Saving Water
Tips and Tools for Integrating Water Conservation and Efficiency in Land Use Policies

APA Colorado 2019
The Big Picture

Why Should Planners Care?
“Whiskey is for drinking; water is for fighting over.”

A mis-attributed quote to Mark Twain
...instead of fighting...

...As planners our job is to best analyze and best prepare our communities to foster stewardship and collaboration across sectors, to serve future generations and their needs.
Water Supply & Importance of ET

- Less than 0.01% of Earth’s Water is in surface lakes, swamps and rivers.
- Precipitation = Streamflow + ET + Change in Storage
Global Climate Change is Causing Temperatures to Increase
Understanding Climate Change effects on ET (H2O Cycle)

- Hotter Temperatures creates more evaporation, less transpiration (overall higher ET loss)
- Less precipitation as snow = Less water storage
- Lower soil moisture potentially leading to mega droughts
- Land management is a key element of fostering resiliency
Change in precipitation patterns will challenge the reliability of water supplies.
Soil Moisture

- Regulates the exchange of water, energy, and carbon between the land surface and the atmosphere,
- Drives the production of runoff, & recharge of groundwater aquifers.
- Soil moisture is projected to decline with higher temperatures
- Especially in the Great Plains, Southwest, and Southeast
Water Stress Ratings

US Current 2019

Projected 2040-2061
Colorado River Water

The Colorado River:

• **Provides drinking water for one in ten Americans,**

• **Nourishes cities including Las Vegas, Los Angeles, Denver, and Phoenix, and**

• **Lower half of the river waters nearly 90 percent of the nation’s winter vegetables.**
Prior Appropriation

- The basis of the right is beneficial use.
- The right is stated in terms of a definite quantity, nature of use and time of use.
- The right may be terminated by abandonment or forfeiture.
- The priority date is the date on which beneficial use began.
- The right is transferable.
- Land ownership adjacent to a stream is not a requirement to obtain a water right.
- Senior appropriators’ rights must be fully satisfied before junior appropriators’ rights are satisfied.
Colorado River’s Over-Allocation Problems

- The root of over-allocation can be traced to the 1922 Colorado River Compact.
- Early 1900s were an especially wet period, with more snow and rainfall than normal.
- No one at the time understood that the water allocations were based on bad data—
- The result is that more water is promised on paper than flows annually in the river, by over one million acre-feet.
Colorado River Compact

- Compact divides the river basin Upper and Lower Basins
  - The states within each basin were required to divide their 7,500,000-acre (30,000 km²) foot per year (289 m³/s) share allotment among themselves.
- Upper Basin states required not to deplete the flow of the river below 7,500,000 acre feet (9.3 km³)
- Specific annual allotments in the Upper Basin were established by the Upper Colorado River Basin Compact of 1948
- Lower Basin current specific annual allotments were established in 1928 as part of the Boulder Canyon Project
The Plumbing of the Colorado River Basin
Western Water Supply Issues:

- Growing populations, increase water demands
- Climate Change effects on precipitation & temperature, increase the likelihood of water shortages & competition for water
- Transferring appropriated agricultural water to municipalities for growth,
- Protection of stressed ecological systems,
- Over-adjudication of water rights
- Hydro-electric power generation,
Colorado’s Projected Water Supply & Demand Gaps
Colorado’s Trans-Mountain Diversions

- The demand for water has become so great that local supplies have been augmented by water imported from hundreds of miles away.
# State Water Plan Goals

<table>
<thead>
<tr>
<th>CLOSING</th>
<th>PLANNING</th>
<th>INTEGRATING</th>
<th>SUSTAINING</th>
<th>PROTECTING</th>
<th>IMPROVING</th>
</tr>
</thead>
</table>
Opportunities for Addressing Climate Change & Colorado Water Supply

Actions We Can Take to Meet Our Water Needs in the Colorado River Basin

Five solutions that meet, and exceed, the expected 3.8 million acre-foot growth in water demand by 2060

- 200,000 Acre-feet
  - Energy Efficiency
- 1.2 Million Acre-feet
  - Municipal Reuse
- 1 Million Acre-feet
  - Innovative Water Opportunities
- 1 Million Acre-feet
  - Agricultural Efficiency & Water Banking
- Saves 4.4 Million Acre-feet

*One Acre-foot is about how much water ten people use in a year.

