Consistent with provisions of the Utah Open and Public Meetings Act, Utah Code Ann. § 54-2-207(4), the Water Conservation and Drought Management Advisory Board Chair has issued written determinations supporting the decision to convene electronic meetings of the Board without a physical anchor location. Due to the health and safety risks related to the ongoing COVID-19 pandemic and considering public health orders limiting in-person gatherings, the Water Conservation and Drought Management Advisory Board will continue to hold meetings by electronic means. The public is invited and encouraged to view the Board’s electronic meetings by viewing the City’s YouTube channel: https://www.youtube.com/MoabCityGovernment.

1. Call To Order
2. Written Determination To Conduct Electronic Meetings
3. Approval Of Minutes
   3.I. June 9, 2021, Regular Meeting
   Documents:
   WB-MIN-2021-06-09 DRAFT.DOCX
4. Board And Staff Reports
   4.I. Carly Castle, Deputy City Manager - Pack Creek Fire Mitigation
   4.II. Annie McVay, Parks, Recreation, And Trails Director - City Parks Watering
   Documents:
   2 WCP GOALS AND POLICIES SUMMARY 2021 JUL 13.PDF
   3 2021-WATER-CONSERVATION-PLAN-CHECKLIST UPDATED.PDF
   4 WATER CONSERVATION PLAN UPDATE 2021 DRAFT.PDF
   5 MOAB WATER CONSERVATION PLAN UPDATE 2016 FINAL.PDF
6. Adjournment

Special Accommodations:
In compliance with the Americans with Disabilities Act, individuals needing special accommodations during this meeting should notify the Recorder’s Office at 217 East Center...
JULY 14, 2021
WATER CONSERVATION AND DROUGHT MANAGEMENT 
ADVISORY BOARD
REGULAR MEETING 2:00 P.M. 
Consistent with provisions of the Utah Open and Public Meetings Act, Utah Code Ann. § 54 2 207(4), the Water Conservation and Drought Management Advisory Board Chair has issued written determinations supporting the decision to convene electronic meetings of the Board without a physical anchor location. Due to the health and safety risks related to the ongoing COVID-19 pandemic and considering public health orders limiting in-person gatherings, the Water Conservation and Drought Management Advisory Board will continue to hold meetings by electronic means. The public is invited and encouraged to view the Board's electronic meetings by viewing the City’s YouTube channel: https://www.youtube.com/MoabCityGovernment.

Call To Order
Written Determination To Conduct Electronic Meetings
Approval Of Minutes
June 9, 2021, Regular Meeting
WB-MIN-2021-06-09 DRAFT.DOCX

Board And Staff Reports
Carly Castle, Deputy City Manager
- Pack Creek Fire Mitigation
Annie McVay, Parks, Recreation, And Trails Director
- City Parks Watering

Water Conservation Plan Update
- Review Draft
2 WCP GOALS AND POLICIES SUMMARY 2021 JUL 13.PDF
3 2021- WATER CONSERVATION PLAN CHECKLIST UPDATED.PDF
4 WATER CONSERVATION PLAN UPDATE 2021 DRAFT.PDF
5 MOAB WATER CONSERVATION PLAN UPDATE 2016 FINAL.PDF

Adjournment

Special Accommodations:
In compliance with the Americans with Disabilities Act, individuals needing special accommodations during this meeting should notify the Recorder’s Office at 217 East Center Street, Moab, Utah 84532; or phone (435) 259-5121 at least three (3) working days prior to the meeting.
Check our website for updates at: www.moabcity.org
The Water Conservation and Drought Management Advisory Board held its regular meeting on the above date. Consistent with provisions of the Utah Open and Public Meetings Act, Utah Code Ann. §54-2-207(4), the Water Conservation and Drought Management Advisory Board Chair has issued written determinations supporting the decision to convene electronic meetings of the Board without a physical anchor location. Due to the health and safety risks related to the ongoing COVID-19 pandemic and considering public health orders limiting in-person gatherings, the Water Conservation and Drought Management Advisory Board will continue to hold meetings by electronic means. An anchor location was not provided. An audio recording of the meeting is archived at http://www.utah.gov/pmn/index.html. A video recording is archived at https://www.youtube.com/watch?v=KnY3rVAdOww.

**Regular Meeting—Call to Order and Attendance:**
Water Board Chair Jeremy Lynch called the meeting to order at 2:03 PM. Participating remotely were Water Board Members Arne Hultquist, Kyle Bailey, Steve Getz, Mike Duncan, Eve Tallman, and Kara Dohrenwend. City staff participating remotely were Sustainability Director Mila Dunbar-Irwin, Public Works Director Levi Jones, Recorder Sommar Johnson, and Deputy Recorder Kerri Kirk.

**Written Determination to Conduct Electronic Meetings:**
Board Chair Lynch read the written determination into the minutes.

**Approval of Minutes: April 14, 2021, and May 10, 2021**
**Discussion:** Board Chair Dohrenwend requested an edit to the April 14 minutes to correct “Utah Department of Agriculture and Food” in Board and Staff Reports to “Utah Conservation District 7”.
**Motion:** Board Vice Chair Hultquist moved to approve both the April and May minutes. Board Member Tallman seconded the motion.
**Vote:** The motion passed 7-0 with Board Members Hultquist, Lynch, Getz, Dohrenwend, Duncan, Tallman, and Bailey voting aye.

**Board and Staff Reports:**
Board Vice Chair Hultquist inquired about reinstating Citizens to be Heard on the agendas for in-person meetings. He requested clarification on how many Water Board members could attend the same MAWP meeting, and the number of Water Board members required for a quorum. Eve said the bylaws suggest that three members equals a quorum, but it still needs to be clarified. Board Member Dohrenwend inquired if the quorum question could be on the next agenda. Board Chair Lynch confirmed it would be on the next agenda, and that Citizens to be Heard would begin again during in-person meetings.

Board Vice Chair Hultquist reported attending a Water Conservation CEU seminar with Public Works Director Jones. He said the seminar discussed localscapes and the Utah Water Watch program. He said one of the USU extension agents will be in touch with the Water Watch group. He said he encourages the city to work with the two new USU extension agents.

Board Member Dohrenwend reported there will be an irrigation workshop at the nursery in affiliation with the community gardens in early July.
Board Vice Chair Hultquist said the Water Watch program is promoting the low-flow toilets. He said Moab residents do not qualify for the $100 rebate on low-flow toilets, but they are eligible for a rebate on smart water timers.

There was a discussion about Mike potentially becoming the chairman of MAWP after he completes his City Council term this year.

Sustainability Director Dunbar-Irwin reported meeting with Communications and Engagement Manager Church regarding a public outreach campaign for this year. She said one project includes a fridge mailer with tips for landscaping during a drought. She reported applying for a grant for technical assistance with drafting the landscaping and graywater ordinances. She reported collaborating with the Engineering department to obtain the data for the Water Conservation Plan update. She reported meeting with Public Works Director Jones to discuss ideas to implement the water conservation goals for the future. She said Governor Cox issued a third executive order that increases water restrictions in the state. She said the Water Conservation Plan needs completed before she drafts the landscaping ordinance, which will incorporate USU’s research. There was a discussion about the effects of the landscaping ordinance on new development versus current residents. There was a discussion about night watering and the effects of the wind and sun on watering. There was a discussion about landscaping water use versus culinary water use. Sustainability Director Dunbar-Irwin said another idea is to have a demonstration xeriscape garden, which will be a multi-pronged approach that includes improvements to the landscape at City Hall.

Board Member Dohrenwend reported working on planting techniques to establish plants along the creeks in the areas that are disconnected from the creeks’ water table.

**Water Conservation Plan Update: Review Data**

Sustainability Director Dunbar-Irwin reviewed the preliminary data for the Water Conservation Plan which was compiled by the Engineering department staff. There was a discussion about the reasons for the decrease of potable water use since 2005. There was discussion about the water use at the old Wastewater Treatment Plant versus the new one. There was discussion about water loss from runoff and leaks, and the output data from the springs and wells. There was a discussion about the 2016 Water Conservation Plan compared to the current plan requirements. Board Member Dohrenwend expressed concern about the current plan’s deadline and ensuring that Sustainability Director Dunbar-Irwin has the necessary information to complete the plan.

**Water Conservation Plan Update: Assignments**

Board Chair Lynch inquired about any comments for Board Vice Chair Hultquist’s document on the Matheson Wetlands. Board Vice Chair Hultquist said that, if stormwater continues to be pumped straight into the creek, it will entrench it more and lead to a lower groundwater table. Board Chair Lynch said the document on the Matheson Wetlands was well written.

Sustainability Director Dunbar-Irwin shared her screen to review the topics available for assignments. Board Members agreed to assist in writing particular sections of the plan. The “Intro to Other Considerations” section was separated from the “Ecological Concerns” section. Sustainability Director Dunbar-Irwin requested that the contributions be submitted on July 1. Board Chair Lynch requested that a reminder two weeks prior to the deadline be sent out to the Board Members.

**Future of Water in the Community: Steve**

Board Member Getz gave a presentation about the future of water in the community. There was
discussion about the current demand projection accuracy and wet water rights versus paper water rights. Board Vice Chair Hultquist said the adjudication process would be completed in November. Board Member Getz said the adjudication numbers will need to be reviewed.

Adjournment: Board Chair Lynch adjourned the meeting at 4:00 PM.
Water Conservation Plan Update 2021
Proposed Goals, Policies, and Programs

Below is a summary of the proposed goals, policies, programs, and investments contained in the Water Conservation Plan Update, which comprises the next five years, and sets a conservation goal to be achieved by 2030. These items are not a hard commitment, but an intention by the City Council to set a goal and a priority list of actions to achieve it. Water conservation is a concept with a moving target. As more data becomes available and the effect of policies becomes apparent, both the goals and the methods can be adjusted accordingly.

GOAL

• *Use the same total volume of water in 2030 as we used in 2020*
  
  o The City of Moab provided 1,667AF of water in 2020 across all categories (residential, commercial, institutional, and industrial). Residential outdoor irrigation used approximately 500AF of the total water use. If this volume were cut by 50%, even accounting for projected increases in population, the current water use volume would stay the same as it is in 2020 by 2030.

  • *This amounts to a goal of 230GPD by 2030*

POLICIES

• Landscaping Ordinance – set water wise landscape standards for new developments
• Greywater Ordinance – require all new buildings be stubbed for greywater re-use
• Emergency Drought Management Plan – strict water-saving measures for extreme drought situations already in place for when needed
• Water-wise Development Standards – set water-wise building standards for new development, including renovations and re-development

PROGRAMS

• Turfgrass buy-back – pay residents to replace their turfgrass with water-wise landscape
• Conservation rebates – water bill rebates based on various levels of conservation either year over year or at set volumes / property (with allowances for special circumstances)
• Offer smart timers and / or moisture meters for residential irrigation systems
• Adopt a leak-fixing penalty in addition to the current leak-fixing incentive
• Proactive outreach and education including changing water bill design, door hangars for inefficient watering, educational mailings, close coordination with USU extension, information and resources from local landscape designers, etc

INVESTMENTS

• Invest in smart technologies for City properties including moisture meters and smart timers for all irrigation systems
• Change all fixtures and appliances on City properties to WaterSense fixtures
• Upgrades / repairs in Capital Improvement Plan & new well development
2021 Water Conservation Plan Checklist

*Draft WCP Plan Due July 15, 2021*

Water Conservation Plans (WCP) contain descriptions of the water system (System), water use history and projections, new and ongoing practices promoting system and consumer efficiency and a report on progress made towards reaching goals set in the previous WCP. Systems are unique and reviewed on an individual basis. In order to facilitate meeting the requirements of the Water Conservation Plan Act ([73-10-32, UCA](#)), we have created the following checklist:

- Clearly state overall water use reduction goal and an implementation plan System profile
- Supply information
- Water measurement
- System water loss
- Water Use
- Water conservation practices

Details to include for each of the featured units are explained in the following pages.
2021 Water Conservation Plan Checklist

Draft WCP Plan Due July 15, 2021

System Profile

• Provide a map of the current service area. If needed, please email waterwise@utah.gov and the Division of Water Resources GIS Team will be happy to assist you.

• List number of M&I water connections, categorized by type: (Residential/Domestic, Commercial, Institutional, Industrial, Unmetered)

• Chart current water supply, categorized by source (Wells, Springs, Surface, Purchased, Exchanged)

• Provide a comparison graph, which includes a) reliable supply through 2060 b) current water use projections and c) efficient use. Example below:

![Water Supply and Use Graph](image)

• If after reaching conservation targets, use exceeds supply, list future water sources and cost projections

• Describe when applicable, occurrences of groundwater depletion, aquifer recharge (artificial and natural) and storage and recovery practices

• The most accurate population data is now supplied by the Kem C. Gardner Institute (https://gardner.utah.edu/demographics/)
2021 Water Conservation Plan Checklist

Draft WCP Plan Due July 15, 2021

System Water Loss Control

- List leak detection and repair methods, include details on a loss prevention plan if applicable
- List water (by volume: acre-feet or M gallons) and revenue losses and the control practices implemented to minimize both. If utilizing the AWWA Free Water Audit Software© please list water audit validity grade. For more info: https://www.ims-awwa.org/members/group.aspx?code=WaterLossControl
- List current water measurement methods and practices. (percent of metered connections by type, reading frequency, calibration schedule, new development laws & replacement schedule)

Billing

<table>
<thead>
<tr>
<th>Increasing Rate Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
</tr>
<tr>
<td>Metered Rates</td>
</tr>
<tr>
<td>Cost of Service Billing &amp; User Charges</td>
</tr>
<tr>
<td>Understandable Water Bill</td>
</tr>
</tbody>
</table>

- List current tiered pricing structure(s). (UT S.B. 28 2016)
2021 Water Conservation Plan Checklist

Draft WCP Plan Due July 15, 2021

Water Use


• List current total potable and non-potable water deliveries by volume (please specify volume: acre-feet or gallons) categorized by type (residential/domestic, commercial, institutional, industrial, wholesale and unmetered)

• Chart current per capita water use in gallons per capita per day (GPCD) by type and use: (Total water deliveries/365/Total service area population=GPCD). Example:

<table>
<thead>
<tr>
<th></th>
<th>Indoor (Winter Use)</th>
<th>Potable (Outdoor)</th>
<th>Non-Potable (Secondary)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>50</td>
<td>47</td>
<td>31</td>
<td>128</td>
</tr>
<tr>
<td>Commercial</td>
<td>26</td>
<td>8</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>Institutional</td>
<td>4</td>
<td>14</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>Industrial</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
<td>89</td>
<td>56</td>
<td>202</td>
</tr>
</tbody>
</table>
2021 Water Conservation Plan Checklist

*Draft WCP Plan Due July 15, 2021*

- Graph your water efficiency progress:
  - Take 2005–today, total potable and non-potable water use by sector and population records and go to [www.conservewater.utah.gov/compliance.html](http://www.conservewater.utah.gov/compliance.html) for a Conservation Goal Calculator and Graph. Then input data and produce a graph for WCP.

  ![Graph Example](image)

Conservation Practices

Utilities are encouraged to review and apply their region’s Regional Water Conservation Goal (these goals have replaced the Governor’s goal of 25% reduction by 2025). More information on Regional Goals can be found at [https://water.utah.gov/regional-conservation-goals/](https://water.utah.gov/regional-conservation-goals/)

- Clearly state overall water use reduction goal and an implementation plan for the water conservation measure(s) chosen to implement, including a timeline for action and an evaluation process to measure progress

- Provide new BMPs that will be implemented for the next five years. When implementing new practices provide an implementation timeline and an evaluation process to measure progress • BMP options at [www.conservewater.utah.gov/compliance.html](http://www.conservewater.utah.gov/compliance.html)

- Provide a summary of the progress made towards goals and BMPs from the previous WCP
• Provide names and contact information for those responsible for meeting efficiency goals (example: administrative staff, conservation coordinator(s), conservation committee, mayor, town council and/or board members)

• List current conservation BMPs and evaluate effectiveness of programs, outreach, education, etc.
  
  ❑ List and detail all Conservation Public Awareness practices implemented
  ❑ List and detail all Education/Training practices implemented
  ❑ List and detail all Rebates/Incentives/Rewards currently implemented

• List and detail conservation Ordinances & Standards currently implemented
  
  ❑ Water Waste Prohibition
  ❑ Model Landscape Ordinance
  ❑ Water Shortage Plan
  ❑ Drought Plan

• List Reviews or Updates to City Codes/Requirements pertaining to
  
  ❑ Greywater, Rainwater, Groundwater Recharge
  ❑ Construction Standards/Building Codes

• New Development Requirements. As developers build new communities do you have water efficiency requirements i.e. outdoor landscape requirements? If not, why?
2021 Water Conservation Plan Checklist

*Draft WCP Plan Due July 15, 2021*

Next Steps

- After draft Water Conservation Plan is completed, submit it to [waterwise@utah.gov](mailto:waterwise@utah.gov)

- The Division of Water Resources will review draft Plan and return feedback

- Make any changes following feedback

- After receiving approval from the Division of Water Resources to move forward with Public/Board/Council Adoption, hold a public meeting to adopt the Water Conservation Plan.

