Task 1: Defining Water-Related Concerns on the Coconino Plateau Through Stakeholder Interviews

For: Coconino Plateau Watershed Partnership
Attn: Ron Doba, Coordinator
9833 E. Preserve Way, Scottsdale, AZ 85262
rdoba@cpwac.org
480.299.5764

By: Global Water Policy Consulting
Kira Artemis Russo, Ph.D.
1385 W. University Ave. # 171, Flagstaff, AZ 86001
 k.russo@globalwaterpolicyconsulting.com
928.607.2855

and

H₂O Consulting
Sharon Masek Lopez, Principal
409 Kiowa, Flagstaff, AZ 86005
sharon.maseklopez@gmail.com
928.699.0480

December 31, 2018
Water is life. As individuals and as a community, we take responsibility for our region’s water. We value water for its social, cultural, and environmental roles. We have an ethical obligation to manage water and use it in a purposeful manner, recognizing our choices and their consequences. To quote Aldo Leopold, "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

Coconino Plateau Watershed Partnership Water Ethic
All images from Bing Creative Commons
# Table of Contents

EXECUTIVE SUMMARY ........................................................................................................... 1  
Common Examples of Water-Related Ecosystem Services .................................................... 2  
Stakeholder Concerns ............................................................................................................. 2  

INTRODUCTION .................................................................................................................... 5  
Stakeholder Identification ....................................................................................................... 5  
Overview of Interview ............................................................................................................ 8  
Interview Process ................................................................................................................... 9  
Interview Questions and Analysis of Responses ................................................................. 9  

PART 1 ..................................................................................................................................... 10  
Questions 1 through 3 - Establishing Rapport ..................................................................... 10  
Questions 4 and 5 - Ranking Water Uses/Values .................................................................. 12  
Expanded Comments on Questions 4 .................................................................................. 15  
   Recreation ............................................................................................................................. 15  
   Tourism ................................................................................................................................ 15  
   Flood Control ..................................................................................................................... 15  
   Agriculture/Ranching ........................................................................................................... 15  
   Culture ................................................................................................................................. 16  
   Industry .................................................................................................................................. 16  
   Non-Use Values .................................................................................................................... 16  
Questions 6, 7, and 8 - Pricing and Economic Benefits of Water ......................................... 16  

PART 2 ..................................................................................................................................... 17  
Measuring Attitudes and Opinions .................................................................................... 17  
   Question 9 - Agriculture .................................................................................................... 18  
   Question 10 - Ranching ....................................................................................................... 19  
   Question 11 - Industrial and Commercial Use .................................................................. 19  
   Question 12 - Municipal Use ............................................................................................. 20  
   Question 13 - Mining ......................................................................................................... 21
Question 14 - Energy ................................................................. 22
Question 15 - Navigation .......................................................... 22
Question 16 - Recreation ........................................................... 23
Question 17 - Environmental Uses ............................................. 23
Question 18 - Domestic Use ....................................................... 23
Question 19 - Export Sales ........................................................ 24
Question 20 - Spiritual Purposes ................................................ 24
Question 21 - Protected Water .................................................... 24
Question 22 - Abundance of Water ............................................. 24
Question 23 - Safe Water ........................................................... 24
Question 24 - Conservation ....................................................... 25
Question 25 - Legal Framework .................................................. 25

PART 3 ....................................................................................... 25

Open-Ended Questions ................................................................ 25
Question 26 - Impediments to Including Stakeholder Values ........ 26
Question 27 - Infrastructure and Equipment Needs ..................... 27
Question 28 - Successes, Failures, and Ongoing Efforts .............. 28
Question 29 - Scientific Information ........................................... 29
Question 30 - Most Critical Issue .............................................. 30
Question 31 - Water Sustainability ............................................. 31
Question 32 - Water Reuse ....................................................... 32
Question 33 - At-Risk and Vulnerable Water Supplies ............... 33
Question 34 - Changes ............................................................. 34
Question 35 - Population Growth and Climate Change ............. 36
Questions 36 and 37 - What to See/Additional Comments ......... 37

CONCLUSIONS AND RECOMMENDATIONS .............................. 38

References ................................................................................ 42

APPENDIX A - Repeated Concerns .......................................... 43
Table of Tables

Table 1. Coconino Plateau Watershed Partnership stakeholder concerns and related ecosystem services. ................................................................. 4

Table 2. Types of organizations interviewed for the Coconino Plateau Watershed Partnership, Phase 1 Ecosystem Services Assessment. ................................. 6

Table 3. Stakeholder list of organizations interviewed for the Coconino Plateau Watershed Partnership, Phase 1 Ecosystem Services Assessment......................... 7

Table 4. Responses to Questions 4 and 5 regarding rankings for uses/values of water, Coconino Plateau Watershed Partnership, Phase 1 Ecosystem Services Assessment. ........................................................................................................ 14
EXECUTIVE SUMMARY

In January 2018, the Coconino Plateau Watershed Partnership (CPWP) contracted with Dr. Kira Russo of Global Water Policy Consulting (GWPC) to complete Phase 1 of a Water-Related Ecosystem Services Assessment. There were two tasks associated with Phase 1. For Task 1, Dr. Russo conducted interviews with 31 water resources stakeholders across the Coconino Plateau. The interviews were foundational for understanding the needs of stakeholders.

Dr. Russo subcontracted Task 2 to Sharon Masek Lopez, principal of H₂O Consulting. The objective of Task 2 was to identify existing data sources necessary to inform Phase 2 of the ecosystem services assessment. These data sources are provided in an ancillary document. Phase 2 of the Ecosystem Services Assessment is expected to start in early 2019.

The purpose of the ecosystem services assessment is multi-faceted:

♦ To help the Technical Advisory Committee (TAC) of the CPWP develop a framework for sustainable water management on the Coconino Plateau,
♦ To help water managers and water providers prioritize, effectively develop, and use available water supplies in a manner that meets the needs of all stakeholders,
♦ To align water managers with appropriate governances that can affect change, and
♦ To provide information that might be beneficial for further cooperation among stakeholders of water resources on the Coconino Plateau.

Broadly defined, water managers can be city employees, council members, regional water boards, government institutions, legislative bodies, utility managers, and courts. The underlying assumption is that these water managers are representative of the public.

The contract with CPWP required GWPC to identify seven or fewer relevant water-related concerns to be assessed in Phase 2 of the Ecosystem Services Assessment. These concerns were informed by interviews with stakeholder representatives and are recommended for inclusion in Phase 2. The concerns are meant to be easily measured and relevant to sustainable water resource management.
Common Examples of Water-Related Ecosystem Services

Ecosystem services are defined as the benefits that people obtain from ecosystems and the direct and indirect contributions of ecosystems to human well-being (Grizzetti et al. 2016). There are four categories of ecosystem services: provisioning, regulating, cultural, and supporting services. As part of the Millennium Ecosystem Assessment (MA), Aylward et al. (2005) identified the ecosystem services provided by fresh water and the hydrologic cycle. Later publications added to and refined the MA’s original list of water-related ecosystem services to include those listed as follows (Capon et al. 2015, Grizetti et al. 2016, Brauman 2017).

**Provisioning services** - water for consumptive use (drinking water, agriculture, industrial use) or water for non-consumptive use (energy generation, transportation/navigation)

**Regulating services** - flood protection, water purification

**Cultural services** - spiritual, cultural, recreation

**Supporting services** - the role of water in soil development and nutrient cycling, which maintain the appropriate conditions for the existence of life

Stakeholder Concerns

Based on the responses of stakeholder-identified needs, GWPC identified the following seven concerns for assessment in Phase 2. Each of these concerns involves more than one ecosystem service.

1) **The groundwater system**

CPWP stakeholders expressed a desire for continued assessment of groundwater flow. Respondents stated that it would be helpful to have a better understanding of groundwater flow through predictive models based on the Northern Arizona Regional Groundwater Flow Model (NARGFM). Ideally, these assessments would include monitoring of specific locations and the use of metrics for evaluating the health of at-risk springs and seeps. Additionally, this modeling would evaluate recharge rates, especially for the C and R-M Aquifers.

2) **Wildfire protection**

Stakeholders stated concern about the potential impacts of catastrophic fire and consequent flooding. They expressed interest in both quantity and quality of water after a high intensity fire. One stakeholder addressed the effect of fire on soil productivity. Both economic and ecological assessments would be useful.
Dr. Russo suggests Phase 2 address various likely fire scenarios and potential responses to each for managing water quality and quantity.

3) Identification of infrastructure needs

Stakeholders were overwhelmingly concerned with funding in regard to infrastructure for water delivery and for water quality. Several respondents specifically acknowledged areas with no running water in the Coconino Plateau Watershed Partnership area of interest. One stakeholder suggested water centers for extremely remote areas.

4) The effects of climate change

Stakeholders addressed shortened snow seasons (e.g. later snow, earlier snowmelt) due to climate change and consequent declines in surface water and groundwater. One respondent mentioned the importance of measuring changes in evapotranspiration with increasing temperatures. Some of this information might become available through climate adaptation plans made available by the partners.

5) Further assessment of water reuse on the Coconino Plateau, in many cases to potable standards

Water reuse was of importance to stakeholders. They expressed caution in dealing with Contaminants of Emerging Concern (CECs) and were concerned about consistent funding to test for quality in a comprehensive way. One respondent suggested that the standard for reuse should be that it is “biologically safe.” Two other respondents recommended behavior and perception studies to better understand community willingness and limitations about reuse.

