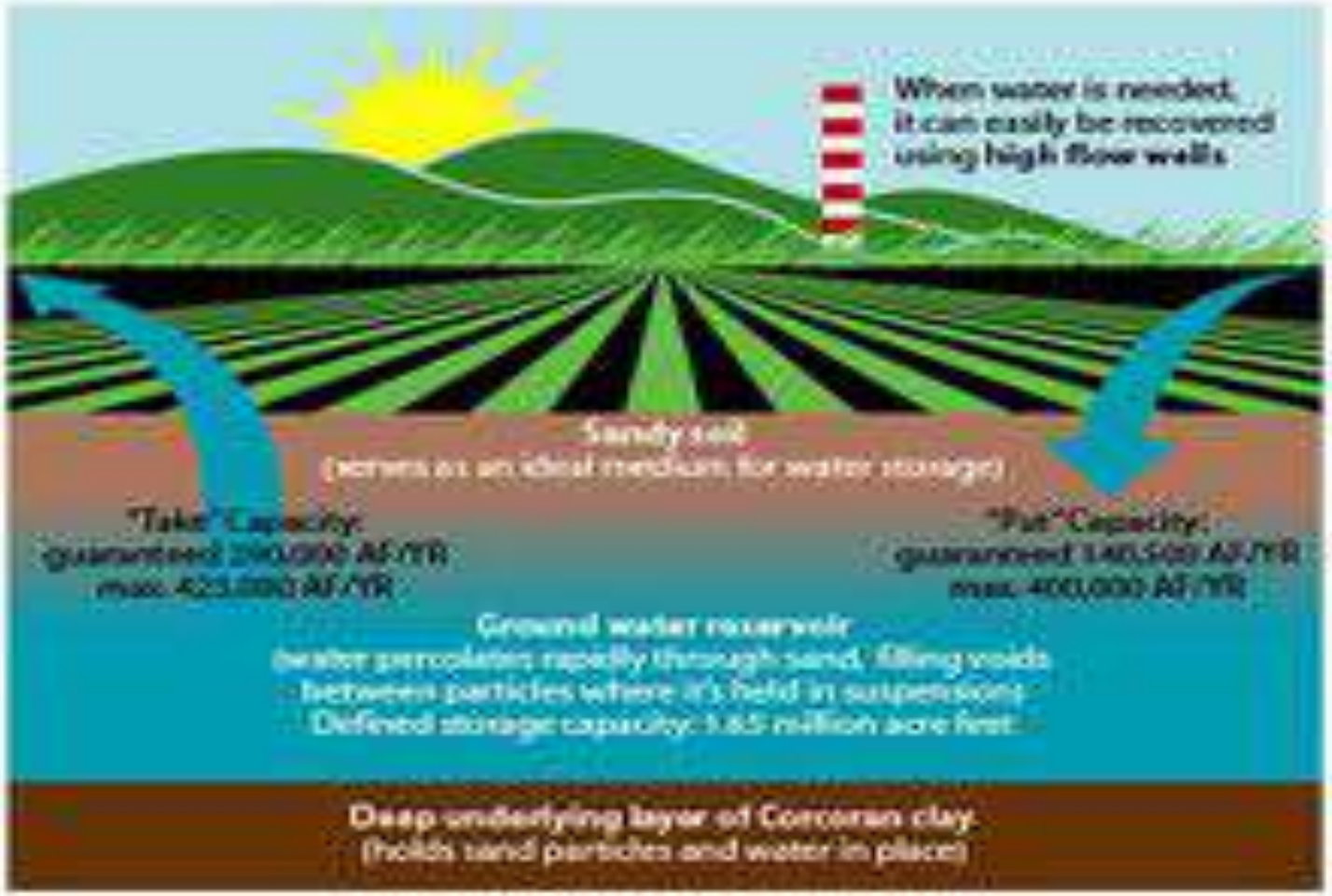
Examples (Storage Bank)

- Semi-Tropic Water Bank District (Groundwater Storage)
  - Pay to put it in
  - Pay to take it out
  - In-lieu component (take surface in lieu of groundwater or visa-versa)
  - Kern Water Bank Authority
    - Pay to put it in
    - Pay to take it out

Semitropic Water Storage District



Coachella Valley Water District's Whitewater Spreading Area constructed in 1973 has infiltrated over 2 million acre-feet. Banks Colorado River Water. Improves groundwater conditions.

Benefits of Water Banks

- Can facilitate non-permanent transfer of water rights
  - Versus buy and dry (agriculture to municipal)
  - However, some agreements have a decades-long time period while others are annual.
- Facilitates the movement of water from those with excess water to those with water shortages.
- Has components of free-market (willing participants).
- Some Water Banks provide the structure for small water right holders to participate who otherwise would be limited.
- Provides for input from many agencies and affected parties.
- Can generate funds for irrigation and water system improvements.

Obstacles to Water Banks

- Cost Issues:
  - Can require new facilities to transfer water.
  - Can require expensive environmental studies due to changes in use and point of diversions.
  - Costs of administration.
- Water accounting can be difficult due to consumptive use and losses.
- Without storage it can only operate on an annual basis.
- Need to have a market with sellers and buyers.
- Need to have laws that accommodate the transactions

Water Banks and Water Law

- Often require changes or amendments to existing laws.
- Reasonable beneficial use is the basis of the water right.
  - What is reasonable?
  - What conservation measures are implied in water right?
  - Intentionally created surplus criteria (USBR Lower Colorado River).
  - In theory water right diversion quantity changes with crops or fallowing (e.g., It is not reasonable to irrigate fallowed land the same as an alfalfa field.).

Water Banks and Water Law

- Is it legally possible?
  - Can water rights change in point of diversion, place of use, and purpose of use?
  - Is groundwater storage of banked water a beneficial use?
  - Does it fit with established decrees and laws?
- Rights of non-used or undeveloped water. Can you lease water you have not used? (Issue for Bear River)
- Will it harm others rights or the environment?

Questions Concerning the Establishment of a Water Bank

- It there a need (i.e. a demand for a water bank)?
- Are there willing participants (buyers and sellers)?
- Are institutions or organizations in place to facilitate water bank transactions.
  - State-based individual-to-individual is handled through the State Engineer's Office
  - Interstate, Compacts, Regional, District, and County can be more complex
- Are physical facilities available to move and/or store water, if not can they be built?

Questions Concerning the Establishment of a Water Bank

- What entity will operate the water bank (existing or new)? Water Conservancy District
- Are participants willing to pay for operation and water costs?
- How is consumptive use and movement of water accounted for?

Risks of a Water Bank

- Not all water banks are successful.
  - May need to establish contracts prior to development of a water bank.
- It is hard to anticipate the demand for water.
- Annual water prices, supplies, and demands can vary drastically from year-to-year.
- Challenges or protests by those who could be impacted.
- Without storage and long term agreements, only operate on an annual basis. This makes planning more difficult.

Example of Price Changes (from Leonard Rice Engineers)

In 2011 the City of Fort Collins rented 15,500 AF of water to agriculture users, with its CBT water renting for $30/AF. Often developers purchase water and turnover to city.

Is a Water Bank for Right for Cache County?

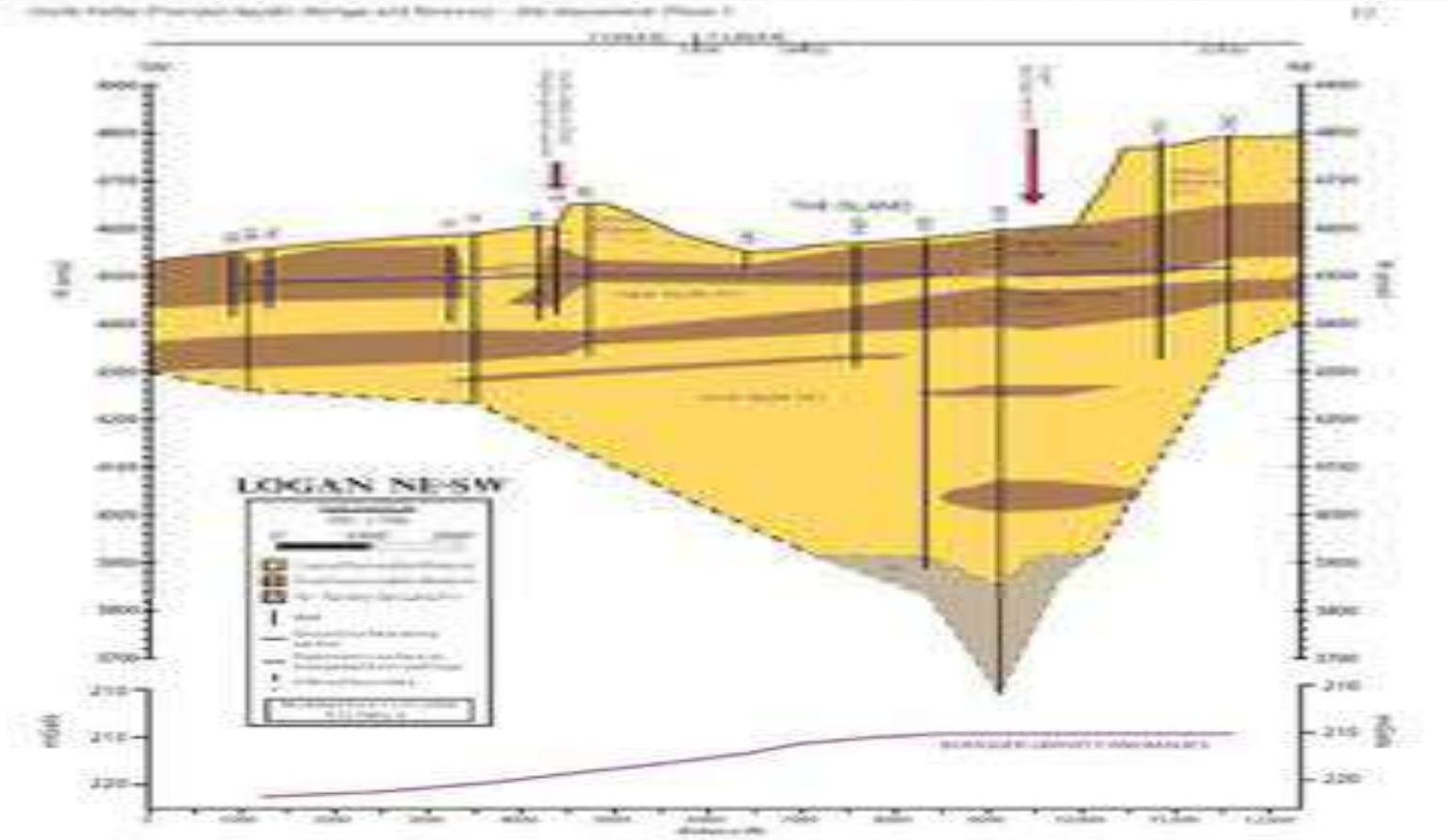
- Should be investigated.
- Question to consider:
  - What needs to occur before a water bank is established?
  - How much will it cost?
  - Who will use the water bank?
    - Only Cache County water users or will it be for other water users to participate in?
  - Can it help protect Cache County's water Bear River's allocation?

Groundwater Artificial Recharge-Recovery

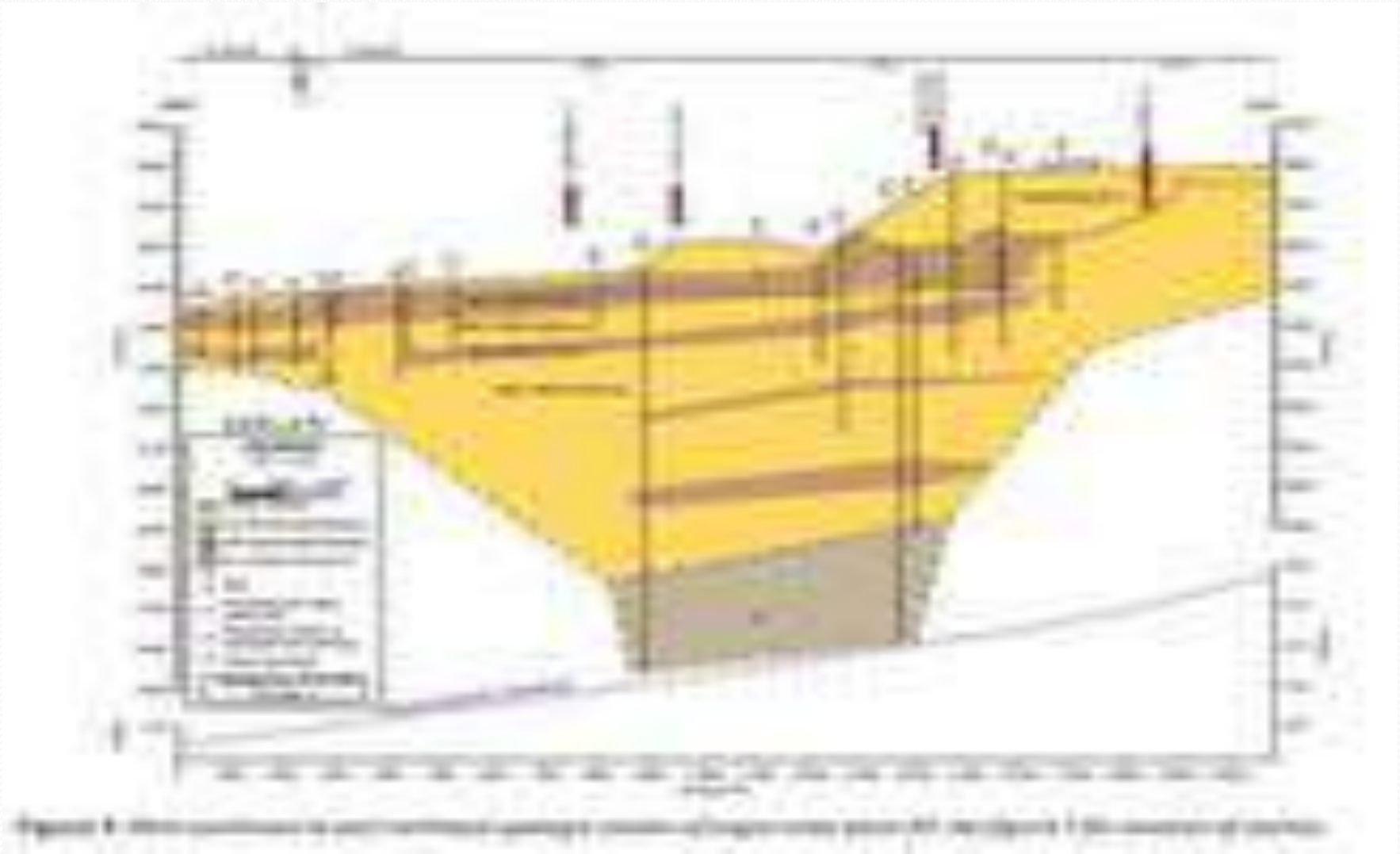
- Groundwater Artificial Recharge-Recovery
  - Small in quantity due to limited available groundwater storage. However, some communities may just need a small quantity of water.
  - Potential lose of water in relationship to water recharged – Recharge recovery ratio (recovered/recharged)

Location Map of Geological Cross-sections near Logan, Utah

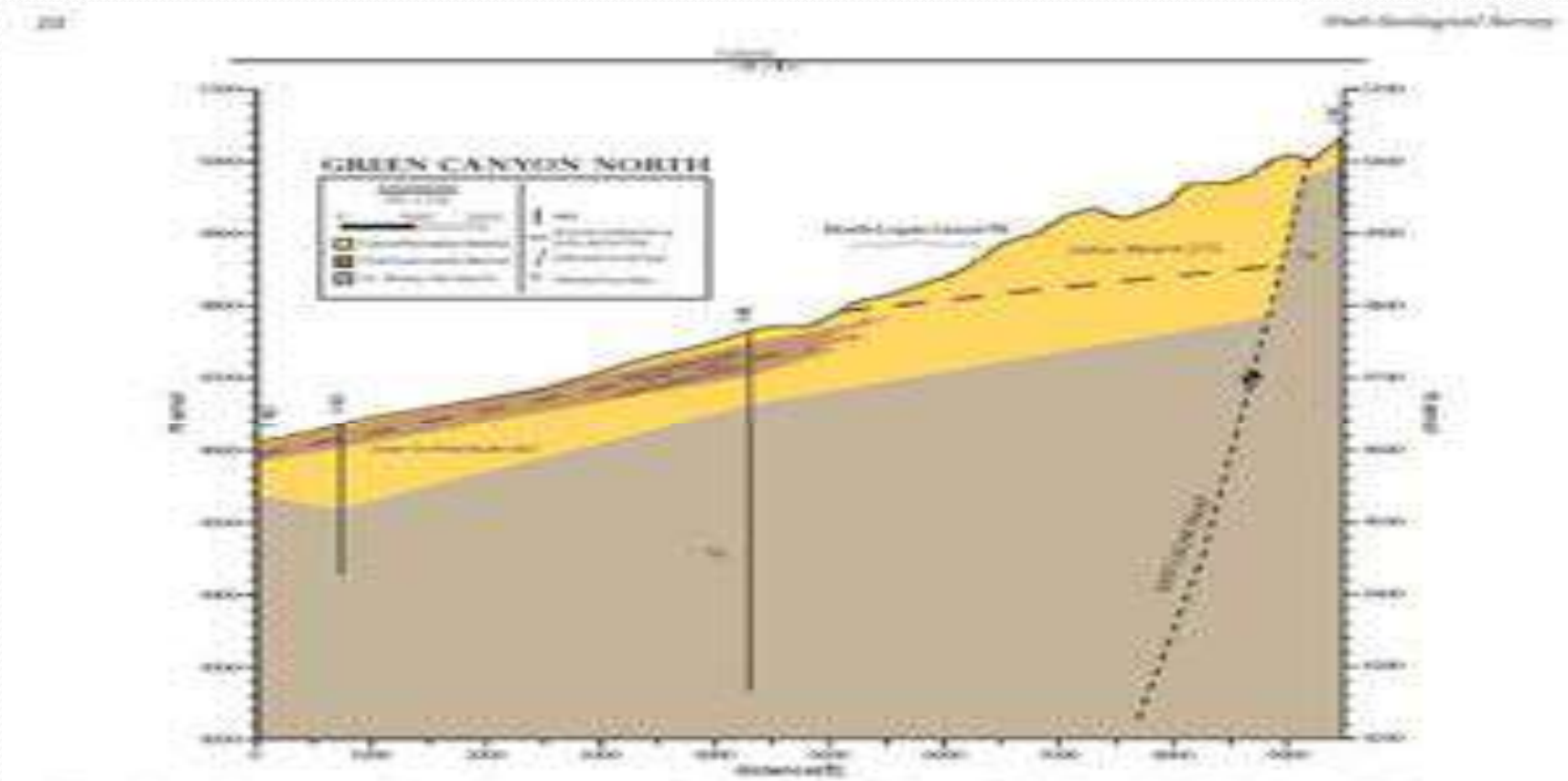
Groundwater Banking in Cache Valley



Groundwater Banking in Cache Valley



Groundwater Banking in Cache Valley



Surface Water Reservoir(s) Bank

- Surface Storage
  - Suitable Reservoir sites
  - Large Capacity (a couple of hundred thousand acre-feet)
  - Water users or general population willing to pay the cost to store water for future use
  - Willingness to engage in multi-year and costly planning

Surface Water Reservoir(s) Bank

- Utah only
  - Including all Wasatch Front
  - Including only Bear River Water Conservancy District, Cache County, Jordan Valley Water Conservancy District, and Weber Basin Water Conservancy District.
  - Water generally moves to higher populations due to ability to pay
  - Can protect Cache Valley's water right
  - The more participants the greater the ability to finance water facilities.

Water Banks and Leasing

- Upstream water rights can generally be used downstream
- Downstream water rights can usually, but not always be used upstream
- Example of the Lower Colorado River
  - California had to cut back from >5 million acre-feet/year to compact allocation of 4.4 million acre-feet. The same scenario could occur on the Bear River.

Bear River Water Market (Water Bank)

- Wyoming, Idaho, and Utah
  - Provides a larger pool of water
  - Provides more storage flexibility (Existing reservoirs on Bear River and Bear Lake)
  - More complicated due to multi-state issues and more water users.
- Cache County only
  - Agreements between towns and cities
  - Agreements between irrigation companies and towns
  - Bear River water development projects
  - Integration of groundwater in the pool of water

Questions

- Cache County Water Bank?
  - Water Supply of 60,000 AF per year
  - Contracts with Municipalities and others (In and out of County)
  - Provides Infrastructure
  - Provides Management
- How is it different than a Water Conservancy District?

Ideas for a Cache County Water Bank

Problem Statement

Cache County has potential problems concerning management of the water rights in the county.

1. Cache County's groundwater is considered fully appropriated, by law, regardless of the hydrological balance. This is because in September 1999 the State Engineer concluded that the mass balance of water moving through Cache County needs to remain constant. Thus the groundwater is considered fully appropriated, because removing any additional groundwater would reduce flows out of the Valley. September 1999 is the 'date certain' that is to be utilized for the bases of water rights in Cache County. Surface and groundwater are both included in the 1999 decision by the State Engineer. If groundwater pumping is to increase, then there needs to be an equivalent decrease in surface water use.

2. The County has worked to get water banking into statute with some success under Title 17 Utah Code; however there is no implemented mechanism that is in place to protect and measure historical water uses that no longer occur in Cache County attributed to the reduction of irrigated lands. Cache County completed mapping the out of production of land converted from irrigation since September of 1999. The mapping shows that during the last 13 years the agricultural irrigated land base in Cache County has decreased 7,661 acres[1]. A portion of the reduced depletion flows out of the county and down the Bear River. During times of controlled distribution of flows this decreases the amount of water Idaho is required to release across the Stateline to meet obligations in Box Elder and Weber Counties. In essence, Cache County has lost the use and value of its historical water use to Idaho and others and it may be difficult to regain the use of the water.

3. Cache County has been allocated 60,000 acre-feet per year for development from the Bear River or its tributaries. Most of this water is not available for use in Cache County without development of water storage to winter flows and spring runoff along with facilities to distribute the water to users. The water is now currently unaccounted for and flows downstream. Additionally, some of the water facilities being planned to utilize the developed water do not facilitate water use in Cache County.

Water Bank Description

A water bank agency is an entity formed to account for and conduct transactions concerning changes in water uses. In Cache County a water bank could be used to help facilitate water leases with or without

[1] Personal Communication with Robert Fotheringham, Cache County Water Manager on January 23, 2013.

additional water storage. The water banking function could be administered as part of a public agency such as a water conservancy district or as an independent agency. The water bank organization would verify and post water that is available for lease. Water users with a need to rent water would contact the water bank organization to begin discussions concerning water leases. The water bank would determine if the water can be delivered to the lessee and help negotiate the contract terms. The value of the water for the downstream users would depend on the competing water uses, because currently Cache County can't store the water and prevent it from going down stream. The water bank organization would also monitor to see that the leased water was not used by water right holder. A procedure and mechanism would need to be in place to facilitate the delivery of water to the lessee. The new use of the water would need to be recognized as a beneficial use or storage for later beneficial use. Another possible function of a water banking agency is to help administer the use of the Utah's undeveloped allocation of the Bear River, although this function could also be administered by another agency.

Objectives

The major objectives of a Cache County water banking agency are listed below:

1. Preserve and account for historical water uses on the tributaries and on the Bear River.
2. Facilitate water leases, transfers, and exchanges.
3. Account for transfers from surface to groundwater diversions or for groundwater to surface water diversions. The bank would allow the exchange of surface water rights for groundwater rights upon reasonable demonstration of no additional depletion and other criteria of needed.
4. Provide a mechanism for the accounting and utilizing of the 60,000 AF allocation of Bear River water to Cache County.

Examples of water that could be deposited into the water bank:

- A landowner with water share or water rights to irrigate 500 acres of irrigated pasture decides to discontinue irrigating and changes the land use non-irrigated wildlife habitat. In this case the historical irrigation consumptive use could be deposited in the water bank.
- Farmers in XYZ Irrigation Company puts 1,000 acres into the conservation reserve program for 10 years. The land is no longer irrigated and the water is not used on other land within the irrigation district. The consumptive use portion of the water right could be deposited into the water bank.
- A developer purchases 160 acres of irrigated land and develops commercial and industrial property that is almost entirely covered with parking lots and building. The reduction on consumptive use could be deposited in the water bank.

Examples of withdrawals from the water bank:

- ABC Irrigation Company (or city) in Cache Valley needs an additional 1,000 acre-feet of water to meet the irrigation demands and facilities are in place for the irrigation company (or city) to receive and use the water. The company or city would purchase the water at an agreed upon price for the irrigation demand. If
- Bear River Wildlife Refuge needs and additional 1,000 acre-feet to enhance wildlife habitat. The Wildlife Refuge could purchase the water and increase their annual diversion by 1,000 acre-feet.
- Weber County Water Conservancy District could use 1,000 acre-feet of water and wants to make sure that the water can be delivered (not diverted by other users). The District could purchase and utilize or store the water.

Water Bank Functions

Functions of a water banking entity can include some or all of the following functions.

- Administration of Water Leases - Establish legal authority through proper jurisdiction to help manage water transactions.
- Enroll or Establish Participants – The water bank would establish its presence and authority and would be recognized with the capacity to help administer water transactions.
- Determine of Reduced Consumptive Use – The determination of amount of water available for lease is the reduced consumptive use. This would require determination of historical consumptive use and in the case of land use changes, the consumptive use of the new land use. This most likely would be the responsibility of the entity leasing the water. The bank would allow the exchange of surface water rights for groundwater rights upon reasonable demonstration of no additional depletion and other criteria of needed.
- Find Willing Leasers and Lessees– The success of a water bank is contingent upon on willing participants that have water to lease and participants to will lease water. If no downstream users lease the water it will flow downstream and be utilized or flow into the Great Salt Lake.
- Verify Water Deliveries – The leased water may travel by many diversions on its way to the lessee. Verifying that water is not inadvertently or intentionally diverted by other is a function that is often assigned to a river commissioner. Communicating information concerning water transactions to river operators is needed to efficiently lease or transfer water.
- Enforce Diversions – When a water lease transaction has occurred there needs to be documentation and enforcement of decreased diversions by the individual or entity leasing the water.
- Facilitate Legal and Regulatory Requirements – This would involve working with governmental agencies to ensure that water leases are legal and in accordance with laws and regulations. There would also be notification, permission, and reporting requirements.

CACHE MASTER WATER PLAN SURVEY (01/16/13)

Question # 1 (Practice Question) - How do you feel about Coach Gary Andersen leaving USU?
a. A man's got to do what a man's got to do
b. I hope the Wisconsin cheese treats him well
c. He really did us wrong
d. I don't care

Question # 2 - What kind of public education do you think is most important?
(11%) a. Improve understanding of Bear River development
(23%) b. To improve water conservation
(54%) c. Improve understanding of water resources and supply and demand projections for Cache County
(11%) d. Improve understanding of different water institutional structures

Question # 3 - How would you categorize the construction of water system interconnects as a strategy?
(9%) a. Poor
(44%) b. Average
(15%) c. Above average
(32%) d. Excellent

Question # 4 - How would you categorize aquifer storage and recovery as a strategy?
(12%) a. Poor
(27%) b. Average
(39%) c. Above average
(18%) d. Excellent
(03%) e. No Answer

Question # 5 - How would you categorize construction of reservoirs as a strategy?
(24%) a. Poor
(21%) b. Average
(26%) c. Above average
(29%) d. Excellent

Question # 6
How would you categorize construction of secondary water systems as a strategy?
(6%) a. Poor
(21%) b. Average
(44%) c. Above average
(29%) d. Excellent

Question # 7 - How would you categorize improving canal delivery systems as a strategy?
(0%) a. Poor
(29%) b. Average
(41%) c. Above average
(29%) d. Excellent

Question # 8 - How would you categorize water banking as a strategy?
(17%) a. Poor
(34%) b. Average
(26%) c. Above average
(23%) d. Excellent

Question # 9 - How would you categorize water reuse as a strategy?

(17%) a. Poor
(23%) b. Average
(40%) c. Above average
(20%) d. Excellent

Question # 10 - How would you categorize surface water treatment for potable uses as a strategy?
(29%) a. Poor
(54%) b. Average
(9%) c. Above average
(6%) d. Excellent

Question # 11 - Should Bear River water allocation be protected for future use in Cache County?
(94%) a. Yes
(6%) b. No

Question # 12 - When should greater efforts be started to protect the Bear River water that is allocated for Cache County?
(85%) a. Now
(3%) b. About 10 years from now
(6%) c. About 25 years from now or even later
(6%) d. We don't need any greater efforts to protect the allocated water

Question # 13 - Should Bear River water be developed in Cache County?
(76%) a. Yes
(24%) b. No

Question # 14 - How should Bear River water development be managed?
(24%) a. Through Cache County
(67%) b. Through a conservancy district
(6%) c. Should not be developed
(3%) d. Other

Question # 15 - How should regional projects be implemented?
(35%) a. Inter-local agreements
(53%) b. Formation of a District
(9%) c. Let Bob Fotheringham take care of it
(3%) d. Other

Question # 16 - If the same institutional structure is kept in place, please indicate your level of concern about water supply within the next 50 years.
(9%) a. Not concerned
(21%) b. Mildly concerned
(41%) c. Concerned
(29%) d. Very concerned

Question # 17 - What should we do to gain a stronger voice on state legislative water issues?
(65%) a. Form a district or districts
(15%) b. Hire a lobbyist
(9%) c. Don't do anything
(9%) d. Other
(3%) e. No Answer

Question # 18 - What institution should be in place to implement needed projects?

(70%) a. Conservancy District
(18%) b. Water Special Service District(s)
(6%) c. County with more resources
(6%) d. Current system (County Water Manager)

Question # 19 - Based on the information that you have assimilated during this master plan, do you now believe water planning and infrastructure development is:
(44%) a. More important
(0%) b. Less important
(56%) c. I feel the same
(0%) d. Other

Question # 20 - Based on feedback given by water entities in a survey conducted in 2007, Cache County learned that there is a desire to protect the allocated 60,000 acre feet for future needs. After going through this process, do you think the preservation of that allocation is:
(6%) a. Less important
(38%) b. Just as important
(12%) c. More important
(44%) d. Absolutely critical

Cache County Water Master Plan

Steering Committee No. 4 Meeting Minutes

4/24/2013

Cache County Water Master Plan
Steering Committee Meeting Minutes
4/24/2013

Meeting Attendees:

- Bill Young – Logan City
- Bob Fotheringham – Cache County
- Bob Oaks – Groundwater Consultant
- Bryan Dixon –Environment
- Chris Slater - J-U-B Engineers
- Clair Allen – Web Irrigation Co.
- Claudia Conder – Pacificorp
- Dan Adams – The Langdon Group
- David Rosenberg – USU
- Don Hartle- Wellsville City
- Douglas Jackson-Smith – USU
- Evan L. Olsen
- Gary Larsen – Millville City
- Jim Williamson – Spring Creek Water Co.
- Joan Degiorgio –TNC
- Jon Hardman – Mendon City
- Josh Runhaar – Cache County
- Joshua Palmer – The Langdon Group
- Kerry Schwartz – Bureau of Reclamation
- L. Bruce Karren – NCCD
- Lee Atwood – Paradise Town
- Lynn Lemon – Cache County
- Marisa Egbert – State DWRe
- Marla Trowbridge – Trenton Town Co.
- Max Pierce – Cornish Town
- Niel Allen –USU Extension
- Randy Eck – Providence City
- Scott Tripp – City Creek Irrigation
- Thad Erickson – Water User
- Todd Adams – Utah Water Res.
- Trevor Datwyler - J-U-B Engineers
- Voneene Jorgensen – BRWCD
- Will Atkin – Water Rights
- Zac Covington – BRAG

Cache County Water Master Plan
Steering Committee Meeting Minutes
4/24/2013

1. **Welcome and Introductions**
2. **Evaluation Overview (See attached meeting slides)**
    a. **Three areas of water use**
        i. Environmental water needs
        ii. Municipal
        iii. Agricultural
    b. **Objective criteria developed through stakeholder feedback**
        i. Water Supply
            1. Adequate storage
            2. Maintain existing irrigation
            3. Efficient use of resources
        ii. Implementation
            1. Collaboration – regional aspect
            2. Cost
            3. Conservation
        iii. Environment
            1. Wildlife
            2. Stream Flows
            3. Long term environmental security
    c. **Priorities**
        i. Make effective use of current water resources
        ii. Secure Bear River allocation
        iii. Increase county wide understanding of water needs
        iv. Determine management structure
    d. **Evaluation**
        i. Based on information gathered during the interviews of key stakeholders and input from the steering committee, a list of objectives was developed with associated metrics
        ii. Many projects were evaluated based on how well they meet the objectives
3. **Master Plan Recommendations** (**Given in no particular order. See descriptions on the second page of attached handout)**
    a. **Aquifer Storage and Recovery (ASR) Projects**
        i. Determine what studies need to be done first
        ii. A lot of studies need to be completed before implementing ASR at a site to verify that the hydrology and geology are good
    b. **Reservoir Development**
        i. Irrigation storage is needed now
    c. **Water Conservation Campaign**
        i. If we were to conserve 25% of municipal and industrial water between now and 2060, we would save approximately 21,000 acre feet a year (based on preliminary projections from Division of Water Resources)
        ii. The Division is finishing a few changes to some of the projections based on feedback from some of the communities

d. **Construct Secondary Water Systems**
    i. This will extend the water supply
e. **Canal Rehabilitation Program**
    i. Developing a program to rehabilitate the canals one segment at a time will make water delivery more efficient to irrigators
f. **Water Banking**
    i. When land is converted from agricultural to residential, less water is used per acre
    ii. A water bank could help utilize this water in areas of the county which are without water
    iii. About 41 square miles of agricultural land is to be converted to residential property in "Envision Cache County" study
    iv. There are other banking benefits beside just doing the conversion from ag to municipal
g. **District Organization Study**
    i. Effort to increase understanding of city council members and other government officials and the residents of the county about water issues within the County
h. **Environmental Water Needs Study**
    i. More data needs to be compiled and evaluated to quantify the environmental water needs and prioritize areas to help us maintain the quality of the environment
i. **Organizational Structure (See second page of attached handout)**
    i. Conservancy District
        1. Protects Bear River water allocation
        2. Provides a stronger voice on legislative issues
        3. Promotes water conservation
        4. Provides representation for irrigators and drinking water users
        5. May function as a water bank
        6. Facilitates cooperation between communities and irrigators for completion of regional projects
        7. Provides a funding source to plan for and help complete needed regional water projects
        8. Allows individual communities and irrigation companies to manage their own water systems
        9. Provides a local governing water board that is 100% focused on water issues
j. **Themes covered during the recommendations discussion included:**
    i. Reservoirs
        1. Could implementing conservation efforts put off the need to develop expensive reservoirs?
        2. Conservation will help but we also have some needs right now for agricultural purposes during the late summer months that require more storage
    ii. Conservancy Districts
        1. Look into the reasons why the conservancy district failed in the past. A lot of the reasons have changed
        2. Taxation without representation was an issue, legislation has changed in this aspect

3. Washington County Conservancy District is an example of a conservancy district where everyone pays in and everyone's interests are met
4. There are multiple ways you can form a conservancy district
5. In order to form one that meets all our needs a study should be done to determine what will serve us the best
6. The Water Statutory Act gives you authority to maintain your infrastructure
7. A major benefit of a conservancy district is that it allows you to plan your water for many years ahead to help protect your water

iii. Canal Improvements
1. As canals are improved, existing trees along the canals may be affected. What kind of evaporation increases would there be along the canals if there was no shade from the trees?
2. An evaluation would need to be done to identify the increase in evaporation losses

4. Recommendation/Next Steps

a. 0-5 Years
i. Conduct district organization study
ii. Evaluate environmental water demands
iii. Form a district based on results of organization study

b. 6-10 Years
i. Start water conservation program
ii. Start banking water rights
iii. ASR studies and development
iv. Planning and studies for above ground storage
v. Secondary water feasibility studies

c. 11-20 Years
i. Planning and studies for above ground storage
ii. Implement irrigation canal rehabilitation program
iii. Construct secondary water systems

d. 21-50 Years
i. Construction of above ground storage reservoirs

e. Themes covered during the recommendations discussion included:
i. Bear River Development Act
1. Covers the entire Bear River drainage basin in Utah (i.e. Logan River, Cub River, etc), not just the water in the actual Bear River
2. Legislation states that 25% of construction and environmental mitigation costs for agricultural uses will be repaid by entities contracting for agricultural water
3. We shouldn't use the "who's paying" reasoning to determine which projects are better
4. There is no stated time frame for when the allocation expires
5. The allocation stays in place but it would be better to have some organization looking over it.

