation. It was characterized by three distinct artifact concentrations that encompassed a total area measuring 75 m north-

south and 65 m east-west. Significantly, ASU recommended that neither site should be impacted without first having completed an acceptable program of site mitigation work.

That mitigation program eventually consisted of two major studies, which were undertaken and successfully completed by the ASU Office of Cultural Resource Management. The first one began in 1978 and included test excavations, pollen sampling, and artifact collection. As fully documented by Rafferty (1978), fieldwork at AZ U:10:15 ASU involved the excavation of two test units and the complete collection of all site surface artifacts (n=47). At AZ U:10:16 ASU, two additional test units were excavated, and 49 specimens were obtained from a five percent sample of its surface artifacts. The analytic results of all such work was later summarized and evaluated in the final report of the Roosevelt Water Conservation District Floodway Project (Rice et al. 1979). Essentially, it recommended that no further mitigation work was needed at AZ U:10:15 (ASU), but further work was recommended for AZ U:10:16 ASU.

That second study began in 1979, and all aspects of it are detailed by Swarthout and Blank-Roper (1984). Accordingly, the principal field activity at AZ U:10:16 ASU consisted of the complete collection of all surface artifacts, which resulted in obtaining an additional 175 sherds and 2 lithic items. As such, this third and final archival site was interpreted as only a temporary locus of unknown Hohokam activity that probably occurred sometime during the Soho phase (A.D. 1200-1300), or early part, of the Classic period.

The protohistoric era typically designates the transition between prehistoric and historic times and, once again, it most commonly dates between A.D. 1450 and 1534. Different investigators rely on different criteria to define this period, however, resulting, understandably, in the fact that a wide variety of dates have been attributed to it (Gilpin and Phillips 1999). Across the lower, southern Salt River and Gila River valleys, this period is most often represented by an array of habitation and economic subsistence activities that are believed to have been undertaken by either of only two Native American groups: the *Akimel O'odham* and the *Pee Posh* ("the people"), who are much better known as the former Maricopa Indians.

The Pima Indians, as well as the *Tohono O'odham*, their Papago relatives to the south, are generally considered to be descendants of the Hohokam. They were sedentary agriculturalists who inhabited riverine reaches of especially the Santa Cruz, Gila, and Salt rivers (Russell 1975; Ezell 1983). In marked contrast, the ancestry of the Maricopa remains an issue of some heated professional debate, but they are probably related to certain Lower Colorado Yumans. As originally studied by Spier (1933) and later by Castetter and Bell (1951), the Maricopa Indians historically lived in settlements situated along the Gila River and its tributaries. There they cremated their dead and relied upon floodwater farming to raise not only corn, beans, and squash, but also wheat and cotton (Harwell and Kelly 1983).

The final historic era of the concerned Chandler Heights Locale is dominated by two major research topics, or cultural themes, of critical significance: 1) Native American development and 2) farming. Important geographic aspects of both topics are summarized by Granger (1960: 179, 182). As such, the former dates to the later part of the Pre-Territorial phase (1848-1863) of the American period and relates to different groups of both Pima and Maricopa that comprise the Gila River Indian Community living on the Gila River Indian Reservation (GRIR). This reservation was originally established by an Act of Congress in 1859, and it has since grown to roughly 372,000 acres.

Local farming has been a big business enterprise ever since Dr. Alexander John Chandler, the namesake of the city of Chandler, developed hydroelectric power and pump irrigation across the Queen Creek delta (Stevens 1954; Salt River Project 1979). Chandler Heights itself occurs immediately north of the northeast corner of the GRIR and about 13 miles southeast of Chandler, Arizona. This small, rural community began much later, during the late 1920s of the Statehood phase, when Dr. Chandler and others established a corporation for the growth of citrus there.

No historic site has yet been formally recorded from the Chandler Heights Locale. The three exclusive archival sites of this area all date to the prehistoric era, therefore, and their relative sparsity is especially interesting given the fact that four other cultural resource studies have previously been undertaken across this same locale. The first and earliest one of these negative resource studies was actually a cadastral survey that was performed for the General Land Office (GLO). It was conducted by U.S. Deputy Surveyor W.F. Ingalls (1869), who physically examined parts of Township 2 South, Range 6 East during August of 1868.

The three remaining resource projects were all undertaken according to legal provisions of professional archeological contracts that were negotiated much later, since the mid-1990a, with a variety of sponsors. In particular, Northland Research, Inc. (Northland) examined a section of Queen Creek Road and the RWCD Canal (ASM Project 1995-441) for the Salt River Project in 1995 (Griffith 1995). Shortly thereafter, in 1997, the Maricopa Department of Transportation contracted Dames & Moore (Olson 1997) to intensively survey eastern and western parts of Higley Road situated immediately south of Queen Creek Road. That project (ASM Project 1997-190) is especially important because it actually resulted in an earlier examination of a far northeastern part of Parcel D of the present CHDB project area. Finally, in September 2001, SAS (Rodgers 2001b) performed an archeological inventory of the 129.1 acres comprising the Tall Pot Ecological Mitigation Area. That study (ASM Project 2001-253) was requested by the Flood Control District and was completed immediately east of the RWCD Canal and between Chandler Heights Road and Riggs Road.

FIELD SURVEY RESULTS

A total of 136 individual transects, or 68 crew swaths, was needed to complete the intensive field survey of the CHDB inventory project area, and the various environmental results of that investigation have already been incorporated into the Environmental Setting section of this report. Several other important facts result from that field survey, however, and, thus, all of them need to be elaborated here. Most significantly, no prehistoric or historic site was ever encountered during any of the project fieldwork and, explicitly, no physical evidence was ever found for the prior documented existence of either AZ U:10:15 ASU or AZ U:10:16 ASU.

At least three obviously abandoned agriculture features do exist within the CHDB project area, though, and all of them are strongly believed to have been used subsequent to, perhaps, the late 1950s. The first one has already been photographed in Figure 9. It consists of a modern irrigation ditch and an adjacent water inlet box, both of which have been constructed of concrete. The ditch itself totals about 3,300 feet long and has a trapezoidal profile measuring 22 inches deep and a maximum of 4.76 feet wide. Beginning near the undeveloped alignment of Ocotillo Road, it extends southward along the undeveloped alignment of 164th Street and then angles southwestward and continues along the western edge of the farm road that occurs immediately west of Queen Creek Wash (Figure 5). Two leveled fields occur immediately west of this ditch and, continuing westward to the East Maricopa Floodway, were definitely watered by this same waterworks. The southern one, at least, contains an abundance of decaying peach pits, suggesting its probable use as an orchard. A third field occurs immediately east of this ditch, between undeveloped 164th Street and Queen Creek Wash, but, although it has also been leveled, no physical evidence was ever found for its actual cultivation.

Third, 13 loci of isolated artifacts were discovered and fully recorded during the field survey. The location of all of them has previously been included in Figure 5, and summary aspects of every locus are provided in Table 1. Further, IAL 6 and IAL 9 are actually photographed in Figure 10 and Figure 11, and the numerous isolates themselves are all detailed later in Appendix A, B, and C.

In terse overview, the 13 IALs produced a total of 389 individual specimens. Only 14 of those specimens date to the prehistoric past, however. They include 5 lithic artifacts and nine sherds that were found at 10 spatially distinct loci (IAL 1, 2, 3, 4, 5, 8, 10, 11, 12, and 13). Hence, most of them were therefore single isolates per se. In marked contrast, the remaining 375 specimens all occurred at only three multiple-artifact loci (IAL 6, IAL 7, and IAL 9), which are elaborated shortly as small trash heaps.

All of the prehistoric artifacts are known or strongly believed to have been discarded by the Hohokam Indians, but none of them can be dated to even a general period. Interestingly, only

Table 1.

Summary Desription of the Isolated Artifact Loci
of the CHDB Archeological Inventory Project

	Location						Artifact Quantities					
IAL	Project Parcel	Crew Swath	Legal	Surface Context	Locus Type*	Locus Size	Sherds	Lithic	Metal	Glass	Cer	Misc
1	D	3	NE4NE4NE4 S15 T2SR6E	Recent fill	D	2.3 m apart	1	1	-	-	-	-
2	D	6	SE4NE4NE4 S15 T2SR6E	Recent fill	S	NA	1	-	-	-	-	-
3	D	8	SW4NE4NE4 S15 T2SR6E	Recent fill	S	NA	1	-	-	-	-	-
4	D	20	SW4SE4NE4 S15 T2SR6E	Floodplain	D	5.5 m apart	-	2	-	-	-	-
5	D	24	NW4NW4SE4 S15 T2SR6E	Recent fill	M	7.0 m diameter	3	-	-	-	-	-
6	D	25	NE4NW4SE4 S15 T2SR6E	Floodplain	M	6.5 by 4.75 m	-	-	87	-	-	-
7	D	26	NE4NE4SE4 S15 T2SR6E	Floodplain	M	6.0 by 5.50 m	-	-	155	15	6	1
8	D	28	SE4NE4SE4 S15 T2SR6E	Floodplain	S	NA	1	-	-	-	-	-
9	D	32	NW4SE4SE4 S15 T2SR6E	Floodplain	M	6.8 by 5.75 m	-	-	89	20	-	2
10	D	37	SW4SE4SE4 S15 T2SR6E	Floodplain	S	NA	-	1	-	-	-	-
11	E	46	NW4NW4NE4 S22 T2SR6E	Field	S	NA	-	1	-	-	-	-
12	E	58	SE4SE4NW4 S22 T2SR6E	Field	S	NA	1	-	-	-	-	-
13	E	63	NW4NE4SW4 S22 T2SR6E	Field	S	NA	1	-	-	-	-	-

* single (S), double (D), multiple (M)

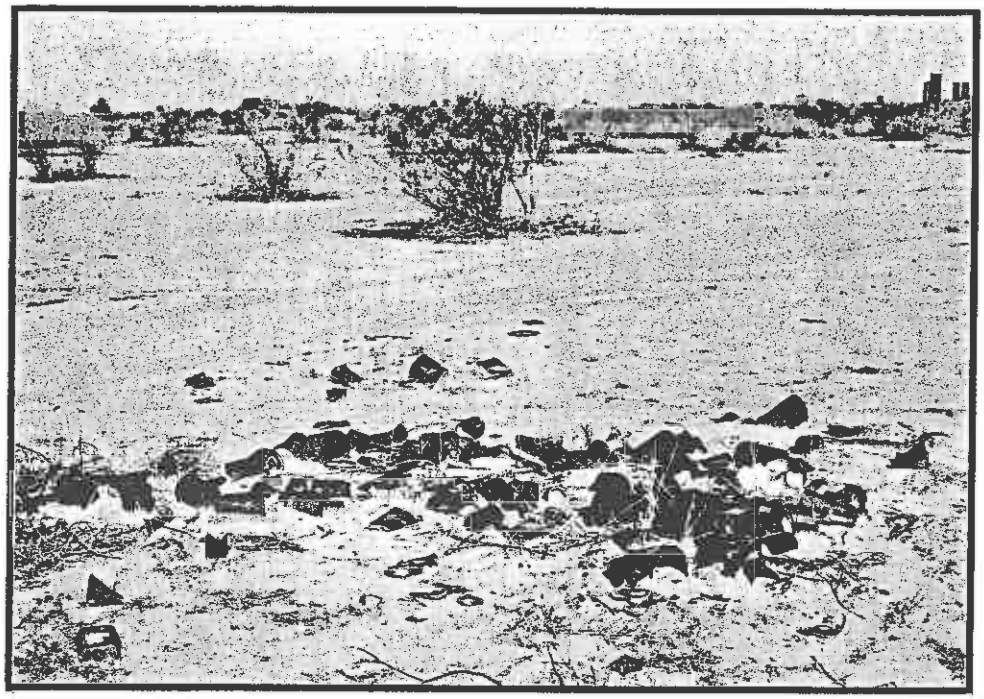


Figure 10. A small, late historic trash dump (IAL 6) located in the undisturbed northern part of project Parcel D.

