THE GUNNISON RIVER BASIN

A HANDBOOK FOR INHABITANTS

from the Gunnison Basin Roundtable 2013-14

When someone says 'water problems,' do you tend to say, 'Oh, that's too complicated; I'll leave that to the experts'? Members of the Gunnison Basin Roundtable - citizens like you - say you can no longer afford that excuse.

Colorado is launching into a multi-generational water planning process; this is a challenge with many technical aspects, but the heart of it is a 'problem in democracy': given the primacy of water to all life, will we help shape our own future?

Those of us who love our Gunnison River Basin - the river that runs through us all - need to give this our attention. Please read on....

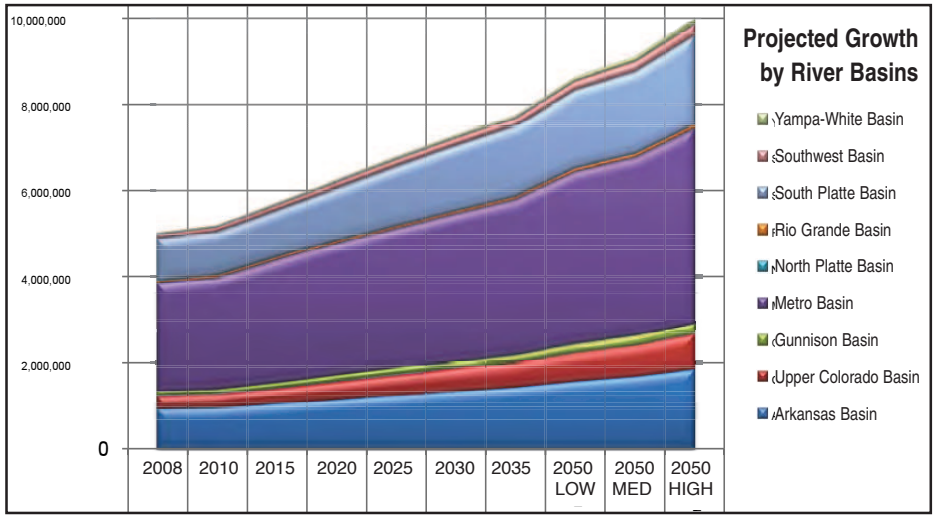
Photo by Luke Reschke

'The Gap' is our Challenge - for the next generation

-- George Sibley, Handbook Editor

People are going to continue to move to Colorado - demographers project between 3 and 5 million new people by 2050, a 60 to 100 percent increase over today's population. They will all need water, in a state whose water resources are already stressed. So the governor this year has asked for a ***State Water Plan***.

Virtually all of the new people will move into existing urban and suburban areas and adjacent new developments - and four-fifths of them are expected to move to the "Front Range" metropolis now stretching almost unbroken from Fort Collins through the Denver region to Pueblo, along the base of the mountains. This means that most of the new water demand will be for "municipal and industrial" (M&I) supply.

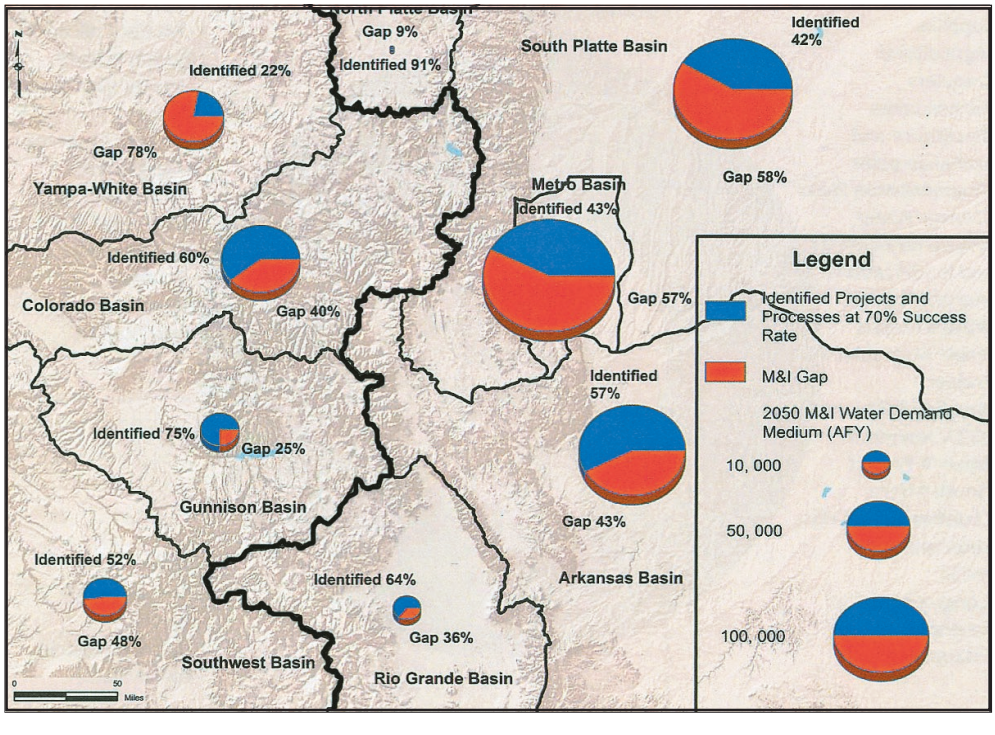


The demographic projection for our Gunnison River Basin is at least a doubling of population by mid-century, from ~110,000 today to a low estimate for 2050 of 206,000 and a high estimate of 240,000, depending on the economy. The graph here, however, shows "graphically" what a tiny part of the statewide situation this is. The graph, which looks like a geologist's map of earth layers, tracks the anticipated growth by the state's river basins (shown geographically on the map below). Our Gunnison Basin is the thin green line barely visible in the population "layers." The three "basins" east of the Continental Divide on the map below dominate the growth. (The "Metro Basin" is not a natural river basin, but much of Colorado's water nonetheless accumulates there.)

The four Colorado River basins west of the Divide constitute just 11 percent of the state's population today, with the Upper Colorado River (red layer) representing more than half of that.

The map below illustrates the "M&I Gap" across the state. The pie graph in each river basin shows, with relative size, the quantity of municipal and industrial water that may be needed by 2050 for that basin. The blue part of each disk is the portion of that projected need whose source is identified, either as projects (*i.e.*, reservoirs) or programs (*i.e.*, conservation). The red portion is "the gap" for that basin - the amount of water for which the source is not yet known.

Every basin has a gap; the projected M&I gap for the Gunnison Basin by 2050 is 1.0-2.1 billion gallons of water per year, depending on the success of identified projects and programs. But that is a drop in the bucket compared to projected gaps for the three Front Range basins: 45-150 billion gallons/year. **Statewide, the 2050 Gap will be from 65 to 200 billion gal/year**.



To begin addressing this problem, Governor Hickenlooper asked all of Colorado's water leaders in May 2013 to prepare by December 2014 a ***State Water Plan for meeting the 2050 Gap.***

Roundtables in each River Basin are being asked to play a major role in developing this Water Plan in a "bottom-up" way that reflects Colorado values and heritage. **The purpose of this handbook, then, is to give those of us who live in and love the Gunnison River Basin a grounding in what we have, value and want to sustain.**

Chart and map from the 2010 Statewide Water Supply Initiative (SWSI).

FROM THE GUNNISON BASIN ROUNDTABLE CHAIR

Dear Reader: You are holding the first ever "Handbook" designed to serve and inform the various water users in the Gunnison Basin. Whether your interest is in agriculture, water for community use, recreation or the environment, this publication was made for you.

The Handbook was prepared by the Public Education and Outreach Committee of the Gunnison Basin Roundtable, created in 2005 (one of nine in Colorado), to develop long-term solutions to conserve, protect, and defend the waters of the Gunnison Basin for the use, enjoyment, and benefit of the people of the Gunnison Basin. Most Roundtable members contributed information or stories to this Handbook.

Like the other Roundtables, the Gunnison Basin Roundtable membership consists of folks that represent the different types of interests, livelihoods and land ownership found in the Basin. Many of us, including me, were ignorant of the intricacies of Colorado Water Law and the serious issues and challenges facing us as we struggle to not only plan for our basin's water future but for our entire state as well.

After eight years of educating ourselves and developing new relationships with our counterparts on other basin roundtables, the time has come to undertake the original goal of this grassroots effort: to develop ***a sustainable and enduring statewide water plan*** to ensure adequate and safe water supplies for Colorado well into the middle of this century. This is an enormous and complex task that will require unprecedented cooperation among all water interests statewide. Failure is not an option; this must be done.

It's my hope that you will find the information contained in this handbook to be timely and of great value. Thanks very much for your interest.

Sincerely,

***Michelle Pierce, Chair**, Gunnison Basin Roundtable (and Hinsdale County municipal representative)*

What will you find in this Gunnison River Basin Handbook?

You will find answers to these more specific questions, and where possible, references for more information:

~ What is the Gunnison Basin Roundtable?
What does it do? Who is on it? (Page 4 - and a member list on back cover.)

~ What is the basic geography of the Gunnison River Basin?
What are its tributary regions? (Pg. 5) What happens in those regions? (Pp. 5, 9-17) Where does the River go when it leaves the Basin? (Pp. 5, 28)

~ Where does our water come from?
What factors of climate and weather bring us water - or don't? (Pg. 6) Why are the headwaters forests important in our water supply? (Pg. 7) How will, or might, global climate change affect our weather here? (Pp. 6, 29)

~ How much water do we have in the Gunnison River Basin? How is the water used, and by whom?
How much water do the major tributaries contribute to the river? (Pg. 8) Who uses the water? (Pp. 9-17) By what right do they use it, and how is the right to use it acquired? (Pp. 10-11) Do fish and animals, and the river itself, have "use rights"? (Pp. 15-17) How much of the river gets 'used up"?Pp. 12, 14)

~ Why do we have so many water organizations? What do they all do?
What is a mutual ditch company? Irrigation district? Water user association? Water conservancy? Watershed Group? Et cetera, et cetera.... (Pp. 18-26)

~ What is the quality of our water in the Gunnison River Basin?
How is water quality measured? What factors influence water quality? Who protects water quality? (Pg. 30)

~ What is likely to happen with the Gunnison River Basin and its water in the future?
What are the growth and use projections for the Basin? (Pg. 2) Do users in other basins want our water - and can they get it? (Pp. 27-29) Will global warming have a big impact on how much water we have? (Pg. 29) Will we or might we run out of water? (Pp. 28, 31) Do we need to be practicing conservation? (Pg. 31)

This 'Gunnison River Basin Handbook' was prepared by the Public Education and Outreach Committee of the Gunnison Basin Roundtable (George Sibley, Chair), with support from the Water Center at Colorado Mesa University (Hannah Holm, Coordinator), and with much-appreciated funding from The Walton Family Foundation and Colorado's Water Supply Reserve Fund.

Here is a land where life is written in Water
the West is where the Water was and is
Father and Son of old Mother and Daughter
Following Rivers up immensities
Of Range and Desert thirsting the Sundown ever
Crossing a hill to climb a hill still Drier
Naming tonight a City by some River
A different Name from last night's camping Fire.

Look to the Green within the Mountain cup
Look to the Prairie parched for Water lack
Look to the Sun that pulls the Oceans up
Look to the Cloud that gives the oceans back
Look to your Heart and may your Wisdom grow
To power of Lightning and to peace of Snow.

- Thomas Hornsby Ferril

What is the 'Gunnison Basin Roundtable'?

Through the 20th century, as Colorado grew rapidly and became more urbanized and industrialized, the development and management of the state's increasingly complex water systems passed into the capable hands of engineers, managers, and other specialized creators of the legal, political and physcial infrastructure underlying most public and private developments after World War II.

But as water projects became larger and more expensive, and easily available water supplies diminished, water supply issues began to increase in complexity, with issues of cultural disruption and fairness that warranted a broader participation from all the people of the state. When voters in 2003 resoundingly defeated a two-billion-dollar "blank check" referendum for new water projects, the state's executive and legislative agencies acknowledged that the public needed to become more involved in the planning process for meeting future water needs.

Russell George, then Department of Natural Resources Director and one of Colorado's visionary leaders, advocated for the creation of a grassroots planning system for the state: "Roundtables" would be set up in each of the state's natural river basins (plus one for the metropolitan area) that would be more inclusive than the traditional organizations for water decision-making - roundtables that would include municipal and county governments, representatives from major economic sectors, environmentalists, and other agencies and entities vested in the future of our water supply.

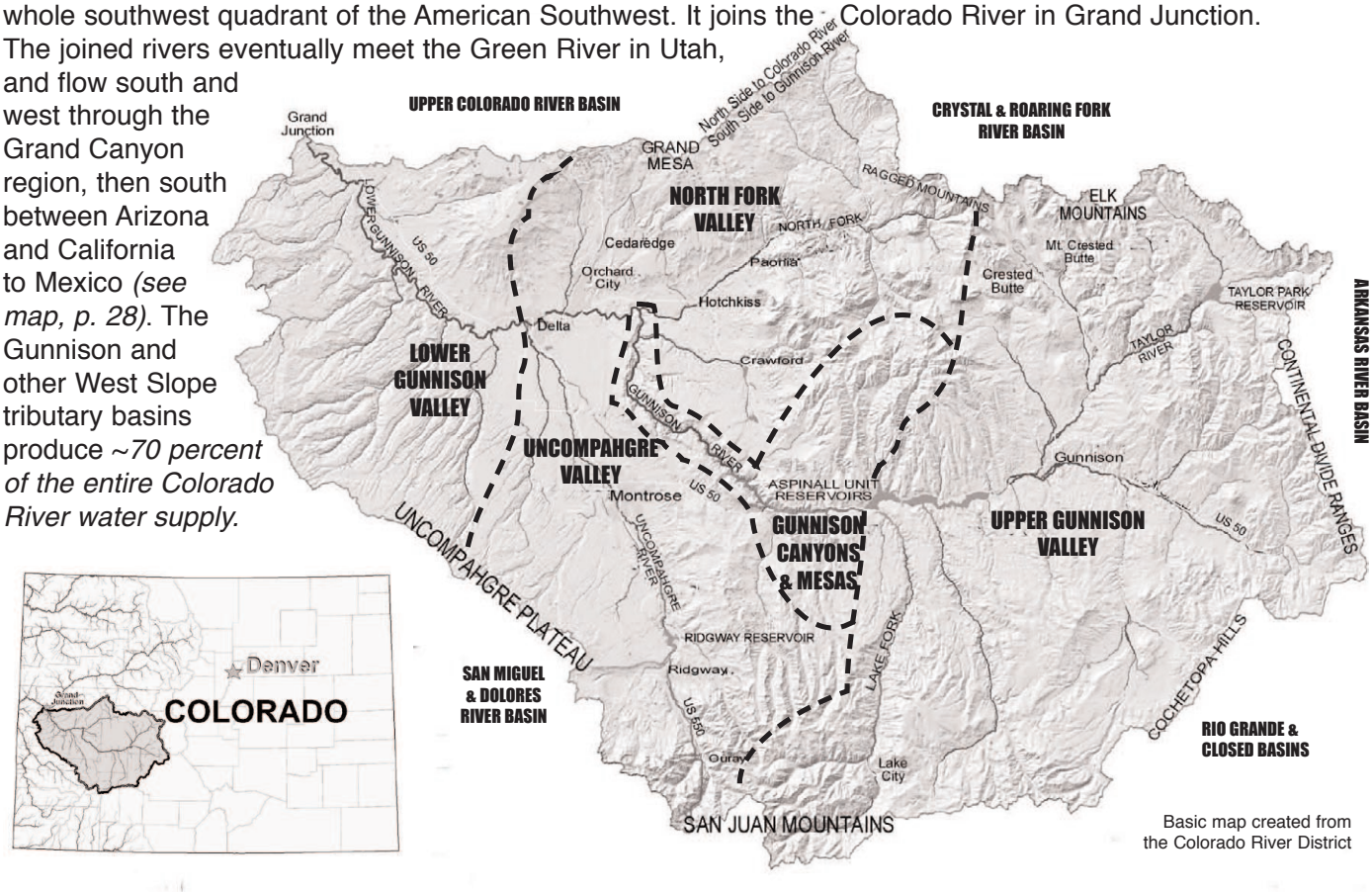
These roundtables would in turn each send two representatives to an "Interbasin Compact Committee" (IBCC), augmented with some appointees from the state government, to resolve differences among the basins over future water supplies and attempt to create "bottom-up" plans for watering Colorado's anticipated growth.

