

GROWING WATER SMART THE WATER-LAND USE NEXUS

**ENSURING A PROSPEROUS FUTURE AND HEALTHY
WATERSHEDS THROUGH THE INTEGRATION OF
WATER RESOURCES AND LAND USE PLANNING.**



BABBITT CENTER
FOR LAND AND WATER POLICY

A Center of the Lincoln Institute of Land Policy



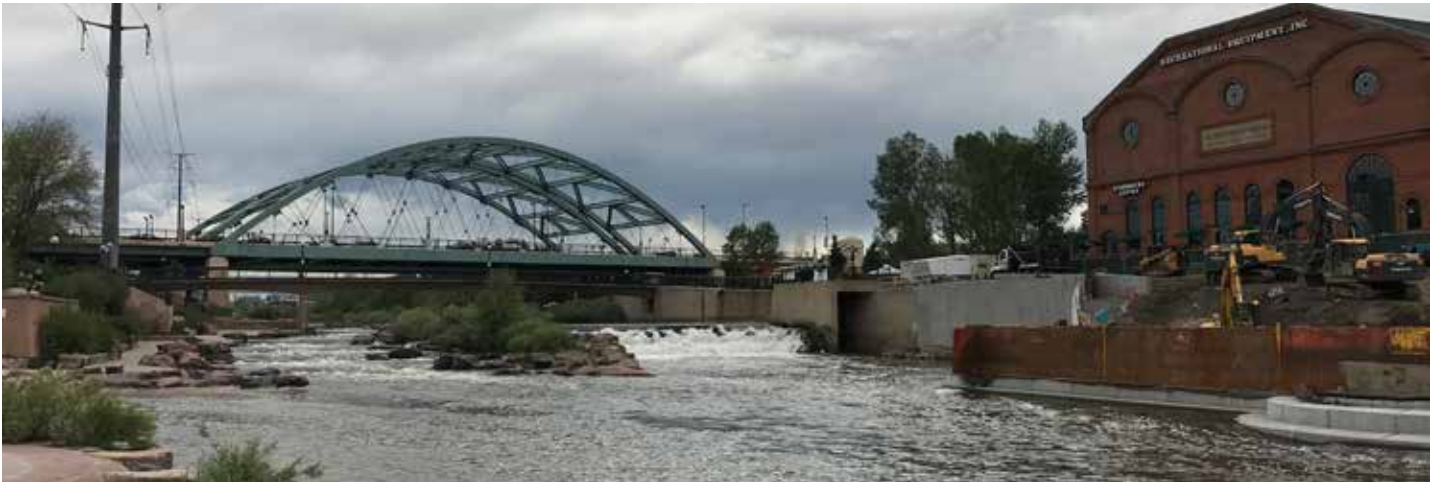
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Our sponsors understand that we are all connected within the Colorado River basin. They know that we must come together to find solutions to the problems we all face. Because of this, they are supporting programs like this that make a positive change. Like you, they care about the future of Colorado, and envision a more resilient future throughout the North American West.





ABOUT GROWING WATER SMART

The Sonoran Institute and Babbitt Center for Land and Water Policy's Growing Water Smart program introduces communities to the full range of communications, public engagement, planning, and policy implementation tools to realize their watershed health and community resiliency goals. Through Growing Water Smart, Colorado communities can learn how they can integrate land use and water planning.

ABOUT SONORAN INSTITUTE

The Sonoran Institute's mission is to connect people and communities with the natural resources that nourish and sustain them. We work at the nexus of commerce, community, and conservation to help people in the North American West build the communities they want to live in while preserving the values which brought them here. We envision a West where civil dialogue and collaboration are hallmarks of decision making, where people and wildlife live in harmony, and where clean water, air, and energy are assured.

ABOUT BABBITT CENTER

Water is the lifeblood of the American West. Land use decisions are made every day that shape our water future. Coordination of land and water use decisions is critical if we are to meet the current and future water needs of our people, economy, and environment. Given the important connection between land and water issues, the Lincoln Institute of Land Policy established the Babbitt Center for Land and Water Policy in 2017. The Babbitt Center will focus initially on the region dependent on one of the most heavily used and over allocated rivers in the world: the Colorado River. Our work begins in Arizona and Colorado, and will extend throughout the Colorado River Basin.

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SHIFTING OUR FOCUS: FROM SUPPLY TO DEMAND SIDE MANAGEMENT

By 2050, Colorado's population is predicted to almost double in size putting pressure on our State's already limited water resources. A growing population can escalate the costs of operating local utilities, the need for enhanced and expanded infrastructure, and, if the water supply is constrained, the cost of acquiring new sources. In the past, water resource managers and water providers have turned to *supply side management* to meet growing demand by investing in water acquisition, treatment, and storage and distribution projects. However, these options come with a significant price tag and can be more resource intensive.

An alternative to these costly investments is more efficient use of existing supplies. Increasingly, communities are turning to *demand side management* - an approach that seeks to reduce the demand for water. A demand side approach generally includes:

- **WATER CONSERVATION:** Encouraging water users to reduce how much water they use by modifying behaviors
- **WATER EFFICIENCY:** Encouraging or requiring the use of technology, building or site designs that uses less water.
- **WATER REUSE:** Treating or converting grey and black water to replace or augment water supply.

One of the more promising strategies in water demand management is integrating land use planning with water conservation and efficiency. Communities throughout the West have found that by increasing development density, utilizing technological efficiencies, and aggressive conservation programs, they have been able to continue to grow without acquiring new 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. This approach increases the cost to benefit ratio of capital investments by using the same amount of water and infrastructure to serve more people per dollar spent. This approach not only benefits the environment and ensures a more sustainable future, it's also good for the triple bottom line.

COMMUNITY OPPORTUNITIES FOR INTEGRATING WATER AND LAND USE

The planning and regulatory mechanisms that guide how and where a community develops each provide an opportunity to strengthen the nexus between water and land use. Determining where to intervene will depend upon a community's political readiness and capacity, what water demand management initiatives have been initiated to date, and the level of aggressiveness desired in achieving water saving goals. The intervention opportunities include:

1. Planning & Policy Making	Water Plans Comprehensive Plans Capital Improvement Plans	Establishes goals and objectives for managing the intersection of natural resources and the built environment.
2. Pre-Development	Water Adequacy Requirements	Links new development to water supply planning.
3. At Development Review	Zoning and Subdivision Regulations Annexation Policies Planned Development Policies Development Agreements	Determines what water resource management, conservation and efficiency requirements are applied to development.
4. At Building & Construction	Building, Plumbing and Landscaping Codes	
5. Post-Occupancy Education	Conservation & Efficiency Incentives Outdoor Watering Restrictions Water Budgets & Auditing	Empowers and incentivizes homeowners and renters to reduce water consumption.