Created by Western Resource Advocates and GroundFloor Media
Benefits of Demand Management

- **Improve**
  - Improve water use productivity and efficiency.

- **Reduce**
  - Reduce capital investments in large-scale infrastructure projects.

- **Improve**
  - Improve the equity of water allocation and charges.

- **Assist in**
  - Assist in the provision of the basic water needs for all sectors.

- **Reduce**
  - Reduce conflict.

- **Manage**
  - Manage water more sustainably.
Colorado Headwaters, Leading By Example
Our headwaters region
DEFINING CHARACTERISTICS

1. Water-dependent economies (recreation-tourism, agriculture, and resource extraction)

2. Water quality and quantity impacted by transmountain diversions
DEFINING CHARACTERISTICS

3. Local governments active in water quality and quantity protection

4. Future uncertainties around climate change and growth
<table>
<thead>
<tr>
<th>QQ REGIONAL GROWTH</th>
<th>2010</th>
<th>Forecast: 2050</th>
<th>Percent increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region 12 (NWCCOG)</td>
<td>113,496</td>
<td>198,180</td>
<td>42%</td>
</tr>
<tr>
<td>Eagle County</td>
<td>52,057</td>
<td>85,838</td>
<td>46%</td>
</tr>
<tr>
<td>Summit County</td>
<td>16,277</td>
<td>23,797</td>
<td>40%</td>
</tr>
<tr>
<td>Garfield County (Carbondale only QQ member)</td>
<td>56,153</td>
<td>105,711</td>
<td>46%</td>
</tr>
<tr>
<td>Routt County (Steamboat Springs only QQ member)</td>
<td>23,451</td>
<td>45,998</td>
<td>49%</td>
</tr>
</tbody>
</table>

“Every community can do better on water conservation and efficiency via locally determined measures, such as, but not limited to, reinvestment in aging infrastructure, community education, enhanced building codes, and water-sensitive land-use planning.”

Guiding statement for county commissioners Boulder County, City and County of Denver, City and County of Broomfield, Eagle County, Grand County, Pitkin County and Summit County, Comments on the Colorado Water Plan (March 5 - May 1, 2015), Item No. 67. May 1, 2015.
QQ Water Saving Standards Project

- Policy Scan and Code Review
- Best Practices Research
- Model Codes and Guidance
Having A Vision

The Role of the Comprehensive Plan
Importance of Comprehensive Plans for Linking Water Savings with Land Use

Communities that Include Water Management in Future Planning are better equipped to tackle Water Efficient Land Use.
State statutes require:

“The general location and extent of an adequate and suitable supply of water.”

- If the master plan includes a water supply element, the planning commission shall consult with the entities that supply water for use within the [“municipality” or “county or region”] to ensure coordination on water supply and facility planning, and the water supply element shall identify water supplies and facilities sufficient to meet the needs of the public and private infrastructure reasonably anticipated or identified in the planning process.
QQ Comp /Master Plan Assessment

Establish if water is present in current comprehensive plans
Understand opportunity for inclusion of water in comp plan updates
## COMPREHENSIVE PLAN ASSESSMENT OF CONTENT

