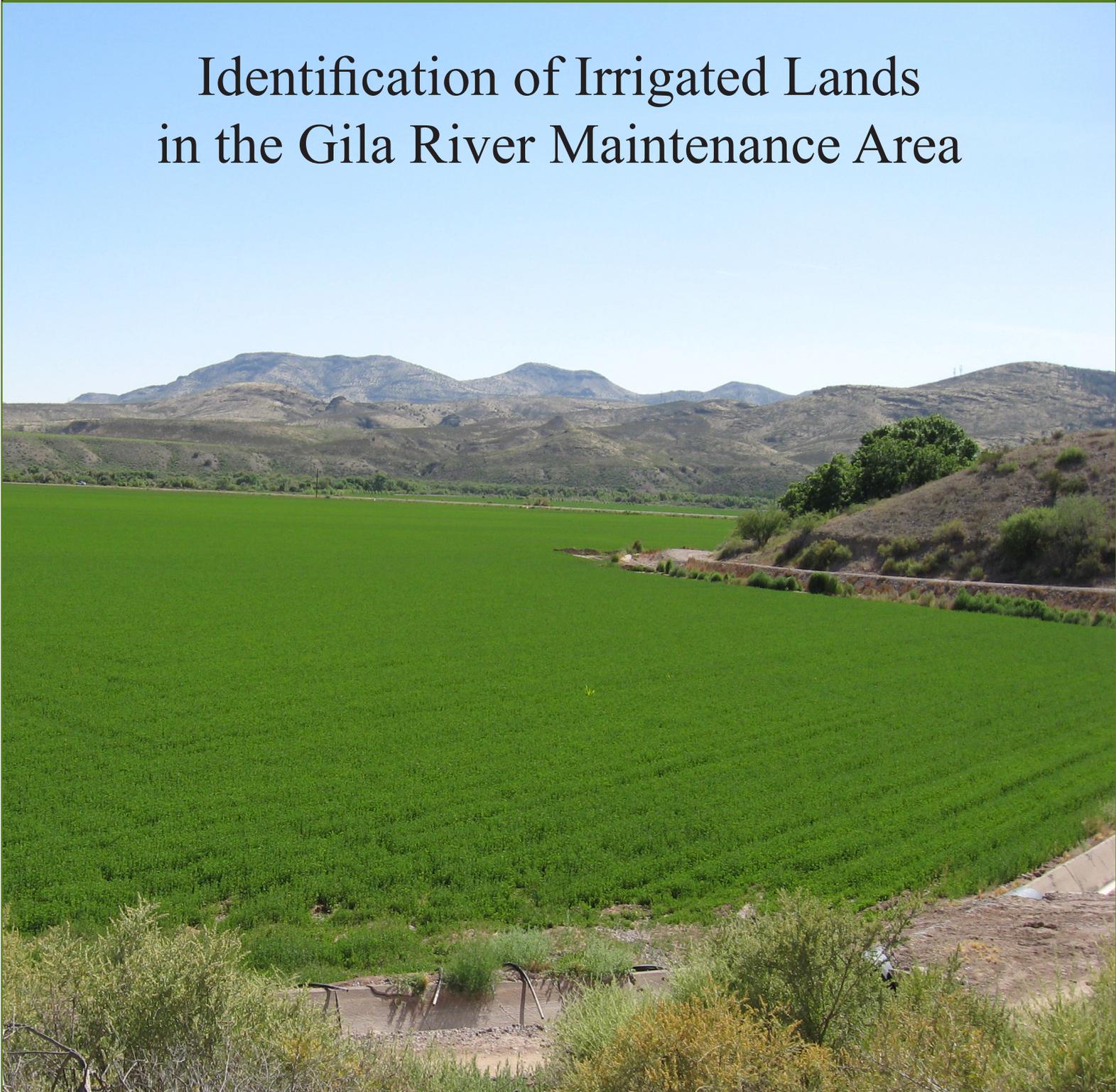


Identification of Irrigated Lands in the Gila River Maintenance Area



ARIZONA DEPARTMENT OF WATER RESOURCES

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Janet Napolitano
Governor

Herbert R. Guenther
Director

January 31, 2008

Honorable Eddward P. Ballinger, Jr.
Superior Court of Maricopa County
Northeast Regional Court
18380 North 40th Street
Phoenix, Arizona 85032

Dear Judge Ballinger:

Enclosed is a copy of the first Gila River Maintenance Area Report. Pursuant to the Gila River Indian Community Water Rights Settlement Agreement (Settlement Agreement), this Report "shall be made a permanent part of the court record in the Gila River Adjudication Proceedings" which is Contested Case No. W1-207. Further, an update of this Report will be filed with the court every five years after the initial qualification window, the next which will occur in 2010.

The State of Arizona agreed, as part of the Settlement Agreement, that it would help to maintain a baseflow of the Gila River by limiting new uses in the watershed through changes in state law. Paragraph 26.8.2 of the Settlement Agreement outlines a "safe harbor" program offered by the Gila River Indian Community (GRIC), the San Carlos Irrigation and Drainage District (SCIDD) and the United States, to existing and certain future water users in the Gila River watershed above Ashurst-Hayden Dam. Under A.R.S. § 45-2641, lands in the watershed that do not have a history of recent irrigation are now prohibited from irrigating with certain waters. The Arizona Department of Water Resources (Department) has the authority and responsibility to enforce these provisions.

This Report was drafted to reflect the interaction between the Settlement Agreement and the new state legislation. Copies of this Report are also being transmitted to the GRIC, SCIDD



Eddward P. Ballinger, Jr.
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and the United States. Please note this Report is submitted by the Department in its capacity as the executive agency responsible for implementing A.R.S. § 45-2601 *et seq.*, and not as technical advisor to the court. Should you have questions please feel free to contact me or Gregg Houtz.

Sincerely



Thomas G. Carr
Assistant Director

TGC/GH/gw

Enclosure

c: Gov. William Rhodes, GRIC
Mr. Patrick Barry, U.S., DOJ
Mr. Doug Mason, SCIDD
Mr. Jon Allred, Gila Water Comm.



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1.0 INTRODUCTION

This report documents the identification of agricultural lands irrigated between January 2000 and September 2005 in an area of southeastern Arizona referred to as the Gila River Maintenance Area (GMA). Geographic information systems (GIS) were utilized for the project and associated tasks. These tasks included analysis of remote sensing data, ground inspections, database management and querying, and landowner notification. The product of this work is a GIS database (geodatabase) and maps of the irrigated lands.

1.1 BACKGROUND

In 2005, Arizona Revised Statute (A.R.S.) Title 45, Chapter 15 was enacted by the Arizona Legislature to implement conditions of the Gila River Indian Community (GRIC) Water Rights Settlement Agreement (“Settlement”). Among the conditions implemented was the establishment of the GMA and GMA Impact Zone. With some exceptions, irrigation of new lands in the GMA is prohibited by the legislation unless the lands were previously irrigated by water sources at any time from January 1, 2000 through the effective date of the legislation (September 2005).

Under State law, water sources for irrigation include wells and surface water diversions located within the GMA Impact Zone and wells located adjacent to the impact zone if their cones of depression capture surface water within the zone. Exceptions to the prohibition include irrigation of lands within the portion of the GMA in Cochise County and irrigation allowed under the Globe Equity No. 59 (GE 59) Decree. Irrigated lands with existing appropriative water rights and other irrigated lands specified in the Settlement are also allowed.

Irrigation of new lands within the GMA in violation of the legislation is subject to enforcement action by the Arizona Department of Water Resources (ADWR). Relevant sections of A.R.S. Title 45, Chapter 15 are provided in **Appendix A**.

The Settlement specifies that ADWR develop a GIS database to memorialize the location of non-GE 59 irrigators in the GMA. In 2007, ADWR staff met with technical representatives of the GRIC, San Carlos Irrigation and Drainage District (SCIDD), and the United States (U.S.),

among others, to discuss and agree upon the imagery (aerial photos and satellite images) used to map recently irrigated lands in the GMA. As required under the Settlement, this imagery shall be a permanent part of the court record in the Gila River Adjudication Proceeding and available for review (GRIC Settlement, 2005). Copies of the GIS database shall also be retained by ADWR, GRIC, SCIDD, and U.S. For reference, sections from the Settlement related to this project are also included in **Appendix A**.

This report describes the methodology used to develop the aforementioned GIS database and transmits a copy of the final database. Note that ADWR attempted to identify all lands irrigated within or adjacent to impact zones in the GMA at any time from January 2000 through September 2005. As described in more detail later in this report, no attempt was made to differentiate recently irrigated GE 59 lands from recently irrigated non-GE 59 lands. The latter are considered “Eligible Safe Harbor Acres,” as defined in the Settlement.

The focus of this report and accompanying GIS database is the documentation of any agricultural fields irrigated during the project window. ADWR will identify potential irrigators in violation of the Safe Harbor provision of the Settlement, and in violation of the State law prohibition of new irrigated lands, by comparing the boundaries of recently irrigated lands in the GIS database against future imagery of the GMA. Differences will be noted and potential new agricultural activities investigated accordingly. If necessary, ADWR will take appropriate regulatory action at that time.

1.2 PURPOSE AND SCOPE

The purpose of this project was to identify agricultural lands in the GMA that were irrigated between January 2000 and September 2005 (“project window”). The GMA covers over 6,350 square miles or over four million acres in southeastern Arizona (**Figure 1**). GMA boundaries are defined by the San Pedro River and Upper Gila River watersheds with some exclusions. The San Carlos Indian Reservation to the north and Cochise County to the southeast were excluded from the GMA. The GMA includes portions of Apache, Gila, Graham, Greenlee, Pima, Pinal, and Santa Cruz Counties. Note that the portion of the GMA within Santa Cruz County was not evaluated during this study, as there is no impact zone in this area. As per the

GRIC Settlement, new irrigation is generally restricted from water wells that pump within or adjacent to designated impact zones. Impact zones were mapped by the settling parties and consist of sediments deposited by Aravaipa Creek and the Gila, San Pedro, San Simon, and San Francisco Rivers.

GIS was utilized during this project to store, view, overlay, and analyze spatial data in a shared digital format. The system offers the power of a database allowing geographic data to be stored in tables and later queried to extract useful information and conduct analyses. Aerial photography and multi-spectral satellite imagery were used in conjunction with GIS analysis to evaluate the irrigation status of agricultural fields over time.

2.0 DATA SOURCES

Determination of irrigation status during the project window was based on several data sources including previously mapped field boundaries, aerial photographs, and satellite imagery. Additional GIS data (layers) were used to create base maps and support the analysis.

2.1 FARM SERVICE AGENCY COMMON LAND UNIT POLYGONS

The Farm Service Agency (FSA), part of the United States Department of Agriculture (USDA), uses Common Land Units (CLU) to map the nation's farms and agricultural fields. A CLU is defined by FSA as "the smallest unit of land that has a permanent, contiguous boundary, common land cover and land management, common owner, and common producer association" (NAIP, 2006). CLU data were acquired for each county within the GMA boundary and found to include the majority of agricultural lands that ADWR eventually identified in the area.

2.2 AERIAL PHOTOGRAPHY

Irrigation status was initially based on analysis of readily available aerial photographs taken during the project window. This included imagery collected for the 2005 Census and hosted by the Arizona State University (ASU) Map Service. The one-meter pixel resolution, color imagery covered the entire project area. With the exception of a small portion of the GMA within Pima County, which was not flown until March 2006, the photographs were taken between May and September 2005 (SCO, 2005), as shown in **Figure 2**. Because it was beyond the project window, the 2006 imagery for the few agricultural fields within Pima County were not used to determine their overall irrigation status. **Figure 3** provides an example of the quality and resolution of the 2005 aerial photography.

ADWR also obtained aerial photographs flown by the National Agricultural Imagery Program in 2003 and 2004 (NAIP, 2006). This color imagery was downloaded at no cost and covered portions of the project area at a two-meter pixel resolution. **Figure 4** shows an index map of the coverage and **Figure 5** provides an example of the quality and resolution of this aerial photography.

2.3 LANDSAT IMAGERY

Landsat Enhanced Thematic Mapper (ETM) images are obtained from a satellite orbiting approximately 440 miles above the earth. The images are taken in north to south paths that cover approximately 115-mile wide swaths from west to east. Landsat repeats each path every 16 days (EROS, 2007). Three path/row swaths cover the entire GMA (**Figure 6**). Due to its large coverage and frequency of collection, ETM images proved useful for this project. Several images per year were available free of charge for years 2000 and 2002-2005 and downloaded through the Multi-Resolution Land Characteristics Consortium program (MRLC, 2007).

Landsat images have a 30-meter pixel resolution in spectral Bands 1 through 7 and 15-meter panchromatic (black and white) resolution on Band 8. Although this imagery was not ideal for digitizing field boundaries, it did provide information for already delineated agricultural fields. Analysis of satellite imagery, described further in Section 4.4 and **Appendix B**, allowed irrigation status to be evaluated for each field during the project window. Both false color and calculated normalized difference vegetation index (NDVI) were used in the analysis (**Figure 7**).

2.4 ADDITIONAL DATA SOURCES

Also used to identify agricultural fields was a land cover file based on analysis of Landsat imagery collected from 1999 through 2001 (SWGAP, 2004). This thematic layer included land use categories such as agriculture, urban, and residential. Following are other data sources used for this project:

- “Impact Zones”: Mapped by the GRIC settling parties along major watercourses in the GMA. Most agricultural fields identified within the GMA are within or near these impact zones (GIS Southwest, 2005);
- Stream Orders 1 through 5 (ALRIS, 2006);
- Roads (ALRIS, 2006);
- Townships and Ranges (ADWR, 2007);
- County Boundaries (ALRIS, 2006);
- ADWR Adjudication Watershed Boundaries (ADWR, 2007);

- Arizona State Boundary (ALRIS, 2006);
- 30-Meter Digital Elevation Model of the State of Arizona (USGS, 2007);
- 10-Meter Hillshade of the State of Arizona (ADWR, 2007); and
- Globe Equity No. 59 Decreed Lands (GIS Southwest, 2007).

3.0 GEODATABASE

The geometry, irrigation status, and various other information about each agricultural field polygon were stored in a GIS database or geodatabase. A geodatabase is a spatial database with extensions for storing, querying, and manipulating geographic information.

3.1 DESIGN/STRUCTURE

The primary feature stored in the GMA geodatabase is the agricultural field boundaries or “polygons.” Numerous attributes are associated with each polygon, most notably its agricultural status for each year during the project window. Other polygon attributes were stored to record specific data to establish irrigation status, for record keeping purposes, and to ensure quality control. The geodatabase was designed to use domains or “look-up” tables that provided a dropdown menu for editing polygon attributes such as irrigation status and the database analyst who created and verified the polygon. This facilitated the editing process and minimized data-entry errors. Agricultural field attributes stored in the GMA geodatabase include:

- Date each field was first edited/created;
- Analyst who completed the editing;
- Irrigation status during years 2000-2005;
- Date the field was ground inspected and by whom;
- Reference to the feature’s source (e.g., FSA CLUs);
- Availability of imagery in a given year;
- Township/Range, based on the centroid, or center point, of each field;
- Yes/No attribute to record whether or not the field should remain in the dataset based on various criteria;
- Attribute to record whether the field was recently irrigated, GE 59 Lands not recently irrigated as determined by ADWR analysis, or other agricultural land not recently irrigated;
- Attribute to record percent confidence that the field irrigation status is accurate for those fields ADWR determined were recently irrigated during the project window;

- Attribute to record the type of response received from landowners notified that their field(s) were not found to be recently irrigated based on ADWR analysis; and
- Miscellaneous remarks about the field.

A complete list of agricultural field attributes and their descriptions is presented in **Appendix C**. Other features stored in the GMA geodatabase include the project boundary, impact zones, and townships within the project boundary.

3.2 CLASSIFICATION OF IRRIGATION STATUS

The following categories were used to differentiate the irrigation status of agricultural fields identified in the GMA:

- Active Cropped/Irrigated
- Active Fallow
- Inactive/Idle
- Questionable

Table 1 provides a comparison of these categories and examples of how they typically appear on aerial photographs, Landsat images, and on the ground. During ADWR's analysis, a fifth category was used to record the changing status of agricultural lands that became urbanized or developed during the project window of January 2000 to September 2005.

4.0 METHODOLOGY

Once data were obtained and the geodatabase designed, several steps were taken to create agricultural field boundaries and associate them with attributes to determine recent irrigation status during the project window. The project area was first divided into townships and each township prioritized based on the anticipated occurrence of agricultural lands. After an initial review of available imagery, several fields were selected for ground inspection. Two field teams consisting of two ADWR staff visited the selected fields and collected additional data that was incorporated into the database. Analysis of Landsat imagery was then performed to confirm irrigation status during the entire project window. Any fields thought to be non-irrigated during the project window were compared to the GE 59 Decree records and landowners of remaining fields were notified. A flow chart that documents the steps followed to identify the agricultural fields and determine irrigation status during the project window is presented in **Appendix D**.

4.1 IDENTIFICATION OF FIELD BOUNDARIES

Irrigation, as it pertains to this project, is defined in A.R.S. Title 45, Chapter 15 as “the use of water on two or more acres of land to produce plants or parts of plants for sale or human consumption, or for use as feed for livestock, range livestock or poultry.” Agricultural fields irrigated within the GMA between January 2000 and September 2005 are referred to in this report as “Recently Irrigated Lands.” The GRIC Settlement allows for continued irrigation of these lands, while restricting irrigation of other lands with some exceptions.

In its interpretation of the Settlement and associated legislation, ADWR assumed that individual agricultural fields less than two acres are included in this mapping project if either of the following criteria applies:

- The field is within 50 feet of another agricultural field that is greater than or equal to two acres; or
- The field is within 50 feet of another agricultural field less than two acres with a combined acreage greater than or equal to two acres.

These criteria account for cases where farmers change their field boundaries and where an irrigated area less than two acres is immediately adjacent to a larger irrigated area. Any delineated fields less than two acres that did not meet either of these criteria were not further evaluated by ADWR.

ADWR first reviewed available imagery and CLU data for evidence of agricultural activity. Edits were made to existing CLU field boundaries, as needed, and new fields were delineated based on ADWR's imagery review. All delineated fields were eventually populated with GIS information on irrigation status. For quality control purposes, two GIS analysts worked on the project and checked each others work.

4.2 REVIEW OF 2003-2005 AERIAL PHOTOGRAPHY

The irrigation status of each field in 2005 was based on review of the 2005 Census aerial photography. Fields that appeared to be actively cropped in the 2005 imagery were recorded and, in most cases, no further review was conducted for those polygons. For fields not found to be actively cropped in 2005, the GIS analyst looked at older NAIP aerial photographs collected in 2003 and 2004.

4.3 FIELD VERIFICATION

Most work on this project was completed in the office using GIS software and existing data sources. However, a random sample of fields were ground inspected in May and June 2007. Prior to this fieldwork, the irrigation status of the fields was determined based on analysis of 2003-2005 aerial photography. During the 2007 field trip, two teams of two ADWR staff toured the GMA and visited most of the fields with a questionable irrigation status and about 10% to 15% of the fields in the other irrigation status categories.

4.3.1 Purpose

The purpose of the fieldwork was to verify the status of representative fields selected randomly from each irrigation category. Although the project window closed in 2005, 2007 field data were considered good indicators of recent irrigation status. Additionally, ground inspections in 2007 supported the subsequent analysis of satellite imagery.

4.3.2 Methodology

A mobile GIS application designed with ArcPad 7.0.1 was used to store data collected from ground inspections. ArcPad is a software program used to create custom applications typically employed during field data collection (ESRI, 2007). **Figure 8** shows the main data entry form utilized by ADWR staff during the GMA fieldwork. Navigation to the agricultural fields was facilitated by overlaying delineated field boundaries and current roads onto the 2005 Census imagery. Upon arrival at a designated field, ADWR staff recorded field data directly into the ArcPad application's data entry screen, took a digital photograph, and recorded information about each photograph in a log book. ADWR staff spoke to a few landowners to gain access and explain the purpose of the project.

4.3.3 Field Data Collected

Data on irrigation status, that could not be determined from analysis of imagery alone, were collected in the field and added to the geodatabase. These additional data included the occurrence of irrigated pastures, non-irrigated lots, and newly planted or emergent fields. For this project, an irrigated pasture was considered a fenced area with irrigated grass used for livestock grazing. A non-irrigated lot was commonly a cleared piece of land that was never cultivated, but probably would be developed in the future. Newly planted or emergent fields included fields just planted or starting to grow. From the imagery alone, these fields may appear fallow or inactive/idle. Other agricultural data collected during the fieldwork included the type and condition of water conveyance system (ditches, siphons, sprinklers, etc.), the condition of rows and furrows, if any, and evidence of active irrigation. The 2007 irrigation status and these

additional attributes helped to confirm the irrigation status during the project window and contributed to the confidence of the overall irrigation status designations.

4.4 ANALYSIS OF 2000 – 2005 LANDSAT IMAGERY

The relatively coarse resolution of Landsat imagery was initially assumed by ADWR to limit its usefulness for this project. However, research has shown that Bands 3 and 4 from Landsat images can be used to show irrigation activity. Band 3, in the visible (red) portion of the electromagnetic spectrum, detects the absorption of solar radiation by active chlorophyll in green vegetation, and Band 4, in the near-infrared portion of the spectrum, detects the reflectance of chlorophyll. The ratio of the difference of these two bands, known as the normalized difference vegetation index (NDVI), directly correlates to the presence of green, healthy vegetation (Lillesand and others, 2004). In the arid southwest, a high NDVI value can be indicative of irrigated fields.

Examples of irrigated and non-irrigated agricultural fields in the project area were randomly selected based on visual inspection of the Landsat imagery, displayed as a false color composite. Under this display, irrigated fields appear pink to bright red while non-irrigated fields appear gray to brown. The NDVI images show irrigated fields as light gray to white (higher numeric ratios) and non-irrigated fields as black to dark gray (lower ratio values). Minimum, maximum, and average NDVI values for the example agricultural fields were graphed to select the best choice of a threshold or cutoff which would categorize each field as either “irrigated” or “non-irrigated.” Similar procedures have been employed recently by the state of New Mexico (Rodriguez, 2004), by the USGS in the area of White Pine County, Nevada (Wellborn and Moreo, 2007) and in a seven state study of the High Plains Aquifer (Qi and others, 2002), and by the University of Nebraska in Scotts Bluff and Kearney Counties, Nebraska (Dappen, 2003). Further discussion of the Landsat NDVI analysis is provided in **Appendix B**.

4.5 NOTICES SENT TO LANDOWNERS

Agricultural fields that showed no evidence of irrigation during the project window based on ADWR's review of aerial photography, ground inspections, and Landsat analysis were categorized as "Other Agricultural Lands." In consultation with GRIC Settlement technical representatives, ADWR decided to notify the landowners of these fields of potential restrictions on new irrigation if those lands had not been irrigated between January 2000 and September 2005. Before notices were sent out, ADWR checked whether the fields were subject to the GE 59 Decree.

4.5.1 Comparison with Globe Equity No. 59 Lands

The location of GE 59 lands is specified in the decree by 40-acre, quarter-quarter section legal descriptions (ADWR, 1993). To ADWR's knowledge, a map that shows more precise locations of GE 59 decreed lands is currently unavailable. What was available for this project is a map prepared by GIS Southwest (2007) based on the original decree legal descriptions and reportedly updated with more recent data from the Gila Commissioner, who administers the decree.

Some quarter-quarter sections are fully decreed under GE 59, while other quarter-quarter sections are only partially decreed. For partially decreed quarter-quarter sections, it is often difficult to know where within the 40-acre area the decreed land is located based on the available map.

"Other Agricultural Lands" identified by ADWR during this project were compared to the GE 59 decree map and, where possible, fields were designated as "Globe Equity Lands Not Recently Irrigated." Landowners of these fields were not sent notices.

Landowners of agricultural fields located on partially decreed quarter-quarter sections or fields that only covered a portion of known decreed lands were sent notices since it was uncertain whether these landowners held GE 59 decreed rights.

4.5.2 Identification of Landowners

To determine land ownership, ADWR requested parcel data from Gila, Graham, Greenlee, Pima, and Pinal Counties. Parcel data were received in various formats including GIS shapefiles, AutoCad drawings, and scanned plat maps. Some counties provided only parcel numbers, while other counties provided current ownership and mailing information. When only parcel numbers were provided, ADWR used 2006 Department of Revenue tax records to obtain owner information.

Each field did not necessarily correspond with one unique parcel number and landowner. Larger fields sometimes covered two or more parcels owned by different individuals, while some larger parcels contained two or more separate fields. A few parcels did not match current ownership records. Finally, some fields were found to partially or fully cover non-parceled lands. Comparison with State Land Department's records indicated that most of these fields were State Trust lands.

