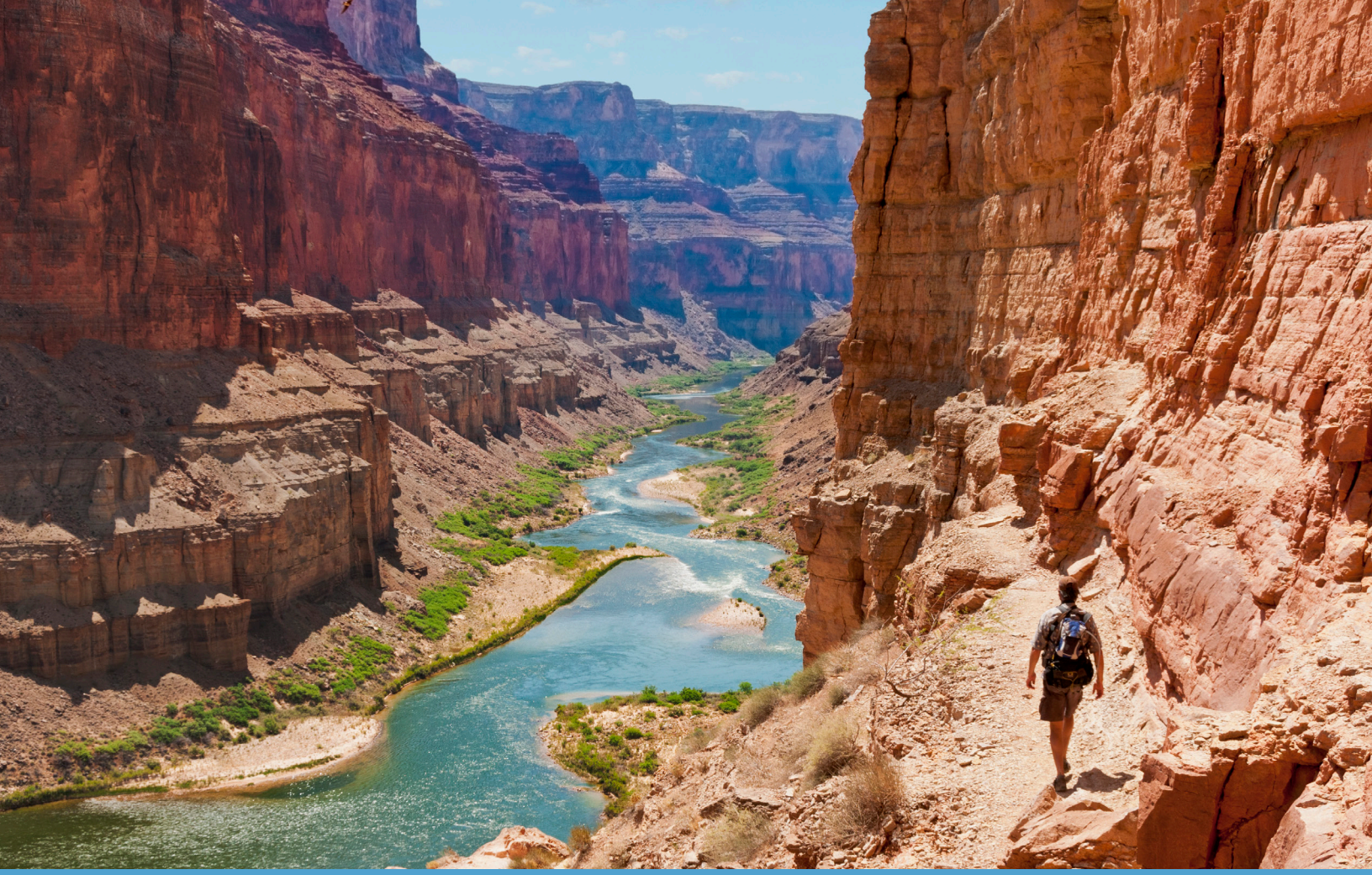
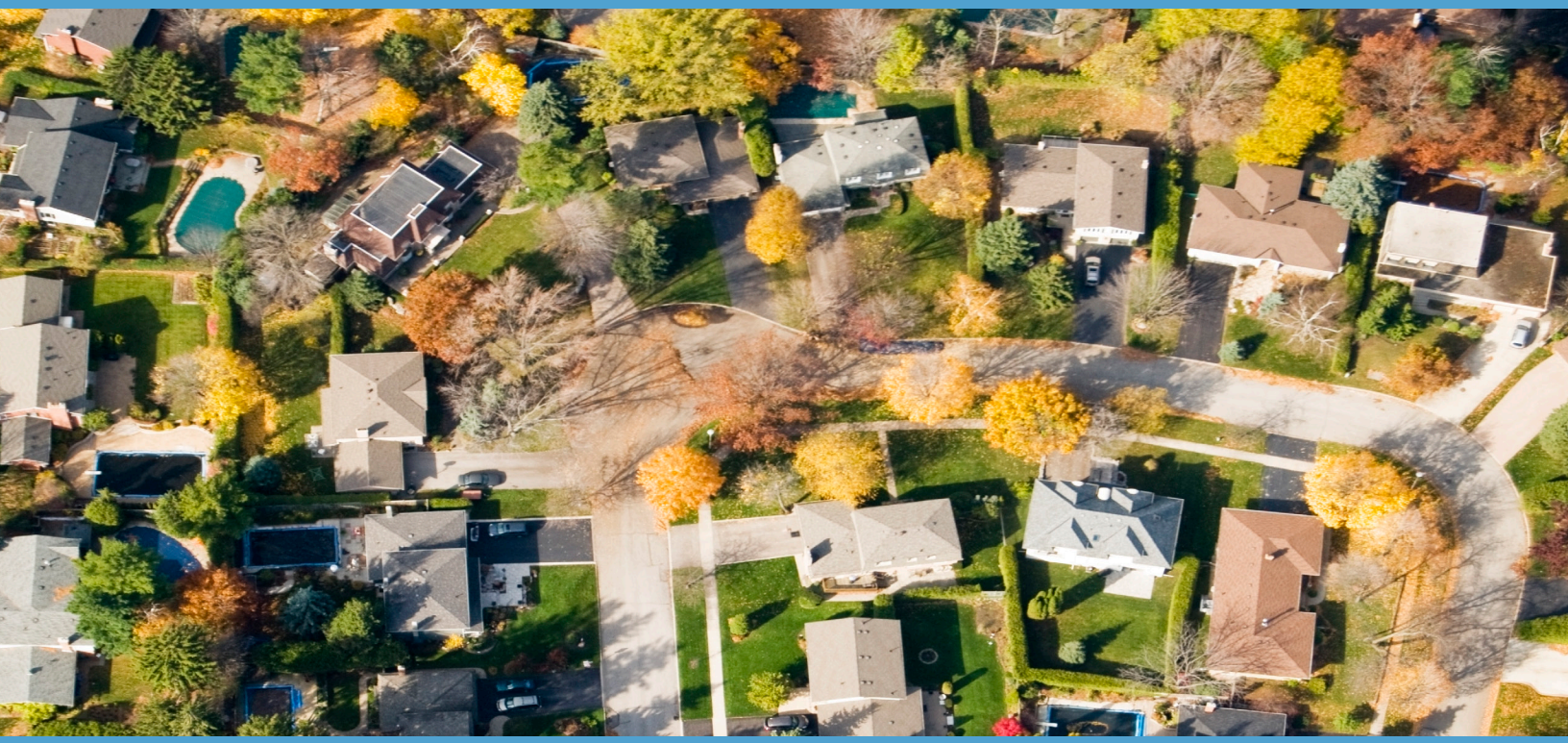


Incorporating Water into Comprehensive Planning

A Manual for Land Use Planners in the Colorado River Basin



ERIN RUGLAND

BABBITT CENTER FOR LAND AND WATER POLICY

About This Manual

Land use planning and water management are siloed disciplines that often operate independently, despite the important overlaps between the two and the mutual benefits of working together. Integrating land use planning and water management can help communities grow more sustainably. By making smart decisions about water before development begins, municipalities and counties can better equip themselves to deal with water scarcity and other challenges, diminishing reliance on water conservation programs or incentives that reduce demand during drought.

An effective way to integrate water management into land use planning is to incorporate it into a comprehensive plan. Different land uses and building types have different impacts on water demand, and water supply can influence the cost and location of development. In order to make informed, sustainable decisions about land use, many communities will have to consider the impact of those decisions on water resources. The comprehensive plan lays out a community's vision for its future, and the policies and land uses that will help to realize that vision. This manual details how land use planners in the seven Colorado River Basin states (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming) can create a comprehensive planning process that ensures enough water for all residents of the region in the years ahead.

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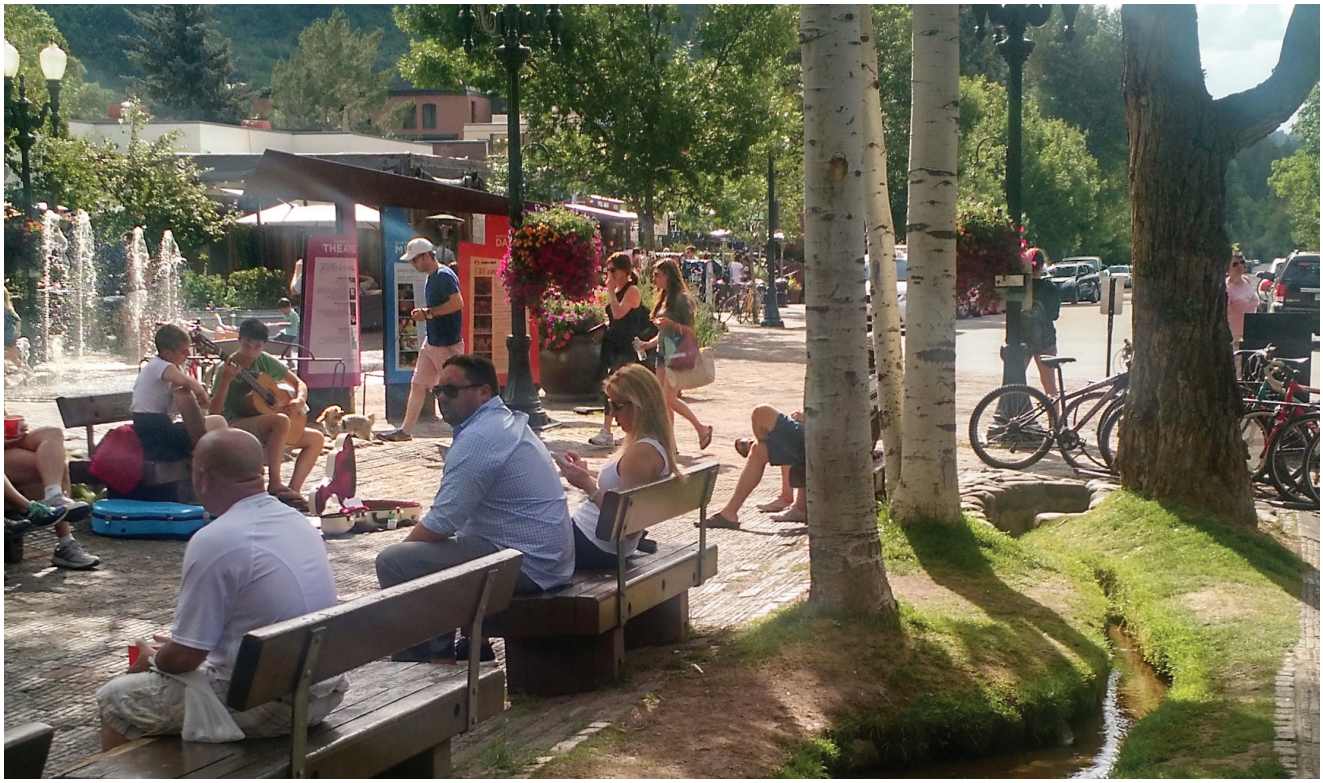
Front Cover: Scenic hike to Ancestral Puebloan granaries near mile 52 on the Colorado River. This is one of several images captured during a 200-mile, 16-day trip through the Grand Canyon (top). © IlexImage via Getty Images. Used with permission. An aerial view of a residential area with several swimming pools (bottom). © Stacey Newman via iStock. Used with permission.

EXECUTIVE SUMMARY



A community gathering in Aspen, Colorado. Photo: J. Stapleton (2016).

Western communities face increasing threats to the sustainability of their water supplies. Growing demand calls for careful management of water and of land uses that impact water resources. The demonstrable connections between land and water are receiving greater attention as local governments begin to understand how decisions about land use can dramatically impact water demand. Strategies that impact urban form, such as compact development, infill development, or smaller lot sizes, can drive down water use when compared to single-family homes on large lots. Pervious cover and green infrastructure can help direct stormwater and other runoff into water recharge areas. Land use codes of all types can be used to improve water efficiency indoors, on landscapes, and throughout entire neighborhoods of a community.

A community's comprehensive plan is the foundation of all its land use efforts. These plans become the means to capture a community's vision of the future–a future that should include a sustainable water supply. Local government officials, professional and citizen planners, and developers use comprehensive plans to inform their land use decisions. Often, such plans do not include water management. Most Colorado River Basin states require or encourage local governments to prepare a comprehensive plan. But even states that offer robust guidance on

local planning do not require water to be an element of plans. Some states suggest that local governments include water as an optional element. Often, local governments recognize the importance of integrated water and land use planning and voluntarily include water in their comprehensive plan.

The absence of water from comprehensive plans represents a tremendous missed opportunity. The comprehensive plan can enable a community to bring its goals and policies for water issues to the forefront of its vision of the future. It can set the stage for water to be woven into development approval processes, zoning and subdivision standards, and development decisions. The public outreach requirement of a comprehensive plan creates an opportunity to educate the public about water resources, provides a time and place for public input on their jurisdiction's water future, and fosters public buy-in for a more sustainable future.

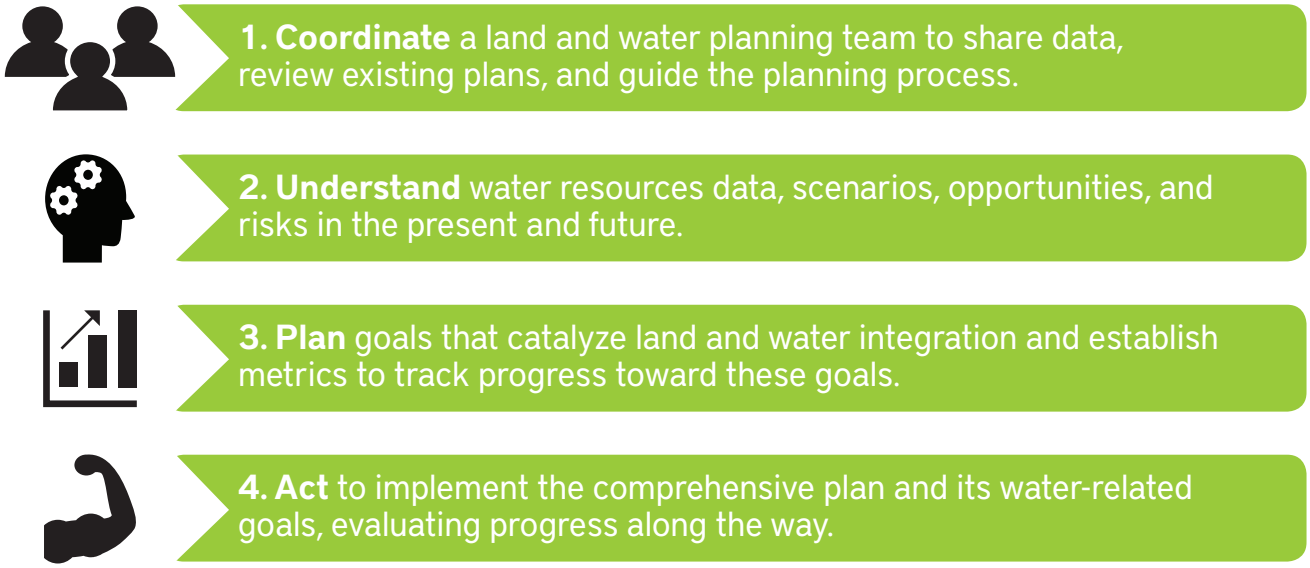
Water conservation policies that target individual end-users in an already built community have improved. However, local governments can use their land use planning authority to influence water use before a development is constructed by integrating water issues into their comprehensive plans.

This manual describes how to use a comprehensive plan to ensure water sustainability and presents best practices from across the Colorado River Basin states. Communities that might be overwhelmed by the complexities of water management or uncertain about the relevant information to include, can use the examples provided herein from plans that local governments in the region have put into practice. The following quick-start guide can serve as a reference for the concepts explained in this manual.

QUICK START PLANNING GUIDE FOR INCORPORATING WATER INTO COMPREHENSIVE PLANS

There are four essential actions a community must take to incorporate water into its comprehensive plan (figure 1). The first is instrumental to the others. These steps are described in detail in the Overview of the Planning Process section of this manual.

Figure 1
Steps to Integrate Water into Planning



Source: Babbitt Center for Land and Water Policy

Numerous water-related topics are relevant to the comprehensive plan, such as supply, demand, quality, stormwater management, natural hazards, and stream protection. Which topics are ultimately included depends on which water issues facing a community are most pressing. Also relevant are any opportunities or commitments that arise from internal and external demands. Examples include emergent problems such as an acute water shortage or persistent flooding, any new or ongoing federal or state grants and program requirements regarding water, and any other community goal that relates to water that surfaces prior to or during the comprehensive planning process.

Communities can write a stand-alone water element or, alternatively, include a section on water within another plan element, such as a public facilities or environment element. A stand-alone water element is a signal to residents, stakeholders, and decision-makers that the community considers water policies to be as important as other core elements of a plan, like housing, transportation, economic development, and land use. Similarly, water issues should be included in other plan elements as appropriate.

By their nature, comprehensive plans have goals, policies, and objectives that overlap and influence one another. There may also be goals that appear to compete with one another. For instance, a community might want to maintain a pro-growth stance despite water supply constraints. Communities should integrate water issues with other policies and goals to determine how competing objectives can be reconciled into a cohesive vision.

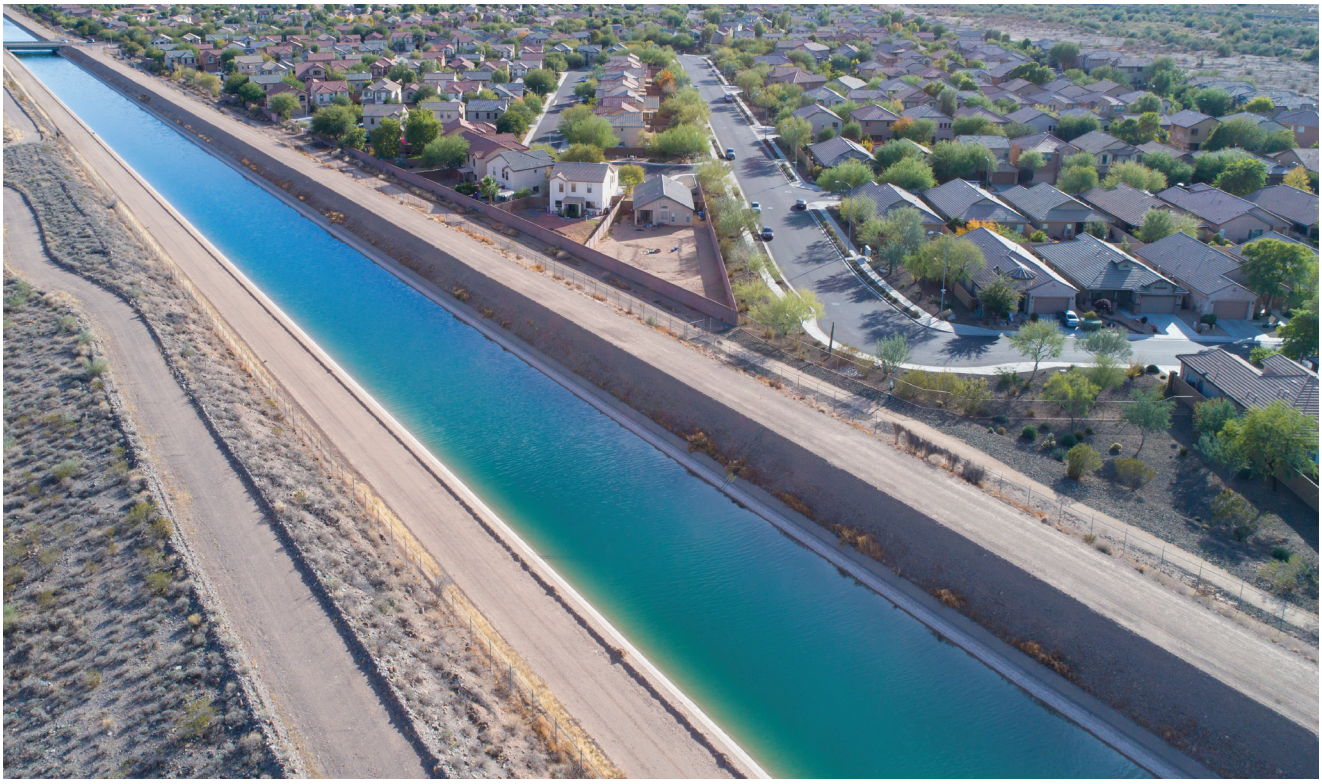
The questions in Figure 2 can prompt a land and water planning team and the community in general to determine which water issues to consider including in their plan. These questions supplement the Water Topics and Examples sections that make up the bulk of this manual, and can be used to quickly generate ideas about which water topics may be most relevant to a community or which questions need additional data and understanding to answer. They could also be used in a public brainstorming workshop to gauge community members' knowledge and values about local water systems and issues.

