ZUNI RIVER BASIN ADJUDICATION
HYDROGRAPHIC SURVEY REPORT
SUB AREAS 1, 2 AND 3 EXCLUDING RAMAH

United States of America
v.
A& R Productions, et al.
CIV No. 01 00072 BB-ACE

Prepared Under the Direction of the

UNITED STATES DEPARTMENT OF INTERIOR

In Cooperation with the

State of New Mexico
Office of the State Engineer
Hydrographic Survey Bureau

By

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1 INTRODUCTION

The *United States v. State of New Mexico ex rel State Engineer, A&R Productions, et al.* case (Case number 01cv00072 BB) is currently pending in the United States District Court for the District of New Mexico. The Zuni River Basin was divided into 10 sub-areas to facilitate the orderly survey of water uses over multiple years (see Figure 1-1). During years 2004 and 2005, sub-areas 1, 2 and 3 of the Zuni River Basin area were surveyed for water uses. On July 21, 2006, the United States District Court ordered that a separate Ramah Sub-area, consisting of Sections 2, 3, 4, and 9 in Township 10N, Range 16W, and Sections 34 and 35 in Township 11N, Range 16W, plus any portion of the Ramah Reservoir outside those sections, be established for purposes of the hydrographic survey and further proceedings to adjudicate the water rights in said Sub-area. The total sub-areas in the basin are now 11. The Court also ordered that the United States may file a Hydrographic Survey Report and propose a Procedural and Scheduling Order for Sub-areas 1, 2, and 3, excluding the Ramah Sub-area. Consequently, this report shows the findings of the hydrographic survey for only non-federal and non-Indian lands in Sub-areas 1, 2, and 3, excluding the Ramah Sub-area. The major water use in these sub-areas is domestic and livestock. Maps showing the location of water uses are included with this report.

1.1 Description of the Area

The Zuni River Basin, depicted in Figure 1-1, covers approximately 1,930 square miles of land in Cibola and McKinley counties in the western central part of New Mexico. The Basin is bounded on the northwest and northeast by the Upper Puerco Basin and the Rio San Jose Basin, respectively, and on the southwest and southeast by the Carrizo Wash Basin and the North Plains Closed Basin, respectively. Figure 1-2 shows sub-area 1 with its map index.

Sub-area 1 of the Zuni River Basin consists of all of Township 10 North Range 19 West; all of Township 10 North Range 20 West; and all of Township 10 North Range 21 West ; all of sections 1-5 and 7-36 and portion of section 6 in Township 11 North Range 19 West; all of sections 12-14, and 21-36 and portions of sections 1, 10-12, 16, 17, 19 and 20 in Township 11 North Range 20 West; all of sections 10, 11, 14, 15, 22, 23, 25-27, and 34-36, and portions of sections 2, 3, 11-13, and 24 in Township 11 North Range 21 West; and all of sections 34-36 and

portions of sections 25-28, 31, 32 and 33 in Township 12 North Range 19 West. The total area of sub-area 1 is approximately 107,565 acres (168.07 sq. miles).

Sub-area 2 of the Zuni River Basin consists of all of sections 5-8, 17-20, and 29-32 in Township 10 North Range 16 West; all of Township 10 North Range 17 West; all of Township 10 North Range 18 West; all of sections 5-8, 17-20, and 29-32 in Township 11 North Range 16 West; all of Township 11 North Range 17 West; all of Township 11 North Range 18 West; all of sections 5-8, 17-20, and 29-32 in Township 12 North Range 16 West; all of Township 12 North Range 17 West; all of sections 12, 13, 23-27, and 31-36 and portions of sections 1, 2, 11, 14, 15, 21, 22, and 28-30 in Township 12 North Range 18 West; all of sections 23-27 and 32-26 and portions of sections 12-15, 21, 22, 28-31. The total area of sub-area 2 is approximately 158,529 ac (247.7 sq. miles).