On November 30, 2007, ADWR sent notices to the landowners of agricultural fields in the GMA requesting either documentation of GE 59 decreed rights or evidence of irrigation between January 2000 and September 2005. Landowners were asked to respond back to ADWR within 30 days from the date of notice. An example notification letter is included as **Appendix E**.

4.5.3 Response Categories

Responses to the landowner notices were grouped by ADWR into five categories:

- 1) Landowner Provided Evidence of Recent Irrigation and/or Decreed Water Right
- 2) Landowner Made Statement of Recent Irrigation and/or Decreed Water Right
- 3) Landowner Responded But Did Not Provide Evidence of Either Irrigation or Decreed Water Right
- 4) No Landowner Response to ADWR Request for Evidence
- 5) ADWR Unsuccessful in Contacting Landowner

If a given field had more than one owner and each owner responded to ADWR's notice differently, the field was split along the parcel boundaries and the responses catalogued accordingly.

Note that 27 landowners provided evidence of either recent irrigation activity or a decreed water right. ADWR did not evaluate whether this evidence was accurate or sufficient. Instead, it was placed in an open file to be evaluated later if the field is identified as being irrigated in the future. At that time, additional evidence may be requested from the landowner and/or collected by ADWR.

Sixteen landowners stated that their fields were recently irrigated or had decreed rights but provided ADWR no evidence. Five other landowners responded to the notice but provided neither evidence nor a statement of recent irrigation. Thirty-eight landowners did not respond to the notice. ADWR was unsuccessful in contacting ten landowners because their notifications were returned due to incorrect address information or their fields are located on lands of unknown ownership. Should any of these fields be identified as irrigated in the future, additional information will be sought from the landowners. A table that summarizes the response from each notice is provided in **Appendix F**.

4.6 OTHER AGRICULTURAL LANDS NOT FURTHER CONSIDERED

After completing ground inspections and analyzing Landsat imagery, it was determined that some fields were not agricultural lands and should be removed from the dataset. For example, some fields were found to be non-irrigated lands (i.e., vacant lots or non-irrigated pasture). As described in Section 4.1, fields smaller than two acres and not adjacent to a larger field were also removed.

Regardless of recent irrigation or existing water rights, agricultural lands in the portion of the GMA within Santa Cruz County were also not considered in this project. Although fields were identified, an impact zone was not mapped by the Settlement parties in this area and current State law therefore does not restrict future irrigation. Agricultural lands in Cochise County and the San Carlos Indian Reservation were also exempted.

5.0 RESULTS

Based on the methodology described in Section 4, agricultural lands mapped by ADWR in the GMA were placed into one of three categories:

- “Recently Irrigated Lands as Determined by ADWR Analysis,”
- “Globe Equity No. 59 Decree Lands Not Recently Irrigated, as Determined by ADWR Analysis,” and
- “Other Agricultural Lands Mapped by ADWR.”

The confidence of ADWR that a field was “Recently Irrigated” varied considerably and ground data collected in 2007 factored into the degree of confidence. As described further in Section 5.2, ADWR attempted to quantify the level of confidence that a given agricultural field was actually recently irrigated.

Table 2 summarizes the results from this project, including the number of fields determined to be recently irrigated and their associated irrigation status. Also summarized are the fields that ADWR determined were not recently irrigated but are believed to have GE 59 decreed rights and other agricultural lands mapped by ADWR.

5.1 FIELD CATEGORIES

Agricultural fields were categorized based on their overall irrigation status during the project window of January 2000 to September 2005. Most fields were considered to be “Recently Irrigated” based on photographic evidence and satellite imagery. In this case, a field had to show agricultural activity at least once during the project window. To be categorized as “Other Agricultural Land Mapped by ADWR,” a field was determined to have *not* been recently irrigated and is potentially subject to future irrigation restrictions under State law. In this case, a field had to show a consistent inactive state and, based on ADWR analysis, may not have a GE 59 decreed right.

Of the 2,431 agricultural fields mapped by ADWR in the GMA, 2,262 are considered “Recently Irrigated Lands.” This represents about 93% of the fields mapped and about 94% of their area, which covers a total of over 41,000 acres. “Recently Irrigated Lands” comprise approximately 10% of the entire GMA project area. **Figure 9** shows the recently irrigated acreage per township.

5.2 CONFIDENCE LEVELS

Due to the poor quality of some aerial photographs and the relatively coarse (30-meter) resolution of the satellite imagery, there was some uncertainty in ADWR’s determination of irrigation status. To quantify the degree of uncertainty, confidence levels were calculated for the irrigation status of each field determination. Primary factors used to calculate confidence levels include:

- Number of aerial photographs reviewed;
- Level of agricultural activity observed in the aerial photographs;
- Quality of aerial photographs reviewed, both resolution and color; and
- Analysis of Landsat imagery.

For fields ground inspected in 2007, the following factors were considered when calculating confidence levels:

- Level of agricultural activity observed;
- Maturity of weeds or the absence of weeds;
- Condition of the rows and furrows, if any; and
- Existence and condition of a water conveyance system.

Depending on the irrigation status of a field, factors were given different weights and signs (some positive, some negative) toward calculating a final confidence level between 0 and

100 percent. A logic flowchart and detailed listing of overall irrigation status and percent confidence determinations is included as **Appendix G**.

5.3 MAPS AND DATA

Appendix H presents a series of maps showing the location of agricultural lands that ADWR identified in the GMA. An index map is included in the appendix and shows the location of 45 townships in the study area where these lands are found. **Appendix I** presents the GIS data associated with these lands, the location of impact zones developed by the Settlement parties, and the GMA project boundary. These data are stored on DVDs attached in an Access geodatabase and as ESRI shapefiles.

6.0 SUMMARY AND FUTURE WORK

6.1 SUMMARY

This report documents how agricultural lands irrigated between January 2000 and September 2005 in the Gila River Maintenance Area were identified and recorded in a geographic information system database. Identification of these lands and development of the GIS database was described in the Gila River Indian Community Water Rights Settlement Agreement and related State law. After obtaining existing aerial photography and field boundary data, the Arizona Department of Water Resources evaluated the level of agricultural activity within each field. This evaluation required design of a geodatabase and detailed analysis of agricultural activity. Some of the agricultural lands initially identified were ground inspected and later analyzed using satellite imagery. Each field was eventually determined by ADWR to be either recently irrigated or not recently irrigated. Further evaluation indicated that some of the not recently irrigated fields are subject to the Globe Equity No. 59 Decree and still others were not further considered because they are not adjacent to impact zones. A confidence level was calculated to quantify the degree of certainty in the irrigation status determinations.

6.2 FUTURE WORK

ADWR's work in the Gila River Maintenance Area will continue into the future. As required by State law, ADWR will develop methodology to identify new agricultural lands in the area that were not recently irrigated and/or do not have decreed water rights. It is expected that such lands will be identified initially based on annual analysis of Landsat imagery. Other actions will be determined at that time.

Additionally, pursuant to the Settlement, ADWR will submit reports to the Adjudication Court, Gila River Indian Community, San Carlos Irrigation and Drainage District, and the United States every five years beginning in 2010 outlining changes in irrigated acreage in the GMA.

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TABLE 1. IRRIGATION STATUS COMPARISONS

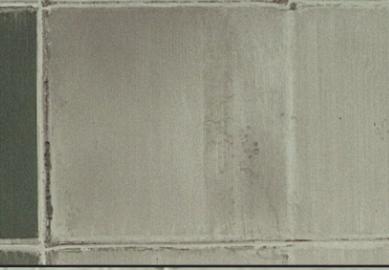
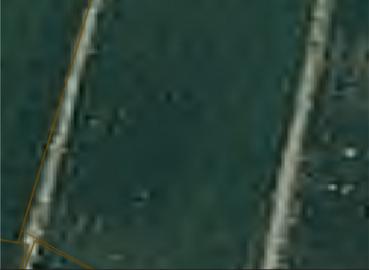
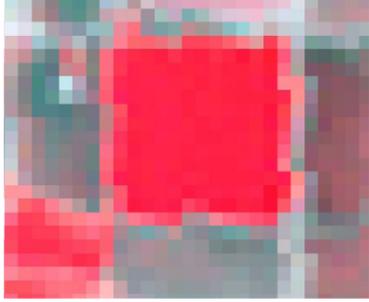
	ACTIVE CROPPED/ IRRIGATED	ACTIVE FALLOW	INACTIVE/IDLE	QUESTIONABLE
Use	Actively growing crops.	Seasonal rotation, annual rest, or extended rest.	Discontinued.	Unkown.
Crop	Yes.	None.	None.	Unkown.
Cropping Period	One or more crops per season.	No crop for about one to two years.	No crop for several years.	Unkown.
Field Condition	Well maintained, crops actively growing on field.	Well maintained, bare, and may have some residue. Recently cultivated field can have rows or no rows.	Unmaintained, weeds, shrubs and brush, weathered faint rows, or no rows.	Unkown.
Rows and Furrows	Good - well maintained and well formed.	Good - well maintained and well formed, bare, crumbly, and/or textured. May have well developed rows ready for seeding.	Poor – severely degraded, weathered or gone, smooth or disturbed ground. No apparent cultivation for several years.	Unkown.
Weeds	None or very few.	Few short weeds.	Few to many weeds, medium to tall in height, few small indigenous shrubs and trees, or bare and spotty with dead weeds.	Unkown.
Water Source	Well maintained – working well or surface water diversion.	Well maintained – working well or surface water diversion.	Often unmaintained – no working well or surface water diversion. Facilities may be in disrepair, disabled, or removed.	Unkown.
Ditch Condition	Good - able to convey water to field, clean or minor debris/vegetation, few cracks, and no holes.	Good - able to convey water to field, clean or minor debris/vegetation, few cracks, and no holes.	Often poor – unable to convey water, filled with weeds, brush, small trees, trash; degraded, numerous cracks, holes, broken or missing segments.	Unkown.
Ground View Example				N/A
Aerial Photograph Example (2005)				
Aerial Photograph Example (2003/2004)				
Landsat Imagery False Color Composite Example				

TABLE 2. GILA RIVER MAINTENANCE AREA (GMA) PROJECT RESULTS¹

Irrigation Status	Number of Fields Mapped (Polygons) ²	Acreage of Fields Mapped	Percentage of Total Field Acreage Mapped	Confidence of ADWR Imagery Analysis (as a percentage) ³			Notes
				Min	Max	Average	
Recently Irrigated Lands, as determined by ADWR analysis							
Active/Cropped	1852	33,072	80%	57%	96%	76%	Based on review of 2003-2005 aerial photographs and some 2007 field visits.
Active/Fallow	236	3,479	8%	44%	83%	63%	
Irrigated	174	2,289	6%	30%	95%	59%	Based on analysis of 2000-2005 Landsat (satellite) images.
<i>Subtotal</i>	2,262	38,840	94%	---	---	---	
Globe Equity No. 59 Decree (GE 59) Lands Not Recently Irrigated, as determined by ADWR Analysis							
Not Recently Irrigated	34	261	1%	---	---	---	Based on review of 2003-2005 aerial photographs and 2000-2005 Landsat images, some 2007 field visits, and a map of GE 59 decree lands.
Other Agricultural Lands Mapped by ADWR							
(a) Landowner provided ADWR evidence of recent irrigation and/or decreed water right ⁴	49	908	2%	---	---	---	Based on the above analysis, ADWR determined that a field was either not recently irrigated and did not have a GE 59 decree right or ADWR's determination had relatively low confidence. ADWR tried to contact the owners of these fields for further information.
(b) Landowner stated to ADWR that field recently irrigated and/or had decreed water right ⁴	25	270	1%	---	---	---	
(c) Landowner responded to ADWR information request but provided neither evidence nor statement of recent irrigation or decreed water right	7	125	0.3%	---	---	---	
(d) Landowner did not respond to ADWR information request	45	578	1%	---	---	---	
(e) ADWR unsuccessful in contacting landowner	9	128	0.3%	---	---	---	
<i>Subtotal</i>	135	2,009	5%	---	---	---	
Total	2,431	41,110	100%				

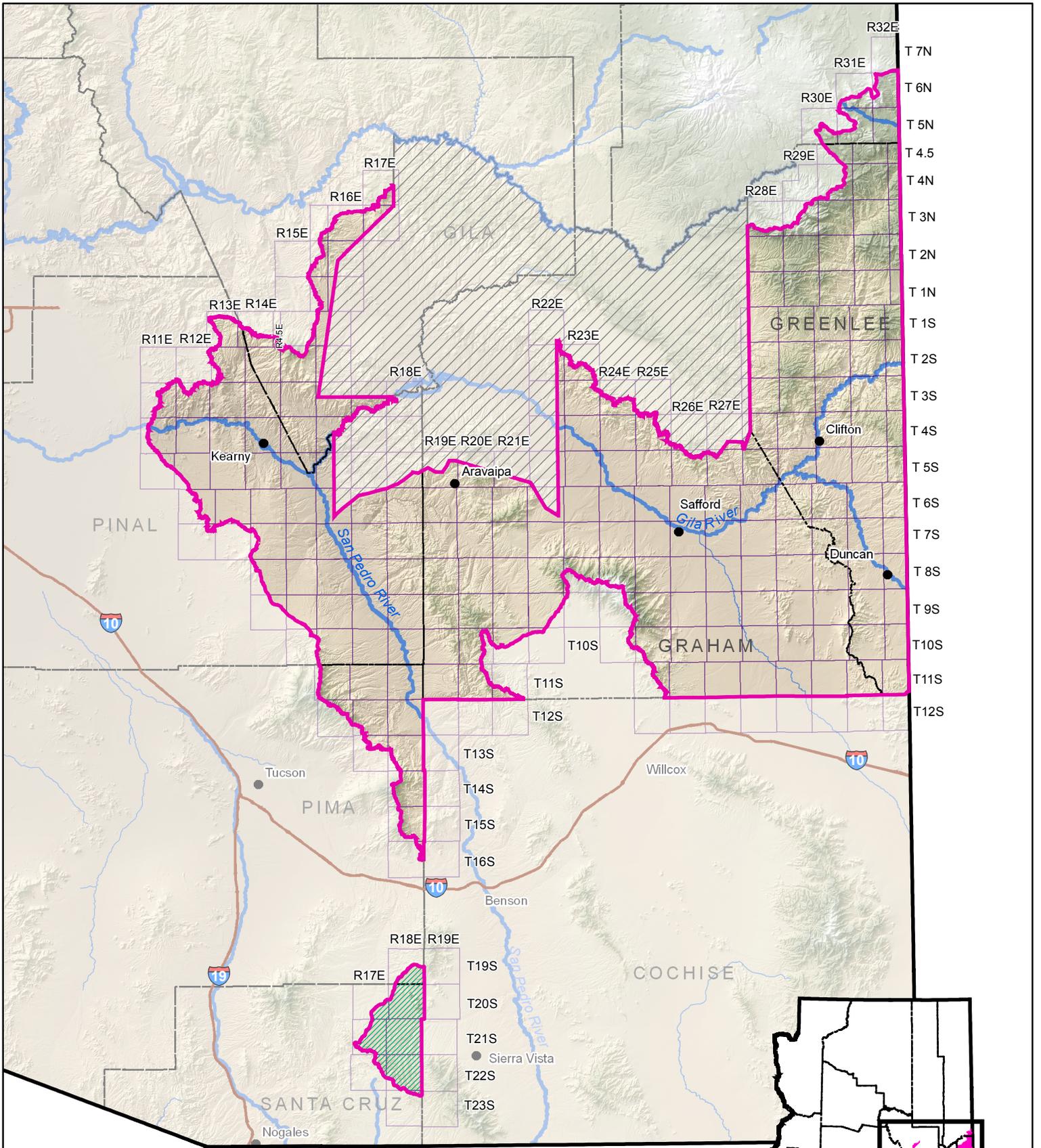
Notes:

¹ For the purposes of this report, 'irrigation' refers to the use of water on 2 or more acres of land to produce plants for sale or human consumption, or for livestock feed. Fields are considered 'recently irrigated' if irrigation occurred at any time from January 1, 2000 through the effective date of the state legislation, or September 2005.

² Generally, only fields 2 acres or greater in area were evaluated by ADWR.

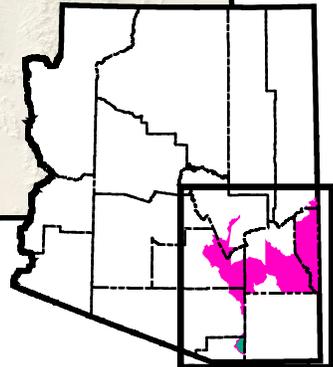
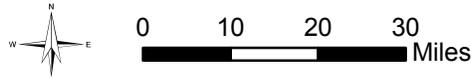
³ Confidence levels were calculated based on a variety of factors described in this report and are expressed here as a percentage with 0% indicating no confidence from the imagery analysis and 100% complete confidence.

⁴ ADWR has not reviewed the evidence provided to date or attempted to substantiate landowner statements. This work will be performed, as needed, during enforcement proceedings.



-  Gila River Maintenance Area (GMA)
-  Portion of GMA Without Adjacent Impact Zone
-  San Carlos Indian Reservation
-  County
-  Townships and Ranges
-  Arizona State Boundary

Figure 1
GMA Project Area



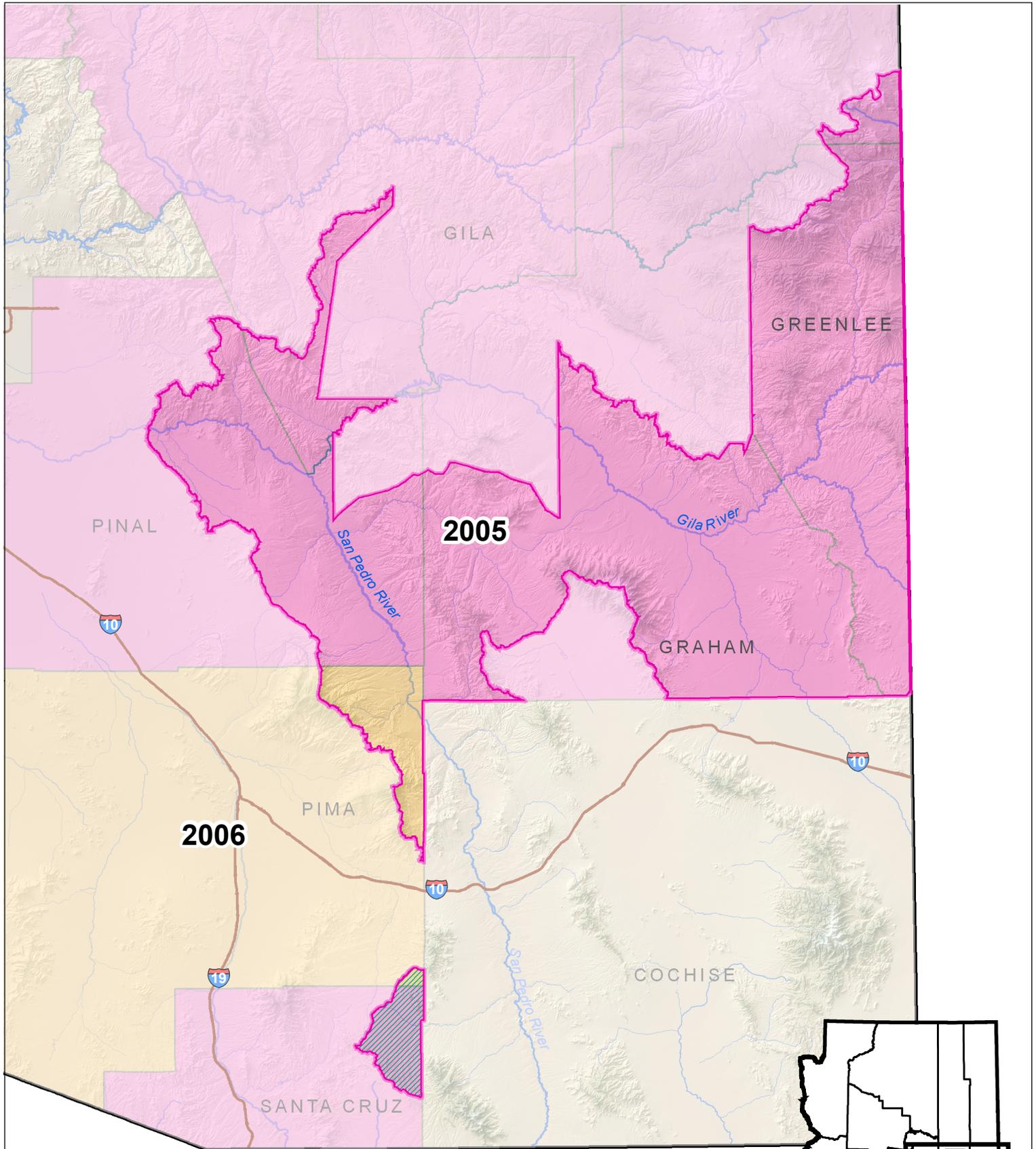
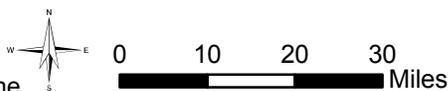


Figure 2
Coverage of 2005 Census Imagery

-  Flown in 2005
-  Flown in 2006
-  Gila River Maintenance Area (GMA)
-  Portion of GMA Without Adjacent Impact Zone
-  State Boundary