Figure 2
Water Related Questions to Answer in a Comprehensive Planning Process

Water Management	Future Projections	Water Efficient Land Use
Where does our water come from?	What is our population, housing, and employment growth?	Are we collaborating on water issues?
How much water do we have?	What are our development expectations?	How does our development process consider water?
How much water do various land use sectors use?	What water challenges does a changing climate pose?	How does our urban form impact our water use?
How do we pay for water system repairs and improvements?	How much water will we need?	Is water used efficiently outdoors?
How is water used or conserved?	Do current water supplies line up with projected demand?	Is water used efficiently indoors?
Is our water system sufficient, safe, and reliable?	How can water and land use be equitably managed?	How does land use impact our watersheds?

Source: Babbitt Center for Land and Water Policy

INTRODUCTION



Aerial view of the Central Arizona Project Canal, Phoenix, Arizona. Photo: D. Von Gausig, iStock (2016).

Water is a critical resource for communities in the seven Colorado River Basin states. The Western U.S. has always been arid, but recent years have brought drought conditions and significant population growth to much of the region. Most projections anticipate that these trends will continue, making sound water management more important than ever. Communities have made great strides with post-construction water conservation and efficiency, but the greatest potential for future water savings will come from land use planning that takes water issues into consideration before developments are built.

Several entities have recognized that sound water management requires integrating water into comprehensive plans. The American Planning Association's Water Task Force put forward a set of recommendations for improved practice in 2015 that includes better incorporation of water into the comprehensive planning process (American Planning Association 2015). The State of Colorado included an objective in its Water Plan that "by 2025, 75 percent of Coloradans will live in communities that have incorporated water-saving actions into land use planning" (Colorado Department of Natural Resources 2015). These examples highlight the extent to which high-level entities recognize the impact that integrating water and land use planning can have.

Despite the value of planning for and promoting sound water management, not every community includes water in its comprehensive plan. Including water in the comprehensive plan strengthens a community's vision for the future by compelling it to think about how development patterns, land use, and urban form will ultimately influence water demand and how water supplies may influence the location and costs of development. Furthermore, because comprehensive plans are implemented through a community's codes, ordinances, regulations, and capital improvement plans, they are blueprints for many land use processes, standards, and decisions. Including water in a comprehensive plan enables a community to be proactive about its water needs and development decisions. It also establishes a legal basis for modifying municipal and county land use practices to accommodate water needs.

Comprehensive plans, one of a community's most accessible public planning documents, require a public outreach process that serves as an opportunity to increase awareness of water issues among residents and local decision-makers. It is also an opportunity to include water management in other areas of a community's vision, such as land use, public safety, economic development, environmental protection, and open space. While management plans produced by water providers afford a more complete analysis of local water resources than comprehensive plans, water providers are often not required to engage other departments, partnering agencies, outside entities, or the public in their process–a gap that a strong water element in a comprehensive plan can help bridge. Incorporating water into the comprehensive plan can bring water to the forefront of the community's planning efforts.

Purpose

This manual is intended to reduce the burden on any planner or comprehensive plan project manager who is involved in incorporating water issues into a comprehensive plan. The siloed disciplines of water management and land use planning present challenges for integration; land use planners may lack training in water issues, water managers may not understand the opportunities available within land use planning, and the two disciplines may use different terms and definitions. This manual explains the processes that facilitate inclusion of water issues into a comprehensive plan so that land use planning can appropriately aid water management and the community can work cohesively to achieve water-related goals.

The objectives of this manual are:

Provide background on comprehensive planning and how to integrate water into the comprehensive planning process

Detail the topics necessary to incorporate water-saving actions into land use planning

Provide direction to municipalities and counties that are diverse in size, location, needs, and capacity

Connect local governments to relevant examples, additional information, guidance, and peer learning opportunities

Audience and Applicability

This manual is applicable to all villages, towns, cities, and counties that are preparing or updating their comprehensive plan and are either required to or opting to include water in the plan. Each topic described in this manual is applicable to all local governments, in varying degrees. The best practices described in this manual can be viewed as aspirational for communities that may have less capacity to fully integrate land and water planning. Further, this information may be useful to water providers that are involved in the comprehensive planning process, or to anyone who is generally trying to better understand how land use planning can shape water management.

Counties and municipalities that are not water providers still have responsibility for and influence over land use policies that influence water management. Comprehensive plans, neighborhood master plans, development standards and codes, site plans, landscaping provisions, and building codes are all municipal- or county-controlled points at which water use can be influenced by shaping the way land will be developed and used. Similarly, some water providers will argue that by the time a developer is ready to arrange water service, it is too late to influence the size of the connection tap or the amount of water the development will demand; the subdivision or building(s) have already been designed, making it difficult for a water provider to recommend water-saving actions. Including a water provider in the development review process can help get ahead of such issues. In any case, impact on the design and expected water demand of a land use is most effective early in the planning and development process. Post-occupancy actions, such as retrofits or rebates for water-saving fixtures, may be more common, but they can be expensive and time-consuming, and they effectively assign responsibility to individual end-users rather than developers.

Terminology in this Guide

Several terms are used in this manual that may differ from those used in a community's local planning context. These terms are explained here and are used in place of other language. A community should use locally appropriate terms during its comprehensive planning process.

Community or **local government** refers to the municipality or county jurisdiction with land use control. This may be a village, a town, a city, or a county. The terms *community* and *local government* are used interchangeably in this manual. The people who live, work, or play in these jurisdictions are referred to as residents, community members, or the public.

Comprehensive plan refers to the broad official document, approved by the local legislative body, that reflects a long-range (on the order of 10 to 30 years) planning horizon for a community's future and that includes elements focused on transportation, housing, environment, economic development, open space, and other community planning concerns. It goes by several names, with the most common being comprehensive plan. In other jurisdictions the term may be *general plan*, *master plan*, *development plan*, *growth plan*, or *community plan*. Colorado River Basin states refer to such comprehensive plans by different names in statute, and the legal term used by the states may differ between municipalities and counties. This manual refers to all as comprehensive plans regardless of any legal or local context.

Water provider refers to the entity, agency, or utility that delivers water to residents, business, or industry in a community. A water provider may be a department within the local government, such as the Water Department, or it may be separate from the local government, such as a private water company or a special district.

Non-municipal water provider refers to an entity that serves water in a community but is not part of the local government. These may be private water companies or special districts. This is an important distinction, as local governments with non-municipal water providers

may have to work with one or more external agencies to receive and understand water data for their community. Additionally, non-municipal water providers answer to a different governing body than the local government, and the provider and local government may have different missions, objectives, goals, and revenue models.

Water plan refers to any report, plan, guide, program description, or other document that a community or water provider uses to guide its water resource management and decision-making. This can include but is not limited to: utility master plans, water resource plans, water efficiency plans, water conservation plans, integrated water resource plans, watershed plans, or water quality plans.

Benefits of Land and Water Integration

Water resource management and regulation are often administered from the top down; federal and state entities create standards for water quality, allocation, treatment, and use. However, planning for and implementing these standards occurs at the local level. Integrating water into the comprehensive plan can have the following benefits and is the first step for local governments to transform their water management values into realities.

- Create ownership and innovation in a community's approach to water management.
- Clarify water conservation and water resource goals and actions among land use plans, economic development plans, local and state water plans, provider water plans, and other planning documents that guide a community.
- Promote water awareness within the community.
- Protect water resources and related cultural heritage.
- Improve data collection and exchange among municipal or county planning staff and water providers.
- Generate more accurate projections of future demand by connecting land uses to water demand.
- Create consensus between planning staff and water providers from a shared set of projections.
- Include low-impact design, green infrastructure, and other water-sensitive design techniques in site and land use plans.
- Promote appropriate and "right-sized" water infrastructure and investments.
- Anticipate and solve conflicts between development goals and resource constraints before they arise.
- Adjust the development approval process to be sensitive to water use and water resources.
- Integrate water into other community priorities, such as economic development, housing, or open space.
- Establish the basis for codifying water-related goals into land use codes.

More benefits are outlined in the *Coordinated Planning Guide* for integrating water and land use more generally (Brendle Group and Western Resource Advocates 2018).

COMPREHSIVE PLANNING REQUIREMENTS FOR COLORADO RIVER BASIN STATES

Aerial view of homes in a large residential community. Photo: iStock (2003).

Communities often begin with the state statutes governing comprehensive plans when determining what elements to include in the plan and what topics to address. All seven Colorado River Basin states enable local governments to prepare a comprehensive plan. Although only Arizona requires a water element in these plans, several other states provide some guidance for including water in another required element, such as a conservation element. In many cases, the decision to include water in a comprehensive plan is at the discretion of the local government.

This section contains the relevant comprehensive planning statutes for each Colorado River Basin state. Excerpts of the statutes relating to water or a summary of the planning requirements are provided. Some Colorado River Basin states have detailed requirements for comprehensive plans, whereas others simply enable local governments to prepare comprehensive plans. These differences are reflected in the length of each state's section below. Communities should ensure that they understand and comply with their state's requirements.

State of Arizona Statutes

View of golf courses and urban development from Camelback Mountain in Phoenix, Arizona. Photo: J. Stapleton (2013).

The State of Arizona requires all local governments to prepare a long-range general plan (Ariz. Rev. Stat. § 9-461.05 2019). It is the only state in the Colorado River Basin that requires a water element within comprehensive plans. The water resources element is required in municipalities with a population of 10,000 or more or a population of at least 2,500 and a two percent growth rate (Ariz. Rev. Stat. § 9-461.05(D)(5) 2019). Counties with a population of at least 125,000 are also required to include a water resources element (Ariz. Rev. Stat. 11-804(B)(3)(d) 2019).

WATER RESOURCES PLANNING REQUIREMENTS

> 3. Planning for water resources that addresses:
>
> (a) The known legally and physically available surface water, groundwater and effluent supplies.
>
> (b) The demand for water that will result from future growth projected in the county plan, added to existing uses.
>
> (c) An analysis of how the demand for water that will result from future growth projected in the comprehensive plan will be served by the water supplies identified in subdivision (a) of this paragraph or a plan to obtain additional necessary water supplies.

The statute notes specifically that the water resources element is not required to include new, hydro-geologic studies from independent sources. It also specifies that a local government that prepares a water resources element is not required to be a water service provider (Ariz. Rev. Stat. § 9-461.05(F) 2019).

Local governments that are required to prepare a water resources element must also include an environmental planning element that contains analyses, polices, and strategies to address anticipated effects, if any, of plan elements on "...water quality and natural resources," among other considerations.

Additionally, a city, town, or county is required to submit its water resources element to the Arizona Department of Water Resources (ADWR) for review and comment 60 days before scheduling a public hearing of the Planning and Zoning Commission of the draft comprehensive plan (Ariz. Rev. Stat. §9-461.06(D) 2019).

Communities and counties under the population thresholds may opt to include a water resources element in their comprehensive plan.

Further requirements for water integration in comprehensive plans are listed below. Arizona law states that comprehensive plans must be revised or readopted every 10 years and that voters must ratify municipality plans.

CITY AND TOWN PLANS – ADDITIONAL ELEMENTS

Arizona municipalities of more than 50,000 are required to adopt comprehensive plans with these additional elements:

> A conservation element for the conservation, development, and utilization of natural resources, including forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, and other natural resources. The conservation element may also cover:

(a) The reclamation of land.

(b) Flood control.

(c) Prevention and control of the pollution of streams and other waters.

(d) Regulation of the use of land in stream channels and other areas required for the accomplishment of the conservation plan.

(e) Prevention, control and correction of the erosion of soils, beaches and shores.

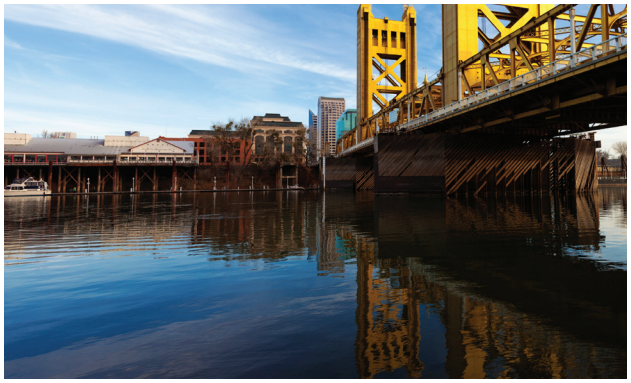
(f) Protection of watersheds.

A safety element for the protection of the community from natural and artificial hazards, including features necessary for such protection as...peak load water supply requirements...
(Ariz. Rev. Stat. § 9-461.05 2019).

There are no additional elements required in comprehensive plans prepared by Arizona counties. The statute also enables municipalities to create special zoning districts or regulations for lands with natural or man-made hazards, such as a lack of water (Ariz. Rev. Stat. § 9-462.01 2019).

More information on planning in Arizona, including the water resources element, was cataloged in the 2004 edition of the *Arizona Planning and Zoning Handbook*.

State of California Statutes



View of the Tower Bridge in Sacramento, California. Photo: iStock (2014).

The State of California requires every incorporated county and city to adopt a comprehensive plan and mandates that land use authorities and water providers coordinate data prior to amending or adopting comprehensive plans. Generally, other land use actions in California–zoning, public works projects, subdivisions–must be consistent with the comprehensive plan. Water is not a required element for California comprehensive plans, but local governments may elect to prepare a water element, and water is included as a topic under the required conservation and open space elements. Substantial changes and updates to the comprehensive plan must be coordinated with water supply or management agencies within the community.

AUTHORITY AND SCOPE OF GENERAL PLANS

The following excerpts from the California Government Code describe requirements for inclusion of water in comprehensive plans:

A conservation element for the conservation, development, and utilization of natural resources including water and its hydraulic force, forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, and other natural resources.... That portion of the conservation element including waters shall be developed in coordination with any countywide water agency and with all district

and city agencies, including flood management, water conservation, or groundwater agencies that have developed, served, controlled, managed, or conserved water of any type for any purpose in the county or city for which the plan is prepared. Coordination shall include the discussion and evaluation of any water supply and demand information described in Section 65352.5, if that information has been submitted by the water agency to the city or county.

(2) The conservation element may also cover all of the following:

(A) The reclamation of land and waters.

(B) Prevention and control of the pollution of streams and other waters.

(C) Regulation of the use of land in stream channels and other areas required for the accomplishment of the conservation plan.

(D) Prevention, control, and correction of the erosion of soils, beaches, and shores.

(E) Protection of watersheds.

(F) The location, quantity, and quality of the rock, sand, and gravel resources.

(3) Upon the next revision of the housing element on or after January 1, 2009, the conservation element shall identify rivers, creeks, streams, flood corridors, riparian habitats, and land that may accommodate floodwater for purposes of groundwater recharge and stormwater management...

(v)(C)(3) Upon the adoption, or revision, of a city or county's general plan, on or after January 1,1996, the city or county shall utilize as a source document any urban water management plan submitted to the city or county by a water agency (California Government Code § 65302 2018).

OPEN-SPACE LANDS

The open space element required in a local general plan in California also includes provisions related to water under the circumstances described here:

> (1) Open space for the preservation of natural resources, including, but not limited to...areas required for ecologic and other scientific study purposes; rivers, streams, bays, and estuaries; and coastal beaches, lakeshores, banks of rivers and streams, and watershed lands.
>
> (2) Open space used for the managed production of resources, including, but not limited to...areas required for recharge of groundwater basins...
>
> (4) Open space for public health and safety, including, but not limited to, areas that require special management or regulation because of hazardous or special conditions such as...flood plains, watersheds...areas required for the protection of water quality and water reservoirs... (California Government Code § 65560–65570 2017).

PREPARATION, ADOPTION, AND AMENDMENT OF GENERAL PLANS

California state statutes also require local governments that are undertaking a general plan revision or substantial amendment to review existing sustainability and groundwater plans prepared by the local groundwater management agencies or the state water board as well as any adjudication of water rights. They must also notify all other water-related agencies that the general plan update is occurring.

> Before the adoption or any substantial amendment of a city's or county's general plan, the planning agency shall review and consider all of the following:
>
> (a) An adoption of, or update to, a groundwater sustainability plan or groundwater management plan pursuant to Part 2.74 (commencing with Section 10720) or Part 2.75 (commencing with Section 10750) of Division 6 of the Water Code or groundwater management court order, judgment, or decree.

(b) An adjudication of water rights.

(c) An order or interim plan by the State Water Resources Control Board pursuant to Chapter 11 (commencing with Section 10735) of Part 2.74 of Division 6 of the Water Code... (California Government Code § 65350.5 2014).

Before a legislative body takes action to adopt or substantially amend a general plan, the planning agency shall refer the proposed action to all of the following entities:

(7) A public water system, as defined in Section 116275 of the Health and Safety Code...

(8) Any groundwater sustainability agency that has adopted a groundwater sustainability plan...or local agency that otherwise manages groundwater pursuant to other provisions of law or a court order, judgment, or decree within the planning area of the proposed general plan.

(9) The State Water Resources Control Board, if it has adopted an interim plan pursuant to Chapter 11 (commencing with Section 10735) of Part 2.74 of Division 6 of the Water Code that includes territory within the planning area of the proposed general plan... (California Government Code § 65352 (a)).

§ 65352.5 (a) The Legislature finds and declares that it is vital that there be close coordination and consultation between California's water supply or management agencies and California's land use approval agencies to ensure that proper water supply and management planning occurs to accommodate projects that will result in increased demands on water supplies or impact water resource management.

(b) It is, therefore, the intent of the Legislature to provide a standardized process for determining the adequacy of existing and planned future water supplies to meet existing and planned future demands on these water supplies and the impact of land use decisions on the management of California's water supply resources.

(c) Upon receiving, pursuant to Section 65352, notification of a city's or a county's proposed action to adopt or substantially amend a general plan, a public water system...shall provide the planning agency with the following information, as is appropriate and relevant:

(1) The current version of its urban water management plan, adopted pursuant to Part 2.6 (commencing with Section 10610) of Division 6 of the Water Code.

(2) The current version of its capital improvement program or plan, as reported pursuant to Section 31144.73 of the Water Code.

(3) A description of the source or sources of the total water supply currently available to the water supplier by water right or contract, taking into account historical data concerning wet, normal, and dry runoff years.

(4) A description of the quantity of surface water that was purveyed by the water supplier in each of the previous five years.

(5) A description of the quantity of groundwater that was purveyed by the water supplier in each of the previous five years.

(6) A description of all proposed additional sources of water supplies for the water supplier, including the estimated dates by which these additional sources should be available and the quantities of additional water supplies that are being proposed.

(7) A description of the total number of customers currently served by the water supplier, as identified by the following categories and by the amount of water served to each category:

(A) Agricultural users.

(B) Commercial users.

(C) Industrial users.

(D) Residential users.

(8) Quantification of the expected reduction in total water demand, identified by each customer category set forth in paragraph (7), associated with future implementation of water use reduction measures identified in the water supplier's urban water management plan.

(9) Any additional information that is relevant to determining the adequacy of existing and planned future water supplies to meet existing and planned future demands on these water supplies.

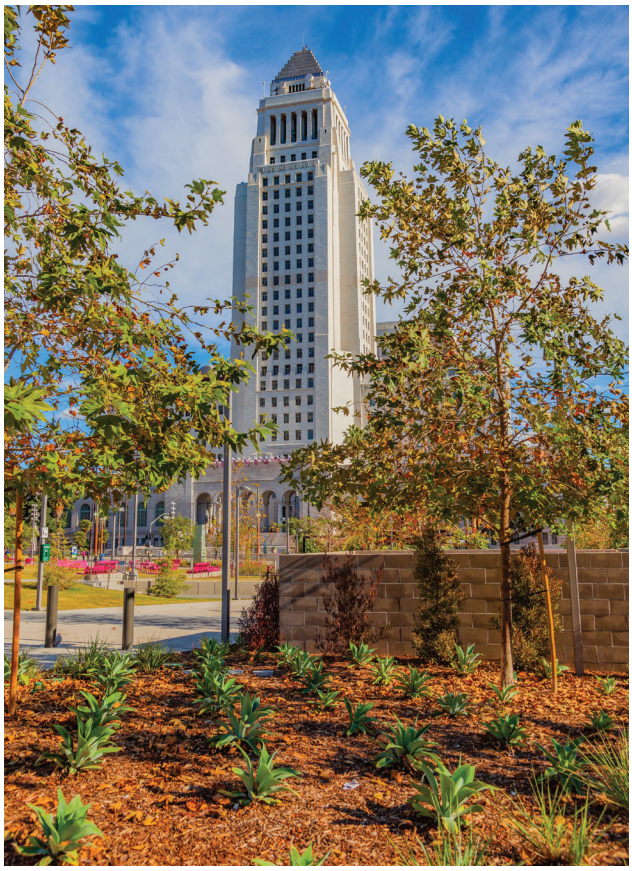
(d) Upon receiving, pursuant to Section 65352, notification of a city's or a county's proposed action to adopt or substantially amend a general plan, a groundwater sustainability agency, as defined in Section 10721 of the Water Code, or an entity that submits an alternative under Section 10733.6 of the Water Code shall provide the planning agency with the following information, as is appropriate and relevant:

(1) The current version of its groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720) of Division 6 of the Water Code.