6) Assessment of tourism and recreation benefits and impacts

Stakeholders expressed interest in a better understanding of how many tourists travel through the area and how they affect water demand. Dr. Russo suggests Phase 2 address various aspects of tourism. These would include “through” tourists, overnight tourists, and main travel corridors. Phase 2 would also include economic benefits, specific water resources impacts, and possible solutions to address those impacts.

7) Protection of springs and seeps

Stakeholders expressed concern about the health of springs and seeps. One stakeholder identified springs as “windows into aquifers.” In general, respondents saw springs as vulnerable and hope for a better understanding of how to assess and monitor spring health.
This report summarizes the interview process and the analyses conducted for each interview question. In addition, Dr. Russo makes recommendations for Phase 2 of the Ecosystem Services Assessment. See Table 1.

Table 1. Coconino Plateau Watershed Partnership stakeholder concerns and related ecosystem services.

<table>
<thead>
<tr>
<th>Stakeholder Concern</th>
<th>Ecosystem Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater Flow</td>
<td>Provisioning: Drinking Water, Water for Environmental Flow</td>
</tr>
<tr>
<td></td>
<td>Regulating: Groundwater Recharge</td>
</tr>
<tr>
<td>Wildfire Protection</td>
<td>Regulating: Flood Protection, Erosion Prevention, Water Purification, Drinking Water</td>
</tr>
<tr>
<td>Infrastructure Needs: Water Monitoring</td>
<td>Regulating: Water Purification</td>
</tr>
<tr>
<td>Climate Change</td>
<td>Regulating: Climate Change Adaptation and Disaster Risk Reduction, Carbon Sequestration</td>
</tr>
<tr>
<td></td>
<td>Regulating: Water Purification, Groundwater Recharge, Recreation, Water for Non-Drinking Purposes, Drinking Water</td>
</tr>
<tr>
<td>Tourism and Recreation</td>
<td>Provisioning: Drinking Water, Water for Non-Drinking Purposes, Water for Environmental Flow</td>
</tr>
<tr>
<td></td>
<td>Cultural: Recreation/Tourism</td>
</tr>
<tr>
<td>Springs</td>
<td>Provisioning: Water for Environmental Flow</td>
</tr>
<tr>
<td></td>
<td>Regulating: Maintaining Wildlife Populations and Habitats</td>
</tr>
<tr>
<td></td>
<td>Cultural: Spiritual</td>
</tr>
</tbody>
</table>
INTRODUCTION

In the year 2000, the United Nations (UN) Secretary-General called for the Millennium Ecosystem Assessment (MA). The Sub-Global Assessments were created to represent different ecosystems worldwide and to address trends in ecosystem management, ecosystem services (services provided from the environment) and human well-being. The MA is generally representative of dominant environmental views and accepted research methods. It also shows the growing trend toward the inclusion of community environmental values and ecosystem and hydrologic services. The assessment framework was meant to offer decision makers tools for meeting demands for clean water and food. In addition, it is meant to offer a means to address health and employment. In theory, this information would allow decision makers to address changing needs and trade-offs for growing demands (Russo and Smith 2013, 40-44).

Phase 1 of the Coconino Plateau Watershed Partnership (CPWP) Ecosystem Services Assessment reflects the overall purpose of the MA: to address long-term human and environmental well-being in the Coconino Plateau Watershed Partnership area of interest.

Dr. Kira Russo conducted interviews with 31 stakeholders of water resources across the Coconino Plateau Watershed Partnership area of interest. In general, the interview respondents are participants in the CPWP. Some respondents reside outside the CPWP boundary but are affected by the actions of stakeholders within CPWP.

Stakeholder Identification

Initially, Dr. Russo identified stakeholders through the CPWP participant list on its website (https://www.cpwac.org/members.htm). A discussion between Dr. Russo and
members of the Technical Advisory Committee (TAC) provided the identification of more stakeholders and optimal contacts within each stakeholder group. “Optimal” is defined as someone who understands the institutional history of their organization, who preferably has had previous contact with the CPWP or who has an understanding of its work, who is a leader in their field, and who at the time of the interview worked for the stakeholder. So that the interview would best represent the stakeholder, respondents were ultimately identified by the stakeholder group itself. Some respondents have retired since the time of the interviews.

Dr. Russo made approximately 100 contacts with stakeholders to set up interviews, and she recorded contact information for each potential respondent, along with the dates each respondent was contacted. With a couple of exceptions, interviews were conducted with one or two people from each stakeholder group. The largest group included six people. Below are the stakeholder groups that were interviewed.

For the purpose of analysis, discrete categories have been created here to identify organization types. Below, “Government” is organized from broad to narrow jurisdiction of the government (e.g. federal, state, county, city, town). Tribal nations are sovereign and are categorized separately. See Tables 2 and 3.

Table 2. Types of organizations interviewed for the Coconino Plateau Watershed Partnership, Phase 1 Ecosystem Services Assessment.

<table>
<thead>
<tr>
<th>Organization Type</th>
<th>Organization Code</th>
<th>Number Interviewed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>E</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>G</td>
<td>20 TOTAL</td>
<td></td>
</tr>
<tr>
<td>Federal</td>
<td>GF</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>GS</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>County</td>
<td>GCo</td>
<td>4</td>
<td>Combined 3 Coconino County Supervisors and 1 Sustainable Building Program</td>
</tr>
<tr>
<td>City</td>
<td>GCi</td>
<td>6</td>
<td>Combined 3 City of Flagstaff</td>
</tr>
<tr>
<td>Town</td>
<td>GT</td>
<td>2</td>
<td>Includes Water Supplier</td>
</tr>
<tr>
<td>Nonprofit</td>
<td>N</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Tribal Nation</td>
<td>T</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>No Formal Affiliation</td>
<td>NFA</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Stakeholder list of organizations interviewed for the Coconino Plateau Watershed Partnership, Phase 1 Ecosystem Services Assessment.

<table>
<thead>
<tr>
<th>Stakeholder Number</th>
<th>Stakeholder Organization Name</th>
<th>Organization Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arizona Department of Environmental Quality (ADEQ)</td>
<td>G, GS</td>
</tr>
<tr>
<td>2</td>
<td>Arizona Department of Water Resources (ADWR)</td>
<td>G, GS</td>
</tr>
<tr>
<td>3</td>
<td>Arizona Game and Fish Department (AGFD)</td>
<td>G, GS</td>
</tr>
<tr>
<td>4</td>
<td>City of Cottonwood</td>
<td>G, GCi</td>
</tr>
<tr>
<td>5.1</td>
<td>City of Flagstaff—Mayor</td>
<td>G, GCi</td>
</tr>
<tr>
<td>5.2</td>
<td>City of Flagstaff—Water Conservation Program</td>
<td>G, GCi</td>
</tr>
<tr>
<td>5.3</td>
<td>City of Flagstaff—Water Services</td>
<td>G, GCi</td>
</tr>
<tr>
<td>6</td>
<td>City of Page</td>
<td>G, GCi</td>
</tr>
<tr>
<td>7</td>
<td>City of Sedona</td>
<td>G, GCi</td>
</tr>
<tr>
<td>8.1</td>
<td>Coconino County—District 1</td>
<td>G, GCo</td>
</tr>
<tr>
<td>8.2</td>
<td>Coconino County—District 2</td>
<td>G, GCo</td>
</tr>
<tr>
<td>8.4</td>
<td>Coconino County—District 4</td>
<td>G, GCo</td>
</tr>
<tr>
<td>8.6</td>
<td>Coconino County—Sustainable Building Program</td>
<td>G, GCo</td>
</tr>
<tr>
<td>9</td>
<td>U.S. Forest Service (Coconino National Forest and Kaibab National Forest)</td>
<td>G, GF</td>
</tr>
<tr>
<td>10</td>
<td>Flagstaff Water Group</td>
<td>NFA</td>
</tr>
<tr>
<td>11</td>
<td>Friends of the Rio de Flag</td>
<td>N</td>
</tr>
<tr>
<td>12</td>
<td>Friends of the Verde River</td>
<td>N</td>
</tr>
<tr>
<td>13</td>
<td>Grand Canyon National Park</td>
<td>G, GF</td>
</tr>
<tr>
<td>14</td>
<td>Grand Canyon Trust</td>
<td>N</td>
</tr>
<tr>
<td>15</td>
<td>Havasupai Tribe</td>
<td>T</td>
</tr>
</tbody>
</table>
There are a couple of notable exceptions from this list. Dr. Russo was unable to set up interviews with The Hopi Tribe and did not hear back from the Hualapai Tribe. She made contact with a representative from the City of Williams, the supervisors for District 3 and District 5 for Coconino County, U.S. Fish and Wildlife Service, and a representative from the Arizona State Land Department, but she has not yet been able to coordinate times for these interviews. She has also attempted to contact a representative from the Cattle Grower’s Association and the Arizona Farm Bureau.

For Phase 2 of the Ecosystem Services Assessment, Dr. Russo recommends that more people in education be interviewed or their research examined. If interviews are preferred, these might be specifically written so that they can extract the important points of that research. One respondent mentioned the importance of talking with representatives from communities on tribal lands. Finally, Dr. Russo also recommends that there be discussions or interviews with water companies within the Coconino Plateau Watershed Partnership area of interest in order to fully understand their needs and the problems they face.