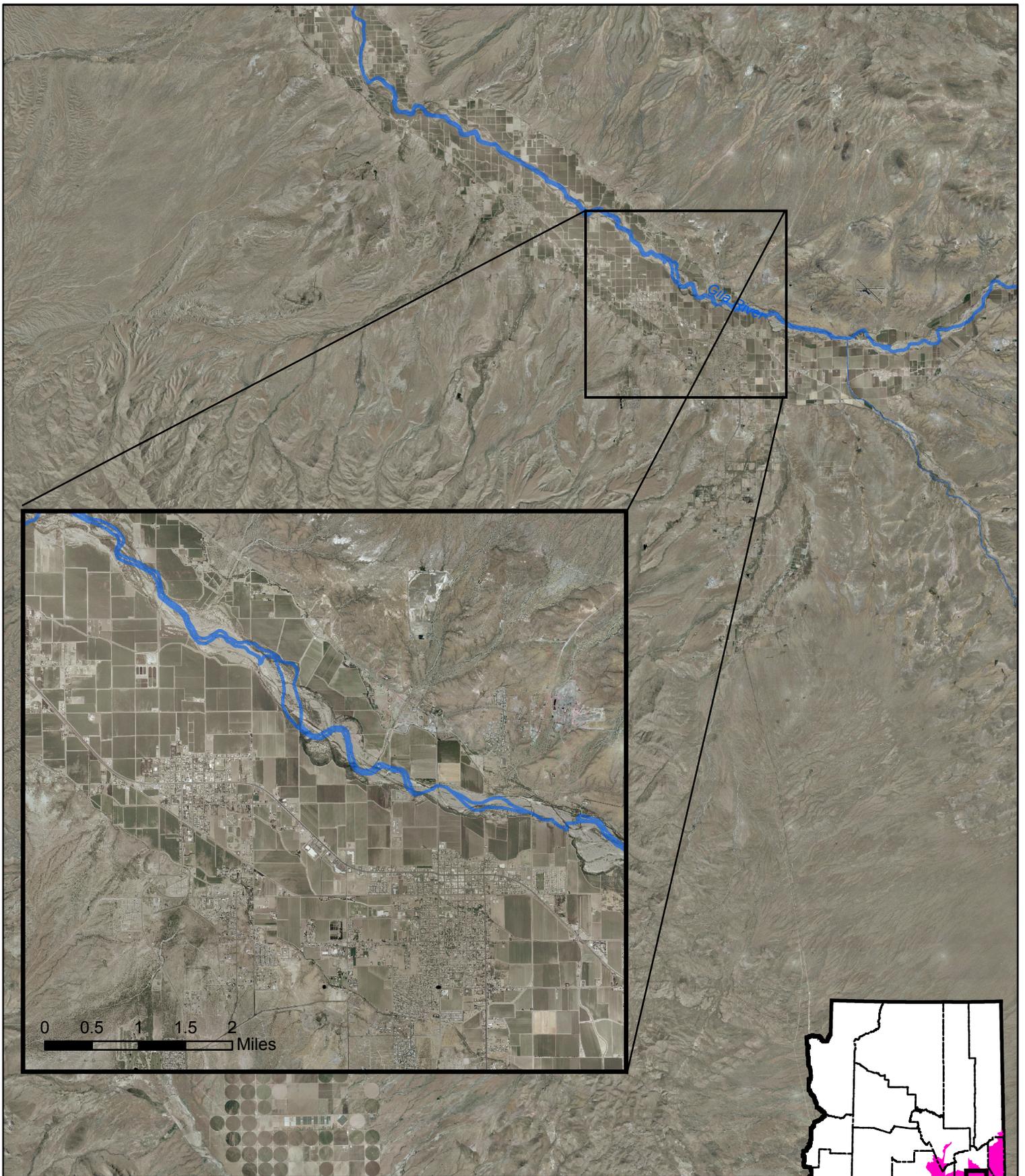
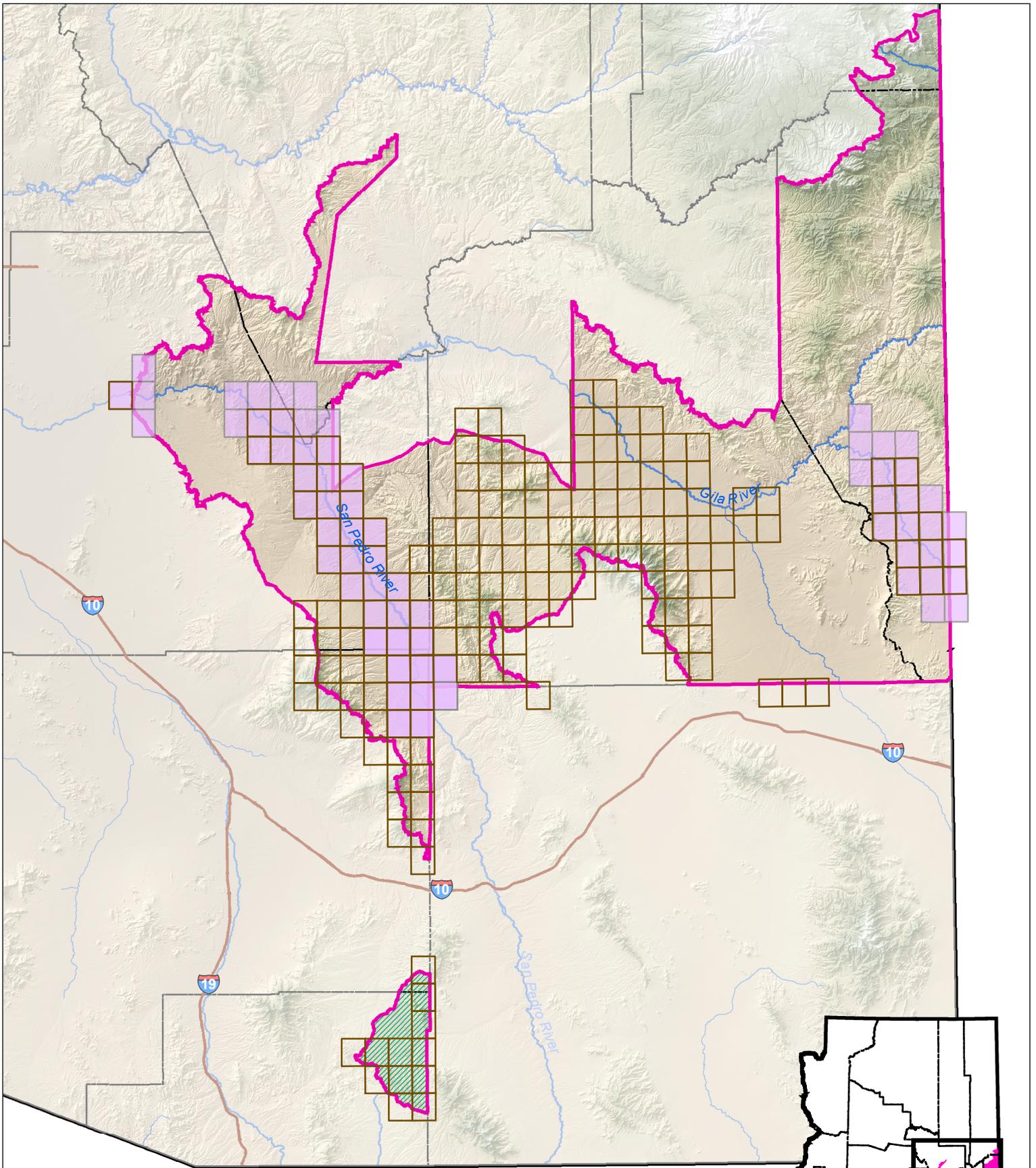


Figure 3
Example of 2005 Census Imagery

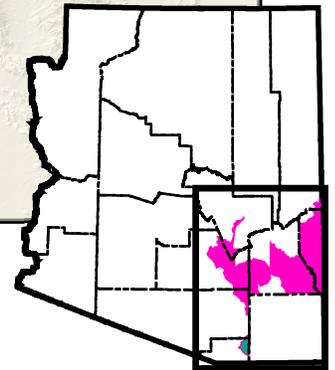
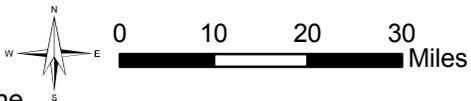




Legend

-  2004 NAIP
-  2003 NAIP
-  Gila River Maintenance Area (GMA)
-  Portion of GMA Without Adjacent Impact Zone

Figure 4
Index of 2003/2004 NAIP Imagery



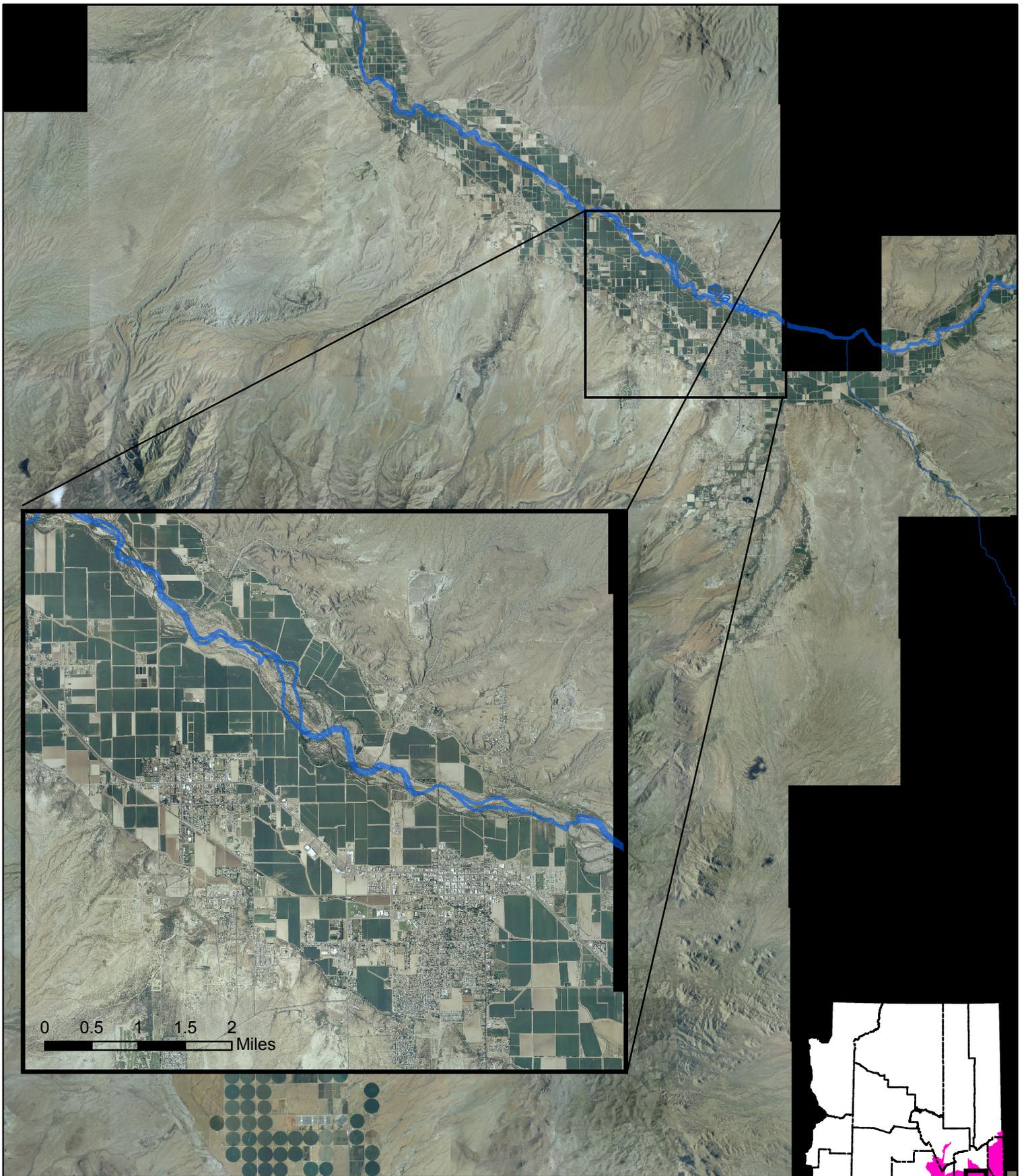


Figure 5
Example of 2003/2004 NAIP Imagery



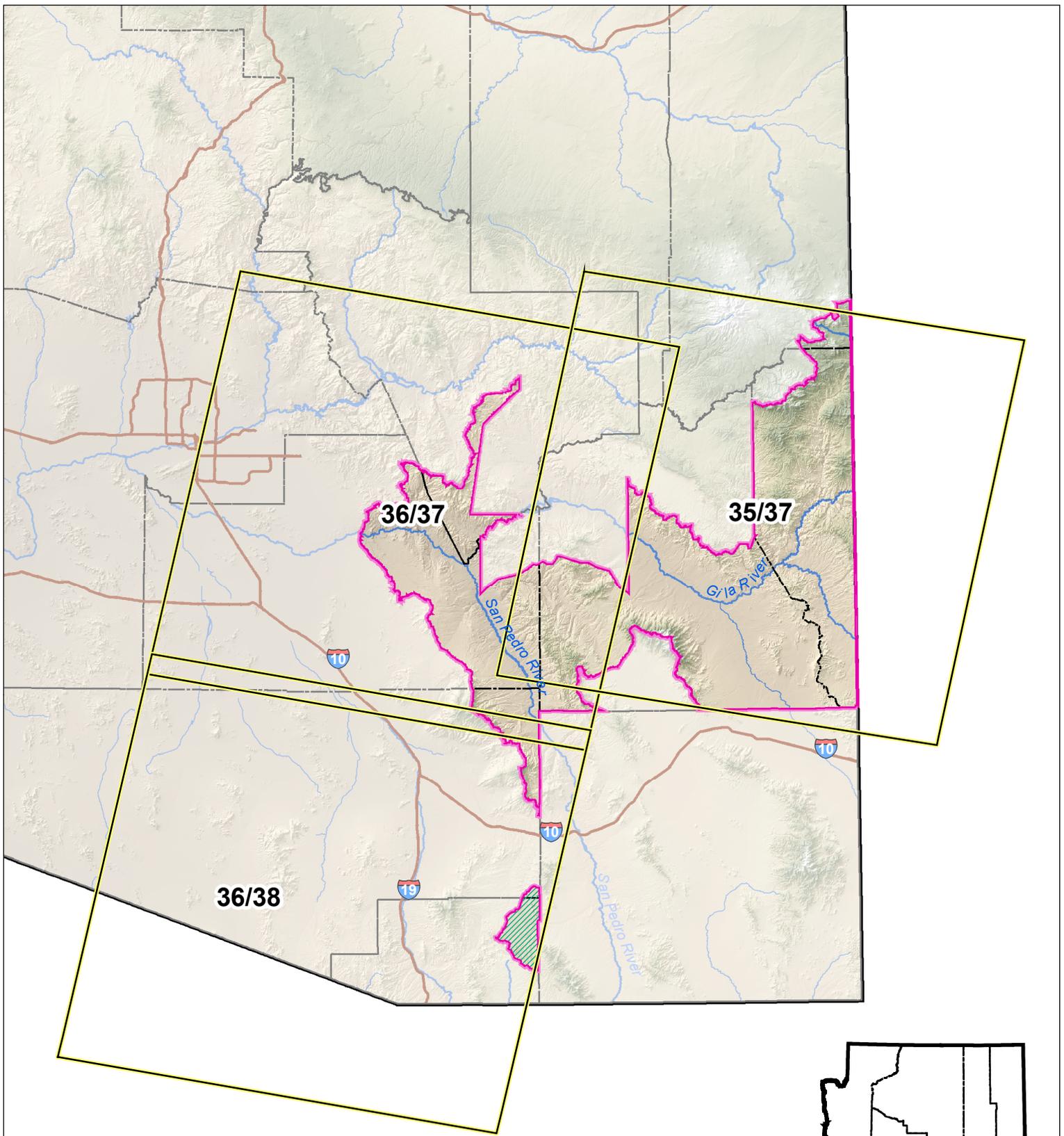
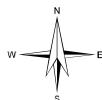
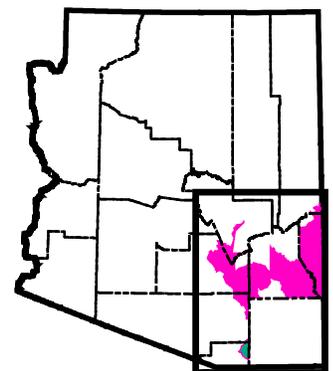


Figure 6
Landsat Path/Rows within Project Area

-  Landsat TM Path/Rows
-  Gila River Maintenance Area (GMA)
-  Portion of GMA Without Adjacent Impact Zone



0 10 20 30
 Miles



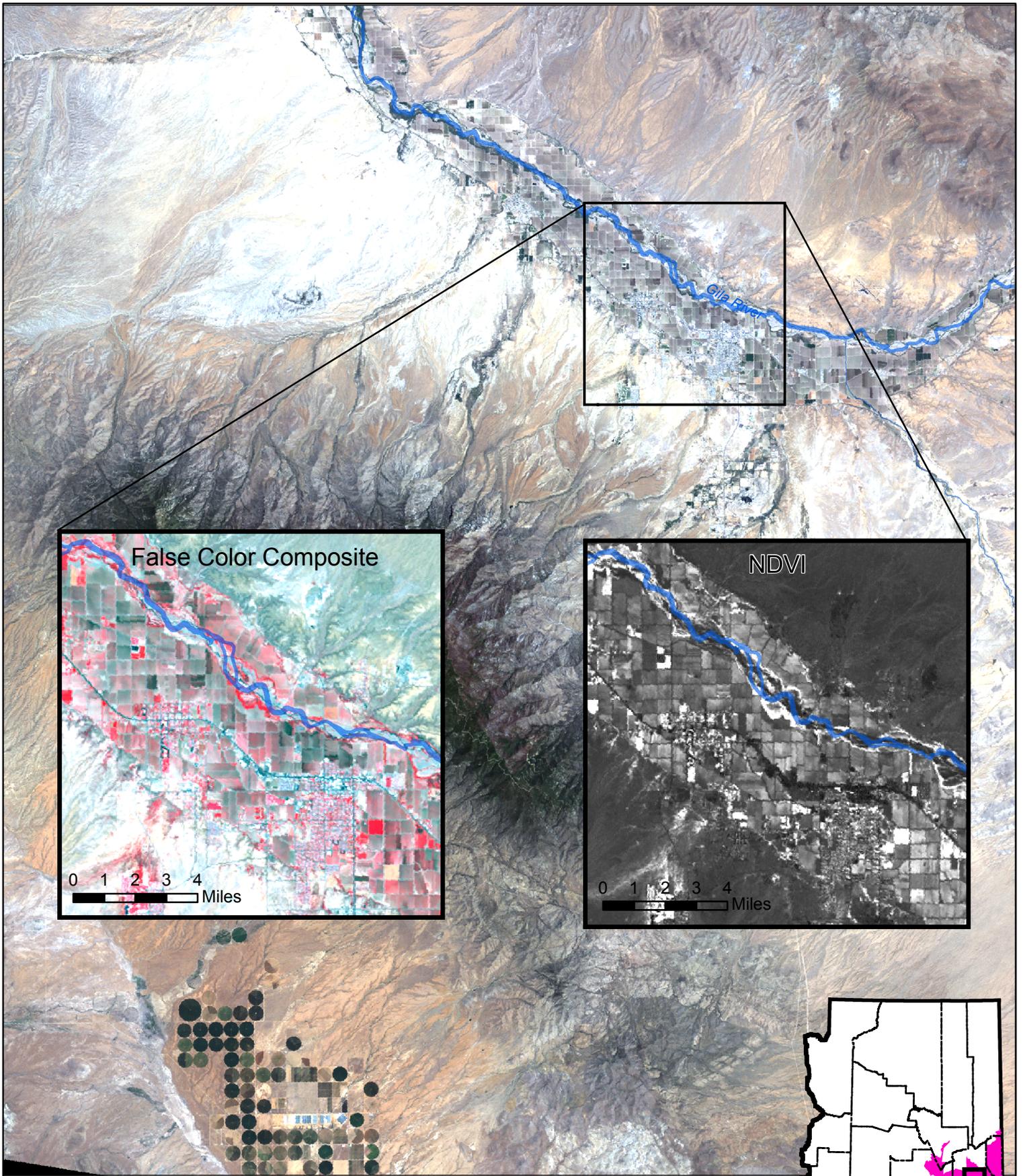


Figure 7
Example of Landsat Imagery



0 2 4 6 Miles



ARIZONA
 DEPARTMENT
 OF WATER
 RESOURCES ©

GMA Mapped Lands [X]

Data | Symbology

ML # Acreage To Visit?

ML1166 82.3178061 Y

Ag Status 2007 % Site Access

Active and Cropped 100 Accessible

Weeds Observed Water Source

Few Weeds Groundwater

AG STATUS: Composite: Active_Cropped

2000	2001	2002
2003	2004	2005
		Active_Cropped

Pre-Field Comments

Created By WRDEY Create Date 2/27/2007

Row Attributes (check all that apply)

- Planted
- Well Formed
- Bare
- Crumbly
- Rounded
- Smooth
- Silty
- Weathered
- Severly Degraded
- None

Observed Conveyence System

- Ditches
- Siphon
- Sprinklers
- Check Dam
- Turn Out Gate
- Non Functioning
- Other, please specify:

Observed Signs of Active Irrigation (check all that apply)

- Wet Field
- Water in Ditches
- Ponding in Field
- Tailing in Pond
- Other, please specify:

Interacted With Landowner (place contact info into comment box)

Field Comments

Team: A

Visited By: WRKAM

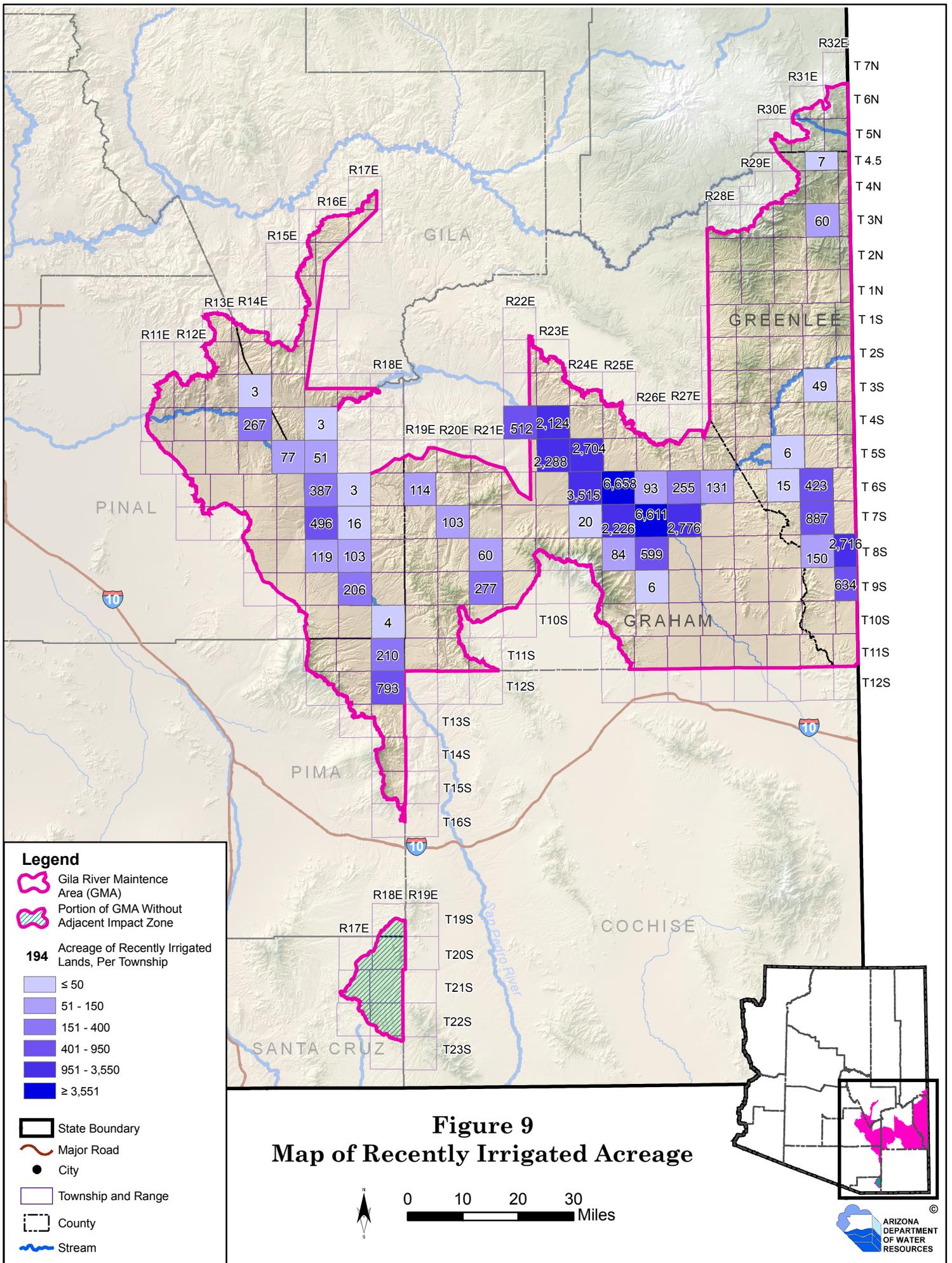
Visited Date: 1/11/2008 1:11:09 PM

Modified By:

Modified Date:

ok [X]

Figure 8
ArcPad Application



ARIZONA LAWS RELATING TO WATER

2007-2008 EDITION



Reprinted from Arizona Annotated Revised Statutes, 2007-08 Edition

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State Bar of Arizona
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Phone: (602) 340-7318

3. Enter into leasing agreements with one or more Indian communities in partnership with other entities for non-Indian agricultural priority or Indian priority central Arizona project water.

4. Enter into contracts for the use of water sources including Colorado river water, surface water other than Colorado river water and effluent.

5. Enter into contracts with eligible entities for the use of imported groundwater from allowable groundwater basins pursuant to sections 45-552, 45-553 and 45-554 for the purposes of Indian firming.

6. Enter into agreements with a multi-county water conservation district established pursuant to title 48, chapter 22 for delivery of water to Indian communities.

7. Subject to periodic review of progress toward meeting this state's Indian firming obligation, allow for the use of existing long-term storage credits developed from withdrawal fees collected pursuant to section 45-611, subsection C, paragraph 3.

8. Transfer long-term storage credits to a multi-county water conservation district established pursuant to title 48, chapter 22 for recovery and subsequent delivery to Indian communities in times of shortage.

9. Enter into agreements for the recovery of long-term storage credits for purposes of Indian firming.

B. Indian firming measures established pursuant to this article shall include funding from the following sources:

1. Legislative appropriations provided for Indian firming on an annual basis to carry out Indian firming measures.

2. To the extent necessary to carry out Indian firming measures after expenditure of legislative appropriations, the authority may use withdrawal fees collected from the Phoenix, Pinal and Tucson active management area water management accounts. 2006

Recent legislative year: Laws 2006, Ch. 114, § 9.

CHAPTER 15

GILA RIVER INDIAN COMMUNITY WATER SETTLEMENT PROGRAM

ARTICLE 1. ADMINISTRATION

Section	
45-2601.	Definitions.
45-2602.	Establishment of southside protection zones; reporting requirements.
45-2603.	Establishment of Gila river maintenance area

Section	and Gila river maintenance area impact zone; notice of intention to drill.
45-2604.	Conservation requirements for persons using groundwater in central protection zone no less restrictive than in third management plan.