<table>
<thead>
<tr>
<th></th>
<th><strong>1</strong></th>
<th><strong>2</strong></th>
<th><strong>3</strong></th>
<th><strong>4</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Supply</strong></td>
<td>Does not provide a summary of water supply.</td>
<td>Includes only a summary of the total AF, not broken down by source.</td>
<td>Includes a total summary of water supply, broken down by source: total ground and total surface.</td>
<td>Includes a summary of water supply by each source and total water available per source.</td>
</tr>
<tr>
<td><strong>Water Use Per capita</strong></td>
<td>Does not provide water use per capita.</td>
<td>Includes water use per capita but does not provide how it has changed over time.</td>
<td>Includes water use per capita and provides how it has changed over time.</td>
<td>Includes water use per capita, provides how it has changed over time, and explains why it changed.</td>
</tr>
<tr>
<td><strong>Water Demand By SECTOR</strong></td>
<td>Does not provide a summary of total water demand.</td>
<td>Includes a summary of total water demand, but only as a total number in AF.</td>
<td>Includes a summary of total water demand by revenue and non-revenue in AF.</td>
<td>Provides a summary of total water demand for each sector (e.g., R, C, L, Ag, NR).</td>
</tr>
<tr>
<td><strong>Water TRENDS</strong></td>
<td>Does not summarize water demand trends.</td>
<td>Provides a summary of total water demand over time, but not broken down by use. (metric: can be AF, gpcd, or per acre)</td>
<td>Provides a summary of total water demand over time by revenue and non-revenue.</td>
<td>Provides a summary of total water demand over time by each sector (e.g., R, C, L, Ag, NR).</td>
</tr>
<tr>
<td><strong>Water Budget</strong></td>
<td>Does not include a summary of the water supply and demand balance.</td>
<td>Explains total water rights in AF but does not include summary of water supply/demand balance.</td>
<td>Explains total water rights in AF (supply) and current demand (AF) but does not include a summary balance.</td>
<td>Includes a complete water supply and demand balance. May also include plans to address current or projected imbalance.</td>
</tr>
<tr>
<td><strong>Water Infrastructure</strong></td>
<td>Does not provide a summary of water treatment, distribution, and storage infrastructure.</td>
<td>Includes a summary of total capacity of water infrastructure, but not of gaps.</td>
<td>Includes a summary of total capacity of water infrastructure and gaps, but not plans for upgrades.</td>
<td>Includes a summary of total capacity of water infrastructure, gaps, and plans for upgrades.</td>
</tr>
</tbody>
</table>

**QQ Comprehensive Plan Review**
67% of QQ Communities Mention Water in Comprehensive Plans
Integration of Water into Comp Plan: Two Methods

**Dedicated Chapter on Water**
- All elements of water are included in a one stop shop
  - Supply,
  - demand,
  - infrastructure,
  - watershed health,
  - land use zoning,
  - landscape requirements, etc.

**Add Water Element within Existing Chapters/Format**
- "Preserve creeks, wetlands, and other water features in their natural state. Use these features for water quality enhancement, stormwater management, open space and recreational purposes when appropriate. Use vegetative buffers to protect wetlands and other water features from development encroachment." (Aurora 2009 Plan, p.153)
What to Include?

Water Management

- Where does our water come from? How much do we have?
- How is it used? Which sectors and land use types use the most? The least?
- Is our water infrastructure sufficient and reliable?
What to Include?

Population Growth & Development

- What is our population growth?
  - Projected Population Change

- What are our development expectations?
  - Projected Development & Land Use Change

- Do current water supplies line up with these projections?
  - Forecasting Water Supply/Demand
  - Water-Related Hazard Mitigation
  - Water Supply Augmentation
  - Water Equity
What to Include?

Water Efficient Land Use

- Are we collaborating on water?
- Does our development process consider water?
- How does our urban form impact our water use?
- Is water used efficiently indoors?
- Is water used efficiently outdoors?
- How does land use impact our watersheds?
- Water for Ecosystem Functions
- Water Efficient Urban Form and Zoning Regulations
- Building/Plumbing Policies
- Landscaping/Irrigation Policies
- Stormwater Management
- Water in Development Processes and Evaluation
- "Show Me the Water" Requirements
- Collaboration for Land/Water
Creating a Water Efficient FLUP and FLUM

**SCENARIO 3**

**WORKING DRAFT:** 7/3/18

**PUTTING IT ALL TOGETHER**

How do the scenarios compare?