In 2005 the General Assembly passed the "Colorado Water for the 21st Century Act" (HB05-1177) to establish such a system. The Roundtables and IBCC, working closely with the Colorado Water Conservation Board, are proving to be important links between governments and the managers and engineers that design and build the water suppply systems we need for our future.

The Gunnison Basin Roundtable has been meeting regularly since autumn 2005, and has developed careful studies of local consumptive and nonconsumptive uses; it has also initiated dialogues with Front Range water users about our common future. This "handbook" is your Roundtable's attempt to better connect with all the people of the Gunnison Basin on that future.

What is the Geography of the Gunnison River Basin?

The Gunnison River is one of the major tributaries of the Colorado River - the principal water supply for the whole southwest quadrant of the American Southwest. It joins the Colorado River in Grand Junction. The joined rivers eventually meet the Green River in Utah, and flow south and west through the Grand Canyon region, then south between Arizona and California to Mexico *(see map, p. 28)*. The Gunnison and other West Slope tributary basins produce *~70 percent of the entire Colorado River water supply.*



Basic map created from the Colorado River District

How natural boundaries shape and divide the Gunnison River Basin

The Gunnison River Basin is a set of rich alluvial high-desert valleys surrounded by mountains and centrally separated by a geological "wilderness" - the consequences of a mid-Basin uplift of hard metamorphic rock, overlaid by volcanic debris; the result today is rugged eroding highlands - Black and Blue Mesas - split by a series of deep river-carved canyons, including the Black Canyon National Park, that divide most of the Basin into these more habitable areas:

The Upper Gunnison River Basin - primarily a region of mountains and relatively broad alluvial mountain valleys, bounded on the north by the Elk Mountains, the Continental Divide on the east, the Cochetopa Hills and San Juans on the south, and the mesa-and-canyon region on the west (Blue Mesa Dam). It ranges in elevation between 7,500 feet at Blue Mesa Dam to 14,000-foot peaks. Despite abundant water from the snowpack above 8,000 feet, the Upper Gunnison growing season (av. 62 days) is too short for most agricultural activities, but is well suited to stock grazing and hay production.

The North Fork Valley - including the Surface Creek valley on the south slope of Grand Mesa and the Smith Fork valley below Black Mesa. These valleys lie between Grand Mesa on the north and the deep Gunnison River Canyons on the south, with the West Elk Mountains to the east. The North Fork proper is a rich alluvial valley bordered by finger mesas; it and the Surface Creek valley are noted for vibrant organic food production and for small "truck farms" focusing on local marketing. The upper North Fork and Smith Fork valleys are cattle and sheep country with good hay production.

The Uncompahgre River Valley - a large alluvial valley draining the San Juan Mountains to the south and the Uncompahgre Plateau to the west. The valley above 8,000 feet elevation is very rugged, with narrow valley openings amid peaks reaching to 14,000 feet, a highland region with a rich mining history. Below that elevation, down to ~5,000 feet, the valley is relatively level and rich but arid, lending itself to extensive irrigation for many field crops.

The Lower Gunnison River Basin - a high desert that is still largely uninhabited. It begins below the confluence of the North Fork and the Uncompahgre Rivers with the Gunnison River, all in the vicinity of the city of Delta, where the river again disappears into canyons, shallower and broader but still somewhat wild. The River receives only intermittent inflows from Grand Mesa to the east and uplands to the west, on its way to its confluence with the Colorado River in Grand Junction.

Where does our water come from?

Probably everyone has heard of the "water cycle" - the process whereby the sun evaporates water from the ocean, and draws it up in ascending air masses, where the water vapor in the air cools as it rises until it condenses and falls on the land below as either snow or rain, and either runs downhill as surface water or soaks into the earth as ground water. It then either gets used by living plants and animals, including humans, or works its way back down to the ocean where it repeats the cycle.

But the process of getting water from the oceans onto the land becomes more complicated - and less predictable - when the land is toward the middle of a large continent, a thousand miles from the ocean, with intervening mountain ranges - the situation with the Gunnison River Basin.

As the diagram shows, mountains force a moving mass of air upward, which cools as it gains altitude. If it cools enough, whatever moisture the air is carrying condenses and falls as rain or snow. Then as the air moves on over the mountains, the cooled and dried air descends, warming again as it descends. As it warms, it sucks up whatever moisture is available, drying out the land beyond the mountains, creating a "rain shadow" extending to the next place where topography forces the air mass to ascend, cool and condense again. The dried-out "region between" is known as an "orographic desert."

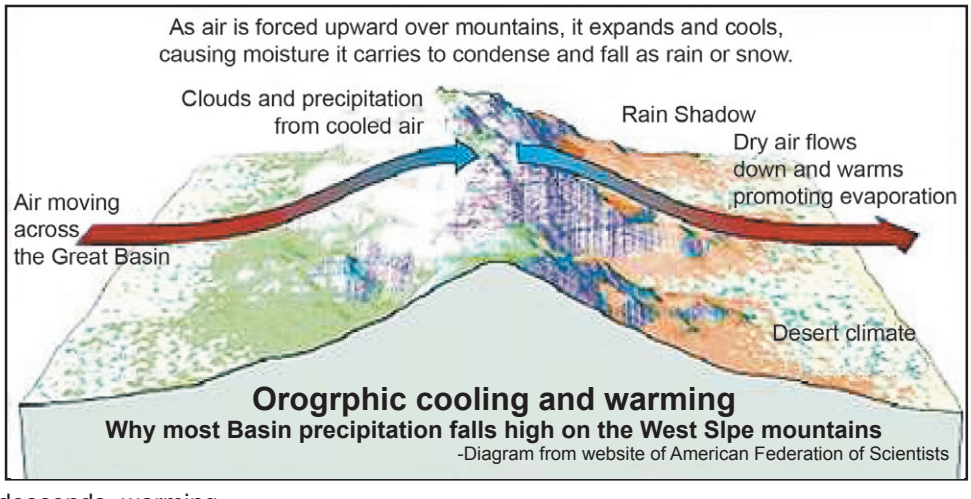
The majority of the precipitation that falls on the Southern Rocky Mountains comes from the Pacific Ocean, but most of the airborne water that rides in from the Pacific gets wrung out of the air over the coastal ranges and Sierra and Cascade mountains. The "basin and range" country between those mountains and the Rockies is all orographic desert except for occasional highlands and isolated small mountain ranges. This includes the majority of the Gunnison River Basin, up to ~8,000 feet elevation.

Air masses that move off the Pacific with lots of water thus arrive at the Rockies, after dropping a lot of rain or snow on two major western ranges and a long bumpy trip across the orographic deserts of the Great Basin and Colorado Plateau, with not a lot of moisture left. Only the great height and winter cold of the Continental Divide can work the orographic magic for what remains, so the majority of water for the Gunnison Basin - and the entire Colorado River Basin - comes in the form of winter snows above 8,000 feet.

Would you like to follow the weather, snowpack and runoff more closely? Click on "Water Related Links" at the Upper Gunnison River District website - www.ugrwcd.org - for links to bookmark.

Storm Patterns

Longtime observers of our Gunnison Basin weather have noticed patterns in the way that all-important winter snowpack comes - or does not. Winter Pacific storms that come inland north of California tend to drop most of their bounty north of Grand Mesa and the Elk Mountains, but often have little or no snow for the Gunnison Basin. The best storms for the Gunnison Basin and Southwestern Colorado come inland south of San Francisco.



Is the Gunnison Basin's climate changing?

Almost certainly, yes. The volatile nature of mountain weather makes it difficult to say what is "natural variability," and what is actually different - a "new normal." But records extending over decades now indicate that we are experiencing long-term changes in weather patterns that mostly match climate change projections from climate scientists.

A recent Bureau of Reclamation study, for example *(see p. 28)*, projects that the Upper Colorado River Basin will probably experience a decline in winter snow of about nine percent with a large plus or minus, in coming decades. In fact, the records from 1991-2010 show that we are already down about that much from the 20th-century average. The 10 warmest average and mean annual temperatures have all come since 2000. Despite a few chilly wet springs like 2011 and 2013, the mean date for the commencement of spring runoff is earlier by a couple of weeks. Violent storms and "unseasonable" weather are occurring more frequently. These indicators all match most scientific projections for climate change in the American Southwest.

Climate scientists hypothesize that the increased energy from warmer tropical water and air should put more tropical moisture into circulation - good news. But they also suspect that this same added energy might push the dry subtropical jet stream further north - bad news. In any case, a warmer Colorado will be drier due to more evaporation, which will mean more forest fires, more years on the edge of drought, and more desert dust blowing in. The future will probably not be so generally mild and beneficent as the past century has been.

Where does the water start?

- Gary Shellhorn, Hydrologist, GMUG National Forests

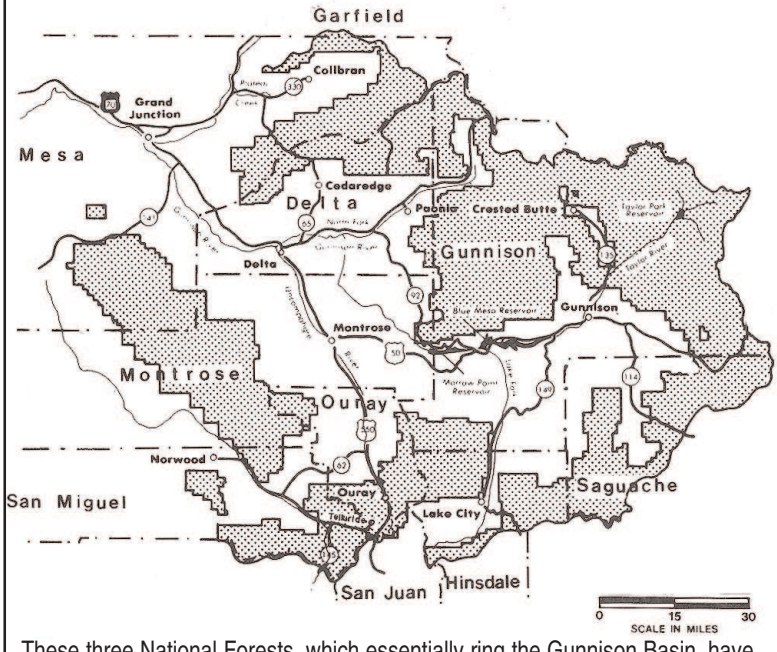
"*The connection between the Forests and the rivers is like that between father and son: no forests, no rivers.*"
- Gifford Pinchot, "Father" of the National Forest System

National Forest lands comprise the headwaters for the entire Gunnison River Basin. Snow accumulates in the Grand Mesa, Uncompahgre and Gunnison National Forests (GMUG), producing the runoff (augmented by summer thunderstorms) that produces virtually all of the water for the Gunnison River Basin.

Congress set aside those National Forests early in the 20th century to comply with the 1897 Forest Service Organic Act that cited "securing favorable conditions of water flows" as a management goal.

By the late 20th century forest managers were realizing that a stream is not just a flow of water; the snowpack and resulting streams are important to the diverse ecologies of the forested landscapes - wetlands, riparian and aquatic ecosystems, grazing lands, and the forests themselves. Precipitation falling on the National Forests sustains those ecological systems as well as providing water flows for human uses below the high regions of origin.

GRAND MESA, UNCOMPAHGRE & GUNNISON (GMUG) NATIONAL FORESTS



These three National Forests, which essentially ring the Gunnison Basin, have been managed as a single unit since 1973. Grand Mesa NF is the smallest, covering Grand Mesa on the north side of the Basin. Uncompahgre NF covers most of the headwaters of the Uncompahgre River. Gunnison NF, largest of the three, rings the rest of the Basin's headwaters. These 2.9 million acres of National Forest land contain almost all of the headwaters tributaries of the Gunnison River Basin. *- Map from Forest Service document*

The Forest Service calculates that about 2.9 million acre-feet of stream flow comes from GMUG National Forest lands. According to State records, about 25 percent of that runoff is diverted from the streams for agricultural production in the Gunnison Basin. About 1,200 points of diversion occur on the National Forest lands, to convey agricultural water to private lands at lower elevations - more on-forest diversions than most other forests. Only a small percentage of the stream flow that originates on the GMUG is used for domestic water, but that goes to 32 domestic water systems supplying about 110,000 people. What is not consumed in the basin flows down the Colorado River to millions of downstream users.

Storing water on the National Forests is another important aspect of meeting the "favorable conditions of flow" mandate. The GMUG has over 450 permitted reservoirs storing water for agricultural and domestic uses. The high elevations of the National Forest lands allow water users to use gravity ditches and pipelines, and cooler temperatures result in lower evaporation. These supply reservoirs also provide recreation opportunities and fish habitats. There are also thousands of constructed ponds that capture small volumes of water for livestock and wildlife.

Sustaining watershed function is a key part of the "multiple use" management prescription for the National Forests. A properly functioning forest watershed results in high quality water, stream flows sustained throughout the year, recharged groundwater, saturated wetlands, productive rangeland and healthy diverse forest vegetation.

Watershed conditions on the GMUG are good. Using the National Forest Service classification system, 80% of our 223 sub-watersheds rate as good and properly functioning while only 20% rate as fair or potentially functioning at risk. None are rated poor. The classification system considers 23 components that relate to watershed function, allowing Forest Service managers to systematically assess the existing watershed function and identify potential risks. From this information, GMUG managers work to carry out watershed restoration or protection efforts that will improve conditions related to water quality, fish habitat, wetlands and riparian vegetation, erosion, and upland vegetative health and sustainability.

The connection between watershed management and sustaining streams on our National Forests is best characterized by this quote from Gifford Pinchot, the first Chief of the Forest Service, who said, "the connection between the Forests and the rivers is like that between father and son: no forests, no rivers."

How much water is in the Gunnison River?

It is difficult, perhaps impossible, to say with any precision how much precipitation falls over the Gunnison River Basin in a year. To begin with, there are extreme variations in precipitation from year to year; "average" and "median" precipitation levels can be calculated from gauging stations in the Basin, but the "average" snowpack or runoff should not be confused with any conception of "normal." In mountain weather, there long-term averages but no "normal."

About 90 percent of the precipitation over the Basin comes in the form of of snow, "stored" in a winter snowpack, mostly above 8,000 feet elevation; the remainder comes in the form of rain throughout the rest of the year - most frequently, summer thunderstorms. Depending on winds and temperatures, some difficult-to-measure amount of the snowpack will *sublimate* - go from water's solid state to its gaseous state without turning to water first; that quantity is lost from the Basin water supply.

Once the snow melts, some of it runs off quickly into the river's high tributaries, recharging reservoirs, and some of it sinks into the ground as groundwater: how much of each depends on how fast the runoff happens, and how dry the ground was when the snow fell on it. A dry autumn often precedes a disappointing spring run-off, although some of the groundwater eventually does make it into the streams.

Those factors noted, the average annual quantity of water flowing down the Gunnison River is **2.4 million acre feet** *(maf - see notes on this page about the measure of water).* This has, however, gone over 3 maf in heavy snow years, and it has been less than 1 maf in dry years.

Of that annual quantity, roughly 550,000 af of water gets "used up" by Gunnison Basin users over a year. The remainder goes downstream to meet Colorado River obligations to other southwestern states. *(More on pp. 28-29)*

How do we measure water?

Those who work with large quantities of water have two measures for water quantity:

- ***Flowing water*** is measured in **cubic feet per second (cfs)**, the quantity of water flowing past a specific point in a specific period of time.
- ***Stored water*** (as in a lake or reservoir) is measured in **acre feet (af)**, the amount of water that would cover one acre of land (43,500 sq. ft. - roughly the size of a football field minus end zones - to a depth of one foot. An acre-foot of water contains 325,851 gallons.

A flow of *one cubic foot per second* will, in 24 hours, convey just under *two acre feet* of water.

Today, an acre foot is considered enough to supply household water for two families of four for a year. Pre-1980, an acre-foot was regarded as a sufficient quantity for *one* family of four; by 2050, it may be regarded as a sufficient quantity for three or four families. This will be a function of more efficient use (e.g., better appliances and fixtures), better land-use planning, and more conservation.

Average annual Gunnison Basin stream flows

This table tells how much water, on average, flows today from the Gunnison River's main tributaries into the mainstem, which joins the upper Colorado River at Grand Junction. The numbers refer to the tributaries on the map above; the quantities are averaged from the actual measured flows at those points and do not include upstream uses.

1 - East River (at Gunnison River confluence)	242,200 af
2 - Taylor River (at Gunnison River confluence)	239,100 af
3 - Gunnison River at Gunnison	540,200 af
4 - Tomichi Creek (at Gunnison River confluence)	122,500 af
5 - Lake Fork of the Gunnison (at Gunn.R. confluence)	169,300 af
6 - Gunnison River at Blue Mesa Dam	950,000 af
7 - North Fork of the Gunnison (at Gunn. R. confluence)	330,000 af
8 - Uncompahgre River (at Gunnison River confluence)	220,300 af
9 - Gunnison River near Colorado River confluence	1,839,000 af

The Gunnison River produces approximately one-sixth of the surface water for the whole Colorado River Basin.