Below is a synopsis of the interview process.

**Overview of Interview**

In the first part of the interview, the respondent discussed the general geographic region they represented and what water uses are valued there. The second part addressed how strongly respondents disagree or agree with values/uses of water. The final part of the interview focused on the abilities of respondents to meet their goals with regard to water resources.

There were 14 changes to the interview from the original. For example, Question 2 was changed to reflect the term water “rights,” instead of water “capture” so that that respondents did not confuse legal privilege with the geomorphological phenomenon of
stream capture. Dr. Russo documented all changes, the dates of those changes, and the compelling reasons for the changes. None of the changes significantly impacted previous respondent answers. Requests for changes were also documented, even when those changes were not made.

Dr. Russo had planned to conduct an initial workshop, but later reconsidered this prospect because she wanted respondents to think independently rather than to reiterate language from other respondents. This change was agreed to via phone call by CPWP Coordinator, Ron Doba.

**Interview Process**

All but two interviews were conducted face-to-face. When possible, Dr. Russo chose to meet the respondent in his or her own geographical area, not only to establish rapport, but also to provide her a good understanding of geography and other site-specific information. On-site interviews also allowed water managers access to their own maps and other work files.

Dr. Russo took handwritten or typed notes during each interview, but the interviews were not recorded via audio or video means. Each interview was approximately two hours long. The answers are confidential. To protect that confidentiality, responses here are represented indirectly or grouped with other responses.

Dr. Russo wrote summary reports of each interview. Each interview generated approximately 11 to 13 pages of summary data. Dr. Russo examined language from every page of these summaries to look for patterns of concerns and important respondent comments. These reports address the interview questions and, when appropriate, Dr. Russo also notes information from each interview that addresses specific language, and she compares distinctive similar or dissimilar views.

**Interview Questions and Analysis of Responses**

Below, each question is addressed in numerical order as follows:

1) Interview question and purpose of question (if not obvious). Interview questions are listed in bold.

2) General findings for each question, and

3) Recommendations, if any, for Phase 2 of the Water-Related Ecosystem Services Assessment.

Dr. Russo conducted 31 unique interviews. Some individuals from these interviews were from the same organization (City of Flagstaff, Coconino County, and Town of Tusayan). Respondents’ answers were averaged for these three entities in order to give equal
weight to every organization. A total of 25 organizations were interviewed. This number is represented in the percentages below. Only comments with substance are included. In order to best represent the responses, some of the questions are grouped.

PART 1

Questions 1 through 3 - Establishing Rapport

The first three questions served to create rapport with the respondent and to acquaint Dr. Russo with the respondent’s representative area. This discussion provided historical, economic, and social context for later questions.

Part 1—The first part of this interview deals with your general geographic region and what uses of water are valued there.

1) Tell me about the geographic area you serve, including type of climate or average precipitation, and pertinent geological features.

2) To the best of your ability, please tell me the history of water use and water rights in your area.

3) What are the pertinent water sources in your region?

Obviously, answers for this series of questions varied widely with regard to the respondent’s geographic area. Based on the questions above, the following is information that provides foundational understanding for Phase 2 of the Ecosystem Services Assessment.

Surface water rights in the Western United States are generally tied to the Doctrine of Prior Appropriation: “First in time, first in right.” As applied in Winters v. United States, tribal water rights are tied to the creation date of each reservation.

Certain areas within Arizona that rely heavily on mined groundwater were identified and designated as Active Management Areas (AMAs) by the 1980 Arizona Groundwater Code. The AMAs were established to provide long-term management and conservation of their limited groundwater supplies. Currently, the state has five AMAs located in the central or southern parts of the state (Prescott, Phoenix, Pinal, Tucson, and Santa Cruz). Groundwater use within the AMAs is subject to regulation, and the Arizona Department of Water Resources (ADWR) administers state laws, develops and implements groundwater management plans, explores ways of augmenting water supplies to meet future needs, and works to develop public policy in order to promote efficient use and an equitable allocation of available water supplies (ADWR. 2019. https://new.azwater.gov/).
Outside the AMAs, there is significantly less regulation. Groundwater use is generally not regulated in areas outside of AMAs. The groundwater code requires only that groundwater be put to reasonable and beneficial use. In all areas of the state, wells are required to be registered with ADWR and new wells to be constructed in compliance with ADWR’s well construction standards. There are also restrictions on transporting groundwater away from groundwater basins, and the Adequate Water Supply program evaluates the availability of a 100-year water supply (water adequacy or inadequacy) considering current and committed demand and growth projections (ibid.).

For most areas outside of the AMAs, an adequacy determination from ADWR is not required prior to recording a plat and initiating lot sales. For those areas (non-mandatory adequacy jurisdictions), developers may apply to ADWR for an adequate or inadequate water adequacy determination, prior to initiating the final plat approval process and filing for a public report with the Arizona Department of Real Estate. However, some local jurisdictions (cities, towns, and counties) have passed measures that require a 100-year water adequacy determination prior to completing the plat approval process (mandatory adequacy jurisdiction). The Coconino Plateau Watershed Partnership area of interest is not subject to mandatory adequacy, and new development can take place even with an inadequate water supply determination from ADWR (ibid.).

ADWR is currently working with stakeholders in Northern Arizona to add additional criteria to the adequate water supply rules outside AMAs, which would limit the amount of groundwater that could be extracted from the deeper aquifers in Northern Arizona.

**RECOMMENDATIONS:** For Phase 2 of the Water-Related Ecosystem Services Assessment, see maps created by Sharon Masek Lopez for Task 2 of Phase 1. Ms. Masek Lopez references water rights data from the Arizona Department of Water Resources (ADWR) website. She has also compiled many Geographic Information Systems (GIS) layers that show geographic and legal/political boundaries of each stakeholder. The layers will be delivered in a GIS map package. Options to overlay these maps with the CPWP Water Source and Demand Menu Maps can be used in conjunction with the Northern Arizona Regional Groundwater Flow Model (NARGFM), and/or other already-existing maps made by ADWR and CPWP. Ecosystem services assessments also typically include economic data in order to look at human health and well-being. This might be a useful element to include in the maps.
Questions 4 and 5 - Ranking Water Uses/Values

In order to provide a ranking of uses/values, Questions 4 and 5 are meant to be combined. Question 4 is meant to look at the ways in which stakeholders use/value water. The purpose of Question 5 is to rank those uses/values of water against others. Such rankings allow a better understanding of the nuances in decision making for each organization. Most are guided by the entity’s missions or goals.

Following is a generalized list of rankings. To maintain confidentiality, rankings for stakeholder uses/values are not listed outright. Also included within this list are the total number of times respondents mentioned a use/value during the course of answering this question. Because of the language in the question, they nevertheless considered it, even if they did not rank that use/value. Mentions (M) are useful because they not only show uses/values that are considered beneficial, but they also show uses/values that the respondent might consider detrimental to their organization’s mission. The discussion below and in Questions 9 - 24 further elucidate the considerations for uses/values. See Table 4.

4) In what ways do the people within your region/district/service area/group value water? In other words, what uses or non-uses do you have? See list below.

- Agriculture
- Ranching
- Residential use
- Non-residential use (including Industrial/Commercial)
- Municipal use for recreation within the city
- Municipal use for city operations
- Mining
- Energy
- Navigation
- Recreation
- Various use or non-use values that affect natural environments
- Water treatment
- Flood control
- Conservation for its own sake (cultural conservation)
Conservation for the sake of wildlife
Religious/Spiritual connections
Restoration of natural systems

5) What considerations/uses provide the most weight in this evaluation?
Table 4. Responses to Questions 4 and 5 regarding rankings for uses/values of water, Coconino Plateau Watershed Partnership, Phase 1 Ecosystem Services Assessment.

<table>
<thead>
<tr>
<th>Uses/Values of Water</th>
<th>Number of Times Ranked</th>
<th>Number of Times Mentioned</th>
<th>Ranks + Mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>12</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Recreation</td>
<td>8</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Ranching</td>
<td>8</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Non-residential (Industry/Commercial)</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Conservation for Its Own Sake</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Use or Non-use - Environment</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Religious/Spiritual</td>
<td>5</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Restoration of Natural Systems</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Water Treatment</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Flood Control</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Municipal - City Operations</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Agriculture</td>
<td>2</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Conservation - Wildlife</td>
<td>2</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Municipal - Recreation</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Energy</td>
<td>1</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Mining</td>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Navigation</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Overall, responses to Question 5 highlight the diverse nature for services of water on the Plateau. Respondents show their support for many aspects of a healthy ecosystem and economy. The responses also show how invested the stakeholders are and how generally knowledgeable they are about the region. Clearly, respondents valued residential use as first. In response to this question, one stakeholder mentioned lack of running water in residences in Coconino County. This issue was further addressed in responses to other questions and will be discussed below.
Expanded Comments on Questions 4

Few respondents expanded upon their rankings from Question 4. Possibly part of the reason for the low response is that rapport was still being established early in the interview. Following are highlights of respondent expansions. In general, they are unique responses, rather than reiterative between respondents. A notable response from one stakeholder is that concerns about catastrophic fire are taking precedent over the uses/values for water within the list above. This issue will be further discussed in Question 30.

