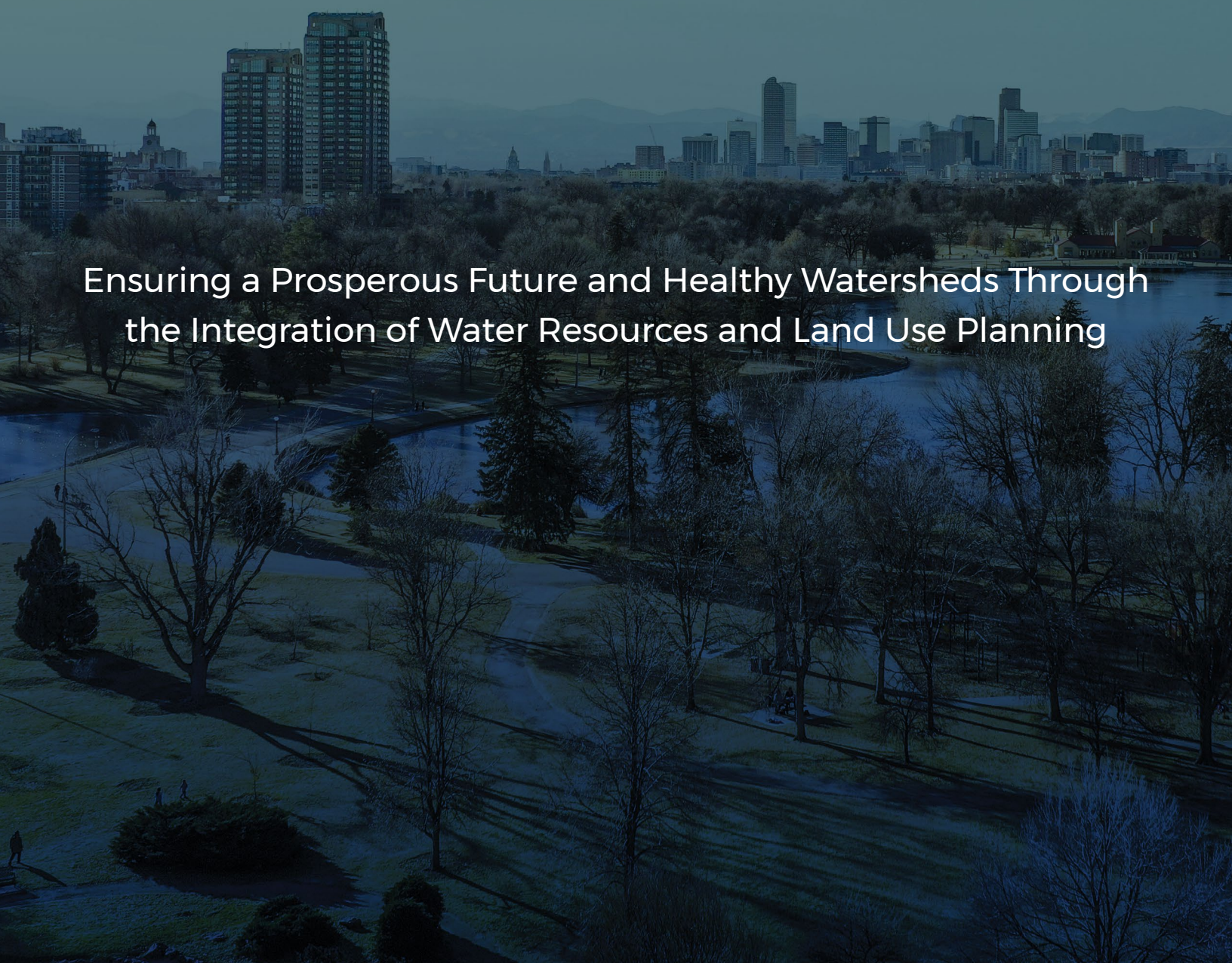
2023

GROWING WATER SMART

THE WATER-LAND USE GUIDEBOOK

COLORADO



Ensuring a Prosperous Future and Healthy Watersheds Through the Integration of Water Resources and Land Use Planning

ACKNOWLEDGEMENTS

CONTRIBUTORS

MARJO CURGUS, DEL CORAZÓN CONSULTING
WAVERLY KLAW, SONORAN INSTITUTE
MERYL CORBIN, SONORAN INSTITUTE
CARREE MICHEL, DESIGN

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ABOUT GROWING WATER SMART

Growing Water Smart, a program of the Sonoran Institute and the Babbitt Center for Land and Water Policy, a Center of the Lincoln Institute of Land Policy, introduces communities to the full range of communications, public engagement, planning, and policy implementation tools to realize their watershed health and community resiliency goals. The Growing Water Smart workshop empowers local government leaders to adopt land use plans and policies that support water resilience. Interested individuals can learn more at www.growingwatersmart.org.

SONORAN INSTITUTE

ABOUT SONORAN INSTITUTE

The Sonoran Institute's mission is to connect people and communities with the natural resources that nourish and sustain them. We envision a Colorado River Basin where rivers flow, landscapes are healthy, and all communities thrive.

BABBITT CENTER FOR LAND AND WATER POLICY
A Center of the Lincoln Institute of Land Policy

ABOUT THE BABBITT CENTER FOR LAND AND WATER POLICY

The Babbitt Center for Land and Water Policy, a center of the Lincoln Institute of Land Policy, seeks to advance the integration of land and water management to meet the current and future water needs of Colorado River Basin communities, economies, and the environment. The Babbitt Center develops tools and best practices to guide decisions through research, training, and partnerships for sustainable management of land and water resources in the Basin and beyond.

Sonoran Institute
growingwatersmart@sonoraninstitute.org

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Cover Photo Credit: Cassie Gallegos

INTRODUCTION

This guidebook serves as a compendium to the Growing Water Smart training and assistance program. It provides resources related to collaborative and holistic water resource management and land use planning so that communities can shift their focus from supply- to demand-side management, from growth to an emphasis on holistic watershed health, and from siloed governance to an integrated water and land use planning paradigm.

THE LIMITATIONS OF SUPPLY-SIDE WATER RESOURCE MANAGEMENT

By 2050, Colorado's population is predicted to almost double in size, putting additional pressure on our State's already limited water resources. Nearly 90% of the current population lives in Front Range communities, while 80% of the State's water falls on the western slope.[1] This disparity will be exacerbated by projected population growth. Groundwater use in some areas already exceeds what is replenished, resulting in declining water levels, drying wells, conflicts between neighbors, land subsidence, and impacts on springs and streams. Even in communities with access to renewable resources, water users are experiencing increased variability in water supply each year.

A growing population combined with water supply constraints escalates the costs of operating local utilities and the cost of acquiring new sources. It may also necessitate enhanced and expanded infrastructure. Water resource managers and water providers have often looked to ***supply-side management*** to meet their growing demand by investing in water acquisition, treatment, storage and distribution projects. However, increasing water supply, particularly for groundwater-dependent communities with few available alternative sources, comes at a significant cost in terms of money, time, and resources. In addition, cities nearing build-out may not have land available to accommodate the necessary infrastructure.

[1] Colorado Water Plan, 2023, pg. 28

SHIFTING OUR FOCUS FROM SUPPLY- TO DEMAND-SIDE MANAGEMENT

Instead of making costly investments to increase water supply, communities increasingly are reducing demand for water by using supplies more efficiently.

Demand-side management generally includes:

- **Water Conservation:** reducing water consumption by encouraging water users to modify their behaviors.
- **Water Efficiency:** using building and site design or technology that uses less water.
- **Water Reuse:** recycling stormwater, graywater, and wastewater to replace or augment the water supply.

One impactful strategy in municipal water demand management is integrating water conservation, efficiency, and reuse into land use planning. In 2015, Colorado's first Water Plan emphasized the importance of this approach by establishing the goal that "by 2025, 75% of Coloradans will live in communities that have integrated water-saving measures into land use planning." In the 2023 Colorado Water Plan update, the Colorado Water Conservation Board established Vibrant Communities as one of four action areas through which to achieve a water-resilient state.

Communities throughout the West have found that by increasing development density, utilizing technological efficiencies, and enacting aggressive conservation programs, they have been able to continue to grow without acquiring new water supplies. Water-smart land use planning can reduce the negative financial impacts of increased water demand through efficiency and conservation measures implemented prior to, during, and after construction.

The demand management approach to water resources is good for the triple bottom line of financial, social, and environmental outcomes. It increases the cost-benefit ratio of capital investments by using the same amount of water and infrastructure to serve more people per dollar spent, benefits the environment by balancing ecosystem and human needs, and ensures a more sustainable future for our communities through a more resilient and long-lasting water supply.

Holistic water management is essential for creating vibrant communities that balance water supply and demand needs to create a sustainable urban landscape. Colorado communities need resilient water supplies, water conscious and attractive urban landscapes, planning that integrates land use and water solutions, and residents who understand the importance of water to their lives and economy. An integrated One Water ethic is necessary to create the transformative change needed to meet the moment and the future.[2]

SHIFTING OUR FOCUS TO WATERSHED HEALTH

Every community lives within a watershed—a land area that channels rainfall and snowmelt to creeks, streams, rivers, and underground aquifers.[3]

Many of Colorado's communities were founded along rivers or rely on them for recreational and economic activities. The amount and quality of water in rivers,

[2] Colorado Water Plan, 2023, pg. 9

[3] USGS, Watersheds and Drainage Basins

streams, and groundwater aquifers all depend on activities in the land area above and upstream from those sources. Watersheds are delicate ecosystems, and a tension exists between preserving the natural environment and developing land for residential, commercial, or industrial uses. While degradation of land within a watershed comes with societal and environmental costs, careful management yields significant benefits. Holistically managed watersheds can capture and store water supplies; reduce erosion and channel incision; increase infiltration into regional aquifers; reduce water treatment costs; and support habitat, biodiversity, recreation, and aesthetic values. Healthy watersheds and resilient natural systems can also help communities cope with increasingly extreme weather events such as droughts, high temperatures, wildfires, and floods.

Fortunately, many measures can be taken to maintain and improve watershed health through land use plans and policies. Development patterns, erosion control measures, vegetation management, habitat protection, floodplain regulations, and stormwater management all influence the health of the watershed and impact water quality and stream flows.

SHIFTING OUR FOCUS TO INTEGRATED WATER RESOURCE MANAGEMENT

The Earth's water cycle is a closed loop that circulates water between the oceans, the atmosphere, and the land via precipitation, drainage, and evaporation.[4]

Just as the natural environment treats water as a cycle, it is important that communities view their water supply, including wastewater and stormwater, as interconnected. Integrated Water Resource Management, also known as One Water, is such an approach. By coordinating the development and management of water, land, and related resources, Integrated Water Resource Management maximizes economic and social benefits while minimizing impacts on the environment. A key step in this process is to change institutional structures to strengthen the coordination and collaboration between water supply and wastewater managers, flood control districts, land use planners, economic development managers, and other key officials.

WATER AND LAND USE INTEGRATION OPPORTUNITIES

Colorado communities are charged with accommodating growing populations and supporting economic development and quality of life while managing increasingly variable and scarce water supplies, aging infrastructure, and the impacts of land and habitat degradation.

Regionally shared risks of extreme weather and wildfires make the interconnectedness of land and water particularly apparent. Across Colorado, communities have experienced record heat, devastating wildfires, dry soils, ongoing drought, and damaging floods, alongside the health and economic impacts associated with the COVID-19 pandemic, which in some places were exacerbated by limited access to safe and reliable water. These conditions have highlighted the urgency to act now to build community, economic, and environmental resilience across regions and watersheds.

[4] USGS, the Water Cycle

At the community level, each planning and regulatory mechanism guiding how and where a community develops provides an opportunity to strengthen the nexus between water and land use. Intervention points are described in Table 1. Determining where to intervene will depend on the community's political motivation and capacity, the water demand management initiatives that have been implemented to date, and the water-saving goals.

Photo by Zach Lucero

TABLE 1: OPPORTUNITIES FOR INTEGRATED WATER AND LAND USE

POINT OF INTERVENTION	TOOL	PURPOSE
WATER-SMART PLANNING	• Visioning • Information Sharing & Alignment • Public Engagement & Education • Regional Partnerships • Comprehensive & Master Plans • Water Efficiency Plans • Local & Regional Water Quality Plans • Capital Improvement Plans • Hazard Mitigation, Response, & Recovery Plans • One Water Plans	Evaluates local water supplies, current and future demands, and related community and economic values. Establishes goals and objectives for managing the intersection of natural resources and the built environment. Aligns and implements goals across multiple community and regional plans.
ADEQUATE WATER SUPPLY STANDARDS FOR DEVELOPMENT	• Adequate Water Supply Rules • Water Budgeting • Water Allocation Policies • Water Demand Offset Programs • Annexation Policies	Links new development to water supply planning. Determines the requirements applied to new development for water resource management, conservation, and efficiency.
WATER-SMART LAND USE POLICIES & PROCESSES	• Compact Development • Water Efficient Landscapes • Water Smart Buildings • Development Review	Directs how land is developed and the amount of water the development will require. Incentivizes or requires water conservation, efficiency, and reuse.
HEALTHY & RESILIENT WATERSHEDS	• Watershed Protection • Green Infrastructure & Low Impact Development	Protects regional water quality, ecosystem services, and other natural processes. Reduces flooding and the need for traditional stormwater infrastructure.
EFFICIENT WATER DEMAND PROGRAMS	• Conservation Rate Structuring • Conservation Rebate Programs • Consumer Education Messaging	Empowers and incentivizes occupants to reduce water consumption. Links community-wide programs to water supply planning.

THE LAND USE–WATER NEXUS RESOURCE GUIDE

This resource guide is intended to help your community identify the most appropriate intervention points related directly to land use that will help you achieve your community's water resource management goals. It is divided into five sections.

Each Section Includes:

- **A Case Statement** justifying each approach.
- **Toolboxes and Tools** describing the specific policy or management actions for achieving water conservation and efficiency outcomes.
- **Approaches** for implementing the tools.
- **Case Studies** demonstrating how other communities have implemented one or more of the tools to integrate their water and land use planning efforts.

SECTION 1:

WATER-SMART PLANNING

Summarizes the opportunities provided by integrating water and land use during planning processes.

SECTION 2:

ADEQUATE WATER SUPPLY FOR DEVELOPMENT

Provides a review of the State of Colorado's requirement for new developments to have an adequate and sustainable water supply.

SECTION 3:

WATER-SMART LAND USE POLICIES & PROCESSES

Introduces regulatory principles, policies, and procedures that can make a community's lots, structures, and development patterns water-smart.

SECTION 4:

HEALTHY & RESILIENT WATERSHEDS

Describes approaches for protecting water quality and ecosystem services while also reducing flooding and the need for traditional stormwater infrastructure.

SECTION 5:

EFFICIENT WATER DEMAND PROGRAMS

Summarizes additional programs and options for managing existing community water demands.

The following additional resources are available at resilientwest.org/2023/co-appendices

- An electronic version of this Guidebook with **hyperlinks to websites** that correspond to green text throughout this document.
- A **resource list** of additional reports, tools, and policy examples.
- A summary of relevant **funding and assistance** from our partners, the state, and federal agencies.

SECTION 1

WATER-SMART PLANNING

For a sustainable future, communities must create guiding plans that integrate land use planning with water availability forecasting and water resiliency goals.

CASE STATEMENT

Traditionally, water planning and land use planning processes have been conducted in separate departments or agencies. Land use planners have focused on the amount and types of growth that may take place in their communities, while water resource managers have focused on ensuring adequate water availability. Comprehensive planning, water planning, capital improvement planning, and climate resilience planning are all interrelated, however, and integrating them requires holistic thinking and cross-departmental collaboration.

Done successfully, an integrated water resource and land use management approach can ensure the following:

A community's vision for the future considers the interrelated impacts of water and growth.

The community's vision and goals for sustainability and resilience are expressed and aligned across plans for water resource management, community health, capital improvement, and economic development.

Development occurs in a way that protects the watershed, including ecological functions and the quality and quantity of water resources.

TOOLBOX: SETTING THE FOUNDATION FOR STRONG PLANS

Planning provides the roadmap for a community's policies, programs, and regulations. Processes such as visioning, information sharing and data alignment, public education and engagement, and regional partnerships serve as the foundation for creating scientifically sound, publicly understood, and supported community plans.

Photo by Colin Lloyd

Visioning & Exploratory Planning

A visioning process identifies what a community desires for its future and what approaches the community intends to take to realize its vision. Scenario planning can help a community clarify its values and create a clear vision for its future, most frequently through using visualization tools that illustrate alternative future scenarios. In this *normative approach* to long-range planning, models assist in decision-making by assessing the impact of different development patterns on indicators such as water demand, air quality, and vehicle trips.