(2) If the groundwater sustainability agency manages groundwater pursuant to a court order, judgment, decree, or agreement among affected water rights holders, or if the State Water Resources Control Board has adopted an interim plan pursuant to Chapter 11 (commencing with Section 10735) of Part 2.74 of Division 6 of the Water Code, the groundwater sustainability agency shall provide the planning agency with maps of recharge basins and percolation ponds, extraction limitations, and other relevant information, or the court order, judgment, or decree.

(3) A report on the anticipated effect of proposed action to adopt or substantially amend a general plan on implementation of a groundwater sustainability plan pursuant to Part 2.74 (commencing with Section 10720) of Division 6 of the Water Code (California Government Code § 65352.5 2014).

More information can be found in the state's *General Plan Guidelines*, which provide in-depth discussion about California comprehensive plan requirements (California Governor's Office of Planning and Research 2017). These guidelines explain the statutes excerpted above and provide suggestions for integrating water throughout the required elements and in specific objectives, programs, policies, and actions, with examples from adopted local plans in California cities and counties.



Low water landscaping outside of Los Angeles city hall, California. Photo: R. Thomas, Getty Images (2013).

State of Colorado Statutes

Walking path near the Snake River in Keystone, Colorado. Photo: J. Stapleton (2017).

The State of Colorado has several statutes that guide the integration of water resource management into planning documents. Municipalities of 2,000 people or more, or that are in counties that are required to have a comprehensive plan, must write a comprehensive plan. Counties required to prepare plans include those with a population of 10,000 or more and that have either a growth rate of 10 percent or more from 1994 to 1999 or 10 percent or more during any five-year period ending in the 2000s; or counties with a population of 100,000 or more regardless of growth rate. The following water-related provisions are required in local government plans in Colorado.

MUNICIPALITY AND COUNTY COMPREHENSIVE PLANS

> [A master plan shall include:]... [(d) or (IV)] The general location and extent of an adequate and suitable supply of water. If the master plan includes a water supply element, the planning commission shall consult with the entities that supply water for use within the ["municipality" or "county or region"] to ensure coordination on water supply and facility planning, and the water supply element shall identify water supplies and facilities sufficient to meet the needs of the public and private infrastructure reasonably anticipated or identified in the planning process. Nothing in this [sub]paragraph [(d) or (IV)] shall be construed to supersede, abrogate, or otherwise impair the allocation of water pursuant to the state constitution or laws, the right to beneficially use water pursuant to decrees, contracts, or other water use agreements, or the operation, maintenance, repair, replacement, or use of any water facility (Colo. Rev. Stat. § 31-23-206 and § 30-28-106 2016).

Water providers meeting certain criteria in Colorado must prepare water efficiency plans and must consider "land use best practices" for water efficiency within these plans. The Colorado Water Conservation Board has prepared a guidance document for local providers on this requirement (Castle and Rugland 2019). Colorado water providers will thus already be thinking about how land use actions can aid their water management goals, leading to opportunities for synergy, overlap, and mutual benefit. Colorado communities should collaborate with their water providers to understand how providers are meeting this requirement and whether the land use goals and policies of the water efficiency plan should be reflected in the comprehensive plan.

WATER EFFICIENCY PLANNING

Colorado statutes identify "covered entities" of the water efficiency planning requirements as "water providers, municipalities, and special districts, among others, that deliver over 2,000 acre-feet of retail water annually and are required to have a state-approved water efficiency plan in order to access state funding." To gain state approval, covered entities must include "a full evaluation" of water-saving measures and programs for water conservation in their water efficiency plans, including:

- Water efficiency fixtures and appliances.
- Low water use landscapes.
- Water-efficient industrial and commercial processes.
- Water reuse systems.
- Distribution system leak identification and repair.
- Water conservation public education efforts.
- Customer water use audits.
- Water-saving demonstrations.
- Water rate structures and billing systems promoting efficiency.

- Relevant regulations.
- Incentives such as customer rebates.
- The role of water conservation in the entity's water supply plan.
- Planning steps.
- The next update date for the conservation plan.
- An estimate of water saved as a result of conservation plan implementation.
- Land use planning best management practices to promote demand management, water efficiency, and water conservation (Colo. Rev. Stat. § 37-60-126 2016).

State of Nevada Statutes

City of Henderson in Clark County, Nevada, lies about 16 miles southeast of Las Vegas. Photo: D. Tangney Jr., Getty Images (2019).

The State of Nevada requires planning commissions to create and adopt comprehensive plans. Planning commissions are required for cities with a population of at least 25,000 people and counties with at least 40,000 people. Municipalities and counties that do not meet these thresholds may still create and adopt comprehensive plans. An entity's capital improvement plan must conform to its comprehensive plan. A conservation element is required in municipalities in counties with a population of more than 100,000. There are regional planning requirements for counties with a population between 100,000 and 700,000 and counties with a population of more than 700,000. A public facilities element is required in all Nevada comprehensive plans. (See Nev. Rev. Stat. § 278.02507 – 278.029 2013 for more information.)

ELEMENTS OF MASTER PLAN

The following excerpts of the Nevada Revised Statutes are related to water in comprehensive plans.

> (a) A conservation element, which must include:
>
> (1) A conservation plan for the conservation, development and utilization of natural resources, including, without limitation, water and its hydraulic force, underground water, water supply, solar or wind energy, forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals and other natural resources. The conservation plan must also cover the reclamation of land and waters, flood control, prevention and control of the pollution of streams and other waters, regulation of the use of land in stream channels and other areas required for the accomplishment of the conservation plan, prevention, control and correction of the erosion of soils through proper clearing, grading and landscaping, beaches and shores, and protection of watersheds...
>
> (e) A public facilities and services element, which must include...
>
> (2) A population plan setting forth an estimate of the total population which the natural resources of the city, county or region will support on a continuing basis without unreasonable impairment... (Nev. Rev. Stat. § 278.160 2013).

Further information on planning in Nevada can be found in the Nevada Chapter of the American Planning Association's 2017 *Nevada Planning Guide*.

State of New Mexico Statutes

Hot air balloons at White Sands National Park, New Mexico. Photo: J. Kruse, Getty Images (2010).

The State of New Mexico allows all local governments to create a planning commission and adopt a comprehensive plan. New Mexico's planning requirements outline land use, transportation, public facilities, economic development, and infrastructure as topics to include in the comprehensive plan. There are no detailed requirements provided for any topic, including for water (NMSA § 3-19-9 1965). The New Mexico Department of Finance and Administration, Community Planning section, recommends water as a topic to address in the comprehensive plan but does not provide any further guidance or detail about what this might entail. Nonetheless, water is a popular topic in many New Mexico comprehensive plans.

State of Utah Statutes

Salt Lake City skyline. Photo: iStock (2012).

The State of Utah requires each municipality and county to prepare and adopt a comprehensive plan, and that all public uses must conform to the comprehensive plan. Among other provisions, Utah requires that comprehensive plans include a discussion of "the efficient and economical use, conservation, and production of the supply of food and water" (Utah Municipal Code §10-9a-403 2019). Counties must also prepare a resource management plan for public lands that addresses water rights, water quality, and hydrology (Utah Municipal Code §17-27a-401 2019). The state does require that specific elements, such as environment and land use, be included in the comprehensive plan, and recommends additional elements for consideration.

GENERAL PLAN PREPARATION

(3) The proposed general plan may include:

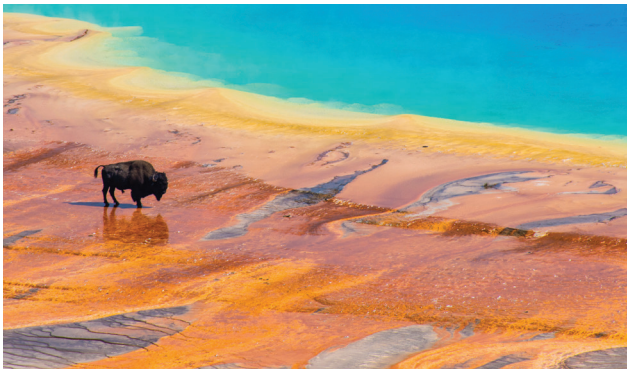
(a) [A]n environmental element that addresses:

(i) the protection, conservation, development, and use of natural resources, including the quality of air, forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, and other natural resources; and

(ii) the reclamation of land, flood control, prevention and control of the pollution of streams and other waters, regulation of the use of land on hillsides, stream channels and other environmentally sensitive areas, the prevention, control, and correction of the erosion of soils, protection of watersheds and wetlands, and the mapping of known geologic hazards;

(b) a public services and facilities element showing general plans for sewage, water, waste disposal, drainage, public utilities, rights-of-way, easements, and facilities for them, police and fire protection, and other public services (Utah Municipal Code §10-9a-403 2019 and §17-27a-403 2019).

State of Wyoming Statutes



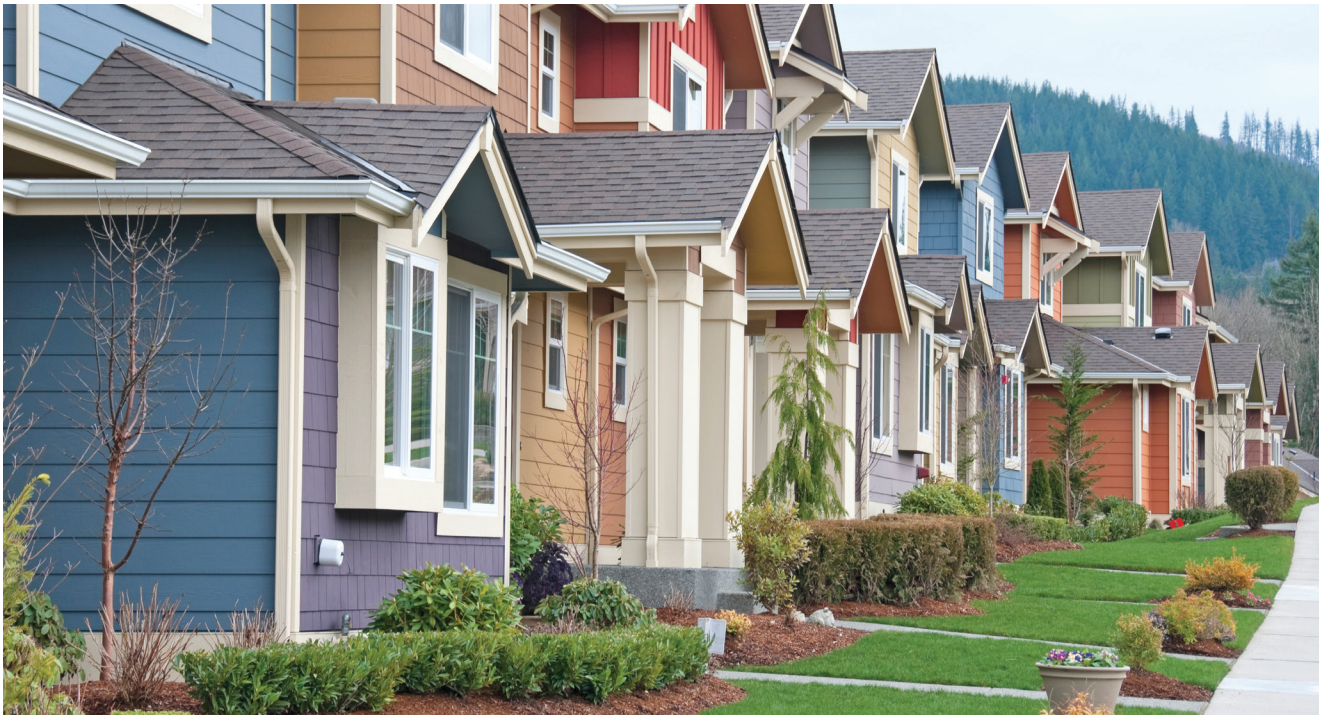
Bison crossing the Grand Prismatic Spring, Yellowstone National Park, Wyoming. Photo: M. Brady, iStock (2017).

The State of Wyoming allows all local governments to create a planning commission and adopt comprehensive plans. Similar requirements do not exist for county comprehensive plans in Wyoming. The following excerpt from the Wyoming State Statutes includes the requirements for comprehensive plans related to water.

CITIES AND TOWNS, PLANNING

(i) Commission's recommendations for the development and may include the general location, character and extent of streets, bridges, viaducts, parks, waterways and waterfront developments...

(iii) General location and extent of public utilities and terminals, whether publicly or privately owned, for water...and other purposes (Wyoming State Statute §15-5-503 2014).



Street view of houses. Photo: iStock (2011).

PLAN STRUCTURE: THE ROLE OF A WATER ELEMENT

Kids playing in a park fountain. Photo: M. Nieves, iStock (2007).

Much thought goes into the content and structure of a comprehensive plan, as planners aim to create a user-friendly, community-focused document. State statutes help inform some of the content of the plan, but even the most rigorous state requirements allow for creative interpretation, if the community demonstrates that the required elements are present. While several Colorado River Basin states do require water to be addressed in the comprehensive plan in some fashion, it's worth noting that these are minimum requirements. Communities must meet them but can choose to exceed the standards. Each community will have to determine how water will be addressed during the planning process–from initial visioning and goal-setting sessions through to identifying and affirming implementation actions. This section discusses the advantages and disadvantages of water elements and other means of incorporating water into the comprehensive plan.

In general, it's best both to have a water element and to integrate water policies throughout the comprehensive plan. A water element or section provides space to discuss water to a depth that may not be appropriate in other elements or sections. A water element can be used to generally answer the questions

"How does our community get water?" "How much do we have?" and "How do we use it?" as well as more forward-thinking questions such as "How will water resource management affect our community's future?" Further questions to answer in a water element are outlined in Figure 2 of the Quick-Start section of this manual. A water element can contain goals, objectives, policies, and actions related to water conservation, water infrastructure, water rates, and other topics that may not have obvious overlap with other comprehensive plan categories.

Communities with multiple water providers may need to write broad or multiple water policies in their comprehensive plan in order to reflect the diversity of goals and policies outlined by their water providers. A water element should be written in the same style as that of other comprehensive plan elements. Sample language for the introduction of a water element can be found in *Integrating Water Efficiency into Land Use Planning* (Nolon Blanchard 2018). This document includes additional perspective and examples, beyond the Colorado River Basin states, of communities that have integrated water into their comprehensive plan.

A water element with a narrative description of a community's water supplies will lay a foundation on which all other water-related information can depend. Clearly expressing the facts of a community's water context creates a framework in which all other water-related actions will operate. A water element provides context for water policies that may be included throughout the plan. Explaining how the water element relates to other parts of the comprehensive plan can also create a clear connection between water management and a community's broader land use goals.

For instance, if a community has a policy related to considering water during the development approval process, a plan reader can refer to the water element for more context about why such a policy is in place; or, detailing a town's sole reliance on declining groundwater resources can demonstrate the need for instituting or strengthening an "assured water supply" rule (also referred as a "show me the water" rule) as a mechanism for ensuring sustainable water supplies in new development.

Tying in Water Plans

Water providers are often required to prepare their own plans that detail water supply, demand, infrastructure, and management. Higher-level water policies in the comprehensive plan should mirror any water policies that are outlined in an existing, separate water plan. Since planning departments write comprehensive plans and water providers write water plans, using these documents in tandem enables better coordination among departments and disciplines, ultimately leading to stronger water management and informed development. Both plans should be updated regularly, as determined by state requirements or the local government or water provider. The local government and water provider should also coordinate data to ensure the same assumptions–about population growth, development, land use, and water resources–underlie both plans.

Detailed water management information may not necessarily need to be transferred into a comprehensive plan because it already exists in a dedicated water plan, but this information should be well-referenced in a comprehensive plan to ensure that relevant data, such as supply and demand projections, are being considered alongside the community's broader development goals. Both comprehensive and water plans provide key information about a community and should not be treated as mutually exclusive. The degree to which a community can fully integrate its water and land use planning may depend on local resources and capacity; thus, referencing a water plan in the comprehensive plan without further integration can be a meaningful first step to coordinated planning. Communities with higher capacity and that are farther along in integrated planning can take this further by more fully incorporating a water plan and associated policies into the comprehensive plan; some communities have even gone as far as updating the plans on the same cycle in recognition of their importance and interdependence.

OVERVIEW OF THE PLANNING PROCESS

Urban planners at work. Photo: iStock (2007).

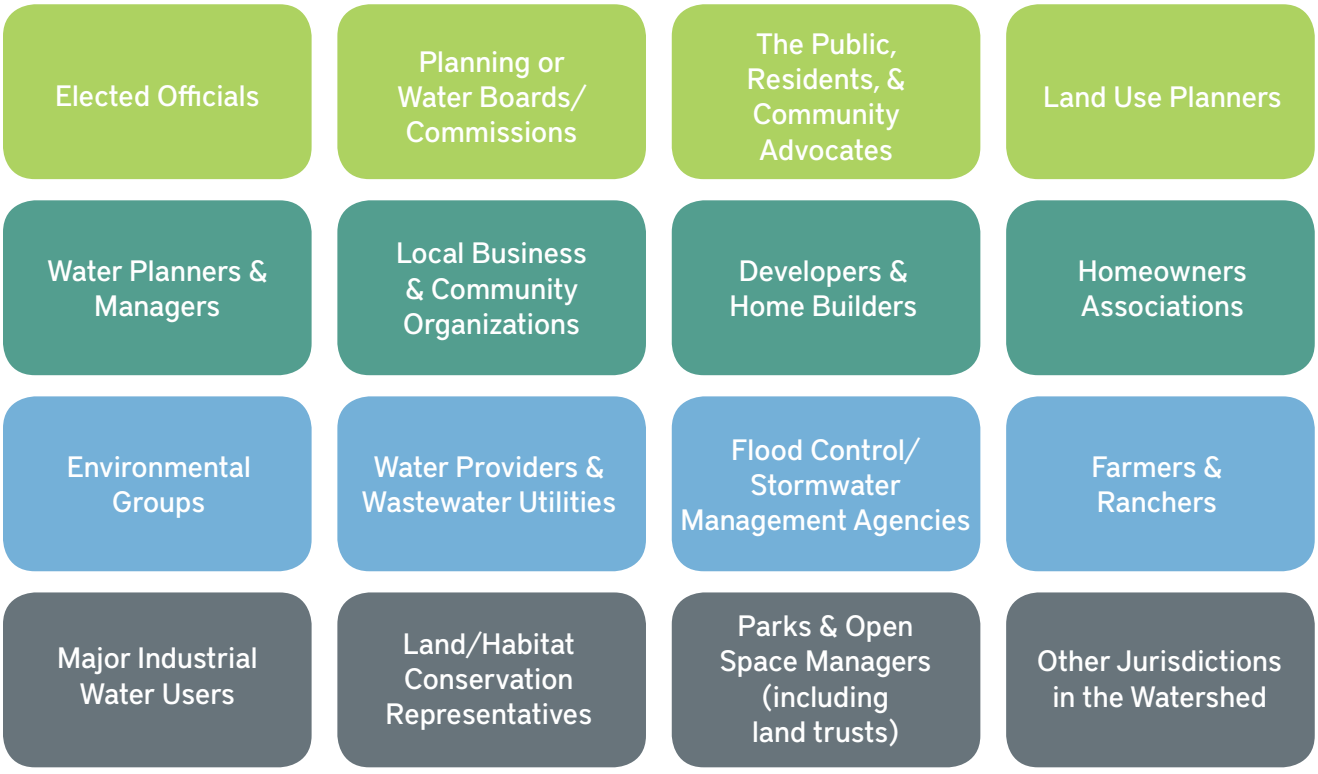
A comprehensive plan is frequently as much about process and garnering input on a community's vision as it is about the actual content of the plan. The American Planning Association's *Sustaining Places: Best Practices for Comprehensive Plans* (2015) identifies authentic participation and accountability in implementation as required processes in a successful comprehensive plan. This section details how to build water into the stakeholder engagement and public participation process, as well as how to strengthen implementation through strong water-related goals and metrics.