ARTICLE 2. TRANSPORTATION OF UNDERGROUND WATER AND STORED WATER AWAY FROM EASTERN PROTECTION ZONES AND WESTERN PROTECTION ZONES

45-2611.	Transportation of underground water and stored water away from an eastern protection zone or western protection zone prohibited; exceptions.
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ARTICLE 3. REPLENISHMENT OF UNDERGROUND WATER AND STORED WATER WITHDRAWN IN EASTERN PROTECTION ZONES AND WESTERN PROTECTION ZONES

45-2621.	Definitions.
45-2622.	Annual southside replenishment obligations.
45-2623.	Satisfaction of southside replenishment obligations.
45-2624.	Southside replenishment bank; credits.
45-2625.	Replenishment related to transportation of underground water or stored water away from an eastern protection zone or a western protection zone for nonirrigation use.
45-2626.	Individual replenishment obligations of persons using underground water or stored water within an eastern protection zone or a western protection zone for industrial use; enforcement action; notice.

ARTICLE 4. DAMS WITHIN GILA RIVER MAINTENANCE AREA

45-2631.	Construction or enlargement of new dams within maintenance area; prohibited; exceptions.
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ARTICLE 5. IRRIGATION OF NEW LANDS WITHIN GILA RIVER MAINTENANCE AREA

45-2641.	Irrigation of new lands in Gila river maintenance area with water withdrawn or diverted from Gila river maintenance area impact zone prohibited; exception.
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ARTICLE 6. ENFORCEMENT

45-2651.	Inspections, investigations and audits.
45-2652.	Cease and desist order; hearing; injunctive relief.
45-2653.	Violation; civil penalties.
45-2654.	Violation; classification.

ARTICLE 1. ADMINISTRATION

Editor's note. For provisions on the conditional delayed repeal of this article, see note following each section under this article.

45-2601. Definitions

Conditional delayed repeal; see notes

Unless the context otherwise requires, the terms defined in sections 45-402 and 45-802.01 have the same meaning in this chapter and for the purposes of this chapter:

1. "Central protection zone" means the central protection zone established under section 45-2602.

2. "Community" means the Gila river Indian community, a government composed of members of the Pima tribe and the Maricopa tribe and organized under section 16 of the act of June 18, 1934 (25 United States Code section 476).

3. "Dam" has the meaning prescribed in section 45-1201 on January 1, 2005.

4. "Designed storage capacity" means the storage capacity in acre-feet of a reservoir at the elevation of the lowest spillway in the dam impounding water in the reservoir, as the dam was originally constructed.

5. "Eastern protection zone" means the eastern protection zone north or the eastern protection zone south.

6. "Eastern protection zone north" means the eastern protection zone north established under section 45-2602, subsection A.

7. "Eastern protection zone south" means the eastern protection zone south established under section 45-2602, subsection A.

8. "Gila river maintenance area" means the Gila river maintenance area established under section 45-2603, subsection A.

9. "Gila river maintenance area impact zone" means the Gila river maintenance area impact zone established under section 45-2603, subsection B.

10. "Globe equity decree" means the decree dated June 29, 1935 and entered in *United States of America v. Gila valley irrigation district, Globe equity No. 59, et al.* by the United States district court for the district of Arizona and includes all court orders and decisions supplemental to that decree.

11. "Industrial use" means all of the following:

(a) A nonirrigation use of water commenced after December 31, 2002 that is not supplied by a municipal provider, including animal industry use and expanded animal industry use.

(b) A use of groundwater commenced before January 1, 2003 by a holder of a type 1 nonirrigation grandfathered right in existence on December 31, 2002, other than a type 1 nonirrigation grandfathered right held by a

municipal provider and other than a use under another groundwater right or permit, in excess of the amount allowed under the type 1 nonirrigation grandfathered right.

(c) A use of groundwater commenced before January 1, 2003 by a holder of a type 2 nonirrigation grandfathered right in existence on December 31, 2002, other than a type 2 nonirrigation grandfathered right held by a municipal provider, in excess of the amount allowed under the right and for which the holder has no other groundwater right.

(d) A use of groundwater commenced before January 1, 2003 by a holder of a general industrial use permit issued under section 45-515 and in existence on December 31, 2002, other than a use under another groundwater right or permit, in excess of the amount allowed under the general industrial use permit.

12. "Irrigation use" means the use of water on two or more acres of land to produce plants or parts of plants for sale or human consumption, or for use as feed for livestock, range livestock or poultry, as defined in section 3-1201.

13. "Municipal acre" means the acre or acres of land within a protection zone, on which water pumped from within a protection zone is supplied by a municipal provider, on which water use was first commenced after December 31, 2002 and for which the water use is reported pursuant to section 45-632, 45-875.01 or 45-2602.

14. "Municipal provider" means a city, town, private water company or special taxing district established pursuant to title 48 that supplies water for nonirrigation use.

15. "Municipal use" means a nonirrigation use of water commenced after December 31, 2002 and supplied by a municipal provider on municipal acres.

16. "Nonirrigation use" means a use of water withdrawn from a well, other than an irrigation use.

17. "Reservation" means the Gila river Indian community reservation.

18. "Settlement agreement" means the agreement entitled the "Gila river Indian community water rights settlement agreement", dated February 4, 2003 between the community, this state and other parties, as amended before December 21, 2005, a copy of which is on file in the department.

19. "Southside protection zones" means the eastern protection zone north, the eastern protection zone south, the western municipal protection zone, the western municipal and indus-

trial protection zone and the central protection zone.

20. "Stockpond" means a pond that has a capacity of not more than fifteen acre-feet and that is used solely for watering livestock or wildlife. Stockpond does not include a pond used primarily for fishing or for the culturing of fish.

21. "Stored water" means water that has been stored or saved underground pursuant to a storage permit issued under chapter 3.1 of this title.

22. "Underground water" means water, other than stored water, withdrawn from a well.

23. "Water company" means either of the following:

(a) A private water company that as of January 1, 2000 was regulated as a public service corporation by the Arizona corporation commission and was withdrawing underground water from lands now within the eastern protection zone north.

(b) Any successor of a private water company described in subdivision (a) of this paragraph.

24. "Western municipal and industrial protection zone" means the western municipal and industrial protection zone established under section 45-2602, subsection A.

25. "Western municipal protection zone" means the western municipal protection zone established under section 45-2602, subsection A.

26. "Western protection zones" means the western municipal protection zone and the western municipal and industrial protection zone.

2006

Recent legislative year: Laws 2005, Ch. 143, § 7; Laws 2006, Ch. 114, § 10.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment."

45-2602. Establishment of southside protection zones; reporting requirements

Conditionally enacted; see notes

A. The following southside protection zones are established on the effective date of this section:

- 1. The eastern protection zone north.
- 2. The eastern protection zone south.
- 3. The western municipal and industrial protection zone.
- 4. The western municipal protection zone.
- 5. The central protection zone.

B. The boundaries of the southside protection zones established under subsection A are shown on the maps that are dated March 25, 2002 and that are on file in the department. The maps shall be available for examination by the public during regular business hours.

C. Each person in the Pinal active management area who withdraws underground water during a calendar year in a southside protection zone established under this section, other than the central protection zone, shall file an annual report with the director no later than march 31 of each year for the preceding calendar year. The report shall contain the following information in addition to any other information required by section 45-632:

- 1. The amount of underground water withdrawn within the southside protection zone and the name of the protection zone.
- 2. If the underground water was used for a nonirrigation use, the purpose for which the underground water was used, the location of the use, the acreage of the parcel or parcels of land on which the underground water was used and the date the use commenced.
- 3. The amount of any water replenished during the year pursuant to section 45-2611, subsection B, paragraph 2, the water use for which the water was replenished and the manner in which the water was replenished.
- 4. The amount of any water replaced during the year pursuant to section 45-2611, subsection B, paragraph 3, the water use for which the water was replaced and the manner in which the water was replaced.

D. A person who is required to file an annual report for a year under subsection C of this section:

- 1. Shall use a water measuring device approved by the director unless exempt under section 45-604.

2. Shall maintain current accurate records of the person's withdrawals, transportation, deliveries and use of underground water as prescribed by the director.

3. May combine the report with an annual report for the same year filed under section 45-632.

4. Shall comply with the requirements prescribed in section 45-632, subsections N, O and P and is subject to the penalties prescribed in section 45-632, subsection O as if the report was required by section 45-632.

E. A person who withdraws underground water from an exempt well is exempt from the record keeping and reporting requirements of subsections C and D of this section. For the purposes of this subsection, "exempt well" means a well that has a pump with a maximum capacity of not more than thirty-five gallons per minute, that is used to withdraw underground water and that would qualify as an exempt well under section 45-454 if used to withdraw groundwater.

F. If stored water is withdrawn in the Pinal active management area in a southside protection zone established under this section, other than the central protection zone, the annual report filed under section 45-875.01, subsection D shall include:

1. The amount of stored water withdrawn within the southside protection zone and the name of the protection zone.

2. If the stored water was used for a nonirrigation use, the purpose for which the water was used, the acreage of the parcel or parcels of land on which the water was used, the location of the use and the date the use commenced.

3. The identification of the storage facility in which the water was stored.

4. The amount of any water replenished during the year pursuant to section 45-2611, subsection B, paragraph 2, the water use for which the water was replenished and the manner in which the water was replenished.

5. The amount of any water replaced during the year pursuant to section 45-2611, subsection B, paragraph 3, the water use for which the water was replaced and the manner in which the water was replaced.

2005

Recent legislative year: Laws 2005, Ch. 143, § 8.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings

Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment."

45-2603. Establishment of Gila river maintenance area and Gila river maintenance area impact zone; notice of intention to drill

Conditional delayed repeal; see notes.

A. The Gila river maintenance area is established on the effective date of this section. The boundaries of the Gila river maintenance area are shown on the map that is dated July, 2002 and that is on file in the department. The map shall be available for examination by the public during regular business hours.

B. The Gila river maintenance area impact zone is established on the effective date of this section. The boundaries of the Gila river maintenance area impact zone are shown on the map that is dated July, 2002 and that is on file in the department.

C. If a proposed well will withdraw water within the Gila river maintenance area impact zone established under subsection B of this section, as determined pursuant to section 45-2641, subsection A, and the water will be used to irrigate lands within the Gila river maintenance area established under subsection A of this section and outside of Cochise county, the notice of intention to drill filed pursuant to section 45-596 shall include one of the following:

1. Proof that the lands to be irrigated were irrigated with water from any source at any time from January 1, 2000 through the effective date of this section.

2. Proof that the irrigation is allowed under the exemptions prescribed in section 45-2641, subsection B, paragraph 1, 2 or 4.

2005

Recent legislative year: Laws 2005, Ch. 143, § 7.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings

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described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment."

45-2604. Conservation requirements for persons using groundwater in central protection zone no less restrictive than in third management plan

Conditionally enacted; see note

Notwithstanding any other law, beginning on the effective date of this section, when adopting or modifying a management plan for the Pinal active management area pursuant to chapter 2, article 9 of this title, the conservation requirements adopted by the director for persons using groundwater within the central protection zone shall be no less restrictive than the conservation requirements for persons using groundwater within the central protection zone as established in the management plan for the Pinal active management area for the third management period in effect on January 1, 2005 or as adjusted after that date as a result of judicial review or administrative review pursuant to section 45-570 or 45-575. 2005

Recent legislative year: Laws 2005, Ch. 143, § 8.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment."

ARTICLE 2. TRANSPORTATION OF UNDERGROUND WATER AND STORED WATER AWAY FROM EASTERN PROTECTION ZONES AND WESTERN PROTECTION ZONES

Editor's note. For provisions on the conditional enactment and conditional delayed repeal of this article, see notes following each section under this article.

45-2611. Transportation of underground water and stored water away from an eastern protection zone or western protection zone prohibited; exceptions

Conditionally enacted and amended; see notes

A. Except as provided in subsection B of this section, beginning on the effective date of this section, underground water or stored water withdrawn in an eastern protection zone or a western protection zone may not be transported away from the protection zone in which the water was withdrawn if the transportation is for a nonirrigation use.

B. Subsection A of this section does not apply to any of the following:

1. The transportation of underground water or stored water away from an eastern protection zone or a western protection zone for a nonirrigation use in an annual amount that does not exceed the highest annual volume of underground water or stored water transported away from the same protection zone for that use during calendar years 1999 through 2001.

2. The transportation of underground water or stored water away from an eastern protection zone or a western protection zone for a nonirrigation use if the person transporting the underground water or stored water replenishes the water as provided in section 45-2625 within twenty-four months after the end of the calendar year in which the transportation occurs.

3. The transportation of underground water or stored water away from an eastern protection zone or a western protection zone for a nonirrigation use if the person transporting the underground water or stored water replaces the water with an equivalent amount of water imported into that protection zone within the same calendar year in which the transportation occurs.

4. The transportation of stored water away from an eastern protection zone or a western protection zone if the stored water was originally stored in the protection zone from which the water was recovered.

5. The transportation of underground water or stored water between the eastern protection zone north and the eastern protection zone south.

6. The transportation of underground water or stored water between the western municipal

ter, if the modification or repair does not increase the designed storage capacity of the dam. For the purposes of this paragraph, "modification or repair of a dam" includes the desilting, lining or rehabilitation of a dam.

C. The director shall not approve an application under section 45-1207 for construction or enlargement of a dam in the Gila river maintenance area established under section 45-2603 if the applicant is prohibited from constructing or enlarging the dam, as applicable, under this section.

D. Any violations of this article are subject to enforcement under article 6 of this chapter on the effective date of article 6 of this chapter, and such enforcement may include injunctive relief that requires removal of any structures constructed in violation of this article. Any delay between the date of the alleged violation of this article and the date of any enforcement action pursuant to article 6 of this chapter shall not be a factor in determining whether to issue an injunction pursuant to article 6 of this chapter.

2005

Recent legislative year: Laws 2005, Ch. 143, § 7.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment."

ARTICLE 5. IRRIGATION OF NEW LANDS WITHIN GILA RIVER MAINTENANCE AREA

45-2641. Irrigation of new lands in Gila river maintenance area with water withdrawn or diverted from Gila river maintenance area impact zone prohibited; exception

A. Except as provided in subsection B of this section, a person shall not use water withdrawn or diverted within the Gila river maintenance area impact zone to irrigate land within the Gila river maintenance area unless the land was irrigated with water from any

source at any time from January 1, 2000 through the effective date of this section. For the purposes of this section, water is withdrawn or diverted within the Gila river maintenance area impact zone if one of the following applies:

1. The water is withdrawn from a well located within the Gila river maintenance area impact zone.

2. The water is surface water diverted on the surface at a location within the Gila river maintenance area impact zone.

3. The water is withdrawn by a well located outside of the Gila river maintenance area impact zone and the well's cone of depression captures surface water within the Gila river maintenance area impact zone as determined by a cone of depression test adopted by the superior court with jurisdiction over the general adjudication of all rights to use water in the Gila river system and source.

B. This section does not apply to:

1. The irrigation of lands pursuant to an appropriative right with a priority date earlier than the effective date of this section and the irrigation of lands to which the right is severed and transferred.

2. The irrigation of lands if the irrigation is allowed under the settlement agreement.

3. The irrigation of lands within the portion of the Gila river maintenance area located in Cochise county.

4. The irrigation of lands if the irrigation is allowed under the globe equity decree or under other rights decreed before the effective date of this section and the irrigation of lands to which the right is severed and transferred.

C. Any violations of this article are subject to enforcement under article 6 of this chapter on the effective date of article 6 of this chapter, and such enforcement may include injunctive relief that requires removal of any structures constructed in violation of this article. Any delay between the date of the alleged violation of this article and the date of any enforcement action pursuant to article 6 of this chapter shall not be a factor in determining whether to issue an injunction pursuant to article 6 of this chapter.

2005

Recent legislative year: Laws 2005, Ch. 143, § 7.

ARTICLE 6. ENFORCEMENT

Editor's note. For provisions on the conditional enactment and conditional delayed repeal of this article, see notes following each section of this article.

45-2651. Inspections, investigations and audits

Conditionally enacted; conditional delayed repeal; see notes

A. The director or the director's authorized representative may enter, at reasonable times, private or public property and the owner, manager or occupant of the property shall permit the entry to ascertain compliance with this chapter.

B. Inspections and investigations under subsection A shall be on reasonable notice to the owner, manager or occupant of the property unless reasonable grounds exist to believe that such notice would frustrate the enforcement of this chapter. The director may apply for and obtain warrants. If warrants are required by law, the director shall apply for and obtain warrants for entry and inspection to carry out the administrative and enforcement purposes of this article.

C. The director shall provide a written report of each inspection, investigation and audit under this section to the person who is subject to the action.

Recent legislative year: Laws 2005, Ch. 143, § 9.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment."

45-2652. Cease and desist order; hearing; injunctive relief

Conditionally enacted; conditional delayed repeal; see notes

A. If the director has reason to believe that a person is violating or has violated this chapter or an order issued pursuant to this chapter, the director may give the person written notice that the person may appear and show cause at an administrative hearing in the county in which the violation is alleged to have occurred why the person should not be ordered to cease and desist from the violation.

B. The decision and order of the director under this section may take such form as the director determines to be reasonable and appropriate and may include a determination of violation, a cease and desist order, the recommendation of a civil penalty and an order directing that positive steps be taken to abate or ameliorate any harm or damage arising from the violation. The person affected may seek judicial review of the final decision of the director as provided in section 45-114, subsection B in the superior court in the county in which the violation is alleged to have occurred.

C. If the person continues the violation after the director has issued a final decision and order pursuant to subsection B of this section, the director may apply for a temporary restraining order or preliminary or permanent injunction from the superior court in the county in which the violation is alleged to have occurred according to the Arizona rules of civil procedure. A decision to seek injunctive relief does not preclude other forms of relief or enforcement against the violator.

D. Section 45-114, subsections A and B govern administrative proceedings, rehearing or review and judicial review of final decisions of the director under this section.

Recent legislative year: Laws 2005, Ch. 143, § 9.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment."

45-2653. Violation; civil penalties

Conditionally enacted; conditional delayed repeal; see notes

A. A person who is determined pursuant to section 45-2652 to be in violation of this chapter or an order issued pursuant to this chapter may be assessed a civil penalty in an amount not exceeding one thousand dollars per day of violation.

B. An action to recover penalties under this section shall be brought by the director in the

superior court.

C. The director may include a determination of violation, a cease and desist order, the recommendation of a civil penalty and an order directing that positive steps be taken to abate or ameliorate any harm or damage arising from the violation. The person affected may seek judicial review of the final decision of the director as provided in section 45-114, subsection B in the superior court in the county in which the violation is alleged to have occurred.

D. Section 45-114, subsections A and B govern administrative proceedings, rehearing or review and judicial review of final decisions of the director under this section.

Revised Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met. The date of publication is the effective date of the conditional enactment.

45-2654.

Conditional delayed repeal; see notes

Unlawful discharge of pollutants into navigable waters. This chapter shall be subject to the provisions of the Arizona Water Quality Act (A.R.S. § 45-2654).

Revised Editor's note.

Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met. The date of publication is the effective date of the conditional enactment.

superior court in the county in which the violation occurred.

C. In determining the amount of the penalty, the court shall consider the degree of harm caused by the violation, whether the violation was knowing or wilfull, the past conduct of the defendant, whether the defendant should have been on notice of the violation, whether the defendant has taken steps to cease, remove or mitigate the violation and any other relevant information.

D. All civil penalties assessed pursuant to this section shall be deposited, pursuant to sections 35-146 and 35-147, in the state general fund.

2005

Recent legislative year: Laws 2005, Ch. 143, § 9.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment."

45-2654. Violation; classification

Conditionally enacted; conditional delayed repeal; see notes

Unless otherwise provided, a person who knowingly violates or refuses to comply with this chapter or an order issued pursuant to this chapter is guilty of a class 2 misdemeanor. A person who, after notice of a violation, continues in violation of this chapter or an order issued pursuant to this chapter is guilty of a separate offense for each day of violation. 2005

Recent legislative year: Laws 2005, Ch. 143, § 9.

Editor's note. Laws 2005, Ch. 143, § 16A provides that title 45, chapter 15 is repealed if the condition prescribed in Laws 2005, Ch. 143, § 15 is not met.

Laws 2005, Ch. 143, § 15 provides: "A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

"B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not

met. The date of publication is the effective date of the conditional enactment."

CHAPTER 16

TOHONO O'ODHAM WATER SETTLEMENT PROGRAM

ARTICLE 1. GENERAL PROVISIONS

Section	
45-2701.	Definitions.
45-2702.	Jurisdiction.

ARTICLE 2. SAN XAVIER RESERVATION WATER PROTECTION PROGRAM

45-2711.	Applications to drill nonexempt wells in the Tucson active management area; well impact analysis; requirements; exception.
45-2712.	Notice of well applications to nation; objection; hearing; appeal.

Editor's note. For provisions on the conditional enactment of this chapter, see notes following § 45-2701.

ARTICLE 1. GENERAL PROVISIONS

Editor's note. For provisions on the conditional delayed repeal of this article, see notes following each section of this article.

45-2701. Definitions

Conditionally enacted; see notes

Unless the context otherwise requires, the terms defined in sections 45-402 and 45-802.01 have the same meaning in this chapter and for the purposes of this chapter:

1. "Exempt well" means a well that qualifies as an exempt well under section 45-454 in effect on January 1, 2005.

2. "Nation" means the Tohono O'odham nation organized under a constitution approved in accordance with section 16 of the act of June 18, 1934 (25 United States Code section 476).

3. "Nonexempt well" means any well, including a recovery well, that does not qualify as an exempt well or a replacement well.

4. "Replacement well" means a well that qualifies as a replacement well at approximately the same location under the rules adopted by the director pursuant to section 45-579, subsection B and that is no more than six hundred sixty feet from the well it is replacing.

5. "Reservation" means the San Xavier Indian reservation established by executive order of July 1, 1874.

6. "Tohono O'odham settlement agreement" means the agreement dated April 30, 2003 between the nation, this state and other parties, as amended before the effective date of

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**AMENDED AND RESTATED
GILA RIVER INDIAN COMMUNITY
WATER RIGHTS SETTLEMENT AGREEMENT**

Final Ex
October 21, 2005

1915. The term “Gila River Indian Reservation” or “Reservation” includes those lands located in Sections 16 and 36, Township 4 South, Range 4 East, Gila and Salt River Base and Meridian.

2.87 “Gila Valley Irrigation District” shall mean the entity of that name that is a political subdivision of the State and organized under the laws of the State.

2.87A “Gillespie Diverters” shall mean those signatories of the Paloma Agreement other than the Community, SCIDD and the United States. The Gillespie Diverters are not Parties to this Agreement and are not bound by any of the terms and conditions hereof.

2.87B “GIS” shall mean a digital electronic geographic information system that is used to incorporate electronic mapping images and associated interactive data and textual information.

2.88 “Globe Equity Decree” shall mean the decree dated June 29, 1935, entered in *United States of America v. Gila Valley Irrigation District et al.*, Globe Equity No. 59, by the United States District Court for the District of Arizona. The term “Globe Equity Decree” includes all court orders and decisions supplemental to that decree.

2.89 “Globe Equity Decree Water” shall mean the Community’s entitlement to water under the Globe Equity Decree as set forth in Paragraph 6.0 of this Agreement, which entitlement is

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2.100 "HVID CAP Water" shall mean that water that was acquired by the Secretary through the permanent relinquishment of the Harquahala Valley Irrigation District CAP Subcontract entitlement in accordance with Contract No. 3-07-30-W0290 among CAWCD, Harquahala Valley Irrigation District, and the United States, and converted to CAP Indian Priority Water pursuant to the Fort McDowell Indian Community Water Rights Settlement Act of 1990, P.L. 101-628, Title IV, 104 Stat. 4468, 4480.

2.100A "Impact Zone" or "Impact Zones" shall mean the Gila River Impact Zone, the San Pedro Ag and New Large Industrial Use Impact Zone, or the San Pedro M&I and Domestic Purposes Impact Zone, or any combination thereof, as the context requires.

2.101 "Imported Water" for purposes of Paragraph 5.0 and Subparagraph 2.94 shall mean all Water transported into a Protection Zone for a Municipal Use, Industrial Use or an Irrigation Use in that Protection Zone.

2.102 "Industrial Acre" for purposes of Subparagraph 2.17 shall mean the acre or acres in an Eastern Protection Zone or Western M&I Protection Zone on which Industrial Use of Water has commenced after December 31, 2002, and for which the Water use is being reported to ADWR.

2.103 "Industrial Use" for purposes of Subparagraphs 2.17, 2.101, 2.102, 2.118.2 and Paragraph 5.0 shall mean a Non-Irrigation Use commenced after December 31, 2002, that is not supplied by

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Risk Allocation agreement, which is also an exhibit to the UVD Agreement); and (ii) any amendment to that agreement made or added pursuant to that agreement.