Exploratory scenario planning applies a slightly different approach and is most effective when used to consider and develop responses to uncertainties. Rather than selecting a preferred scenario and developing a plan to achieve that specific vision, an exploratory approach envisions how a community may need to adapt and manage different outcomes for a variety of scenarios that are driven by forces which are often out of a community's control. Across the West, water and planning departments are using exploratory scenarios to think strategically about how to plan for water, growth, and climate change.

The Colorado Water Plan identifies nine high-impact drivers that influence Colorado's water future: 1) social/environmental values, 2) population/economic growth, 3) urban land use/urban growth patterns, 4) availability of water efficient technologies, 5) climate change/water supply availability, 6) level of regulatory oversight/constraint, 7) agricultural economics/water demand, 8) energy economics/water demand, and 9) municipal and industrial water demands.[5]

[5] Colorado Water Plan, 2023, pg. 19-21.

These drivers were incorporated into five planning scenarios (business as usual, weak economy, cooperative growth, adaptive innovation, and hot growth) that represent how Colorado's water future might look in 2050.

Information Sharing & Alignment

Land use and water departments often use different data sets and analysis methods in their decision-making processes, such as growth rates to inform future land use or water demand projections. Identifying the discrepancies and understanding the implications of different projection methods can help estimate the extent of uncertainty and error in results. Coordinating around these issues, sharing information, and looking for ways to align data sets and methods will promote consistency and mutual understanding across departments and lead to better decision-making.

Public Engagement & Education

Community members can support integrated water and land use. When invited to learn and participate in visioning and goal setting, the public can provide feedback and information on how climate change is impacting groundwater, water bodies, and agricultural outputs. Meanwhile, education or training programs for staff, elected officials, and public stakeholders strengthen understanding and support for strategies that incorporate water-saving measures into land use.

Regional Partnerships

Some goals are attainable within a single jurisdiction while others may require scaling collaboration outside your jurisdiction. Adding partners and coordinating across jurisdictions can expand resources and result in a larger impact. Regional committees and partnerships can provide an opportunity for cross-jurisdictional planning around shared water resources. They offer a way for county, municipal, water district staff, and stakeholders to collaboratively study local and regional issues, define desired future conditions, evaluate potential paths forward, and partner on implementation.

Measuring & Tracking Progress

Measuring and tracking the results of water and land use integration is vital to determining whether a community's vision and goals are being met. Growing Water Smart Metrics: Tracking the Integration of Water and Land Use Planning offers a set of indicators that can be assessed as a "scorecard" of progress or year-over-year to calculate trends that demonstrate achievement of water savings through land use planning. Ten "progress" metrics track considerations as to whether the community's land use plan integrates water efficiency and its water plan integrates land use strategies; conservation-oriented system development charges and pricing structures are being used; indoor and outdoor water efficiency measures are being utilized; and collaboration around development proposals is occurring. Fourteen "impact" metrics measure increasing or decreasing trends in water demand and use and trends in development patterns and land use.

Best Practices for Setting the Foundation for Strong Plans:

- Engage stakeholders early and often to ensure concerns are prioritized and addressed. This increases confidence in the final documents and buy-in during plan implementation.
- Employ Exploratory Scenario Planning techniques to thoroughly prepare for a variety of potential future conditions.
- Train elected officials on vision documents and how land use planning decisions align with the community's strategic vision.
- Partner with regional, state, and federal entities to develop and fund related regional plans and studies.
- Use visioning processes and scenario planning to assess future vulnerabilities and uncertainties affecting water resources.

Photo by Nathan Anderson

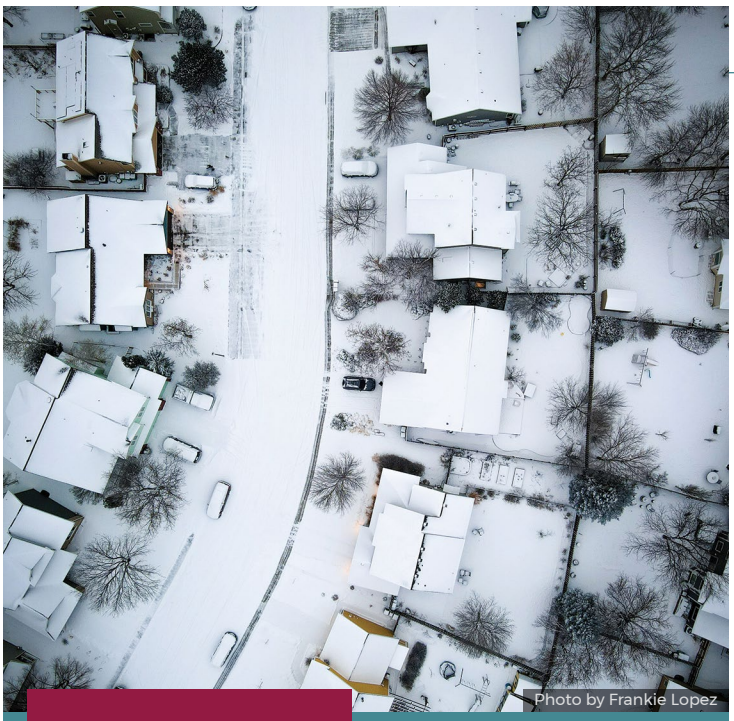


Photo by Frankie Lopez

CASE STUDY

WATER SMART COLLABORATION — FORT COLLINS, CO

The City of Fort Collins has made successive steps toward integrating water into the City's planning, policymaking, and development review processes.

With a current population of approximately 170,000, the northern Front Range city is expected to grow by 70,000 residents by 2040. The City manages its own utility with three additional water suppliers providing service within the Growth Management Area, resulting in inconsistent fees, policies, and conservation programs.

A key challenge for Fort Collins, and the region, is aligning practices, scaling efficiency, and acting together to ensure an affordable, sustainable water supply to meet future demand.

The City of Fort Collins and the North Front Range Metropolitan Planning Organization (NFRMPO) both participated in the Growing Water Smart program in 2017 and carried out a joint Growing Water Smart technical assistance project. Over two full-day workshops a group of stakeholders including the City of Fort Collins' Planning Deptepartment, Fort Collins Utilities, Fort Collins-Loveland Water District, East Larimer County Water District, the NFRMPO, and an observer from the City of Greeley came together to identify the greatest opportunities for cooperation on water resource management across agencies and service areas.

At the time, the City was in the process of updating its comprehensive plan using scenario planning to assess different development pattern options. Water demand was one of the sustainability indicators assessed under three different scenarios that explored different futures and their associated water reduction percentages based on the proposed development pattern. For example, the "no change/as is" scenario was predicted to result in a reduction in household water use of 2% overall by 2040, while a denser development pattern was predicted to result in a 14% water demand reduction overall. Each water provider was asked to assess how each future land use scenario would impact their organization, and a collective assessment followed. This exercise helped align growth areas with planned and existing infrastructure. Scenario planning informed the development and update of *City Plan*, the City's comprehensive plan that guides how the community will grow and travel from 2020-2040.

Fort Collins Utilities and City Planning staff desired to continue the integration of water conservation and efficiency goals into new development, and in 2021 applied to participate in the Water and Land Use Metrics pilot project. This project was led by the Sonoran Institute with funding support from CWCB and the Babbitt Center for Land and Water Policy and technical assistance provided by Brendle Group. The project intended to communicate and elevate water use as a project consideration before project design to allow developers an opportunity to adjust their plans in ways that reduce the development's overall water use and associated costs. Three metrics from the Growing Water Smart Metrics Guidebook were harnessed by the project team: Progress Metrics #9: Community planners and providers have regular coordination meetings and #10: Community routes development proposal to providers for review and comment; and Impact Metric #20: Water demand by land use type.

CASE STUDY, *CONT.*

To advance Metrics #9 and 10, technical assistance focused on identifying when water-related comments are provided in the development review process, and to what degree, and providing tools and resources to introduce water conservation and water supply considerations earlier to applicants. The assistance also explored common water supply and conservation-related questions that Planners receive from applicants and the public, and helped to align common responses.

To support Impact Metric #20, technical assistance developed a tool to estimate how much water a proposed development might use. The tool builds on Fort Collins Utilities' water supply requirement calculations and costs and can be used by the utility and planning department to support project design choices and decision-making that promotes development water conservation before development approval.

In addition to supporting these metrics, the work also supports Fort Collins Utilities' ongoing Water Efficiency Plan (WEP) update by implementing some of the best practices outlined by the State of Colorado requirement to integrate land use and water planning into WEPs.

TOOLBOX: PLANNING DOCUMENTS

Most community plans share some nexus with water. The following plans offer the greatest opportunity to acknowledge and address water-related concerns in relation to community development and growth.

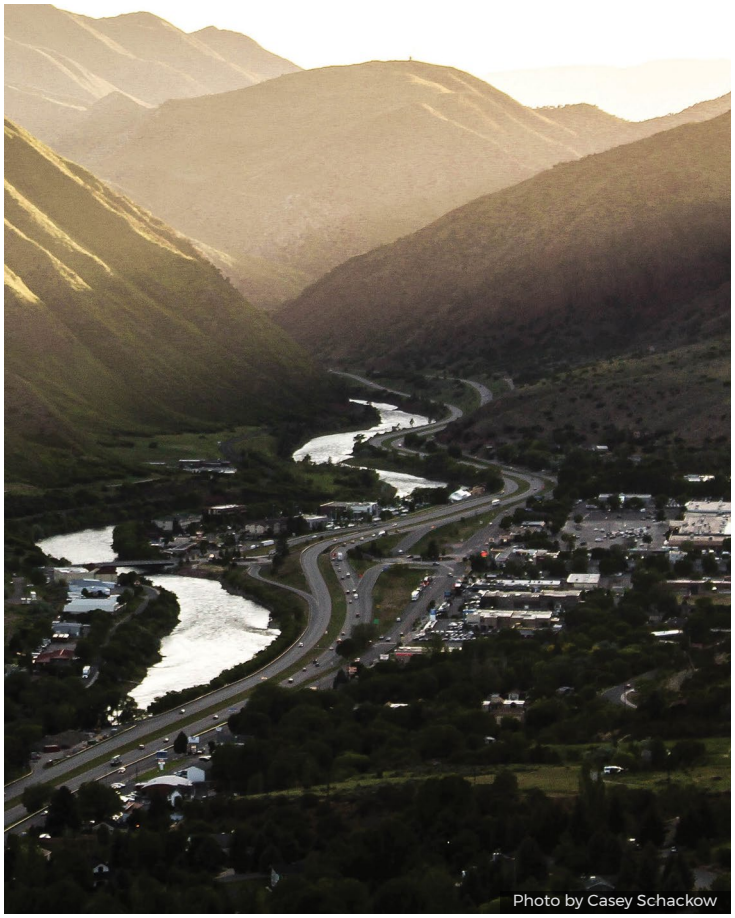


Photo by Casey Schackow

Comprehensive & General Plans

Comprehensive or general plans guide how a community will manage future land use and its implications for a wide variety of functions including transportation networks, parks and open space, natural resources, housing, economic development, and future infrastructure needs. One of the greatest values of a comprehensive planning process is that it provides a rare opportunity for a community-wide dialogue about the future.

By state statute, every municipality or county in Colorado is required to create a comprehensive or master plan. In Colorado, the State's comprehensive planning requirements for municipalities (C.R.S. § 31-23-206) and counties (C.R.S. § 30-28-106) allow for, but do not require a water element, or chapter, in the plan.[6] However, House Bill 20-1095 now requires that if a comprehensive or master plan addresses water supply, then it must also address water conservation.[7]

Implementation of the House Bill 20-1095 creates a powerful new tool for local governments in achieving water savings. Local governments can require adherence to the master goals as a condition of approval directly, particularly in situations where the land use code is inconsistent with the plan, or the code lacks specific direction for achieving plan intent. It should be noted that this complements the state's adequate water supply rules which grant local governments the ability to negotiate the inclusion of water demand management when approving a development's water supply.

[6] California, Arizona, and New Mexico provide more guidance on integrating water into land use.

[7] House Bill 1095, passed and signed in 2020.

How this new rule might be applied will depend upon a community's master plans and existing regulations. In general, the options available for conditions are similar to what might be included in a water efficient land use code. A local government could require an applicant to meet a requirement such as:

- **A Water Allowance.** A development could be required to adhere to a specified water budget for indoor and/or outdoor water use for each household or a commercial development. This requirement would be included in the HOA covenants or demonstrated when acquiring a building permit.
- **Design Standards.** Subdivision design guidelines can include best practices for water efficient construction such as indoor/outdoor metering, water budgets, xeric standards, efficient irrigation standards, watering restrictions.
- **Water Sources.** Subdivision approval can be tied to water sources such as requiring use of nonpotable or recycled water sources.

Integrating all water related goals into one plan or plan element ensures the complex interrelationships between water systems, human systems, and ecological processes are considered together.

Comprehensive plans help the community understand:

- Projections for future population and drivers of growth.
- The type and location of development occurring in the community.
- The source, capacity, and conditions of a community's water supply, distribution systems, and water-related infrastructure.
- Adequacy, sustainability, and vulnerability of the water supply.
- Health conditions of the watershed.
- Current programs and projects.
- The tradeoffs required to best achieve the community's goals.

Water-related goals and policies may also be relevant in other plan elements, depending on the planning and development concerns and priorities of the local government. Water resource considerations may influence policies developed for parks and recreation, environmental sustainability, or community livability.

Comprehensive plans can help identify opportunities to integrate water into land use policies to address:

- Water supply and demand.
- Wastewater treatment and reuse.
- Watershed and stream health.
- Floodplain and stormwater management.
- Interagency coordination and collaboration.

Water Supply, Efficiency, & Drought Preparedness Planning

A **water supply plan** inventories supply and infrastructure in an evaluation of a system's ability to meet its customers' needs. CO guidelines recommend that the plan should consider probable and worst-case scenarios for surface water and groundwater supplies. Colorado Revised Statutes (C.R.S. § 29-20-304-3) does not require an applicant to provide a letter or report identifying adequate water supply for the proposed development if the water is provided by a water supply entity that has a water supply plan. There are numerous requirements that the water supplier must satisfy, but integrating water supply plans in the comprehensive or master planning effort encourages development within regional water limitations.

A **water efficiency plan** is designed to increase water efficiency in the system and encourage consumer conservation efforts. The Colorado Water Conservation Act of 1991 requires water utilities with a water demand of greater than 2,000-acre feet annually to develop a water conservation/efficiency plan (C.R.S. § 37-60-126). These plans require a summary of the water provider's water supply and demand budget and a plan for water conservation and efficiency. In 2015, the State of Colorado added a requirement to this statute to evaluate best practices in water demand management that can be implemented through land use.

A **drought preparedness plan** is an evaluation of strategies to reduce water demand in response to drought conditions and should include specific demand-reduction measures to be implemented during specified stages of drought. Drought preparedness planning can occur at the local or regional level.

Local & Regional Water Quality Plans

Local and regional entities have several existing water planning authorities related to water quality control planning. Local plans and regulations around water quality are driven by federal Clean Water Act requirements related to reducing pollutant discharge. Stormwater Management Plans provide another opportunity for local entities to link water-related goals and policies across planning efforts and departments.

Local water quality control plans are connected through regional-level planning. Clean Water Act section 208 (33 U.S. Code § 1228(a)) requires states to do area-wide waste treatment management plans (208 Plans). For each area, a designated representative organization develops and updates an area-wide waste treatment plan. The process must contain (among other things) "the identification of nonpoint sources of pollution, and the proposed control, using best management practices (BMPs), to attain or maintain an approved water use."[8]

Tying regional 208 Plans to local stormwater management plans and comprehensive/general plans (and vice versa), provides an opportunity to integrate goals, policies, and programs for stormwater infrastructure (including green infrastructure and low-impact development stormwater management options), sewer construction, and wastewater treatment facilities across local and regional planning efforts. It could also provide significant justifications for local decisions made on creating, updating, and implementing capital plans.

Capital Improvement Plans

Capital improvement plans (CIPs) forecast and match a community's projected revenues and its capital needs over a multi-year period. Planning departments, parks, public works, and water and wastewater utilities often rely on grants and bonds to invest in green and gray infrastructure improvements or new construction. By creating a long-term investment strategy for the infrastructure improvements identified in a comprehensive plan or water system plan, a CIP ensures that resources match community priorities and further water infrastructure that is resilient to climate change and other future scenarios.

