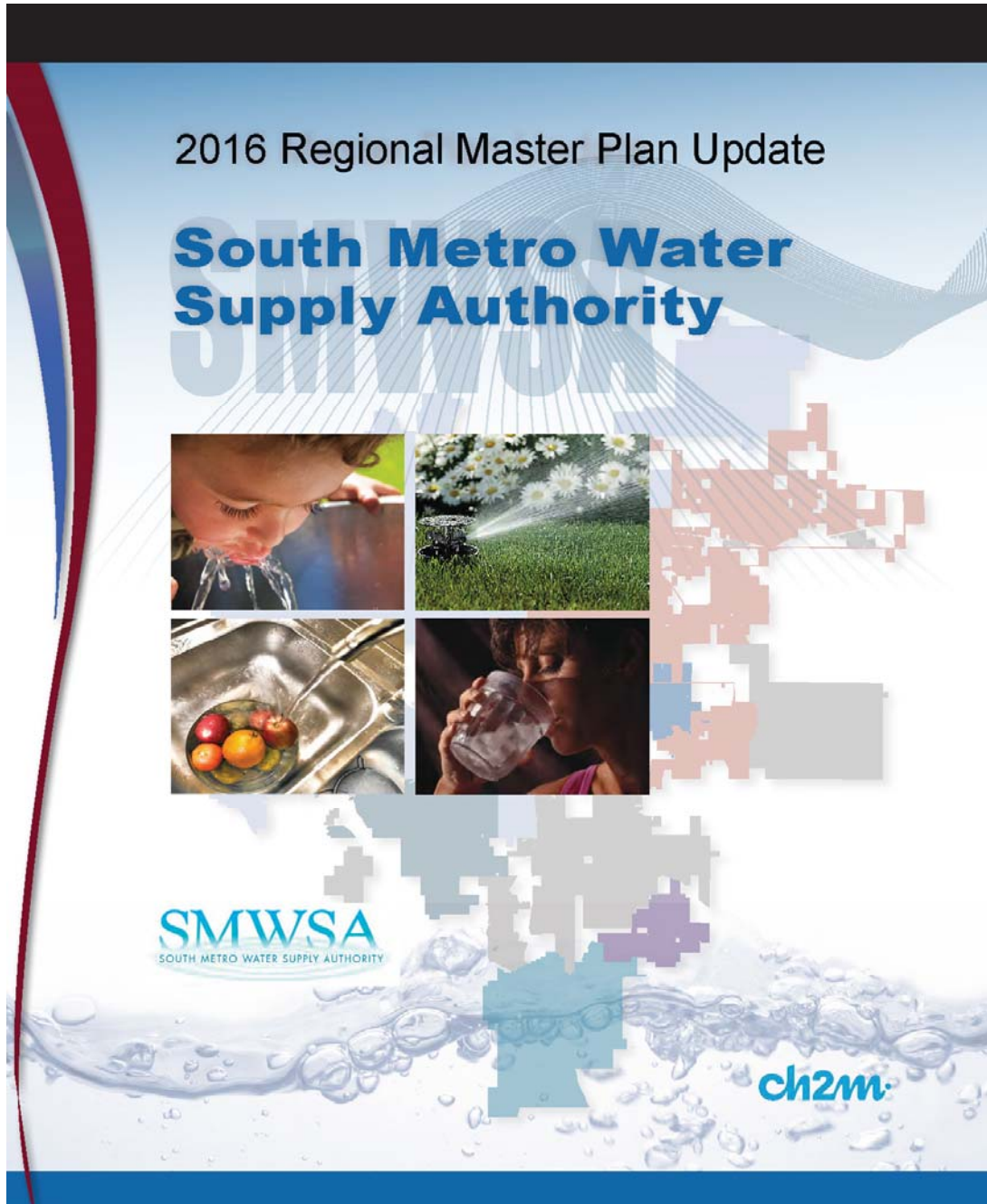
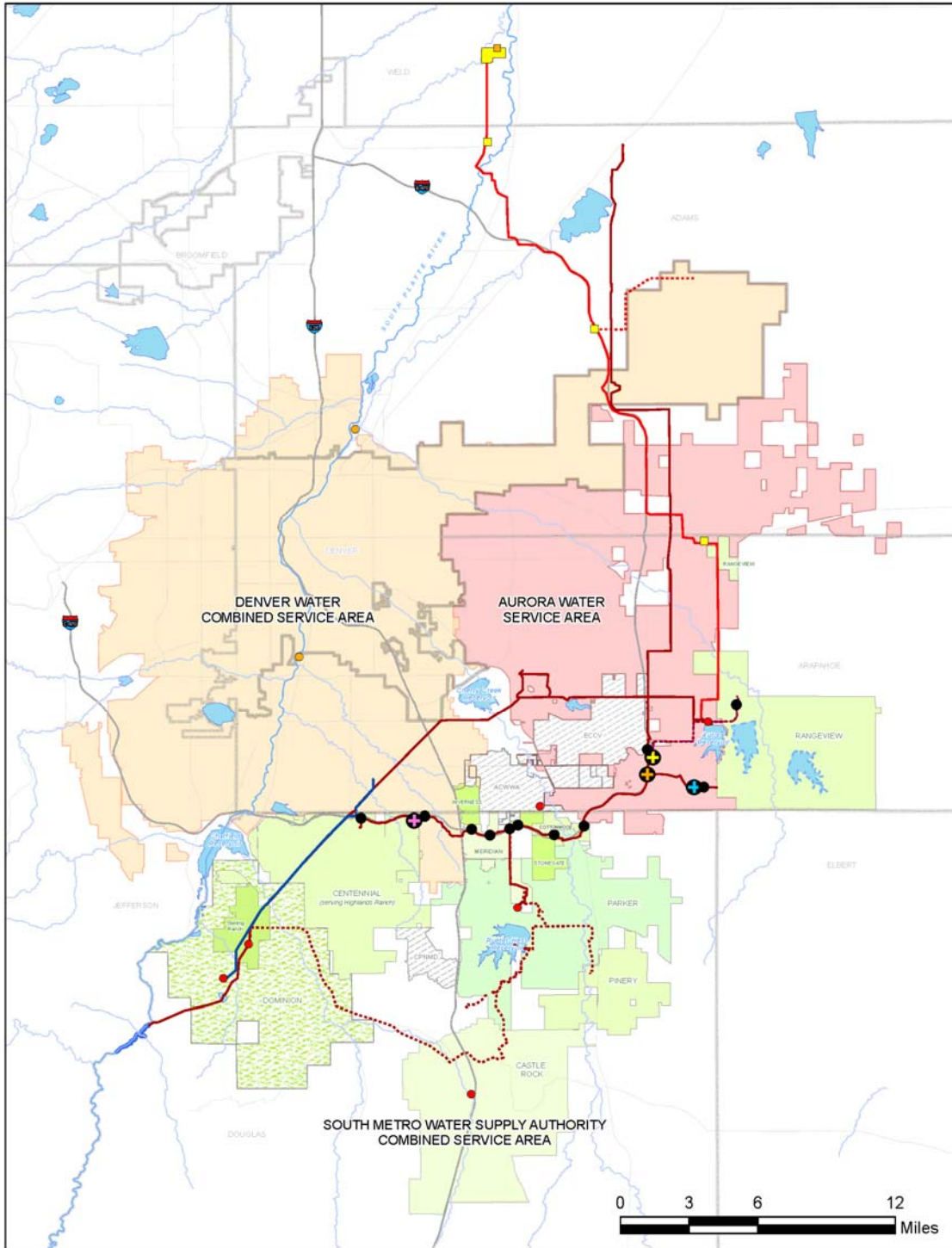


