Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Backwater Inventory: Reaches 5 & 6
Step 1: Identification of Backwaters for Screening and Evaluation

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

September 2007

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

Federal Participant Group

Bureau of Reclamation
Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

Arizona Participant Group

Arizona Department of Water Resources
Arizona Electric Power Cooperative, Inc.
Arizona Game and Fish Department
Arizona Power Authority
Central Arizona Water Conservation District
Cibola Valley Irrigation and Drainage District
City of Bullhead City
City of Lake Havasu City
City of Mesa
City of Somerton
City of Yuma
Electrical District No. 3, Pinal County, Arizona
Golden Shores Water Conservation District
Mohave County Water Authority
Mohave Valley Irrigation and Drainage District
Mohave Water Conservation District
North Gila Valley Irrigation and Drainage District
Town of Fredonia
Town of Thatcher
Town of Wickenburg
Salt River Project Agricultural Improvement and Power District
Unit "B" Irrigation and Drainage District
Wellton-Mohawk Irrigation and Drainage District
Yuma County Water Users' Association
Yuma Irrigation District
Yuma Mesa Irrigation and Drainage District

Other Interested Parties Participant Group

QuadState County Government Coalition
Desert Wildlife Unlimited

California Participant Group

California Department of Fish and Game
City of Needles
Coachella Valley Water District
Colorado River Board of California
Bard Water District
Imperial Irrigation District
Los Angeles Department of Water and Power
Palo Verde Irrigation District
San Diego County Water Authority
Southern California Edison Company
Southern California Public Power Authority
The Metropolitan Water District of Southern California

.

Nevada Participant Group

Colorado River Commission of Nevada
Nevada Department of Wildlife
Southern Nevada Water Authority
Colorado River Commission Power Users
Basic Water Company

Native American Participant Group

Hualapai Tribe
Colorado River Indian Tribes
The Cocopah Indian Tribe

Conservation Participant Group

Ducks Unlimited
Lower Colorado River RC&D Area, Inc.

Lower Colorado River
Multi-Species Conservation Program

Backwater Inventory: Reaches 5 & 6

Step 1: Identification of Backwaters for Screening and Evaluation

Lower Colorado River
Multi-Species Conservation Program Office
Bureau of Reclamation
Lower Colorado Region
Boulder City, Nevada
http://www.lcrmscp.gov/

September 2007

Introduction

In 2006, the Bureau of Reclamation (Reclamation) completed *Draft Final Guidelines for the Screening and Evaluation of Potential Conservation Areas* (Reclamation 2006), which detailed a five-step process that the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) will use to screen and evaluate potential backwater land cover types (LCR MSCP 2006). During Step 1, Reclamation is tasked with inventorying and initially screening backwaters to identify approximately 25 candidate backwaters for further screening and evaluation. The five-step process is summarized in Figure 1.

Background

The LCR MSCP planning area comprises areas up to and including the full-pool elevations of lakes Mead, Mohave, and Havasu and the historical floodplain of the Colorado River from Lake Mead to the Southerly International Boundary (SIB) (LCR MSCP 2004). The historical flood plain is defined as all lands that are or have been affected by the meandering or regulated flows of the Colorado River, and which historically have been defined by the change in elevation that forms the adjoining uplands. The full-pool elevation of Lake Mead is defined as a water surface elevation of 1,229 feet National Geodetic Vertical Datum (NGVD). The full-pool elevation of Lake Mohave is defined as a surface water elevation of 647 feet NGVD. The full-pool elevation of Lake Havasu is defined as a surface water elevation of 450 feet NGVD. The full-pool elevation at Lake Mead is 8 feet above the spillway gates in the raised position. The full-pool elevations for lakes Mohave and Havasu correspond to the top of their respective spillway gates (Reclamation 1981).

For use in implementation of the LCR MSCP, the planning area is divided into discrete reaches:

- Reach 1—from Separation Canyon in the lower end of the Grand Canyon to Hoover Dam, including Lake Mead up to full-pool elevation
- Reach 2—from Hoover Dam to Davis Dam (River Mile [RM] 276), including Lake Mohave up to full-pool elevation
- Reach 3—from Davis Dam (RM 276) to Parker Dam (RM 192.3), including Lake Havasu up to full-pool elevation
- Reach 4—from Parker Dam (RM 192.3) to Adobe Ruin and Reclamation Cibola Gage (RM 87.3) at the lower end of Reclamation's maintenance Cibola Division
- Reach 5—from Reclamation Cibola Gage (RM 87.3) to Imperial Dam (RM 49.2)
- Reach 6—from Imperial Dam (RM 49.2) to the Northerly International Boundary (NIB) (RM 23.1)
- Reach 7—the portion of the LCR from NIB (RM 23.1) to SIB (RM 0.0) within the United States

Water surface elevation and river miles were determined from LCR Maps, Colorado River Frontwork & Levee System, Arizona-California (Reclamation 1976). The LCR MSCP planning area and river reaches are shown in Figure 2. It should be noted that the above-described LCR MSCP planning reaches do not fully correspond with Reclamation's maintenance divisions.

Backwater creation requirements for native fish[1] under the LCR MSCP include a total of 360 acres of backwaters in reaches 3-6. Backwaters may be either "connected" (maintaining an open surface connection to the river), or "disconnected" (lacking an open surface connection to the river).

Disconnected backwaters, which are isolated from the river and relatively free of non-native fishes, are preferred for razorback sucker and bonytail. Backwaters targeting flannelmouth suckers can be ephemeral, but must be connected to the river. Up to 85 acres will be targeted for flannelmouth suckers in Reach 3; therefore, this report does not address candidate backwater sites related to flannelmouth suckers.

Because a very large number of backwaters exist across a very large planning area, the process for backwater site selection is broken down into phases, according to LCR MSCP reaches. Reaches 5 and 6 together comprise the first phase, with reaches 3 and 4 together comprising the second phase. This report represents the outcome of the inventory and initial screening (Step 1) for backwaters in reaches 5 and 6.

The purpose of this effort was to generate a list of candidate backwaters for reaches 5 and 6 to undergo site visits (Step 2) as part of the backwater habitat site screening and evaluation process. Therefore, beyond selecting 25 candidate backwater sites to evaluate, no conclusions related to habitat suitability have been made at this time.

Study Area

The efforts described in this report were confined to LCR MSCP reaches 5 and 6, which span from the Reclamation Cibola Gage (RM 87.3) to the Northerly International Boundary (RM 23.1), encompassing some 64.2 miles of the southern extent of the Lower Colorado River (Figure 2).

Within the area, the majority of large backwaters (>1 acre) are located in Reach 5, which is likely influenced by water impoundment at Imperial Dam maintaining elevated surface and groundwater levels. Large backwaters (>1 acre) are relatively scarce in Reach 6, below Imperial Dam, as this reach is restricted to a narrower channel than found upstream.

[1] LCR MSCP covered native fish species include razorback sucker (*Xyrauchen texanus*), bonytail (*Gila elegans*), and flannelmouth sucker (*Catostomus latipinnis*).

Figure 1. Site-Selection Process for Backwaters

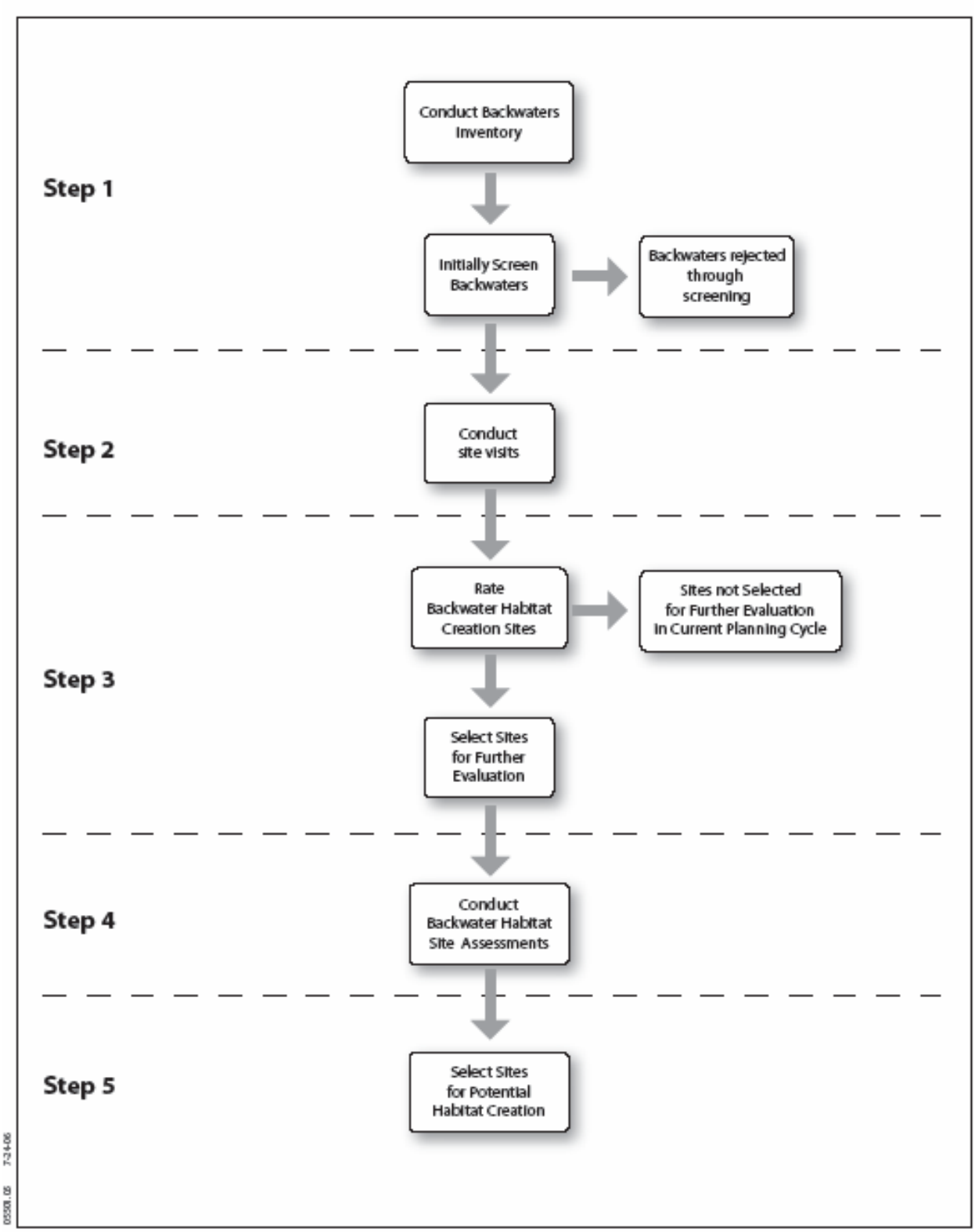
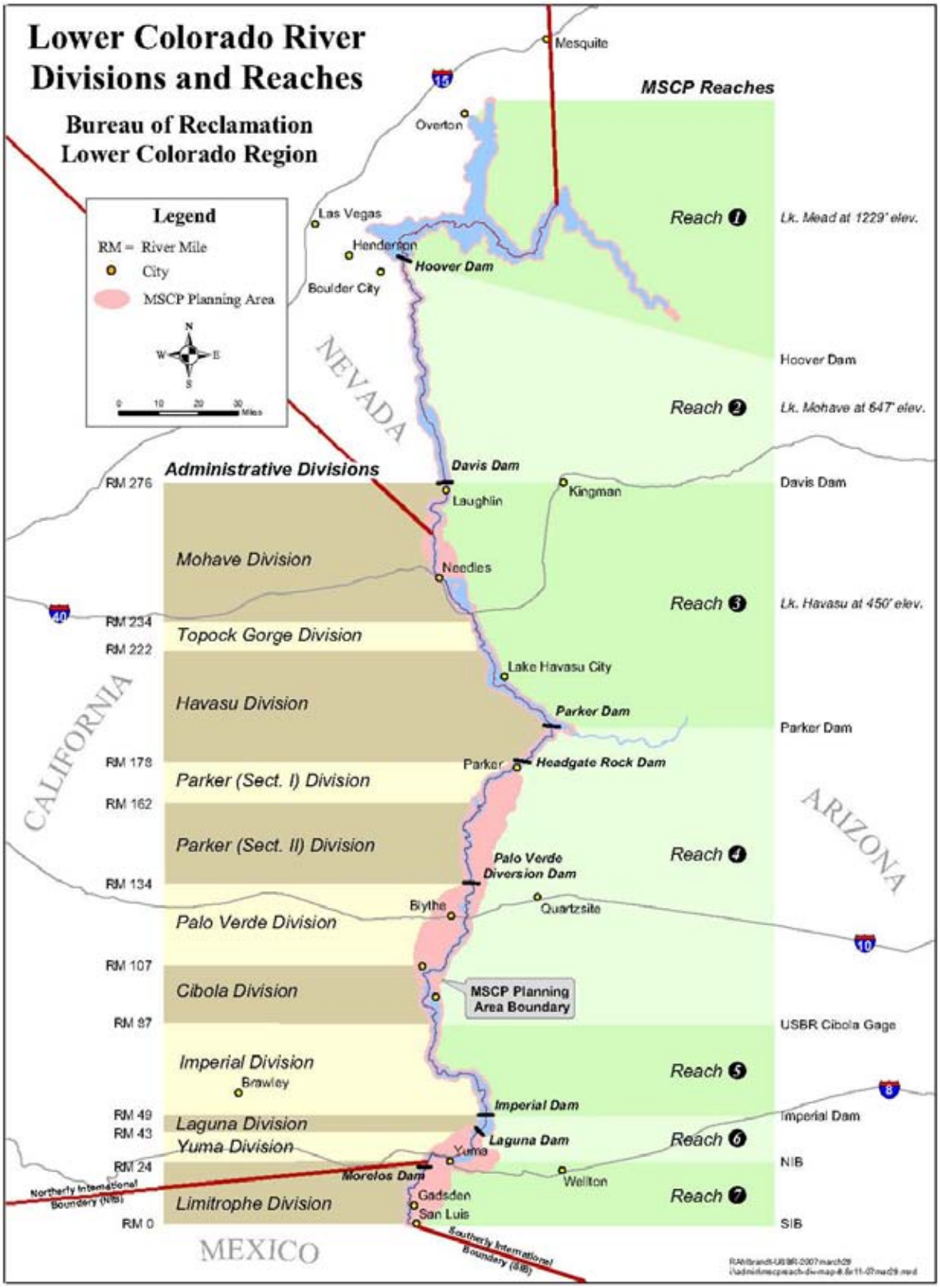


Figure 2. LCR MSCP Planning Area Reaches



Methods

Reclamation inventoried the 768 identified backwaters located within LCR MSCP reaches 5 and 6. Because of the large number of potential sites, the process of selecting candidate sites was completed in two stages: first through analysis using a geographic information system (GIS) and consideration of potential land use conflicts, and second by performing an aerial helicopter survey during a period of typical winter low flows. The following sections describe the methodology used in the GIS analyses, as well as a general description of the factors used to further narrow the range of candidate backwater sites during the helicopter survey.

GIS Analyses of Backwater Coverage

A Geographic Information System (GIS) was used to create a set of map sheets for use in selecting candidate backwaters. The sources of the GIS data were two studies directed by Bio-West, Inc.

The first study, Geo/Graphics (2000), identified and delineated backwaters along the river. An alphanumeric coding system was applied to each backwater, which identified backwaters individually by state and river mile[2]. All backwaters were characterized as directly or indirectly connected to the river. Each backwater was then further divided into areas of open water or emergent vegetation, as individual polygons within the GIS.

The second study, Bio-West (2006), classified all riparian vegetation types along the river and identified backwaters as a unique land-cover type. Unlike the previous study, backwaters were only defined as the open water portion of backwater/emergent vegetation complex. As such, the 2004 backwaters generally corresponded to the open water portion of the 2000 backwater study.

Using ArcGIS 9.1 software, the GIS procedure used to develop the map sheets was as follows: open water backwater polygons from the 2000 study were selected and categorized as either directly or indirectly connected. These were then placed into one of six size classes (less than 1 acre[3], 1-4.99 acres, 5-9.99 acres, 10-19.99 acres, 20-39.99 acres, and 40 acres and greater). The 2004 backwaters were placed into the same size classes. Backwaters were further delineated by LCR MSCP Reach.

Color schemes were developed that uniquely identified: a) 2000 backwaters by size and connection, and b) 2004 backwaters by size. Both sets of backwaters were plotted on a series of maps using 2004 color imagery as background.

[2] Under this coding system, each backwater was given a unique coding to identify its location. The two-part coding includes a letter designation for the state ("A" for Arizona, "C" for California) and a number designation for River Mile (e.g., C57.7 would occur at approximately River Mile 57.7 on the California side).

[3] LCR MSCP (2006) established a minimum size threshold of 1 acre for evaluation of backwaters; therefore, all backwaters less than 1 acre were removed from further consideration.

Land Use

Most of the backwaters identified within LCR MSCP reaches 5 and 6 are managed by federal parties: the U.S. Fish and Wildlife Service, Reclamation, and the Bureau of Land Management (BLM). In addition, a small number of identified backwaters are on lands controlled by the State of California and private parties.

To identify current land use issues, which may conflict with any proposed habitat creation under the LCR MSCP, discussions were held between Reclamation and other agencies with land management or resource management responsibilities related to the candidate backwater sites (BLM, Imperial National Wildlife Refuge, Arizona Game and Fish Department, and California Department of Fish and Game). To the extent practicable, priority in selecting candidate sites was given to those that are not highly used for recreation, mainly because of their isolation. For site-specific information regarding potential land-use issues, refer to Appendix B: Candidate Backwater Sites.

Aerial Survey

To assess whether the candidate backwater sites contained open water year-round, a 2-day helicopter survey was performed during winter low flows (December 13-14, 2006). This survey covered more than 130 miles of shoreline, including both sides of the Colorado River across the extent of LCR MSCP reaches 5 and 6.

During the first day, selected backwaters were visually inspected for presence of open water, observed public use, potential access points, percentage of emergent vegetation, and water visibility. Each backwater visit was brief (up to 1 minute) due to time and fuel constraints. Generalized observations were made for the extensive series of connected backwaters known as the “Arizona Channel” and “California Channel”, which consist of many interconnected backwaters containing generally similar habitat features.

The presence of open water was verified at all potential candidate backwater sites during the helicopter survey. Sites that contained no visible open water during the flights were removed from further consideration as candidates.

During the second day, water quality and depth measurements were taken at nine backwaters. Eight of these backwaters were selected during the Day-1 flight, and one was identified and selected during the Day-2 flight. Sites selected for aerial sampling targeted backwaters, which were expected (based on visual observations) to be either moderate, or relatively good in terms of water quality. Profiles were generally not conducted at sites where water quality was expected to be either excellent or poor, relative to the Colorado River.

Water Quality

Limited water quality and depth measurements were taken at nine backwaters by helicopter and two by boat, using a Hydrolab minisonde®. At sites sampled by boat, water profiles were measured at 0.5-meter increments, from the surface to bottom. At sites sampled from the helicopter, a single reading was taken from just below surface only. Depth of the backwater was

established using the Hydrolab's internal depth sensor. Aerial Hydrolab sampling required attaching a grounding wire to the frame of the helicopter to discharge built-up static electricity, which may have otherwise damaged the equipment (Figure 3).

Figure 3. Hydrolab minisonde modified with grounding wire for aerial sampling

Backwater Classification by Wetland Type

Based on observations from the aerial imagery as well as the aerial survey, the candidate backwaters were preliminarily classified by Prieto (1998) wetland types[4]. It is important to note that these classifications are currently based on limited field observations and sampling. Once the more detailed site visits are conducted, these classifications may require further refinement.