How is the water of the River used - and who may use it?

The flat and fertile Uncompahgre River valley is one of Colorado's most productive agricultural regions. Agriculture is by far the largest user of Gunnison Basin water. - Photo from Uncompahgre Valley Water Users Association archive

In a good wet year with lots of snow, like the 2011 water year (measured from October 1, 2010 to September 30, 2011), everyone usually gets the water they need. But in most other years, water users are operating in a scarcity situation, especially in late summer and early fall when the snow has gone from the mountains. In this section of this Handbook, we will look at the different ways in which water gets used in the Gunnison Basin. We will also look at how waters of the state are apportioned out - who gets it and who doesn't in a time of shortage.

A Distinction about Water Uses

The water of the Gunnison River and all of its tributaries is used and reused for human purposes on its way down the Basin - most of it probably at least twice and some more than that. But despite all of that use and reuse, when the River joins the Colorado River near Grand Junction, only about one-fourth of the water has actually been "used up" for human purposes.

The first distinction to make, then, about the use of water is the distinction between *consumptive* and *nonconsumptive* uses:

~A *consumptive use* is one in which the water used disappears (as water) from the river system. Irrigation water that is converted into plant cells has been used consumptively, as has water that has evaporated off of the field or been transpired by the plants; water from the kitchen tap that "irrigates" your cells and blood has been used consumptively. Water that billows into the sky as steam from a power plant has been used consumptively.

~A *nonconsumptive use* is one for which the water either is never even taken out of the river, or is returned to the river after being used. Water used to generate hydroelectric power is a nonconsumptive use that briefly removes the water from the stream for use. Fishing, rafting and kayaking, environmental uses like instream flows, and other recreational or environmental uses are all nonconsumptive uses effected with the water "used" instream.

Many human uses of water are only partially consumptive. Irrigation water is only partly consumed by the plants and field evaporation; much of the diverted water either reenters the stream from which it was taken as tailwater or as groundwater seeping back into the stream. On average only 10 percent of domestic water used in-house is consumed; the remainder is flushed or drained off to a treatment facility and from there returned to the river. It is the return flows that enable water to be used over and over.

Next we look at the way in which the right to use the water is distributed among users in Colorado....

Who gets to use the water? Some Basics of Colorado Water Law

Colorado water law has a reputation of being incomprehensibly complex, and beyond "the ordinary citizen's ability to understand." This may be due more to the almost incomprehensibly convoluted situations the state is confronting where a fixed (possibly diminishing) water supply is under increasing pressure from a seemingly unlimited demand.

But Colorado's water law itself is based on some fairly straightforward principles, conceived by and for settlers bringing into a new region a mix of political and economic ideas and ideals that were sometimes in tension.

The people own the water - but individuals own the right to use it Settlers came west in North America seeking the to invest "sweat equity" in developing the wealth and security that they believed to be grounded in the ownership of land. They quickly learned that much of the land in the arid region was not farmable without water to irrigate it. In their humid-region Anglo-European heritage, water was an essential but abundant "commons" which all used but no one owned, but in the arid West, land property also required some property in water.

Their solution was to evolve a system of appropriation from the water commons that was important enough to include in the 1876 Colorado Constitution: while "the water of every natural stream" is "the property of the public", that common property is "subject to appropriation" to personal use, and "the right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied." Water users would not own the water they use, but they would own - as a viable, transferable property right - the *right to use* that water.

Water *users* only - no speculators Actually putting the water to some beneficial use was essential to acquiring a water right: no one could claim water he or she was not actually using - or was not at least working diligently on the structures necessary to put the water to use (conditional right). Limiting the right to appropriate to only that amount of water one was actually putting to use was a conscious attempt to foil speculators who might otherwise lay claim to whole streams to be sold at a profit later to those with otherwise waterless land.

A related Constitutional condition was the mandate to allow "right-of-way across public, private and corporate lands" for water structures to serve water users not immediately riparian to the river. The non-riparian user would have to pay "just compensation" for that access, but it could not be denied.

First in time, first in right The Constitution then stated that, when there was not enough water to fill all the claimed appropriations, "priority of appropriation shall give the better right." A senior appropriator could "call" upstream junior appropriators, shutting off their water until the senior's decree was met.

The law only steps away from "first in time, first in right" when the water situation became really desperate: then domestic users would have priority over agricultural users, who in turn would have priority over industrial users (with compensaton to senior users whose priority was thus "condemned.").

Originally water rights had to be based on actual diversions from streams. But as Colorado's economy changed and grew after World War II, water law also expanded to include economically beneficial uses instream.
- Photo from Neal Schwieterman

That barely begins to lay out the finer points of Colorado's appropriations doctrine, but it does show its basic thrust: the law first evolved to favor the people actually working the land, and to thwart big-money speculation - an attempt to balance democratic access and equity against the acquisitive energy and financial power of capitalism.

Spuculation v. Prudence From a West Slope perspective, speculation became an issue in the late 1930s when the Denver Board of Water Commissioners filed on twice as much water for their Moffat Tunnel project as they actually had use for at that time. The Grand County District Court agreed that it was speculation, and cut their decree accordingly. But Denver appealed to the State Supreme Court, which reversed the lower court. "It is not speculation," the Court said, "but the highest prudence on the part of the city" to be acquiring water for future growth that could be reasonably anticipated.

In the decades since, the State Supreme Court has reconsidered this several times, most recently in 2009, in a decision that further defined and limited the reasonable planning horizon a water provider might claim in "being prudent."

Keeping it all straight This seniority-based system of course required substantial record-keeping. A State Engineer's Office was created in 1879 to record and organize water rights, but the actual adjudication of water rights was decentralized to the district court system, and each court had its own systems.

The water rights themselves were administered down on the ground by ***water commissioners*** *(continued on next page)*

Some Basics of Colorado Water Law, continued....

each working under the State Engineer in watershed-scale ***water districts*** - there are seven in the Gunnison Basin.

There was, however, no coordination among those seven districts, so it was difficult to administer priority on the same river among them. The General Assembly finally took on the mammoth task of untangling the whole situation in 1969 with a "Water Right Determination and Administration Act." Under this act, all of the water districts in each of the state's eight major river basins became part of a "division," under a Division Engineer. (The Gunnison Basin is Division 4.) Adjudication was still left to the district courts.

Ground water The 1969 law also took on the even larger task of incorporating into the priority system all wells using "tributary ground water" - water in the ground hydrologically connected to surface streams. The number of big irrigating wells had begun to have unignorable impacts on surface flows. This has been accomplished for all wells over 15 gallons per minute ("exempt wells").

In 1973 rules were also established for "non-tributary ground water" - water in deep aquifers not hydrologically connected to any surface streams. This is essentially water to be "mined," but at an annual rate of no more than one percent of the estimated total - thus theoretically a 100-year supply.

Expanding the Doctrine to include instream uses The appropriations doctrine in its early evolution dealt only with diversions *out* of a surface stream - and the diversions could completely dry up a stream. That was, in fact, a condition for a senior appropriator to call the river.

But as early as the Colorado-Big Thompson Project discussions in the mid-1930s, West Slope communities were worried about keeping enough water in the streams to maintain "fish flows" and "a living river." As both environmental concerns and recreational interests gained importance in the 1970s, Colorado became the first appropriations state to adopt an "instream flow" law, to maintain the environmental health of its streams "to a reasonable degree." Most of the Gunnison Basin's headwaters now have instream flow decrees (appropriated only by the Colorado Water Conservation Board), although most of those rights are very junior to the big irrigation and M&I rights.

At the end of every ditch is a someone on the operating end of a shovel.... *- Uncompahgre Valley WUA Archive*

Federal Reserved Rights Another task the 1969 reorganization law undertook was to resolve the lurking "time bomb" of implied water rights claimed but unquantified by the federal government on federal lands.

In 1908 the U.S. Supreme Court decreed that, when the federal government had reserved lands for any specific purpose (Indian reservation, national park, et cetera), it has also implicitly reserved enough water, *from that same date of reserva-tion*, to carry out that purpose. Since the government was creating reservations and parks before Colorado was even a state, this meant a lot of implied but unquantified "reserved rights" that could cause legal chaos in a district when the government finally quantified a very senior reserved right.

The 1969 water rights law did what it could to force the government to identify and quantify all of its reserved rights in Colorado. This had its largest Gunnison Basin impact in the Black Canyon, which had been set aside as a National Monument in 1933. In 2001, noting that the Black Canyon had been created and maintained by pulsing spring floods, the Park Service declared that it could only fulfill its mission of "preserving the natural and cultural resources" of the place if periodic floods were restored through releases from the Aspinall Unit dams, to strip plant life and clear rock debris.

The Service filed in 2001 for a substantial spring flow, at the peak of the Aspinall Unit storage season, and within days, almost 400 individuals and groups had filed Statements of Opposition. Negotiations commenced, and lasted for the next five years. Since it involved some of Colorado's last unused water, many labyrinthian statewide political machinations ensued - an entertaining story to read in detail. Finally, in 2008, the district court approved a "consent decree" that gave the Park Service an annual flood, to be quantified by water conditions each year, with a priority equal to the Aspinall Unit.

Federal and State Environmental Legislation Laws passed at both the state and federal levels in the 1960s and 70s - the Clean Water Act (1972), the Endangered Species Act upgrades (1973), Colorado's Areas and Activities of State Interest Act (1973), and the Environmental Protection Agency rules have resulted in changes in the appropriations doctrine, much as zoning laws set some limits on private land property rights.

Colorado's appropriations doctrine has thus far generally shown the sensitivity and adaptability to changing times and concerns that is the mark of a durable body of law. But the challenges keep growing as water to appropriate diminishes.

John McClow, General Counsel for the Upper Gunnison River WCD, has a good overview of Colorado water law, and stories of legal encounters in Gunnison Basin history, on the Upper Gunnison website: www.ugrwcd.org.

Using the Water 1 - Gunnison Basin Irrigated Agriculture

The origins of agriculture in the Gunnison Basin turn some of our western myths about settlement upside down. Agriculture began in the 1870s in the most difficult part of the Basin for agriculture, the high, cold and snowy headwaters. This was because everything west of the 107th meridian (a line just west of present-day Crested Butte and Gunnison) was still Ute Indian reservation, by an 1868 Treaty - a situation that prevailed until 1881 and the final eviction of the Utes from most of the West Slope, after the so-called "Meeker Massacre." Only then did the really productive agricultural areas in the North Fork and Uncompahgre valleys open up for Anglo-European settlement.

A second unusual thing was the first settler, Alonzo Hartman: he was not the small fmily farmer envisioned by the Homestead Act, but a contractor raising cattle for the federal government to feed the Utes. That did nothing to make Hartman's life as an early settler any easier, but we do not usually think of the federal government as the avatar of frontier settlement.

And finally, the pattern of settlement reversed the early American image of farmers settling a region in small farm villages, growing into larger towns with the industrial city eventually emerging to complete the "civilizing" of a region. In the Gunnison Basin, as throughout much of the West, the industrial city came first, in the form of an urban mass of prospectors, miners, shysters and businessmen and women following a gold or silver strike. Gunnison was a failing agrarian experiment in town building until the San Juan and Leadville mining booms boiled over into the valley in 1880. It was, as West Slope historian Duane Smith has explained, an "urban frontier." And everyone in these overnight cities lived out of imported tin cans and barrels from "back East" until stock growers and farmers began to fill in the mountain valleys to meet the fervent desire for fresh meat and produce.

The eviction of the Utes in 1881 unleashed a land rush for the rich but arid North Fork and Uncompahgre valleys, the sunny south slopes of Grand Mesa, and the Grand Valley, and within a decade most of the Basin's best land was under irrigated cultivation. Three distinct types of agriculture evolved in the Basin over the following decades:

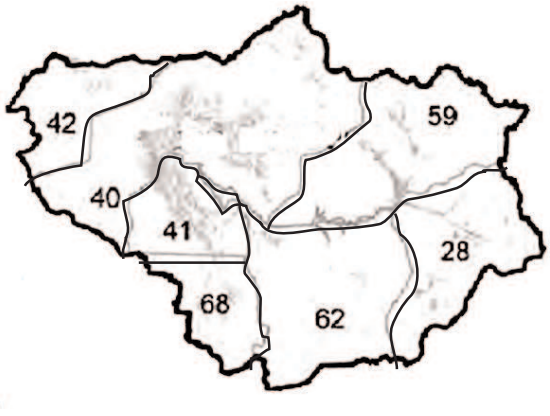
TOOLS THAT BUILT THE WEST, B.B.*

(*Before Bulldozers and Backhoes)

Most of the ditch infrastructure for irrigating the Gunnison Basin was built with real "horse power" and human muscle, along with some basic tools: shovels, picks, black powder, and devices like the ***slip scraper*** above. This was operated by a mule team in front and a man on the two handles at the rear (also holding the team reins). Raising the handles lowered the blade of the scoop into the dirt to be moved. If the blade went too deep or encountered a big buried rock, the slip scraper could become a "flip scraper" if the operator didn't let go of the handles or stop the team fast enough.

~Cattle and sheep ranching: This is based in the mountain valleys above ~7,000 feet, where the growing season is too short for much beyond hay or other animal feed crops. Ranchers lease public lands to pasture their stock through the summer and early fall while they grow

(continued on next page)



COLORADO WATER DIVISION 4
Division Engineer: Bob Hurford, Montrose
Gray patches are irrigated areas

IRRIGATED ACREAGE AND WATER USE BY DISTRICTS

WD	District Name	Acres Irrigated	Consumptive Use af/yr	Shortage af/yr
28	Tomichi Creek	28,000	~45,000	~20,000
40	North Fork & Tribs	90,000	~150,000	~75,000
41	Lower Uncompahgre	80,000	~170,000	<10,000
42	Lower Gunnison River	8,000	~15,000	<10,000
59	East & Taylor Rivers	34,000	~55,000	~15,000
62	Upper Gunnison River	17,000	~30,000	<10,000
68	Upper Uncompahgre	15,000	~25,000	<10,000
TOTALS		**272,000**	**~500,000**	**~128,000**

The shortages are primarily due to lack of storage for late-season water. More water is diverted for irrigation than is consumed; these figures are calculated estimates of how much is actually consumed - difficult calculations due to variable factors of land and weather.

- Information from SWSI 2010 Study

Irrigated agriculture in the Gunnison Basin

- continued from previous page

winter feed in the valleys. Hay grown in the high country is valued across the West for its nutritional quality.

Flood irrigation is mainly used for watering the land because of the deep alluvial soil and gravels in mountain valleys: large quantities of water are needed to keep the water table up to the root level of the plants.

This type of "mountain ranching" is the principal agricultural activity in the Upper Gunnison valley above the canyons, the Upper Uncompahgre and Dallas Creek valleys, the upper slopes of the Uncompahgre Plateau, the Smith Fork and Black Mesa, the Big Muddy and Anthracite Creeks in the upper North Fork valley, and the upper reaches of Surface Creek on Grand Mesa.

~Orchards and Vinyards: The Gunnison Basin below 6,000 feet elevation is probably best known for fruit production; its apples, cherries, pears and other fruits have been known beyond the region ever since the 1893 Columbian Exposition in Chicago from which North Fork fruit brought home several awards.

The North Fork, Surface Creek on the south slopes of Grand Mesa, the lower Uncompahgre Valley, and the lower Gunnison valley near the confluence with the Colorado River are all known for their high-value orchards. More recently, some growers have been trying vinyards, with some local wineries adding value to the grapes.

Among other virtues, orchards can be very efficiently irrigated through drip systems and other enclosed water systems that deliver water directly to trees with minimal losses to evaporation, although not all producers have been able to afford the upfront costs for such systems, and continue to use ditch and furrow or flood methods.

Picking cherries in Paonia, which celebrates with an annual Cherry Days Festival. - Photo from Dixie Luke

Clifford Sheets, a manager for the Uncompahgre Valley Water Users Association into the 1970s, operates one of the gates on the extensive irrigation system in that valley. - Photo from UVWUA archive

~Field Crops: The lower Uncompahgre Valley, from Montrose to the Delta area, is known for its potatoes and other root crops, onions and garlic, and its corn and other grains, as well as its orchards. "Olathe Sweet Corn" is probably its best known agricultural brand today - a summer treat sought well beyond the Gunnison Basin. For several decades, Moravian barley was being produced for Coors beer, but that is no longer the case.