6. The water is likely to be used by someone sometime
7. A plan to put the allocation to beneficial use would help protect it
8. If there's not a huge demand for the Bear River water, there is opportunity to lease water to those who may need it sooner
9. There are cities in Idaho downstream of Palisades reservoir that lease water they own in the reservoir. They use groundwater for their municipal water
10. If we don't develop and use Bear River water here, growth may occur somewhere else

ii. Existing Reservoir Dredging

1. The project team looked into the possibility of dredging some of the existing reservoirs in Logan Canyon, but very little storage could be added at those locations through dredging.

5. Review of survey results

a. Joshua Palmer gave an overview of the survey results

i. The specific projects on the survey are representative of the project types that are proposed
i. 16 steering committee members took the survey
ii. All projects received an above average score
iii. Water banking and water conservation campaign scored the highest

6. Committee Feedback on Recommendations (Themes during the discussion)

a. Recommended Schedule

i. Efforts to conserve water should start as soon as possible
ii. A district would improve conservation efforts after formation
iii. We should do what we can now to start conserving water
iv. Some of the projects might be joint projects and happen at the same time

b. Conservancy District

i. The board members were about 8 for and 2 against a district last time
ii. Dee Hansen called Cache County the best groundwater reservoir in the state, so why haven't we developed it?
iii. Maybe politically we just haven't arrived there yet
iv. In a poll before the last district election 65% of the county was for a conservancy district, then there was some controversy
v. Glad to hear there have been changes to the structure
vi. Realistically if we're going to be able to develop the water (sell, or use), we're going to have to be able to store the water
vii. If we have to raise a lot of funds the only way to do it is through a conservancy district
viii. We need to educate the public that we need a conservancy district so we can compete with the Wasatch front areas that are going to want the water in the future
ix. We need to do a better job of responding to objections
x. The County Council has too much going on to be able to focus adequate attention on the water issues

xi. Water projects and the organizational structure need to be worked on at the same time
xii. A different name like "Modern Water Conservancy District" could be used to differentiate from the water buffalo of the 50's
xiii. Put bullet points of the benefits of the water conservancy district to include in a water bill (very simplified) so people will actually read it and start thinking about it
xiv. Make an effort to include people who are opposed to a water conservancy district
xv. What are other water districts charging per person?
xvi. Timing of election is key
xvii. What is the opposition today?
xviii. Should give personal invitation to opposition to attend an open house
xix. Just the label water conservancy district raises opposition
xx. If people realize that a water conservancy district will allow Newton, Trenton, etc. to have water, we wouldn't have to be building new subdivisions in North Logan etc.
xxi. Some have the notion that a "large machine" comes with high operating costs
    1. After interviewing Jordan Valley and Weber Basin, it has been stated that they have reduced their operating expenses dramatically, so there is little funded by taxes
    2. Past opposition may have been simply that we don't need that large of a management structure
    3. Phase the approach so it's not a huge organization up front.
xxii. Cost benefit – what's it going to cost me, and how am I going to benefit?
xxiii. Educate public that our water is very precious
xxiv. The state legislature could vote in their next session and the Bear River allocation could be gone
xxv. We need to convey to the public that we need to protect the water while we can
xxvi. We don't have a majority in the state legislature
xxvii. Convey the sense of urgency - other counties are already purchasing ROW for Bear River development
xxviii. There are no agricultural people left in the Utah legislature
xxix. Cost to preserve and protect our water – there is a cost to regain our water if we lose it as well. Should put a cost to what happens if we do nothing and lose the water
xxx. Gathering information from the public about their views and using GIS to map where different views are expressed could be a good tool
xxxi. Focus on what's new, why is this needed etc. People may feel like the outcome will be the same so why even show up to vote
xxxii. We now have better information with regards to population growth projections as compared with the times when past efforts to form a district were made
xxxiii. Could look at aerial images to see what the County was like 40 years ago compared with today

c. Bear River Development

i. Bob has been attending Bear River development meetings with the other entities that are listed in the development act

ii. Development act itself needs to be included in the master plan

d. Handout Feedback

i. Too small, make it bigger
ii. Separate info into Bear River Development Act, then water master plan.
iii. Disclaimer that projects, management structures etc. aren't listed by priority
iv. List projects and recommendations in order of importance or even alphabetical so they're not prioritized
v. Change the proposed time frame to 0-5, 0-10, and 0-10 years
vi. State year of water conservation start
vii. Include cost/ac-ft for projects (magnitude)
viii. Include website and number to contact water manager
ix. Demonstrate that we know the opposition
x. List projects that conservancy districts have made possible

e. ASR

i. How many injection wells are there in the state and how successful are they?
    1. There are maybe 10 statewide
ii. Do you have to treat the water when you inject it?
    2. It depends on the water quality as well as the aquifer it's going into.
    3. A good example is Brigham City. They inject water from Mantua into their well and improve the quality of the water in the well

7. Master Plan Next Steps

a. Complete master plan draft

b. Present master plan to County Council in work session

i. We are considering going before the council on May 28th but nothing is scheduled yet
ii. Steering Committee would like to know when the County Council work session will be held

c. Integrate council comments

d. E-mail a copy of the draft report or post it on the ftp site for steering committee review

e. 20 day comment period on draft after release for steering committee

f. Final Revisions

g. Release Final Master Plan

CACHE COUNTY WATER MASTER PLAN — RECOMMENDATIONS

THE PURPOSE of the Cache County Water Master Plan is to evaluate existing water resources and demands, determine future demands, and educate and build consensus to create a plan for the future. The following recommendations are based on feedback from several municipal, irrigation, environmental and state representatives combined with technical analysis.

AREAS OF FOCUS

- Environmental
- Municipal
- Agricultural

W.I.S.E.

PRIORITIES

WATER
Management Structure

INCREASE
County-Wide Understanding of Water Needs

SECURE
Cache County's Bear River Allocation

EFFICIENT
Use of Current Water Resources

RECOMMENDATIONS

- Conservancy District
- Aquifer Storage & Recovery (ASR)
- Reservoir Development
- Water Conservation Program
- Public Education
- Water Banking
- Environmental Studies

RECOMMENDATIONS: PROJECTS:

- ASR Projects
- Reservoir Development
- Water Conservation Campaign
- Public Education Campaign
- Construct Secondary Water Systems
- Canal Rehabilitation Program
- Water Banking

STUDIES:

- District Organization Study
- Environmental Water Demands Study

ORGANIZATIONAL STRUCTURE:

- Conservancy District

DETAILS ON BACK

PROJECTS:

Aquifer Storage and Recovery (ASR) Projects: ASR stores excess spring runoff water in the ground to be removed for use during dry periods.

- Uses and protects allocated Bear River development water (5,000 to 20,000 acre feet)
- Supplements ground water
- Less costly than storing water above ground
- Provides additional water supply for many communities and irrigators

Some sites that could be used for ASR are located near the mouth of Green Canyon, in the Logan Island area, near Providence Canyon, and in Millville along the foothills.

Reservoir Development: Build above ground reservoirs to store excess spring runoff water. Reservoirs are used to meet late season irrigation needs for areas that are currently irrigated, environmental needs and future drinking water needs.

- Uses and protects allocated Bear River development water (Up to 60,000 acre feet)
- Provides additional water supply for many communities and irrigators
- Increased late summer flows for habitat in rivers downstream of the reservoirs

Water Conservation Campaign: Campaign to reduce water use in the county by 25% by year 2060. Efforts may include holding large water user workshops to promote conservation.

- Saves 21,000 acre feet of water per year in Cache County by year 2060
- Conserves energy

Construct Secondary Water Systems: Install pressure irrigation pipes from existing canals to homes that are using drinking water for the watering of yards. Promote secondary water systems for areas that are developed in the future.

- Allows for existing drinking water systems to serve more future growth demands on potable water

Canal Rehabilitation Program: Line, pipe, or restore prioritized segments of existing canals each year.

- Benefits many water entities
- Creates more efficient delivery of water to irrigators

Water Banking: A water bank is an institution or part of an institution with a goal to move water to where it is needed most within a given region. For example, in Cache County agricultural land is being developed. Once a piece of agricultural property is developed, less water is needed to meet the demands of that land. The unused water runs down the rivers and out of the County. The rights to that water could be banked for another water user in the region to buy or lease.

- Protects Bear River allocation rights
- Keeps existing water rights for use in Cache County
- Maintains future supply of water rights for Cache County residents
- Helps water users more easily understand the worth of water

STUDIES:

District Organization Study: Meet with county and city leaders and local state representatives to present findings of the master plan and present options to form a district. May also include open houses, and town hall meetings to answer questions and find out concerns. Evaluate possibility of forming a district and options for formation of a district.

- Informs local leaders and county residents of the Cache County water situation and future needs
- Builds consensus for future water institutional structure

Environmental Water Demands Study: Locate and prioritize wildlife habitat areas and their water demands.

- Helps maintain or improve the quality of our environment
- Helps maintain or improve wildlife habitat

ORGANIZATIONAL STRUCTURE:

CONSERVANCY DISTRICT

An organization created for the purpose of providing the conservation and development of water on a regional level.

- Protects Bear River water allocation through planning and development
- Provides a stronger voice for Cache County on water legislation issues
- Promotes water conservation
- Provides representation for both irrigators and drinking water users
- May function as a water bank
- Facilitates cooperation between communities and irrigation companies to complete regional projects
- Provides a funding source to plan for and help complete needed regional water projects
- Allows individual communities and irrigation companies to manage their own water systems
- Provides a local governing water board that is 100% focused on water issues

NEXT STEPS:
Years from now

0-5
Conduct district organization study
Evaluate environmental water demands
Form a district based on results of organization study

6-10
Start water conservation program
Start banking water rights
ASR studies and development
Planning and studies for above ground storage
Secondary water feasibility studies

11-20
Planning and studies for above ground storage
Implement irrigation canal rehabilitation program
Construct secondary water systems

21-50
Construction of above ground storage reservoirs

This schedule is an estimate and could change based on funding availability and other factors.

Appendix 2-D

Reports to County Council

Summaries for three updates to the council on the master plan progress.

i: Cache County Council Meeting Notes –May 2012

ii: Cache County Council Meeting Notes –July 10, 2012

iii: Cache County Council Meeting Notes –December 11, 2012

CACHE COUNTY
WATER MASTER PLAN

Cache County Water Master Plan-May 29, 2012

- Working with Bob Fotheringham for the past three or four months on the Master Plan. The Plan will be completed next summer.

PURPOSE

- Outline how to utilize and conserve water resources in the County as efficiently as possible now and in the future.

GOALS

- Evaluate existing and future water resources and demands
- Educate and build consensus
- Create a plan for the future
- Recommend methods to manage water resources in the county

BEAR RIVER

- The Bear River Development Act passed in 1991 gave direction for the Division of water resources to "develop the surface waters of the Bear River and its tributaries."
- How should the Bear River water resource be used/developed in Cache County and how should it be managed?

CURRENT PROJECT STATUS

- Gathering information
    - Stakeholder interviews (Stakeholder Input)
        - Current needs and challenges
        - Future needs and practices
        - Bear river development
        - How should water be managed in Cache County?
    - DWRe compiling the current and future water resource and demand information. Technical Supply and demand data)
        - I talked to Todd Adams today, they have collected the current 2010 individual water system water use information and will have the current report done very soon.
        - The water use projections will be based on the projections in the 2010 census projections that will come from the Association of Bovernment and will then be given to the GOPB. That will be done sometime around the middle of July.

FUTURE STEPS

- Create a plan for the future through an analysis of alternatives based on future projected shortages, stakeholder input and by evaluating alternatives using a weighted criteria matrix.

- We will have key stakeholder meetings about every three months to evaluate alternatives and options moving forward.
- Based on the key stakeholder input and technical data, we will develop a recommendation for the organizational structure needed to manage water resources in the county and to gain a greater voice with the state legislature on water issues

SCHEDULE

- Key stakeholder meetings and presentations to the County Council to be held quarterly throughout the master plan.
- Recommendations – March 2013 to April 2013 Review recommendations with stakeholders - culinary water systems, irrigation systems, county council)

J·U·B ENGINEERS, INC.

1047 South 100 West, Ste. 180, Logan, UT 84321
p 435 713 9514 f 435 713 9503 w www.jub.com

Memo

To: Cache County Council

From: Chris Slater

CC:

Date: 7-10-12

Re: CCWMP – Progress Update

The Cache County Water Master Plan (CCWMP) is progressing. We have completed interviews with 37 project stakeholders to gather feedback with regards to water issues in Cache County. The interviews focused on understanding the stakeholder's needs, priorities and feelings with regards to the following four areas:

- Past and current water challenges and water situation
- Projected future water needs and water improvement strategies
- Bear River Development Act
- Management of water in Cache County

Some general themes that have come from the interviews are:

- There is not enough current irrigation water storage
- Many of the communities on the west side of the valley have more water challenges than the communities on the east side
- There is a need for a greater understanding of the Bear River Development Act
- Cache County needs to have a stronger voice on water issues

We are now organizing a steering committee made up of many of the people that were interviewed along with some other stakeholders identified through the interview process. This steering committee will meet four times over the next year at master plan milestones to establish group goals and provide feedback. The four meetings are planned as follows:

1. **Kickoff Meeting -** Overview of the 37 stakeholder interviews (cities, irrigators and others)

2. **Technical Meeting -** Review Division of Water Resources Supply and Demand Forecasts

3. **Problem Solving Session -** Prioritize future efforts and outline water strategies

4. **Review of Draft Water Master Plan –** Gather feedback from the steering committee on the final Master Plan

The kickoff meeting will be held in the Cache County Administration Building in the large room on the first floor. The meeting will be Wednesday July 18th, from 11:00 am to 1:00 pm. We want to invite one or two County Councilman to attend our steering committee meetings.

Please let us know if you have any questions.

J·U·B ENGINEERS, INC.

1047 South 100 West, Ste. 180, Logan, UT 84321
p 435 713 9514 *f* 435 713 9503 *w* www.jub.com

Memo

CACHE COUNTY WATER MASTER PLAN

To: Cache County Council

From: Chris Slater

CC: Bob Fotheringham

Date: 12-11-12

Re: CCWMP – Progress Update

The Cache County Water Master Plan (CCWMP) is progressing. We last came before the council in July to tell you a little about the plan and a steering committee that has been formed to provide guidance as we complete the master plan. The steering committee is made up of representatives from the communities, the irrigation companies and other key water experts in the county. The steering committee has now met twice and will meet again in January or February.

The steering committee first met on July 18, 2012 and:

- Identified the roles and responsibilities of the committee
- Set ground rules for communication
- Set goals - The goals of the committee are to provide guidance for:
    - Determining how to confront future water challenges and opportunities
    - Planning of future reports, actions and projects
    - Identifying the organizational structure to manage water in the County
    - Educating and building consensus with stakeholders
- Reviewed key themes that came from key person interviews

- Received input from the steering committee. Some of the input helped us identify things that should be discussed at the second meeting including:

    - Bear River Water Development
    - Water Management Options

The second steering committee meeting was held on October 25, 2012. The following items were part of the meeting.

- Review of preliminary water supply and demand data from the Division of Water Resources (DWRe)

    - Governor's office of planning and budget has changed the population projections for Cache County. We are currently working with Bear River Association of Governments and the Division of Water Resources to update the projections county wide and then community by community.

- Bear River development update from DWRe, Eric Millis

- Expert panel to answer questions about water management options. The panel was made up of:

    - Tage Flint (General Manager – Weber Basin Water Conservancy District)
    - Mark Anderson (Attorney for Utah Association of Special Service Districts)
    - Voneene Jorgensen (General Manager – Bear River Water Conservancy District)
    - Legrand Bitter (Executive Director of Utah Association of Special Service Districts)

At the third steering committee meeting we will:

- Hear an updated report from DWRe on the water supply and demand projections.

- Talk about water strategies to implement to help meet the future needs

- Learn more specifically about:
    - Aquifer Storage and Recovery (ASR)
    - Bear River Development
    - Water Banking
    - Public Education

- Conduct an instant poll of the steering committee members to see how they feel about some key issues after completing three of our committee meetings.

We will hold a fourth steering committee meeting this spring. The meeting will be used to present a draft master plan to the committee and receive feedback on the draft conclusions and recommendations.

More detailed information about the master plan and the steering committee meetings can be reviewed by accessing an ftp site using the following information:

Site: ftp://ftp.jub.com
Username: CCWMP
Password: MasterPlan1

Appendix 2-E

Additional Meetings

Presentation slides from two Northern Utah Mini Water Conference presentations and notes from two meetings held with USU staff members.

i: Northern Utah Mini Water Users Conference Presentation 2012

ii: Northern Utah Mini Water Users Conference Presentation 2013

iii: USU Staff Meeting November 7, 2012

iv: USU Staff Meeting November 30, 2012

CACHE COUNTY
WATER MASTER PLAN

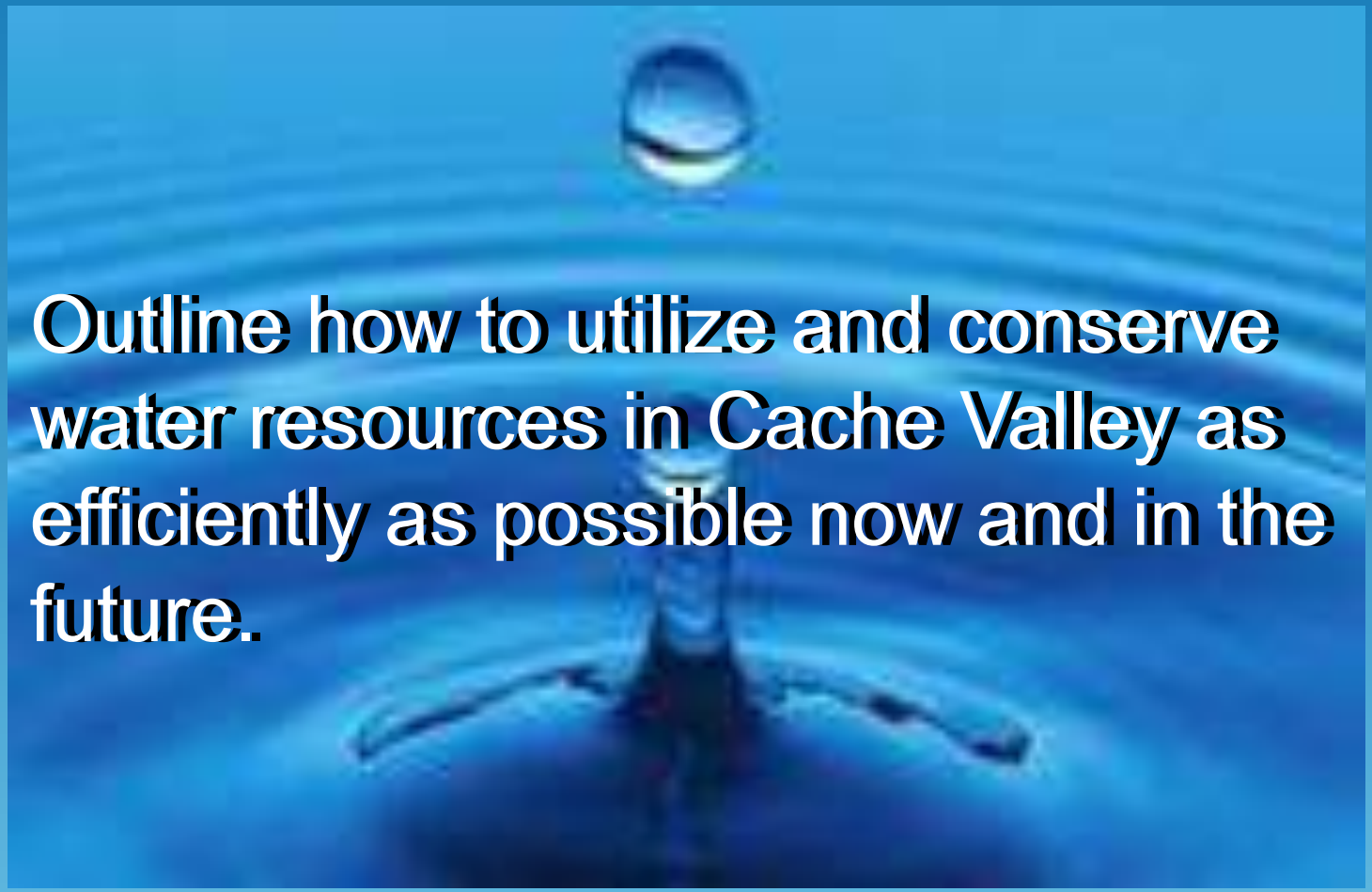
Cache County Water Master Plan

www.loganutah.org

Cache County Water Master Plan

Discussing Water Rights…. A Western Pastime

MASTER PLAN PURPOSE



MASTER PLAN GOALS

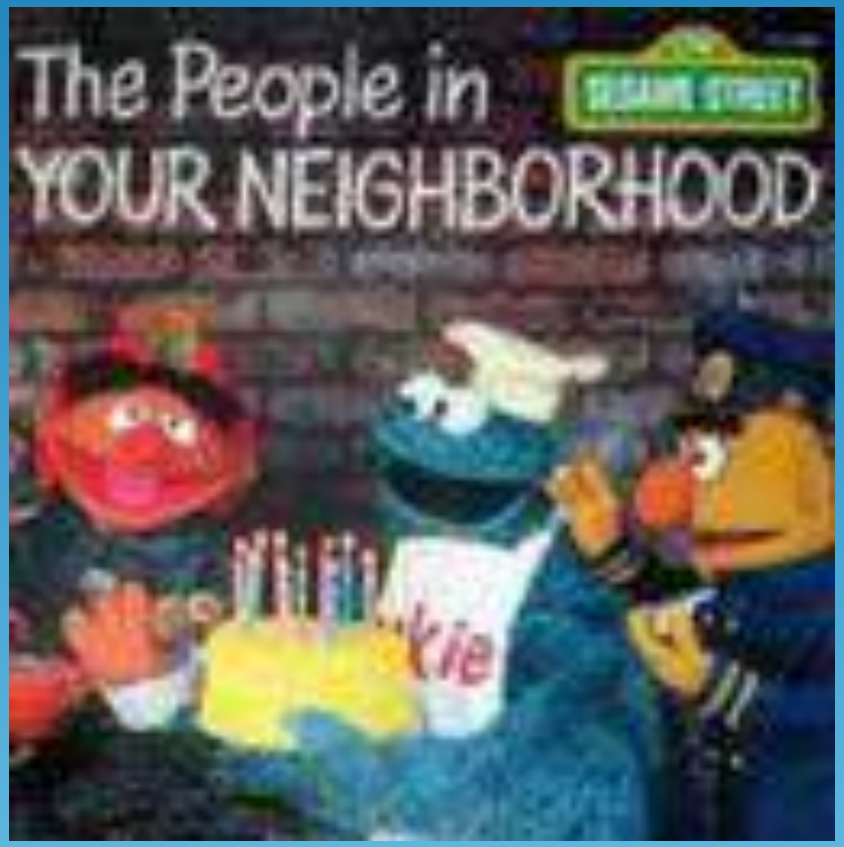
- Evaluate existing water resources and demands
- Determine future water demands
- Educate and build consensus
- Create a plan for the future
- Recommend methods to manage water resources in the county

BEAR RIVER: An Important Resource

MASTER PLAN SCHEDULE

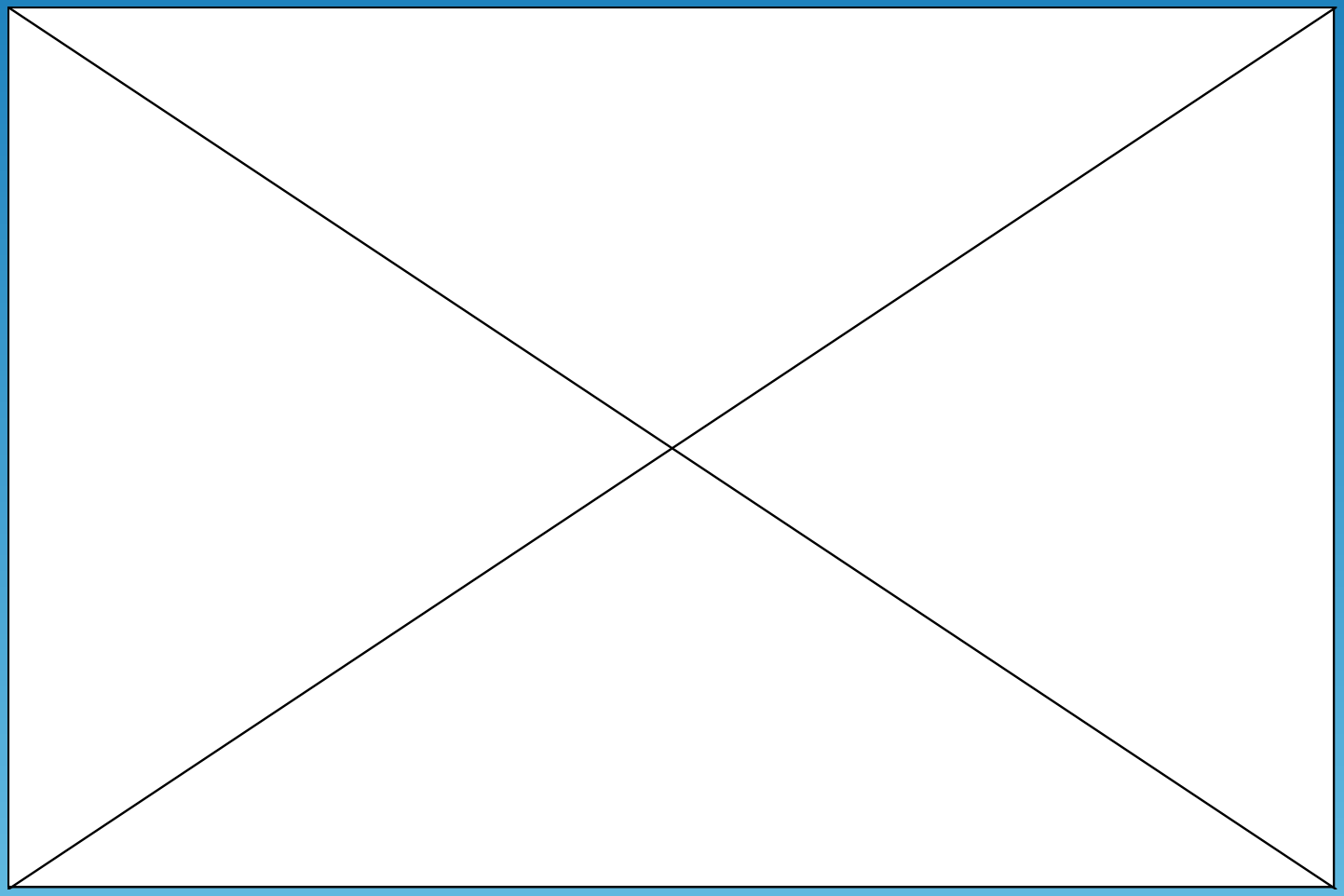
March - June 2012	• Gather resource data • Stakeholder interviews
June 2012 – February 2013	• Analysis of alternatives using objective criteria
March – April 2013	• Review recommendations

Water Panel

Who Are 

?

Is the Glass Half Full or Half Empty?

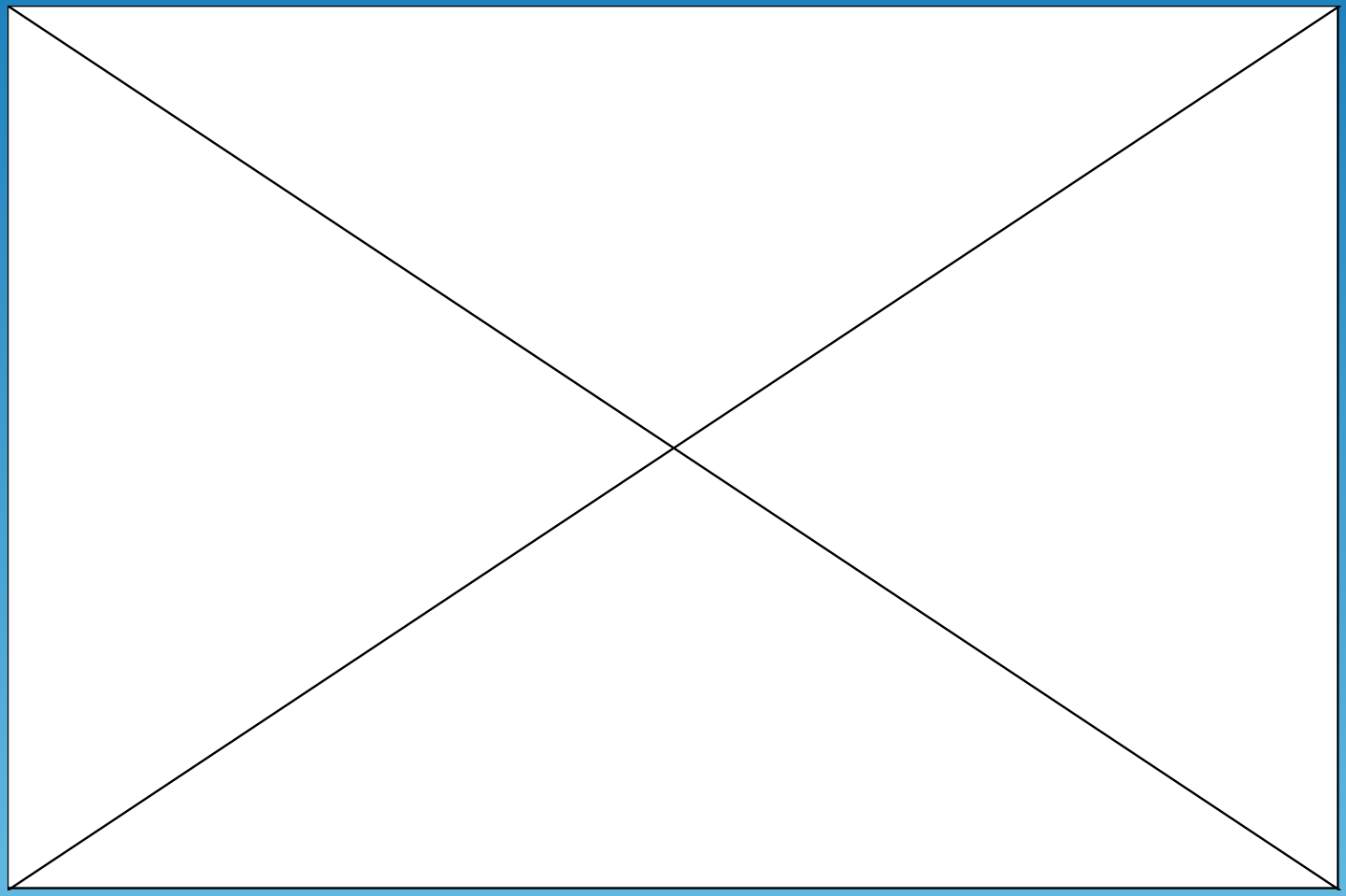


Priorities Discussion

What are the biggest challenges to water stability in Cache County within the next 20 years?

What are the solutions to these challenges?

What factors do you think will play the greatest role in water stability over the next 20 years?



Key Questions To Consider

- How should Bear River water be developed in the future?
- How can we build consensus among water users?
- How can we be heard by the state legislature on water issues that are important to us?
- How can water improvements be funded?

Thank You!