- Following adoption, please email the following to [waterwise@utah.gov](mailto:waterwise@utah.gov):
  - Final approved Water Conservation Plan
  - Water Conservation Plan Resolution/Adoption signatures
  - Public meeting notice & meeting minutes

*Water Conservation Plans must be adopted by December 31, 2021*

If the Division of Water Resources can be of further assistance, please contact us at [waterwise@utah.gov](mailto:waterwise@utah.gov)
Water Conservation Plan Update 2021
City of Moab
Acknowledgements
This plan was written as a joint effort between City Staff and the Water Conservation and Drought Management Advisory Board. City staff included Mila Dunbar-Irwin, Chuck Williams, Mark Jolissaint, Levi Jones, Marcy Mason and Ben Billingsley. Contributors from the Water Conservation and Drought Management Board were Jeremy Lynch, Eve Tallman, Arne Hultquist, Mike Duncan, Kara Dohrenwend, and Steve Getz. Other contributors include Elaine Gizler and Dave Engleman.
INTRODUCTION

The City of Moab 2021 Water Conservation Plan has been prepared to comply with the Utah Water Conservation Plan Act of 1998 amended in 2004 with HB71 Section 73-10-32. Statute requires that every Utah water conservancy district and water retailer adopt a Water Conservation Plan every five years and file the plan with the Utah Board of Water Resources. This 2021 Water Conservation Plan Update presents updated data for water supply and demand, trends, future growth and consumption projections, and proposes policies and actions to achieve regional conservation goals.

The Regional Water Conservation Goal for the “Upper Colorado River” area (Carbon, Emery, Grand, and San Juan Counties) is 20% by 2030, from an average of 333 gallons / day / person (GPCD) to 267GPCD. Moab is close to this goal and is currently at 278GPCD according to 2020 population estimates. The 2020 Census data will be available in 2022, at which time, the City will have a more accurate resident number, and it is likely the actual GPCD will be lower.

The City proposes to meet and exceed the Regional Goal by setting a new goal of 230GPCD by 2030. This represents a 50% decrease in outdoor landscape irrigation and would result in the total volume of residential water use staying the same, while still accounting for the projected increase in population. A goal of 230GPCD by 2030 is a representation of the water conservation values of the community and an effort to keep water use at a safe level to ensure sustainable quality of life for the City of Moab and its environs.

To meet this goal, the City plans to implement a suite of water conservation measures including policies, outreach, infrastructure improvements, and water resource management planning. Proposed policies include regulating landscapes and turfgrass for new development, water wise development standards, and re-landscape incentives. Outreach and education for current residents as well as making technical resources and expertise available are a key component of meeting the City’s goal. The City has committed to system upgrades which will be completed over the next five years and have the potential to reduce loss and improve efficiency, as well as developing a new source (well). In addition, the City is embarking on a water resource management planning effort in coordination with other water providers who share the groundwater supply, to make smart decisions now and prevent shortages in the future. Underpinning all of these efforts is on-going research by state, local, and federal agencies to improve data accuracy and forecasting.

Data for this plan comes from ongoing studies by the Utah Division of Water Rights (DWRI), the United States Geological Survey (USGS) and the Utah Geological Survey (UGS) as well as the City and neighboring water users, Grand Water and Sewer Service Agency (GWSSA), and Moab Irrigation Company (MIC). Population data was derived from the 2020 US Census.
SECTION 1: SYSTEM PROFILE

1.1 History, Government and Population

The City of Moab was incorporated in 1902 and is the largest city in Grand County. The City of Moab has a Council-Manager form of government, with five elected Council members, a separately elected Mayor, and an appointed City Manager.

The area has been known for mining, filming, and now tourism over the decades. It is the jumping off point for Arches and Canyonlands National Parks, as well as home to world-renowned mountain bike and 4x4 trails, which means that the area seems millions of visitors every year. This transient population makes water planning more complicated, and can be a point of contention for those concerned that our GCPD does not differentiate between visitors and residents, resulting in each resident being “responsible” for some portion of the tourism impact. Please see Section 6, Water Conservation, for more details.

The resident population of the City has slowly grown over the past ten years, with an average estimated growth rate of 1.01%. Current resident population is estimated at 5,341 using this assumed growth rate, and will be updated with the 2020 Census data available in 2022. Using simply the average growth rate from the past 10 years, Moab City would see an increase of approximately 2,500 people in the next 40 years.

Fig 1. Projected Population Growth

However, build-out projections are complex, and have many different scenarios based on current zoning, potential zone changes, types of uses, and possible future regulations such as water availability. 2020 Census data may be higher than the previous growth rates, and post-covid, Moab seems to have undergone a boom in popularity if the housing market is any indication of current residential demand.

There are currently 240 vacant properties within City limits, representing 725 buildable acres (there are 1116 vacant acres, but the remaining 391 acres are unbuildable due to natural hazards). Approximately 30% of these are zoned for commercial uses. The lowest end of the
build-out scenario is one single-family dwelling on each residentially zoned property and non-residential uses on the others, which adds only about 223 people (using as average of 3 people/household) to the projected population. The build-out number gets much higher assuming each property uses their total density allowance, and higher still if any are rezoned to zones allowing more density than currently permitted. With a medium scenario, where every vacant residential property is subdivided and developed to the maximum density allowed by current zone (excluding multi-family options), then there are 3,000 new units built, and approximately 9,000 more people.

The City is currently looking into these various scenarios to develop smart land use policy based on limited resources and community desires. The matter is complicated further by the addition of other water users outside City limits who share the aquifer — residents of both Grand County and San Juan County. Acknowledging this reality is the inspiration behind the initiation of the Moab Spanish Valley Water Providers Coalition, a water resource management planning group to be convened later in 2021.

It is impossible to address the population of Moab without representing tourism. Though the City only has around 5,000 permanent residents, the area (including Spanish Valley) sees more than a million visitors per year, many of which stay at least one night in the many overnight accommodations available in both City limits and Grand County.

1.2 Water governance structure**

Fig. 2 Map of Current Service Area

![Map of Current Service Area](image)
1.3 Water Distribution System
The City of Moab supplies drinking water to almost all the residents and businesses within the City. Three wells and three springs provide drinking water year round, and an additional spring and well are used for irrigation only. Water sources in the distribution system for the City of Moab vary seasonally and yearly. From the north end of town, water from Skakel Spring is pumped through a chlorination station and into a one-million-gallon tank, which then feeds the Northwest low pressure zone of the city. Birch Springs 1, 2 and 3 and Wells #6 and #10 south of Moab are channeled into pipes and flow into two gas chlorination stations. From each of these chlorination stations, water flows downhill to the City grid. Two one-million-gallon storage tanks are not in line with the main transmission lines, but branch off at the south end of the system. See Section 2 for volume and supply information.

Fig. 3 Number and Type of Connections in 2020

<table>
<thead>
<tr>
<th>Type of Connection</th>
<th>Number in 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>1,773</td>
</tr>
<tr>
<td>Commercial</td>
<td>430</td>
</tr>
<tr>
<td>Institutional</td>
<td>60</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2,263</td>
</tr>
</tbody>
</table>

The City of Moab’s water system operates as an Enterprise Fund in which fees are charged to users of the system to pay for the costs. The Water Fund revenue sources consists of water base and usage fees from residential and commercial customers, bulk water sales, water impact fees, and proceeds from debt service secured by water rates. In April of 2021 the water revenue was used to secure a bond to enable the City to complete a backlog of necessary water related projects in the next 5 years, including developing a new well, Well #12. These projects also include water line improvements along Mill Creek Drive, a new 2 million gallon storage tank on Spanish Valley Drive, and various optimization projects on existing facilities. The Water Department keeps up on leak and loss maintenance regularly (see Section 4).

1.4 Water Treatment System
- New sewer plant
- Potential for re-use of water (Matheson wetlands)

SECTION 2: SUPPLY
2.1 Sources – Aquifers, Surface Water, and Water Rights
2.1.1 History **
2.1.2 Aquifer and surface water descriptions and maps**
During the last several years the City, GWSSA and several other concerned entities funded a USGS study to help better understand the aquifers in our area (citations here). The City of Moab also hired a consultant, Ken Kolm, to further understanding of this very complex system (citations here).
Due to the complexity of the aquifers fed by snow melt from the La Sal Mountains there is not complete agreement on exactly how the system functions, and there is still a wide range in the estimates of how much water is in the aquifer and what the recharge rate is. This discussion is ongoing in the community and will be a part of groundwater management planning efforts.

The complexity of our water source not only makes quantifying it difficult, but it also means our water supply is relatively invisible to residents and visitors alike. Conservation of a resource that may only be understood to be gone when wells run dry creates a challenging conservation planning atmosphere. The City of Moab and others in the community can help lead the conversation about understanding our water system is complex, how we are working to understand the security of our water supply, and how every resident can help through water conservation.

Table 1. SUPPLY CATEGORIZED BY TYPE of SOURCE**

2.2 Secondary Water (Irrigation Sources)

2.2.1 Moab Irrigation Company

Moab Irrigation Company (MIC) is a non-profit organization founded about 1890 which has senior water rights to almost all of the water in the Mill Creek drainage, including North Fork, which is usually around 6,000 acre-feet per year. Headwaters of both branches of Mill Creek are high on the west side of the La Sal mountains. Mill Creek is the principal drainage supplying water to Spanish Valley.

There are three diversions in the upper reaches of the creek that supply water to three ditches – Wilson Mesa, South Mesa, and Horse Creek – for agricultural and irrigation uses. There is another large diversion, discussed below, supplying water through Sheley Tunnel to Ken’s Lake, which is a reservoir supplying irrigation water to upper valley users.

There are three more diversions on Mill Creek below its confluence with North Fork. The two lower dams are near each other and not far from the intersection of Spanish Valley Drive and Powerhouse Lane. The uppermost dam of this group supplies mostly small farms on the southeast edge of the city. The remaining two dams supply two "ditches" (long since replaced by closed plastic piping) that stretch from east to west across Moab City. The users on these ditches are more than a hundred of mostly urban landscapers who enjoy relatively inexpensive irrigation water compared to what it would cost to irrigate with city culinary water. Delivery takes advantage of the steady downhill grade to the west to hydrostatically pressurize the pipelines; no pumps are used. The majority of these users flood irrigate their properties.

Since 1980, all flow (except a BLM required 3 cfs minimum in-stream flow) in Mill Creek is diverted by Grand Water and Sewer Service Agency (GWSSA) into Ken’s Lake where it is used for irrigation in the upper valley. [A hydrologist employed to study the City’s culinary water supply asserts that this reduced (since 1980) stream flow has detrimentally reduced the city’s production from its springs and wells at the golf course as well as Skakel Springs farther north along a NW trending Kayenta fault line.] MIC charges GWSSA for this diverted water, and in turn if MIC wishes to augment its city pipelines in late summer (a common occurrence in recent frequent drought years) when Mill Creek flow is low, GWSSA charges MIC for water pumped...
from Valley Fill Aquifer wells in the same geographic area as MIC diversions. Ken's Lake also owns a large number of MIC shares, for which it pays an assessment fee like any other MIC shareholder.

In summer, MIC frequently takes all Mill Creek flow at its two lower dams to serve its city users, leaving Mill Creek almost dry, particularly in the daytime when more people are watering than they do at night. Water does seep back into the creek below the lower dam so that by the time Mill Creek crosses Main Street (Hwy 191) there is some flow back in the creekbed. The aesthetics and ecological amenity of leaving some modest flow, ideally even in drought years, in the creek all the way through town is desirable, but there's not enough water to serve MIC customers and leave some in the creek unless water distribution can be made more efficient. Doing so is certainly possible, but it requires considerable upgrade to both MIC and user systems with technologies such as pumps, timers, tanks, automated diversion dams and automated valves. Surface water is messy to handle, involving foreign material such as sand, limbs, leaves and beavers, making the situation more complicated.

Similarly, the idea of using MIC water, its pipelines, or at the least its right-of-way through town to grow a secondary municipal water system surfaces periodically. This is possible, but likely means converting MIC from a non-pressurized to a pressurized, metered system, which is not currently in City or MIC budgets.

2.2.2 The Colorado River
Another potential secondary irrigation system is surface water out of the Colorado River. The City of Moab holds xxcfs/AF in water rights (see above) and has the opportunity to conserve culinary water and add non-potable supply for outdoor irrigation needs. Developing this system would cost XX$$ and take XX years and is not within the scope of City capital improvement projects at the moment. However, as a means to further conserve culinary water supplies, this development could be well warranted in the future.

2.3 Water Rights**
- Summary of Moab water rights
- Other water rights on the same source
- Opportunity for water banking

SECTION 3: WATER MEASUREMENT
3.1 Water Measurement Methods and Practices**
- Requirement: List current water measurement methods and practices
  - Percent of metered connections by type, reading frequency, calibration schedule, new development laws and replacement schedule.

SECTION 4: SYSTEM WATER LOSS
4.1 Water Loss
There were approximately 550 acre-feet of water, or about 20%, lost between production and metered connections in 2020, which is typical for recent years. The City engineering and public works team attributes this loss to four possible causes:
1. **Dispersed Leaks**: individual leaks may be too small to be noticed but taken together could have a significant effect. Water lines are in various types of soils, some of which may be able to absorb a slow leak for a long time without evidence showing.
2. **Water Line Breaks**: these are repaired quickly, but large amounts of water can be lost during the leaking period.
3. **Unmetered Connections**: there may be older connections that are as yet unmetered.
4. **Fire Hydrant Exercise**: public works exercises fire hydrants on a schedule, and the water used is not metered.

Source overflow from springs is not metered and bypasses the system, so would not be counted as loss.

### 4.2 Leak Detection and Repair

Moab City has four full time Water Department personnel directly supervised by the Public Works Director. They work around the clock to provide safe drinking water for the City of Moab. They monitor and perform regular maintenance on the water production and treatment process daily and always make necessary repairs immediately. They have a SCADA system that is able to monitor and control various parts of the water system remotely from a desktop computer or a phone app with full control of all the pumps in the system. This means they are able to see intrusion alarms and all of the tank levels in real time.

The Water Department takes leaks seriously and responds immediately to all identified issues, making a conscious effort to lose the least amount of water possible during repairs. They are always on high alert and inspecting the water system for leaks and have personnel on-call 24/7 through local dispatch through the Sheriff’s office or by the on-call number (435)210-1982. The City Water Department responded to 35 water leaks in 2020 and completed repairs on 8 water mains and 22 service lines.

The Treasury and Water Departments work closely together on water conservation. The Water Department reads all water meters, most of which are digitally broadcast, and reports those readings to the Treasury Department monthly. The Treasury Department is able to identify high usages through their billing software which creates a re-read list. The Water Department will then verify the unusually high readings on the ground and report the conditions back to the Treasury Department. If there is evidence of a water leak the homeowner is notified immediately and work begins on a solution. When the leak is properly fixed, the homeowner can request a rebate on the amount of their water bill caused by the leak. This is intended as an incentive to fix leaks and not simply let them run, though, that has happened in the past, and it may be time to add a penalty for those who do not choose to fix their leaks.

In addition, the Water Department works to educate customers on ways to conserve water. From irrigation watering schedules to overflowing swamp coolers and leaking faucets, they help customers identify high usage areas and come up with solutions.

In an effort to maintain water quality the Water Department cleans and inspects water storage facilities every 5 years. They flush low flow and dead-end lines on a regular basis and upon restoring water after an outage, they flush water mains until free of sand. There is sediment that flows naturally from the springs and settles in main lines due to aging infrastructure. New
infrastructure additions strictly follow AWWA water standards. From installation and pressure testing to treatment and sampling all applicable standards are followed every time to maintain water quality.

SECTION 5: WATER USE

5.1 Water Use

Total water used from 2005 – 2020 has decreased. In recent years, the proportion of water going to commercial uses has begun to decrease in comparison to residential use as well, as the City becomes more built-out and residentially focused, and commercial and agricultural uses move out into Spanish Valley. The City has set the goal of a 50% reduction in outdoor landscape irrigation by 2030 to effectively keep residential draw the same as it is today, regardless of the projected increase in population.