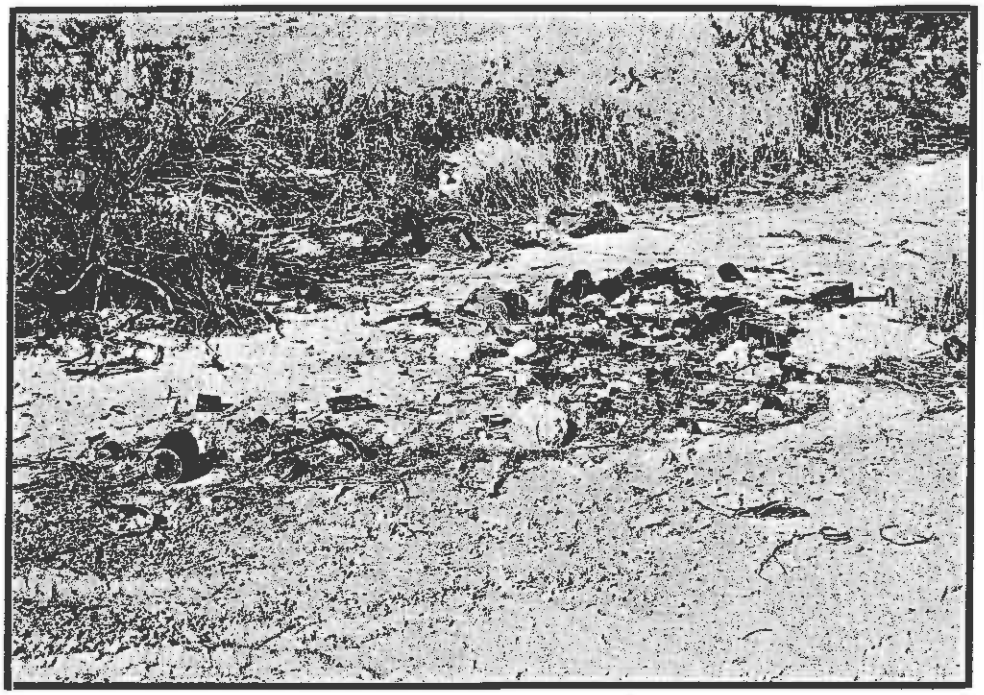


Figure 11. A similar trash dump (IAL 9) located farther southeast but also in the northern part of project Parcel D.

four of them were found across the undisturbed floodplain of project Parcel D. Three other ones were observed in leveled fields, and the final seven occurred in the modern fill that was originally dredged from the RWCD Floodway.

Very little variability is represented by the 14 prehistoric isolates. The five lithic specimens, for example, are limited to only one tertiary core and four waste flakes, or pieces of debitage, that are usually of fine-, medium-grained, and porphyritic basalt. All but one of the nine sherds are equally exemplified by either of the two major kinds of Hohokam plainware: 1) the four Gila Plain, Salt Variety specimens are characterized by sand temper and 2) the four Gila Plain, Gila Variety sherds typically have a finely ground temper of muscovite mica. Similarly, they are all body sherds of either ceramic bowls or jars. The single exception was noted at IAL 8. It is an unpainted specimen of Hohokam red-on-buff ware that, unfortunately therefore, could not be dated.

The three loci of historic isolates all occur across the undisturbed part of project Parcel D and, importantly, are all only secondary dumps, or truly non-sites (Beth Grindell, personal communication on 10/20/94), that were simply deposited alongside no fewer than two dirt roads that once traversed the western Queen Creek floodplain there. Never being any more than about 7.0 meters long and 6.0 m wide, all three are similar in size, they represent only single episodes of deposition, they have been only very minimally alluviated, and, they contain different metal (n=331), glass (n=35), ceramic (n=6), and miscellaneous (n=3) materials. Functionally speaking, the concerned 375 historic specimens at IAL 6, 7, and 9 represent seven major categories of common domestic artifacts: 1) clothing, 2) general food, 3) food preparation and consumption, 4) hardware, 5) household furnishings, 6) leisure & recreation, and 7) transportation.

The majority (92.5%) of the isolates at IAL 6, 7, and 9 relate directly to food, its preparation, or its consumption. Metal food containers are most numerous, as usual, and, among others, include those of milk, fruit, coffee, vegetables, meat, and kitchen condiments. Food preparation tools include not only a metal butter knife, but different pieces of ceramic dinnerware and even a few mixing and serving bowls of glass. Household furnishings are limited to only a broken iron, a baby bed mattress springs, a bathtub spout, and a small, unidentifiable electric motor. A toy wagon wheel and a luggage hinge constitute the exclusive items of leisure or recreation, while observed hardware includes a couple plumbing nuts and several nails and carpentry staples. The last two functional artifact categories are each merely represented by a single class of specimens: personal clothing (shoe) and vehicle transportation (motor oil).

Only a modicum of datable specimens exists at IAL 6, 7, and 9. However, nearly all of the metal food containers are of the post-1920 unsoldered, or "sanitary," type, and the majority of them have been unsealed with rotary, or gear operated, openers, that have been most popular since 1925 (Gillio et al. 1980:9). Further, the

condensed milk cans are all of the small variety (No. 18) that Somonis (n.d.) documents as having been manufactured between only 1920 and 1931. Clear glass specimens are most common, and such characterize the post-1930s. Most informatively, the few cans of vehicle motor oil are all of the variety that the Pennzoil Company began producing in 1933 (Hull-Walski and Ayres 1989:204). Provisionally, therefore, these several items consistently suggest that all three of this historic trash dumps were deposited sometime after the mid-1930s, or during the later part of Arizona's Statehood phase.

Two final results of the project fieldwork need to be especially emphasized. First, no intensive field survey was ever made by SAS personnel of either the defined project section of the East Maricopa Floodway (Parcel A) or the small FCD sedimentation basin (Parcel C) that is located immediately west of Queen Creek Wash and just northeast of the intesection of Greenfield Road and Chandler Heights Road. These two parcels total 71.7 acres, and the SAS decision not to intensively examine them is easily justified by the fact that their initial field inspection quickly revealed that all potential archeological surfaces there had obviously been totally removed or destroyed by both heavy equipment excavation and subsequent construction. SAS did perform a reconnaissance survey of both parcels, however, in order to locate any subsurface archeological features that might have been exposed during any of those major land altering activities.

Lastly, the intensive field survey examination of project Parcel B, D, and E has revealed that only one undisturbed part of the CHDB project area presently exists. As previously defined in the Environmental Setting section and actually plotted in Figure 5, it consists of 84.04 acres of the Queen Creek floodplain. An additional 92.55 acres of Parcel E have been variously disturbed by, among others, crop cultivation, heavy equipment blading, the County use of a local maintenance yard, the commercial dumping of construction materials, and off-the-road vehicle traffic. Even more significant is the final fact that the surface of another 136.11 acres of project Parcel D has been totally destroyed by the repeated deposition and leveling of spoil that had previously been dredged from the nearby RWCD Floodway. Fortunately, all that acreage had been carefully examined for cultural resources before its surface was so drastically modified.

PROJECT EVALUATION AND RECOMMENDATIONS

This archeological inventory of the proposed Chandler Heights Detention Basin has been extremely productive, and the numerous results of both its archival research and intensive field survey activities have produced very similar, or complementary, results. The different record checks and literature searches have proven especially valuable. In particular, they indicate that several cultural resource studies have previously been undertaken within the surrounding project vicinity of the northern Chandler Heights

archeological research locale. While the earliest study was undertaken in 1868, most of them result from professional archeological compliance investigations that have been completed since the mid-1970s.

Further, the archival research efforts of SAS have revealed that the northern Chandler Heights Locale was never one of truly major cultural activity during either the prehistoric or historic past. In fact, only three sites have previously been recorded there and, quite surprisingly, two of them (AZ U:10:15 ASU and AZ U:10:16 ASU) were originally recorded within Parcel D of the present CHDB project area. Both sites were finally interpreted to have possibly been temporary activity camps of the prehistoric Hohokam Indians. After four phases of archeological survey, test excavation, and impact mitigation research, their surface and subsurface contexts had been essentially destroyed. Both sites were then included in a much larger area that was subsequently used by the government for the disposal of soil that was dredged from the RWCD Floodway, or modern East Maricopa Floodway.

The fieldwork phase of this inventory was originally designed to result in a thorough examination of the entire (100%) CHDB project area. Due to the total surface destruction that had previously occurred there, however, SAS was able to conduct only a reconnaissance investigation of the 71.70 acres comprising Parcel A and Parcel C. Contrastingly, though, all 312.7 acres of Parcel B, D, and E were intensively examined. That examination involved the walking of 136 individual transects, or 68 crew swaths, and it discovered that only a small part, or 84.04 acres, of the concerned project area presently exists in its natural state. An additional 136.11 acres were found to have been destroyed by prior soil disposal at Parcel D, and, at Parcel D and Parcel E, the final 92.55 acres had been heavily disturbed by, primarily, cultivation and heavy equipment blading.

Ground visibility was generally excellent across all surveyed areas, but SAS encountered no prehistoric or historic sites and, understandably, no physical remnants of either AZ U:10:15 ASU or AZ U:10:16 ASU. One modern irrigation system was found to have been recently abandoned, however, and 13 loci of isolated artifacts were fully recorded. Ten of those loci contained a total of 14 prehistoric sherds or lithic artifacts. The other three loci are rather small domestic trash dumps that were likely deposited after 1935 and contain 375 specimens of either metal, glass, ceramics, or rubber. None of those prehistoric or historic isolates even begin to meet any of the criteria of 36 CFR 60.6(d) and, thus, none of them are considered eligible for nomination to either the Arizona Register or the National Register of Historic Places.

Based on all available field and archival research data, therefore, SAS concludes this report with three pertinent and closely interrelated recommendations. First, SAS maintains that the proposed Federal undertaking will have no effect upon any historic property, as defined by both the Advisory Council on Historic Preservation in 36 CFR 800.16(l) (1999:113) and by the U.S. Army Corps

of Engineers (1999) in Appendix C of 33 CFR 325. Second, the Flood Control District of Maricopa County is strongly encouraged to continue the ongoing compliance process by making a review copy of this report available to the State Historic Preservation Office and, of course, the Corps itself. Third, it is highly recommended that all appropriate authorization from all pertinent government agencies be provided so that the Flood Control District of Maricopa County might continue its planned development of the Chandler Heights Detention Basin in eastern Maricopa County, Arizona.

APPENDIX A:

ISOLATED PREHISTORIC CERAMIC ARTIFACTS OF THE CHDB INVENTORY AREA

IAL	Total Quantity	Pottery Type	Quantity	Vessel Type		
				Bowl	Jar	Unknown
1	1	Gila Plain, Salt	1	1	-	-
2	1	Gila Plain, Gila	1	-	+	-
3	1	Gila Plain, Gila	1	-	-	+
5	3	Gila Plain, Gila	2	2	-	-
		Gila Plain, Salt	1	-	1	-
8	1	Unidentifiable Buff	1	-	1	-
12	1	Gila Plain, Salt	1	-	1	-
13	1	Gila Plain, Salt	1	-	1	-

APPENDIX B:

ISOLATED PREHISTORIC LITHIC ARTIFACTS OF THE CHDB INVENTORY AREA

IAL	Qty	Artifact Type	Material	Cond*	Dimensions (cm) Length	Width	Thick
1	1	Flake, tertiary	Basalt, porphyry	W	3.5	2.7	1.1
4	2	Flake, tertiary	Basalt, medium	W	5.5	3.8	1.3
		Core, tertiary	Basalt, fine	W	6.3	4.8	3.2
10	1	Flake, primary	Andesite, medium	W	4.2	3.7	0.8
11	1	Flake, tertiary	Basalt, medium	W	4.5	3.5	1.1

* fragment (F), whole (W)

APPENDIX C:

Isolated Historic Artifacts of the CHDB Inventory Area

IAL	Functional Category	Material Type				Description
		Metal	Glass	Ceramic	Misc	
6	General food	12	---	--	--	Condensed milk cans
		7	---	--	--	Baking powder cans
		65	---	--	--	Mixed fruit and vegetable tins
		1	---	--	--	Large (10" by 2 1/4") soldered canteen
	Household furnishings	1	---	--	--	Damaged iron
		1	---	--	--	Baby bed mattress springs
7	Clothing	---	---	--	1	Rubber tennis shoe sole
	General food	105	---	--	--	Mixed fruit and vegetable tins
		12	---	--	--	Round and rectangular friction can lids
		9	---	--	--	Corned beef tins
		7	---	--	--	Coffee cans/strip bands
		3	---	--	--	Crown-type bottle caps
		---	3	--	--	Clear fruit jars*
		---	5	--	--	Brown beer bottles*
		---	6	--	--	Clear milk bottles*
	Food prep & consumption	---	---	2	--	Plate w/ floral pattern
		---	---	3	--	Ironstone saucer
		---	1	--	--	Clear baking dish
		---	---	1	--	Coffee cup lug
	Hardware	11	---	--	--	Nails/large staples
	Household furnishings	1	---	--	--	Bathtub spout
	Leisure & recreation	1	---	--	--	Luggage hinge
	Transportation	6	---	--	--	Pennzoil quart motor oil cans
9	General food	75	---	--	--	Mixed fruit and vegetable tins
		6	---	--	--	Crown-type bottle caps
		5	---	--	--	Rectangular friction can lids
		---	8	--	--	Pepsi and Coca-Cola bottles*
		---	5	--	--	Clear fruit jars
		---	5	--	--	Clear baby food jars*
	Food preparation	---	2	--	--	Clear mixing bowls
		1	---	--	--	Nickel-silver butter knife
	Hardware	2	---	--	--	Plumbing nuts
	Household furnishings	---	---	--	1	Small electric motor
	Leisure & recreation	---	---	--	1	Rubber toy wagon wheel

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APPENDIX C

STATE HISTORIC PRESERVATION OFFICE LETTER

APPENDIX D

CHANDLER HEIGHTS BASIN HYDROLOGY / HYDRAULIC REPORT

In reply refer to **SHPO-2002-1914**
No historic properties affected

October 11, 2002

Theresa M. Pinto
Environmental Services Planner
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, AZ 85009-6399

RE: Chandler Heights Detention Basin; MCFCD
SHPO-2002-1914 (12488)

Dear Ms. Pinto:

Thank you for consulting with our office regarding the above referenced proposed detention basin that will be located in Section 15 and the W1/2 and HE1/4 of Section 22, T2S, R6E in eastern Maricopa County. I have reviewed the supporting cultural resources survey report *The Chandler Heights Detention Basin Archeological Inventory Project of Eastern Maricopa County, Arizona*, prepared by Scientific Archeological Services (01-8) and have the following comments:

The survey of 312.7 acres recorded 13 isolated artifact occurrences, each of which lack significance and thus are not eligible for inclusion on the State or National Register of Historic Places. A finding of **no historic properties affected** is warranted for this project.