MASTER PLAN OVERVIEW



South Metro Water Supply Authority

SMWSA & WISE General Infrastructure



Major Components

- ⊕ Quebec WTP
- ⊕ Pressure Sustaining Valve
- ⊕ Smoky Hill Tank
- ⊕ Aurora Temporary Connection

Legend

- Existing Wastewater Treatment Plants
- Existing Water Treatment Plants
- Pipeline Connections
- Existing Pipelines
- ⋯ Proposed Pipeline
- Highways
- Proposed Reservoirs
- SMWSA & WISE Members
- ▨ SMWSA Only Members
- Counties





Water is essential to the outstanding quality of life in the South Metro Denver region. It enables our economy to thrive, our families to prosper, and our children and grandchildren to call this region home for years to come.

Historically, our region has relied on the non-renewable Denver Basin Aquifer system for a large portion of our water supply. As depicted in the generalized cross-section below, the Denver Basin Aquifer system is comprised of four distinct aquifers that are separated by comparatively impermeable confining layers. The Denver Basin Aquifer system extends from Greeley south to Colorado Springs and from the foothills east to Limon. In ascending order, these aquifers are the Laramie-Fox Hills, Arapahoe, Denver, and Dawson aquifers.

The Denver Basin aquifers receive very little recharge, so the groundwater is considered a non-renewable resource. Groundwater pumping from the aquifers for municipal use in the South Metro Denver region has far exceeded the natural rate of recharge leading to groundwater level declines.

