The Status of Reuse in Colorado

September 6, 2017

Brenley McKenna – President, WRCO
Laura Belanger – WRA
John Rehring – Carollo Engineers
Agenda - Water Reuse in Colorado

- WateReuse Colorado – Who We Are
- What is Water Reuse
- Increasing Reuse Opportunities
- Direct Potable Reuse
- Water Energy Nexus
Mission

The primary objectives of WateReuse Colorado include supporting the mission of the WateReuse Association, advocating for legislation and regulations which facilitate appropriate water reuse, promoting safe and effective reuse throughout the state, and improving public understanding of water reclamation.
What is Water Reuse?

Recycled water is treated domestic wastewater that is used more than once before is passes back into the water cycle.
Types of Water Reuse

• **Nonpotable Reuse** – refers to reclaimed water that is not used for drinking, but is safe to use for irrigation, industrial uses, or other non-drinking water purposes.

• **Potable Reuse** – refers to recycled water that you can drink. The reclaimed water is purified sufficiently to meet or exceed federal and state drinking water standards and is safe for human consumption.

  • **Indirect Potable Reuse** – water is blended with other environmental systems such as a river, reservoir, or groundwater basin before the water is reused.
  • **Direct Potable Reuse** – water is distributed directly into a potable water supply distribution system

• **De-Facto Reuse** – occurs when water intakes draw raw water supplies downstream from discharges of clean water from wastewater treatment plants.
## Reuse in Colorado

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td>• Water reuse has been practiced for over 50 years in Colorado.</td>
</tr>
<tr>
<td><strong>Places</strong></td>
<td>• Denver, Aurora, and Colorado Springs are among the 26 cities reusing water.</td>
</tr>
<tr>
<td><strong>Water Rights</strong></td>
<td>• Only existing reusable water rights can be utilized in a reuse program.</td>
</tr>
<tr>
<td><strong>Water Quality</strong></td>
<td>• Treatment can be tailored to meet the water quality needs of the intended use.</td>
</tr>
<tr>
<td><strong>Users</strong></td>
<td>• Commercial, industrial, and municipal users range from power plants to irrigation.</td>
</tr>
</tbody>
</table>
Benefits of Reusing Water

- More water for the environment
- Lower costs to users
- Year round supply
- Adds to a diverse water supply
- Utilizes nutrients
- Less costly than developing new sources
- Reduces potable water demand
- More water for the environment
- Lower costs to users
- Year round supply
- Adds to a diverse water supply
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- Less costly than developing new sources
- Reduces potable water demand
80% of the Water

80% of the Population

Population Projected to Double by 2050

Transbasin Diversion

26 Reuse Facilities in 11 Counties
Questions?

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https://watereuse.org/sections/watereuse-colorado/
Reuse and Colorado’s Future
- Increasing Opportunities

Laura Belanger, P.E.
Western Resource Advocates
Important Role Reuse Will Play

Colorado’s Water Plan:

- Colorado’s population projected to ~double by 2050
- 2050 annual M&I supply-demand gap that could be as high as 560,000 acre-feet

Need a diverse set of water supply & demand management strategies – Including reuse
Significant Statewide Support for Increasing Reuse

Colorado’s Water Plan:

- “Water conservation activities and water reuse will play an important role in balancing the need for additional water supply with strategies to lessen that need.”

- “Widespread development of potable reuse will be an important facet of closing the future water supply and demand gap.”
Basin Implementation Plans

South Platte:

• “Maintain leadership in conservation and reuse and implement additional measures to reduce water consumption rates”

• “…enhance current levels of municipal reuse.”

• “Efficient use of the basin’s resources, through water reuse and conservation, is a critical component of meeting future water needs:

• “Implement additional reuse where practicable.”
Basin Implementation Plans

- **Arkansas**: “...future demands will have to be met from **better management of existing supplies including reuse of transbasin water supplies to the maximum potential**...”

- **Gunnison**: “Entities must **first reuse** all legally available reusable water supplies to the maximum extent possible prior to further development of Colorado River System water”

- **Southwest**: “Municipalities receiving water from a new TMD will fully develop their existing water supplies within their basin (such as reuse strategies, storage, etc.).”