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.

SECTION 1 **Planning & Policy Making**

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

SECTION 2 **Adequate & Sustainable Water Supply Requirement**

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 Policy**

Introduces planning principles that can make a community's development pattern water smart.

SECTION 4 **Healthy & Resilient Watersheds**

Provides guidance on how to protect your water supply to support community resilience and ecological systems.

SECTION 5 **Conservation Rate Structuring**

Summarizes how a utility can manage water demanded of households through market-based incentives and pricing mechanisms.

Each section includes:

1. **A rationale** for why a particular approach should be considered.
2. **A case statement** that provides justification for each approach and what water saving impacts can be expected.
3. **A tool box** of the particular policy or management actions a community can take to achieve water conservation and efficiency outcomes for this approach.

A resource list of where to find more information including community case studies and policy examples is included in the **Growing Water Smart Resource Appendix**.

SECTION 1:

PLANNING & POLICY MAKING

The sustainability of a community is dependent upon the availability of water; consideration of future water needs must be integral to decision making.

CASE STATEMENT

The State of Colorado provides limited guidance for drafting policy to link land use and water in required plans. However comprehensive planning, water planning, and capital improvement planning are all interrelated. Integration of these planning processes will require breaking down the traditional planning and operational silos of different departments and agencies. Land use planners have focused on how much and what type of growth may take place in their communities while water resource managers have focused on ensuring adequate water availability. An integrated water resource and land use management approach can ensure:

- A community's vision for the future considers water and growth together.
- A water resource management plan and a capital improvement plan consistent with the vision for future land use and the community's sustainability and resilience goals.
- Development occurs in a way that protects the watershed including ecological functions and the quality and quantity of water supplies.

TOOLBOX: PLANNING

1. COMPREHENSIVE PLANNING

Comprehensive 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 one of the few opportunities for a communitywide 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](#) and [counties](#) allow for, but do not require a water element.¹ 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 also offer an excellent educational opportunity in helping the community understand the:

- Projections for future population and drivers of growth.
- The type of development occurring in the community and where.
- 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.

A comprehensive plan can help a community identify opportunities to integrate water into traditionally land use focused comprehensive plans by including goals for:

- Water supply and demand management
- Wastewater treatment and disposal
- Watershed processes and health
- Floodplain and stormwater management
- Interagency coordination and collaboration

¹ California, Arizona, and New Mexico provide more guidance on integrating water into land use. To review content of the Arizona requirement visit <http://flagstaff.az.gov/DocumentCenter/Home/View/8317>. To review content of the California optional element visit http://opr.ca.gov/docs/General_Plan_Guidelines_2003.pdf.

2. VISIONING

Some communities incorporate a robust visioning process into their comprehensive plans or water resource management plans. A visioning process identifies how a community can intervene to most positively influence the development of their community in response to change. Some of these visioning exercises take the form of clarifying community values and choosing from among a series of desirable futures. This *normative approach* to long range planning aims to create a clear vision for the future, most frequently through using visualization tools that illustrate alternative scenarios. These models can assist in decision making by assessing the impact of different development patterns on indicators such as water demand, air quality, and vehicle trips.

Exploratory approaches to considering the future take a slightly different approach. This approach is most effective when used to consider and strategize responses to uncertainties. Rather than selecting a preferred scenario and developing a plan to achieve that particular future, this approach explores how a community may need to adapt and manage different outcomes for a variety of scenarios. The use of exploratory scenarios is being applied across the West in water departments wanting to think strategically about water, growth, and climate change.

3. WATER CONSERVATION PLANS

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 plan.² These plans require a summary of the water providers water supply and demand budget and a plan for water conservation and efficiency. More recently, the State of Colorado added a requirement to also evaluate best practices in water demand management that can be implemented through land use.

4. CAPITAL IMPROVEMENT PLANS

Planning departments, parks, public works, and water and wastewater utilities often rely on grants and bonds to invest in green and grey infrastructure improvements or new construction. Capital Improvement Plans (CIPs), which forecast and match projected revenues and capital needs over a multi-year period, provide the greatest opportunity to create a long-term investment strategy for the infrastructure improvements identified in a comprehensive plan or water resource management plan. A CIP ensures resources are allocated to community priorities.

STRATEGIES FOR PLANNING & POLICY MAKING

- Link water supply and demand to projected land use patterns, not just growth projections in both comprehensive plans as well as water plans.
- Use visioning processes and scenario planning to assess vulnerabilities and uncertainties affecting water resources as the future unfolds

² [CRS 37-60-126](#)

- Create an independent water element in the comprehensive plan or add a water conservation plan as a supplement.
- Use the CIP to ensure investments are made in water management physical infrastructure or projects including stormwater management, green infrastructure, growth area infrastructure, disaster mitigation, and watershed restoration.

CASE STUDY

WATER SMART PLANNING - WESTMINSTER, COLORADO

The City of Westminster has a long history of linking water and land use policy. In 2004, the citywide Comprehensive Land Use Plan was updated to improve the alignment between land development and water resources including:

- Revised tap fee structure to reflect water usage.
- Revised landscape requirements for low-water using materials and creation of an inspection position to ensure landscape plan compliance.
- Linking water and parcels of land through geographic information systems (GIS).
- Increased reporting to City Council on water supply and demand projections.

In 2013 Westminster adopted a new comprehensive plan which was amended in 2015. This plan intensified redevelopment and designated growth focus areas and included the Department of Public Works and Utilities in the development process to ensure infrastructure is sufficient for new development. A 2018 code update removed a disincentive the city had identified that was not achieving desired development goals. The revised standards dictate that any land use change may not negatively impact infrastructure including: drainage, water and sewer infrastructure, and water supply.

A new comprehensive plan, Westminster Forward, is currently underway with an expected completion in 2019. The new comprehensive plan has been expanded to include a sustainability plan and a water supply plan. Combined, these two elements will cover water quality, quantity, supply and demand, and climate change vulnerability.

Westminster is a Growing Water Smart community and received a technical assistance grant to do a code audit and revise anything contradicting the attainment of their water and land use goals.

CASE STUDY

WATER SMART COLLABORATION - FORT COLLINS, COLORADO

The City of Fort Collins, current population of about 170,000, is expected to double in size over the next 20 – 30 years. The City manages its own utility with three additional water suppliers providing service within the Growth Management Area (GMA), resulting in inconsistent fees, policies and conservation programs. One developer in a third-party's service area has already petitioned to be served by the City of Fort Collins, seeking lower costs for water.