Hazard Mitigation, Response, & Recovery Plans

Hazard mitigation plans identify specific hazards likely to impact a community, including acute shocks such as wildfire or flooding, as well as long-term stressors

[8] Joel M. Gross and Kerri L Stelcen, Basic Practice Series: Clean Water Act. 117-118 (2nd ed. 2012).

such as drought. These plans identify pre-disaster risk reduction as well as post-disaster response activities. Planning should include determination of how hazards can impact water infrastructure and plans for reducing vulnerability and risks.

"One Water" Plans

Integrated Water Resource Management, or "One Water" plans promote the holistic management of water in all its forms—drinking water, stormwater, wastewater, and source water. These plans offer innovative, cross-departmental solutions to traditional water management practices to maximize the strategic use of all forms of water. One Water approaches can be integrated into planned development or sub-area plans to promote a water cycle approach to site and building plans.

Best Practices for Planning Documents:

- Link water supply and demand to projected land use patterns in both comprehensive plans as well as water supply and wastewater management plans for a more granular understanding of water use by land use type.
- Reference comprehensive and master plan goals and strategies in the establishment or update of associated land use policies.
- Meaningfully address water throughout the community comprehensive or master plan elements, as well as thoroughly in the water resources element.
- Link water supply and demand, conservation, and recharge priorities and policies across related plans—including stormwater management plans and water quality plans—to address common resource concerns through a variety of approaches and authorities.
- Set aside land for water-related infrastructure, such as recharge basins, in your future land use maps.
- Use capital improvement plans to ensure investments are made in the physical infrastructure needed for water management, such as treatment facilities and water reuse infrastructure, or in projects that manage stormwater through green infrastructure, infill development, hazard risk reduction, and watershed restoration.
- Increase strength of your plans with consistency requirements, which require that future plans and zoning codes be consistent with the comprehensive plan.
- Look for confusing or conflicting language, goals, policies, processes, or regulations and take steps to clarify and align them.

Photo by Julie Blake

CASE STUDY

MOVING FORWARD ON LINKING WATER & DEVELOPMENT — WESTMINSTER, CO

Stemming from acute water supply infrastructure challenges that resulted in a Mother's March on City Hall in 1962, the City of Westminster has become progressively more sophisticated in linking water and land use plans, policies, and programs.

For example, the City operated a Growth Management Program starting in 1978 with an annual competition for service commitments of residential developments. The competition used a series of minimum standards and a menu of incentive points to rank projects, with a limited number of service commitments awarded annually for new dwelling units to be built. This resulted in growth that maintained the balance between water supply and demand and established park and open space amenities across the City.

Over the past 20 years, the City has implemented several key strategies to ensure that water supply and demand was appropriately addressed in new development. These included:

- A revised tap fee structure to reflect water usage that incentivizes low water using plumbing fixtures and drought tolerant landscape palettes.
- Revised landscape requirements that require water-wise vegetation and irrigation and limits the amount of turfgrass.
- Partnership between Community Development Department and Public Works to establish a landscape reviewer and an inspection position to ensure compliance with landscape requirements post-construction.
- Establishing a forecasting system, recently enhanced, for projecting the water demand of proposed new development by use type, rather than by a water-per-capita measurement that is adjustable based on differing water conservation assumptions.
- Increased reporting to City Council on water supply and demand projections.

In 2013, Westminster adopted a new comprehensive plan that changed the trajectory of future growth by emphasizing redevelopment and designating growth focus areas within the City. The City participated in the inaugural Growing Water Smart workshop in 2017 and received technical assistance funding to conduct a gap analysis to review existing ordinances, codes, and guidelines and make recommendations for design standards and landscape code updates to increase sustainability. The City updated its development review process to include Public Works and Utilities, updated their landscape code, and retired the growth management program after ensuring the achievement of desired infrastructure and water supply/demand goals through other means.

From 2018-2020, the City launched a major community engagement process that sought to further the integration and alignment of the city's major plans: Comprehensive, Transportation & Mobility, Sustainability, Water Supply, and a Unified Development Code update. Combined, these elements will cover water quality, quantity, supply and demand, and resilience.

CASE STUDY, *CONT.*

Adopted in March 2023, the City's 2040 Comprehensive Plan puts the link between water supply and growth front and center. The second paragraph of the plan states that "Westminster's water supply is finite and all decisions related to the physical development of the city are grounded in water supply....To be truly sustainable, the city must live within available resources, which may be further constrained by drought and the extent of conservation activities."

With a robust set of 14 initiatives around water conservation and sustainable resource management, the 2040 Plan sets the City up to achieve the following:

1. Coordinate development review for water-land use integration
2. Monitor development trends that impact water
3. Educate decision-makers on water and development
4. Implement Water Efficiency Plan recommendations
5. City facilities and properties lead by example
6. Enforce and adapt low water use, native, pollinator-friendly landscaping regulations
7. Encourage high-efficiency indoor technology
8. Utilize reclaimed water to reduce potable water demand
9. Align conservation program with equity and sustainability goals
10. Evaluate developer responsibility for water and wastewater infrastructure
11. Adopt water-efficient tap fees that recover impacts of development
12. Adopt fair and equitable water rates that fund CIP and utility services
13. Maintain income-qualified water bill assistance program
14. Implement stormwater fee that supports floodplain, stormwater, and infrastructure needs

Photo by Jordan Hopkins

CASE STUDY

INCORPORATING WATER EFFICIENCY GOALS INTO THE MASTER PLAN — EVANS, CO

The City of Evans has taken a proactive and cross-disciplinary approach to ensure that future development and redevelopment in the City aligns with their water conservation goals. After participating in the Growing Water Smart workshop alongside neighboring City of Greeley, Evans identified the need to more thoroughly integrate the goals in their newly updated Water Efficiency Plan into the update of their long-range Community Master Plan.

Evans received a Growing Water Smart Technical Assistance grant to work with Del Corazón Consulting on a policy scan and recommendations project that highlighted opportunities for strengthening the water element in their master plan.

The water element of the now-adopted 2022 community master plan is entitled "Water Conservation," highlighting the focus of the goals contained in the section. The plan's five principles, each accompanied by implementation strategies, include:

1. Promoting the wise use of water in the residential and commercial sector
2. Aligning codes, zoning, policies, and development with the direction provided in the water efficiency plan
3. sustainably managing its water resources to enhance community resilience
4. Protecting the watershed and promoting watershed health
5. Using easements, acquisitions, and other creative strategies to protect watersheds and promote new housing opportunities.

In order to track progress toward their water goals,, the City applied to participate in the Water and Land Use Metrics Pilot Program. The project explored how land use strategies in their Water Efficiency Plan, Master Plan, and outdoor land use code impact potable and non-potable water. This was done by developing a tool that allowed for metric calculation over time to evaluate impacts.

The project team, supported by Brendle Group, developed a tool to evaluate the City's progress toward their potable and non-potable water efficiency goals. Progress is being made toward the goal of reducing water use by 10% by 2029, even with increasing population. To accelerate savings, the water tool illuminated additional opportunities. Areas identified include outdoor water conservation programs, new development, and the promotion of non-potable use.

SECTION 2

ADEQUATE WATER SUPPLY FOR DEVELOPMENT

Water supply should be demonstrated as adequate and sustainable before any development is approved.

CASE STATEMENT

Water adequacy rules link supply-side management to demand-side management. Local governments are often able to set their own standards that: (1) establish procedures to comply with statutory water supply requirements prior to development approval; (2) require longer time horizons for demonstrating sustainable water supply; or (3) connect zoning and community goals to water supply adequacy and development approvals.

States across the West have adopted statutes intended to ensure that communities have sufficient water supplies for new development, recognizing that:

New development creates new water demand.

Government has a role to play in ensuring sufficient and sustainable water supplies for new and existing property owners.

Growth pressures on water supplies require stronger connection between land use approval and water planning at the state, regional, and local levels.

Collaboration between local governments and water providers is essential to ensuring water supply reliability as well as promoting water conservation and efficiency.

TOOLBOX: ADEQUATE WATER SUPPLY REGULATIONS

The State of Colorado Revised Statutes (C.R.S.) require local governments to determine whether a proposed development will have an adequate and sustainable water supply prior to approval. Known as the water adequacy rule, the state defines water adequacy as "*a water supply that will be sufficient for build-out of the proposed development in terms of quality, quantity, dependability, and availability to provide a supply of water for the type of development proposed and may include reasonable conservation measures and water demand management measures to account for hydrologic variability.*"

The Water Adequacy Rule is contained within Part 3 of the *Local Government Land Use Control Enabling Act* (C.R.S. §29-20-301), which applies to all local governments. Counties and local governments reliant on groundwater designated by the State of Colorado must also comply with additional parts of the Colorado Revised Statutes. Relevant statutes are identified in the table below and explained further in the following sections of this chapter.

TABLE 2: COLORADO REVISED STATUTES[9]	COUNTIES	MUNICIPALITIES
TITLE 29 LOCAL GOVERNMENT		
Article 20 - Local Government Regulation of Land Use and the Local Government Land Use Control Enabling Act		
§29-20-103 Part 1: Definition of Development Permit	●	●
§29-20-301 Part 3: Water Adequacy	●	●
TITLE 30 COUNTY GOVERNMENT		
Article 28 - County Government Planning and Building Codes		
§30-28-101 Part 1: Definitions	●	
§30-28-133 (3) c-d Part 1: Subdivision Regulation Submission Requirements	●	
§30-28-133 (6) Part 1: Subdivision Approval Requirements for Water Supply	●	
§30-28-136 Referral And Review Requirements	●	
TITLE 37 WATER AND IRRIGATION		
Article 90 - Underground Water		
§37-90-106 Small Capacity Wells	●	●
§37-90-137 (4)(b)(I) Statewide Non-tributary Ground Water Rules and the 100 Year Depletion Rule	●	●
Article 91 - Water Well Construction and Pump Installation Contractors		
§37-91-101 — 37-91-113 2 CCR 402-2 Division of Water Resources Rules And Regulations For Water Well Construction, Pump Installation, etc.	●	●
Article 92 - Water Right Determination and Administration		
§37-92-602 Exempt Wells	●	●

[9] Current Colorado Revised Statutes can be found on the Colorado General Assembly Office of Legislative Services webpage.

Local Government Compliance for Adequate Water Supply

These interrelated layers of state statutes create differences in the compliance requirements with adequate water supply for counties and towns/municipalities.

Towns and Municipalities

For statutory towns and municipalities, the *Local Government Land Use Control Enabling Act* is the guiding statute for water adequacy compliance. The minimum threshold for compliance is established in the definition of a development permit as "an application regarding a specific project that includes new water use in an amount more than that used by 50 single-family equivalents (SFEs) or fewer as determined by the local government" (C.R.S. §29-20-103). While this threshold of 50 SFE is quite high, local governments have the authority to establish a lower threshold and a more rigorous review process.

Counties

Counties are held to a higher standard of adequate water supply review by the statute for *County Government Planning and Building Codes*. This statute requires that any subdivision, defined as any parcel of land that is divided into two or more parcels, must submit, as part of the development application additional materials, proof of adequate water supply. Additionally, the *County Government Planning and Building Codes* adds a requirement for information for water and sewer systems within counties. The first two of these requirements are in addition to the water adequacy rule and the third is repetitive. These include:

- Estimated total number of gallons per day of water system requirements where a distribution system is proposed.
- Estimated total number of gallons per day of sewage to be treated where a central sewage treatment facility is proposed, or sewage disposal means and suitability where no central sewage treatment facility is proposed.
- Adequate evidence that a water supply that is sufficient in terms of quality, quantity, and dependability will be available to ensure an adequate supply of water for the type of subdivision proposed. Such evidence may include, but shall not be limited to:
  - Evidence of ownership or right of acquisition of or use of existing and proposed water rights;

TABLE 3: STATE OF COLORADO REQUIREMENT FOR APPLYING WATER ADEQUACY REVIEW

	COUNTIES	TOWNS/MUNICIPALITIES
Threshold for Adequacy Determination	2 or more lots (exemption: statutory cluster developments)	50 single family equivalents (SFEs), or fewer if required
State Engineer Review	Required	Not Required, Optional
Determination Timing	Either Preliminary or Final Plat	By Final Plat

- Historic use and estimated yield of claimed water rights;
- Amenability of existing rights to a change in use;
- Evidence that public or private water owners can and will supply water to the proposed subdivision stating the amount of water available for use within the subdivision and the feasibility of extending service to that area;
- Evidence concerning the potability of the proposed water supply for the subdivision.

Finally, counties are also required, as part of the Referral and Review Requirements in Title 30 (C.R.S. § 30-28-136), to submit a subdivision application's proof of adequate water supply to the Division of Water Resources (the State Engineer's Office) for review of both the approval of a well permit and a review of water quantity.

Designated Groundwater and the 100 Year Depletion Rule for Water Supply

For counties and municipalities reliant on water supply from the state's designated groundwater basins, there are additional layers of review as part of Colorado's Groundwater Management Act and rules established by the Colorado Ground Water Commission. Where surface and tributary groundwater regulations in Colorado are based on prior appropriation (*first in time, first in right*), groundwater is managed to prevent groundwater mining by placing a limit on the total amount of water that can be withdrawn from a high capacity well (a well of more than 50 gallons per minute). The quantity of the withdrawal is determined on the estimated amount of groundwater below a parcel and establishes a maximum total amount of withdrawal (either annually or for the valid period of a well permit) and is determined through a process (either a decree and/or well permit). The total quantity of water to be withdrawn is limited by the 100-year water supply rule. This rule, defined in the state statutes in the definition of non-tributary and not non-tributary water, states the withdrawal "will not, within one hundred years of continuous withdrawal, deplete the flow of a natural stream at an annual rate greater than one-tenth of one percent of the annual rate of withdrawal." Development applications in managed groundwater basins must meet the requirements of both the adequate water supply rule and the 100-year rule.

The caveat for the 100-year supply rule is that the Groundwater Management Act notably excludes oversight of *small capacity wells* (defined for the designated groundwater basins as wells producing 50 gallons per minute or less). Small capacity wells are often the primary water source for most domestic household and commercial use in rural areas of Colorado. For counties in designated groundwater basins, the water supply adequacy rule provides important authority to address this exemption of small capacity wells and to integrate a review requirement for small capacity wells into the development review process.

Exemption for Statutory Cluster Subdivisions

The water adequacy rule exempts any statutory cluster subdivision defined in the County Government Planning and Building Codes as "any division of land that creates parcels containing less than thirty-five acres each, for single-family residential purposes only, where one or more tracts are being divided pursuant to a rural land use process and where at least two-thirds of the total area of the tract or tracts is reserved for the preservation of open space." (CRS § 30-28-401)

TABLE 4: SUMMARY OF GROUNDWATER RULES FOR COLORADO

WATER SOURCE	NON-TRIBUTARY GROUNDWATER	NON-TRIBUTARY GROUNDWATER	NOT NON-TRIBUTARY GROUNDWATER
Location	Outside of any designated groundwater basin	Designated basin	Specified Denver Basin aquifers
Influence on Surface Water	No	No	Yes
Return Flows or Augmentation Plan Requirement	No	Yes. In some basins that have been designated as over-appropriated.	Yes. At least 4% of the water pumped to be returned to the surface streams, and in some cases, actual replacement of depletions.
Oversight Responsibility	DWR/Office of State Engineer	Colorado Ground Water Commission, OSE, and Groundwater Management Districts	DWR/Office of State Engineer
Well Permit Requirement	Mandatory	Mandatory	Mandatory
Water Court Decree Requirement	Optional	Optional	Mandatory
Water Depletion Rule	Withdrawal will not, within 100 years, deplete the flow of a natural stream at an annual rate greater than 1/10 of 1% of the annual rate of withdrawal.		
Water Allocation Rule	Overlying land ownership based on an assumed 100-year aquifer life where withdrawal does not exceed 1% of the total amount of water recoverable beneath the underlying land.		
Exemptions	Small capacity wells (50 gpm or less) domestic purpose wells consisting of household use, livestock watering, commercial, monitoring and observation, and firefighting. They are permitted by the OSE and exempt from state statutes regulating groundwater unless a groundwater district has adopted rules regulating small capacity wells.		

Proof of Adequate Water Supply Application Submission Requirements

For development application materials, the water supply adequacy rule specifies **the minimum** information a local government should require, depending on the water source, to comply with the rule. It should be noted that an applicant is not required to own or have acquired the proposed water supply or to have constructed the related infrastructure at the time of the application, only to satisfactorily demonstrate the adequacy of the supply.