Prieto (1998) wetland[5] types, and their classification features used in this survey, are presented below:

Connected Lakes

- Visible surface connection to the river
- Specific conductivity similar to the river (≤1,275 μS/cm)

True Seeps

- No surface connection to the river
- Very high specific conductivity and salinity relative to the river (≥3,000 μS/cm)
- Can be adjacent (several meters) up to several hundred meters from the river

Pseudo-Seeps

- No apparent surface connection to the river
- Specific conductivity and salinity similar to the river (generally ≤1,275 μS/cm, but possibly ranging up to 3,000 μS/cm)

[4] Prieto (1998) developed a classification system for wetlands along the LCR, which is useful in very cursory evaluations. Prieto's classification scheme includes three wetland types (connected lakes, pseudo-seeps, and true seeps), which are based on their degree of connection to the mainstem of the Colorado River, as well as their resultant physicochemical properties.

[5] In the present context, the terms "backwaters" and "wetlands" are used somewhat interchangeably.

RESULTS

GIS Categorization

Seven hundred sixty-eight (768) backwaters were identified in the GIS, with distribution between reaches 5 and 6 being 555 and 213 backwaters, respectively. Of these, 672 backwaters (88%) fell below the 1-acre threshold and were rejected. Only three sites (<1%) were greater than 40 acres, which exceeds the desired range of 1-40 acres. The remaining 93 sites (12%) fell within the 1 to 40-acre desired size range. Tables 1 and 2 present the distribution of backwaters by size, state, and reach. The results of the GIS classification are presented as Appendix A.

Table 1. Distribution of Backwaters by Size and Reach (2004)

Size (ac)	Reach 5 (ac)	Reach 6 (ac)
<1	470	202
1-4.99	51	10
5-9.99	13	1
10-19.99	12	0
20-39.99	6	0
40+	3	0
Total	555	213

Aerial Survey

Most of the backwaters visited during the aerial survey were extremely remote, typically with no road or trail access. Public use was observed only at backwaters containing boat access to the river (see Table 2).

Generally, emergent vegetation coverage in all of the candidate sites most frequently ranged between 10% and 60%. Sites that contained emergent vegetation coverage below 10% often contained visible salt rings around the shorelines. Sites with greater than 60% coverage of emergent vegetation often contained no open water, or appeared extremely shallow.

All candidate sites selected for further evaluation contained visible open water during the helicopter survey. The mean estimated water depth of the 11 backwaters where hydrolab profiles were performed was 0.9 meters (min = 0.5 m, max = 1.5 m, n = 11). Depths for selected backwaters are presented in Table 3. Known water quality issues specific to each candidate backwater are discussed in Appendix B.

Table 2. Aerial Survey Observations at Selected Backwaters

Backwater Code	Public Use Observed	Road Observed	Trail Observed	Boat Access	emergent vegetation (%)	Fish Observed	Water Visibility	Water Quality Profiles
A78.5	N	N	N	N	<10	N	Moderate	
A63.7 "Cable Lake"	N	N	N	N	10-60	N	Moderate	
A62.5 "Clear Lake"	N	Y	Y	N	<10	N	Moderate	
C69.1 "Taylor Lake"	N	N	N	N	10-60	N	Moderate	
A65.4 "Cabin Lake"	N	N	N	N	<10	N	Moderate	
A65.9 "Island Lake"	N	N	N	N	10-60	N	Moderate	
C82.7 "Draper Lake"	N	N	N	N	>60	N	Low	
C85.3 "Walker Lake"	N	N	N	N	<10	N	High	
A69.7	N	N	N	N	10-60	N	High	*
A68.75	N	N	N	N	<10	N	Moderate	*
A67.9 "Hidden Lake"	N	Y	Y	Y	10-60	N	High	
C67.6	N	N	N	N	<10	N	High	*
A67.5	N	N	N	Y	<10	N	High	*
C65.0	N	N	N	Y	10-60	N	High	*
A64.5 "Lookout Lake"	N	N	N	Y	10-60	N	High	
C64.4	N	Y	N	N	10-60	N	High	*
C62.9 "Duck Lake"	N	N	N	N	10-60	Y	Moderate	
A62.3 "Secret Lake"	N	Y	Y	Y	10-60	N	High	
A61.55 "Butler Lake"	N	Y	Y	N	10-60	N	Low	
A61.1 "McAllister Lake"	N	Y	Y	N	10-60	N	Low	
C60.01	-	-	-	-	-	-	-	*
A59.7a (Headquarters Lake)	N	Y	Y	Y	10-60	N	High	*
A59.7b (Headquarters Lake)	N	N	N	Y	10-60	N	High	*
C59.5	N	N	N	N	<10	N	Low	
C57.6	-	-	-	-	-	-	-	*
A55.4	N	N	N	N	10-60	N	Moderate	*
California Channel, generalized for all connected	Y	N	N	Y	10-60	Y	High	
Arizona Channel, generalized for all connected	Y	N	N	Y	10-60	Y	High	

Table 3. Water Quality and Depth Measurements at Selected Backwaters

Backwater #	Connection	Temp C	DO	pH	SpC µS/cm	Estimated Depth (meters)
A55.4	indirect	10.82	11.56	8.56	1494	0.89
C57.6	indirect	11.35	11.26	8.44	4277	0.83
A59.7	direct	9.98	8.98	8.08	1440	1.5
A59.7	direct	11.01	10.06	7.99	1389	1.2
C60.01	indirect	12.94	5.9	8.3	85000	0.87
C64.4	direct	10.67		8	1587	0.95
C65.0		10.41	9.71	8.06	1873	0.92
C67.6	direct		10.2	8.08	1232	0.86
A67.5	direct			8.2	1566	0.45
A68.74	indirect			7.9	23700	0.5
A69.7	direct				1450	0.9

Candidate Backwater Sites

After a review of the inventory, discussion with the land managers, and the helicopter survey, a total of 25 candidate sites and 6 alternate sites were selected to undergo brief site visits (Step 2). Of these sites, 28 sites (299 acres) are located in Reach 5, and 3 sites (62 acres) are located in Reach 6. The cumulative acreage of all candidate and alternate sites is 303 acres and 58 acres, respectively, with 17 sites (160 acres) in Arizona and 14 sites (201 acres) in California (Table 4).

Table 4. Distribution of Candidate Backwaters, by states and reaches

	California (acres)	**Arizona (acres)**	**Total Sites (acres)**
Reach 5	143	156	299
Reach 6	58	4	62
Total Sites	201	160	361

The following is a list of candidate backwater sites, which were selected to undergo additional evaluation (Table 5). These sites will be evaluated during the summer of 2007 during brief, 1-2 day site visits, which will include the necessary data collection to apply the *Site Selection Guidelines* for identifying high potential sites for potential habitat creation under the LCR MSCP. An additional six alternate backwater sites have been identified, in the event that evaluation of one or more of the candidate sites is not possible. Detailed information on all of the candidate and alternate sites is presented in appendices A and B.

Table 5. Backwater Candidate Site List

Backwater number	Backwater Name	Reach #	Acreage 2004	Connection	Backwater Type	Landowner
A69.7a & b	Norton Lake	5	7.2	direct	pseudo seepage	INWR
A69.7 c		5	2.4	direct	connected lake	INWR
A68.75		5	4.0	indirect	seepage lake	INWR
A67.9	Hidden Lake	5	28.8	direct	connected lake	INWR
C67.6 a		5	4.1	direct	pseudo seepage	INWR
C67.6 b		5	4.7	direct	pseudo seepage	INWR
A67.5		5	2.3	direct	connected lake	INWR
C65.0		5	17.6	direct	connected lake	INWR
A64.5	Lookout Lake	5	4.1	direct	connected lake	INWR
C64.4		5	8.4	indirect	pseudo seepage	INWR
C63.8		5	4.7	direct	connected lake	INWR
A63.7	Cable Lake	5	17.4	direct	connected lake	INWR
C62.9	Duck Lake	5	36.1	indirect	pseudo seepage	INWR
A62.3	Secret Lake	5	11.0	direct	connected lake	INWR
A59.7	Headquarters Lakes	5	12.0	direct	connected lake	INWR
C57.6	Northern Ferguson Lake	5	22.1	direct	connected lake	INWR
C57.6	A, B, and C	5	15.0	indirect	seepage lake	INWR
A55.4		5	14.3	indirect	pseudo seepage	USBR
A54.3		5	3.2	direct	connected lake	USBR
A53.4		5	4.8	indirect	connected lake	USBR
C52.5		5	6.5	direct	connected lake	USBR
A51.4		5	10.8	direct	connected lake	USBR
A49.2		5	8.5	direct	connected lake	USBR
C48.5	West Pond	6	52.1	indirect	seepage lake	USBR
C48.2	Horseshoe Pond	6	5.4	indirect	seepage lake	USBR
Alternate Site List						
C53.5		5	6.4	direct	connected lake	USBR
A62.5	Clear Lake	5	17.0	direct	pseudo seepage	INWR
C64.1		5	3.5	direct	pseudo seepage	INWR
A50.5		5	8.0	direct	connected lake	USBR
A43.5		6	4.3	direct	connected lake	USBR
C53.0		5	14.2	direct	connected lake	USBR

References

Bio-West, Inc. 2004. 2004 Lower Colorado Region Vegetation Type Mapping, Backwaters Delineation, Orthophotography, and GIS Development. Prepared for U.S. Bureau of Reclamation, Boulder City, Nevada. March 2006. Logan, UT.

Geo/Graphics, Inc. 2000. Lower Colorado River Backwaters Mapping, Davis Dam to Laguna Dam. Submitted to U.S. Bureau of Reclamation. Boulder City, NV. June 15, 2000.

Kretschmann, A. E. 2006. Literature Review of Historic Work Occurring in Senator Wash Reservior, CA. Arizona Fish and Game. Phoenix, AZ.

Lower Colorado River Multi-Species Conservation Program. 2006. Draft Final Guidelines for the Screening and Evaluation of Potential Conservation Areas. U.S. Bureau of Reclamation. Boulder City, NV.

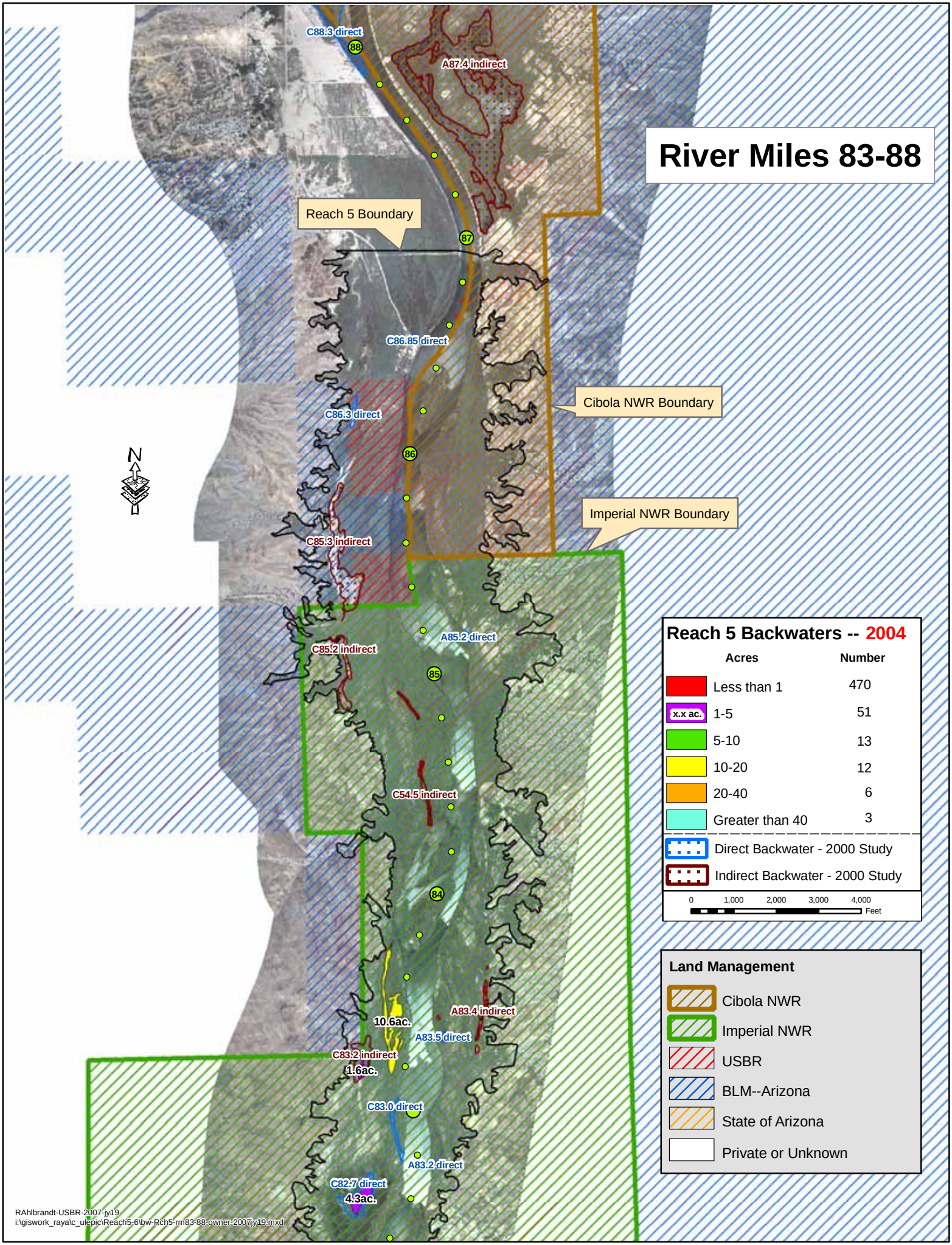
Lower Colorado River Multi-Species Conservation Program. 2004. Final Habitat Conservation Plan, Volume II. U.S. Bureau of Reclamation. Boulder City, NV.

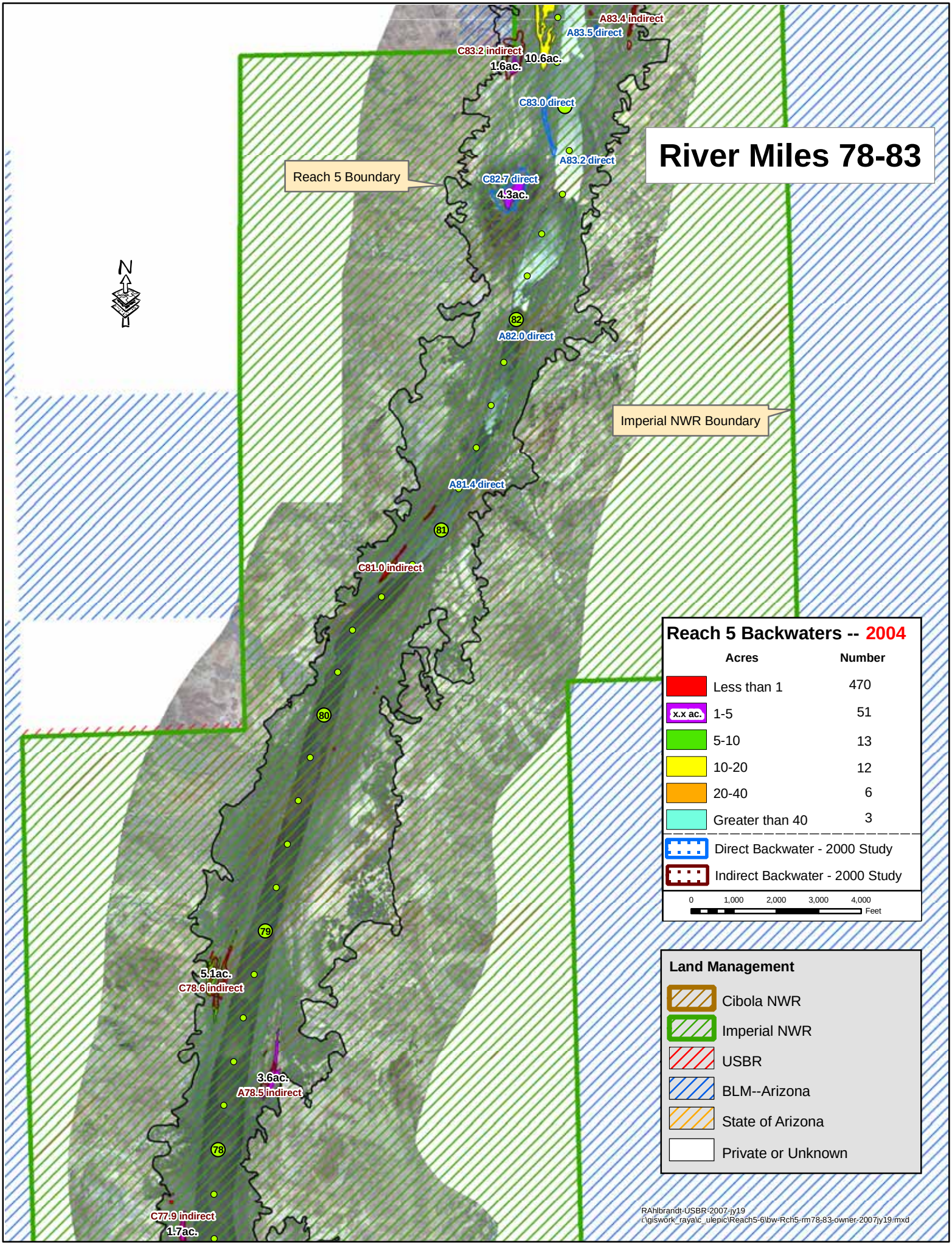
Prieto, F.G. 1998. Selenium and Water Quality in Three Wetland Types Along the Lower Colorado River – Imperial National Wildlife Refuge, Arizona. M.S. Thesis. University of Arizona.

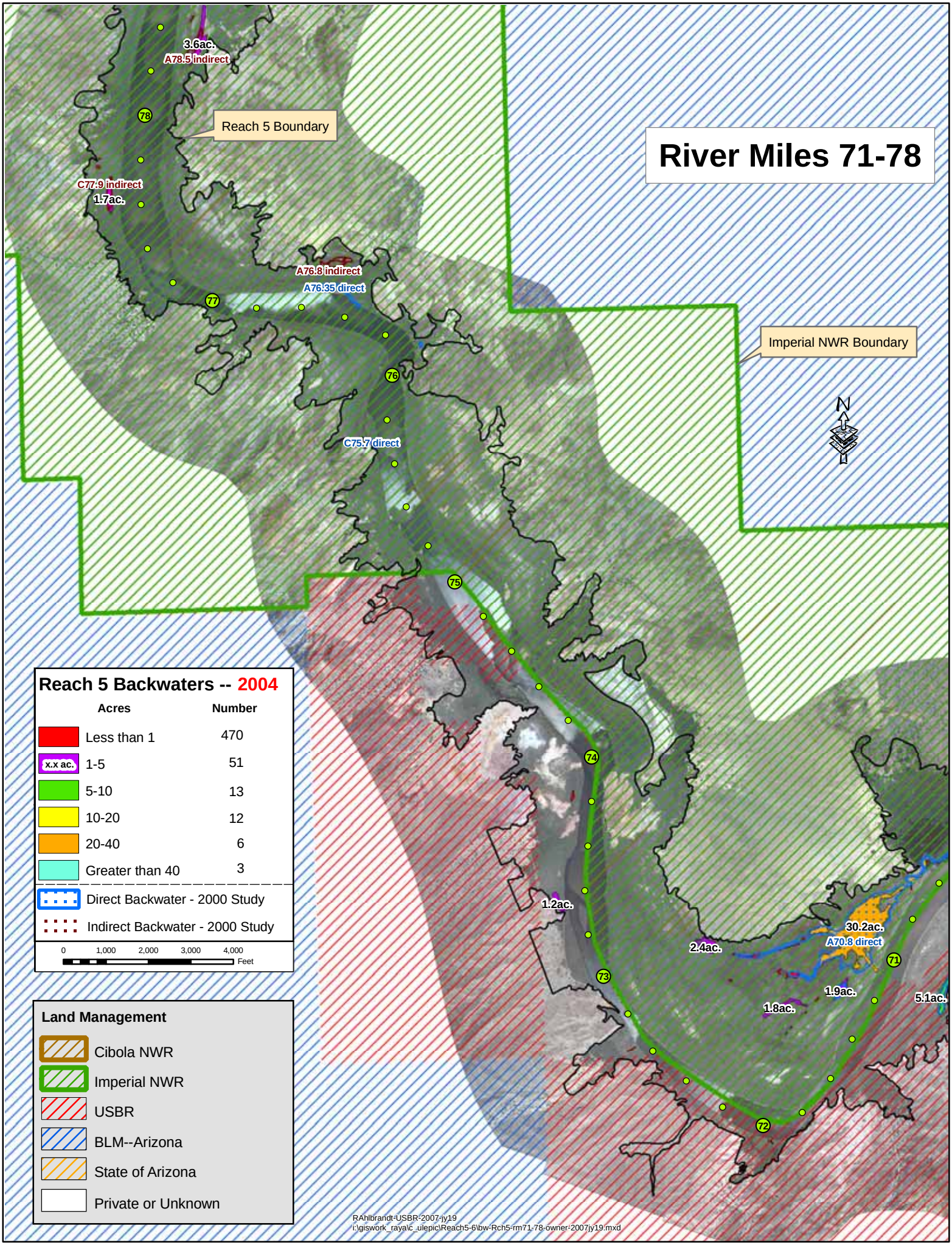
U.S. Bureau of Reclamation. 1981. Project Data Book. Denver, CO: Government Printing Office.