A key challenge for Fort Collins, and the region, is aligning practices, scaling efficiency and acting together to ensure an affordable, sustainable supply of water 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 submitted a joint-application for Growing Water Smart technical assistance funding. They utilized a facilitator to lead two full-day workshops to identify the greatest opportunities for cooperation on water resource management across agencies and service areas. This process brought together, the City of Fort Collins' Planning Dept., Fort Collins Utilities (FCU), Fort Collins-Loveland Water District (FCLWD), East Larimer County Water District (ELCO), and the NFRMPO. A representative from Greeley also observed the process.

The workshop started with understanding current conditions and trends. Each organization completed a self-assessment prior to the workshop with information including water supply and demand balance, drought contingency plans, service connection requirements, water costs, and water efficiency plan strategies. This information was collated into a comparative report and used as a discussion guide to identify opportunities for aligning water management. The discussion focused on supply vulnerabilities, inconsistencies in methodology, organizational business models, and water demanded by new development.

At the time, the City was in the process of updating its comprehensive plan utilizing scenario planning to assess different development pattern options. Water demand was one of the sustainability indicators assessed under the different scenarios.

The growth scenarios explored three different futures and their associated water reduction percentages based on the development patterns. For example, the "no change/as is" scenario would result in a reduction in household water use of 2% overall by 2040 while a denser development pattern would result in a 14% water demand reduction overall. To vet the draft scenarios, each water provider was asked to assess how their organization would be impacted by each scenario followed by a collective assessment of the impacts of the growth scenarios. This exercise proved useful in ensuring the designated growth areas were aligned with not only future water infrastructure, but existing infrastructure as well.

Another outcome was identifying opportunities for collaborating on post-occupancy water conservation programs. Each organization has a different level of capacity for working with its customers. The City had the most capacity with full time staff dedicated to water conservation education.

The region is continuing its efforts to enhance collaboration by formalizing its process as a regional working group.

SECTION 2:

ADEQUATE AND SUSTAINABLE WATER SUPPLY STANDARDS

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

CASE STATEMENT

Water adequacy rules link supply side management to demand side management. States across the West have adopted state statutes intended to protect communities from the threat of not having adequate water supplies for new development recognizing that:

- New development creates new water demand.
- Government has a role to play in ensuring sustainable and adequate water supplies for new and existing property owners.
- Growth pressure on water supplies requires stronger connection between land use approval and water planning at the State, regional, and local level.
- Collaboration between local governments and water providers is essential to ensuring reliability

TOOL BOX: WATER ADEQUACY

The State of Colorado water adequacy statute was revised in 2017 and requires that all local governments must determine that a proposed development will have an adequate and sustainable water supply for build out of a development proposal. The State defines adequate and sustainable as:

“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 statute also provides guidance on what information should be used in the determination process. The rules exempt the statutory cluster subdivisions pursuant to Part 4 of Article 28 of Title 30, C.R.S.

While the statute requires local government to prove water supply, there is wide variation across the state in how this requirement is integrated into the development code. Best practices linking water supply to new development all contain similar elements. The following components should be included in an adequate water supply requirement:

- 1. Definition of both Adequate and Sustainable Supply:** The update to the Colorado statute now includes a clearer definition of an adequate and sustainable water supply as quality, quantity, dependability, and availability. Communities are updating their regulations to both include these definitions as well as any relevant additional description of these indicators.
- 2. Articulation of Water Source(s):** Definition of and clearly identified allowable water sources whether from a water provider, individual wells, shared wells, or cisterns.
- 3. Water Rights Inventory:** Legal demonstration of future water source(s) by either the acquisition or dedication of surface water rights or approval for future wells. Most communities require the water demand projections at pre-development and the securing of the actual water rights at final plat.
- 4. Demonstrations of Water Availability:** For each source(s) as defined by requirements for water quantity (e.g. pump rates or water supply plan), 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.

§ 29-20-305 Adequate Water Supply Regulation Summary

If your water source is:

A. Water Entity w/o Water Plan

B. Water Entity w/ Water Plan on File w/ Government

C. Not a Water Entity

Proof of water supply application requirements should include:

A LETTER provided by a registered professional engineer or water supply expert from the entity stating:

- (a) Willingness to commit service.
- (b) Ability to provide service.

Ability to serve proven by:

- Estimate of water supply requirements for development through build out.
- Description of the physical source of water supply to serve development.
- Estimate of water yield under various hydrological conditions.
- Water conservation measures that may be implemented in the development.
- Water demand measures that may be implemented in the development.
- Such other information as may be required by local government.

The WATER SUPPLY PLAN must meet these requirements:

- Reviewed or updated by water entity board within last 10 years.
- Has a minimum 20 year planning horizon.
- Lists water conservation measures implemented within area.
- Lists water demand management measures, if any, for development.
- General description of the physical source of water supply for entity.
- General description of water supply entities obligations.
- Such other information as may be required by local government.

A WATER SUPPLY REPORT with the following information:

- Estimate of water supply requirements for development through build out.
- Description of the physical source of water supply to serve development.
- Estimate of the amount of water yield projected from proposed water supply under various hydrological conditions.
- Water conservation measures that may be implemented in the development.
- Water demand measures that may be implemented in the development.
- Such other information as may be required by local government.

It is the sole discretion of the local government as to whether an applicant has a water supply that is adequate to meet the requirements based on the following criteria:

- (a) Documentation required above.
- (b) If requested, a letter from the state engineer commenting on the documentation.
- (c) Whether the applicant has paid required fees/charges for the purpose of acquiring water and/or expanding or constructing infrastructure to serve the development.
- (d) Any other information deemed relevant by the local government pursuant to applicable local government land use regulations or state statutes.



- 5. Development Water Demand Projections:** A projection of the amount of water (water budget) that a proposed development will likely require at full buildout for proposed development. Many communities are now including a specific methodology for determining this projection based on issues in the past with developments underestimating water demand.
- 6. Water Efficiency, Conservation or Demand Management Practices:** While not widely used across Colorado, the state statute gives authority to the local government to include pre-development requirements or incentives for developments to reduce projected water demand through efficiency and conservation practices.
- 7. Uniform or Specific Area Application:** Effective development regulations apply to all new development or define specific 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.)
- 8. Maps:** Maps of geographic locations or zones where different adequacy requirements or review processes apply.
- 9. Defined Review Processes:** Specificity on what is required for the review and when in the process as well as who conducts the reviews. For individual wells, review by the DWR should occur to verify the permit as well as comment on water supply adequacy prior to final plat.

10. 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 reference to specific guidelines.

11. Requirement, where necessary, for augmentation: Augmentation requirements differ across the State, but generally is either a requirement for an augmentation plan or purchase of a certificate from an approved supplier.