Most of these same field crops are being produced, on a smaller scale, in the North Fork and Surface Creek valleys - much of it for local farmers' markets and Community Supported Agriculture shares (CSAs). The North Fork valleys have many small family farms - as "Jeffersonian" a region as can be found in the West.

Irrigation methods vary widely in getting water to these field crops. Many farmers are using large sprinkler systems; others are still using furrow irrigation, and where it seems fitting, flood irrigation.

Agriculture is economically important in every part of the Gunnison River Basin - moreso in some than others, but a factor everywhere. It is also culturally important for economic sectors that have little interest in agriculture. Visitors to the area value the open space and vistas - and high elevation flood irrigation, where evaporation rates are low, provides some spring flood control and slows the flow of a lot of water out of the basin that is available downstream later in the season for other irrigators and users.

And food is just good for us all.

Using the Water 2 - Rural Domestic, Municipal & Industrial Use

Less than five percent of the water in the Gunnison River Basin is used by humans for domestic, municipal and industrial (M&I) purposes. This includes water provided by public utilities in the towns and cities of the basin, by special water or water and sanitation districts, and by private wells in the unincorporated rural parts of the Basin. This page of the handbook provides some information on those uses. The figures are for all the water that moves through the various water systems, but most of that water is not used consumptively. Most utilities estimate that up to 90 percent of the water "used" inside the home, and roughly half of that used for landscaping outside, eventually returns to the river for reuse downstream.

Water Suppliers by County	Pop. '10	Total af/yr
Delta County Total	**30,952**	**6,000**
Upper Surface Creek Domestic WUA	2,870	
Coalby Domestic Water Company	235	
Fruitland Domestic Water Company	350	
Town of Orchard City	5,303	
Town of Cedaredge	2,346	
Town of Crawford	400	
Town of Hotchkiss	2,000	
Sunshine Mesa Domestic Water	85	
Lazear	263	
City of Delta (Project 7)	7,314	
Town of Paonia	2,971	
Tri-County WCD (Project 7)	4,291	
Gunnison County	**15,458**	**3,400**
City of Gunnison	5,600	
Town of Crested Butte	1,530	
Mt. Crested Butte Water & San Dist.	2,650	
Crested Butte South Metro Dist.	740	
Hinsdale County	**1,358**	**370**
Lake City	400	
Montrose County (Basin portion)	**31,552**	**7,900**
Chipeta Water District	2,982	
City of Montrose (Project 7)	16,024	
Tri-County WCD (Project 7)	8,582	
Menoken Water District	2,675	
Town of Olathe (Project 7)	1,289	
Ouray County	**3,359**	**840**
City of Ouray Public Works	950	
Tri-County WCD (Project 7)	1,430	
Town of Ridgway	979	
Mesa County (Basin portion)	**14,672**	**2,000**
Residents on own supply (see table below)	14,569	7,050
Gunnison Basin Total	**103,500**	**27,560**

The chart at the left describes the water consumed by municipal, industrial and rural domestic water users in the Gunnison River Basin. The breakdown is by counties, with the populations of the various water suppliers for each county; information on the consumption for each supplier was not available, but estimates of annual consumption are given for each county in the Basin.

Many of the headwaters communities store surface stream water for their supply - even Grand Junction gets some of its water from Grand Mesa streams. But most of the utilities lower down in the Basin draw much of their supply from tributary ground water wells - with some depending on ground water recharge from nearby irrigation. No one yet "mines" non-tributary ground water.

Also included in the chart (next to last line) is the estimated amount of water consumed by the users of wells in the unincorporated parts of the Basin. More than a fourth of the water consumed domestically is drawn from those wells - an unusually high portion that fairly closely parallels the percentage of homes served by those wells whose owners are part-time residents living outside of the Basin. These wells are broken down by the water districts in the Gunnison Basin. Almost half of those wells are in the Upper Gunnison "headwaters" of the Basin.

Vulnerability A large number of the M&I water suppliers in the Basin are described as "vulnerable," in that they have limited water reserves in the event of a system emergency. This is as low as barely half a day for some towns like Ridgway and Ouray. The Project 7 Water Authority that serves most of Ouray, Montrose and Delta Counties *(see page 24)* has a 30-day reserve - but is largely dependent on the aging Gunnison Tunnel; a tunnel cave-in would undoubtedly stress Project 7 supplies to more than 50,000 inhabitants. Addressing these vulnerabilities is one of the challenges facing the inhabitants of the Gunnison Basin.

Rural wells: Domestic and Household Use Only, and their vulnerability

Recent decades have seen a large increase in outlying homes (non-agricultural) and subdivisions in the Gunnison Basin that depend on wells for their water supply. These are either "domestic wells" that permit use for outside landscaping water, or "household use only wells" that do not permit outside use (although permit holders don't always remember that).

Many of the small wells (<15 gal/min) are "exempt" from the priority system; wells larger than that are now required in the Gunnison Basin to have an "augmentation plan" to avoid being shut off from a downstream call.

The State Engineer has estimated that most domestic wells use ~1.0 af per year; household wells, about 0.33 af a year. This table shows the water used by these wells, by water district.

Water District	Domestic Wells	Household Use Wells	Total Use af/yr
28 Tomichi Creek	628	416	765
40 North Fork & Tributaries	1,549	557	1,733
41 Lower Uncompahgre R.	898	108	934
42 Lower Gunnison River	243	78	269
59 Upper Gunnison River	1,826	893	2,121
62 Lake Fork	603	347	718
68 Upper Uncompahgre R.	470	126	512
Total	**6,217**	**2,525**	**7,050**

Nonconsumptive Uses and Needs in the Gunnison Basin

Participants and spectators at the Gunnison Whitewater Festival, held every mid-June at the city's Whitewater Park, where several rafting and kayaking "challenges" were created instream as one of Colorado's new Recreational In-Channel Diversions (RICDs). The City of Gunnison worked with the Upper Gunnison River WCD to develop the right.
- Photo from Frank Kugel, UGRWCD Manager

Nonconsumptive uses or needs are those that need water to be left instream, or return it to the stream after use (as in passing through a hydropower plant). As early as the 1930s, Gunnison Basin inhabitants were expressing what would today be called "environmental" and "recreational" concerns about nonconsumptive needs in the development of the Basin's water resources - especially the threat of transmountain projects that would irrecoverably take the purest water from the headwaters. At the time they expressed those concerns in terms of maintaining "fish flows" and "a living river."

Over the next several decades, the articulation of those concerns would grow more scientific, but the basic intuition would be affirmed: a river is something more than just a conduit filled with water to be diverted for out-of-stream uses. The water story for much of the last third of the 20th century focused on the cultural challenge of balancing the consumptive needs for diverted water with a growing concern for and investment in the nonconsumptive needs and uses associated with "the river as a river."

These concerns were not entirely due to altruistic love of nature and the Gunnison country. Even before World War II the Upper Gunnison River was gaining a national reputation for its fishing. At a seminal West Slope water meeting early in 1937, *Gunnison News Champion* publisher Henry F. Lake Jr. declared that the biggest element in Western Colorado's economy "is not water, it is not agriculture.... The greatest element is the tourist business in dollars and cents." And, he continued, "What brings tourists to Colorado? Climate, scenery and water."

Whether that was entirely true of the 1937 economy, it was certainly true for the second half of the 20th century. Through the 1950s and 60s, as America "got wheels," visits to National Parks and Forests doubled roughly every 5-6 years. An "amenities economy" based around outdoor recreation, both active (boating, fishing, skiing) and passive (aesthetic appreciation, "second homes"), has become a major component of the larger Gunnison Basin economy. Beyond just the visitors who come for vacations, the natural and cultural amenities and recreations attract many retirees and second-home owners, a major source of transfer payments into the local economy and a mainstay of the Basin's construction and service industries.

Hand in hand with the growth of that water-based recreational economy was an "environmental revolution" as Americans became aware of both the limits on how heavily we could tap into renewable resources like water, air and forests, and the limits on how much waste we could expect the natural environment to absorb.

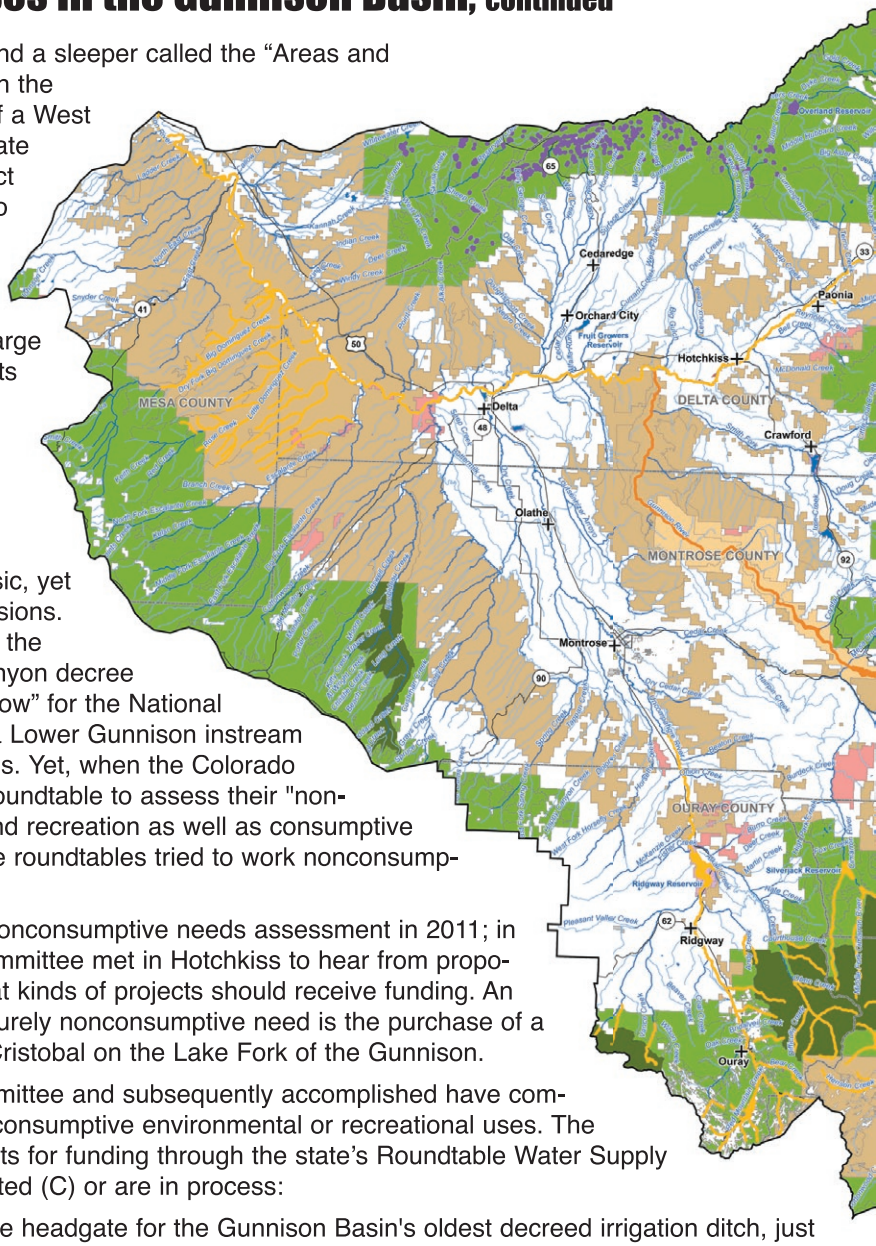
The early 1970s saw a huge amount of both federal and state environmental legislation that, by the end of the 20th century changed practically every aspect of "the way we do water in Colorado": at the national level the Clean Water Act, the Endangered Species Act, the Environmental Protection Agency with its assessments and impact statements; at the state level, the creation of agencies to work

(continued on next page)

Nonconsumptive Needs and Uses in the Gunnison Basin, continued

with the EPA, the nation's first instream flow law, and a sleeper called the "Areas and Activities of State Interest Act" which would prove in the 1980s and 90s that the Board of Commissioners of a West Slope county could essentially shut down or mandate significant changes in a transmountain water project or other major urban-industrial incursion, in order to protect their county's land and water resources from environmental damage.

The Colorado Water for the 21st Century Act that created the Roundtables issued an explicit charge to include each Basin's nonconsumptive needs in its analysis of future options.



Preserving our River System

- by Jennifer Bock, Gunnison Basin Roundtable Environmental Representative

Water for the environment is one of the most basic, yet difficult concepts in our state's water supply discussions. Water has been appropriated for instream flows by the CWCB since the late 1970s. In 2008 the Black Canyon decree assigned minimum flows and an annual "flushing flow" for the National Park; the 2011 Aspinall Reoperation plan created a Lower Gunnison instream flow for the endangered Colorado River fish species. Yet, when the Colorado Water for the 21st Century Act asked each basin roundtable to assess their "non-consumptive needs" - water for the environment and recreation as well as consumptive uses - there was more than a little confusion as the roundtables tried to work nonconsumptive projects into the state funding programs.

The Gunnison Basin Roundtable completed its nonconsumptive needs assessment in 2011; in May 2012, the Roundtable nonconsumptive subcommittee met in Hotchkiss to hear from proponents of nonconsumptive projects and discuss what kinds of projects should receive funding. An example of a significant project that addresses a purely nonconsumptive need is the purchase of a conservation easement in the inflow to Lake San Cristobal on the Lake Fork of the Gunnison.

Most of the works recommended by the subcommittee and subsequently accomplished have combined benefits for both consumptive uses and nonconsumptive environmental or recreational uses. The Roundtable has approved a number of such projects for funding through the state's Roundtable Water Supply Reserve Account; these projects are either completed (C) or are in process:

75 Ditch and Gunnison Whitewater Park (C): The headgate for the Gunnison Basin's oldest decreed irrigation ditch, just west of Gunnison, was rebuilt in a way that created a new water drop for Gunnison's Recreational In-channel Diversion.

Hartland Diversion Dam Reconstruction with Boat and Fish Passage (C): An irrigation diversion dam dangerous to boaters with no fish passage, west of Delta, was rebuilt to add safe passage for boats and fish in the "Endangered Species" stretch of the Lower Gunnison.

Relief Ditch Headgate Reconstruction with Recreational Improvements: Trout Unlimited, with some funding through the Gunnison Basin Roundtable, is improving the intake for the Relief Ditch irrigation headgate below the river's canyons, in ways that will also restore fish habitat and improve boat passage.

Lake San Cristobal Outlet Project (C): In a three-way partnership among Hinsdale County, Lake City and the Upper Gunnison River District (with funding through the Roundtable), an Obermeyer spillway gate was installed in 2012 to store and control the top three feet of Lake San Cristobal, above Lake City; in addition to firming up the water supply for Lake City and other users, this provides better environmental and recreational management of streamflow in the Lake Fork of the Gunnison.