Sub-area 3 of the Zuni River Basin, excluding Ramah Sub-area, consists of all of Township 10 North Range 15 West; all of sections 1, 10-16, 21-28 and 33-36 in Township 10 North Range 16 West; all of sections 2-11 and 14-36 and portions of sections 1, 12, and 13 in Township 11 North Range 15 West; all of sections 1-4, 9-16, 21-28, 33 and 36 in Township 11 North Range 16 West; a portion of section 30 in Township 12 North Range 14 West; all of sections 2-11, 15-22, and 26-35, and portions of sections 1, 12, 13, 14, 23, 24, 25 and 36 in Township 12 North Range 15 West; all of sections 1-4, 9-16, 21-28 and 33-36 in Township 12 North Range 16 West; a portion of section 31 in Township 13 North Range 14 West; all of sections 7, 18-20, 29-35 and portions of sections 6, 8, 16, 17, 21-23, 25-28 and 36 in Township 13 North Range 15 West; all of sections 11-36 and portions of sections 1-5 and 7-10 in Township 13 North Range 16 West; and a portion of Township 16 North Range 14 West. The total area of sub-area 3 including Ramah Sub-area is approximately 144,428 ac (225.7 sq miles).

The climate of the area is characterized as semi-arid. The annual average minimum temperature is in the range of 30 to 34ºF, and the annual average maximum temperature is in the range of 64 to 67ºF. More variations in temperature are observed, with highs up to the 90's in the summer and lows down to the teens in the winter. The average annual precipitation is in the range of 12 to 14 inches, while average annual snowfall is in the range of 17 to 44 inches, depending on location and elevation.