Stakeholder Engagement

One of the strengths of comprehensive planning is the public outreach process and the involvement of multiple stakeholders to establish an inclusive vision for a community, informed by the desires of residents and the expertise of staff. To incorporate water resources into a comprehensive plan, water managers and other stakeholders need to be meaningfully involved in the planning process. This inclusion informs planners of water resource opportunities and vulnerabilities identified by their community and fosters buy-in among those who must implement the goals to achieve water sustainability.

Equitable public engagement and input are central to the success of a comprehensive plan. Communities that are dedicated to integrating land use and water resource planning should use the public engagement process to take stock of community issues, attitudes, values, and priorities about water. Meaningful engagement will include outreach to all residents, with consideration to those who may be underrepresented. Including a representative mix of stakeholders provides three advantages to the planning process: (1) it delivers the benefit of local knowledge and expertise; (2) it provides a channel for individuals' or agencies' concerns as they relate to current practices and future development; and (3) it creates understanding of the water policies that will impact various stakeholders. Stakeholder roles and responsibilities should be clearly defined to strengthen implementation strategies and to maintain transparency regarding who is involved.

Figure 3
Topics to Increase Water Integration within a Comprehensive Plan



Source: Babbitt Center for Land and Water Policy

Four-Step Planning Process

There are four essential steps that a local government should undertake to make water a part of its normal procedures for preparing a comprehensive plan. The steps described here and the additional detail in subsequent sections will guide a local government through the collection of necessary data to create, track, and implement water resource goals. The degree to which a community completes each step or collects the identified data may depend on time and money as well as the community's overall priorities.

Step One: Coordinate

The first step is to create a land and water planning team from diverse disciplines to develop and inform the effort. At a minimum, this team should consist of land use planners and managers from the water providers that serve the community. Elected officials and members of planning boards and commissions can also be crucial additions to the team.

The formation of the team can be initiated by anyone: the planning director, a water resource manager, or a leader within the local government who sees the need for integrated planning. Whoever assembles the team should make it clear to prospective participants that the mission will be to contribute to a strong plan, that the process will be an iterative one in which all ideas are welcomed, and that the goal will be to end up with a plan that aids the community's water management. Absent or disengaged participants can inhibit success and lead to gaps in implementation.

Building a land and water planning team may require land use planners and water providers to establish a new working relationship. For a community served by multiple water providers, this may be complicated and time-consuming. It may not be possible to have total participation for a variety of reasons–the number of water providers in a service area or willingness to participate–but it is critical that all providers be invited and encouraged to participate.

Joining-Up Urban Water Management with Urban Planning and Design (Water Research Foundation 2018) identifies opportunities and major barriers to collaboration among land use planners and water professionals. It also includes a Barriers-to-Bridges Matrix tool to help communities overcome potential divides. Other resources that offer guidance on creating a land and water planning team include the *Coordinated Planning Guide* (Brendle Group and Western Resource Advocates 2018); *Best Practices for Implementing Water Conservation and Demand Management Through Land Use Planning Efforts* (Castle and Rugland 2019); and *Integrating Water Efficiency into Land Use Planning* (Nolon Blanchard 2018).

The efforts of the land and water planning team can be strengthened by buy-in and direction from upper management, such as senior staff, city or town councils, planning commissions, county supervisors, or water provider boards. It may be appropriate for senior leadership from the planning department or the water provider to serve as committee leaders or chairs. The team should communicate, meet, and share data throughout the planning process and into the implementation stages and should consider presenting its work to relevant governing bodies at each milestone of the process. More suggestions for formalizing a land and water planning team can be found in *Integrating Water Efficiency into Land Use Planning* (Nolon Blanchard 2018).

The team should consider turning its comprehensive plan meetings into an ongoing working group after the plan is completed. This will support continued coordination throughout the plan implementation phase even if there is staff or leadership turnover.

Step Two: Understand

Once the land and water planning team is assembled, it can begin preparing the plan, starting with data collection, evaluation, and analyses of current conditions. Early tasks for team members are assessing the degree to which water is addressed in the community's

existing comprehensive plan and evaluating the status and content of existing water plans. The team should review any existing comprehensive plan language on water for consistency with existing water plans, community regulations, and development processes. These assessments of existing plans may demonstrate a need to update data and may reveal whether existing policies have resulted in positive outcomes in water management. Further, staff should compile key information from all water planning documents to evaluate the data and to check for discrepancies between assessments or projections.

Water providers should come to the planning process prepared with assessments of current conditions of water supplies, water demands, reuse opportunities, water quality, stormwater management concerns, and the integrity of the delivery system—especially if these data differ from the provider's current water plan. Planners and water providers should collaborate on projections of population, land use growth, and climate conditions to build-out (or another planning horizon) and compare these to a range of estimates for low-, medium-, and high-water use. If differing projections already exist, the land and water planning team will need to reconcile these differences or agree on which model to use.

Pace University's Land Use Leadership Alliance (2017) and the Sonoran Institute (2018) have self-assessment questions that can aid communities in understanding their water issues and in determining the level of incorporation they have already achieved. This process can be aided by understanding terms used by both water managers and planners. *Joining-Up Urban Water Management with Urban Planning and Design* (Water Research Foundation 2018) includes a glossary of common language used by planners and water managers respectively.

In the arid West, water availability is a key concern. Communities may opt to use Exploratory Scenario Planning (XSP) to prepare for uncertain futures. Topics of sustainability and resilience are apt for XSP. XSP can be employed to navigate the uncertainties that threaten communities and organizations, like the quantity, quality, availability, reliability, and affordability of water. The XSP process raises awareness, allowing stakeholders to exchange perspectives and build consensus on the actors, actions, and adaptations needed to address their concerns and implement collaborative solutions across a range of possible futures, not just the one that is ideal and desirable. Stakeholders identify the critical uncertainties shaping their future, explore the implications of alternative possible scenarios, outline strategies to mitigate disruption and attain their collective vision, and create contingency plans for when conditions take a turn.

For more information on XSP, see the *Scenario Planning Model Report* (American Planning Association 2016); *Opening Access to Scenario Planning Tools*, a 2012 policy focus report from the Lincoln Institute of Land Policy; XSP resources from the Sonoran Institute on ResilientWest.org including an explainer and facilitator training videos; the Lincoln Institute's Consortium for Scenario Planning; and the Colorado Water and Growth Dialogue's *XSP Demonstration Project* (Keystone Policy Center, Lincoln Institute, and Sonoran Institute 2017), which explores water uncertainty facing the Colorado Front Range region.

Step Three: Plan

The land and water planning team should create actionable goals, objectives, and metrics to measure progress, effectiveness, and achievement. The American Planning Association outlined a scoring system for comprehensive plans in *Sustaining Places: Best Practices for Comprehensive Plans* (2015). More points are awarded if a plan practice "is defined and addressed through data, analysis, and support, and included in goals, policies, and implementation actions of the plan" (21–22). The Babbitt Center's evaluation of water in comprehensive plans similarly awarded the highest points for evidence of implementation (Rugland et al. 2019). The study defines implementation in terms of a detailed set of actions that staff must undertake, the establishment of new regulations or standards, and narrative descriptions or reports on how goals and implementation tools for water resources are reflected in other planning documents, among the other implementation aspects listed here:

- Timelines for action.
- Delegation of responsibility.
- Sources of funding for a program/action.
- Monitoring and evaluation of progress.
  - Provisions for tracking change in community conditions.
  - Goals are based on measurable objectives.
  - Indicators of objectives to assess progress.
- Demonstration sites.
- New requirements established by a plan, ordinance, code, or regulation.
- Example of how the topic has been or will continue to be implemented.
- Requirements or actions go beyond state and federal standards.
- Topic ties in information or implementation discussed in another planning document into the comprehensive plan.
- Topic is described according to multiple metrics or measurements.
- Narrative topic informs further action or implementation steps.
- Plan connects data and information about the topic to other framework categories or other aspects of the plan.

These scoring systems reflect the importance of defining implementation steps and measures of success in the planning process, and including those in the plan. Plan goals and objectives should have baselines for measurements and timelines for completion and should be informed by sound data. Water goals should be broken down into specific strategies and steps, clearly establishing which departments, staff members, and partner agencies will complete each step. Doing so will provide a clearer path to implementation, making comprehensive plan policies more likely to be brought into action. Comprehensive plan policies linking land and water with and without implementation steps might look like these two examples:

> **Example without implementable steps.**
> We will work to incorporate water-saving actions into land use planning efforts.
> *Example is overly broad and does not delve into implementation actions.*

> **Example with implementable steps.**
> Land use density and intensity should correspond to existing and planned water infrastructure and supply. This will be achieved through infill development to minimize costs of operations and maintenance and efficiently manage growth. The planning department has designated areas of the land use map as infill priority areas to help guide growth. The city will adopt a comprehensive infill development strategy by [year]. The water provider will review development proposals to ensure that adequate water service infrastructure is present and that any proposed development will not push the city above its water budget.
> *Example discusses the integration of land in water through a specific, implementable mechanism. Example may be split into "objectives" and "policies" in the plan to represent the level of detail it includes.*

Plan goals and metrics will depend on the specific water management goals and water supplies of a community and on the goals and strategies that may be in an existing water plan. The most recent water plans or studies should be used to create the water-related goals of the comprehensive plan.

There are at least two idea-generating exercises that land and water planning team leaders can introduce during the planning process if a community has trouble establishing its water goals. The first would bring together staff, stakeholders, and the public. The group could begin with a brainstorming exercise to identify intervention points where improved water management can be achieved. They could also identify programs that would reduce water demand in the sector with the highest water demand (commercial, industrial, residential; indoor versus outdoor demand). And third, they can identify the physical features of the jurisdiction that may warrant water-related policy interventions. These could include: habitat or riparian restoration; green infrastructure in areas of impervious surface; overlay zones that promote groundwater recharge; development setbacks near source water; and development regulations on floodplains.

METRICS TO TRACK PROGRESS OF WATER RESOURCE GOALS

- Water use per capita; volume of water per acre or by zoning type; or total volume billed
- Percentage of water use from reuse, renewable, or non-potable sources
- Stream flows or rate of aquifer withdrawals
- Rate of groundwater recharge
- Amount of water stored
- Surplus or deficit of secure water supplies
- Outdoor water use
- Implementation of water conservation practices
- Water use before and after code changes
- Peak water demand reduction
- Watershed or stream health indicators
- Improvement in water quality

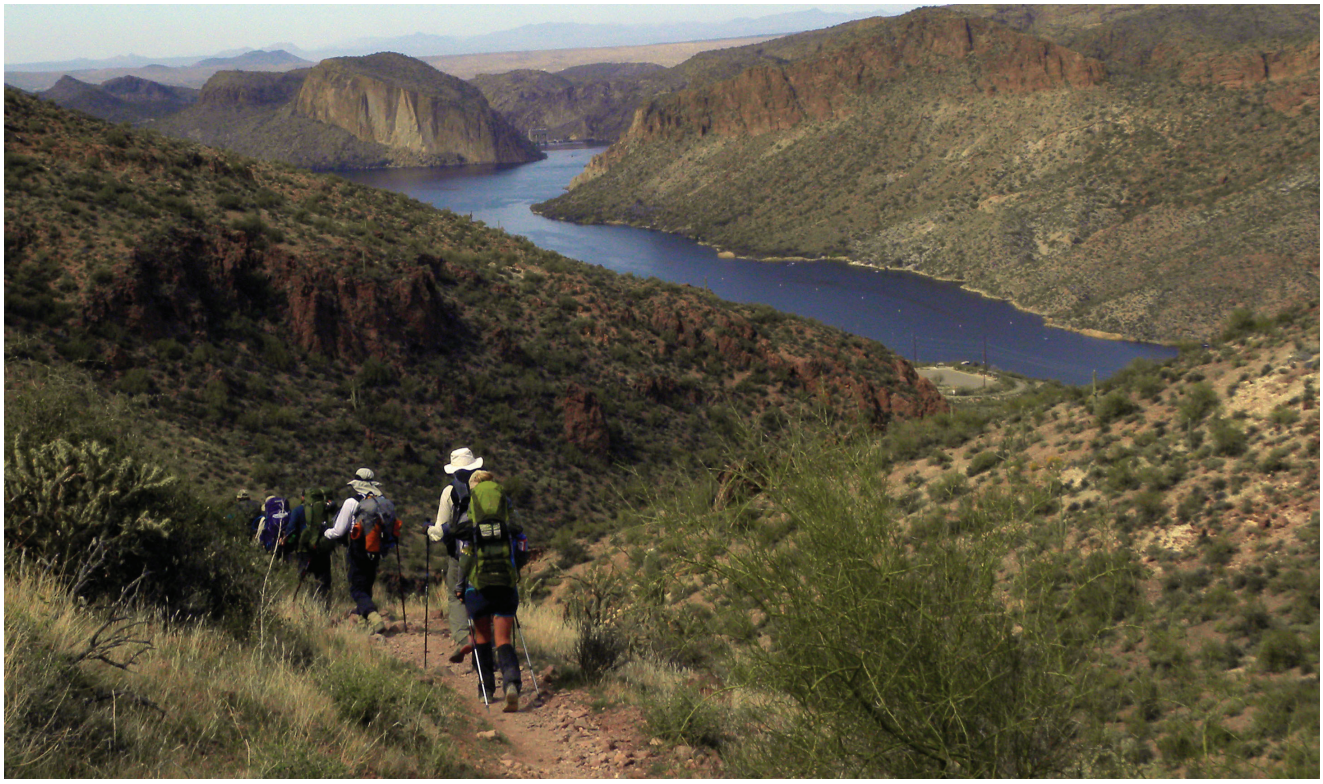
The second exercise considers specific plan implementation actions that could be put in place to meet water goals. These activities could be undertaken by a technical working group of planners, staff from the water provider, and representatives from related internal and external entities whose programs and policies influence water goals. The group could pursue the following topics:

- Identify the local government's existing regulatory tools and incentives that support water management goals.
- Identify studies needed to better understand water supply and demand in the community.
- Consider new administrative procedures to formalize collaboration between the planning department and water provider.
- Draft code language that would add water as a consideration during development review and rezoning.
- Codify actions that help achieve water-saving goals within zoning and subdivision ordinances, building and plumbing codes, and land use codes.
- Include water infrastructure, services, and quality costs within capital improvement project budgets and development impact fees.

Step Four: Act

The fourth step is for the local planning commission or elected body to formally adopt the new comprehensive plan that integrates water. Staff should work throughout the planning process to ensure they have buy-in from the top to implement the plan and should confirm this buy-in during the final approval and adoption process. The adopted plan will ideally include a water element that describes the community's water resources and issues, with actions needed in the near, mid-, and long term to implement water-related goals. It should also reference water goals in every other relevant section of the plan. All goals should identify the departments or agencies responsible for implementation and funding sources for new processes or staff needed to monitor and measure progress toward the goals. Once the plan is adopted, staff can share data with all stakeholders as progress is made, or on a regular basis through established meetings. As the five-year, ten-year, or lengthier planning timeframe goes by, staff should regularly measure, monitor, and report on metrics for the plan's progress. If the data indicates that an implementation measure is not achieving the desired result, staff should recommend changes to commissioners and elected officials so that new efforts can be made to meet the goals identified in the plan.

WHAT TO INCLUDE: WATER TOPICS AND EXAMPLES



Hikers in the Superstition Mountains, Arizona. Photo: J. Stapleton (2014).

The world of water is vast and unfamiliar to many planners. Even if planners understand state requirements, the benefits of including a water element in a comprehensive plan, and the public process involved, knowing which specific topics to cover when it is time to sit down and write the plan can be daunting. The Babbitt Center for Land and Water Policy has worked extensively through literature, peer review, and plan review to identify water topics that should be included in a comprehensive plan. This section describes these topics, identifies some potential barriers or opportunities for inclusion, and provides additional resources and examples from comprehensive plans throughout the Colorado River Basin region.

To effectively integrate land and water in a comprehensive plan, a local government must understand its current water resources, future projections, and which land use tools can be implemented to support water resource goals. A community can understand its existing water resources by getting a handle on its water management and water system. Future projections in the comprehensive plan should demonstrate whether a community has the water supplies to sustain projected demands and, if not, what alternative supplies or demand

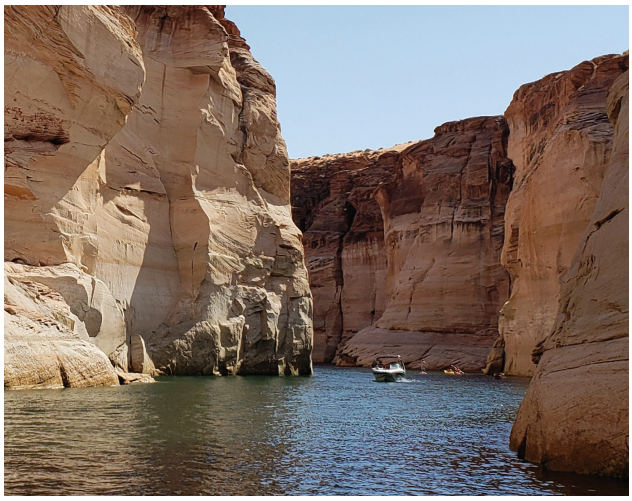
management strategies the community could implement to fill the gap, while maintaining the health and sustainability of existing and potential water resources. Finally, a community should consider how its land use form, planning and development processes, and land use policies aid water management goals. Incorporating water into the comprehensive plan through these categories will ensure that water is well represented in a community's vision and its plans for a resilient and sustainable future.

"One Water": Moving Toward Integrated Water Management

"One Water" is an umbrella term put forward by the US Water Alliance that defines water resource planning that combines the management of drinking water, wastewater, water for the environment, and stormwater–traditionally separate areas of water resource planning that are often carried out in different agencies–to create a more sustainable, inclusive, and integrated water management system. This approach promotes collaboration among water managers and creates a more holistic understanding of a community's water system. It transcends any single planning process and is equally applicable to comprehensive plans and water plans. Separate water planning documents should inform a community's comprehensive plan and ensure that all aspects of water management are addressed in a community's overarching aspirations. More information about the One Water approach can be found at the One Water Hub (2018), the American Planning Association's *Planners and Water* (2017), and the Water Research Foundation's *Blueprint for One Water* (2017).

None of the water topics described in this manual works in isolation. In many cases, the distinctions drawn between them may seem arbitrary, particularly for communities that are moving toward integrated water management. Many of these topics inform each other or overlap; for example, forecasting water supply and demand requires current data on water supplies and uses, and general water conservation programs often encompass landscaping, irrigation, building, and plumbing policies. A plan need not discuss these topics as distinct if they are related or interdependent. This framework simply provides guidance on the kind of information that is useful in a comprehensive plan; how these topics are represented in a plan is at the discretion of the land and water planning team.

Figure 4 highlights the topics that will increase a comprehensive plan's integration of water. Discussion of these topics makes up the bulk of the rest of this manual, complete with a description, subtopics, resources, and examples from plans. These topics were chosen from a review of water and land use integration literature and plan requirements, and an examination of how water has been integrated into comprehensive plans. A local government's ability to provide information on some of these topics will depend on the ownership of local water systems and available data. Collaboration between land use planners and water providers is key to integrating this information into a comprehensive plan.



Antelope Canyon on Lake Powell on the Arizona and Utah border. Photo: E. Rugland (2018).

Figure 4

Water Topics for a Comprehensive Plan

Water Management	Future Projections	Water Efficient Land Use
Existing Water Supplies & Availability	Projected Population & Economic Change	Collaboration for Land/Water
Water Use/Demand	Projected Development & Land Use Change	"Show Me the Water" Requirements
Water Financing	Water-Related Hazard Mitigation	Development Process & Evaluation
General Water Conservation Programs	Forecasting Water Supply/Demand	Urban Form & Zoning Regulations
Water & Wastewater Infrastructure	Water Supply Diversification	Landscaping/Irrigation Policies
Water Quality	Water Equity	Building/Plumbing Policies
		Stormwater Management
		Water for Ecosystem Functions

Source: Babbitt Center for Land and Water Policy

Water Management

Hoover Dam on the Arizona and Nevada border. Photo: J. Sharp, Getty Images (2010).

Prior to launching new water management strategies or integrating water into land use planning, the community must gain an understanding of its water portfolio. This portfolio is an accounting of every source of water that comes into a jurisdiction that will be managed, used, protected, allocated, and conserved depending on the source and demand. The portfolio may include storm-water, surface water, groundwater, and gray water and recycled water, as well as the available supply of one or more non-municipal water providers, where present. The topics below detail the information that will help planners understand their community's water portfolio and how it's managed–the first step to creating a base-line for future projections and figuring out the most appropriate land use techniques to use.

Water providers may be required to regularly report information about water management to a state entity. Where this is the case, water providers should also have this information available to discuss with a local government. Knowing water provider reporting requirements is particularly important for local governments with non-municipal providers, who may have to collaborate with multiple outside agencies to understand water management within their community. In any case, local governments should work closely with their water providers to incorporate the most accurate data about water management into their comprehensive plans.