Fig. 3 Water Use by Sector and Year

Table 2. Potable vs. Non-Potable Water Use

The City of Moab only began keeping records on non-potable water production and use in 2017. There are only three connections that are considered non-potable water used for irrigation. Well #7 is used exclusively by the Golf Course for spring irrigation to make up for shortfalls when their usual water source (GWSSA) does not have enough supply. They use varying levels per year depending on available surface water. The City Center well is exclusively used for irrigation of City facilities near City Hall, and McConkie spring is a diversion near Old City Park used for irrigation there.
<table>
<thead>
<tr>
<th>SOURCE</th>
<th>2020</th>
<th>2019</th>
<th>2018</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Center Well</td>
<td>1.35</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>McConkie Spring (Irrigation)</td>
<td>120.00</td>
<td>120.00</td>
<td>120.00</td>
<td>152.03</td>
</tr>
<tr>
<td>Well #7 Golf Course (Irrigation)</td>
<td>8.43</td>
<td>18.00</td>
<td>182.70</td>
<td>41.06</td>
</tr>
<tr>
<td>Total Per Year</td>
<td>129.78</td>
<td>138.00</td>
<td>302.70</td>
<td>193.09</td>
</tr>
</tbody>
</table>

5.1.1 Water Use – Permanent Residents
Total water use has been trending downwards in the past 15 years, even as population has risen. This is due to shifting uses from commercial and mining towards residential, conversion of agricultural land to residential use, replacement of an old sewage treatment facility, and likely some water conservation awareness as well. In 2005 the total water used was 1,965 acre-feet and in 2020 the total was 1,667 acre-feet. *The City of Moab aims to keep total water use at or around the current level into 2030, regardless of population growth.*

Fig. 3 Population vs Water Use
Table 3. Gallons per Capita per Day 2005 - 2020

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>GPCD Residential</th>
<th>GPCD Commercial</th>
<th>GPCD Institutional</th>
<th>GPCD Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>4,936</td>
<td>192.76</td>
<td>162.72</td>
<td>-</td>
<td>355.48</td>
</tr>
<tr>
<td>2006</td>
<td>4,968</td>
<td>191.78</td>
<td>161.60</td>
<td>-</td>
<td>353.38</td>
</tr>
<tr>
<td>2007</td>
<td>5,001</td>
<td>164.18</td>
<td>129.78</td>
<td>-</td>
<td>293.96</td>
</tr>
<tr>
<td>2008</td>
<td>5,033</td>
<td>174.56</td>
<td>144.34</td>
<td>-</td>
<td>318.89</td>
</tr>
<tr>
<td>2009</td>
<td>5,066</td>
<td>168.42</td>
<td>150.65</td>
<td>-</td>
<td>319.06</td>
</tr>
<tr>
<td>2010</td>
<td>5,111</td>
<td>135.46</td>
<td>183.40</td>
<td>-</td>
<td>318.87</td>
</tr>
<tr>
<td>2011</td>
<td>5,097</td>
<td>131.05</td>
<td>157.60</td>
<td>-</td>
<td>288.64</td>
</tr>
<tr>
<td>2012</td>
<td>5,186</td>
<td>142.79</td>
<td>166.56</td>
<td>-</td>
<td>309.35</td>
</tr>
<tr>
<td>2013</td>
<td>5,184</td>
<td>143.89</td>
<td>207.67</td>
<td>-</td>
<td>351.56</td>
</tr>
<tr>
<td>2014</td>
<td>5,225</td>
<td>162.38</td>
<td>156.24</td>
<td>-</td>
<td>318.62</td>
</tr>
<tr>
<td>2015</td>
<td>5,251</td>
<td>145.69</td>
<td>136.18</td>
<td>-</td>
<td>281.88</td>
</tr>
<tr>
<td>2016</td>
<td>5,261</td>
<td>135.68</td>
<td>171.73</td>
<td>-</td>
<td>307.41</td>
</tr>
<tr>
<td>2017</td>
<td>5,219</td>
<td>139.50</td>
<td>139.97</td>
<td>46.21</td>
<td>325.69</td>
</tr>
<tr>
<td>2018</td>
<td>5,288</td>
<td>143.66</td>
<td>127.38</td>
<td>36.12</td>
<td>307.17</td>
</tr>
<tr>
<td>2019</td>
<td>5,336</td>
<td>145.33</td>
<td>99.91</td>
<td>27.43</td>
<td>272.67</td>
</tr>
<tr>
<td>2020</td>
<td>5,341</td>
<td>166.47</td>
<td>89.23</td>
<td>22.97</td>
<td>278.67</td>
</tr>
</tbody>
</table>

Fig. 6 Gallons per Capita per Day by Type
5.1.2 Water Use – Visitors

No discussion of water use in Moab would be complete without addressing the impact of our many visitors. Currently, overnight accommodations account for approximately 16% of the commercial water used. In 2019 (a more typical year than 2020), this was a total of 95AF. As visitors increase, we can expect their water usage to increase concurrently unless more conservation measures are implemented at overnight accommodations. Outreach efforts are part of the five year conservation plan. However, considering that overnight accommodations only account for 16% of the City’s commercial usage, this sector does not have an oversize impact on the total.

5.2 Water Production and Projections**

Fig. 4 Water Produced by Source / Year

<table>
<thead>
<tr>
<th>Water Source Data (AF)</th>
<th>5-yr average</th>
<th>2016 (2,388 AF)</th>
<th>2017 (2,540 AF)</th>
<th>2018 (2,478 AF)</th>
<th>2019 (2,264 AF)</th>
<th>2020 (2,218 AF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birch Springs 1,2,3 (WS003)</td>
<td>535.82</td>
<td>515.78</td>
<td>551.85</td>
<td>539.83</td>
<td>503.63</td>
<td>468.42</td>
</tr>
<tr>
<td>Sommerville Springs Nos. 1 &amp; 2 (WS001,2)</td>
<td>535.79</td>
<td>518.19</td>
<td>572.11</td>
<td>517.06</td>
<td>472.09</td>
<td>469.22</td>
</tr>
<tr>
<td>Well No. 10 (WS010)</td>
<td>529.13</td>
<td>533.68</td>
<td>565.79</td>
<td>487.91</td>
<td>521.26</td>
<td>409.36</td>
</tr>
<tr>
<td>Well No. 6 (WS007)</td>
<td>415.20</td>
<td>450.83</td>
<td>426.63</td>
<td>368.13</td>
<td>458.60</td>
<td>478.65</td>
</tr>
<tr>
<td>Skakel Springs (WS012)</td>
<td>241.73</td>
<td>232.35</td>
<td>230.31</td>
<td>262.53</td>
<td>169.92</td>
<td>264.30</td>
</tr>
<tr>
<td>McConkie Spring (Irrigation, estimated)</td>
<td>130.68</td>
<td>120.00</td>
<td>152.03</td>
<td>120.00</td>
<td>120.00</td>
<td>120.00</td>
</tr>
<tr>
<td>Well #7 Golf Course (Irrigation)</td>
<td>80.14</td>
<td>16.67</td>
<td>41.06</td>
<td>182.70</td>
<td>18.00</td>
<td>8.43</td>
</tr>
<tr>
<td>Total Per Year</td>
<td>2,468.48</td>
<td>2,387.50</td>
<td>2,539.78</td>
<td>2,478.16</td>
<td>2,263.50</td>
<td>2,218.38</td>
</tr>
</tbody>
</table>
5.3 Billing

The City recently updated water rates to adopt a stronger tiered rate structure to encourage conservation, particularly for commercial properties. These new rates were only recently adopted in the winter of 2020 / 2021 and have yet to see a full summer season. We are hoping that it will encourage adoption of conservation behaviors and more awareness of water use. See below for the current rates.

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Minimum Charge</th>
<th>Rate for 3,001 to 10,000 gal.</th>
<th>Rate for 10,001 to 60,000 gal.</th>
<th>Rate for 60,001 or more gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential, within the City</td>
<td>$13.00</td>
<td>$1.13</td>
<td>$1.50</td>
<td>$1.88</td>
</tr>
<tr>
<td>Residential, outside the City</td>
<td>$18.85</td>
<td>$1.50</td>
<td>$2.25</td>
<td>$2.63</td>
</tr>
<tr>
<td>Commercial, within the City</td>
<td>$37.50</td>
<td>$1.50</td>
<td>$2.25</td>
<td>$3.40</td>
</tr>
</tbody>
</table>

Requirement: comparison graph with a) reliable supply through 2060, b) current water use projections, and c) efficient use

Water source development, supply, and cost projections

Fig. 4 Water Production Trends by Source
<table>
<thead>
<tr>
<th>Service Description</th>
<th>Charge Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial, outside the City</td>
<td>$4.25/thousand for 50,001 or more gal.</td>
</tr>
<tr>
<td></td>
<td>$44.25 minimum charge (includes the first 2,000 gal.)</td>
</tr>
<tr>
<td></td>
<td>$3.00/thousand for 2,001 to 5,000 gal.</td>
</tr>
<tr>
<td></td>
<td>$3.38/thousand for 5,001 to 10,000 gal.</td>
</tr>
<tr>
<td></td>
<td>$4.25/thousand for 10,001 to 50,000 gal.</td>
</tr>
<tr>
<td></td>
<td>$4.68/thousand for 50,001 or more gal.</td>
</tr>
<tr>
<td>Shop Water Retail Fee (City Public Works Yard)</td>
<td>$32.50 for first 2,000 gallons, $12.75/1,000 gal.</td>
</tr>
<tr>
<td>Shop Water Government Fee (City Public Works Yard)</td>
<td>$26.00 for first 2,000 gallons, $9.38/1,000 gal.</td>
</tr>
<tr>
<td>Construction Fire Hydrant Fee</td>
<td>$32.50 for first 2,000 gallons, $12.75/1,000 gal.</td>
</tr>
<tr>
<td>Construction Fire Hydrant Rental Fee</td>
<td>$15 per day</td>
</tr>
<tr>
<td>City Parks &amp; Cemeteries</td>
<td>$0.81/1,000 gal.</td>
</tr>
<tr>
<td>Moab Golf Course Well #7</td>
<td>Current Commercial Rate</td>
</tr>
<tr>
<td>Water turn-on fee, after failure to pay</td>
<td>$25.00 during normal working hours;</td>
</tr>
<tr>
<td>City water/sewer charges</td>
<td>$50.00 after normal working hours</td>
</tr>
<tr>
<td>Water meter re-read charges</td>
<td>$10.00</td>
</tr>
<tr>
<td>The City crew will re-read the customer’s meter.</td>
<td></td>
</tr>
<tr>
<td>The City crew will test a customer’s meter.</td>
<td>$20.00</td>
</tr>
<tr>
<td>The City crew will change a tested customer’s meter, at the customer’s request.</td>
<td>Actual labor costs with a one hour minimum</td>
</tr>
<tr>
<td>The costs incurred for these requests will be paid within thirty days. If that bill is not paid, the water will be turned off until the debt is satisfied, and a reconnect charge (1/2 hour minimum) during regular hours or reconnect charge (2 hour minimum) after hours, will be applicable.</td>
<td>During regular working hours, actual labor costs with a ½ hour minimum</td>
</tr>
<tr>
<td>If the problem proves to be the city’s responsibility, there will be no charge to the customer.</td>
<td>after hours, actual labor costs with a 2-hour minimum</td>
</tr>
</tbody>
</table>

There is a space on City bills for a small message, which can be anything from information about the new rates to conservation messages. Currently, the City is sending out the Sustainability website address as a place for water conservation tips and resources. There is current information maintained on that site as well as links to other water conservation resources.
resources and programs. In the future, the City is contemplating bill restructuring to include conservation goals and measurements aimed at such.

SECTION 6: WATER CONSERVATION

6.1 Introduction
The City of Moab is interested in a nuanced approach to conservation that does not simply focus on up-and-coming technologies and strategies alone (which are often the rediscovered practices of yesteryear’s farmers anyway). The multi-pronged approach described in this Water Conservation Plan is comprised of policies, infrastructure improvements, investment in technologies and incentive programs, outreach and education, coordinated resource management, and on-going research and data refinement.

The ultimate goal is to better define and achieve conservation as a term and set of practices which become embedded in the community ethos and carry forward to a sustainable future.

6.2 Water Use Reduction Goal
In 2000, Governor Levitt proclaimed a conservation goal of 25% in gallons per capita day (GPCD) by 2050 using 2000 water use as the indexing year. The conservation proclamation was aimed at municipal and industrial (M&I) users, agriculture was intentionally omitted from the goal. A few years later Governor Herbert decreased the timeline and proclaimed a conservation goal of 25% by 2025 using the same year, 2000, as the indexing year. The goals were not intended to reduce the total demand for M&I water, they were established to make room for new growth because a fair number of regions were reaching the limit of their water resources.

Since then, the Utah Legislature began getting involved which led to a 2015 Legislative Audit, followed by a 2017 Follow-up Audit, then a Third-Party Review, and finally a 2017 Recommended State Water Strategy. Those efforts recommended the State develop regional water conservation goals. The Utah Division of Water Resources (UDWR) was tasked with the project and developed the latest goals in their document Utah’s Regional M&I Water Conservation Goals. Grand County was put in the “Upper Colorado Region” which also includes Carbon, Emery and San Juan County.

The draft recommendations were for the Upper Colorado Region to reduce their per-capita water consumption by another 17% and the final recommendations were for 20% reduction from average regional 2015 usage (333GPCD) by 2030. The 20% reduction for the region resulted in a recommended goal of 267GPCD. Moab is currently at 278GPCD (depending on accurate population data) and has set a new goal of 230GPCD by 2030. The table below shows the percent reduction from the year 2000 as per the original call from Governor Levitt, which Moab would meet with the 267GPCD regional goal, and exceed with a new goal of 230GPCD.
<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Total AF</th>
<th>gallons per capita day</th>
<th>% change from 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4779</td>
<td>1926.63</td>
<td>359.9</td>
<td>0.0%</td>
</tr>
<tr>
<td>2015</td>
<td>5251</td>
<td>1657.96</td>
<td>281.9</td>
<td>21.7%</td>
</tr>
<tr>
<td>2020</td>
<td>5341</td>
<td>1667.31</td>
<td>278.7</td>
<td>22.6%</td>
</tr>
<tr>
<td>2030</td>
<td>N/A</td>
<td>N/A</td>
<td>267</td>
<td>25.6%</td>
</tr>
<tr>
<td>2030*</td>
<td>5906*</td>
<td>1667*</td>
<td>230*</td>
<td>36%</td>
</tr>
</tbody>
</table>

6.3 Water Conservation Metric
The State has determined the metric for conservation goals at gpcd, or gallons per capita per day. The metric is a reasonable measure if you were only measuring municipal use. The concept being we are measuring household use and the number of people in households affects that number. However, adding commercial, industrial, and institutional into the metric is problematic because the people who are supported by that water use may not be living in the area where the water is being used. Furthermore, differing industrial and commercial uses may not have any relationship to the number of people being served by the water provider. Furthermore, trying to determine whether metrics represent conservation or a change in economy are not represented using the current measurements.

The City of Moab has a tourism economy. There are between 1.6 and 2.6million visitors in our community per year. As such, the metric per capita does not include the numbers of visitors our municipality supports, who use at least 16% of all commercial water, or 95AF, just on overnight accommodations. This does not include the amount of water used in other businesses catering to visitors such as restaurants, washing of off highway vehicles, etc. The City of Moab is interested in considering other metrics to determine their conservation goals. One which has potential is an Equivalent Residential Unit (ERU). It is already used for a variety of requirements associated with water supply and could be a metric which allows a comparison between economies and water conservation strategies.

6.4 Current Conservation Measures

Leak protection program / rebates
The leak protection program provides a rebate for the amount assumed to be lost due to a leak after the customer has fixed it. This is intended to provide an incentive for fixing leaks.

New Water Treatment Facility
The new Wastewater Treatment Facility uses only 20,000 gallons of water per month whereas the old one used 2 million gallons per month. This saves the City over 23.5million gallons of water per year.

Outreach, Education
The City of Moab maintains a column in the Moab Happenings and the monthly City Newsletter devoted to issues of Sustainability. Water conservation is an important and frequent topic in these articles.

6.5 Current Conservation Ordinances and Standards
The City of Moab does not currently have any ordinances or standards addressing water conservation directly. However, the WaterNOW Alliance just awarded the City a grant for technical assistance to develop three things: 1) a greywater ordinance, 2) a landscaping ordinance, and 3) new development standards, which will be completed in early 2022. The City is looking forward to working with WaterNOW Alliance as well as USU Extension experts to get smart, relevant, and up-to-date ordinances adopted as soon as possible. The City will also be working on an Emergency Drought Management Plan.

6.6 New Conservation Measures for the Next Five Years
6.6.1 Planning Efforts**
- Water Resource Management Plan (Moab Spanish Valley Water Providers Coalition)
- USGS monitoring and research

6.6.2 Ordinances and Policies
A. Landscape Ordinance
The Water Board recommends developing a landscape ordinance which would have three main components. 1) Requiring new development to use waterwise landscaping principles, limit or omit turfgrass, and design in conjunction with greywater systems (see below), 2) Instituting outdoor landscape watering rules for all residents during times of drought (see Drought Management Plan), and 3) Developing a recommended/required species list for any new development in Moab. This effort will be particularly helpful in conserving culinary water supply, which is currently being used as irrigation water on most properties in the City for lack of a secondary irrigation system.