For municipalities and counties, when the service provider is not a government utility and there are numerous water providers, it can complicate having a clear picture of the region's water supply. Enhanced cooperation between water providers and the local government becomes critical to ensure the water supply standards are applied consistently and achieve intentions for sustainable water resource management.

Evaluation Criteria for Water Adequacy Determination

To make a determination of water supply adequacy, the state statute provides local government with criteria including:

1. The application submits materials in the development application consistent with the requirements of C.R.S. § 29-20-304 Adequate Water Supply.
2. For counties, a letter from the Division of Water Resources (state engineer) commenting on the sufficiency of the required documentation (on both water rights/permits AND water quantity).
3. Whether the applicant has paid a water supply entity a fee or charge for the purpose of acquiring water for or expanding or constructing the infrastructure to serve the proposed development.
4. Any other information deemed relevant by the local government to determine, in its sole discretion, whether the water supply for the proposed development is adequate, including, without limitation, any information required to be submitted by the applicant pursuant to applicable local government land use regulations or state statutes.

It should be noted that while the state statute outlines what evidence serves as proof of adequate supply and the criteria the local government should use, **the rule gives local governments considerable authority to require information above and beyond the minimum proof of adequacy** outlined in the statute.

TABLE 5: C.R.S. § 29-20-304 ADEQUATE WATER SUPPLY REQUIREMENTS

IF THE WATER SOURCE IS:	THE APPLICANT SHALL PROVIDE:	THE LETTER OR REPORT SHALL INCLUDE AT A MINIMUM:	LETTER OR REPORT PREPARED BY:
Not a water entity	A Water Supply Report	• Estimate of water supply requirements through build out conditions. • Description of the physical source of water supply to serve development. • Estimate of the amount of water yield projected from water source under various hydrologic conditions. • Water conservation measures that may be implemented within the development. • Water demand management measures that may be implemented within the development to account for hydrologic variability.	Registered professional engineer or water supply expert acceptable to the local government
A water entity with a water supply plan	No Requirement	*Nothing needs to be submitted **IF** the following conditions are met:* • The water supply plan is adopted by the water entity's board. • It has been prepared within the past 10 years. • It has a 20-year planning horizon. • Lists the conservation measures within the service area (if any). • Lists water demand management measures that may be implemented within the development. • Includes a general description of the water supply entity's water obligations. • Includes a general description of the water supply entity's water supplies. • The report is on file with the local government.	
A water entity without a water supply plan **Additional Information:** The statute gives a local government the authority to require additional information to make a determination of adequacy.	A Will Serve Letter *(in lieu of a water supply report only IF approved as an alternative by local government)*	• Estimate of water supply requirements through build out conditions. • Description of the physical source of water supply to serve development. • Estimate of the amount of water yield projected from water source under various hydrologic conditions. • Water conservation measures that may be implemented within the development. • Water demand management measures that may be implemented within the development to account for hydrologic variability.	Registered professional engineer or water supply expert from the water entity

Best Practices for Adopting an Adequate Water Supply Policy:

While the statutes require local governments to prove water supply, there is wide variation across Colorado in how this requirement is integrated into local government regulations and policies. Best practices linking water supply to new development include:

1. **Define Water Adequacy:** The statute defines water adequacy as quality, quantity, dependability, and availability. Policies should specifically define each of these indicators and the information required to demonstrate proof.
2. **Articulation of Approved Water Source(s)**: Definition of and clearly identified allowable water sources, whether from a water provider, individual wells, shared wells, cisterns, renewable or nonrenewable.
3. **Water Rights Inventory:** Legal demonstration of future water source(s) by either the acquisition or dedication of surface water rights or state approval for future wells.
4. **Methodology for Water Demand Projections:** A specific methodology for how to calculate the amount of water that the development will require at full build-out for indoor and outdoor and for different uses.
5. **Demonstration of Water Availability:** For each source(s) as defined by requirements for water quantity (e.g. water supply plan, well test, conditional will serve letter), the expected availability of the water supply (e.g. availability under drought and normal conditions), the water supply plan timeframe (e.g. minimum of 20 years), etc.
6. **Proof of Water Potability:** When wells are drilled, a requirement for a potable water test to be conducted and submitted to either DWR or the local government entity. If a water provider, they are regulated by CDPHE.
7. **Water Efficiency, Conservation or Demand Management Practices:** While not widely used across Colorado, the state statute gives authority to the local government to include water efficiency and conservation practices as conditions of approval that would reduce the projected water demand.
8. **Uniform or Specific Area Application:** A policy that applies to all new development, includes thresholds that trigger higher level of review or additional information, or define specific overlay zones where water resources are particularly scarce or there are variations that trigger specific requirements (e.g. recharge zones, different water provider service areas, specific hydrological zones, etc.)
9. **Maps:** Maps of geographic locations or zones where different adequacy requirements or review processes apply.
10. **Clearly Defined Review Processes:** Specificity on what information is required for each phase of the development review process and who conducts the review at each phase.
11. **Engineering Standards for Water Distribution System:** Except for individual wells, the engineering requirements for a water system connection or distribution system clearly articulated in development regulations or a reference to specific policy guidelines.
12. **Clear requirement, where necessary, for augmentation:** Augmentation requirements differ across the state, but generally the requirement is for an alternative water supply plan, an augmentation plan, or purchase of augmentation certificates.

State Agengy Roles and Responsibilities During Development Review

The State of Colorado Department of Public Health & Environment as well as the Division of Water Resources each play an important role in the water supply review process. Development code regulations should mention them as a review agency to be in compliance with the state regulations.

TABLE 6: STATE AGENCY RESPONSIBILITIES

DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENT	DIVISION OF WATER RESOURCES
Permitting of potable water systems.	Design standards for construction of wells by contractors.
Facility design standards for construction of water supply treatment and distribution system through the Engineering Section.	Permitting of wells for public, community, and individual residential and commercial wells.
Water quality compliance of public and community water systems at the Water Quality Control Division.	Review and approval of augmentation plans.
At this time, individual wells are not required to be tested by the State. CDPHE does encourage property owners to conduct testing. Some counties have begun to require a water quality test for new wells as part of the submittal requirement.	

TOOLBOX: WATER BUDGETS

Water providers and local governments use water budgets, also known as water allowances, as a tool to manage water supplies. The term water budget is applied to multiple practices and they are often confused. In general, water budgets can be thought of in the context of:

- **During development review to assess water adequacy.**
- **As part of a development or service agreement assigning a specific quantity of water to a development application.**
- **As part of a strategy to reduce or limit indoor or outdoor water demand.**
- **A conservation rate structuring strategy to incentivize water savings in individual households or businesses.**


Photo by Nathan Dumlao

These different purposes are summarized below.

As a development review tool. When used in the development approval process, it helps assess water availability and adequacy. A water budget summarizes the total water demand estimated for new development. It should include all uses of water (indoor, outdoor), reuse and/or recharge, and land use type (residential/commercial/industrial/agriculture). Local governments and water providers use a wide variety of methodologies to determine a development's water budget. These different methodologies vary in accuracy. The most common methodologies include:

- Per capita per unit.
- Per standardized unit for a household or business (like equivalency units).
- Per historical use.
- Per individual indoor and outdoor calculations.
- Per acre/square foot

The water demand calculation is evaluated against existing supplies to determine if sufficient water is available to serve the development. While the water budget may be used solely for the development review process and extension of service, it can also be used to establish the "water allowance" for a development where the water provider then monitors the development for compliance with the approved water allowance.

As an outdoor water conservation tool. An outdoor water budget is a water management tool used to estimate and/or allocate the amount of water a landscape will require. A good landscape water budget takes into account evapotranspiration data, plant type(s), purpose and functionality of the landscape, irrigated landscape area, irrigation efficiency, and climate data. Most frequently, it is integrated into a development application as part of the regulatory requirements for a landscape plan.

As an indoor water conservation tool. An indoor water budget establishes how much water a new building may require. An indoor water budget is calculated based on the flow rates of the fixtures and the appliances that will be provided by the builder (e.g. toilets, faucets, shower heads, dishwashers). There are more and more off-the-shelf calculators available to estimate individual project or household indoor and outdoor water budgets.

As a conservation water rate structure tool. For utilities, a water budget is the amount of water a customer is allotted annually and per billing cycle based on the size and use of the structure, quantity of outdoor landscaping, and historical water demand. Water budgets help promote water conservation by incentivizing water customers to stay within their budget as they pay more for exceeding their budget. Water budgets are often in tiered blocks with customer rates increasing for each tier they exceed.

Best Practices for Developing a Water Budget:

- Develop a consistent water demand calculation methodology for assessing water adequacy. It is more accurate if it accounts for indoor, outdoor, use type typologies, and density.
- Align methodologies and data sources across partners. Communities that compare and coordinate data and information build a mutual understanding, improve communication, and reduce uncertainty about water availability.
- Connect water billing and actual land use data using GIS. Granularity and accuracy of estimations inform rate structuring and advance efficiency programs. It helps with understanding the water use patterns and trends of land uses and densities. While this approach requires significant capacity, it helps not only with water adequacy review, but other types of development applications such as what impact rezoning proposal could have.
- For commercial and industrial, shift units of demand measurement for greater accuracy. Instead of water demand “per-acre,” scale to a “per-unit” or “per-square-foot-of-building-area” calculation.
- For residential uses, align water allowances with building permit applications and water budget worksheets that account for fixtures, appliances, and irrigation.
- Utilize water allowances to establish a maximum amount of water for indoor and outdoor use. While there are many methodologies, some communities have moved to a water allowance, then enabling the developer/builder to have flexibility in selecting fixtures, appliances, and landscaping within that budget.

CASE STUDY

ZONING BY HYDROLOGY IN THE DENVER BASIN — DOUGLAS COUNTY, CO

Douglas County is reliant on the Denver aquifer, a non-renewable water source with great variability in hydrology across the county. Additionally, there are many water providers serving different areas of the county. In order to better manage water resources, Douglas County developed a water-supply zoning overlay with four districts that align with and address the variations between different hydrological zones. Each zone requires a different combination of water sources intended to protect groundwater by diversifying the water supply and the County's reliance on non-renewable sources.

The overlay requirements apply to rezoning permits and planned developments that either increase density or propose a change in land use as well as site and subdivision applications. The requirements define appropriate water supply sources, standards for well tests or a renewable water right, a land dedication for open space to protect groundwater, and documentation standards to demonstrate compliance with the water adequacy rule. The policy documentation standard requires a report with the content determined upon whether the water source is a water provider or a well.

While the state's 100-year rule applies, the policy identifies two zones where the aquifer characteristics are less reliable and unlikely to produce the full quantity of water. Water supply verification requires both static and dynamic water supply analysis. The code explain that the "static analysis would include evaluation of the volume of water that is appropriable for the proposed development" while "the dynamic analysis would evaluate whether the appropriable water supply is sustainable for 100 years, giving consideration to the location within the Basin, as well as impacts caused by both current and future pumping by others in the Basin."

An individual and/or non-district water source must submit a water plan that includes:

- The source(s) of water.
- The water supply delivery system, including the structures to be used for the diversion or extraction of the water, the conveyance system, and the required storage facilities.
- Demonstration of the reliability of the water supply, both from a physical and legal supply perspective, and including all losses associated with the delivery and storage system to be used.
- Proof that the water supply is owned and can be used by the applicants for the purposes intended in the application.
- Proof that all necessary decrees, permits, and any other legal requirements are in place that allow the legal use of the water supply.
- The timing of the development demands through the build out of the project.
- Estimated demand of the development.

A water provider water source must submit a water supply report that includes:

- A summary or report of the water rights owned or controlled.
- A description of fully-executed contracts and/or IGAs with other water providers in which all of the terms and conditions of the contract and/or IGA have been satisfied, as demonstrated by a signed will-serve letter from the provider.
- The anticipated yield of these rights in both an average year and a dry year.
- The present demand and the anticipated demand on the supplier due to commitments for service entered into that are not yet supplied.
- The amount of uncommitted firm supply available for future commitment and development.
- A summary of what water rights the applicant will convey to a District and what water credits the applicant must purchase from a District, if any, to serve the development.
- A map of the service area.

Photo by O'Neal Turner

CASE STUDY

REQUIRING A 300-YEAR SUPPLY VERSUS THE STATE 100-YEAR RATE OF WITHDRAWAL – EL PASO COUNTY, CO

El Paso County, one of Colorado's fastest growing regions, established one of the state's clearest water adequacy rules in the mid-1980's. It was developed over three years to address concerns of unprecedented growth and challenging surface and groundwater resources. The El Paso County water adequacy standards are clear and extremely comprehensive, offering extensive detail in defining terminology and processes for verifying water adequacy for each water source, including:

- Articulation of approved water sources.
- Demand calculation methodologies for surface-water and groundwater sources.
- For urban density projects, a 300-year supply requirement, regardless of surface or groundwater.
- Specific information requirements for water provider's will serve letters.
- The water supply report for wells or surface diversions.
- Standards for well tests to determine both well yields as well as water-bearing capacity of the aquifer.
- Standards for water supply infrastructure.
- Water quality tests or CDPHE compliance reports for potability.
- Articulation of required information for each phase of the development review process.
- Criteria establishing a clear basis for review and determination of sufficient water supply.

The standards apply to all developments, although subdivisions with four or fewer lots may submit a simpler water-resource summary in lieu of a full water supply report. This policy is an example of how to provide detail and clarity in a code requirement and how to be explicit about the information required at what stage in the decision-making processes.

The state's 100 year rule determines the quantity of water permitted to be withdrawn from under a parcel and the rate of withdrawal based on a 100 year supply. It does not determine how much water that allowance can serve. The density of the project and type of project is the responsibility of the local government's zoning regulations. El Paso County's 300 year requirement establishes that a project's water supply for a project (surface and/or groundwater) needs to be sufficient for a period of 300 years. This requirement does not change the total amount of water allocated by the state, but rather the total quantity of water an applicant needs to have available to serve a new development. If the water supply is inadequate to meet this standard, a developer must either acquire additional supplies or reduce the density of the development to comply with the 300-year requirement.

Photo by Holly Mandarich

CASE STUDY

ZONING FOR UNRELIABLE GEOLOGY WITH RENEWABLE GROUNDWATER — JEFFERSON COUNTY, CO

Jefferson County, a participating team in the 2018 Growing Water Smart workshop, has identified and honed approaches for confirming that new development possesses adequate and sustainable water supply even in its mountainous areas.

The Jefferson County Section 21: Water Supply policy requires applicants to submit information on:

- Proof of legal water based on documentation that includes Water Court decrees and/or well permits.
- A water-supply report proving quality, quantity, dependability, and quality prepared by a professional geologist or registered engineer qualified in water resource engineering.
- Requirements for report content are specified.
- A water supply information summary.
- An aquifer test with specific requirements outlined for cases where water requirements are greater than identified standards per acre.
- A final water availability analysis, conducted by the planning and zoning department, is used to review sub-basin hydrology, climate and existing land development.

The two-page Water Supply Information Summary form, which must be completed and submitted for development proposals using well-water systems, is based on a similar format developed by the Division of Water Resources. This application form includes a checklist of the water-quality bacteriological and chemical analysis results, well test data, water-demand estimates, water right verification, and when required, aquifer test results. The form is used by both the County hydrologist and the Division of Water Resources to review development applications.

Additionally, Jefferson County developed the Mountain Groundwater Overlay District (Section 42) to respond to increasing development occurring on wells in mountainous areas of the county where the hydrogeology was unreliable. The water supply in this zone draws from a complicated fractured rock aquifer which is common in Colorado's high country. In this type of aquifer, recharge from septic or natural replenishment does not necessarily occur in the same place where water is withdrawn. The overlay adds requirements to the water supply standards for a higher level of review for developments that exceed an estimated water demand including a 4-hour pump yield test to demonstrate well yield adequacy and aquifer recharge sustainability.

TOOLBOX: WATER DEMAND OFFSET PROGRAMS

Water demand offset programs (WDOs) help manage water supplies by requiring new development to offset their projected water demand either through retrofitting existing development or a dedication of new water rights. The goal is that all new development, including the expansion of existing homes or businesses, can be "water neutral" in the water supply system. Some communities provide an in-lieu fee alternative that is then used by the water provider to acquire new water rights. WDOs are not a common tool in Colorado, but have been used successfully in California and New Mexico.