Water Management Topics

EXISTING WATER SUPPLIES AND AVAILABILITY

A community should take stock of its existing water portfolio as the first step to understanding its water context. The comprehensive plan may describe the legal rights of its water providers compared to the annual use or yield of its supply sources. In other words, the plan may describe its "paper" water as well as its "wet" water when expressing supply and demand data.

A community's water supply can be expressed by many metrics, including the percentage, gallons per day, firm yield, wet- and dry-year yield, multiple dry-year conditions, or yearly acre-feet of surface water, groundwater, effluent, or recycled water available on average. The plan should describe whether these water supplies are local, trans-mountain, or otherwise procured, in order to provide a sense of scale to the public. Residents and community members may react differently to proposed water policies depending on how well they understand where their water comes from. Local sources may inspire more local stewardship of water resources, whereas diverted sources may convey a greater need for water conservation.

Communities should include supplies from non-municipal water providers in their water portfolio, even if further information about water supply is not available. Most water providers will have detailed information about their water supply sources. Acquiring this information can be a first step in a collaborative process with non-municipal providers and can inform the local government about current and future supply challenges that may exist in their jurisdiction that could be alleviated through land use mechanisms.

Existing Water Supplies and Availability Subtopics

- Surface water
  - Seasonal, annual, or multiyear variability
  - Basis for availability estimate
- Groundwater
- Desalination—potable, non-potable, seawater, groundwater
- Water providers
  - Municipality, private company, special district, residential wells, water hauling
- Water rights
  - Amount obtained from each source

Resources and Examples from Plans

Town of Gilbert, AZ, describes how it interacts with other water suppliers in order to receive its water supplies and how these supplies may vary with streamflow and other system variations (2012, chap. 7: 4–6).

City of Fresno, CA, describes the snowpack, rivers, and aquifers that its water supply relies on, including the cost, infrastructure, and drawdown challenges associated with the aquifer it primarily depends on. In addition to identifying these challenges, the city discusses ways it could become a regional leader in sustainable management of its aquifer (2014, 7-24).

Arapahoe County, CO, includes in the appendix to its comprehensive plan a description of each water provider's service area and the source and quantity of water they provide (2018, app. B: 12).

City and County of Broomfield, CO, describes its water supplies and water rights in terms of "tap equivalents" to illustrate how much additional residential and commercial development it can support at buildout (2016, 136).

Santa Fe County, NM, describes the water supply sources for residents that are not served by the county water provider. Counties and communities with non-municipal providers can follow this example to demonstrate how to address water supply when the community is not the water provider for all of its service area. "At the present time, residents not served by the County water utility are reliant on two main sources, domestic wells or community water systems. The County has developed major policy statements that require use of surface water preferentially to groundwater in the Conjunctive Management Plan (CMP), the 40 Year Water Plan, and the draft amendment to the 40 Year Water Plan and the Santa Fe County Water Conservation Plan. These, together with new methods of financing water supply systems, will help establish surface water as the primary source of water to most users in the unincorporated areas, with groundwater serving as a backup in the event of drought or an emergency" (2015, 192).

City of Fernley, NV, differentiates between surface and groundwater supplies in its discussion of water supply, as well as water storage and future infrastructure needs associated with these supply sources (2018, 106).

WATER USE/DEMAND

There are many ways to describe water use in a community: acre-feet per year, gallons per capita per day, number of customers or connections, water use by sector, water use by zoning type, and more. The appropriate metric or combination of metrics will depend on a community's context and capacity. For instance, gallons per capita per day is not the most illustrative metric if a community has a few large water users that will skew this calculation; residential gallons per capita per day would be more appropriate. A community that is struggling to make meaningful advances in water conservation and decreasing water use may be well-served by examining its water use by land use sector to determine whether it has been targeting the appropriate users in its water conservation programs. Further, the appropriate water demand metric can help explain the course of certain water policies. For example, implementing a xeric landscape ordinance may be better received if the community has data demonstrating that outdoor use in residential areas represents the water provider's biggest water user by land use type.

Water Use/Demand Subtopics

- Demand based on land use or zone
- Water use per capita
- Water use by sector
  - Residential, industrial, commercial, agricultural, single-family, multifamily, etc.
- Water use–indoor and outdoor
- Total water delivered (acre-feet per year or another measurement)
  - Total water drawn from sources
- Peak/seasonal water demand
- Water customers/accounts

Resources and Examples from Plans

Maricopa County, AZ, describes the total water use in the region, including both surface water and groundwater. The county describes the shift in water use per sector over time, noting that overall water use remained stable even as agricultural water use declined and municipal use increased. It uses this information to estimate projected total water use in 2025 (2016, 96–99).

City of Porterville, CA, models a typical water use/demand description in its comprehensive plan: "In 2001, the City estimated per capita consumption at 250 gallons per day and total deliveries of almost 11,000 acre–feet per year. This value includes all City water uses (residential, commercial, municipal, industrial, etc.). In 2005, water usage by customer type was

roughly 62 percent for single family residential, 12 percent for multi-family residential, 19 percent for commercial/institutional, 4 percent for large landscape irrigation, and 5 percent for other uses" (2007, chap. 8: 2).

Santa Fe County, NM, compiles water use data from Santa Fe County Water Utility, City of Santa Fe, 53 other water suppliers, and estimates for self-supplied homes, to understand the nature of water withdrawals in the county. This is historical use data allocated by type of land use, which aids the county's ability to use this data for land use and development approval processes (2015, 198–199).

Clark County, NV, uses "net gallons per capita per day," which discounts water that has been reused, as its water use metric to underscore the importance of water reuse as a supply and demand management resource (2017, chap. Conservation Element: 10).

WATER FINANCING

Water rates and development fees are used to cover water costs. In most cases, a municipal water department is operated as an enterprise fund, meaning that it is self-supporting from its rates and fees. In other cases, municipal general fund revenues are used to subsidize the water utility. A comprehensive plan does not necessarily need to delve into utility financing; rather, the plan should consider generally how water infrastructure, delivery, maintenance, and service is paid for and by whom, and whether these financing structures are sufficient, equitable, and sustainable into the future, as well as whether they promote efficient water use.

Many communities have policies or express interest in ensuring that development pays its "fair share" of the infrastructure required to connect to or expand existing water systems. Other communities consider the costs that are borne by customers and whether these costs are equitable compared to those borne by industry or nonresidential development. Particulars about investment in water systems are more appropriate for a capital improvement plan. However, considering some bigger-picture questions about water costs in a community can allow a local government to think more strategically about its investments and the revenue streams that support these investments. Communities served by non-municipal providers will need to work together to understand how planning and development policies will affect water financing, such as whether annexation or zoning policies and water connection fees are complementary for either incentivizing or disincentivizing growth. Further, communities with non-municipal providers may be responsible for permitting water infrastructure or approving individual groundwater wells and could consider the land use implications of these investments.

Water Financing Subtopics

- Water rate structure or charge to customer
- Fees for water connections
  - Conservation incentives–connection charge explicitly promotes water conservation in its design/intention
  - Development disincentives–connection charge discourages irresponsible, sprawling, or water-inefficient development
  - Tap fees
- Tax increment financing for water-related incentives (Georgetown Climate Center 2019)
- Cost of infrastructure
  - Cost of infrastructure repairs
  - Impact fees
  - Special assessment districts or betterment contributions for water systems (see, for example, Independence Township 2015)
  - Public-private partnerships or exactions to fund water infrastructure
  - Water infrastructure in capital improvement planning and financing

Resources and Examples from Plans

Water Connection Charges: A Tool for Encouraging Water-Efficient Growth (Western Resource Advocates, the University of North Carolina at Chapel Hill, and Ceres 2018) presents methods on how water fees can encourage developers to use water-efficient building strategies.

City of Tucson, AZ, strives to ensure that new development pays its fair share of the cost of additional public facilities. Tucson Water, the city's water provider, supports this goal through system equity fees and water resource fees (2013, 3.119).

San Joaquin County, CA, states in its comprehensive plan that it will verify with water providers whether developers have paid water infrastructure fees and wastewater facility infrastructure fees prior to approving development (2016, 3.2-40).

City of Las Vegas, NV, discusses how its water connection fees have increased over time, in order to send a price signal and encourage water conservation, and discusses how these fees may impact affordable housing (2000, chap. Housing Element: 23).

GENERAL WATER CONSERVATION PROGRAMS

Water conservation encompasses any water-saving action. A community should consider both its specific programs and its overall strategy for water conservation, such as the sectors or users targeted and the mechanisms it uses to deliver its programs. Education, incentives, and regulations work best in tandem to achieve water-saving results; however, any one of these may better suit a community than all three. An affluent community, for example, may have the best results from an education program if its water users are not motivated by cost saving incentives or by the financial penalties that may accompany regulations. Additionally, depending on the community's context or regulatory environment, it may want to consider an overall water conservation goal, such as decreasing water use by so many acre-feet or gallons per capita by a certain date. If such a goal is in place, a community should describe its methods for reaching it in the comprehensive plan.

Water conservation is closely related to the Landscaping and Irrigation Policies and Building and Plumbing Policies topics. There is overlap between them, and separating them into distinct topics for the purpose of addressing them in a comprehensive planning process may not be appropriate for all local contexts.

General Water Conservation Programs Subtopics

- Public education on water conservation
- Water budgets and information
- Fixture and appliance efficiency standards
- Information on water conservation to developers
- Lead by example in government buildings or demonstration projects
- Water conservation codes
  - Retrofit on resale requirements
  - Retrofit requirements for new building permits
  - Sub-metering ordinances
  - Smart meters
  - Water efficiency allocation policy
- Water conservation bank
- Incentive programs

Resources and Examples from Plans

The *Water Conservation Leadership Guide: Issues for Local Governments to Consider* (2010) was produced by the Institute for Local Government, a unit of the California Climate Action Network, to assist local governments in knowing the options available to them to help promote water efficiency in their communities, regardless of whether they own or operate a water utility.

The State of Colorado requires certain water providers to have a state-approved water efficiency plan containing certain required minimum plan elements. (The requirements are summarized in the State of Colorado Statutes section above.) *The Municipal Water Efficiency Plan Guidance Document* (2012) also describes what this plan must include and presents water conservation best practices.

Also in Colorado, the Alliance for Water Efficiency published a case study of Westminster, Colorado (2013), where water conservation and efficiency programs have been used to reduce, defer, and eliminate the cost of infrastructure.

The Alliance for Water Efficiency also published The *Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies* (2017), evaluating water conservation laws and policies in all 50 states.

Town of Gilbert, AZ, has in place the following programs from the Arizona Department of Water Resources' list of "reasonable conservation measures": "...Water Audit and Fixture Retrofit Program for the Existing Residential Customers; Exterior Audit Program for Existing Residential Customers; Ordinance for Model Homes in New Residential Developments; Combined Non-Residential Interior and Exterior Audit Program for Existing Non-Residential Customers; Distribution of Conservation Information to all New Non-Residential Customers and Submittal of a Water Use Plan by New Large Facilities; Public Information and Education" (2012, chap. 7: 10).

City of San José, CA, has a goal to reduce residential per capita water consumption by 25 percent by 2040. To get there, the city's comprehensive plan includes goals for education programs, improved efficiency, and water reuse (2018, chap. 7: 13).

Stanislaus County, CA, describes a strategy for both urban water conservation and agricultural water conservation in its comprehensive plan (2015, chap. VII Agriculture: 31).

City of Aurora, CO, is a big proponent of water conservation, with a history of ambitious and successful water saving goals. The city has enacted strategies "such as limiting outdoor watering to three days a week, waterwise landscaping rebates, and other programs. Conservation, water efficiency, and demand management practices are incorporated into Aurora's land use planning and development standards. These programs have saved 528 million gallons of water between 2014 and 2016" (2018, 13).

City of Roswell, NM, lays out in its comprehensive plan the need for a Water Conservation Plan that includes drought response in addition to voluntary water conservation and incentives (2015, 113–114).

Washoe County, NV, emphasizes the importance of water meters for achieving water conservation in several policies: "Require the uniform mandatory installation and use of water meters in Washoe County. Water meters are essential to provide for water conservation, equity in billing for water use and effective management of water resources. [Related policies:] 1. Water meters will be required on all new residential, commercial and industrial construction, to the extent allowed by law. 2. The Washoe County Utility Services Division will recommend that the Washoe County Board of County Commissioners amend the water conservation ordinances to allow the use of water meters to monitor and enforce water conservation. 3. Where legally allowed, individual non-metered water users will be encouraged to request the installation of water meters on a voluntary basis. Economic incentives can be used to provide the needed encouragement" (2010, chap. Public Services and Facilities Element: 13–14).

WATER AND WASTEWATER INFRASTRUCTURE

Comprehensive plans should describe the water system and how it functions. This can be a broad overview or it can provide a high level of detail, such as delving into how many treatment plants and miles of pipe a community has and outlining the capacity of water and wastewater treatment plants. Maximum capacity amounts can be compared to water supply and demand to determine whether any upgrades or expansions are needed to the system. Minimum capacity loads can have implications for water quality and should be compared to any water conservation targets a community has to ensure that water savings do not cause sewer flows to drop below minimum flow requirements.

Additional water or wastewater infrastructure needs, such as treatment plant upgrades or expansions, also have the land use implications of siting, treated water use and waste disposal, and connecting to development, making such concerns apt for a comprehensive plan. Communities should also consider any state or local requirement for water loss or leak limits. In any case, it should consider whether improving water loss or leak programs improve water efficiency and garner water and cost savings.

For communities that are served by non-municipal providers, it would be useful to the public for the plan to describe information or policies related to septic

systems or the entities responsible for water and wastewater treatment. Further information about the operations of water and sewer entities within the community should be included to the extent possible and practical to provide a holistic overview of the whole water system.

Water and Wastewater Infrastructure Subtopics

- Existing sources, treatment, distribution, service
  - Infrastructure repair and replacement schedules
  - System depreciation/renewal
- Wastewater treatment and disposal
  - Existing and planned water and wastewater infrastructure
  - Water reuse, existing and potential
- Water storage and delivery projects
- Water meters
  - Automatic meter infrastructure (AMI)
  - Well metering
- System water efficiency
  - Leak detection/repair
  - Water loss programs or limits

Resources and Examples from Plans

City of Avondale, AZ, uses a constructed wetland, Crystal Gardens, to nominally treat surface water prior to using it for artificial recharge (2012, 84).

City of Sacramento, CA, relies on a Water Distribution System Master Plan to guide its water infrastructure needs and cross-references the plan in its comprehensive plan. The comprehensive plan calls for an update to the Water Distribution System Master Plan every five years, with the next update to explore additional opportunities for water reuse and automated meter infrastructure (2015, 4-42). This is a good model of integrating existing water plans into the comprehensive plan–keeping the information high-level and creating a policy connected to the master water plan without reiterating the same information covered by that plan.

Merced County, CA, describes the special districts that provide sanitary sewer infrastructure in its unincorporated communities and identifies the wastewater challenges in the county: "The primary issue is that many communities have wastewater facilities that are near capacity and cannot provide additional sewage treatment services without being expanded/upgraded. Additionally, the improper location and/or operation of septic tanks and other individual wastewater systems in the County can affect the quality of groundwater and impair the use of water for domestic, recreation, and wildlife habitat purposes. The policies in this section support adequate wastewater capacity for development in unincorporated urban areas, promote the phasing of wastewater facilities in areas designated for growth, and encourage public education and monitoring for areas using septic systems" (2013, PFS-4).

City of Las Cruces, NM, is working toward eliminating septic systems and getting residents on city wastewater collection systems. It uses its comprehensive plan to present policies to meet this goal (2013, 116).

WATER QUALITY

Water providers must be in compliance with federal and state water quality requirements. The plans should state how the water provider meets or exceeds these requirements and any water quality challenges it may still face. This topic ties closely with water and wastewater infrastructure and stormwater management, as water quality is often a chief concern of both. Development standards, such as setback requirements, may impact water quality by regulating how close development is sited to rivers, streams, or recharge areas. Poor water quality, or inadequate water treatment, may also put water supplies in jeopardy, creating another supply constraint that's not about the quantity of available water.

Communities may also be concerned about threats to the quality of their watershed at large from outside their jurisdiction. Regional watershed groups or councils of governments may be the most appropriate avenues for collaborating with other users in the watershed to ensure both downstream and upstream water quality protection.

Water Quality Subtopics

- Federal and state water quality requirements and regulations
- Water quality related to specific pollutants or industries
- Existing and potential water pollution sources
  - Threats to water quality
  - External threats to the watershed
- Water quality by sector
  - Municipal, industrial, agricultural, etc.

Resources and Examples from Plans

The Northwest Colorado Council of Governments, Water Quality and Quantity Committee, created *Model Water Quality Protection Standards* (2018) to provide member communities and others with model standards and ordinance language to guide site design, construction, and post-construction activities. It includes standards for stormwater runoff and detention, slopes, landscaped buffers, sediment and erosion control during construction, and re-vegetation after construction. It also contains a list of related plans, content, and data that each local government should undertake to comprehensively address water quality problems.

City of Chandler, AZ, has a brief explanation of its water quality efforts: "Chandler is responsible for providing water to all customers that meets all applicable local, county, state, and federal water quality standards. The City of Chandler municipal utilities department consistently performs more water tests than [are] required by law and issues an annual report detailing the quality of drinking water to comply with state and EPA regulations" (2016, 77).

Maricopa County, AZ, reviews plans, performs inspections, and issues permits for water services in order to protect water quality. The county has a drinking water program and a water and wastewater treatment program to help oversee water facilities and promote improved water quality (2016, 98).

City of Point Arena, CA, is concerned with coastal water quality and imposes additional requirements on certain types of development to protect coastal water quality. These requirements include a Water Quality Management Plan and additional treatment control if necessary (2006, 97).

City of Glenwood Springs, CO, has a description of water quality activities in its comprehensive plan that may serve as a helpful model: "The City of Glenwood Springs routinely monitors its water for contaminants according to federal and state requirements and annually reports the results to the Colorado Department of Public Health and Environment, and to the general public. In its 2010 Drinking Water Consumer Confidence Report for Calendar Year 2009, the City reported that potential sources of contamination in the City's source water can typically come from EPA Superfund sites, abandoned hazardous waste generators, leaking storage tank sites, existing/abandoned mine sites, agriculture (row crops, pasture/hay fields), forests, septic systems, oil/gas wells, and roads" (2011, 148).

City of Las Vegas, NV, specifically discusses the impact of land use decisions on watershed management in the Las Vegas Wash. The comprehensive plan describes its three-tier system for protecting groundwater quality in the wash (2000, chap. Conservation Element: 64).

Kane County, UT, has implemented a land use ordinance for drinking water source protection zones intended to improve watershed conditions and protect water quality. Several large protection zones were in place before the ordinance was adopted, including Kanab City, Johnson Canyon, Swains Creek and Best Friends protection zones (2018, 22).

Future Projections

Aerial view of canal passing through a residential district in suburban Phoenix, Arizona. Photo: A. Wager, Getty Images (2018).

Integrating water into land use planning is done with the goal of better management of water supply and demand. Understanding a community's future water budget and supply portfolio enables a local government to anticipate changes in the uses and conditions of watersheds and plan to reduce water use or increase supplies accordingly. Comprehending a community's water trends can help planners and decision-makers decide which land use techniques will best prepare the community for the future. The following topics describe a community's potential range of pressures, scenarios, and water trends.

Future Projections Topics

PROJECTED POPULATION AND ECONOMIC CHANGE

Projecting population and economic change is a primary focus of any comprehensive plan. Forecasts of population growth and changes in the local economy, demographics, and housing all have implications for land use and water demand. These projections can be presented in the introduction or background sections of a comprehensive plan. The water element or section should discuss the implications of these anticipated changes–be it population growth, decline, stagnation, or changing patterns–on water demand, such as whether existing supply covers projected population numbers or whether economic changes such as shifting employment sectors may require more or less water than historical trends. Population growth projections should be aligned with those used by the water providers in a community. Land use planners and water providers should use the same growth rate and formula for population change when possible. However, water provider service areas and a local government's boundaries may differ and cover different populations, potentially requiring different population projections and assumptions. In some areas, regional planning entities like Metropolitan Planning Organizations (MPOs) or councils of governments (COGs) provide population projections at a granular level.

Projected Population and Economic Change Subtopics

- Population projections
- Multiple scenarios for population growth
- Multiple growth rates
- Employment growth/change
  - By industry, such as business, energy, agriculture, mining
  - Commercial change
  - Workforce demographic change such as increasing service jobs
- New resident growth
- Peak/visitor population

Resources and Examples from Plans

Every Colorado River Basin state has some sort of population or demography office that hosts current or projected populations at the state and local level. These databases can be accessed for baseline population estimates or to cross-reference with internal population projections.

- Arizona's Office of Economic Opportunity: Population Estimates and Projections (2020).
- California Department of Finance: Forecasting Demographics (2019).
- Colorado Department of Local Affairs: State Demography Office (2019).
- Nevada Department of Taxation: Population Statics and Reports (2019).
- New Mexico
  - New Mexico's Indicator-Based Information System: Estimated Population Counts (2018).
  - The University of New Mexico: Geospatial and Population Studies Population Projections (2017).
- The University of Utah Kern C. Gardner Policy Institute: Population Projections (2015).
- Wyoming Department of Administration and Information: Population Estimates and Forecasts (2019).