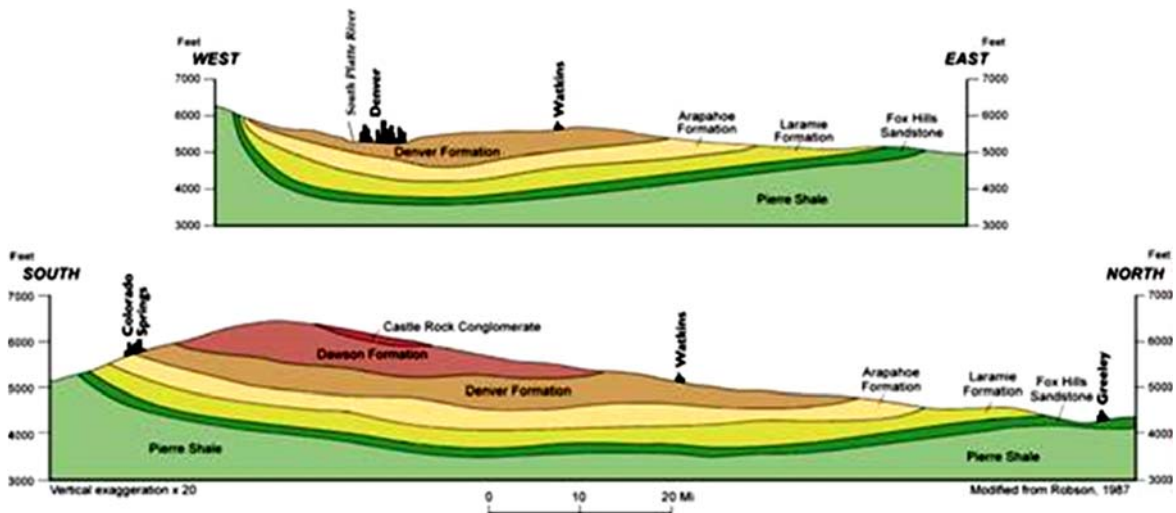


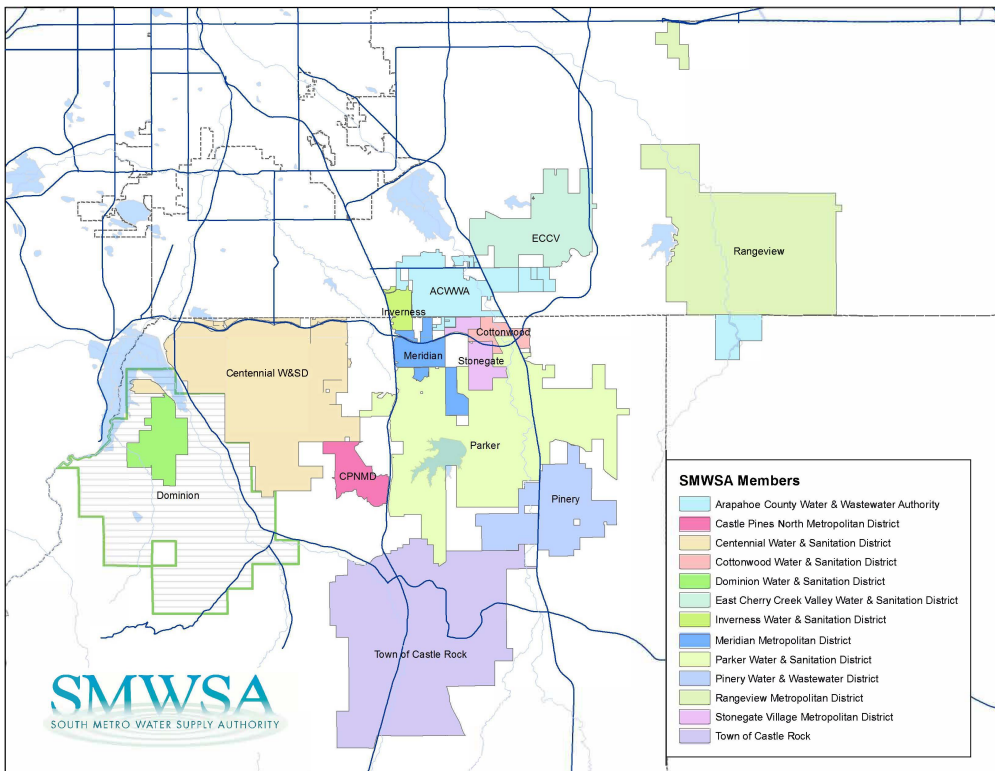
Image from Topper, Ralph et al., 2003, Ground Water Atlas of Colorado, Special Publication 53, Colorado Geological Survey



In some places of the South Metro Denver region, the groundwater level declines are minimal. However, in other areas, the declines are significant and threaten the long-term viability of the region’s water supply. The consequences, if allowed to continue, would be far reaching. It would impact property values, jobs, our environment, and the overall economic vitality and quality of life for future generations.

The South Metro Water Supply Authority (SMWSA) was formed in 2004 to address the challenge of a high reliance on groundwater as a primary water supply. Together, our 13 members set out on a mission to develop a supply of renewable, sustainable, and reliable water, and to transition away from the heavy reliance on non-renewable Denver Basin groundwater.

Tremendous progress has been made over the last 12 years. The 2016 Master Plan Update and other ongoing regional efforts show that through a commitment to conservation, efficient use of water, reuse, and a multitude of new water projects, some by individual members and some through a regional approach involving multiple members, we have significantly reduced per capita consumption, reduced our reliance on non-renewable groundwater, reduced the rate of decline in our aquifers and improved our overall water supply portfolio.



SMWSA’s 13 current members include Arapahoe County Water and Wastewater Authority, Castle Pines North Metropolitan District, Centennial Water and Sanitation District (serving Highlands Ranch), Cottonwood Water and Sanitation District, Dominion Water and Sanitation District, East Cherry Creek Valley Water and Sanitation District, Inverness Water and Sanitation District, Meridian Metropolitan Districts, Parker Water and Sanitation District, Pinery Water and Wastewater District, Rangeview Metropolitan District, Stonegate Village Metropolitan District, and the Town of Castle Rock.

While we have made immense progress, our job is not yet done. We need to continue to reduce our reliance on non-renewable groundwater and to strengthen and enhance even more our water stewardship within the community.

In order to reduce regional reliance on non-renewable groundwater, we need to shift how water demands are being met.

Groundwater as a drought supply is a strong asset as its yield is not impacted during dry years. In contrast, renewable surface water supplies are greatly reduced during dry years. Replacing our non-renewable supply with a renewable supply during wet and average hydrologic years will help protect this resource and continue to provide our communities with a safe and reliable water supply into the future. This will shift how we use non-renewable groundwater from a primary supply to a backup supply.

This 2016 Master Plan Update was commissioned to better understand our future water supply and quality needs and to identify potential options for meeting those needs. The findings of this and parallel efforts are outlined in the following pages.