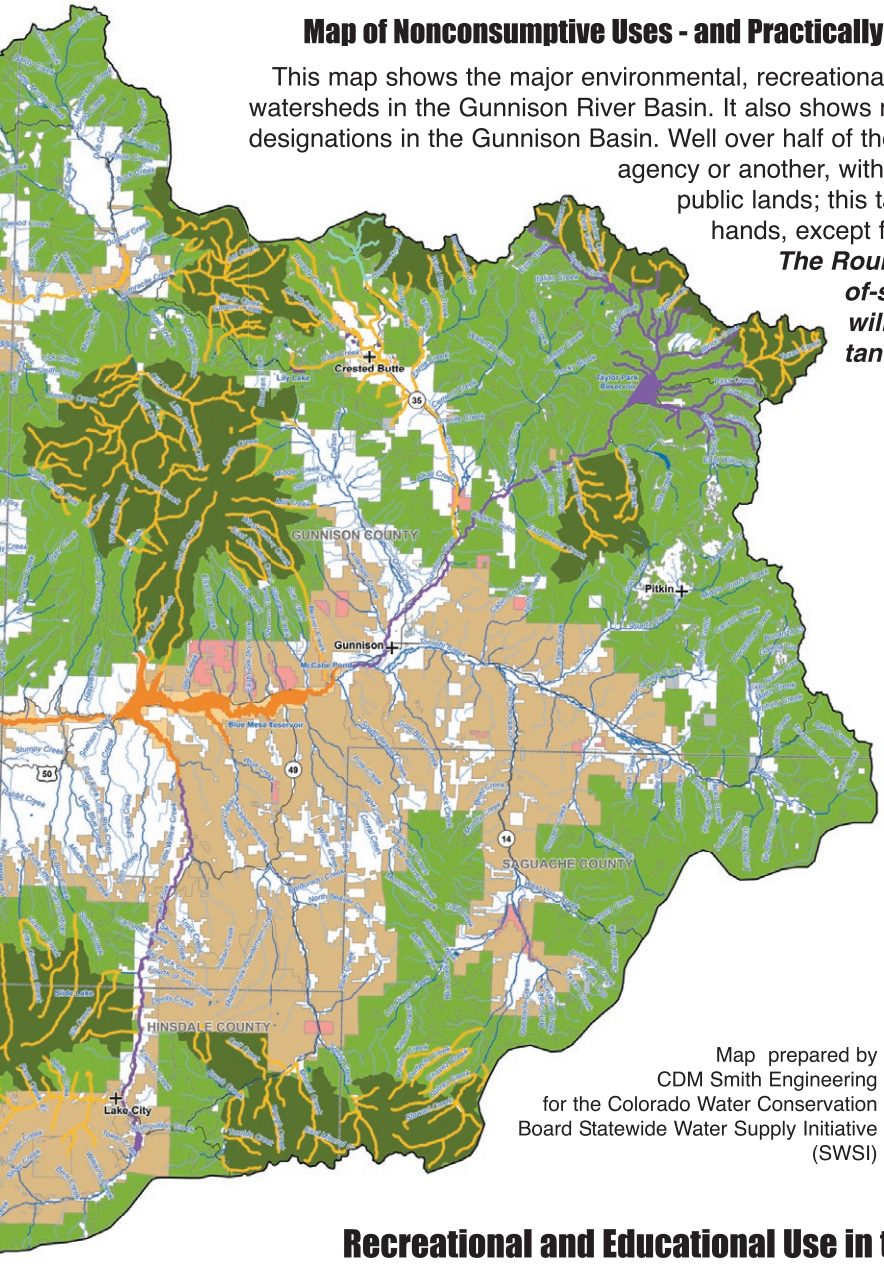
Gunnison River Restoration Project: The City of Gunnison, Colorado Parks and Wildlife, and other local stakeholders are partnering, north of the city, to repair riparian segments of the Gunnison to enhance recharge of the city's aquifer, improve several irrigation diversion structures, and restore healthier stream ecology and aesthetics on a popular stretch for boating.

Jennifer Bock is interested in ideas for restoring or improving the environmental quality of the Gunnison River Basin, and can be reached at her High Country Citizens Alliance office in Crested Butte, 970-349-7104.

Map of Nonconsumptive Uses - and Practically Everything Else in the Gunnison Basin

This map shows the major environmental, recreational and scientific/educational segments of the watersheds in the Gunnison River Basin. It also shows most of the federal, state and private land-use designations in the Gunnison Basin. Well over half of the Basin is federal or state land under one agency or another, with most of the nonconsumptive uses on those public lands; this takes most of the management out of local hands, except for "passionate oversight" of agency actions.

The Roundtable consensus is that any further out-of-stream diversions within or out of the Basin will diminish quality and quantity for important nonconsumptive uses.



Map prepared by
CDM Smith Engineering
for the Colorado Water Conservation
Board Statewide Water Supply Initiative
(SWSI)

MAP LEGEND

- Environmental and Recreational Segments
- Recreational Segments
- Scientific/Educational Segments
- Environmental Segments
- Roads
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary
- Wilderness Areas

Land Management

- Bureau of Land Management
- Bureau of Reclamation
- Colorado Division of Parks and Wildlife
- City
- County
- Fish and Wildlife Service
- Land Trust
- National Park Service
- Priivate Land
- School District
- State Land Board
- Other State
- State Parks
- U. S. Forest Service

Recreational and Educational Use in the Gunnison River Basin

Most of the recreational and amenities economy in the Gunnison Basin is based around two "resources": public lands and water - resources that are intimately related, with nearly all of the Gunnison River's tributary streams originating on public lands. No comprehensive study has been done for the economic impact of the recreational, educational and other "amenity" activities in the Gunnison Basin, but visitor statistics collected by the various public land agencies are good indicators:

~**Grand Mesa, Uncompahgre and Gunnison National Forests** attract around 2 million visitors a year, many for multi-day visits at 50+ public campgrounds. Because the ski trails are on Gunnison National Forest, this number also includes...

~**Crested Butte Ski Resort** averages 350,000-400,000 skier days every winter. (It might be noted that, since the advent of snow-making, skiing is not entirely a nonconsumptive use; about 10 percent of snowmaking water is used consumptively.)

~**Curecanti National Recreation Area**, surrounding the Aspinall Unit reservoirs, has 800,000 to 1 million annual visitors.

~**Black Canyon National Park** and the **Gunnison Gorge** add another 250,000-300,000 visitors.

~**Commercial whitewater rafting companies** cater to 20,000 whitewater enthusiasts, just on commercial rafts (not including the private boaters).

~**Sport fishermen** are hard to get statistics on, but areas like the Taylor River and the Gunnison Gorge have international reputations with anglers.

Western State Colorado University in Gunnison and the **Rocky Mountain Biological Laboratory** above Crested Butte depend heavily on the environmental attributes of the Gunnison Basin, and have huge cultural as well as economic impacts.

Why are there so many water organizations? What do they all do?

It is indeed true: the Gunnison River Basin - like the American West in general - has a multitude of water-related agencies and organizations, at every level of governance: local, state and federal. This section of the handbook will help you understand what role each of these organizations plays to help with the development, use and protection of the Gunnison Basin's water. This page briefly describes the federal and state agencies that play a role in the Gunnison Basin. The following page describes the way the Bureau of Reclamation changed the Basin through the 20th century. And following that - a look at all the in-basin entities that keep good water in all the ditches and pipes - and in the river.

Federal agencies

Bureau of Reclamation (BOR)
The BOR is the Interior Department's main water development agency. See the next page for more on the Bureau in the Basin. The regional BOR office is in Grand Junction.

National Park Service (NPS)
The NPS is also a branch of the Interior Department; it operates the Black Canyon National Park and the Curecanti National Recreation Area in the Gunnison Basin.

United States Forest Service (USFS)
The USFS, a branch of the Department of Agriculture, manages the Grand Mesa, Uncompahgre and Gunnison National Forests that are close to one-fourth of the Gunnison Basin, mostly above 7,000 feet. Most of the Basin's minimum instream flow are in the National Forests. *(See p. 7 for more on the USFS in the Basin.)*

Burea of Land Management (BLM)
The BLM manages all federal lands that are not managed by the USFS or the NPS - roughly a fifth of the Gunnison Basin, mostly below 7,000 feet elevation. This includes the Gunnison Gorge Wild and Scenic River candidate and the proposed Escalante wilderness area in the Lower Gunnison.

U.S. Fish and Wildlife Service (FWS)
The USFWS is the federal wildlife conservation organization, working primarily through the acquisition and operation of wildlife refuges and enforcement of the 1973 Endangered Species Act. The Gunnison Basin has no wildlife refuges, but is involved with the FWS over five endangered fish species: the pikeminnow, razorback sucker, humpback chub and bonytail chub, all in the Lower Gunnison; and the greenback cutthroat trout once in most of the headwaters streams.

Army Corps of Engineers (ACE)
Anyone doing anything involving the nation's rivers and wetlands needs a permit from the ACE, and in the case of wetlands, a mitigation plan to replace any that are altered.

The Water Measurers
Western water users depend heavily on the SNOTEL measuring devices of the **Natural Resources Conservation Service** and the river gages of the **U S Geological Survey.** The NRCS also works extensively with private land owners on land and water conservation programs.

State agencies

Colorado Water Conservation Board (CWCB)
The CWCB was created in 1937, to nurture cooperative planning among the river basins of Colorado; this was required for tapping into federal funds for water development. The federal government no longer develops water projects, but the CWCB continues to fill a statewide water planning role, and will take a lead role in the Governor's State Water Plan. The CWCB also operates revolving loan funds for raw water development.

Division of Water Resources (DWR)
The DWR, also known as the Office of the State Engineer, oversees the administration of water rights for the eight basin Divisions (each with a Division Engineer) and the numerous Water Districts within each Division, each with a Water Commissioner who actually checks and sets the headgates and other withdrawals to make sure everyone is getting the water to which he or she is entitled - and only that amount. All state water rights are compiled in the State Engineer's office, and can now be accessed electronically at the DWR website (http://water.state.co.us/Home/Pages/default.aspx).

Colorado Parks and Wildlife (CPW)
CPW operates four state parks in the Gunnison Basin, all associated with water features: Ridgway Reservoir, Paonia Reservoir, Crawford Reservoir and Sweitzer Lake (near Delta). Also a fish hatchery near Gunnison.

Colorado Water Quality Control Division (WQCD)
This agency executes at the state level the regulations and rules adopted at the federal level under the National Environmental Policy and Clean Water Acts. The WQCD regularly tests all the streams and groundwater in the state for quality. *(See p. 30 for more on quality.)*

State Revolving Loan Funds
Several state entities offer loans to communities (incorporated or unincorporated) for the construction of drinking and waste water treatment facilities in quasi-governmental special districts: **Colorado Water Resources and Power Development Authority**, **Drinking Water Revolving Fund**, and the **Water Pollution Control Revolving Fund**.

Other state and federal organization do have indirect or peripheral involvements with Gunnison Basin rivers and watersheds, but these are the major ones.

All of the state and federal agencies have well-maintained websites - type the agency name in your browser.

Reclamation, Early Conservation, and the Bureau in the Gunnison Basin

Few river basins in the West have been more changed than the Gunnison Basin by human efforts to "reorganize nature" to meet human needs. The organization most associated with those changes - and also with the creation of new organizations to manage those changes - was the ***Bureau of Reclamation.*** This page chronicles how the Bu-reau and its local partners "re-engineered" the Gunnison Basin - yet left it the beautiful region we know today.

The Bureau of Reclamation was created in 1902, under Theodore Roosevelt's administration, to execute what was perceived then as a conservation mission: to stop the "wasting" of arid-lands water that ran off to the ocean in a fast spring flood. "Conservation" in 1900 meant reclaiming such "wasted" resources for more efficient human use.

This primarily meant storage projects, which were hugely expensve; trial and failure showed them to be beyond the means of local farm communities, private corporate investors, and even the states themselves. Only the federal government could finance the reclamation ideal that was perceived as a national mission well into the 20th Century.

The Bureau pursued the goal of controlling and storing the rampant waters of the West's scarce rivers into the 1970s. But then the national perception of "conservation" for an urbanizing, industrializing nation moved toward preservation of the remaining undeveloped natural environment, and the Bureau has since seen its mission changing toward project maintenance, conservation and efficiency.

These are the Bureau's big works in the Gunnison Basin:

The Uncompahgre Project: This is a 5.8 mile tunnel from the Gunnison just above the Black Canyon to the fertile but water-stressed Uncompahgre Valley. Local farmers and the state both attempted the tunnel in the 1890s, but lacked the financial resources. In 1903, its second year, the new Bureau took over the project, finishing the tunnel in 1909. Storage for the project, however, had to wait for....

Taylor Park Dam and Reservoir: Late-season storage for the Uncompahgre Project was to be 100 miles east, high in the Taylor River watershed near the Continental Divide. Arkansas Basin irrigators also had their eye on the Taylor River for a transmountain diversion in the 1930s. But West Slope Congressman Edward Taylor went over Bureau heads to the Interior Secretary for a promise of funding for Uncompahgre storage, preempting the transmountain plans. The 106,000 af reservoir was finished in 1937, and Taylor River water stayed in the Gunnison Basin.

Fruitgrowers Reservoir: In 1937 a small farmer-built (and rebuilt) dam in the Surface Creek valley collapsed, threatening the livelihood of fruitgrowers in that valley. The Bureau, with uncharacteristic speed and WPA workers, had a new 3,200 af reservoir in place for the 1939 fruit season.

The Colorado River Storage Project: CRSP was a huge program for developing most of the waters of the Upper Colorado River Basin in Colorado, Wyoming, New Mexico and Utah. As finally passed by Congress in 1956, four big

Colorado's Legislative Water Committee watches a test of the unique spillway on Morrow Point Dam in the Gunnison River canyons. Part of the Colorado River Storage Project, this was the Bureau's first big thin-arch double-curvature dam, the crown jewel of the Aspinall Unit.
-1970 Photo by Bureau photographer Vern Jetley

storage and power dams would produce electricity revenues sufficient to pay for those dams *and* for a number of smaller irrigation and M&I projects in the four states. Six CRSP dams and related works were built in the Gunnison Basin from the mid-1960s through the 1980s:

~The Curecanti Unit (now "Aspinall Unit"): Three dams in the river's canyon region with total storage of ~1.1 million af and a total power-generating capacity of 283 megawatts - one of CRSP's four "big projects." Blue Mesa Dam is first in line, an earthfill dam creating Colorado's largest reservoir and the heart of Curecanti National Recreation Area; second is Morrow Point Dam, with most of the unit's generating capacity; then Crystal Dam, for regulating flows downriver. The unit was finished in 1976.

~Paonia Unit: A small earthfill dam on the Big Muddy tributary of the North Fork of the Gunnison and an enlargement of the 25-mile Fire Mountain Canal, to irrigate portions of the North Fork Valley. Paonia Dam was completed in 1962, and has a capacity today of ~14,000 af.

~Smith Fork (or Crawford) Unit: An off-stream reservoir storing Smith Fork water near the town of Crawford, primarily for pasturage agriculture. The dam was completed in 1963, with a capacity of ~14,000 af.

~Dallas Creek (Ridgway) Unit: Ridgway Dam stores 84,000 af for two purposes: supplemental water for Uncompahgre Valley irrigators and M&I water for the valley's urban/suburban places. The dam was completed in 1985.

‘Grassroots’ Water Organizations in the Gunnison River Basin

The Redlands Power Canal Diversion, last structure on the Gunnison River, with a very early decree.
- Redlands Water & Power Company Photo (thanks to Chuck Mitisek)

As has already been shown, humans have put the waters of the Gunnison River to use in three principal ways over the past 138 years: for irrigated agriculture; for domestic, municipal and industrial uses; and more recently for nonconsumptive uses associated with hydropower, recreation and environmental needs. Except for private wells and single-farm irrigation ditches, those uses have all involved some degree of local organization with economic and social implications. And as the "easy" floodplain riparian water got developed, and the projects for water development became larger, more complex and more distant from their source stream, those organizations became larger and more complex as well.

The next pages of this Handbook define and describe the various types of water organizations that have emerged in the Gunnison Basin, with brief descriptions of the organizations of each type. The local and subregional organizations portrayed in the pages that follow are only the organizations that have continuity through time. “Ad hoc” water groups often come into being around specific concerns; they are not covered here.

Pre-Bureau Irrigation Organizations

Disregarding for a moment the ecological and aesthetic functions of a river in a landscape, a river and its tributaries function as a drainage system, carrying off water that has not been absorbed into the landscape's "sponge" of earth and plant life. The riparian ecology of a river is a final strategy of that "sponge" to retain water for the landscape.

Irrigation is the act of moving that draining water back onto the land for another shot at nurturing plant life. Most of the water in the Gunnison River - or any western river - gets diverted out of the streams and onto the land more than once, with some of the diversion - usually around 50 percent with open furrow or flood irrigation - eventually filtering out of the "sponge" and back into the river, to be moved out onto the land again further downstream for another irrigation project.

Irrigated agriculture - more than 90 percent of the Basin's consumptive water use - has led to more organizations than any other uses, and is the place to start this overview. The creation of the Bureau of Reclamation in 1902, and the commencement of the national reclamation program with federal funding, is a convenient divide: prior to 1902, irrigation organizations were all basically homegrow and grassroots - farmers figuring it out and generating their own solutions; after 1902, new local organizations were usually formed in a kind of partnership with the Bureau of Reclamation.

Joint Ditch: This is the most straightforward and simple organization for irrigating land; it is a group of farmers or ranchers who are neighbors, usually on a floodplain adjacent to the river, running their personal laterals from a single headgate and a common ditch they have dug around the upslope side of their irrigable lands. That "mother ditch" is just enlarged as newcomers join on, rather than all of them taking their water directly from the stream (which would usually require buying right-of-way for a ditch across another farmer's field). Beyond an agreement to all participate in cleaning the ditch annually, maintaining the headgate, and other essential work, there is little or no formal structure to the joint ditch.

The **Short Ditch**, in the floodplain south of the North Fork of the Gunnison and southwest of Paonia, came into being as a joint ditch; when the ditch received its decree in 1889, it was carrying water to 21 different farmers, all of whom were listed individually by name in the decree. That is probably a large number for a joint ditch; more frequently it is probably fewer than five. *(continued on next page)*

'Grassroots' Water Organizations: Local Ditch Companies *- continued from previous page*

Mutual ditch company: This is a more formal organization of the users of an irrigation system, with written bylaws and a board of directors. The company thus created is the decreed owner of the right to use water, and the members of the company buy shares of that decree. Such companies usually incorporate as non-profits to limit members' liability.