Photo by Adrien Gonin Unsplash

Best Practices for Managing a Water Demand Offset Program:

- Establish a water bank or authority to monitor and administer the program.
- Determine the offset ratio. A ratio of 1:1 will maintain the current water supply-demand balance, and a 2:1 mitigation ratio will reduce the ratio of demand relative to supply. Wastewater reclamation projects are more reliable and are given a 1:1 offset value, and supplies created through demand management are considered temporary and are given a 2:1 ratio.
- If fee-based, ensure the charge reflects the costs of implementing the offset as well as administrative costs. Costs of developing new supplies are borne by the entity needing to offset demand. Fee schedules can be a flat rate or based on percentage.
- Require verification of sufficient water supplies and water budgets. Work completed by developers must include documentation and verification by local program administrators.
- Consider when the offset fee is to be paid to allow enough time to procure supplies with those fees by the time the new demand is created by the development.

Photo by Nina Henry

CASE STUDY

WATER DEMAND OFFSET PROGRAM – CITY OF SANTA FE, NM

The City of Santa Fe, New Mexico began a Water Conservation Program in 1997 that has contributed to a per capita water use reduction of more than 50% since 1995 bringing demand down to 56 gallons per capita per day (GPCD).

A 2002 drought caused the City's demand to exceed supply. The City took aggressive action initiating a rate structure increase, a rebate program, and a water demand offset program. Their water demand offset program gained national recognition demonstrating its effectiveness as a way to meet future demand. The program set requirements for all new development to offset water demand either through conservation in existing development or transfer of water rights to the City The requirements are:

- For residential development requiring under 10 acre feet/yr and commercial development requiring under 5 acre feet/yr, the water demand offset could be met through conservation;
- For new development requiring greater than this demand, water rights would be required to offset new demand.

To help developers offset demand, the City developed a toilet retrofits program in the 1990s. The program connected willing homeowners who desired a retrofit to developers who could either buy credits from a qualified broker or do it themselves.

This program was so successful that the City nearly maximized its conservation potential. In response, the City updated its water demand offset program. The revised program includes the creation of a water bank to hold conservation credits for future development and a Water Conservation Credit Program. This program includes:

- The addition of rebates for more types of water use efficient appliances or retrofits of older ones and for outdoor watering equipment;
- A water budget program where a water user enters into an agreement to use less water and the City monitors the usage and pays the customer for the reduction in use; and
- A "free stuff" program including low-flow faucet and shower heads.

The water demand offset program applies to commercial projects that require 5 acre-feet per year (AFY) or more, residential projects that require 10 AFY or more, and mixed use projects that require 7.5 AFY or more.

TOOLBOX: WATER ALLOCATION POLICIES

Water supply for new development typically occurs on a "first come, first serve" basis. With infinite supplies, the allocation of water is not an issue, but as communities across the West find themselves with water supply and demand gaps, communities are wanting to be more deliberate with how they allocate their remaining supplies to grow their community.

A water allocation policy offers water providers and local governments a decision-making structure to dedicate their water resources in accordance with their community's needs and vision. An allocation policy is tailored to suit the strategic goals and priorities of a community by allocating its water supply to categories of development such as specific land use types, economic development, affordable housing, water efficiency, and community infill or revitalization.

Photo by Josh Olalde

Best Practices for Developing a Water Allocation Policy:

- Evaluate your water supply in terms of achieving your community plans, priorities, and build out.
- Establish a base water allowance per development based on an assessment of your water data to determine water demand averages for different development types and uses.
- Determine what type of water allocation policy will best suit your water resource management needs. There are many ways to structure a water allocation policy. Some communities chose a tiered-allocation approach where they only evaluate a development application that crosses a higher water demand threshold while most other development projects remain unaffected by the policy. Other communities opt for a points-based system with points awarded for achieving community goals with a minimum score required to receive a water allocation. Others chose to distribute the community's remaining water supply in acre feet available for certain types of development consistent with the community's goals.
- Communicate the allocation policy as a tool for protecting the rights of your current water users and stewarding your community's natural resources for the greatest benefit to the community.

TOOLBOX: ALTERNATIVE WATER SUPPLIES

Alternative water supplies can also help diversify a water portfolio, allowing existing water supplies to be stretched farther. They can be particularly useful to ease the demand pressure placed on water and wastewater systems during warmer months when irrigation demand increases. Alternative water supplies include:

- Raw surface water
- Building rainwater harvesting
- Recycled water
- Graywater use
- Stormwater harvesting (see Section 4)

Raw Surface Water

Communities may require outdoor irrigation, with appropriate water rights, to be supplied by untreated, or "raw" surface water from ponds, lakes, ditches, and rivers. While this water source takes pressure off the treated water system, it should not be considered an unlimited water supply nor incentivized as a lower-cost option. Rather it should be considered a valuable resource and used as efficiently as other water sources. Where the infrastructure exists, raw water can be required. To stretch raw water supplies, apply water conservation and efficiency practices as you would with treated water.

Building Rainwater Harvesting

Rainwater harvesting is runoff that is collected from roofs into storage systems, reducing demand for treated water supplies. Rainwater can be harvested in rain barrels or cistern systems that funnel rooftop runoff to water collection tanks to be used with minimal to no treatment for landscape irrigation. In Colorado, rainwater harvesting is limited compared to other western states. Authorized under C.R.S § 37-96-103, rainwater capture for outdoor irrigation purposes only are allowed under the following three circumstances:

1. At single-family households or multi-family households with four or fewer units. A maximum of two (2) rain barrels can be used per household and the combined storage of the 2 rain barrels cannot exceed 110 gallons.
2. Single-family households on an exempt well may apply for a Rooftop Precipitation Collection System Permit from the Division of Water Resources. These collection system permits do not limit the size of the rain barrel, but water collected may only be used for the uses allowed under the resident's exempt well permit.
3. Developers are eligible to participate in pilot projects that harvest rainwater and put it to beneficial use in the subdivision. These projects must be approved by the Division of Water Resources. Sterling Ranch used this option as part of its water supply plan.

For developments with Colorado adapted landscapes, rainwater harvesting is a significantly lower cost investment compared to the cost of installing irrigation systems, turf, and outdoor water tap and meter fees.

Recycled Water

Water recycling is the collection of wastewater for treatment and reapplication for beneficial uses. Recycled water is a reliable supply that is "drought-proof" and locally controlled. Most often recycled water is treated to non-potable, or non- drinkable, standards and used for irrigation and some industrial uses. However, there are limits to non-potable reuse applications, and costs must be considered, such as the costs of treatment, for planning and operating a dual infrastructure system. As treatment technology has improved, some communities have opted to recycle water through an advanced purification process to treat to potable water standards.

Potable water reuse systems can be direct or indirect. *Direct reuse systems* integrate the ultrapure treated water directly into the drinking water system or into the raw water supplying the system. A growing handful of communities in the United States practice direct reuse. Far more common are *indirect reuse systems*, in which recycled water is treated to similarly high standards and is then released into another body of water, called an "environmental buffer," for storage. Environmental buffers can be groundwater—reached through either natural infiltration or injection wells—or surface water such as reservoirs, wetlands, or riverbeds. The blended water is eventually retrieved, treated again, and ultimately distributed into the drinking water system.

Graywater Use

Unlike recycled water, graywater is collected from non-sewage water (bathtubs, sinks, laundry) and used on-site, with little treatment, for irrigation. By law, graywater is defined in Colorado in Regulation 86 Graywater Control Regulation as "that portion of wastewater that, before being treated or combined with other wastewater, is collected from fixtures within residential, commercial, or industrial buildings or institutional facilities for the purpose of being put to beneficial uses. Sources of graywater are limited to discharges from bathroom and laundry room sinks, bathtubs, showers, and laundry machines."

Graywater does not include wastewater from toilets, urinals, kitchen sinks, dishwashers, or non-laundry utility sinks. Graywater use is only allowed under a local graywater control program and must meet the local requirements adopted pursuant to these regulations. Unauthorized graywater use and discharges are prohibited (for exclusions see Reg 86).

Best Practices for Using Alternative Water Supplies:

- Require non-potable water for irrigation but use it efficiently. Water used outdoors does not re-enter the treatment system and thus should not be considered an unlimited supply.
- Set the culture that all water is valuable, and non-potable water should not be incentivized as a lower-cost option, particularly if your community struggles to fund treatment or delivery infrastructure.
- Use and promote reclaimed or recycled water on commercial and industrial landscapes.
- Establish "purple pipe" recycled water delivery systems throughout all new development. Strategically place "purple pipes" in redevelopment projects to promote access to parks and other areas with large non-potable water demand.
- Incorporate on-site water recycling technologies at high-water-use industries such as car washes and laundromats in a water conservation ordinance.
- Direct industrial- or institution-scale air conditioning condensate into a water harvesting feature in the landscape design.
- Adopt a graywater ordinance or incentive for residential use. Enable inexpensive "laundry to landscapes" home installations in your code.
- Promote residential rain barrels. Develop rebate incentive programs for cisterns at discounted rates or as a negotiation with developers for an increased water allowance as a condition of approval. Target residential development to require rain barrels in your landscape code or water conservation ordinance.

SECTION 3

WATER-SMART LAND USE POLICIES & PROCESSES

Policies, programs, and processes that govern where and how development occurs can greatly impact the management of water resources.

CASE STATEMENT

Water demand is both a function of household size, income, and lifestyle habits as well as how we plan, design, and maintain our communities. Research indicates that when it comes to saving water, where and how we build really matters. To use less water, the best policy is to make water-smart development— using the development patterns, standards, and practices listed below—the most common type of development.

Efficiencies can be found in compact development patterns and in the design of the building, site, and systems, especially landscaping. We know that:

Medium density development consumes less water per capita than low density development patterns.

Smaller lots consume less water than larger lots.

High-performing, water-efficient plumbing and building standards reduce water consumption.

Newer appliances and plumbing fixtures are more efficient than old ones.

Xeric and climate-appropriate plantings and maintenance practices consume less water.

Households that conserve water save money for themselves and the water provider, while preserving water for other people and nature.

TOOLBOX: COMPACT DEVELOPMENT

While most water conservation and efficiency efforts related to land use have primarily focused on outdoor watering and indoor plumbing fixtures, encouraging compact development patterns can bring considerably more benefits. Water usage studies have consistently demonstrated that in urban areas, increasing density may decrease the total water demand of new growth by 2-19 percent.[10] Research from Colorado and Arizona has demonstrated that even small adjustments can yield large water savings for cities.

Promoting water efficient land use patterns provides many additional benefits than simply saving water. It can also support the more efficient use of existing infrastructure, protect natural resources, promote walkability, control flooding, and enhance community vibrancy.

Best Practices That Promote Compact Development:

- Make rezoning, annexations, and Planned Unit Development (PUD) applications conditional on meeting water conservation and efficiency standards.
- Develop future land use plans that establish designated future growth areas where adequate infrastructure exists for accommodating growth at higher and/or more urban densities.
- Change the zoning code to permit smaller lot sizes and higher densities by right in designated districts.
- Reduce or remove development standard barriers to compact development such as parking requirements, minimum lot sizes, lot setbacks.
- Consider the density and height thresholds that trigger the need for cooling towers and mitigate their associated water demand. Craft your code for your climate and context.
- Change zoning code to permit multiple types of residential development (e.g., multiplex, townhomes, apartments, accessory dwelling units) by right in designated growth areas to provide a diversity of housing options.
- Change zoning code to permit compact mixed-use development by right in designated growth areas.
- In exurban and rural areas, change zoning code to permit and incentivize cluster and conservation development by right.
- Manage commercial uses by making water intensive uses, such as car washes, nurseries, etc. conditional instead of by right. Permit based on standards to meet water conservation and efficiency standards such as water recycling.
- Provide incentives for increased densities using development or utility fee reductions/ waivers and density bonuses.
- Use citizen/stakeholder committees, public education, and outreach to help elevate options, assess feasibility and public opinion, and prioritize actions.

[10] Colorado Water and Growth Dialogue Final Report, 2018

Photo by Maddy Baker

CASE STUDY

LAND USE REQUIREMENTS FOR WATER AVAILABILITY & RESILIENCE — SANTA FE COUNTY, NM

Santa Fe County, New Mexico has been working for nearly forty years to integrate water and land use planning by applying a development suitability lens to reduce natural resource degradation.

The County's efforts began in 1980 with the Santa Fe County General Plan. The growth management approach was to locate new growth in locations with adequate services and infrastructure while trying to limit growth in areas constrained by limited or low-quality water and natural hazards. In areas dependent upon groundwater, the County was divided into four hydrologic zones where a minimum lot size (base zoning) was set to reduce groundwater depletions. Within these zones, a 100-year water supply was required with demand calculated based on an estimate of 1-acre foot per lot, the same as permitted by the State. The minimum lot sizes for the four zones included: 160 acres, 80 acres, 40 acres and 10 acres. The development code was updated to include a requirement for new developments to conduct an analysis of land suitability, available infrastructure, and water resources. Developers could increase density if they completed a geo-hydrological study or entered into an agreement to use less than the allowed one-acre foot of water articulated in a conservation plan.

A 1999 update to the comprehensive plan continued to link new development to locations with suitable water, services, and infrastructure. In 2001, the County's Sustainable Development Growth Plan changed direction. After thirty years of trying to protect natural resources by linking lot size and hydrological zones, the County adopted new zoning districts and development standards intended to better protect sensitive land, preserve open space, and ensure high quality infrastructure and services.

The new approach identified three growth tiers:

- A priority growth area to accommodate new compact development served by surface water or community system and adequate public facilities and services.
- A future development area for infill development likely to occur within the limits of groundwater availability.
- And low-density agricultural land, environmentally sensitive land and conservation areas.

The code includes a Water Supply, Wastewater and Water Conservation requirement (Chapter 7 Section 7.13.) that defines how developers can satisfy the need for an adequate water supply. The location and scale of the development, the lot size, and proximity to water infrastructure determine whether a development uses a community water system or individual wells. The standards depend on the water source.

- County Utility: If applicants are connecting to the County utility, the only requirement is a written agreement to provide services.

CASE STUDY, *CONT.*

- Well: If the applicant is not connecting to the County utility, then a more stringent set of requirements must be met. For a minor subdivision over 5 lots that is zoned to permit an individual or shared well, the County requires a valid Office of the State Engineer's well permit and a hydrological study. Standards for the hydrological study include proof of an adequate water supply for 99-years and well test requirements for pump rates and recovery days linked to the different hydrological formations.

As part of development review, a Water Service Availability Report (WSAR) summarizes how a development meets the requirements for an adequate water supply. The WSAR includes:

- an analysis of: existing system capacity of the public water or wastewater supply proposed for use;
- well field capacity or stream, spring, or other source of raw water supply;
- historical average and peak use of potable water;
- the number of hook-ups and the estimated potable water demand per hook-up;
- and the number of hook-ups for which contractual commitments have been made or previous development orders have been approved.

Additionally, an application for a letter to serve to the water utility must for service requires a submit a Ready, Willing, and Able applicant form which is used to determine the applicant's water allowance. The application includes not only estimated total demand, but indication of peak periods of demand and a calculation for the maximum water allowance based on type of use.

Developments must also meet water conservation requirements and file signed water restrictions and covenants with the plat or site development plan committing to not using more than 0.25 acre foot per year per lot. Water conservation requirements include:

- Low water landscaping/xeriscapes
- Drip irrigation and mulching
- Kentucky bluegrass is prohibited, non-native grass is limited to 800 sq feet, and must be watered by water harvested or gray water
- Water is permitted for new landscaping for up to two years, but thereafter only for viability
- Between May and November, outdoor watering is prohibited between 11am and 7pm
- Rain sensors
- Fugitive water prohibition
- Rainwater catchment for all new construction to capture a minimum of 85% of the roof area drainage
- A domestic well metering program and sub-metering of landscape water use
- WaterSense certified or equivalent plumbing toilets, urinals, lavatory faucets, and shower heads
- EnergyStar certified or equivalent dishwasher, washing machines
- Water and energy efficiency hot water systems
- For food service, water available only upon request
- For lodging services, daily linen services only upon request
- Conservation signage and literature distribution

TOOLBOX: WATER-EFFICIENT LANDSCAPES

According to Colorado State University, "as a percentage of total water use in the urban Front Range, outdoor water use accounts for about 40 percent of all urban water use." Some communities can see their peak demand triple in the summer, requiring storage and infrastructure to provide a reliable supply. Communities working to make landscaping water smart from the start can integrate tools to reduce water demand from new construction. There are numerous tools available to local governments that integrate best practices for water conservation and efficiency into their codes and standards.