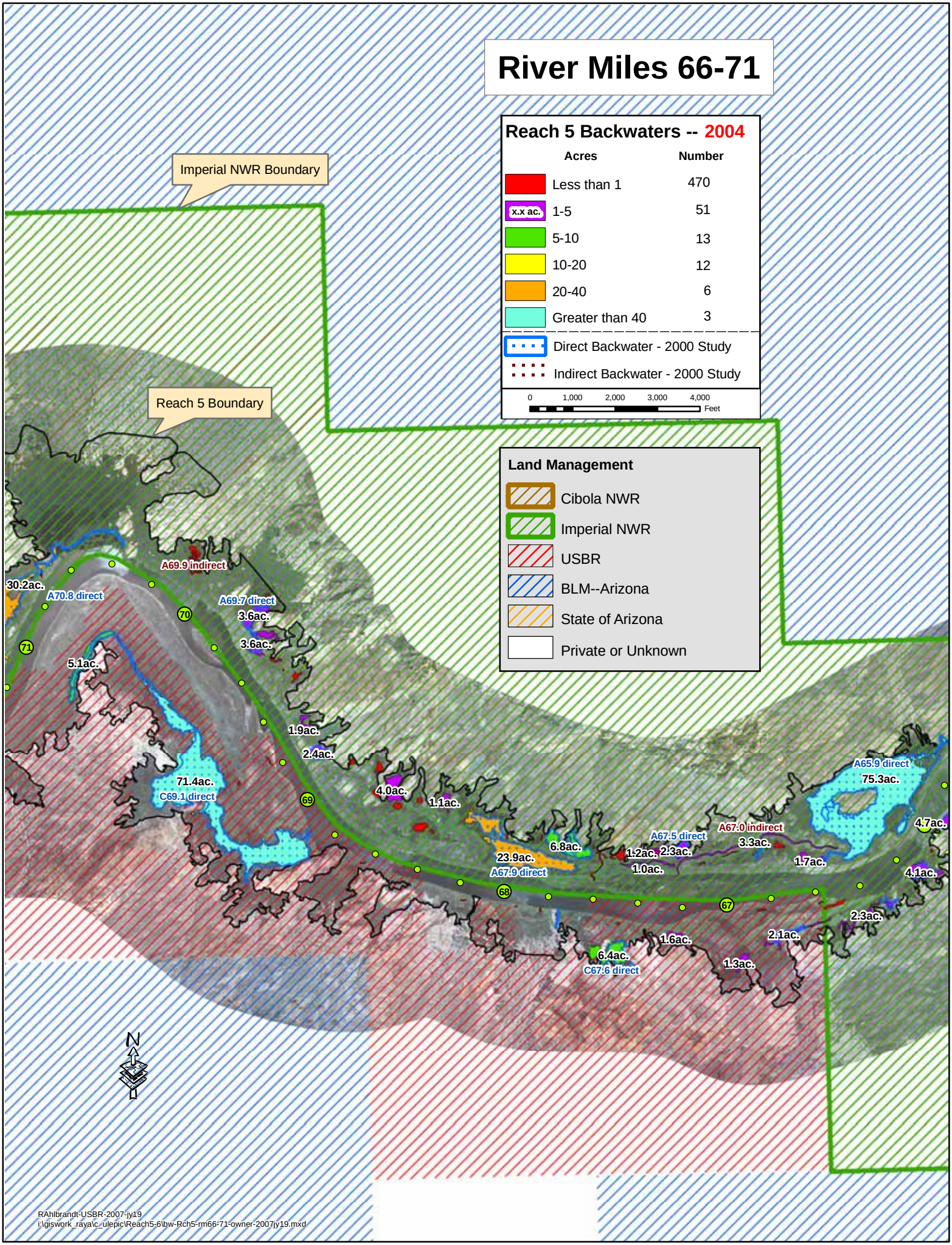
U.S. Bureau of Reclamation. 1976. Lower Colorado River Maps. December. Denver, CO: Government Printing Office.

Appendix A. Backwater Land Cover Type Map Sheets

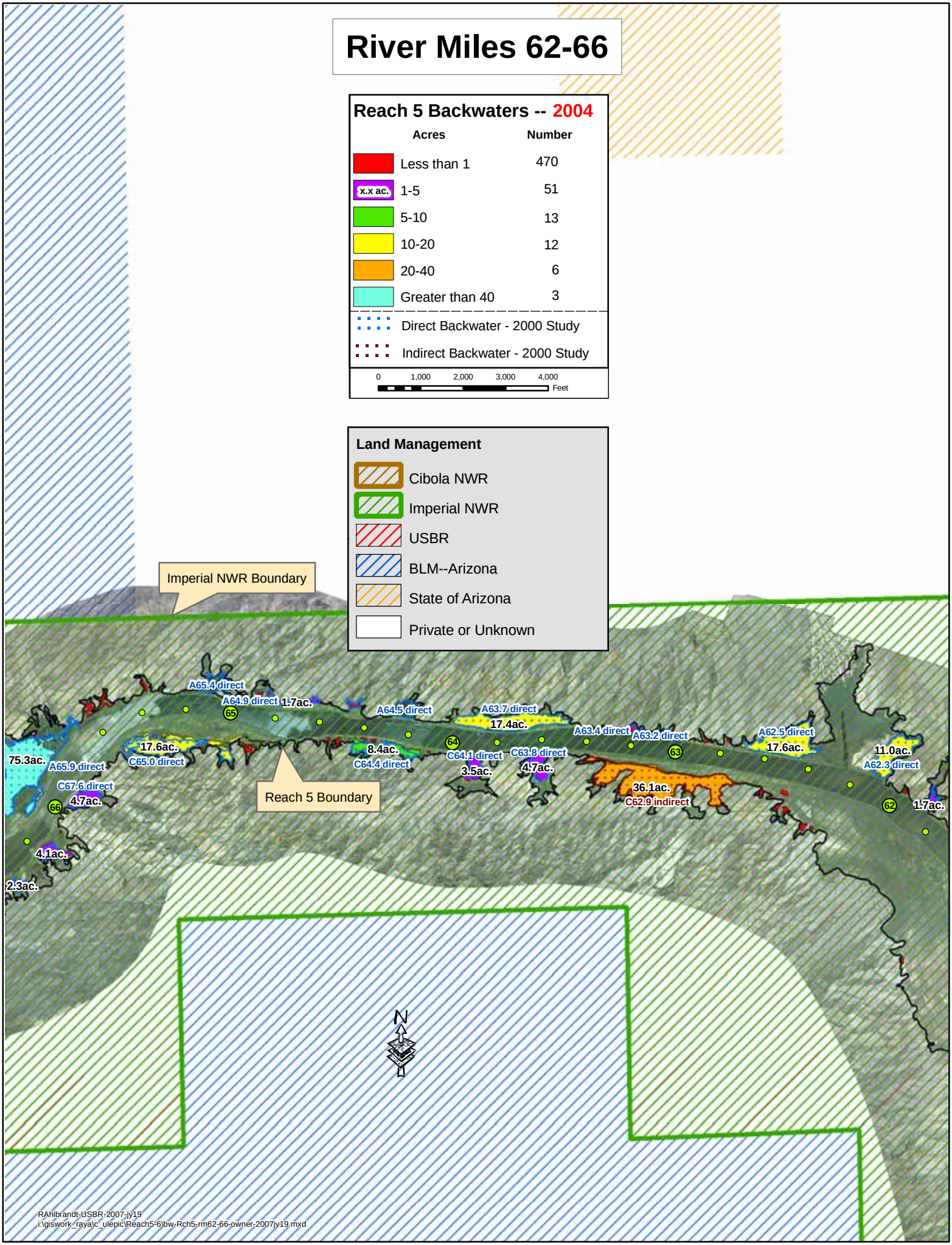

River Miles 83-88
C88.3 direct
88
A87.4 indirect
Reach 5 Boundary
87
C86.85 direct
C86.3 direct
Cibola NWR Boundary
86
N
Imperial NWR Boundary
C85.3 indirect
A85.2 direct
C85.2 indirect
85
C54.5 indirect
84
A83.4 indirect
10.6ac.
A83.5 direct
C83.2 indirect
1.6ac.
C83.0 direct
A83.2 direct
C82.7 direct
4.3ac.
Reach 5 Backwaters -- 2004
Acres
Number
Less than 1
470
x.x ac.
1-5
51
5-10
13
10-20
12
20-40
6
Greater than 40
3
Direct Backwater - 2000 Study
Indirect Backwater - 2000 Study
0
1,000
2,000
3,000
4,000
Feet
Land Management
Cibola NWR
Imperial NWR
USBR
BLM--Arizona
State of Arizona
Private or Unknown
RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch5-rm83-88-owner-2007jy19.mxd

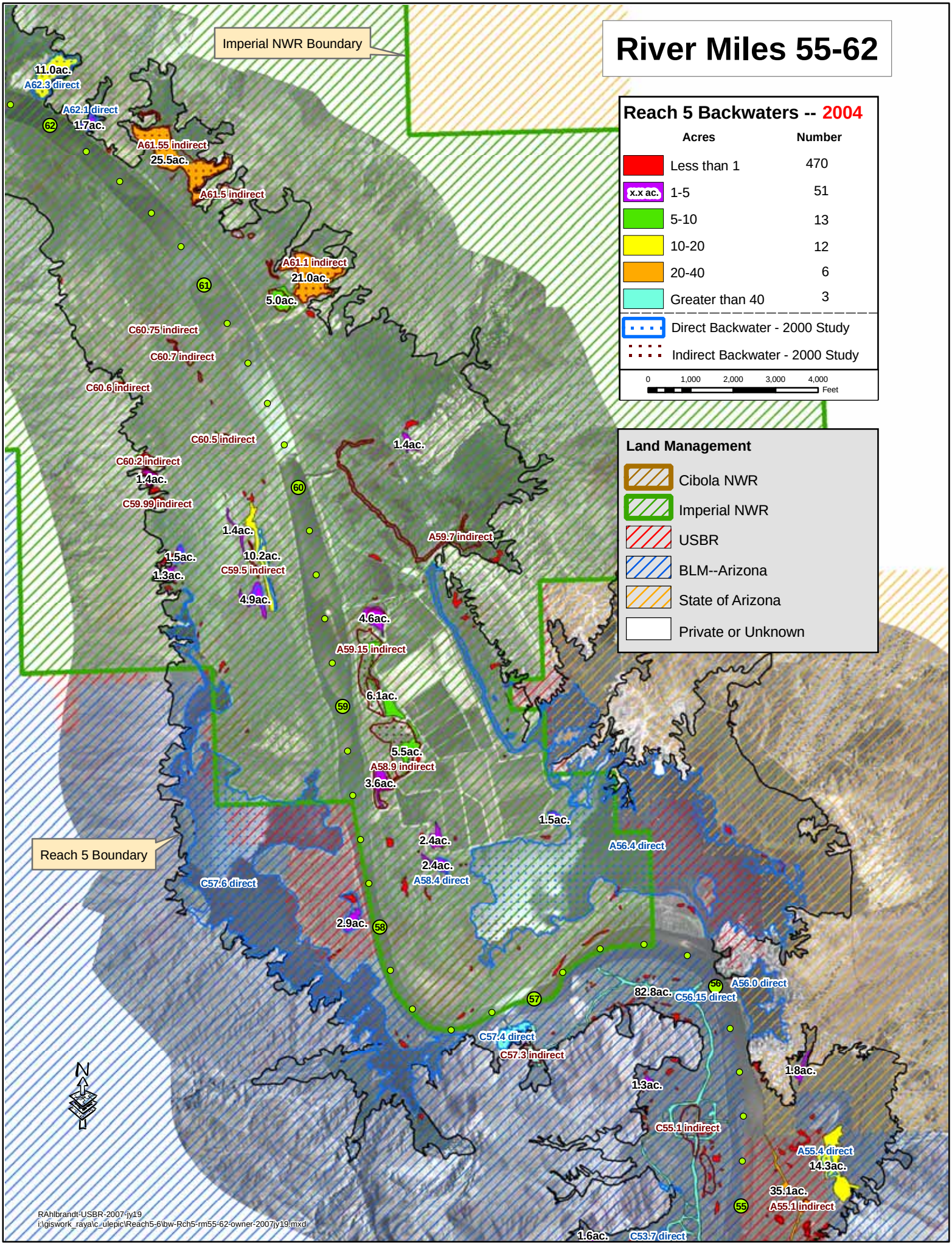

River Miles 78-83
A83.4 indirect
A83.5 direct
C83.2 indirect
1.6ac.
10.6ac.
C83.0 direct
A83.2 direct
Reach 5 Boundary
C82.7 direct
4.3ac.
N
82
A82.0 direct
Imperial NWR Boundary
A81.4 direct
81
C81.0 indirect
80
79
5.1ac.
C78.6 indirect
3.6ac.
A78.5 indirect
78
C77.9 indirect
1.7ac.
Reach 5 Backwaters -- 2004
Acres
Number
Less than 1
470
x.x ac.
1-5
51
5-10
13
10-20
12
20-40
6
Greater than 40
3
Direct Backwater - 2000 Study
Indirect Backwater - 2000 Study
0
1,000
2,000
3,000
4,000
Feet
Land Management
Cibola NWR
Imperial NWR
USBR
BLM--Arizona
State of Arizona
Private or Unknown
RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch5-rm78-83-owner-2007jy19.mxd

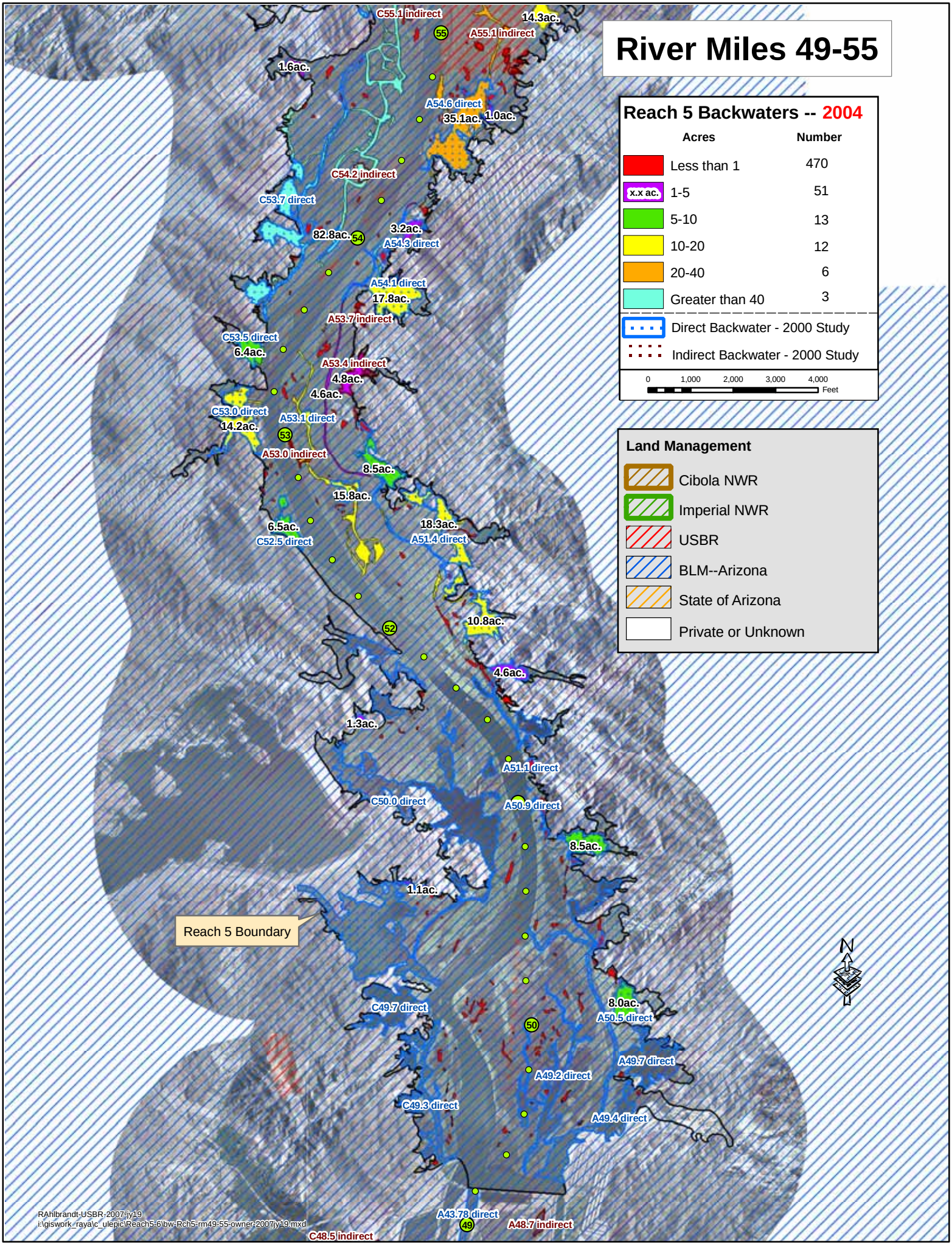

River Miles 71-78
Reach 5 Boundary
Imperial NWR Boundary
3.6ac.
A78.5 indirect
C77.9 indirect
1.7ac.
A76.8 indirect
A76.35 direct
C75.7 direct
1.2ac.
2.4ac.
30.2ac.
A70.8 direct
1.9ac.
1.8ac.
5.1ac.
78
77
76
75
74
73
72
71
N
Reach 5 Backwaters -- 2004
Acres
Number
Less than 1
470
x.x ac.
1-5
51
5-10
13
10-20
12
20-40
6
Greater than 40
3
Direct Backwater - 2000 Study
Indirect Backwater - 2000 Study
0
1,000
2,000
3,000
4,000
Feet
Land Management
Cibola NWR
Imperial NWR
USBR
BLM--Arizona
State of Arizona
Private or Unknown
RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch5-rm71-78-owner-2007jy19.mxd