This level of organization became essential once the floodplains were developed and the local irrigation effort moved up onto the less easily watered finger mesas and benches bordering the valley. Such projects often required long upstream gravity-flow canals, siphons and other more complex and expensive infrastructure.

More complete histories of the specific projects summarized in these pages will be posted on the Colorado Mesa University Water Center website: www.coloradomesa.edu/watercenter/

While some level of financial investment was necessary, many mutual ditch companies allowed - of necessity - for "sweat equity" investments by members, who would work on the irrigation system for some or all of their shares and annual assessments. Pay for such work pre-1900 was usually a dollar a day for a man, $2.50 for a man with a horse or mule team.

The **Fire Mountain Canal and Reservoir Company** is a classic example of a mutual ditch company - with a lot of sweat equity investment. Fruit growers on Rogers Mesa, just west of Hotchkiss in the North Fork valley, needed more water than local ditches could squeeze out of Leroux Creek on the southwest slope of Fire Mountain. So in the fall of 1896, after crops were in, they took camping and cooking gear 25 miles up the North Fork River, above Somerset, and began digging the 30-mile Fire Mountain Canal along the side of the mountain. They worked fall and early winter for five years to complete the canal.

Even then, they were short of water in the late summer when ripening fruit most needs it, so they began going up into the headwaters every fall in search of small lakes, beaver ponds, or dammable swales for affordable reservoir storage. Eventually the Bureau of Reclamation came to their rescue with the Paonia Reservoir. The Fire Mountain C&R Company continues to operate today.

Carrier ditch company: This is a company or corporation created by investors working with farmers to capitalize basic irrigation infrastructure, then selling or leasing the water to the farmers with the hope of eventually getting a return on the investment. It flirts with speculation - illegal under Colorado water law - but such companies usually formed to supply supplemental water for existing systems where farmers were struggling with limited local streamflows.

The Gunnison Basin had two carrier companies that may have been the most creative projects ever in the Basin, although neither of them ever turned a profit for their creators. First was the **Redlands Water and Power Company**, taking 670 cfs from the river just a few miles above its confluence with the Colorado River with a very senior 1905 decree. Only about a tenth of that was actually used for irrigation, however; the rest was used to generate electricity to pump the irrigation water up to the mesas south of the rivers, above Grand Junction, serving farmers already there and opening up new land. But as seemed to be the case with all water projects, the costs were much higher than estimated, and revenues from land sales and irrigation shares were considerably lower. Eventually, the farmers using the water took over the failing company, and turned it into a mutual ditch company with the same name. The land served has been mostly "suburbanized," but the company continues to produce electricity for the grid.

The other creative carrier company was the **Fruitland Mesa Company** high in the Smith Fork valley. A Gould family, looking for a place to invest earnings from a store in Aspen, decided to provide supplemental water to Fruitland Mesa, between the Smith Fork and Gunnison Canyons, from Crystal Creek, a Gunnison River tributary. Their complex project involved a small storage reservoir, two tunnels, two long wooden-pipe siphons, and 20 miles of ditch. Their dam was built with a unique application of the principles of hydraulic mining: they essentially washed the rocks and dirt of a hillside down into Iron Canyon to create a 45-foot dam that is still in place today. The project took four years to build, and a lot more money than the Goulds had expected. Then farmers trying to grow fruit on Fruitland Mesa found that the difference in elevation from the North Fork valley below increased the risk of frost and delayed fruit ripening enough to make it uncompetitive, so the Goulds never made a profit, and eventually that company too became a mutual ditch company owned by the users.

These private-capital ventures were replicated all over the West - the Grand Valley in the Colorado River Basin had some even larger ownership problems. Such ventures led to the conclusion that only the federal government could do the large projects - which led to another set of water organizations....

The Ditch and Reservoir Company Alliance (DARCA)

Colorado irrigators find common cause through the statewide Ditch and Reservoir Company Alliance (DARCA), a advocacy membership organization for the benefit of all types of irrigation enterprises - ditch companies, reservoir companies, laterals, private ditches, and irrigation districts. Membership in DARCA is also open to interested individuals, professionals and government or corporate organizations.

DARCA's stated mission is "to become the definitive resource for networking, education and advocacy" for members. Featured benefits include updated and useful information for the water community through the web site and by email correspondence, an annual convention, specialty workshops, and password access to the "good stuff" on the DARCA web site, **www.darca.org**.

'Grassroots' Water Organizations: Early Coordination with the Bureau *-continued from previous page*

By the turn of the century, the search for supplemental water was taking irrigators ever farther from their home fields; projects were getting more complicated and expensive. The creation of the Bureau of Reclamation in 1902 gave the farmers a source of both engineering expertese and funding - but it was no free lunch; all or most of the Bureau project costs had to be repaid to the government, although low interest rates did constitute a subsidy.

Taylor Dam, built by the Bureau of Reclamation for the Uncompahgre Valley Water Users Association, nearing completion in 1937, beginning to fill while the last of the earthfill and rock facing is put in place. The Continental Divide is in the background.
- Photo from Western State Colorado University Library

Water User Associations

To build big regional projects like the Gunnison Tunnel, the project developers had to increase their fund-raising capacity, and a way to do that was to incorporate *all* the potential water users in their project area, rather than just those who wanted to actively participate (as in a mutual ditch company). The Reclamation Act required that ***water user associations*** be legally created to work with the Bureau before funding or work could commence. This was facilitated by the Colorado General Assembly in 1902, enabling the creation of quasi-municipal organizations with power to levy assessments on all water users who stood to benefit from the project.

Colorado's first WUA was the **Uncompahgre Valley Water Users Association,** created in 1903 to work with the Bureau on completing the Gunnison Tunnel Project; it is still active today. In addition to constructing the tunnel itself, the Project involved the purchase of the existing unintegrated canals, ditches and diversion dams in the Uncompahgre Valley, and their reorganization and reconstruction for more efficient and effective delivery. That part of the project cost $6.8 million (1900 dollars), which has been paid off. But Taylor Dam cost another $2 million in the 1930s; there have been substantial tunnel repair costs over the years; and today major sections of the project are being piped to reduce selenium deposition in the river from the Mancos Shale in the valley soil, so debt persists.

Irrigation Districts

In 1905 the state legislature passed the Irrigation District Law, which permitted project organizers to set up Irrigation Districts, if approved by county commissioners in affected counties; these districts could levy assessments on *all irrigable lands* within the district, whether yet developed or not. This created a larger "assessment umbrella," and was used for some Bureau projects as well as private carrier ditch projects.

Only one irrigation district still operates in the Gunnison Basin: the **Orchard City Irrigation District**. This was created in the late 1930s, following the collapse in 1937 of a rickety Fruitgrowers Dam built in 1898 and raised several times by a mutual ditch company, to store Surface and Dry Creek water off-stream on Alfalfa Run near Eckert, on the sunny slopes of Grand Mesa. The Bureau of Reclamation agreed to replace the dam, and the Orchard City ID was created to assess all those in sprawling Orchard City (then as now, more orchard than city) to repay the project.

Because it was a small project, but vital to fruitgrowers in the Orchard City area, the Bureau made it a priority; a new 55-foot dam was built with WPA labor rather than contracted out, and was collecting water for delivery by the summer of 1939. The total cost of the dam was $149,500, but it has subsequently had some expensive repairs, and has developed serious water quality problems due to stressed upstream sewer systems.

Water Conservation and Conservancy Districts

As projects continued to grow in scale and complexity, it becamse evident that the direct beneficiaries of the projects could not handle the repayment schemes themselves. This was the case in the 1930s, when the Bureau and the people of the South Platte Basin on the East Slope began serious planning for the massive Colorado-Big Thompson Project (C-BT) to take Colorado River water to South Platte irrigators.

The only way to pay for projects on that scale was through organizations that had general taxing capability within the entire district receiving the water. So in 1937 - the same year that Congress first funded the C-BT - Colo-

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'Grassroots' Water Organizations: Water Conservancy Districts

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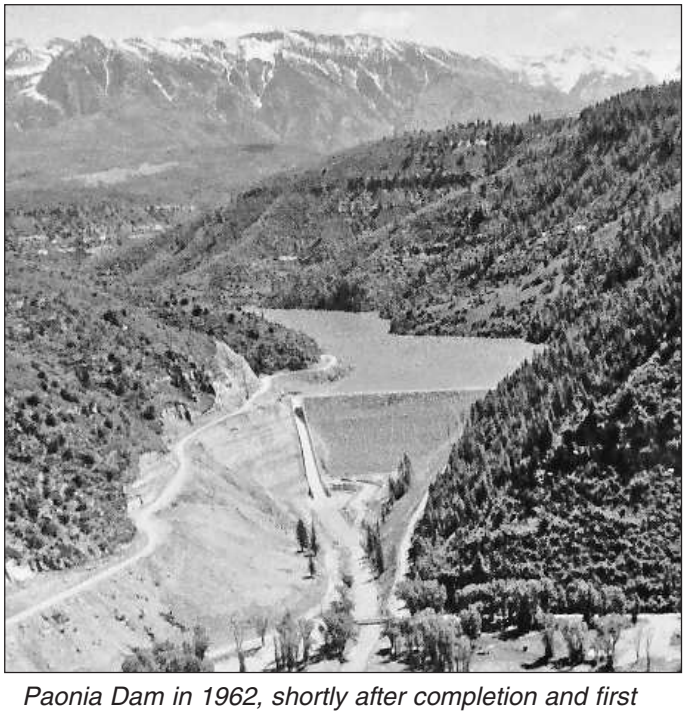
rado's General Assembly passed a Water Conservancy District Act, permitting the creation of quasi-municipal organizations that could levy a property tax on everyone within the district so long as a majority of those affected - non-irrigators as well as irrigators - voted for the creation of the district. The **Northern Colorado Water Conservancy District** in the South Platte Basin was the first "WCD" so created.

Shortly after passing the WCD Act, the General Assembly created the **Colorado River Water Conservation District**, also with general taxing power. The "River District" (as the organization is now known) encompasses the Gunnison, Upper Colorado, White and Yampa River Basins; it was created to oversee the development of Colorado's share of the Colorado River under the compacts and laws dividing the River's water among the states *(See p. 29)*, to make sure that obligations to other states were met, and to make sure that western Colorado got its share of Colorado's water. (Three other Colorado basins have similar districts now: Rio Grande, Republican and San Juan/Dolores basins.)

In following through on the task of helping western Coloradans develop a fair share of West Slope water, the River District assumed responsibility for encouraging, nudging, pushing and nagging local water users to form conservancy districts for projects they would need Bureau assistance in building. These are the Gunnison Basin WCDs that the River District helped bring into being:

North Fork Water Conservancy District: The North Fork WCD was created in 1941, to work with the Bureau (in Washington as well as at home) to bring the Paonia Dam project into the construction phase. The project had made it through the Bureau's reconnaissance and feasibility studies in the late 1930s, and had twice gone to Congress for project funding. But there were cost-benefit analysis problems, and it wasn't until the Colorado River Storage Project Act was passed in 1956 *(see p. 1_)* that it made the cut; it was the first Colorado CRSP project funded, in 1959, and the first completed, in 1962.



Paonia Dam in 1962, shortly after completion and first filling. The road along the reservoir was as hard to construct as the dam itself - Photo from Dixie Luke

Crawford Water Conservancy District: The "Smith Fork Project" was originally considered to be part of the Paonia Dam Project, until after the war; the Crawford WCD was formed in the mid-1950s as discussion of the Colorado River Storage Project began to pick up steam. Once CRSP power revenues were subsidizing project construction, the Smith Fork Project - Crawford Dam and some mesa canals - became feasible.

The Smith Fork Project was authorized in 1960, and bid on by the Paonia Dam contractor, at some savings to the Bureau, but it was still a $4.4 million job, completed in 1963. Crawford lore holds that all the rock for the dam was blasted from the cliffs near town in a single blast that rattled windows and allegedly broke a few.

Upper Gunnison River Water Conservancy District: The people of the Upper Gunnison River watersheds gave the Bureau a hard time over their original plan for the "Cure-canti Unit of CRSP, which was supposed to be one of the four large-storage reservoirs with big power plants. The Bureau wanted a 2.5 maf reservoir that would have backed water up almost to the Gunnison city limits; the people of Gunnison opposed that vigorously, and ultimately successfully. The reservoir was reduced to just under 1 maf, but the people still resented the flooding of world-class trout streams. By way of amends, the Bureau sketched plans for an Upper Gunnison River Project with several small high altitude reservoirs and expansion of agricultural land. The Upper Gunnison River WCD was created in 1959 to work toward that project.

The Upper Gunnison Project, however, was one of a number of CRSP projects that never got built, as urban-industrial America lost interest in reclamation programs. But the Upper Gunnison, by default, received benefit of a project, when the Bureau, the Upper Gunnison WCD and the Uncompahgre Valley WUA agreed to begin storing the latter's Taylor Reservoir water in Blue Mesa Reser-voir, a day closer to the fields. This meant the Taylor River below the dam could be "managed like a river again," rather than an irrigation canal. Annually a "Local Users Group" of irrigators, whitewater and flatwater recreation users, fishermen and local property owners set the schedule for Taylor releases to Blue Mesa that best serve all parties' interests. The Upper Gunnison WCD has also filed on second-fill rights for Taylor Reservoir.

Tri-County Water Conservancy District: The county commissioners of Ouray, Montrose and Delta Counties organized the Tri-County WCD in 1957 to advocate for a storage project in the Upper Uncompahgre Valley. Originally, this

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'Grassroots' Water Organizations: Municipal, Industrial and Domestic

Most of the municipal/domestic and industrial water used in the Gunnison Basin is either supplied by municipal utilities, or by special districts created for specific public infrastructure. Special districts are quasi-municipal organizations that are created through publication of a "Service Plan," followed by a vote of those who will live within the district. *(See the list of municipalities and special districts that provide water and/or sanitation services on p. 14.)*

Project 7 Water Authority

In the mid-1970s, facing rapid growth, seven communities in the Uncompahgre Valley all approached the Farm Home Administration more or less simultaneously, for loans to upgrade their water systems. The seven were the cities of Montrose and Delta, the towns of Olathe and Ridgway, Tri-County WCD (serving rural domestic users), and the Menoken and Chipeta Water Districts.

The FmHA told them it would only consider one project from the valley, so the idea of the Project 7 Water Authority was born - one entity treating and distributing water for all of them. Ridgway - a little too far up the valley - dropped out, but the Uncompahgre Valley WUA came on board, to supply water to the organization from the Gunnison Tunnel. The Project 7 Water Authority was created in 1977, acquired land on the east side of the valley for its treatment facility, and today is treating and distributing an average of 5 million gallons per day in the winter and 15 mgd in the summer - but with a developed capacity of 27 mgd.

The biggest problem Project 7 faces today is is dependence on the Gunnison Tunnel, now more than a century old; the 30-day reserve supply would not outlast a serious problem in the tunnel. Project 7 and the UVUWUA are exploring the possibility of a 10,000 af reservoir in the valley, which (when full) would give them close to one year supply.

Water Conservancy Districts

(continued from previous page)

was conceived as a second source of late-summer water for the irrigators in the Lower Uncompahgre, in addition to water from Taylor Reservoir and the Gunnison Tunnel; but before the Bureau got around to the project, it was also needed for domestic and M&I water in the growing cities of Montrose and Delta and the suburban developments around them.

The Bureau of Reclamation did not get to their "Dallas Creek Project" until after passage of the National Environmental Policy Act, thus necessitating an Environmental Impact Statement. That was finally done in 1976, and construction on the Ridgway Dam began in 1979 - a larger project than it might appear, given the amount of alluvium in the valley. The dam was completed in 1987 - the Bureau's last big project in the Gunnison Basin.

Tri-County WCD had already begun supplying domestic water, and now services 6,800 taps with more than 600 miles of pipe in the Lower Uncompahgre, in conjunction with the Project 7 Water Authority *(see on this page).*

Grand Mesa Water Conservancy District: The sunny south slopes of Grand Mesa are a fruitgrowers paradise - if there is enough water, and as usual, there was not, for the number of people who wanted to farm there.

The top of Grand Mesa has many small lakes; most of them were enlarged and gated for irrigation releases to the north or south slopes, but that still left the usual need for late season water.

In 1954, a private company, the **Grand Mesa Water Users Association,** was organized to managed the lakes whose water flowed to the south slopes. (This was not a WUA like the Uncompahgre Valley WUA, organized to work with the Bureau of Reclamation.)