These include requirements for:

- A total amount of landscaping permitted based on lot size percentage or square footage.
- The types of plants that are best suited for the climate and irrigated by hyrdozones.
- The type and amount of turf allowable based on square footage or total landscaped area.
- Soil enhancements and mulching.
- Scheduled timing of irrigation to limit evapotranspiration.
- Low-flow and efficient irrigation system technology like drip, bubblers, or low-flow sprinklers.
- Rain sensors with a shutoff device to reduce watering during natural rainfall events.
- Evapotranspiration (ET) sensors to adapt irrigation to changing weather and soil conditions.
- Code enforcement and fines for violations of standards.
- A water budget for outdoor water use, ideally tied to tiered rate structuring that sends a price signal to the rate payer.
- Training for landscape professionals on water saving landscaping like the Qualified Water Efficient Landscaper (QWEL) training program.
- Maintenance standards and agreements for multifamily and commercial properties to use in contracting landscape services.

Since mandatory requirements significantly increase water savings, the goal of a community committed to water conversation should be to make all new developments and retrofits meet water efficiency standards.

Best Practices for Promoting Water-Saving Landscapes:

- Assess potential water savings by comparing annual water demands on a new property against an older property or properties with comparable area, plantings, and irrigation methods.
- Develop a landscaping design manual that provides specific guidance to individuals and developers on water-saving tree and plant types and sizes, planting seasons, soil enhancement, mulching, and watering times appropriate for local climate.[11]
- Promote and/or incentivize the use of individual household rainwater harvesting for outdoor irrigation.

[11] Water-Smart Landscaping Principles are widely promoted in education programs as well as adopted into landscape and water conservation plans.

- Develop an incentive for the removal of water-intensive landscaping by offering landscaping conversion rebates.
- Provide incentives for developers to use water efficient or xeric landscapes through reduction of tap fees.
- Maximize the use of graywater and recycled water for appropriate applications including outdoor irrigation, toilet flushing, and commercial and industrial processes.
- Establish residential, commercial, and public water efficient landscape code that reduce use of water for irrigation by regulating:
    - Irrigated lot coverage
    - Plant types
    - Irrigation system efficiency
    - Rain sensors and/or evapotranspiration (ET) sensors that adjust watering to changing site conditions
    - Watering schedules (e.g., before 8 a.m. and after 8 p.m., scheduled by zones and day of the week)
    - Soil amendments
- Change property owner behavior through non-regulated options, such as education and rebate programs managed by the water provider:
    - Offer rebate programs for water-efficient plumbing fixtures such as low-flow toilets and shower heads, and front-loading washing machines.
    - Develop rebate programs for turf removal and replacement with low-water-use landscaping.
    - Educate about xeriscaping and water-efficient irrigation systems.
    - Conduct water audits that evaluate systems and educate property managers on opportunities to increase efficiency.
    - Empower staff, HOAs, and maintenance companies with a command of desert plants, soil health, and watering best practices.

Photo by Paul Hanaoka

CASE STUDY

WATER FEES AND WATER WISE LANDSCAPING — CASTLE ROCK, CO

The Town of Castle Rock, Colorado is a fast-growing region with the population of 78,000 in 2022, and is anticipated to double by 2055. The town relies heavily on groundwater and aquifer levels have been steadily declining. It was clear a sustainable solution was required to support the water needs of a growing population.

In response, Castle Rock developed a voluntary, incentive-based fee program in 2015, which was updated in 2021,[12] to encourage new development to be water-efficient. Developers are responsible for the engineering and construction of all water and sewer mains up to and including 12" in diameter. The system development fees pay for the infrastructure of the water system in both residential or commercial developments, and for actual water obtained and developed by the utility for future water supply. Development with lower gallon per minute (GPM) water use is rewarded with a reduced system development fee.

In March 2023, the Town Council approved updates to the Water Efficiency Master Plan. The updates include a goal to achieve a per capita demand of 100 gallons per person per day by 2050[13]. Key elements to achieve the water reduction goal include reducing the amount of irrigated turf, installing advanced metering, and promoting graywater systems. For developments with a water efficiency plan that meets a set of minimum standards, the Town offers steep reductions in utility system fees. The standards include indoor and outdoor water efficiency, resident education, third-party verification, and monitoring and enforcement. Specifically, the requirements are that:

- The developer is responsible for seeing the landscape plan through to completion. All front and rear yards must be designed and installed by the builder.
- Non-functional turf in non-residential areas like apartments, condominiums, townhomes, homeowners associations common areas, and commercial businesses is prohibited.
- No turf is allowed in new front yards and is limited to no more than 500 square feet of irrigated turf in backyards. Kentucky bluegrass is prohibited. Turf species that require more than 19 inches of supplemental irrigation per growing season are not allowed.
- 100 percent xeric landscapes are allowed but must provide a minimum coverage of 75% by plant materials at 5-year maturity in front yards and side yards when adjacent to streets. Rear yards must have a minimum of 40% plant coverage at 5-year maturity. The remainder of yard coverage can be composed of mulches, aggregate surfacing, artificial turfs, and hardscapes.
- Residential irrigation design must follow the Town of Castle Rock's Landscape and Irrigation Performance Standards and Criteria Manual. Automatic irrigation controllers that are weather-based or soil-moisture based are required and must be hydrozoned.

The Town is taking active steps to reduce its dependence on groundwater, diversify its water portfolio, and encourage innovative water conservation measures in new development. You can learn about how Castle Rock is managing water on the Town's website.

[12] Town of Castle Rock Landscape and Irrigation Criteria Manual 2022
[13] Town of Castle Rock Water Resources Strategic Master Plan 2021

Photo by Raychan

CASE STUDY

LAUNDRY TO LANDSCAPE ORDINANCE — GOLDEN, CO

The City of Golden, in partnership with Western Resource Advocates (WRA) and WaterNow Alliance (WNA), developed a graywater ordinance and communication program with the goal of encouraging the implementation of laundry-to-landscape (L2L) graywater systems in residential homes to reduce peak potable water demands and energy demands related to water and wastewater treatment. The project involved engaging with community members and the Golden Sustainability Advisory Board to solicit input on a graywater ordinance, drafting ordinance language to be integrated into the current permitting process, and creating a robust community outreach and education plan that includes demonstration projects to inform the community.

The project set out with the immediate goal of reducing water use and planning for a drier and warmer climate. On September 10, 2020, the City of Golden unanimously approved Ordinance 2143, the first in Colorado to focus exclusively on L2L systems. The ordinance approves the capture of graywater from laundry machines and laundry room sinks to water non-edible outdoor plants. The affordable system utilizes gravity-fed water from laundry rooms to water outdoor plants, with no tanks, pumps, or filters required, and typically costs roughly $250.

The City of Golden's L2L ordinance was the fourth graywater and first L2L ordinance in Colorado and served as a model for other cities. The successful integration of community members, key stakeholder groups, and the City helped to ensure the approval of Ordinance 2143. Open collaboration between the City of Golden, Western Resource Advocates, and WaterNow Alliance was a determining factor in ensuring the L2L ordinance passed. The team outlined three key roadblocks: permitting, implementation, and water rights. The ordinance resolved these challenges and established a framework for the city to further develop and expand future graywater reuse offerings.

On September 14, 2021, the City and County of Broomfield approved Ordinance 2158, which approved graywater reuse in single family and non-single family facilities. Broomfield expanded on Golden's L2L ordinance and approved the reuse of graywater from laundry and bathroom sinks, bathtubs, showers, and laundry machines. Graywater can be used for subsurface irrigation and/or indoor toilet and urinal flushing.

The approval of Ordinance 2143 is the first step in integrating graywater systems into single-family homes. Further education and outreach are necessary to encourage implementation and overcome sentiments that graywater reuse is difficult or too costly to install and maintain.

TOOLBOX: WATER-SMART BUILDINGS

Reducing indoor water use in residences and businesses can be accomplished through water-efficiency standards for indoor plumbing fixtures. As a result of a WaterSense bill adopted in 2016 (SB 14-103) and revised in 2019 (HB 19-1231), C.R.S. § 6-7.5-103 states that fixtures and appliances sold in Colorado must meet or exceed EPA's WaterSense standards. The 2019 revision added that the statute "…does not preempt any action of a municipality, county, or city and county that prescribes additional or more restrictive water conservation or energy efficiency requirements affecting the sale or use of plumbing fixtures, appliances, or other products if the requirements comply with the standard specified in subsection (1) of this section." Local jurisdictions can incentivize water-efficient buildings in local ordinances and through retrofit programs.

Best Practices to Promote Plumbing Fixtures and Building Efficiency Standards:

- Adopt the Colorado WaterSense plumbing standards as base requirement.
- Use standardized "green" codes for guidance and technical best practices, like the green plumbing code or the international green building code.
- Adopt building code standards that permit the use of water recycling systems.
- Adopt building code standards for submetering of multifamily units.
- Incentivize the replacement of less-efficient toilet and faucet technologies with WaterSense units through rebates or free fixtures.
- Require retrofits for redevelopment or resale. This is particularly effective for communities with a high percentage of housing stock pre-1994. Certificates of compliance can be self-submitted, verified by third party, or verified by staff. Certificates can be issued for retrofits on resale or purchase, reconnection for water service, or on building permits.
- Create incentives for developers to receive lower tap fees for meeting water efficiency standards beyond the building code.
- Link tap fees to water budgets to guarantee that the low demands projected when tap fees are paid will be observed over time.
- Include a requirement in your code to repair indoor leaks (e.g., a leaking pipe, a leaking value, or a leaking faucet) within a given time.
- Adopt indoor water efficiency standards for non-residential commercial and multi-family development for water-efficient plumbing fixtures, appliances, and equipment in new construction, remodels, and redevelopment.
- Use a water conservation ordinance to target high-water-use sectors, including data centers; breweries and wineries; institutions such as hospitals, schools, jails; car washes; laundromats; and restaurants and hotel sectors.

TABLE 7: COLORADO WATERSENSE RULE STANDARDS FOR FIXTURES AND APPLIANCES SOLD IN THE STATE
GALLONS PER MINUTE (GPM) & GALLONS PER FLUSH (GPF)

Lavatory Faucet	0.5 gpm
Lavatory Faucet	1.5 gpm
Shower Head	2.0 gpm
Flushing Urinal	0.5 gpf
Flushometer Valve Toilet, Commercial	1.28 gpf
Tank Toilet	1.28 gpf
Kitchen Faucet/Aerators, Residential	1.8 gpm
Spray Sprinkler Bodies	WaterSense
Dishwasher, Commercial	Energy Star
Steam Cookers, Commercial	Energy Star

CASE STUDY

INDOOR WATER EFFICIENCY ORDINANCE — TOWN OF MT. CRESTED BUTTE, CO

Mt. Crested Butte is a ski town at the base of Mount Crested Butte in Gunnison County, Colorado. The Town, with a year-round population of just shy of 1,000 sees its population swell by thousands of visitors each year who want to enjoy winter sports like skiing, snowboarding, snowshoeing and snowmobiling. As a member of the Gunnison county-wide Growing Water Smart workshop team in 2019, the Town identified the opportunity to increase water conservation and efficiency by enacting an indoor water conservation ordinance. This strategy also grew out of their water planning documents, in particular the 2015 *Final Water Conservation and Use Efficiency Plan for Mt. Crested Butte Water and Sanitation District*, which found that "future residential conservation may be best served through code development and enforcement related to the placement of high-efficiency fixtures and appliances."

Through a Growing Water Smart technical assistance grant, Mt. Crested Butte received a Growing Water Smart policy scan from Del Corazón Consulting and worked with city leadership and planners, non-profit organization High Country Conservation Advocates, and Mt. Crested Butte Water and Sanitation District to develop an ordinance with the following specifications:

Applicability: Applies to all new construction, any construction to existing structures requiring new or expanded water service, and remodels that require a permit that involve replacement of plumbing fixtures (applicable to those fixtures only).

Indoor fixture and appliance minimum efficiency requirements: toilets, shower heads, faucets, dishwashers, clothes washers, ice makers, commercial refrigerators, and automatic car washes have established maximum flow rates or quantities.

Lodging establishments, water features and water restrictions: outdoor swimming pools and hot tubs must be covered when closed, water features must use recirculating water systems and where available, recycled water shall be used as a source for decorative water features. Standard irrigation regulations and emergency irrigation restrictions will be enforced by the Mt. Crested Butte Water and Sanitation District.

Compliance, modification, and enforcement: Applicants shall submit a Water Use Efficiency Compliance Form or a modification request to the community development department. Compliant fixtures shall be approved and in place prior to final building inspection approval.

The ordinance adopting the new Indoor Water Use Efficiency Article was passed on June 15, 2021.

The Town of Mt. Crested Butte is continuing to move forward on blending their water conservation and efficiency goals into their long-range master plan. In their 2022 Draft Water Analysis Matrix, the Town included the goal of "identify[ing] and address[ing] municipal and industrial water shortages" by "support[ing] projects to update water conservation, landscaping, and building codes to require increased water conservation and efficiency for municipal development" and the goal of "develop[ing] implementable water conservation measures" through "water conservation strategies to reduce the demand for water to meet indoor and outdoor municipal needs…" and "requirements or incentives for water fixture retrofits and conservation in new development" among several other important goals toward achieving water resiliency. The Master Plan will be finalized and adopted in 2023.

TOOLBOX: DEVELOPMENT REVIEW PROCESSES

The development review process encompasses all the procedures necessary to ensure development applications meet the community's land use regulations. Each community's development review process varies slightly but engaging water providers in the process can support water resilient outcomes.

Best Practices for Integrated Development Review:

- Document the development review process. Identify opportunities to add water resource managers and other sustainability or resilience expertise to the process to identify and resolve water-related challenges or opportunities.
- Promote collaboration and build relationships with counterparts through regular meetings that maintain a shared understanding of the community's strategic vision and priorities.
- Ensure that water-related compliance challenges are addressed, and alternative approaches are considered early by involving water managers at pre-application meetings and preliminary plat review.
- Seek mutual agreement from water resources departments on final approval of land use decisions.
- Ensure that the development is built, operated, and maintained as stated in the proposal by training site inspectors to recognize compliance on water-efficient design.
- Shape development agreements or planned unit developments (PUDs) to include water efficiency standards, alternative water use, or watershed protection efforts.
- Integrate low-impact development design recommendations into the site planning review.
- Use connection charges, such as tap fees, water impact fees, and others as incentives to guide development in areas with supportive infrastructure. Connection charges can reflect water budgets and allocation policies.
- Promote voluntary, incentive-based programs to implement creative plat designs with open space, water-use offsets, and water-smart plumbing, landscaping, and rainwater harvesting systems (in new builds and/or retrofits). Developer incentives can encourage developers to exceed the required water-efficiency standards.
- Develop guidance and user's manuals to help residents and builders understand and comply with building and design codes.

SECTION 4

HEALTHY & RESILIENT WATERSHEDS

The effects of increasing development, climate change, and natural hazards can all degrade the quality of the watershed, impacting both water yield and water quality.

CASE STATEMENT

How we manage all forms of water, from stormwater to wastewater, impacts both the built and natural environment. Approaches that integrate a holistic, "one water" management approach into building, site, subdivision, and infrastructure standards can protect ecosystems and harness the utility of all forms of water.

The way a community develops impacts water quality and the overall health of the watershed. By applying the principles and tools in this section, communities can reduce or reverse the impacts of the following:

Water pollution from urban stormwater runoff.

Sedimentation from soil disturbances, vegetation loss, and erosion from roads and new development.

Destruction of riparian areas from climate change and development in the floodplain.

Reduced stream flows caused by drought and groundwater pumping.

Decrease in water infiltration and aquifer recharge due to impervious surfaces and traditional stormwater management.

TOOLBOX: WATERSHED PROTECTION

Landscape scale changes that result from both human and natural forces have a significant impact on natural ecosystems and water resource availability and quality. Safeguarding available water resources through watershed protection standards and policies is an important but often overlooked goal in Western communities. Watershed planning and protection has often been considered a function of collaboratives and nonprofits working with local governments to restore ecological processes and functions. The way communities develop and redevelop can either escalate the threat to our watersheds or nurture nature and harvest the returns.

Watershed planning focuses on minimizing negative impacts as new development occurs. Watershed protection goals are included in a wide variety of community plans, such as comprehensive plans, emergency management plans, watershed plans, water resource management plans, and open space plans. Converting these goals into concrete policy in development codes is essential to preventing watershed degradation and enhancing community resiliency.