Recreation

All but two respondents stated a beneficial value for recreation. One respondent was concerned about the environmental costs associated with recreation, and the other stated a preference that water mostly be used by residents rather than tourists. This respondent also stated that municipal use of water for recreation was their lowest preference.

Tourism

In responses to other questions, respondents stated concern over the environmental costs of tourism. One stakeholder addressed the idea of “cultural conservation” as “archeologic” conservation and emphasized that certain government stakeholder entities exist because of tourists. These concerns will also be addressed later in this report. Another respondent addressed the important link between environmental use, recreation, conservation, and spiritual connection.

Flood Control

Three respondents expanded upon flood control. One of these three mentioned the importance of Low Impact Development (LID). Another stressed the importance of flooding for soil production, sediment deposition, and revitalization.

Agriculture/Ranching

Generally, respondents mentioned agriculture and ranching in conjunction. With regard to agriculture, one respondent noted that some local agriculture is important, but that it needs to be appropriate for the region and should apply premium technologies to edible, low water-use crops. Regarding ranching, a respondent addressed the often-competing goals between rural ranching and urban conservation. This is further discussed later. Another respondent identified ranching as a legacy, stated that the survival of ranches prevents the development of wildcat subdivisions, and expressed concern that lot splitting can lead to overuse of resources. Another stakeholder
representative expressed concern that many people in urban areas do not know how or where their food is grown and how it is transported to them.

Culture

Culture is also represented in a couple of different ways, including the cultures that accompany hunting and boating, particularly rafting. Navigation was generally seen as recreational; however, two respondents were aware that the Colorado River is considered a Navigable Water of the U.S.

Industry

With regard to industry, one respondent stated a need for low water-consumptive industry and disagreed with the use of water in any way that is extractive. There were two comments about mining with regard to this question, one ranking mining at the bottom of their list. The other addressed helium fracking in Northern Arizona. Preferences about mining were typically revealed in Question 13 below.

Non-Use Values

There were four comments regarding non-use values. The first respondent addressed in-stream flows, seeps, springs, and creeks. The second respondent addressed biodiversity. The third respondent focused on endangered species mitigation. The fourth respondent addressed recharge and the importance of addressing environmental and water needs up front instead of waiting until late in a project when that consideration might be deemed a restraint.

Questions 6, 7, and 8 - Pricing and Economic Benefits of Water

6) What uses/values of water do you consider when you make decisions about pricing and distributing water?

Five of 25 entities interviewed (20%) actually make decisions about pricing. Among all five of these respondents, there were no preferences for uses/values. Two of the five respondents suggested price as a way to modify consumer behavior, one of the two stating that rates should not only include delivery costs but that water should also be priced to reflect mindfulness and conservation of a finite resource. This respondent stated that costs for outdoor water use should be higher. The second of the two stated that high prices of water often preclude luxury uses of water. This respondent mentioned car washes, pools, fountains, and landscape as extraneous uses.

Of respondents who do not make decisions about pricing, one stated that recreational use and landscape use should be the most expensive.
7) What uses/values of water are most tied to economic benefit for your area?

Seven of 25 (28%) of respondents had significant input with regard to this question. Of those seven, five mentioned tourism specifically, and one implied economic benefit from tourism. Tourism-related activities mentioned here include angling, hunting, and wildlife watching (especially birds). All these recreational activities were also associated with local residents.

One respondent addressed the economic benefit not only to communities, but also to the region.

Also mentioned as economic benefits of water were the following: water to support residents, water to support municipal development, water to support small business, water to support agriculture/ranching, and water to support low consumptive-use industries. These benefits were not ordered in any particular way.

Costs associated with tourism did not arise through this question, but they are addressed below.

8) What other uses/services of water are needed in your area other than the ones you already have?

There were no significant responses for this question.

Recommendations: For Phase 2 of the Water-Related Ecosystem Services Assessment, Dr. Russo recommends that the consultant quantify the economic benefits of water. In addition, she recommends that the Phase 2 consultant should calculate the risk of low economic diversity in case of an economic decline. One respondent stated the importance of also addressing the foundational aspects that make an economy viable (e.g. forest health).

PART 2

Measuring Attitudes and Opinions

The following questions addressed values/uses of water based on a Likert scale, a rating scale that measures attitudes or opinions. The Likert scale allowed respondents to measure the importance of their values and how strongly they disagreed or agreed with this use/value of water for their organization. The respondent was allowed to add information, and Dr. Russo used probing questions to clarify and expand material. Following are the questions. The analyses follow each question.
Part 2—The second part of this interview addresses your current values of hydrologic services.

In this series of questions, I’ll ask how strongly you agree or disagree with the following statements with regard to YOUR region/district/service area/group.

Tell me whether you strongly disagree, disagree, neither disagree nor agree, agree, or strongly agree.

The answers were measured in the following manner:

0 - Not Applicable (N/A)
1 - Strongly Disagree
2 - Disagree
3 - Neither Disagree nor Agree
4 - Agree
5 - Strongly Agree

Question 9 - Agriculture

9) The first group of questions addresses AGRICULTURE. Using the categories I just mentioned, answer the following questions. Tell me whether you strongly disagree, disagree, neither disagree nor agree, agree, or strongly agree.

*Feel free to elaborate on your answers.

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used for local agriculture?

b. How strongly do you agree or disagree that water ought to be used for agriculture WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty-one respondents answered this question. Responses for this question averaged 3.36 on the Likert scale.

Three stakeholders added comments. One stated that their organization supports low water-consumptive agriculture on a small scale.
Question 10 - Ranching

10) Consider the following statements about RANCHING:

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used for ranching?

b. How strongly do you agree or disagree that water ought to be used for ranching WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty-two stakeholders responded to Question 10. Answers for this question averaged 3.44 on the Likert scale. One respondent stated that it depends on how the land is managed as to whether their organization would support ranching. Additionally, this respondent stated that ranching is a tool to use and hold land in a stable state. The respondent asserted that ranching does not hurt plants, produces seeds, and creates healthy soil that holds moisture and does not degrade.

Two respondents expressed concern for raising cattle in the area, one within the context of this question and the other in response to another question. The first expressed unease over manipulating watersheds to make water tanks. This respondent asserted that water tanks affect ungulate habitat and that ranching influences groundwater and wetlands. This respondent also mentioned concern over minimum wage in the ranching business. The second addressed subsidization and suggested analysis of cattle stocking rates.

In response to other questions, four respondents of 25 (16%) stated explicitly that they do not support buffalo/bison ranching on the Coconino Plateau.

RECOMMENDATION: It is recommended for Phase 2 of the Ecosystem Services Assessment that the consultant analyze the appropriate stocking rates under certain conditions.

Question 11 - Industrial and Commercial Use

11) Consider the following statements about INDUSTRIAL AND COMMERCIAL USE:

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used for industry?

b. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA provides commercial use?

c. How strongly do you agree or disagree that water ought to be used for industry WITHIN YOUR REGION/DISTRICT/SERVICE AREA?
Nineteen respondents answered this question. The average of those responses was 2.5 on the Likert scale. Four others stated that their response was dependent upon the kind of industry proposed. One of these stakeholders expressed that industry is necessary, but that manufacturing should be appropriate with regard to low water use. Another asserted that any industry should keep water local, rather than export it. This respondent preferred small industry. A third respondent asserted that the goal was to balance water availability with jobs.

d. How strongly do you agree or disagree that water ought to provide commercial use WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty stakeholders responded to this question, and three others stated that their answer depends on how well commercial businesses manage their water resources. Answers for this question average 3.7 on the Likert scale. One of the twenty respondents stated that commercial business is the key to the economy in the area. Another asserted that hotels are one of the most inefficient users of water. A third respondent focused on other commercial users of water, such as recreational outfitters, gear, and river catering. This respondent also stressed the importance of economic multipliers with regard to river recreation.

RECOMMENDATIONS: It is recommended that Phase 2 of the Water-Related Ecosystem Services Assessment look closely at the benefits and costs of commercial recreation and the economic multipliers associated with this. In addition to addressing water use and water needs associated with commercial recreation, an understanding of economic multipliers can allow communities to build on their strengths, possibly providing low water use industries and appropriate limits for growth in those industries.

Question 12 - Municipal Use

12) Consider the following statements about MUNICIPAL USE:

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used for a residential water supply?

b. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used to support city services?

c. How strongly do you agree or disagree that water ought to be used to for a residential water supply WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty-one respondents answered this question, and the average score was 4.3 on the Likert scale. Two respondents stated that their answer depends on circumstances surrounding this use. Of these two, one stated that the water ought to be healthy. One other response concerned the balance between residential landscape use and drinking
water. This stakeholder stated that residential use ought to be appropriate, so that benefits for wildlife can also be realized.

d. How strongly do you agree or disagree that water ought to be used to support city services WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

This question was originally not included in the interview questions. It was added by request to reflect water that is used for city services, such as municipal pools. Twenty-one stakeholders responded to this question. The average was 3.5 on the Likert scale. Two respondents supported non-polluting uses that were not overly consumptive.

RECOMMENDATIONS: With regard to water use and recreation, values differ greatly. It is recommended that individual stakeholders identify uses that are deemed appropriate by people in their communities and consider conservation plans with regard to each form of recreation and in relationship to other forms of recreation. In other words, the stakeholder might 1) rank the values of certain recreational activities that require water, 2) address what economic benefits they provide and the costs associated with that use and, 3) accordingly construct a plan that provides ways to conserve water among those uses/values while encouraging the greatest economic benefit.