“The Roundtable continues to firmly believe that conservation and **reuse** must be a major means to reduce demand and address future gaps...”
Basin Implementation Plans

- **Yampa-White-Green**: “Water re-use should be an increasing part of meeting future water needs. Where water can legally be reused to extinction (transbasin water, already converted consumptive use water, non-tributary groundwater), it should be.”

- **Colorado**: “TMDs should be the last “tool” considered as a water supply solution, once….and once everything that can be done to conserve and reuse water has been undertaken.”
Benefits of Reuse

West Slope:
• Decreases need for new transbasin diversions (TBD)
• Ensures TBD supplies are used effectively and efficiently

Environmental and Recreational:
• Takes pressure off streams and rivers for new diversions

Agricultural:
• Decreases need to look to agriculture for new municipal supplies (*does* impact return flows)
• Ensures any transferred agriculture CU is used effectively and efficiently

Municipal:
• New supply options are limited
• Often least costly option
Water Plan: Strategies to Meet the Municipal (M&I) Gap

- Water Conservation and Reuse
- Alternative Agricultural Transfers (ATMs)
- Identified Projects and Processes (IPPs)
  - Agricultural water transfers (traditional & ATMs)
  - Reuse of existing fully consumable supplies
  - Growth into existing supplies
  - In-basin projects
  - New transbasin projects
- Water Storage
## South Platte BIP Reuse Identified Projects and Processes (IPPs)

From SPBIP Table 4-10

<table>
<thead>
<tr>
<th>Basin</th>
<th>Providers</th>
<th>Project</th>
<th>Estimated Yield (AFY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro</td>
<td>Aurora</td>
<td>Prairie Waters Project Expansion &amp; Storage</td>
<td>TBD</td>
</tr>
<tr>
<td>Metro</td>
<td>Northglenn</td>
<td>Northglenn Reuse Plan</td>
<td>700</td>
</tr>
<tr>
<td>Metro</td>
<td>Thornton</td>
<td>Thornton Reuse</td>
<td>2,000</td>
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<tr>
<td>Metro</td>
<td>Denver Water</td>
<td>Denver Water Reuse</td>
<td>17,500</td>
</tr>
<tr>
<td>Metro</td>
<td>Westminster</td>
<td>Westminster Reclaimed Water</td>
<td></td>
</tr>
<tr>
<td>Metro</td>
<td>Denver Water</td>
<td>Downstream Reservoir Exchanges</td>
<td>12,000</td>
</tr>
<tr>
<td>Metro</td>
<td>Castle Rock</td>
<td>Alternative water Supply Project</td>
<td>2,500</td>
</tr>
<tr>
<td>Metro</td>
<td>Castle Rock</td>
<td>Plum Creek Diversion &amp; WPF Upgrades</td>
<td>4,100</td>
</tr>
<tr>
<td>Metro</td>
<td>ACWWA</td>
<td>Reuse of ACWWA Flow Program Deliveries</td>
<td>3,520</td>
</tr>
<tr>
<td>Metro</td>
<td>City of Brighton</td>
<td>South Platte and Beebe Draw Well</td>
<td>3,200</td>
</tr>
<tr>
<td>Metro</td>
<td>SMWSA, Denver Water, Aurora</td>
<td>WISE</td>
<td>7,225</td>
</tr>
<tr>
<td>South Platte</td>
<td>Erie</td>
<td>Erie Reclaimed Water</td>
<td>5,390</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>58,135</strong></td>
<td></td>
</tr>
</tbody>
</table>
Water Plan: Strategies to Meet the Municipal (M&I) Gap

• Water Conservation and Reuse
• Alternative Agricultural Transfers (ATMs)
• Identified Projects and Processes (IPPs)
  • Agricultural water transfers (traditional & ATMs)
  • Reuse of existing fully consumable supplies
  • Growth into existing supplies*
  • In-basin projects*
  • New transbasin projects
• Water Storage

*May be reusable - supply specific.
Reuse Potential

• Additional IPP Reuse Opportunities
  • Agricultural Transfers - 19,900 AF identified in the SPBIP
  • Transbasin Projects - 58,000 AF identified in the SPBIP
  • Unquantified overlap with Reuse IPPs
  • Additional reuse IPPs and opportunities in other basins
  • Higher yields as potable reuse is pursued through subsequent reuse of indoor return flows
Increasing Reuse

- **Water Plan Critical Action** (Chpt 10): “Evaluate regulations to foster reuse of water supplies while protecting health and the environment.”