We appreciate your cooperation with our office in considering the potential effects of the agency's projects on Arizona's precious cultural resources.

Sincerely,

Jo Anne Medley
Compliance Specialist/Archaeologist
State Historic Preservation Office

Arizona State Parks
1300 W. Washington
Phoenix, Arizona
85007

Tel & TTY: 602-542-4174

1-800-285-3703
from (520) area code

Fax: 602-542-4188
http://www.pr.state.az.us

HYDROLOGY/HYDRAULIC REPORT

Rittenhouse and Chandler Heights Detention Basins

FCD 2000C040

October 2003

Prepared for:
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009-6399

By:
Kirkham Michael Consulting Engineers
9201 North 25th Avenue, Suite 150
Phoenix, Arizona 85021
(602) 944-6564

KIRKHAM MICHAEL
CONSULTING ENGINEERS

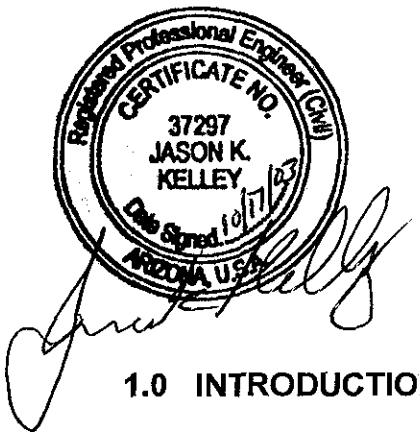
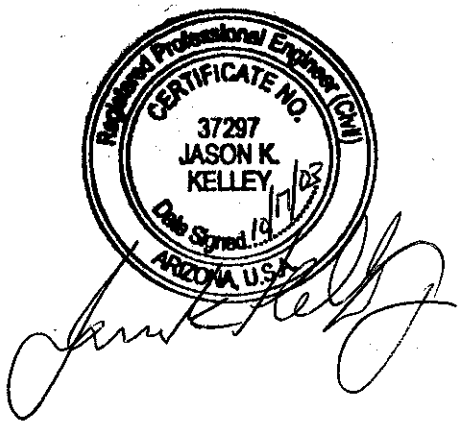


TABLE OF CONTENTS

Page

TABLE OF CONTENTS



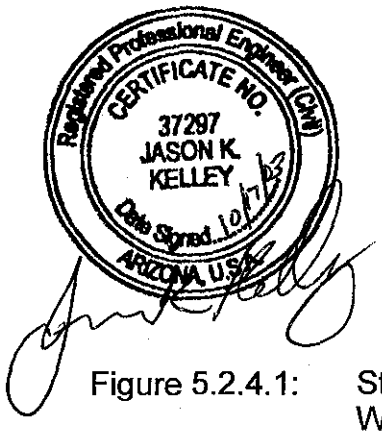


TABLE OF CONTENTS

Page

List of Figures

List of Tables

1.0 INTRODUCTION

In March 2002, the Flood Control District of Maricopa County (FCDMC) contracted with Kirkham Michael and Associates, Inc. (KM) for the Final Design of the Rittenhouse and Chandler Heights Detention Basins. This report presents a summary of the criteria and analyses that serve as the basis for the basin designs. Background information may be found in the Rittenhouse and Chandler Heights Predesign Reports. Detailed supporting documentation, calculations and analyses are also provided in the Rittenhouse and Chandler Heights Basin Design Data Report Calculations and Analysis Notebooks.

2.0 DESIGN CRITERIA

The design criteria for the Rittenhouse and Chandler Heights Basins include:

- Hydrology based upon the 100-yr, 24-hr future build-out conditions of the East Maricopa Floodway (EMF) watershed provided by the FCDMC that includes Capital Improvements Projects (CIPs) for flood control.
- Attenuation of the EMF peak flow downstream of the Chandler Heights Detention Basin to a maximum of approximately 6700 cfs.
- Drainage of detention basins within 36 hours after the cessation of the design storm duration (24 hours).
- Accommodation of features to provide opportunities for the use of the basins for recreation, recharge and other compatible multi-use purposes.

2.1 HYDROLOGY

The basin design hydrology is based upon the 100-yr, 24-hr future build-out conditions of the EMF watershed. The hydrology was provided by the FCDMC and includes proposed flood control CIPs in the EMF watershed.

2.2 EMF PEAK FLOW DISCHARGE ATTENUATION

The EMF attenuation criteria for this project is set at a maximum peak discharge of 6660 cfs immediately downstream of the Chandler Heights Basin. The predesign attenuation criteria along the EMF at Rittenhouse Road and at the County Line have been relaxed in belief that meeting the criteria at Chandler Heights will achieve the desired peak discharge attenuation and EMF freeboard. Attenuation criteria were established based upon a FCDMC assessment and evaluation of freeboard availability along the EMF.

2.3 BASIN DRAINAGE

The basins are designed to drain, as much as feasible, within 36 hours after the cessation of the 100-yr, 24-hr design storm.

2.4 MULTI-USE OPPORTUNITIES

The basins are designed to accommodate multi-use and aesthetics features and provide an opportunity for the basins to be used for recreation, recharge and other compatible multi-use purposes. Accommodations are made to the extent that they do not supplant the primary function and operation of the basins and channels for flood control.

2.5 OTHER DESIGN CRITERIA

The hydraulic analysis of the EMF is based upon a previous study (Collins-Pina/Tetra Tech, 2000). The study recommended changes to the channel for proposed multi-use and recreational improvements that would increase the channel n values (over the existing conditions) and include a low flow channel. These proposed improvements are part of the design criteria established by the FCDMC. Other design criteria were also developed during the process of design, established in meeting minutes or provided in the FCDMC drainage design guidelines and may be found in the Design Data Report.

3.0 HYDROLOGY

3.1 INTRODUCTION

The hydrology used for the basin designs include several hydrologic models and include both HEC-1 and HEC-RAS unsteady state flow simulation models. Generally, the HEC-1 models are used to analyze the EMF contributory watershed, route flow along the EMF and develop the input hydrographs for the HEC-RAS models. The HEC-RAS unsteady state flow models are used to analyze the lateral weirs, detention basins and the basin outlets.

3.2 HYDROLOGY SOFTWARE

HEC-1 and HEC-RAS are used to develop hydrology for the basin designs. Both were developed by the US Army Corps of Engineers, Hydrologic Engineering Center. For the design of the basins, HEC-1 Version 4.1 (June, 1998) and HEC-RAS Version 3.0.1 (March 2001) are used for the hydrologic analyses. Using different versions of the software models may produce results different than those presented in the supporting documentation.

TABLE 3.3 - Basin Design Models

Description	Model Type	Filename	Purpose
EMF-Watershed (NE Mesa)	HEC-1	WS1-NWM.DAT	Hydrologic analysis of the EMF watershed (future build-out conditions) Develops input hydrographs for Rittenhouse Basin HEC-RAS Model (RBD.PRJ)
EMF-Watershed (NW Mesa)	HEC-1	WS2-NEM.DAT	
EMF-Watershed (Queen Creek &	HEC-1	WS3-QCSW.DAT	
EMF-Watershed (SE Mesa)	HEC-1	WS4-SEM.DAT	
EMF-Watershed (Routing Model)	HEC-1	RT1-BASE.DAT	
Rittenhouse Basin	HEC-RAS	RBD.PRJ	Analysis of the Rittenhouse Basin and its impact on flow attenuation in the EMF. Develops input hydrograph for EMF HEC-1 (RCHB.DAT).
EMF – South of Rittenhouse Rd	HEC-1	RCHB.DAT	Routes flow in the EMF from the Rittenhouse Basin and provides input hydrographs for the Chandler Hts Basin HEC-RAS Model (CHBD.PRJ)
Chandler Heights Basin	HEC-RAS	CHBD.PRJ	Hydrologic/Hydraulic analysis of the Chandler Heights Basin & its impact flow attenuation of flow in the EMF. Develops the input hydrograph for the EMF– South of Chandler Heights Rd Model (SOFCH.DAT)
EMF – South of Chandler Heights Rd	HEC-1	SOFCH.DAT	A preliminary hydrologic evaluation of the EMF watershed below Chandler Heights Rd that includes the impact of the proposed Rittenhouse and Chandler Heights Detention Basins. The analysis is to be used by the FCDMC to evaluate freeboard in the EMF downstream of Chandler Heights Rd.

3.3 HYDROLOGIC MODELS

The hydrologic models used for the basin designs are identified in Table 3.3.

3.3.1 EMF Watershed Models

Several HEC-1 models are used to describe the hydrology for the EMF watershed upstream of the Rittenhouse Basin. The models were progressively developed in previous studies initiated by the FCDMC and were provided as the basis for design of the Rittenhouse and Chandler Heights Basins. The models describe the 100-year, 24-hour future build-out conditions for the EMF watershed and include proposed flood control CIPs.

TABLE 3.3.1 - Rittenhouse Basin Input Boundary Hydrographs

Source File: RT1-BASE.DAT Concentration Point	Destination File: RBD.PRJ	
	Channel	Cross Section
RWFLD1	EMF – Reach 4	17.082
RITTEN	Rittenhouse	820.00

All the "EMF Watershed Models" (Table 3.3) are necessary to develop the input boundary hydrographs for the HEC-RAS Unsteady State analysis of the Rittenhouse Basin. The models produce the input boundary hydrographs from model RT1-BASE.DAT needed for the HEC-RAS analysis of the Rittenhouse Basin (RBD.PRJ). Table 3.3.1 show the concentration point hydrographs and the corresponding cross section input boundary hydrographs.

3.3.2 Rittenhouse Basin Model (RBD.PRJ)

The Rittenhouse Basin HEC-RAS analysis is used to model the proposed Rittenhouse Detention Basin design and develop a hydrograph for the EMF downstream of the basin. The model includes a lateral weir between the EMF and the proposed basin and a flap gated outlet structure to drain the detention basin. The analysis uses input boundary hydrographs from RT1-BASE.DAT. From the results of the analysis, a hydrograph for EMF-Reach 4 Cross Section 16.000 (XS 16.000) can be obtained. This hydrograph represents the entire EMF watershed upstream of XS 16.000. The hydrograph is hard coded into a HEC-1 model (RCHB100.DAT) and routed to the Chandler Heights Basin.

3.3.3 EMF – South of Rittenhouse Road Model (RCHB.DAT)

This HEC-1 model is used to develop input boundary hydrographs for the Chandler Heights Basin HEC-RAS analysis. This model routes flow from the Rittenhouse Basin to the Chandler Heights Basin and includes the future build-out conditions hydrology for the Queen Creek and Sanokai Wash watersheds. Also included in this model is an update to a hard-coded hydrograph for the Sanokai Flood Retarding Structure on Queen Creek Wash.

The hydrograph from the Rittenhouse Basin HEC-RAS analysis (RBD.PRJ) at EMF-Reach 4, XS 16.000 is hard-coded into the model as concentration point RITBAS and routed in the EMF to the Chandler Heights Basin. The model will produce the input boundary hydrographs needed for the HEC-RAS analysis of the Chandler Heights Basin (CHBD.PRJ). The hydrographs for the concentration points and the corresponding cross section input boundary hydrographs are shown in Table 3.3.3.

TABLE 3.3.3 - Chandler Heights Basin Input Boundary Hydrographs

Source File: RCHBD100.DAT Concentration Point	Destination File: CHBD.PRJ	
	Channel	Cross Section
RQCS	EMF – Reach 3	13.084
CO508	QC/SW	5535
*(source is an initial run of CHBD.PRJ)	EMF – Reach 3	11.609

* See Section 3.3.4 for discussion of the source of the input boundary hydrograph at XS 11.609

3.3.4 Chandler Heights Basin Model (CHBD.PRJ)

The Chandler Heights Basin HEC-RAS analysis is used to model the proposed design of the Chandler Heights Detention Basin and develop a hydrograph for the EMF that meets the peak discharge design criteria of 6660 cfs downstream of the basin. The model includes a lateral weir, an emergency spillway, in-line weirs/drop structures and a gated outlet.

The model uses input boundary hydrographs for the EMF flow at Queen Creek Road (XS 13.084), the flow in Queen Creek/Sanokai Wash at the confluence of Queen Creek and Sanokai Wash (XS 4376.49) and the confluence of the EMF with Queen Creek/Sanokai Wash (XS 11.609) (Table 3.3.3).

Due to model instabilities, the junction option could not be used to represent the confluence of the EMF with Queen Creek/Sanokai Wash. Because there is no physical connection at this confluence, it is necessary to use a lateral inflow hydrograph at EMF XS 11.609. The hydrograph is created by an initial running of the to obtain a hydrograph at the downstream end of the Queen Creek (XS 1084.9) and then using the hydrograph as the lateral inflow hydrograph at EMF XS 11.609. The model is then re-run to accurately determine peak flow conditions in the EMF downstream of the confluence with Queen Creek/Sanokai Wash.