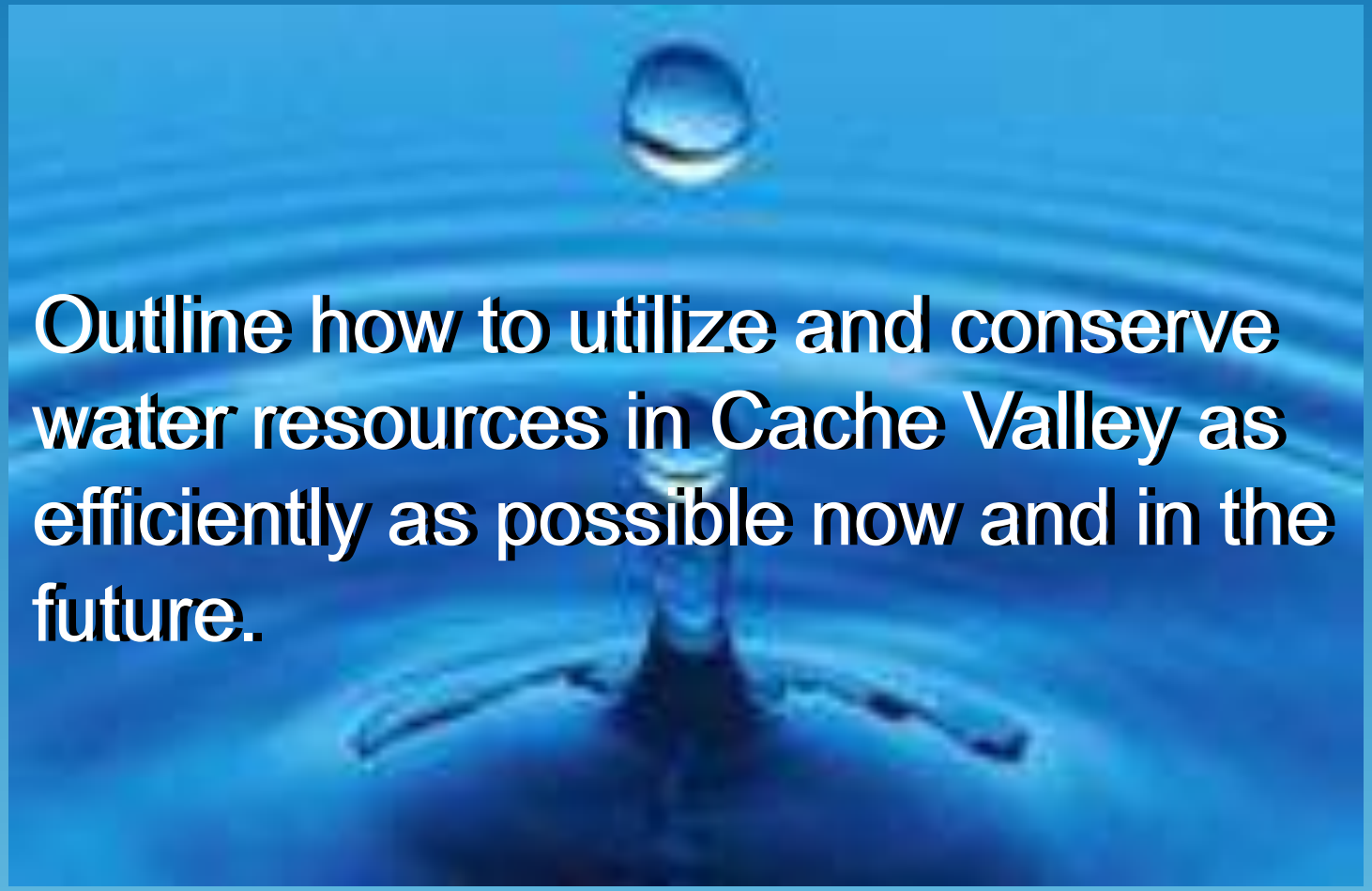
CACHE COUNTY
WATER MASTER PLAN

Northern Utah Mini Water Conference

April 4, 2013

CACHE COUNTY
WATER MASTER PLAN

MASTER PLAN PURPOSE



CACHE COUNTY
WATER MASTER PLAN

Efficient Use of Water Resources

CACHE COUNTY
WATER MASTER PLAN

MASTER PLAN GOALS

- Evaluation of water supply and demands
- Educate and build consensus
- Create a plan for the future
- Recommend methods to manage water resources in the county

CACHE COUNTY
WATER MASTER PLAN

MASTER PLAN PROCESS

- Evaluate existing water resources and demands
- Stakeholder involvement
  - Interviews
  - Formation of steering committee

CACHE COUNTY
WATER MASTER PLAN

KEY OBJECTIVES

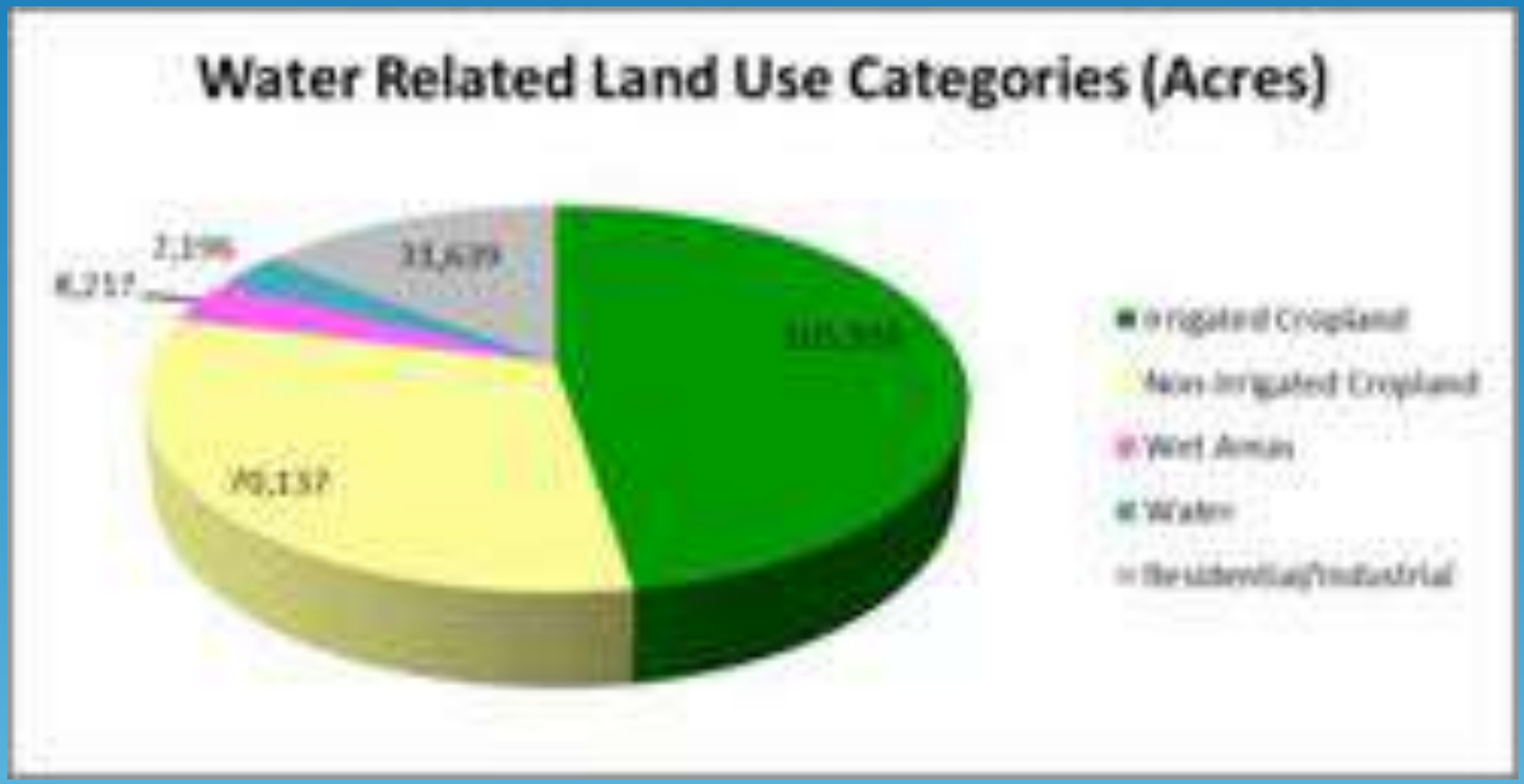
- Provide reliable water supply
- Protect Bear River allocation
- Promote collaboration
- Educate the public
- Protect the environment

Agricultural Water

- Provide reliable water supply
  - Agricultural

Agricultural Needs

Water Related Land Uses

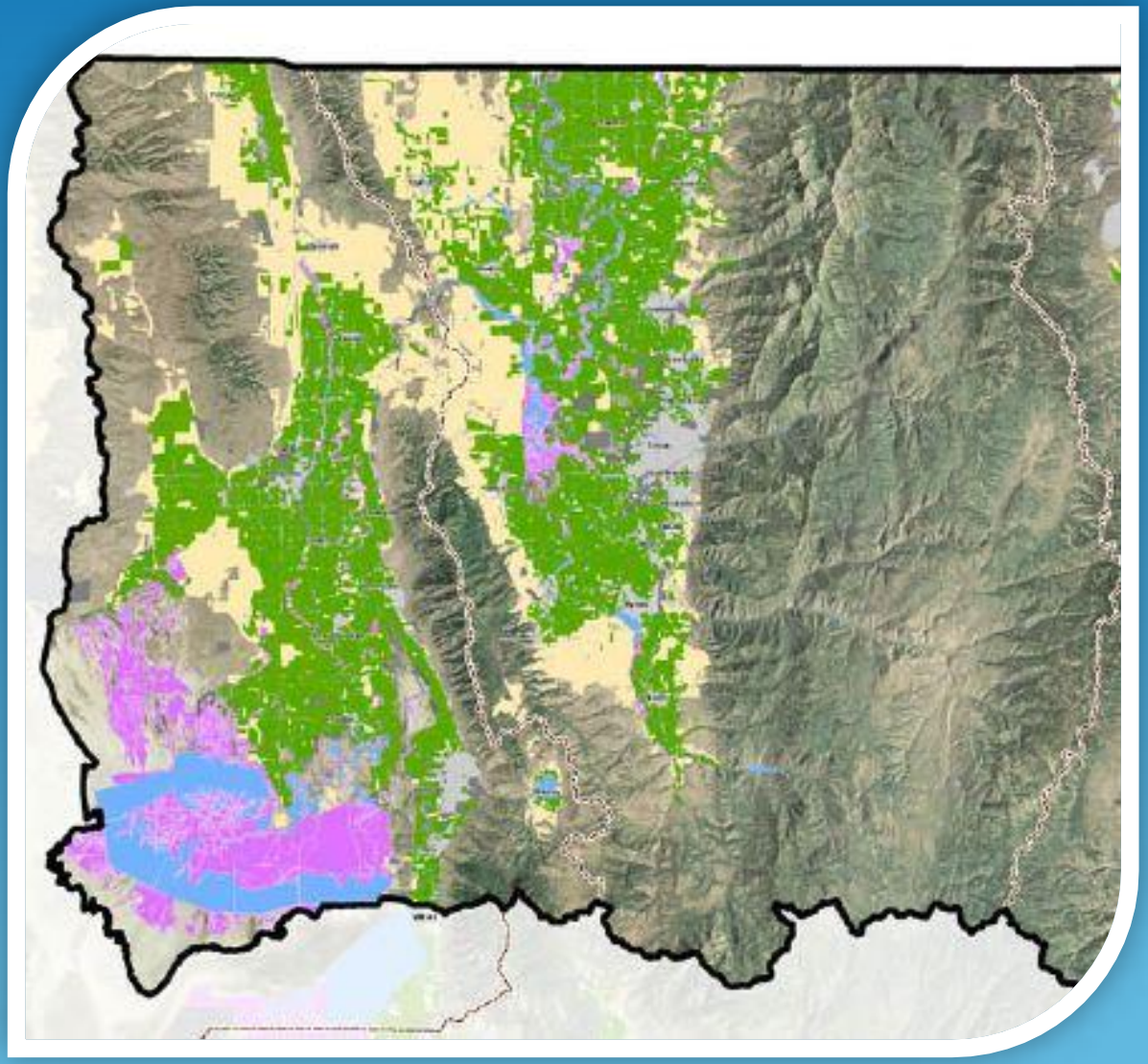


Source: Division Of Natural Resources Bear River Basin 2009 Water Related Land Use Inventory

CACHE COUNTY
WATER MASTER PLAN

Agricultural Needs

Water Related Land Uses



Source: Division Of Natural Resources Bear River Basin 2009 Water Related Land Use Inventory

CACHE COUNTY
WATER MASTER PLAN

BEAR RIVER: An Important Resource

Bear River Development

Bear River Development Act Allocations (Acre-feet)	
Bear River Conservancy District	60,000
Jordan Valley Water Conservancy District	50,000
Weber Basin Water Conservancy District	50,000
Cache County and any water conservancy district in Cache County	60,000

Bear River Development

- Plans for Bear River development are being made now
- Entities contracting for agricultural water pay 25% of construction and environmental costs
- Project costs allocated to recreation, fish and wildlife, and flood control shall be paid entirely by the state.

Advantages of More Developed Bear River Water

- Maintain stream flows
- More crop production in late times of agricultural season
- More secure water supply to meet future needs
- Maintain or improve environmental quality in Cache County
- More flexibility and options to control where new growth occurs

Thank You!

Cache County Water Master Plan – USU Staff Update Meeting

November 7, 2012

Group Discussion

- Environmental Demands
    - Key Points
        - Beneficial use should not just be agricultural or urban
        - More key points need to be developed around environmental demand
    - Action Items
        - David/Chris meet with Nancy to develop the key points
- 60,000 Acre Feet
    - Key Points
        - What is the supply/demand? What is the gap? It must be defined based on the need.
        - What is the environmental use?
        - If you don't use it, do you lose it?
        - Be specific about what the water uses are
    - Action Items
        - Chris/Bob call Todd Adams to set date for receiving DWRe information
- Climate Change
    - Key Points
        - Future water availability is uncertain
        - The plan needs to have a contingency based on climate change
        - May need to do a sensitivity analysis
    - Action Items
        - Bob find GSL committee study used to determine the effect of climate change on the Bear River
        - David will review the GSL committee study and determine if results should be incorporated
        - David will share GSL committee study with Sarah Null for additional review
        - Chris review questions about this study with Todd Adams. Find out if DWRe factors climate change in supply projections.
- Bear River Water Development Act
    - Key Points
        - Use caution about not looking too much at the planning process based solely on the BRWDA
    - Action Items
        - Study ASR
        - USU professors review the alternative evaluation matrix (to be posted to an ftp site)
- Incorporation of Existing Studies and Plans (USU, State, etc.)

- Key Point
  - Make sure the study team is using all pertinent data from other studies
- Action Items
  - David will research the current USU studies and see what would be pertinent to the master plan.
  - David will ask university staff members if they want to submit any previous work that has been done by the University that they feel should be reviewed, and see which studies or information are relevant to the current CCWMP
  - David continue to coordinate with USU to identify other studies or information that USU identifies as helpful to the current master plan
    - Chris to include all references that David identifies and include in the master plan

- Transparency and Ongoing USU Engagement
  - Key Points
    - University wants to have enough information to help in commenting and evaluation
    - Continue to ensure that the planning process is open and transparent so that it builds trust in the process and the data
    - Critical to continue to keep USU staff involved throughout the planning process
    - Engage USU staff with specific inquiries about specific needs so that the USU experts can help
    - Ensure that there is proper education to the public at large about components of the master plan and recommendations
  - Action Items
    - Chris post current master plan information and future information to ftp site and invite USU to review
    - Notify USU staff of the future steering committee meetings to be held at the master plan milestones
- Future Organizational Structure
  - Key Points
    - The data and needs should be studied first and this information should then drive the future organizational structure. Don't study what the organization should be first in the planning process.
    - Let the objectives guide what the management structure is (what we are trying to do in the future as Cache County residents)…
  - Action Item
    - A great master plan!
    - Create the matrix and evaluate the alternatives based on the matrix
    - Have USU staff review the evaluation matrix prior to the January 2013 meeting

Other Action Items

- Chris establish an ftp site and post master plan information
- Chris extend invitation ftp site and all available data to USU and the Steering Committee
- Cache County to create a webpage on the Cache County website that has an introduction to the CCWMP and then hosts all of the CCWMP information as well as a link to the ftp site. Chris will provide an introduction to the CCWMP for the website.

Meeting With USU 11-30-12

Environmental Needs and Demands:

What are some beneficial uses for the environmental applications, issues with climate change:

Climate change:

Bob sent out report about climate change.

Sarah: There is some "low hanging fruit" that would be a mistake to ignore relating to climate change. This may be dealing with the amount of precipitation as snowpack, and the time that runoff occurs will be earlier. Runoff is happening sooner, and we're not holding as much in the snowpack.

What does climate change do to us:

Sarah: Higher likelihood of wetter winters, more precipitation in rain, less snow. Flooding potential higher. Dries up sooner in the spring, more droughts.

How do you manage it?

Sarah: We are lucky to have groundwater storage here, because we don't have the evaporation losses. Groundwater storage is a lot nicer than building a reservoir.

The challenge with ASR is how to get the water into the aquifer. Wells are often easier to get the water into the principal aquifer. You have to treat the water before you inject it into the well. Surface spreading doesn't require treatment.

Is there a thought of more reservoirs that are smaller? Sarah: A lot of the hydro climate people are thinking a lot more micro storage reservoirs rather than a large reservoir.

So more reservoirs like out in the central part of the valley?

Have you talked to Joe Weaton about the work he has done in the Weber Basin?

Beavers creating retention in the system… Change the environment… Beaver needs wood. Relieve the trapping pressure. Reinforce the beaver dams.

Does Joe's research show that total flow out the bottom changes? Not yet.

Do you have any other thoughts on climate change? Items we could include in the water projections? Input to the division's water accounting methods. You could increase the demands to account for the increased ET rates caused by the higher temperature. You could do a sensitivity analysis to see how much things changed based on the changes.

If you could quantify the increased demands: Use WEEP to model the changes to the ET (rainfall runoff model).

Sarah has ET model running into Great Salt Lake. Maybe be able to extract useful data for Cache County.

Delta change approach. Sensitivity analysis. Set up scenario saying if we change this much, what are the effects. What changes will actually hurt us? What will the impacts be?

Ex: If spring runoff occurs 15 days earlier… what happens, what happens if 20 days earlier?... A smart user can get WEEP to tell you the sensitivity to the different variables: timing, temperature….

Say certain conditions occur, what are the adjustments we'll have to make?

Adaptively managing the watershed…. – it's hard

Avoid crises, think about change in use. – follow up on comment with Bob.

A few years ago there was a concern about not being able to deliver the water needed. They convinced farmers to shift away from the high water consumptive crop that year.

DWRe is doing this model, do we need to meet with them to see how we can implement this into their model?

Yes, but probably won't be incorporated this year. From his data, apply climate change issues, and write suggestions for the future.

Cache County and the other counties have an allocation from the legislature. If Cache County gets 60k Ac-ft, how much of it needs to be dedicated to environmental services?

What do we have right now? There are a lot of common benefits. Have riparian corridors, preserving temperature,

Protect against building right up next to the riparian areas.

Manage riparian areas to make sure they're healthy, and you can often use the same water downstream. The water quality may be even better after floating through.

Most of the Bear River corridor is private property. This will present a greater challenge for creating riparian environment.

If you identify in the WMP critical riparian areas, then you can limit building in the flood plains etc.

In 2000 is when Pacific Corp stopped the power surge drawing from the reservoirs.

You could quantify the area of land that is currently "wetland" in riparian corridors.

One of the things we've identified as an objective is "improving the environment…." How can we measure if we're improving the environment?

Surveys of user information, willingness to pay, talk about what species we're talking about – temperature tolerances, salinity tolerances… Water quality thresholds.

Riparian areas: Pole some wildlife people in, look at wildlife connectiveness. Maintain or improve the existing corridors…

A lot of GIS work is done on habitat, vegetation, etc…

Talk to Joan Dijorjio – look at the conservation plan do see what they're planning…

Dissolved oxygen is a good parameter to measure.

Mike Allred with DWQ is over monitoring the TMDL on the cutler reservoir.

Talk to Joan about metrics to use.

Fisheries – metric to measure.

Educate the public: Ways to measure if we're improving in this method:

Education rarely changes behavior. Measure the changes in behavior over time rather than the education by itself. Often it's economics that controls. Youth education is often more valuable, instilling ethics and values, awareness.

In master plan identify stormwater requirements upcoming in the future. Not till county hits 225,000 population.

Focus on a program we can participate in. (further public education etc…)

Do meaningful outreach/education, not just putting a check in the box.

Help people understand the impact of water quality, where their water comes from. Connect their water supply to the rivers…. Where does your drink come from.

If you think things might be bond funded, working in terms of education…. Teach people that if we don't do things now, it will cost more in the future.

Tie it to things they value. Fish water etc….

If you're interested in outreach campaigns let USU know because it could be a project… There used to be grants etc from the EPA, they've gone away now. A campaign could be valuable. Educating people on water is hard.

Appendix 3-A

Existing Supply and Demand

Existing Municipal and Industrial supply and demand estimates provided by the Utah Division of Water Resources (DWRe).

i: DWRe Supply and Demand Methodology and Assumptions

A summary of the methods used and assumptions made by DWRe to evaluate the municipal and industrial (M&I) water supplies and demands. The summary comes from a portion of a DWRe report prepared in November 2007 entitled "Municipal and Industrial Water Supply and Uses in the Bear River Basin."

ii: DWRe 2010 Supply and Demand Estimates

A summary of the existing M&I demand versus the supply for each of the individual water systems in the County

CACHE COUNTY
WATER MASTER PLAN

WATER SUPPLY AND USE METHODOLOGY

Background

Over the past 45 years, the Division of Water Resources (DWRe) has employed various procedures to obtain municipal and industrial (M&I) water use data. In recent years, these procedures have become more comprehensive. When the DWRe began water planning in the 1960's, available data consisted mainly of supplies and uses for the state as a whole. At that time, Utah's agricultural water uses far exceeded M&I uses. M&I water use was calculated simply by multiplying estimated per capita water use rates by census population data.

By the early 1980's, M&I diversions made up a larger percent of all statewide water uses and the entire water community increased their focus on M&I water supplies and uses. The Division of Water Rights (DWRi) and the Division of Drinking Water (DDW) launched a program to collect yearly, statewide M&I data from each public community water system. The procedure involved mailing a survey designed to query major public water suppliers about their sources of water supply. Additionally, the United States Geological Survey (USGS) began M&I water use studies. The DWRe relied on both data sources in its planning efforts by the late 1980's.

With the preparation of the State Water Plan Basin reports, and the increasing focus on water conservation, the DWRe saw the need to verify and improve the quality and quantity of the available data. The first method used included assisting the DWRi and the DDW in the improvement of their M&I data collection program. Currently, the collection of water use data is a joint effort between all three divisions, administered by the DWRi. Additionally, the DWRe began verifying the accuracy of the data through yearly field surveys, as described in the following four sections.

Data Collection Methodology for Public Community Water Systems

Each year, the DWRe targets several hydrologic basins for M&I water supply and use analysis. The most recent water use information supplied by the DWRi is the basis used to begin the study. Prior to 2003, this information was submitted using a standard form by each water supplier. An example of the water use data form for Enoch is found in **Appendix A**. Since 2003, the program has been updated, allowing for the water suppliers to electronically submit their data.

The DWRe staff contact the manager or operator of each community water system (as defined by the DDW) to schedule a data collection and analysis meeting. These meetings are necessary because data often is not reported (either on the water use forms or electronically) in the detail required for a complete M&I water use study. During these meetings, staff clarifies and collects additional data as needed. Total water supply and usage of the water systems are calculated based on information gathered during these meetings. When data is not available, it is necessary to estimate a part or all of the system use.

A secondary objective of these meetings is to instruct the operator or manager on how to most accurately and effectively complete the water use data form and/or submit their information electronically. This methodology has been used since 1992.

Water Supply

Potable Water

Two factors define the potable water supply for public community water systems: maximum developed potable water supply available under present conditions and reliable potable water supply. The maximum developed potable water supply available under present conditions is defined as the water resource that is presently being utilized. It is limited by a mechanical constraint (such as pump capacity or pipe size), a hydrologic constraint (such as reliable stream flow or groundwater safe yield) or a legal constraint (such as a water right or legal contract).

The lesser amount of water supply, due to these three constraints, is considered to be the maximum developed potable water supply available under present conditions used in this analysis.

The determination of well pump capacities, average annual spring flow estimates, treatment plant capacities, and water right information aid in the calculation of this value. It should be noted that, due to the complexity of water rights, contracts, exchanges, etc., a detailed search of water right limitations associated with each entity is not within the scope of this study.

The reliable potable water supply is defined as the capacity to meet peak day demands, expressed as an annual volume. It is valuable in determining future water supply capacities of the particular community water system sources (wells, springs, etc.). **The reliable potable water supply is calculated by adding together the maximum developed water supply capacity of surface sources, one-half of the maximum yield of wells or their pump capacities (unless otherwise indicated by the system manager), and a percentage of the average annual flow of spring sources.** The percentage of the spring source flows range between 50% and 100%. The determination of the percentage is based on information provided by the water supplier.

On page 12, **Figure 4** graphically presents the relationship between the maximum developed potable water supply and the reliable potable water supply of a system. By quantifying the maximum developed and the reliable potable water supply of a system, the total population that a system may potentially support can be determined. The current total yearly water use is the volume under the lower curve (*Present Water Use Pattern*). The future total yearly water use is the volume under the upper curve (*Future Water Use Pattern*). The latter volume is equivalent to the reliable developed potable water supply.

The maximum developed potable water supply under present conditions is the volume under the upper line (*Maximum Water Supply*) in **Figure 4**. This amount is a

theoretical annual volume based upon a maximum daily flow rate (limited by the water right or system capacity). Consequently, the peak day demand point on the future water use curve (*Future Peak Day Demand*) cannot exceed this upper limit. Due to the fluctuating nature of some sources (particularly springs), and the fact that most culinary water system storage tanks are designed to store only about one day of water demand, not all of the total maximum developed potable water supply is available to meet future water needs.

It is important to note that the reliable potable water supply is a theoretical annual volume based upon the current daily peak demand flow rate of any one system, under its current demand conditions. Additional supply may be made available by lowering and/or increasing the size of existing well pumps, pumping existing wells for longer durations, increasing storage capacity and/or distribution pipe sizes. However, being based only on current conditions, these systematic changes may cause operational problems during times of peak demand. Therefore, the DWRe uses the reliable potable water supply only as a reference tool to quantify the annual amount of water that can be delivered by each community water system.

For planning purposes, the reliable potable water supply is essential for estimating what population base each system can theoretically support with current demand patterns. It is also a guideline to help predict the approximate timing of future system improvements in order to meet any increase in demand.

Secondary Water

Deliveries of non-potable (secondary) water are an important component of the water use within the boundaries of public community water systems. However, quantifying the available supply of this water is difficult. In Utah, many of the secondary water systems are part of a larger agricultural irrigation system. Hence, the theoretical supply includes both agricultural and M&I water. Currently, separating M&I secondary from agricultural water is mostly estimated, due to the lack of and/or absence of metering, particularly at the level of individual property connections.

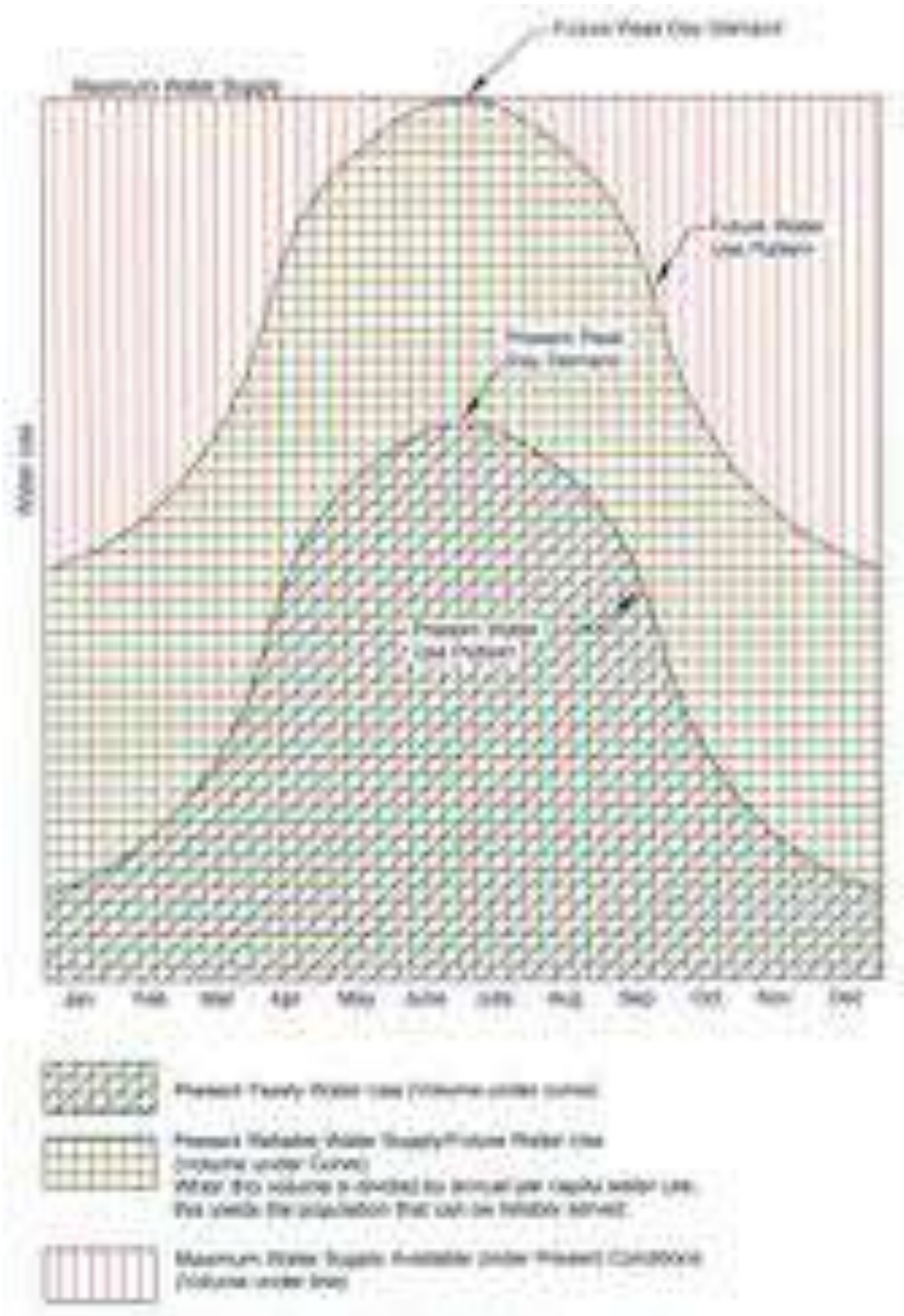


Figure 4. Water Supply and Use Hydrograph

With secondary water use becoming more prevalent for outdoor landscaping, estimating the available supply of this water is becoming increasingly more important. **For planning purposes, the DWRe assumes that the supply for M&I secondary irrigation is simply equal to the current use.**

Water Use

Present water use, as defined herein, is the developed water supply that is actually delivered by the distribution system from surface or subsurface sources. Water use is divided into four categories: residential, commercial, institutional and industrial.

Residential

The staff collects data about the number of residential connections and the amount of water used by those connections from a water system representative. Water use in this category is divided into three subcategories: culinary-outdoor, culinary-indoor, and secondary-outdoor. While most systems will meter the total culinary residential water use, indoor and outdoor use are rarely metered separately. Secondary water use is rarely metered. Therefore, the DWRe usually estimates these subcategory totals.

Typically, culinary indoor use will be estimated first. One method to estimate the indoor use is to review residential meter reading totals for the system from the winter months, if available. Since outdoor watering typically does not occur during the winter months, it can be assumed that the water used in winter months is for indoor use only. The winter water use is then used to determine the total yearly indoor use.

When the above method does not yield a reasonable value for indoor use, the per capita indoor water use for a system can be estimated by using an equation that was developed in a detailed residential study, “Identifying Residential Water Use”,

completed by the DWRe in 2001. The mathematical equation that was developed is as follows:

$$GPCD_{Indoor} = 90.3 / P_{PH} + 42.3$$

where:

$GPCD_{Indoor}$ = gallons per capita day (per capita indoor water use)

P_{PH} = persons per household (US Census Bureau)

The total yearly indoor water use is then calculated for the system by multiplying the result of the above equation by the current population. Outdoor culinary water use can then be estimated by subtracting the total yearly indoor water use from the given total residential culinary water use.

Because very few entities meter secondary outdoor water use, the DWRe staff estimates the outdoor secondary water use by using the average lot size, percent irrigated, percent of residences that are supplied by separate secondary (pressurized and ditch) irrigation systems, water right-duty rates (volume of water required for turf growth) in the area, and other related information for each system. In determining residential secondary use, care is taken to not include irrigation water use for small pastures or farm fields that can often be found adjacent to residences, particularly in rural communities.

Commercial

For most systems, the system operator can separate metered commercial water use data from the total water use. In cases where this data is not available, or is extremely difficult to obtain, the DWRe staff attempts to estimate commercial water use by inventorying commercial businesses in the area and using published commercial water use estimates. The DDW and the Utah State Water Lab, among others, publish these estimates. In some rural communities where there are a relatively small number of commercial connections, the businesses are visited individually by the DWRe staff and asked about their water use.

Some commercial facilities use secondary water to irrigate outside landscapes. This is especially typical for commercial golf courses. Again, it is typical that secondary water is not metered. The DWRe staff estimates this use by multiplying the size of the irrigated area by a water right-duty rate or the evapotranspiration (ET) rate with assumed application efficiency percentage. The ET used is indicative of the amount of water, in inches, necessary for turf growth.

Institutional

Institutional water use is water used for city, county, state and federal government facilities, parks, municipal golf courses, schools, hospitals, churches, military facilities, as well as fire hydrant testing and other municipal losses in the water system. Because this water use is often not metered, the process to acquire this data is difficult. The system operator is asked to provide information about city facilities such as the number and size (irrigated acreage) of parks, schools, churches, and municipal golf courses. Water right-duty rates and/or the ET, with appropriate efficiencies, are used to calculate the amount of water that is needed to irrigate these areas. Estimates of leakage and water use for testing of system facilities are also included in this category.

Industrial

Industrial water use is defined as water used in the production of a product. Therefore, such commercial establishments as dairies, mink farms, and greenhouses, as well as stockwatering, are included in this category, provided a community water system serves them. Industrial water use within community water systems is calculated with the same process used to calculate commercial water use data discussed earlier.

Data Collection Methodology for Public Non-Community Water Systems

The DWRe staff attempts to contact each non-community system and/or make a personal visit to these systems. Non-community systems rarely meter their water use, so the DWRe staff estimate the annual water use. Questions are asked to determine the types of facilities on the system, population served, water source information, irrigation of outside areas, etc. This data, along with information found in water-related publications, is used to determine water use. The maximum and reliable water supplies for these systems are relatively small, often not available and are therefore not included in this study. However, for planning purposes, the DWRe assumes that the water supply for these systems is equal to their water use.

Data Collection Methodology for Self-Supplied Industrial Water Systems

Although self-supplied industries are included in the Non-Community Water Systems category as defined by the DDW, the DWRe has divided them into a separate category due to their importance. The category is equivalent to the DDW's Non-Community, Non-Transient category.

Water use is acquired for self-supplied industries by using data from the DWRi's Industrial Water Use Form and/or electronically submitted data. The DWRi collects

annual water use data from most of the major self-supplied industrial water users in the state. This data is confidential. Therefore, the data presented in this M&I study is only presented as county totals. As with other non-community systems, the maximum and reliable water supplies are often not available and are not in the scope of this study. For planning purposes, the DWRe assumes that the water supply for these systems is equal to their water use.

Data Collection Methodology for Private Domestic Water Systems

Private domestic systems are residences that are not connected to any public community or non-community water system. They are usually supplied by individual wells. To determine the water use data for this category, the population of those served by private domestic systems is estimated. This population is estimated by subtracting the population served by community water systems from the county population data acquired from the Governor's Office of Planning and Budget (GOPB). The remainder is assumed to be the population that is served by private domestic systems. The per capita water use rate for this category is assumed to be the same as the rate for the public community system residential category for that county. To determine the total water use by private domestic systems, the estimated population is then multiplied by this rate. Again, the maximum and reliable water supplies for private wells, being relatively small, are not in the scope of this study. Similarly, for planning purposes, the DWRe assumes that the water supply for these systems is equal to their water use.

DEFINITIONS OF WATER TERMS

Water is supplied by a variety of systems for many types of users. The general term supply is defined as the amount of water available. Municipalities own most of the individual water supply systems. However, in some cases the owner/operator is a private company, state or federal agency. Thus, a "public" water supply may be either publicly or privately owned and supply treated and/or untreated water.