Need to make progress on non-potable and potable regulations.

Non-potable reuse (reclaimed water)

Potable reuse

*Colorado Water Conservation Board*

**WATER SUPPLY RESERVE ACCOUNT APPLICATION FORM**

- **Today’s Date:** 01/20/2016
- **Name of Water Activity/Project:** WaterReuse Colorado

*Advancing Direct Potable Reuse to Optimize Water Supplies and Meet Future Demands*
Regulatory Progress

Current Regulation


Sufficient Resources for Ongoing SDW Program Staff and Services?

One-Time CWCB & WRPDA Funding for WQCD

CWCB WSRF Support

WateReuse Colorado DPR Project

Add’l Technical Analysis

DPR Stakeholder & Rulemaking Processes: Regs, Guidance, Policy

New WQCD Oversight of DPR Services

CWCB Water Plan Grant Support & WQCD Resources?

One-time Funding for WQCD?

Ongoing New WQCD Resources?
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What’s the role of reuse in Colorado?

- Non-potable reuse
- Some surface water IPR
- No DPR projects in place or imminent

2050 POPULATION ~2X
M&I SUPPLY GAP 560K AC-FT/YEAR
Supply benefits of Potable Reuse

- Year-round supply
- Year-round demand
- No dual distribution
WateReuse Colorado
Direct Potable Reuse
Project goals

• Set a clear framework for DPR regulations: Regulatory/Technical Workgroup
• Increase public understanding and acceptance: Outreach Workgroup
• Adapt & use existing planning tools to help utilities assess potable reuse
A proactive approach to support DPR implementation in Colorado

OUTCOMES

Regulatory framework
Outreach tools and products
Planning tools to assess DPR options
Workgroup comprises project supporters from utilities and organizations

Colorado Water Conservation Board
*Water Supply Reserve Account Grant*

- Denver Water
- City of Aurora
- Centennial WSD
- SMWSA
- MSK Consulting
- Town of Castle Rock
- PCWRA
- Colorado Springs Utilities

Water Environment & Reuse Foundation

WateReuse Colorado

WateReuse Association
Regulatory Development
Why develop DPR regulations?

- Confidence in public health protection
- Certainty in planning for Utilities / Water Providers
- Public Acceptance

DPR Regs

ALIGNMENT

Water Providers CDPHE WQCD Stakeholders
State of the Union (from a DPR Perspective)

- No national DPR regs – or plans to create them
- One operational DPR system / More in the works
- Some states have IPR regs
- Several states working on DPR regs
When is the right time to develop DPR regulations?

- Before a DPR project is proposed
- Concurrent with a project’s design
- During or after startup of a project
Colorado’s Regulatory Focus for Potable Reuse

INITIAL FOCUS
DPR
Structure for Regs, Policy, Guidance

FUTURE WORK
IPR
Adapt applicable provisions from DPR regs

Reg. 11 Colorado Primary Drinking Water Regulations

Surface Water Treatment Rule
Groundwater Rule
NEW Potable Reuse Rule
Total Coliform Rule
Nitrate and Nitrite Rule
…
Flexibility and adaptability through three levels of regulatory documents

**Regulation**
- Non-compliance has consequences and requires public notification.
- Commission hearing process to modify.

**Policy**
- Interprets the Regulation, provides specifics.
- Can be modified at CDPHE staff level, approved by Commission.