A key component to the success of the landscaping ordinance is outreach to current residents and businesses to encourage adoption of waterwise landscaping and abandonment of unused turfgrass. City staff is working on opportunities to improve existing demonstration landscaping around City Hall, as well as removing turfgrass and installing waterwise landscaping in prominent location. These demonstration areas will serve to encourage current residents to do the same in their own homes and will provide inspiration and education to current and future residents.

This ordinance is planned for development in 2021 and adoption by 2022.

B. Grey Water Ordinance
Residents of the City of Moab (City) began installing grey water systems a couple of years ago as pilot projects with the Southeast Utah Health Department (SEUHD). The projects were successful and with the new information SEUHD collaborated with the Utah Division of Water Quality to re-write the rules associated with permitting grey water reuse in Utah. Since then,
the SEUHD has permitted several residential homes including affordable housing projects. The systems are relatively easy to install compared to most landscaping irrigation systems and inexpensive if installed during the building of a new home.

The City plans to take advantage of the local expertise and the willingness of new homeowners to embrace these systems. This effort will make the City more resilient to drought and conserve water by reusing grey water to irrigate landscapes instead of sending it to the Wastewater Reclamation Facility and discharging it out of the area. It is estimated that new residences with lots less than .25 acres could save 50% of the water they would have used for outdoor irrigation.

The City is developing ordinances that would require the indoor plumbing associated with grey water systems be installed during the construction or re-construction of new single family and multi-resident housing. The City also intends to encourage the use of these systems by refunding some of the impact fees associated with new construction to home and multi-housing units if they complete the installation with outdoor grey water irrigation.

The City is also looking to make the City’s water portfolio more resilient by developing grey water ordinances for new commercial developments. The ordinance would require new commercial buildings to install either grey water or rainwater catchment systems that would provide all the water required for the landscaping associated with the new development.

C. New Development Standards
In conjunction with the landscaping and greywater ordinances, the City will implement standards for new development that incorporate waterwise landscaping principles and water saving construction features. Landscaping will be required to be waterwise, using a recommended list of plants and features, as well as a limitation on turfgrass area. New construction will be required to use WaterSense labeled fixtures and appliances, and stub for greywater.

D. Emergency Drought Management Plan
The City intends to develop and adopt an Emergency Drought Management Plan to prepare for a situation of actual shortfall in water production. With thoughtful pre-planning, the City will be able to take the time needed for calculations, engage the public, and decide what measures make the most sense to conserve water when a drastic situation arrives. This may involve recommendations to install infrastructure for emergency shut-offs or secondary lines in all new construction so irrigation may be divorced from culinary uses. The City aims to adopt this plan within the next five years.

6.6.3 City Facilities Improvements
There are opportunities to improve municipal water efficiency which the City intends to complete as funds become available, beyond the infrastructure improvements bonded for and contained within the Capital Improvements Plan (mentioned in Section 1). There are three main City parks that use water for irrigating turfgrass – Rotary Park, Swanny Park, and Old City Park.
In addition, the City maintains the ballfields outside City Hall and various other smaller areas. Improvements to the system involve four things:

1) installing smart timers and moisture meters for more efficient watering
2) removing grass where it is not needed
3) evaluating and fixing old systems to water where needed and not where it’s not
4) replacing plants which have died and are still being irrigated, allow them to establish, and re-evaluate and reduce irrigation appropriately

In addition, there are opportunities to install green infrastructure and improve stormwater management to facilitate more infiltration and less runoff, as well as contribute to a greener streetscape. As City drainage features are renewed or repaired, green infrastructure can be incorporated into new designs and implemented where possible. If funding becomes available, the City will be able to develop a green infrastructure plan for areas where projects would be possible. The proposed greywater ordinance could work in concert with green infrastructure between residential property and City streets.

6.6.4 Outreach and Education

Successful water conservation in Moab will depend on both tangible and intangible elements. Efforts like replacing old fixtures and repairing leaks are opportunities to passively conserve water by updating systems. Behavior change is the intangible piece of the puzzle which will require a different approach. The City of Moab values the impact of education and outreach on water conservation and will be continuously working to develop a community spirit of water conservation without sacrificing quality of life or economic opportunities.

Planned outreach efforts include articles in the local newspaper, the City Newsletter, and Moab Happenings, changing the design of the water bill to include conservation-oriented metrics, creating and distributing door hangars at properties with inefficient watering systems to offer consultation and resources, educational mailings with best practices and goals, and providing resources from local landscape designers, USU extension, and other knowledge holders to assist residents and businesses in their water conservation efforts. Keeping the community informed about progress towards our conservation goals is a key component of the outreach and education effort, and an essential piece of meeting our water conservation goals.

6.6.5 Programs

If funding becomes available, the City can invest in programs to accelerate landscaping conversion and outdoor irrigation water savings. These may include the following:

- **Turfgrass buy-back / rebate**: providing cash payments or rebates for property owners to replace lawn with water wise landscaping (this is a common program to encourage lawn conversion)
- **Conservation rebates**: direct water-bill rebate rewards for meeting conservation goals on top of the tiered rates
- **Free smart timers and moisture meters**: providing smart technologies to assist property owners with efficient watering
- **Penalty for failing to fix leaks**: adopting a penalty in addition to the rebate for failing to fix a leak in a timely manner
6.7 Responsibility for Meeting Conservation Goals
Chuck Williams, City Engineer: cwilliams@moabcity.org
Levi Jones, Public Works Director: ljones@moabcity.org
Mila Dunbar-Irwin, Sustainability Director: sustainability@moabcity.org
Carly Castle, Assistant City Manager: ccastle@moabcity.org

6.8 Action and Implementation Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Action</th>
</tr>
</thead>
</table>
| 2021 | • Water-wise landscaping guide sent to all addresses in Moab City including information on watering turfgrass, resources for xeriscaping, and other ways to reduce use of water outdoors  
• Establish Moab/Spanish Valley Water Providers Coalition |
| 2022 | • Adopt Landscaping Ordinance and Greywater Ordinance  
• Adopt new development standards including water wise elements  
• Adopt Moab/Spanish Valley Water Providers Coalition Water Resource Management Plan  
• Inform community of the newly adopted Water Conservation Plan Update |
| 2023 | Implement incentive programs (when / if financially feasible):  
  o promote fixture replacement and inventory old fixtures where possible;  
  o campaign to reduce water waste in the home and improve efficiency;  
  o offer smart timers;  
  o implement turfgrass buyback program |
| 2024 | Update landscaping guide and outreach regarding landscaping and greywater ordinances and new development standards |
| 2025 | Work with USU Extension to develop demonstration xeriscape garden in Moab |

SECTION 7: ECOLOGICAL CONCERNS
7.1 Introduction
The Mill Creek Watershed, its creeks and the wetlands they are connected to at the Colorado River’s edge, are critical components of not only a functional watershed and sustainable aquifer, but also have importance to community residents. It is critical to include functional riparian corridors and wetlands while exploring ways to ensure sustainable water for the Moab and Spanish Valley communities. Not only are the riparian corridors important for wildlife, but they also are important transportation and natural corridors through the town. Springs and smaller wetlands within the system arguably act as indicators of overall water quantity in the system in a qualitative way.

Water Conservation and Drought Management in the Moab Valley needs to include maintenance and enhancement of the ecological components as well as water delivery to residents and businesses.
7.2 Matheson Wetlands

The Matheson Wetland is a unique and rare wetland in the American Southwest along the Colorado River. The wetlands are not incorporated into the City of Moab’s town limits, but they are sandwiched between the City of Moab and the Colorado River. They are effected by the City of Moab and the entire Mill/Pack Creek hydrobasins surface and groundwater practices. The wetlands are owned by the State of Utah Department of Natural Resources and The Nature Conservancy in approximately 50/50 split. The Wetlands are co-managed by the same two agencies.

The wetlands have had difficulty maintaining hydric vegetation during the previous two decades due to several anthropogenic and natural impacts. Climate change and drought have reduced the regularity of high seasonal flows in the Colorado that would flood the wetlands. Mill Creek historically provided some surface water and maintained the groundwater table but currently it is entrenched and several feet below the surface area of the wetlands. Increased domestic use of springs on the Northwest portion of the valley has also altered the water budget. There is also some concern that decreases in the freshwater layer by any of the previously stated means could affect the level of the brine layer under the freshwater layer and allow it to reach the surface or leach to the Colorado River.

This conservation plan suggests that the City of Moab support the wetland monitoring plan being developed by the State of Utah Division of Water Rights and management agencies of the wetlands. It is further suggested that the City of Moab and other Spanish Valley institutions pursue stormwater management plans the slow water down as opposed to diverting directly to Mill and Pack Creek.

7.3 Mill Creek
See Section 2.2.1 on Moab Irrigation Company.

7.4 Pack Creek

Pack Creek is a small stream that runs through Moab and Spanish Valley. Although Pack Creek is not a source of culinary water the aquifer below it is used for culinary and irrigation purposes. The aquifer has relatively high total dissolved solids (TDS) and the creek is not meeting the beneficial use standards for TDS, temperature and E. coli. However, the creek and the aquifer still provide irreplaceable environmental goods and services to Spanish Valley and its residents. The water quality in Pack Creek is very good above its diversions near the USFS boundary. The water is used to irrigate a small community there. The creek is generally dry from the USFS boundary until ½ mile above Spanish Trail Road where the groundwater table becomes shallow and recharges the creek. The valley is somewhat pinched there, and several springs of varying water quality add volume to the creek. From there till the confluence with Mill Creek, Pack Creek and the underlying aquifer are responsible for a verdant riparian area that has several human benefits. During the irrigation season Pack Creek is responsible for most of the water in Mill Creek below their confluence due to withdrawals on Mill Creek. In the Mill Creek the Pack Creek water and the underlying valley fill aquifer also provide water to the Matheson Wetlands. The environmental concerns with the wetlands were discussed earlier in this document.
The growing population, development plans and long-term drought have made the valley fill aquifer a target for new water development. The aquifer itself is temporal with a relatively small amount of annual recharge. There are concerns that continued development of the valley fill aquifer will result in lower water tables, reduced or ceased recharge to Pack Creek, deterioration of water quality and subsequent termination of the environmental goods and services the residents of Spanish Valley and Moab currently profit from.

SECTION 8: OTHER CONSIDERATIONS

8.1 Colorado River

Moab City has water rights out of the Colorado River, and could potentially change some of their unusable groundwater rights to increase the rights out of the Colorado. This water has been contemplated for use as an eventual secondary irrigation system, relieving some of the pressure of the culinary water drawn from the aquifer and allowing for a more ready method of regulation should the need for outdoor watering restrictions arise. Developing this system would require a large amount of funding and infrastructure, however, and is not currently feasible.

In the more immediate future, it would be possible to shift non-potable water, such as that used for construction sites, to surface water from the Colorado rather than culinary groundwater. Setting up a metered pump station would not be exceedingly onerous, and the City just needs to identify a suitable location. There is already a construction water pump station at the boat ramp at the 191 bridge, which is owned by Le Grand Johnson, a construction and paving company.

8.2 Water Banking

Water banking is adding water to an aquifer for later use, putting it “in the bank” so to speak, either literally or figuratively through water rights. The banked water is allowed to percolate down into the aquifer where it then disperses and is available for later use. In concept, this can either be done at the surface level, and recharge goes to shallow aquifers, or via deep injection wells to access deeper aquifers.

In Moab, water for recharge could come from the Colorado River, storm water, or future flash floods generated by increasing monsoonal storms predicted by climate change models. Untreated Colorado River water could be pumped up the valley, used for purposes mentioned above, and eventually be emptied into designated recharge areas such as Kens Lake, flood irrigated fields, or purpose-built shallow ponds or wells. This could be a way for the City to “use” water that is currently considered lost from the system due to variations in seasonal needs and continuously flowing springs. There are about xx acre feet of water the City does not actively put to use each year that instead of running off to the river, could conceivably be banked for future withdrawals.

Developing a water bank is not currently on the City’s priority list, however, it is something to keep in mind for the future.
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Acknowledgements

The assistance of the following personnel is greatly appreciated: Eve Tallman, Jeff Adams (Executive Director of the Canyonlands Watershed Council), John Weisheit (Executive Director of Living Rivers), Leigh Anne Reinhart, Levi Jones, Jennie Ross, Zacharia Levine, Chantel Lindsay, Dana Van Horn, Ralph Ferrara, Geoff Freethy, Carmella Galley, and Jeff Reinhart.
CHECKLIST for Moab City 2016 / Water Conservation Plan

- Current population: 5235 (per census.gov for 2015)
- Number of M&I water connections, categorized by type:
  - Residential 1575
  - Commercial & Industrial 414
  - Institutional 84
- Total water deliveries, categorized by type: See Table 11.
- Current water supply, categorized by source: See Table 4.
- Projected needed supply to Build-out: see Table 12.
- Projected supply that can be delayed by implementing conservation programs and practices. This is not fully defined in our report. See Tables 13 and 15.
- Current per capita water use in gallons per capita per day (gpcd), categorized by type: See Table 7.
- Compare to state’s 2010 average (potable 185, secondary 55 gpcd).
  (Residential Potable 127 gpcd, Residential Secondary 40 gpcd) See Table 8.
- Conservation Goals: See Table 15 and “Conservation Goals” chapter.
- Your current metering situation and replacement schedule.
  All but 20 meters are now radio-read, on track to replace all manual-read.
- Your current pricing and rate structure: See Table 14.
- List any water conservation ordinances currently implemented:
  See “Water Conservation Policies/Ordinances”
- List any conservation measures currently implemented: See “Current Water Conservation”
- Do you have a Water Conservation Coordinator on your staff? No
- Proposed conservation measures: See “Water Conservation Goals”
- Plan adopted by Moab City Council December 13, 2016 Resolution #35-2016
INTRODUCTION AND EXECUTIVE SUMMARY

The State of Utah requires that each Utah community adopt a Water Conservation Plan every five years. The City of Moab last adopted a Plan in 2011; this Water Conservation Plan Update for 2016 considers new data for water supply and demand, trends for the last five years, and future growth and consumption trends for the Moab area. Based on this information, the 2016 Water Conservation Plan Update presents goals and objectives to ensure that Moab will meet its future water demand needs through water conservation programs and practices.

Emerging data from the ongoing study spearheaded by the Utah Division of Water Rights (DWRI), and undertaken by the United States Geological Survey (USGS), will inform this Water Conservation Plan. Additional data is drawn not only from Moab City sources but also from reports prepared by neighboring agencies, including Grand Water and Sewer Service Agency (GWSSA), Moab Irrigation Company (MIC), and the Grand County Community Development Department.

After decades of water supply projections showing abundant and pure culinary water, new data suggest an over-allocation of water rights and a trend of water use that appears to be significantly depleting available resources. Until recently, population projections have not taken into account denser zoning codes or the burgeoning tourist economy and its impact on per capita water usage.

The 2016 Water Conservation Plan Update sets forth an analysis of the period of 2011-2015. Average per capita consumption for 2015 was 282 gallons per person per day, when including all culinary consumption (residential and commercial), divided by the resident Moab population. This consumption level requires significant conservation measures to decrease consumption to a level that meets State and Federal consumption goals. If only residential use is taken into account, the figure was much lower (146 gallons per person per day), but does not portray a realistic picture of total impact on the existing water supply. Further, at current usage rates which take into account current tourism impacts, this report suggests the City will exceed water supply when the population reaches 11,552 residents.

Overall, from 1998 to 2015, the total water delivered by the City of Moab culinary system has increased by 14%. Because previous water conservation plans have indicated abundant water supply and relatively low per capita water usage rates, the City of Moab has not been aggressive in pursuing water conservation measures.

Due to new information about culinary water scarcity and the fast pace of growth in the Moab residential and overnight accommodation industry, it is recommended that the City aggressively implement the water conservation measures outlined in this plan, capitalizing on changing perceptions of what is feasible, and concentrating on reduction in outdoor use of culinary water and implementing recommendations to reduce threats to water quality.
This plan recommends that the City aim for a 25% reduction in per capita water consumption over the next five years, and that the City reduce outdoor usage of culinary water by 25% in the same time period. In addition, it is recommended that the City integrate the water conservation goals set forth here and in the existing Moab sustainability plan entitled “2020 Vision”\(^1\) into the City’s Master Plan and adopt a Water Conservation Mission Statement. Finally, it is recommended that the Council pursue an interlocal agreement to establish a regional water authority, and call upon community citizens to form a Moab City Water Conservation and Drought Management Committee.\(^2\)

The format of this Plan includes data required by the Utah Department of Natural Resources that at times makes for arduous reading. When possible, data is presented in Acre-Feet (an acre-foot is equivalent to one foot of water over an area that equals one acre of land area, and one acre-foot equals 325,850.943 gallons. The primary audience for this report is the City’s leadership. The details starting with the section entitled “Intersystem Agreements” are perhaps most critical for consideration of future directions for Moab’s Water Conservation program.