Water Supply Terms

Maximum Developed Potable Water Supply - The annual volume of potable (culinary) water which is the lesser of the hydrologic capacity of the water source, the physical capacity of the water system, or the amount allowed by the collective water rights. (See pages 8-10 for a more detailed explanation)

Reliable Potable Water Supply - The annual volume within the maximum developed water supply that is available to meet peak demands. This is generally calculated as 100% of the maximum supply from surface water sources, 50% of the maximum yield of wells, and between 50% and 100% of the average annual spring flows. When this number is divided by the average per capita usage, the resulting number represents the theoretical maximum population that the water source can serve. (See pages 8-10 for a more detailed explanation)

Municipal and Industrial Water Supply - Includes all water (potable and non-potable) supplied for residential, commercial, institutional, light industry, and self-supplied industries. This supply is delivered by public community systems, public non-community (transient and non-transient) systems, self-supplied industrial systems, unregulated Indian water systems and private wells.

Types of Water

Potable Water – Includes water meeting all applicable Federal, State, and Local drinking water requirements for residential, commercial, institutional and industrial uses. It is also referred to as culinary water supply.

Secondary Water – Includes water not meeting safe drinking water requirements. It is also referred to as non-potable (non-culinary) water. This water is usually delivered by pressurized or open ditch systems for irrigation of privately and publicly owned landscapes, gardens, parks, cemeteries, golf courses and other open areas. Sometimes called "dual" water systems, they are installed to provide an alternative to irrigating with culinary water for these outdoor areas. Although Irrigation companies most often provide this water, public community systems may deliver this water as well. Self-supplied industries can also use secondary water for industrial processes.

Water System Categories

Public Community Water System - Provides potable and/or non-potable water by either a privately or publicly owned water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Water from the public community water supplies may be used in both indoor and outdoor applications for residential, commercial, institutional, and industrial purposes.

Public Non-Community Water System - Provides potable and/or non-potable water by either a privately or publicly owned water system of one of two types: transient and non-transient. Transient systems are systems that do not serve 25 of the same non-resident persons per day for more than six months per year. Examples include campgrounds, RV parks, restaurants, convenience stores, etc. Non-transient systems are systems that regularly serve 25 of the same non-resident persons per day for more than six months per year. Examples include churches, schools and industries. This report categorizes industrial non-transient systems as self-supplied industries.

Self-Supplied Industrial System - Provides potable and/or non-potable water for use by individual privately owned industries (usually from their own wells or springs).

Private Domestic System – Provides potable and/or non-potable water from privately owned wells and/or springs for use by individual homes.

Water Use Terms

Water is used in a variety of ways and for many purposes. It is often said that water is "used" when it is diverted, demanded, withdrawn, depleted or consumed. But it is also "used" in place for such things as fish and wildlife habitat, recreation and hydropower production. **Water use in this report is defined as "delivered" water.** A table that shows the basin's M&I water deliveries and depletions is provided in **Appendix B**.

In the previous water supply section, the word "use" can be interchanged with the word "supply" to define the current demand associated with those definitions. Some additional water use terms are as follows:

Commercial Use - Use normally associated with small business operations that may include drinking water, food preparation, personal sanitation, facility cleaning and maintenance and irrigation of facility landscapes. Examples include retail businesses, restaurants and hotels.

Industrial Use - Use associated with the manufacturing or production of products. The volume of water used by industrial businesses can be considerably greater than water used by commercial businesses. Examples include manufacturing plants, oil and gas producers, mining companies, mink farms and dairies.

Institutional Use - Use normally associated with general operation of various public agencies and institutions (i.e. schools, municipal buildings, churches) including

drinking water, personal sanitation, facility cleaning and maintenance and irrigation of parks, cemeteries, playgrounds, recreational areas, golf courses, and other facilities. The amount of water used by cities for outside irrigation of public areas typically is not metered.

Residential Use - Use associated with residential cooking, drinking water, washing clothes, miscellaneous cleaning, personal grooming and sanitation, irrigation of lawns, gardens and landscapes, and washing automobiles, driveways and other outside residential facilities. Examples include single-family homes, apartments, duplexes and condominiums.

Other Water Terms

Consumption - Water evaporated, transpired or irreversibly bound in either a physical, chemical or biological process. Consumed water results in a loss of the original water supplied.

Consumptive Use - Losses of water brought about by human endeavors when used for residential, commercial, institutional, industrial, agricultural, power generation, and recreation. Naturally occurring vegetation, fish and wildlife also consumptively use water.

Deliveries - Water already within a system that is being provided to an individual connection, whether potable or non-potable and/or metered or not. The connection can be for residential, commercial, institutional, and/or industrial uses. **For the purpose of this report, the delivered water amount is equivalent to water use.**

Depletion - Water consumed and made unavailable for return to a given designated area, river system or basin. It is intended to represent the net loss to a system. The terms consumption and depletion are often used interchangeably but are not the same. For example, water exported from a basin is depletion from the basin system

but is not consumed in the basin. The exported water is available for use (consumption) in another basin or system. Water diverted to irrigate crops in a given system, but not returned for later use, is depletion. Precipitation that falls on irrigated crops is not considered a part of the supply like surface water and groundwater diversions. For this reason, precipitation falling on and consumed by irrigated crops is not considered as being depletion from the system.

Diversion - Water diverted from supply sources such as streams, lakes, reservoirs or groundwater for a variety of purposes, including cropland irrigation, as well as residential, commercial, institutional and industrial uses.

Withdrawal - Water withdrawn from supply sources such as lakes, streams, reservoirs or groundwater. This term is normally used in association with groundwater withdrawal. The terms *diversion* and *withdrawal* are often used interchangeably.

Base Year Year 2010	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	530	661	5	666	1,122	686	5	691	25
Benson Water Culinary District	747	169	50	219	262	348	50	398	178
Clarkston Town Culinary Water	800	211	83	293	327	1,049	83	1,132	838
Cornish Town Water	290	92	44	136	420	142	44	186	50
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	129	49	2	51	352	66	2	68	17
Hyde Park City	3,830	712	340	1,052	245	1,417	340	1,757	706
Hyrum City	7,550	4,278	1,400	5,678	671	6,382	1,400	7,782	2,104
Lewiston City	1,770	711	96	807	407	1,612	96	1,708	900
Logan City	48,000	8,957	1,820	10,777	200	16,652	1,820	18,472	7,695
Mendon City Culinary Water System	1,400	171	190	361	230	356	190	546	184
Millville City Water	1,900	444	54	498	234	825	54	879	382
Newton Town Water	800	219	187	406	453	246	187	433	27
Nibley City	5,400	836	300	1,136	188	2,499	300	2,799	1,663
North Logan Water	8,250	1,435	235	1,670	181	1,727	235	1,962	292
Paradise Town	900	111	290	401	397	497	290	787	386
Providence Town Water System	7,000	2,069	100	2,169	277	4,076	100	4,176	2,006
Richmond City Corp.	2,470	700	300	1,000	361	1,388	300	1,688	688
River Heights City	1,930	516	34	550	254	2,099	34	2,133	1,582
Smithfield City	9,600	1,685	1,405	3,090	287	5,976	1,405	7,381	4,291
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	500	165	48	213	381	225	48	273	60
Wellsville City Corp.	3,400	1,473	20	1,493	392	5,730	20	5,750	4,257
Cache County summary for Base Year 2010	**107,326**	**25,677**	**7,037**	**32,713**	**272**	**54,586**	**7,037**	**61,623**	**28,909**

Appendix 3-B

Annual Volume of Ideal Irrigation Supply

A breakdown of flood irrigated acres and sprinkler irrigated acres with estimated annual volumes of water needed for those acreages and a total ideal volume of irrigation supply needed in the County.

CACHE COUNTY
WATER MASTER PLAN

ESTIMATED ANNUAL VOLUME OF WATER NEEDED FOR IRRIGATION

	Flood	Sprinkle	Sub-irrigated	Total	Source
Agricultural Irrigated Areas (Acres)	**32,178**	**64,787**	**8,953**	**105,918**	DWRe 2009 Land use inventory
Feet of irrigation water required per year	2.50	2.50			USU Extension Service recommended Application Rates 1996
Efficiency factor	1.70	1.25			
Total water applied outside per year (Feet)	4.25	3.13			
Estimated Acre feet of Water	**137,000**	**202,000**		**339,000**	

Appendix 3-C

Identifying Environmental Water Demands

Preliminary environmental and ecological water uses fact sheet and overview of a potential pilot study to determine where rivers and riparian areas provide environmental benefits, how they are connected, and quantify the volume and timing of water needed to maintain these benefits.

CACHE COUNTY
WATER MASTER PLAN

Identifying Environmental Water Demands for Cache County

May 2013
Dr. David E. Rosenberg, Dr. Sarah Null, Dr. Nancy Mesner, Dr. Joanna Endter-Wada
Utah State University

This fact sheet lists many important environmental and ecological uses of water in Cache County, Utah and the environmental benefits derived from those uses. We overview a pilot/scoping study to determine where rivers and riparian areas provide environmental benefits, how they are connected, plus quantify the volume and timing of water needed to maintain these benefits. We also estimate the cost to undertake such a study. This type of study will be needed to sustainably and cost-effectively develop water in Cache County over the coming 50 years in ways that both protect and enhance the County's water resources and unique environmental features. The work can also simultaneously identify the environmental and economic impacts of and benefits from water development strategies proposed in the County's Water Master Plan.

Important Environmental Water Uses and Associated Benefits

Use: Provide Ecosystem Habitats

- Riparian and wetland areas
  - Wildlife habitat
  - Maintain water temperature
  - Flood damage reduction
  - Protect property (and value)
  - Recharge groundwater
  - Maintain flow during dry periods
- In-stream
  - Regulate water quality (temperature, phosphorus, nitrogen, etc.)
  - Support fisheries (sport, native)
  - Support aquatic ecosystems and habitats

Use: Support Recreation Opportunities

- Hunting
- Fishing
- Boating/water skiing
- Birding
- Hiking
- Aesthetic values

Key Questions to Answer before Developing the County's Water Resources

1. Where are environmental and ecosystem water uses located?
2. How are the locations connected physically and hydrologically? If an upstream location is disturbed, what are the effects on downstream resources?
3. How do uses intersect with nearby landowners/stakeholders?
4. What volume and timing of water are needed to maintain environmental benefits?

Suggested Pilot/Scoping Study Method to Answer the Key Questions

1. Pick a few key pilot sites where multiple environmental benefits are co-located (e.g., Bear River bottoms along the Bear River, a headwaters stream like the Logan or Blacksmith fork where the river leaves the mountains and enters Cache Valley).
2. Identify environmental water uses present at each site, connectivity, and volume and timing of water needed to maintain services.
3. Gather prior existing environmental and ecosystem data within the County (e.g., USU research in Temple fork, Logan River, Cub River, Curtis Creek, Little Bear, Bear River TMDL, Cutler Reservoir TMDL, PacifiCorp recreation study for Cutler Reservoir, etc.)
4. Use prior existing data to upscale findings from pilot sites to entire Cache County.
5. Identify locations requiring further study to improve up-scaling.

Estimated Cost for Pilot/Scoping Study: $200,000 -- $250,000.

- e.g., 3-years to support 4-6 part-time personnel
- Limited primary data collection at pilot sites

Appendix 3-D

Endangered Species List

Summary of the threatened species and the species that are listed as candidates in the State of Utah including a list for Cache County.

CACHE COUNTY
WATER MASTER PLAN

FEDERALLY LISTED AND PROPOSED ENDANGERED, THREATENED AND CANDIDATE (1) SPECIES AND CRITICAL HABITAT IN UTAH - SPECIES LIST BY COUNTY

Tuesday, April 02, 2013

County	Common Name	Scientific Name	Federal Status
BEAVER			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Frisco buckwheat	*Eriogonum soredium*	Candidate
	Frisco clover	*Trifolium friscanum*	Candidate
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Ostler's peppergrass	*Lepidium ostleri*	Candidate
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
BOX ELDER			
	Goose Creek milkvetch	*Astragalus anserinus*	Candidate
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	June sucker (5)	*Chasmistes liorus*	Endangered
	Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	Threatened
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
CACHE			
	Canada lynx	*Lynx canadensis*	Threatened
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Maguire primrose	*Primula maguirei*	Threatened
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
CARBON			
	Bonytail (2,6)	*Gila elegans*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Graham's beardtongue	*Penstemon grahamii*	Proposed
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened

County	Common Name	Scientific Name	Federal Status
CARBON			
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Uinta Basin hookless cactus	*Sclerocactus wetlandicus*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
DAGGETT			
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Colorado pikeminnow (5)	*Ptychocheilus lucius*	Endangered
	Gibbens' beardtongue	*Penstemon gibbensii*	Petitioned
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
DAVIS			
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
DUCHESNE			
	Barneby ridge-cress	*Lepidium barnebyanum*	Endangered
	Black-footed ferret (8)	*Mustella nigripes*	Endangered
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Graham's beardtongue	*Penstemon grahamii*	Proposed
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Mexican spotted owl (9)	*Strix occidentalis lucida*	Threatened
	Pariette cactus	*Sclerocactus brevispinus*	Threatened
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Shrubby reed-mustard	*Schoenocrambe suffrutescens*	Endangered
	Uinta Basin hookless cactus	*Sclerocactus wetlandicus*	Threatened
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate

County	Common Name	Scientific Name	Federal Status
EMERY			
	Barneby reed-mustard	*Schoenocrambe barnebyi*	Endangered
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Jones cycladenia	*Cycladenia jonesii*	Threatened
	Last Chance townsendia	*Townsendia aprica*	Threatened
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	San Rafael cactus	*Pediocactus despainii*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog (10)	*Cynomys parvidens*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Winkler cactus	*Pediocactus winkleri*	Threatened
	Wright fishhook cactus	*Sclerocactus wrightiae*	Endangered
GARFIELD			
	Autumn buttercup	*Ranunculus aestivalis*	Threatened
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Jones cycladenia	*Cycladenia jonesii*	Threatened
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Winkler cactus	*Pediocactus winkleri*	Threatened
	Wright fishhook cactus	*Sclerocactus wrightiae*	Endangered

County	Common Name	Scientific Name	Federal Status
GRAND			
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Cisco milkvetch	*Astragalus sabulosus*	Petitioned
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Isely milkvetch	*Astragalus iselyi*	Petitioned
	Jones cycladenia	*Cycladenia jonesii*	Threatened
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
IRON			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Virgin River chub (3)	*Gila seminuda*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Woundfin (3)	*Plagopterus argentissimus*	Endangered
JUAB			
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
KANE			
	Bonytail (3)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Coral Pink Sand Dunes tiger beetle	*Cicindela albissima*	Proposed

County	Common Name	Scientific Name	Federal Status
KANE			
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Jones cycladenia	*Cycladenia jonesii*	Threatened
	Kanab ambersnail (7)	*Oxyloma haydeni kanabensis*	Endangered
	Kodachrome bladderpod	*Lesquerella tumulosa*	Endangered
	Las Vegas buckwheat	*Eriogonum corymbosum var. nilesii*	Candidate
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Siler pincushion cactus	*Pediocactus sileri*	Threatened
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Virgin River chub (3)	*Gila seminuda*	Endangered
	Welsh's milkweed (6)	*Asclepias welshii*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Woundfin (3)	*Plagopterus argentissimus*	Endangered
MILLARD			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Frisco clover	*Trifolium friscanum*	Candidate
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
MORGAN			
	Canada lynx	*Lynx canadensis*	Threatened
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
PIUTE			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
RICH			

County	Common Name	Scientific Name	Federal Status
RICH			
	Canada lynx	*Lynx canadensis*	Threatened
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
SALT LAKE			
	Canada lynx	*Lynx canadensis*	Threatened
	June sucker (5)	*Chasmistes liorus*	Endangered
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
SAN JUAN			
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greenback cutthroat trout	*Oncorhynchus clarkii stomias*	Threatened
	Gunnison sage-grouse	*Centrocercus minimus*	Proposed
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Isely milkvetch	*Astragalus iselyi*	Petitioned
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Navajo sedge	*Carex specuicola*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
SANPETE			
	Bonytail (3)	*Gila elegans*	Endangered
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Heliotrope milkvetch (6)	*Astragalus montii*	Threatened
	Humpback chub (3)	*Gila cypha*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
SEVIER			

County	Common Name	Scientific Name	Federal Status
SEVIER			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Heliotrope milkvetch	*Astragalus montii*	Threatened
	Last Chance townsendia	*Townsendia aprica*	Threatened
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Winkler cactus	*Pediocactus winkleri*	Threatened
	Wright fishhook cactus	*Sclerocactus wrightiae*	Endangered
SUMMIT			
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
TOOELE			
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
UINTAH			
	Black-footed ferret (8)	*Mustella nigripes*	Endangered
	Bonytail (2,6)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Clay reed-mustard	*Schoenocrambe argillacea*	Threatened
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Graham's beardtongue	*Penstemon grahamii*	Proposed
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered

County	Common Name	Scientific Name	Federal Status
UINTAH			
	Mexican spotted owl (9)	*Strix occidentalis lucida*	Threatened
	Pariette cactus	*Sclerocactus brevispinus*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Shrubby reed-mustard	*Schoenocrambe suffrutescens*	Endangered
	Uinta Basin hookless cactus	*Sclerocactus wetlandicus*	Threatened
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	White River penstemon	*Penstemon scariosus albifluvis*	Candidate
UTAH			
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Clay phacelia	*Phacelia argillacea*	Endangered
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Deseret milkvetch	*Astragalus desereticus*	Threatened
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	June sucker (6)	*Chasmistes liorus*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
WASATCH			
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
WASHINGTON			

County	Common Name	Scientific Name	Federal Status
WASHINGTON			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Desert tortoise (6)	*Gopherus agassizii*	Threatened
	Dwarf bear-poppy	*Arctomecon humilis*	Endangered
	Gierisch mallow	*Sphaeralcea gierischii*	Proposed
	Holmgren milkvetch (6)	*Astragalus holmgreniorum*	Endangered
	Las Vegas buckwheat	*Eriogonum corymbosum var. nilesii*	Candidate
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Shivwits milkvetch (6)	*Astragalus ampullariodes*	Endangered
	Siler pincushion cactus	*Pediocactus sileri*	Threatened
	Southwest willow flycatcher (6,11)	*Empidonax traillii extimus*	Endangered
	Virgin River chub (2,6)	*Gila seminuda*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Woundfin (3,5)	*Plagopterus argentissimus*	Endangered
WAYNE			
	Barneby reed-mustard	*Schoenocrambe barnebyi*	Endangered
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Last Chance townsendia	*Townsendia aprica*	Threatened
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	San Rafael cactus	*Pediocactus despainii*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Winkler cactus	*Pediocactus winkleri*	Threatened
	Wright fishhook cactus	*Sclerocactus wrightiae*	Endangered
WEBER			
	Canada lynx	*Lynx canadensis*	Threatened

County	Common Name	Scientific Name	Federal Status
WEBER			
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	June sucker (5)	*Chasmistes liorus*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate

1 Candidate species have no legal protection under the Endangered Species Act. However, these species are under active consideration by the Service for addition to the Federal List of Endangered and Threatened Species and may be proposed or listed during the development of the proposed project.

2 The species occupies habitat in one or more hydrologic unit (8-digit HUC) within this county. In addition, water depletions from any portion of the occupied drainage basin may adversely affect the species or designated critical habitat of the endangered fish species, and must be evaluated with regard to the criteria described in the pertinent fish recovery programs.

3 The species is not present in this county. However, water depletions from any portion of the occupied drainage basin may adversely affect the species or designated critical habitat of the endangered fish species, and must be evaluated with regard to the criteria described in the pertinent fish recovery programs

4 This species is designated a non-essential, experimental population east of I-15 to 191, and south of I-70. Animals occurring outside the designated areas are protected as Endangered.

5 Introduced, refugia population.

6 Critical habitat designated in this county. Critical habitat shapefiles are available on http://criticalhabitat.fws.gov.

7 Critical habitat proposed in this county.

8 Non-essential, experimental population.

9 Suitable habitat occurs in southern Duchesne County, including Nine-Mile and Argyle canyon.

10 The species is not known to be present in this county, however a portion of this county is within the survey area as defined by the Utah Division of Wildlife Resources.

11 Nests in this county of Utah.

Appendix 4-A

Future Supply and Demand

i: Population Projections

Population projections for each of the communities and for the County as a whole from BRAG and the Governor's Office of Planning and Budget.

ii: Supply and Demand without Conservation

Tables that summarize the supplies versus the estimated future demands based on current per-capita water use for each community on the following years: 2010, 2020, 2025, 2030, 2040, 2050, and 2060. A countywide total is given for each decade as well.

iii: Supply & Demand Maps Without Conservation

Maps that show the water supply versus demand status for each of the M&I water systems at future points in time without improving water conservation.

iv: Supply and Demand with 25% Conservation

Tables that summarize the supplies versus the estimated future demands for each community assuming that water use per capita is reduced by 25% between now and year 2025. The following time frames are tabulated: 2010, 2020, 2025, 2030, 2040, 2050, and 2060. A countywide total is given for each decade as well.

v: Supply & Demand Maps with 25% Conservation

Maps that show the water supply versus demand status for each of the M&I systems at future points in time assuming water use per capita is reduced by 25% between now and year 2025.

Cache County Population Projections by Community

	Projected Population					
CITY/TOWN	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Amalga	488	540	587	603	930	1,095
Clarkston	666	696	841	983	1,162	1,369
Cornish	288	332	362	384	465	548
Hyde Park	3,833	4,930	6,214	7,552	7,673	8,454
Hyrum	7,609	9,328	11,079	12,794	15,851	19,012
Lewiston	1,766	1,777	2,186	2,555	3,487	3,833
Logan	48,174	57,057	63,943	76,658	92,987	111,717
Mendon	1,282	1,689	2,239	2,555	2,790	3,286
Millville	1,829	2,196	2,593	2,951	3,834	4,673
Newton	789	835	841	983	1,162	1,369
Nibley	5,438	8,796	14,136	15,725	18,597	21,905
North Logan	8,269	11,641	14,964	16,708	18,597	21,905
Paradise	904	1,123	1,334	1,552	1,879	2,236
Providence	7,075	9,050	11,770	13,759	16,273	19,167
Richmond	2,470	2,785	3,026	3,342	4,184	5,203
River Heights	1,734	2,088	2,152	2,258	2,557	3,012
Smithfield	9,495	12,051	15,171	18,307	19,069	21,245
Trenton	464	557	673	786	930	1,095
Wellsville	3,432	4,160	5,036	5,831	7,098	8,444
Balance of Cache	6,651	7,597	8,991	10,274	12,941	14,247
Total	**112,656**	**139,228**	**168,136**	**196,559**	**232,468**	**273,817**
Projected Annual Growth Rate		2.14%	1.90%	1.57%	1.69%	1.65%

Linear forecast based on previous 30 years percent of county population as a whole
Most recent decade in each forecast was weighted at double value
Adjustments were made based on availability of developable resources (land, water)

Conserve 0% Year 2010	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	530	661	5	666	1,122	686	5	691	25
Benson Water Culinary District	747	169	50	219	262	348	50	398	178
Clarkston Town Culinary Water	800	211	83	293	327	1,049	83	1,132	838
Cornish Town Water	290	92	44	136	420	142	44	186	50
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	129	49	2	51	352	66	2	68	17
Hyde Park City	3,830	712	340	1,052	245	1,417	340	1,757	706
Hyrum City	7,550	4,278	1,400	5,678	671	6,382	1,400	7,782	2,104
Lewiston City	1,770	711	96	807	407	1,612	96	1,708	900
Logan City	48,000	8,957	1,820	10,777	200	16,652	1,820	18,472	7,695
Mendon City Culinary Water System	1,400	171	190	361	230	356	190	546	184
Millville City Water	1,900	444	54	498	234	825	54	879	382
Newton Town Water	800	219	187	406	453	246	187	433	27
Nibley City	5,400	836	300	1,136	188	2,499	300	2,799	1,663
North Logan Water	8,250	1,435	235	1,670	181	1,727	235	1,962	292
Paradise Town	900	111	290	401	397	497	290	787	386
Providence Town Water System	7,000	2,069	100	2,169	277	4,076	100	4,176	2,006
Richmond City Corp.	2,470	700	300	1,000	361	1,388	300	1,688	688
River Heights City	1,930	516	34	550	254	2,099	34	2,133	1,582
Smithfield City	9,600	1,685	1,405	3,090	287	5,976	1,405	7,381	4,291
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	500	165	48	213	381	225	48	273	60
Wellsville City Corp.	3,400	1,473	20	1,493	392	5,730	20	5,750	4,257
Cache County summary for 2010	**107,326**	**25,677**	**7,037**	**32,713**	**272**	**54,586**	**7,037**	**61,623**	**28,909**

Conserve 0%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2020									
Cache County									
Amalga Town Culinary Water System	587	734	6	740	1,122	686	5	691	-49
Benson Water Culinary District	1,358	309	91	400	262	348	50	398	-2
Clarkston Town Culinary Water	836	221	86	307	327	1,049	83	1,132	824
Cornish Town Water	334	107	51	157	420	142	44	186	29
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	235	89	4	93	352	66	2	68	-25
Hyde Park City	4,926	918	438	1,356	245	1,417	341	1,758	402
Hyrum City	9,255	5,259	1,721	6,979	671	6,382	1,404	7,786	806
Lewiston City	1,781	718	97	815	407	1,612	96	1,708	893
Logan City	56,851	10,638	2,162	12,799	200	16,652	1,825	18,477	5,678
Mendon City Culinary Water System	1,844	226	251	477	230	356	191	546	69
Millville City Water	2,281	534	65	599	234	825	54	879	280
Newton Town Water	847	232	199	431	453	246	188	434	3
Nibley City	8,734	1,355	487	1,842	188	2,499	301	2,800	958
North Logan Water	11,614	2,025	332	2,357	181	1,727	236	1,963	-394
Paradise Town	1,118	138	361	499	397	497	291	787	288
Providence Town Water System	8,954	2,654	128	2,782	277	4,076	100	4,176	1,393
Richmond City Corp.	2,785	791	339	1,130	361	1,388	301	1,689	559
River Heights City	2,324	623	41	664	254	2,099	34	2,133	1,468
Smithfield City	12,184	2,145	1,788	3,933	287	5,976	1,409	7,385	3,452
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	600	199	58	257	381	225	48	273	17
Wellsville City Corp.	4,121	1,790	24	1,815	392	5,730	20	5,750	3,935
Cache County summary for 2020	**133,699**	**31,717**	**8,762**	**40,479**	**270**	**54,586**	**7,056**	**61,642**	**21,162**

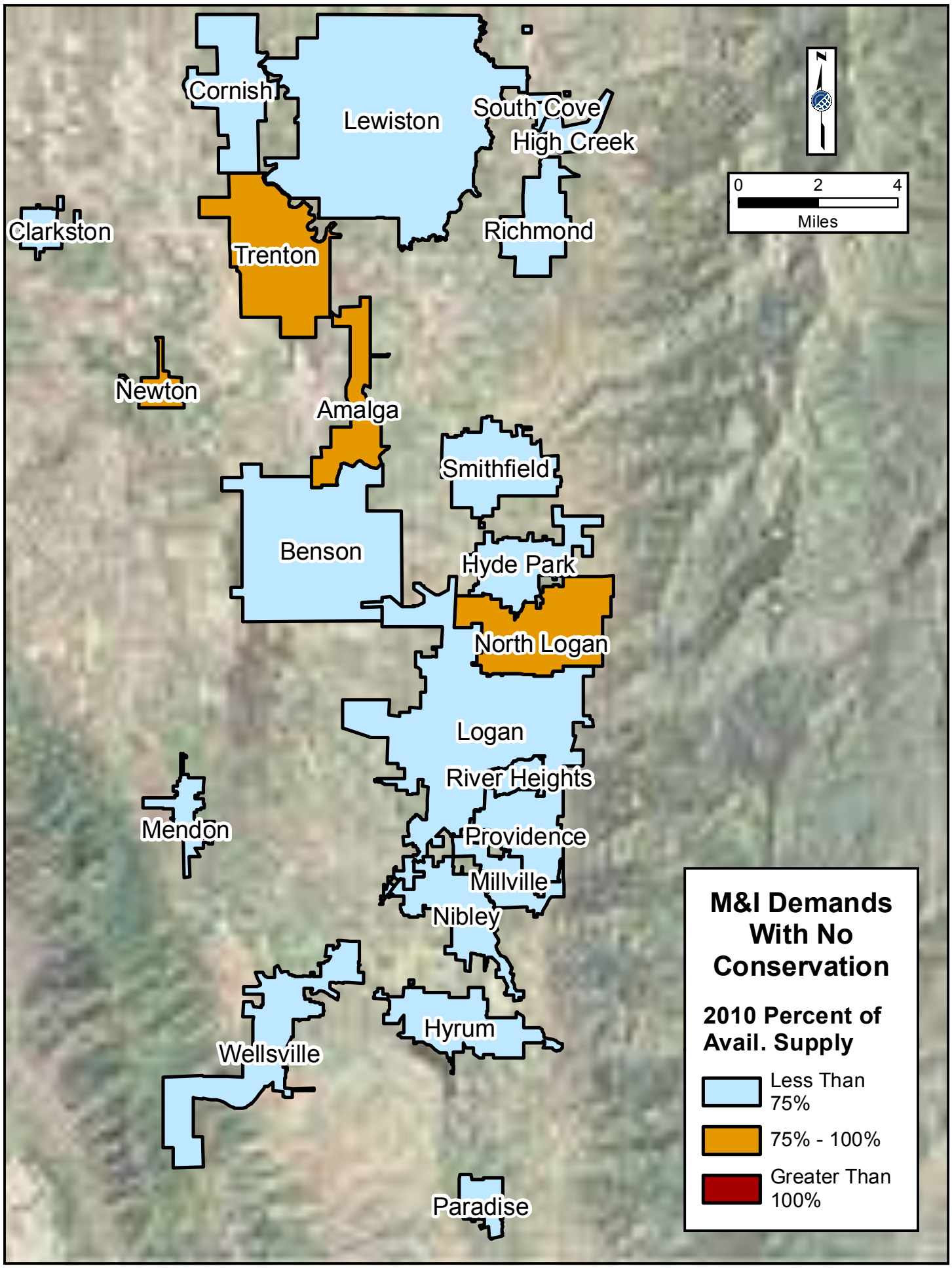
Conserve 0% Year 2025	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	612	763	6	769	1,122	686	5	691	-78
Benson Water Culinary District	1,915	434	128	562	262	348	50	398	-165
Clarkston Town Culinary Water	923	243	95	338	327	1,049	83	1,132	793
Cornish Town Water	349	111	53	164	420	142	44	186	22
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	332	126	5	131	352	66	2	68	-63
Hyde Park City	5,568	1,034	494	1,529	245	1,417	340	1,757	228
Hyrum City	10,124	5,737	1,877	7,614	671	6,382	1,400	7,782	168
Lewiston City	1,986	798	108	906	407	1,612	96	1,708	802
Logan City	60,281	11,249	2,286	13,535	200	16,652	1,820	18,472	4,937
Mendon City Culinary Water System	2,145	262	291	553	230	356	190	546	-8
Millville City Water	2,487	581	71	651	234	825	54	879	228
Newton Town Water	850	232	199	431	453	246	187	433	2
Nibley City	11,386	1,762	633	2,394	188	2,499	300	2,799	405
North Logan Water	13,272	2,308	378	2,686	181	1,727	235	1,962	-724
Paradise Town	1,223	150	394	545	397	497	290	787	242
Providence Town Water System	10,299	3,044	147	3,192	277	4,076	100	4,176	984
Richmond City Corp.	2,906	823	353	1,176	361	1,388	300	1,688	512
River Heights City	2,360	631	42	673	254	2,099	34	2,133	1,460
Smithfield City	13,761	2,416	2,014	4,430	287	5,976	1,405	7,381	2,951
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	662	219	64	282	381	225	48	273	-9
Wellsville City Corp.	4,555	1,974	27	2,000	392	5,730	20	5,750	3,750
Cache County summary for 2025	**148,126**	**34,911**	**9,697**	**44,608**	**269**	**54,586**	**7,037**	**61,623**	**17,014**