Shortly after that, the Colorado River Storage Project Act passed (1956), and with the Collbran Project underway on the north side of the Mesa, south slope farmers envisioned a similar project for the south side. In 1961 they organized the **Grand Mesa Water Conservancy District**, a project that would have significantly enlarged some of the lakes up on top, and created a more coordinated release system for the water.

Like the Upper Gunnison River Project, this was another idea that did not get in the queue before funding ceased for new water projects. Today both the Grand Mesa WUA and the Grand Mesa WCD coexist cooperatively, with the former managing the lakes on top, and the WCD more engaged with the somewhat bewildering system of ditches and streams around the south and southwest sides of Grand Mesa.

Bostwick Park Water Conservancy District: Bostwick Park is a small agricultural community in a small valley east of Montrose, accessible from the Black Canyon Road.

The Bureau expressed interest in a project to deliver water from the Cimarron River valley between Cerro Summit and Blue Mesa, and in 1961 the Bostwick Park water users, as well as some in the Cimarron valley and surrounding mesas, organized the Bostwick Park WCD.

The Bureau's project included the 13,500 af Silver Jack Reservoir high in the Cimarron valley, and a high-line canal that provided some water for the Cimarron valley, but carried most of over the watershed divide into Bostwick Park (the big pipe that crosses Highway 50 on Cerro Summit).

Construction began in 1966, but both the dam and the canal were plagued with landslides, and the 173-foot dam was not completed until 1971 when the first irrigation water was delivered; the 23-mile canal to the existing Bostwick Park ditch systems was not fully completed and working until 1976.

'Grassroots' Water Organizations: Environmental Groups in the Basin

The "environmental revolution" of the 1960s and 70s gave rise to a number of local and regional organizations throughout the "headwaters counties" of Colorado, including the Upper Gunnison River Basin; environmentally oriented organizations filtered down through the rest of the basins in the late 1970s and 80s. These organization tended in their early years to be protagonistic and often extreme in speaking for the environment, but over the subsequent decades they have earned a legitimate and important place at the table. The organizations briefly described below do not include national organizations that have some local presence, like Trout Unlimited or the Sierra Club; these are all "homegrown":

High Country Citizens Alliance (HCCA) began in Crested Butte in 1977, in opposition to a major mine development near the town; it has since broadened its scope "to champion the protection, conservation and preservation of the natural ecosystems within the Upper Gunnison River Basin."

Water has been a special emphasis of HCCA's, led until recently by Water Director Steve Glazer - also on the board of the Upper Gunnison WCD and a former Environmental Representative on the Gunnison Basin Roundtable. He oversaw the production of the booklet, "Gunnison B asin Blueprint," a roadmap for the basin's future. This is available on the HCCA website: www.hccaonline.org.

Ridgway-Ouray Community Council (ROCC) came into being in 1993 and makes restoring and protecting water quality in the Uncompahgre River Valley a priority, and work with other citizen groups toward that end. More information is available on their website: http://www.roccnet.org/Home/tabid/36/Default.aspx.

Uncompahgre Valley Association (UVA) organized in 1983, in part around air and water issues associated with a Louisiana-Pacific waferboard plant between Montrose and Delta, and at this point is mostly focusing on community sustainability issues. The UVA website: http://wccongress.org/wcc/uncompahgre-valley-association/.

Western Colorado Congress (WCC) is an "umbrella" organization for five West Slope environmental groups, including ROCC and UVA. WCC was created in 1980 to coordinate efforts among the concerned citizens of western Colorado. Its best work has probably been in sustainable community development. It is based in Grand Junction, where an adjunct **Western Colorado Congress of Mesa County** has also formed. Website: http://wccongress.org/wcc/.

Other environmental organizations have arisen around proposed developments in mining, water projects or real estate; some disappear, but more often they tend to seque into other organizations - like those below....

'Grassroots' Water Organizations: Watershed Groups

-by Anthony Poponi

"Watershed groups" are a relatively new type of water organization in western river basins, consciously seeking to avoid contention and blame and working instead to develop collaborative stakeholder groups to address local watershed quality and quantity challenges.

Instead of working on discrete stretches with political boundaries, today's "watershed groups" work on whole natural tributaries of a larger stream such as the Gunnison River - some even focusing on "tributaries of tributaries" where there has been intensive hard use of the water over time.

Today, five watershed groups are working within the Gunnison River Basin, each with myriad issues, some common among the groups, some unique. Some efforts are government driven; others are citizen-initiated. Projects are often supported by grants, but they also depend on support from their communities. These are Gunnison Basin watershed groups:

The Coal Creek Watershed Coalition was formed in 2003 to address impaired water quality caused primarily by historic mining in the creek that flows from Kebler Pass through Crested Butte providing that town's water supply. The Coalition of local environmentalists, schoolteachers, recreational users, and general townfolk began by developing a watershed plan, which prioritized water monitoring, reclaiming abandoned mines, reducing road contaminants like magnesium chloride, and restoring riparian and wetland habitats. The Coalition's water quality monitoring program provides data to determine the effectiveness of projects - data now used by the Colorado Water Quality Control Division to establish water quality standards for Coal Creek. The Coali-tion worked with the federal government to get a Superfund project addressing leakage from the old Standard Mine above the town. Outreach is a major focus of the organization and takes many forms such as workshops, programs for children, and outdoor events like bike tours and scavenger hunts. For more information: www.coalcreek.org.

The Lake Fork Valley Conservancy has practiced stewardship along the Lake Fork in Hinsdale County for over a decade, combining two Lake Fork groups dealing with historic mining impacts. The Conservancy works to sustain the environmental and rural character of the valley through education, restoration, and stewardship. Mining drove the development of the upper Lake Fork, but as mining faded into the past, abandoned mines continued to affect water quality in the present. The Conservancy is reducing the impact of several mines along Henson Creek; and enhancing three miles of the Lake Fork and Henson Creek to improve bank stability, fish habitat, boating, and public access. The Conservancy also works to

(continued on next page)

Looking at the San Juans from Silver Jack Reservoir (Bostwick Park Project) - Photo by Luke Reschke

Watershed Groups *- continued from previous page*

conserve lands through easements and donations, and public education. For more info: www.lfvc.org.

The Selenium Task Force is one of the few watershed groups with a narrow focus on one water contaminant, selenium. Selenium is a trace element found naturally in the environment, and is common in marine sediments like the Mancos shale that is ubiquitous in the Uncompahgre and Lower Gunnison basins; water dissolves it out of the shale. Elevated levels of selenium cause reproductive failures and deformities in fish and aquatic birds. Poisoning in humans would only occur if a person were consuming selenium-contaminated fish daily. Several tributaries in the Uncompahgre and Gunnison basins are not currently meeting the water quality standard for selenium, so the Task Fork - made up of 20 local, state and federal entities - works to address selenium contamination by improving irrigation efficiency, lining ponds and canals, and piping irrigation ditches to reduce the amount of water infiltrating the Mancos shale, while still nur-turing the agricultural heritage of the valley. For more information: www.seleniumtaskforce.org.

The Uncompahgre Watershed Partnership (UWP) was created in 2007 to enhance understanding of watershed resources, to protect and restore sensitive areas, and to build an in-formed and engaged citizenry on watershed issues through coordinated community and agency efforts. The UWP is currently working primarily in the Upper Uncompahgre Watershed, on reducing heavy metal and sediment loading, reclaiming abandoned mines, restoring riparian buffers and streambanks, enhancing recreation opportunities and hazards education, and conducting watershed outreach and education through mine tours, stakeholder meetings, and educational volunteer events, often for the youth in the Uncompahgre communities. For more information visit: http://www.uncompahgrewatershed.org.

The Conservation Center, based in Paonia on the North Fork of the Gunnison River, was formed when the **North Fork River Improvement Association** (NFRIA)- the West Slope's first watershed group - merged with the **Western Slope Environ-mental Resource Council** (WSERC) in 2010. Natural gas de-velopment has increased in their watershed in recent years and the Conservation Center works to engages industry, agencies and the locally community to discuss how and where to allow extraction of gas without compromising the equally important considerations of human health, clean water, wildlife and recreation. Though natural gas extraction has become a focal point for the Conservation Center in recent years, they also work to develop responsible coal extraction, improve protection and access to public lands for multiple uses, monitor water quality, restore rivers, expand recycling and maintain communication with the public via numerous events, meetings and festivals. For more information: http://www.theconservationcenter.org.

The Colorado Watershed Assembly provides programs and networking for ~80 watershed groups in the state. The Assembly hosts an annual “Sustain Colorado’s Watersheds” conference, oversees the River Watch program to train water-monitoring volunteers, advocates for the Healthy Rivers Fund check-off on the Colorado tax form, and helps the groups identify funding sources. For more information (including how to start a watershed group): www.coloradowater.org.

Anthony Poponi is the former director of the Coal Creek Watershed Coalition.

Back to the Future: What do we need to be thinking/worrying/acting on?

Most of this Gunnison River Basin Handbook has been, to this point, an inventory and some analysis on what we have now in our Basin, and how we got here. We also let you know at the very beginning that the Gunnison Basin Roundtable prepared this Handbook because the Governor of Colorado wants the state to have a Water Plan in place next year, to address the challenge of "The Gap" between our known water supplies and the anticipated new demand by mid-century. This will affect us in all Colorado basins eventually.

Now it is time to look to some of the concerns and issues we will all be invited to respond to over the coming months and years - concerns and issues that need to be covered in the Water Plan, and that the Roundtable will want your input on. These are some questions we can anticipate :

~Is our Basin water threatened by the metro-region gap? What can we do?

~What is happening in the larger Colorado River Basin (and how will it affect us)?

~Is climate change going to be a factor in the future water supply?

~How are we doing on water quality? How will heavier usage affect that?

Can 'They' come get 'Our' Water?

"They" of course are the big water providers in the Front Range metropolitan area, who have been looking longingly at Gunnison Basin water resources since the 1930s. And it is important to remember that, constitutionally, all the unappropriated water water in the *state* belongs to *all the people of the state*, and the state Supreme Court has denied any basin's legal right to "our water."

That noted, however, it is increasingly unlikely that a major transmountain diversion from the Gunnison Basin will be part of the state's Water Plan. The most recent transmountain attempt was the Union Park Project plan, to move water accumulated from most of the Gunnison Basin headwaters streams to urban developments south of Denver; it took more than a decade, millions of dollars and two trips to the Colorado Supreme Court, but that showed conclusively that there is not enough unappropriated water in the Basin headwaters for a viable transmountain project.

That judgment has since been reinforced by a decade of drought, a federal water right for the Black Canyon National Park, and a "reoperation" plan for the Aspinall Unit dams to provide water for endangered fish species in the Lower Gunnison Basin - all on top of existing irrigation and power rights throughout the Basin. All together these pretty well assure that there is not enough water anywhere in the Basin for major water movements out of basin.

We can anticipate, however, that the waters of the Gunnison Basin will play a role in the Colorado Water Plan. That plan has to take into account Colorado's obligation (shared with Utah, Wyoming and New Mexico) to not deplete Colorado River flows to the Lower Colorado River Basin states below 75 million acre-feet over any 10-year period. This means that water moved out of the Colorado River Basin to any other basin will have an impact on the future options available to us in the Gunnison Basin since we will have to pick up more of that obligation.

Many of the major transmountain diversions (which are primarily in the Upper Colorado Basin) are junior in priority to most of the irrigation water rights on the West Slope; but if Colorado ever does have to cut some uses in order to meet Lower Colorado Basin obligations, junior water to the Front Range cities will not be cut off so senior irrigators can keep growing hay on the West Slope. Constitutionally, domestic uses take precedence over agricultural uses in serious shortfalls, with appropriate compensation or mitigation for the irrigators curtailed.

There is already discussion between the East and West Slopes about creation of a "water bank" in Blue Mesa Reservoir that would store "fat year" agricultural water there for release downstream in the event of a Colorado River Compact administration requiring Upper Basin water for the Lower Basin. As currently sketched out, this would affect irrigators both above and below Blue Mesa, and it will be important for West Slope water user groups to be very proactive as such ideas advance in the planning process.

In any case, any future West to East Slope water diversions will likely be interruptible-supply projects, delivering only in above-average water years - should there be any.

Where do we stand with the rest of the Colorado River Basin?

The article below and the one at the top of the next page are adapted from essays by John McClow, Colorado's Representative on the Upper Colorado River Commission, the Gunnison Basin's Representative on the Colorado Water Conservation Board, and General Counsel for the Upper Gunnison River WCD. Mr. McClow also serves as the legislative representative on the Gunnison Basin Roundtable. The full essays condensed for this Handbook are available on the Gunnison Basin site at www.coloradomesa.edu/watercenter. Mr. McClow also has some more in-depth writings on these topics, water law, and some Gunnison Basin history on the Upper Gunnison River WCD website at www.ugrwcd.org.

Colorado River Basin Water Supply and Demand, Present and Future projected....

Summary of the 2012 Bureau of Reclamation Study of Colorado River Basin water supply and demand

In December, 2012, the Bureau of Reclamation, in collaboration with the seven Colorado River Basin states and other significant stakeholders, completed the "Colorado River Basin Water Supply and Demand Study". The two-year, $2 million study is a 1,500 page tome that analyzes water supply and demand imbalances through 2060 in the Colorado River Basin and those adjacent areas that receive Colorado River water, including an assessment of potential impacts of climate change on both supply and demand.

The Study also analyzes adaptation and mitigation strategies to resolve those imbalances, but provides no decisions as to how future supply and demand imbalances should or will be met. Instead, the study "provides a common technical foundation that frames the range of potential imbalances that may be faced in the future and the range of solutions that may be considered to resolve those imbalances."

The Study recognizes the inherent uncertainty of predicting future water supply and demand; nevertheless projections are necessary to assess the future reliability of the Colorado River to meet the needs of the Basin. A scenario planning process was used to provide a broad range of projections, with four scenarios related to future water supply and six related to demand. Assumptions underlying the supply scenarios range from one assuming the future will resemble the past century, two assuming that the future will be variations on reconstructions of the past 12 centuries of paleohistory, and one assuming that the future will be shaped according to 112 future global climate model projections.

Demand scenarios are projections for a future much like the present, a slow growth scenario, two rapid growth scenarios, and two scenarios reflecting expanded environmental awareness and stewardship in a growing economy.

The result of this process is a range of projected water supply and demand projections under the various scenarios, all of which predict that without action future demand will definitely exceed available supply *(see graph, p. 31).*

Input on options to address that imbalance was solicited from Study participants and the general public. Over 150 options were received, ranging from practical demand reduction ideas to shoot-the-moon supply augmentation ideas like bringing water from the Missouri River.

Recognizing that no single option will be sufficient to resolve the imbalance, four groups of options were then developed as "portfolios" to reflect different sets of strategies. The portfolios represent a range of reasonable but varied approaches for resolving the projected water supply and demand imbalances over the next 50 years.

The Gunnison River Basin (oval on map) is a small part of the Colorado River Basin, but it provides on average a sixth of the river's total water.

The analysis revealed that if all the options in the most inclusive portfolio are implemented as they become available, it is still plausible that the Colorado River system will be vulnerable in the future under certain conditions.

Consequently, "complete elimination of Basin vulnerability is not likely attainable". This result is primarily the result of hydrologic conditions - the predicted warmer, dryer climate. Even so, the portfolios succeed in improving the resiliency of Basin resources.

An Executive Summary as well as the complete Study, including seven Technical Reports, can be accessed at http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/index.html. *(And for the longer version of this essay, go to Colorado Mesa's Gunnison River site described above.)*

The Colorado River Compact: Will the Lower Basin 'call' the river? *-by John McClow (see page 28 top)*

The Colorado River Compact, signed on Nov. 24, 1922, is a compact among the seven Colorado River Basin states and the United States that apportions the use of Colorado River water. The water is apportioned not to the individual states, but to an Upper Basin (Colorado, Wyoming, Utah, New Mexico) and a Lower Basin (Nevada, Arizona, and California), with the dividing line intersecting the river at Lee Ferry, Ariz., a short distance below Glen Canyon Dam.

The Compact allocates to each Basin the "exclusive beneficial consumptive use" of 7.5 million acre-feet per year, with the Compact directing that the Upper Basin states "will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet (maf) for any period of 10 consecutive years." Most of the river's water originates in the Upper Basin (~70 percent from Colorado, ~17 percent from the Gunnison Basin), and that language assures that the Lower Basin will get its 7.5 maf on average, with allowances for good and bad water years. (In addition, the Upper and Lower Basins equally bear the burden of deficiencies to an obligation of 1.5 maf a year promised to Mexico in a 1944 treaty, making the average annual delivery 8.23 maf.)