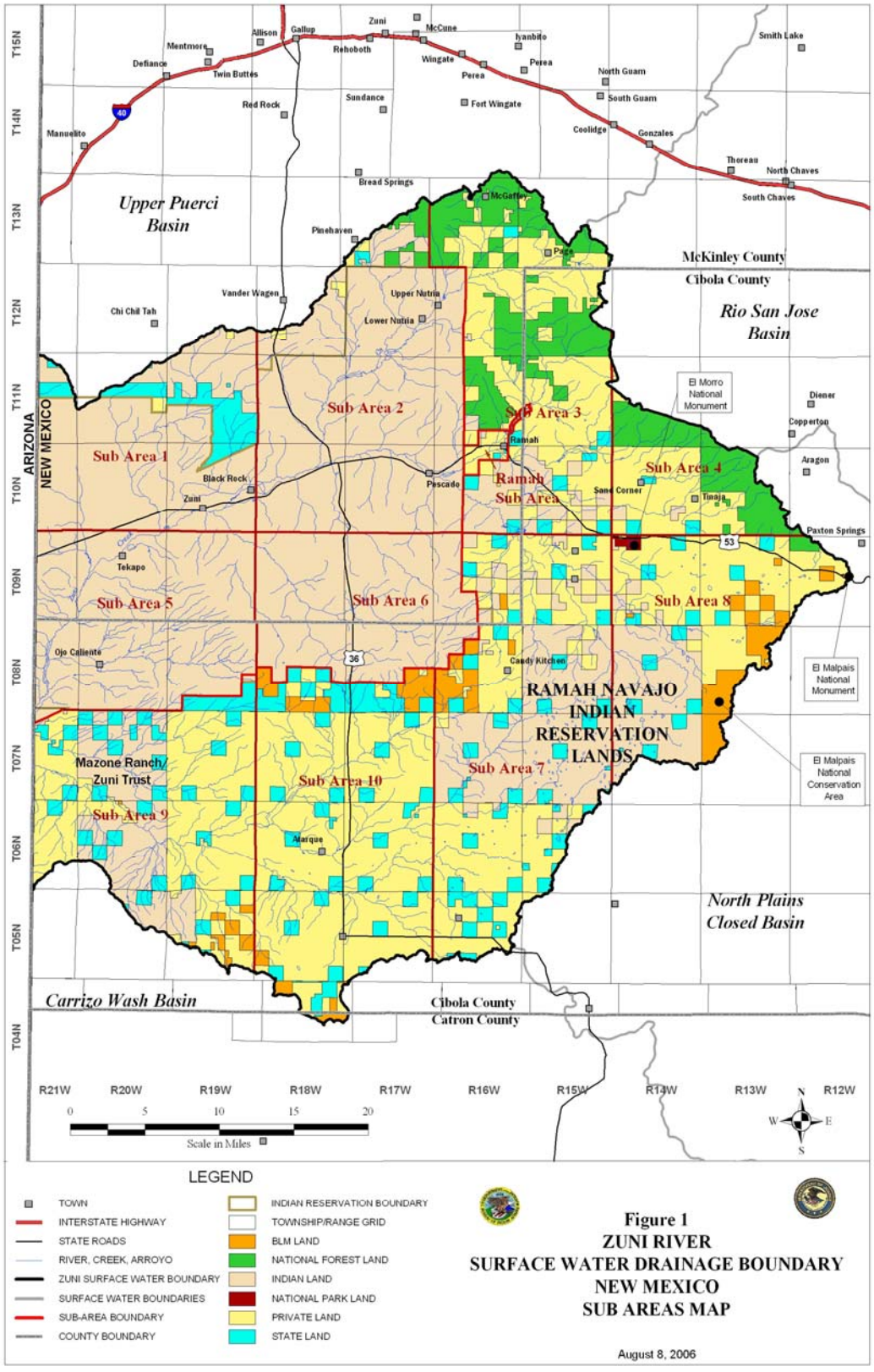

Figure 1-1: Adjudication Boundary of the Zuni River Basin

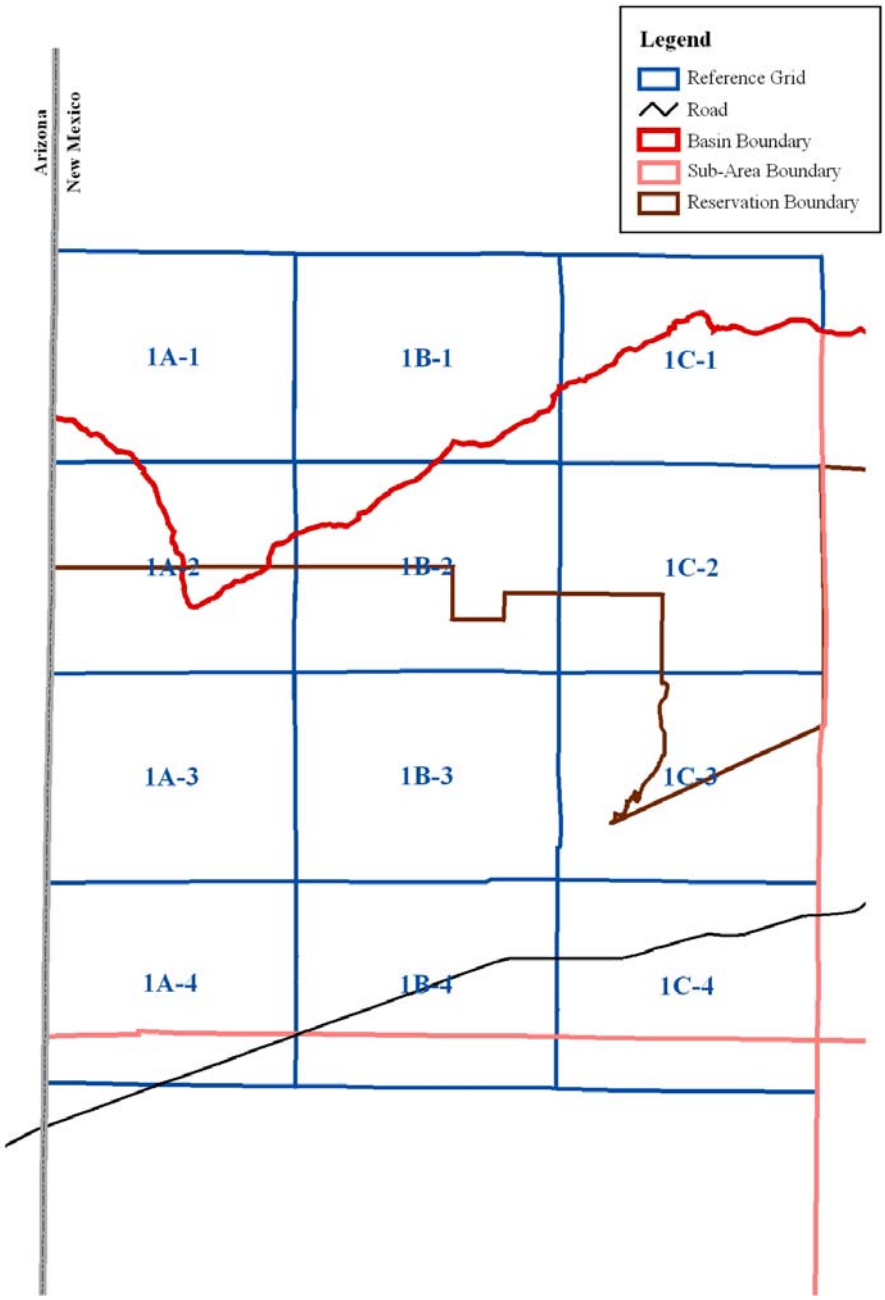

Figure 1-2: Map Index for Sub-area 1 of the Zuni River Basin

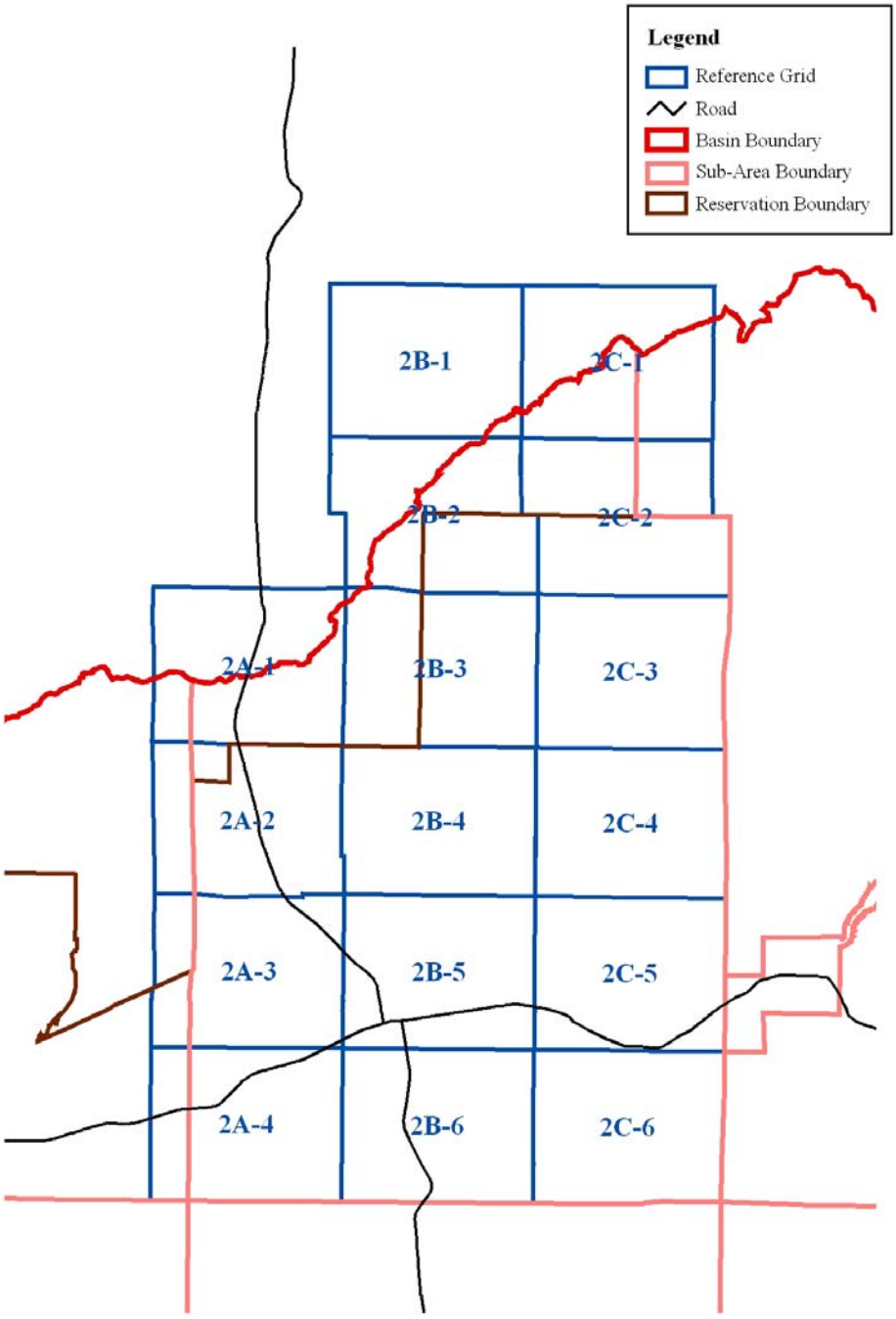

Figure 1-3: Map Index for Sub-area 2 of the Zuni River Basin

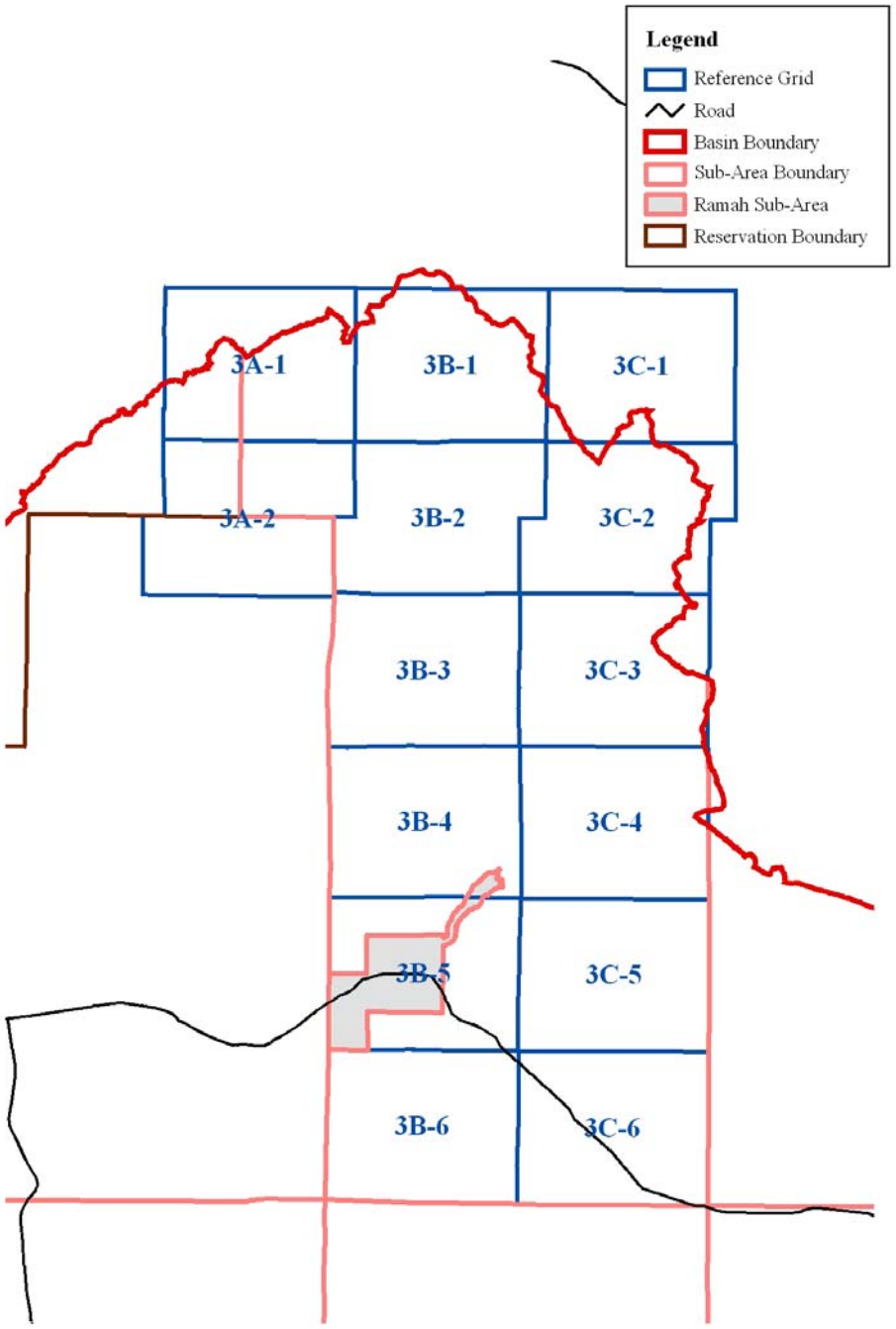

Figure 1-4: Map Index for Sub-area 3 of the Zuni River Basin

1.2 Technical Specification for Hydrographic Survey

The technical specifications for the hydrographic survey follow those prepared by the State of New Mexico, Office of the State Engineer, Hydrographic Survey Bureau (Hydrographic Survey Specifications) dated April 15, 2003. The United States and the State of New Mexico prepared a document entitled 'Joint Technical Progress Report, Zuni River Hydrographic Survey' (February 2003), which describes the procedure, variances, and schedule for the hydrographic survey. The United States and the State of New Mexico Hydrographic Survey Bureau consulted during the hydrographic survey field work and report preparation.