City of Thornton, CO, estimates its population growth according to low, medium, and high projections and discusses potential land use decisions that could affect whether any of these scenarios come to pass. In particular, these projections consider whether a new transit line and the corresponding density of housing development along the line will affect whether Thornton sees low, medium, or high population growth (2012, chap. 2: 2.14).

City of Provo, UT, has an in-depth description of each method it used to forecast its population growth. These include four methods: simple arithmetic, historical population growth rates, potential population growth based on building permits available, and the housing growth designated in the comprehensive plan (2004, chap. 3: 7–9).

City of Cheyenne, WY, describes its potential population growth according to different growth rates, predicts employment growth in the county, and connects potential job growth to land use designations to estimate how many jobs its retail, office, and industrial land uses could support (2014, 185).

PROJECTED DEVELOPMENT AND LAND USE CHANGE

Projected development and land use change are the crux of a comprehensive plan and thus will be addressed in multiple plan element sections, maps, and figures. They encompass a community's predicted changes over the course of some planning timeframe, which may be the build-out year, the planning horizon for the current comprehensive plan, or some other target date. The community's development vision can furnish insight into its expected future water use and demand, as well as indicate which sectors may become the biggest water users. For rural and agricultural communities, this section could also include any policies related to the preservation of small-town character or agricultural land preservation, or anticipated changes in agricultural land use such as conversion of irrigated or non-irrigated lands.

To further connect land use changes to water, a community can consider the relative water use of its growing or changing land use types. The comprehensive plan is a crucial point for connecting water to land use in large part because of the opportunity to tie water use to existing and future land use maps, zoning designations, or other land uses that are presented in the comprehensive plan. Water demand in a densifying downtown core will be much different than water demand in a master planned single-family subdivision in a newly annexed part of town. The ease with which a community can tie water use to its land use types will depend on available data and staff's capacity to use the data. Water-efficient growth decisions depend in part on staff's access to accurate and complete data on the water use of different zones or parcels in a community. For example, a community could choose to densify residential zones or make a zone commercial rather than industrial to encourage land uses with lower water demand.

General understanding of water use. A community with little historical data about parcel water use may only be able to use general assumptions to understand the water demands of the land use categories specified on its land use map. These assumptions may include that denser and multifamily developments use less water per capita; limiting lot sizes or restricting irrigated area reduces water use; commercial uses will vary by type of establishment, such as retail versus restaurant; and industrial or technology uses may be intensive but are often limited in number. A community should work with its water providers or look for peer examples to create an accurate set of assumptions about water use, even if it can't base these assumptions on actual data from within its boundaries. Organizations within the water industry may also have estimates of water demand by building type that can serve as a starting point for communities.

Ranges of water use by zoning type. A community with broad land use types can use historical data to understand the upper and lower ends of water use in its zoning designations. For instance, retail and hotel parcels will have very different water demands and could represent the potential range of water use under an umbrella of commercially zoned properties.

Water use by parcel. Communities with historical (five-year average or more) data on water use at the parcel scale can begin to understand the water demands of their different users, for example understanding that the average restaurant in the community uses X acre-feet of water per year and the average single-family house uses X acre-feet per year. Examining parcel-level data may reveal that refined land use categories are needed to better account for these nuances in water use. Building an inventory of land use types and typical water use can pave the way for a community to refine its land use map based on available water supply and make smarter growth decisions that account for any water resource constraints.

Projected Development and Land Use Change Subtopics

- Year of build-out or planning horizon
- Planned areas of annexation
- Growth by land use type, sector, or zone
- Scenarios for land use change
- Impacts of future development on water bodies
- The effect of development patterns on water
- Designate priority areas for growth and areas for conservation (Nolon Blanchard 2018)
- Future of agricultural land
- Housing unit growth
  - By type/density
  - Occupancy
- Employment space growth
  - For business category (industrial, commercial, retail, etc.)
  - Employment density

Resources and Examples from Plans

City of Chowchilla, CA, calculates the amount of land it will need for its anticipated population growth. Its comprehensive plan includes urban and agricultural land designations for anticipated population growth (2010, chap. Land Use Element: LU-5–LU-10).

City of Woodland Park, CO, tries to balance its future land use with a limited water supply–development decisions that involve tradeoffs to stay within water supply limits. In its 2010 plan, the City of Woodland Park noted that, "since 1996, the City has tried to balance annexed land area, densities, population and water supply so that annexations and land use approvals do not eventually exceed the City's ability to serve them with water. This has worked well until the last two years when several land use proposals have been presented to the City. These proposals have been for housing projects believed to be needed by the community and include workforce housing and housing for the elderly. Also, some were located in the downtown area where increased housing is believed to be appropriate to support increased vitality and expansion of the downtown business community. These projects would

require land use changes approved by City Council. The downside is that they would increase the City's projected build-out population above the projected water service population at full development of the currently planned water supply. The City's challenge is to support desired housing and business projects without creating a planned population greater than the planned water service population and incurring unaffordable costs for additional water development" (2010, 62).

Natrona County, WY, is conscious of the housing demand it will take to accommodate its projected population for 2040. This need for housing translates into its future land use map and amount of land designated for residential development. The county follows a similar logic pattern for its retail, commercial, and industrial sectors: anticipating potential growth in these sectors and translating that into acres of land needed to accommodate this growth (2016, 5-4–5-6).

WATER-RELATED HAZARD MITIGATION

The reality of climate change means that communities will face increasingly uncertain futures, particularly as it relates to extreme weather, precipitation, and natural disasters. Hazard mitigation as a general category is often covered in comprehensive plans as part of a safety element. Counties and municipalities also often have separate hazard mitigation plans that cover the range of threats they may face into the future. These may be referenced as a part of the comprehensive plan. The purpose of including water-related hazard mitigation–that is, any water-resource-related threat in a community–in a comprehensive plan water element is to consider how any future scenarios may impact overall water supply, demand, quality, and stormwater management. The Colorado River Basin is anticipated to become hotter and drier, with various regions experiencing overall lower precipitation, more intense precipitation events when they do occur, shifting snowpack runoff, and a whole suite of other impacts. Communities should endeavor to understand the local implications of climate trends and other water-related hazards to determine which water policy or land use mechanisms would be useful to mitigate these threats.

Water-Related Hazard Mitigation Subtopics

- Evaluate community's risk to water-related hazards
  - Identify water infrastructure risk to hazards
  - Identify water storage/water treatment options for emergencies
  - Identify historical and projected climate variability (e.g., temperature and rainfall patterns)
  - Identify or discuss compounding risks of water-related hazards
  - Identify water quality risks
- Evaluate climate change impacts on water resources or the occurrence of hazards
  - Reduced stream flow
  - Increased flash-flooding risk
  - Rising temperatures leading to water quality degradation, algal blooms, increased outdoor water demands, and pipe expansion
  - Sea-level rise causing coastal erosion, storm surges, or saltwater intrusion
- Participate in Federal Emergency Management Agency (FEMA) programs
- Prepare for drought or other water shortage scenarios (U.S. Environmental Protection Agency (EPA) 2016)
  - Haul in water with tanker trucks permitted to carry potable water
  - Consider interconnections with other water sources and systems
  - Secure a diverse water portfolio
  - Place restrictions designed to reduce or eliminate non-essential uses
  - Institute emergency pricing or surcharges
  - Establish a conservation or drought response fund
  - Establish a measure for number of days of water available during emergencies
- Plan for wildfire risks (U.S. EPA 2016)
  - Create a forest health program to prevent post-fire flooding and protect water storage/quality
  - Remove debris, trees, or other fire-hazard materials
  - Modify treatment process for sediment in water

Resources and Examples from Plans

Climate change. Communities can begin to understand climate impacts in the Southwest–Arizona, California, Colorado, Nevada, New Mexico, and Utah–through the *National Climate Assessment* (2018). Local governments may want to work with other entities, such as consultants or universities, to better understand the specific impacts within their jurisdiction.

Hazard mitigation. Comprehensive guides for hazard mitigation planning can be found at the EPA's *Hazard Mitigation for Natural Disasters: A Starter Guide for Water Wastewater Utilities* (2016) and Colorado's Department of Local Affairs' *Planning for Hazards: Land Use Solutions for Colorado* (2019). Both guides detail information on planning for floods, earthquakes, drought, and wildfire, among other hazards.

Drought planning. Arizona, California, and Nevada require water providers to create drought preparedness plans. The robustness of these plans varies by state requirement. Planners may want to connect with their water suppliers to understand local drought plans and coordinate on drought response. The National Drought Mitigation Center at the University of Nebraska hosts several resources on planning for drought, applicable to entities ranging from individuals to regional planning bodies. The Arizona Department of Water Resources hosts a Drought Resources (2020) web page that includes national and state resources. The Colorado Water Conservation Board offers an online Drought Planning Toolbox (2020) that contains information, data, financial assistance, and planning tools to address drought. The State of Utah hosts a *Drought Management Toolkit for Public Water Suppliers* (2008) with a model drought mitigation plan and a model drought response plan, applicable to non-municipal water suppliers and local governments. This toolkit also recommends including drought management measures in a water management plan–similarly, the measures described therein could be included in a comprehensive plan. Finally, the Alliance for Water Efficiency released *Use and Effectiveness of Municipal Irrigation Restrictions During Drought* (2020), which evaluates the effectiveness of drought restrictions both during and after drought events.

City of Flagstaff, AZ, describes anticipated local climate change impacts, including "decreasing water supplies; reduction in annual snowpack and decrease in snowmelt; depleted soil moisture; increasing temperature, drought, wildfire, tree mortality, and invasive species; increased frequency and altered timing of flooding; impacts on the region's unique tourism and recreation opportunities; increasing risks to cities and agriculture from a changing climate; increased vulnerabilities of the lower income, poor, and elderly..." and identifies ways to prepare for these impacts, such as water conservation and forest health initiatives (2014, IV-11).

City of Chowchilla, CA, details its drought mitigation triggers in its comprehensive plan: "Maintain water use limitations that could be enacted by the City Council in the event of severe drought. Measures could include, but are not limited to, the following: 1. Limit all domestic outdoor water usage to designated days 2. Limitations on all auto washing by individuals, auto dealerships, and private and charitable car washes 3. Prohibit domestic irrigation between 10:00 am and 7:00 pm 4. Designate specific types of landscape irrigation to be discontinued" (2010, chap. Open Space and Conservation Element: OC-43–OC-44).

Arapahoe County, CO, has restrictions on development in floodplains, which is common in most jurisdictions. In Arapahoe County, these restrictions are to keep floodplain land undeveloped save for passive recreational uses. The county is also considering adding setback requirements for floodplains and waterbodies (2018, 44).

Town of Rico, CO, requires new development served by the town's water system to provide water storage and adequate pressure for fire protection (2004, 17).

FORECASTING WATER SUPPLY AND DEMAND

Many of the topics described thus far help to set the stage for a community to be able to forecast its water supply and demand over time. Existing supplies, infrastructure, quality, and water-related hazards create a picture of existing supplies, availability, and capacity

and potential threats to supply. Water demand, projected population change, and land use change can help a community determine how its water use might change over time. Deciding which particular methods a community uses to forecast supply and demand is up to the local government, as is its forecast timeline. Water forecasts are often included in water plans, and the assumptions, data, and processes behind the forecasts are perhaps more appropriately left to such a plan. However, the benefit of also including such forecasts in a comprehensive plan (perhaps in an abbreviated form with references to the full water plan that describes the methodology) is to inform land use and development decisions and provide the justification for changes in water policy and management. This is particularly the case if a community's water forecast demonstrates a supply and demand gap at build-out; if a community has enough water for the development described in its comprehensive plan but would like to create some wiggle room through water conservation; or if a community is dependent on a single supply source, such as groundwater, and wants to diversify its supply. A community's water forecast can be the lynchpin of any land use or policy changes made in the name of water.

No local government should create water supply and demand forecasts without input and verification from its water providers. Communities with non-municipal water providers may work with their water providers to understand and aggregate supply and demand forecasts within their jurisdictions. This can open the door for discussions about the supply and demand constraints or opportunities of water providers in the community. For instance, providers throughout the Colorado River Basin may face increasingly high costs for acquiring additional water rights to serve new development. The local government can help alleviate this by adopting water conservation landscape codes or by requiring developers to acquire water as part of the development approval process. A local government may also be concerned with protecting agricultural land from being bought out for water rights. Land use actions may be required to prevent such "buy and dry" from occurring, such as growth or density boundaries that make agricultural land unattractive to developers or unsuitable for new water purveyance infrastructure.

Forecasting Water Supply and Demand Subtopics

- Statement of water supply and demand into the future
  - Sufficient to support growth and land uses
  - Sufficient under normal conditions
  - Sufficient under shortage conditions
  - Need for additional water supplies
- Supply and demand calculations into the future
  - Trends by sector
- Future threats to supply
  - Climate change
  - Water supply variability
  - Overuse or over-pumping
  - Water quality threats
- Relate supply and demand to population growth
- Relate supply and demand to land use change
- Strategies to address supply and demand gap
- Water demand scenarios for future population or land use

Resources and Examples from Plans

Alpine County, CA, describes the ability of water systems in the county to meet current and projected water demand for its service areas (2017, 76).

City of Turlock, CA, describes the limits of its groundwater supply to meet future demand, by detailing past well production compared to use and recognizing that groundwater levels are declining and will continue to decline in drought years. The comprehensive plan lays out a sustainable target for groundwater withdrawals and compares this number to projected demand and population growth over time, finding a gap between sustainable groundwater withdrawal and its projected water demand (2012, 3-43–3-45).

City of Westminster, CO, does an annual analysis of water supply and demand to keep accurate accounting of its water budget and provides this report to the city council each year (2013, 8-20).

City of Woodland Park, CO, recognizes the connection between its ability to grow and its water availability and does not necessarily plan to acquire new water supplies. Rather, the city describes its water supply in terms of additional dwelling units that could be built: "The City's Utilities Director believes that the City's water supply might be stretched to support a limited number of additional housing units. The Utilities Director suggested that 400 additional dwelling units could be supported because this amount would represent only a marginally increased risk of a future water problem.... UAC [Utilities Advisory Committee] recommended that City Council cautiously utilize these 400 additional taps or dwelling units to support the City's highest priority housing needs. Furthermore, the UAC recommends that the City develop and City Council approve criteria that help ensure these taps are appropriately distributed. These criteria should help identify which projects are the best uses of this finite water service capacity. City Council should recognize that each approval of a project or land use change that uses some of these taps increases the risk of having to fund expensive future water development to close a potential gap between water needs and water supply" (2010, 13).

City of Santa Fe, NM, analyzes the connection between population growth, dwelling units, water demand, and water supply in an annual Growth Management Report to gauge projected needs of population growth, such as whether its current water supplies are adequate to meet the population's needs (1999, chap. 4: 4-28).

City of Elko, NV, discusses its total groundwater rights in relation to water use. Because the city uses less than its full water right, it proposes that additional water connections will use up the remaining water and that existing vacant ground and boundaries represent the land area for these potential connections, meaning that the city has enough water to develop its existing land area but that additional proposed annexations may be less certain (2011, chap. Land Use: 11).

WATER SUPPLY DIVERSIFICATION

Communities with a gap in their water forecast, ones that are seeking a more redundant water portfolio, or ones that are concerned with protecting renewable water sources may be particularly concerned with diversifying their supplies with additional sources, including treated wastewater reuse or groundwater recharge. Diversifying supplies could include acquiring additional water rights, permitting additional wells, fallowing agricultural land, or implementing stormwater or rainwater capture and reuse, aquifer storage and recovery, water sharing, or water reuse.

Considerations for future water supplies should be as realistic as possible. For example, if climate and hydrology models predict a shortage with respect to a water source that is already fully allocated to various users, acquiring additional rights to that source is not a likely solution. Plans to acquire additional supplies for diversification should not be taken lightly and should fully consider costs and benefits when compared to water conservation and demand management.

Water conservation and maximizing reuse may be more feasible and cost-effective than procuring new, additional supplies. Creating robust conservation targets, improving effluent treatment for potable use, improving leak detection, and undertaking other methods to reduce demand and inefficiency can also be considered diversification strategies, in that they can help "stretch" existing water supplies.

The variety of diversification options make this subject ripe for comprehensive plans, as there may be land use, capital improvement, and infrastructure needs associated with any additional water supply. Communities with non-municipal providers may consider how land use or policy changes can support providers in their jurisdiction to act on water supply diversification opportunities.

Water Supply Diversification Subtopics

- Water reuse for water system
  - Potable, non-potable, domestic, irrigation, direct, indirect, gray water systems, etc.
- Groundwater recharge projects
  - Groundwater banking
  - Aquifer storage and recovery projects
- Groundwater drawdown limits
- Large-scale rain and stormwater capture

- Goals for renewable water sources (e.g., surface water rather than groundwater)
- Programs and policies to ensure future supply
  - Future supply for agriculture
- Augmentation from non-traditional sources to traditional sources
  - Using effluent or gray water to recharge groundwater or boost surface water flows
  - Watershed modification and stewardship
- Water transfer programs and agreements
- Water leasing
- Water sharing
- Agricultural water
  - Alternative transfer methods
  - "Buy and Dry" transfers – for or against

Resources and Examples from Plans

Town of Gilbert, AZ, has extensive water reuse facilities, in part because water reuse and treated recharge credits are used to offset the town's groundwater pumping and add storage credits to its water portfolio (2012, chap. 7: 6–7).

City of Fresno, CA, uses recycled water for a variety of purposes, including non-food agricultural irrigation, aquifer recharge, and a surface water exchange program with a local irrigation district (2014, 7-29).

Santa Fe County, NM, follows a Conjunctive Management Plan with the following goals: "1. Establishing surface water as the primary source and groundwater for supply redundancy in the Santa Fe Basin; 2. Limiting aquifer depletion by reducing groundwater reuse; 3. Promoting aquifer recharge; 4. Water conservation and reuse; and 5. Creating regulatory framework for implementation of Conjunctive Management Plan" (2015, 194).

City of Las Vegas, NV, engages in substantial groundwater recharge, water banking, and water reuse programs both within city boundaries and in collaboration with other Southern Nevada agencies (2000, chap. Conservation Element: 58).

WATER EQUITY

Equity is a subject of increasing importance for land use planners and within comprehensive plans. Water equity means ensuring that all segments of the community have equal access to water that is affordable, reliable, available, in sufficient quantities, and high quality. Water equity, like water-related hazard mitigation, will be increasingly important under climate change. Communities with limited water supplies will need to ensure that everyone has enough water, even under shortage conditions.

Equity is especially concerned with vulnerable or at-risk populations. Goals to serve high-quality water to all residents may not address potential inequities that already exist, nor may such goals account for differences among residents that may affect their ability to obtain high-quality water. A community will need to identify groups that may face barriers to water access, even in normal conditions, to work toward more equitable water programs. Communities should describe vulnerable or at-risk populations in their own terms and tie that description to a community equity assessment, if one exists. Guidelines for defining these populations may include (adapted from Local Government Commission 2018 and Godschalk and Rouse 2015):

- Populations that have experienced exclusion, marginalization, disenfranchisement, or underrepresentation; and
- Populations adversely affected by economic, environmental, or health challenges, or vulnerable to health and safety factors. Examples include:
  - Age–elderly and children;
  - Low-income, socioeconomic status;
  - Communities of color, race, ethnicity;
  - Geography/location–populations in rural, unincorporated, and tribal lands and/or populations with transportation barriers or limited access to resources;
  - Gender;
  - Behavior;
  - Disability;
  - Institutionalized populations;
  - Populations with language barriers;
  - Minority groups; and
  - Populations with a lack of leadership, organization, and/or planning.

Water Equity Subtopics

- Residential access to high-quality water
- Water pricing and affordability
  - Utility's cost of providing water service
  - Community's ability to pay for increases in water service
    - Limits to increases in water cost
  - Affordability of water for individual households
    - Subsidies for low-income residents
    - Blocks on water account shutoffs
- Water quality impacts for at-risk populations
- Prioritize upgrades to water infrastructure and facilities in older and substandard areas
- Protect vulnerable populations from water-related hazards
- Land use or development improvement of at-risk or disadvantaged neighborhoods that may impact water provision, affordability, or quality

Resources and Examples from Plans

San Diego County, CA, reflects requirements of California housing law with goals to work with water and sewer purveyors to ensure that affordable housing projects are a priority, and with plans to share its comprehensive plan with the water and sewer purveyors that may provide service to the areas the county designates for affordable housing (2011, chap. Implementation Plan: 14).

City of Tulare, CA, describes the water providers that serve its nearby disadvantaged communities, including the water challenges these providers or their communities may face (2014, 2-7–2-12).

WATER-EFFICIENT LAND USE

Man watering lavender in a courtyard in Santa Fe, New Mexico. Photo: J. Huizenga, Getty Images (2019).