2.124B “Non-GE 59 Water Users” shall mean: (1) the Arizona State Land Department, to the extent that it Diverts Water from within the Gila River Watershed above Ashurst-Hayden Diversion Dam the Diversion of which is not specifically authorized by the Globe Equity Decree; (2) all persons, entities, corporations or municipal corporations under Federal, State or other law in the Gila River Watershed above Ashurst-Hayden Diversion Dam who now or in the future Divert Water from within the Gila River Watershed above Ashurst-Hayden Diversion Dam, which Diversion is not specifically authorized by the Globe Equity Decree; (3) any successor in interest to any persons, entities, corporations or municipal corporations under Federal, State or other law that otherwise meet the definition of Non-GE 59 Water User set forth in Subparagraphs 2.124B(1) or (2) above.

Notwithstanding anything to the contrary in the first paragraph of this definition, the term “Non-GE 59 Water User” shall not include: (i) persons, entities, corporations or municipal corporations under Federal, State or other law located in the Gila River watershed above Ashurst-Hayden Diversion Dam who now or in the future Divert Water from within the Gila River Impact Zone for Irrigation Use with respect to such Diversion; (ii) persons, entities, corporations or municipal corporations under Federal, State or other law located in the Gila River watershed above Ashurst-Hayden Diversion Dam who now or in the future Divert Water from outside an Impact Zone with respect to such Diversion; (iii) Asarco; (iv) the San Carlos Apache Tribe, its

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members, allottees, or the United States on behalf of each; and (v) any Party whose use of Water is governed by an Exhibit to this Agreement. Whether and the extent to which pumping from a well located outside the exterior boundary of an Impact Zone results in a cone of depression that extends into an Impact Zone and is considered to be Diverting Water from within such Impact Zone shall be determined in accordance with the cone of depression test standard that is to be determined by the Gila River Adjudication Court.

The term "Non-GE 59 Water Users" is solely for: (1) determining eligibility for the safe harbors described in Subparagraph 26.8.2, including as such safe harbors may apply in Subparagraph 26.2; (2) determining the scope of the Community's and United States' retention of rights under Subparagraphs 25.12 and 25.24; and (3) no other purpose.

2.125 "Non-Irrigation Use" shall mean a use of Underground Water other than an Irrigation Use.

2.126 "Off-Reservation Trust Land" shall mean land outside the exterior boundaries of the Reservation that is held in trust by the United States for the benefit of the Community as of the Enforceability Date.

2.127 "Operation, Maintenance and Replacement" or "OM&R" shall mean, solely for purposes of Paragraph 27.0, all activities required for the efficient delivery of Water and drainage of lands,

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2.171 "TON CAP Water Delivery Contract" shall mean the contract for delivery of Central Arizona Project water entered into by the United States and the Tohono O'odham Nation on December 11, 1980, as amended.

2.172 "Underground Storage Facility" shall mean a facility as described in section 45-802.01(20), Arizona Revised Statutes, as amended.

2.173 "Underground Water" shall mean any water beneath the surface of the Earth regardless of its legal characterization as appropriable or non-appropriable under any applicable law.

2.174 "United States" or "United States of America" in any given reference herein shall mean the United States acting in the capacity as set forth in said reference. When the term "United States" or "United States of America" is used in reference to a particular agreement or contract, the term shall mean the United States acting in the capacity as set forth in such agreement or contract.

2.175 "Upper Gila River Watershed Maintenance Program" shall mean the program to be established by State law pursuant to the provisions of Exhibit 26.8.1.

Nothing in any Exhibit shall be construed to preclude any Party that is not also a party to such Exhibit from enforcing its rights, if any, with respect to the use of Water from within the watershed of the Gila River.

26.8 Non-GE 59 Water Users in the upper Gila River watershed.

26.8.1 State legislation/Upper Gila River Watershed Maintenance Program.

The Parties agree to the establishment of an Upper Gila River Watershed Maintenance Program. It will be necessary to enact State legislation to establish the Upper Gila River Watershed Maintenance Program. For purposes of establishing the Enforceability Date, the date of establishment of the Upper Gila River Watershed Maintenance Program shall be the date on which the Secretary, with the concurrence of the Community and the Director of ADWR, certifies in writing that State legislation has been enacted that: (1) meets the minimum requirements set forth in Exhibit 26.8.1; and (2) shall take effect not later than the Enforceability Date. The continued existence and enforcement of the Upper Gila River Watershed Maintenance Program shall constitute a term and condition of the Community's and SCIDD's provision of the safe harbors set forth in Subparagraph 26.8.2, a violation of which term and condition shall nullify the safe harbors set forth therein.

26.8.1.1 One or more of the following conditions shall constitute the violation of the term or condition referred to in Subparagraph 26.8.1, resulting in the nullification of the safe harbors set forth in Subparagraph 26.8.2:

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- 26.8.1.1.1** the repeal of, or substantive amendment to, some or all of the state legislation establishing the Upper Gila Watershed Maintenance Program in a manner that is inconsistent with this Subparagraph 26.8.1 or Exhibit 26.8.1 or that may have a material adverse impact on the Community or SCIDD or both;
- 26.8.1.1.2** the absence of an adequate enforcement effort on the part of the State that constitutes a pattern of failure to enforce the provisions of the Upper Gila Watershed Maintenance Program, which shall be demonstrated by one or more of the following:
- 26.8.1.1.2.1** the failure by ADWR to revise the Notice of Intent to Drill forms, subject to concurrence of the Community and SCIDD, as required under Subparagraphs 26.8.2.5.1, 26.8.2.5.2, 26.8.2.6.1, and 28.8.2.6.2 of this Agreement, such forms shall include at a minimum notice of the safe harbor provisions and notice of the requirement to report certain information to the Community and SCIDD in order to qualify for safe harbor protections;
- 26.8.1.1.2.2** a failure by ADWR to file a report every five (5) years with the Gila River Adjudication Court, as required under Subparagraph 26.8.2.9.1.2, on the status of

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the use of Water Diverted or Pumped from within the Impact Zones or the failure to provide copies of the report to the Community, SCIDD, and the United States;

26.8.1.1.2.3 the failure to by ADWR to take enforcement action pursuant to A.R.S. 45-2652 after the Enforceability Date to prohibit the construction of a new dam or the enlargement of an existing dam within the Gila River watershed upstream and to the east of Ashurst-Hayden Diversion Dam. ADWR shall initiate such enforcement action within one hundred eighty (180) days from the date on which ADWR receives notice of the violation;

26.8.1.1.2.4 the issuance of a permit for the construction of a new dam or the enlargement of an existing dam within the Gila River watershed upstream and to the east of Ashurst-Hayden Diversion Dam, except as provided in Exhibit 26.8.1; or

26.8.1.1.2.5 the failure by ADWR to take enforcement action pursuant to A.R.S. 45-2652 after the Enforceability Date to prohibit New Ag Use of Water from the appropriate Impact Zone in the Gila River watershed upstream and to the east of Ashurst-Hayden Diversion Dam, except for lands located in Cochise County. ADWR shall initiate such enforcement action within one hundred eighty (180) days from the date on which ADWR receives notice of the violation.

26.8.1.1.2.5.1 the ADWR shall not be found to have violated Subparagraph 26.8.1.1.2.5 if the total amount of New Ag Uses is less than fifty (50) acres during any rolling three year period, provided that each acre or portion thereof that constitutes a New Ag Use in any single Year shall be applied against the fifty (50) acre total.

26.8.1.2 The Community, SCIDD, or the United States may revoke the safe harbors protections provided under Subparagraph 26.8.2 for any individual who violates the prohibitions of Subparagraph 26.8.1. Nothing in Subparagraph 26.8.1 shall preclude the Community, SCIDD, or the United States from enforcing their respective rights under the Settlement Agreement for violations of Subparagraph 26.8.1.

26.8.2 Safe harbor uses of Water.

26.8.2.1 Applicable only to Non-GE 59 Water Users.

The safe harbor provisions of this Subparagraph 26.8.2 shall be construed to benefit only Non-GE 59 Water Users.

26.8.2.2 Water Diverted outside the Impact Zones.

For purposes of Subparagraph 2.124B and the safe harbors set forth in Subparagraph 26.8.2, a well that is drilled after December 31, 2002, and that is located outside of the exterior boundary of an Impact Zone, but the Pumping of

which results in a cone of depression that extends into an Impact Zone, shall be considered to be Diverting Water from within such Impact Zone. Whether and the extent to which Pumping from a well located outside the exterior boundary of an Impact Zone results in a cone of depression that extends into an Impact Zone and is considered to be Diverting Water from within such Impact Zone shall be determined in accordance with the cone of depression test standard that is to be determined by the Gila River Adjudication Court; provided, however, that any well for Domestic Purposes only that is located more than one-quarter (1/4) mile outside the exterior boundary of an Impact Zone shall be deemed to be Diverting Water from outside such Impact Zone.

26.8.2.3 Water Diverted for Irrigation Uses from within the San Pedro Ag and New Large Industrial Use Impact Zone.

The Community, SCIDD, and the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree, shall not exercise their respective rights under the Globe Equity Decree to challenge, object to or call upon any eligible Non-GE 59 Water User's use of Water Diverted from within the San Pedro Ag and New Large Industrial Use Impact Zone for irrigation of Eligible Safe Harbor Acres; provided, however, that the Community, SCIDD, and the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights

described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree may, after adjudication of a Non-GE 59 Water User's Water Right in the Gila River Adjudication Proceedings, object to such Non-GE 59 Water User's use of Water if that use exceeds such Non-GE 59 Water User's adjudicated Water entitlement. To be an eligible Non-GE 59 Water User under this Subparagraph 26.8.2.3, a Non-GE 59 Water User must file with the Gila River Adjudication Court, with a copy to the Community, SCIDD and the United States, a description of the Eligible Safe Harbor Acres that such Non-GE 59 Water User owns. The Community, SCIDD, and the United States on behalf of the Community and Allottees and as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree shall have the right to challenge the accuracy of such filing.

26.8.2.4 Water Diverted for M&I Uses from within the San Pedro M&I and Domestic Purposes Impact Zones or the Gila River Impact Zone.

With respect to any Non-GE 59 Water User using Water Diverted from within the San Pedro M&I and Domestic Purposes Impact Zone or the Gila River Impact Zone for M&I Uses, the Community, SCIDD, and the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree, shall not exercise their

26.8.2.9 Monitoring of safe harbor water uses.

26.8.2.9.1 GIS database.

The Eligible Safe Harbor Acres shall be memorialized by a GIS database. ADWR, the Community, SCIDD, and the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree shall agree upon a set of aerial photographs, satellite images, or both, that reflect the Eligible Safe Harbor Acres.

26.8.2.9.1.1 Such images will be archived in digital format, and shall be made a permanent part of the court record in the Gila River Adjudication Proceedings upon the Gila River Adjudication Court's approval of the Agreement, which shall be available for review. The Community, SCIDD, the United States and ADWR shall also retain complete copies of the images and the digital GIS database.

26.8.2.9.1.2 Beginning on the Enforceability Date, and every five (5) Years thereafter, ADWR shall report to the Gila River Adjudication Court on the status of the use of Water Diverted or Pumped from within the Impact Zones. Such report shall include satellite imagery translated into GIS format for comparison to the map previously prepared and attached to the decree. A copy of such report shall be provided to the Community, SCIDD, and the United States.

26.8.2.10 **Miscellaneous.**

26.8.2.10.1 Any Non-GE 59 Water User that Diverts Water from within an Impact Zone for Irrigation Uses, New Domestic Uses or M&I Uses that fails to make the filings required by Subparagraph 26.8.2.3, 26.8.2.4, 26.8.2.5, and 26.8.2.6 to be an eligible Non-GE 59 Water User shall remain subject to the Community's retention of rights under Subparagraph 25.12.1.

26.8.2.10.2 The Diversion or use of Water by any Non-GE 59 Water User in a manner that is in violation of or contrary to the terms, conditions, limitations, requirements or provisions of Subparagraph 26.8.2 in any given Year shall be subject for the duration of such Year to objection, challenge or call by the Community, SCIDD, or the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree without limitation and without regard to the safe harbor rights set forth in Subparagraph 26.8.2.

26.8.2.10.3 Any Non-GE 59 Water User that violates or acts in a manner contrary to the terms, conditions, limitations, requirements or provisions of Subparagraph 26.8.2

on three separate occasions shall thereafter no longer be eligible for any of the safe harbors described in Subparagraph 26.8.2 and shall thereafter be subject to call, challenge or objection by the Community, SCIDD, or the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree without limitation and without regard to any safe harbors set forth in Subparagraph 26.8.2.

26.8.2.10.4 A failure to call by any Party pursuant to any provision of this Agreement, including the safe harbor provisions described in Subparagraph 26.8.2, shall not serve as a defense against any call against any other Water user at or upstream of the Ashurst-Hayden Diversion Dam.

26.8.2.10.5 The safe harbors set forth in Subparagraph 26.8.2 are subject to the approval by the Gila River Adjudication Court of the stipulation and form of judgment set forth in Exhibit 25.18A. Such stipulation shall include the right of the Community, SCIDD, and the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree to enforce their rights under the Globe Equity Decree in the Gila River Adjudication Court against Non-GE 59 Water Users for actions in

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violation of or contrary to the terms, conditions, limitations, requirements or provisions of Subparagraph 26.8.2.

26.8.2.10.6 The Community, SCIDD, and the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree shall recognize and be limited by the safe harbors set forth in Subparagraph 26.8.2 as to any person or entity to which any Water Rights attendant to such safe harbor are transferred pursuant to a severance and transfer or a change in the type of use procedure under State law.

26.8.2.10.7 The Community, SCIDD, and the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree shall not object to the transfer or change in type of use by an eligible Non-GE 59 Water User, AWC (but only in its capacity as provider of Water to the San Manuel CC&N and the Winkelman CC&N), BHP or the Town of Winkelman of any Water Rights attendant to Eligible Safe Harbor Acres to M&I Use or Domestic Purposes; provided, however, that for this Subparagraph to apply, the amount of Water transferred or for which the use has been changed shall not exceed the consumptive use of Water by crops being irrigated on such

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Eligible Safe Harbor Acres and the agricultural lands from which the Water is transferred must be maintained by the transferee in a manner that prevents growth of Phreatophytes on those lands.

26.8.2.10.8 Emergency use for public safety purposes.

The Community, SCIDD and the United States on behalf of the Community and Allottees and in its capacity as owner of all Water Rights described as belonging to the plaintiff in articles V and VI (excluding those described in article VI(2)) of the Globe Equity Decree shall not object to the use of Water by a Non-GE 59 Water User as required by public authorities to respond to declared emergencies for the safety and protection of the public.

Appendix B: Analysis of Landsat Imagery

1.0 Introduction

This appendix describes procedures for using Landsat Enhanced Thematic Mapper (ETM) imagery to estimate irrigation activity on agricultural fields in the Gila River Maintenance Area (GMA). The images are taken in north-south paths that cover approximately 115-mile wide swaths from west to east. Landsat repeats each path every 16 days (EROS, 2007). Three path/row swaths (35/37, 36/37 and 36/38) are required to cover the entire GMA for 2000-2005. The general characteristics of Landsat ETM imagery are shown in **Table B-1**.

Table B-1: Landsat ETM+ bands, resolutions, and spectral ranges

Band	Spatial Resolution	Wavelength (microns)	Spectral Location
1	30m (98ft)	0.45-0.52	Visible blue
2	30m (98ft)	0.52-0.60	Visible green
3	30m (98ft)	0.63-0.69	Visible red
4	30m (98ft)	0.76-0.90	Near-infrared
5	30m (98ft)	1.55-1.75	Mid-infrared
6	30m (98ft)	10.4-12.5	Thermal Infrared
7	30m (98ft)	2.08-2.35	Mid-infrared
8	15m (49ft)	0.52-0.90	Panchromatic (Black & White)

Several images per year were available free of charge through the Multi-Resolution Land Characteristics Consortium program (MRLC, 2007). Although the satellite repeats its path every 16 days, only some scenes are available through the MRLC. Images were chosen to best coincide with peak crop maturity in the study area, while having little to no cloud cover. One image per scene was selected for each year between 2000 and 2005 with the exception of 2001, in which free images were unavailable for two of three of the GMA path/rows. Images with little to no cloud cover taken between May and July were selected for this analysis. The coarse resolution of Landsat imagery is not ideal for digitizing field boundaries, but vegetation indices derived from satellite imagery do provide an estimate of the health and vigor of agricultural crops for already delineated fields.

2.0 Normalized Difference Vegetation Index

Band 3 detects the absorption of solar radiation by the active chlorophyll in green vegetation and Band 4 detects the reflectance of chlorophyll. The Normalized Difference Vegetation Index (NDVI) uses ratioing of Bands 3 and 4 to provide a spectrally enhanced single band panchromatic image that directly correlates to the presence of green, healthy vegetation (Lillesand and others, 2004). NDVI is widely used because it conveys the spectral or color characteristics of images regardless of variations caused by topographic slope and aspect, shadows, or seasonal changes in illumination conditions (Dappen, 2003). Healthy vegetation

yields high NDVI values, and in the arid southwest, high NDVI values indicate recently irrigated agriculture, grass or riparian vegetation (phreatophytes) along rivers.

NDVI of Landsat ETM imagery is calculated as:

$$\text{NDVI} = \frac{\text{Near Infrared Radiance (band 4)} - \text{Visible Red Radiance (band 3)}}{\text{Near Infrared Radiance (band 4)} + \text{Visible Red Radiance (band 3)}}$$

3.0 Procedures

The procedures used here are similar to those followed during supervised classification. An image specialist recognizes classes in a scene from prior knowledge of the region it was taken, by experience with thematic maps and/or by on site visits. The specialist chooses discrete classes with assigned category names and locates specific ‘training sites’ on the image to identify them. Usually mean pixel values and the variances for each band used to classify them are calculated from all pixels within each sample site, resulting in a spectral signature. This step is followed by statistical processing in which all image pixels are compared to the various signatures and assigned to the class whose signature is most similar (Short, 2007).

Within the GMA, samples of both irrigated and non irrigated agricultural fields were selected based on visual inspection of the Landsat imagery, displayed in false color composite in which Band 4 is assigned to the red color gun, Band 3 is assigned to the green color gun and Band 2 is assigned to the blue color gun. False color composites appear similar to an infrared photograph where objects do not have the same colors or contrasts as they would naturally (Myint, 2006). In this display, irrigated fields appear pink to bright red (**Figure B-1**) while non-irrigated fields appear gray or brown (**Figure B-2**).

Figure B-1: Example of irrigated fields in false color

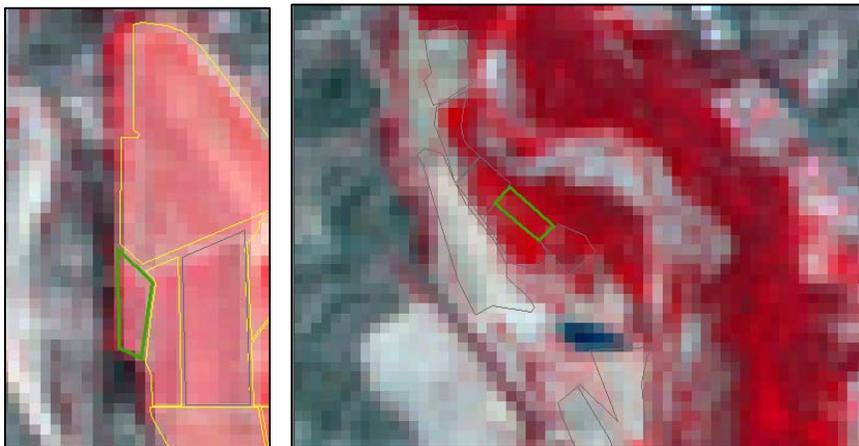


Figure B-2: Example of non-irrigated fields in false color



The ratioed NDVI image shows irrigated fields as light gray to white (**Figure B-3**) and non-irrigated fields as black to dark gray (**Figure B-4**).

Figure B-3: Example of irrigated fields in a ratioed NDVI image

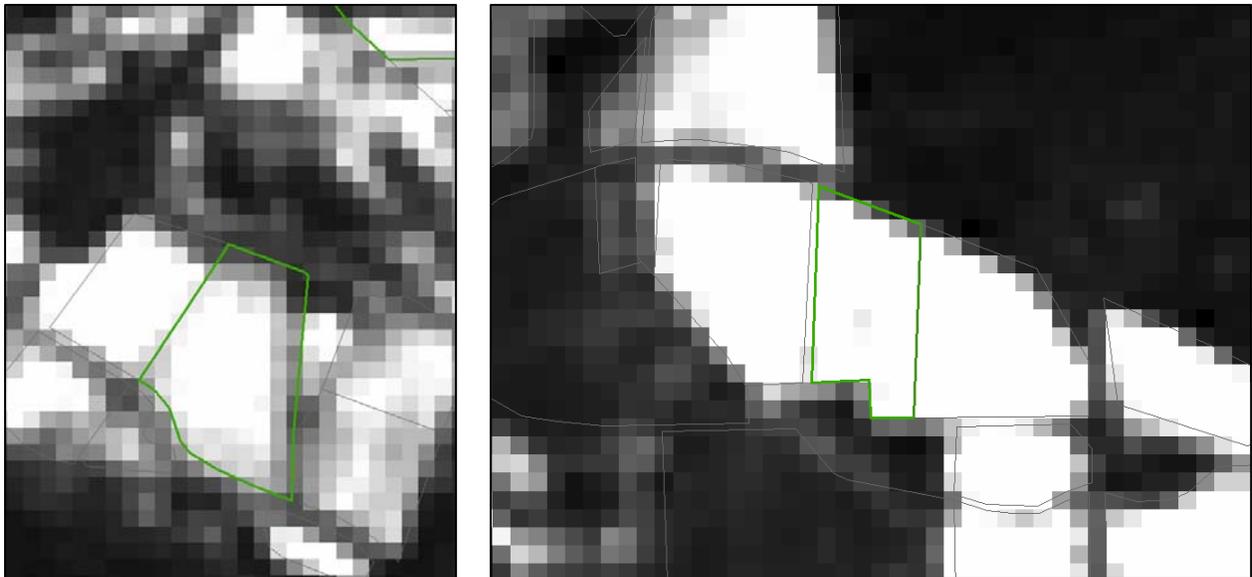
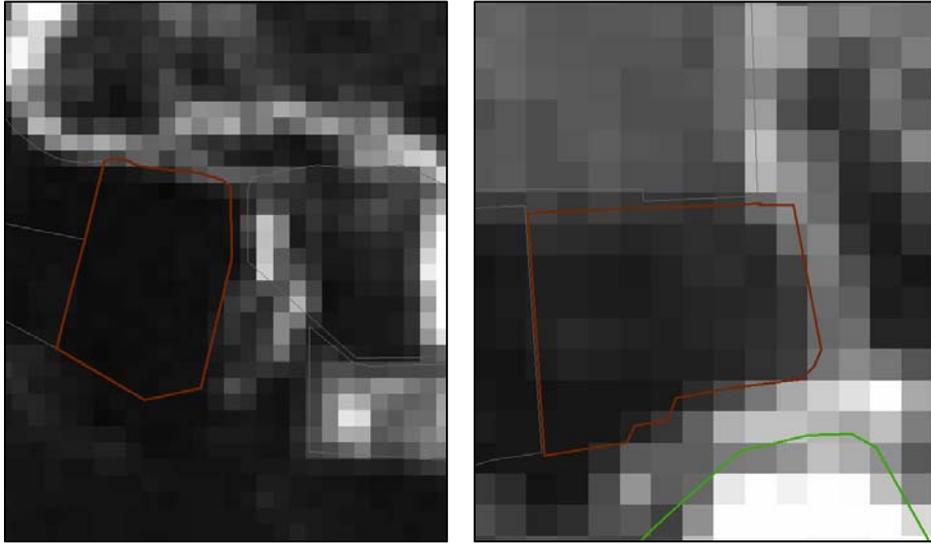


Figure B-4: Example of non-irrigated fields in a ratioed NDVI image



Several training sites were selected representing both irrigated and non-irrigated agricultural fields. Minimum, maximum and average NDVI pixel values for sample fields were graphed to select the best threshold or cutoff to categorize each polygon as either “irrigated” or “non-irrigated”. Similar procedures have been used by the state of New Mexico (Rodriguez, 2004), by the USGS in the area of White Pine County, Nevada (Wellborn and Moreo, 2007) and in a seven state study of the High Plains Aquifer (Qi and others, 2002), and by the University of Nebraska in Scotts Bluff and Kearny Counties, Nebraska (Dappen, 2003).