Photo: Chatfield Reservoir provided by Centennial W&SD



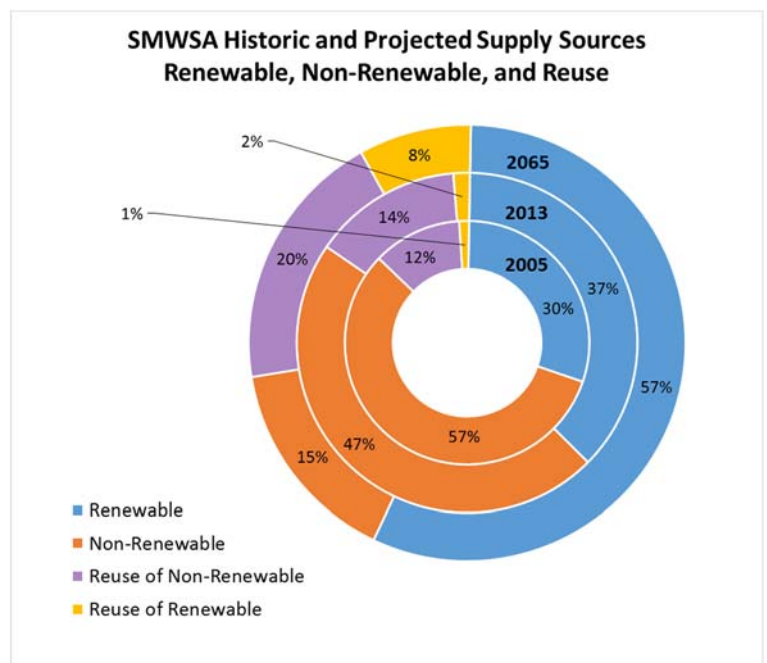
SMWSA Progress

The 2016 Master Plan Update evaluated the historical and projected demands and supplies of the SMWSA's members to identify the degree to which reliance on non-renewable aquifers has changed over the last 12 years and is expected to change into the future. The evidence of our progress is clear.

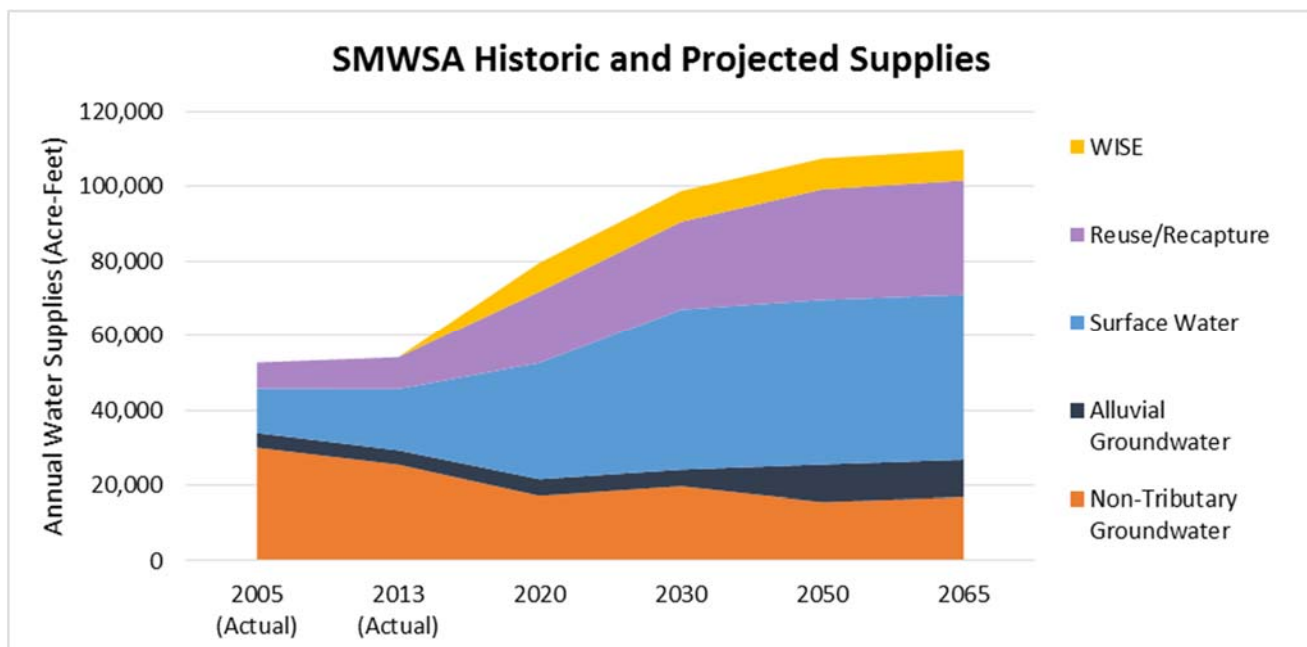
- In 2005, 57% of our region's supplies were from non-renewable sources. By 2013, just eight years later, that had been reduced to 47%. By 2020, that number is expected to fall even further to about 22%, and by buildout in 2065, it will be down to nearly 15%.
- Some members have or have very nearly achieved a primarily renewable supply on average, using their renewable surface water supplies during wet and average years and their non-renewable groundwater supplies as a backup during dry years.
- In the 1990s, groundwater levels in the Denver Basin Aquifers were declining by about 30 feet per year. Today, groundwater levels in these aquifers are declining by around 5 feet. Note that level declines are not consistent within each of the aquifers and at all locations within these aquifers. This is a generally accepted representation of average aquifer level declines.
- Through a strong commitment to conservation and efficient water use, **per capita demand for water has been reduced by 30% since 2000**. Our region averages about 120 gallons of water use per capita per day, one of the lowest per capita rates in the state and well ahead of the state's 2050 goal of 129 gallons per capita per day for the Denver metro region.
- The South Metro region is leading the way in Colorado in reusing our supplies. Most members are approaching full reuse of their reusable supplies and plan to fully reuse as much as legally allowed.

This graph shows the reduction in reliance on non-renewable supplies and how South Metro water demands are being met by an increasingly balanced portfolio of renewable and reuse supplies.

In 2005, renewable supplies accounted for only 30% of the total regional supply, with 13% of total supplies being from reuse. In 2013, this increased to 37% and 16%, respectively. Projections for buildout in 2065 project renewable supplies to represent about 57% of total supplies and around 28% being reused supplies. It is estimated that the buildout reuse supply will be attributed to the reuse of 30% renewable supplies and 70% non-renewable supplies. Information for this figure only includes existing and planned supply sources.