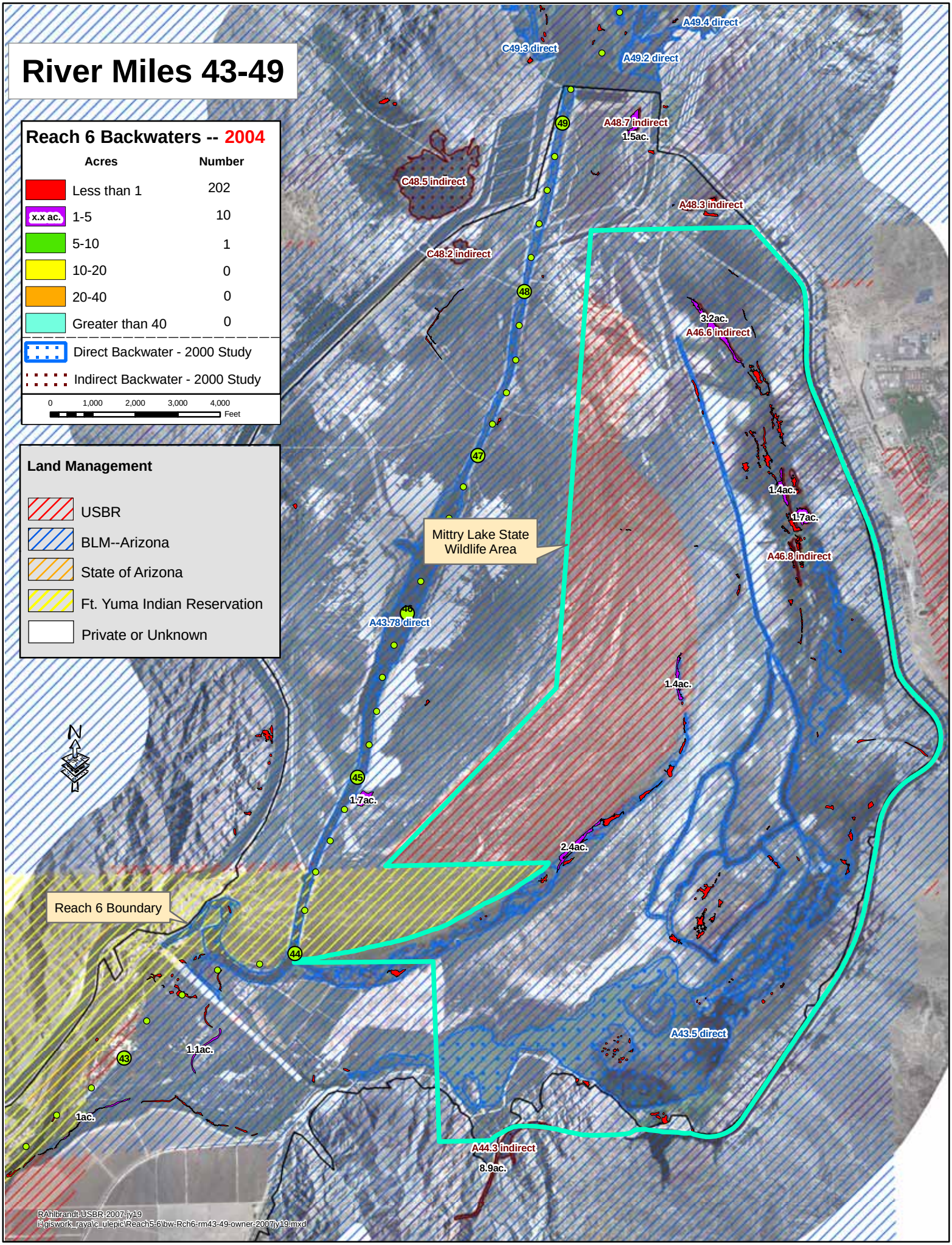

River Miles 66-71
Reach 5 Backwaters -- 2004
Acres
Number
Less than 1
470
x.x ac.
1-5
51
5-10
13
10-20
12
20-40
6
Greater than 40
3
Direct Backwater - 2000 Study
Indirect Backwater - 2000 Study
0
1,000
2,000
3,000
4,000
Feet
Imperial NWR Boundary
Reach 5 Boundary
Land Management
Cibola NWR
Imperial NWR
USBR
BLM--Arizona
State of Arizona
Private or Unknown
A69.9 indirect
30.2ac.
A70.8 direct
A69.7 direct
3.6ac.
3.6ac.
70
71
5.1ac.
1.9ac.
2.4ac.
71.4ac.
C69.1 direct
69
4.0ac.
1.1ac.
A65.9 direct
75.3ac.
4.7ac.
A67.5 direct
A67.0 indirect
3.3ac.
6.8ac.
1.2ac.
2.3ac.
23.9ac.
1.0ac.
1.7ac.
A67.9 direct
4.1ac.
68
67
2.3ac.
1.6ac.
2.1ac.
6.4ac.
C67.6 direct
1.3ac.
N
RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch5-rm66-71-owner-2007jy19.mxd

River Miles 62-66

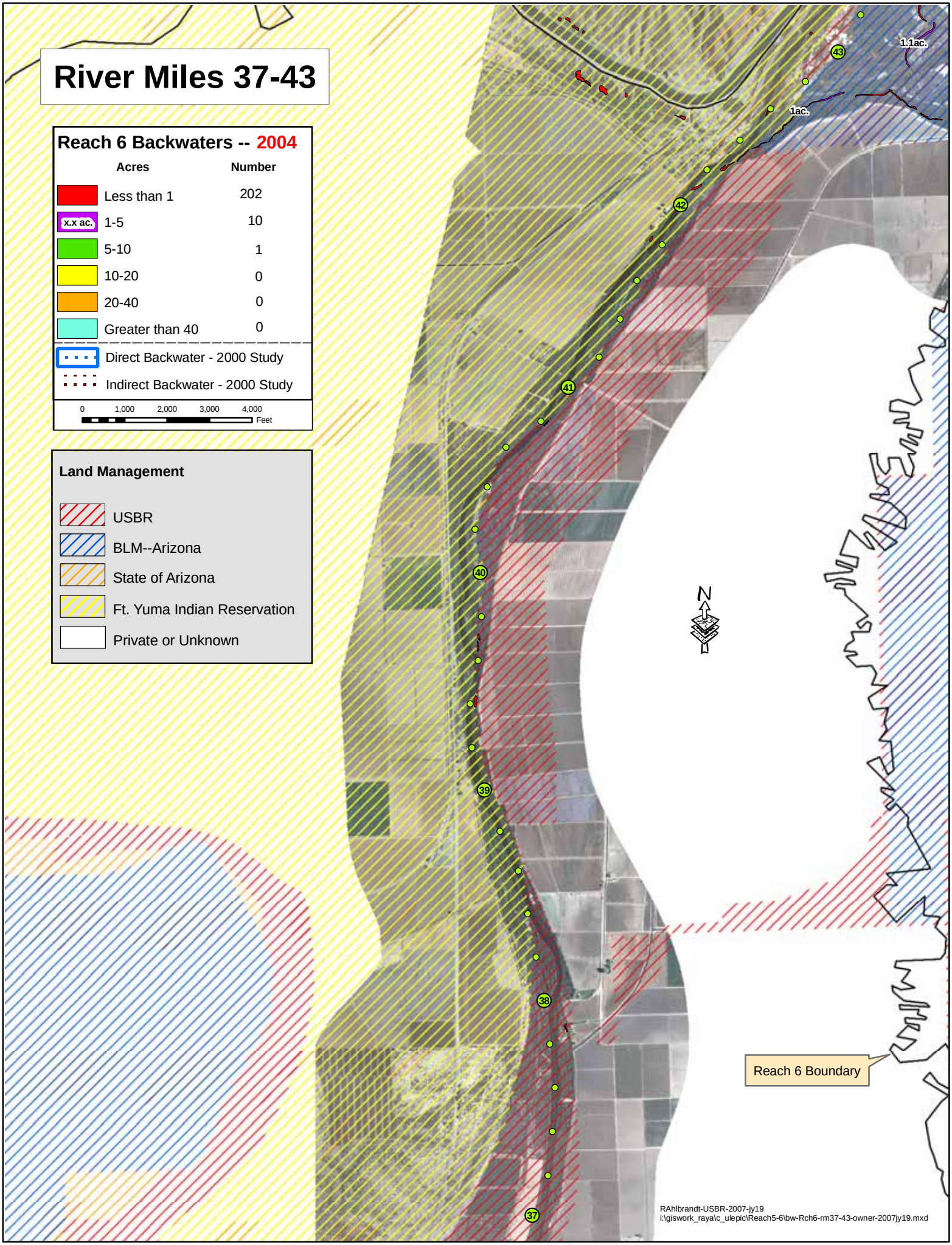



River Miles 55-62
Imperial NWR Boundary
Reach 5 Boundary
Reach 5 Backwaters -- 2004
Acres
Number
Less than 1 470
x.x ac. 1-5 51
5-10 13
10-20 12
20-40 6
Greater than 40 3
Direct Backwater - 2000 Study
Indirect Backwater - 2000 Study
0 1,000 2,000 3,000 4,000 Feet
Land Management
Cibola NWR
Imperial NWR
USBR
BLM--Arizona
State of Arizona
Private or Unknown
11.0ac.
A62.3 direct
A62.1 direct
1.7ac.
A61.55 indirect
25.5ac.
A61.5 indirect
A61.1 indirect
21.0ac.
5.0ac.
C60.75 indirect
C60.7 indirect
C60.6 indirect
C60.5 indirect
C60.2 indirect
1.4ac.
C59.99 indirect
1.4ac.
1.5ac.
1.3ac.
10.2ac.
C59.5 indirect
4.9ac.
1.4ac.
A59.7 indirect
4.6ac.
A59.15 indirect
6.1ac.
5.5ac.
A58.9 indirect
3.6ac.
1.5ac.
A56.4 direct
2.4ac.
2.4ac.
A58.4 direct
C57.6 direct
2.9ac.
82.8ac.
C56.15 direct
A56.0 direct
C57.4 direct
C57.3 indirect
1.3ac.
1.8ac.
C55.1 indirect
A55.4 direct
14.3ac.
35.1ac.
A55.1 indirect
1.6ac.
C53.7 direct
N
RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch5-rm55-62-owner-2007jy19.mxd

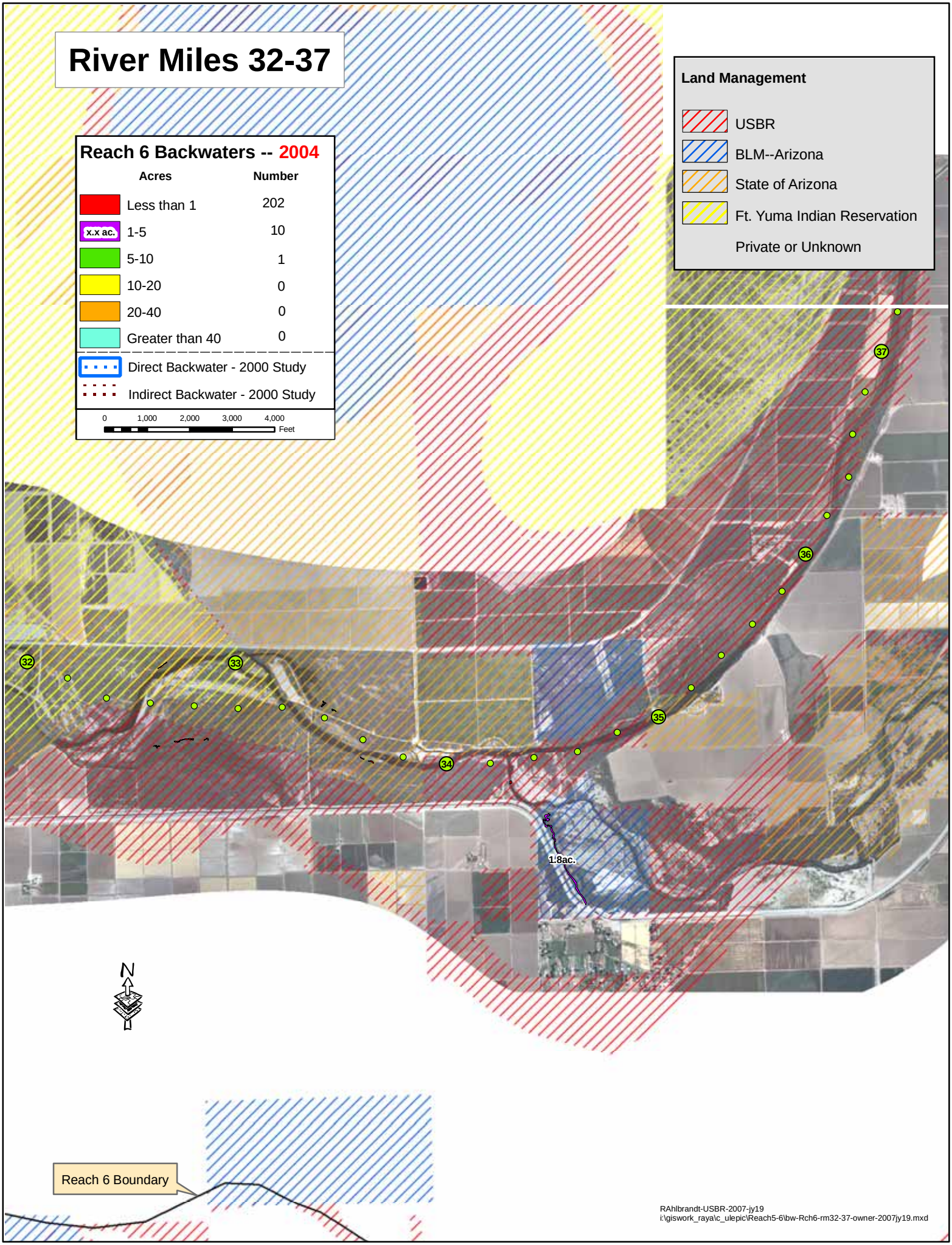

River Miles 49-55
Reach 5 Backwaters -- 2004
Acres
Number
Less than 1 470
x.x ac. 1-5 51
5-10 13
10-20 12
20-40 6
Greater than 40 3
Direct Backwater - 2000 Study
Indirect Backwater - 2000 Study
0 1,000 2,000 3,000 4,000 Feet
Land Management
Cibola NWR
Imperial NWR
USBR
BLM--Arizona
State of Arizona
Private or Unknown
Reach 5 Boundary
N
C55.1 indirect
14.3ac.
55
A55.1 indirect
1.6ac.
A54.6 direct
35.1ac.
1.0ac.
C54.2 indirect
C53.7 direct
82.8ac.
54
3.2ac.
A54.3 direct
A54.1 direct
17.8ac.
A53.7 indirect
C53.5 direct
6.4ac.
A53.4 indirect
4.8ac.
4.6ac.
C53.0 direct
14.2ac.
A53.1 direct
53
A53.0 indirect
8.5ac.
15.8ac.
6.5ac.
C52.5 direct
18.3ac.
A51.4 direct
52
10.8ac.
4.6ac.
1.3ac.
A51.1 direct
C50.0 direct
A50.9 direct
8.5ac.
1.1ac.
8.0ac.
A50.5 direct
C49.7 direct
50
A49.7 direct
A49.2 direct
C49.3 direct
A49.4 direct
A43.78 direct
49
A48.7 indirect
C48.5 indirect
RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch5-rm49-55-owner-2007jy19.mxd


River Miles 43-49
Reach 6 Backwaters -- 2004
Acres
Number
Less than 1
202
x.x ac.
1-5
10
5-10
1
10-20
0
20-40
0
Greater than 40
0
Direct Backwater - 2000 Study
Indirect Backwater - 2000 Study
0
1,000
2,000
3,000
4,000
Feet
Land Management
USBR
BLM--Arizona
State of Arizona
Ft. Yuma Indian Reservation
Private or Unknown
N
A49.4 direct
C49.3 direct
A49.2 direct
49
A48.7 indirect
1.5ac.
C48.5 indirect
A48.3 indirect
C48.2 indirect
48
3.2ac.
A46.6 indirect
47
1.4ac.
1.7ac.
Mittry Lake State Wildlife Area
A46.8 indirect
46
A43.78 direct
1.4ac.
45
1.7ac.
2.4ac.
Reach 6 Boundary
44
A43.5 direct
43
1.1ac.
1ac.
A44.3 indirect
8.9ac.
RAhlbrandt-USBR-2007-jy19
i:\gislwork_raya\c_ulepic\Reach5-6\bw-Rch6-rm43-49-owner-2007jy19.mxd