The following procedures were used by ADWR:

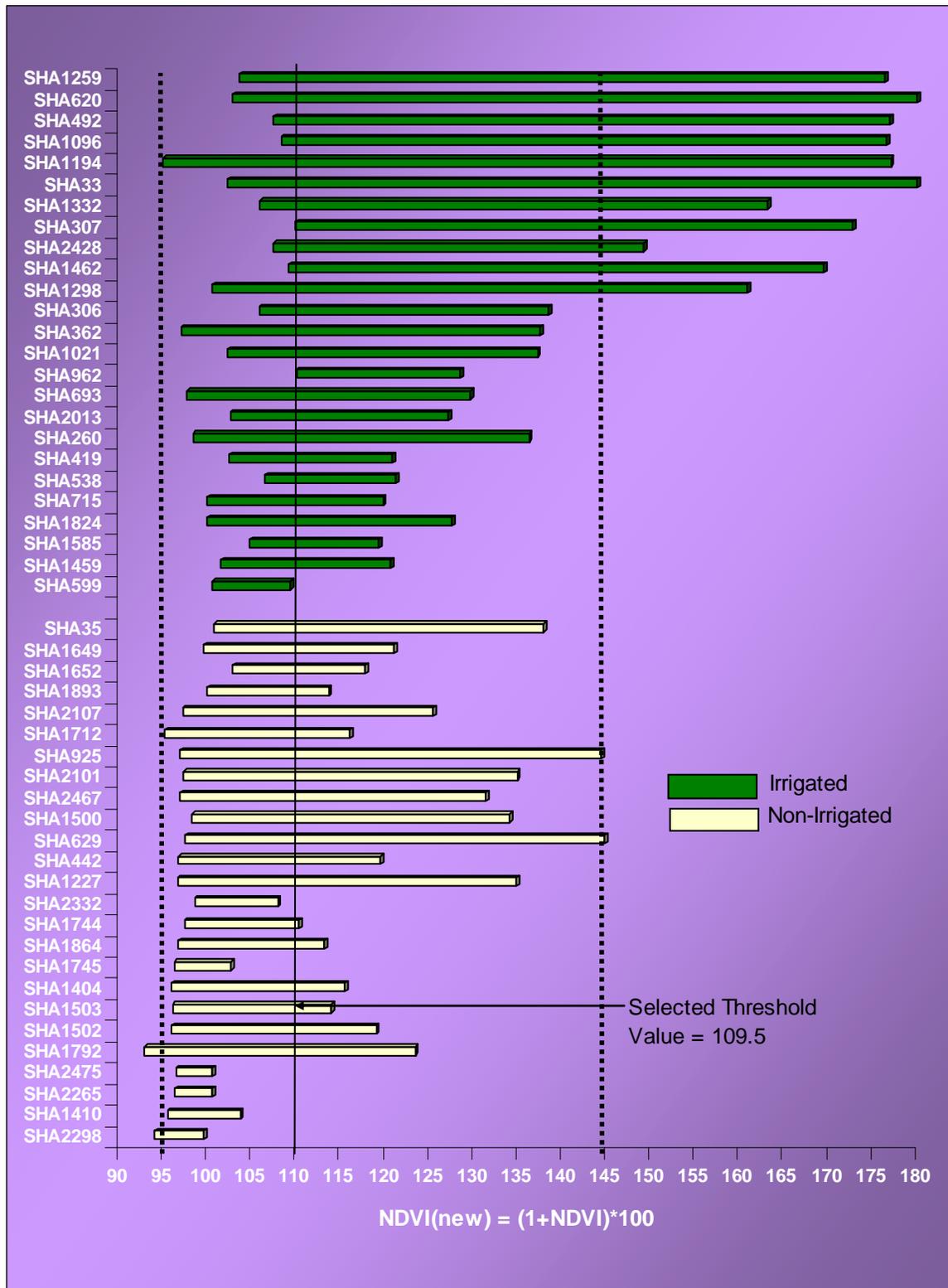
1. Free Landsat ETM data were obtained from the USGS EROS Data Center’s Glovis website (EROS, 2007).
2. The raw data were in generic binary format. It was processed, in accordance with procedures published by the North Carolina State University Center for Earth Observation, into a georeferenced, multi-spectral image using ERDAS remote sensing software (NCSU, 2007).
3. Bands 3 and 4 were ratioed to create an NDVI of the image, also using ERDAS Remote Sensing Software.
4. False color composite Landsat image was overlain in ArcGIS with agricultural field polygons.
5. Using Hawth’s Tools, a random selection tool by Spatial Ecology (2007), a representative percentage of polygons within a Landsat path/row scene were randomly selected. The following number of polygons were selected:
 - p35r37: at least 100 polygons
 - p36r37: 15% (23 of 154 polygons selected)
 - p36r38: 15% (6 of 38 polygons selected)

6. Since the Landsat analysis occurred during summer 2007, using 2000 – 2005 imagery, no ground-truth samples were available. As a surrogate, ADWR staff visually inspected the randomly selected polygons looking for evidence of irrigation.
7. The interpreted irrigation status was recorded in the polygons' attribute table. Care was taken to assure enough samples were taken from each irrigation category to adequately train the image.
8. Of the sample polygons selected, half were used for classification to obtain an appropriate NDVI threshold and the other half were reserved as reference samples to check the accuracy of a given threshold before it was applied to the remaining polygons, and as necessary, to make adjustments.
9. Using the NDVI image, a calculation was made to create a new image that eliminated negative values and rescaled the pixel values to range between 0 – 200. The following computation was made to create the new NDVI:

$$\text{NDVI}_{\text{new}} = (1 + \text{NDVI}) * 100$$

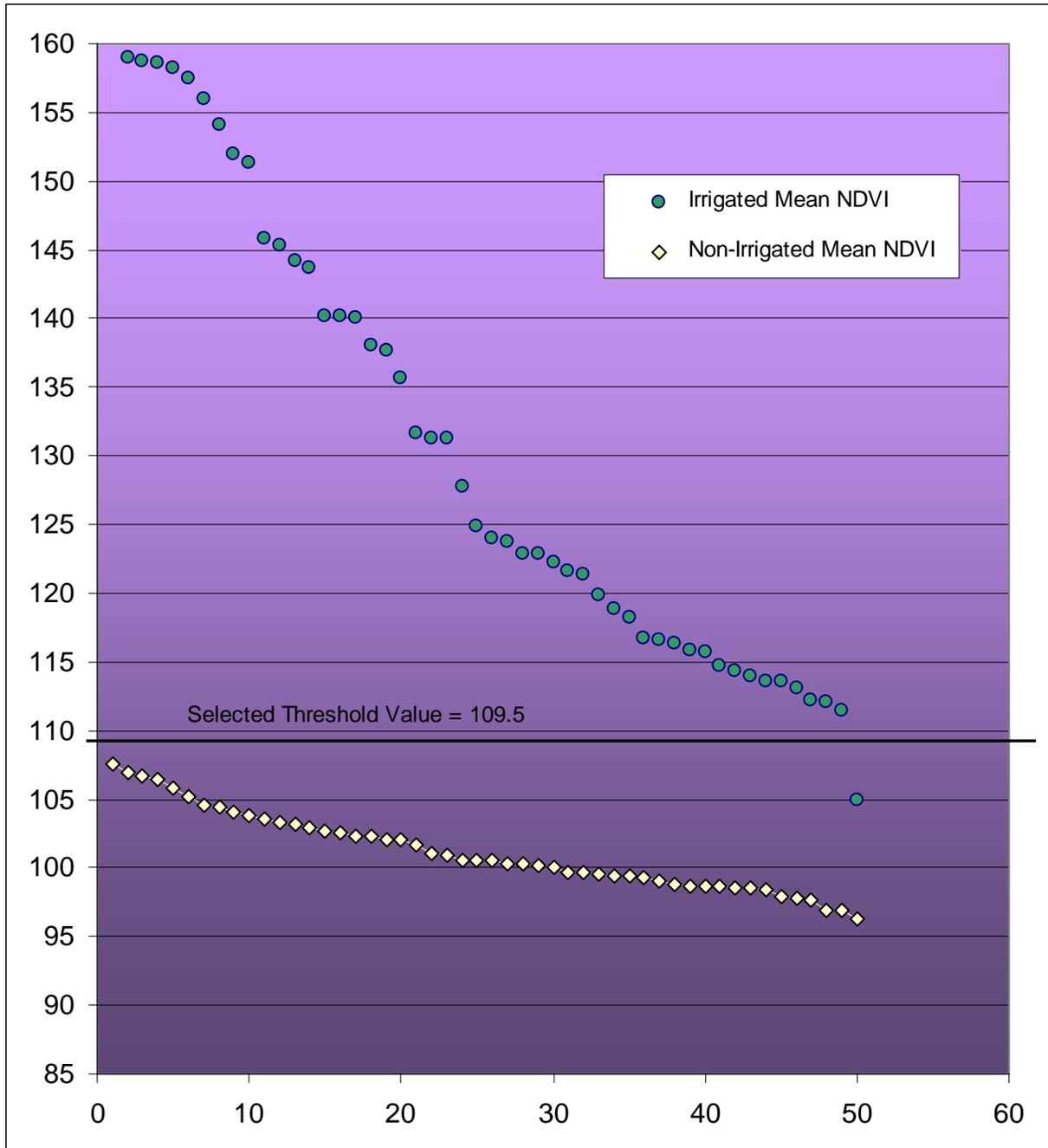
10. The ArcGIS Spatial Analyst Extension's Zonal Statistics Tool was used to calculate the following statistics for pixel values of a raster (NDVI_{new}) within the zones (agricultural field polygons):
 - Count of pixels
 - Minimum pixel value
 - Maximum pixel value
 - Range of pixel values (max – min)
 - Mean or average pixel value
 - Standard Deviation of the pixel values
 - Sum of the pixel values
11. Pixel value statistics were joined to the polygons and associated values were graphed as shown for the Path 35, Row 36 Landsat image taken on June 16, 2000 (**Figure B-5**).

Figure B-5: NDVI_{new} field sample ranges
P35/R36 Landsat Image taken June 16, 2000



12. An area of overlap was identified for the range of pixel values for irrigated and non-irrigated fields. After further evaluation, a threshold was selected that allowed most irrigated fields to be distinguished from non-irrigated fields.
13. The selected threshold was then plotted against mean NDVI values for both classification and reference samples, as shown in the example in **Figure B-6**.

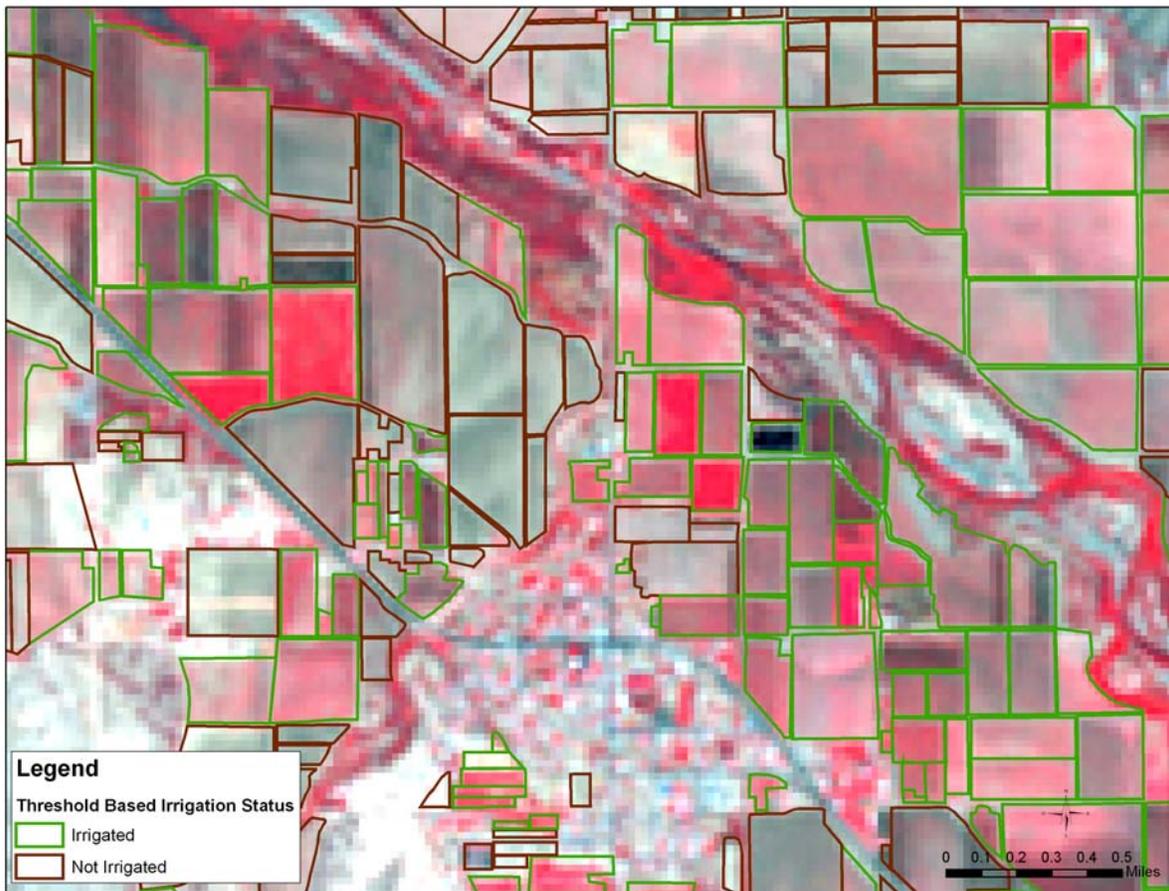
Figure B-6: NDVI_{new} mean values for field samples
P35/R36 Landsat Image taken June 16, 2000



In this example, a $NDVI_{new}$ threshold of 109.5 accurately classified all non-irrigated samples and only miss-classified one out of 50 (2%) of the irrigated samples.

14. Once a threshold was selected for an image, any field polygon whose mean $NDVI_{new}$ value was equal to or above the threshold was classified as irrigated, and any value below the threshold was considered non-irrigated. This information was stored in the polygon feature class, symbolized and visually inspected against the original false color image to assure an acceptable classification had occurred, as shown in **Figure B-7**.

Figure B-7: Threshold-based irrigation status results vs. false color composite imagery



15. When all Landsat images had been processed, irrigation status results were recorded in the agricultural field's attribute table in the goatabase. This information was then factored into the overall irrigation status of the agricultural field, and ultimately the designation of the field as Recently Irrigated.

NDVI threshold values were different for different image dates because pixel values can change due to varying soil condition, soil moisture, vegetative health, leaf area and atmospheric effects (Qi and others, 2002). **Table B-2** lists the Landsat images used in this study, their dates

and the NDVI_{new} threshold selected that provided the best determination of irrigation status of agricultural fields.

Table B-2: Landsat Images and NDVI_{new} Threshold Values

YEAR	PATH/ROW	DATE	Threshold*
2000	35/37	06/16/00	109.5
	36/37	06/15/00	84
	36/38	06/15/00	77.5
2002	35/37	06/14/02	82
	36/37	06/05/02	85
	36/38	06/21/02	75
2003	35/37	07/27/03	118
	36/37	07/02/03	114
	36/38	07/02/03	106.8
2004	35/37	07/13/04	114.5
	36/37	07/04/04	115.3
	36/38	07/20/04	113.65
2005	35/37	06/14/05	111.6
	36/37	05/04/05	120
	36/38	06/21/05	106

*Threshold value selected based on $NDVI_{new} = [1 + ((band\ 4 - band\ 3) / (band\ 4 + band\ 3))] * 100$

Based on the above methodology, nearly 86% (2,092 of 2,431) of the agricultural fields identified by ADWR were determined to have mean NDVI_{new} values above the thresholds within at least one year from January 2000 through September 2005.

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Appendix C: Geodatabase Design/Structure

This appendix describes the design and structure of the geodatabase developed for the Gila River Maintenance Area (GMA) project. The geometry, irrigation status and various other information about each agricultural field polygon was stored in the geodatabase. A geodatabase is a spatial database with extensions for storing, querying and manipulating geographic and other spatial information. Included are lists and descriptions of elements within the geodatabase including feature datasets, feature classes and their attributes, or fields. Environmental Systems Research Institute (ESRI) defines a feature dataset as “a collection of feature classes stored together that share the same spatial reference and coordinate system” and a feature class as “a collection of geographic features with the same geometry type (i.e., point, line, or polygon), the same attributes, and the same spatial reference” (ESRI, 2007a). All data in the GMA geodatabase are projected in North American Datum (NAD) 1983 High Accuracy Reference Network (HARN) Universal Transverse Mercator (UTM) Meters.

The GMA geodatabase was designed in ESRI’s ArcCatalog 9.2 software program as a personal geodatabase. Data in this type of database are stored within a Microsoft Access data file with a two gigabyte (GB) size limitation (ESRI, 2007b). A personal geodatabase was chosen to allow for use of standard query language (SQL) to extract useful information about the data needed for analysis. **Figure C-1** shows the structure within the ArcCatalog tree. There are three feature datasets in the GMA_Final.mdb geodatabase. They include the GMA_ProjectFeatures dataset, which holds general project features, the Mapped_Lands Dataset containing the agricultural field polygons delineated for this project and those removed from consideration, and the Remote_Sensing dataset that contains the polygon feature class pertaining to the remote sensing analysis. **Table C-1** lists and describes individual feature classes within each feature dataset, the geometry type and the original source of the data.

Figure C-1: GMA geodatabase file structure

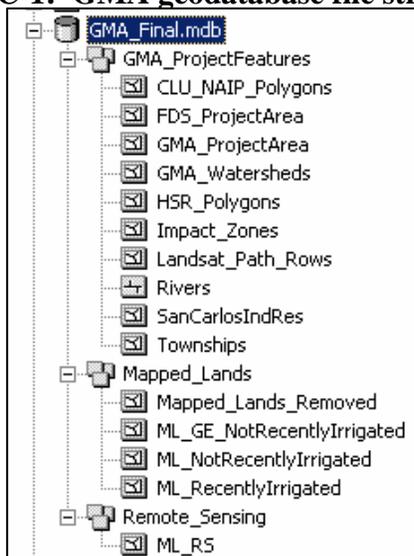


Table C-1: GMA Geodatabase Feature Classes

GMA_Final.mdb				
Feature Dataset	Feature Class	Type	Description	Source
GMA_ProjectFeatures	CLU_NAIP_Polygons	Polygon	Merged common land unit polygons	Farm Service Agency
	FDS_ProjectArea	Polygon	Fluvial depositional system zones (similar to impact zones)	GIS Southwest/Gila River Indian Community
	GMA_ProjectArea (see Table C-9)	Polygon	The final project boundary polygons	Newly created from existing watersheds with portions that intersect either the San Carlos Indian Reservation or Cochise County removed.
	GMA_Watersheds	Polygon	Upper Gila and San Pedro watersheds that make up the project boundary, before the exclusions	ADWR SDE Database
	HSR_Polygons	Polygon	Polygons delineated during previous hydrologic survey reports	The Globe Equity or San Pedro Hydrologic Survey Reports
	Impact_Zones	Polygon	Areas along the major watercourses in the GMA where there is believed to be strong surface water/groundwater interaction.	GIS Southwest/Gila River Indian Community
	Landsat_Path_Rows	Polygon	Index of the location of the Landsat scenes the cover the project area	EROS Data Center
	Rivers	Line	Rivers/Streams	ALRIS/ADWR SDE Database
	SanCarlosIndRes	Polygon	San Carolos Indian Reservation	Bureau of Indian Affairs

GMA_Final.mdb				
Feature Dataset	Feature Class	Type	Description	Source
	Townships (see Table C-10)	Polygon	Township/Range polygons that intersect the GMA Project Boundary	Imported from ALRIS/ADWR SDE Database and selected by intersection with the project boundary-subset further attributed.
Mapped_Lands	ML_RecentlyIrrigated (see Table C-2)	Polygon	Agricultural fields irrigated between January 2000 and September 2005 based on ADWR analysis.	Newly created from CLU polygons or digitized new polygons during the project.
	ML_GE_NotRecentlyIrrigated	Polygon	Agricultural fields not irrigated between January 2000 and September 2005, however they do have irrigation rights under the Globe Equity No. 59 Decree based on a map comparison.	Newly created from CLU polygons or digitized as new polygons during the project.
	Mapped_Lands_Removed	Polygon	Other agricultural fields or polygons not further considered.	Exported from working polygon feature and added to this feature as they were removed for various reasons.
Remote_Sensing	MappedLands_RS (see Table C-11)	Polygon	Agricultural field Polygons with remote sensing analysis results	Newly created from Mapped Lands Polygons to store remote sensing analysis results.

*Note: **Bold** items represent new features created specifically for this project.

Table C-2 lists attributes associated with the Recently Irrigated Land polygon features (ML_RecentlyIrrigated), their descriptions, and the type of field (Text, Number, etc.). Some attributes are bounded by a domain or “look-up” table that provided a dropdown menu for editing attributes such as irrigation status and the database user who created and verified the polygon. Domains facilitate the editing process and minimized data-entry errors by limiting the input to allowable values. The other polygon feature classes in the Mapped Lands feature dataset, included Globe Equity Lands Not Recently Irrigated (ML_GE_NotRecentlyIrrigated),

Other Agricultural Lands Mapped by ADWR (ML_GE_NotRecentlyIrrigated) and Mapped Lands Removed (Mapped_Lands_Removed) all have the same data structure.

ArcPad 7.0.1 a mobile GIS application designed to store data collected during ADWR’s fieldwork could not display geodatabase feature classes in the field so attributes names were truncated to 8 characters or less, to conform to standards of the ESRI Shapefile format. After field work was completed, newly edited shapefiles were imported back into geodatabase feature class format. Attribute names remain 8 characters or less, to allow for easy transfer between file formats. **Tables C-3 through Table C-9** lists the domains and their values.