The Zuni River Basin lies within the Gallup Underground Administrative Basin, which was declared in March 14, 1994. Many of the domestic wells in the Zuni River Basin were drilled before the basin was declared and therefore did not require a permit. For this reason, a process was established requesting that water users update their water rights to include wells constructed prior to 1994. This process included mailing packets of information to land owners, holding a public meeting, and establishing field offices staffed by Office of the State Engineer personnel to help water users update and complete their water rights records. Additionally, whenever possible, the land owners were consulted concerning wells and ponds on their property at the time of the field assessments. The field assessment identified many wells without permits. The water rights identified during the abstracting process were linked to the information obtained in the field during the hydrographic survey.

1.3 Aerial Photography

Aerial photography and topographic maps were used as a basis for mapping the areas of interest. For Sub-areas 1, 2 and 3, United States Geological Survey (USGS) digital orthophoto quarter quadrangles (DOQQs), produced using aerial photography acquired in June and October of 1997, were plotted on a scale of 1:12,000 (1"=1000'). DOQQs are adequate for mapping of domestic and stock water uses based on the State of New Mexico Hydrographic Survey Technical Specifications dated April 15, 2003.

2 GEOGRAPHIC INFORMATION SYSTEM

All the geospatial components of the hydrographic survey water uses that were field inspected are stored in a Geographic Information System (GIS). The system used is in Windows-based ArcGIS software. The data and information stored consists of:

- Digital image data acquired for survey.
- Data (hard copy and electronic) obtained from state agencies including landowners, addresses, and ownership maps.
- Data and information acquired from the hydrographic survey field work.

As stated previously, USGS DOQQs were used for mapping purposes. The images were transferred into the New Mexico State Plane Coordinate System, West Zone, using the 1983 North American Datum.

Property ownership data and maps were obtained from the Cibola County Assessor's Office in Grants, New Mexico and from the McKinley County Assessor's office in Gallup, New Mexico.

All data gathered was compiled in a Microsoft Access database. The database includes names and addresses of owners, sub-file numbers, map labels, Office of State Engineer file/permit numbers, types of water source use and source, stock pond and well types, locations (PLSS), coordinates, aerial photograph dates and field visit dates, comments, and photograph identifications of the water features.

2.1 Global Positioning System

All water-feature locations were mapped using a Global Positioning System (GPS). Field crews used a Trimble GeoXT (hand-held 12 channel) GPS receiver. The integrated Wide Area Augmentation System (WAAS) differential GPS data service was used to achieve location data while in the field.

2.1.1 Field Data Logging Procedures

All GPS observations were made at an approximate antenna height of four feet. GPS data was logged at one position per second at maximum position dilution of precision 8.0 and a minimum

signal noise ratio of 3.0. The elevation mask used was 12 degrees. GPS data was collected using the internal antenna of the receiver.

2.1.2 Office Data Processing Procedures

Data was post-processed using a GeoXT software package that includes the Trimble Pathfinder Office version 2.90. Post-processing consisted of differential corrections of the raw receiver files using the New Mexico Institute of Mining and Technology base station at the University of New Mexico, Albuquerque. All data was analyzed in the North American Datum of 1983 and mapped in the New Mexico State Plane Coordinate System.

2.2 Field Inspections

2.2.1 Well Locations

Well locations were mapped using GPS. Rough locations of wells that have permit numbers were obtained from the New Mexico Office of the State Engineer's Water Administration Technical Engineering Resources System (WATERS) database. Wells that have no permit numbers were located either using information provided by land owners or using topographic maps. Locations of these wells were verified in the field. Photographs of wells were obtained during the field visits.