River Miles 37-43

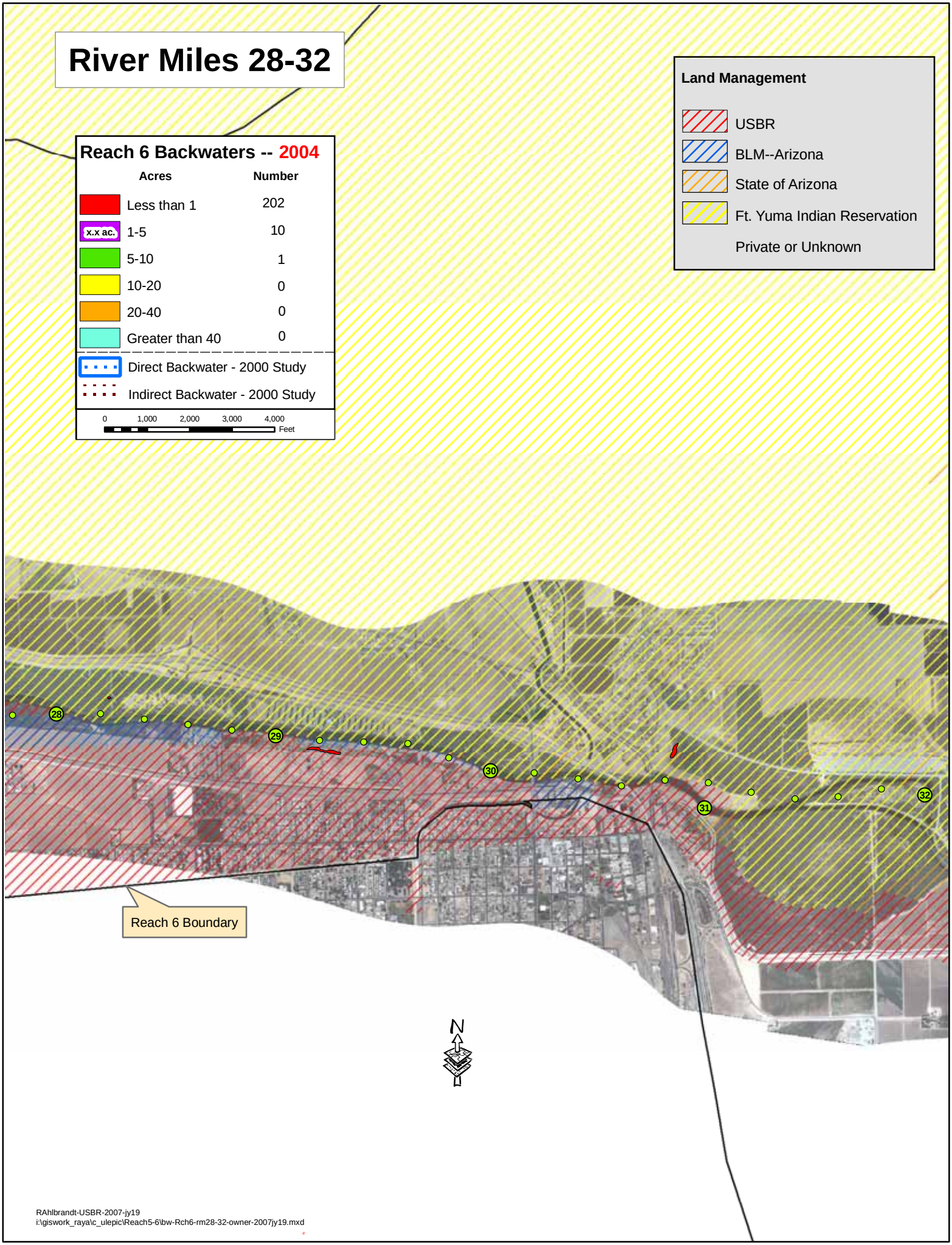


River Miles 32-37

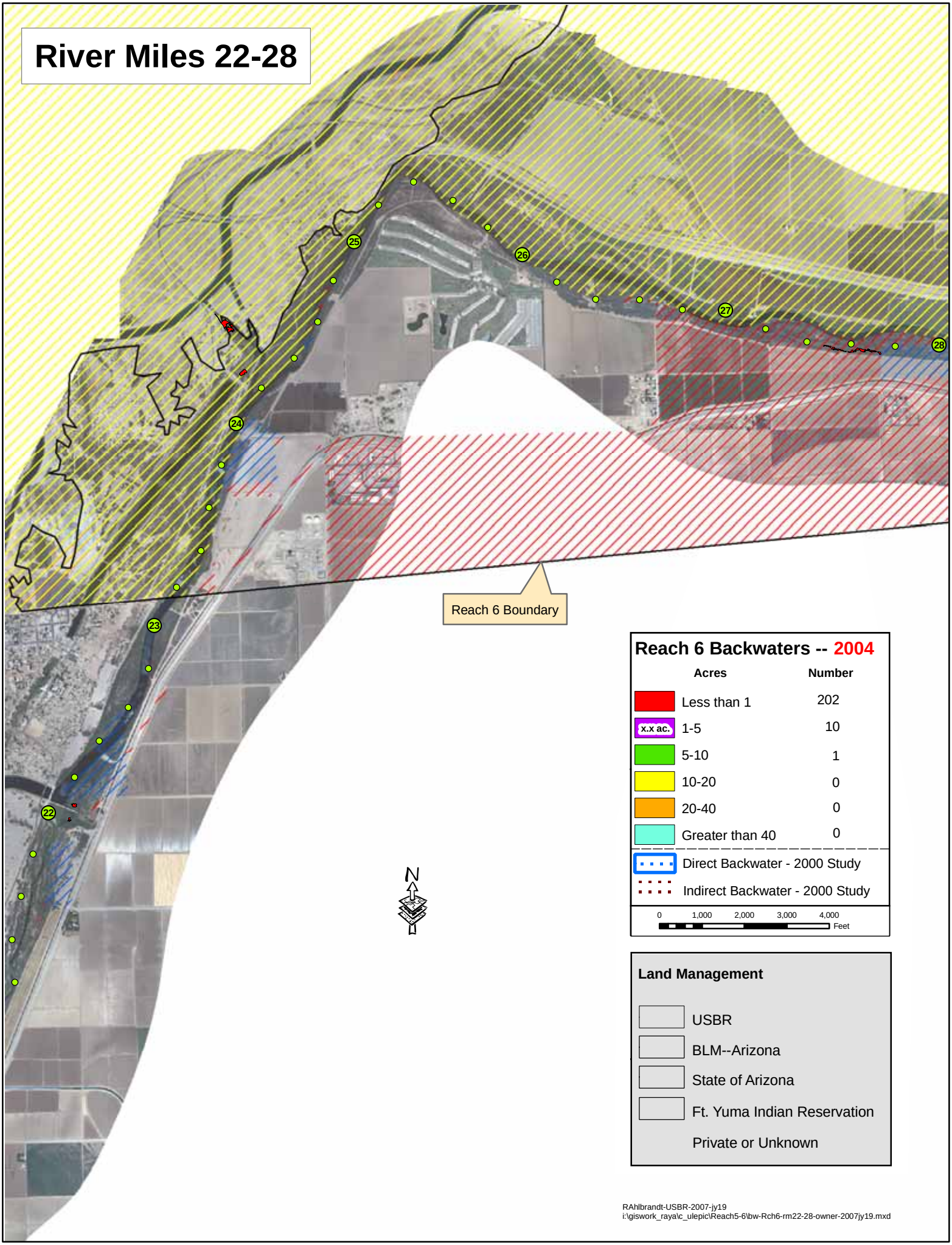


RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch6-rm32-37-owner-2007jy19.mxd

River Miles 28-32



RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch6-rm28-32-owner-2007jy19.mxd


River Miles 22-28
22
23
24
25
26
27
28
Reach 6 Boundary
N
Reach 6 Backwaters -- 2004
Acres
Number
Less than 1
202
x.x ac.
1-5
10
5-10
1
10-20
0
20-40
0
Greater than 40
0
Direct Backwater - 2000 Study
Indirect Backwater - 2000 Study
0
1,000
2,000
3,000
4,000
Feet
Land Management
USBR
BLM--Arizona
State of Arizona
Ft. Yuma Indian Reservation
Private or Unknown
RAhlbrandt-USBR-2007-jy19
i:\giswork_raya\c_ulepic\Reach5-6\bw-Rch6-rm22-28-owner-2007jy19.mxd

Appendix B. Backwater Candidate Sites

A69.7 Norton Lake

River Mile: 69.75
Reach: 5
Connection: Indirect[1]
Backwater Type: Pseudo-Seep

UTM: (720947, 3658650)
Size: 7.2 ac, AZ
Distance from river: 733 ft, 520 ft
Pools: 2

Norton Lake consists of two indirectly connected backwaters (3.6 ac each) on the Arizona side of the Colorado River at river mile 69.75. These two backwaters could potentially be expanded and connected into one, managed independently, or connected without expansion. Water clarity extended to the bottom, and water quality conditions were similar to that of the Colorado River (based on visual and hydrolab observations taken by helicopter). Because this backwater exhibited similar water quality conditions to the river without a visible surface connection, it is classified as a pseudo-seep.

Site access to this backwater is virtually nonexistent from the river or land. Norton Lake is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at Norton Lake at the time of the helicopter survey.

[1] This backwater was previously identified in the 2000 GIS dataset as directly connected; however, during the helicopter survey no visible surface connections were observed.

A69.7c (downstream)

River Mile: 70
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (721419, 3657750)
Size: 2.4 ac, AZ
Distance from river: 419 ft
Pools: 1

A69.7c is a directly connected backwater (2.4 ac) on the Arizona side of the Colorado River at river mile 70. The backwater is connected to the river via a small inlet channel.

Water quality in A69.7c was very similar to the Colorado River. Water clarity was good to moderate. Because of the similarities in water quality based on water quality profiles, as well as the observed connection to the river, A69.7c is classified as a connected lake.

Site access to A69.7c is limited. There appears to be access by kayak or small jon boat via a small inlet to the river. In addition, a trail was observed from the backwater to the river.

A69.7c is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. In addition, this backwater is very close to Picacho State Park, a popular recreational area. Public access is not restricted; however, no people were observed at A69.7c at the time of the helicopter survey.

A68.75

River Mile: 68
Reach: 5
Connection: Indirect
Backwater Type: True Seep

UTM: (721956, 3657491)
Size: 4 ac, AZ
Distance from river: 1390 ft
Pools: 1

A68.75 is an indirectly connected backwater (4.0 ac) on the Arizona side of the Colorado River at river mile 68.

High salinity was identified as an issue that would need to be addressed; however, it appears that it may be possible to connect this backwater to the river. Water clarity was moderate. Based on a water quality profile conducted here, this backwater exhibited drastically higher salinity than the river without a visible surface connection. It is classified as a true seep.

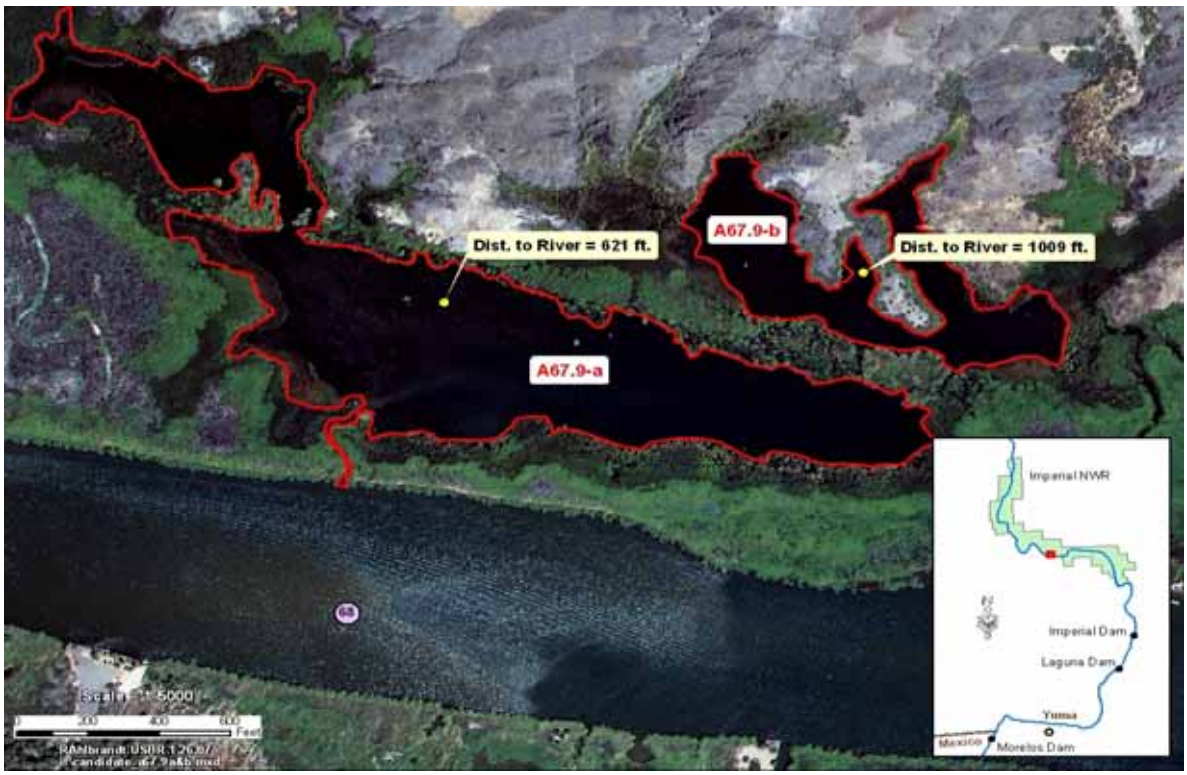
This backwater is well isolated, virtually without site access from the river or land. A68.75 is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at A68.75 at the time of the helicopter survey.

A67.9 Hidden Lake

River Mile: 68

Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (722855, 3657050)
(723202, 3657080)
Size: 28.8 ac, AZ
Distance from river: 621 ft, 1009 ft
Pools: 2



Hidden Lake consists of two directly connected backwaters (21.9 and 6.9 ac) on the Arizona side of the Colorado River at river mile 68. These two backwaters could potentially be connected and then isolated from the river, or be managed as two separate backwaters.

Water quality in Hidden Lake is likely very similar to the Colorado River; however, no water quality profiles were performed. Water clarity extended to the bottom. Because of the observed surface connection to the river, Hidden Lake is classified as a connected lake.

The only known site access to Hidden Lake may be via a small channel from the river. The backwater is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at Hidden Lake at the time of the helicopter survey. Determining recreational use at Hidden Lake would require additional effort.

C67.6a (upstream)

River Mile: 66
Reach: 5
Connection: Indirect
Backwater Type: Pseudo-Seep

UTM: (725743, 3656900)
Size: 4.1 ac, CA
Distance from river: 362 ft
Pools: 1

C67.6a is an indirectly connected backwater (4.1 ac) on the California side of the Colorado River at river mile 66.

Water quality in C67.6a was very similar to the Colorado River. Water clarity extended to the bottom. Because of the similarities in water quality without an observed connection to the river, C67.6a is classified as a pseudo-seep.

This backwater is isolated, virtually without access from the river or land. C67.6a is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at C67.6a at the time of the helicopter survey.

C67.6b (downstream)

River Mile: 66
Reach: 5
Connection: Indirect
Backwater Type: Pseudo-Seep

UTM: (725985, 3657280)
Size: 4.7 ac, CA
Distance from river: 340 ft
Pools: 1

C67.6b is an indirectly connected backwater (4.7 ac) on the California side of the Colorado River at river mile 66.

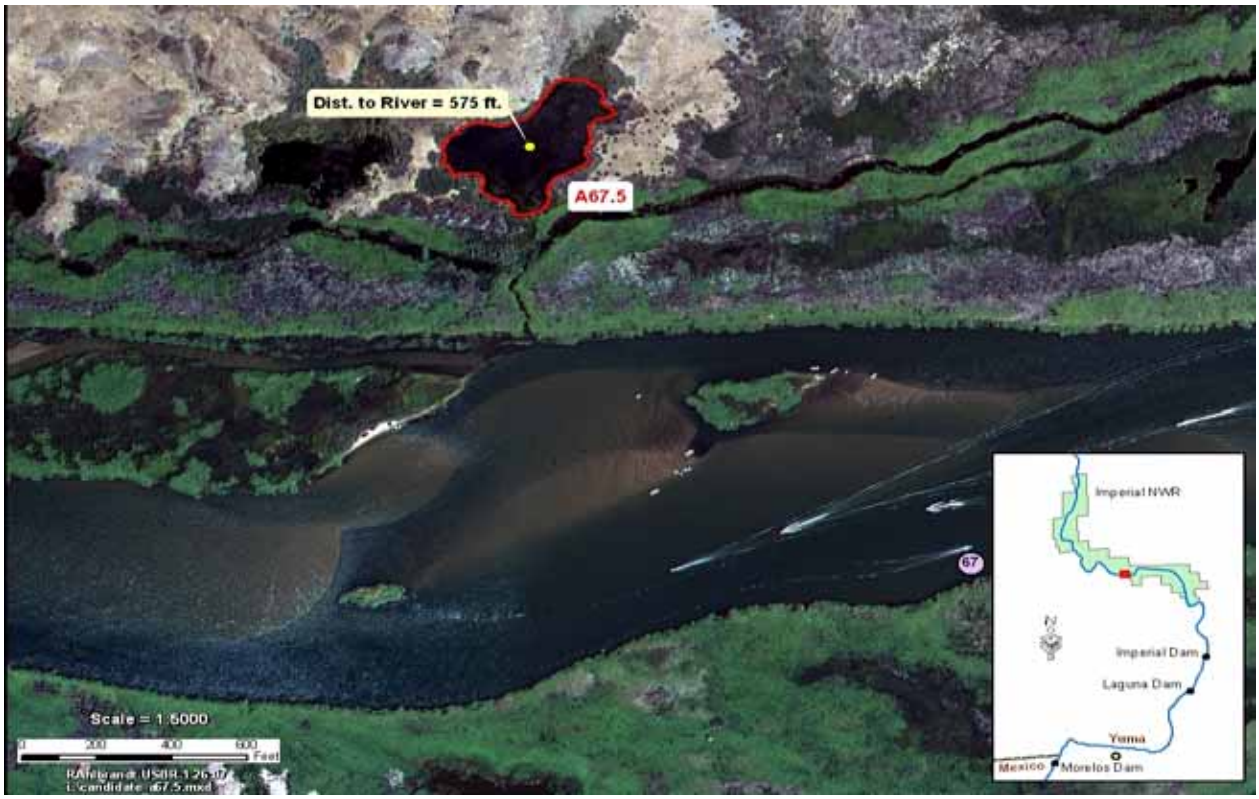
Water quality in C67.6b is was very similar to the Colorado River based on water quality profiles. Water clarity extended to the bottom. Because of the similarities in water quality without an observed connection to the river, C67.6b is classified as a pseudo-seep.

This backwater is isolated, virtually without site access by the river or by land. C67.6b is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at C67.6b at the time of the helicopter survey.

A67.5

River Mile: 67.5
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (724002, 3657060)
Size: 2.3 ac, AZ
Distance from river: 575 ft
Pools: 1



A67.5 is a directly connected backwater (2.3 ac) on the Arizona side of the Colorado River at river mile 67.5. The backwater is connected to Island Lake and the river via a small inlet channel, but it may be possible to isolate the backwater.

Water quality in A67.5 was very similar to the Colorado River based on water quality profiles. Water clarity was good to moderate. Because of the similarities in water quality, as well as the observed connection to the river, A67.5 is classified as a connected lake.

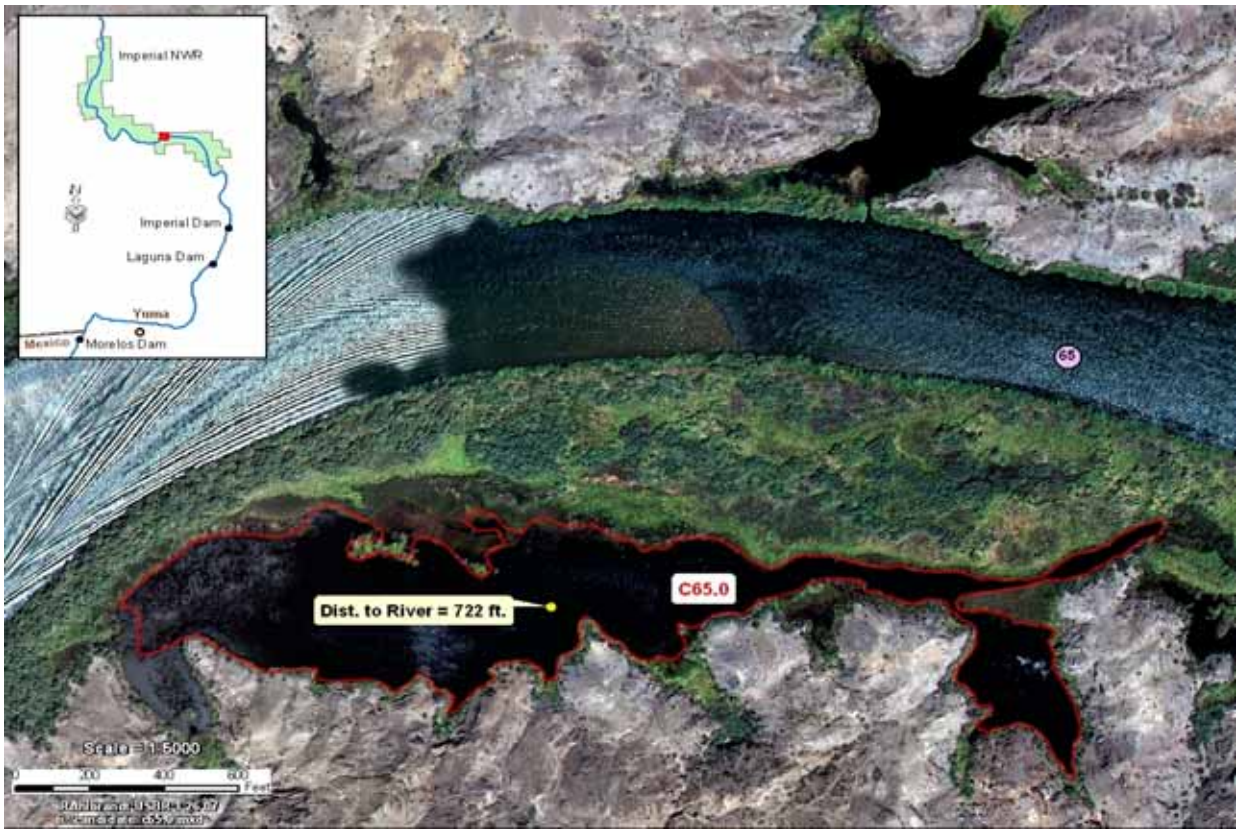
Site access to A67.5 is very limited. There does not appear to be any access by boat or road; however, the small inlet may potentially provide access via kayak or canoe.