**Guidance**
- Best practices and information on how utilities can best comply with the Regulation.
- Non-enforceable.
## Topic Areas for DPR Reg / Policy / Guidance

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Definitions/Terminology</td>
</tr>
<tr>
<td>2</td>
<td>Source Control</td>
</tr>
<tr>
<td>3</td>
<td>Wastewater Treatment</td>
</tr>
<tr>
<td>4</td>
<td>Pathogen Disinfection/Removal</td>
</tr>
<tr>
<td>5</td>
<td>Chemical Pollutants</td>
</tr>
<tr>
<td>6</td>
<td>Advanced Treatment Processes</td>
</tr>
<tr>
<td>7</td>
<td>Monitoring Requirements</td>
</tr>
<tr>
<td>8</td>
<td>Reporting</td>
</tr>
<tr>
<td>9</td>
<td>Facility operations/ certification programs</td>
</tr>
<tr>
<td>10</td>
<td>Education and outreach</td>
</tr>
<tr>
<td>11</td>
<td>Technical, Managerial and Financial (TMF) capacity</td>
</tr>
</tbody>
</table>
An example of how the Reg / Policy / Guidance Matrix works

<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Regulation</th>
<th>Policy</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Control</td>
<td>✓ Require a source control program.</td>
<td>✓ Required components of program.</td>
<td>✓ Best practices for sampling and emergency response.</td>
</tr>
<tr>
<td></td>
<td>✓ Require review and updates of source control program.</td>
<td>✓ Specific requirements for all components of the program (i.e., monitoring frequency, location, reporting).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Require regulatory reviews of monitoring results.</td>
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</tr>
</tbody>
</table>
Workgroup “breakout” teams helped vet and enhance the Reg / Policy / Guidance matrix for each topic

<table>
<thead>
<tr>
<th>What information is missing from the regulatory matrix?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where do the components of each topic belong: regulation, policy, or guidance?</td>
</tr>
<tr>
<td>What resources are available for each topic?</td>
</tr>
<tr>
<td>What additional information or research is needed?</td>
</tr>
</tbody>
</table>
Path from framework to regulation

Early 2018: WateReuse Colorado Reg / Policy / Guidance Framework

Develop Health-Based Standards

Develop Implementation Programs

Water Quality Control Commission Rulemaking

Reg / Policy / Guidance

Unresolved Issues:

Timeline

Resources
Taking a proactive approach to DPR outreach and education to foster success in future project implementation
Effective communications strategy for each target audience starts with a good plan

**Example audiences**
- Local elected officials
- Press/media
- Community organizations
- Local health department
- Community leaders
- Industry
- Environmental groups
- State legislators
Workgroup members evaluated best strategies to reach target audiences

| Outcomes        | • Advocate, not oppose  
|                 | • Promote with constituents |
| Motivations     | • Economic growth    
|                 | • Getting re-elected |
| Hurdles to Overcome | • Cost    
|                 | • Perception     |
| Messaging       | • Safety            
|                 | • Has been proven before |
| Messengers      | • Staff             
|                 | • Constituents     |
| Delivery Mechanisms | • Board meetings 
|                 | • Concise and consistent bullets |
Work plan and outreach needs extend beyond the WateReuse Colorado project

- Identify target audience(s)
- Craft an outreach message and strategy
- Develop new and leverage existing materials
- Assign a timeline for implementation
- Identify and utilize evaluation tools
Takeaways: Facilitating DPR in Colorado

Regulatory development can apply leading research & best practices from other states to result in flexible & adaptable requirements.

Statewide outreach efforts start with knowing who to reach and how we can make the most impact.

Resource limitations could constrain ability to develop regulations and prepare Colorado for this significant supply source.
Direct Potable Reuse in Colorado
AN UPDATE ON THE WATERUSE COLORADO DPR PROJECT

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Reuse and the Energy-Water Nexus

Laura Belanger, P.E.
Western Resource Advocates
Water and Energy

Two of our most important resources Inextricably linked

Water and Energy

Water for Energy
• 2010 thermoelectric power plants = ~0.7% (86,300 AF) of total Colorado freshwater withdrawals\(^1\)
  • Mostly for cooling, recirculated until fully consumed.
  • 2010 Municipal withdrawals = 7.7% (950,000 AF) of total freshwater withdrawals\(^1\)

Energy for Water
• ~13% of energy use nationwide is embedded in water use\(^2\)
  • Energy is second biggest cost for many utilities, second to staff salaries\(^3\)

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\(^1\) USGS Circular 1405. Estimated Use of Water in the US in 2010
\(^2\) Sanders, K and M. Webber. 2012
\(^3\) AWWA State of the Water Industry 2013
Providing Water