\(^2\) It is recommended that the City make use of the vast knowledge of local water and conservation experts to guide water management issues into the future. Washington County formed such a committee in 1993.
THE CITY OF MOAB AND ITS WATER SYSTEM

History, Government and Population

The City of Moab was incorporated in 1902. The 2015 City population was 5,235\(^3\). The City of Moab has a Council-Manager form of government, with five elected Council members serving at large and a separately elected Mayor.

The City’s resident population has ebbed and grown slowly over the past ten years, with total growth of 5.3%. At the same time, rapid growth of overnight accommodations has increased the number of connections drawing from Moab’s water supply. In addition, the population of unincorporated Grand County has increased along with non-resident tourist facilities. Altogether, the Moab Area Travel Council currently estimates there are approximately 4,000 overnight accommodation units in the Moab Valley.\(^4\)

This chart shows the City of Moab’s slow and steady population growth trend.

Figure 1. Moab Population

![Moab Population Chart]

The City’s build-out is projected as the City’s full growth potential, which is based on existing zoning.\(^5\) The City of Moab has anticipated additional culinary water demand created by limited annexations and/or higher density rezoning to occur in the future. Because of rapid growth outside the City limits, in addition to higher density rezoning that has occurred, it is important that the City anticipate

---

\(^3\) Per Zacharia Levine, Grand County Community Development Director (2016-11-16)

\(^4\) Moab Area Travel Council: 3,938 total rooms, condominiums, and commercial campsites in Grand County (2016-11-29).

\(^5\) Build-out population (Zacharia Levine 2016-11-16)
drought conditions and development patterns that are different from those contemplated in the older build-out analyses, as well as other prospective factors that may affect water supply and distribution. It should be noted that the 2014 Spanish Valley Water Conservation Plan\(^6\) anticipates a population for unincorporated Grand County in the year 2060 at fewer than 6,000 persons, which is far lower than the eventual projected build-out population. In the GWSSA Culinary Water Master Plan of 2016, it is projected that the agency will exceed culinary water supply within twenty years.\(^7\) This build-out population does not account for available water resources. Potential production capacity is detailed later in this report.

**Table 1. Projected Population at Build-out (Moab and Grand County)**

<table>
<thead>
<tr>
<th>Area (Acres)</th>
<th>Population (2.34 avg. household size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moab City</td>
<td>2,594</td>
</tr>
<tr>
<td>Unincorporated Grand County</td>
<td>98,725</td>
</tr>
<tr>
<td>Total Build-out Population</td>
<td>94,552</td>
</tr>
</tbody>
</table>

*Courtesy of Grand County Community Development*

**Moab Water Rights/Water Source Capacity**

Through its history, the City of Moab has acquired water rights and water source capacity to meet historically anticipated build-out projections.\(^8\)

Shortly after its incorporation in 1902, the City of Moab acquired an approximate half-interest in Skakel Spring, located behind the Grand Old Ranch House about a mile south of the Colorado River. The amount of the acquisition was 0.625 cubic feet per second (cfs). Skakel Spring was used as the culinary source for the City’s drinking water system installed in the original platted town blocks to the south. Outlying farmhouses utilized wells for water.

Contemporary with formation of the City, the Moab Irrigation Company (MIC) built a diversion dam on Mill Creek where the creek enters the east side of Spanish Valley, and currently provides irrigation water throughout the City and to unincorporated areas north and west of Moab City. Many residential lots in the original Moab City town blocks still have irrigation shares with which outside watering is done, with the water being delivered down the gutters of the town streets to inlets into yards.

When the uranium boom occurred in Southeast Utah after World War II, Moab’s population suddenly jumped from about 1,500 to 8,000. The City of Moab, motivated by severe water shortages during the boom which lasted into the early 1950s, acquired rights to underground water that exceeded


culinary demand at what was then considered to be the City’s expected build-out. In 1955, the City purchased the 1,600-acre Lloyd Sommerville Ranch, which contained Sommerville #1, #2, #3, McKonkie, and Birch springs. The City sold most of the ranch lying west of the spring area to George White, and located the Moab City Cemetery, Old City Park (which contains McKonkie and Birch springs) and the Moab Golf Course (which contains the Sommerville #2 and #3 springs) on part of the remainder.

Water rights were also purchased subsequent to the boom, further augmenting supplies beyond anticipated demand. The City drilled six wells adjacent to the Sommerville #2 and #3 springs; from 1998 through 2005 only wells #6 and #10 have been pumped into the culinary system. The springs (including Skakel) and the wells are the City of Moab water supply source today. Water from the Sommerville Ranch springs historically filled the three City water storage tanks having 3,500,000 gallons—or 10.74 acre-feet (AF)—total capacity by gravity flow. In 1999 the City acquired the remaining interest of 0.626 cfs in Skakel Spring, and afterward rebuilt the Skakel Spring diversion structure to secure it from accidental or deliberate contamination. Full rights to Skakel were acquired by the City in order to supply future demand anticipated from annexation of commercial properties in the north US 191 corridor.

The City of Moab’s total water rights equal 13.930 cfs, which is 6,251.78 gallons per minute (gpm) or 27.63 AF per day. The following charts summarize Moab’s water rights, for both springs and wells:

Table 2. Municipal Springs (water rights perfected)

<table>
<thead>
<tr>
<th>Name of Spring</th>
<th>Water Right #</th>
<th>cfs</th>
<th>Limits</th>
<th>AF/YR available</th>
<th>Type of Right</th>
<th>Priority Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skakel Spring</td>
<td>a29873</td>
<td>1.252</td>
<td>453.50 AF/YR Diversion; 236.62 AF/YR Depletion</td>
<td>236.62</td>
<td>Diligence claim</td>
<td>05-2105 = 1889, 05-2103 = 1898, a29873 = 2/18/2005</td>
</tr>
<tr>
<td>Skakel Spring</td>
<td>05-2740</td>
<td>1.00</td>
<td>“remainder of flow”</td>
<td>723.91</td>
<td>Fixed-time application</td>
<td>1/27/1999</td>
</tr>
<tr>
<td>McConkie Spring</td>
<td>05-2007</td>
<td>0.21</td>
<td></td>
<td>152.02</td>
<td>Diligence claim</td>
<td>05-2007 = 1903</td>
</tr>
<tr>
<td>Sommerville Spring #1</td>
<td>05-2008 a30363 changed point of diversion</td>
<td>0.2</td>
<td>102 AF/YR; Period of Use: April 1 to October 31</td>
<td>102</td>
<td>Diligence claim</td>
<td>05-2008 = 4/15/1896, a30363 = 6/21/2005</td>
</tr>
<tr>
<td>Sommerville Springs #2, 3</td>
<td>05-251</td>
<td>0.207</td>
<td>Period of Use: November 1 to March 31</td>
<td>62.438</td>
<td>Application to Appropriate</td>
<td>10/20/1958</td>
</tr>
</tbody>
</table>

Springs sub-total: 2.662 cfs or approximately 1,928.48 AF/yr. When adjusted for seasonal use limits and maximum depletion limits listed on the State Department of Water Rights website, approximately 1,277.00 AF/YR are available for use.

9 Water rights history (Zacharia Levine 2016-11-16)
NOTES:

1) Water rights for Skakel are held under three separate rights, updated in the table above.
2) Total diversion and depletion limits are set for Skakel via change form a29873 allowing a total depletion of 236.62 AF, while right 05-2740 is for the “remainder of flow”. It is unclear at this time whether Skakel spring’s total flow capacity is 2.252 cfs or if this additional right (05-2740) is to capture the remaining diversion flows of right a29873. More information is needed to clarify.
3) Sommerville Springs have seasonal restrictions, limiting each of the two listed rights to distinct seasons as Right 05-2008 limited to 4/1 to 10/31 (7 months) and Right 05-251 limited to 11/1 - 3/31 (5 months). Also, Right 05-2008 is listed as 0.2 cfs or 102 AF, meaning total production is 42.78 AF less than Use Rate/ Potential Production of 144.78 AF/yr at the listed flow rate.
4) Total cfs is 2.662 when only one Sommerville Spring right is included at a time to reflect distinct seasonal rights. See waterrights.utah.gov for more information.
5) Total AF from springs is 1,277.00 AF when adjusted for Limits to seasonal use and maximum depletion
6) Nearly all Spring and Well rights are appurtenant (linked) to each other. More research and knowledge of water rights are needed to fully understand how this influences total water rights and available water production from the sole-source aquifer

Table 3. Municipal Wells (Water rights perfected and proving)

<table>
<thead>
<tr>
<th>Name of Well</th>
<th>Water Right #</th>
<th>cfs</th>
<th>AF/YR available (approximate)</th>
<th>Type of Right</th>
<th>Priority Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wells 4a, 5, 6, 7, 9, 11</td>
<td>05-169</td>
<td>3</td>
<td>2,173.34</td>
<td>Application to Appropriate</td>
<td>9/15/1955</td>
</tr>
<tr>
<td>Same</td>
<td>05-206</td>
<td>1.63</td>
<td>1,180.85</td>
<td>Application to Appropriate</td>
<td>10/7/1964</td>
</tr>
<tr>
<td>Same</td>
<td>05-716</td>
<td>2.256</td>
<td>1,634.35</td>
<td>Application to Appropriate</td>
<td>10/24/1968</td>
</tr>
<tr>
<td>Same</td>
<td>05-101</td>
<td>1</td>
<td>724.44</td>
<td>Application to Appropriate</td>
<td>1/27/1954</td>
</tr>
<tr>
<td>Same</td>
<td>05-183</td>
<td>1.114</td>
<td>807.03</td>
<td>Application to Appropriate</td>
<td>2/21/1956</td>
</tr>
<tr>
<td>Same</td>
<td>05-336</td>
<td>1</td>
<td>724.44</td>
<td>Application to Appropriate</td>
<td>4/14/1961</td>
</tr>
<tr>
<td>Well #10</td>
<td>05-429</td>
<td>1</td>
<td>724.44</td>
<td>Application to Appropriate</td>
<td>7/23/1962</td>
</tr>
<tr>
<td>West Park Well</td>
<td>05-1540</td>
<td>0.15</td>
<td>108.67</td>
<td>Application to Appropriate</td>
<td>10/12/1978</td>
</tr>
<tr>
<td>West Park Well</td>
<td>05-1744</td>
<td>0.118</td>
<td>85.48</td>
<td>Application to Appropriate</td>
<td>4/24/1980</td>
</tr>
</tbody>
</table>

Wells sub-total: 11.268 cfs = approximately 8,163.22 Acre Feet/yr

Notes:
Several of these Rights have been segregated from each other. 05-183 originally was for 5cfs; Right 05-206 was segregated in 1959 for 3.886 cfs (a27898), from which right 05-716 was segregated in 1968 for 2.256 cfs (a27898a). The current cfs attributed for each of these rights is depicted in the table above.

1) Water Rights in blue include information (in the listing on waterrights.utah.gov) about seasonal use restrictions for Spring #1 (05-2008) and Spring 2 and 3 (05-251), which appears to infer a hydrologic connection between the wells and springs. These rights total 97.6%, or 7,963.09 AF, of Well Rights. Figure 4 in the 2011 Update listed Production values for Well 6 and 10 only, while this table above highlights the interconnectedness of the majority of available rights to wells.

2) Water Right 05-716 lists three surface springs and three wells as the source. At this time, it is unclear how this right is executed in relation to the gravity use information provided in Figure 5. See "Comparison of Total Rights and Reported Usage in 2010" for more information about how this may influence use of available rights.
3) Language indicating “perfected and proving” comes from 2011 Update; it is unclear which Rights are still proving, and this should be investigated.

**Current City of Moab Water Distribution System Configuration**

The City of Moab supplies drinking water to almost all of the residents and businesses within the City. As noted, not all of the above-named water rights currently provide water into the Moab water distribution system. Some of these rights are seasonal. As indicated above, Moab also holds groundwater rights to six major wells that penetrate the aquifer. Only two of these wells are currently on line, and are only utilized during peak irrigation season. Water sources in the distribution system for the City of Moab vary seasonally. Moab obtains water from three wells and three springs during the summer months. From the north end of town, water from Skakel Spring is pumped through a chlorination station and into a one-million-gallon tank, which then feeds the Northwest Low pressure zone of the city. Moab City Springs One, Two and Three plus Moab City Wells Six and Ten south of Moab are channeled into pipes and flow into two gas chlorination stations. From each of these chlorination stations, water flows downhill to the City grid. Two one-million-gallon storage tanks are not in line with the main transmission lines, but branch off at the south end of the system.

The City of Moab contracted with the University of Utah Department of Civil and Environmental Engineering in 2010 to produce a report that looked at the utilization of water sources in the Moab water distribution system. According to the report, Moab at that time used less than half of the water sources allotted and developed for the City. The following table provides a current view of the water production of each of the in-service water sources for the City:

<table>
<thead>
<tr>
<th>Source</th>
<th>Volume Used Acre Feet</th>
<th>Potential Production Acre Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Springs 1 and 2</td>
<td>840.23</td>
<td>840.23</td>
</tr>
<tr>
<td>Spring 3</td>
<td>636.76</td>
<td>636.76</td>
</tr>
<tr>
<td>Skakel Spring</td>
<td>317.29</td>
<td>711.98</td>
</tr>
<tr>
<td>Well 6</td>
<td>258.77</td>
<td>2418.28</td>
</tr>
<tr>
<td>Well 10</td>
<td>253.61</td>
<td>1126.28</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2306.66</strong></td>
<td><strong>5733.53</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Volume Used Acre Feet</th>
<th>Potential Production Acre Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 1 and 2</td>
<td>634.25</td>
<td>634.25</td>
</tr>
<tr>
<td>Spring 3</td>
<td>510.63</td>
<td>510.63</td>
</tr>
<tr>
<td>Skakel Spring</td>
<td>272.73</td>
<td>711.98</td>
</tr>
<tr>
<td>Well 6</td>
<td>360.53</td>
<td>2418.28</td>
</tr>
<tr>
<td>Well 10</td>
<td>432.41</td>
<td>1126.28</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2210.55</strong></td>
<td><strong>5401.42</strong></td>
</tr>
</tbody>
</table>

Drought conditions beginning in 1998 with a shift in the Northern Pacific Decadal Oscillation system\(^{11}\) in ocean currents caused a shift from water production from gravity sources to pumped sources. The amount of water pumped as a percentage of total water diverted changed dramatically in 2000. It was noted in the 2011 plan that diminished pressure due to reduced infiltration due to drought conditions takes two years to reach the point of discharge. Further research may be needed to determine this two-year assumption figure. The chart on the following page shows the City’s total water production over time, along with the percentage breakdown of pumped versus gravity sources and a comparison to pre-drought conditions:

**Table 5. Total Water Production from Gravity and Pumped**

<table>
<thead>
<tr>
<th>Year</th>
<th>Gravity - AF</th>
<th>Annual Gravity as % of 1998</th>
<th>Pumped - AF</th>
<th>Annual pumped as % of 1998</th>
<th>Total diversion - AF</th>
<th>Annual Diversion as % of 1998</th>
<th>% pumped</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>1,589.38</td>
<td>100.0%</td>
<td>295.26</td>
<td>100.0%</td>
<td>1,884.63</td>
<td>100.0%</td>
<td>15.7%</td>
</tr>
<tr>
<td>1999</td>
<td>1,547.33</td>
<td>97.4%</td>
<td>288.38</td>
<td>97.7%</td>
<td>1,835.72</td>
<td>97.4%</td>
<td>15.7%</td>
</tr>
<tr>
<td>2000</td>
<td>1,567.59</td>
<td>98.6%</td>
<td>861.19</td>
<td>291.7%</td>
<td>2,428.78</td>
<td>128.9%</td>
<td>35.5%</td>
</tr>
<tr>
<td>2001</td>
<td>1,422.46</td>
<td>89.5%</td>
<td>1,051.06</td>
<td>356.0%</td>
<td>2,473.52</td>
<td>131.2%</td>
<td>42.5%</td>
</tr>
<tr>
<td>2002</td>
<td>1,306.95</td>
<td>82.2%</td>
<td>735.00</td>
<td>248.9%</td>
<td>2,041.95</td>
<td>108.3%</td>
<td>36.0%</td>
</tr>
<tr>
<td>2003</td>
<td>1,220.65</td>
<td>76.8%</td>
<td>861.50</td>
<td>291.8%</td>
<td>2,082.15</td>
<td>110.5%</td>
<td>41.4%</td>
</tr>
<tr>
<td>2004</td>
<td>1,292.65</td>
<td>81.3%</td>
<td>845.97</td>
<td>286.5%</td>
<td>2,138.62</td>
<td>113.5%</td>
<td>39.6%</td>
</tr>
<tr>
<td>2005</td>
<td>1,295.10</td>
<td>81.5%</td>
<td>865.89</td>
<td>293.3%</td>
<td>2,160.99</td>
<td>114.7%</td>
<td>40.1%</td>
</tr>
<tr>
<td>2006</td>
<td>1,385.97</td>
<td>87.2%</td>
<td>1,086.88</td>
<td>368.1%</td>
<td>2,472.85</td>
<td>131.2%</td>
<td>44.0%</td>
</tr>
<tr>
<td>2007</td>
<td>1,376.76</td>
<td>86.6%</td>
<td>877.64</td>
<td>297.2%</td>
<td>2,254.40</td>
<td>119.6%</td>
<td>38.9%</td>
</tr>
<tr>
<td>2008</td>
<td>1,518.36</td>
<td>95.5%</td>
<td>1,060.73</td>
<td>359.3%</td>
<td>2,579.09</td>
<td>136.8%</td>
<td>41.1%</td>
</tr>
<tr>
<td>2009</td>
<td>1,424.33</td>
<td>89.6%</td>
<td>934.81</td>
<td>316.6%</td>
<td>2,359.15</td>
<td>125.2%</td>
<td>39.6%</td>
</tr>
<tr>
<td>2010</td>
<td>1,434.43</td>
<td>90.3%</td>
<td>900.69</td>
<td>305.1%</td>
<td>2,335.12</td>
<td>123.9%</td>
<td>38.6%</td>
</tr>
<tr>
<td>2011</td>
<td>1,794.29</td>
<td>112.9%</td>
<td>512.38</td>
<td>173.5%</td>
<td>2,306.67</td>
<td>122.4%</td>
<td>22.2%</td>
</tr>
<tr>
<td>2012</td>
<td>1,766.82</td>
<td>111.2%</td>
<td>677.15</td>
<td>229.3%</td>
<td>2,443.97</td>
<td>129.7%</td>
<td>27.7%</td>
</tr>
<tr>
<td>2013</td>
<td>1,534.20</td>
<td>96.5%</td>
<td>679.54</td>
<td>230.2%</td>
<td>2,213.74</td>
<td>117.5%</td>
<td>30.7%</td>
</tr>
<tr>
<td>2014</td>
<td>1,171.67</td>
<td>73.7%</td>
<td>644.47</td>
<td>218.3%</td>
<td>1,816.14</td>
<td>96.4%</td>
<td>35.5%</td>
</tr>
<tr>
<td>2015</td>
<td>1,263.77</td>
<td>79.5%</td>
<td>892.83</td>
<td>302.4%</td>
<td>2,156.60</td>
<td>114.4%</td>
<td>41.4%</td>
</tr>
</tbody>
</table>

\(^{11}\) An internet search produces numerous academic reports on this topic. A good starting point is: [https://en.wikipedia.org/wiki/Pacific_decadal_oscillation](https://en.wikipedia.org/wiki/Pacific_decadal_oscillation)
Table 6. Water Production Trends 2010 - 2015 (in acre feet/ year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Springs - AF</th>
<th>Wells - AF</th>
<th>Total Use - AF</th>
<th>% Spring</th>
<th>% Well</th>
<th>Total % of 2010</th>
<th>Spring % of 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1,773.82</td>
<td>586.16</td>
<td>2,359.97</td>
<td>75%</td>
<td>25%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>2011</td>
<td>1,794.29</td>
<td>512.38</td>
<td>2,306.67</td>
<td>78%</td>
<td>22%</td>
<td>98%</td>
<td>101%</td>
</tr>
<tr>
<td>2012</td>
<td>1,766.82</td>
<td>677.15</td>
<td>2,443.97</td>
<td>72%</td>
<td>28%</td>
<td>104%</td>
<td>100%</td>
</tr>
<tr>
<td>2013</td>
<td>1,534.20</td>
<td>680.13</td>
<td>2,214.32</td>
<td>69%</td>
<td>31%</td>
<td>94%</td>
<td>86%</td>
</tr>
<tr>
<td>2014</td>
<td>1,481.78</td>
<td>680.86</td>
<td>2,162.64</td>
<td>69%</td>
<td>31%</td>
<td>92%</td>
<td>84%</td>
</tr>
<tr>
<td>2015</td>
<td>1,417.61</td>
<td>792.94</td>
<td>2,210.55</td>
<td>64%</td>
<td>36%</td>
<td>94%</td>
<td>80%</td>
</tr>
<tr>
<td>AVERAGE:</td>
<td>1,628.09</td>
<td>654.94</td>
<td>2,283.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Trends from 2010 – 2015:
- Use of Skakel has decreased by 11% of potential production (See Table 4)
- Use of Springs 1, 2, and 3 has remained 100% of Potential Production, while Potential Production has decreased 80% since 2010. This data requires further investigation.
- Use of Springs 1,2,3 remains several times higher than amount available through Rights to springs. The relationship of Right 05-716 must be better understood.
- Total Use has decreased 6% since 2010, while total use provided by ground water has risen 11%
- Compared to 2010 figure, water use from well 6 has increased 21% and well 10 increased 50%
Secondary Water (Irrigation Sources)

With the loss of cultivated farmland to residential development, 308.79 of the 1,086.897 shares of Moab Irrigation Company (MIC) stock were acquired in 1979 by the Grand County Water Conservancy District, which diverts Mill Creek upstream into Ken’s Lake for irrigation delivery above Moab in Spanish Valley. Since then, 66.5 shares of MIC stock have been leased or purchased and transferred by private owners upstream to the Mill Creek Diversion for Ken’s Lake. Seventeen years ago, the MIC put in pressurized irrigation pipelines to replace their original open ditch system within Moab.

With a motivation to reduce culinary water use on outdoor landscaping, the City should explore the possibility of acquisition of water shares from the MIC that could be used for outdoor watering. Most of the remaining MIC water shares that are delivered in Moab, north and west of Moab, and on Wilson and South Mesas above Mill Creek to the east of Spanish Valley could be bought and transferred to the Ken’s Lake diversion on Mill Creek or used by the City for outdoor irrigation. Inside the City limits and in the north US 191 corridor, a number of orchards, hay fields, pastures and gardens are currently irrigated with these shares. Recharge from this irrigation may be largely responsible for inflow to the Matheson Wetlands Preserve operated by the Nature Conservancy at the north end of Spanish Valley. Over the years, some of the agricultural parcels were converted to residential or commercial development, and the predominant pattern has been to cluster buildings, leaving landscaped open areas. The 2011 Water Conservation plan called for the City to explore and define ways in which parcels developed with large open spaces could obtain and/or retain MIC water shares for more widespread outdoor landscaping irrigation. The 2011 report noted that acquisition of water shares by the Nature Conservancy to maintain recharge of the Matheson Preserve should be considered in this planning; City discussion with the Nature Conservancy to date has considered additional treatment of Wastewater Treatment Plant effluent so it can be discharged into the Sloughs. It is possible that reuse could be preferable to higher quality water for that purpose. It is not recorded whether any discussions with the MIC or private shareholders has occurred in the last five years.

It will be to the City’s benefit to implement a secondary water system to preserve pristine groundwater demand savings since growth patterns indicate that the total culinary demand on the City’s water system is greater than anticipated supply, or the City finds it profitable to “swap” conserved pristine groundwater for irrigation water from the Grand Water and Sewer Service Agency because the Agency is unable to divert enough pristine groundwater out of the same aquifer the City is using to meet growth demands in the Agency’s service area. In 2005, it appeared that 180,641,000 gallons of pristine groundwater were consumed by 31 City customers for irrigation; another 185,075,000 gallons were apparently used by 2,121 residential customers for outdoor watering. Although dated, this statistic provides an idea of the total amount of pristine groundwater that could be conserved by the City if it was replaced by water from a secondary irrigation water

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13 See “Demand Projections to Build-Out” later in this report.
14 See 2014 and 2016 GWSSA documents cited earlier in this report.
system. Options for a secondary water system constitute the greatest potential for future water sources.

Another scenario for the use of secondary water includes the more complex prospect of utilizing secondary water for flushing toilets and other non-potable uses. This is most likely a project that would involve municipal facilities such as park restrooms. More research needs to be done to determine the costs and benefits of such a proposal.

**Moab Area Geology and Origin of Water Sources**

The City of Moab is located at the north end of Spanish Valley to the south of the Colorado River. Spanish Valley is a salt collapse graben, formed when a dome of Paradox Formation salts bulged up, fracturing the overlying sedimentary formations. The fractured formations and part of the salt dome eroded away, largely from runoff from the La Sal Mountains through the Pack Creek drainage. The La Sal Mountains compose a small mountain range southeast of Moab that rises approximately 12,000 feet above sea level. The Glen Canyon Group (Navajo, Kayenta and Wingate) of sandstones conducts water downward from the mountains, which then surfaces in springs at various points along the Eastern Moab Fault complex on the edge of Spanish Valley. The City’s water source, consisting of wells and springs, is a large aquifer contained in the highly porous Wingate sandstone to the east of the city. This aquifer is fed by the snowmelt from the La Sal Mountains. This water is classified as Pristine Ground Water by the Utah DEQ Division of Drinking Water.

Water harvesting practices over the decades have disrupted the hydrology of Spanish Valley over time, affecting discharge into Pack Creek and the riparian zone. Please see “Environmental Concerns” later in this report.
Figure 3. Moab Area Watershed (Courtesy of Canyonlands Watershed Council)
Water Use Trends, Current Water Use, and per Capita Consumption

Current water use in the past five years reflects an ongoing trend of increased water consumption for residential users and fluctuating consumption for commercial water consumers. Peak water usage in 2013 and 2014 may be attributed to “Shop Water” deliveries to tankers for oil and gas drilling practices. Previous Water Conservation Plans indicate that delivery of water through residential meters decreased from a 1996-2000 average of 4.16 Acre-Feet per day to a 2006-2010 average of 2.69 Acre-Feet per day; and a further reduction to approximately 2.35 Acre-Feet per day in 2015 could be due to changing designations for water use. Note that per capita numbers are gallons per day (Tables 7 and 8). Total consumption is shown in Acre-Feet (Table 9).

Table 7. Per Capita Water Consumption Trends. (Does not include Shop water deliveries)

<table>
<thead>
<tr>
<th>Years</th>
<th>Per Capita – Dwellings (GPD)</th>
<th>Per Capita – Dwellings + Commercial (GPD)</th>
<th>Per Capita – Dwellings + Commercial + Winter Overflow (GPD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006 – 2010</td>
<td>171.67</td>
<td>311.40</td>
<td></td>
</tr>
<tr>
<td>2011- 2015</td>
<td>146.58</td>
<td>313.05</td>
<td>394.72 (average for 2011-2013 only)</td>
</tr>
<tr>
<td>Change</td>
<td>- 25.10</td>
<td>+ 1.65</td>
<td></td>
</tr>
<tr>
<td>% Change</td>
<td>- 15%</td>
<td>+ 0.53%</td>
<td></td>
</tr>
</tbody>
</table>

Table 8. Average Gallons Per Day Water Consumption Residential versus Commercial 2011-2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Per Capita Average GPD – Dwellings</th>
<th>Average GPD Dwellings</th>
<th>Average GPD Commercial and Other</th>
<th>Total GPD Delivered</th>
<th>Per Capita Average GPD – All Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>5,088</td>
<td>131</td>
<td>667,930</td>
<td>803,270</td>
<td>1,471,200</td>
<td>289</td>
</tr>
<tr>
<td>2012</td>
<td>5,116</td>
<td>145</td>
<td>740,503</td>
<td>863,774</td>
<td>1,604,277</td>
<td>313</td>
</tr>
<tr>
<td>2013</td>
<td>5,121</td>
<td>146</td>
<td>745,907</td>
<td>1,076,572</td>
<td>1,822,479</td>
<td>355</td>
</tr>
<tr>
<td>2014</td>
<td>5,140</td>
<td>165</td>
<td>848,436</td>
<td>816,332</td>
<td>1,664,768</td>
<td>323</td>
</tr>
<tr>
<td>2015</td>
<td>5,235</td>
<td>146</td>
<td>765,041</td>
<td>715,096</td>
<td>1,480,137</td>
<td>282</td>
</tr>
</tbody>
</table>

Table 9. Average consumption in Acre Feet Per Year and percent by type (not including winter overflow)

<table>
<thead>
<tr>
<th>Year</th>
<th>Dwellings</th>
<th>Commercial and Other</th>
<th>Total</th>
<th>% use by Dwellings</th>
<th>% use by Commercial and Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>748.18</td>
<td>899.78</td>
<td>1,647.96</td>
<td>45%</td>
<td>55%</td>
</tr>
<tr>
<td>2012</td>
<td>829.47</td>
<td>967.55</td>
<td>1,797.02</td>
<td>46%</td>
<td>54%</td>
</tr>
<tr>
<td>2013</td>
<td>835.52</td>
<td>1205.92</td>
<td>2,041.44</td>
<td>41%</td>
<td>59%</td>
</tr>
<tr>
<td>2014</td>
<td>950.37</td>
<td>914.41</td>
<td>1,864.78</td>
<td>51%</td>
<td>49%</td>
</tr>
<tr>
<td>2015</td>
<td>856.96</td>
<td>801.01</td>
<td>1,657.97</td>
<td>52%</td>
<td>48%</td>
</tr>
</tbody>
</table>

Table 10. Table showing Acre-Feet adjustments to include winter overflow volumes in Water System Totals and per capita estimates, 2011-2013\textsuperscript{17}

<table>
<thead>
<tr>
<th>Year</th>
<th>Winter Overflow AF</th>
<th>Adjusted – Dwell+Comm + Overflow AF</th>
<th>Per Capita – All sources + overflow(\text{GPD})</th>
<th>% Total - Dwellings</th>
<th>% Total - Commercial</th>
<th>% Total - Overflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>529.90</td>
<td>2,178.91</td>
<td>382.31</td>
<td>35%</td>
<td>41%</td>
<td>24%</td>
</tr>
<tr>
<td>2012</td>
<td>549.83</td>
<td>2,406.01</td>
<td>419.85</td>
<td>35%</td>
<td>42%</td>
<td>23%</td>
</tr>
<tr>
<td>2013</td>
<td>313.96</td>
<td>2,191.19</td>
<td>381.99</td>
<td>41%</td>
<td>45%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Winter overflow needs to be considered in the water supply budget as this water moves from its source through municipal piping and eventually overflows into Mill Creek further down valley. Prior to the development of the City water infrastructure, more of this water would have infiltrated into the aquifer and moved down valley slowly in the sub-surface soil matrix. Winter overflow ranged from 14% - 24% during the three-year period for which data was compiled.

While current Per Capita usage based on gallons per day consumed at dwellings has decreased from the 2006-2010 average, the total per capita water usage has increased when commercial water use is included (Table 7). Factoring in winter overflow and shop water sales increases the average per capita water use even further.

**Number of Water Connections**

The number of water connections in the City of Moab system as of November 2016 is 2073. This is an approximate 8.5% increase from 2010. For 2016, there were 1575 Residential connections, 414 Commercial connections, and 84 Institutional connections.

**Retail Water Deliveries (Shop Water)**

Moab sells culinary water at the City Shop, mainly by the tanker-load to off-grid agencies such as the National Park Service and Dead Horse Point State Park. In the last five years, there was a significant uptick in shop water deliveries due to a boom in oil and gas drilling, which required culinary water for drilling purposes. The City took action to revise the billing structure for this impact on the water supply system\textsuperscript{18}.

**Table 11. Retail Water Deliveries (Shop Water)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Shop Water Billed (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>4,298,250</td>
</tr>
<tr>
<td>2012</td>
<td>8,858,325</td>
</tr>
<tr>
<td>2013</td>
<td>7,174,290</td>
</tr>
<tr>
<td>2014</td>
<td>13,098,811</td>
</tr>
<tr>
<td>2015</td>
<td>3,789,275</td>
</tr>
</tbody>
</table>

\textsuperscript{17} Data from Water Systems PowerPoint presented by Donna Metzler.  
http://www.riversimulator.org/Resources/farcountry/Moab/MoabWaterSystem.pdf

\textsuperscript{18} Tap Water for Oilfield Drilling Becomes an Issue in Moab By Jon Kovash (2014-02-13) http://upr.org/post/tap-water-oilfield-drilling-becomes-issue-moab
Demand Projections to Build-out

It is important that a water conservation plan not only consider the five-year time frame called for by the plan, but a longer time horizon. This plan looks to Build-out, which is currently set at 24,000 persons.