A67.5 is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at A67.5 at the time of the helicopter survey.

C65.0

River Mile: 65
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (726513, 3657660)
Size: 17.6 ac, CA
Distance from river: 722 ft
Pools: 1



C65.0 is a directly connected backwater (17.6 ac) on the California side of the Colorado River at river mile 65. A smaller backwater exists nearby to the south, which could be connected for additional acreage or managed as separate backwater. C65.0 could potentially be isolated from the river.

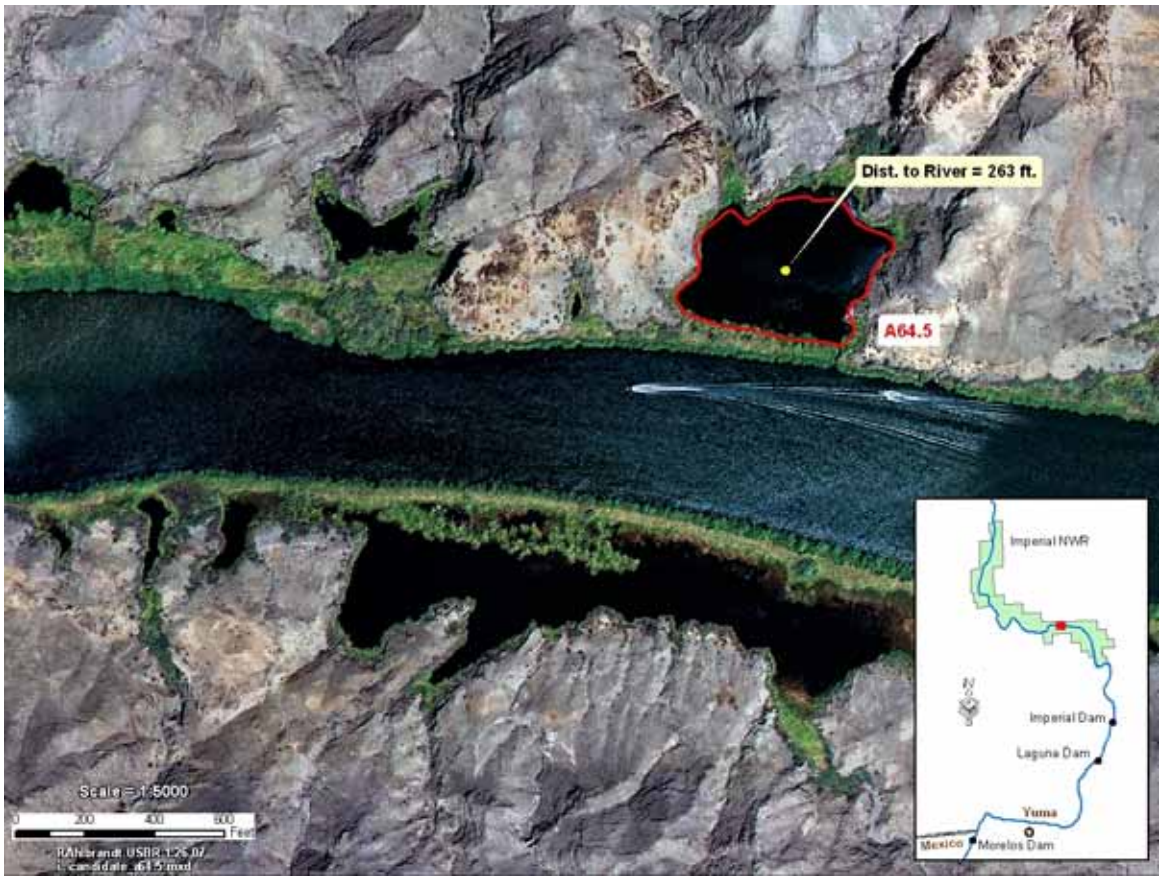
Boat access from the river appears to exist at the south end of C65.0. Water clarity extended to the bottom, and depth appeared to be shallow (less than 5 feet). Because of the apparent connection to the river, as well as the high water clarity, water quality is likely very similar to the river. C65.0 is classified a connected lake. No water quality profiles were conducted at C65.0.

C65.0 is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at C65.0 at the time of the helicopter survey.

A64.5 Lookout Lake

River Mile: 64
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (72877, 3657930)
Size: 4.1 acres, AZ
Distance from river: 263 ft
Pools: 1



Lookout Lake is a directly connected backwater (4.1 ac) on the Arizona side of the Colorado River at river mile 64. Boat access from the river appears to exist, but the backwater could potentially be isolated from the river.

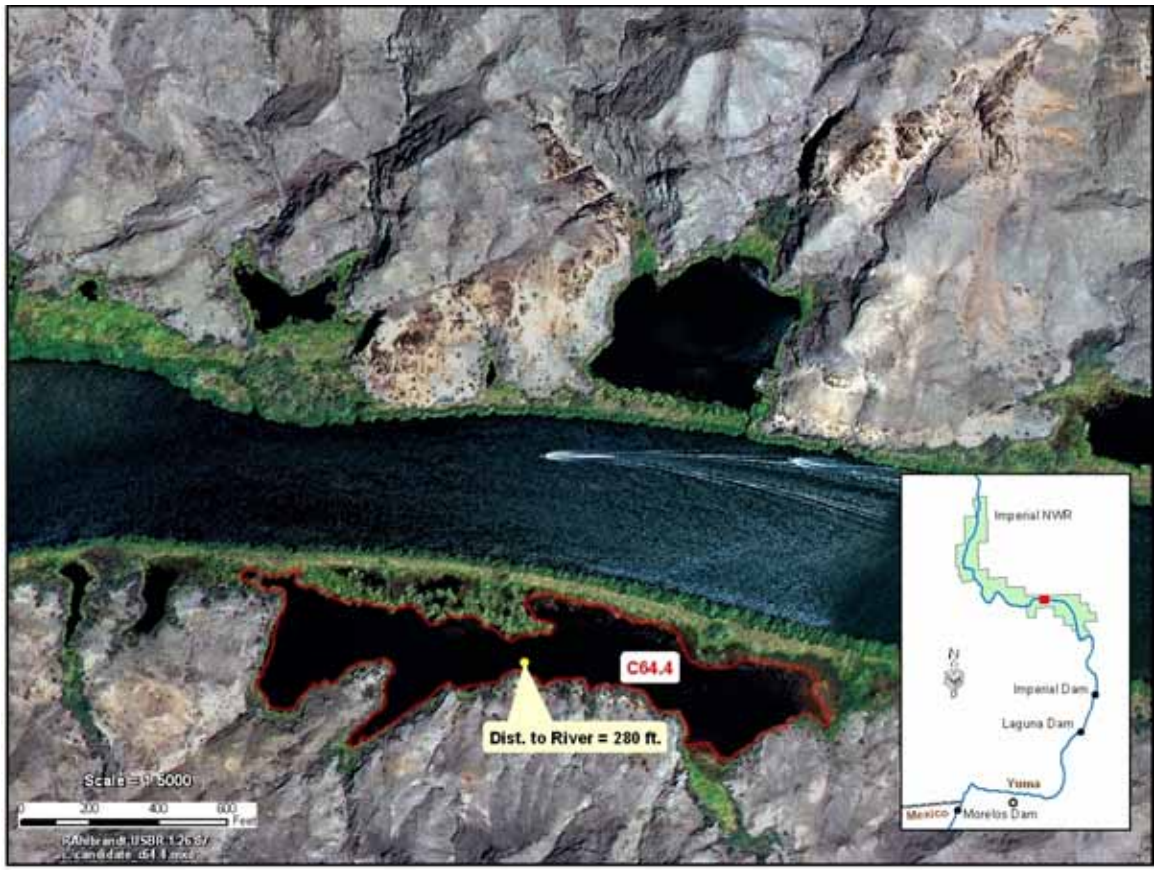
Water clarity at Lookout Lake extends to the bottom, which implies relatively good water quality. Because of the apparent connection to the river, as well as the high water clarity, water quality is likely very similar to the river. Lookout Lake is classified a connected lake. No water quality profiles were conducted at this backwater, only visual observations were made.

Lookout Lake is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at Lookout Lake at the time of the helicopter survey.

C64.4

River Mile: 64.5
Reach: 5
Connection: Indirect
Backwater Type: Pseudo-Seep

UTM: (728113, 3657640)
Size: 8.4 ac, CA
Distance from river: 402 ft
Pools: 1



C64.4 is an indirectly connected backwater (8.4 ac) on the California side of the Colorado River at river mile 64.5. This backwater appears to be potentially accessible via a nearby road; however, no boat access to the river appears to exist.

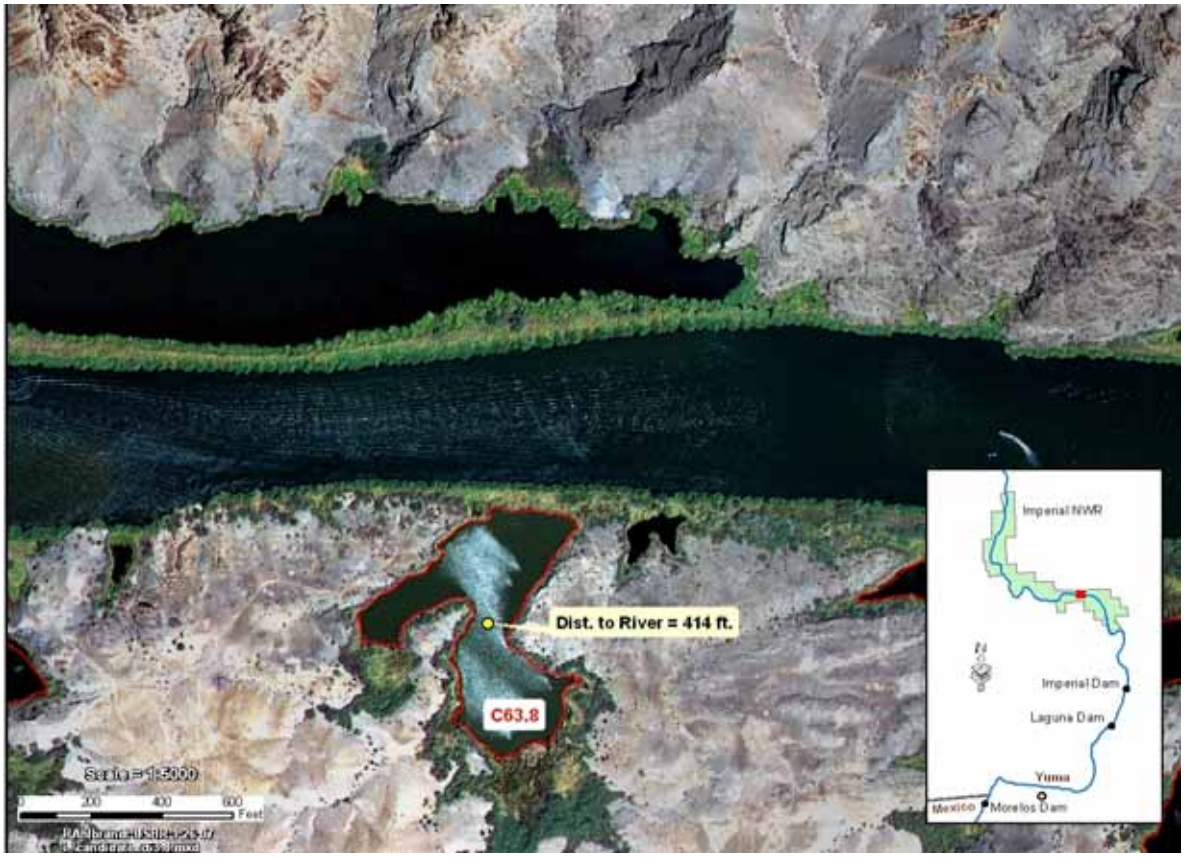
Water quality at C64.4 was very similar to the Colorado River based on water quality profiles. Because of the high water quality, without an apparent surface connection to the river, this backwater is classified as a pseudo-seep.

C64.4 is within a designated wilderness area, which would likely limit the size of the construction footprint. However, the existence of a nearby road would improve access for heavy equipment. Public access is not restricted; however, no people were observed at C64.4 at the time of the helicopter survey.

C63.8

River Mile: 63.5
Reach: 5
Connection: Indirect
Backwater Type: Pseudo-Seep

UTM: (729236, 3657530)
Size: 4.7 ac, CA
Distance from river: 414 ft
Pools: 1



C63.8 is an indirectly[2] connected backwater (4.7 ac) located on the California side of the Colorado River at river mile 63.5. During the aerial survey, the backwater was 50% dry. This backwater is classified as a pseudo seep because while no visible surface connections to the river are visible; it most likely maintains close connection to the river during higher flows. The site is being considered as a candidate site due to possible expansion with an inflow and outflow channel to maintain permanence of water year-round.

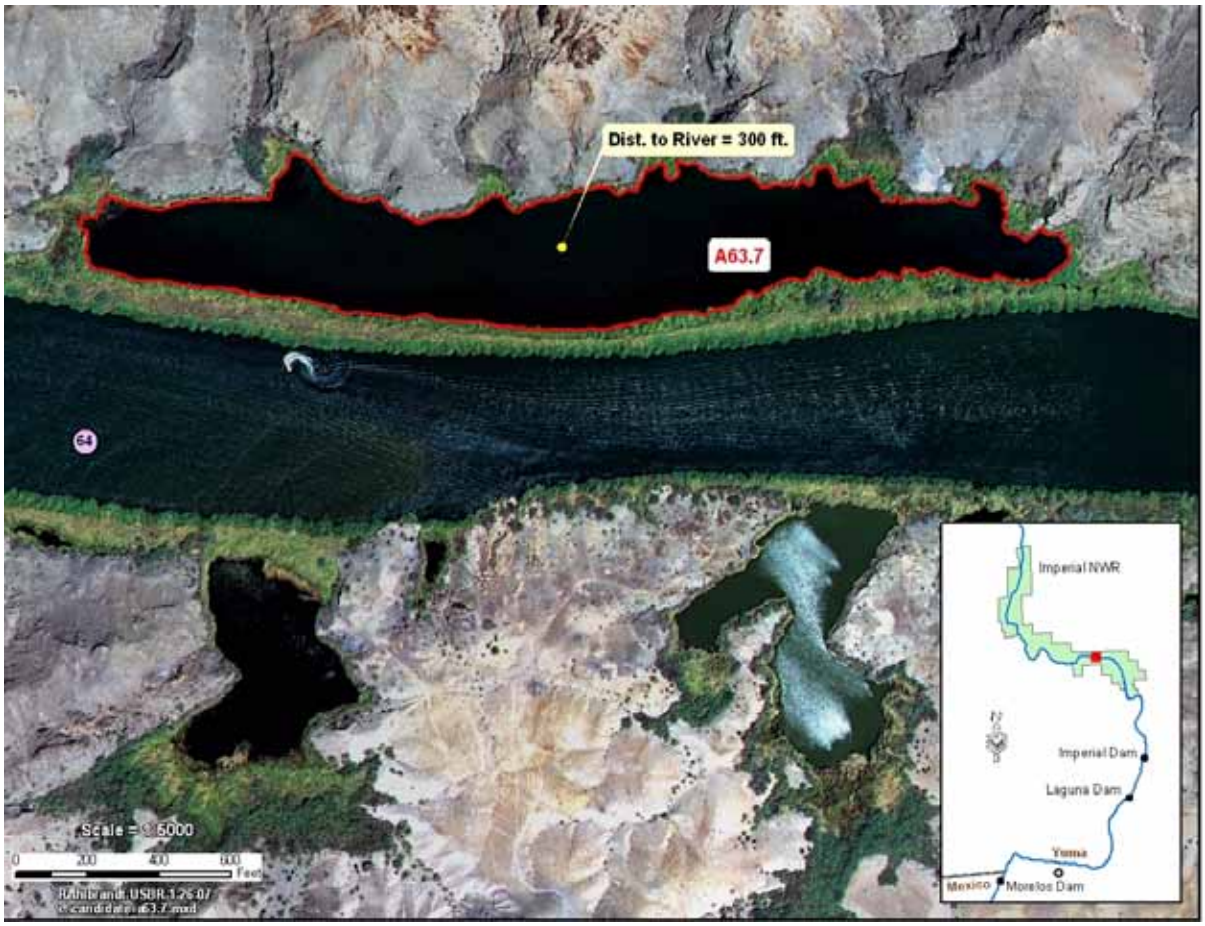
Site access is limited to boating upriver and establishing a trail. C63.8 is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only.

[2] This backwater was previously identified in the GIS as directly connected; however, at the time of the helicopter survey no surface connection could be seen.

A63.7 Cable Lake

River Mile: 64
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (729028, 3657840)
Size: 17.4 ac, AZ
Distance from river: 300 ft
Pools: 1



Cable Lake is a directly connected backwater (17.4 ac) on the Arizona side of the Colorado River at river mile 64. Boat access to Cable Lake from the river appears to exist, but the backwater could potentially be isolated from the river. Cable Lake is classified as a connected lake due to the surface connection to the river. Because of the apparent connection to the river, water quality is likely very similar to the river. No water quality profiles were conducted here at the time of the helicopter survey.

No road access was noted during the helicopter survey. Cable Lake is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at Cable Lake at the time of the helicopter survey.

C62.9 Duck Lake

River Mile: 63
Reach: 5
Connection: Indirect
Backwater Type: Pseudo-Seep

UTM: (730092, 3657400)
Size: 36.1 ac, CA
Distance from river: 519 ft
Pools: 1

Duck Lake is an indirectly connected backwater (36.1 ac) on the California side of the Colorado River at river mile 63.

During the helicopter survey, it was observed that water exchange was present through the emergent vegetation. Due to water exchange through vegetation, Duck Lake is classified as a pseudo-seep, which would typically exhibit water quality similar to the river. Water clarity at Duck Lake was moderate.

Duck Lake is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only. Public access is not restricted; however, no people were observed at Duck Lake at the time of the helicopter survey. This backwater is a well-known hunting site; however, the access point could not be identified.

A62.3 Secret Lake

River Mile: 62
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (731773, 3657610)
Size: 11.0 ac, AZ
Distance from river: 696 ft
Pools: 1

Secret Lake is a directly connected backwater (11.0 ac) on the Arizona side of the Colorado River at river mile 62. The backwater is connected to the river via a small inlet channel, accessible by very small boats (kayaks, canoes) only, but could potentially be isolated.

Water quality in Secret Lake is likely very similar to the Colorado River, due to the surface connection. Water clarity was moderate. Because of the presumed similarities in water quality, as well as the observed connection to the river, Secret Lake is classified as a connected lake.