From the analysis, a hydrograph for EMF-Reach 3 XS 11.033 can be obtained which represents the entire EMF watershed upstream of XS 11.033..

4.0 HYDRAULICS

4.1 INTRODUCTION

The hydraulic analyses used to evaluate the operation of the detention basins was performed using HEC-RAS Unsteady State models. These models were used to establish the overall sizes, lengths and volumes of the detention

basins, basin weirs and outlet structures. The detailed design of the weir and outlet structures are based upon separate analyses and will be provided in the Calculations and Analyses Notebooks.

For the Chandler Heights Basin, a steady state analysis was also conducted to design channel improvements, sedimentation basins and drop structures.

4.2 HYDRAULIC SOFTWARE

The HEC-RAS Version 3.0.1 (March 2001) hydraulic software developed by the US Army Corps of Engineers, Hydrologic Engineering Center (USACE-HEC) was used to design the basins, the hydraulic structures, and the new channel configurations. Version 3.0.1 is a release that includes a number of new features used in the design of the basins including Unsteady State Flow Analysis, Lateral Weirs, and Time Series Gate Openings.

4.2.1 HEC-RAS Software Bugs

HEC-RAS Version 3.0.1 also includes a number of software bugs. Among them is that at hydraulic connections such as gates or lateral weirs between a channel and a storage basin, hydrographs from the analyses may show some flow passing through the gate or over the weir even though at that time period the gates are shut or the water surface elevation is too low to pass over the weir. However, this does not significantly impact the results of the analyses.

4.2.2 Unsteady State Flow Analysis Instabilities

The addition of unsteady state flow analysis to HEC-RAS is a new, powerful tool that has the ability to route hydrographs through a network of channels, basins, weirs and other hydraulic structures. However, unsteady flow analysis is more complex and can be extremely difficult compared with steady flow analysis because of model instabilities. Instabilities result from the program having difficulty converging on a solution. Even minor changes to input parameters can dramatically affect the stability of a model.

Model instabilities occur for many reasons. According to the HEC-RAS User's Manual, instabilities can occur at low flows because:

1) Flow depths are small. As flow increases between time steps, flow depth can increase dramatically. If flow depth increases significantly between time steps, oscillations can occur in the analysis and can grow to the point at which the solution becomes unstable.

2) At low flows or shallow depths, water is more likely to be flowing in a pool or riffle sequence. At the riffles, the flow may be passing

through critical depth and going supercritical. The current version of the unsteady flow solver in HEC-RAS cannot handle supercritical flow or even flows approaching critical depth. Such conditions may cause may cause the model to go unstable.

Instabilities can also occur when analyzing inflow/outflow between two hydraulically connected features, such as flow between a basin and a channel through a gated opening or spillway/weir. Typically, instabilities occur when the basin and the channel water surface elevations are very close and the hydraulic connection (gate, spillway or weir) is in operation. Under these conditions, reiteratively solving for the outflow/inflow through the hydraulic connections combined with the resulting fluctuation in water surface elevations between the basin and the channel makes it difficult to converge on a solution.

4.2.3 Improving Model Stability

There are ways to help prevent model instabilities without affecting the results. HEC-RAS has a pilot channel option to help prevent low flow instabilities. The pilot channel does not physically exist but is used theoretically during the analysis of low flows. At higher flows, the pilot channel is ignored.

Another method to provide stability during periods of low flow that occur at the onset of a storm event is to increase the initial flow in the Initial Conditions of the Unsteady Flow Data Editor. The initial flow is used to perform a backwater analysis to compute stages at each cross section. By increasing the initial flow, supercritical flow depths can be avoided at the start of the analysis and instabilities can be avoided. The effect increase diminishes quickly as the model re-establishes the normal water surface elevation at each cross section.

Instabilities that arise from the analysis of hydraulically connected features can be resolved by modifying the model to avoid the calculation of flow between the features when they are at similar water surface elevations. This requires more familiarity with the model to insure the model continues to reflect overall operating conditions and that the results are not compromised. In the case of a gate opening, this can be done by opening the gate earlier, later, or only during periods where there is significant difference between the water surface elevations of the hydraulic features. For a weir or spillway, minor changes in the weir/spillway elevation or length and changes in the channel or basin configuration can improve model stability by increasing the difference in water surface elevations and/or the frequency at which calculations are made at similar water surface elevations.

Another way to improve model stability is to modify Computation Options and Tolerances in the Unsteady State Flow editor or by modifying computation intervals. Modifying these options may impact the analysis results. According

the HEC-RAS User's Manual, increasing the default calculation tolerances can result in computational errors in the water surface profile.

4.3 HEC-RAS MODELING OF FLAP GATE OUTLETS

HEC-RAS Version 3.0.1 does not specifically model flap gate outlets, therefore, during predesign, a process using manual calculations and an iterative procedure of balancing water surface elevations, gate opening heights and flow discharge was used to model flap gates. Subsequent to the predesign analysis, another procedure was developed that produced results comparable to the predesign procedure, but was more simple to implement.

The new procedure uses the HEC-RAS Time Series Gate Openings Option in the Unsteady State Flow Data Editor to model flap gates. The procedure involves "homing in" on the time at which flap gates would open and then opening the gates. When the detention basin water surface elevation is above the channel water surface elevation, the flap gates are assumed to open and discharge flow into the channel, otherwise, the gate remains closed. A typical procedure to model a flap gate outlet is as follows:

1) Either assume a time when the flap gates will be open or let the gates remain closed for the entire run and set the Time-Series Gate Openings in the Unsteady Flow Data Editor accordingly.

2) Run the model and estimate from the basin outlet stage hydrograph the time at which the basin water surface elevation will exceed the channel water surface elevation.

3) Revise the Time-Series Gate Openings in the Unsteady Flow Data Editor so that the gates open at (or slightly after) that point in time and rerun the analysis.

4) Review the basin outlet stage hydrograph. If the Time Series Gate Opening data agrees with the time at which the basin water surface elevation begins to exceed the channel water surface elevation, the analysis is complete. If the times are significantly different, adjust the Time Series Gate Opening data to agree with the basin outlet stage hydrograph and repeat Step 4.

If the analysis becomes unstable due to the gate opening, adjust the time so that the gate does not open until the difference between the basin water surface elevation and the channel water surface elevation is larger. If the instability occurs later in the analysis (as the basins is draining) and the basin water surface elevation begins to approach the channel water surface elevation, it might be appropriate and necessary to close the gate.

4.4 HYDRAULIC MODELS

The HEC-RAS models used for the basin designs were generally described previously in the Hydrologic Model Section of this report. This section discusses in more detail the HEC-RAS analyses for the basins.

4.4.1 Rittenhouse Basin Analysis

This HEC-RAS analysis is used to model the design of the Rittenhouse Detention Basin and develop a hydrograph for the EMF downstream of the basin. The model includes a lateral weir between the EMF and the proposed basin and a flap gated outlet structure to drain the detention basin. The analysis uses input boundary hydrographs from RT1-BASE.DAT. From the HEC-1 analysis, a hydrograph for EMF-Reach 4 Cross Section 16.000 can be obtained. This hydrograph represents the entire EMF watershed upstream of Cross Section 16.000. The hydrograph is hard coded into a HEC-1 model (RCHB100.DAT) and routed to the Chandler Heights Basin.

It is not believed debris accumulation at the EMF bridge crossings at Rittenhouse Road have been problematic, however, to evaluate possible impact of debris accumulation on the Rittenhouse Basin design analysis, the bridge pier widths for the Rittenhouse Road bridge and the SPRR bridge were increased four-fold and the design analysis rerun. The results indicate that such debris accumulation would have no significant effect and therefore the original bridge sections were used unchanged for the EMF analysis.

4.4.1.1 Geometric Data

Cross Sections and Bridge Sections

The EMF cross sections, bridge sections and 'n' values remain unchanged from the HEC-RAS model provided by the FCDMC (Collins-Pina/Tetra Tech, 2000). The study model incorporated changes to the channel for proposed future multi-use and recreational improvements that increased channel 'n' values (over the existing conditions) and included a meandering low flow channel, approximately eight feet wide by two to three feet deep.

For the Rittenhouse Channel, two channel cross sections and a junction at the confluence were added to the geometric data.

Lateral Weir and Gated Outlets

Beginning at EMF XS 16.940, a lateral weir between the EMF and the

proposed Rittenhouse Basin is included in the geometric data. At the end of the lateral weir, a flap-gated outlet is also modeled. The lateral weir is analyzed as a broad-crested weir with a weir coefficient of 2.3 based upon a detailed investigation and estimation of weir coefficient performed during the Predesign phase (Predesign Reports).

Detention Basin

The stage-volume curve is based upon a basin that accommodates landscaping and aesthetic features to enhance the basin appearance.

4.4.1.2 Unsteady Flow Data

Boundary Conditions

EMF - Reach 4 RS 17.082
This is the upstream end of the EMF in the analysis. A hydrograph obtained from the EMF Watershed Models for the upstream watershed is input as a boundary condition (Section 3.3.1).

EMF - Reach 4 RS 16.93 LW
This is the lateral weir and flap-gate outlet between the EMF and the Rittenhouse Detention Basin. A boundary condition is necessary at this location to model the outlet. Time Series Gate Opening Data is used as the boundary condition. In the data, the flap-gates are completely opened approximately at the time the basin water surface elevation exceeds the EMF water surface elevation. The HEC-RAS model then automatically calculates the discharge through the flap gates from the difference in water surface elevations between the basin and outlet channel (Section 4.3).

EMF - Reach 4B RS 16.00
This is the downstream end of the EMF in the analysis. Normal depth calculations using the approximate EMF channel slope (0.00031 ft/ft) is used as the downstream boundary condition.

Rittenhouse Channel - Main Channel RS 820.0
This is the upstream end of the Rittenhouse Channel in the hydraulic analysis. A flow hydrograph developed from the EMF Watershed Models representing the watershed upstream of this location is input as the boundary condition (Section 3.3.1).

Initial Conditions

Initial flow conditions are required at three locations and an initial elevation is required for the Rittenhouse Basin Table 4.4.1.2). Initial

flow conditions are based upon the flow rate of at each cross section at the beginning of the analysis unless the flow rate is zero, at which a nominal flow rate of 2 cfs is entered to avoid model instability. The initial elevation is set at the bottom of the detention basin.

EMF - Reach 4 RS 16.93 LW
This location is at the lateral weir and flap-gate outlet between the EMF and the Rittenhouse Detention Basin. To model the basin flap-gate outlet, Time Series Gate Opening Data is used as the boundary condition. In the data, the gates are opened when the basin water surface elevation exceeds the EMF water surface elevation.

EMF - Reach 4B RS 16.00
This location is at the downstream end of the EMF in the analysis. Normal depth calculations using the approximate EMF channel slope (0.00031 ft/ft) is used as the downstream boundary condition.

Rittenhouse Channel - Main Channel RS 820.0
This location is at the upstream end of the Rittenhouse Channel. A flow hydrograph obtained from the EMF Watershed Models for the Rittenhouse contributory watershed upstream of this location is input as the boundary condition (Section 3.3.1).

Initial Conditions

Initial flow conditions are required at three locations and an initial elevation is required for the Rittenhouse Basin. Initial flow conditions are based upon the flow rate of at each cross section at the beginning of the analysis unless the flow rate is zero, at which a nominal flow rate of 2 cfs is entered to avoid model instability. The initial elevation for the Rittenhouse Basin is set at the bottom of the detention basin. Input initial flow conditions and elevations are shown in Table 4.4.1.2.

TABLE 4.4.1.2 - Rittenhouse Initial Flow & Elevation Conditions

Location	Initial Flow (cfs)	Initial Elevation (ft)
EMF Reach 4, RS 17.082	75	-
EMF Reach 4B, RS 16.251	77	-
Ritt Channel, Main Channel RS 820.00	2	-
Rittenhouse Basin	-	1311

4.4.2 Chandler Heights Basin Analyses

Two separate HEC-RAS models are used to model the proposed Chandler Heights Basin design.

An unsteady state model (CHBD.PRJ) is used to size the proposed basin and associated structures. The model contains several structures including a lateral weir, an emergency spillway and a flap-gated outlet.

The analysis uses input boundary hydrographs from RCHB100.DAT for flow in the EMF at Queen Creek Road and in Queen Creek after the confluence with Sanokai Wash. The analysis provides a hydrograph representing the EMF watershed upstream of the Chandler Heights Road that includes the proposed Rittenhouse and Chandler Heights Basins (EMF Reach 3 RS 11.033).

A steady state model (QCSW.PRJ) is used for the analysis and design of channel improvements and drop structures in Queen Creek and Sanokai Wash. It includes the proposed sedimentation basin in Queen Creek, channel drop structures and inlet and outlet structures to the sedimentation basins.