The figure below represents another look at the projected water supply portfolio through buildout in 2065. Note that this only includes existing and planned supplies, not our renewable supply goal. Although demands will continue to increase into the future, the quantity of non-renewable groundwater being used is declining. The great majority of demands will be met through increased renewable supply projects including the Water Infrastructure and Supply Efficiency (WISE) Project, new surface and alluvial groundwater, and reuse and recapture of certain supplies. **By buildout, these renewable and reuse supplies are projected to comprise about 85% of our region's supplies.**



From 2005 to 2065, use of non-tributary groundwater, or non-renewable supply, is projected to reduce by around 13,000 acre-feet (more than 4 billion gallons). The remaining supplies are WISE, reuse, surface water, and alluvial groundwater. Reuse is comprised of the reuse of both non-renewable and renewable supplies. WISE, surface water, and alluvial groundwater are all considered renewable supplies. As the region reduces use of non-renewable groundwater, all other supply uses increase over time.

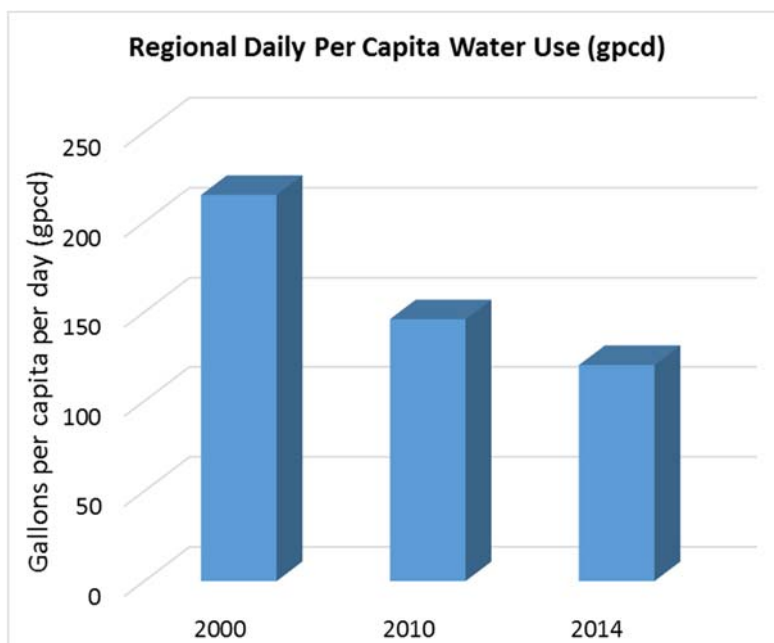




Conservation & Efficiency

Our secure water future begins with a commitment to conservation. Reducing water demands means that less new supplies will need to be pursued and less non-renewable groundwater will need to be pumped.

The South Metro Denver region has been on the cutting edge of conservation-related activities and programs over the last decade. Between 2000 and 2010, we saw a reduction in per capita demands of over 30%. The Colorado Water Plan has set a 2050 goal for our region of 129 gpcd for all potable use. We have already surpassed that goal, reaching about 120 gpcd regionally in 2014. Although we have taken huge strides in reducing our potable water demand, we plan to continue our efforts to further reduce our water use.



Regional residential per capita use has steadily declined since 2000. The Statewide Water Supply Initiative (SWSI) reported that Douglas County's water use in 2000 was 215 gpcd. That was reduced to 146 gpcd by 2010. (About 80% of Douglas County is served by SMWSA members.) In 2014, residential use among just SMWSA members was around 120 gpcd.



All of our members have active Water Conservation Plans. Programs that many other water providers throughout the state are just beginning to implement, our members have been operating for a number of years. Below is a snapshot describing a handful of these programs and activities that have been implemented and operated throughout the last decade.

- Castle Rock recently approved a new set of Landscape and Irrigation Performance Standards, Criteria, and Regulations targeting efficient landscaping materials, techniques, and practices. These were developed to promote water conservation, encourage appropriate use of materials, increase public safety, and facilitate successful projects.
- Two of our members (Castle Rock and Centennial Water and Sanitation District serving Highlands Ranch) have been leaders in the state in implementing a water budget rate structure. This rate structure defines an amount of water tailored to individual customers based on estimates of indoor and outdoor needs (their “water budget”). Once a customer exceeds their individually assigned budget, a higher rate structure is applied to the additional water used. Only a handful of other water providers in the state have implemented this conservation

-driven rate structure.

- Two of our members (Inverness Water and Sanitation District and Meridian Metropolitan District) are zero-discharge providers, meaning that all of their wastewater is treated and fully reused for irrigation within their respective service areas.
- SMWSA manages the Water Ambassador Program throughout the region to educate local high school students about the importance of water, what water solutions are being pursued in our region, and to train them in best practices in conservation. These students then visit elementary schools and, through interactive activities, teach elementary students about regional water issues, what their local providers are doing to provide a safe and reliable water supply to their community, and how they can make a difference in the water practices of their homes and communities.

SMWSA Members have extensive portfolios of programs & efforts aimed at conservation and efficiency.

- All members participating in the WISE Project have committed to a specified level of conservation through agreements with Denver Water and Aurora Water.
- Dominion Water and Sanitation District will serve Sterling Ranch, a development that has been planned and designed with conservation and efficiency in mind from the beginning. The development has focused on minimizing water demand by integrating water demand management into the design of the community. As a result, Sterling Ranch will dramatically decrease the amount of water needed to serve future residents as compared to a typical housing development. Sterling Ranch integrates land use planning and water demand management with a conjunctive waters supply system of renewable water, groundwater, non-potable reuse, and storage to provide a dependable supply that prolongs the life of the aquifer.
- Sterling Ranch is the first and, currently, only rainwater harvesting pilot project approved by the Colorado Water Conservation Board and the State Engineer.
- Castle Pines North Metro District provides 20 to 25 free classes each year focusing on efficient landscaping and irrigation.
- Three of our members (Castle Rock,

Inverness, and Castle Pines North) are among some of the few water providers in the state currently offering rebates for removal of turf or high water use plants.