Table C-2: Recently Irrigated Lands Polygon Feature Attributes

Attribute Name	Description	Type	Domain
OBJECTID	Auto Number assigned by ArcGIS	Integer	
Uniqu_ID	Unique Identifier: ML + Original Object ID	TEXT	
Acreage	Acreage calculated w/ tool after edits were completed	Double	
Status00	Irrigation Status in 2000	Text-Lookup	LU_AG_STATUS
Status01	Irrigation Status in 2001	Text-Lookup	LU_AG_STATUS
Status02	Irrigation Status in 2002	Text-Lookup	LU_AG_STATUS
Status03	Irrigation Status in 2003	Text-Lookup	LU_AG_STATUS
Status04	Irrigation Status in 2004	Text-Lookup	LU_AG_STATUS
Status05	Irrigation Status in 2005	Text-Lookup	LU_AG_STATUS
Composit	Composite/Overall Irrigation Status Status based on review of years 2000-2005 (See Appendix F)	Text-Lookup	LU_AG_STATUS
FeatSorc	Feature Source (e.g. AD = Digitized from an Aerial Photograph)	Text-Lookup	LU_FEAT_SRCE
CreatdBy	Created By (who digitized and/or edited/reviewed the polygon)	Text-Lookup	LU_USERS
CreateDt	Create Date (mm/dd/yyyy of when the polygon was first created or edited)	Date: mm/dd/yyyy	
ValtdBy	Validated By	Text-Lookup	LU_USERS
RchckdBy	Rechecked By (only populated for a small subset of polygons)	Text-Lookup	LU_USERS
Refrnce	Reference: Where the shape originated- either from the USDA CLU polygons or from ADWR’s in-office observations of aerial photos	Text	
Remarks	Remarks about the polygon during the initial review	Text	
Township	Township (North or South)	Text	
Range	Range (East or West)	Text	
To_Visit	A field created to hold the results of whether a polygon would be visited in the field or not.	Text-Yes, No or Try	

Attribute Name	Description	Type	Domain
VisitdBy	The ADWR staff that visited the polygon, if applicable	Text-Lookup	LU_USERS, Auto Generated based on Pen Tab Login
Status06	Irrigation Status in 2006 (Pima Co. only)	Text-Lookup	LU_AG_STATUS
Status07	Irrigation Status in 2007 (as observed during fieldwork)	Text-Lookup	LU_AG_STATUS
Visit_Date	Date Visited (mm/dd/yyyy of when the polygon was field verified, automatically generated based on mobile computer's date setting)	Date: mm/dd/yyyy	
ImgYr_06	Aerial Photograph available in given year (based on index)	Text-Yes, No	
ImgYr_05	Aerial Photograph available in given year (based on index)	Text-Yes, No	
ImgYr_04	Aerial Photograph available in given year (based on index)	Text-Yes, No	
ImgYr_03	Aerial Photograph available in given year (based on index)	Text-Yes, No	
ImgYr_02	Aerial Photograph available in given year (based on index)	Text-Yes, No	
ImgYr_01	Aerial Photograph available in given year (based on index)	Text-Yes, No	
Shape	Automatically generated vector data type (points, lines or polygons)	Auto	
Stays	Is this polygon an agricultural field to be further considered?	Text-Yes, No	
Why	Why: Reason the polygon remains in the dataset or should be removed	text	
Remarks2	Remarks (made by additional ADWR staff)	text	
Weeds	Weeds	Text-Lookup	LU_WEEDS
H2O_SRCE	H2O_SRCE	Text-Lookup	LU_H2O_SRCE
Row_Pltd	Row Attribute: Planted	Checkbox	
Row_wFmd	Row Attribute: Well Formed	Checkbox	
Row_Bare	Row Attribute: Bare	Checkbox	
Row_Crum	Row Attribute: Crumbly	Checkbox	
Row_Roun	Row Attribute: Rounded	Checkbox	
Row_Smth	Row Attribute: Smooth	Checkbox	
Row_Slty	Row Attribute: Silty	Checkbox	
Row_Wxd	Row Attribute: Weathered	Checkbox	
Row_SvrD	Row Attribute: Severely Damaged	Checkbox	
Row_None	Row Attribute: None	Checkbox	
CNV_Dtch	Observed Conveyance System: Ditches	Checkbox	
CNV_Siph	Observed Conveyance System: Siphon	Checkbox	

Attribute Name	Description	Type	Domain
CNV_Spkl	Observed Conveyance System: Sprinklers	Checkbox	
CNV_CDam	Observed Conveyance System: Check Dams	Checkbox	
CNV_Gate	Observed Conveyance System: Turn-Out Gates	Checkbox	
CNV_nonF	Observed Conveyance System: Non-Functioning	Checkbox	
CNV_Othr	Observed Conveyance System: Other	Text (50)	
Aclr_WetF	Observed Signs of Active Irrigation: Wet Field	Checkbox	
Aclr_H2oD	Observed Signs of Active Irrigation: Water in Ditches	Checkbox	
Aclr_Pond	Observed Signs of Active Irrigation: Ponding On Field	Checkbox	
Aclr_Tail	Observed Signs of Active Irrigation: Tail Water Ponds	Checkbox	
Aclr_Othr	Observed Signs of Active Irrigation: Other	Text (50)	
LandOwnr	Interaction With Landowner	Yes/No Checkbox	
PcntStat	Percent of Field Covered by the Irrigation Status Selected in 2007	Percent (Default to 100%)	0-100
FieldCom	Field Comments	Text (at least 255)	
PreFldCm	Pre-Field Comments	Text	
Team	Team designated to visit the polygon	A or B	A or B (or NULL)
ST_ACCESS	Site access-the ease of entry onto the property	Text	LU_SITE_ACESS
MODIF_BY	Modified by-automatically populated based on the User ID of the person logging into the mobile application during fieldwork.	Text-Lookup	LU_USERS
MODIF_DATE	Modified date-automatically populated by the date/time a modification was made to the polygon from the mobile application	Date: mm/dd/yyyy	
Rcntlrr	Was the polygon recently irrigated? (see Appendix G)	Text-Yes, No, GE (not recently irrigated but has Globe Equity Rights)	
Pct_Cnft	The percentage from 0 - 100 that the polygon's irrigation status is correct (see Appendix G)	Number	
Photo	The file path to the digital photograph, if applicable, of the field	Text	
Remarks3	Remarks (made by additional ADWR staff during secondary reviews)	Memo	

Attribute Name	Description	Type	Domain
Index_TR	Township and Range as a single ext element	Text	
PreWindowStat	Irrigation Status in a given year of the 1990s	Text-Lookup	LU_AG_STATUS
PreWindowFlightDate	The corresponding flight date of the 1990s imagery	Text	
Resp_Cat	Type of response ADWR received after the land owner was notified for those fields not recently irrigated.	Text	LU_Responce_Category
Shape_Length	Automatically generated geometric calculation	Number	
Shape_Area	Automatically generated geometric calculation	Number	

***Note:** Polygons removed from considerations are stored in a separate feature class Mapped_Lands_Removed. This feature class follows the same schema as ML_RecentlyIrrigated.

Table C-3: Irrigation Status Domain

CODE	DESCRIPTION
Active_Cropped	Active and Cropped
Active_Fallow	Active but Fallow
Questionable	Questionable
Urbanized_Developed	Urbanized or Developed
Inactive_Idle	Inactive or Idle
Newly_Planted_Emergent	Newly Planted or Emergent or Crop Ready
Irr_Pasture	Irrigated Pasture
NonIrrigated_Lot	Non-Irrigated Lot
Native_Desert	Native Desert
I	Irrigated (Remote Sensing Only)
N	Not Irrigated (Remote Sensing Only)

Table C-4: Feature Source Domain

Code	Description
GPS	Based on GPS Coordinates
AD	Digitized from an Aerial Photograph
FD	Digitized based on a Field Visit
Combo	Created from a combination of methods

Table C-5: Users Domain

Code	Description
WRAXF	Andy Fisher
WRCAB	Carol Birks
WRDAK	David Keadle
WRDEY	Dianne Yunker

Code	Description
WRJFP	Jacqueline Pursell
WRJRS	Jeremy Shaw
WRKAM	Karen Martini
WRLFG	Leslie Graser
WRPMC	Patrick Crowley
WRWDM	Bill Musielak

Table C-6: Weeds Domain

Code	Description
Few	Few Weeds
Many	Many Weeds
No	No Weeds
Shrubs_Trees	Shrubs and Trees

Table C-7: Site Access Domain

Code	Description
A	Accessible
N	Not Accessible

Table C-8: Water Source Domain

Code	Description
Both	Both
GW	Well
None	None
NA	Not Applicable
SW	Surface Water
UNK	Unknown

Table C-9: Response Categories

Code	Description
a	Landowner Provided Evidence of Recent Irrigation and/or Deeded Water Right
b	Landowner Made Statement of Recent Irrigation and/or Deeded Water Right
c	Landowner Responded But Did Not Provide Evidence of Either Irrigation or Deeded Water Right
d	No Landowner Response to ADWR Request for Evidence
e	ADWR Unsuccessful in Contacting Landowner

Tables C-10 lists attributes associated with GMA project boundary polygons. The project boundary polygons were created from merging the Upper Gila and San Pedro Adjudication Watersheds features stored in ADWR's special data engine (SDE) enterprise geodatabase and then removing those portions that were part of either the San Carlos Indian Reservation or Cochise County, as per state law. After the exclusions were made, the GMA project area included two separate polygons. The larger polygon to the north is 3,963,242 acres

and the small, southwestern polygon is 94,694 acres. The portion of the GMA within Santa Cruz County was not adjacent to any impact zones and not evaluated further in this project.

Table C-10: GMA Project Area Feature Attributes

Attribute Name	Description	Type
OBJECTID	Auto Number assigned by ArcGIS	Object ID
Shape	Automatically generated vector data type (points, lines or polygons)	Polygon
Shape_Length	Automatically generated geometric calculation	Number
Shape_Area	Automatically generated geometric calculation	Number
Acres	Acreage in this portion of the project	Number
Status	Describes the status of that portion. Either GMA or GMA Without Adjacent Impact Zone	Text

Table C-11 lists attributes associated with the Townships feature class in the GMA geodatabase. This dataset includes only those townships that intersect the GMA project boundary. Townships were compared to Impact Zones, Fluvial Deposition Zones, Common Land Unit polygons, Previous Hydrologic Survey Report (HSR) polygons, and Streams polylines and assigned weight point values. The townships were ranked accordingly from highest to lowest points and those townships with the most points were analyzed first.

Table C-11: GMA Townships Feature Attributes

Attribute Name	Description	Type	Domain
OBJECTID	Auto Number assigned by ArcGIS	Object ID	
Shape	Automatically generated vector data type (points, lines or polygons)	Polygon	
TOWNSHIP_HOOK	A unique identifier of the township and range, often used to make joins	Text	
MAB_LABEL	A unique identifier of the township and range, sometimes used in map labeling	Text	
TOWNSHIP_LABEL	A unique identifier of the township sometimes used in map labeling	Text	
RANGE_LABEL	A unique identifier of the range, sometimes used in map labeling	Text	

Attribute Name	Description	Type	Domain
ImpactZonePoints	Points assigned to the township based on relation to Impact Zone Polygons (10 points if intersecting, 5 points if within 10 miles and 0 points for all others)	Number	
FDSPoints	Points assigned to the township based on relation to Fluvial Deposition Systems (8 points if intersecting, 4 points if within 10 miles and 0 points for all others)	Number	
CLUPoints	Points assigned to the township based on relation to Common Land Unit Polygons (6 points if intersecting 0 points for all others)	Number	
HSRPoints	Points assigned to the township based on relation to previously delineated Hydrologic Survey Report (HSR) Polygons (4 points if intersecting and 0 points for all others)	Number	
Class1RvrPoints	Points assigned to the township based on relation to Class 1 (major) rivers (3 points if intersecting and 0 points for all others)	Number	
Class2RvrPoints	Points assigned to the township based on relation to Class 1 (major) rivers (2 points if intersecting and 0 points for all others)	Number	
Class3RvrPoints	Points assigned to the township based on relation to Class 1 (major) rivers (1 point if intersecting and 0 points for all others)	Number	
AggregatePoints	The total of all points, used to prioritize the township review process	Number	
Priority	The order in which townships were reviewed, ranked from highest to lowest aggregate points	Number	
CreateBy	The person who performed the primary review/editing/creation of polygons in a particular township.	Text	LU_USERS
ValidateBy	The person who performed the secondary quality control check of polygons within a particular township.	Text	LU_USERS
Notes	Remarks about a particular township	Text	
Shape_Length	Automatically generated geometric calculation	Number	
Shape_Area	Automatically generated geometric calculation	Number	

Table C-12 lists attributes associated with the Mapped Lands Remote Sensing polygon feature class (MappedLands_RS). This feature contains the results of the Landsat imagery NDVI threshold analysis (See Appendix B) and was used in conjunction with the Mapped Lands polygons to establish a composite irrigation status within the January 2000 to September 2005 project window (See Appendix G). **Table C-13** contains the remote sensing domain table with allowed values.

Table C-12: Remote Sensing Polygon Feature Attributes

Attribute Name	DESCRIPTION	Type	Domain
OBJECTID	Auto Number assigned by ArcGIS	Integer	
Shape	Automatically generated vector data type (points, lines or polygons)	Polygon	
Uniqu_ID	Unique Identifier: SFA + Original Object ID	TEXT	
Acreage	Acreage calculated w/ tool after edits were completed	Double	
RSStatus00	Irrigation Status in 2000 (based on NDVI threshold analysis)	Text-Lookup	LU_RS_STATUS
RSStatus01	Irrigation Status in 2001 (based on NDVI threshold analysis)	Text-Lookup	LU_RS_STATUS
RSStatus02	Irrigation Status in 2002 (based on NDVI threshold analysis)	Text-Lookup	LU_RS_STATUS
RSStatus03	Irrigation Status in 2003 (based on NDVI threshold analysis)	Text-Lookup	LU_RS_STATUS
RSStatus04	Irrigation Status in 2004 (based on NDVI threshold analysis)	Text-Lookup	LU_RS_STATUS
RSStatus05	Irrigation Status in 2005 (based on NDVI threshold analysis)	Text-Lookup	LU_RS_STATUS
Shape_Length	Automatically generated geometric calculation	Number	
Shape_Area	Automatically generated geometric calculation	Number	

Table C-13: Remote Sensing Status Domain

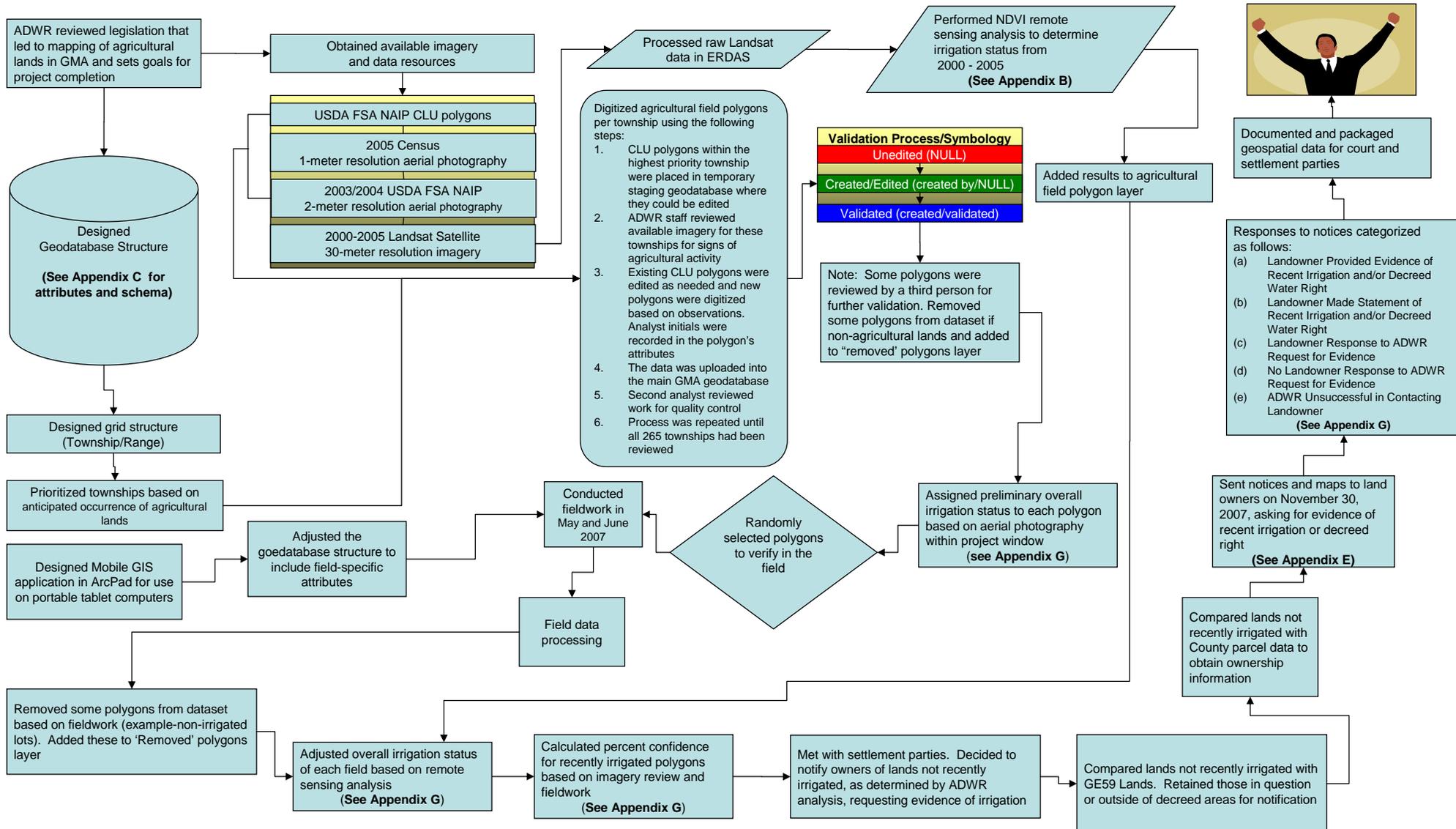
CODE	Description
I	Irrigated
N	Not Irrigated

References

ESRI, 2007a. Elements of a Geodatabase. Accessed October 2007 at: <http://www.esri.com/software/arcgis/geodatabase/about/elements.html>

ESRI, 2007b. Geodatabase. Accessed October 2007 at: <http://www.esri.com/software/arcgis/geodatabase/index.html>

Appendix D: Methodology Flowchart



Appendix E Example ADWR Notification Letter

ARIZONA DEPARTMENT OF WATER RESOURCES

3550 North Central Avenue, Phoenix, Arizona 85012

Telephone 602 771-8523

Fax 602 771-8681



Janet Napolitano
Governor

Herbert R. Guenther
Director

November 30, 2007

Dear Land Owner:

You have been identified as the owner of one or more parcels of land, as shown on the enclosed map. We are sending this letter to determine whether your land has recently been irrigated for agriculture or has a decreed water right.

In 2005, the State Legislature enacted laws related to the enforcement of the Gila River Indian Water Rights Settlement. Included in this legislation were restrictions on new irrigation in what is referred to as the Gila River Maintenance Area. The legislation states in part, with some exceptions, that land in the area can only be irrigated in the future if it was previously irrigated between January 1, 2000 and September 2005. One exception is if the land is subject to an existing water right decree, such as Globe Equity No. 59.

Our review of aerial photographs and satellite imagery and ground inspections suggest that the field or fields delineated with a red border on the enclosed map were not irrigated between January 1, 2000 and September 2005. Our records review also suggests that the delineated field or fields may not have a decreed water right. If our information is incorrect, and you can demonstrate that your land was irrigated during this time and/or has a decreed water right, please forward your information within 30 days to:

Arizona Department of Water Resources
Adjudications and Technical Support Section

Attn: Ana M. Marquez

3550 North Central Avenue

Phoenix, Arizona 85012

Telephone (602) 771-8405

Fax (602) 771-8680

ammarquez@azwater.gov

Thanks for your assistance with this matter.

Sincerely,

Rich Burtell, Manager
Adjudications and Technical Support Section



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Appendix F: Landowner Responses to ADWR Notifications¹

(a) Landowner Provided Evidence of Recent Irrigation and/or Deeded Water Right					
County	Parcel Number	ADWR Field Identifier	Landowner	Township/Range	Appendix H Map Number
Graham	102-04-003	ML88	DAVIES, CAROL P	T 7S R26E	Map 30
	105-02-043A	ML516	BRYCE, DAVID BOYCE & MARILYN	T 6S R25E	Map 26
		ML518		T 6S R25E	Map 26
	105-08-001	ML796	HOWARD, RONALD G & JANICE A	T 6S R25E	Map 26
	105-08-006	ML796	SKINNER, RANDY D & WENDY A	T 6S R25E	Map 26
	105-10-002	ML677	WELKER, LAVELL A	T 6S R25E	Map 26
	105-49-006	ML261	DALEY, BROOKS & MARGARET	T 6S R25E	Map 26
	106-13-003	ML2213	BLACK, ROY L	T 8S R26E	Map 31
		ML2216		T 8S R26E	Map 31
		ML958		T 8S R26E	Map 31
	106-16-012A	ML2213		T 8S R26E	Map 31
	106-28-020A	ML2333	FERGUSON FARMS	T 8S R26E	Map 31
		ML2334		T 8S R26E	Map 31
		ML2335		T 8S R26E	Map 31
		ML2336		T 8S R26E	Map 31
		ML2337		T 8S R26E	Map 31
		ML2338		T 8S R26E	Map 31
		ML2340		T 8S R26E	Map 31
	106-31-004	ML2362	YAPP, CLIFFORD E & MARIE A	T 8S R26E	Map 31
	107-30-001	ML455	LARSON, MARILYN P	T 7S R27E	Map 34
ML465		T 7S R27E		Map 34	
107-45-050	ML218	T 7S R27E		Map 34	
107-47-005A	ML365	T 7S R27E		Map 34	
109-39-003	ML1475	COLVIN, JAY D & BRENDA	T 5S R24E	Map 23	
109-42-001	ML865	COLVIN, ROBERT J & VERNA RAE	T 5S R24E	Map 23	

(a) Landowner Provided Evidence of Recent Irrigation and/or Deeded Water Right (Cont.)

County	Parcel Number	ADWR Field Identifier	Landowner	Township/Range	Appendix H Map Number
Graham (Cont.)	110-14-009	ML2512	THE NATURE CONSERVANCY	T 6S R19E	Map 16
	110-25-001	ML2511		T 6S R19E	Map 16
		ML2512		T 6S R19E	Map 16
	110-45-025E	ML1873	CAVENDER, MICHAEL J & SUSAN S	T 7S R20E	Map 17
		ML1874		T 7S R20E	Map 17
		ML2054		T 7S R20E	Map 17
		ML2064		T 7S R20E	Map 17
		ML2065		T 7S R20E	Map 17
	112-12-134	ML2091	MCLEOD, VERA SMITH	T 7S R24E	Map 25
	113-03-022A	ML2333	SILVER PRINA LLC	T 8S R26E	Map 31
		ML2334		T 8S R26E	Map 31
	113-03-023B	ML2055	MOTES, DELBERT N & GWENA	T 9S R26E	Map 32
		ML2097		T 9S R26E	Map 32
		ML2099		T 9S R26E	Map 32
	113-03-024	ML2097		T 9S R26E	Map 32
ML2099		T 9S R26E		Map 32	
Greenlee	300-53-010F	ML1836	BOLING FAMILY TRUST	T 6S R31E	Map 41
	300-78-012	ML1862	BARNEY, LARRY W	T 6S R31E	Map 41
	400-36-007B	ML912	MAHAN, ERLINDA SUE	T 7S R31E	Map 42
	Non-Parceled Private Land	ML1862	UNKNOWN	T 6S R31E	Map 41
		ML912		T 7S R31E	Map 42
Pima	205-17-0010	ML2111	BAYLESS & BERKALEW CO	T11S R18E	Map 14
	205-17-010D	ML2114		T11S R18E	Map 14
	205-21-010D	ML2111	UNKNOWN	T11S R18E	Map 14
	205-24-002A	ML2404	BAYLESS & BERKALEW CO	T12S R18E	Map 15
	205-27-001A	ML935		T12S R18E	Map 15
Pinal	300-16-001	ML2488	THE NATURE CONSERVANCY	T 6S R16E	Map 06
		ML2489		T 6S R16E	Map 06
	300-16-702	ML2489	NONE IDENTIFIED	T 6S R16E	Map 06
	300-20-003A	ML2513	SCHWENNESEN, ERIC & JEAN	T 6S R16E	Map 06
	306-07-006	ML2048B	SWIFT CURRENT LAND & CATTLE LLC	T 8S R17E	Map 11
		ML2049A		T 8S R17E	Map 11
		ML2050		T 8S R17E	Map 11
		ML2051		T 8S R17E	Map 11
306-33-007	ML2041	CLARK, BENNY H & FRANCES	T 8S R17E	Map 11	

(b) Landowner Made Statement of Recent Irrigation and/or Decreed Water Right

County	Parcel Number	ADWR Field Identifier	Landowner	Township/Range	Appendix H Map Number
Gila	101-02-014K	ML2168	BARTON, JANET A	T 4S R16E	Map 04
Graham	103-20-003	ML198B	GILBERT, ANDREW J III & SHIRLEY L	T 7S R26E	Map 30
	104-01-002	ML2090	DURFEE, ELAINE RENEE	T 7S R25E	Map 27
	104-09-117C	ML1195	HOWARD, VERDELL & NELDA JO	T 7S R25E	Map 27
	105-01-009	ML1227	BRYCE, W E	T 6S R25E	Map 26
	105-13-015	ML671	PHELPS DODGE CORPORATION	T 6S R25E	Map 26
	105-36-073C	ML700	SALINE, ALMA M & DAVID K	T 6S R25E	Map 26
	106-06-038	ML2183B	HATCH, CHARLES	T 8S R26E	Map 31
	106-06-058	ML2076	MARKS, ALAN EDWARD	T 8S R26E	Map 31
		ML2120		T 8S R26E	Map 31
		ML2121		T 8S R26E	Map 31
		ML2131		T 8S R26E	Map 31
		ML2132		T 8S R26E	Map 31
		ML2148		T 8S R26E	Map 31
		ML2149		T 8S R26E	Map 31
	106-28-021A	ML2339	ST PAISIUS MONASTERY	T 8S R26E	Map 31
	106-34-005B	ML2323A	JOHNSON, BRADFORD D & LOLA J	T 8S R26E	Map 31
109-64-004B	ML315A	MORRIS, BRENT & EVELYN R	T 6S R24E	Map 24	
109-73-015	ML1635B		T 6S R24E	Map 24	
Greenlee	400-06-004	ML1779	SEXTON, MARVIN & DONNA	T 7S R31E	Map 42
		ML1790		T 7S R31E	Map 42
	400-59-002	ML1680	HARRINGTON RANCH & FARMS	T 8S R31E	Map 43
	400-61-001	ML1680		T 8S R31E	Map 43
	500-01-004	ML2225B		T 8S R31E	Map 43
Pinal	300-16-007E	ML2491	BROWNRIGG, TROY A & NORINE J	T 6S R16E	Map 06
	306-02-007	ML2040	MILLER, CLARENCE R	T 8S R16E	Map 08

(c) Landowner Responded But Did Not Provide Evidence of Either Irrigation or Decreed Water Right

County	Parcel Number	ADWR Field Identifier	Landowner	Township/Range	Appendix H Map Number
Graham	113-03-008	ML2124	SCHRODER, JOHN & PEGGY JO	T 9S R26E	Map 32
Pinal	300-16-006	ML2493	ASARCO INC	T 6S R16E	Map 06
	300-16-010B			T 6S R16E	Map 06
	300-26-084	ML2393	CASILLAS, ROBERT S & BETTY G	T 6S R16E	Map 06
	306-07-003	ML2048A	MAGMA COPPER CO	T 8S R17E	Map 11
		ML2049B		T 8S R17E	Map 11
	307-06-002	ML2100		T 9S R17E	Map 12
307-23-004F	ML2078	KING, OSCAR J & JUDY E	T10S R18E	Map 13	

(d) No Landowner Response to ADWR Request for Evidence

County	Parcel Number	ADWR Field Identifier	Landowner	Township/Range	Appendix H Map Number
Graham	103-20-007	ML198A	LATTER DAY SAINTS	T 7S R26E	Map 30
	103-28-013	ML2508	RHEA, MILTON T & JUNE M	T 8S R26E	Map 31
		ML2509		T 7S R26E	Map 30
		ML2510		T 7S R26E	Map 30
		105-01-011H		ML501	CURTIS, MICHAEL T & AMANDA
	105-01-011M	ML501	LAMOREAUX, DAVID MAX	T 6S R25E	Map 26
	105-37-018C	ML780	ALDER, JOSEPH L & EVELYN	T 6S R25E	Map 26
	105-44-010	ML893	SHIFLET, JOSEPH ROY	T 6S R25E	Map 26
	106-06-016D	ML1877A	LARSON, KENT & ROSE	T 8S R26E	Map 31
	106-06-016E	ML1877A	LARSON, JASON K & AMANDA D	T 8S R26E	Map 31
		ML1877B		T 8S R26E	Map 31
		ML1877C		T 8S R26E	Map 31
	106-06-016F	ML1877A	LARSON, KENT & ROSE	T 8S R26E	Map 31
		ML1877B		T 8S R26E	Map 31
		ML1877C		T 8S R26E	Map 31
	106-06-016G	ML1877C	WRIGHT, DAVID & DANA	T 8S R26E	Map 31
	106-06-055	ML2183A	SHERMAN, RUSTY & BRENDA	T 8S R26E	Map 31
	106-06-057A	ML2183A	ODLE, JAMES W & JO FRANCES	T 8S R26E	Map 31
	106-06-062	ML2183A	TEIGEN, WILLIAM S	T 8S R26E	Map 31
	106-34-005A	ML2323B	PEW, JN III	T 8S R26E	Map 31
	107-39-022C	ML126	CURTIS, BROOKS AND MYRNA JEAN	T 7S R27E	Map 34
		ML127		T 7S R27E	Map 34
		ML128		T 7S R27E	Map 34
		ML466		T 7S R27E	Map 34
	107-47-001	ML457	BOWMAN, TERRY O & SARA C	T 7S R27E	Map 34
		ML459		T 7S R27E	Map 34
	108-10-002	ML1275	WARD, MONTEE HINTON	T 4S R22E	Map 20
	108-13-008	ML1324	GAR-PRIDE ENTERPRISES LLC	T 4S R23E	Map 21
108-13-018	ML1324	GARCIA, ALBERT & JOSEPH M	T 4S R23E	Map 21	
109-22-003	ML1871	LANGLEY FARMS LLC	T 5S R23E	Map 22	

(d) No Landowner Response to ADWR Request for Evidence (Cont.)