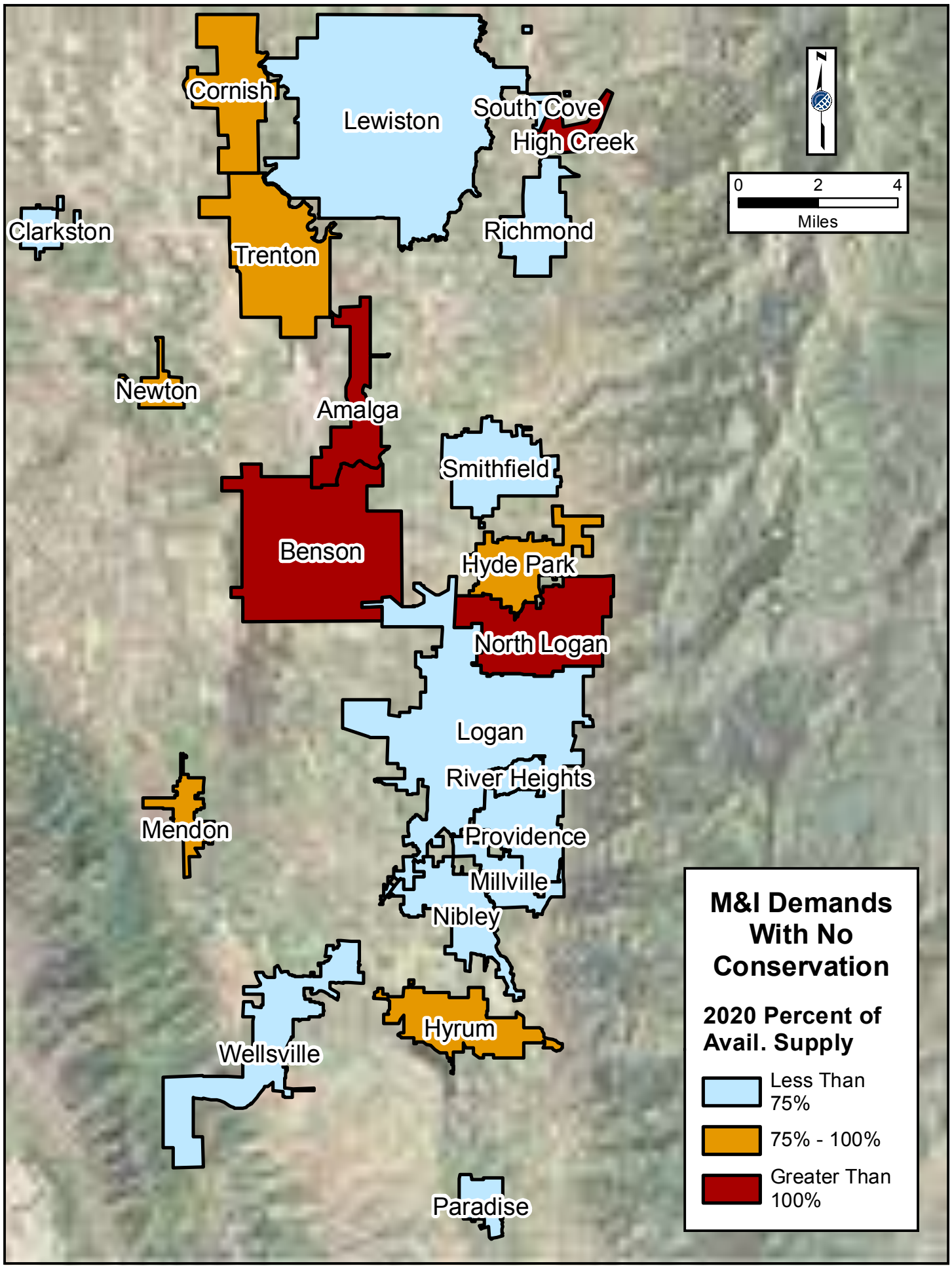
Conserve 0% Year 2030	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	637	795	6	801	1,122	686	5	691	-110
Benson Water Culinary District	2,472	561	165	726	262	348	50	398	-329
Clarkston Town Culinary Water	1,010	266	104	370	327	1,049	83	1,132	761
Cornish Town Water	364	116	55	171	420	142	44	186	15
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	429	163	7	169	352	66	2	68	-101
Hyde Park City	6,209	1,153	551	1,705	245	1,417	340	1,757	52
Hyrum City	10,993	6,229	2,038	8,267	671	6,382	1,400	7,782	-485
Lewiston City	2,191	880	119	999	407	1,612	96	1,708	708
Logan City	63,712	11,889	2,416	14,305	200	16,652	1,820	18,472	4,167
Mendon City Culinary Water System	2,445	299	332	631	230	356	190	546	-85
Millville City Water	2,694	629	77	705	234	825	54	879	174
Newton Town Water	852	233	199	432	453	246	187	433	1
Nibley City	14,038	2,172	780	2,952	188	2,499	300	2,799	-153
North Logan Water	14,930	2,597	425	3,022	181	1,727	235	1,962	-1,060
Paradise Town	1,328	163	428	591	397	497	290	787	195
Providence Town Water System	11,645	3,442	166	3,609	277	4,076	100	4,176	567
Richmond City Corp.	3,026	857	368	1,225	361	1,388	300	1,688	463
River Heights City	2,395	640	42	683	254	2,099	34	2,133	1,450
Smithfield City	15,338	2,692	2,245	4,937	287	5,976	1,405	7,381	2,444
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	725	240	70	309	381	225	48	273	-36
Wellsville City Corp.	4,989	2,162	29	2,191	392	5,730	20	5,750	3,559
Cache County summary for 2030	**162,552**	**38,191**	**10,656**	**48,847**	**268**	**54,586**	**7,037**	**61,623**	**12,775**

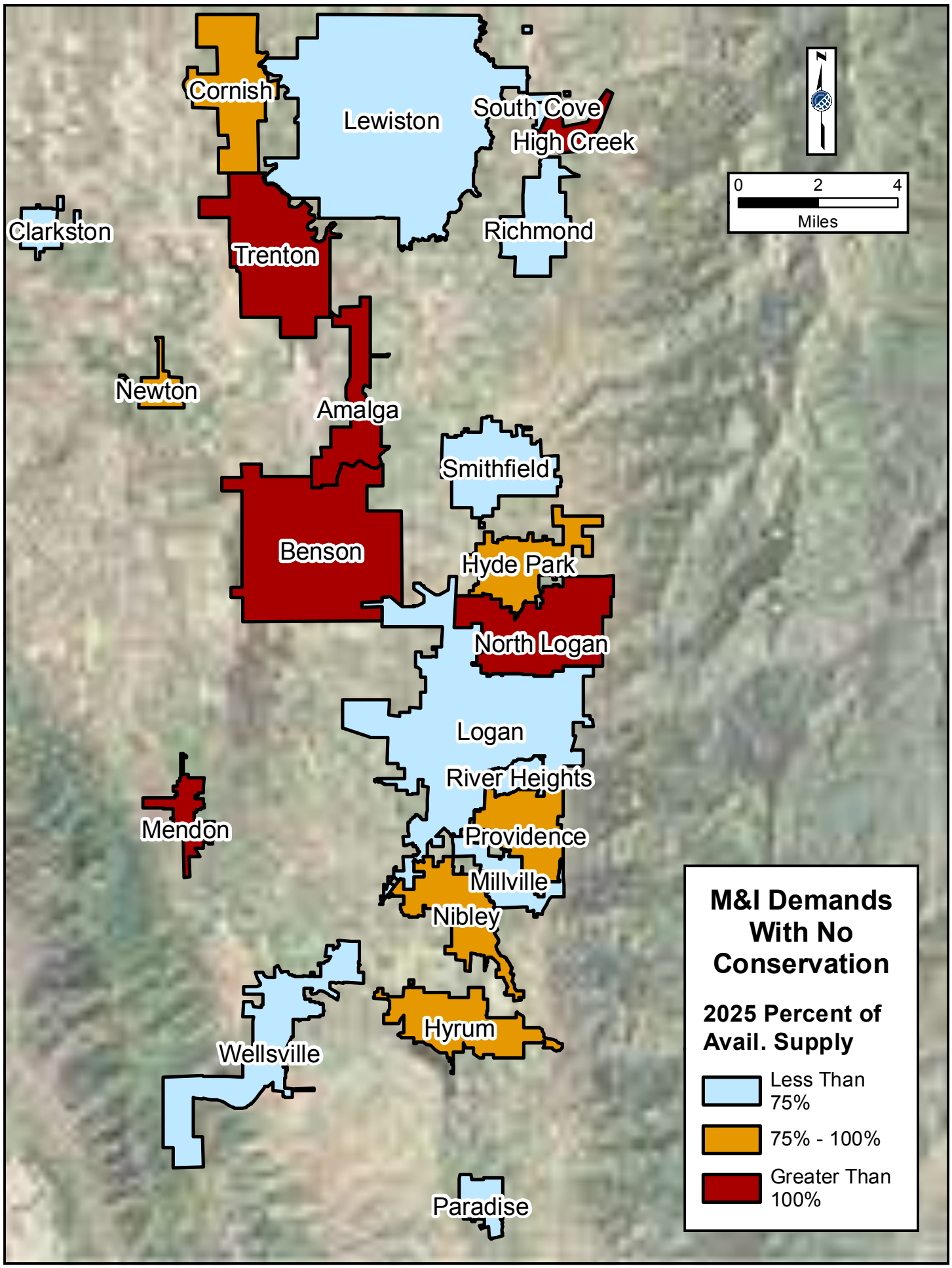
Conserve 0% Year 2040	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	655	819	6	825	1,122	686	5	691	-134
Benson Water Culinary District	3,505	797	235	1,032	262	348	50	398	-635
Clarkston Town Culinary Water	1,181	312	122	434	327	1,049	83	1,132	698
Cornish Town Water	387	124	59	182	420	142	44	186	4
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	607	231	9	240	352	66	2	68	-172
Hyde Park City	7,546	1,406	672	2,077	245	1,417	341	1,758	-319
Hyrum City	12,695	7,213	2,360	9,574	671	6,382	1,404	7,786	-1,788
Lewiston City	2,561	1,032	139	1,171	407	1,612	96	1,708	536
Logan City	76,381	14,292	2,904	17,196	200	16,652	1,825	18,477	1,281
Mendon City Culinary Water System	2,790	342	380	722	230	356	191	546	-176
Millville City Water	3,065	717	87	805	234	825	54	879	74
Newton Town Water	996	273	233	506	453	246	188	434	-73
Nibley City	15,615	2,423	870	3,293	188	2,499	301	2,800	-493
North Logan Water	16,669	2,907	476	3,383	181	1,727	236	1,963	-1,420
Paradise Town	1,545	191	499	690	397	497	291	787	98
Providence Town Water System	13,613	4,035	195	4,230	277	4,076	100	4,176	-54
Richmond City Corp.	3,342	949	407	1,356	361	1,388	301	1,689	333
River Heights City	2,514	674	44	719	254	2,099	34	2,133	1,414
Smithfield City	18,509	3,258	2,716	5,974	287	5,976	1,409	7,385	1,411
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	847	281	82	362	381	225	48	273	-89
Wellsville City Corp.	5,776	2,510	34	2,544	392	5,730	20	5,750	3,206
Cache County summary for 2040	**190,929**	**44,798**	**12,566**	**57,364**	**267**	**54,586**	**7,056**	**61,642**	**4,278**

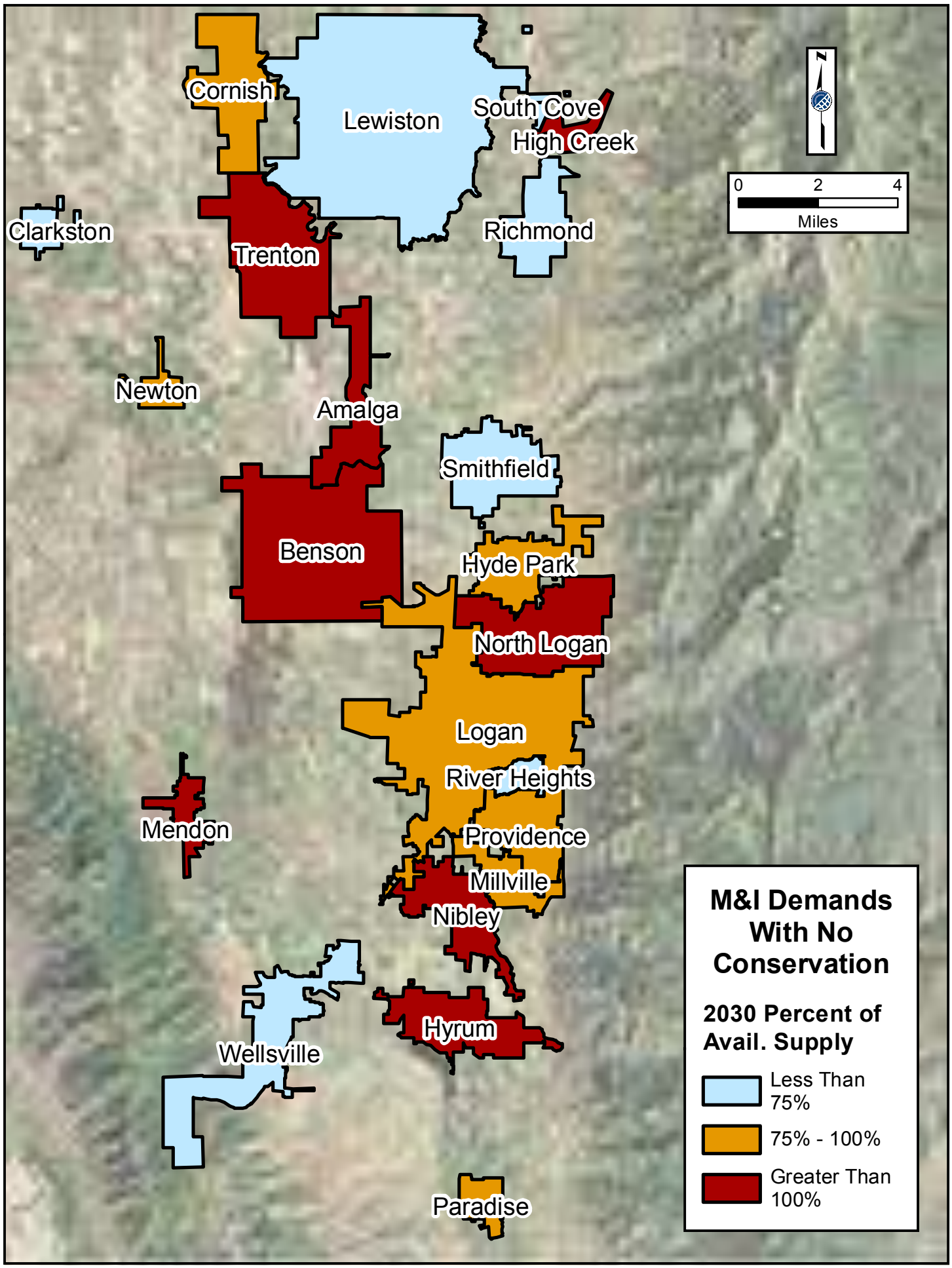
Conserve 0% Year 2050	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	1,010	1,260	10	1,269	1,122	686	5	691	-578
Benson Water Culinary District	5,698	1,292	381	1,674	262	348	50	398	-1,276
Clarkston Town Culinary Water	1,396	368	144	512	327	1,049	83	1,132	620
Cornish Town Water	468	149	71	220	420	142	44	186	-34
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	988	375	15	390	352	66	2	68	-322
Hyde Park City	7,667	1,424	681	2,105	245	1,417	340	1,757	-348
Hyrum City	15,729	8,913	2,917	11,829	671	6,382	1,400	7,782	-4,047
Lewiston City	3,495	1,405	190	1,594	407	1,612	96	1,708	113
Logan City	92,651	17,289	3,513	20,802	200	16,652	1,820	18,472	-2,330
Mendon City Culinary Water System	3,046	372	413	786	230	356	190	546	-240
Millville City Water	3,983	930	113	1,043	234	825	54	879	-164
Newton Town Water	1,179	322	276	598	453	246	187	433	-165
Nibley City	18,467	2,858	1,026	3,884	188	2,499	300	2,799	-1,085
North Logan Water	18,555	3,227	529	3,756	181	1,727	235	1,962	-1,794
Paradise Town	1,871	230	603	833	397	497	290	787	-47
Providence Town Water System	16,100	4,759	230	4,989	277	4,076	100	4,176	-814
Richmond City Corp.	4,184	1,185	508	1,693	361	1,388	300	1,688	-5
River Heights City	2,846	761	50	811	254	2,099	34	2,133	1,321
Smithfield City	19,280	3,384	2,822	6,206	287	5,976	1,405	7,381	1,175
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	1,002	331	96	427	381	225	48	273	-154
Wellsville City Corp.	7,032	3,047	41	3,088	392	5,730	20	5,750	2,662
Cache County summary for 2050	**226,777**	**53,894**	**14,662**	**68,556**	**270**	**54,586**	**7,037**	**61,623**	**-6,934**

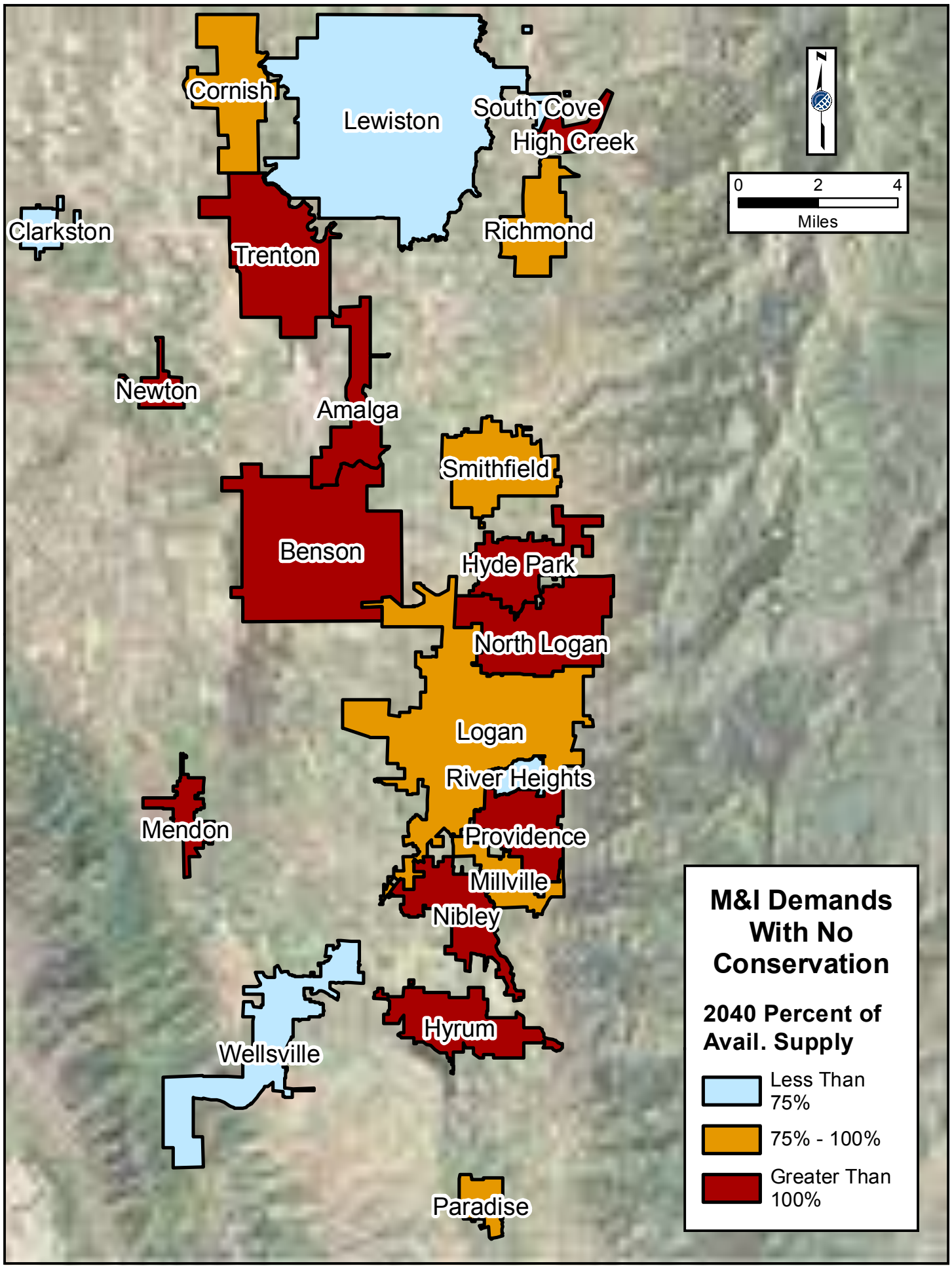
Conserve 0% Year 2060	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	1,190	1,488	11	1,500	1,122	686	5	691	-809
Benson Water Culinary District	6,690	1,521	449	1,970	262	348	50	398	-1,573
Clarkston Town Culinary Water	1,645	434	170	605	327	1,049	83	1,132	527
Cornish Town Water	551	176	84	260	420	142	44	186	-74
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	1,160	441	18	459	352	66	2	68	-391
Hyde Park City	8,448	1,574	752	2,326	245	1,417	341	1,758	-568
Hyrum City	18,864	10,718	3,508	14,226	671	6,382	1,404	7,786	-6,440
Lewiston City	3,842	1,548	209	1,757	407	1,612	96	1,708	-49
Logan City	111,314	20,829	4,232	25,061	200	16,652	1,825	18,477	-6,584
Mendon City Culinary Water System	3,588	440	488	928	230	356	191	546	-382
Millville City Water	4,854	1,136	138	1,274	234	825	54	879	-395
Newton Town Water	1,388	380	325	706	453	246	188	434	-272
Nibley City	21,752	3,375	1,212	4,587	188	2,499	301	2,800	-1,787
North Logan Water	21,855	3,811	624	4,436	181	1,727	236	1,963	-2,473
Paradise Town	2,226	275	719	994	397	497	291	787	-206
Providence Town Water System	18,964	5,621	272	5,893	277	4,076	100	4,176	-1,717
Richmond City Corp.	5,203	1,478	634	2,111	361	1,388	301	1,689	-423
River Heights City	3,352	899	59	958	254	2,099	34	2,133	1,175
Smithfield City	21,480	3,781	3,152	6,933	287	5,976	1,409	7,385	452
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	1,180	391	114	505	381	225	48	273	-231
Wellsville City Corp.	8,365	3,634	49	3,684	392	5,730	20	5,750	2,066
Cache County summary for 2060	**268,041**	**63,965**	**17,254**	**81,219**	**270**	**54,586**	**7,056**	**61,642**	**-19,577**

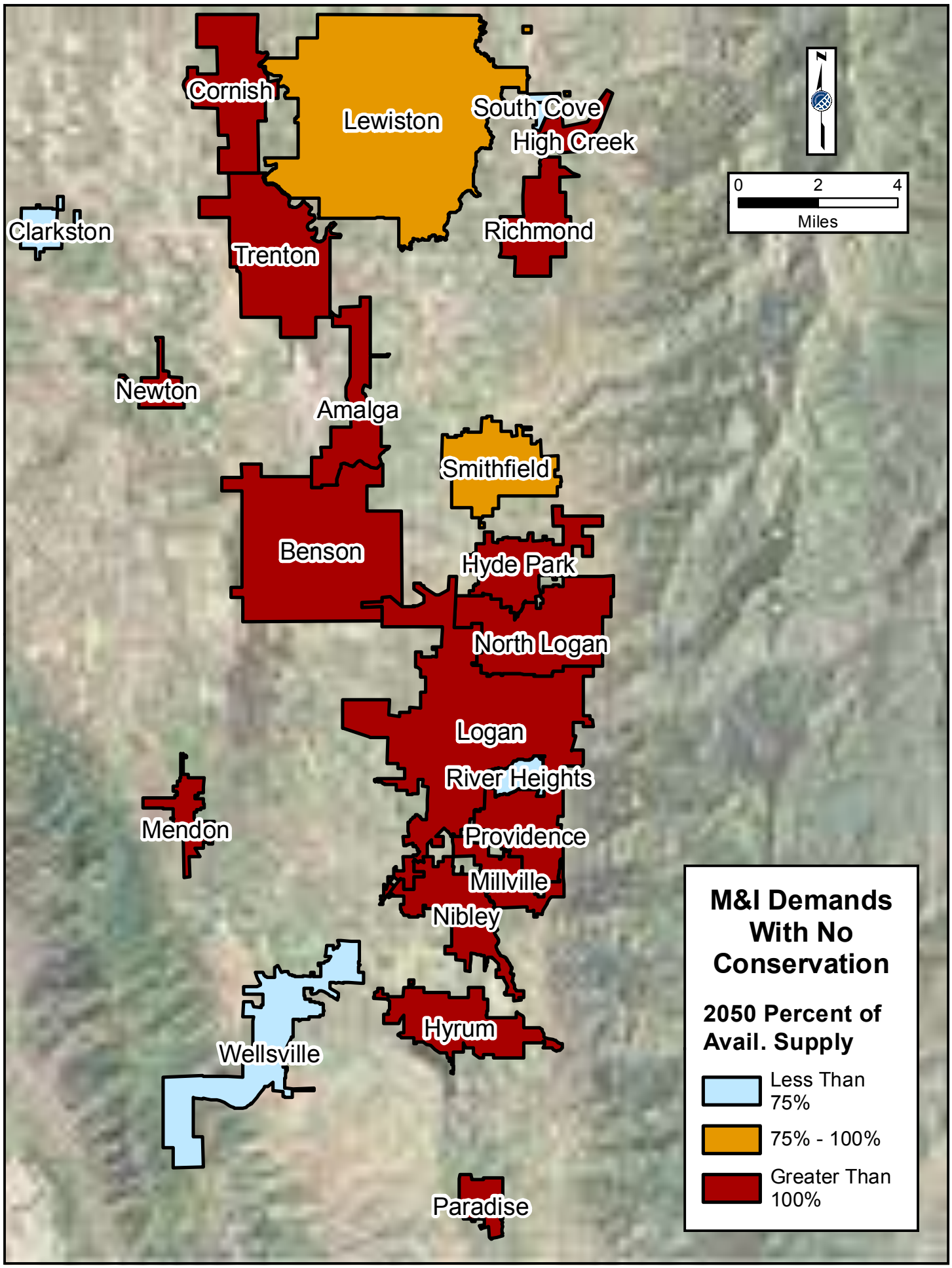

Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With No Conservation
2010 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%

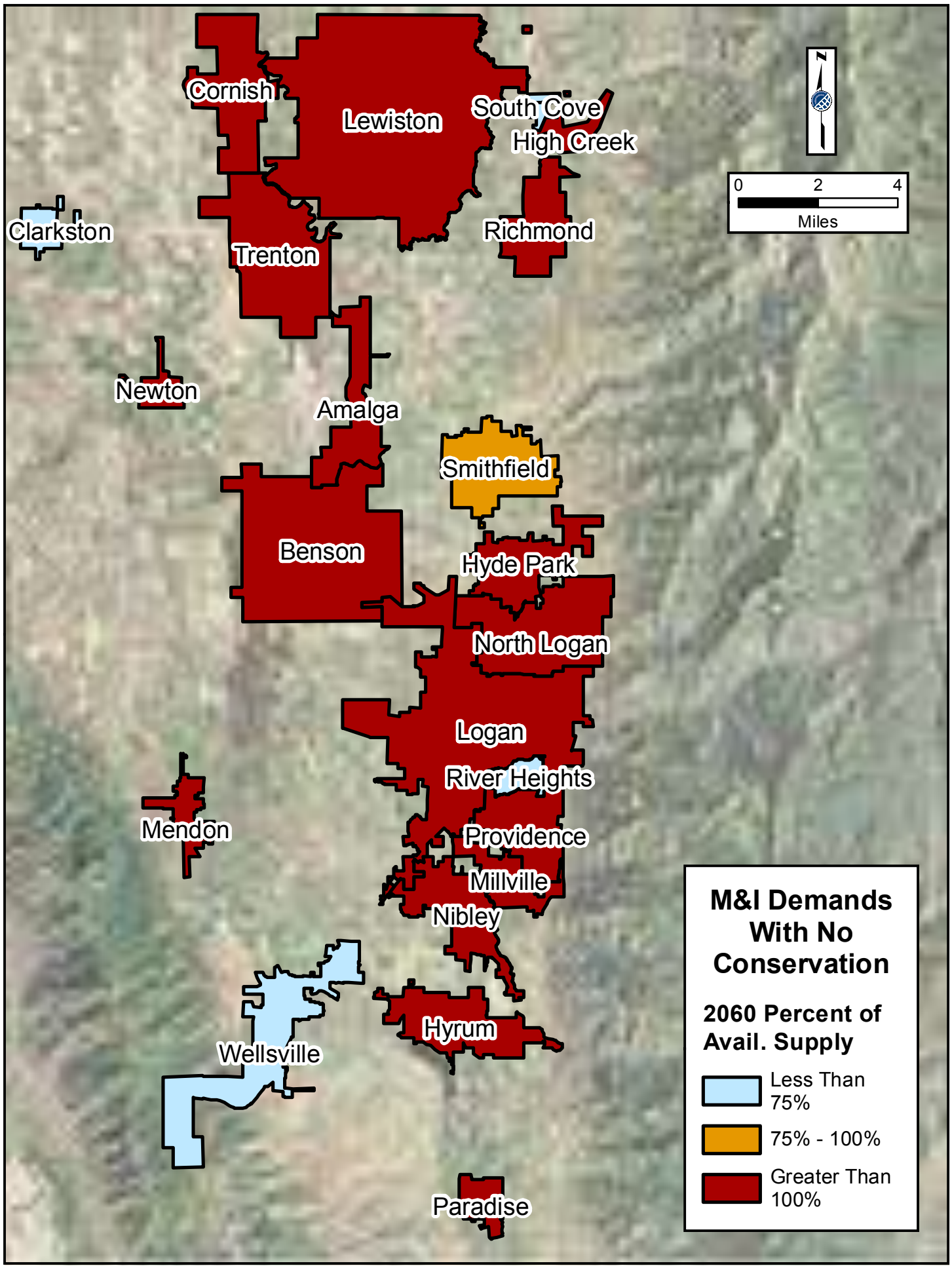

Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With No Conservation
2020 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With No Conservation
2025 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With No Conservation
2030 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With No Conservation
2040 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With No Conservation
2050 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With No Conservation
2060 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%

Bear River Basin conserve 25% from 2000 to 2025

Base Year

Year 2010

Cache County

	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Amalga Town Culinary Water System	530	661	5	666	1,122	686	5	691	25
Benson Water Culinary District	747	169	50	219	262	348	50	398	178
Clarkston Town Culinary Water	800	211	82	293	327	1,049	82	1,132	838
Cornish Town Water	290	92	44	136	420	142	44	186	50
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	129	49	2	51	352	66	2	68	17
Hyde Park City	3,830	712	340	1,051	245	1,417	340	1,757	706
Hyrum City	7,550	4,278	1,400	5,678	671	6,382	1,400	7,782	2,104
Lewiston City	1,770	711	96	807	407	1,612	96	1,708	900
Logan City	48,000	8,957	1,820	10,777	200	16,652	1,820	18,472	7,695
Mendon City Culinary Water System	1,400	171	190	361	230	356	190	546	184
Millville City Water	1,900	443	54	497	234	825	54	879	382
Newton Town Water	800	219	187	406	453	246	187	433	27
Nibley City	5,400	836	300	1,136	188	2,499	300	2,799	1,663
North Logan Water	8,250	1,435	235	1,670	181	1,727	235	1,962	292
Paradise Town	900	111	290	401	397	497	290	787	386
Providence Town Water System	7,000	2,069	100	2,169	277	4,076	100	4,176	2,006
Richmond City Corp.	2,470	700	300	1,000	361	1,388	300	1,688	688
River Heights City	1,930	516	34	550	254	2,099	34	2,133	1,582
Smithfield City	9,600	1,685	1,405	3,090	287	5,976	1,405	7,381	4,291
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	500	165	48	213	381	225	48	273	60
Wellsville City Corp.	3,400	1,473	20	1,493	392	5,730	20	5,750	4,257
Cache County summary for Base Year 2010	**107,326**	**25,677**	**7,037**	**32,713**	**272**	**54,586**	**7,037**	**61,623**	**28,909**

Bear River Basin conserve 25% from 2000 to 2025

Conserve 20%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2020									
Cache County									
Amalga Town Culinary Water System	587	683	5	688	1,044	686	5	692	3
Benson Water Culinary District	1,358	287	85	372	244	348	85	439	67
Clarkston Town Culinary Water	836	205	80	286	304	1,049	80	1,135	850
Cornish Town Water	334	99	47	146	390	142	47	193	46
Goaslind Spring Water Works Co.	60	6	11	17	251	394	11	406	389
High Creek Culinary Water System	235	83	3	86	328	66	3	70	-17
Hyde Park City	4,926	854	408	1,261	228	1,417	408	1,855	594
Hyrum City	9,255	4,892	1,601	6,493	625	6,382	1,601	8,103	1,610
Lewiston City	1,781	668	90	758	379	1,612	90	1,708	951
Logan City	56,851	9,896	2,011	11,906	186	16,652	2,011	18,814	6,907
Mendon City Culinary Water System	1,844	210	233	444	214	356	233	606	163
Millville City Water	2,281	497	60	557	217	825	60	890	333
Newton Town Water	847	216	185	401	421	246	185	445	44
Nibley City	8,734	1,261	453	1,713	175	2,499	453	2,986	1,272
North Logan Water	11,614	1,884	309	2,193	168	1,727	309	2,059	-134
Paradise Town	1,118	128	336	464	370	497	336	858	393
Providence Town Water System	8,954	2,469	119	2,588	257	4,076	119	4,204	1,616
Richmond City Corp.	2,785	736	316	1,051	336	1,388	316	1,727	676
River Heights City	2,324	580	38	618	237	2,099	38	2,140	1,522
Smithfield City	12,184	1,995	1,663	3,658	267	5,976	1,663	7,764	4,106
South Cove Water Works Co., Inc.	70	6	21	27	343	197	21	219	192
Trenton Town Corp. Water	600	185	54	239	354	225	54	283	44
Wellsville City Corp.	4,121	1,666	23	1,688	365	5,730	23	5,754	4,066
Cache County summary for 2020	**133,699**	**29,505**	**8,151**	**37,655**	**251**	**54,586**	**8,151**	**63,348**	**25,693**

Bear River Basin conserve 25% from 2000 to 2025

Conserve 25%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2025									
Cache County									
Amalga Town Culinary Water System	612	666	5	671	978	686	5	692	21
Benson Water Culinary District	1,915	379	112	491	229	348	112	476	-15
Clarkston Town Culinary Water	923	212	83	295	285	1,049	83	1,144	849
Cornish Town Water	349	97	46	143	366	142	46	195	52
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	332	110	4	114	307	66	4	71	-43
Hyde Park City	5,568	902	431	1,333	214	1,417	431	1,911	578
Hyrum City	10,124	5,003	1,637	6,640	586	6,382	1,637	8,259	1,619
Lewiston City	1,986	696	94	790	355	1,612	94	1,719	929
Logan City	60,281	9,810	1,993	11,803	175	16,652	1,993	18,938	7,134
Mendon City Culinary Water System	2,145	229	254	483	201	356	254	647	164
Millville City Water	2,487	506	62	568	204	825	62	896	328
Newton Town Water	850	203	173	376	395	246	173	445	69
Nibley City	11,386	1,537	552	2,088	164	2,499	552	3,132	1,043
North Logan Water	13,272	2,013	330	2,343	158	1,727	330	2,105	-238
Paradise Town	1,223	131	344	475	347	497	344	891	416
Providence Town Water System	10,299	2,655	128	2,783	241	4,076	128	4,223	1,439
Richmond City Corp.	2,906	718	308	1,026	315	1,388	308	1,741	715
River Heights City	2,360	550	36	587	222	2,099	36	2,140	1,553
Smithfield City	13,761	2,107	1,756	3,863	251	5,976	1,756	7,990	4,127
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	662	191	55	246	332	225	55	289	42
Wellsville City Corp.	4,555	1,721	23	1,745	342	5,730	23	5,757	4,012
Cache County summary for 2025	**148,126**	**30,446**	**8,457**	**38,903**	**234**	**54,586**	**8,457**	**64,283**	**25,381**

Bear River Basin conserve 25% from 2000 to 2025

Conserve 25%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2030									
Cache County									
Amalga Town Culinary Water System	637	693	5	698	978	686	5	692	-6
Benson Water Culinary District	2,472	489	144	633	229	348	144	513	-120
Clarkston Town Culinary Water	1,010	232	91	323	285	1,049	91	1,153	830
Cornish Town Water	364	101	48	149	366	142	48	197	48
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	429	142	6	148	307	66	6	73	-75
Hyde Park City	6,209	1,006	481	1,487	214	1,417	481	1,968	482
Hyrum City	10,993	5,432	1,778	7,210	586	6,382	1,778	8,420	1,210
Lewiston City	2,191	768	104	871	355	1,612	104	1,730	859
Logan City	63,712	10,368	2,107	12,475	175	16,652	2,107	19,068	6,593
Mendon City Culinary Water System	2,445	261	289	550	201	356	289	687	137
Millville City Water	2,694	548	67	615	204	825	67	902	286
Newton Town Water	852	203	174	377	395	246	174	445	68
Nibley City	14,038	1,894	680	2,575	164	2,499	680	3,279	704
North Logan Water	14,930	2,264	371	2,635	158	1,727	371	2,152	-483
Paradise Town	1,328	142	373	516	347	497	373	924	409
Providence Town Water System	11,645	3,002	145	3,147	241	4,076	145	4,242	1,095
Richmond City Corp.	3,026	747	321	1,068	315	1,388	321	1,756	688
River Heights City	2,395	559	37	595	222	2,099	37	2,141	1,545
Smithfield City	15,338	2,348	1,958	4,306	251	5,976	1,958	8,221	3,915
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	725	209	61	270	332	225	61	295	25
Wellsville City Corp.	4,989	1,885	26	1,911	342	5,730	26	5,759	3,849
Cache County summary for 2030	**162,552**	**33,306**	**9,293**	**42,599**	**234**	**54,586**	**9,293**	**65,242**	**22,643**