In addition to extensive member conservation practices, SMWSA fosters the sharing of conservation successes among our members and pursues regional conservation and efficiency projects and programs. These regional efforts are currently focused on linking land use planning with water supply planning in order to ensure efficient outdoor water use throughout the region.



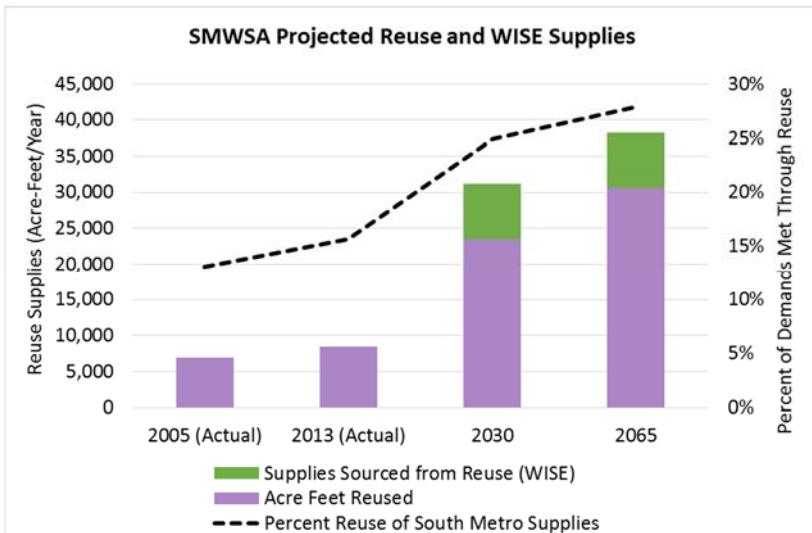
Reuse

Our commitment to wise water use extends beyond just conservation and efficiency. The members of the SMWSA are also leaders in Colorado in water reuse. In practice, reusable supplies are treated after their initial use and either stored in a non-potable storage facility for future use or directly applied for irrigation and other non-potable uses. Reusable supplies can also be discharged into a downstream water source and exchanged for the same amount taken at an upstream location to be used for potable or non-potable uses.

The ability of South Metro members to reuse supplies varies depending on the source of the water. Not all water is legally reusable. Members with reusable supplies are approaching the full reuse of their supplies and plan to fully reuse as much as they are legally allowed and physically able. The supply for Arapahoe County Water and Wastewater Authority, for example, will consist of 47% reuse by buildout. Many of our members expect to exceed 40% reuse by buildout. These are among the highest percentages of reuse in Colorado.

Many of our members expect to exceed 40% reuse by buildout.

Together, SMWSA members plan to meet about 28% of their total demands at buildout through reuse. This is in addition to the first use of WISE water by SMWSA members. WISE water delivered to our members is the second use of the water, as the supply provided by Aurora and Denver is a reuse supply through Aurora’s Prairie Waters Project. This water can be reused to extinction by SMWSA members receiving WISE water. In the figure below, the first use of WISE water by participating members is shown separately from the member reuse total. Subsequent use is included in the overall reuse supply.



In 2005, reuse of supplies accounted for approximately 13% of the total supplies in the SMWSA region. As reuse systems expand, it is anticipated that reuse could account for around 28% of all supplies in the SMWSA region by 2065. Note that this only includes existing and planned supplies, excluding the renewable supply goal. Beginning in 2017, the WISE Project will begin deliveries, totaling on average 7,725 acre-feet annually beginning in 2021. The first use of this water by participating SMWSA members is the second use of this water, shown above as a separate reuse supply. It can then be used to extinction within member service areas and is included in the general reuse supply.





Water Supply Projects

Conservation, efficiency and reuse are not enough, however. New water projects have also been essential to the progress we have made. The projects that have helped us get here are a combination of individual projects, SMWSA member partnership projects, and regional projects. Examples include:

Individual projects/programs

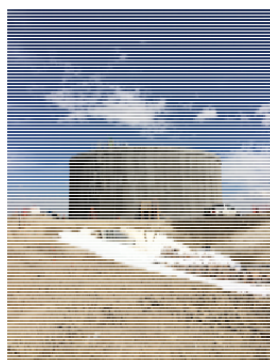
- Centennial's South Platte Reservoir—<http://southmetrowater.org/south-platte-reservoir/>
- Castle Rock's Plum Creek Water Purification Facility—<http://southmetrowater.org/plum-creek-water-purification-facility/>

Partnership projects/programs led by individual members

- ACWWA/ECCV Northern Project—<http://southmetrowater.org/member-projects/northern-project/>
- Reuter-Hess Reservoir—<http://southmetrowater.org/member-projects/rueter-hess-reservoir/>
- Cottonwood/ACWWA Joint Water Purification Plant—<http://acwwa.com/water-operations/jwpp/>
- Various interconnect projects—<http://southmetrowater.org/interconnect-pipeline-project/>

Regional partnership projects/programs through SMWSA

- The WISE Partnership — <http://southmetrowater.org/wise-partnership/>
- The Chatfield Reallocation Project — <http://chatfieldreallocation.org/>



Future Needs

This Master Plan Update along with other ongoing regional efforts makes it clear that significant progress has been made in our efforts to shift to a secure and sustainable supply of renewable water. Yet, more is needed to ensure that our water future is secure. More people will live in our region in the coming years as our children and grandchildren have families of their own and others come here to enjoy the outstanding quality of life our region offers.