Best Practices for Watershed Protection Standards:

- Map all sensitive areas including wetlands, riparian corridors, infiltration zones, water supply watersheds, groundwater basins, and natural-disaster-prone areas, such as flood, drought, and wildfire areas.
- Adopt plans for wildfire mitigation, watershed management, stormwater management, and floodplain management that designate sensitive areas and goals for mitigation. These plans should reference other plans so that priorities and objectives build on each other and that the environment is viewed holistically.
- Minimize development in sensitive areas through overlay zones that cluster or limit development densities and include design standards.
- Adopt development design and site standards for stream buffers and setbacks to protect water quality and shallow groundwater areas.
- Adopt vegetation protection standards that minimize disturbance to vegetation within the riparian corridor.
- Adopt stormwater management and site design standards that utilize best practices for low-impact design reducing stormwater runoff and increasing water infiltration.
- Adopt site-level soil erosion mitigation standards for new development to reduce sedimentation and runoff, and to protect water quality from land disturbance.
- Protect existing and potential sources of drinking water supplies by adopting surface and/or groundwater districts with standards to minimize contamination of streams and shallow aquifers.
- Organize and encourage regionally collaborative efforts to restore watershed functions through watershed restoration projects and public education.

CASE STUDY

PLANNING FOR HEALTHY WATERSHEDS — THE ROARING FORK AND SOUTH PLATTE RIVERS

One hundred years ago, rivers were seen as mechanisms for moving waste away from areas of human settlement, and that such waste would soon dissipate and cause no impact to ecosystems and downstream communities. The City of Aspen has preserved an article from the 1893 Aspen Daily Times that reflects this flawed opinion. We now understand how wastewater and stormwater management and water diversions for agricultural and municipal use impact water quality and threaten stream flows, and stakeholders are coming together to develop Integrated Water Management Plans to prevent and reverse negative impacts.

In 2016, the City of Aspen and Pitkin County began a joint project to create a River Management Plan for the upper Roaring Fork River, focusing on identifying impacts caused by modified patterns of streamflow and developing goals and strategies for managing land and water to improve river health in the upper Roaring Fork watershed.

The plan process compiled years of studies and data using computer models that let water managers simulate how different factors might affect stream flows. These studies showed that since the early 2000s, the ecological health of the Roaring Fork River has been declining as a result of water flow modifications, pollution, and development that has negatively impacted the river's ecological health. The upper Roaring Fork near Aspen was identified as most at risk due to water diversions. During the summers, the upper Roaring Fork often does not meet the minimum flow set by the State of Colorado of 32 cubic feet per second. Stakeholders and members of the public then established geographic priorities, community values regarding the various ecosystem attributes, and the types of water management actions that the City of Aspen and Pitkin County may employ to improve river health (e.g. water transactions, water storage, channel reconfiguration, infrastructure upgrades, etc.).

The plan was released in the summer of 2018. While the plan outlined a suite of potential management actions for the region to address low flows, the most significant outcome was a continued commitment by stakeholders to collaborate on achieving long term goals for enhancing the health of the Roaring Fork.

In 2022, in a significantly denser location, the City and County of Denver's Department of Transportation and Infrastructure, Denver Parks and Recreation, Community Planning & Development and the Mile High Flood District commissioned a *Healthy River Corridors Study* to achieve a healthy South Platte River corridor that restores and enhances the natural beneficial function of Denver's waterways, improves user experience, and builds community and economic vitality along the banks of the South Platte River. The study area included 12.5 miles of the South Platte River corridor running through the CIty of Denver from Adams County to Englewood.

The study captured current river corridor conditions and established community-based goals and objectives around water & ecology, mobility & recreation, and land use & development. It was determined that the goals and objectives for South Platte River would be achieved by developing a 200-foot Influence Zone comprised of a 50-foot area adjacent to the channel prioritized for the reestablishment of water quality and riparian function and a 150-foot outer area prioritizing health and access and the interface with adjacent land uses. The study recommended two near-term actions - a multi-departmental policy statement and site-specific narratives as well as the establishment of design standards & guidelines and an overlay zone district to carry out the goals and objectives along the South Platte River corridor. The plan is currently in draft form and is anticipated to be released in late 2023.

CASE STUDY

STREAMSIDE OVERLAY ZONE — COLORADO SPRINGS, CO

Colorado Springs passed its first set of Streamside Design Guidelines in 2002, after neighborhood and conservation groups and City staff came together to regulate and protect waterways from increasing development pressures. The Streamside Ordinance applies to City lands that are adjacent to a stream channel, including stream-adjacent wetlands, and within a specified distance of the edge of the stream channel of specific intermittent and perennial streams. The Streamside Overlay extends between 70' and 120' beyond the edge of the stream channel; the width is based upon the three-tiered stream typology. The Ordinance "is not intended to reduce or prohibit development along streams, but rather aims to arrange development in a fashion that is compatible with natural stream characteristics existent on or adjacent to developing sites. to designate specific buffer zones according to three sizes of waterways."[14]

If a land owner's parcel lies within any part of the streamside, or "SS" overlay zone district, they can refer to the revised 2009 Streamside Design Guidelines to determine how to complete a streamside development or side plan that addresses eleven review criteria,, including: 1) grading and landform, 2) site design, 3) wildlife habitat preservation, 4) trails and recreation, 5) floodplain, 6) significant natural features, 7) complementary plans, 8) riparian buffers and impervious surfaces, 9) landscape, 10) streambank stabilization, and 11) stream reclamation.

Streamside Overly Zone (SS)

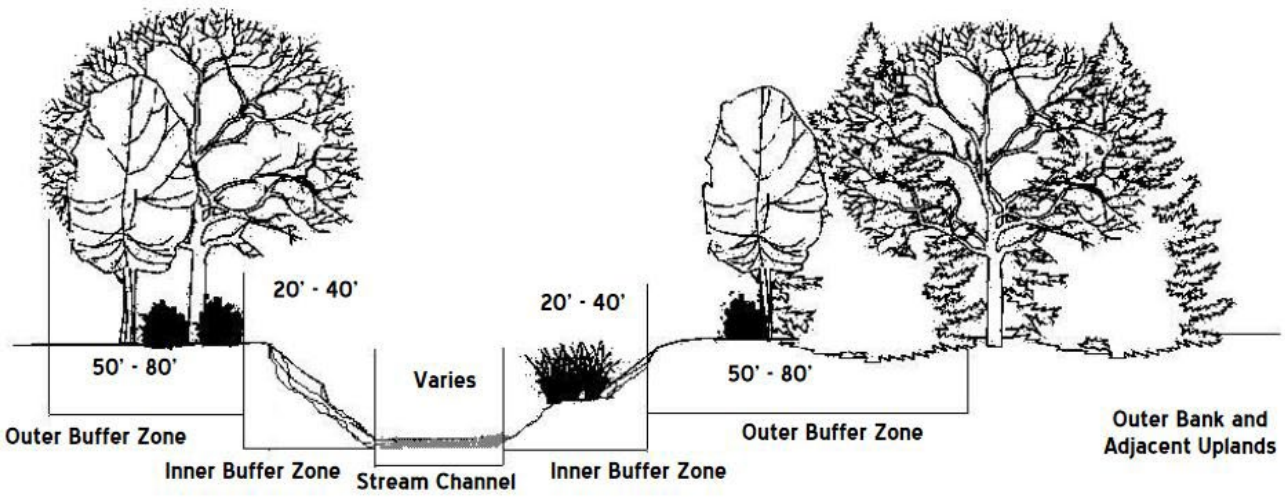


FIGURE 3 - Cross Section of the Streamside Overlay Zone. The Streamside Overlay Zone is comprised of a stream channel, an inner buffer zone, an outer buffer zone, and the outer bank. The widths of each of these zones varies based on stream type.

[14] Colorado Springs Streamside Design Guidelines (2009)

TOOLBOX: GREEN INFRASTRUCTURE AND LOW-IMPACT DEVELOPMENT

Green Infrastructure (GI) uses the natural ability of permeable surfaces to absorb stormwater. Low-Impact Development (LID) is the retention or restoration of natural hydrologic patterns by using landscape and site design to keep as much rainwater as possible from leaving the site. Instead of designing a site or streetscape to funnel stormwater off-site as fast as possible, GI and LID approaches use natural vegetation, porous materials to "slow the flow" and encourage the infiltration of stormwater.

Some of the benefits of green infrastructure include:

- Reducing peak flooding and treating stormwater on-site reduce downstream flood intensity, decrease pollutant loads, and lower the risk of sewer overflow.
- Reducing the need for outdoor irrigation and landscaping, since native plants that rely solely on naturally occurring rainfall can vegetate gardens and basins used for GI.
- Allowing stormwater to infiltrate into vegetation and soils increases groundwater recharge.
- Providing access to green spaces fosters active, healthy lifestyles through increased neighborhood beautification.
- Planting trees and other plant materials mitigates heat by providing shade, sequestering carbon, and absorbing radiation from the sun. Trees and plants also absorb pollutants, thus improving soil and stream health, as well as air quality.
- Adding natural vegetation along streets aids with traffic calming.

Best Practices for Green Infrastructure:

- Work with transportation and civil engineering professionals to update development standards. When possible, use the minimum street width and direct runoff from pavement and buildings to vegetation-lined channels.
- Design all aspects of landscaping—from the selection of plants to soil preparation and installation of irrigation systems—to reduce water demand, retain runoff, decrease flooding, and recharge groundwater.
- Preserve regional open space by clustering development, thereby maximizing unpaved areas for stormwater retention. Use permeable surfaces for hardscapes.
- Map areas of high flood risk and apply GI approaches to capture water.

TABLE 8: COMMON LOW-IMPACT DEVELOPMENT AND GREEN INFRASTRUCTURE TECHNIQUES

APPLICATION	DESCRIPTION
BIORETENTION BASINS, STORMWATER HARVESTING BASINS, AND RAIN GARDENS	Small- to large-scale planting areas containing shrubs, trees, and grasses designed to capture stormwater.
BIOSWALES	Shallow and uncovered channels that induce meandering and are placed within a drainage channel.
CURB OPENINGS AND CURB EXTENSIONS	Drainage inlets that divert stormwater into bioretention basins. Basins can be extended into the shoulder to expand the harvesting capacity with added traffic-calming effects.
DETENTION PONDS	Basins that provide flow control by collecting stormwater runoff.
PERMEABLE PAVEMENT, GRAVEL, OR PAVERS	Methods of paving that allow infiltration and can be used in low- to moderately trafficked areas like sidewalks and parking lots.

Photo by Engin Akyurt on Unsplash

CASE STUDY

RAIN GARDENS IN PARKING LOT ISLANDS – CARBONDALE, CO

Carbondale is a Town of approximately 6,500, located on Colorado's western slope. In its 2013 Comprehensive Plan, the Town established a goal of "improving watershed health and water quality," in part, by "employing naturalized stormwater treatment techniques such as naturalized detention, bio-swales, rain gardens, trees, terracing and porous pavements."[15]

Management of impervious coverage was an important consideration during the drafting of the Town's Unified Development Code. One of the strategies utilized is the landscape island and rain garden requirement within parking areas. In Chapter 17.05: Development Standards (2016, amended in 2020), Carbondale specifies that parking lots shall include landscaped islands and/or Rain Gardens[16] in all districts. When the islands are designed with curb cuts, they collect stormwater runoff from the pavement and allow it to percolate into the ground through natural features in those islands.[17]

Figure 5.4.3-A: Landsacped Islands

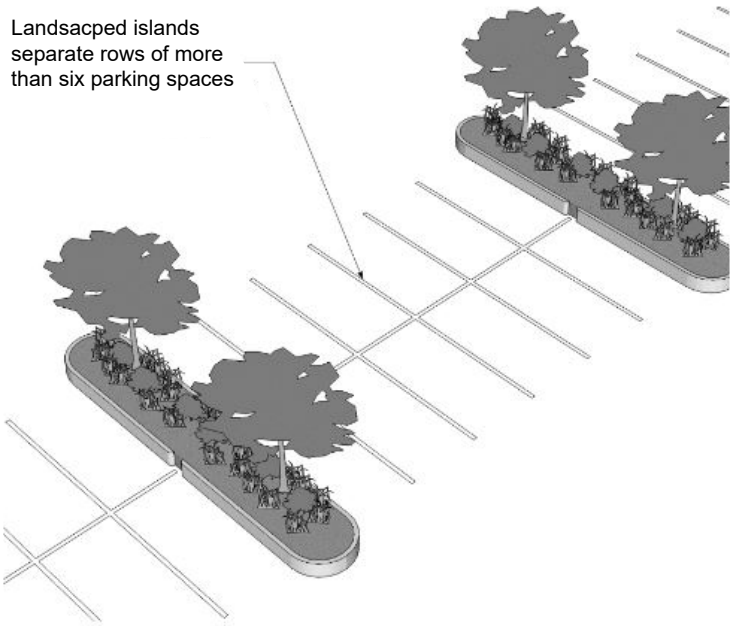
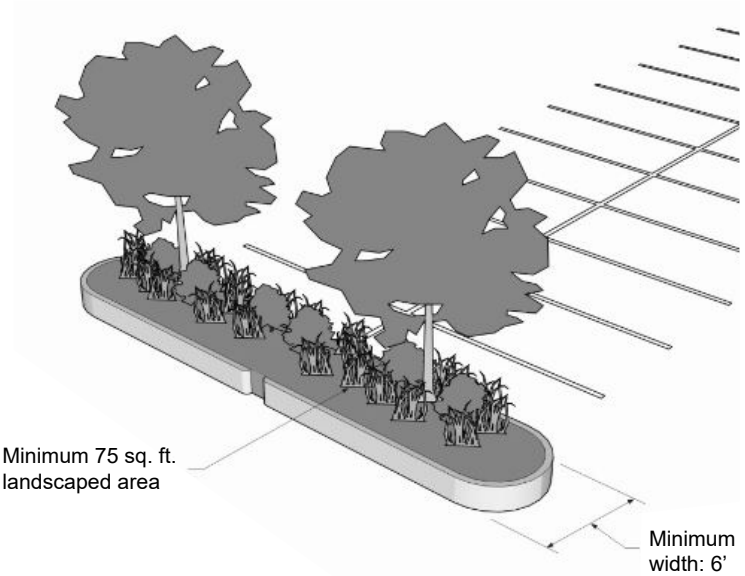


Figure 5.4.3-B: Landsacped Island Dimensional Standards



[15] Board of Trustees Plan Update Session, August 24, 2021.
[16] Carbondale Unified Development Code, amended November 2020.
[17] Planning for Hazards Landscaping Ordinance.

SECTION 5

EFFICIENT WATER DEMAND PROGRAMS

Rate structuring, retrofit programs, and consumer education enable water conservation and efficiency opportunities for existing development.

CASE STATEMENT

Establishing water conservation, efficiency, and reuse in new development enables a community to grow water-smart from the start. Programs that incentivize or assist consumers in reducing water demand serve an important role in retrofitting existing development and promoting a continued focus on wise water use.

Largely within the purview of water providers, incentive programs and rate structures can promote efficient water demand by:

Sending a price signal to incentivize water conservation.	Helping consumers invest in and manage efficient fixtures, appliances, and irrigation.	Monitoring and communicating data about water usage to consumers.

TOOLBOX: CONSERVATION RATE STRUCTURING

Water providers set rates to collect the revenue they need for operations, invest in infrastructure, and protect public health. With a revenue goal identified, providers can develop a rate structure to meet additional objectives, including water conservation and acquisition of supplies. Prioritizing conservation and mitigating water demand can lower water provider expense by sizing water supply acquisition or storage to the lower level of demand.

Water rates are determined by two factors: fixed and variable costs. The fixed costs of water are determined by the costs of water acquisitions and the costs to establish, operate, and maintain the infrastructure to convey the water. A variable cost is based on the amount of water a consumer uses.

Common goals for adopting water conservation rate structures include:

- Reducing daily peak usage.
- Reducing seasonal peak usage.
- Reducing total system demand.

Consumer water conservation does not create financial strain if the offset demand allows new customers to be added to the system while maintaining overall water use. If it is possible that customer conservation may exceed the point where it would present a revenue challenge with the current price of water, consider having a public dialogue to design solutions and rate structures that reflect the community's values and needs. Keep in mind that less demand pressure can result in considerable cost savings over time by reducing strain on water system infrastructure, thus delaying the need for maintenance, retrofitting, or expanding infrastructure.

There are a variety of rate structuring options:

- Drought Demand Pricing: Rates are higher during drought periods.
- Excess Use: Rates are higher for above average water use.
- Inclining Block: Rate per block increases as water use increases.
- Indoor/Outdoor: With separate meters, or sub-metering, rates for indoor use are lower rates than outdoor use.
- Penalties: Customers are charged for exceeding allowable limits of water.
- Scarcity Pricing: The costs of developing new supplies is added to bills.
- Seasonal Pricing: Water rates are higher during the season with the most demand.
- Sliding Scale: The unit price increases based on an average consumption.
- Spatial Pricing: Water rates are determined by the actual costs to supply water to specific locations.
- Time-of-Use: Water rates are higher during peak days or specific hours of the week.
- Water Budget: Block rate is defined for each individual customer based on efficiency projections/expectations for that customer.