**Question 13 - Mining**

13) Consider the following statements about MINING:

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used for mining?

b. How strongly do you agree or disagree that water ought to be used for mining WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty-three respondents answered this question. The average score for the responses was 2.0 on the Likert scale. One respondent stated that their answer would depend on the type of mining. One stakeholder considered it appropriate to extract flagstone on private property. Another respondent agreed (a Likert score of 4) to sand and gravel mining. Another stakeholder representative stated that, until there is consensus by a community not to mine, there should be a right to extraction.

In response to other questions, five stakeholder representatives also mentioned mining. Four of these responses related to contamination and uranium mining. One of these stakeholders suggested continuing tracer studies in and around the Grand Canyon. Another stated that mining has an almost unmeasurable local economic benefit because of the short-term commitment to communities by mining companies.
**Question 14 - Energy**

14) Consider the following statements about ENERGY:

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used for energy production?

b. How strongly do you agree or disagree that water ought to be used for energy production WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty-one respondents answered Question 14. The responses averaged 1.9 on the Likert scale. One stakeholder representative said that their response was dependent on the kind of energy production. Another discussed the economic benefit of Navajo Generating Station (NGS). A third stated that any type of energy production requires some water, and that overall, energy production depletes and pollutes.

In response to other questions, one stakeholder representative discussed the water-energy nexus and the amount of energy used to pump water within and outside a network.

**RECOMMENDATIONS:** It is suggested that Phase 2 of the Ecosystem Services Assessment look at the water-energy nexus in the Coconino Plateau Watershed Partnership area of interest. Researchers often include food in that nexus. An understanding of these relationships might provide an additional approach to discussing issues about conservation. The following website from the University of California, Davis (UCD), might provide initial insight into this topic: https://cwee.ucdavis.edu/about/water-energy-nexus/

**Question 15 - Navigation**

15) Consider the following statements about NAVIGATION:

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used for navigation?

b. How strongly do you agree or disagree that water ought to be used for navigation WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty-three stakeholder representatives answered this question, and the average for the responses was 2.1 on the Likert scale. Four respondents considered navigation on the Coconino Plateau to be recreation-related; with that definition in mind, these stakeholder representatives generally ranked it high. One respondent stated that the value of navigation as recreation is largely non-consumptive and that the economic benefits associated with boating are high. This person encouraged management of navigation that pollutes or has noise impacts, such as motorboating.
**Question 16 - Recreation**

16) Consider the following statements about RECREATION:

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used for recreation?

b. How strongly do you agree or disagree that water ought to be used for recreation WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Stakeholder representative answers about recreation averaged 4.1 on the Likert scale. There were 23 responses. Two stakeholders specifically stated that, overall, recreation tends to be non-consumptive and non-polluting. One of these two stated that recreation at Snowbowl might benefit Flagstaff, but that it impinges on sacred rites.

**Question 17 - Environmental Uses**

17) Consider the following statements about ENVIRONMENTAL USES:

a. Are you aware that water IN YOUR REGION/DISTRICT/SERVICE AREA is used to support environmental preservation/protection?

b. How strongly do you agree or disagree that water ought to be used to support environmental preservation/protection WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty-three stakeholder representatives answered Question 17, and the average response was 4.1 on the Likert scale. One respondent stated that federal law requires support of the environment. Another stated their organization would rather see spring restoration instead of stock tanks.

**Question 18 - Domestic Use**

18) Domestic use of water is important.

Twenty-three stakeholder representatives answered Question 18, and the average response was 4.1 on the Likert scale. One respondent qualified the response that there should be no lawns.
Question 19 - Export Sales

19) Export sales of water are important.

The average for this response was 2.1. Twenty-three respondents answered the question. One respondent stated that their organization disapproved of water export to Snowbowl. Another noted that the cost of water mining is high on the environment.

Question 20 - Spiritual Purposes

20) Water may be used for spiritual purposes.

Twenty-three respondents answered this question, and the average score for this response was 3.9 on the Likert scale. Three of these stakeholder representatives stated that they support water for spiritual uses as long as they are non-consumptive. Another stated that providing water for spiritual purposes is part of their organization’s mission.

Question 21 - Protected Water

21) Certain bodies of water should be protected.

Responses for Question 21 averaged 4.3 on the Likert scale, with 23 stakeholder representative answers. Three of these 23 people said their response depends on the threats from which the bodies of water are being protected. They stated that it was appropriate to protect bodies of water against pollution or depletion but not from regular use by the public. One suggested a need to define the goal of protection.

Question 22 - Abundance of Water

22) I want my grandchildren/future generations to have an abundant supply of water.

Twenty-four respondents answered this question, and the average for the responses was 4.7 on the Likert scale, the highest of all the questions. Three stakeholder representatives corrected the question to reflect “sustainable” and “healthy,” rather than “abundant.”

Question 23 - Safe Water

23) I want my grandchildren/future generations to have a safe supply of water.

The average of the responses for Question 23 was 4.5 on the Likert scale. Twenty-four people answered the question, and there were no further comments.
**Question 24 - Conservation**

24) Water conservation is important.

Twenty-four respondents answered this question, and the average of the responses was 4.3 on the Likert scale. One respondent in an area with low precipitation expressed that conservation is part of life in many dry areas. This stakeholder representative noted that their examples might benefit other members of the CPWP.

**Question 25 - Legal Framework**

Part 3—Finally, we'll look at your CURRENT abilities to meet your goals.

25) The legal framework I work within allows me to incorporate into water policy the water uses I find important.

Twenty-three stakeholder representatives responded to Question 25, and the average for the responses was 3.4 on the Likert scale. Two respondents made substantial comments with regard to this question. The first addressed the inflexibility of water market transactions and uncertainty in relation to pending adjudications regarding subflow. This respondent also addressed fallowing as a solution to water savings in years of low precipitation. The second stakeholder representative stated, “Having a voice doesn’t mean I have my way.”

**PART 3**

**Open-Ended Questions**

The final twelve questions were open-ended. The purpose of using open-ended questions was to allow respondents a broader response and to offer the opportunity for respondents to address complexity. This section of the interview centered on whether the respondents’ needs are being met and how those needs might be fulfilled. These questions focused on at-risk water resources and their vulnerability to increased water use due to population growth and climate change. These questions did not consider current geographical, technological, or political limitations; rather, they assumed that all things are possible so that the respondent could expound on possible solutions to their concerns.

In order to further inform the responses from these questions, Dr. Russo compiled additional lists of repeated concerns by various stakeholders. (See Appendix A.) These concerns were revealed in varied interview questions, rather than through a single question. The information from these lists makes the data dynamic and allows for
further analysis. Below, it is noted when answers for each question have been expanded using comments made throughout the interview. Percentages are rounded.

**Question 26 - Impediments to Including Stakeholder Values**

26) What, if anything, prevents you from acting in accordance with the values you want to include?

Eighteen of 25 (72%) respondents had substantial answers for this question. Of those 18 respondents, five addressed funding issues through this question. Concerns about staffing, education, and funding for watershed restoration were mentioned specifically. Notably, funding issues were mentioned by all respondents at some point in their interviews.

Eight of the 18 respondents who answered this question perceived Arizona state water law as archaic, inflexible, or otherwise inadequate. Five of the 18 respondents identified bifurcated law as a problem in water management, four specifically and one by implication (e.g. groundwater versus surface water adjudications). One of these stakeholders stated that bifurcated law is a considerable impediment to the judicious management of water resources. In answer to another interview question, one other organization mentioned problems associated with bifurcated law.

Concerns about federal government were also mentioned, but with less frequency. Three of these 18 respondents mentioned issues with specific federal entities, and one concern was non-descript.

Three of 18 respondents expressed uneasiness about the rulemaking moratorium on counties in Arizona. Two of these three noted concern that counties cannot consider water in land use planning, and one of these suggested that all land use planning should be connected with water and that the bar should be raised with regard to conservation in new subdivisions.

Respondents were also concerned about litigation and water rights. Two of these 18 respondents mentioned that lawsuits or threats of lawsuits prohibited their abilities to have open, frank discussions about water.

Concerns about water rights and uncertainty were not mentioned specifically in the responses to this question; however, these considerations arose in response to various further questions in six other interviews. Four of these respondents cited the Navajo-Hopi water rights settlement for the Little Colorado River (LCR). One respondent mentioned adjudications on the Verde River, and the other mentioned litigation and uncertainty broadly.
Other less repeated but substantial comments to this question include the following:

- Two of 18 respondents expressed concerns about the General Mining Act of 1872.
- Two of 18 stakeholders addressed concerns about the Department of Real Estate and the discontinuity in disclosing lack of adequate supply to all future buyers.
- One of the 18 respondents addressed flooding as a social justice issue.
- One respondent mentioned climate variability and early melt of the snowpack as an impediment in addressing the values of the organization they represent.

Question 35 deals specifically with climate change.

Solutions from stakeholders about legislation were broad. Included in this paragraph are responses from other questions regarding legislation. One respondent suggested updating rules and statutes be updated for the entire state. The other stated that legislative changes should reflect current realities.