The South Metro region will need to develop about 30,000 acre-feet of additional renewable water supplies by 2065.

To meet these and other challenges, the Master Plan Update helped identify four needs for the South Metro Water Supply Authority and our 13 members.

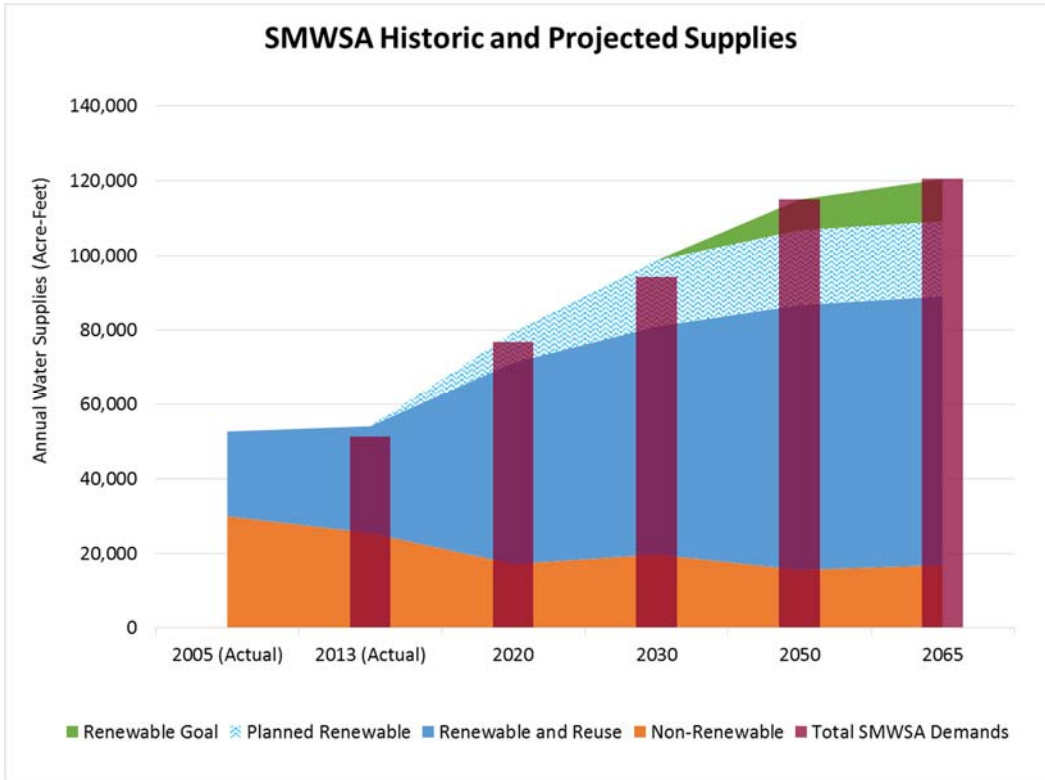


Photo: Rueter Hess Reservoir, March 2015

1. Additional Supply

The South Metro region will need to develop approximately 30,000 acre-feet of additional renewable water supplies by 2065. The region consumed approximately 52,000 acre-feet of water in 2013. By 2065, regional demand is expected to increase to approximately 120,400 acre-feet, an increase of 68,400 acre-feet. Projects that have recently been or will soon be completed, including WISE, Chatfield Reallocation and others, will meet approximately 38,400 of that additional need. To fill the remaining need of approximately 30,000 acre-feet, individual members have planned a number of projects that will yield approximately 20,000 acre-feet (“Planned Renewable”). Successful implementation of those projects will be essential to meeting our future needs. To meet the region’s remaining need of 11,000 acre-feet of renewable water supply, additional projects will need to be explored.

The figure below illustrates this demand through buildout in 2065 and how those demands will be met. The blue hatch represents the 20,000 acre-feet of planned projects (“Planned Renewable”) and the green represents the additional 11,000 acre-feet that are needed (“Renewable Goal”).



From 2005 to 2013, actual use of non-renewable supplies decreased by almost 5,000 acre-feet and is projected to decline by another 8,000 acre-feet to around 17,000 acre-feet by 2065. During this same time period, demands are projected to increase to around 120,000 acre-feet. Planned Renewable (about 20,000 acre-feet) plus Renewable Goal (about 11,000 acre-feet) represents the total additional renewable supply goal that SMWSA members will need to meet through member-specific, member participation, and SMWSA regional partnership projects.



This future demand could be met through individual member projects, projects that involve partnerships between SMWSA members, or regional projects that SMWSA implements. Through this Master Plan effort, potential sources for these projects were identified as viable options for the SMWSA region. These include:

1. The South Platte Basin

- A. Upstream of the Metro area near Chatfield Reservoir
- B. Downstream of the Metro area in cooperation with agriculture and other municipalities

2. The West Slope

- A. Supplies from the Colorado River through a Colorado Cooperative Project in compliance with the Colorado River Cooperative Agreement (“CRCA”)
- B. If the Colorado Cooperative Project does not advance on the timelines laid out in the CRCA, SMWSA may evaluate Yampa, Gunnison, and Colorado main stem projects in the next Master Plan update

3. WISE Phase II

- A. Second phase of WISE Project building on cooperation with Denver Water and Aurora Water

To help identify, prioritize, and select water supply projects to help meet this future demand, a new decision-based tool was developed as part of the 2016 Master Plan Update. This interactive tool allows SMWSA to evaluate various supply alternatives using both cost and non-cost criteria. The tool provides a robust, transparent, and consistent methodology in which new water supply alternatives can be evaluated. It can aid SMWSA members in collectively deciding which non-cost criteria are most important and apply the approach across all projects to build consensus. The non-cost criteria used to evaluate potential projects in the Master Plan include:

- 1. Time to implement and permit the project
- 2. Reliability of the potential supply
- 3. Number of parties anticipated to be involved
- 4. Political and regulatory acceptability of the project
- 5. Socioeconomic impacts
- 6. Environmental or aesthetic flow implications

The user can force-rank the criteria relative to each other, and this data will be used to calculate weighted benefit scores for each alternative. These scores are compiled with costs to provide relative cost-benefit evaluations for each alternative.