Best Practices for Conservation Rate Structures:

- Develop a utility water conservation plan to clarify water conservation goals.
- Conduct a rate assessment to determine options for rate structuring.
- Develop a rate structuring plan and conduct community education and outreach to minimize opposition to potential rate increases.
- Adopt a conservation rate structuring strategy.

Photo by Bill Griepenstroh

CASE STUDY

CONSERVATION RATE STRUCTURING – DENVER, CO

Effective water rates are a key tool for managing demand as well as generating sufficient revenue for operations, maintenance, and capital improvement projects. A key challenge for water providers is finding ways to maintain financial sustainability as customers embrace water conservation. In April 2016, Denver Water implemented a new rate structure. The previous rates covered service costs, but were no longer generating adequate revenue for operations and maintenance due to an average reduction in consumption of 20 percent over 10 years.

The rate structure includes three tiers based on water use. Indoor water use— for bathing, cooking and flushing toilets—is considered essential for human life and is charged at the lowest rate. Efficient outdoor water use is charged in the second tier (middle rate), followed by inefficient outdoor water use in the third tier (highest rate). In addition to variable charges based on water use, the rate structure includes a monthly fixed charge based on the size of an individual's water meter and additional fees for customers in suburban areas. Rates are typically increased annually.

The public's reaction to the rate structure was not positive. Customers found themselves initially shocked by summer water bills 25 to 35 percent higher than previous years. Denver Water was criticized for not being transparent over the increase despite having included notices in bills three months prior to the changes. The sheer number of phone calls from baffled residents to Denver Water customer service indicated that the communication strategy needed to be approached differently. However, tiered rates are no longer a novel concept and customers fall under such rate structures in cities and towns across Colorado.

To offset the impact to customers, income-based assistance programs should be established. Denver Water directs customers who qualify for the Colorado Low-Income Energy Assistance Program (or LEAP) to apply for the new Low-Income Housing Water Assistance Program - a federal program that helps residents pay their water and wastewater bills, avoid shut-offs and support reconnections related to nonpayment. Elsewhere, like the City of Westminster, income assistance programs provide a monthly credit for qualified customers.

TOOLBOX: POST-OCCUPANCY INCENTIVES AND EDUCATION PROGRAMS

Both land use planning programs and water providers can engage consumers and provide incentives and education on the benefits of using water efficiently in their homes and businesses. Using technology like advanced water meters and sub-metering helps tailor these post-occupancy interventions.

Conservation Rebate Programs

Incentive programs can be a useful way to reduce current water demands for both residential and commercial properties/water users. They can serve as a complementary way to involve current residents/post-occupancy developments in implementing water-smart building and design features. Providing rebates for homeowners and businesses to remove grass and retrofit water-smart plumbing fixtures is a well-tested tool that can generate meaningful water savings.

Best Practices for Conservation Rebate Programs:

- Offer rebates to residents for installation of low-flow plumbing fixtures such as toilets and shower heads, appliances such as high-efficiency washing machines, and "smart" home water monitors to reduce indoor water use.
- Offer rebates to residents and commercial customers for "smart" irrigation controllers, xeric landscaping, and removal of turf grass to reduce outdoor water use.
- Use rebates or grants to incentivize homeowner's associations to remove turf grass and install water-efficient irrigation systems and controllers.
- Establish a rebate program for multi-family residential buildings that have cooling towers to upgrade their conductivity controllers.

Water Metering, Audits, & Leak Detection

Water customers, including commercial, industrial, and residential users, may not be aware that water leaks and inefficient fixtures may be unnecessarily increasing their water use. While water providers may perform their own system-wide water loss audits, they can also support and incentivize customers to do the same.

Water metering is a method of measuring water consumption. Advanced metering technology, called "smart meters," ease the data collection process and increase the specificity of the data. This increased granularity of information creates the opportunity for easily justifiable rate structures, rapid leak detection, and customized demand management programs. Utilities that pair metering and commodity rate structures report a 15% to 30% reduction in water consumption.

Privately purchased metering devices are growing in popularity because they connect the consumer to their water data in real time. In the absence of utility-wide advanced metering, encouraging consumers to purchase their own meters can achieve similar water demand reductions at individual properties.

Furthermore, sub-metering multi-family, commercial, and outdoor uses can provide data granularity to empower refinement and optimization of water policies, rates, and fees. The value of this information may be worth more than the cost of installing an extra meter.

Metering and the corresponding audits and interpretation can identify opportunities to modify water-consumptive behaviors. They can also detect leaks in the system and signal when infrastructural updates are necessary to mitigate water loss.

Best Practices for Water Metering, Audits, & Leak Detection:

- Deploy leak detection equipment, such as specialized meters temporarily attached to the main meter, in scenarios where low staff capacity limits on-site visits.
- Offer landscape audits that recommend watering schedules, infrastructure upgrades, and drought-tolerant plants.
- Offer audits at no cost to customers or pair it with an incentive, like a free fixture.
- Encourage participation by providing water audit results of public buildings as examples that demonstrate potential water saving outcomes.
- Use the aggregated analysis of audit results to identify code and policy changes.
- Update your codes to allow individuals to install privately purchased metering devices on the utility meter and provide guidance on how to attach them in a way that avoids disturbance to utility operations.

Photo by Chandler Cruttenden

Photo by Greta Hoffman

CASE STUDY

RESOURCE CENTRAL'S OUTDOOR WATER EFFICIENCY PROGRAMS

Turf removal programs aim to replace water-intensive lawns with water-wise gardens, permeable green landscaping, or other water-efficient plant material. Resource Central's lawn replacement program is an example of such a program, specifically designed to assist Colorado residents in replacing their lawns with water-efficient landscapes.

Resource Central is a non-profit organization dedicated to providing services and support to help Colorado residents conserve natural resources. The lawn replacement program assists residents in replacing their water-intensive lawns, thereby conserving water, saving money, and reducing maintenance costs. This is achieved through free landscape design services and rebates for residents who complete their lawn replacement projects. These rebates, provided by the local water utility, are based on the amount of turf removed and the type of landscape installed.

In Colorado, many communities have implemented measures to limit irrigated turf to conserve outdoor water. Additionally, water providers have developed turf buyback rebate programs to incentivize homeowners to make the switch. For instance, the city of Aurora updated its Unified Development Ordinance in 2020 to reduce and prohibit turf in residential front, side, and rear yards, with a maximum allowance of 33% of the site's total area. To further encourage homeowners, the city also created the Grass Replacement Incentive Program (GIRP), which offers incentives to property owners who voluntarily remove existing turf and replace it with plant-based landscape or water-wise native grass.

Resource Central's lawn replacement program complements the landscape codes and water provider incentive programs of cities like Aurora, providing additional support for their efforts to conserve outdoor water. Municipalities provide the regulatory framework for reducing water-intensive lawns, and water providers offer rebate programs. The lawn replacement program offers additional incentives and resources for residents to facilitate landscaping projects. Together, these programs provide a comprehensive approach to water conservation that addresses regulatory and voluntary practices.

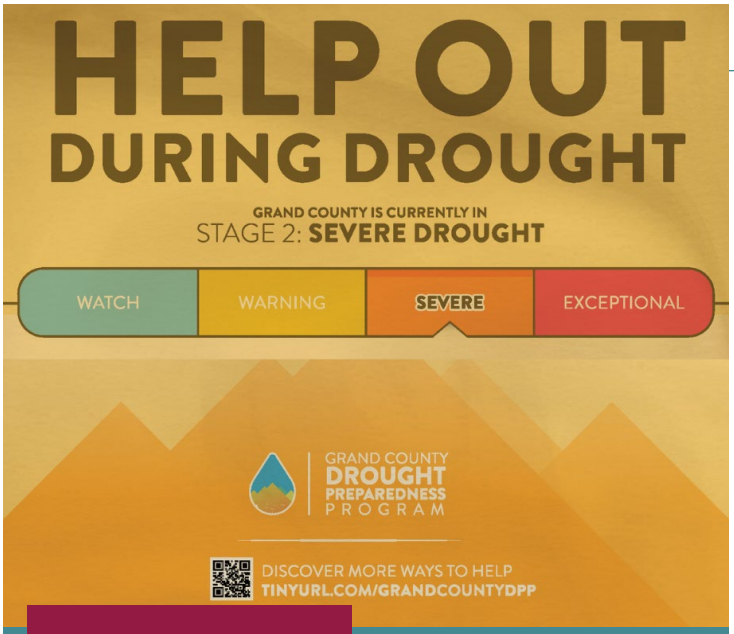
The landscape codes, water provider rebates, and Resource Central's lawn replacement program are powerful tools for water conservation in Colorado. By combining regulatory and voluntary approaches, these programs effectively reduce water-intensive lawns and promote drought-tolerant landscapes. Residents participating in these programs can benefit from reduced water bills, improved aesthetics, and reduced maintenance.

TOOLBOX: CONSUMER EDUCATIONAL MESSAGING

There are many ways for planners and water providers to reach consumers with conservation messaging. Utility bills often include an educational insert or other content to inform the reader about policy changes and to encourage water savings with tips and tricks. Some include warnings and fear-inducing messages designed to curb water use. These messages often miss the mark, since people tend to defend themselves from fear or negative self-images by ignoring this messaging or rationalizing why the new information does not apply to them. Instead, studies show that messaging techniques that promote a sense of control, offer social incentives, provide immediate rewards, and are framed positively are more effective in changing behavior.

Best Practices for Compelling Messaging:

- Help your reader feel they have control or influence. Provide tangible acts or decisions they can make to "move the needle" toward a goal.
- People generally want to be either the same or better than their peers. Offer comparisons or share high compliance figures (e.g., "Nine out of ten residents follow these irrigation best practices to save water.").
- Near-term rewards make people feel good. This reward structure can even motivate behavior changes that relate to long-term goals or outcomes that are not immediately visible. The reward can be external or intrinsic.
- People are more likely to believe and act on positive rather than negative information. So, when given an opportunity to describe a trend, note progress toward goals.



CASE STUDY

DROUGHT PROGRAM MESSAGING — GRAND COUNTY, CO

"The Colorado River is the lifeblood of the West, and it all begins in Grand County!" was the opening sentence of the Growing Water Smart message that Grand County developed in 2019. With climate unpredictability becoming the new norm, climatologists predict an increase in the frequency of drought.

To address this challenge, Grand County established a Drought Preparedness Plan through a stakeholder process involving water districts, agricultural interests, environmental organizations, fire districts, town representatives, and Grand County government. The plan's objective is to preserve essential public services and minimize the adverse effects of drought on public health and safety, economic activity, environmental resources, and individual lifestyles. The plan is intended to remove the crisis from drought preparedness efforts, reduce the hardships caused by water shortages, create a county area-wide approach to drought preparedness, and raise public confidence in the actions taken to address water supply shortages. The plan was written to give each municipal water supplier or district the flexibility to respond appropriately depending on the stage of drought.

In order to best integrate all perspectives on the issues surrounding drought and water, the County hired a consultant to facilitate a series of eight meetings. During these meetings, the stakeholder team reviewed and discussed materials from drought experts across the state, determined drought stages, reviewed drought plans for different communities in the U.S., created a subcommittee of stakeholders that drafted a drought preparedness plan. The Plan was operationalized in July 2020 and in August 2021, the Stakeholder group formalized how it operates via a memorandum of understanding.

Throughout the process of executing the plan, the County identified a need to develop ways to make drought, its conditions, and the Drought Preparedness Plan's recommended conservation measures easily digestible. With this in mind, the County established subcommittees to develop materials for public awareness campaigns to promote a greater awareness of drought in the community, and ultimately get individuals to conserve. They hired a consultant to develop visual materials that described community actions to take when various stages of drought were announced, as well as a promotional video that emphasizes the community's values around water and informs viewers about how to take action during when a drought stage (watch, warning, severe, exceptional) is announced. The video and Drought Management Plan can be accessed on Grand County's website.

Grand County received Growing Water Smart technical assistance grants to support both the Drought Preparedness Plan and the development of public outreach materials.

CONCLUSION

The toolboxes outlined in this workbook highlight some of the most effective strategies communities can employ to take a more holistic and sustainable approach to water management. Integrated water and land use actions occur throughout the planning process, from the visioning and planning stage, through development review, and in post-occupancy. All communities have an opportunity to apply an integrated water and land use intervention. Ultimately, by linking land use to water demand, we can wisely manage our limited resources in a way that sustains thriving economies, healthy environments, and vibrant communities in Colorado for future generations.

ADDITIONAL ONLINE RESOURCES

GROWINGWATERSMART.ORG

The Growing Water Smart program offers additional resources to Growing Water Smart participants through our program website. The website provides information related to all of our state programs, including Arizona, Colorado, and California. Please visit resilientwest.org/2023/CO-Appendices to find resources relevant to Colorado, including:

- A **resource list** of additional reports, tools, and policy examples.
- A summary of relevant **funding and assistance** from our partners, the state, and federal agencies.

THE GROWING WATER SMART PEER-TO-PEER NETWORK

Our **Growing Water Smart Peer-to-Peer Network** is a place for workshop participants to strengthen their professional connections with other local government leaders and affiliates who are integrating water and land use in their communities.

If you or your community recently attended a Growing Water Smart workshops, visit Growing-Water-Smart.mn.co to join the Network.

As a Network Member, you gain an opportunity to:

- **Strengthen professional knowledge and skills** by accessing resources, studies, and news related to integrating water and land use.
- **Build a network of peers** working on similar challenges and advancing community change.
- **Learn about peer projects and share individual experiences** advancing water-smart goals.
- **Explore and identify innovations** in the field.
- **Access technical expertise** to support organizational policy change and action.
- **Be a champion** in the region for water smart principles.

GROWING WATER SMART METRICS: TRACKING THE INTEGRATION OF WATER AND LAND USE PLANNING

Tracking the results of water and land use integration are an important component to determining whether community goals are being met. Sonoran Institute's Growing Water Smart Metrics guidebook offers a set of baseline data that can be assessed for year-over-year trends to empower adaptation. Ten "progress" metrics track things such as the development of long- range plans, implementation of water conservation and efficiency programs, adoption of landscaping and building codes, implementation of adequate water supply rules, and regionalization efforts.

Fourteen metrics are then recommended to measure the "impact" of your community's strategies by assessing trends in land use, development patterns, and water demand.

Grow Water Smart

GrowingWaterSmart.org

450+ Community Representatives

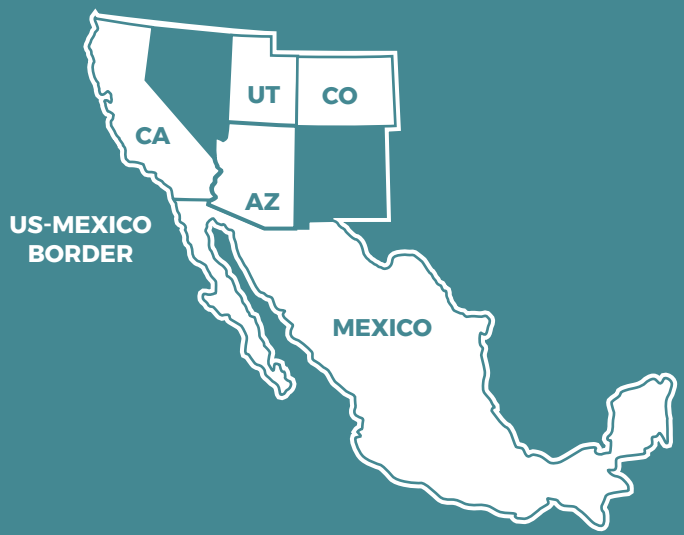
Across the Colorado River Basin

Growing Water Smart Workshops are helping leaders build capacity and implement action plans to steward their community's future by ensuring clean, reliable water for people, nature, and industry.

Through our Growing Water Smart workshop series, we have trained over 450 community representatives and impacted the lives of over 4 million Coloradans and 3 million Arizonans.

With your continued support of Growing Water Smart, more communities can take advantage of our expertise and lessons learned through nearly thirty years of shaping the future of the West.

GET INVOLVED



WHERE WE WORK

JOIN US. MAKE THIS WORK HAPPEN.

To sponsor a workshop in a community you care about, contact us.

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