County	Parcel Number	ADWR Field Identifier	Landowner	Township/Range	Appendix H Map Number
Graham (Cont.)	109-31-013A	ML1347	SLEATER, DAVID	T 5S R24E	Map 23
	109-35-022A	ML1497	MARSHALL, G STEVE & LINDA S	T 5S R24E	Map 23
	109-37-024	ML1503	INDIAN SPRINGS RANCH INC	T 5S R24E	Map 23
	109-37-027B	ML1498	MARSHALL, G STEVE & LINDA S	T 5S R24E	Map 23
	109-73-016	ML1635A	CLUFF, GREGG D & JANA S	T 6S R24E	Map 24
	113-03-015	ML2368	U S GOVERNMENT	T 9S R26E	Map 32
		ML2369		T 9S R26E	Map 32
	113-04-016A	ML2098	REED, VERNELLE W	T 9S R26E	Map 32
	113-04-017B	ML2098	HAMBLIN, ROLAND L & MAE	T 9S R26E	Map 32
	State Trust Land	ML2083	STATE OF ARIZONA	T 7S R24E	Map 25
		ML2084		T 7S R24E	Map 25
		ML2085		T 7S R24E	Map 25
		ML2086		T 7S R24E	Map 25
		ML2087		T 7S R25E	Map 27
ML2088		T 7S R24E		Map 25	
	ML2096		T 7S R25E	Map 27	
Greenlee	300-64-004B	ML1856	TYLER, A RAY & JANETTE	T 6S R31E	Map 41
	400-37-001	ML1754	BRINDLEY, MARGARET L ETALS	T 7S R31E	Map 42
	400-37-018	ML1754	BOWEN, KRISTI	T 7S R31E	Map 42
	400-37-019	ML1754	BODINE, MAYBLE	T 7S R31E	Map 42
	400-63-002	ML1773	ELMER, ALVIN C/BETTY J	T 8S R31E	Map 43
	500-01-117B	ML2228	MCGETRICK, J OHN M/MARY E	T 8S R32E	Map 44
	500-12-005	ML1773	ELMER, ALVIN C/BETTY J	T 8S R31E	Map 43
	Non-Parceled Private Land	ML2228	UNKNOWN	T 8S R32E	Map 44
Pima	20518025A	ML2134	STRAUSSER, VALORY	T11S R18E	Map 14
	20518027F	ML2135	BIGELOW, HAROLD O & ERMA E	T11S R18E	Map 14
	205210030	ML2144	STATE OF ARIZONA	T11S R18E	Map 14
	20521010D	ML2144	NONE IDENTIFIED	T11S R18E	Map 14
Pinal	306-25-004A	ML2129	MERCER, VIRGIL E & MARY A	T 9S R17E	Map 12
	307-05-001B	ML2128		T 9S R17E	Map 12
		ML2129		T 9S R17E	Map 12

(e) ADWR Unsuccessful in Contacting Landowner					
County	Parcel Number	ADWR Field Identifier	Landowner	Township/Range	Appendix H Map Number
Graham	106-09-029	ML2374	POWELL, DAVID R	T 8S R26E	Map 31
	109-64-004C	ML314	KREBS, KATHERINE	T 6S R24E	Map 24
		ML315B		T 6S R24E	Map 24
	109-64-004D	ML314		T 6S R24E	Map 24
	109-73-009J	ML1635C	R & L PROPERTIES	T 6S R24E	Map 24
	Non-Parceled Private Land	ML1635C	UNKNOWN	T 6S R24E	Map 24
ML2066		T 7S R20E		Map 17	
Greenlee	400-60-001	ML2225A	HARRINGTON RANCH & FARMS	T 8S R31E	Map 43
	400-60-008	ML2225A	SCHOOL DISTRICT #24	T 8S R31E	Map 43
	Non-Parceled Private Land	ML2225A	UNKNOWN	T 8S R31E	Map 43
Pinal	300-12-004D	ML1786	ARVIS, C & ANNA L FORREST	T 5S R16E	Map 05
	300-57-004	ML2153	ARAVAIPA CREEK RANCH LLC	T 6S R17E	Map 09
	307-21-704	ML2079	NONE IDENTIFIED	T10S R18E	Map 13

¹ Status of responses to ADWR notices, as of January 22, 2008.

Appendix G: Overall Irrigation Status and Confidence Determination

1.0 Introduction

This appendix describes ADWR's criteria to determine recent (January 2000 to September 2005) irrigation status and calculate the confidence level of the determinations. Most agricultural fields were considered recently irrigated based on aerial photographs or Landsat imagery that indicated irrigation activity. To be categorized as "Recently Irrigated," a field only had to show agricultural activity once during the project window. To be categorized as "Not Recently Irrigated," a field had to show no evidence of irrigation during the entire period.

Due to the poor quality of some aerial photographs and the coarse (30-meter) resolution of the satellite imagery, there was some uncertainty in ADWR's irrigation status determinations. Also, aerial photographs were not available for every growing season of the project window and no aerial photographs were available from 2000 through 2002. Landsat imagery was analyzed, as described in Appendix B, to help further classify agricultural fields as irrigated or not-irrigated during each year. To quantify the degree of uncertainty in these determinations, confidence levels were calculated for mapped fields found to be recently irrigated.

Primary factors used to calculate confidence levels for the irrigation status determinations include:

- Number of aerial photographs reviewed;
- Level of agricultural activity observed in the aerial photographs;
- Quality of aerial photographs reviewed, both resolution and color; and
- Analysis of Landsat imagery.

For agricultural fields ground inspected in 2007, the following additional factors were also considered when calculating confidence levels:

- Level of agricultural activity observed;
- Maturity of weeds or the absence of weeds;
- Condition of rows and furrows, if any; and
- Existence and condition of a water conveyance system.

Depending on the irrigation status of a field, the preceding factors were given different weights and signs (some positive, some negative) and used to calculate a final confidence level between 0 and 100 percent.

1.1 Overall Irrigation Status

Irrigation activity was reviewed each year and considered in assigning an overall irrigation status for the fields. The assignment was based on a hierarchical logic that ranked actively irrigated (active and cropped) fields highest and less active or idle fields lowest, with some fields considered questionable. The following logic was used:

1. If a field was cropped in any year of the project window, its overall irrigation status was designated “Active/Cropped.” These fields are considered Recently Irrigated Lands. Otherwise,
2. If a field was in an active but fallow state in any year of the project window, that is the field appeared well maintained but no crops were observed, its overall irrigation status was designated “Active/Fallow.”
3. If a field was determined to be irrigated based on Landsat NDVI threshold analysis, its overall irrigation status was designated “Irrigated.” These fields are also considered “Recently Irrigated Lands.” Otherwise,
4. If a field’s status was questionable in any year of the project window, its overall irrigation status was designated “Questionable.” These fields were considered “Other Agricultural Lands Identified” and were subject to further evaluation beginning at Step 6. Otherwise,
5. If a field was thought to be inactive or idle during all years of the project window based on available photography and Landsat analysis, its overall irrigation status was designated “Inactive/Idle.” These fields were also considered “Other Agricultural Lands Identified and were subject to further evaluation beginning at Step 6.
6. The remaining fields found by ADWR map analysis to have Globe Equity No. 59 decreed rights were designated “Globe Equity No. 59 Lands Not Recently Irrigated.” Such lands are currently exempt from future irrigation restrictions. If a given field did not intersect Globe Equity No. 59 lands, was only partially located on them, or was fully on Globe Equity No. 59 land but the quarter quarter section was only partially decreed, the landowners were notified in Step 7.
7. Landowners were notified by ADWR that their lands did not appear to have been recently irrigated and/or did not have decreed rights. The notification requested documentation of recent irrigation activity or a decreed right such as Globe Equity No. 59. Landowners or their representatives responded to ADWR in one of five ways:
 - a) Landowner Provided Evidence of Recent Irrigation and/or Decreed Water Right
 - b) Landowner Made Statement of Recent Irrigation and/or Decreed Water Right
 - c) Landowner Responded but Did Not Provide Evidence of Either Irrigation or Decreed Water Right
 - d) No Landowner Response to ADWR Request for Evidence
 - e) ADWR Unsuccessful in Contacting Landowner

ADWR has not evaluated whether the evidence received from the notifications is either accurate or sufficient, but it will maintain an open file of this information. If a field identified in this mapping effort is found to be irrigated in the future, the file may be evaluated at that time.

Figure G-1 provides a logic flowchart used to determine the overall irrigation status of agricultural fields in the GMA.

2.0 Recently Irrigated Lands

Sections 2.1 through 2.3 of this appendix describe the confidence points assigned to calculate confidence levels for the agricultural fields ADWR determined were recently irrigated. Section 2.4 describes adjustments to the confidence points to account for those fields ground inspected in 2007.

2.1 Percent Confidence Points For Active/Cropped Fields

All agricultural fields with an overall irrigation status of “Active/Cropped” are considered recently irrigated lands. **Table D-1** lists confidence points for these field designations based on review of aerial photography and Landsat imagery analysis.

Table D-1: Confidence Points For Active/Cropped Fields

Category		Points
Most recent aerial photography within project window shows field as active and cropped	2005	70
	2004	60
	2003	60
Additional years designated as "Active/Cropped"	2004	5
	2003	5
2006 status (Pima County only)	Active/Cropped	2
	Active/Fallow	1
2007 status (ground inspected only)	Active/Cropped*	3
	Active/Fallow	2
	Inactive or Idle	-2
	NonIrrigated Lot	-3
Irrigated based on Landsat imagery analysis	2000	2
	2002	2
	2003	2
	2004	2
	2005	2

*“Active/Cropped” includes "Irrigated Pasture," "Newly Planted," and “Emergent” fields observed during the 2007 fieldwork.

2.2 Confidence Points For Active/Fallow Fields

All agricultural fields with an overall irrigation status of “Active/Fallow” are also considered recently irrigated fields. **Table D-2** lists confidence points for these field designations based on review of aerial photography and Landsat imagery analysis.

Table D-2: Confidence Points for Active/Fallow Fields

Category		Points
Most recent aerial photography within project window shows field as active but fallow	2005	60
	2004	50
	2003	50
Additional years designated as "Active/Cropped"	2004	5
	2003	5
2006 status (Pima County only)	Active/Cropped	2
	Active/Fallow	1
2007 status (ground inspected)	Active/Cropped*	3
	Active/Fallow	2
	Inactive/Idle	-2
	NonIrrigated Lot	-3
Irrigated based on Landsat imagery analysis	2000	2
	2002	2
	2003	2
	2004	2
	2005	2

*“Active/Cropped” includes "Irrigated Pasture," "Newly Planted," and “Emergent” fields observed during the 2007 fieldwork.

2.3 Confidence Points For Irrigated Fields

All agricultural fields with an overall irrigation status of “Irrigated” are not otherwise designated as “Active/Cropped” or “Active/Fallow” based on review of aerial photography. These are also considered recently irrigated lands, however at a lower confidence level. **Table D-3** lists confidence points for these field designations.

Table D-3: Confidence Points for Irrigated Fields

Category		Points
Base Points		40
Points subtracted for each aerial photograph designated as "Inactive/Idle"	2005	-5
	2004	-5
	2003	-5
2006 Status (Pima County only)	Active/Cropped	2
	Active/Fallow	1
	Inactive/Idle	-2
2007 Status Points (ground inspected only)	Active/Cropped*	3
	Active/Fallow	2
	Inactive/Idle	-2
	NonIrrigated Lot	-3
Irrigated based on Landsat imagery analysis	2000	10
	2002	10
	2003	10
	2004	10
	2005	10

*"Active/Cropped" includes "Irrigated Pasture," "Newly Planted," and "Emergent" fields observed during the 2007 fieldwork.

2.4 Confidence Point Adjustments for Recently Irrigated Lands Ground Inspected in 2007

Table D-4 lists confidence points that were added or subtracted for those agricultural fields believed to be irrigated between January 2000 and September 2005 and ground inspected during May and June 2007. Ground conditions that indicated a field was being used for agriculture during 2007 increased confidence that it was irrigated during the project window of 2000-2005. These conditions included a relative lack of weeds, well formed rows or furrows, and a functioning water conveyance system.

Table D-4: Confidence Point Adjustments Based on 2007 Ground Inspections

WEEDS		WATER CONVEYENCE SYSTEM	
None	5	Functioning	
Few	3	Ditches	5
Many	-5	Siphon	3
Shrubs_Trees	-10	Sprinklers	3
ROWS		Check Dam	3
Planted	2	Turn Out Gate	3
Well Formed	2	Other	3
Crumbly	2	Non Functioning	
Rounded	2	Ditches	-5
Smooth	-2	Siphon	-3
Weathered	-3	Sprinklers	-3
Bare	0	Check Dam	-3
Silty	0	Turn Out Gate	-3
Severely Degraded	-5	Other	-3
None	-3	Non-Functioning (not specified)	-5

3.0 Lands Not Recently Irrigated

Agricultural fields that showed no evidence of irrigation during the project window based on review of aerial photography, ground inspection, and Landsat imagery analysis may be subject to future irrigation restrictions. However, some of these lands identified in the GMA have decreed water rights, notably Globe Equity No. 59. Other fields identified in the GMA are not in an area with an impact zone. Confidence levels were not calculated for these lands.

3.1 Globe Equity Lands Not Recently Irrigated

In November 2007, ADWR received a geodatabase from GIS Southwest, a contractor for the GRIC. The contractor had prepared a map of Globe Equity No. 59 decree lands based on the decree's 40-acre, quarter quarter section legal descriptions and, reportedly, updated with data from the Gila Commissioner who administers the decree. Some quarter quarter sections are fully decreed, while others are only partially decreed. Fields that ADWR determined were not irrigated during the project window and completely on decreed Globe Equity lands based on the GIS Southwest map were considered "Globe Equity Lands Not Recently Irrigated." Because these fields are exempt from future irrigation restrictions, confidence levels were not calculated.

Unfortunately, some agricultural fields were located in partially decreed quarter quarter sections. Landowners of fields located on partially decreed lands or fields only partially located on decreed lands were sent notices asking for documentation of an existing decreed right and/or evidence of irrigation during the January 2000 to September 2005 project window.

3.2 Other Agricultural Lands Mapped by ADWR

3.2.1 Questionable Fields

Agricultural fields with an overall irrigation status of “Questionable” are not otherwise designated as “Active/Cropped,” “Active/Fallow,” or “Irrigated” based on aerial photography and Landsat satellite imagery analysis. These fields are not considered recently irrigated lands. For most of these fields, aerial photography was of poor quality or the field appeared in a state between active and idle. Landsat imagery analysis also suggested prolonged inactivity. Nearly half of these “Questionable” agricultural fields were ground inspected in 2007. The irrigation status in 2007, two years after the end of the 2000 to 2005 project window, was not used for determining the final irrigation status.

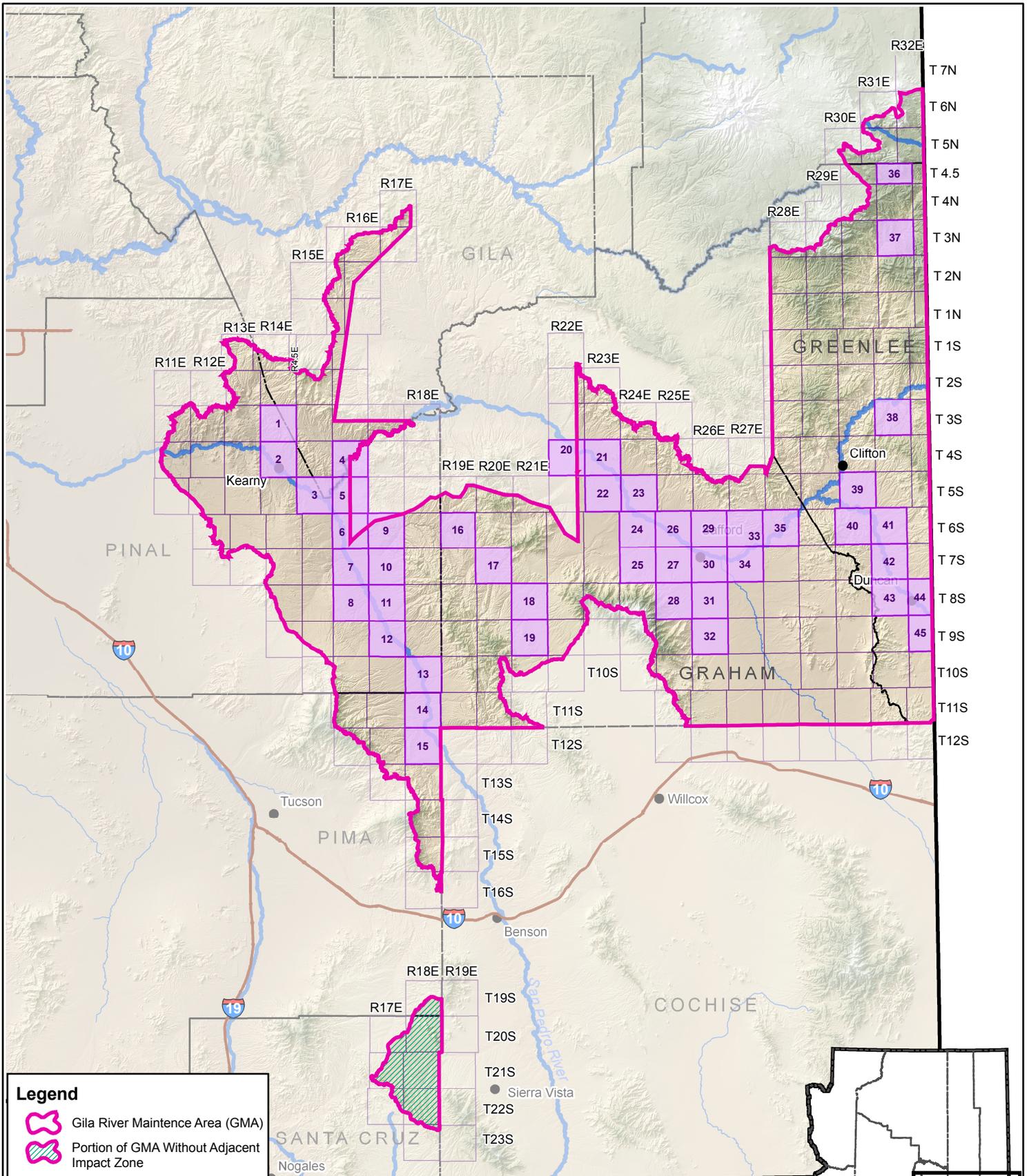
3.2.2 Inactive or Idle Fields

Agricultural fields with an overall irrigation status of “Inactive/Idle” are not otherwise designated as “Active/Cropped,” “Active/Fallow,” “Irrigated,” or “Questionable” based on aerial photography and Landsat imagery analysis. These fields are not considered to be recently irrigated lands. On aerial photographs, these fields appeared unmaintained and often overgrown with weeds. Landsat analysis also suggested prolonged inactivity.

Appendix H: Field Maps

Appendix H presents a series of maps, by township, that show the location of Recently Irrigated Lands, Globe Equity No. 59 Decree Lands Not Recently Irrigated, and Other Agricultural Lands Mapped by ADWR in the GMA. Impact zones developed by the Settlement Parties are included on the maps. An index map of the GMA is provided at the beginning of the appendix to show the location of the 45 townships, labeled by map number, that contained these lands.

Recently Irrigated Lands are outlined on the maps in dark green, the Globe Equity No. 59 Decree Lands Not Recently Irrigated are outlined in light green, and the Other Agricultural Lands Mapped by ADWR are outlined in red. Other map layers are provided for reference, including impact zones and the GMA boundary. All map layers are overlain onto 2005 Census aerial photography.



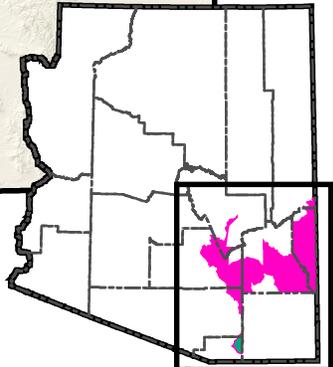
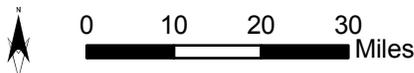
Legend

- Gila River Maintenance Area (GMA)
- Portion of GMA Without Adjacent Impact Zone
- 19 Map Extent and Number
- State Boundary
- Major Road
- City
- Township and Range
- County
- Stream

Appendix H

Gila River Maintenance Area

Index Map



Appendix I: GIS Data

Contents of DVDs:

- **Disk 1** – GIS Database, Ground Photos, Aerial Photography and Landsat Imagery
- **Disk 2** - Ground Photos, Aerial Photography and Landsat Imagery
- **Disk 3** - Ground Photos, Aerial Photography

DVD	GIS Database	Ground Photos	Aerial Photography		Landsat Imagery (see table below)
			2003/2004 NAIP	2005 Census	
Disk 1 of 3	GMA_Final.mdb	FieldPhotos2.zip	2003_2004_NAIP.zip	Apache.zip	Landsat2.zip Landsat3.zip
Disk 2 of 3	---	FieldPhotos1.zip	---	Gila.zip, Greenlee.zip Santa_Cruz.zip	Landsat1.zip
Disk 3 of 3	---	FieldPhotos3.zip (includes photo logs)	---	Graham.zip Pinal.zip	---

File	DVD	Path/Row	Date
Landsat1.zip	Disk 2 of 3	35/37	6/16/2000
			6/14/2002
			7/27/2003
			7/13/2004
			6/14/2005
Landsat2.zip	Disk 1 of 3	36/37	6/15/2000
			6/5/2002
			7/2/2003
			7/4/2004
		5/4/2005	
		36/38	6/15/2000
Landsat3.zip	Disk 1 of 3	36/38	6/21/2002
			7/2/2003
			7/20/2004
			6/21/2005