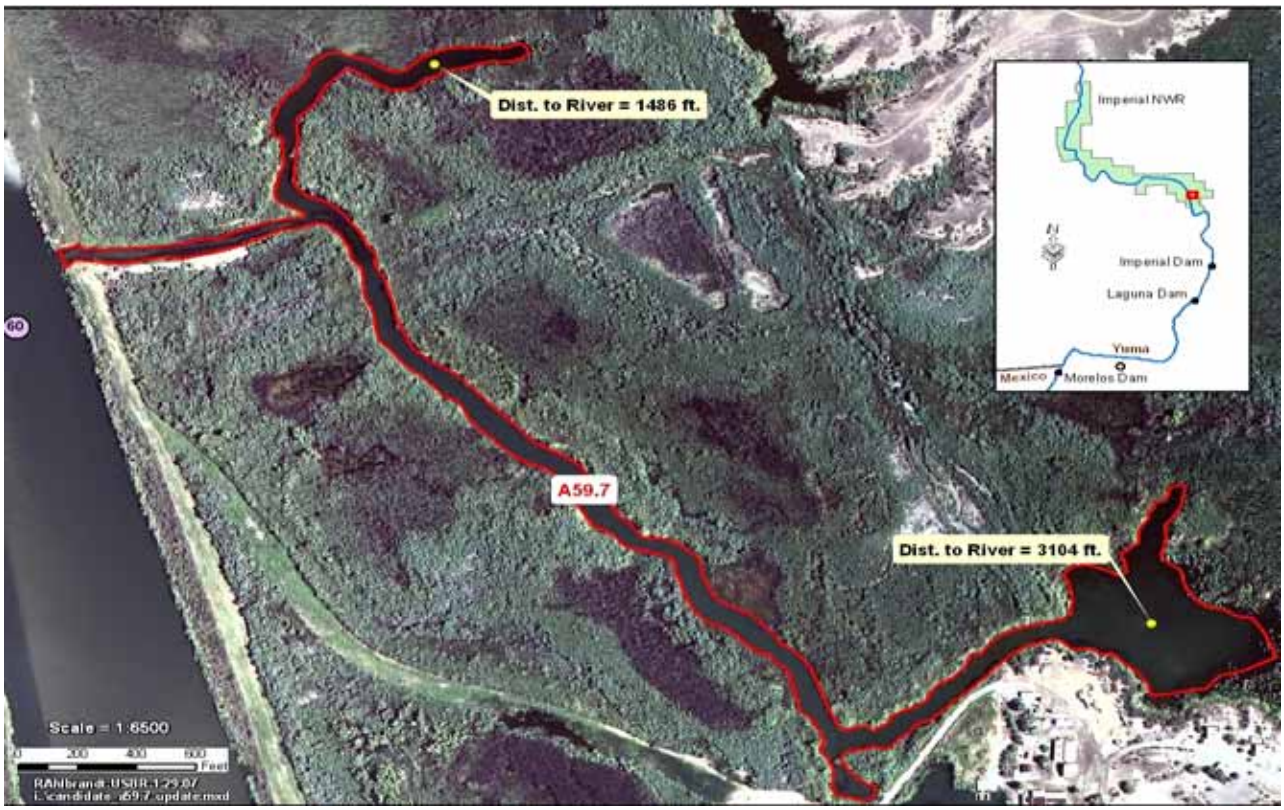
In addition to boat access, there is a trail, which presumably connects to a nearby dirt road. Public access is not restricted; however, no people were observed at Secret Lake at the time of the helicopter survey.

A59.7a and A59.7b Headquarters Lakes

River Mile: 60
Reach: 5

Connection: Direct
Backwater Type: Connected Lake

UTM: a (734418, 3654350)
b (733923, 3654940)
Size: 12 ac, AZ
Distance from river: 1486 ft, 3104 ft
Pools: 2



Headquarters Lakes consist of two directly connected backwaters (7 ac, 5 ac) on the Arizona side of the Colorado River at river mile 60. The backwaters are connected to the river via a dredged inlet canal, but it may be possible to isolate the backwaters.

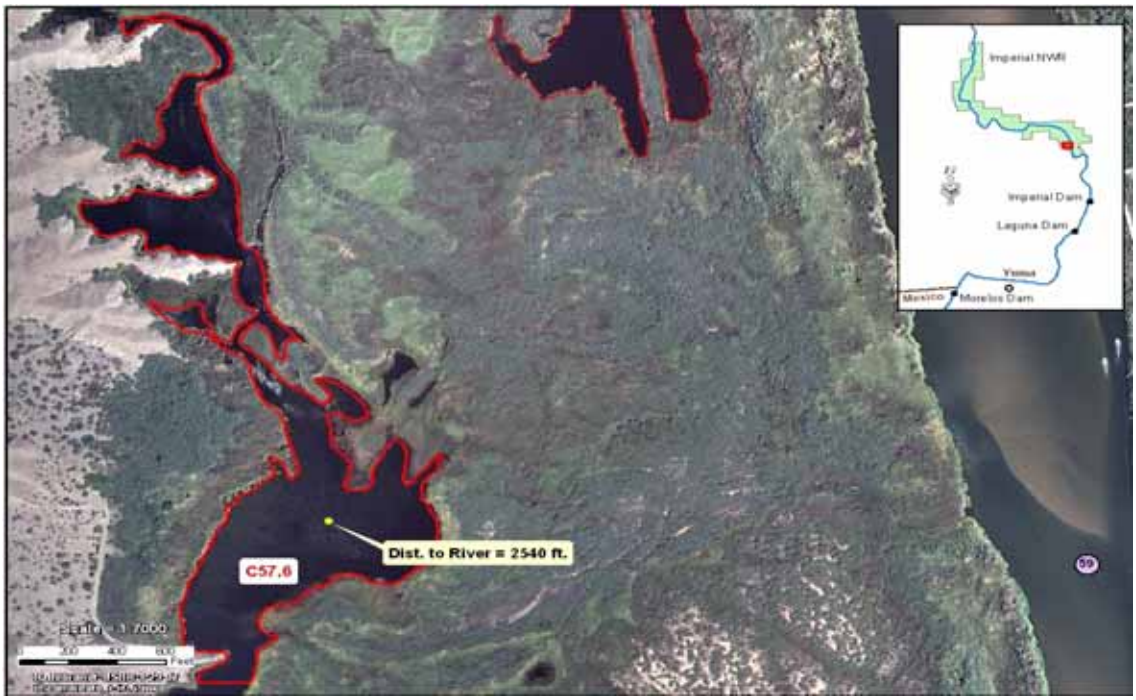
Water quality in Headquarters Lakes was very similar to the Colorado River based on water quality profiles. Because of the similarities in water quality, as well as the observed connection to the river, Headquarters Lakes are classified a connected lakes.

Both of these backwaters are ideal in terms of site access; public access is restricted and the sites are located central to INWR's headquarters. The northernmost of the two backwaters would likely be inaccessible to any land-based heavy equipment.

C57.6a Northern Ferguson Lake

River Mile: 59.5
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (732688, 3654150)
Size: 22.1 ac
Distance from river: 2540 ft
Pools: 1



The upper end of Ferguson Lake contains an approximately 22-ac backwater area directly connected to the river at river mile 59.5. This location is closed to the public from November to April for waterfowl habitat. Water quality diminishes in the summer months presumably due to a lack of fresh water inflow into the upper end of the lake. Ferguson Lake is well connected, and is classified a connected lake.

Creating an isolated backwater habitat may entail isolating the northern part of the lake and creating an inflow from the river through the backwater lake complex to improve and maintain water quality.

Site access is excellent with a launch ramp located at the southern end of the lake. There is also river access year-round. Site access to the northernmost part of the lake could be limited during low flows in the winter months.

C57.6

River Mile: 59.5
Reach: 5

Connection: Indirect
Backwater Type: True Seeps

UTM: (733115, 3654315)
(733304, 3654100)
(733243, 3653850)
Size: 15 ac, CA
Distance from river: 1256 ft, 827 ft, 1126 ft
Pools: 3

C57.6 comprises several isolated backwaters (15 ac total) on the California side of the Colorado River at river mile 59.5. The backwaters are isolated between the river and Ferguson Lake.

C57.6 exhibited moderately high salinity based on a water quality profile. Water clarity was moderate. Because of the elevated salinity, as well as the observed lack of connection to the river, C57.6 backwaters are classified as true seeps.

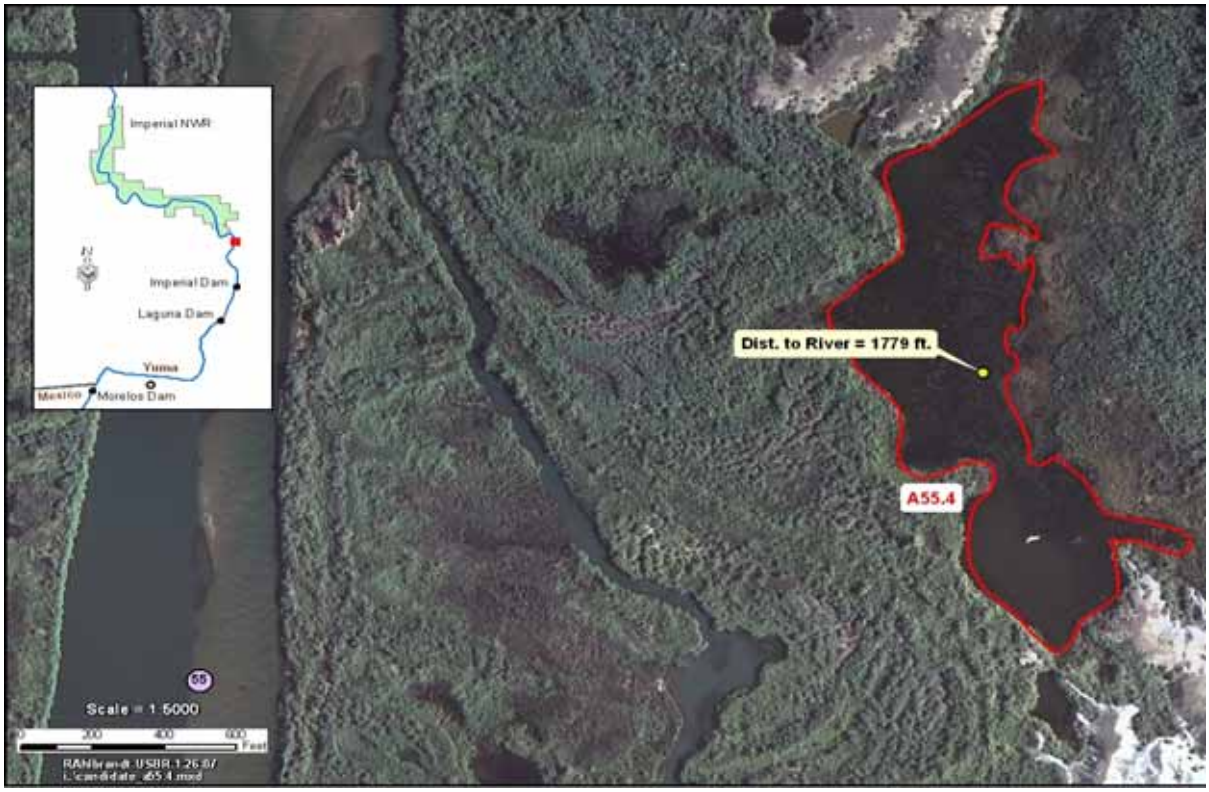
A passive flow system could potentially be created through an inflow from the river and outflow into Ferguson Lake.

Site access to C57.6 is very limited. There does not appear to be any access by boat, road, or trail. C57.6 backwaters are within a no hunting/no fishing area, and are seasonally restricted from public access. No people were observed at C57.6 at the time of the helicopter survey.

A55.4

River Mile: 55
Reach: 5
Connection: Indirect
Backwater Type: Pseudo-Seep

UTM: (737336, 3649800**)**
Size: 14.3 ac, AZ
Distance from river: 1779 ft
Pools: 1



A55.4 is an indirectly connected backwater (14.3 ac) on the Arizona side of the Colorado River at river mile 55. The backwater appears to have been connected to the river via the dredged Arizona Channel, which has since become closed off from boat access by overgrown emergent vegetation.

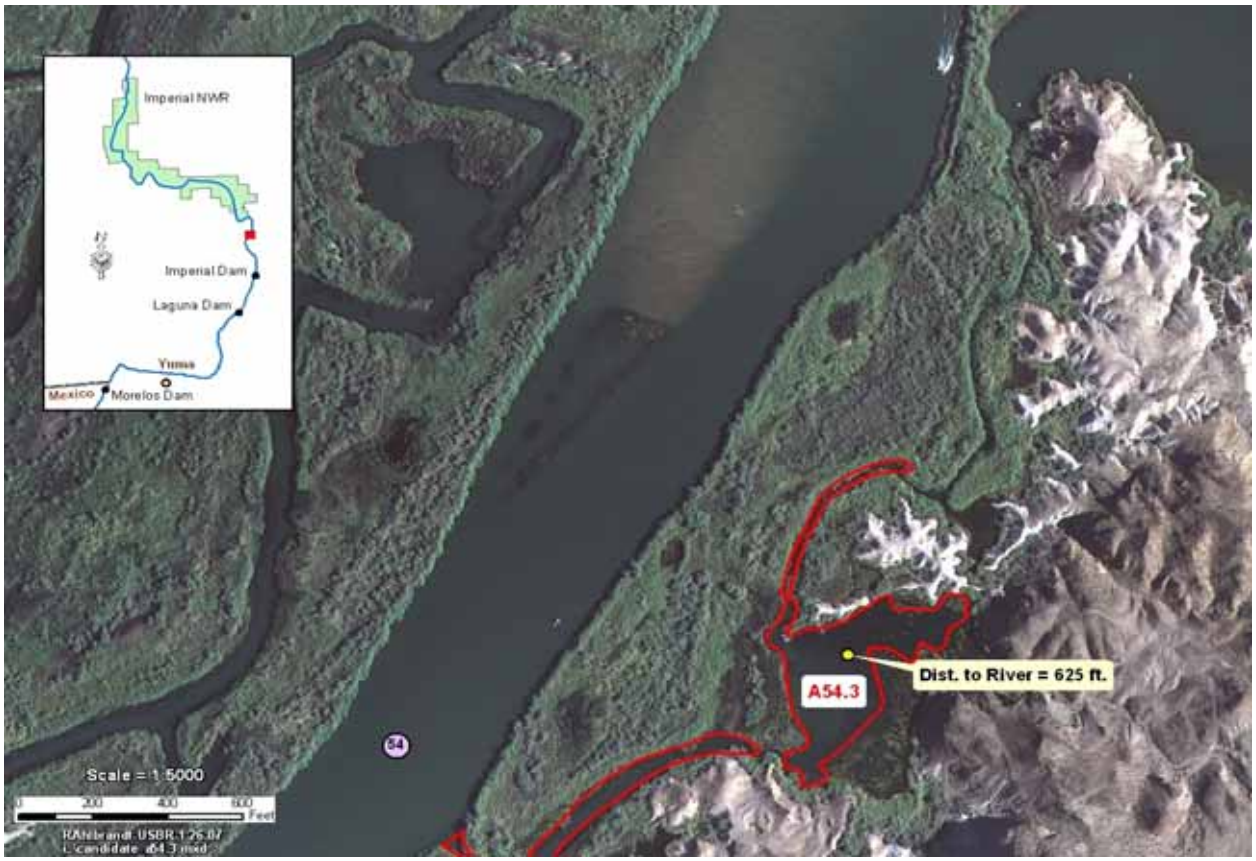
Water quality in A55.4 was very similar to the Colorado River based on water quality profiles. Water clarity was moderate. Because of the similarities in water quality, as well as the lack of apparent surface connection to the river, A55.4 is classified as a pseudo-seep.

This backwater appears to be potentially accessible via a nearby road. Boat access does not appear to exist. Recreational use is not likely as high in A55.4 as in other connected backwaters along the Arizona Channel.

A54.3

River Mile: 54
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (736448, 3648020)
Size: 3.2 ac, AZ
Distance from river: 625 ft
Pools: 1



A54.3 is a directly connected backwater (3.2 ac) on the Arizona side of the Colorado River at river mile 54. A surface connection to the river potentially exists via an inlet channel; however, it may be possible to isolate this backwater.

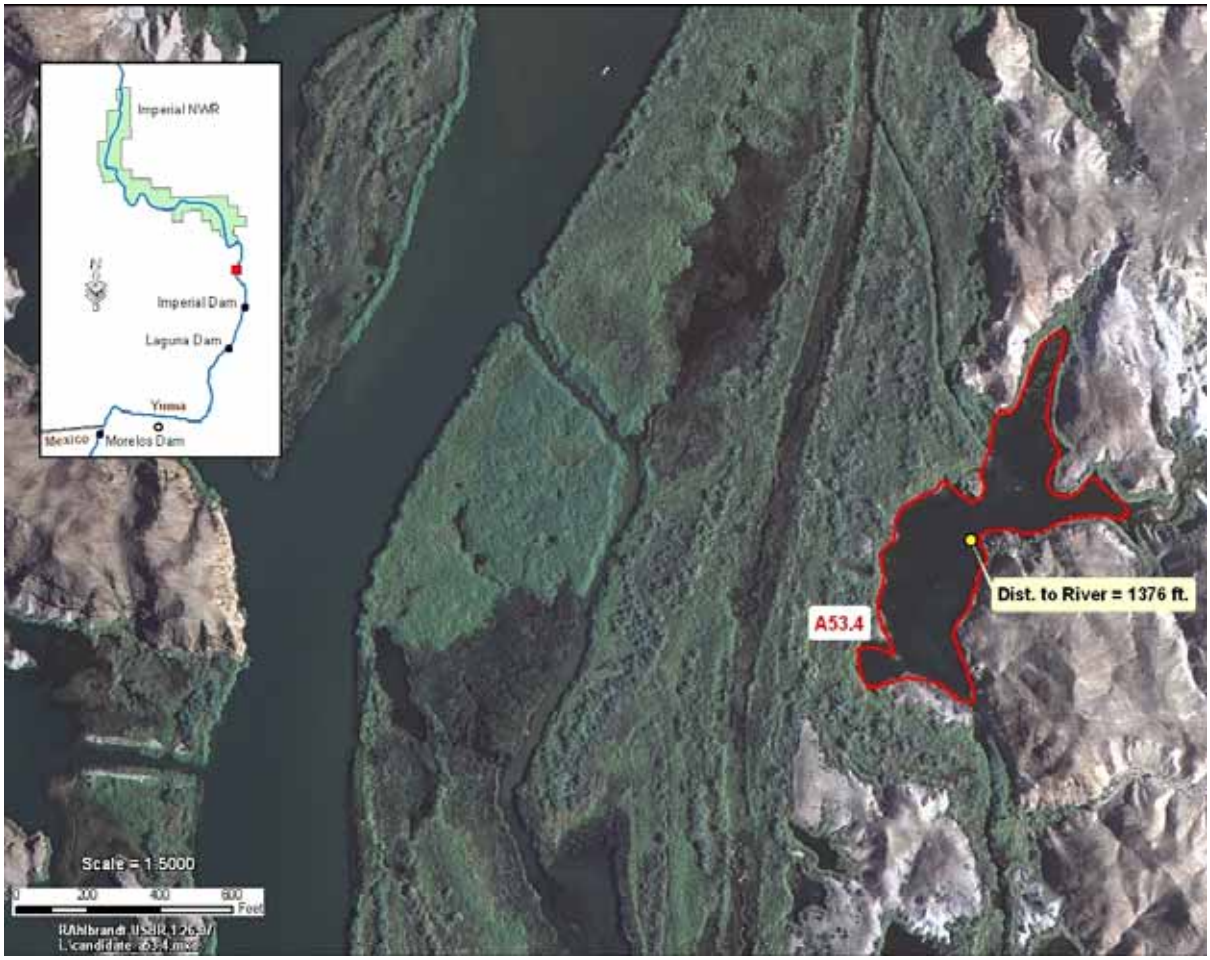
Water quality in A54.3 is most likely very similar to the Colorado River based on visual observations during the helicopter survey. Because of the presumed similarities in water quality, as well as the suspected connection to the river, A54.3 is tentatively classified as a connected lake.

Site access to A54.3 appears to be by boat only. Recreational use of this backwater is currently unknown, and would depend on site access. Public access is not restricted; however, no people were observed at A54.3 at the time of the helicopter survey. Recreational use is likely to be high, as is the case with most of the Arizona Channel backwaters, but would depend on boat access.