In 1996, future build-out considering zoning at the time accounted for 4,298 additional units to be added to the 2,051 then existing. Annexation of unincorporated “islands” would add 288 additional existing residences to the 32 existing in these islands in 1995. At build-out, total residential units were estimated to be 6,669, housing a projected population of 18,473.19

In 2010, the City’s Water Conservation Update stated that the City would meet build-out in approximately 130 years. Water demand would be 5,135,494 gallons per day at the build-out population potential of 18,473. With a source capacity of 9,136,958 gallons per day in hand, the report stated, the City possessed 44% more in water rights and source capacity than what would be needed at build-out. Further, the report went on to state that the City’s population would reach approximately 7,438, by 2050, and would put water demand at 2,067,764 gallons per day in 2050. Given that the City has water rights of 9,157,009 gallons per day, the report stated, the City would not need to acquire more water rights any time before build-out potential is reached.

Since then, Moab’s zoning has been upgraded for more dense housing. As stated earlier in this report, the City’s build-out population is now estimated to be 24,000. The acute uptick in overnight accommodations has also increased daily water usage that must be accounted for in a reasonable water budget.

The 2010 Moab Water Distribution System Report reviewed future development scenarios and provided recommendations regarding the City system’s ability to accommodate the anticipated developments. Regarding the Lionsback development, the report recommended that the City allow development itself but recommended against utilizing the water storage tank contemplated for the project for City storage. The report also examined other potential commercial and residential development, and indicated that water sources were more than adequate to meet the demands of the planned developments. The 2010 Moab Water Distribution System Report maintained that the “data indicate that the City of Moab can double its current population before new sources need to be developed or administrative constraints need to be placed on water use” and that “currently the greatest motivation for water conservation is energy conservation.” Further, the report maintained that “total water availability…is not a limiting factor for growth in the foreseeable future.”

At issue and of extreme importance to City leaders and regional water managers is the deceptive notion that water rights equal water supply. Actual data pertaining to water levels in the aquifer as

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19 1996, Public Facilities Analysis, Grand County/City of Moab.
established by the USGS study and data measuring water supplied by the City’s springs and wells are far more crucial to determining future supply than water shares.

The tables below show water demand anticipated at build-out, and Moab’s “carrying capacity” based on well and spring supplies.

Table 12. Build-Out Water Demand, as a percentage of Paper Rights and reported 2015 Potential Production, based on average Per Capita use (2011-2015)

<table>
<thead>
<tr>
<th>Build Out Water demand:</th>
<th>Build-out - AF/day</th>
<th>AF per YR at Build-out based on current GPD</th>
<th>Total Water Rights (AF/yr)*</th>
<th>Build-out AF/yr as % of Rights</th>
<th>2015 Potential Production (AF/yr)</th>
<th>Build-out as % of Potential Production (AF/yr)</th>
<th>Surplus or Deficit Water Rights at Build Out</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dwellings Only</td>
<td>10.80</td>
<td>3,940.96</td>
<td>9,434.10</td>
<td>41.77%</td>
<td>5,401.43</td>
<td>72.96%</td>
<td></td>
</tr>
<tr>
<td>Dwellings + Commercial^</td>
<td>23.06</td>
<td>8,416.85</td>
<td>9,434.10</td>
<td>89.22%</td>
<td>5,401.43</td>
<td>155.83%</td>
<td>10.78%</td>
</tr>
</tbody>
</table>

NOTES:
* Based on 2016 Updated Figure 2 and 3 per Water Rights review
^ Dwellings + Commercial is the figure to use, as this represents the majority of water used in the municipality
^ Does not include Winter Overflow or Shop Water sales
These projections assume that water supply will remain constant, while climate scientists predict increasing climate uncertainty in the Southwest. See https://en.wikipedia.org/wiki/Pacific_decadal_oscillation as a starting point.

Table 13. Maximum Population of Moab at current rates of consumption, based on potential production and paper water rights

<table>
<thead>
<tr>
<th>Potential Production</th>
<th>Paper Rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acre feet per year</td>
<td>5,401.43</td>
</tr>
<tr>
<td>Safety factor</td>
<td>25%</td>
</tr>
<tr>
<td>Available Production (AF/yr)</td>
<td>4,051.07</td>
</tr>
<tr>
<td>Per Capita Use (GPD)-Total</td>
<td>313.05</td>
</tr>
<tr>
<td>Maximum Population</td>
<td>11,552.75</td>
</tr>
</tbody>
</table>

NOTES:
1) Assumes current rates of water use are continued
2) Does not account for Colorado River Basin-wide reductions that may be needed
3) Assumes Potential Production from 2011 figure 4 can be sustained without harming the aquifer
4) The safety factor can be adjusted to look at different scenarios

Future Supply Sources

Preliminary information from the USGS report indicates the City should begin to consider the Colorado River as an alternate source of culinary water. This prospect is complex and costly, not only because of the great expense to process river water to culinary quality, but also because of the gravely politicized battle for the river water in both the Upper and Lower Colorado River basins.
**Distribution System**

The City of Moab water distribution system requires some replacement of water mains. A schedule for replacement of these mains should be developed. The system is sized to meet current and projected demand, with the exception of new service lines needed for new development. Each water connection is serviced by a meter. The City has nearly completed its meter replacement program, with all but 20 meters now part of a radio-read meter system.

During the period of this report, there was a 50 gallon per minute leak where the City’s water system connected with the GWSSA system at an emergency connect point near the golf course. That point is now disconnected and the leak was stopped. In the event of an emergency where one water system is required to augment the other, the connection will be made manually by crews.

**Treatment System**

Treatment for the City of Moab water system consists of minimal chlorination. USGS water sampling in 1997 found the drinking water of the City of Moab, before treatment, equals or exceeds the quality of 80 percent of brands of bottled drinking water from springs sold in stores (comparison data is from the published Natural Resources Defense Council study of bottled water quality).

**Reuse Potential**

In the City’s 2020 Vision: A Sustainable Moab Plan, Water Reuse was addressed with an actionable goal to allow Utah residents to reuse relatively clean, safe “gray water” to off-set outdoor landscaping and gardening water use while at the same time conserving Utah’s scarce culinary water sources. City officials were encouraged to work with other Utah communities to foster State of Utah changes to rules and regulations to allow more flexible gray water use. Graywater pilot projects are now underway in Moab and Grand County, due to a successful collaboration between state officials, permaculture designers, and USU faculty.

**Emergency Action Plan**

The City’s on-file emergency plan can be considered a water conservation plan for circumstances in which pumped culinary water from City wells is not available. In event of emergency, such as the main well pump failure that occurred in 1998 at the Moab Golf Course, citizens are asked through the media to discontinue all outside watering until adequate water flow is restored. City Public Works staff go in the field to identify customers who haven’t gotten the message. If citizens refuse to stop outside watering when asked, their water meter is turned off and locked. Gravity flow from the Sommerville springs to the City storage tanks is sufficient to keep the storage tanks full while meeting inside culinary water needs; during the winter months, spring flow normally exceeds water usage in...
the system and the well pumps are not operated. Under emergency conditions, the City’s concern is to maintain the storage tanks full so that water is available for firefighting.

**Intersystem Agreements**

There are currently no significant intersystem agreements for culinary water. The Grand Water and Sewer Service Agency, which serves Spanish Valley and is uphill and to the south of the City, does not have sufficient water sources in hand to meet its service area’s build-out demand\(^{22}\). It is suggested that the City of Moab work to establish a regional water authority that will include all water systems in the watershed including Moab City, Grand Water and Sewer Service Agency, Castle Valley, San Juan Special Service District and water systems in southern Spanish Valley and Pack Creek. In lieu of the unlikely annexation of the San Juan County users into Grand County, a regional water authority can help to mitigate threats to the water system in the years to come. The Southern Nevada Water Authority sets a good example.

With regard to the new Manti-La Sal Forest Plan in development, it should be noted that Grand County and Castle Valley have cooperating agency status and the City of Moab does not. It is advised that the City leadership have a “seat at the table” by engaging with federal land management agencies to oversee potential impacts on Moab’s watershed, particularly Water Source Protection.

**Figure 4. Moab area watershed boundaries as defined by the hydrological unit codes for Mill and Castle Creek**
Water Quality

Water quality in the Moab water system meets all state and federal standards. All drinking water supply for the City of Moab is Pristine Ground Water from wells and springs discharging from a sandstone aquifer. This aquifer enjoys the protections of U.S. Environmental Protection Agency designation as a Sole Source Aquifer. [Sole Source Aquifer Determination for Glen Canyon Aquifer System, Moab, Utah, published in the January 7, 2002 Federal Register, volume 67 #4, pp. 736-738.]

Recently, citizens residing near the GWSSA's Chapman Well and just to the west have raised concerns about declining water quality in their wells. One resident has noted that the Chapman Well is slightly higher in elevation and the cone of depression from the Chapman Well is allowing Pack Creek Aquifer water to flow into nearby wells. It is claimed that the quality of the water in nearby wells is declining. The possibility of Pack Creek Water intruding into Glen Canyon Aquifer is something that should be investigated in the ongoing USGS study. Specifically, it is recommended to explore whether the USGS study can verify that pumping on the edge of the Glen Canyon Aquifer is reducing the outflow of water from the Glen Canyon Aquifer and allowing water from the Pack Creek aquifer to intrude into the Glen Canyon Aquifer. There is a question of whether Pack Creek water is moving into or close to the Moab City’s wells during heavy pumping in the summer. Additionally, he asks if this is an indication that nearly all of the total available underground water near the Chapman Well is being utilized and whether any new allocations should be made from the Chapman well.

In addition to this possible depletion or invasion of the system, it is recommended that the City take action to protect the aquifer from potential threats posed by proposed developments throughout the watershed. This includes SIITLA land at Johnson’s Up-On-Top, as well as upgradient public and private land administered by counties, the BLM, and the USFS. It is recommended that the City participate directly in federal land management agency planning efforts which include the Moab area watershed, and cover activities which may impact the quantity or quality of water percolating into the aquifer, including oil and gas drilling, and vegetation management.

Institutional and Political Factors

There are several institutional and political factors relevant to the City of Moab Water Conservation Plan. It will be important to review any water rights applications submitted by adjacent water agencies such as the Grand Water and Sewer Service Agency, San Juan Special Service District, and other water users in the past five years to ensure that applications that involve such things as a change in points of diversion do not negatively affect the quantity or quality of Moab’s water sources. In addition, the ability of the City to work with the Moab Irrigation Company (MIC) and its shareholders to keep surface-diverted irrigation water flowing to areas within the City, rather than

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being moved away from these lands for application elsewhere is key. A large part of the MIC’s water shares are currently used by homeowners for yard irrigation, so it functions as a de facto secondary irrigation water system for residences in older portions of town. The City must look to the future of utilizing MIC water for outdoor uses within the City limits.

Also, the potential development of a new water system in northern San Juan County should be of great concern to the City leadership. The San Juan Spanish Valley Special Service District has already changed a point of diversion from the San Juan River to Spanish Valley for 500 Acre Feet (not to be used until after USGS study) and have another right to 5000 Acre Feet to the Colorado River that could potentially have a change in point of diversion filed.26

**Environmental Concerns**

Environmental concerns for the culinary system are growing; as stated earlier in this report, the USGS water study may reveal less water in the aquifer than assumed, and private wells near the golf course are reporting degraded water quality. Also, the potential development of SITLA land above the aquifer at Johnson’s Up-On-Top could be a threat, along with potential hydraulic fracturing used in oil and gas drilling within the watershed. It is likely the City of Moab will need to develop new water supply sources or water rights, and does not yet have a water treatment facility for lower-grade water such as Colorado River water. The City will need to continue to monitor water quality and quantity to ensure the long-term sustainability of Moab’s water sources.

Also of importance is climate change and how it affects our local aquifer. The City should consider scientific modeling to inform watershed policy. Global Climate Models (GCMs) are computer representations of the global climate system—the atmosphere, the oceans, ice sheets and sea ice, and the land surface—based on both physical laws and parameters derived from observation. The consensus of projections from about 35 GCMs is that the Intermountain West will warm by +2°F to +6°F by mid-century, relative to the 1971–2000 baseline. The range of projections reflects both greenhouse gas emission scenarios and differences among the models in how future climate will unfold under a given emissions scenario. The projections show summers warming more than winters, and typical summer temperatures by 2050 will be as warm or warmer than the hottest 10% of summers that occurred in the 20th century. The individual GCM projections have less agreement about whether average annual precipitation will increase or decrease in our region by 2050. The multi-model average shows little change in annual mean precipitation by 2050. Further, the models also suggest a seasonal shift in precipitation, with the combined effects of a northward-shifting storm track, potentially wetter storms and a drying of the sub-tropical regions globally resulting in more mid-winter precipitation, and in some areas, a decrease in late spring and summer precipitation. Together, the uncertain changes in precipitation and the more certain impacts of warming lead to a broad range of plausible futures for water in the Intermountain West. Consistent themes across those

26 Mark Stilson, Regional Engineer, USGS Presentation 2016-11-08.
futures include snowmelt and runoff occurring earlier in the spring, decreased late-summer stream flows, and increased water use by crops and other vegetation.  

Although the analysis in this document does not include allowances for climate change, it may be prudent for City water policy to err on the conservative side to account for possible decrease in water supply relative to demand in the context of the changing climate, as well as potential changes in seasonal distribution of precipitation, snow melt, and peak events.

**Fiscal Structure and Financial Resources**

The City recently issued bonds to complete the new Wastewater Treatment Plant, due to be completed in 2018. It is recommended that the City plan for expanded water rights, irrigation water rights, and incentive programs for commercial and residential projects to enhance water conservation to meet the City’s conservation targets. One avenue for potential funding is the “WaterSMART Grants” program administered by the Department of Reclamation.  

The City leadership should determine a realistic budget for Water Conservation. At the low end, the City should maintain an educational page on the City’s website. In the medium range of funding, the City should coordinate public workshops, pilot and demonstration projects, and dedicated sustainability staff. At the high end of fiscal commitment, the City should consider financial rebates and incentives and technical assistance for retrofits of residential and commercial systems.

The City’s current water rate structure was updated in 2016. The following is the City’s current water rate structure:

**Table 14. Current Water Rate Structure for the City of Moab (Revised 7/1/2016)**

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27 Western Water Assessment, Intermountain West Projection [http://wwa.colorado.edu/climate/change.html](http://wwa.colorado.edu/climate/change.html)

28 [https://www.usbr.gov/watersmart/grants.html](https://www.usbr.gov/watersmart/grants.html)
WATER CONSERVATION GOALS

Why Conserve?

Several sources were consulted to gather suggestions for water efficiency programs that may be adopted for Moab, including The City of St. George\textsuperscript{29}, the State of California\textsuperscript{30}, the Alliance for Water Efficiency\textsuperscript{31}, and the Utah Governor’s Office\textsuperscript{32}.

There are important benefits to increasing water use efficiency, including:

- Reduced stress on the environment of the watershed
- Reduced landscape runoff (contaminated with fertilizers, pesticides, and road debris) to surface waters
- Ability to stretch existing water supplies
- Ability to provide water for surface or groundwater storage in wet years
- Delayed capital cost of new infrastructure to treat and deliver water
- Reduced water-related energy demands and associated greenhouse gas emissions
- Better capacity to meet the water demand of Moab’s growing population and visitors

Current Water Conservation

In the last few years, the overburdened wastewater treatment plant made robust water conservation campaigns difficult. More water has been needed to lessen the strain on the aging facility. Water conservation campaigns focused on indoor usage may need to delay a large-scale roll-out until the new wastewater treatment plant comes online in 2018 or beyond, while campaigns focused on outdoor conservation can begin immediately.

Another challenge related to implementation of water conservation measures is that the City of Moab has a very small Water Department staff. The City does not have a Water Conservation Coordinator or Sustainability staff, although there is a Community Development Director and a Public Works Director. It is recommended that the City consider creating such a role on the City staff. Regardless, the City should embrace initiatives that are cost effective and not staff intensive, and that the effectiveness of water conservation efforts be simple to measure. This situation is another motive

\textsuperscript{29} City of St. George Water Conservation Plan Update 2013


to call upon community citizens to form a Moab City Water Conservation and Drought Management Committee, which can provide advice and guidance to staff and report to the City Council regularly with recommendations and actionable water conservation objectives.

The City of Moab is poised to ramp up public efforts with respect to water conservation. Past water conservation efforts, a relatively dry climate, public perception, a high percentage of outdoor water usage, impacts on the City Waste Water Treatment Plant, and uncertainty with respect to the long-term availability of water sources are just a few of the challenges to be addressed.

The idea of water conservation has not been thoroughly institutionalized and culturally accepted within the community. People are under the impression that water is a readily available resource with no need for conservation efforts, and adjusting this perception may be difficult. However, the population in general is changing perceptions of what is feasible. Also, the easy access to low-flow plumbing fixtures and other water-saving technologies will make a City-wide water conservation program understandable and palatable to the local populace.

Water conservation measures such as progressive rate structures are difficult when trying to address outdoor use only, but the City has recently implemented a new rate structure.