The State of Colorado Department of Public Health & Environment as well as Division of Water Resources each play an important role in the water supply review process. Development code regulations generally mention them as a review agency or that design must be in compliance with the department's regulations.

DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENT	DIVISION OF WATER RESOURCES
Responsible for:	
Permitting of water provider 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 Division of Water Quality.	Review and approval of augmentation plans.
At this time, individual wells are not required to be tested by the State. They do 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.	

Municipal and county regulatory standards will emphasize different information. Municipalities most frequently provide water from a municipal utility while counties rely on a water district and/or individual wells. For a municipality, its water adequacy standards may be quite simple including only the need for a letter to serve, connection standards, potentially a water rights transfer standard in order to meet new demand, and a prohibition against individual wells within the service boundary.

County water supply standards are substantially more complicated and should be tailored to the specific hydrology of the area. They may set requirements or standards for different water sources; at a minimum, require the standards for application review as outlined in the state statute; maps and requirements for different hydrological zones; and clarify design standards for private, community, and public water supply and/or distribution systems.

For both municipalities and counties, when the service provider is not a government utility or there are numerous water providers it can complicate having a clear picture of the region's water supply and demand budget. Enhanced cooperation between water providers and the local government becomes critical to ensure the water supply standards are applied consistently and consider individual entity capacity.

CASE STUDY

WATER SMART SUPPLY - SANTA FE COUNTY, NEW MEXICO

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 well. If applicants are connecting to the County utility, the only requirement is a written agreement to provide services. However, if the applicant is not on 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 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.

Developments must also meet water conservation requirements and file a 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 grey 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 11 am and 7 pm
- 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 showerheads.
- EnergyStar certified or equivalent dishwaters, 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.

SECTION 3:

WATER SMART LAND USE POLICY

As a population increases, the demands on water supply and water related infrastructure including water treatment plants, delivery systems, wastewater and watersheds will also increase.

CASE STATEMENT

Water demand is a function of household size, income, residency and conservation behaviors/habits. But water demand is also a function of how we plan, design, and maintain our communities. Research indicates that when it comes to saving water, where and how we build really matters. Efficiencies can be found in density [development patterns], building, site and systems design, especially landscaping. We know that:

- Certain building types and development patterns consume or conserve more water than others.
- Certain land use types consume more water than others.
- Newer appliances and plumbing fixtures are much more water efficient than old ones.
- Certain types of landscaping plants and trees either consume or conserve more water than others.
- Households that conserve water save money for themselves and the water provider and water for other people and nature.

To use less water, the best policy is to make water smart development the easiest type of development to build. **Three types of tools** are available to communities to do that:

1. Promote higher density and compact development, especially where existing infrastructure already exists.
2. Promote high performing, water efficient plumbing and building standards.
3. Promote water saving and climate appropriate landscaping standards and maintenance practices.

TOOL BOX: COMPACT DEVELOPMENT

While the majority of water conservation and efficiency efforts related to land use have primarily focused on outdoor watering and indoor plumbing fixtures, there are considerable benefits to encouraging more compact development patterns. Water usage studies have consistently demonstrated that in urban areas, the largest consumption of water is by large lot single family homes where 50% or more of the water consumed is used for outdoor use during spring and summer. Even with gains from landscaping efficiency and conservation, the density of a development can mean less water consumption. Research has demonstrated that developments between **3-8 units per acre have the greatest gains for water conservation**. 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 neighborhood or community vibrancy.

STRATEGIES FOR PROMOTING COMPACT DEVELOPMENT

- At pre-development review, make rezoning, annexations, and Planned Unit Development (PUD) applications conditional on meeting water conservation standards.
- Develop future land use plans that establish designated future growth areas, both infill and greenfields, 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. As for height

CASE STUDY

WATER DEMAND OFFSET PROGRAM - CITY OF SANTA FE, NEW MEXICO

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 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.

- 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. 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 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.
- A "free stuff" program including low-flow faucet and shower heads.

The water demand offset program applies to commercial projects that require 5 AFY or more, residential projects that require 10 AFY or more, and mixed use projects that require 7.5 AFY or more.

limitations, evidence shows water demand begins to climb at the point a cooling tower is needed for the building. Craft your code for your climate and context.

- Change zoning code to permit multiple types of residential development (*multiplex, townhomes, apartments, ADUS*) by right in designated growth areas to diversify single family homes.
- 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.

TOOL BOX: WATER EFFICIENT LANDSCAPING

In Colorado, outdoor watering for urban landscapes accounts for 50 percent or more of water providers total annual water demand during spring and summer. 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 into their development code for water conservation and efficiency. These include requirements for:

- The types of plants that are best suited for the climate and irrigated by hydrozones.
- A total amount of landscaping permitted based on lot size percentage or square footage.
- The type and amount of turf allowable based on square footage or total landscaped area.
- Low flow and efficient irrigation system technology including drip, bubblers, or low flow sprinklers.

CASE STUDY

WATER FEES AND WATER WISE LANDSCAPING - CASTLE ROCK, COLORADO

The Town of Castle Rock, Colorado is a fast-growing region with the current population of 60,000 people anticipated to grow to 140,000 by 2050. 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 to encourage new developments to be water efficient. They implemented system development fees that 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. The fee structure is intended to reward lower gallon per minute (GPM) water use with a reduced fee.

For developments with a water-efficiency plan that meets a set of minimum standards the Town offers prorated water resources fees. The standards include indoor and outdoor water efficiency, resident education, third-party verification, and monitoring and enforcement. Specifically, the requirements are that:

1. All front and rear yards must be designed and installed by the builder. The developer is responsible for seeing the landscape plan through to completion.
2. Turf areas cannot exceed 19% to 32% of the lot size, depending on actual square footage of the lot. Kentucky bluegrass is prohibited. Allowable turf species must be approved by the town and must be able to survive on 19 inches of supplemental irrigation per year.
3. 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.
4. 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.
5. The Town is taking active steps to reduce their dependence on groundwater, diversify their water portfolio, and encourage innovative water conservation measures in new developments. You can find more information about how Castle Rock is managing water at the Town's [website](#).



- Rain sensors with a shut off device to reduce watering during natural rainfall events.
- Evapotranspiration (ET) Sensors to adapt irrigation to changing weather and soil conditions.
- A water budget for outdoor water use, ideally tied to tiered rate structuring that sends a price signal to the rate payer.
- Soil enhancements and mulching.
- Scheduled timing of irrigation to limit evapotranspiration.
- Code enforcement and fines for violations of standards.
- Training for landscape professionals on water saving landscaping.
- Model Maintenance Standards and Agreements for HOA's and others to use in contracting landscape services.