2.2.2 Stock Pond Locations

Stock ponds (dirt tanks) were located using aerial photos, declarations, state records, and information from land owners and then field mapped using GPS. In many instances, new stock ponds not visible on aerial photos were identified. These stock ponds were delineated with the GPS using a polygon feature. At the time of the visit, ponds were determined to be either man-made stock ponds or natural ponds. If a natural pond was excavated or diked, then the pond was determined to be man-made. Only dam elevations that are greater than 9-feet were recorded. Photographs of the stock ponds were taken during the field visit.

3 DUTY OF WATER (DIVERSION)

3.1 Wells

Wells were categorized according to water use based on field visits, water right records, and information received from owners. The following categories were used:

- Domestic – The duty of water for domestic wells is the historical beneficial use up to a maximum of 0.7 acre-feet per year.
- Livestock – The duty of water for stock wells is the estimated water use of livestock that could be or is actually sustained by the area served by the well. The water use of cattle was calculated based on the information prepared by State of New Mexico. The area of land in which the well is located was determined from property ownership maps and database obtained from Cibola Assessors office. Carrying capacity is based on the number of "animal units" that can be sustained on an area of land, with one cow or five sheep equivalent to one unit. The land carrying capacity, which is the number of animals that a habitat maintains in a healthy, vigorous condition, was assumed to be 15 animal units per section, or the count provided by the owner, whenever applicable. The 15 animal units per section estimate is based on information from the New Mexico Department of Agriculture. The water consumption of an animal unit is estimated at an average of 10 gallons/day (488 $feet^3$ per year or 0.0112 acre-feet per year) (Wilson and Lucero, 1997). An efficiency factor of 0.5 was assumed to account for consumptive and other losses. As an illustrative example, if a stock well serves 1,280 acres (2 sections), the carrying capacity of this land is 30 animal units. The water duty will be 0.672 acre-feet per year. However, if the owner said that he has 15 head of cattle, the water duty for that well would then be 0.336 acre-feet per year. The water duty for post-basin livestock-only wells (wells that were drilled after March 14^{th}, 1994) will be the historical beneficial use up to a maximum of 0.7 ac-ft if the calculated stock water duty is less than 0.7 ac-ft. If the latter is greater than 0.7 ac-ft, water duty will be the historical beneficial use up to that value.
- Domestic and Livestock - The duty of water for wells used for both domestic and stock use is the historical beneficial use up to a maximum of 0.7 acre-feet per year plus the stock

water duty. For example, the same above mentioned well would have a duty of 0.336 + 0.7 = historical beneficial use up to a maximum of 1.036 ac-ft/year.

– Commercial/sanitary – In the absence of other information, wells used for these purposes will be given the default water duty of domestic wells.

3.2 Ponds

The duty of water for ponds is based on their capacities. The number of times a pond fills during a year is not estimated. The capacities of the ponds were determined using the following methodology:

Stock pond depths were estimated based on the high-water mark observed in the field. Visible pond boundaries were delineated in the office prior to the field visit. Second, the boundaries were verified /modified in the field and then they were brought into GIS for area calculations. The capacity of the stock pond was calculated by multiplying the depth times the area times a factor of 0.6 that accounts for the irregularity of the pond's geometry. The coordinates of the pond represent the location of the pond's center of gravity.

Priority dates for man-made stock ponds were obtained from owners declarations whenever available. In the case where owners did not declare their stock pond priority dates, the date of the aerial photo was set as the priority date of the pond.

4 FINDINGS OF THE HYDROGRAPHIC SURVEY

The findings of the Zuni River Basin Hydrographic survey of Sub-areas 1, 2 and 3 excluding Ramah documented in this report are presented in two appendices. Appendix 1 lists the water uses that have been developed for beneficial use (wells and constructed stock ponds). Appendix 2 lists naturally-occurring ponds that may be beneficially used (i.e. natural ponds). Appendix 3 lists springs that may be beneficially used. Documentation is presented in the form of sub-files, summaries of surveyed features, and maps. The information was prepared under the direction of Dr. Hadi Jaafar and Dr. Lee Niel Allen, a Licensed Professional Civil Engineer in the State of New Mexico.