In response to this question, two stakeholders suggested the creation of an Active Management Area (AMA). The respondents did not specify location, but one noted the need for better information. These two responses correlated with five suggestions that arose from other questions about similar management practices. One of these five suggested groundwater management districts.

**Question 27 - Infrastructure and Equipment Needs**

27) What infrastructure or equipment is currently available? Is the infrastructure and equipment adequate? What else do you need?

Sixteen of 25 (64%) respondents answered this question. Obviously, infrastructure needs differed among stakeholders of water resources across the Coconino Plateau. Four of the 16 respondents specifically addressed funding needs through this question. As stated in the analysis for Question 26, all respondents mentioned funding at some point during their interviews.

Monitoring equipment was mentioned most frequently. Seven of the 16 respondents identified various needs. These include the following: drones, remote sensing cameras, smart metering, well monitoring, and stream flow monitoring. The locations for gauges mentioned in response to this question are Lower Chevelon Creek, Chevelon Creek, and Clear Creek. One respondent mentioned the need for gauges that monitor intermittent streamflow, with a hope to better understand more about the relationship between groundwater and surface water. This concern was reiterated by many stakeholders of water resources and is addressed in depth in Question 29.

Six of the 16 respondents identified new infrastructure needs. One of these respondents expressed a desire to connect purple pipe to all residences. Four other respondents
expressed a need to upgrade aging infrastructure, and another stated a need for more livestock catchments as the climate changes. One respondent stated a desire for less infrastructure. Better monitoring of wildlife was also recommended.

RECOMMENDATIONS: For Phase 2 of the Ecosystem Services Assessment, Dr. Russo recommends that a comprehensive list of continual funding sources be created and consistent timelines for applying for each. She recommends that stakeholders continually approach funding in a collaborative way when advantageous. In addition, Dr. Russo recommends that this list be updated every five years. In order to meet proposal deadlines, it is also recommended that stakeholders create concise infrastructure wish lists and estimated costs in case funding opportunities arise.

Question 28 - Successes, Failures, and Ongoing Efforts

28) What are some significant successful, failed, and ongoing efforts to address the values you hold for certain uses of water?

Sixteen of 25 (64%) stakeholders of water resources responded to Question 28. Two stakeholders mentioned as a success the 20-year moratorium on uranium mining for one million acres, which went into effect in 2012. Other answers varied greatly. Successes include the following:

- installation of no-flush toilets in parks
- partnership/collaboration
- conservation education
- rotational grazing
- no severe regulation
- awareness of recharging with effluent
- modernizing ditch operations including the removal of invasive species
- working with fire officials and using effluent to fight fires, and
- increasing merit given to environmental issues.

Two respondents identified the Navajo-Hopi water rights settlement as unsuccessful to date. One respondent expressed concern about development, long-term water supplies, and disclosure of adequate supply to all buyers. Another identified permanent damage to an area spring.

Two of the 16 stakeholders expressed ongoing efforts. One stated a continual need for rate studies, and the other expressed a need for a better understanding of what the public needs and how to balance that with expertise.
Question 29 - Scientific Information

29) What scientific information would best help you address/conserve your water resources?

Twenty of 25 (80%) of respondents mentioned a need for better understanding of groundwater flow and springs. Nine of these 20 respondents stated that they need a model for their area that would allow them to understand groundwater and surface water relationships and flow. Two of these nine specifically addressed the need for a predictive model based on the Northern Arizona Regional Groundwater Flow Model (NARGFM). Six respondents mentioned groundwater recharge, one stating that, in general, people don’t understand how important recharge is. Another respondent summed up the need for “continuous, accurate, spatially relevant data collection of surface and groundwater.” Only three of the 31 total respondents did not answer this question at all.

Respondents expressed various preferences for monitoring. Seven addressed quality, and two of these specifically mentioned Contaminants of Emerging Concern (CECs). One other respondent stressed the importance of acceptable levels of risk and suggested the standard should be “biologically safe.” One of these seven mentioned a concern with asphalt from roofs, and another of these seven stakeholders addressed arsenic as a problem. Citizen science and consistent funding were mentioned as concerns. One stakeholder suggested widespread groundwater monitoring throughout the Colorado River Basin and throughout the Grand Canyon anywhere there is active use or potential contamination.

Two of the 25 respondents mentioned the importance of measuring precipitation and runoff and another encouraged continual studies to determine the carrying capacity for livestock. This stakeholder also addressed the ability to figure out which stock tanks might be removed so that unused water can contribute to downstream values.

Three of the 25 respondents mentioned that they would like to see more studies about forest treatment and forest health. Question 33 addresses these issues more thoroughly.

Two respondents addressed the continual problems with monitoring. Cost and maintenance were of main concern. One of these two respondents mentioned the need to measure evapotranspiration but stated that monitoring is costly. The respondent stated that this measurement is not addressed in the Four Forest Restoration Initiative (4FRI) or in the Flagstaff Watershed Protection Project (FWPP).

Listed below are site-specific places for monitoring mentioned in this question:

- The Verde River, especially during irrigation season (April through October)
- Lower Oak Creek
- Page Springs
- Downstream of Highway 260 bridge
- Chevelon Creek
- Clear Creek
- Little Colorado River (LCR)
- Watersheds that contribute near Leupp
- Better gauging near Cameron

In other questions throughout the interview, three respondents suggested metering. One respondent hoped to use meters to find unaccounted water, and another suggested sub-metering commercial properties and smart metering for homes.

Two stakeholders suggested studies within the social sciences to determine the reasons people change their behaviors and why they do not. One respondent requested a study on the impacts of constructed waters on wildlife and ungulates.

**Question 30 - Most Critical Issue**

30) What would you say is the most critical issue WITHIN YOUR REGION/DISTRICT/SERVICE AREA?

Twenty-three (92%) of 25 respondents offered substantial answers to this question. Within the context of this question, two stakeholders expressed concerns about funding. As stated above, all stakeholders mentioned funding issues at some point in their interviews. Twelve of these 23 stakeholder representatives discussed scarcity. Three of the twelve addressed scarcity and climate change. One stakeholder representative stated that it is important to deal with “sustainability and understanding the limits of that supply.”

Four of the 23 respondents addressed catastrophic fire, and four others discussed water quality. Two of the quality concerns were related to uranium contamination, one of the quality concerns addressed reclaimed water use at Snowbowl and Contaminants of Emerging Concern (CECs), and the other quality concern linked climate change and water shortage to the inability of water to dilute toxins. Other concerns regarding catastrophic fire are addressed in Question 33.

Two respondents mentioned social justice issues having to do with both water adequacy and flooding, and another stakeholder representative addressed the importance of redundancy. One respondent mentioned the importance of communicating correct information about water and the environment.

For this question, one respondent commented on sustainability and tourism. This matter was also addressed in other various questions throughout the interviews. Five
other stakeholder representatives also expressed these concerns, one of which asked, “How much water do tourists use, and how much does this cost?”

**RECOMMENDATIONS:** Consistent with the CPWP Water Ethic, it is recommended that Phase 2 of the Ecosystem Services Assessment proceed with the Precautionary Principle in mind. In other words, the Partnership should not assume that actions cause no harm. It is recommended that the Phase 2 consultant research emerging technologies that deal with water quality, including CECs, and that this list be updated regularly. The Water Ethic states, “We have an ethical obligation to manage water and use it in a purposeful manner, recognizing our choices and their consequences.”

Further, it is recommended that Phase 2 address divergent values of water services such that stakeholders might agree on the best ways to communicate with the public. This communication would include agreed-upon information about water quantity and quality, as well as environmental issues.

Studies about tourism are recommended above. Additionally, it is suggested that Phase 2 look at redundancy on a regional scale.

**Question 31 - Water Sustainability**

31) Are water resources in your area decreasing or stable? Considering your current needs, are your water supplies sustainable?

Twenty-one of 25 (84%) respondents answered Question 31. Five of these respondents stated that their water resources are stable, 13 said water resources are decreasing, and three explained that it depends on the location in their area or on certain patterns of use. The last three respondents were counted in both lists. One stakeholder representative asserted that the number of visitors to their area affects the threshold of how stable their resources are.

Four of the 13 respondents who saw their water resources as decreasing stated that the decrease in water resources is gradual or mild. Two of these four respondents added that there has been a long-term drying trend since the 1990s, and one of these two added that supporting data includes depth to water measurements and long-term observational streamflow gauges. That respondent stated that the drying trend is evident in meteorological data. A third respondent said it was difficult to tell what is happening, and a fourth stated that water resources are decreasing, but how much depends on the scale of study.

The second part of Question 31 elicited 15 total responses. Six stakeholder representatives said water resources are sustainable, and six stated that they are not. Two respondents said it depends on trends of use. These respondents were counted in both lists. Another stakeholder representative asserted that the real question is
whether demand is up. One of the respondents who answered Yes stated that water resources are sustainable if drought cycles are understood.

**RECOMMENDATIONS:** It is recommended that the consultant for Phase 2 of the Water-Related Ecosystem Services Assessment compile data related to long-term climate, water level, and streamflow in the Coconino Plateau Watershed Partnership area of interest. These data might be informed by climate plans created by water resources stakeholders in the area. Further, these plans might be useful in looking at climate change regionally and possibly developing a comprehensive regional plan. One respondent identified the question as follows: “How much do you have, and how much do you need?

**Question 32 - Water Reuse**

32) Do you have any systems in place for reuse?