Energy is used to collect, pump, treat, distribute, heat, and use water; to treat and discharge wastewater; and/or to treat water for reuse.
Energy Intensity of Water

Varies Greatly:

• Gravity Fed Surface Supplies
  • Minor amounts of energy to treat and distribute potable water to their customers
  • Ex: Denver Water, Fort Collins
    • Energy intensity of Denver Water, including supplying water and treating wastewater, averages 821 kWh/AF\(^1\)

• Groundwater, Distant Sources
  • Significant energy needed to pump water
  • Ex: Parker Water and Sanitation to pump groundwater from aquifers.
    • Energy intensity of water in Parker, including supplying water and treating wastewater, averages 4,494 kWh/AF\(^1\)

\(^1\) Water Conservation = Energy Conservation: A Report for the CWCB, Western Resource Advocates, 2009

Photo: Mark Conlin

Photo: Chris Austin
New Water Supplies

New water supplies will require more energy:

- Have tapped easiest, least energy-intensive supplies
- Groundwater pumped from greater depths
- Surface water conveyed long distances, transbasin diversions
- Lower quality water requiring more treatment

How does reuse compare?

- Locally available supply
- Likely less energy intensive than other alternatives
- Source water is treated wastewater
- Incremental additional treatment for reuse
- WWTP often at bottom of system so pumping needed to provide to users
Includes conveyance from source, treatment and delivery. Does not include wastewater treatment.

Source: 2013 unpublished analysis by Western Resource Advocates. Data provided by cities. Updated data may be available for projects that are now operational.
Colorado Data Source: 2013 Unpublished Analysis by Western Resource Advocates. Updated data may be available for projects that are now operational.

Water for Energy

Extraction
Mining, drilling (oil, natural gas), Biomass

Raw Material Refining
Coal, petrol, natural gas, uranium, biofuels

Transport & Transmission
Pipelines, waterways

Energy Generation

End Use
Industrial, commercial, residential, public utilities, transportation

Source: Adapted from WitW 2013, Water in the West: Water and Energy Nexus: A Literature Review. Stanford Woods Institute
Oil and Gas Extraction

- Green circle = Approved well
- Light blue square = Pending well
- Red circle = Permitted, historic & abandoned wells

Source: COGCC GIS Online
Oil and Gas Extraction

Annual Colorado water demands vary
- # of wells drilled, depth, length...
- ~0.1 – 0.15% of total water withdrawals
- Locally impacts can be significant in areas (e.g. Weld County)

Many O&G operators in Colorado recycle water:
- Decreases need to secure water supplies
- Cuts downs on truck traffic through communities
- Decreases volume of water that must be disposed of
- Can cut costs

Reusable municipal return flow lease
- Anadarko Petroleum’s 2012 5-yr lease w/Aurora to divert ~1,500 AF/yr reusable return flows from the South Platte
Thermoelectric Power Plants

Water required for electricity generation varies considerably, depending on fuel and cooling technology

- Most water consumed is to cool and condense steam in thermoelectric power plants
- Colorado’s energy sector has decreased water use and continues to as renewables and no/low water cooling systems come online
- As a result, reuse opportunities in Colorado associated with power plants are limited.
- 3 thermoelectric power plants in Colorado use reclaimed water: Cherokee, Drake and Rawhide.

Image: CFWE Headwaters Magazine Fall 2013
Xcel Example

Xcel serves ~60% of Colorado’s energy load

“By far, the majority of Xcel Energy's water use is for generating electricity, compared to water used in office buildings.”

Source: Xcel Energy Water Management website

= ~2,500 AF or 8% of total water withdrawn by Xcel in Colorado
= ~40% of Cherokee Power Plant total water consumed
Key Takeaways

• We are moving in the right direction to use resources efficiently in water and energy sectors
• Water reuse can play an important role
• Water reuse – potable and non-potable – is increasing attractive
  • In part due to costs - including energy
  • Less energy intensive than many new supply options
  • Additional opportunities to control energy intensity (efficient pumps, plant design, treating so is fit for purpose…)
• Fresh water inputs to the energy sector are decreasing
  • As power plants switch to renewables, more efficient technologies, use reclaimed water where practical
  • As oil and gas operators increase use of water recycling and creative water agreements
Thank You

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