4.1 Sub-file Numbering

Sub-files were created to identify the water right(s) of property owners within Sub-areas 1, 2 and 3. Each owner or group of co-owners having a water right is assigned a sub-file, identified by a number. The sub-file number is unique for each owner or group of co-owners. It starts with the letters ZRB (Zuni River Basin), and then the number "4", indicating that this is the fourth hydrographic survey report in this adjudication process. The sub-file contains information about the surveyed water uses (stock ponds, wells, and springs). The total number of sub-files included in this report is 426. In Appendix 1, information about the features include owner name and address, water use (domestic, stock, etc.), type of feature (well or pond,), water source and point of diversion (if applicable), priority date, date of field visit, height of dam (if greater than 9 ft), estimated depth, area, and volume (for impoundments); and place and location of use (section, township, range, and coordinates). Naturally impounded water or springs that are contained within owner's property do not require a water right and can be beneficially used. Information about natural ponds and springs is presented in Appendices 2 and 3, respectively.

4.2 Map Labels

The map labels contained on the maps and in the report summaries provide information concerning the type of water use feature and the location of the feature. The first number in the label is the sub-area number and the first three characters are the map plate number on which the feature is located. The label has an identification of the feature type (SP for a stock-pond, W for

a well, RS for a reservoir, and SPR for a spring). For example, 3A-3-SP23 indicates that this is a stock pond in sub-area 3 located on map plate 3A-3. The last two numbers were assigned arbitrarily for every feature. Also shown on the map label is the sub-file number associated with the feature for easy reference in the survey report.

4.3 Office of State Engineer File Number

When applications for water uses have been filed to the State, the Office of the State Engineer assigns a file number to the water use feature. These file numbers are obtained from the WATERS database. For wells, the Office of the State Engineer file number begins with the letter G, indicating the Gallup Underground Water Basin. OSE file numbers associated with surveyed wells are shown in the Hydrographic Survey report.

4.4 Summary of Findings of the Hydrographic Survey

The features surveyed in this report include ponds (man-made and natural), wells and springs. Tables 4-1 and 4-2, and 4-3 show a summary of the findings of the survey in Sub-areas 1, 2 and 3 excluding the water features on federal and Indian lands as well as those within Ramah Sub-area.

Table 4-1 Counts of Surveyed Ponds

Pond	**Count**
Man-made	255
Natural	28
Total	**283**

Table 4-2 Counts of Surveyed Wells and their Uses

Well Use	**Count**
Commercial	4
Domestic Only, Single Household	335
Domestic and Livestock	24
Domestic, Multiple Households	7
Exploration	4
Livestock Only	68
Sanitary Only	1
Sanitary & Commercial	2
No Right	1
Total	**446**

Table 4-3 Counts of Surveyed Springs

Springs	Count
Livestock	22
Total	**22**

4.5 Disclaimer

This hydrographic survey report does not include information concerning the federal water claims including claims on behalf of Indian Tribes or allottees in Sub-area 1, 2 and 3. This information will be filed with the court at a later date. While the United States, State of New Mexico, and Natural Resources Consulting Engineers, Inc. (consultant) make every effort to provide accurate and complete information, various data may change in the future. The United States, State of New Mexico, and Natural Resources Consulting Engineers, Inc. (consultant) provide no warranty, expressed or implied, as to the accuracy, reliability or completeness of information in the declarations submitted by landowners or the land-ownership information obtained from the Assessors Offices of Cibola or McKinley County. The United States, the State of New Mexico, and Natural Resources Consulting Engineers, Inc. (consultant) reserve the right to update or change any of the information in this hydrographic survey report.

5 REFERENCES

New Mexico Department of Agriculture. Online. Available http://nmdaweb.nmsu.edu/links.html.

New Mexico Office of State Engineer. Online. Available http://www.ose.state.nm.us/

Wilson, B. C. and A.A Lucero. 1997. Water Use by Categories in New Mexico Counties and River Basins, and Irrigated Acreage in 1995. New Mexico State Engineer Office. Technical Report 49.

APPENDICES

Appendix 1

Zuni Basin Hydrographic Survey
Sub-areas 1, 2 and 3 excluding Ramah

Report of Water Right Findings

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Appendix 2

Zuni Basin Hydrographic Survey
Sub-areas 1, 2 and 3 excluding Ramah

Report of Natural Ponds

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Appendix 3

Zuni Basin Hydrographic Survey
Sub-areas 1, 2 and 3 excluding Ramah

Report of Springs

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