Bear River Basin conserve 25% from 2000 to 2025

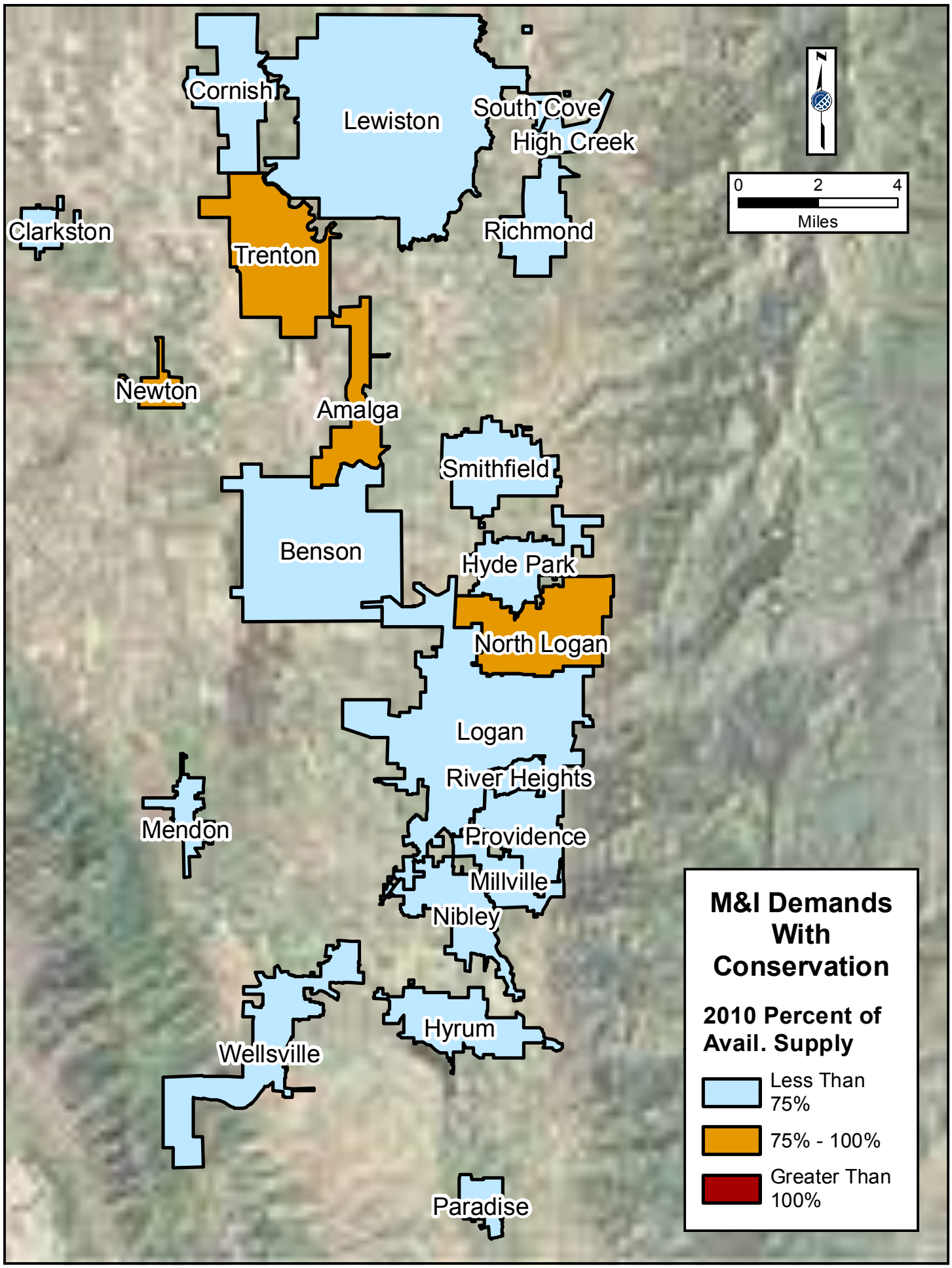
Conserve 25%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2040									
Cache County									
Amalga Town Culinary Water System	655	714	5	720	978	686	5	692	-28
Benson Water Culinary District	3,505	695	205	900	229	348	205	583	-317
Clarkston Town Culinary Water	1,181	272	107	379	285	1,049	107	1,171	793
Cornish Town Water	387	108	51	159	366	142	51	201	42
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	607	201	8	209	307	66	8	75	-134
Hyde Park City	7,546	1,226	586	1,812	214	1,417	586	2,089	277
Hyrum City	12,695	6,291	2,059	8,349	586	6,382	2,059	8,742	393
Lewiston City	2,561	900	121	1,021	355	1,612	121	1,751	729
Logan City	76,381	12,464	2,533	14,997	175	16,652	2,533	19,556	4,559
Mendon City Culinary Water System	2,790	298	331	629	201	356	331	735	106
Millville City Water	3,065	626	76	702	204	825	76	912	211
Newton Town Water	996	238	204	442	395	246	204	479	38
Nibley City	15,615	2,113	759	2,872	164	2,499	759	3,369	497
North Logan Water	16,669	2,535	415	2,950	158	1,727	415	2,203	-747
Paradise Town	1,545	166	435	602	347	497	435	996	394
Providence Town Water System	13,613	3,519	170	3,689	241	4,076	170	4,271	582
Richmond City Corp.	3,342	828	355	1,183	315	1,388	355	1,795	612
River Heights City	2,514	588	39	627	222	2,099	39	2,143	1,516
Smithfield City	18,509	2,841	2,369	5,210	251	5,976	2,369	8,692	3,482
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	847	245	71	316	332	225	71	307	-9
Wellsville City Corp.	5,776	2,189	30	2,218	342	5,730	30	5,764	3,546
Cache County summary for 2040	**190,929**	**39,068**	**10,958**	**50,026**	**233**	**54,586**	**10,958**	**67,152**	**17,125**

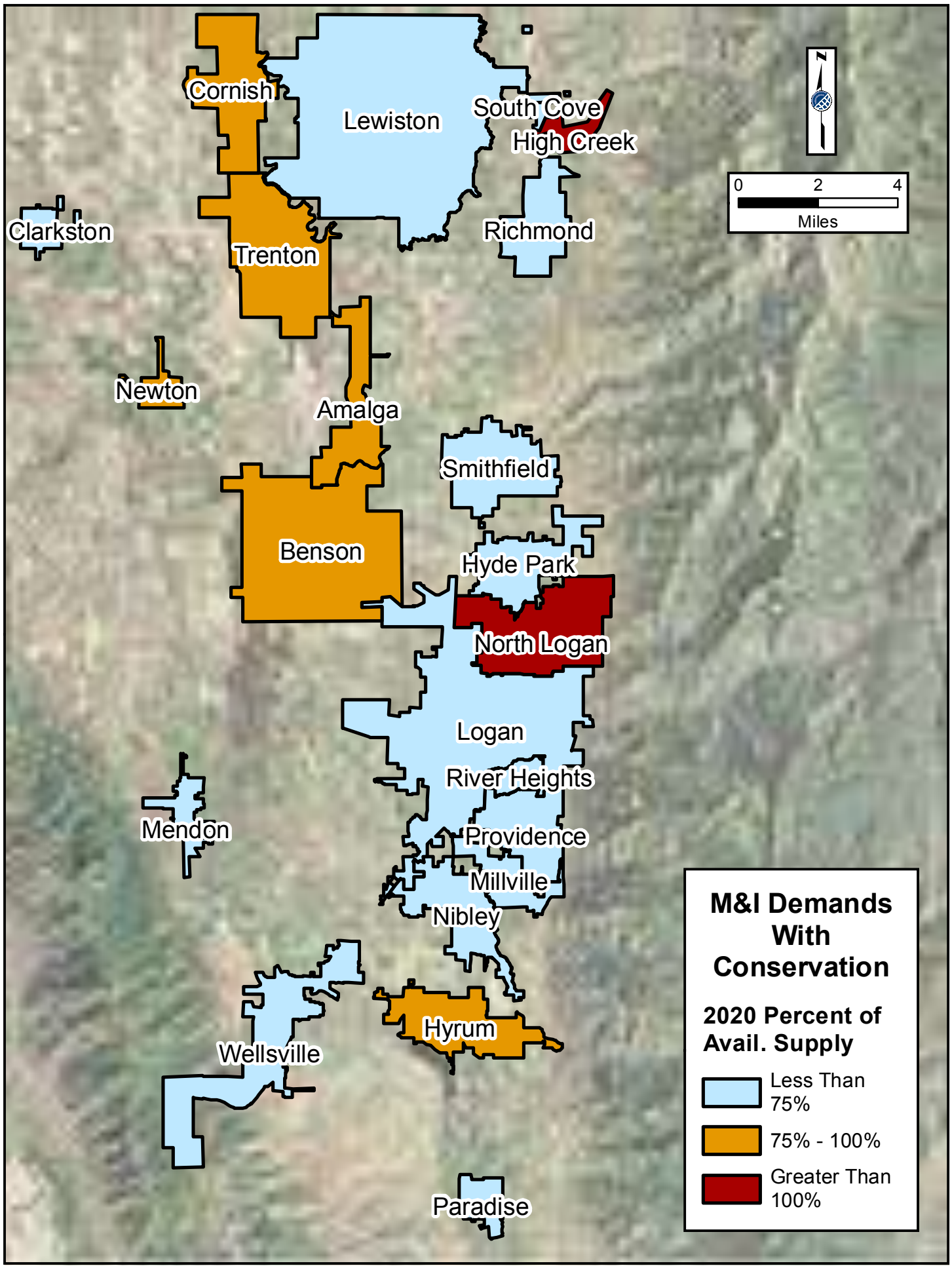
Bear River Basin conserve 25% from 2000 to 2025

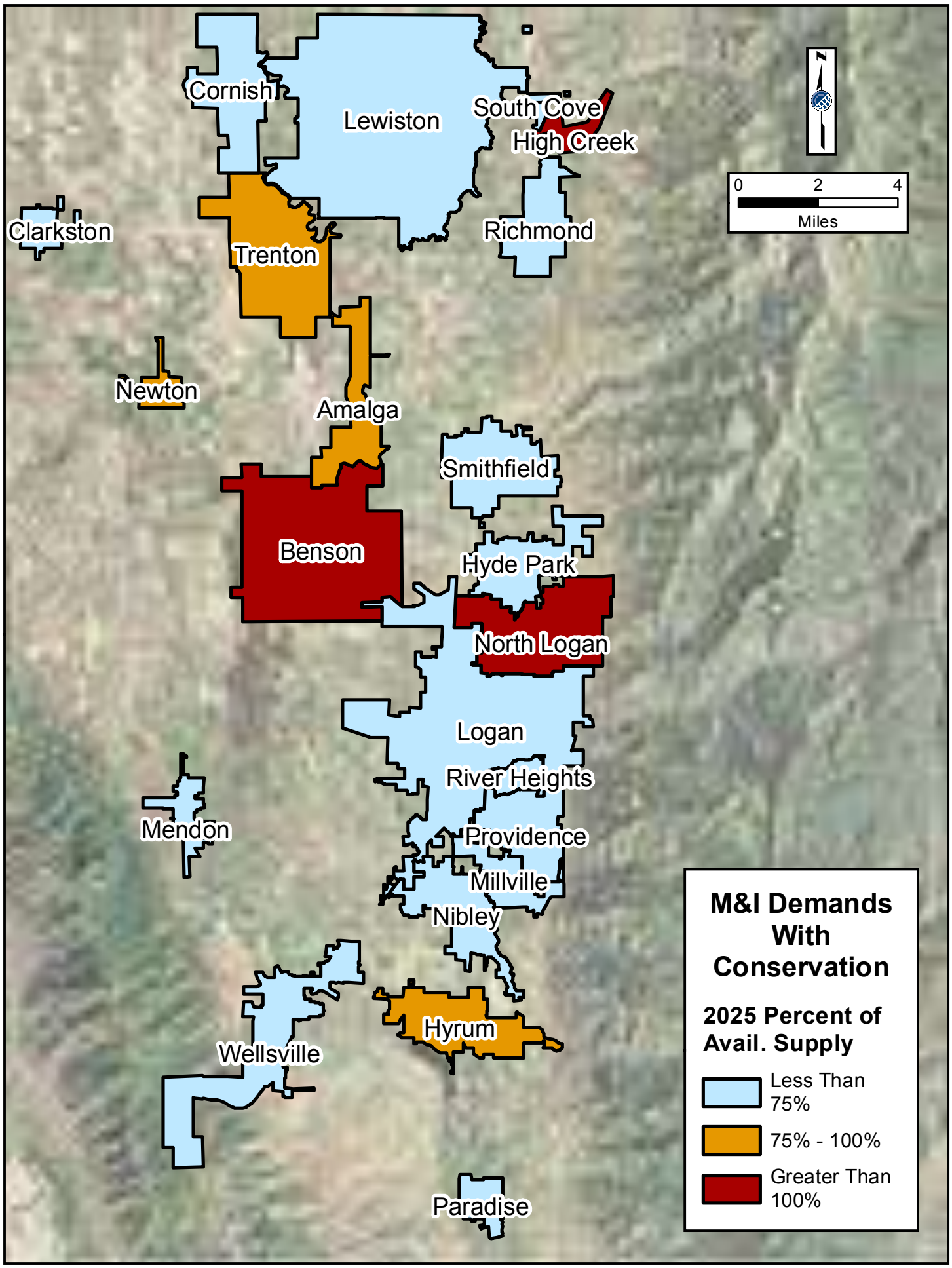
Conserve 25%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2050									
Cache County									
Amalga Town Culinary Water System	1,010	1,099	8	1,107	978	686	8	696	-411
Benson Water Culinary District	5,698	1,127	333	1,459	229	348	333	729	-731
Clarkston Town Culinary Water	1,396	321	126	446	285	1,049	126	1,193	747
Cornish Town Water	468	130	62	192	366	142	62	213	21
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	988	327	13	340	307	66	13	81	-259
Hyde Park City	7,667	1,242	594	1,836	214	1,417	594	2,098	262
Hyrum City	15,729	7,773	2,544	10,316	586	6,382	2,544	9,299	-1,018
Lewiston City	3,495	1,225	165	1,390	355	1,612	165	1,801	411
Logan City	92,651	15,078	3,064	18,142	175	16,652	3,064	20,165	2,023
Mendon City Culinary Water System	3,046	325	361	685	201	356	361	769	84
Millville City Water	3,983	811	99	910	204	825	99	938	29
Newton Town Water	1,179	281	240	521	395	246	240	522	0
Nibley City	18,467	2,492	895	3,387	164	2,499	895	3,525	138
North Logan Water	18,555	2,814	461	3,275	158	1,727	461	2,256	-1,020
Paradise Town	1,871	201	526	726	347	497	526	1,099	373
Providence Town Water System	16,100	4,150	201	4,351	241	4,076	201	4,306	-46
Richmond City Corp.	4,184	1,033	443	1,477	315	1,388	443	1,896	420
River Heights City	2,846	664	44	707	222	2,099	44	2,149	1,441
Smithfield City	19,280	2,952	2,461	5,412	251	5,976	2,461	8,798	3,385
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	1,002	289	84	373	332	225	84	321	-51
Wellsville City Corp.	7,032	2,657	36	2,693	342	5,730	36	5,771	3,078
Cache County summary for 2050	**226,777**	**47,001**	**12,787**	**59,787**	**235**	**54,586**	**12,787**	**69,248**	**9,461**

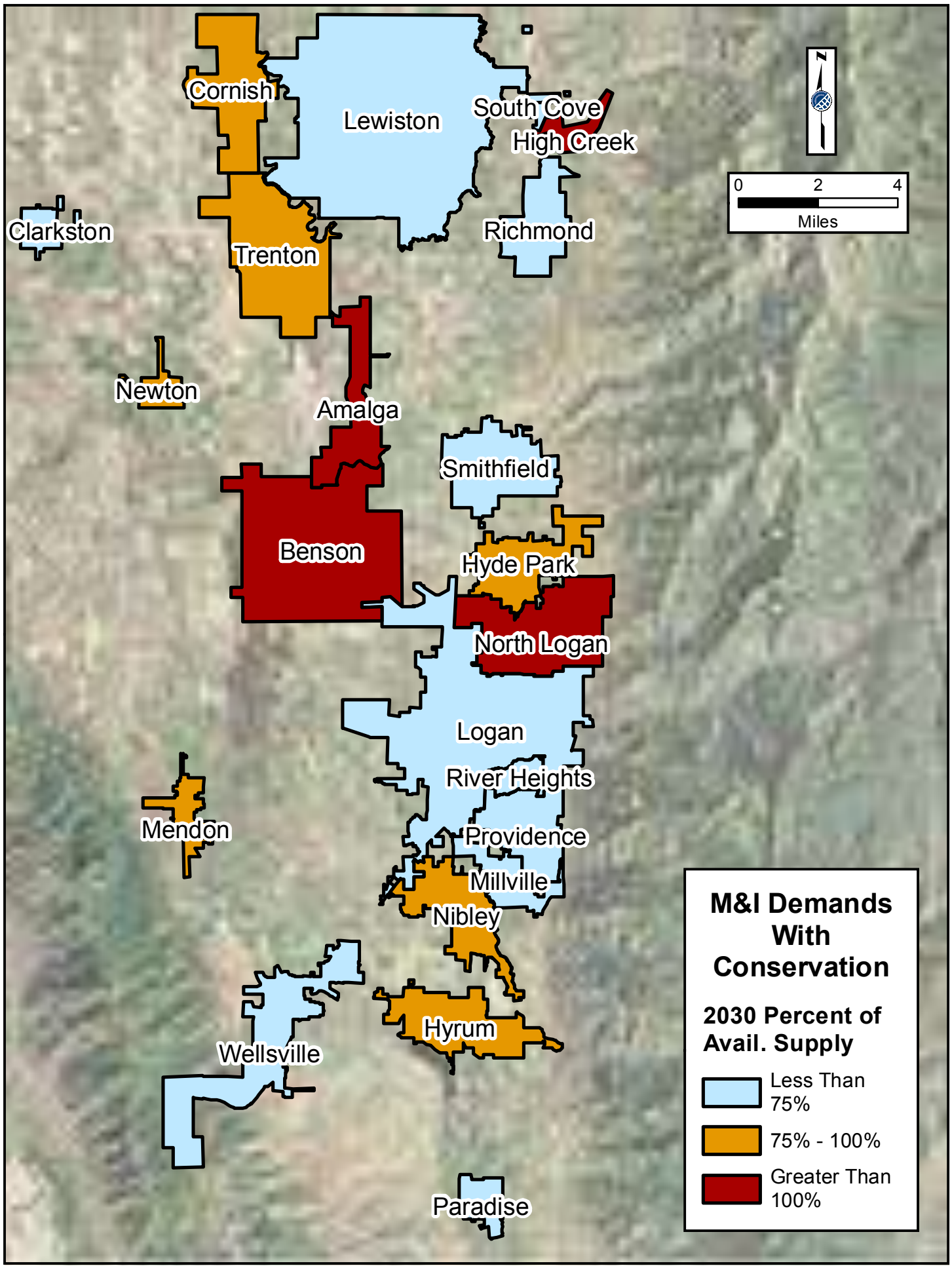
Bear River Basin conserve 25% from 2000 to 2025

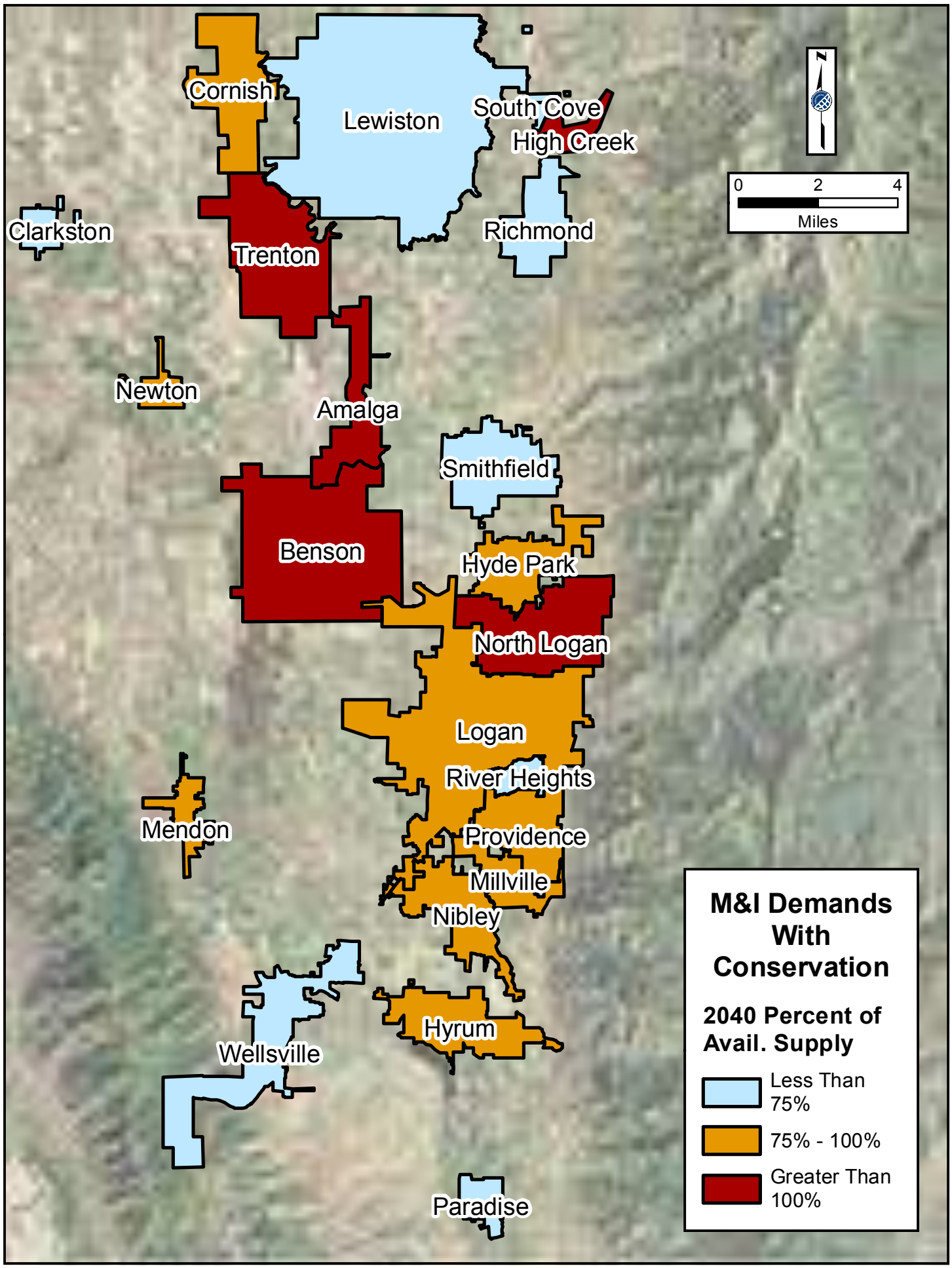
Conserve 25%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2060									
Cache County									
Amalga Town Culinary Water System	1,190	1,298	10	1,308	978	686	10	697	-611
Benson Water Culinary District	6,690	1,327	392	1,718	229	348	392	797	-922
Clarkston Town Culinary Water	1,645	379	148	527	285	1,049	148	1,219	692
Cornish Town Water	551	153	73	226	366	142	73	226	-1
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	1,160	385	16	400	307	66	16	84	-316
Hyde Park City	8,448	1,372	656	2,028	214	1,417	656	2,169	141
Hyrum City	18,864	9,347	3,059	12,406	586	6,382	3,059	9,890	-2,517
Lewiston City	3,842	1,350	182	1,532	355	1,612	182	1,820	288
Logan City	111,314	18,165	3,691	21,856	175	16,652	3,691	20,884	-972
Mendon City Culinary Water System	3,588	384	426	810	201	356	426	844	34
Millville City Water	4,854	991	121	1,111	204	825	121	963	-148
Newton Town Water	1,388	332	284	616	395	246	284	571	-44
Nibley City	21,752	2,943	1,057	4,000	164	2,499	1,057	3,711	-289
North Logan Water	21,855	3,324	544	3,868	158	1,727	544	2,351	-1,517
Paradise Town	2,226	239	627	867	347	497	627	1,216	349
Providence Town Water System	18,964	4,902	237	5,139	241	4,076	237	4,347	-792
Richmond City Corp.	5,203	1,289	553	1,841	315	1,388	553	2,022	180
River Heights City	3,352	784	52	835	222	2,099	52	2,158	1,322
Smithfield City	21,480	3,297	2,749	6,046	251	5,976	2,749	9,128	3,082
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	1,180	341	99	440	332	225	99	339	-101
Wellsville City Corp.	8,365	3,170	43	3,213	342	5,730	43	5,779	2,567
Cache County summary for 2060	**268,041**	**55,783**	**15,047**	**70,830**	**235**	**54,586**	**15,047**	**71,840**	**1,010**

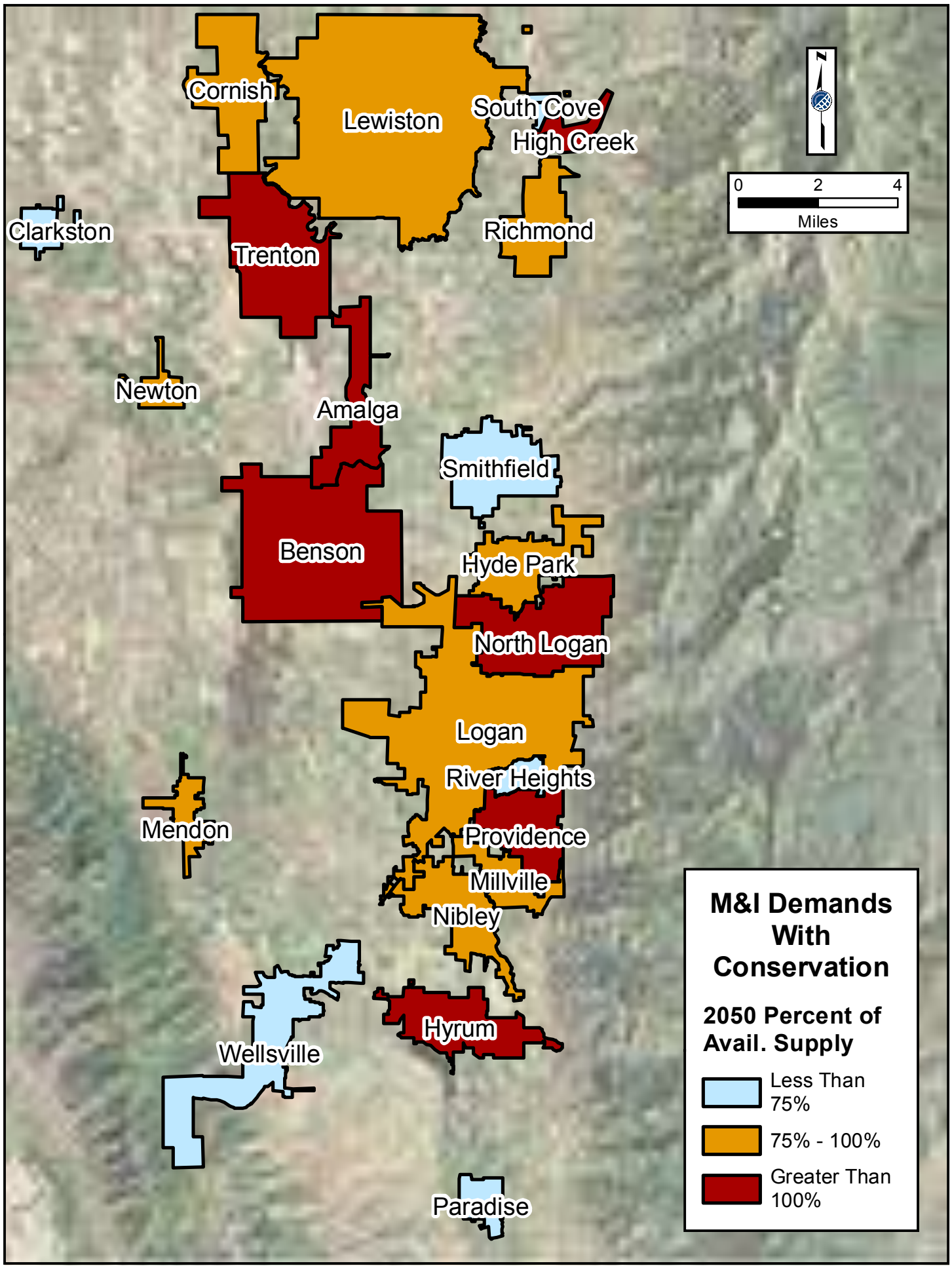

Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With Conservation
2010 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%

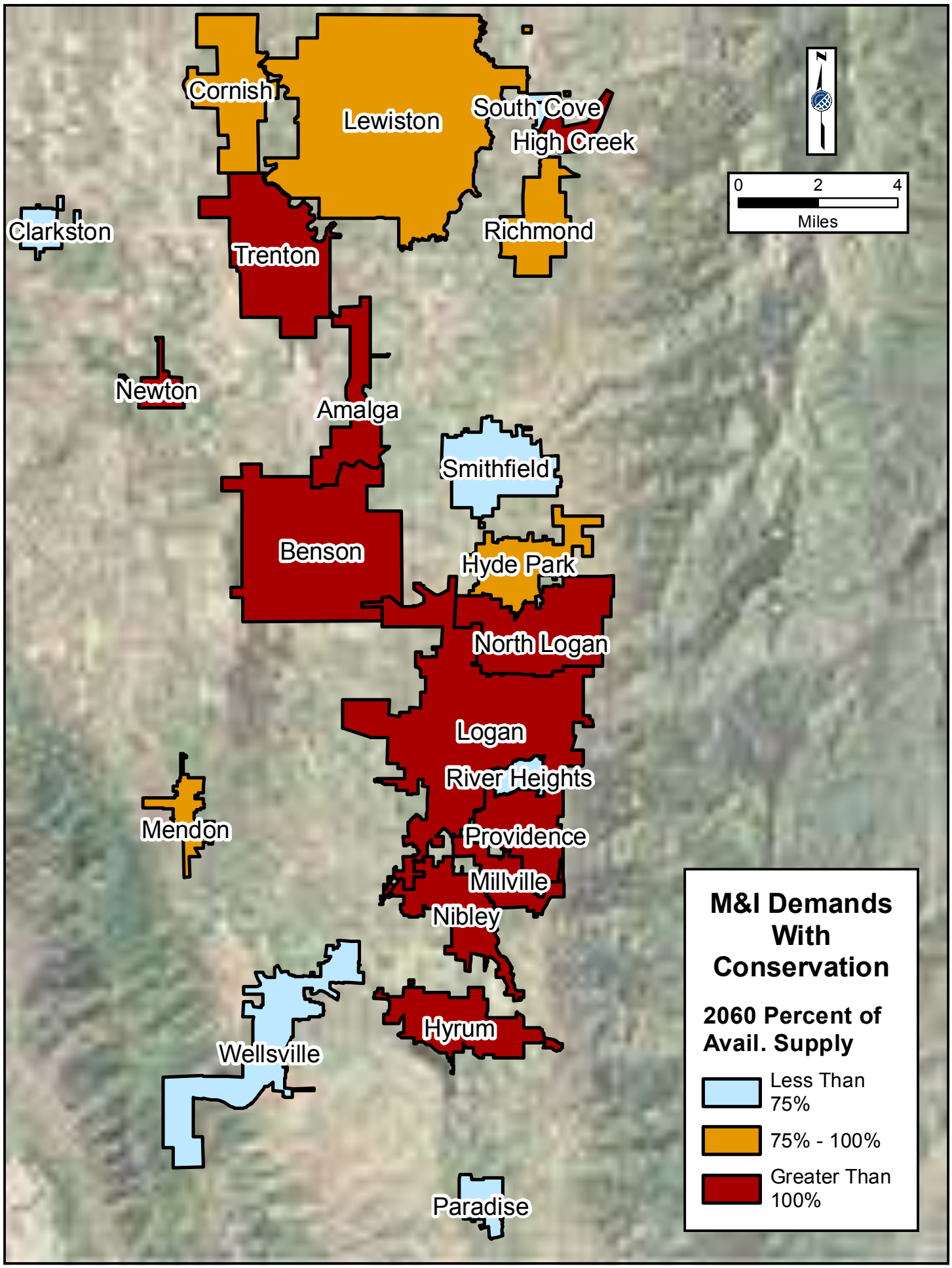

Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With Conservation
2020 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With Conservation
2025 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With Conservation
2030 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With Conservation
2040 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With Conservation
2050 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%


Cornish
Lewiston
South Cove
High Creek
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Benson
Hyde Park
North Logan
Logan
River Heights
Mendon
Providence
Millville
Nibley
Hyrum
Wellsville
Paradise
N
0
2
4
Miles
M&I Demands With Conservation
2060 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%

Appendix 4-B

Cache Valley Groundwater Management Plan

Guidelines followed by the Division of Water Rights in managing the groundwater resources in Cache Valley.

CACHE COUNTY
WATER MASTER PLAN

State of Utah

[illegible]

[illegible]

[illegible] CACHE VALLEY GROUND-WATER MANAGEMENT PLAN

[illegible]

The purpose of this plan is to set forth the framework for [illegible] management of groundwater resources in Cache Valley and the State Engineer's guidelines regarding proper water appropriations and change applications. The State Engineer believes there exists a close hydrologic connection between groundwater aquifers, springs and streams, and that welfare and private owner must be jointly managed. In providing this plan, the State Engineer's primary objective is to protect prior water rights while promoting [illegible] and the greatest amount of beneficial water.

In maintaining the private-water resources of Cache Valley, the State Engineer has used, among other [illegible], the U.S. Geological Survey (USGS) ground-water modeling of Cache Valley, Cache County, Utah, and adjacent part of Idaho, with emphasis on [illegible] of ground-water flow (Bartolino, et al., 1998).

BACKGROUND

The State Engineer believes that there is [illegible] water available in Cache Valley, Utah, during certain times of the year, according to the Utah State Water Plan, Bear River Basin, there is [illegible] acre-feet of unappropriated water available each year in the Bear River system for development (p.[illegible]). Much of this water is available during the spring runoff period. During most summer periods of dry years, junior-right water owners who fully appropriate their rights in the traditional flow or volume sources to meet the demands of all existing surface water rights. In [illegible] basin, appropriation based strictly on date and priority sustain rights established [illegible].