Development review and approval procedures, zoning codes, building codes, plumbing codes, landscape ordinances, and land use mechanisms can all be used to support goals related to water resources. Writing water goals into the comprehensive plan will create a legal and policy foundation for maintaining and updating these processes and standards. These land use tools are broadly described below; however, the diversity of community contexts in the Colorado River Basin means that each local government has a unique planning and development environment that requires land use tools tailored to its local setting.

Communities that are not water providers can undertake many of the actions described by these topics despite a lack of direct authority over water provision. Land use actions, as described in the following sections, can impact water quality, quantity, and demand, regardless of whether the local government is a water provider. Local governments should collaborate with their water providers to best understand how their land use actions can support the goals of their water providers as well as how the actions of water providers can support local government land use policies.

Water-Efficient Land Use Topics

COLLABORATION FOR LAND AND WATER

There is no shortage of opportunities for collaboration on water topics. Any action to integrate land and water management will likely require some degree of collaboration, whether it be between local government departments, between a local government and its water providers, or between local governments and water providers in a larger region. Collaboration should go beyond mandatory coordination with regulatory or oversight agencies. Within a local government, collaboration may mean joint development reviews, joint planning, data sharing, and regular meetings between the planning department and municipal water utility. These kinds of activities can be taken to agencies outside of the local government, too. Local governments with non-municipal water providers will need to work with these external water agencies to get started with collaboration.

Collaboration can also be scaled up to a region, bringing in neighboring local governments and water providers. Regional coordination can include creating regional standards of codes and ordinances for water efficiency that set consistent expectations for development in a wider area. These can include uniform conservation ordinances, landscape codes, irrigation regulations, contractor certifications, green building and plumbing codes, and coordinating water efficiency education and outreach materials. Regional consistency can make developers and the public aware of what to expect when it comes to land use and water policies in a region and can prevent local governments with weaker provisions from being taken advantage of. For example, water-scarce metropolitan regions may have some local governments with strict, drought-tolerant landscape codes and others with more lenient landscape codes. Adopting a uniform landscape code in such a region could ensure that developers build water-smart landscapes throughout the region and that communities don't drive away development based on their ability or inability to adopt drought-tolerant landscape codes.

Collaboration For Land And Water Subtopics

- Interagency–Between water provider and planning department
  - Coordinated water and land use agency outreach and education programs
    - For general public, developers, HOAs, or all of the above
  - Aligned data, particularly assumptions about growth and population
  - Joint continuous research and monitoring of water-related goals
  - Water provider is part of the development review process
  - Collaboration on development code
  - Aligning codes and processes to meet water-related goals
  - Water provider participates in comprehensive plan process
  - Regular meetings between planning department and water provider
- Regional–Between local governments and non-municipal water providers
  - Coordinate education and outreach in a regional campaign
  - Region or watershed adopts similar water policy and procedures
    - Water conservation and efficiency requirements
    - Uniform landscape codes or recommended contractors

- Water goals relate to overall watershed health
- Intergovernmental agreements (IGAs) with other jurisdictions related to water

Resources and Examples from Plans

City of Avondale, AZ, participates in regional flood control programs, maximizes regional effluent use in cooperation with the local association of governments, and participates in other regional projects to protect and conserve local rivers (2012, 130, 155).

City of Tucson, AZ, collaborated with Pima County on a Water and Wastewater Infrastructure, Supply, and Planning Study (2013) to enable regional cooperation on water issues including balancing water supply and demand, linking urban form to water use, and acknowledging environmental water needs. The study corresponds with a joint city/county sustainability action plan (2013, 3.88–3.90).

Merced County, CA, recognizes that although it does not own or control water rights, its land use decisions affect water demand. The county works with irrigation districts and water agencies to manage water, and it commissions and supports countywide water supply studies to understand the nature of water resources in the county, to the benefit of all communities and water agencies (2013, W-7).

San Diego County, CA, has goals to reduce water demand and recognizes the need to work collaboratively with water agencies to achieve those goals: "Coordinate efforts with the San Diego County Water Authority and other water agencies to better link land use planning with water supply planning with specific regard to potential impacts from climate change and continued implementation and enhancement of water conservation programs to reduce demand. Also support water offset programs and other conservation measures to encourage efficient water use" (2011, chap. Implementation Plan: 39).

City of San José, CA, endeavors to work with local, regional, and statewide agencies to expand water efficiency efforts. In particular, the city works with local water providers on outreach, education, and expansion of recycled water programs (2018, chap. 3: 21).

City of Santa Fe, NM, has a joint powers agreement with Santa Fe County to collect development fees and maintain water and wastewater infrastructure (1999, 7-41).

"SHOW ME THE WATER" REQUIREMENTS

"Show me the water" requirements, also called "adequate" or "assured water supply," are laws or policies that require developers or water providers to demonstrate a sufficient source of water as part of the development approval process. Arizona, California, Colorado, New Mexico, Nevada, and Wyoming have laws requiring that an assured water supply be demonstrated before local governments can approve a new subdivision. Each state has varying requirements, including the minimum project size, years of water supply, and standards of review. In states without requirements, local governments may choose to implement assured water supply policies, as has been done in some Utah communities. Local governments should become familiar with their state's show me the water rules and how they apply to their jurisdiction. Local governments may have the opportunity to tailor show me the water rules to their local context, setting smaller minimum size requirements, multiple verification stages, or more stringent review standards. Municipalities outside of regulated active management areas in Arizona, for example, can elect to be "mandatory adequacy jurisdictions" and have the same standards that are applied to active management areas. Colorado counties vary in the standards they set for supply adequacy, with some localities requiring that development applicants prove up to a 300-year water supply.

Show me the water requirements are different from other requirements for water in the development review process. They are often intended in part as a consumer protection mechanism, to help ensure that prospective residents do not unknowingly buy a home that may run out of water. The consumer protection role these rules play warrants special mention in a comprehensive plan,

for the edification of both the public and developers. Show me the water rules may also differ from other development requirements because of the approval process needed to "prove" water supplies, as this designation must come from the state in many cases. This level of oversight and verification may be absent from other development requirements that similarly strive to ensure long-term access to water service.

"Show Me The Water" Requirements Subtopics

- Assured/adequate water supply
- Demonstrate adequate water supply before approving new development
  - Demonstrate in preliminary plat applications
  - Demonstrate for final plat approval
  - Demonstrate for site plan approval
  - Demonstrate for zoning or rezoning approval
- Water adequacy determination for new subdivisions
- Water adequacy determination for redevelopment or change of use
- Water adequacy allotment or water budget, agreed to during development review

Resources and Examples from Plans

More information about show me the water requirements in Western states, including the requirements mentioned above for Arizona, California, Colorado, New Mexico, Nevada, and Wyoming, can be found in *Assured Water Supply Laws in the Western States: The Current State of Play* (Green and Castle 2017).

Town of Florence, AZ, details its compliance with the state's show me the water requirement, including how its designation of an assured water supply will be impacted by rapid population growth, and the town's plan to update its assured water supply designation accordingly (2012, 12-2–12-3).

Arapahoe County, CO, amended its show me the water requirement to a 300-year supply: "The County will evaluate and consider adopting a requirement for new development to provide a 300-year water supply. This requirement should be included in the Land Development Code and apply to all development applications" (2018, 110).

San Joaquin County, CA, echoes the state's requirements in its comprehensive plan: "The County shall require new developments over 500 dwelling units in size to prepare a detailed water source sufficiency study and water supply analysis for use in preparing a Water Supply Assessment, consistent with any Integrated Regional Water Management Plan or similar water management plan. This shall include analyzing the effect of new development on the water supply of existing users" (2016, 3.2-35).

WATER IN DEVELOPMENT PROCESSES AND EVALUATION

Including water in the development review process can require several steps, from initial pre-application meetings with developers to final development approval. Involving water providers and considering the water supply, demand, and wastewater implications of new development or redevelopment in the earliest stages of the process allows for more thoughtful consideration about how the development could impact existing water resources and how it could be more water-efficient. Water providers may be able to make recommendations about tap size or site design that can both reduce water use and save the developer money. Water providers and wastewater utilities can also provide information on overall system requirements, such as whether the proposed density of a rezoning is compatible with the site's existing water and sewer infrastructure.

Often these processes may be more behind-the-scenes or procedural than what is typically included in a comprehensive plan. Thus, the comprehensive plan, both in the water element or section and in the plan implementation chapter, depending on the organization, should cover any new policies or procedures that may affect developers or the public, such as water-saving measures as a requirement in development approvals. A plan may refer to its development codes and standards, or forms for development approval, for specific information about how water plays into the process. This topic may also include requirements for developers to be responsible for infrastructure improvements or connections to the water and wastewater system, for the local government to consider existing water service prior to annexation, or for incentives to improve water efficiency in new development or redevelopment.

Water in Development Processes and Evaluation Subtopics

- Development review/pre-development
  - Development decisions consider water supply and demand
    - Incentives for low-water-consuming businesses, industry, and users
  - Infrastructure decisions account for water supply and demand
    - Water delivery infrastructure
    - Wastewater infrastructure
    - Developers pay for or provide water infrastructure improvements
  - Water infrastructure influences development decisions
    - Development is concentrated in areas with existing water service
    - Density is concentrated in areas with water system capacity
- Development regulations
  - Development code includes water efficiency
  - Annexation decisions include water supply and demand
  - Water conservation provisions are required for new development or redevelopment
- Development incentives
  - Financial, process, or marketing incentives for water efficiency
  - Net Blue or water demand offset policy (Christiansen 2015)
  - Sustainable development bonuses
- Post-occupancy enforcement
  - Fines for water customers
  - Water use limitations on new development

Resources and Examples from Plans

City of Cottonwood, AZ, includes "Meeting the highest standards for water conservation with drought tolerant landscaping, appropriate site design, conservation plumbing and effective water use methods" as part of its expectations for applicants who apply for a Planned Area Development Zoning permit (2014, 8-17).

Pima County, AZ, requires Water Supply Impact Reviews for proposed comprehensive plan amendments and rezoning applications. These reviews must contain: "a) Water service and renewable water supply options to site; b) Current and projected depth of groundwater and groundwater trend data at the site or wells; c) Proximity of site or wells (if known) to areas of known or potential ground subsidence; d) Proximity of site and wells (if known) to known groundwater-dependent ecosystems; and e) Location within a hydro geologic basin, including depth to bedrock" (2015, 4.8).

City of San Diego, CA, expedites project processing for sustainable housing developments, which includes water efficiency measures. The city also requires implementation of water conservation measures and source water protection guidelines during the development review process (2009, 27, 29).

Tulare County, CA, has development standards in place for the protection of groundwater basins: "The County shall amend County ordinances to include development standards which protect groundwater basins and surface water drainage areas and provide incentives for use of conservation techniques.... The County shall establish development or design standards for the protection of groundwater recharge areas, such as placing limitation on the amount of impervious surfaces, or other planning and zoning techniques" (2010, 11-15).

City of Westminster, CO, doles out "service commitments" to new developments, which serve as water allotments or budgets for the proposed end use of that development. Property owners are penalized with a higher water rate if water use surpasses the service commitment, and may be required to purchase additional water if annual use consistently exceeds their service commitment. Due to the city's excellent historical tracking of water use data over time by parcel and land use, the city has estimates for the average water use of restaurants, homes, offices, and all other land uses, on which it can base new service commitments. This system is described in the comprehensive plan: "The city's Growth Management Program was established in 1978 to aid the city in balancing growth with the ability to provide and expand services including

water, water treatment, sewer, police, fire, and parks and recreation. The Growth Management Program establishes an annual allocation of 'service commitments' that are adopted by resolution by City Council. Service commitments, each the equivalent of one single family residential water tap, are allocated based on the following factors: The amount of raw water that can realistically be acquired and be treated; the amount of existing raw water supply presently available from all sources which can safely be used for new growth without imperiling the city's ability to serve water to the existing Westminster water system consumers; the ability of the city to continue to balance between growth rate and consumer demands through orderly and cost effective expansion of utility systems... the demand of a given proposed land use on the city's utility system compared to other land uses. Award of service commitments to a residential project represents an agreement by the city to provide municipal services (e.g., water and sanitary sewer) to a project" (2013, 9-4).

Santa Fe County, NM, has a water allocation policy that established a maximum water use of .25 acre-feet per year for residential use as well as a Line Extension and Water Service Policy that requires those needing water service to pay for the infrastructure needed to connect to the water system (2015, 193).

WATER-EFFICIENT URBAN FORM AND ZONING REGULATIONS

A community's urban form can influence water use in multiple ways, including by determining water infrastructure needs and influencing water infrastructure efficiency. Water-efficient urban form can include increased density, compact or cluster development, smaller lots, mixed-use facilities, and multifamily housing. Zoning regulations can be used to encourage these kinds of buildings and development patterns, which tend to be less water-intensive in large part due to the lower percentage of lot area devoted to landscaping. Additionally, a community can place restrictions on urban development to preserve areas important for water quantity or quality. For example, agricultural protection zoning (also known as farmland preservation zoning) can be used to limit the conversion of agricultural land to nonagricultural uses, elevation restrictions in mountain communities can avoid intensive pumping infrastructure, and overlay zones can be applied in areas important for groundwater recharge.

Tying water use to land use types can be a powerful tool for integrated planning. Some communities have been able to tie historical water use by parcel to more refined zoning types that reflect the water use of a development after occupancy. For instance, retail and restaurants–both under a commercial zoning category–use very different amounts of water, despite being in the same land use category. Understanding the difference in water use between two such commercial occupants can help a community understand the water implications of its zoning or land use map, and subsequently be able to make zoning or development decisions with a keener eye toward the ultimate water demand of each land use type. The comprehensive plan is a crucial mechanism for making this connection between land use type and water use. Additionally, most states require that zoning amendments be in conformance with the comprehensive plan–so any aspirations a community may have to incorporate water into its zoning code or categories should first be rooted in the comprehensive plan.

Density is often equated with creating water-efficient development; however, it is not a one-size-fits-all approach. The relationship between density and water efficiency is highly dependent on the unique character of residential development in each community and how this character relates to outdoor water use. Some studies have even shown that the water efficiency benefits of density begin to plateau or reverse at certain densities (Keystone Policy Center 2018, 9). Similarly, water savings gained from density are often due to decreases in outdoor landscapes and irrigable area–and land use forms other than high-density development can reduce outdoor landscaping area. Additionally, high-density development may not always align with a community's character or the kind of built environment its residents desire. High density can disrupt the small-town character that may attract people to these communities. Low water use is possible in a variety of urban forms; thus, solutions must be community-specific.

Water-Efficient Urban Form and Zoning Regulations Subtopics

The following are ways zoning can promote water efficiency. These are adapted from Nolon Blanchard 2018.

- Support water-efficient land uses
  - Denser development
  - Cluster development
  - Compact and infill development
  - Permitting accessory dwelling units
  - Rezonings consider water supply impact
  - Bonus density zoning
  - Planned unit development regulations include water conservation
  - Mixed-use development
  - Urban growth boundary
- Prevent development in areas important for water quality, quantity, or conservation
  - Agricultural protection zoning
  - Environmental zoning
  - Floating zone
  - Overlay zoning
  - Transfer of development rights
- Encourage water-efficient buildings and landscapes
  - Conditionally permit water-intensive uses that commit to water conservation measures
  - Allow for more multifamily and attached housing
  - Small lot, single-family, limited-landscape/irrigable-area development
  - Zoning categories reflect water use

Resources and Examples from Plans

Pima County, AZ, requires water conservation measures as part of a rezoning: "a) All rezoning proposals shall include a condition requiring implementation of Water Conservation Measures identified in the PIW-MP [Preliminary Integrated Water Management Plan] through a Final Integrated Water Management Plan which will be required at tentative plat or development plan. These measures will become a condition of rezoning and may include a requirement for restrictions to be identified in CC&Rs [covenants, conditions and restrictions]. b) For rezoning proposals that are served by potable and renewable supply, a recommendation of approval. c) Rezoning proposals without physical access to renewable and potable water supply and that are greater than one mile from a groundwater-dependent ecosystem and whose wells draw water from an area greater than one mile from groundwater-dependent ecosystem shall not be recommended for approval by staff until either a renewable and potable water supply becomes available in the area or unless additional Water Conservation Measures or offsets are proposed to reduce the demand to the demand associated with the existing zoning. Written proof from the water provider that the wells are outside of the groundwater-dependent ecosystem shall be a condition of rezoning. d) Rezoning proposals without physical access to renewable and potable water supply and that are within a subsidence area or whose wells draw water from a subsidence area shall not be recommended for approval by staff until either a renewable and potable water supply becomes available in the area or unless additional Water Conservation Measures or offsets are proposed to reduce the demand to the demand associated with the existing zoning" (2015, 4.13).

City of Safford, AZ, uses a variety of strategies to support water-efficient development, such as: "1. Integrate efficient water demand management practices and strategies in land use decisions; 2. Direct new development to areas where the City could obtain additional water sources to supplement the existing water supply, or to specific areas within the City's distribution systems that have capacity to serve additional development; 3. Encourage new construction to implement efficient water practices and use renewable water resources where feasible and available" (2016, 9.4–9.5).

City of San José, CA, has an urban service area boundary to reinforce its urban growth boundary. Beneficial use of recycled water is among the allowed types of water consumption for development outside of the urban service area (2018, chap. 2: 18).

City of Cheyenne, WY, proposes a variety of measures in its comprehensive plan to conserve resources and landscapes, such as: "establish an overlay zone for conservation site planning and design to avoid resources;

allow density transfers out of the natural and cultural areas to other parts of the property, if feasible; encourage clustered development away from resources; and establish guidelines for wildlife-friendly development" (2014, 75). The city also has policies to provide incentives for clustering to preserve agricultural lands: "Revise zoning for Agriculture and Rural lands identified on the Future Land Use Plan to make it consistent with these areas appropriate for continued ranching and agricultural uses. The intent of the Plan is to limit inappropriate urban-scale or rural large lot sprawling development in these areas and to provide incentives for clustering" (141).

LANDSCAPING AND IRRIGATION POLICIES

Reducing outdoor water use is often a big conservation opportunity for Colorado River Basin communities, whose typical development pattern has been single-family lots with plenty of landscaping and irrigable area. As such, outdoor use can be an effective intervention point for driving down water consumption and promoting water conservation. Landscaping and irrigation policies can be used to decrease residential water use, address commercial landscaping, and address the landscaping in community-owned and maintained street medians or stormwater retention basins. Requirements for outdoor water use may be mandated by law, ordinance, or building standards; required for special development privileges; or encouraged by a community as a best practice. Communities should ensure that any new landscaping or irrigation policies in their jurisdiction do not contradict other policies–for example, enacting a residential xeriscape requirement while requiring irrigated turf in open space or stormwater retention basins will send a mixed message to residents and developers.

Landscaping and Irrigation Policies Subtopics

- Landscaping
  - Native landscapes
  - Water recharge landscapes
  - Water-efficient landscaping and irrigation in large landscapes, golf courses, open space, and stormwater retention areas
  - Low-water-use plant list
  - Model landscape plans
  - Model landscape ordinance
  - Water-efficient landscape code
    - Public landscape requirements
    - Xeriscape
    - Soil quality requirements
    - Tree-size requirements
    - Rain sensors
    - Spray nozzle
    - Positive shut off
- Incentives to reduce irrigation
  - Turf rebates
  - Turf limitations–species limits or planted-area limits
  - Irrigation system efficiency requirements
- Water feature codes–limiting foundations, splash pads, and other features
- Recommended specialists in native plants and low-water-use landscaping
- Watering and irrigation restrictions

Resources and Examples from Plans

State landscaping resources. Arizona's Department of Water Resources website hosts landscaping resources (2020) for residents and landscape professionals. California has a plethora of water-efficient landscaping (2020) resources, from plant lists to watering guides to lawn removal. California also has a model water efficient-landscape ordinance (2015), which all counties and local governments must adopt as-is or with stricter standards. The Southern Nevada Water Authority has tools for plant selection and landscape maintenance (2020), as well as a landscape rebate to promote these programs. New Mexico hosts an online interactive plant list (2011). University cooperative extensions may also have local plant lists and landscaping recommendations for their states, such as this guide from Utah State University (2019).

The South Metro Water Supply Authority, made up of 13 members serving the Denver metropolitan area, developed a model regional water-efficient landscape and irrigation ordinance (2017). It is based on best practices for landscape criteria not related to design standards and thus is a useful resource for communities in that region and beyond.

City of Flagstaff, AZ, implements a variety of landscaping and irrigation policies, including requiring all larger turf areas to be irrigated with reclaimed water or by rainwater harvesting (2014, VIII-23).

City of Chowchilla, CA, has a policy for landscaping arterial and major collector streets with drought-tolerant plants and low-water-use irrigation systems—a great way to lead by example and showcase water-efficient landscaping to the broader community (2010, Land Use-55).