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

STRATEGIES PROMOTING WATER SAVING LANDSCAPING

- Conduct an assessment of saving potential by comparing annual water demands on a new property against an older property or properties with comparable area, plantings, and irrigation methods.

⁴ Water Smart Landscaping Principles are widely promoted in educational programs as well as adopted into landscape and water conservation plans. http://www.davidclarkdesign.com/images/DCD_flyer_xeriscapeprinciples.pdf

- 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.⁴
- Promote and/or incentivize the use of individual household rain water harvesting for outdoor irrigation.
- Develop an incentive promoting 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.
- Change your subdivision code to include residential, commercial, and public landscaping standards that reduces 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 (before 8 a.m. and after 8 p.m., scheduled by zones and day of the week)
 - soil amendments
 - water loss limits

Non-regulatory options include property owner behavior change education managed by the water provider:

- Rebate programs for water efficient plumbing fixtures such as low-flow toilets, showerheads, and front-loading washing machines.
- Rebate programs for turf removal and replacement with low-water use landscaping.
- Education about xeriscaping and water efficient irrigation systems.
- Water audits that educate property managers and evaluate systems.

TOOL BOX: WATER SMART PLUMBING FIXTURES AND BUILDING EFFICIENCY

Reducing indoor water use in residences and businesses can be accomplished through water-efficiency standards for indoor plumbing fixtures. As a result of a new state rule adopted in September 2016, all new construction will now meet many of the Water Sense requirements. The result will be that most water savings typically gained by water efficient fixtures and appliances in the future will likely come from retrofits.

STRATEGIES FOR PLUMBING FIXTURES AND BUILDING EFFICIENCY STANDARDS

- Use the green plumbing code as a guide or adopt the green plumbing code requiring high-efficiency faucets, showerheads and toilets in the plumbing 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 older less efficient toilet and faucet technologies with water wise ones through rebates or free fixtures.
- 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.

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

In addition to managing water use it is important to safeguard a community's water supply. The quality and quantity of a community's water is inextricably linked to the health of the watershed. Human and naturally occurring factors can degrade ground and surface water quality and quantity including:

- Pollution from urban and agricultural runoff and natural disasters.
- Sedimentation due to soil disturbances, vegetation loss, and erosion from roads and new development.
- Destruction of riparian areas due to development and changes in climate.
- Increased stormwater due to increase in impervious surfaces from development.
- Decrease or lack of water infiltration resulting from impervious surfaces and more rapid runoff.
- Inconsistency in water supply caused by periodic droughts.



TOOLBOX: WATERSHED PROTECTION

Landscape scale changes resulting from both human and natural forces have a significant impact on natural ecosystems and water resource availability. 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 non-profits working with local governments to restore ecological processes and functions.

A complementary approach is watershed sensitive planning which focuses on minimizing negative impacts as new development occurs. Watershed protection goals are generally 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.

STRATEGIES WATERSHED PROTECTION STANDARDS

- Map all sensitive areas including wetlands, riparian corridors, infiltration zones, water supply watersheds, groundwater basins, and natural disaster-prone areas.
- Adopt plans for wildfire mitigation, watershed management, stormwater management, and floodplain management that designate sensitive areas and goals for mitigation.
- Minimize development in sensitive areas through clustering or limited development densities and design standards or at the least, guidelines.

- Create zoning districts with lower densities and/or cluster development to protect surface and groundwater sensitive areas.
- Adopt development standards for stream buffers and setbacks to protect water quality.
- 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 storm event runoff and increasing water infiltration.
- Adopt site level soil erosion mitigation standards for new development to reduce sedimentation and run-off and protect water quality from land disturbance.
- Adopt surface and/or groundwater districts with standards to minimize contamination of streams and shallow aquifers that will protect existing and potential sources of drinking water supplies.
- Participate in collaborative efforts to restore watershed functions through watershed restoration projects.

CASE STUDY

HEALTHY RIVER SYSTEMS - PITKIN COUNTY ROARING FORK RIVER MANAGEMENT PLAN

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. The plan goal was to enhance the health of the Roaring Fork river and its tributaries. 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 2000's, the ecological health of the Roaring Fork River has been declining as a result of water flow modifications, pollution, and development negatively impacting 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 cfs.

The plan was released in the summer of 2018. While the plan outlines management actions for the region to move forward, 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.

SECTION 5:

WATER CONSERVATION RATE STRUCTURING

Utility pricing, or rate structuring, can incentivize consumers to use less water, maximizing conservation benefits.

CASE STATEMENT

Water demand varies due to size and type of property, seasons, weather, income and education, and conservation habits. For individual households and businesses sensitive to the price of water, rate structuring is one of the more effective ways to modify human behavior.⁵ Most water providers use declining block or uniform water rate structures that do not encourage conservation. *Rate structuring* aims to incentivize water conservation by charging higher prices as a household or business uses more water. Common goals for adopting water conservation rate structures include:

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

When well executed, rate structuring can produce significant water savings and expedite shifts in water use behavior.

⁵ Higher income households are less sensitive to rate fluctuations.

TOOL BOX: CONSERVATION RATE STRUCTURING

Water utilities set rates to collect the revenue they need to operate the water utility, invest in its infrastructure, and protect public health. With a revenue goal identified, utilities can develop a rate structure to meet additional objectives including water conservation and acquisition of supplies, but prioritizing conservation can ensure costs are mitigated by right-sizing any acquisition or storage to meet a mitigated demand. Water rates are determined by two factors. First, the fixed costs of water determined by the costs of acquisitions of water and the costs to establish and maintain the infrastructure to convey the water. Second, a variable cost based on the amount of water consumed by a consumer. 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, 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.

STRATEGIES 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.

CASE STUDY

CONSERVATION RATE STRUCTURING – DENVER, COLORADO

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 was no longer generating adequate revenue for operations and maintenance due to an average reduction in consumption of 20 percent over 10 years.

The 2016 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.

The public's reaction to the rate structure was not positive. Customers found themselves 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. In 2018, Denver Water elected to increase the fixed monthly charge and decrease the monthly rate per 1,000 gallons of water used.

The revenue generated by the new rate structure is being used to make updates to the city's aging water infrastructure. Denver Water has a five-year plan to put \$1.25 Billion into 143 capital improvements. Some of these capital improvement projects include new storage tanks at Hillcrest Facility that serves growing demands in southeast Denver, building a new water treatment plant and pipelines for northern Denver, and replacing 60,000 feet of old water main pipes per year.

CONCLUSION

Ultimately, by linking land use (and landscaping) 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.

APPENDIX | RESOURCES

SUMMARY OF COLORADO WATER SUPPLY & DEMAND LEGISLATION

1. COLORADO WATER ADEQUACY

Signed into law in May 2008 and revised in 2017, the [Colorado Water Adequacy Rule](#) gives local government agencies the authority to approve new development based on a determination of sufficient water supply to ensure the pace of development does not exceed water supplies.