The Cache Valley aquifer system, through [illegible] and water conservation, [illegible] surface and ground water within Cache Valley are [illegible] considered. Although the groundwater flow model [illegible] developed by the USGS is a simplified representation of the physical [illegible], it does provide the relationship of the [illegible]. It is a useful tool in evaluating the effects of ground-water withdrawals. Given [illegible] the groundwater system to evaluate water sources and adjustments to [illegible] withdrawals and changes in recharge to the groundwater system, the model [illegible], et al., 1998) indicates that on an [illegible] basis, the effect of additional groundwater withdrawal and consumption, in a [illegible] is nearly [illegible]. Consequently [illegible] applications [illegible] it [illegible] to be exchanged from one [illegible] to

surface water routed to discharge areas and, to a lesser degree, [illegible] more water to enter the aquifer system from surface water sources in recharge areas. In assessing the impact on the hydrologic system of existing and future ground-water withdrawals, it is important to consider that a portion of the withdrawn water may be returned to the system.

Physically, there are significant quantities of water within the basin fill aquifers. However, because ground water and surface water within Cache Valley are interconnected, it is anticipated that additional development and depletion of ground water will affect surface water flows. The ground-water system discharges water to the surface streams, springs, and reservoirs, and this water constitutes part of the flow in the tributaries and main stem of the Bear River. The limiting factor regarding ground-water development in Cache Valley is not the amount of water which is physically available within the aquifers, but rather the amount of ground water which can be withdrawn without impairing prior rights. Because of their interrelationship, ground-water and surface water systems need to be jointly managed as one system.

Ground-water withdrawals in Cache Valley represent about [illegible]% of the annual recharge. The ground-water system is not currently experiencing any significant, regional, long-term declines. Locally, water levels fluctuate seasonally due to well withdrawals and climatic conditions; however, long-term, regional water levels appear to be stable. Estimated average annual recharge and discharge to the ground-water system in the Utah portion of Cache Valley for 1982 through 1990 are shown in Table 4.

Recharge	Acre-feet
Infiltration of precipitation	[illegible]
and unconsumed irrigation water	
Seepage from streams	[illegible]
Seepage from canals	[illegible]
Other forms of recharge (subsurface)	[illegible]
Total	[illegible]
Discharge	
Seepage to streams	[illegible]
Spring discharge	[illegible]
Evapotranspiration	[illegible]
Seepage to reservoirs	[illegible]
Withdrawals from wells	[illegible]
Total	[illegible]

Table 4. Estimated water budget for the ground-water flow system in Cache Valley, Utah, 1982-90.

Table 1 shows a [illegible] balance of the recharge and discharge components of the ground-water system and its relationship to surface water sources. Changes in one component will generally cause changes in other components. The table also shows that about [illegible] percent of the total discharge from the ground-water system is to springs.

Springs supplied from the valley-fill aquifers generally occur in those areas where either the water level in a water table aquifer intersects the land surface or the water level in a confined aquifer is above the land surface and water [illegible] through an opening in the confining layer. Therefore, to maintain the discharge of springs at current levels, no significant change in the ground-water level should occur.

The issue is whether ground-water development should be curtailed in order to maintain current spring [illegible]. The State Engineer's water management objectives for the valley are to protect prior rights while putting to beneficial use the greatest amount of available water. The challenge is to [illegible] [illegible] to guide development in a reasonable and equitable manner. The State Engineer recognizes the prior rights of spring users; however, he does not believe at this time it is reasonable or good water management to close ground-water to further appropriations.

The effects of additional ground-water withdrawals are difficult to predict because they are dependent on several factors, such as, location, rate of withdrawal, geologic conditions, aquifer permeability and other related parameters. However, it is anticipated that as additional ground-water is withdrawn in [illegible] Valley, generally, water levels will change, with the greatest changes in the vicinity of large production wells. These general water level changes may result in a corresponding decrease in certain spring flows.

In the case where the discharge of a spring decreases to a point where the flow is insufficient to supply their beneficial uses, the spring user should be allowed to drill a well to replace that water no longer supplied from the spring. The well should be used only within the limitations of the water right and would carry the same priority date as the spring.

Surface water rights are supplied from many different sources, such as, runoff, ground-water inflow and irrigation return flow. Senior water rights are entitled to rely on upstream sources to make up their water supply. Since the ground-water system is hydraulically connected to some surface sources, the State Engineer believes that both surface and ground-water rights should be managed conjunctively. If surface flows are not sufficient to supply all rights, both surface and ground-water rights should be distributed according to priority.

Municipal and industrial water demand has been projected for Cache Valley through 2020 (Thaeler, 1994). Based on population projections and historical water use patterns, it is estimated that water diversion will increase by 10,000 AF from 1990 usage. Other uses and demands on the system may account for an additional 15,000 AF over the next 20 years. The State Engineer believes that potential withdrawals of 25,000 AF is a reasonable quantity of additional water to be developed to meet future demands for water over the next 20 years.

MANAGEMENT GUIDELINES

After considering at length the total situation of the Cache Valley hydrologic system as briefly summarized above, the State Engineer has formulated a plan which seeks to reasonably and wisely manage the water resources of Cache Valley. The plan strives to balance the protection of existing water rights in a reasonable manner, with the objective of encouraging that the greatest amount of available water be put to beneficial use. The State Engineer will use the following guidelines in reviewing applications and managing the ground-water resources of Cache Valley.

1) Cache Valley is open to new appropriations of ground water for individual family domestic purposes. Such applications are limited to a maximum diversion of 1.73 acre-feet per year for the domestic purposes of one family, up to 0.25 acres of irrigation of lawn and garden and incidental stock watering of 10 livestock. Applications considered under this paragraph may not be approved if water can be supplied by a public water system or the land is in a subdivision. The State Engineer may approve no more than one application to appropriate ground water under the provisions of this paragraph on any parcel of land which exists as of the effective date of this plan.

2) Applications to appropriate ground water, larger than the limitations set forth in paragraph 1, above, will be considered for approval, if the applicant can show that: (a) There is reason to believe that prior water rights will not be impaired, or (b) That impacts to prior water rights will be compensated or adequate replacement water provided. It is the responsibility of the applicant to make an evidentiary showing to the State Engineer at the time the application is filed, pursuant to (a) or (b) above. The evidentiary showing should address local, regional, and cumulative effects on springs, streams, and the ground-water system. Applications considered under this paragraph will be subject to the annual withdrawal limitations set forth in paragraph 3, below. All applications are also subject to the statutory criteria of Section 73-3-8, Utah Code Annotated.

3) Change applications that propose to move surface water rights to ground water wells or move within the groundwater system will be considered on their own individual merits subject to the statutory criteria set forth in sections 73-3-3 and 73-3-8, Utah Code Annotated. Applications will be reviewed to ensure there is no enlargement of the underlying right and intervening rights are not impaired. Changes under this paragraph will be subject to the annual withdrawal limitations set forth in paragraph 5, below.

4) Extension of time requests on approved applications will be critically reviewed and if the applicant is not diligently pursuing the development of the water, the extension request may be denied, the quantity of water reduced, or the priority date reduced.

5) The State Engineer will allow an additional [illegible] acre-feet/year of potential groundwater withdrawals. As this water is fully developed and used, the effect of such development on the hydrologic system will be evaluated to determine if additional withdrawals can be allowed. The State Engineer will continue to monitor groundwater withdrawals, water levels in observation wells, and, as necessary, discharge at various springs in Cache Valley. As ground water is developed and provisions for replacement water implemented, or at the request of water users, the State Engineer will investigate the need to appoint a water commissioner to ensure the proper distribution of both surface and ground water.

6) Owners of existing water rights, whose source of supply is from springs, will be allowed to drill a well(s) if the flow of their spring is reduced by new groundwater development to a point where the flow is insufficient to supply their beneficial uses. A water user would need to file a change application and set forth their claim of reduced spring flow.

7) Local water administration practices which exist within Cache Valley will supplement this plan and will remain in effect and are not superseded by this plan. These areas include Logan, Paradise and Peterboro, among others.

8) The effective date of this management plan is September 1, [illegible].

REFERENCES

[illegible], Trevor C., Sanpete County Water Demand/Supply Model. Final Report to Utah Division of Water Resources, U.S. Bureau of Reclamation and Sanpete County, Utah State University, December [illegible].

[illegible], [illegible], [illegible], [illegible], [illegible] of [illegible] Valley, Sanpete County, Utah and adjacent [illegible], with emphasis on simulation of ground-water flow. United States Geological Survey in cooperation with Utah Department of Natural Resources and Utah Division of Water Rights, [illegible].

Utah Code Annotated, 1953, as Amended, Title 73.

Utah State Water Plan, Sevier River Basin, Utah Board of Water Resources, January [illegible].

Appendix 5-A

Evaluation of Project Alternatives

Explanation of the evaluation completed to determine what water projects need to be completed in Cache County to meet current and future water needs. The actual evaluation table is included after the explanation.

CACHE COUNTY
WATER MASTER PLAN

Overview of Project Evaluation Table Parts

The evaluation table is broken into the following parts:

Project Alternatives

The alternatives that were evaluated are listed down the left hand side of the table and are sorted by the type of project.

Objectives

The goals or objectives that have been identified as important by the steering committee and project team are listed across the top of the table. These objectives are split into the following three categories:

- Water Supply (shown in blue)
- Implementation (shown in purple)
- Environment (shown in green)

Metrics

The metrics for each objective are listed across the top of the table just below the objectives. The metrics provide the units and the method used to measure how well a given alternative meets the corresponding objective. In the future, as more specifics are gathered for a given alternative, more solid data can be added to the analysis.

Color Key

A color key is shown just below the metrics and gives four ranges of values for each metric. The alternatives were evaluated at a conceptual level. Therefore, there is a level of uncertainty in the values calculated for the evaluation. The four color levels indicate how well the objectives or goals are attained by a given alternative, with the darker colors indicating a higher level of attainment than the lighter colors.

Evaluation

In the rows to the right of each alternative, numbers are given in cells to indicate the estimated value that each alternative has for each of the metrics. For metrics that could not be exactly quantified, without further evaluation, an assignment of “None”, “Low”, “Medium”, or “High” was given. Any cell that is labeled with “N/A” indicates that the metric in that column does not apply to the alternative listed on that row.

The strength of a given alternative can be determined by looking across a row for the given alternative and comparing how dark the cells are for that alternative with the cells for other alternatives. Alternatives that have darker cells are stronger than alternatives with lighter cells.

EVALUATION OF PROJECT ALTERNATIVES

PROJECT ALTERNATIVES	OBJECTIVES																			
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Aquifer Storage and Recovery Projects																			
Aquifer Storage and Recovery (ASR)at mouth of Green Canyon	2,000	2,000	3	Low	0	0	0	0	More than 15	$600,000	$20	50% Grant	None	None	None	Low	None	No	Some Decrease
ASR using River Park Well	5,000	5,000	3	Low	0	0	0	0	More than 15	$3,000,000	$30	50% Grant	None	None	None	Low	None	No	Some Decrease
Reservoir Projects																			
Logan Canyon Reservoir - add 0.5 feet of irrigation water each year to irrigators (approx. 35,000 acres served)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$138,000,000	$240	75% funding for irrigation reservoir	None	None	Low	Low	High	No	No Change
Reservoir in Logan Canyon - Irrigate 8000 new acres in Petersboro area (Pump from Cutler)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$173,000,000	$330	75% funding for irrigation reservoir	None	None	Med	Low	High	No	Large Increase
Reservoir on Cub River, adds one foot more summer water for small pumpers and West Cache Irrigation	15,000	15,000	15**	15,000	0	0	Low	0	More than 15	$95,000,000	$340	75% funding for irrigation reservoir	None	None	Low	Low	High	No	Some Increase
Construct Multiple Small (less than 10,000 acre feet) Reservoirs to provide more secure irrigation water supply	60,000	60,000	15**	60,000	0	0	Low	0	More than 15	$315,000,000	$370	75% funding for irrigation reservoir	None	None	None	None	Low	No	No Change
Enlarge Hyrum reservoir to provide more irrigation to South Cache Irrigators	16,000	16,000	15**	16,000	0	0	Low	0	More than 15	$84,000,000	$280	75% funding for irrigation reservoir	None	None	Low	Low	Low	No	Some Decrease

*Low values are preferred and are shown in a darker color than higher values.

**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																			
	Water Supply								Implementation						Environment					
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																			
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																			
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Reservoir near Avon - Irrigate Mt. Sterling Area (pump from Hyrum reservoir)	12,000	12,000	15**	12,000	0	0	Low	0	More than 15	$118,000,000	$550	75% funding for irrigation reservoir	None	None	Low	Low	Med	No	Large Increase
Logan Canyon Reservoir- Irrigate Petersboro area (Pipe from Logan Canyon)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$286,000,000	$480	75% funding for irrigation reservoir	None	None	None	None	Med	No	No Change
Reservoir near Avon - Irrigate Mt. Sterling Area (Pipe from Avon)	12,000	12,000	15**	12,000	0	0	Low	0	More than 15	$199,000,000	$830	75% funding for irrigation reservoir	None	None	None	None	Med	No	No Change
Participate in a Box Elder Reservoir, pump back to cutler, pump to west bench areas	30,000	30,000	15**	30,000	0	0	0	0	1 to 5	$170,000,000	$470	75% funding for irrigation reservoir	None	None	None	None	None	No	Large Increase
Construct Millcreek Reservoir	10,000	10,000	15**	10,000	0	0	Low	0	More than 15	$79,000,000	$420	75% funding for irrigation reservoir	None	None	Med	Med	Med	No	No Change
Water Banking Projects																				
Bank water that is made available during conversion from Ag to Municipal & Through Bear River Development	60,000	0	13	0	0	12,000	0	0	More than 15	Depends on organizational structure used (less than $4Million)	Depends on organizational structure used	50% Grant	None	None	Low	Low	Low	No	No Change
Secondary Water Projects																				
Construct secondary water system in North Logan below L&N canal	0	0	1	0	0	0	1,800	50	3 or 4	$6,800,000	$230	50% Grant	None	None	None	None	None	No	Some Decrease
Construct secondary water system in Logan	0	0	1	0	0	0	3,000	100	3 or 4	$6,500,000	$230	50% Grant	None	None	None	None	None	No	Some Decrease

*Low values are preferred and are shown in a darker color than higher values.
**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																			
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Irrigation Delivery Projects																			
Reduce seepage from canals and use saved water to create more habitat for wildlife (1200 feet per year)	0	0	0	0	60,000	0	0	5,000	More than 15	$30,000,000	$270	50% Grant	None	None	Med	Med	Low	No	No Change
Program to rebuild or improve major canals in Cache County (1200 ft per year)	0	0	0	5,000	60000	0	Low	5,000	More Than 15	$30,000,000	$270	50% Grant	None	None	None	None	None	No	No Change
Enclose Crockett Canal east of Logan Center Street	0	0	0	Low	2450	0	0	440	12	$2,600,000	$17,000	50% Grant	None	None	None	None	Low	No	No Change
Create access along major canals in Logan, North Logan Hyde Park, Providence, River Heights	0	0	0	0	0	0	0	0	12	$400/lineal foot. Does not develop water	N/A	Low	None	None	None	None	Low	No	No Change
Culinary Water Distribution Projects																			
Culinary water pipe between Mendon and Wellsville	1,300	0	2	0	0	0	0	0	2	$2,200,000	$80	Low	None	None	None	None	None	No	No Change
Culinary water pipe Between Lewiston and Cornish	1,300	0	1	0	0	0	0	0	2	$600,000	$20	Low	None	None	None	None	None	No	No Change
Culinary water pipe between Trenton and Lewiston	1,300	0	1	0	0	0	0	0	2	$2,100,000	$80	Low	None	None	None	None	None	No	No Change
Culinary water pipe between Trenton and Cornish	1,300	0	1	0	0	0	0	0	2	$2,100,000	$70	Low	None	None	None	None	None	No	No Change
12" Culinary water pipe between Logan and Cache Junction, 8" lines to Mendon and Newton	2600	0	2	0	0	0	0	0	4	$14,000,000	$260	Low	None	None	None	None	None	No	No Change

*Low values are preferred and are shown in a darker color than higher values.

**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																				
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																				
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																				
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Public Education Projects																					
Visit each city council/ culinary water board to discuss results of master plan	0	0	Low	Low	0	0	0	0	More than 15	$40,000	0	Low	350	350	None	None	None	Yes	No Change
Water Conservation Projects																					
Water Conservation Campaign to reduce water usage by 25% by year 2050	0	0	8	0	0	0	0	21,000	More than 15	$28,000,000	$60	50% Grant	None	10,000	None	None	None	No	Some Decrease
Water Wise landscaping classes	0	0	Low	0	0	0	0	5,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	Low	Some Decrease
Large water user workshops to help promote conservation	0	0	Low	0	0	0	0	5,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	No	Some Decrease
Water conservation demonstration garden	0	0	Low	0	0	0	0	2,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	No	Some Decrease
Water Quality Projects																					
Public Education campaign in Cache County to help public understand how to protect our aquifers	0	0	0	0	0	0	0	0	More than 15	$100,000	N/A	Low	None	None	None	None	None	Yes	No Change
Water Study Projects																					
Study to quantify environmental water needs in Cache County (min stream flows etc.)	0	0	0	0	0	0	0	0	More than 15	$250,000	N/A	Low	None	None	High	High	Med	Yes	No Change
Climate change study	0	0	0	0	0	0	0	0	More than 15		N/A	Low	None	None	None	None	None	No	No Change
Other Projects																					
Construct riparian Meadows	less than 1000	0	0	0	0	0	0	0	10 to 12	?	?	50% Grant	None	None	Med	Med	No	Yes	No Change
500 Beaver Dams	500	500	0	500	0	0	0	0	2 or 3	Small	small	50% Grant	None	None	500	500	No	No	No Change

*Low values are preferred and are shown in a darker color than higher values.
**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

Appendix 5-B

Summary of Major Cost Assumptions

A summary of the major assumptions that were used to create the conceptual cost estimates for the evaluated projects.

CACHE COUNTY
WATER MASTER PLAN

PROJECT COST ASSUMPTIONS

The following types of projects were evaluated.

- Aquifer Storage and Recovery (ASR)
- Reservoirs
- Water Banking
- Secondary Water
- Irrigation Delivery (Canal improvements)
- Culinary Water Interconnects
- Water Quality Projects
- Water Study Projects

Multiple specific project examples were evaluated for some of the above listed project types.

One of the objectives used in the evaluation of projects was to minimize costs. Three metrics were used to measure how well a given project met the cost objective:

- Capital Costs
- Cost to pay back a loan on a project (Debt Service), and to operate a given project for a period of 50 years
- Potential for grant money to help fund a project

The following general cost assumptions were made for all of the projects evaluated:

- All estimates of yearly cost per acre foot (debt service and operation and maintenance) for a given project are based on a 50 year loan with a 4% interest rate.
- All capital cost estimates include a 50% contingency to account for engineering, studies, and uncertainty in construction costs.

The cost assumptions that are specific for projects evaluated are listed below.

ASR PROJECTS

Capital Costs:

River Park Well: Based on the cost to develop the Brigham City ASR project which was $165,000 in 1998. The project developed approximately 525 acre feet of water per year based on a withdrawal capacity of 3.5 feet acre feet per day (DWRe Bear River Basin Planning for the Future 2004 report) and assuming 5 months of withdrawal per year. The costs were inflated to 2013 dollars using the Engineering News Record Cost Index and adjusted to include engineering fees. This gave a cost of

$600/acre foot and a total project cost of $3,000,000. It was assumed that water would be injected utilizing the existing well.

Green Canyon: The costs for the Green Canyon site are based on some input from UGS as to what general items will need to be done to develop the site. The construction of the Green Canyon site will be less cost prohibitive then River park well site. The Green Canyon project will utilize surface infiltration instead of injection through a well. The following table shows the assumptions made for the Green Canyon costs.

Description	Unit	Quantity	Unit Cost	Opinion of Probable Cost
Hydrology/ Geology Studies	LS	1	$ 30,000	$30,000
Earthwork	CY	25000	$ 10	$250,000
Monitoring well with 2 piezometers (150-170' deep)	LS	1	$ 30,000	$30,000
Measure amount of water entering basin (2 flumes)	LS	1	$ 18,000	$18,000
Deliver Water to infiltration Basin (piping/canal)	LS	1	$ 50,000.00	$50,000
		Total Construction Cost		$378,000
	Construction Contingency (35%)			$ 132,300
		Engineering (15%)		$ 76,545
			TOTAL	**$ 586,845**
		Cost per acre foot		**$ 293.42**

The cost for the Green Canyon site is significantly less than the cost for the River Park Well. The 2004 Bear River Basin Report prepared by DWRe states that ASR facilities cost an average of about $360 per acre-foot per year for construction.

Storage Volumes: Estimates of anticipated storage volumes are based on conversations with UGS.

RESERVOIR ASSUMPTIONS

Capital Costs:

- **Construction Capital Costs for New Reservoirs:** $2,300 per acre foot based on average costs of selected reservoirs studied in the past and an inflation factor given from the Bureau of Reclamation (BOR) cost index for the construction of reservoirs with earthen dams.
- **Construction Capital Costs to expand Existing Reservoirs:** $2000 per acre foot based on past studies to enlarge Hyrum reservoir and BOR cost index mark up.
- **Construction Capital Costs for Reservoirs smaller than 10,000 Acre Feet in Capacity:** $4,000 per acre foot based on costs for reservoirs of similar size studied by the BOR in a Southeast Oregon 2010 Study. No pumping or piping included in costs for small reservoirs. Reservoir location unknown.

The total costs to construct the reservoirs are based on the total storage volume and not solely by the estimated yield volume.

The cost per acre foot per year is based on the estimated reliable yield that was estimated based on past reservoir studies where available.

Delivery : Costs to Deliver Irrigation Water to the areas served by the Reservoir

Pipe Costs: $10 per lineal foot per inch diameter of pipe size

Property along pipe alignment (estimated 40' easements with purchase cost of $30,000/acre)

Irrigation Distribution Piping Throughout the Area Served:

Major distribution lines =$2,100 per acre served. On-farm piping and sprinklers not included. (Assumptions are based on past large irrigation distribution construction projects)

Pump Stations: costs to pump water to areas that can't be served by gravity out of the reservoir

Elevation Lift: Assumed 300 feet of lift for all lift stations. Assumed two pump stations for Box Elder Reservoir

Cost per horsepower: $1,300.

Operation and Maintenance Costs**:** 1% of pump station construction

WATER BANKING

Costs depend on the type of management structure implemented. Assumed to be less than $400,000 per year and are categorized as such in the evaluation table.

SECONDARY WATER PROJECTS

Service Areas

North Logan Project: Assumed serving area between 1400 East and HWY 91 and 1700 North and 2500 North.

Logan Project: Assumed serving area between 800 East and Main Street and 1400 North and Canyon Road

Costs: Based on the recent costs to build a secondary water system in Santaquin City. Cost per acre foot = $3,034 plus contingencies.

Assumed that system will be fed from existing canals and will not require pumping.

IRRIGATION DELIVERY PROJECTS

Construction Costs: Average cost of $325 per lineal foot to improve a canal.

Crockett Canal: Cost based on feasibility 2010 report completed by JUB Engineers for canal enclosure.

CULINARY WATER INTERCONNECT PROJECTS

Construction Costs: Assumed cost of $12 per inch diameter foot of pipe**.**

Assumes pipes are sized to keep maximum flow velocity below 5 ft per second.

WATER QUALITY PROJECTS

Public Education campaign in Cache County to help public understand how to protect our aquifers

Capital cost of $100,000 assumed for an education campaign for water quality improvement.

WATER STUDY PROJECTS

Study to quantify environmental water needs in Cache County (min stream flows etc.)

Assumed $250,000 based on conceptual scope of work from Utah State University given in Appendix 3-D.

Appendix 5-C

Reservoir Cost Summary

Summary table that lists the different reservoirs that were evaluated along with conceptual cost estimates. Specific conceptual reservoir sites were evaluated with different methods of water delivery to determine how well they meet the objectives. The reservoir sites evaluated are at locations that have been evaluated in previous studies.

CACHE COUNTY
WATER MASTER PLAN

		Logan Canyon Reservoir -add 0.5 feet of irrigation water each year to irrigators (approx. 35,000 acres served)			Reservoir in Logan Canyon - Irrigate 8000 new acres in Petersboro area (Pump from Cutler)			Reservoir on Cub River, adds one foot more summer water for small pumpers and West Cache Irrigation		
		approx yield (acre-feet)		30,000	approx yield (acre-feet)		30,000	approx yield (acre-feet)		15,000
ITEM	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Construction of Reservoir	AC-FT	40,000	$ 2,300	$ 92,000,000	40,000	$ 2,300	$ 92,000,000	27,000	$ 2,300	$ 62,100,000
Conveyance Pipe ($12/in. dia./ft)	LF	0		$ -	0		$ -	0		$ -
Property for Easements for Pipes	ACRES	0	$ 20,000	$ -	0	$ 20,000	$ -	0	$ 20,000	$ -
Major Distribution Pipes	ACRES SERVED	0	$ 2,100	$ -	8,000	$ 2,100	$ 16,800,000	600	$ 2,100	$ 1,260,000
Pump Station Construction	EA	0		$ -	1	$ 6,825,000	$ 6,825,000	0	$ -	$ -
Cost				$ 92,000,000			$ 115,625,000			$ 63,360,000
Construction Contingency	35%			$ 32,200,000			$ 40,468,750			$ 22,176,000
Total Construction Cost				$ 124,200,000			$ 156,093,750			$ 85,536,000
Engineering	15%			$ 13,800,000			$ 17,343,750			$ 9,504,000
Total				**$ 138,000,000**			**$ 173,437,500**			**$ 95,040,000**
O&M (yearly Costs)										
Reservoir Maintenance (1% of Reservoir Constuction)				$ 920,000			$ 920,000			$ 621,000
Conveyance Pipe Maintenance (.05% of Conveyance Pipe)				$ -			$ -			$ -
Pump Station Maintenance (1% of Pump Station Construction)				$ -			$ 68,250			$ -
Yearly Power Costs							$ 950,670			$ -
Total yearly O&M Costs				$ 920,000			$ 1,938,920			$ 621,000
Present Value Costs										
Loan Term (years)	50									
Interest rate	4%									
O&M Costs (Present Value)				$19,800,000			$41,700,000			$13,300,000
Total Present Value Cost of Project				$ 157,800,000			$ 215,137,500			$ 108,340,000
Total Present Value Cost /acre- foot (including operation and maintainence				$ 5,260			$ 7,171			$ 7,223
Yearly Loan Payments										
Yearly payment including O&M				$7,345,622			$10,014,694			$5,043,249
Yearly payment per acre foot of reliable storage including O&M				$244.85			$333.82			$336.22

		Construct Multiple Small (less than 10,000 acre feet) Reservoirs to provide more secure irrigation water supply			Enlarge Hyrum reservoir to provide more irrigation to South Cache Irrigators			Reservoir near Avon - Irrigate Mt. Sterling Area (pump from Hyrum reservoir)		
		approx yield (acre-feet)		45,000	approx yield (acre-feet)		16,000	approx yield (acre-feet)		12,000
ITEM	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Construction of Reservoir	AC-FT	60,000	$ 3,500	$ 210,000,000	28,000	$ 2,000	$ 56,000,000	30,000	$ 2,300	$ 69,000,000
Conveyance Pipe ($12/in. dia./ft)	LF	0		$ -	0		$ -	0		$ -
Property for Easements for Pipes	ACRES	0	$ 20,000	$ -	0	$ 20,000	$ -	0	$ 20,000	$ -
Major Distribution Pipes	ACRES SERVED	0	$ 2,100	$ -	0	$ 2,100	$ -	3,200	$ 2,100	$ 6,720,000
Pump Station Construction	EA	0	$ -	$ -	0	$ -	$ -	1	$ 2,730,000	$ 2,730,000
Cost				$ 210,000,000			$ 56,000,000			$ 78,450,000
Construction Contingency	35%			$ 73,500,000			$ 19,600,000			$ 27,457,500
Total Construction Cost				$ 283,500,000			$ 75,600,000			$ 105,907,500
Engineering	15%			$ 31,500,000			$ 8,400,000			$ 11,767,500
Total				**$ 315,000,000**			**$ 84,000,000**			**$ 117,675,000**
O&M (yearly Costs)										
Reservoir Maintenance (1% of Reservoir Constuction)				$ 2,100,000			$ 560,000			$ 690,000
Conveyance Pipe Maintenance (.05% of Conveyance Pipe)				$ -			$ -			$ -
Pump Station Maintenance (1% of Pump Station Construction)				$ -			$ -			$ 27,300
Yearly Power Costs				$ -			$ -			$ 360,514
Total yearly O&M Costs				$ 2,100,000			$ 560,000			$ 1,077,814
Present Value Costs										
Loan Term (years)	50									
Interest rate	4%									
O&M Costs (Present Value)				$45,100,000			$12,000,000			$23,200,000
Total Present Value Cost of Project				$ 360,100,000			$ 96,000,000			$ 140,875,000
Total Present Value Cost /acre- foot (including operation and maintainence				$ 8,002			$ 6,000			$ 11,740
Yearly Loan Payments										
Yearly payment including O&M				$16,762,727			$4,468,819			$6,557,759
Yearly payment per acre foot of reliable storage including O&M				$372.51			$279.30			$546.48

		Logan Canyon Reservoir- Irrigate Petersboro area (Pipe from Logan Canyon)			Reservoir near Avon - Irrigate Mt. Sterling Area (Pipe from Avon)			Participate in a Box Elder Reservoir, pump back to cutler, pump to west bench areas		
		approx yield (acre-feet)		30,000	approx yield (acre-feet)		12,000	approx yield (acre-feet)		21,500
ITEM	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Construction of Reservoir	AC-FT	40,000	$ 2,300	$ 92,000,000	30,000	$ 2,300	$ 69,000,000	30,000	$ 2,300	$ 69,000,000
Conveyance Pipe ($12/in. dia./ft)	LF	132,000	$ 600	$ 79,200,000	114,500	$ 480	$ 54,960,000	50,000	$ 360	$ 18,000,000
Property for Easements for Pipes	ACRES	121	$ 20,000	$ 2,424,242	105	$ 20,000	$ 2,102,847	46	$ 20,000	$ 918,274
Major Distribution Pipes	ACRES SERVED	8,000	$ 2,100	$ 16,800,000	3,200	$ 2,100	$ 6,720,000	5,733	$ 2,100	$ 12,040,000
Pump Station Construction	EA	0	$ -	$ -	0	$ -	$ -	2	$ 6,825,000	$ 13,650,000
Cost				$ 190,424,242			$ 132,782,847			$ 113,608,274
Construction Contingency	35%			$ 66,648,485			$ 46,473,996			$ 39,762,896
Total Construction Cost				$ 257,072,727			$ 179,256,843			$ 153,371,169
Engineering	15%			$ 28,563,636			$ 19,917,427			$ 17,041,241
Total				**$ 285,636,364**			**$ 199,174,270**			**$ 170,412,410**
O&M (yearly Costs)										
Reservoir Maintenance (1% of Reservoir Constuction)				$ 920,000			$ 690,000			$ 690,000
Conveyance Pipe Maintenance (.05% of Conveyance Pipe)				$ 39,600			$ 27,480			$ 9,000
Pump Station Maintenance (1% of Pump Station Construction)				$ -			$ -			$ 136,500
Yearly Power Costs										$ 1,259,329
Total yearly O&M Costs				$ 959,600			$ 717,480			$ 2,094,829
Present Value Costs										
Loan Term (years)	50									
Interest rate	4%									
O&M Costs (Present Value)				$20,600,000			$15,400,000			$45,000,000
Total Present Value Cost of Project				$ 306,236,364			$ 214,574,270			$ 215,412,410
Total Present Value Cost /acre- foot (including operation and maintainence				$ 10,208			$ 17,881			$ 10,019
Yearly Loan Payments										
Yearly payment including O&M				$14,255,364			$9,988,475			$10,027,491
Yearly payment per acre foot of reliable storage including O&M				$475.18			$832.37			$466.39

		Construct Millcreek Reservoir			General reservoir cost		
		approx yield (acre-feet)		10,000	approx yield (acre-feet)		50,000
ITEM	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Construction of Reservoir	AC-FT	23,000	$ 2,300	$ 52,900,000	66,667	$ 2,300	$ 153,334,100
Conveyance Pipe ($12/in. dia./ft)	LF	0	$ -	$ -	0		$ -
Property for Easements for Pipes	ACRES	0	$ 20,000	$ -	0	$ 20,000	$ -
Major Distribution Pipes	ACRES SERVED	0	$ 2,100	$ -	0	$ 2,100	$ -
Pump Station Construction	EA	0	$ -	$ -	0		$ -
Cost				$ 52,900,000			$ 153,334,100
Construction Contingency	35%			$ 18,515,000			$ 53,666,935
Total Construction Cost				$ 71,415,000			$ 207,001,035
Engineering	15%			$ 7,935,000			$ 23,000,115
Total				**$ 79,350,000**			**$ 230,001,150**
O&M (yearly Costs)							
Reservoir Maintenance (1% of Reservoir Constuction)				$ 529,000			$ 1,533,341
Conveyance Pipe Maintenance (.05% of Conveyance Pipe)				$ -			$ -
Pump Station Maintenance (1% of Pump Station Construction)				$ -			$ -
Yearly Power Costs							
Total yearly O&M Costs				$ 529,000			$ 1,533,341
Present Value Costs							
Loan Term (years)	50						
Interest rate	4%						
O&M Costs (Present Value)				$11,400,000			$32,900,000
Total Present Value Cost of Project				$ 90,750,000			$ 262,901,150
Total Present Value Cost /acre- foot (including operation and maintainence				$ 9,075			$ 5,258
Yearly Loan Payments							
Yearly payment including O&M				$4,224,431			$12,238,101
Yearly payment per acre foot of reliable storage including O&M				$422.44			$244.76

Appendix 5-D

Comparison of District Types

A summary of the differences between district types is given in a table. There are four types of local districts included in the table with one of those being a conservancy district. Conservancy districts were the only type of local districts included in the final evaluation of management alternatives because the other types do not fit as well to manage both irrigation and drinking water. The table can be used as a guide to locate sections of the state code that cover specific topics related to districts. The table is not comprehensive and should be used accordingly. Two of the alternatives evaluated in the master plan are forms of districts, special service and water conservancy. Information about these two types of districts is given in Utah Code Annotated Section 17B and 17D.