A53.4

River Mile: 53
Reach: 5
Connection: Indirect
Backwater Type: Connected Lake

UTM: (736086, 3647010)
Size: 4.8 ac, AZ
Distance from river: 1376 ft
Pools: 1



A53.4 is a directly connected backwater (4.8 ac) on the Arizona side of the Colorado River at river mile 53, and is classified a connected lake.

The backwater appears to have been connected to the dredged Arizona Channel, which connects numerous backwaters to the Colorado River via a dredged inlet channel. Water quality appears to be excellent in these connected lakes with numerous fish visible during the helicopter surveys. No water quality profiles were conducted at A53.4 at the time of the helicopter survey.

Site access to A53.4 is most likely by boat only. Recreational use is likely to be high, as is the case with most of the Arizona Channel backwaters, but would depend on boat access.

C52.5

River Mile: 52.5
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (735614, 3645910)
Size: 6.5 ac, CA
Distance from river: 272 ft
Pools: 1

C52.5 is a directly connected backwater (6.5 ac) on the California side of the Colorado River. This backwater has an inlet channel that is accessible from the main river channel, which classifies the site as a connected lake. Because of the inlet to the backwater, the water quality is likely very similar to the river; however, no water quality profiles were conducted at the time of the helicopter survey.

No road access to this backwater is present; site access is only from the river. Due to the inlet channel from the river and the close proximity to Squaw Lake, recreation pressure at this backwater is likely to be high.

A51.4

River Mile: 52.5
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (737004, 3645260)
Size: 10.8 ac, AZ
Distance from river: 1489 ft
Pools: 1

A51.4 is a directly connected backwater (10.8 ac) on the Arizona side of the Colorado River at river mile 52. The backwater appears to have been connected to the Arizona Channel, which connects numerous backwaters to the Colorado River via a dredged inlet channel. A51.4 is classified as a connected lake.

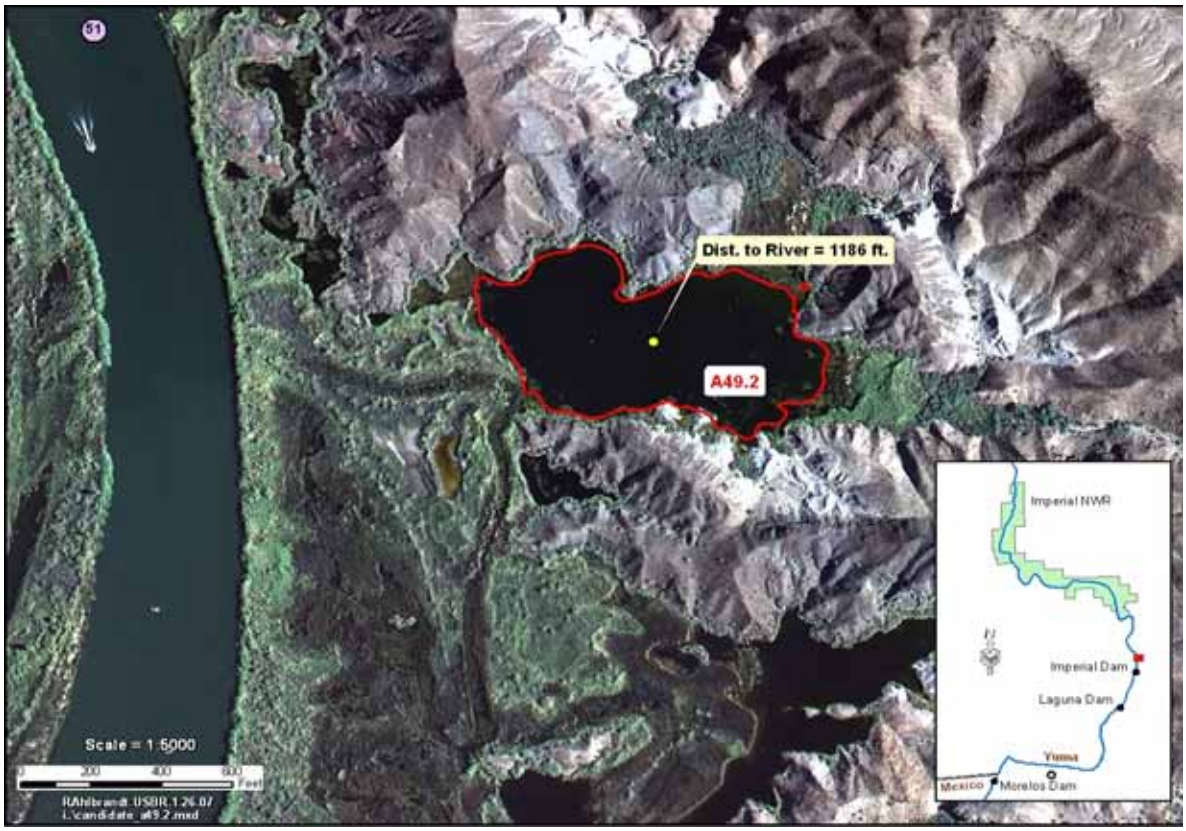
Water quality appears to be excellent in this connected lake with numerous fish visible during the helicopter surveys. No water quality profiles have been conducted at A51.4 at this time.

Site access to A51.4 is most likely by boat only. Recreational use is likely to be high, as is the case with most of the Arizona Channel backwaters, but would depend on boat access. There does not appear to be any road access to this site.

A49.2

River Mile: 50.5
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (737744, 3643660)
Size: 8.5 ac, AZ
Distance from river: 1186 ft
Pools: 1



A49.2 is a directly connected backwater (8.5 ac) on the Arizona side of the Colorado River at river mile 50.5.

The backwater appears to have been connected to the Arizona Channel, which connects numerous backwaters to the Colorado River via a dredged inlet channel. Because this backwater is connected to the main channel via a dredge channel, it is classified as a connected lake.

Water quality appears to be excellent in this and other connected lakes along the Arizona Channel, with numerous fish visible throughout during the helicopter survey.

Site access to A49.2 is most likely by boat only. Recreational use is likely to be high, as is the case with most of the Arizona Channel backwaters, but would depend on boat access.

C48.5 West Pond

River Mile: 48.5
Reach: 6
Connection: Indirect
Backwater Type: True Seep

UTM: (736004, 3640511)
Size: 52.1 ac, CA
Distance from river: 2482 ft
Pools: 1

West Pond is located on the California side of the Colorado River, just west of the Imperial Dam Desilting Works. This backwater (52.1 ac) has no direct connection to the main river channel. The water source for West Pond is seepage from the All American Canal and Senator Wash (Kretschmann 2006) which classifies this backwater as a true seep.

Razorback suckers were stocked into West Pond from 1980 to 1983. During a survey in 1988, no razorback suckers were found; however, sport fish (largemouth bass, flathead catfish, sunfish) were present (Kretschmann 2006). Due to groundwater seepage and presence of sport fish, the water quality is likely to be suitable for native fish. No water quality profiles were conducted at West Pond during the helicopter survey.

Road access and a launch ramp are present at West Pond. This backwater is also a well-known fishing spot.

C48.2 Horseshoe Pond

River Mile: 48.25
Reach: 6
Connection: Indirect
Backwater Type: True Seep

UTM: (736163, 3639990)
Size: 5.4 ac, CA
Distance from river: 1596 ft
Pools: 1

Horseshoe Pond is located south of the Imperial Dam Desilting Works, between the All American Cannel and the road to Yuma Proving Grounds. This backwater (5.4 ac) has no direct connection to the main river channel, which classifies this site a true seep. Most likely, the water source is seepage from the All American Canal.

During the time when razorback suckers were stocked into West Pond there was discussion regarding stocking razorback suckers into Horseshoe pond (Kretschmann 2006). No documentation was found that indicated razorback suckers were stocked into Horseshoe Pond. No water quality profiles were conducted at Horseshoe Pond during the helicopter survey.

Site access to this backwater is by road only; a dirt launch ramp might be present. This backwater is a popular sport fishing location.

Appendix C. Alternate Backwater Sites

C64.1

River Mile: 63.75
Reach: 5
Connection: Indirect
Backwater Type: Pseudo-Seep

UTM: (728782, 3657510)
Size: 3.5, CA
Distance from river: 402 ft
Pools: 1

C64.1 is an indirectly[3] connected backwater (3.5 ac) on the California side of the Colorado River at river mile 64. During the helicopter survey, the backwater was 50% dry. Because this backwater appears to be connected to the river through a thick wall of emergent vegetation, it is preliminarily classified as a pseudo-seep. No water quality profiles were conducted at C64.1 during the helicopter survey.

This site could potentially be expanded and provided with inflow/outflow channels to maintain open water year-around. It appears that emergent vegetation has filled in, closing off any surface connection.

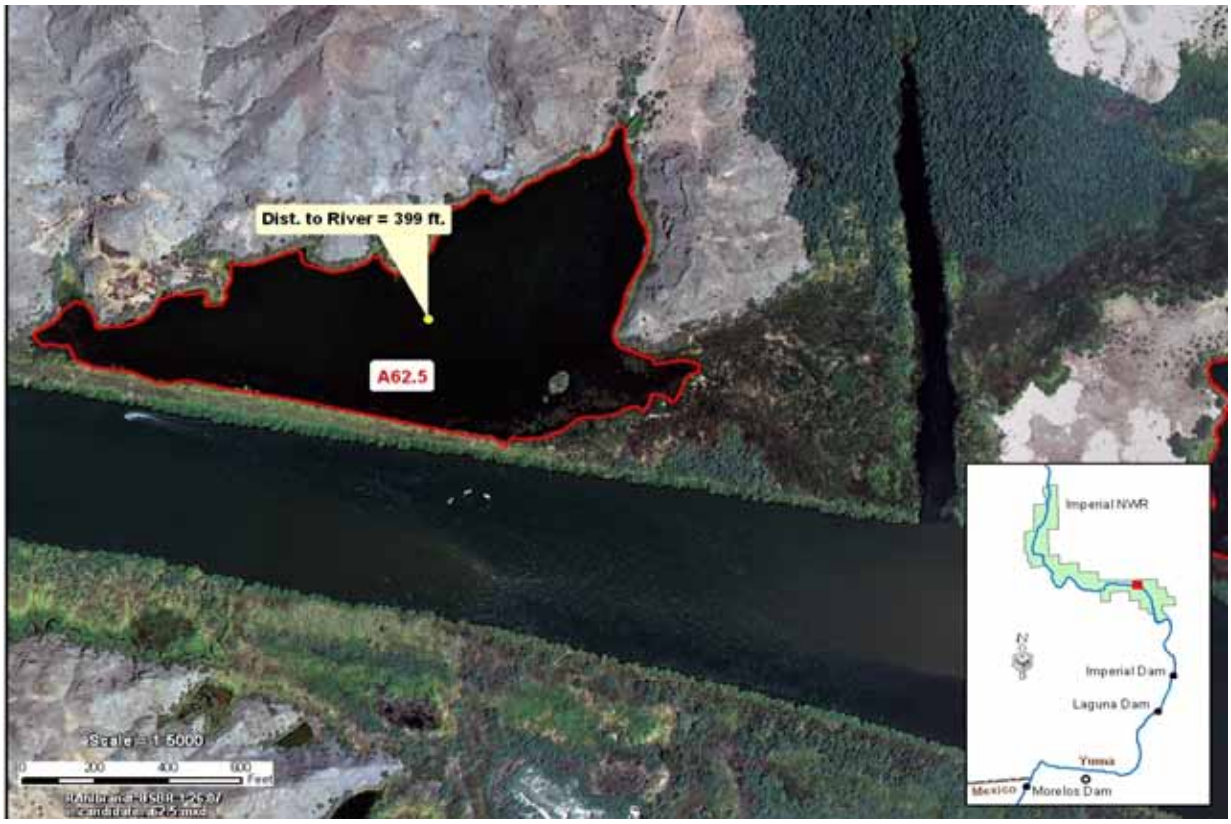
Site access is limited. No trails or surface connections were visible during the helicopter survey. C64.1 is within a designated wilderness area, which would likely prevent the construction of any new roads for site access outside of the floodplain; heavy equipment access would be by river only.

[3] This backwater was previously identified in the 2000 GIS dataset as directly connected; however, during the helicopter survey no visible surface connections were observed.

A62.5 Clear Lake

River Mile: 62.5
Reach: 5
Connection: Direct
Backwater Type: Pseudo-Seep

UTM: (731017, 365690)
Size: 17.0, AZ
Distance from river: 399ft
Pools: 1



A62.5 Clear Lake is a directly connected backwater (17.0 ac) on the Arizona side of the Colorado River at river mile 62.5. There is no visible surface connection to the river during the helicopter survey; however, this backwater is likely connected during high flows. Because this backwater appears to be intermittently connected to the river it is classified as a pseudo seep.

This site is a well-known sport fishing site, which would infer moderate to excellent water quality. No water quality profiles were conducted at C53.5 during the helicopter survey.

Site access to the backwater is by road (Red Cloud Mine Road) with a dirt launch ramp and possibly by boat during high flows. No anglers were present during the aerial survey.

C53.5

River Mile: 53.5
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (735325, 3647210)
Size: 6.4 ac, CA
Distance from river: 253 ft
Pools: 1

C53.5 is a directly connected backwater (6.4 ac) on the California side of the Colorado River at river mile 53.5. The backwater appears to have been possibly connected to the California Channel, which connects numerous backwaters to the Colorado River via a dredged inlet channel. Because of the connection to the main river channel, this backwater is classified as a connected lake.

Water quality appears to be excellent in this and other connected lakes along the California Channel, with numerous fish visible throughout during the helicopter survey. No water quality profiles were conducted at C53.5 during the helicopter survey.

Site access to C53.5 is most likely by boat only. Recreational use is likely to be high, as is the case with most of the California Channel backwaters, but would depend on boat access. There does not appear to be any road access to this site. This site may be moderately difficult to isolate. Additional information would need to be collected to make that determination, however.

C53.0

River Mile: 53
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (735270, 3646710)
Size: 14.2 ac, CA
Distance from river: 513 ft
Pools: 1

C53.0 is a directly connected backwater (14.2 ac) on the California side of the Colorado River at river mile 53. The backwater has two inlet channels (upper stream and downstream) that are accessible by boat. Water quality at this site is presumed to be similar to the river due to the two inlet channels; however, no water quality profiles were conducted at C53.0 during the helicopter survey. Because this backwater has two inlets to the main channel, it is classified as a connected lake.

Site access is limited to boat only. No road access was observed during the helicopter survey. Due to boat access from the river and close proximity to Squaw Lake, recreation pressure is most likely high in this backwater.

A50.5

River Mile: 50
Reach: 5
Connection: Direct
Backwater Type: Connected Lake

UTM: (738032, 3642520)
Size: 8.0 ac, AZ
Distance from river: 2791 ft
Pools: 1

A50.5 is a directly connected backwater (8.0 ac) on the Arizona side of the Colorado River at river mile 50. The backwater appears to have been connected to the Arizona Channel, which connects numerous backwaters to the Colorado River via a dredged inlet channel. Because the backwater is connected to the river via the dredge channel, this site is classified as a connected lake.

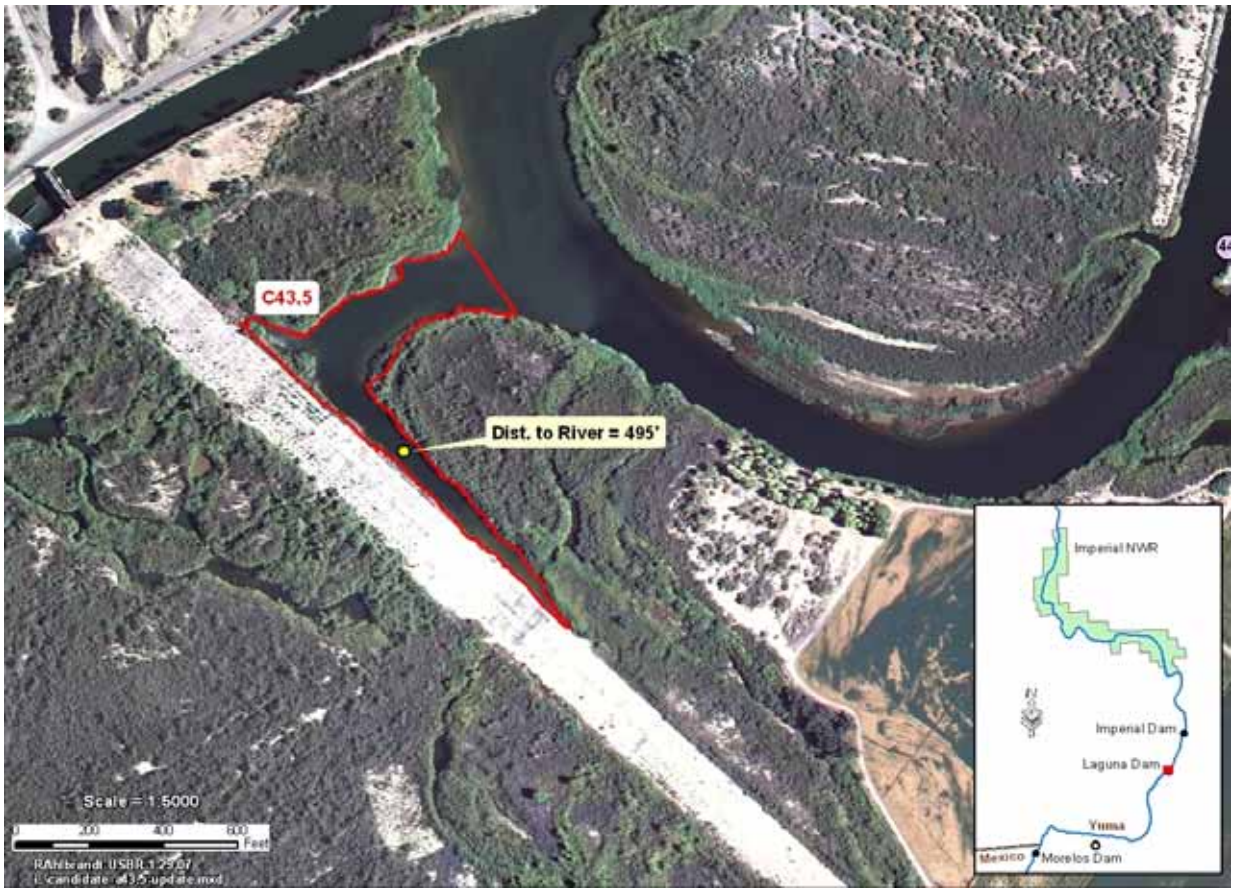
Water quality appears to be excellent in this and other connected lakes along the Arizona Channel, with numerous fish visible. No water quality profiles were conducted at A50.5 during the helicopter survey.

Site access to A50.5 is most likely by boat only. Recreational use is likely to be high, as is the case with most of the Arizona Channel backwaters, but would depend on site access.

A43.5

River Mile: 43.5
Reach: 6
Connection: Direct
Backwater Type: Connected Lake

UTM: (734314, 3634833)
Size: 4.0
Distance from river: 495 ft
Pools: 1



A43.5 is directly connected to the main channel of the Colorado River. This backwater (4.0 ac) is located east of Laguna Dam and west of the Pratt Agriculture Field. Water quality is expected to be similar to the main river channel due to a direct connection to the river. Because of the direct connection to the main channel, this backwater is classified as a connected lake. No water quality profiles were conducted at A43.5 during the helicopter survey.

Site access is by boat or road. A launch ramp accessing the main river channel is located approximately a mile away from the site. This portion of the river is well known for sport fishing.