The metrics below illustrate how well each scenario would meet our future needs for housing, jobs, and transportation. The metrics also show how much the proposed transportation improvements could cost and how much progress we could make toward achieving community goals for climate action and access to amenities and services.

- **Diversity of Housing Types**
- **Average Density in Mixed-Use Areas**
- **Character of Mixed-Use Development**
- **New Job and New Housing Unit Capacity**
- **Jobs/Housing Balance**
- **Household Water Consumption**

**SCENARIO 1**

- Diversity of Housing Types: 8.3
- Average Density in Mixed-Use Areas: 8.5
- Character of Mixed-Use Development: 8.5
- New Job and New Housing Unit Capacity: 1.8
- Jobs/Housing Balance: 1.23
- Household Water Consumption: 50%

**SCENARIO 2**

- Diversity of Housing Types: 8.9
- Average Density in Mixed-Use Areas: 12.0
- Character of Mixed-Use Development: 9.5
- New Job and New Housing Unit Capacity: 12.5
- Jobs/Housing Balance: 1.26
- Household Water Consumption: 25%

**SCENARIO 3**

- Diversity of Housing Types: 14.0
- Average Density in Mixed-Use Areas: 18.9
- Character of Mixed-Use Development: 14.0
- New Job and New Housing Unit Capacity: 18.5
- Jobs/Housing Balance: 1.07
- Household Water Consumption: 10%
Water Efficient Codes

Integrating Water & Land Use
Why Land Use Codes Matter.

1. **SMALLER LOT SINGLE FAMILY DEVELOPMENT**
   Studies found 10 to 60% water savings with increased density of single-family residences.

2. **MULTI FAMILY DEVELOPMENT**
   Multifamily units consume 35 to 50% less water than single family detached homes. If a high-density development requires cooling towers, the savings may decrease or be eliminated.

3. **EFFICIENT LANDSCAPING AND IRRIGATION**
   Landscape code requirements can reduce outdoor water use by 35-50%.

4. **INDOOR WATER USE**
   Water efficient fixtures and appliances, building and plumbing codes can have significant savings.
Growing Water Smart Toolboxes.
**Planning & Policy Making**
- Link new development to water supply plans.
  - Water Supply Standards
  - Water conservation plans

**During Development Review**
- Determines what water conservation & efficiency requirements are applied to buildings.
  - Building & Plumbing Codes

**At Building & Construction**
- Incentivizes property owner & renters to reduce water consumption.
  - Education & Programs
  - Rate Structuring

**Post-Occupancy**
- Establish goals and objectives linking water and land use.
  - Comprehensive Plans
  - Water Plans
  - CIP

- Determines what water conservation & efficiency requirements are applied to site design.
  - Zoning & Subdivision Regulations
  - Annexation Policies
  - Planned Developments
  - Development Agreements

**Water – Land Use Intervention Points**
<table>
<thead>
<tr>
<th>Type of Standard</th>
<th>Strength of Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescriptive</td>
<td>Voluntary</td>
</tr>
<tr>
<td>Suggestive</td>
<td>Landscape Standards</td>
</tr>
<tr>
<td></td>
<td>Voluntary</td>
</tr>
<tr>
<td></td>
<td>Water Use Restrictions</td>
</tr>
<tr>
<td></td>
<td>Water Conservation Ordinance</td>
</tr>
<tr>
<td></td>
<td>Mandatory</td>
</tr>
<tr>
<td></td>
<td>Strength of Standard</td>
</tr>
</tbody>
</table>
1. ENSURE ADEQUATE WATER SUPPLY (§29-20-305)