It is not believed debris accumulation at the EMF bridge crossing at Chandler Heights has been problematic, however, to evaluate the impact of debris accumulation at the bridge, pier widths for the Chandler Heights Road bridge were increased four-fold and the design analysis rerun. The results indicate that such debris accumulation would have no significant effect and therefore the original bridge sections were used unchanged for the EMF analysis

4.4.2.1 Geometric Data

Cross Sections and Bridge Sections

Most of the EMF cross sections and bridge sections remain unchanged from the HEC-RAS model provided by the FCDMC. These cross sections and 'n' values are based upon a previous study conducted by Collins-Pina/Tetra Tech (Collins-Pina/Tetra Tech, 2000). The model incorporated proposed changes to the channel for future multi-use and recreational improvements that increased channel 'n' values (over the existing conditions) and included a meandering low flow channel, approximately eight feet wide by two to three feet deep.

The design model contains EMF cross sections that were modified to reflect the proposed relocation of the existing drop structure to just upstream of the Chandler Heights Bridge (previously at ~XS 11.321) to upstream of the proposed basin outlet (~XS 11.794).

The geometric data for Queen Creek and Sanokai Wash is based upon the realignment and channelization of the existing washes adjacent to the proposed detention basin. The steady state model geometry, used to design channel improvements and drop structures, extends to Higley Road along both Queen Creek and Sanokai Wash. To maintain model stability, the geometry in the unsteady state model extends only to the upstream end of the proposed lateral weir (downstream of the confluence of Queen Creek and Sanokai Wash).

Lateral Weirs and Gated Outlets

A lateral weir is located at Queen Creek ~XS 5377 that connects the Queen Creek channel to the Chandler Heights Basin. The structure is analyzed with a weir coefficient of 2.44 based upon an estimation of weir coefficients performed during the predesign phase of the project.

Between the EMF and the proposed basin, two lateral weir structures are included in the geometry data. One models an emergency spillway of the basin into the EMF (~XS 11.988). The spillway provides emergency relief if the basin stage exceeds the 100-year stage (approximately 1306.5). The other lateral weir contains gates and models the flap-gated outlet used to drain the basin (~XS 11.741).

Lateral weirs and outlet geometry is not included in the steady state model as it is not needed to analyze the channel and drop structures.

Detention Basin

The stage-volume curve is based upon a footprint that accommodates landscaping and aesthetic features to enhance the basin appearance. There is no detention basin geometry in the steady state model.

4.4.2.2 Flow Data

Boundary Conditions – Unsteady State Model

EMF - Reach 3 RS 13.084

This location is at the upstream end of the EMF in the model (just downstream of Queen Creek Rd). A flow hydrograph (RQCS) representing the EMF watershed upstream of this location is input as the boundary condition. The hydrograph is developed in an HEC-1 model (RCHB100.DAT) that routes flow from the EMF downstream of the Rittenhouse Basin to the Chandler Heights Basin (Section 3.3.1).

EMF - Reach 3 RS 11.741 LW
This location is at the flap-gated outlet between the EMF and the Chandler Heights Basin. To model the flap-gate outlet, Time Series Gate Opening Data is used as the boundary condition. In the data, the flap-gates are completely opened when the basin water surface elevation exceeds the EMF water surface elevation.

EMF - Reach 3 RS 11.609
This location is at the confluence of the EMF and the Queen Creek channel. Because of model instabilities, there is no "physical" connection of Queen Creek and the EMF in the HEC-RAS model. Instead, the confluence is modeled by adding a Lateral Inflow Hydrograph as a boundary condition at this location in the EMF. It is important to note that because the confluence has no "physical" connection in the model, it is necessary to perform an initial run of the Chandler Heights Basin HEC-RAS model in order to obtain the Lateral Inflow Hydrograph at ~XS 11.609 (Section 3.3.4).

EMF - Reach 3 RS 11.033
This location is at the downstream end of the EMF in the analysis. Normal depth calculations using the approximate EMF channel slope (0.0003 ft/ft) is used as the downstream boundary condition.

Queen Creek - R1 RS 1084.9
This location is at the downstream end of Queen Creek just prior to the confluence with the EMF. As the downstream boundary condition, normal depth calculations are used with a friction slope of 0.01 ft/ft.

Queen Creek - R1 RS 5535
This location is just upstream of the lateral weir and downstream of the confluence of Queen Creek and Sanokai Wash channels. A flow hydrograph representing the respective contributory watersheds of Queen Creek and Sanokai Wash upstream of this location is input as the boundary condition. The hydrograph (CO508) is obtained from the

TABLE 4.4.2.2.1 - Chandler Heights Basin Initial Flow & Elevation Conditions

Location	Initial Flow (cfs)	Initial Elevation (ft)
EMF Reach 3, RS 13.084	700	-
Queen Creek R1, 5535	400	-
Chandler Heights Basin	-	1296

Table 4.4.2.2.2 Steady State Model Starting Water Surface Elevations

River	Reach	Upstream	Downstream
Sanokai Wash	R1	Normal Depth S = 0.002 ft/ft	QC/SW Junction
Queen Creek	R1	Normal Depth S = 0.0003 ft/ft	QC/SW Junction
Queen Creek	R2	QC/SW Junction	EMF/QCSW Junction
EMF	Reach 3	Normal Depth S = 0.0003 ft/ft	EMF/QCSW Junction
EMF	Reach 3-Lower	EMF/QCSW Junction	Normal Depth S = 0.0003 ft/ft

HEC-1 model RCHB100.DAT which develops the hydrology for the Queen Creek Wash and Sanokai Wash watersheds (Section 3.3.1).

Initial Conditions—Unsteady State

Initial flow conditions are required at the upstream reach locations in the unsteady state model along with an initial basin elevation for the Chandler Heights Basin. Initial flow conditions and initial basin elevation are shown in Table 4.4.2.2.1.

For model stability, the initial flow rates used in the analysis are larger than actual input hydrograph information at the initial time period at each location (Section 4.2.3). The increase does not adversely impact the analysis results.

Starting Water Surface Elevations and Flow Data– Steady State Model

Starting Water Surface Elevations
Starting water surface elevations for the Chandler Heights Basin steady state analysis are provided in Table 4.4.2.2.2.

Flow Data
Flow data for the Chandler Heights Basin steady state analysis is derived from HEC-1 models and the Unsteady State Analysis of the Chandler Heights Basin (CHB.PRJ). Flow data and their sources are identified in Table 4.4.2.2.3.

Table 4.4.2.2.3 Steady State Model Peak Flow Changes

River	Reach	Cross Section	Peak Discharge (cfs)	Source Hydrograph
Sanokai Wash	R1	2016.8	3310	RCHB100.DAT (CO508A)
Queen Creek	R1	10723	2930	RCHB100.DAT (CO484)
Queen Creek	R2	6135	5536	RCHB100.DAT (CO508)
Queen Creek	R2	5382	5536	CHB.PRJ (5382)
Queen Creek	R2	5157	4872	CHB.PRJ (5157)
Queen Creek	R2	4932	4010	CHB.PRJ (4932)
Queen Creek	R2	4707	3090	CHB.PRJ (4707)
Queen Creek	R2	4482	2312	CHB.PRJ (4482)
EMF	Reach 3	13.084	3859	RCHB100.DAT (RQCS)
EMF	Reach 3	11.741	3804	CHB.PRJ (11.741)
EMF	Reach 3	11.609	4357	CHB.PRJ (11.609)
EMF	Reach 3-Lower	11.572	6627	CHB.PRJ (11.572)

5.0 SUMMARY OF BASIN DESIGNS AND ANALYSES RESULTS

5.1 INTRODUCTION

The analysis and design of the detention basins were developed through an intensive evaluation and refinement of alternative basin designs and configurations during the Pre-design phase and subsequent design phases. This section briefly discusses the process of optimizing basin designs conducted during the 30% design phase and also presents a summary of the basin designs and related analytical results for the detention basins.

5.2 RITTENHOUSE BASIN

5.2.1 Optimizing Basin Design

During the 30% Design Phase, the initial Predesign recommendations were further developed for changes in design criteria, refinement for multi-use opportunities, and more detailed design of the structures. Optimizing the basin design consisted of using a revised basin volume that included additional area for landscaping and then analyzing various lateral weir lengths, elevations and outlet sizes. Based upon the weir optimization analysis, the weir alternative that achieved the best combination of flow attenuation, weir length and weir crest elevation was then selected as the configuration for the design weir.

Weir length and elevation both have a direct impact on effectiveness of the basin to attenuate flow in the EMF, therefore, a series of analyses were performed at various weir lengths and elevations. The analyses indicated that each weir length had an elevation at which the weir was most effective.

Sizing the basin outlets was simplified since the outlet did not have an impact on the EMF peak flow rate. The outlet was sized to drain the basin within the 36 hours after the storm event. While the basin cannot be drained completely within 36 hours due to flow in the EMF, it will drain to within a few inches.

5.2.2 Value Engineering

After the 30% design review, a Value Engineering (VE) session was conducted on the detention basin designs. The recommendations from the VE session, along with other subsequent design review comments, were accommodated in the development of the basin design plans. VE recommendations and other revisions made to address subsequent design review comments were not necessarily based upon the optimal operation of the basin. Therefore a comprehensive optimization process, as performed for the 30% design phase, was not performed. The basin design, however, should still reflect a relatively efficient basin configuration.

5.2.3 Basin Design

5.2.3.1 Detention Basin

The proposed Rittenhouse Detention Basin is approximately 130 acres in size (~158 acres with landscape area, ~172 acres with area south of the Pecos Rd. alignment) and has an estimated stage-storage volume relationship as shown in Table 5.2.3.1. The basin bottom elevation is 1311 ft, the weir elevation is set at 1315 ft (sloping to 1314.75 ft over the ~800-ft weir length), and the minimum top of basin elevation is approximately 1319.5 ft.

TABLE 5.2.3.1 - Rittenhouse Basin Stage vs. Storage Volume

Basin Elevation (ft)	Area (acres)	Cumulative Storage Volume (acre-ft)
1311	0	0
1312	44	22
1313	109	99
1314	118	213
1315	119	331
1316	120	451
1317	121	571
1318	122	693

*Peak basin WSEL occurs at ~1316.67 for a maximum basin storage volume of ~530 acre-ft

In the future, the basin footprint should not be significantly modified and fill should not be imported into the basin without investigating the impact a reduction in the basin storage volume will have on the basin and the EMF drainage system, including the proposed Chandler Heights Basin. However, it is felt that the bottom can be regraded to provide additional relief as long as positive drainage of the basin can be achieved.

5.2.3.2 Lateral Weir/Basin Outlet

The proposed lateral weir is ~ 800 ft in length and varies in width for aesthetic purposes, however, a minimum 15 ft width across the top is provided for vehicular access. At the upstream end of the weir the weir elevation is set at 1315.00. The weir elevation gradually decreases in elevation at approximately the same slope of the EMF (~0.0003 ft/ft) to 1314.75 at the end of the weir. The basin outlet is a 3–6' x 4' flap-gate outlet built into the lateral weir.

5.2.4 Analysis Results

The results of the Rittenhouse Basin design analysis are described in the hydrographs presented in Figures 5.2.4.1 – 5.2.4.3.

Figure 5.2.4.1 shows the stage hydrograph for the Rittenhouse Basin and the EMF channel upstream and downstream of the lateral weir. The results show the basin elevation peaking at ~1316.7 for a peak storage volume of ~535 acre-ft. At this elevation, almost 3 feet of freeboard is provided around the perimeter of the basin (minimum top basin elevation is 1319.50). The figure also shows the basin drains to ~1311.25 within 36 hours after the storm event, leaving 0.25 ft to drain from the basin through percolation. The presence of protracted flow in the EMF after the storm event prevents complete basin drainage through the outlet within 36 hours, however, the remaining water should percolate quickly. Figure 5.2.4.1 also identifies the time at which the

Figure 5.2.4.1 - Stage Hydrographs at the EMF/Rittenhouse Basin Weir and Flap Gate Outlet

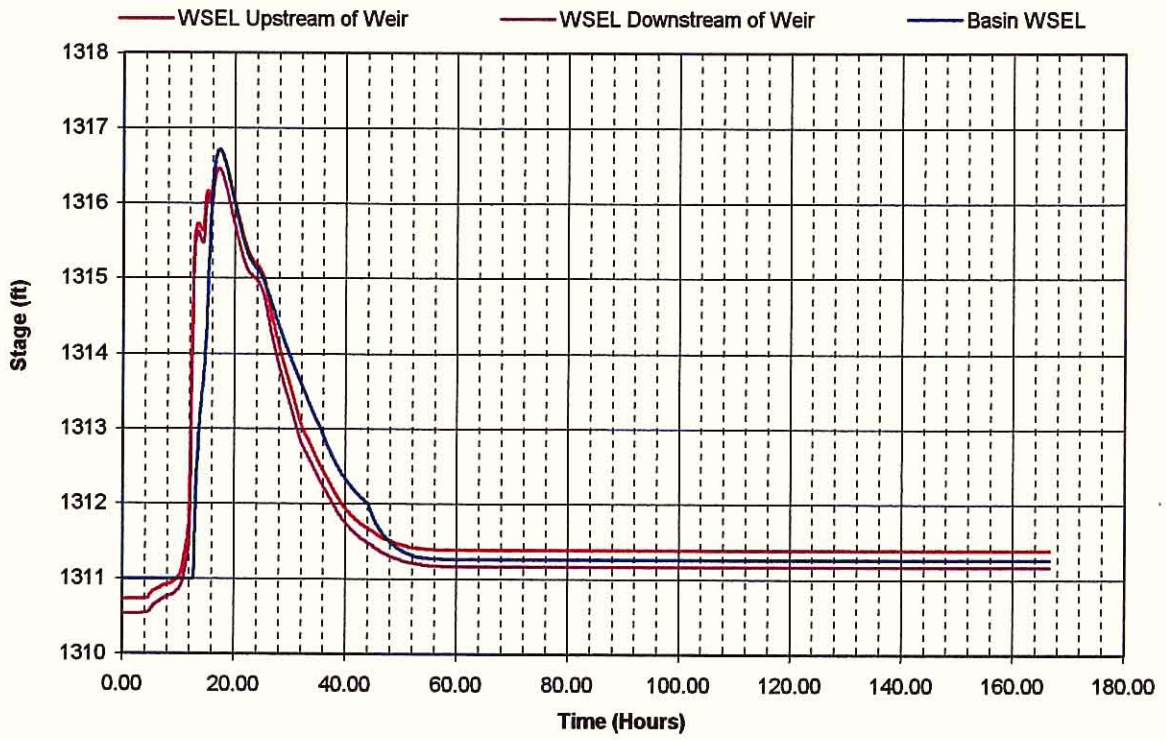


Figure 5.2.4.2 - Flow Hydrographs at the EMF/Rittenhouse Basin Weir and Flap Gate Outlet