It is important to address the challenges and constraints in the development of short and long term water conservation goals. The fact that the City of Moab has not implemented intensive conservation efforts in the past, the overall public perception about the availability of water, the fact that Moab’s outdoor water use is relatively high, the need to maintain water flow into the wastewater treatment plant to ensure its efficient operation, and the issues related to preserving and promoting the secondary water system all must be taken into consideration.

Lastly, it is important to recognize that there is uncertainty associated with understanding the City’s water sources, rights, and implications of multiple users on the same aquifer. There are issues such as water quality, drought conditions and unknown factors that may affect our water sources. These issues point to the need for conservation.

Public Education on Wise Water Use

The City should rekindle the former campaign on wise water use, specifically, the following: (1) Renewal of City public education through the media and bill enclosures, reminding people to not water in the heat of the day; to water for a long period of time at intervals to get deep penetration of water and encourage deep rooting of landscaping, rather than for brief periods often; and to encourage low-water-demand plant selection for non-edible landscaping (xeriscaping)\(^{33}\). There are

\(^{33}\) Water conservation advocates tend to ignore the distinction between edible and non-edible landscaping. Moab is dependent on what are possibly even more drought stressed agricultural areas for shipped-in food, including produce from California and Arizona, and which utilize Colorado River water which suffers significant evaporation losses. Local agriculture and self-reliance are valued in our community. Local ag with conscientious irrigation, while less conserving in a conventional sense than xeriscape, may represent a regionally more appropriate response to limited water supplies.
numerous topics that can and should be included, including water harvesting (on-site stormwater management to offset irrigation demand and provide additional benefits), and graywater reuse.

(2) Sponsoring of public workshops on water-efficient irrigation and landscaping as a public service.

(3) Revision of landscaping standards in residential and commercial site development zoning regulations to require water-efficient landscaping cultivar selection and irrigation systems.

(4) Development and placement of placards in restrooms reminding visitors that they are visiting an arid climate in which water is limited, and stating ways to conserve water during their stay.

The Travel Council should fund and publicize water saving tips in all overnight accommodations and commercial restrooms, as well as at the MRAC. It is very common for tourists to ignore or not understand the water challenges faced in a hot and dry climate. It can be an everyday occurrence to observe a line of rental jeeps at the carwash, or notice campers taking 20 minute showers at the pool. Even seemingly small savings can add up, when magnified by the 25,000 average visitors in peak summer months. For example, turning off the tap after wetting a toothbrush or while lathering hands with soap; reusing towels; taking five-minute showers; sweeping patios instead of hosing them down; and wiping down a mountain bike with a dry cloth instead of using water.

An aggressive public information campaign directed toward residential, commercial, and institutional outdoor water use, commercial use in restaurants and hotels, and tourism-related water use is needed. The Transient Room Tax (TRT) is a likely source for publicity funds to mitigate the impacts of the tens of thousands of tourists the City hosts on a daily basis in the peak months of the year.

Promoting strategies to convert landscapes from high water use to drought tolerant plantings and high efficiency irrigation systems can greatly reduce outdoor water usage. Further, incorporating landscape-based stormwater retention strategies, roof water catchment, and greywater reuse can further decrease the amount of outdoor water used for landscaping while producing additional benefits to water quality, decreased energy use and more.

Another public education challenge, faced by communities throughout the west, is that Moab is in an arid climate. The 2005 Water Conservation Plan showed that approximately 60% of the water that is delivered to customers from City sources is used for outdoor irrigation, and this number is in line with

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34 Analysis of TRT & Sales Tax statistics from the City of Moab Treasurer for 2014-2016, compared January (with little or no outdoor water use and few tourists) with peak demand in August (with outdoor water use and the highest tax revenues per year) resulting in a figure representing consumption generated by tourists and outdoor water use that is approximately 2.5 times the indoor usage of residents alone. Assuming that some portion of the Moab population spends significantly in Grand Junction, online, or elsewhere, then this ratio would increase and there would be more average tourists per day using the infrastructure. For example, in 2015 if half of March sales were actually tourists (to establish baseline of 41,805), then it would be 360% (3.6x), or an additional 26,000 people per day. So, likely we are somewhere in between this 2.5x and 3.6x population much of the time. Deborah Barton, Grand County’s Solid Waste Special Service District manager, reported on December 1, 2016, a 3.5x increase in volumes to landfill/recycling facilities during tourist season vs. baseline, so the water-use estimates have this additional credence.
the range for communities throughout the West. This means that conservation efforts need to be aimed toward outdoor use.

Water Conservation Policies/Ordinances

In 2009, the City of Moab adopted Resolution #18-2009, A RESOLUTION ADOPTING THE 2020 VISION: A SUSTAINABLE MOAB PLAN. This plan recognizes the leadership role of the City of Moab in “championing volunteer efforts to preserve and conserve natural resources and promote a cleaner, healthier environment.” It also acknowledges “new paradigms of natural resource utilization, [to] ensure the health and well-being of future residents while at the same time meeting the needs of our current residents.”

The first part of the plan presents goals for water conservation, to ensure the long-term productivity of The City of Moab’s aquifers. It calls for reduction of per-household, per-business and City-owned facilities’ water use by 20 percent by the year 2020.

The Action Steps proposed included these measures:
- Adopt a new water rate structure that rewards culinary water conservation. (Completed 2016)
- Investigate how other communities have implemented successful water conservation plans and implement productive programs.
- Implement water use reduction and water reuse programs at City-owned facilities.
- Expand public awareness of the City of Moab and Grand County culinary water resources.

The City staff has embraced several water conservation measures for City-owned properties, including elimination of mid-day watering of landscapes (when possible, watering between midnight and four AM). In addition, the City Hall landscape, along with a few other “demonstration gardens” at the public library, the hospice garden, and at USU, present water-wise landscapes and plants for citizen education.

The Moab City Water Conservation and Drought Management Committee can embrace these objectives and make recommendations for public education campaigns and revisions to the City Code.

Another element of Vision 2020 addresses sustainable construction practices. While the goal is far-reaching in its effort to utilize renewable energy sources and green building elements in residential and commercial building projects, a simple piece of this is codifying water-efficient plumbing fixtures, landscaping, and graywater systems to cut down on culinary water use City-wide. The Water

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35 Annual water use for 1,000 houses in each of 12 cities. [http://bcn.boulder.co.us/basin/local/heaney.html](http://bcn.boulder.co.us/basin/local/heaney.html)
Conservation and Drought Management Committee can research what is feasible, what other jurisdictions have already adopted, and tailor a campaign that fits Moab’s needs.

“Retrofitting for Sustainability” provides existing home and business owners incentives to reach the goal of increasing energy efficient retrofits by 40% by 2020. This goal called upon collaboration with the Southeast Utah Association of Local Governments to identify and retrofit energy inefficient dwellings owned or occupied by low and moderate income households, and to work with utility companies to promote energy efficiency and renewable energy incentives for homes and businesses.

Moab City and the City Hall in particular have been models for the community with solar projects, low-water landscaping, energy efficient fixtures, and more. The City can continue its impact by embracing the existing action steps of providing regular commentary to local news outlets regarding sustainable practices and Moab’s success in achieving the goals of the Vision 2020 Plan; assigning staff and a citizens’ committee to provide regular reports to the Moab City Council on the progress of this plan; provide regular reports to community groups and organizations on the progress of this plan as well as information on sustainable “best practices” in other locales that can be successfully implemented here; and utilize the City of Moab’s website and internet-based written, audio and video networks to encourage sustainable practices.

Future Planning and Zoning ordinances should be required to balance the “water budget” to ensure water conservation measures do not compete with development and to ensure Moab City remains drought and flood resilient.

**Numerical Goals for Water Conservation**

As stated earlier in this report, current water supply can optimistically sustain a total Moab population of approximately 11,552. Capping the population would be the easiest numerical goal to ensure adequate water resources. However, the always-growing tourist market may further alter this level. As stated earlier, the average number of daily visitors in peak months has already topped about 25,000 visitors on top of the Moab resident population of about 5,000. The Moab-Area Travel Council mission to promote Moab as a year-round destination threatens the City’s ability to “make up” for record usage in summer during the low-use winter months.

In lieu of capping the population, the table below shows the estimated conservation rates needed to match the build-out projections. One column shows the high percentage of reduction needed based on reported potential production of available sources; the other column shows the more modest rates of conservation that is needed if all water rights exercised resulted in “wet water” delivered:
Table 15. Estimated Conservation Rates to match Build Out population projections

<table>
<thead>
<tr>
<th></th>
<th>Potential Production*</th>
<th>Paper Rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation Rate to achieve Build-Out population:</td>
<td>51.87%</td>
<td>15.94%</td>
</tr>
<tr>
<td>Per Capita GPD to achieve Build-Out (Dwellings + Commercial)</td>
<td>150.67</td>
<td>263.16</td>
</tr>
</tbody>
</table>

NOTES:
Conservation rates estimated as ratio of population for Carrying Capacity to projected Build Out, based on 2015 rates of consumption and safety factor used in carrying capacity estimates.
*Potential production may be revised when final USGA report is issued.

As stated earlier in this report, it is recommended that the City embrace an initial goal of 25% reduction in culinary water consumption for both indoor and outdoor use over the next five years. By comparison, the current goal for the City of Albuquerque is 40%\(^{38}\).

**RECOMMENDATIONS FOR IMPLEMENTATION OF WATER CONSERVATION MEASURES**

The City of Moab is primed to embrace water conservation efforts in light of our high per capita use due to the heavy burden of tourism, which drives the local economy. There are several areas where conservation measures are needed, and many are relatively easy to embrace.

- Appoint a Citizens’ Water Conservation and Drought Management Committee.
- Create a Sustainability Coordinator role on the City staff.
- Implement a public education campaign as detailed above.
- Ensure plumbing codes require more efficient fixtures.
- Adopt a water efficient landscape ordinance.
- Reward new technologies in the commercial/industrial sector, including waterless or 0.5 gallon urinals, high-efficiency toilets, commercial washing machines, and pre-rinse spray valves in restaurant kitchens, and commercial dishwashers.
- Mitigate existing inefficiencies in residential plumbing, including Toilets, Showers, Leaks, Faucets, and Clothes Washers.
- Revise codes to allow graywater systems and composting toilets within City limits.
- Prohibit hosing down sidewalks and washing cars with hoses that do not have a shut-off valve.
- Reduce impact on current supply: The approvals of large new developments in Moab must be linked to assurances that there is an adequate water supply over a twenty year period. Without assurances that there is a reliable source of water, even in dry years, large development projects cannot proceed.

\(^{38}\) [http://www.harvesth2o.com/alb.shtml](http://www.harvesth2o.com/alb.shtml)

MOAB WATER CONSERVATION PLAN 2016 29
• Adopt a green infrastructure ordinance for stormwater management to protect water quality, increase localized groundwater recharge and off-set landscape irrigation through matching plantings with green infrastructure treatments.

• Prohibit outdoor watering between the hours of 10:00 am and 6:00 pm. and introduce practical solutions for staff to enforce corrections for over-watered lawns, poorly maintained systems with unnecessary overspray, and etc. More research is needed to determine what level of water savings can be realized if all irrigation is shifted to night.

• Ensure all City-owned facilities adhere to the Governor’s Executive Order No. 2015-4 and encourage all governmental facilities located within Moab City limits (Federal, State, and County) to adhere to the same.

• Study feasibility and effectiveness of allowing winter overflow to recharge the aquifer as high as possible.

• Pursue implementation of a secondary water system for outdoor watering and other secondary uses to preserve pristine groundwater.

• Update Vision 2020 to acknowledge what has been accomplished, and reset targets as part of the revised General Plan.

• The City should work with other governmental users in taking measures to reduce application of culinary water to large lawn and other planted areas.

• In addition to work already done by the City’s Water Department staff, The City should conduct water usage audits of City and other facilities to determine more efficient water application and lawn maintenance practices. In addition, the City should continue to consider alternatives to grass and other high water plants when developing new parks and to re-landscape “wasted turf” (not playing fields and etc.) in existing park areas. In addition, the City should work with Moab Irrigation to determine if it is feasible for the City to acquire water shares. This could potentially reduce the City’s reliance on culinary water for City use, and add more City control over the use of runoff water for irrigation purposes.

• The long-term viability of the Moab Irrigation Company (MIC) should be of concern to the Council. It has been mentioned several times that the ability of city residents to use MIC water is important for preservation of culinary water for indoor use. It is important to maintain a positive relationship with MIC to ensure continued operation of the irrigation system within city limits. It is also important to recognize that the MIC system, while recently upgraded to a pressurized system, is an old system with constant maintenance challenges.

• Integrate water conservation with issues at the Wastewater Treatment Plant – include education on composting to minimize use of garbage disposals and create a soil amendment that helps with landscape water retention, and promote composting toilets. The State of Arizona has been a leader in innovation in this area.


As stated earlier, it is recommended that the City take action to protect the aquifer from potential threats posed by proposed developments throughout the watershed. This includes SITLA land at Johnson’s Up-On-Top\textsuperscript{41}, as well as upgradient public and private land administered by counties, the BLM, and the USFS. It is recommended that the City participate directly in federal land management agency planning efforts which include the Moab area watershed, and cover activities which may impact the quantity or quality of water percolating into the aquifer, including oil and gas drilling, and vegetation management.

\textsuperscript{41} A Look at Johnson’s Up-On-Top. \url{http://www.livingrivers.org/pdfs/Johnsons.pdf}
Stormwater Management: A Scenario

Rainwater is a resource, and when not managed properly can become a nuisance and liability. The potential to manage precipitation as part of the water supply portfolio should be explored. Pursuing site-scale water harvesting through green infrastructure best practices would simultaneously improve stormwater management.

Table 16. Water Falling on Moab City at different precipitation levels:

<table>
<thead>
<tr>
<th>Area (sq ft)</th>
<th>Precip/YR (in)</th>
<th>Constant</th>
<th>Coefficient</th>
<th>Gallons/YR</th>
<th>AF/YR total</th>
<th>AF/YR avail for Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>112,994,640.00</td>
<td>4</td>
<td>0.623</td>
<td>0.75</td>
<td>211,186,982.16</td>
<td>648.11</td>
<td>324.05</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculated as:

Area in square feet is Acres within City Limits (2,594) x square feet per acre (43,560)
Precipitation per year is average total rain and snow, in inches. Average precipitation in Moab is 9 inches, and 3 scenarios were estimated

Constant is used to convert to gallons, based on 7.48 gal/cubic ft x 1ft/12inches
Coefficient is the percent of precipitation running off surfaces. 0.75 was selected to reflect high levels of imperviousness in built environment. A more thorough analysis of land use would inform the best coefficient to use.
The percent put to use reflects a selected target for the amount of precipitation that could be captured or directed to offset existing or future water demand

Table 17. Estimated Total Water Use and potential conservation through Landscape Conversions, per 1,000 square feet

<table>
<thead>
<tr>
<th></th>
<th>PF</th>
<th>IE</th>
<th>ETWU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional turf and sprinklers</td>
<td>0.8</td>
<td>0.75</td>
<td>43,063</td>
</tr>
<tr>
<td>Water-wise plantings and drip</td>
<td>0.3</td>
<td>0.81</td>
<td>14,953</td>
</tr>
<tr>
<td>Potential water conservation:</td>
<td></td>
<td></td>
<td>28,110</td>
</tr>
<tr>
<td>Percent reduction:</td>
<td></td>
<td></td>
<td>65%</td>
</tr>
</tbody>
</table>

Based on the above values and assumptions, 1 acre foot/ year of water conservation could be achieved for every 11,600 square feet of landscape conversion. Additional benefits would accrue when landscape conversion projects are designed to harvest runoff, build healthy soil, and/or reuse greywater on-site.

Calculation based on CA Water Efficient Landscape Ordinance, where:

ETWU = PF x ET x 0.623 / IE
ETWU = Estimated Total Water Use, in gallons per year
PF = Plant factor, with 1 being an open pan evaporation test. Expressed in decimal form as percent water use relative to open pan
ET = evapotranspiration (inches per year) less effective precipitation (0.75 * average precipitation per year)
IE = Irrigation efficiency. The percent of water applied that is beneficially used by the plants. Rates from 2015 CA WELO update.
Additional Readings on Water Conservation

(Courtesy of John Weisheit, Executive Director of Living Rivers)


GWSSA Water Conservation Plan for Spanish Valley, Utah (2014)


2016 - Grand County Water Master Plan. GWSSA.


1998 - National Drought Policy Act

2005 - Grand Challenges for Disaster Reduction (emphasis on drought and floods). National Science and Technology Council.


2010- Forest and Water Climate Adaption: A case Study of Moab and Castle Valley, Utah. CWC.

2012 -Crossroads Utah. URC.

2013 - Hydrologic Assessment of the Surface Water and Groundwater Resources of Castle Valley, Utah: Part 1: Hydrologic and Environmental Analysis (HESA) and Preliminary Water Budget

EPA Review of Proposed Lionsback Resort Development