There was a total of sixteen responses to this question (response rate 64%). Fifteen stakeholder representatives stated that their organizations do have systems in place for reuse. One respondent said that their organization currently does not, but that plans are being developed. Reuse is required by ordinance in one community. One respondent suggested that public education is necessary to deal with perceptions about potable reuse.

Respondents also initiated conversation about reuse in response to other interview questions. Three respondents mentioned reuse in a general way. One community currently treats effluent from outside its area of jurisdiction and then sells that effluent. Five other stakeholder representatives addressed reuse to potable standards. One of these respondents stated that water must, nevertheless, be returned to the ecosystem, and another mentioned that effluent should be returned for wildlife. Two respondents stated a preference for Direct Potable Reuse (DPR) as opposed to Indirect Potable Reuse (IPR).

**RECOMMENDATIONS:** It is recommended that the consultant for Phase 2 of the Ecosystem Services Assessment study public perceptions of water reuse in the CPWP area of interest. The study might consist of three phases: 1) an initial phase looking at public perceptions of reuse, 2) a public campaign regarding water reuse, and 3) a follow-up to address the ways in which the campaign was effective and the ways in which it was not.
**Question 33 - At-Risk and Vulnerable Water Supplies**

33) What are the most at-risk supplies of water in your area, and what is most vulnerable?

Twenty-four of the 25 (96%) stakeholder organizations responded to this question. Some respondents named more than one vulnerability. Twenty-two of these 24 stakeholder representatives addressed groundwater supply as vulnerable. Nine of these 22 mentioned concerns about seeps and springs specifically for this question. Other questions also elicited responses about the vulnerability of seeps and springs.

With regard to Question 33, eight respondents stated that surface water is the most vulnerable, and three stakeholder representatives addressed water quality issues. One of these respondents mentioned uranium contamination, and the other two comments were general.

Within the context of this question, six of the 24 respondents expressed concern about catastrophic fire. Five of these mentioned the potential severity of post-fire flooding and debris flow due to hydrophobicity after a high intensity fire. One respondent also mentioned concerns with water quality after fire, and another pointed out that most people are unaware of the link between forests and healthy watersheds.

The topic of catastrophic fire was also addressed in other questions by respondents throughout the interview. In addition to the six respondents who talked about this topic through this question, ten other respondents also made comments (during other responses to other questions) about catastrophic fire and its potential consequences. Three of these stakeholder representatives addressed fire and flooding. One respondent expressed concern that any fire could limit water supply, especially in mid-summer. Another added that the fire season now starts earlier due to early snowmelt. This stakeholder representative also expressed concern about the limited number of egress routes. Four others focused on forest restoration. One respondent said that fire knows no boundaries or ecosystems.

In direct response to the possibility of catastrophic fire and consequent flooding, five stakeholder respondents recommended appropriate forest industries for the area. These responses occurred throughout the interview. One respondent stated that forest industries are in the interest of people in the area because they are part of the whole continuum of forest restoration. Another respondent stated that the healthier the industry is, the better the resources are used. Another stakeholder representative stated that ponderosa has the lowest value for wood, with the implication that this would need to be considered when dealing with the economic viability of such an industry.
**RECOMMENDATIONS:** In Phase 1, Task 2 of the Water-Related Ecosystem Services Assessment, Sharon Masek Lopez has created many maps that address the concerns of stakeholders in the Coconino Plateau Watershed Partnership area of interest. For Phase 2 of the Ecosystem Services Assessment, it is recommended that the issues of vulnerability are specifically mapped as such for the Coconino Plateau Watershed Partnership area of interest and that these maps are updated every five years.

It is also recommended that the consultant for Phase 2 of the Ecosystem Services Assessment address various likely fire scenarios and potential responses for each in managing water quality and quantity. Additionally, it would beneficial if the consultant for Phase 2 would assess the feasibility of an “appropriate” forest industry, one that is low water consumptive and has long-term economic viability.

**Question 34 - Changes**

34) What would you do if you could change anything with regard to water resources in your area? What would you need in order to implement that change?

Twenty-one of 25 (84%) respondents answered Question 34, and some had more than one suggestion. Nine of the 21 respondents stated their hopes for legislative changes. Three of these respondents suggested the creation of some sort of active management. One of these identified the creation of groundwater management districts as part of a solution to groundwater management. As stated above, other questions within the interview elicited similar responses about AMA-type solutions.

Four of these 21 respondents stated the need for water reuse. One of these supported the building of a direct potable reuse (DPR) plant that treats to “biologically safe” standards and is powered mostly by renewable energy. Another of these stakeholder representatives expressed uncertainty about the legal climate for reuse and whether the public supports it. This is addressed under the heading Recommendations in Question 32.

Five respondents focused on the need for continual monitoring, and another mentioned the need for social science research that addresses ways to communicate scientific information to the public. Four respondents talked about the importance of continued education. Two stakeholder representatives mentioned that they would like to see more focus on climate change. Within the context of this question, three respondents discussed a need for new or improved infrastructure. In other questions, two more identified this concern.
Other suggestions were broad and are stated below:

- Connect land use planning with water
- Address lot splits and water adequacy with regard to land sales
- Manage flooding issues along the Rio de Flag
- Address mining on Forest Service land and the effects to watershed management
- Stop issuing uranium permits
- Reconsider reclaimed water use/high energy consumption at Snowbowl
- Update the General Mining Act of 1872
- Find a way to have water issues resolved by pertinent parties that hold rights to water
- Get rid of bifurcated law
- Settle tribal water adjudications and Colorado River Upper Basin adjudications

As a response to Question 34, one respondent stated that there is a need in the state to pursue a legal understanding between urban and rural. In other questions, respondents addressed this concern three times. One of these stakeholder representatives mentioned that decision makers should count population density and per capita use of water versus land size.

Four respondents addressed the need to assign a fundamental right to people and ecosystems. One stakeholder representative mentioned the desire to let water flow. Others stated the importance of not treating water like a capital investment and asked for a way of expressing value on water in streams and springs.

**RECOMMENDATIONS:** It is recommended in Phase 2 of the Water-Related Ecoservices Assessment that stakeholders meet in facilitated discussion groups. It is suggested that the discussions be confidential and that stakeholders with both similar and opposing views meet.

It is recommended that four people meet in each group. One such discussion might focus on the dichotomies between the need for monitoring and the desire for less regulation. The goal of a facilitated discussion of this nature is to ensure that a balance is addressed so that, in cases of political change, neither the pursuit of regulation nor the desire to avoid it come back, as one respondent stated, with a vengeance. Another such discussion might focus on the distinctions between rural and urban water needs and use.
Question 35 - Population Growth and Climate Change

35) Is your group/organization doing anything to deal with population growth and climate change? If so, what? If not, why?

Nine of the 25 (36%) stakeholder representatives stated that their organizations are attempting to manage issues that deal with population growth. One respondent stated that their organization opposes water consumptive or poorly planned development projects.

Twelve of the stakeholder representatives said their organizations are managing climate change issues. Three of these respondents mentioned their organizations’ involvement with forest health programs. Another discussed fire emergency plans.

Other respondents referred to flooding, eradication of invasive species, and rainwater harvesting. One stakeholder representative stated a policy goal to uphold the Paris Agreement with regard to climate change and adaptation.

One stakeholder representative stated that their organization is engaged in climate-friendly resource development, low-carbon and energy sources, and policy and protection of ecosystems that protect resilience. Another respondent noted that their organization deals with climate change through education, especially about past civilizations in the area. This stakeholder representative stated that middle school field trips encourage the ability to address a more diverse audience. This respondent also encouraged baseline studies to better understand climate change impacts in the CPWP area of interest.

In response to this question, one respondent stated their concerns about season length. The stakeholder representative mentioned less snowmelt and a change in monsoonal activity: less frequent storms but more intense and leading to major flooding events. This respondent said that land use policy was the best way to manage grazing permits and to address erosion. In other questions throughout the interview, three respondents mentioned the change in season length as a concern about climate change. One of these respondents stated that less winter snowpack reduces recharge. This respondent was concerned about the consequent depth of the R Aquifer. Another pointed out the trend toward less snow and more rain.

In response to this question, one respondent summed up concerns about climate change in this way: “Does this increase the difference between supply and demand?”

RECOMMENDATIONS: It is recommended that the consultant for Phase 2 of the Ecosystem Services Assessment access for the area the climate data referenced by Sharon Masek Lopez in Task 2 of Phase 1 of the Ecosystem Services Assessment.
Questions 36 and 37 - What to See/Additional Comments

36) Is there anything particular in your area you want me to see?

These answers were varied, depending on the respondent and their corresponding region. Dr. Russo visited as many of these sites as possible and has plans to visit more in the future.

37) Is there anything else you want to add that you think is important?

The purpose of this question was to offer the respondent the opportunity to add information not covered in the interview or to reiterate concerns.

Ten of 25 (40%) of the respondents added final remarks. These comments are quite broad.

One stakeholder representative reiterated the importance of a viable forest industry. The respondent stated that, without this industry, forest restoration cannot work.

Another emphasized the value of conservation and the importance of resolving the Navajo Water Rights Settlement in Arizona. Conservation was also addressed by another respondent who stated that low-flush toilets should be mandatory and that building codes should support water strategies. Another stakeholder representative added that climate change (whether man-created or naturally caused) makes a significant impact because it determines sustainability and usable water supplies.