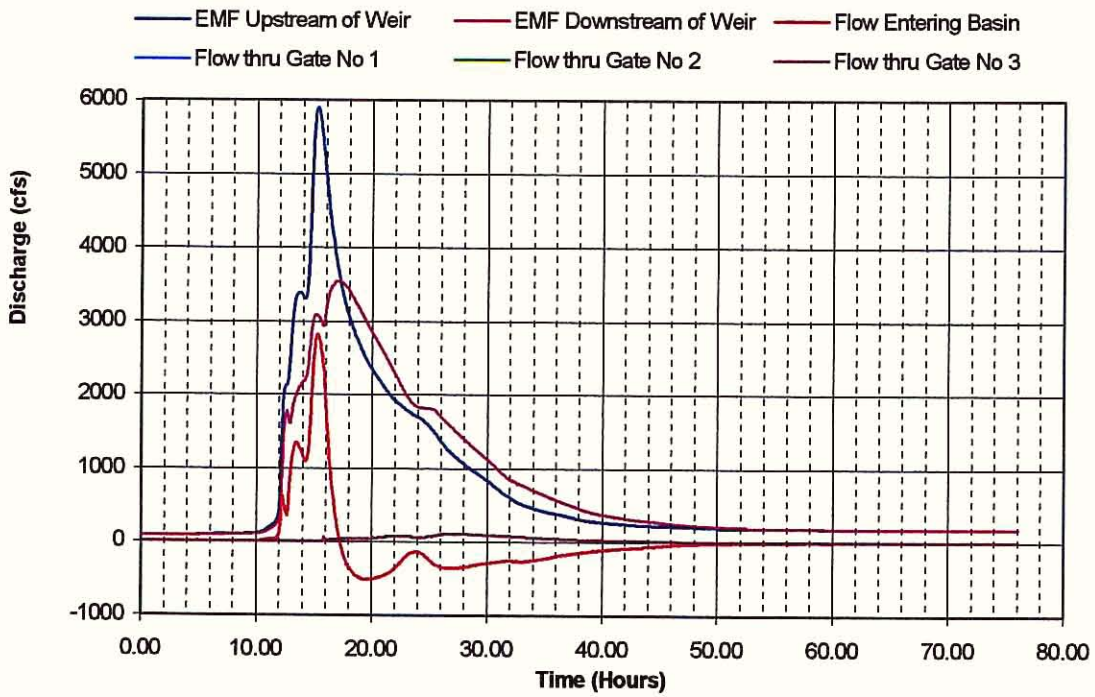
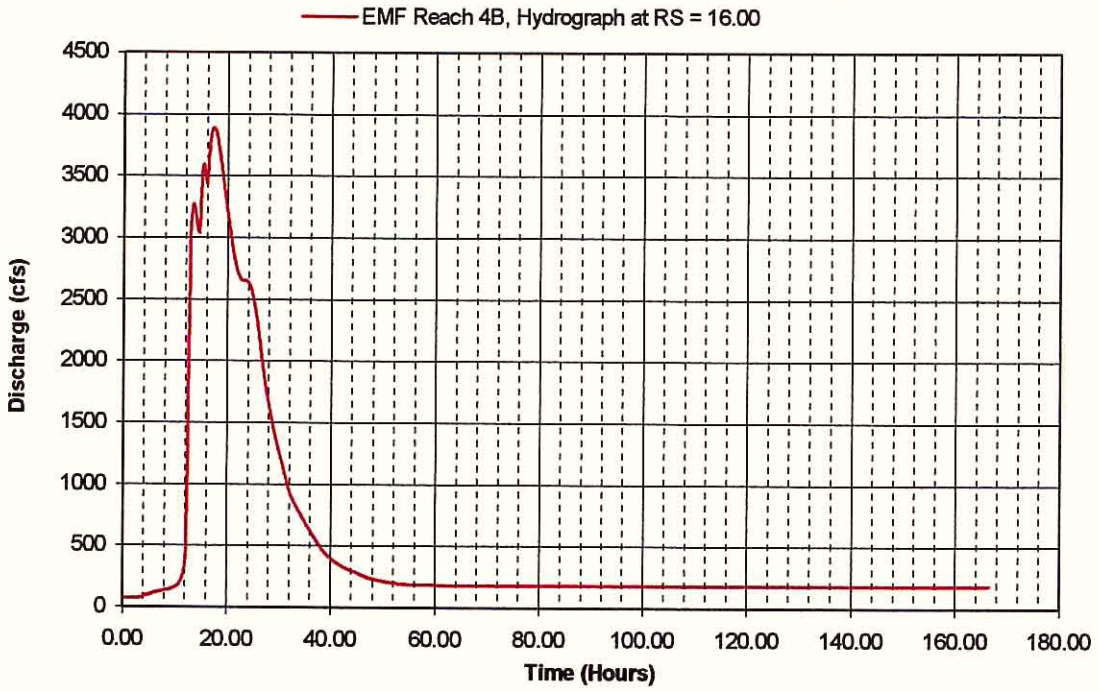


Figure 5.2.4.3 - Flow Hydrograph
Downstream of Rittenhouse Basin
(Exported to HEC-1 Model RCHBD60.DAT)



flap gates should start to open. At 15:50 hours into the storm event, the basin water surface elevation (WSEL) starts to exceed the WSEL in the EMF at the flap gate outlet ("WSEL Downstream of Weir").

Figure 5.2.4.2 shows the impact of the operation of the basin and lateral weir/ flap gate outlet on flow in the EMF channel.

The peak flow upstream of the weir of ~5900 cfs is reduced to ~3080 cfs after the weir. The amount of flow passing over the lateral weir ("Flow Leaving EMF") and into the detention basin peaks around 2820 cfs. After the peak, flow into the basin quickly drops and flow begins leaving the basin and flowing back over the lateral weir and through the flap gate outlet back into the EMF (a negative value for "Flow Leaving the EMF" means flow is entering the EMF).

Figure 5.2.4.3 shows the resulting EMF hydrograph downstream of the Rittenhouse Basin and downstream of the Rittenhouse Channel at EMF-Reach 4B, XS 16.000. The results show the peak flow in the EMF, downstream of the Rittenhouse Channel, has been attenuated to ~3890 cfs. This hydrograph is routed down the EMF for use in the analysis of the Chandler Heights Basin.

5.3 CHANDLER HEIGHTS BASIN

5.3.1 Optimizing Basin Design

Various design goals were accounted for in the optimization of the Chandler Heights Basin. These included accommodations for future multi-use activities within the EMF and basin, detailed design and analysis of the Queen Creek and Sanokai Wash channels, sedimentation basin, channel drop structures, lateral weir structure and detention basin outlet structure.

The structures and channels integrated into the Chandler Heights Basin were evaluated to assess the impact that each had on the entire system. Features, such as the channel drop structures, were also analyzed individually in order to design for a range of conditions not assessed in the overall evaluation.

Optimization of the Chandler Heights Basin system consisted of:

- Adjusting the overall design of the Chandler Heights Basin system based upon the design of the Rittenhouse Basin;
- Reconfiguring the basin stage/volume to accommodate landscaping features while minimizing basin excavation and maximizing basin storage effectiveness;
- Developing a lateral weir length/elevation and Queen Creek channel configuration to:
  - -maximize the attenuation of EMF flow;
  - -maintain acceptable channel freeboard;
  - -maintain acceptable channel velocities.
- Optimizing the size of the basin outlet structure to:
  - -minimize basin storage requirements;
  - -efficient attenuation of EMF flow;
  - -drain the basin within 36 hours after the 24-hour storm event.

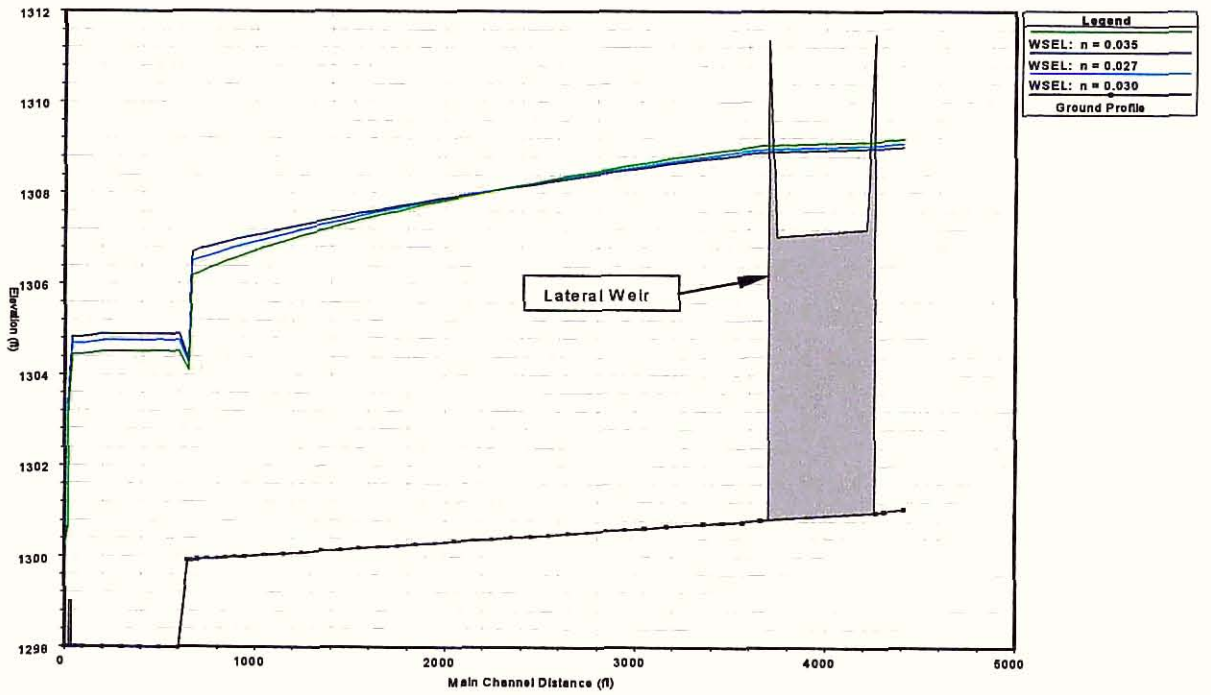
As a result of the optimization of the basin design:

- the basin outlet consists of a 2-6'x4' RCBC with flap gates;
- the lateral weir is 800 ft in length with an average height above the Queen Creek channel of 6.25 feet;
- the proposed basin contains 1350 acre-feet of volume during the 100-year event while maintaining a minimum of 2 ft. of freeboard;
- the Queen Creek channel downstream of the lateral weir structure has a bottom width of 50 feet.

5.3.2 'n' Value Sensitivity Analysis

At the 30% and 60% design phases, sensitivity analyses were performed using a range of n-values on both Queen Creek and the EMF to evaluate the impact

Figure 5.3.2.1: Queen Creek Channel 'n' Value Sensitivity Analysis



that variations in Manning's 'n' would have on the function of the proposed Chandler Heights Basin, the EMF and the Queen Creek channel

Figure 5.3.2.1 shows the impact 'n' values of 0.027, 0.030, and 0.035 have on the water surface elevation in the Queen Creek channel. At the critical location of the lateral weir, the increase in 'n' value from 0.027 to 0.035 increases the water surface profile by approximately 0.1 feet. The increase in water surface elevation increases the amount of flow over the lateral weir 100-200 cfs (Figure 5.3.2.2). This increases the maximum stage in the detention basin by 0.5 to 1.0 feet and the amount of detention storage by 100 to 270 acre-ft. Channel velocities in Queen Creek decrease by 0.5 fps or less.