1. Identify the Water Source
2. Provide Proof of Water Rights
3. Provide a Methodology for New Development Water Demand Estimate
4. Specify Water Supply Adequacy Standards for Quantity and Quality
5. Specify Water System, Distribution, and Connection Standards
6. Provide Standards for When Proof Required in Approval Process

Additionally, this section establishes a maximum allowable outdoor water use limit for the development to insure this development does not exceed its outdoor water allocation as established by the Water Dedication Requirement and Water Rights Dedication Policy of the Eagle River Water and Sanitation District as well as the Water Service Agreement between Fox Hollow and the Upper Eagle Regional Water Authority (Authority). The maximum limit is enforceable by the Authority and the County. Specifically, Fox Hollow will not exceed 413,831 gallons of outdoor water use in any year after the second growing season. The following monthly budget is based upon a total irrigated area of 12,820 SF of buffalo grass lawn and 20,569 SF of native grasses and the plant material list dated August 27, 2018 and attached as an appendix:

<table>
<thead>
<tr>
<th>Tract A1.</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Gallons</strong></td>
<td>58653</td>
<td>94497</td>
<td>107531</td>
<td>84721</td>
<td>58653</td>
<td>9776</td>
<td>413831</td>
</tr>
</tbody>
</table>
2. PROMOTE COMPACT FORM
Best Practices

Decrease water waste by improving site-specific water efficiency through irrigation system design, best practices and technology.

Reduce the amount of water needed for irrigation by enhancing soil conditions, appropriate plant types and landscape design.

Use water budgets to establish the maximum amount of water permitted for landscapes.
Aspen Water Efficient Landscape Standards

WATER EFFICIENT LANDSCAPE WORKSHEET -- WATER BUDGET ANALYSIS

Note: Project Applicant must complete this worksheet as it is a required element of the Landscape & Irrigation Documentation Package.

<table>
<thead>
<tr>
<th>Address</th>
<th>Contact Info</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CALCULATING GALLONS OF WATER NEEDED BY PLANT CATEGORY AND IRRIGATION TYPE

The specific irrigation water needs of each hydrozone in the design should be determined using the following formula and factors:

Irrigation Water Budget = [(ET0 x Plant Factor) - Re] x Irrigated Area / Irrigation Efficiency x 0.625

Where:
ET0 = Reference Evapotranspiration in inches/season (May - Sept.)
Re = Effective Precipitation in inches/season (May - Sept.)

<table>
<thead>
<tr>
<th>Hydrozone Efficiency</th>
<th>Water Use Category</th>
<th>Plant Factor</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool Season Turf</td>
<td>0.90</td>
<td>VM</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>0.80</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>0.65</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>0.40</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Very Low</td>
<td>0.25</td>
<td>VL</td>
<td></td>
</tr>
</tbody>
</table>

Effective Precipitation

<table>
<thead>
<tr>
<th>Effective Precipitation</th>
<th>6.8 inches/year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.2 gallons/square foot</td>
</tr>
</tbody>
</table>

Reference Evapotranspiration

<table>
<thead>
<tr>
<th>Reference Evapotranspiration</th>
<th>27.4 inches/year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.1 gallons/square foot</td>
</tr>
</tbody>
</table>

Directions for Use
Fill in these blue sections below. Some columns have drop down menus to assist you in filling out. The formulas will calculate the site average annual water use. Once completed you should insert it into the design set.

HYDROZONE WATER BUDGET CALCULATION

Complete the hydrozone table for each hydrozone. Use as many rows as necessary to provide the square footage of landscape are per hydrozone.