One stakeholder representative claimed that water education should provide an understanding of “embodied water” (e.g. It takes 30 cups of water overall to support the resources for one cup of coffee.) Another respondent addressed access to running water. According to one stakeholder representative, implementation of all successful proposals is challenging but critical.
CONCLUSIONS AND RECOMMENDATIONS

As stated above, the underlying assumption in talking with water managers and certain stakeholders of water resources is that these people represent local public values of water. Interviews of individual stakeholders provide an in-depth and dynamic way to approach water resources management. These interviews often identify and clarify stakeholder needs and ways to approach comprehensive solutions in relationship to other stakeholder uses and values.

Through the interview process, Dr. Kira Russo identified the seven most important concerns of Coconino Plateau Watershed Partnership (CPWP) stakeholders. These concerns are as follows:

1. **Groundwater Flow** - Continued assessment of groundwater flow to inform decision-making for sustainable long-term groundwater use that ensures sufficient water for environmental flows and springs ecosystems,
2. **Wildfire Protection** - Protection against catastrophic fire and subsequent flooding,
3. **Infrastructure Needs** - Identification of water supply and water monitoring infrastructure needs,
4. **Climate Change** - Effects of climate change on water availability for natural systems and human use, especially a) changes in seasonality (e.g. more rain, less snow, earlier spring), b) increased occurrence of extreme weather events, and c) prolonged drought due to temperature increases,
5. **Water Reuse** - Further assessment of water reuse in the Coconino Plateau, including a strong interest in treating for direct potable reuse,
6. **Tourism and Recreation** - Assessment of tourism economic benefits balanced with costs of additional water demand, and
7. **Springs** - How groundwater use, wildfire, forest health, climate change, and tourism affect spring discharge and spring ecosystem health.

Following is a compilation of the recommendations made throughout this report.

**Use Overlay Maps** - For Phase 2 of the Water-Related Ecosystem Services Assessment, see maps created by Sharon Masek Lopez for Task 2 of Phase 1. Ms. Masek Lopez references water rights data from the Arizona Department of Water Resources (ADWR) website. She has also compiled many Geographic Information Systems (GIS) layers that show geographic and legal/political boundaries of each stakeholder. The layers are delivered with this report as a GIS map package. Options to overlay these maps with the CPWP Water Source and Demand Menu Maps can be used in conjunction with the Northern Arizona Regional Groundwater Flow Model (NARGFM), and/or other already-existing maps made by ADWR and CPWP. Ecosystem services assessments also typically
include economic data in order to look at human health and well-being. This might be a useful element to include in the maps.

**Quantify Economic Benefits of Water** - For Phase 2 of the Water-Related Ecosystem Services Assessment, Dr. Russo recommends that the consultant quantify the economic benefits of water. In addition, she recommends that the Phase 2 consultant should calculate the risk of low economic diversity in case of an economic decline. One respondent stated the importance of also addressing the foundational aspects that make an economy viable (e.g. forest health).

**Analyze Appropriate Stocking Rates** - It is recommended for Phase 2 of the Ecosystem Services Assessment that the consultant analyze the appropriate stocking rates under certain conditions.

**Look at Benefits and Costs of Commercial Recreation** - It is recommended that Phase 2 of the Water-Related Ecosystem Services Assessment look closely at the benefits and costs of commercial recreation and the economic multipliers associated with this. In addition to addressing water use and water needs associated with commercial recreation, an understanding of economic multipliers can allow communities to build on their strengths, possibly providing low water use industries and appropriate limits for growth in those industries.

**Recognize the Water-Energy Nexus** - It is suggested that Phase 2 of the Ecosystem Services Assessment look at the water-energy nexus in the Coconino Plateau Watershed Partnership area of interest. Researchers often include food in that nexus. An understanding of these relationships might provide an additional approach to discussing issues about conservation. The following website from the University of California, Davis (UCD), might provide initial insight into this topic: https://cwee.ucdavis.edu/about/water-energy-nexus/

**List Possible Funding Sources** - For Phase 2 of the Ecosystem Services Assessment, Dr. Russo recommends that a comprehensive list of continual funding sources be created and consistent timelines for applying for each. She recommends that stakeholders continually approach funding in a collaborative way when advantageous. In addition, Dr. Russo recommends that this list be updated every five years. In order to meet proposal deadlines, it is also recommended that stakeholders create concise infrastructure wish lists and estimated costs in case funding opportunities arise.

**Regard the Precautionary Principle in All Decisions** - Consistent with the CPWP Water Ethic, it is recommended that Phase 2 of the Ecosystem Services Assessment proceed with the Precautionary Principle in mind. In other words, the Partnership should not assume that actions cause no harm. It is recommended that the Phase 2 consultant research emerging technologies that deal with water quality, including CECs, and that this list be updated regularly. The Water Ethic states, “We have an ethical obligation to
manage water and use it in a purposeful manner, recognizing our choices and their consequences.”

**Discuss Best Practices for Communication** - It is recommended that Phase 2 address divergent values of water services such that stakeholders might agree on the best ways to communicate with the public. This communication would include agreed-upon information about water quantity and quality, as well as environmental issues.

**Address Redundancy Regionally** - Studies about tourism are recommended above. Additionally, it is suggested that Phase 2 look at redundancy on a regional scale.

**Compile Regional Data Regarding Climate Change** - It is recommended that the consultant for Phase 2 of the Water-Related Ecosystem Services Assessment compile data related to long-term climate, water level, and streamflow in the Coconino Plateau Watershed Partnership area of interest. These data might be informed by climate plans created by water resources stakeholders in the area. Further, these plans might be useful in looking at climate change regionally and possibly developing a comprehensive regional plan. One respondent identified the question as follows: “How much do you have, and how much do you need?

**Study Public Perceptions of Reuse** - It is recommended that the consultant for Phase 2 of the Ecosystem Services Assessment study public perceptions of water reuse in the CPWP area of interest. The study might consist of three phases: 1) an initial phase looking at public perceptions of reuse, 2) a public campaign regarding water reuse, and 3) a follow-up to address the ways in which the campaign was effective and the ways in which it was not.

**Map Issues of Vulnerability** - In Phase 1, Task 2 of the Water-Related Ecosystem Services Assessment, Sharon Masek Lopez has created many maps that address the concerns of stakeholders in the Coconino Plateau Watershed Partnership area of interest. For Phase 2 of the Ecosystem Services Assessment, it is recommended that the issues of vulnerability are specifically mapped as such for the Coconino Plateau Watershed Partnership area of interest and that these maps are updated every five years.

**Address Likely Fire Scenarios and Potential Responses** - It is also recommended that the consultant for Phase 2 of the Ecosystem Services Assessment address various likely fire scenarios and potential responses for each in managing water quality and quantity. Additionally, it would beneficial if the consultant for Phase 2 would assess the feasibility of an “appropriate” forest industry, one that is low water consumptive and has long-term economic viability.

**Form Discussion Groups for Certain Stakeholder Issues** - It is recommended in Phase 2 of the Water-Related Ecoservices Assessment that stakeholders meet in facilitated
discussion groups. It is suggested that the discussions be confidential and that stakeholders with both similar and opposing views meet. It is recommended that four people meet in each group. One such discussion might focus on the dichotomies between the need for monitoring and the desire for less regulation. The goal of a facilitated discussion of this nature is to ensure that a balance is addressed so that, in cases of political change, neither the pursuit of regulation nor the desire to avoid it come back, as one respondent stated, with a vengeance. Another such discussion might focus on the distinctions between rural and urban water needs and use.

**Access Climate Data Referenced in Task 2 of Phase 1 of the Water-Related Ecosystem Services Assessment** - It is recommended that the consultant for Phase 2 of the Ecosystem Services Assessment access for the area the climate data referenced by Sharon Masek Lopez in Task 2 of Phase 1 of the Ecosystem Services Assessment.

This concludes the Phase 1 Ecosystem Services Assessment Task 1 report, including annotated bibliography and recommendations. References and Appendix A follow.
References


APPENDIX A - Repeated Concerns

Funding

More Precise Groundwater Modeling
- Springs/seeps as Part of Groundwater Concerns
- Monitoring as Part of Groundwater Concerns
- Metering
- Recharge

Catastrophic Fire
- Post-fire Flooding
- Appropriate Forest Industry for the Area (mentioned in relationship to catastrophic fire)

Infrastructure

Water Equity
- Water Availability

Climate Change/Variability

Water Reuse

Tourism
- Accurate Tourism Numbers

Water Rights and Certainty
- Lawsuits
  - Navajo-Hopi
  - Verde River
  - Other

Legislation
- Bifurcated Law
- Rulemaking Moratorium
- Creation of AMA-type Agreement
- Water Supply Adequacy

Mining

Issues with Rural Arizona
Ranching
   Cattle
   Bison
Wildcat Subdivisions
Conservation
Risk
Education
Golf Courses
Snowbowl
Examples Communities
Standard of Quality for Certain Elements in Water Versus Amount of Water to Dilute
Water Rates
Water/Energy Nexus
Protected Resources/Can’t Use
Mining Act (1872)
Pools
Export Sales
Role of Bureaucracy
Red Gap Ranch
Lack of Redundant Water Supplies Outside Central Arizona Project (CAP) Area
Current State Legislature
Innovations
Potential Solutions
Usable Quotes