Due to the response of the detention basin stage and storage resulting from changes in 'n' value, the design 'n' value should account for future vegetative growth and the channel should be maintained to insure the proper operation of the channel and the Chandler Heights Detention Basin. Based upon the results, an 'n' value selected for use in design based on FCDMC criteria was 0.030 (Table 6.11, Drainage Design Manual for Maricopa County, Volume II, Hydraulics, January 28, 1996). This value accounts for significant growth in the channel, including grass and shrubs.

The effects of 'n' value variation were also evaluated in the EMF. Figure 5.3.2.3 shows the EMF water surface profiles corresponding to 'n' values of 0.030, 0.035, and 0.040. The water surface varies by approximately 0.5 feet

Figure 5.3.2.2 - Flow Across Weir into Chandler Heights Basin

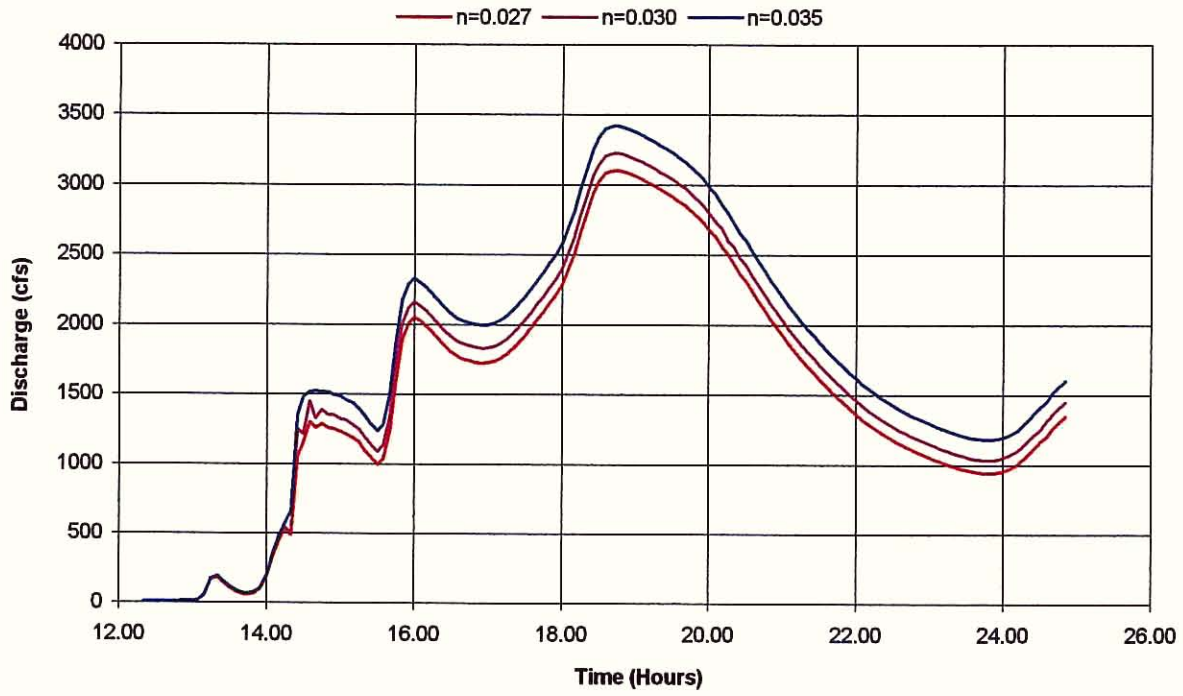
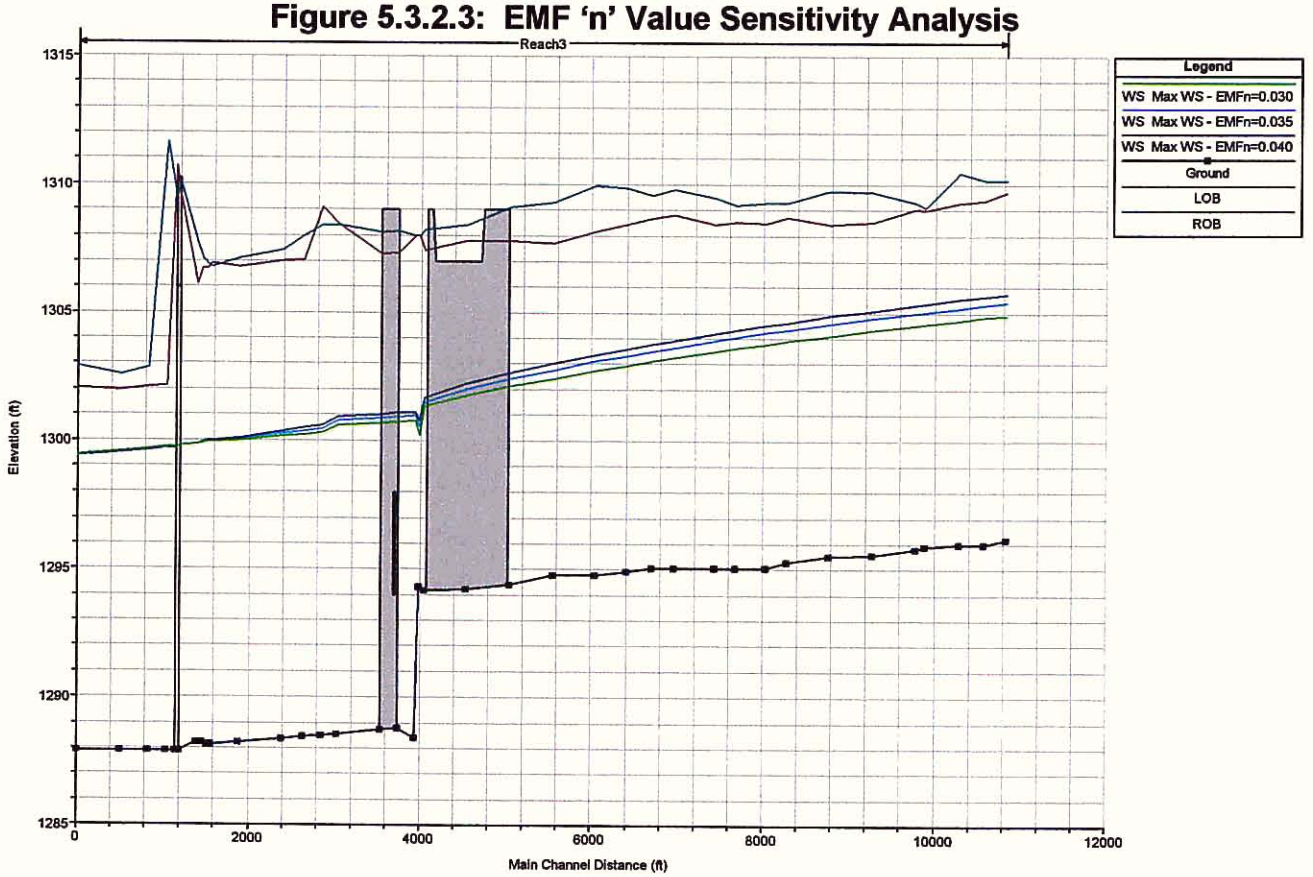


Figure 5.3.2.3: EMF 'n' Value Sensitivity Analysis



between profiles and the velocity varies by less than 0.5 fps along the entire reach. The slight increase in the EMF water profile slightly increases the tailwater on the basin's flap-gate outlet. However, the impact is insignificant, increasing the basin stage by 0.1 ft and the basin volume by approximately 10 acre-ft. Ultimately, an n-value of 0.040 was used for design in accordance to a previous study and at the direction of the FCDMC (Section 4.4.2.1).

5.3.3 Basin Design

5.3.3.1 Detention Basin

The Chandler Heights Detention Basin is approximately 230 acres in area (including landscape areas) and has an estimated stage-storage volume relationship as shown in Table 5.3.3.1. The basin bottom elevation is at 1296 and the minimum top basin elevation is 1309. This allows for over two feet of freeboard at the peak basin water surface elevation (~1306.5) during the 100-yr, 24-hr event. Due to existing topography, the northern end of the basin is deeper and has significantly more freeboard than the southern end.

In the future, the basin footprint should not be significantly modified and fill should not be imported into the basin without investigating the impact a reduction in the basin storage volume will have on the basin and the EMF. However, it is felt that the bottom can be regraded to provide additional relief as long as positive drainage of the basin can be achieved.

TABLE 5.3.3.1 - Chandler Heights Basin Stage vs. Storage Volume

Basin Elevation (ft)	Area (acres)	Cumulative Storage Volume (acre-ft)
1296	0	0
1297	19	9
1298	53	45
1299	58	101
1300	125	192
1301	174	342
1302	175	516
1303	177	693
1304	179	871
1305	181	1050
1306	182	1232
1307	184	1415
1308	186	1600
1309	187	1786

*Peak basin WSEL occurs at ~1306.5 for a maximum basin storage volume of ~1325 acre-ft

5.3.3.2 Lateral Weir

The proposed concrete lateral weir is a 800 feet long. The width of the weir varies for aesthetic purposes but the proposed minimum width is 15 feet to provide maintenance access across the weir crest. The lateral weir elevation varies from 1307.24 to 1307.00 from upstream to downstream.

5.3.3.3 Basin Outlet

The proposed basin outlet is a 2-6'x4' RCBC with flap-gates. The inlet invert is set at 1294, two feet lower than the proposed basin bottom elevation of 1296. The outlet invert is at 1293 allowing for a net 1.5-foot drop for flap gate clearance and apron slope to the proposed EMF elevation of approximately 1291.5. The outlet drains the basin within 36 hours. The model was also run to evaluate a situation in which the flap gates were blocked. In such a case, the basin fills to a peak stage of 1307.9, drains over the emergency spillway until the basin stage is 1307.0 and then ceases to drain.

5.3.3.4 Emergency Spillway

The emergency spillway is located adjacent to the EMF along the west edge of the Chandler Heights Basin just north of the basin outlet structure. It is 550 feet in length along the crest. Access across the spillway is maintained with 10:1 ramps at each end extending from the top of the embankment (el.1309) two feet down to the crest (el.1307). The spillway is protected from scour during operation by rock mattresses and a cut-off wall. It is sized to pass the peak discharge entering the basin (3,225 cfs) without overtopping the embankment (el. 1309) when the outlet structure fails to operate.

5.3.4 Channel Design

5.3.4.1 General

The channelization of Queen Creek, Sanokai Wash and a portion of the EMF is part of the overall Chandler Heights Basin system design. Channel improvements along Queen Creek and Sanokai Wash are necessary to control the lateral weir operations, provide adequate conveyance with freeboard, control channel flow velocities and control sediment transport and degradation/ aggradation in the channels. Drop structures are proposed to maintain milder, more stable channel slopes. The relocation of an existing drop structure in the EMF near Chandler Heights Road Bridge to upstream of the Chandler Heights Basin outlet has been proposed to reduce the EMF water surface elevation at the basin outlet. This will allow for gravity drainage of the detention basin.

5.3.4.2 Queen Creek

Queen Creek will be realigned and channelized from downstream of Higley Road to the confluence with Sanokai Wash. The proposed channel will be aligned just west and adjacent to the existing wash and incised to remove the levee conditions. It will have a 100-foot bottom width, 4:1 side slopes and a channel slope of 0.0003 ft/ft. The channel will be earthen except in the vicinity of six proposed weir/drop structures (Section 5.3.5).

5.3.4.3 Sanokai Wash

Sanokai Wash, between the confluence with Queen Creek and Higley Road, will consist of an earthen, incised channel located north of the proposed Ocotillo Road alignment. It will have a 110-foot bottom width, 4:1 side slopes and a channel slope of 0.0022 ft/ft. The channel contains a 5-ft drop structure and ends at Higley Road at the proposed invert for a future bridge or culvert.

5.3.4.4 Queen Creek / Sanokai Wash

From the Queen Creek and Sanokai Wash confluence to the upstream end of the lateral weir, the channel is an incised, earthen channel with a 200-ft bottom width, 4:1 side slopes and a channel slope of 0.0003 ft/ft. Along the lateral weir, the channel bottom will narrow from 200 ft to 50 ft. Within this transition, the channel side slopes will be 4:1 and the channel grade will continue at 0.0003 ft/ft. The narrowing of the channel increases the water surface elevation along the length of the weir, thus maintaining head on the weir and increasing the weir efficiency. The 50-ft wide channel downstream of the weir will outfall into a sedimentation basin prior to discharging into the EMF.

5.3.4.5 EMF

To allow for gravity drainage of the basin, the existing EMF drop structure near Chandler Heights Road will be removed and the EMF will be excavated to a new drop structure constructed upstream of the basin outlet. The EMF channel invert will be lowered approximately 5.5 feet for a distance 2700 feet upstream. The EMF bank side slopes will be extended deeper at existing 3:1 slopes thereby narrowing the bottom width through this reach from 200 feet to 167 feet. The EMF will be transitioned back to its full 200 foot bottom width near the location of the removed existing drop structure. A sloping, grouted-rock drop structure will be constructed at the new location.

5.3.5 Drop Structure Design

5.3.5.1 General

The proposed drop structures consist of an upstream constriction, approach apron, sloping drop and downstream apron with sill and cut-off walls. The upstream and downstream ends are protected with dumped riprap. The structures are comprised of grouted rock. The crest widths, drop heights and cut-off wall depths of each structure meet the needs at the given location. Drop structures were designed for a range of flow rates in order to contain potential hydraulic jumps on the drop structure apron. The design of each structure accounts for seepage, uplift forces and local scour.