<table>
<thead>
<tr>
<th>Hydrozone</th>
<th>Plant Water Use Type(s)</th>
<th>Plant Factor</th>
<th>Irrigation Method</th>
<th>Irrigation Efficiency</th>
<th>Hydrozone Area</th>
<th>Plant Water Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>L</td>
<td>0.40</td>
<td>Drip</td>
<td>0.90</td>
<td>2000</td>
<td>5769</td>
</tr>
<tr>
<td>Zone 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>#DIV/0!</td>
</tr>
<tr>
<td>Zone 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>#DIV/0!</td>
</tr>
</tbody>
</table>
Carbondale Parking Lot Landscape Standard

Rain Gardens
# Fountain Water Efficiency Tap Fee Incentive

<table>
<thead>
<tr>
<th>Lot Size in Square Feet</th>
<th>Standard Water Acquisition Fee</th>
<th>Water Acquisition Fee with Conservation Incentive: 50% or Less Irrigated Area</th>
<th>Water Acquisition Fee with Conservation Incentive: 30% or Less Irrigated Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 9,000</td>
<td>$4,875</td>
<td>$2,438</td>
<td>$1,024</td>
</tr>
<tr>
<td>9,001 – 13,000</td>
<td>$5,688</td>
<td>$2,844</td>
<td>$1,706</td>
</tr>
<tr>
<td>&gt;13,001</td>
<td>$6,500</td>
<td>$3,250</td>
<td>$1,950</td>
</tr>
</tbody>
</table>
4. WATER EFFICIENT INDOOR FIXTURES & APPLIANCES

Indoor Water Use in the United States: 1999 and 2016

Toilets were and remain the largest indoor use of water for households, though they have seen a large jump in efficiency. The average length of a shower (7.8 minutes) has remained unchanged, while average flow rate decreased 0.7 gallons per minute. Clothes washers have seen the biggest reduction in water use of any category. Efficiency improvements have decreased average gallons per load from 41 to 31.

Colorado WaterSense Law (products sold)

Headwaters Region

Need to Update Requirements to Match Evolution of State Standards

EAGLE COUNTY ECOBUILD

Since 2006
Mandatory Point System

<table>
<thead>
<tr>
<th>RESIDENTIAL</th>
<th>COMMERCIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point Options</td>
<td>Point Options</td>
</tr>
<tr>
<td>• Reduce irrigated turf, use drip where appropriate</td>
<td>• Submeters for buildings over 50,000 sq feet</td>
</tr>
<tr>
<td>• Water efficient landscaping</td>
<td>• Efficient toilets</td>
</tr>
<tr>
<td>• Water efficient appliances and fixtures</td>
<td>• Efficient urinals</td>
</tr>
</tbody>
</table>

Mandatory Point System

EAGLE COUNTY ECOBUILD

Since 2006
Mandatory Point System

<table>
<thead>
<tr>
<th>RESIDENTIAL</th>
<th>COMMERCIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point Options</td>
<td>Point Options</td>
</tr>
<tr>
<td>• Reduce irrigated turf, use drip where appropriate</td>
<td>• Submeters for buildings over 50,000 sq feet</td>
</tr>
<tr>
<td>• Water efficient landscaping</td>
<td>• Efficient toilets</td>
</tr>
<tr>
<td>• Water efficient appliances and fixtures</td>
<td>• Efficient urinals</td>
</tr>
<tr>
<td>• Submeters for irrigation</td>
<td>• Efficient irrigation design</td>
</tr>
</tbody>
</table>
Indoor Efficiency

How to Maximize Indoor Water Efficiency
What Is Your Community’s Water Vision?

It is possible to grow without increasing water demand by utilizing the available water efficiency toolbox.
1. Is linking water and land use important in your community?

2. What is already happening/not happening?

3. What can you do as a planner in helping connect land and water in your community? Where can you start?

So, What About Your Community?
Thank You

Torie Jarvis
qqwater@nwccog.org
nwccog.org/programs/water-qualityquantity-committee

Gretel Follingstad
www.terraplanning.com
gretelfollingstad@gmail.com
(505) 603-5402

Marjo Curgus
(505) 699-8532
delcorazonconsulting@gmail.com
www.delcorazonconsulting.com