CACHE COUNTY
WATER MASTER PLAN

	Local Districts (17B-1)				
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**Special Service District (17D)**
Purpose	**17B-2a-403** Own and operate all or any part of a system or systems for the supply, treatment, and distribution of water	Obtain and distribute water for irrigation of lands	Provide services to meet municipal water needs	**17B-2a-1002** - Conservation and development of water and land resources - Provide for greatest beneficial use of water - Make use of unappropriated waters for beneficial uses including domestic, manufacturing, irrigation, and power - Obtain the highest duty for domestic uses and irrigation of lands	
Status and Powers (All Local Districts)	**17B-1-103** Political subdivision of the state that may: - Acquire or lease property, or a groundwater right, - Acquire, construct, operate, use and maintain works and facilities - Borrow money - Issue Bonds - Levy and collect property taxes (Not Irrigation Districts) - Invest money - Impose fees for services provided by the district - Contract with another political subdivision of state to allow them to use district's surplus water				**17D-1-103** A body corporate and politic with perpetual succession, separate and distinct from the county or municipality that creates it; a quasi-municipal corporation; that may: - Exercise the power of eminent domain - Enter into contracts to carry out district functions - Acquire or construct facilities - Acquire real or personal property, or an interest in real or personal property, including water and water rights, by purchase, lease, gift, devise, bequest, or otherwise - Own, hold, improve, use, finance, or deal in and with the property or property right - Sell, convey, lease, exchange, transfer property or assets, including water and water rights - Mortgage, pledge, or encumber property or assets, including water and water rights - Contract for the use, operation, or maintenance of all or any part of district's property or assets, including water and water rights - Accept a government grant or loan - Use an officer, employee, property, equipment, office, or facility of the county or municipality that created the special service district, subject to reimbursement - Employ one or more officers, employees, or agents, including one or more engineers, accountants, attorneys, or financial consultants, and establish their compensation; - Must reimburse the county or municipality for what the special service district uses. - Designate an assessment area and levy an assessment - Borrow money and incur indebtedness; - Issue bonds - Impose fees for commodities, services, or facilities - Provide service to an area outside the district's boundary, if the governing body finds that there is a public benefit - Provide other services that the governing body determines will more effectively carry out the purposes of the district
Additional Powers	**17B-2-403** - Acquire / operate a water system - Appropriate or acquire water and water rights inside or outside boundaries - Sell water or services outside of boundaries	**17B-2a-503** - Purchase irrigation stock - Access lands to survey and locate and construct a canal - Lease water in the neighborhood of the district (5 year max lease period) - Acquire water from in or out of state - Lease, rent or sell water not needed by the owners of land in district to a municipality, corporation, association, or individual inside or outside of district	**17B-2a-603** - Acquire or lease property in or out of district - Encumber district property - Acquire or construct improvements in and out of the district and state - Acquire water, works, water rights, and sources of water in and out of the district and state and encumber, transfer an interest in, or dispose of water, works, water rights, and water sources - Develop, store, and transport water - Provide, sell, lease, and deliver water in or out of district - Subscribe for, purchase, lease, or otherwise acquire stock in a canal company, irrigation company, water company, or water users association	**17B-2a-1004** - Acquire water, works, water rights, and water sources needed in and out of district - Encumber, sell, lease, transfer an interest in, or dispose of water, works, water rights, and sources - Levy assessments against lands where water is allotted - Promote water conservation and development - Appropriate and acquire water and water rights - Develop, store, treat, and transport water - Acquire stock in canal companies, water companies, and water users associations - Acquire, construct, maintain irrigation works - Sell services to individual customers - Own property for district purposes - Coordinate water planning among public entities - Contract with public entities or private persons for joint operation or use of works, or the sale, purchase, lease, exchange, or loan of water, water rights, works - Contract with entities out of state for the joint construction, operation, or ownership of a facility - May not sell water to a customer in a municipality for culinary use without consent of the municipality **17B-2a-1007** - Contract with municipalities, irrigation companies, and private entities to sell water	
Service Area	**17B-1-202-5** May include all or part of the unincorporated area of one or more counties and all or part of one or more municipalities				**17D-1-202-2-d** A county may not create a district that includes some or all of the area within a municipality unless the legislative body of that municipality adopts a resolution or ordinance consenting to the inclusion.

	Local Districts (17B-1)				Special Service District (17D)	
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**PETITION**	**RESOLUTION**
Process to Create (by Petition or by Resolution)	**17B-1-203** **PETITION:(Each municipality and county must do steps 1 through 3)** 1 - File a request for services signed by owners of 10% of the private land area and cover 7% of private land value and 10% of the registered voters (17B-1-204) 2 - Hold a public hearing on the request for services (17B-1-210) 3 - Adopt a resolution to provide or not provide the proposed services (17B-1-212) 4 - Petition must be signed by property owners who's property covers at least 33% of private land, and is equaling value to at least 25% of the total private property in the area and covers 33% of the registered voters in the proposed area (17B-1-203) 5 -Election 6 - Signature from Lieutenant Governor (17B-1-215)			**RESOLUTION:(Each municipality and county must do steps 1 through 3)** 1 - Adopt a signed resolution by the legislative body proposing the creation of a district (17B-1-203) 2 - Hold a public hearing on the resolution (17B-1-210) 3 - 60 day protest period (17B-1-213) 4 - Election 5 - Signature from Lieutenant governor (17B-1-215)	1 - Petition signed by owners of at least 10% of value of taxable property or 10% of registered voters (17D-1-203) 2 - Give public notice of petition and public hearing (17D-1-205) 3 - Hold a public hearing (17D-1-207) 4- Period for public protest (17D-1-206) 5 - Adopt a resolution or ordinance approving the creation of district (17D-1-208) 6 - Signature from Lieutenant Governor (17D-1-209)	1- Adopt a resolution stating need to create a district (17D-1-203) 2- Give written notices of resolution to create a district(17D-1-205) 3 -Hold a public hearing (17D-1-207) 4- Period for public protest (17D-1-206) 5 -Adopt a resolution approving the creation of a district (17D-1-208) 6 -Signature from Lieutenant Governor (17D-1-209)
Election to form District	**17B-1-214** - Held by the responsible clerk in the county if the district will be located completely within the county - Not required if a petition is completed that covers at least 67% of private land area and is equal to at least 50% of the values of private property or if the petition has signatures from at least 67% of registered voters				No Election Required to Form	
How Opposed				**17B-1-213** **Protest of Resolution Process** 1- 60 day protest period after public hearing 2- Protest must be signed by property owners that own 25% of private land by area and at least 15% of value of private property 3- If protest is successful, governing body can not take any further action for 2 year period	**17-D-206** - Submit written protest t no later than 15 days after the public hearing - The legislative body may not adopt a resolution or ordinance creating a district if adequate protests are filed **17D-1-207** -At the public hearing the legislative body will give full consideration to each written protest that has been filed. **17D-1-212** -May file an action in district court within 30 days of adoption of resolution or of ordinance to create district	
Governing Body	**17B-1-302** - Board of Trustees - Each board member must live in district boundaries and if district has divisions, within the appropriate division boundaries - odd number of board members - At least 3 board members **17B-1-308** - Board can be made up of county or municipal legislative bodies but must hold separate meetings, and each board member represents the district at large				**17D-1-301** - Legislative body of the county or municipality that creates the district - The legislative body may create an administrative control board for the special service district and delegate to the administrative control board the exercise of any right, power, or authority that the legislative body possesses with respect to the governance of the district.	
Board of Trustees (or Administrative Board)	**Board of Trustees**				**Administrative Control Board**	
	Term of Service (17B-1-303 and 17D-1-304) Elected or appointed to four year term of service, except that approximately half the members of the initial board of trustees, chosen by lot, serve a two-year term. There is no limit on number of terms served.					
	17B-1-308 County Council could serve as board but must meet at different times than council meetings. May use municipal facilities with proper compensation. Each board member represents the district at large				**17D-1-301** - The administrative control board must allow the legislative body to act on some items that the board does not have authority to do, such as levy a tax or issue bonds, or hold an election **17D-1-303** - Some board members could be appointed and some could be elected. - A municipality may appoint one member to represent it on an administrative control board created by a special service district - An institution of higher education for which a special service district provides services, may appoint members to an administrative control board	
	17B-2a-404 - Legislative body of county may elect at time of creation to be the board and adopt at any time a resolution providing for the election of board members, or the appointment of board members - Legislative body of each included municipality each elects or appoints one member of the board - The legislative body of the county elects or appoints all other board members	**17B-2a-504** - One member elected from each division established in the district -Each landowner casts one vote per acre foot or fraction of an care foot of water allotted to the owned land	**17B-2a-604** Board members appointed or elected	**17B-2a-1005** Board members appointed or elected		
Number of Board Members	**17-B-2a-404 (6)** - Number of included municipalities plus one if the number of municipalities is even - Number of included municipalities plus two, if the number of municipalities is odd - Board members do not have to come specifically from each of the municipalities -allows for a board member from the unincorporated (remaining) area	**17B-2a-504** Equal to number of divisions in the district	**17B-2a-604** - Municipalities each appoint or elect a board member - At least one board member shall be appointed by each municipality	**17B-2a-1005** Not more than 11 persons who are residents of the district	**17D-1-302** Equal to the number of council members of the legislative body or at least 3 members of an administrative control board	

	Local Districts (17B-1)				
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**Special Service District (17D)**
District Divisions	**17B-1-306.5** Board may split district into divisions so that board members may be elected by division rather than at large	**17B-2a-505** - Must split the district into divisions - The number of divisions is the same as the number of board members	***?***	**17B-2a-505** - Board of trustees divides district into equal sized divisions, - Number of divisions is equal to number of board members	No divisions
Procedure to Appoint Board Members	**17B-1-304** -Prepare a notice of vacancy -Advertise the notice -Allow all interested persons to be heard -After 2 months, select a person from the applicants who meet the qualifications -Adopt a resolution appointing a person	**17B-2a-504** Board members are elected	**17B-2a-604** - If district contains some or all of the retail water service area of more than one municipality, the legislative body of each municipality shall appoint board members from that municipality - One member from each municipality is a officer that is responsible for the municipality's water system -The number of members appointed by each municipality shall be determined by agreement between the district and the municipalities	**17B-2a-1005** -For a district located entirely within the boundaries of a single county, the county legislative body of that county appoints each trustee - In a division composed solely of municipalities, the legislative body of each municipality within the division shall submit two nominees per trustee - In all other divisions, the county legislative body submits three nominees per trustee. - In districts where substantial water is allocated for irrigated agriculture, one trustee appointed in that district is a person who owns irrigation rights and uses those rights as part of that person's livelihood	**17B-1-304** -Prepare a notice of vacancy -Advertise the notice -Allow all interested persons to be heard -After 2 months, select a person from the applicants who meet the qualifications -Adopt a resolution appointing a person
Procedure to Elect Board Members	**17B-1-306** - Give notice of positions to be filled at next municipal general election with instructions for how to file for candidacy - Prospective board members that are qualified are allowed to file for candidacy - If no person files for candidacy, a person is appointed by following the requirements for appointment	**17B-2a-504** Each landowner casts one vote per acre foot or fraction of an acre foot of water allotted to the owned land	**17B-2a-604** Members of the board can be elected if three-fourths of all board members vote in favor of changing to an elected board; and the legislative body of each municipality that appoints a member to the board adopts a resolution approving the change to an elected board **17B-1-306** - Give notice of positions to be filled at next municipal general election with instructions for how to file for candidacy - Prospective board members that are qualified are allowed to file for candidacy - If no person files for candidacy, a person is appointed by following the requirements for appointment	**17B-2a-1005** - Elected in accordance with the petition or resolution to create district, or are appointed. - Members of an existing appointed board can be elected if three-fourths of all board members vote in favor of changing to an elected board; and the legislative body of each municipality that appoints a member to the board adopts a resolution approving the change to an elected board. **17B-1-306** - Give notice of positions to be filled at next municipal general election with instructions for how to file for candidacy - Prospective board members that are qualified are allowed to file for candidacy - If no person files for candidacy, a person is appointed by following the requirements for appointment	**17B-1-306** - Give notice of positions to be filled at next municipal general election with instructions for how to file for candidacy - Prospective board members that are qualified are allowed to file for candidacy - If no person files for candidacy, a person is appointed by following the requirements for appointment
Compensation of Board Members	**17B-1-307 and 17D-1-305** Can be compensated up to $5,000 as determined by board of trustees, but not in addition to compensation they receive as members of a county or municipal legislative body				

	Local Districts (17B-1)				
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**Special Service District (17D)**
Debt Limit	**17B-1-613** The board of trustees of a local district may not make any appropriation in the final budget of any fund in excess of the estimated expendable revenue for the budget year of the fund				
Bonds	**17B-1-1102 General Obligation Bonds** **-** Must first obtain the approval of district voters for issuance of general obligation bonds at an election - May issue refunding general obligation bonds, without obtaining voter approval - May not issue general obligation bonds that cause the outstanding principal amount of all general obligation bonds to exceed a specified percentage of the vale of taxable property in the district **17B-1-1103** -May make an annual levy of ad valorem property taxes to pay bond debts, but for a conservancy district may not exceed total tax levy limits **17B-1-1104** Bonds may be payable from the revenues to be derived by the district from providing its services, taxes, federal, state, or local grants, in the case of special assessment bonds, the special assessments pledged to repay the special assessment bonds; and other money legally available to the district. **17B-1-1105 Revenue Bonds** -District may, but is not required to, submit to district voters for their approval the issuance of the revenue bonds at an election held for that purpose -Impose rates and charges for the services or commodities it provides, along with other sources of district revenues, to carry out all undertakings of the district with respect to its revenue bonds				**17D-1-502** -If a special service district intends to issue general obligation bonds, it must first obtain the approval of district voters, but it may issue refunding general obligation bonds without obtaining voter approval -May not issue general obligation bonds if the issuance of the bonds will cause the outstanding principal amount of all of the district's general obligation bonds to exceed the amount that results from multiplying the fair market value of the taxable property within the special service district by 0.12 - May not be considered to be a municipal corporation for purposes of the debt limitation **17D-1-505** - May issue revenue bonds with or without a vote, but shall impose rates and charges sufficient to pay back the debt **17D-1-507** Before bonding, must obtain a report prepared by a qualified person, that outlines the project and how it will be financed **17D-1-508** District obligations are not obligation of any other entity
Water Banking	**17B-1-202-1c** - May bank ground water rights in a critical management area following adoption of groundwater management plan by the state engineer or **17B-1-103-2a** - May acquire or lease groundwater rights necessary or convenient to the full exercise of the district's powers				
Maximum savings	**17B-1-612** - The accumulation of a fund balance in the general fund may not exceed the greater of: 100% of the current year's property tax; or 25% of the total general fund revenues for a district with an annual general fund budget greater than $100,000; or 50% of the total general fund revenues for a district with an annual general fund budget equal to or less than $100,000.				
Annexing an Area	**17B-1-402** - An area outside the boundaries of a local district may be annexed **17B-1-403** The following steps must be followed: 1- Petition signed by owners of land that covers at least 10% of the proposed private land area to be annexed and is equal to at least 10% of the property to be annexed or represents at least 10% of the registered voter in the area to be annexed (17B-1-403) 2 - A resolution adopted by the legislative body each municipality whose boundaries include any of the area proposed to be annexed; or a resolution adopted by the board of trustees of the proposed annexing local district if, for at least 12 consecutive months immediately preceding adoption of the resolution, the local district has provided retail service to the area; or a wholesale service to a provider of the same service that has provided that service on a retail basis to the area (17B-1-403) 3- Public hearing held for each body that has petitioned to join the district (17B-1-409) 4 - Adopt a resolution to provide or not provide the proposed services (17B-1-408) 5 - Hold an election if protests are filed from landowners that own 10% of the total private land in the proposed area to be annexed, and that is equal to at least 10% of the vale of private property in the proposed area, or it is filed by at least 10% of the registered voters that live in the proposed area. 6- If voters vote in favor of annexation, board adopts resolution approving the annexation (17B-1-412) **17B-1-412** - An owner of private real property located within or a registered voter residing within an area proposed to be annexed may protest an annexation by filing a written protest with the board of trustees **17B-1-413** - The public hearing and protest provisions do not apply if the petition covers 75% of the private land area and is equal to at least 75% of the property value of the proposed annexation area or is signed by 75% or registered voters in the area				**17D-1-401** - Must follow same steps as are needed to create a special service district **17D-1-402** - Could annex an area with only a petition if all the owners of the taxable property within the proposed annexation area sign the petition
Fees	**17B-1-643(1)** Before imposing a new fee or increasing an existing fee for a service provided by a local district, the board must first hold a public hearing at which any interested person may speak for or against the proposal to impose a fee or to increase an existing fee **17B-1-1106** Board may fix the rate or rates for services or commodities provided by the district that will, in conjunction with the proceeds of any maintenance and operation tax and other district revenues: (1) pay the district's operating expenses (2) provide for repairs and depreciation of works owned or operated by the district (3) pay the interest on any bonds issued by the district (4) provide, as much as practicable, a sinking or other fund to pay the principal of the bonds as they become due				17D-1-105 - A county or municipality that has created a special service district may levy a tax on the taxable property in the special service district. - Each levy is subject to the prior approval of a majority of the registered voters of the special service district voting in an election held for that purpose 17D-1-506 - District must set taxes to cover district expenses and pay back any bonds
		17B-2a-506 May divide the district into units and apply different use charges to the different units based on amount of water the district provides the area served, or any other reasonable basis	**17B-2a-606** The rates, charges, and assessments may be established by agreement between the district and the municipalities serviced by the district.		

	Local Districts (17B-1)				
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**Special Service District (17D)**
Tax Levy Limits	**17B-1-616** - Tax set based on planned budget **17B-1-1002** - Maximum property tax of .0008	**17B-2a-503** Cannot levy a property tax	**17B-1-1002** - Maximum Tax of .0005	**17B-2a-1006** - May not exceed .0001 before the planning or design of works; the acquisition of the site or right-of-way on which the works will be constructed; or the commencement of construction of the works - May not exceed .0002 until after the earliest of the events listed above	**17D-1-105** - Subject to the prior approval of a majority of the registered voters of the special service district voting in an election held for that purpose **17D-1-503** - If a district has issued general obligation bonds, or expects to have debt service payments due on general obligation bonds during the current year, the legislative body of the county or municipality that created the district may make an annual levy of ad valorem property taxes -The levy is without limitation as to rate or amount; and subject to the prior approval of a majority of registered voters of the special service district voting in an election held for that purpose.
Preferential Right to Purchase Water			**17B-2a-605** Each city that is in the district and provides water on a retail level in the district has a preferential right to purchase a portion of the water served by the district.		
Costs and Expenses of Creation	**17B-1-216** -Each county whose unincorporated area includes and each municipality whose boundaries include some or all of the proposed local district shall bear their respective costs and expenses for creating a local district. - Within a year after its creation, each local district shall reimburse the costs and expenses associated with the preparation, certification, and recording				

Appendix 5-E

Evaluation of Management Alternatives

Explanation of the evaluation completed to determine what water management system should be implemented in Cache County to complete needed water projects and to meet future water needs. The actual evaluation table is included after the explanation.

CACHE COUNTY
WATER MASTER PLAN

Overview of Management Structure Evaluation Table Parts

The evaluation table is broken into the following parts:

Project Alternatives

The alternatives that were evaluated are listed down the left hand side of the table and are sorted by the type of project.

Objectives

The goals or objectives that have been identified as important by the steering committee and project team are listed across the top of the table. These objectives are split into the following three categories:

- Water Supply (shown in blue)
- Governance (shown in red)
- Implementation (shown in purple)
- Environment (shown in green)

Metrics

The metrics for each objective are listed across the top of the table just below the objectives. The metrics provide the units and the method used to measure how well a given alternative meets the corresponding objective. In the future, as more specifics are gathered for a given alternative, more solid data can be added to the analysis.

Color Key

A color key is shown just below the metrics and gives four ranges of values for each metric. The alternatives were evaluated at a conceptual level. Therefore, there is a level of uncertainty in the values calculated for the evaluation. The four color levels indicate how well the objectives or goals are attained by a given alternative, with the darker colors indicating a higher level of attainment than the lighter colors.

Evaluation

In the rows to the right of each alternative, numbers are given in cells to indicate the estimated value that each alternative has for each of the metrics. For metrics that could not be exactly quantified, without further evaluation, an assignment of “None”, “Low”, “Medium”, or “High” was given. Any cell that is labeled with “N/A” indicates that the metric in that column does not apply to the alternative listed on that row.

The strength of a given alternative can be determined by looking across a row for the given alternative and comparing how dark the cells are for that alternative with the cells for other alternatives. Alternatives that have darker cells are stronger than alternatives with lighter cells.

EVALUATION OF MANAGEMENT ALTERNATIVES

MANAGMENT ALTERNATIVES	OBJECTIVES																		
	Water Supply	**Governance**							**Implementation**										**Environment**
	Protect Bear River Allocation	Represent Cache County on water legislation issues	Represent all County water users	Operate and maintain water systems on a local level	*Minimize management costs	Fund needed regional water studies and projects	Ease of creation	Focus on water issues	Complete water management projects							Promote collaboration			Maintain or improve environmental quality
	METRICS (methods of measurement)																		
	Water put to beneficial use or in an approved none use status (acre feet)	Influence with state water coalition and executive task force (Scale)	Entities represented on water board for regional water decisions (number)	Culinary water systems that make own source, storage, distribution and other local system improvements (number)	*Cost to manage each year ($)	Funding available each year for studies/ projects ($/year)	Election required (yes/no)	Board members that are focused on water issues (number)	Study and develop ASR sites (yes/no)	Evaluate environmental water demands (yes/no)	Study and develop above ground storage sites (yes/no)	Implement water conservation program to achieve 25% water conservation (yes/no)	Water banking (yes/no)	Implement canal rehabilitation program (yes/no)	Secondary water studies and installation (yes/no)	Facilitates cooperation between municipalities and irrigation companies (complete contracts for projects) (yes/no)	Steering committee members that support organization (percent)		
	COLOR KEY																		
	None	None	None	None	$400,001 to $500,000	None	Yes	None	None	None	None	None	None	None	None	None	None	less than 15%	None
	1 to 5000	Low	No Board	1 to 10	$300,001 to $400,000	$30,000		Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	16% to 30%	Low
	5,001 to 20,000	Medium	Culinary water users	11 to 20	$200,000 to $300,000	$30,000 to $150,000		Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	30% to 65 %	Medium
	More than 20,000	High	Culinary and irrigation water users	More than 20	less than $200,000	$150,000 to $700,000	No	High	High	High	High	High	High	High	High	High	High	More than 65%	High
MANAGEMENT STRUCTURES																			
Water Manager with more Resources (additional $120,000 for projects)	15,000	Low	No water board	23	$185,000	$30,000 to $150,000	No	Low	Med	Med	Low	Low	None	Low	Low	Med	6%	Med	
Special Service District	5,001 to 20,000	Med	Culinary Water Users	23	$350,000	$150,000 to $700,000	Yes	Med	High	High	High	Medium	High	High	High	High	18%	High	
Water Conservancy District	60,000	High	Irrigation and Culinary	23	350,000	$150,000 to $700,000	Yes	High	High	High	High	High	High	High	High	High	70%	High	
Continue with Current System (Water Manager)	5,000	Low	No water Board	23	$185,000	$30,000	No	Low	Low	Low	None	None	None	None	None	Low	6%	Low	

*Low values are preferred and are shown in a darker color than higher values.

Appendix 6-A

Next Steps

i: Five Year Action Plan Summary Table

Table that outlines projects to complete in the next 5 years. The table lists actions that should be completed for each objective each year, the expected results of those actions and the estimated costs.

ii: Three Year Public Education Campaign

Detailed list of tasks for the three year public education campaign to complete in years 2014 - 2016.

CACHE COUNTY
WATER MASTER PLAN

5 YEAR ACTION PLAN				
Stage (Year)	**Task-(Objective)**	**Actions**	**Results**	**Estimated Cost**
2014	Public Education – Water Conservation	Public Education Campaign: • Conduct a poll to understand public opinion of conservation • Identify desired conservation strategies with steering committee • Prepare conservation promotion tips for cities • Meet with individual city water policy leaders about importance of conservation • Give conservation presentations to councils • Meet with irrigators	• Increase in water conservation in County to meet state conservation averages • Water policy makers understand the current and future water needs in the County.	$50,000
	Public Education – District Formation	Public Education Campaign: • Conduct a poll to understand public opinion of districts • Review poll outcomes with steering committee • Prepare list of answers to common questions about districts • Review master plan recommendations with city leaders • Give presentation to councils about organizational structures • Interviews with key stake holders • Meet with irrigators	• Improved consensus and unified direction for future water management	$50,000
	ASR (Bear River Dev.)	• Complete Millville ASR Water Storage and Nitrate Remediation Study	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Improves ground water quality • Adds water supply for communities and irrigators	$30,000
	Environmental Demand Studies/Storage (Bear River Development)	• Quantify and prioritize environmental water demands (Year 1) • Monitor and coordinate planning efforts with the Wasatch Front	• Preserves and prioritizes critical environmental areas • Maintains or improves wildlife habitat • Quantifies environmental water demands for studied areas • Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights	• Organize water bank	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
			Year Total	**$295,000**

5 YEAR ACTION PLAN

Stage (Year)	Task-(Objective)		Actions	Results	Estimated Cost
2015	Public Education	Water Conservation	Public Education Campaign: • Hold a steering committee meeting to develop strategies to improve water conservation • Follow up with steering committee members on conservation progress • Continue polls to evaluate the effectiveness of the public education process	• Increase in water conservation in County to meet state conservation averages • Water policy makers understand the current and future water needs in the County	$50,000
	Public Education	District Formation	Public Education Campaign: • Prepare a handout that outlines ways conservancy district can be structured • Hold steering committee meetings to evaluate potential conservancy district structures • Disseminate information about the district formation through open houses and committee members • Continue polls to evaluate the effectiveness of the public education process • Interviews with key stake holders • Meet with irrigators	• Improves consensus and unified direction for future water management	$50,000
	ASR (Bear River Dev.)		• Construct Millville ASR project	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Improves ground water quality • Adds water supply for communities and irrigators	$100,000
	Environmental Demand Studies/Storage (Bear River Development)		• Quantify and prioritize environmental water demands (Year 2) • Monitor and coordinate planning efforts with the Wasatch Front	• Preserves and prioritizes critical environmental areas • Maintains or improves wildlife habitat • Quantifies environmental water demands for studied areas • Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights		• Execute lease agreements	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
				Year Total	**$365,000**

5 YEAR ACTION PLAN

Stage (Year)	Task-(Objective)	Actions	Results	Estimated Cost
2016	Public Education: Water Conservation	Public Education Campaign: • Progress update with city councils • Track water conservation effort progress with committee • Information dissemination through open houses to educate about conservation • Meet with irrigators	• Increase in water conservation in County to meet state conservation averages	$50,000
	Public Education: District Formation	• Progress update with city councils • District information dissemination through steering committee and open houses • Interviews with key stake holders • Meet with irrigators • Prepare Legal Documents • Hold Election	• Implementation of a water management organization (conservancy district) to continue conservation efforts and to protect Cache Valley's water interests	$80,000
	ASR (Bear River Dev.)	• Construct Millville ASR Project	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Improves ground water quality • Adds water supply for communities and irrigators	$100,000
	Environmental Demand Studies/Storage (Bear River Dev.)	• Quantify and prioritize environmental demands (Year 3) • Monitor and coordinate planning efforts with the Wasatch Front • Storage site investigation for potential small dams	• Preserves and prioritizes critical environmental areas • Maintains or improves wildlife habitat • Quantifies environmental water demands for studied areas • Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights	• Execute lease agreements	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
			Year Total	**$395,000**
2017	Water Conservation	• Increase resources to promote conservation • Implement programs identified through 2014 and 2015 steering committee meetings	• 25% Reduction in per capita Water use by year 2025	$120,000
	District Formation			Done
	ASR (Bear River Dev.)	• Finish Millville Project, Study River Park Well ASR Site	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Improves ground water quality • Adds water supply for communities and irrigators	$150,000
	Environmental Demand Studies/Storage (Bear River Dev.)	• Monitor and coordinate planning efforts with the Wasatch Front • Storage site investigation for potential small dams	• Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights	• Execute lease agreements	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
			Year Total	**$435,000**

5 YEAR ACTION PLAN				
Stage (Year)	**Task-(Objective)**	**Actions**	**Results**	**Estimated Cost**
2018	Water Conservation	• Increase resources to promote conservation • Implement programs identified through 2014 and 2015 steering committee meetings	• 25% Reduction in per capita Water use by year 2025	$120,000
	District Formation			Done
	ASR (Bear River Dev.)	• Green Canyon ASR Development	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Adds water supply for communities and irrigators	$200,000
	Environmental Demand Studies/Storage (Bear River Dev.)	• Monitor and coordinate planning efforts with the Wasatch Front • Storage site investigation for potential small dams	• Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights	• Execute lease agreements	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
			Year Total	**$485,000**

PUBLIC EDUCATION CAMPAIGN TO PROMOTE WATER CONSERVATION AND DISTRICT FORMATION (2014-2016)

The following is given as a recommendation for the public education campaign and includes:

- Objectives to accomplish through the campaign
- Actions to take to meet the objectives
- Results expected from actions

OBJECTIVES

1. Begin water conservation efforts now in order to enhance awareness amongst the community and further secure the potential for state funding on future water projects.
2. Educate public with regard to the water needs of Cache Valley and the need for an organization (conservancy district) to represent those needs and protect water allocated for use in Cache Valley.
3. Create a water conservancy district

Strategies

1. Use the momentum and organization from the CC Water Master Plan to meet the goals. This includes continued input from the CCWMP Steering Committee.
2. Share the knowledge of the Master Plan Team and Steering Committee gained from the master planning process to leaders in each community to create consensus and buy-in.
3. Invite community leaders to educate their constituents with regard to the goals and promote efforts to attain those goals.
4. Reinforce efforts by community leaders to reach the goals through County support of educational information and countywide programs to reach the goals.
5. Promote conservation and education/organizational goals together to take advantage of time and expense.

Water Conservation Ideas – The Low Hanging Fruit

1. Establish a link to the state water conservation website from the County website and encourage communities to do the same.
2. Utilize the USU extension office as an education resource for conservation.
3. Create water conservation tips that communities can place in their utility billings.
4. Place a booth at the County Fair to educate people about the water master plan and water conservation practices.
5. Run advertisements that promote water conservation on local radio stations.
6. Expand the 4th grade water fair program to include elements on water conservation.
7. Implement a rebate program for water conservation practices (after management organization is in place).

ACTIONS
Year 2014

- **Conduct Public Poll –** Develop a public poll to gage current feelings about water conservation and the level of current support for water conservancy district. Coordinate with the county council for the poll strategy and approval of the poll questions. Execute the poll, analyze and

draft the findings of the poll. Report on the poll findings and develop an education strategy. The poll will help evaluate understanding of current water issues and effectiveness of the public education process and will promote interest and research by citizens. (January 2014 - March 2014)

- **Steering Committee Kickoff Meeting** - Meet with the master plan steering committee to review the planned public education process and gather input on the process. Identify key stakeholders that should be interviewed, informed on the master plan process and invited to future committee meetings. Include two county council members in all steering committee meetings. The steering committee will be used as a tool to help identify water conservation strategies to implement along with other Tasks in the 5 Year Action Plan. (April 2014)

- **Conservation and Conservancy District Information** - Prepare initial information that gives water conservation promotion tips for cities. Prepare answers to commonly asked questions about conservancy districts, and summarize how conservancy districts have changed since the last time a district was proposed in Cache County. (April 2014 - October 2014)

- **Meetings with Individual City Water Policy Leaders -** Identify and meet with the key water policy maker of each City. Review results of master plan, importance of water conservation and reasons for master plan recommendations. Set time to meet with each City Council. (March 2014 - September 2014)

- **Steering Committee Meeting** - Hold a steering committee meeting to provide an update and report on the meetings with water policy leaders and overview of input gathered from stakeholder interviews. Include water policy leaders in the meeting. Report any water conservation strategies and input about the formation of a district, gathered from the meetings. (October 2014)

- **Presentations to City Councils** - Visit each city council to explain the need to conserve water by showing results of the master plan, explain the master plan findings and recommendations and identify additional key stakeholders to meet with. Ask for a designated council person to attend all future steering committee meetings. (October 2014 - April 2015)

Year 2015

- **District Organization Handout** - Prepare a handout that outlines how a conservancy district can be formed and ways the board can be structured. (January 2015 – February 2015)

- **Winter Steering Committee Meeting** - Hold a steering committee meeting to develop strategies for a water conservation campaign. Ideas to discuss include the use of mailers, open houses, media interviews etc. (January 2015)

- **2015 Steering Committee Meetings** - Hold two additional steering committee meetings in 2015. The meetings will be used to track the water conservation effort progress and strategies, and to learn more about water districts. More specifically, these meeting will provide information about how districts can be organized, governed, and potential powers of districts. Input gathered at these meetings will be used as a guide for the formation of the district. These meetings will also be used to organize a greater outreach effort that will occur between meetings. (April 2015 and October 2015)

- **District Information Dissemination** - Carry out an information dissemination campaign through open houses around the valley with help from steering committee members to educate the public about districts. (Assume 1 open house in 2015)

- **Conduct Public Poll –** Complete a public poll to evaluate understanding of current water issues and effectiveness of the public education process. A comparison to results from earlier efforts will be made to guide changes to the public education process. (November 2015 - December 2015

Year 2016

- **Presentations to City Councils** - Visit each city council to request the adoption of a resolution proposing the creation of a district. (January 2016 - May 2016)

- **2016 Steering Committee Meetings** - Hold two steering committee meetings in 2016 prior to the general election. The meetings will be used determine how to disseminate accurate district information to the public leading up to the district election. Steering committee members will be utilized to distribute information. These meetings will also be used to implement and track the water conservation effort progress and strategies. (April 2016 and August 2016)

- **District Information Dissemination** – Continue the information dissemination campaign through open houses around the valley and with help from steering committee members, to educate the public about district and conservation. (Assume 2 open houses in 2016)

- **Prepare District Legal Documents -** Prepare legal documents for formation of a district. (May 2016 - July 2016)

- **District Election -** Place vote for district formation on the ballot. (November 2016)

Items to Complete Throughout the 3 Project Years

- **Interview Key Stakeholders** (**45**) - Hold individual interviews with key stakeholders as identified through the steering committee and other interviews. Discuss outcomes of master plan and recommendations moving forward. Discuss conservation efforts and resolve concerns and provide answers to questions. (January2014 - November 2016)

- **Meet with USU Staff** – Hold meetings every six months with key USU staff members identified through input from the steering committee and through the additional stakeholder interviews. These meetings will be used to update the USU Staff on the progress of the public education campaign. Invite USU staff to all steering committee meetings. Only one meeting will be held in 2014. (April and October each year)

- **Irrigation Meetings –** Attend irrigation meetings to provide updates, answer questions and receive feedback on the process. Anticipated meetings to attend annually are the Mini Water Conference, Bear River Small Pumpers Board meeting and North Cache and Blacksmith Fork Conservation District board meetings. (January2014 - November 2016)

- **Other Meetings -** Attend annual mayor's meeting and also the city manager's meeting to provide updates and receive feedback on the process. (January2014 - November 2016)

- **Quarterly updates to the County Council** - Throughout the three year process, give quarterly progress updates to the County Council on water conservation and the district organization efforts. (January2014 - November 2016)

RESULTS

1. Increase in water conservation in Cache Valley to meet state conservation averages (catch up).
2. Water Policy makers understand the current and future water needs in the County.
3. Implementation of a water management organization (conservancy district) to continue conservation efforts and to protect Cache Valley's water interests.