Initially the adequacy determination was required at final plat, but has since been changed to permit the local government to determine when a determination ought to be submitted. Verification of water adequacy is determined by the Colorado water engineer, a registered professional engineer, or a water supply expert. The approval agency is determined based on the source of future water. The determination is guided by the submission of a report including:

- An estimate of the amount of water supply needed for buildout.
- A description of the source of the water supply.
- An estimate of the yield from the source under various hydrological conditions.
- Water demand management measures to be used.
- Any additional information the local government may require.

The rule is not applicable under the Colorado Cluster Development Statute which exempts the development of houses in rural areas from county subdivision regulations encouraging clustering of housing.

2. INDOOR WATERSENSE FIXTURE REQUIREMENT

Initiated in September 2016, SB 103 requires all manufacturers who sell new plumbing fixtures to distributors, wholesalers, retailers, developers, and homebuilders in Colorado to sell only those labeled WaterSense. The EPA's WaterSense program is similar to the Energy Star label but is designed to reduce water usage through low-efficiency plumbing fixtures including:

- Lavatory faucets
- Flushing urinals
- Shower heads
- Tank-type toilets

Excluded from this policy are value type and composting toilets, residential kitchen faucets, public lavatory faucets, metered fixtures, and non-flushing urinals.

Source: http://cwcb.state.co.us/water-management/waterEfficiency/Documents/SB103_FAQS_Final_Oct2016.pdf

3. WATER METERING

Water suppliers serving 600 or more taps are required to install meters on all new taps and retrofit all existing taps by 2009.

4. WATER HARVESTING RULES

As of August 2016, House Bill 16-1005 permitted rain barrels to be installed at single-family households and multi-family households with four (4) or fewer units. A maximum of two (2) rain barrels can be used at each household and the combined storage of the 2 rain barrels cannot exceed 110 gallons. Rain barrels can only be used to capture rainwater from rooftop downspouts and the captured rainwater must be used on the same property from which the rainwater was captured, for outdoor purposes only, including to water outdoor lawns, plants and/or gardens. Rain barrel water cannot be used for drinking or other indoor water uses.

Under special circumstances explained in Senate Bill 09-080, rural residents that qualify for “exempt” wells may collect rainwater with a Rooftop Precipitation Collection System Permit from the Colorado Division of Water Resources. Though these collection system permits do not limit the size of the rain barrel, the water must be collected from the roof of the primary residence and the rainwater may only be used for the uses allowed under the resident’s exempt well permit.

A unique provision of HB09-1129 is that it allows developers to participate in pilot projects that harvest rainwater and put it to beneficial, though non-essential, use in the subdivision. These projects may only operate according to an engineered plan, submitted to the state engineer for approval and eventually, to the water court. Individual landowners are not eligible for these pilot projects.

Source: <http://extension.colostate.edu/topic-areas/natural-resources/rainwater-collection-colorado-6-707/>

5. CITIZEN GUIDE ON COLORADO WATER LAW

The Colorado Foundation for Water Education created a Citizen’s Guide to Colorado Water Law. https://www.colorado.edu/geography/class_homepages/geog_4501_s14/readings/CG-Law2004.pdf

GROWING WATER SMART RESOURCES

General: Integrating Water and Land Use

THE IMPORTANCE OF INTEGRATING WATER AND LAND USE.

1. A comprehensive review of the land use and water nexus is available in the Colorado's Water Plan - Land Use and Water: Story Map of Land use planning and water management in Colorado. <https://cwcb.maps.arcgis.com/apps/MapSeries/index.html?appid=8c8f4b394db6407e873d5f8ee43cb0e2>
2. Colorado APA, CWCB, and DOLA worked together to develop resources for Breaking Down Silos. It includes a [resource guide](#) and a series of deep dive webinars that cover case studies across Colorado for integrating water and land use. These resources can be found at the Colorado State Water Plan Linking Land Use and Water page: <https://www.colorado.gov/pacific/cowaterplan/integrating-water-land-use-planning>
3. Western Resource Advocates have developed many high-quality resources linking water and land use. The overview, New House New Paradigm, provides a good explanation of the benefits of this approach and the tools available. See all their resources at: <https://westernresourceadvocates.org/healthy-rivers/land-use-planning-for-water-efficiency/>

METHODS FOR PROJECTING WATER DEMAND FOR LAND USE

1. California workbook to assist water demand projections for land use. Starting on page 9 is an explanation of the methodologies for projecting water demand by either dwelling unit or per acre. <https://www.norcalwater.org/res/docs/NCWA-guidebook-final.pdf>
2. The Water Efficiency Rating System (WERS) is a tool developed and used by the City of Santa Fe and Green Builders Coalition, but is now available for universal use. WERS is a third-party verified tool that is used by developers to predict water use for new and existing properties. It allows for developers to identify water efficiency goals and determine what design modifications will allow them to reach that water demand goal. <http://www.wers.us/>
3. Colorado Water and Growth Dialogue's [Residential Land Use and Water Demand Tool](#) is useful for stimulating discussion about how residential development patterns and demand are interrelated.

PLANNING & POLICY MAKING

Integrate water efficiency and conservation into land use planning through comprehensive plans.

1. Examples of communities who have integrated water into their comprehensive plans:
 - [The City of Westminster](#)
 - [Douglas County](#)
 - [Santa Fe County](#) has an integrated Water, Wastewater, Stormwater Management plan that is a great example of how a plan can be both educational and strategic.
 - The [City of Greeley](#), CO has adopted a landscaping plan that is a supplement to the Comprehensive Plan. The plan outlines goals and strategies for achieving water conservation and efficiency in outdoor landscapes.
2. The American Planning Association has developed a guide for developing comprehensive plans that sustain places. <https://www.planning.org/sustainingplaces/compplanstandards/>
3. Colorado APA, CWCB, and DOLA worked together to develop a series of deep dive webinars, Breaking Down Silos, that cover case studies across Colorado for integrating water and land use. A webinar on integrating water into comprehensive plans is available here. <http://cwcbweblink.state.co.us/weblink/0/doc/201110/Electronic.aspx?searchid=ec765dc6-1058-439e-8e9b-57ca5acb1aa5> All the webinars can be found here: <https://www.colorado.gov/pacific/cowaterplan/integrating-water-land-use-planning>
4. The CWCB provides a resource for water providers to develop a water conservation plan. <http://cwcb.state.co.us/technical-resources/water-conservation-plan-development-guide/Pages/main.aspx>
5. A simple rationale for integrating water and land use in plain language. <https://www.linkedin.com/pulse/4-reasons-have-water-element-your-comprehensive-plan-marilyn>

USING EXPLORATORY SCENARIOS AS A TOOL TO EXPLORE THE LINK BETWEEN WATER AND LAND USE

1. The Lincoln Institute of Land Policy and Sonoran Institute have been working to help integrate exploratory scenarios into land and water planning. <http://www.lincolninst.edu/sites/default/files/pubfiles/marlow-wp15jm1.pdf> <http://www.lincolninst.edu/publications/articles/embracing-uncertainty>

ADEQUATE & SUSTAINABLE WATER SUPPLY

Adequate water supply should be demonstrated as sufficient and sustainable.