City of Sacramento, CA, has a variety of landscaping and irrigation policies, including public education efforts and demonstration gardens: "The City shall continue to require the use of water-efficient and river-friendly landscaping in all new development, and shall use water conservation gardens (e.g., Glen Ellen Water Conservation Office) to demonstrate and promote water conserving landscapes.... The City shall promote 'River Friendly Landscaping' techniques which include the use of native and climate appropriate plants; sustainable design and maintenance; underground (water efficient) irrigation; and yard waste reduction practices.... The City shall continue providing public education (e.g., Bluethumb Program) and conducting outreach campaigns to promote water conservation efforts. Programs should highlight specific water-wasting activities to discourage, such as the watering of non-vegetated surfaces and using water to clean sidewalks and driveways, and educate the community about the importance of water conserving techniques. Water efficiency training and certification for irrigation designers, installers, and property managers should also be offered" (2015, chap. Utilities: 2-229).

City of Fresno, CA, includes a description common in California communities about how it will implement the state's Model Water Efficient Landscape Ordinance: "Refine landscape water conservation standards that will apply to new development installed landscapes, building on the State Model Water Efficient Landscape Ordinance and other State regulations. Evaluate and apply, as appropriate, augmented xeriscape, 'waterwise,' and 'green gardening' practices to be implemented in public and private landscaping design and maintenance. Facilitate implementation of the State's Water Efficient Landscape Ordinance by developing alternative compliance measures that are easy to understand and observe" (2014, 7-37).

Many communities use their comprehensive plan to lay the groundwork for exploring potential policy options or to create goals about revising regulations. Arapahoe County, CO, does so for its landscaping requirements: "Update Landscaping Regulations: Current landscaping regulations are cumbersome and require minimum landscape areas along with prescribed plant quantities. Consideration should also be given to modifying these regulations to simplify the requirements and provide flexibility in landscape design, but also to provide guidance in the effective use of landscaping for screening and transitions between new uses and existing neighborhoods. Modifications should also strengthen the requirements for xeriscaping, water-conserving irrigation techniques, and maintenance and replacement of dead or diseased landscaping" (2018, 82).

Southern Nevada is well known for its landscaping and irrigation restrictions. City of Las Vegas, NV, participates in these programs, including turf limitations enacted through a zoning ordinance: "The city shall continue to implement the turf limitation provisions of the Zoning Ordinance, which reduce the amount of turf that may be used in new residential (50 percent maximum for single-family front yards and 30 percent for multi-family landscapable area) and commercial/industrial (maximum 25 percent of total landscapable area) development. The Zoning Ordinance also limits turf on new golf courses to an average of five acres per hole, with an extra 10 acres for a driving range, and prohibits the use of turf for public facilities except for schools, parks and cemeteries. Procedures to enforce these landscaping conditions of development are delineated in chapter 19.00.70 of the Las Vegas Zoning Code" (2000, chap. Water Element: 32).

BUILDING AND PLUMBING POLICIES

Improvements in plumbing fixtures since the 1990s and programs like the U.S. EPA's WaterSense, which certifies fixtures, have helped lower indoor water use (Water Research Foundation 2019). Nonetheless, there are opportunities for local governments to go deeper with building and plumbing codes to maximize water efficiency and facilitate water reuse. Indoor water use can be made more efficient if water-saving fixtures are installed before buildings are occupied rather than depending on fixture rebates or building retrofits to improve water efficiency. Communities may want to consider adopting green building or plumbing codes, which are updated by the International Green Construction Code (2018) regularly. Requirements for interior fixtures may be mandated by law, ordinance, or building standards; may be required as an incentive for developers to receive special development privileges; or may be encouraged by a community as a best practice.

Building And Plumbing Policies Subtopics

- Pre-occupancy: development, site planning, and construction phases
  - Demonstration homes with water-efficient options in new subdivisions
  - Water efficiency certification, WaterSense certification, LEED certification, or green building design
- Post-occupancy: incentives for water customers (residents, business owners, etc.)
  - Water-efficient fixtures
    - Fixture rebates
  - Water audits
  - Water-efficient certification programs
- Regulatory–building and plumbing codes
  - Adopt green building codes
  - Amend local codes to encourage water efficiency
  - Formalize green building standards in all relevant codes

Resources and Examples from Plans

California and Colorado have state-level efficiency standards for plumbing fixtures that go beyond the requirements of the federal Energy Policy Act of 1992. Colorado's law (CO SB 14-103 2014) requires these fixtures to be WaterSense listed. California also has its own set of green building codes, CALGreen (2019).

San Diego County, CA, expedites plan reviews for developments that use water conservation measures and requires buildings to improve water efficiency as a condition of renovation, additions, or sales. These measures are taken in part to reduce the need for additional water purveyors (2011, chap. Implementation Plan: 25, 39).

City of San José, CA, promotes the use of green building techniques, with particular emphasis on water efficiency: "Promote use of green building technology or techniques that can help reduce the depletion of the City's potable water supply, as building codes permit. For example, promote the use of captured rainwater, graywater, or recycled water as the preferred source for non-potable water needs such as irrigation and building cooling, consistent with Building Codes or other regulations.... Update the Green Building Ordinance to require installation of water efficient fixtures and appliances that are WaterSense certified, Energy Star rated, or equivalent during construction or renovation of bathrooms, kitchens, laundry areas, and/or other areas with water fixtures/appliances that are proposed to be replaced" (2018, chap. 3: 6).

City of Las Vegas, NV, has a water-efficient home certification program: "The SNWA [Southern Nevada Water Authority] has offered incentives for several different programs, including... A home certification program called Water Smart Homes, in which new homes are certified to ensure homeowners purchase a home that can save as much as 75,000 gallons of water annually. The city of Las Vegas recognizes Water Smart Homes program as a part of its Green Building Program. This program is the nation's largest water efficiency program for new homes and serves as a model for

the EPA. In 2011, 410 new Water Smart Homes were labeled, bringing the program-to-date total to almost 8,700 labeled homes.... Use of water efficient technologies, which exchanges existing water usage equipment at commercial businesses with more efficient equipment. This has resulted in a cumulative conservation of more than 2.4 billion gallons" (2000, chap. Conservation Element: 60).

STORMWATER MANAGEMENT

Stormwater management intersects with water quality, supply, hazard mitigation, and site design. Stormwater solutions are related to infrastructure, urban form, and site design, making it an apt topic for a comprehensive plan. Solutions can be imposed on an individual development or parcel scale or codified in zoning and development codes, subdivision ordinances, stormwater regulations, stormwater credits, or retrofits. Urban form and conveyance systems are used to direct stormwater into washes or water bodies to prevent flooding. Stormwater runoff collected by MS4s (Municipal Separate Storm Sewer Systems) is often discharged, untreated, into local water bodies. Stormwater may also be collected by a community's wastewater treatment plant. The arid communities of the Colorado River Basin are continually struggling with stormwater management as precipitation events become more variable and unpredictable, sometimes resulting in deluges of rainfall where they hadn't occurred previously.

Additionally, the field of stormwater management is evolving as planners, engineers, and communities as a whole realize the benefits of green infrastructure, low-impact development, and other ways of conveying, storing, or recharging stormwater in a more ecological and fiscally sound manner.

Stormwater management often requires planners to collaborate with more than just the water providers in a community. Flood control districts, drainage districts, or other state, regional, and federal agencies may have authority over stormwater management. Working with all relevant agencies will lead to stronger stormwater management programs and help to achieve the goals of integrated water management.

Stormwater Management Subtopics

- Identify and assess stormwater conveyance system, gaps, and needs
- Green infrastructure
  - E.g., Bioswales, tree planters, pervious pavement, and rain gardens
- Low-impact development
- Permeable/pervious paving
- Restore natural hydrology
  - E.g., Creek daylighting, riparian corridor restoration
- On-site stormwater harvesting, retention, and use or groundwater recharge
- Pollutant and sedimentation mitigation
  - Riparian buffers, development setbacks, or vegetated buffers
  - Protected or constructed wetlands
- Multipurpose sites for flood and stormwater control
  - Open space and recreational areas with stormwater retention basins
- Technical assistance and education programs for developers/landscapers

Resources and Examples from Plans

The U.S. EPA has a variety of resources related to green infrastructure. Find these via its Green Infrastructure Basics site.

Further information for community implementation can be found in EPA's Green Infrastructure in Arid and Semi-Arid Climates (2010) case studies.

The City and County of Denver, CO, published the *Ultra-Urban Green Infrastructure Guidelines* (2016) as a critical part to their long-term stormwater management strategy. This guide focuses on site-scale green infrastructure best management practices.

The Cities of Mesa and Glendale, AZ, jointly developed a *Low Impact Development Toolkit* (Logan Simpson and Dibble Engineering 2015) that details best practices for stormwater management using LID techniques.

The Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration created a workbook (2016) for evaluating local codes and ordinances to promote and advance green infrastructure implementation. It provides instructions on how to audit local codes and ordinances, as well as sample language and definitions for green infrastructure zoning.

City of Sacramento, CA, lays out the intention to update its Stormwater Drainage Master Planning Program every five years in its comprehensive plan (2015, chap. Implementation: 4-45).

Tulare County, CA, oversees the preparation and adoption of stormwater management plans for its communities and neighborhoods, as well as considers stormwater drainage in site improvements and development requirements (2010, 14-8).

City of Fort Collins, CO, employs a watershed approach to stormwater management and uses public lands as multifunctional stormwater facilities: "Design stormwater systems to minimize the introduction of human caused pollutants. Pursue educational programs and demonstration projects to enhance public understanding of pollution prevention efforts. Design tributary systems for water quality control with appropriate use of buffer areas, grass swales, detention ponds, etc. Include receiving water habitat restoration and protection in stormwater master plans in conjunction with habitat mapping efforts.... Utilize public lands, such as street rights-of-way, for the design of multi-functional stormwater facilities by maximizing the carrying capacity of streets with curb and gutter, and by modifying design standards to promote infiltration or detention where appropriate depending on area specifics. Emphasize the development of a linked surface stormwater system that reinforces the City's open lands policy and reduces the need for large stormwater pipes" (2019, 64).

City of Clovis, NM, reiterates the 21 drainage improvement projects of its 2018 Drainage Master Plan in its comprehensive plan (2018, 90).

WATER FOR ECOSYSTEM FUNCTIONS

Water for ecosystem functions—which is both a policy approach and a prescribed set of actions applicable to any given setting—such as ensuring water availability for stream flows or wetlands, is not a new concept and has gained traction in recent years as the needs of humans and the environment become increasingly challenging to balance. Included in this arena of considerations is watershed preservation and stewardship (e.g., ensuring natural flows, maintaining riverbanks or washes, protecting source water quality and groundwater recharge areas, or similar measures). Water for ecosystem functions has the benefits of sustaining renewable water supplies, boosting water quality, providing wildlife habitat, and creating recreation and economic opportunities. These measures can ensure that development does not disrupt watershed quality, maintains stormwater drainage, and otherwise preserves environmental quality. Each of these factors is important for communities with economies that rely on recreation and tourism. A community's natural environment will determine the extent to which it may be concerned with water for ecosystem functions; some communities may have no bodies of water, whereas others may have an active group of volunteers or staff working to save, protect and restore local rivers, and others may have a public-private coalition whose aim is to construct and support artificial wetlands in service of other water management goals. Communities may want to consult watershed protection groups or plans, in addition to water providers, to understand environmental water needs and the policies that can best serve these needs.

Water for Ecosystem Functions Subtopics

- Identification and protection of environmentally sensitive areas that include water features
- Environmental demands and stream flow included in water supply and demand calculations
- Minimum flow requirements
- Water for recreation
- Wildlife water use
- Water for fishing
- Development impacts on aquatic ecosystems or riparian health

- Preservation of natural watersheds, stream banks, wetlands, or riparian areas
  - Floodplain, erosion hazard, and watercourse codes
- Identification of areas where surface waters are impacted by nearby groundwater withdrawals

Resources and Examples from Plans

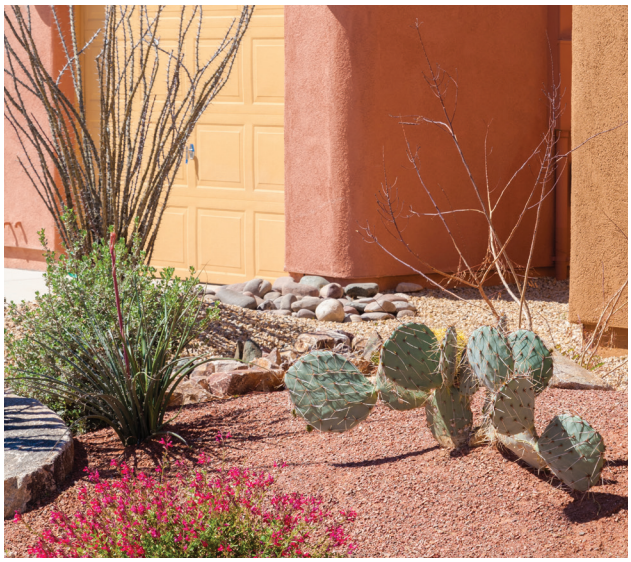
City of Phoenix, AZ, participates in a habitat restoration project along the Salt River and notes that this project has yielded "more open space, use of trail systems, improvements in flood management, and has triggered development near the River; thereby improving the urban landscape" (2015, 134).

Alpine County, CA, has a number of requirements for development proposals that impact wetlands: "Require the submittal of a detailed wetland delineation, performed by a qualified biologist, for development projects proposed in or near suspected wetland areas; Require proponents of development projects in wetland areas to mitigate impacts on wetlands such that, at minimum, there will be no net loss of either wetland habitat values or acreage; Require U.S Army Corps review prior to County approval of projects impacting wetlands; No use that would involve significant vegetation removal or earth disturbance should be allowed in stream environment designated areas. Due to the generalized standard used to delineate stream environments, variances in the above standards should be allowed where it can be proven projects will not generate unmitigable significant adverse effects upon the following features: groundwater recharge, surface water quality, aquatic or riparian habitat, wetlands, archaeological sites, aesthetics, and cliff or stream bank erosion. The County may approve projects that would impact designated stream environment areas where it is found that negative effects upon any of the listed parameters are outweighed by public need or concern. However, variance provisions should not apply to streams presently serving or intended to serve as habitat for threatened trout species. The County may require developers to dedicate land or easements to and along streams that support fisheries for the protection of stream environments or their public use" (2017, 22–23).

City of Aspen, CO, highly values its local river and strives to maintain minimum instream flows through a dedicated water right and reduced diversions from the river (2012, 52).

City of Fort Collins, CO, highly values its local river and includes several policies in its comprehensive plan for the maintenance and improvement of the river's health: "Update the 2016 State of the Poudre River Assessment to assess progress toward a 'B' grade for river health and identify specific opportunities to preserve or enhance the river's health.... Maintain a natural area protection buffer along both banks of the Poudre River to protect natural features and scenic qualities and to account for the natural instability of the River channel.... Seek opportunities to perform restoration and enhancement projects to reconnect the river to its floodplain, reduce fragmentation of habitat, protect instream flows and create/restore/maintain wetlands.... Engage in regional projects and collaborative initiatives to positively influence watershed and river health and sustain critical ecological services provided by the Poudre River" (2019, 236).

City of Santa Fe, NM, contributes treated effluent to instream flows for the Santa Fe River, return flow in the Rio Grande, and indirect recharge of city groundwater (1999, chap. Infrastructure and Public Services: 7-19).



New home construction with xeriscape landscaping in Tucson, Arizona. Photo: D. Sucsy, Getty Images (2007).

CONCLUSION

Hot air balloon near Lake Havasu, Arizona. Photo: iStock (2013).

The local comprehensive plan provides a mechanism to reinforce the community's water management strategies and serves as a platform to launch new water-related policies, goals, and objectives. The major opportunity is to tie water to urban form, the future land use map, and major policy goals, so that a community can make better-informed decisions about the water implications of future development.

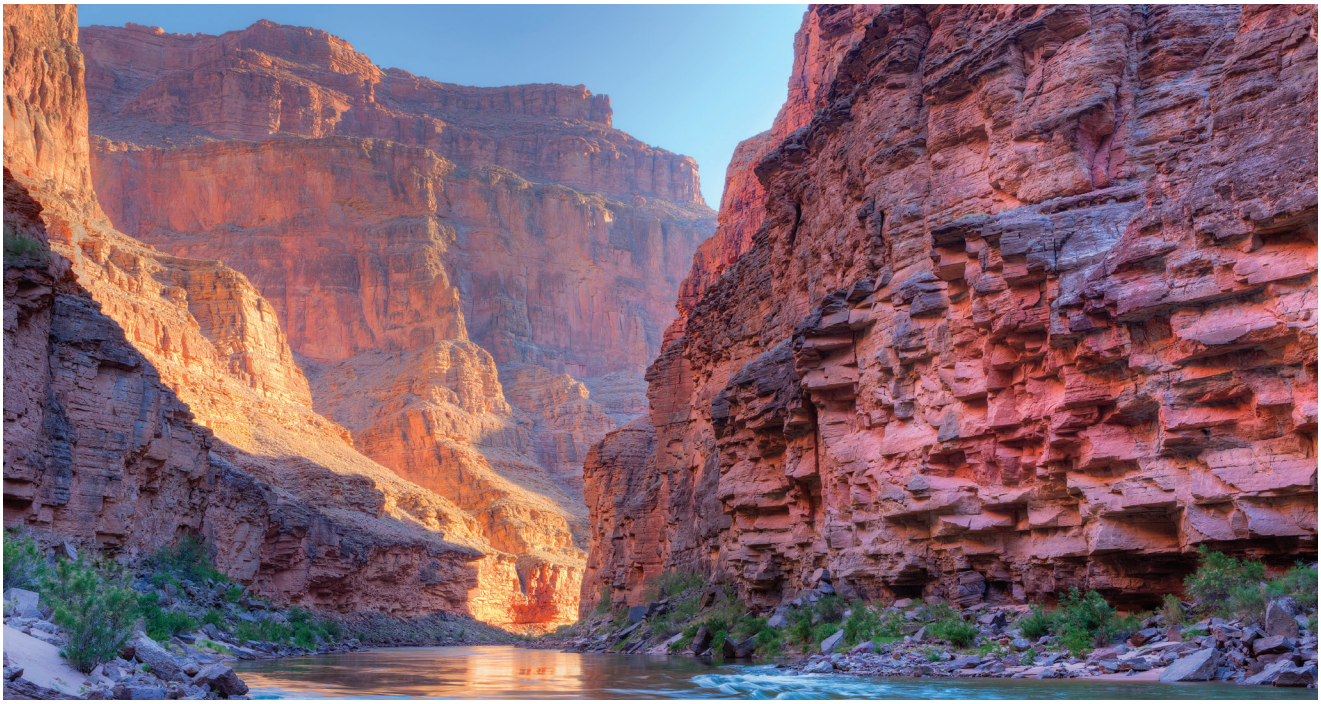
Colorado River Basin states have varying requirements for whether and how local governments include water in their comprehensive plans. Communities must meet their state requirements but be aware that such requirements are typically only a minimum threshold. Communities have an opportunity to go further than their state requires and fully interject water into their comprehensive plan.

A water element or section can be particularly useful for diving deeper into a community's water context, in order to inform the public about the community's water resources and system and to lay a foundation for further water-related policies that may be elsewhere in the comprehensive plan and in other community or utility plans.

To integrate water into a comprehensive plan, a community should first form a land and water planning team of water managers and land use planners, among other stakeholders, to guide and inform the process. Working collaboratively between disciplines, departments, agencies, and the public will ensure that the best information is being used to drive the process. Working together, the team will understand the challenges and opportunities faced by each member and will be able to come up with the appropriate plan goals, strategies, and solutions to ensure better outcomes. The goals should include metrics to track progress, effectiveness, and achievement of new strategies and programs, and the team should outline other steps to facilitate implementation. With full support from planning commissions and elected officials, the new plan can be adopted, and the appropriate parties can use the established metrics to gauge results and adapt programs as necessary during plan implementation.

The number of water topics a community can discuss in its comprehensive plan is nearly endless. The important takeaway, however, is that the plan should provide an overview of the community's water management, including both threats and opportunities the water system may need to manage in the planning timeframe, projections for future water supply and demand, and any plans or policy initiatives intended to integrate water into land use processes, standards, and decisions. Communities across the Colorado River Basin, regardless of size or geography, are finding ways to include water in their comprehensive plans and serve as examples and inspiration for others.

The comprehensive plan is the guiding document for a local government, created with intensive input from members of the community, endless hours of care from planning staff, and careful consideration by decision-makers. Incorporating water into community planning enables a local government to envision a sustainable water future with community buy-in. Councils, commissions, and departments all rely on the comprehensive plan to guide their decision-making. With water woven throughout, a community can rest assured that these decisions will be mindful of water resources and needs, ultimately leading to better decisions and to a community that will be supported by sustainable water supplies for generations to come.



The Colorado River flowing through the Grand Canyon. Photo: Tonda iStock (2014).

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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, was established in 2017 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. The Lincoln Institute of Land Policy seeks to improve quality of life through the effective use, taxation, and stewardship of land. A nonprofit private operating foundation whose origins date to 1946, the Lincoln Institute researches and recommends creative approaches to land as a solution to economic, social, and environmental challenges.

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