SMWSA and its members will continue to evaluate and pursue the potential sources of renewable water supply listed above using the tools developed through this Master Plan update.



2. Additional Storage

Development of additional storage opportunities will be critical for the SMWSA region to help firm existing and future supplies as renewable supply volumes increase.

This also provides additional flexibility within member systems. Storage options include surface storage and Aquifer Storage and Recovery (ASR). Members are currently and in the near future relying upon surface water storage in Reuter-Hess Reservoir and through the Chatfield Reallocation Project. SMWSA and its members will continue to evaluate and pursue additional surface storage throughout the region.

Typically, ASR works by injecting treated water into the aquifer at hydrologically and geologically feasible locations until it is recovered by conventional pumping. The Master Plan Update discussed the opportunity for individual and regional ASR programs. Injection of water into the aquifers could help mitigate declining groundwater levels, but to be successful, an ASR program must be carefully engineered and the local geology needs to be amenable to injection and recovery. Currently, Centennial Water & Sanitation District operates a successful ASR program, and their success will be relied upon moving forward with additional ASR in the region. Potential benefits of additional ASR in the region include:

- Further decreasing reliance on non-renewable groundwater
- Help facilitate water transfers
- Optimize the location of best-performing wells for multiple users
- Enable the storage of renewable water when deliveries occur during lower water use months
- Protects and may enhance the health of the aquifer system

In 2016, SMWSA reinitiated an effort to evaluate the feasibility, economic constraints, and benefits of ASR, which will help guide additional ASR efforts in the future. This and other storage opportunities will need to be explored in the coming years.

3. *Water Quality and TDS Management*

As we bring on additional supplies from WISE or other renewable surface supplies, a growing challenge is the potential increase in total dissolved solids (TDS) in these supplies. Higher concentrations of TDS tend to cause water supplies to appear cloudy or colored and may present salty taste to consumers. Higher TDS concentrations are not a concern for human health but rather a taste and aesthetic concern.

As we move towards more renewable supplies, renewable surface water sources generally have higher levels of TDS than groundwater sources. Additionally, 10 SMWSA members have subscribed for WISE water that will initially be a blend of supplies resulting in TDS below 500 mg/L. However, in 2030, the guaranteed blend supply from Denver and Aurora expires and water is expected to have TDS concentrations typical of Middle South Platte River water near Brighton, which typically varies between 400 mg/L and 700 mg/L. Therefore, TDS management for new supplies and existing WISE supplies is a very important consideration.

SMWSA's target TDS concentrations for new supplies is at or below 500 mg/L, which is the current secondary standard limit set by the EPA. This can be achieved by acquiring low TDS supplies, acquiring a mix of supplies that can be blended to achieve the TDS goal, or by utilizing desalination treatment technologies to reduce salinity in supplies with elevated TDS. Managing levels of TDS in our water supplies will help ensure a reliable and trusted water supply.



Photo: Plum Creek Water Purification Facility in Castle Rock

4. Conservation & Efficiency

Locally and regionally, SMWSA members are focused on our region's commitment to conservation and efficient water use. The following new programs and projects are currently being pursued and implemented at local and regional levels. While this is not a comprehensive list of planned efficiency measures, this represents a few examples of SMWSA's continued role as a leader in conservation in the state.

1. Meridian is developing local landscape regulations
2. SMWSA's Conservation and Efficiency Subcommittee is investigating the possibility of regionalized consistency of irrigation and landscaping regulations where possible
3. SMWSA's Conservation and Efficiency Subcommittee is designing and defining logistics for implementing a regional landscape certification program beginning with a one-year pilot program
4. Sterling Ranch will construct a community that was designed with extreme efficiency and cutting edge conservation planned from the beginning, resulting in very low water use throughout the community



According to the University of Nevada, Las Vegas, "Xeriscaping is a water conservation concept that originated in Colorado, eventually spreading throughout the west. The idea was to save water by utilizing water efficient landscape designs that could also be used as an attractive outdoor decoration." Some benefits of xeriscaping include a beautiful, natural landscape and meaningful savings in water, money, time, and energy.

Master Plan Summary

Since its inception, the SMWSA and its 13 water provider members have worked together to develop new renewable supplies, to become leaders in water conservation and efficiency in the state, and significantly reduce groundwater level depletions.

While we have made immense progress, our job is not yet done. The 2016 Master Plan Update, along with other regional efforts, identifies a number of efforts we plan to pursue in the months and years ahead to continue to reduce our reliance on non-renewable groundwater and enhance our water stewardship within the community.

Our priorities moving forward include:

1. Developing an additional increment of renewable water supply, about 30,000 acre-feet
2. Increasing storage (surface and ASR) to firm existing and new supplies
3. TDS management for new supplies and WISE
4. Conservation and efficiency initiatives by individual members and as a region

These efforts, coupled with the progress that has been made, will help ensure a secure water future for our region for generations to come.