1. For a comprehensive review of Western States water adequacy requirements and recommendations read <http://www.waterpolicy.info/wp-content/uploads/2016/09/Integrated-Land-and-Water-Planning-in-Colorado.pdf>
2. Douglas County, CO created a water supply overlay district to protect the different water sources within the county, especially groundwater. The water supply policy for new development requires a 100-year supply of water, a static analysis to evaluate the volume of water that is appropriable for the proposed development, a dynamic analysis to evaluate the sustainability over 100 years of the water supply considering the location in the water basin, and determination of adequacy depending upon water provider.
 - Explanation of the Water Supply Standard <https://www.douglas.co.us/documents/water-supply-standards-packet.pdf>
 - Water Supply Overlay Ordinance <http://www.douglas.co.us/documents/section-18a.pdf>

WATER SMART LAND USE POLICY

Models & Case Studies for Land Use Policy

1. This model ordinance is for water neutral development from Net Blue. <http://www.allianceforwaterefficiency.org/net-blue-ordinance.aspx>
2. City of Santa Fe water demand offset ordinance summary. Their toilet retrofit requirement was a nationally recognized success. http://www.santafenm.gov/archive_center/document/2124

Promoting more efficient development patterns

1. This Smart Growth America guide illustrates the most effective zoning and ordinance strategies for more efficient development patterns. https://www.epa.gov/sites/production/files/2014-01/documents/2009_essential_fixes_0.pdf
2. Clarion Associates did a comparison of the different development typologies across the West to identify water savings from land use patterns and density. Read the report here: <http://www.clarionassociates.com/wp-content/uploads/2016/08/Keystone-Colorado-Water-Dialogue.pdf>
3. Colorado APA, CWCB, and DOLA worked together to develop a series of deep dive webinars, Breaking Down Silos, that cover case studies across Colorado for integrating water and land use. The slides for Integrating Water Savings Into Development Codes can be viewed here <http://cwcbweblink.state.co.us/weblink/0/doc/201100/Electronic.aspx?searchid=807fbc7-46c7-48ed-be74-c38d436e88da>
4. The American Planning Association as part of its Sustaining Places program has developed guidance on integrating water into comprehensive plans in the new “Planners and Water” report. <https://www.planning.org/publications/report/9131532/>
5. Compact form, mixed use development, and placemaking have benefits for communities beyond water conservation – they also contribute to economic development. Community Builders Place Value report provide the rationale for thinking about downtowns and neighborhoods that promote walkability, include mixed uses, a variety of housing types, and places supporting social interaction as ways to build a thriving economy. <https://communitybuilders.org/how-we-help/research/place-value>

Western Resource Advocates

6. [Integrating Water Efficiency Into Land Use Planning in the Interior West: A Guidebook for Local Planners](#)
7. [A Guide to Designing Conservation Oriented Water System Development Charges](#)
8. [Submetering Fact Sheet](#)
9. Colorado Water Conservation Board updated its Water Efficiency Plan Guidance to include: [Best Management Practices for Implementing Water Conservation and Demand Management Through Land Use Planning Efforts](#)
10. Colorado Division of Water Resources’s [Rainwater Collection Rules](#)

Promoting water conservation and efficiency through water smart landscaping and plumbing codes.

1. Examples of communities who have integrated water into their code:
 - Metropolitan Water District, San Diego County Water Authority, and Southern Nevada Water Authority's turf replacement programs highlighted in a water research foundation webinar. <https://mavensnotebook.com/2015/09/30/a-look-at-three-successful-turf-replacement-programs/>
 - City of Erie Landscape Guidelines <https://www.erieco.gov/896/Homeowners-Waterwise-Landscaping-Manual>
 - City of Aspen Landscape Ordinance <https://www.cityofaspen.com/199/Landscape-Ordinance>
 - The Colorado Department of Local Affairs' WaterWise Model Landscaping Ordinance.
 - City of Aurora water shortage ordinance https://library.municode.com/CO/Aurora/codes/code_of_ordinances?nodeId=CICOAUCOVOII_CH138UT_ARTVWASE_DIV2WASH
2. Western Resource Advocates has developed resource guides for communities working to link water and land use. The Codes and Ordinance Fact Sheet is a good overview of landscaping and plumbing fixture benefits. <http://westernresourceadvocates.org/download/2107/> They also have a fact sheet on submetering for multifamily units. <http://westernresourceadvocates.org/download/2386/>
3. Comprehensive best practices guide for water conservation and efficiency for prepared for the CWCB. <http://coloradowaterwise.org/Resources/Documents/BP%20Project/CWW%20Best%20Practices%20Guide%20-%20FINAL.pdf>
4. The Colorado Water Conservation Board has created a set of best practices for water conservation and efficiency. <http://cwcb.state.co.us/technical-resources/best-management-practices/Pages/main.aspx>

Additional Landscape Standard Resources

5. [Green Strategies for Colorado Landscapes](#). Associated Landscape Contractors of Colorado.
6. Soil Amendments From Colorado Extension [Choosing a Soil Amendment](#)
7. City of Colorado Springs Grass Choices [PDF](#)

8. EPA [Water Budget Tool and Resources](#)
9. Federal Energy Management Program [Estimating Unmetered Landscapes](#)
10. EPA WaterSense [Water Efficiency Management Guide Landscaping and Irrigation](#)
11. DOLA Planning for [Hazards Model Landscape Ordinance](#)
12. CSU [Rain Garden Guide](#)
13. [Bioretention Best Practices](#)

HEALTHY & RESILIENT WATERSHEDS

Protect ground and surface water resources through watershed protection standards and restoration projects.