5.3.5.2 Seepage and Uplift Analyses

Seepage and uplift forces were estimated using Lane's Weighted Creep as described in the "Design of Small Dams" (Bureau of Reclamation, 1973) and in accordance with the FCDMC design criteria. Based upon the analyses, the minimum thickness of each drop structure was estimated to counteract uplift forces and the depths of cut-off walls for each structure were determined to counteract seepage and piping under the structure.

5.3.5.3 Local Scour

Local scour calculations were performed and cutoff wall depths checked to insure safety against undermining of the channel structures. Scour estimates are based upon technical guidelines described in "Computing Degradation and Local Scour" (Bureau of Reclamation, 1984). Local scour is estimated based upon Type A & B Equations, the Lacey Equation, the Blench Equation and the USBR II Equation. Since these values tend to have a wide range of variability, engineering judgment was used to select the scour estimate.

5.3.5.4 Cutoff Wall Depths

Based upon the results of the seepage and local scour calculations, the required depths of cutoff walls for each drop structure were determined. A comparison of the cutoff wall depth required to counteract seepage versus local scour was made. Each cut-off wall protects against local scour. If necessary, the cutoff walls are deepened to meet seepage requirements.

5.3.5.5 Hydraulic Jump Analyses

The hydraulic jump condition at each drop structure was assessed for a range of flow-rates to obtain the minimum downstream apron length. The apron length is determined such that a hydraulic jump would be contained on the

apron. HEC-RAS was used to approximate the occurrence, location and height of the jump. An estimate of the length of the jump was made using the Froude number and downstream flow depth (Chow, 1959). By modeling each drop structure over a range of flows, the 'worst case' flow condition was used as the basis for design. Typically, the 'worst case' condition was caused by a lower flow rate than the 100-year peak discharge. At high flow rates, the drop structures tend to be inundated and no jump occurs.

5.3.5.6 EMF Drop Structure

To allow for the gravity drainage of the proposed Chandler Heights Detention Basin within 36 hours, it is necessary to relocate the existing vertical drop in the EMF to upstream of the detention basin outlet. The existing concrete drop structure will be removed and a new, sloping, grouted-rock structure will be constructed upstream at the new grade control/drop structure location.

5.3.6 Sedimentation Basin Design

A new sedimentation basin is to be located just downstream of the Higley Road Bridge on Queen Creek to capture incoming sediment loads from Queen Creek and. The inlet and outlet of the sedimentation basin is protected by a grouted rock weir structure and an outlet pipe with drain filter to drain the basin. The existing sedimentation basin at the confluence of Queen Creek and the EMF will remain with some modification to the lower invert of the Queen Creek channel.

Figure 5.3.7.1 - Stage Hydrographs at EMF/Chandler Heights Outlet

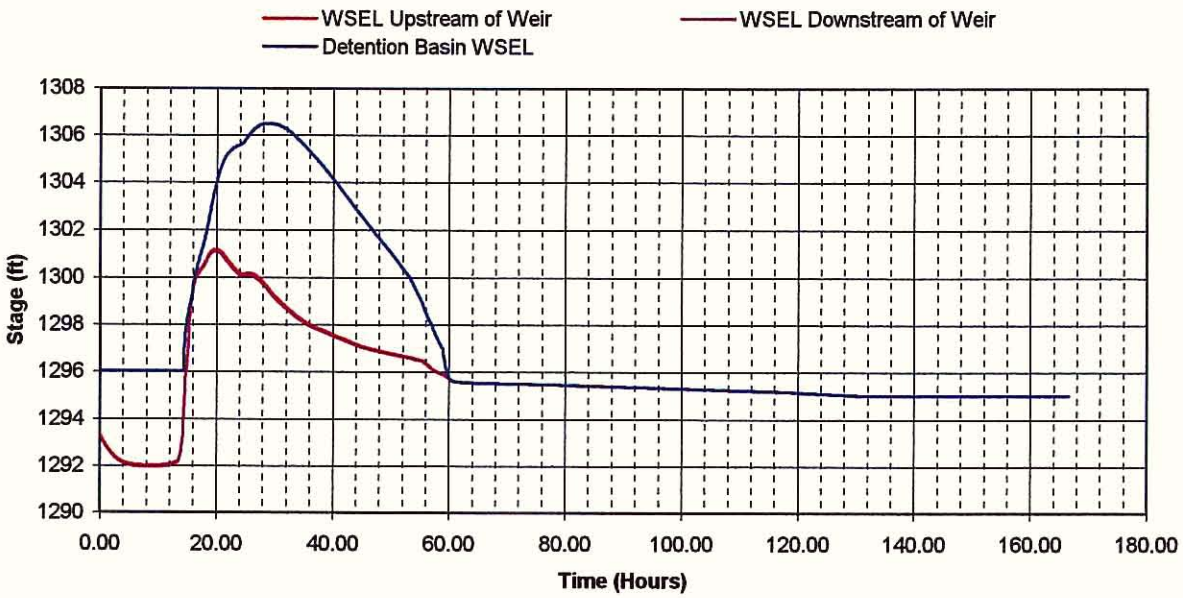
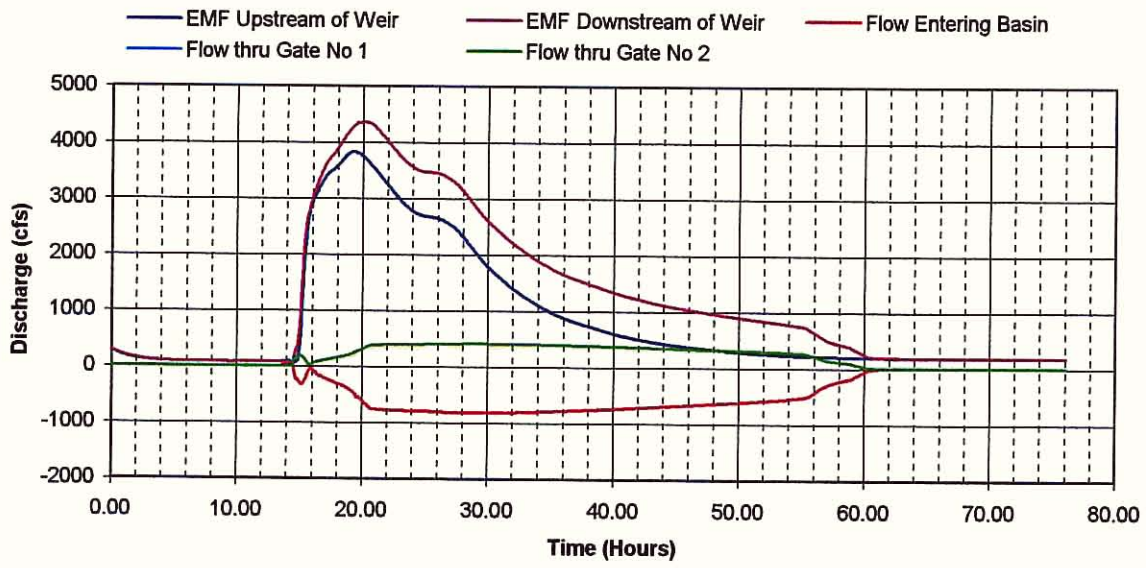


Figure 5.3.7.2 - Flow Hydrographs at EMF/Chandler Heights Outlet



5.3.7 Analysis Results

Hydrographs from the Chandler Heights Basin analysis are depicted Figures 5.3.7.1 – 5.3.7.3. Figure 5.3.7.1 shows stage hydrographs for the Chandler Heights Basin and the EMF at the basin outlet. It shows the basin stage peaking at 1306.5 for a maximum storage volume of 1320 acre-ft and providing a minimum of 2 feet of freeboard around the basin. I also shows that within 36 hours, the basin drains to an elevation of 1296.3. The remaining 0.3

Figure 5.3.7.3 - Flow Hydrographs at Weir on Queen Creek

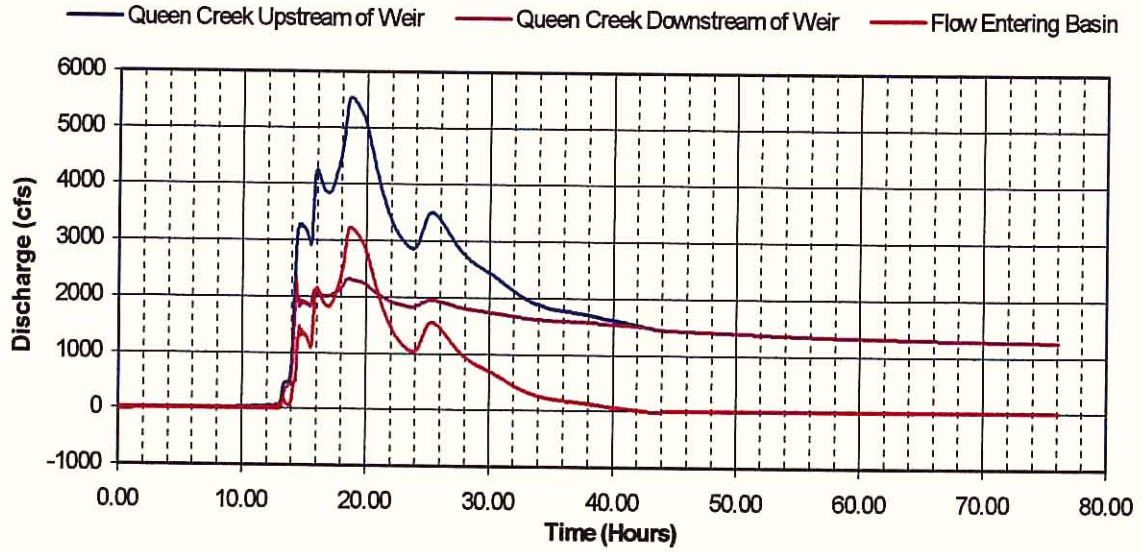
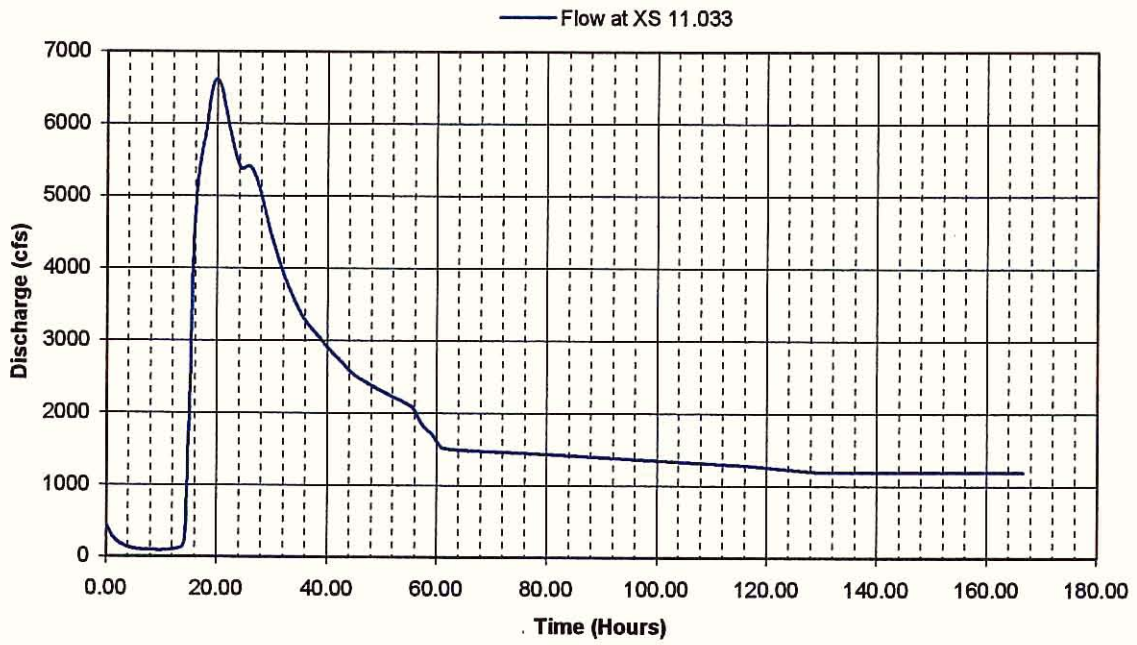


Figure 5.3.7.4 - Flow Hydrograph Downstream of Chandler Heights Basin Outlet and Queen Creek Confluence



feet of water should quickly dissipate through soil infiltration shortly, thereafter. Figure 5.3.7.2 shows the impact of the operation of the basin outlet on flow in the EMF channel. The peak flow in the EMF increases from approximately 3830 to 4370 cfs due to flow draining from the basin through the flap gates.

Figure 5.3.7.3 shows the operation of the lateral weir as it reduces the peak flow from 5540 to ~2340 cfs in Queen Creek by diverting it into the Chandler Heights Detention Basin.

Figure 5.3.7.4 shows the hydrograph in the EMF downstream of the Chandler Heights Basin Outlet and downstream of the confluence with the Queen Creek Channel. The results show the peak flow in the EMF is approximately 6610 cfs.

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