1. These resources provide a great overview of water resource management for both surface and groundwater:
 - <https://www.colorado.gov/pacific/sites/default/files/Citizen%27s%20Guide%20to%20Where%20Your%20Water%20Comes%20From.pdf>
 - <https://www.watereducationcolorado.org/news-and-publications/citizen-guides/citizens-guide-to-denver-basin-groundwater/>
 - Colorado Groundwater Management <http://www.pg-tim.com/id74.html>
2. Protecting Water Resources with Smart Growth (2004) is for communities, local governments, state and regional planners, and other audiences already familiar with smart growth who are seeking more ideas for protecting water resources. The document compiles 75 policies designed to protect water resources and implement smart growth strategies. <https://www.epa.gov/smartgrowth/protecting-water-resources-smart-growth>
3. The CWCB has a substantial floodplain management resource available at <http://cwcb.state.co.us/technical-resources/floodplain-stormwater-criteria-manual/Pages/main.aspx>
4. The Colorado Water Plan includes an entire chapter on watershed health and collaborative watershed management. The chapter can be reviewed here <https://www.colorado.gov/pacific/cowaterplan/watershed-health>
5. Managing the upper watershed often requires collaborative approaches with public land agencies and private land owners. This resource created by the CWCB and Colorado State Forest Service reviews the key principles of managing

forest lands for watershed health. <http://www.northernwater.org/docs/WaterQuality/2017WaterResourcesReport.pdf>

6. The Colorado Department of Local Affairs (DOLA) Division of Local Government released [Planning for Hazards: Land Use Solutions for Colorado](#) a guide and website designed to help Colorado counties and municipalities prepare for natural disasters and reduce risks through the integration of resilience and hazard mitigation. <https://www.planningforhazards.com/home>
7. The CWCB drought planning resources can help communities manage their response to drought. <http://cwcb.state.co.us/technical-resources/drought-planning-toolbox/Pages/main.aspx>
8. The Northwest Counties Council of Government's Water Quality & Quantity Committee completed a water quality protection model water quality standards resource guide in 2018. <http://nwccog.org/wp-content/uploads/2018/06/2018.06.20.-NWCCOG-Model-Water-Quality-Prot.-Stnds-FINAL-with-appendices.pdf>

BEHAVIOR CHANGE FOR WATER CONSERVATION

Use available management tools of pricing and technology investments to incentivize household water demand behavior.

1. An excellent resource for utility managers for managing water supply and demand for the financial health of the utility. <https://www.financingsustainablewater.org/>
2. A comprehensive study of water rate structuring best practices, [Designing Water Rate Structures for Conservation and Stability](#), was conducted for Texas communities by the University of North Carolina and the Sierra Club in 2014.
3. The City of Boulder is in the process of reviewing their utility rate structures and whether they are achieving intended goals. The project purpose and policy recommendations can be found under the City's [Water Department](#) page.

Public Education on conservation programs and incentives.

1. Both of these sites provide a great review of what other communities from all over Colorado are doing with regards to more sustainable and efficient water management. <http://www.waterrebates.com/colorado> and <http://coloradowaterwise.org/page-645756>
2. Denver Water has won national attention for its water education programs to raise awareness about water conservation. Read the backstory of the Use Only What You

Need campaign. <https://www.denverwater.org/about-us/history/use-only-what-you-need>

3. The City of Santa Fe, NM began a “lead by example” Water Conservation Program in 1997, building a comprehensive and effective program which has resulted in Santa Feans reducing per capita water consumption by more than 50% since tracking began in 1995. Much was done through public education. The success of the conservation awareness program and an aggressive rebate program are demonstrated by water demand. While most major NM cities are all below 100 gpcd, Santa Fe is at 56. <http://www.sustainablesantafe2040.com/water.html> and https://www.santafenm.gov/water_conservation
4. Santa Fe’s more recent efforts is the “It’s Not Coming Back” campaign. <http://savewatersantafe.com/2015/05/seasonal-drought-campaign-2015/>

GENERAL RESOURCES

Improve water management

1. The following professional service organizations all provide tools to support communities working on water conservation. They include the Alliance for Water Efficiency, American Water Works Association, and EPA Water Sense. <http://www.allianceforwaterefficiency.org>
<https://www.awwa.org>
<https://www.epa.gov/watersense>
2. Water Education Colorado provides an excellent Citizen’s Guide series that covers all aspects of water resource management, law, and best practices. <https://www.watereducationcolorado.org/news-and-publications/citizen-guides/>
3. There are many movements or philosophies all proposing that we need to manage water differently. The One Water initiative of the US Water Alliance is working to integrate water resource management in a holistic and coordinated manner. The webpage has some great examples and resources. <http://uswateralliance.org/one-water>

Integrated Water Resource Management (IWRM) is about the management of water in all its forms – drinking water, stormwater, wastewater and source water.

<https://www.americanrivers.org/conservation-resources/integrated-water-management>

1. Environmental Law and Policy Center's [Land Use Tools to Protect Groundwater Quality: Overlay Districts](#)
2. APA [Integrated Water Resource Management](#)
3. The Pacific Institute released a useful resource, [A Community Guide to Calculating Future Water Demand](#). It outlines some of the methodological concerns with water demand forecasting and provides a checklist to utilize when reviewing water demand projections (pages 3-6) for accuracy. It includes a summary of the methodologies used in water demand forecasts (pages 9-11) followed by the best practices that should be integrated into water demand forecasting.
4. Northwest Colorado Council of Government's Quality and Quantity Commission's [Model Water Quality Protection Standards](#)

Public Outreach, Communication, and Engagement

1. AWWA has an entire webpage dedicated to communication strategies for utilities. <https://www.awwa.org/resources-tools/public-affairs/communications-tools/public-communications-toolkit.aspx#2213174-strategic-planning> including sharing their own messaging platform. file:///C:/Users/marjo/OneDrive/Sonoran%20Institute/Curriculum%20Development/Communication%20and%20Outreach/Hand%20outs/VOWMessagingPlatform.pdf
2. A research agency conducted a poll of US water users and identified which values and messages resonated the most in water messaging. Download the report <https://sheltongrp.com/posts/water-conservation-is-the-next-big-thing-have-consumers-gotten-the-memo/>
3. For organizations and agencies with fewer resources, the Use It Wisely campaign provides opportunities to integrate conservation education into your website. <http://wateruseitwisely.com/jump-in/>

The logo features the text "Be Resilient." in a large, bold, black sans-serif font. Below this, the website "ResilientWest.org" is written in a smaller, green sans-serif font. The entire logo is set against a light beige rectangular background.

Be Resilient.
ResilientWest.org



Through our Growing Water Smart workshop series, we've trained over 135 community representatives and impacted the lives of over 3,000,000 Coloradans in the last two years. We are still scaling the program. By the end of 2020 we aim to train and assist communities serving over 60% of Colorado's population.

By continuing to support Growing Water Smart more Colorado communities will have the opportunity to take advantage of Sonoran Institute's expertise and share in lessons we have learned over nearly thirty years of shaping the future of the West.

JOIN US. MAKE THIS WORK A REALITY.





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