Because the entire Colorado River Basin is currently experiencing a protracted drought that began in 2000 and has continued into 2013 (despite a very wet 2011), the Compact language directing that the Upper Basin states "will not cause the flow of the river at Lee Ferry to be depleted" below that average of 8.23 maf for downstream obligations is causing concern in the Upper Basin. The emerging body of evidence for a changing climate deepens that concern: this "drought" may actually be "the new normal" for the Colorado River Basin.

How does the Upper Basin accomplish meeting its downstream obligation, given a river whose flows vary between 5 and 20 maf a year? The short answer is storage. Enacted in 1956, the Colorado River Storage Project (CRSP) Act authorized the construction of a series of Upper Basin reservoirs with a total capacity of nearly 30 maf, the largest being Lake Powell behind Glen Canyon Dam, capable of holding 24 maf just above the Lee Ferry division. The Gunnison Basin's CRSP unit is the Aspinall Unit west of Gunnison (~1.1 maf).

If releases from Lake Powell average less than the minimum required over a 10-year period, creating a "Lee Ferry deficit", a strict interpretation of the Compact would result in curtailment of Upper Basin water uses with post-compact water rights, if those uses are responsible for depleting the flows. Such a curtailment has been characterized as a "compact call." The aggregate flow at Lee Ferry for the ten-year period ending September 30, 2012 was still around 91 million acre-feet, but the drought of the past 12 years has caused that rolling total to decline. Currently, storage in Lake Powell is about 14 million acre-feet and Colorado River total system storage is at 57% of capacity. As the worst Colorado River Basin drought in over a century continues, with low inflows and depleted reservoirs, is a “compact call” imminent?

Highly unlikely. In May 2005, the Secretary of the Interior initiated a process to develop strategies to address the drought. Many stakeholders participated, led by representatives of the seven Colorado River Basin states. The result was the adoption of interim guidelines for the operation of Lake Powell and Lake Mead that coordinate operations to minimize shortages in the Lower Basin and avoid the risk of curtailment in the Upper Basin. The Interior Secretary adopted the guidelines, and the seven basin states signed an agreement that facilitates water management practices (shortage sharing, forbearance, conservation) and contains mandatory provisions to deal with future disputes through negotiation before litigation.

This agreement extends until 2026, providing a reasonable assurance that the Upper and Lower Basins can work together to avoid a compact call at least until then. The ultimate objective is to use that time to develop more permanent solutions that forestall a compact call indefinitely. Let's keep our fingers crossed . . . and urge our water leaders to find those permanent solutions.

What is Climate Change going to do to us (and what is it already doing to us)?

Higher average and median temperatures. This is already happening, and has been happening gradually but with some acceleration over the past half century. We can, however, continue to expect some nasty cold spells because....

More extreme weather episodes. The increased heat energy retained in the atmosphere will probably cause more powerful fronts, bigger storms, extended dry or wet spells and temperature extremes. This may be harder to “measure” since the West has always been a land of extremes.

Reduced water supply. Climate models vary wildly in projecting precipitation changes in the future; 70 percent of models say the West Slope will have less precipitation (ranging from 5 to 45 percent less); 30 percent say it will remain roughly the same or even increase a little in some areas. Those changes will not be uniform; there may be variations from the northern to the southern parts of the state, as well as east and west.

Regardless of precipitation changes, however, the Gunnison Basin will have a reduced water supply on average because of the warmer temperatures: snow will melt earlier, with more sublimation, and there will be more evapotranspiration from field and forest. The Bureau’s study projects ~9-10 percent water supply loss by mid-century.

More dust on snow events. This has not been under study long enough to really project for the future, but all of the changes mentioned to this point, occurring not just here but throughout the Southwest, will undoubtedly lead to more dust from the Southwest deserts, speeding the earlier snowmelt.

What can we do? Efforts to reduce carbon emissions enough to reduce some of the climate impacts should still be done. But we will also be adapting to changes already in motion. *How we do this needs to be a public conversation starting sooner rather than later.*

Water Quality in the Gunnison Basin

Water quality is an important factor in all water use - both the quality of the water to be used, and the quality of the water after use. Moving water by its nature picks up and carries along materials as it flows (suspended substances), and water also dissolves elements from that material (dissolved substances). It is virtually impossible to use water - for irrigation, domestic or industrial uses - without adding dissolved or suspended materials, or both, that affect the quality of the water.

Increased use and reuse also affect water quality. The State Supreme Court decided decades ago that "dilution cannot be the solution to pollution" - that is to say: water cannot be decreed for use in decreasing the concentration of suspended or dissolved solids in the water. Pollutant concentrations in excess of standards must be treated to remove (or cease picking up) the excess pollutants.

Following passage of the 1972 Clean Water Act, detailing standards to be enforced by the Environmental Protection Agency, the Colorado legislature created the Colorado Water Quality Control Division of the Department of Public Health and Environment, to maintain or improve water quality in the state's streams in line with federal standards.

Most of the Gunnison River's tributaries have high water quality ratings, especially in the headwaters regions, where most streams have the highest quality rating, for recreational uses in which water might be swallowed. So high is that quality that ranchers in the Upper Gunnison tributaries rejected the highest quality rating, out of concern that it might bring new recreational pressures on their streams!

The exceptions in the headwater valleys are where abandoned mines leak water into watersheds with high levels of heavy metals and other dissolved or suspended pollutants. These are now targeted by watershed groups *(p. 25)*, and some receive federal help as Superfund sites. Solutions range from just preventing mine drainage from entering the stream to very expensive treatment plants.

Lower down in the river, where the water is more heavily used and there is more sedimentary rock, dissolved solids have become problematic. Much of the Basin is underlaid with Mancos Shale, a rich soil when decomposed, as is the case in much of the Uncompahgre Valley, but with high concentrations of heavy metals - notably selenium, a mineral essential to life in small quantities, but destructive in larger doses, and with serious impacts on four listed endangered fish species in the Lower Gunnison.

Selenium leached out of the Mancos soil in the Lower Uncompahgre and Lower Gunnison valleys significantly exceeds federal standards. The Uncompahgre Valley WUA is working with the Bureau of Reclamation and the Colorado River District to address this quality issue by lining or piping irrigation ditches, improving irrigation efficiency, and otherwise minimizing the amount of soil-leaching from agricultural causes. New subdivisions in the Montrose-Delta corridor, on previously undeveloped Mancos soils, present a larger challenge in a growth-oriented area.

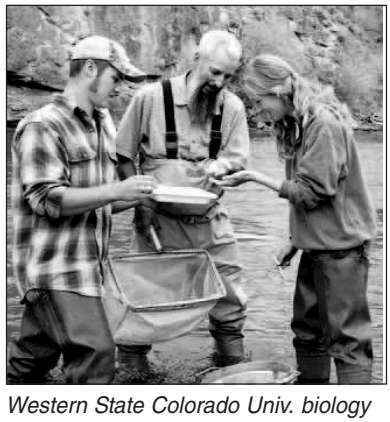
A new water quality challenge is now being ushered in by new measures for water quality - see below....

It's all about bugs: Biocriteria as water quality measure

From a Paper by Kelly Haun, Western State Colorado University

Colorado's water quality watchdog, the Colorado Water Quality Control Division (CWQCD), is in the process of upgrading its standards for water quality, replacing former chemical criteria with a more complex biological criteria.

Formerly the health of Colorado's aquatic ecosystems was evaluated through set Total Maximum Daily Loads (TMDLs) for chemical elements (metals, arsenic, selenium, etc.) in the water. The new "biocriteria" analysis seeks a more holistic look at the indigenous plants, algae, insects, fish, and other organisms that provide more holistic information about the health of specific aquatic ecosystems. The emphasis is on the bottom-dwelling macroinvertibrates - mayflies, stoneflies and other bugs - that are key to the ecosystems, feeding on the plant life and feeding the fish and larger more mobile life.



Western State Colorado Univ. biology professor Kevin Alexander and students "counting bugs." - WSCU Photo

The CWQCD sets its "multimetric" standards for three bioregions: Mountains, Plains and Xeric (desert) - with most of the Gunnison Basin falling into the first and third bioregions. The metrics include specific measures of diversity, composition, functional feeding group representation, and information on tolerance to pollution.

Measuring biocriteria is more difficult than the more straightforward measure of chemicals in water, but it brings the measure of water quality closer to the main goal of the Clean Water Act, "to restore and maintain the chemical, physical and biological integrity of the nation's waters."

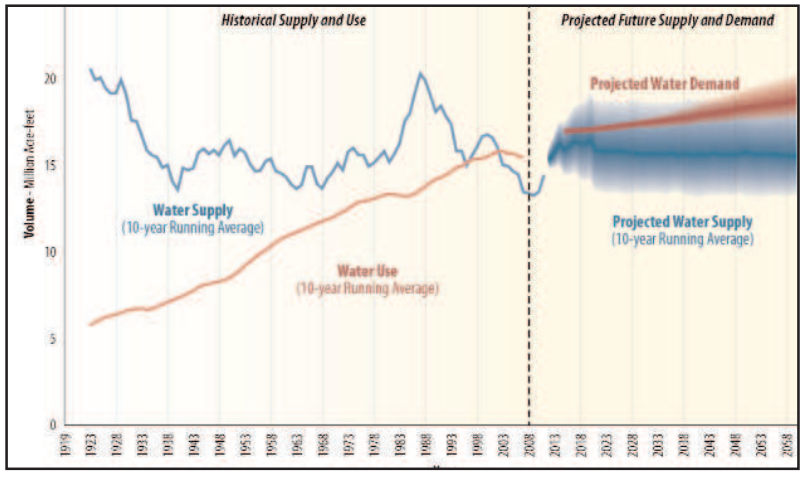
The CWQCD is constantly measuring water quality around the state, and every two years publishes lists of impaired or "gray zone" stream segments requiring some remediation.

Ms. Haun's entire paper is available on the Gunnison Basin site at www.coloradomesa.edu/watercenter.

Summing up the situation....

- George Sibley, Handbook Editor and GB Roundtable Member

After this tour through the natural and cultural background for the water situations we face in the Gunnison River Basin, at the beginning of the 21st century, it is time to return to the dilemma laid out on the first page of this "Handbook": "The Gap" of 200,000-600,000 acre feet of water, between the water needed for the three to five million new people expected to arrive in Colorado by the middle of this century, and the amount of water we'll need to meet those needs. Roughly it's the quantity of water we *don't* see this year in half-full Blue Mesa Reservoir.



And that is just the State of Colorado – one of seven states depending on the water that originates in the high headwaters of the Gunnison River and other Colorado River tributaries. The overall picture is well illustrated in this graph, from the Bureau of Reclamation study described on page 28. The water supply and demand lines have now crossed, and future projections blur off into red and blue smears covering questions that Governor Hickenlooper has charged us all to address through a State Water Plan to 2050. That charge is why the Gunnison Basin Roundtable has prepared this "Handbook".

Realistically, there are three possible ways to reduce the municipal and industrial Gap in Colorado's water future, and that of Basin as a whole: ***conservation, transfers from agricultural water, and new supply projects***. We'll finish off here with a quick look at each of those.

Conservation. Two types of conservation require our consideration. One is the conscious and active conservation when water suppliers ask their users to reduce their water use with more efficient in-home, landscaping, and industrial usage. The other is "upfront demand reduction" (called "passive conservation" for the Statewide Water Supply Initiative): this is taking measures to prevent inefficient or unnecessary water use from even occurring. Requiring efficient appliances and plumbing fixtures in all new construction and remodeling is upfront demand reduction. Land use planning that rewards density and penalizes sprawl would be another.

Questions arise about both types of conservation. People will conserve in emergencies like serious drought, but will they be so willing to cut their use, to make more water available for growth, which means more traffic, bigger crowds everywhere, et cetera? And can regional water suppliers or the state "interfere" in local land use planning by limiting the gallons-per-person-per-day permitted for new construction or remodeling? Will it kill the Front Range economy if the metropolis has to adopt the motto: "It's the desert; live with it"? And for the West Slope – how should a largely non-urban region approach conservation, where most of the water is used agriculturally and recreationally? Most West Slope valleys will have little trouble addressing their comparatively modest M&I gaps, but preserving agricultural uses may be more difficult.

Transfers from Agriculture. The key is to avoid the "buy and dry" syndrome, whereby agricultural land is bought by cities or developers and the water diverted to municipal and industrial uses elsewhere, essentially abandoning the land. Some of this will happen, as retiring ranchers and farmers liquidate for a retirement fund, and there will be "buy and replumb" situations where developers convert a farm to new developments. But the big question is: can programs be developed for fallowing, interruptible supply in emergencies, deficit irrigation, and the like, whereby sufficient water can be freed up for M&I use without taking the land completely out of production? This raises other questions: what should ag-transfer water cost? Who should pay? And ultimately, it raises difficult questions about the relative value of different kinds of agriculture.

New Supply. From a West Slope perspective, this discussion begins with a question: Is there actually any more water in the Upper Colorado River Basins that might be dependably developed, even in dry years ("firm yield"), for the metro region that has to reach beyond its own boundaries for more water? This discussion now revolves around consideration of the ***risk*** that any further major Upper Basin development might impose by causing depletions at Lee Ferry that short the Compact obligation to the Lower Basin *(see p. 29).* West Slope water leaders believe that there may be "big water years" that will sometimes permit new supply for the Front Range, but no annual firm yield that can be depended on. Most Front Range and other East Slope water leaders are equally convinced that there *must* to be enough remaining for at least one more substantial transmountain diversion. Expect this to be debated intensely over the next decade or two.

Probably most of the water absolutely needed to address The Gap will come from a combination of the first two options – demand reduction/conservation, and transfers from agriculture. The latter will most impact the Gunnison Basin if Compact administration requires more water to be sent downstream: Senior West Slope agricultural water will be purchased or leased in order to enable junior transmountain projects to continue delivering *essential* domestic/municipal water supplies to the Front Range. Whatever "essential" means.

In any case, this will be our common challenge for the near future, and the members of the Gunnison Basin Roundtable *(see next page)* hope this Handbook will help you help us meet that challenge.

Members of the Gunnison Basin Roundtable

These are the Basin inhabitants currently serving on the Gunnison Basin Roundtable (2013). One of them lives somewhere near you, and when you have questions or concerns or ideas about water, please contact your representative and discuss it with him or her. It's the only way this system will work....

Thomas Alvey
North Fork Water Conservancy Dist.

Mike Berry
Tri-County Water Conservancy Dist.

Jennifer Bock
Environmental Representative

Rick Brinkman
Mesa County Municipalities

Tim Decker
Montrose County Government

Cary Denison
Ouray County Government

Allen Distel
Bostwick Park Water Conservancy Dis.

Joanne Fagan
Ouray Municipalities

Steve Fletcher
At-Large Member

John Justman
Mesa County Government

Austin Keiser
Grand Mesa Water Conservancy Dis.

Wendell Koontz
Delta County Municipalities

Frank Kugel
At-Large Member

Rachel Kullman
Montrose County Municipalities

Henry LeValley
Crawford Water Conservancy District

Olen Lund
At-Large Member

John McClow
Legislative Appointment

Chuck Mitisek
Redlands Water & Power/Ute Water

Bill Nesbitt
Gunnison County Municipalities

Michelle Pierce, Chair
Hinsdale County Municipality

Mark Roeber
Delta County Government

Hugh Sandburg
Industrial Representative

Neal Schwieterman
Recreational Representative

Ronald Shaver
At-Large Member

Steve Shea
Agricultural Representative

George Sibley
At-Large Member

Steve Snyder
Saguache County Government

Ken Spann
Upper Gunnison River Water Cons. Dist.

Bill Trampe
Colorado Ri verWater Conservation Dist.

Adam Turner
Local Domestic Water Provider (Proj. 7)

Stan Whinnery
Hinsdale County Government

Rufus Wilderson
Gunnison County Government

Non-voting Members and Agency Liaisons

Phil Boawn
U S Army Corps of Engineers

Sharon Dunning
Assistant Recorder

David Graf
Division of Wildlife

Steve Harris
Non-Voting At-Large Member

David Kanzer
Non-Voting At-Large Member

Jedd Sondergard
U S Bureau of Land Management

Bob Hurford
Division of Water Resources

Gary Shellhorn
U S Forest Service

Mike King
Department of Natural Resources

John Stulp, Chair
Interbasin Compact Committee

Jay Skinner
Division of Wildlife

(vacant)
Colorado State Univ. Extension

Ed Warner
U S Bureau of Reclamation

John Harris
City of Montrose Liaison

Jay Winner
Non-Voting At-Large Member

The Gunnison Basin Roundtable meets at 4:00, first Monday of each month (except for January, July and September), usually at the Holiday Inn Express in Montrose. The meetings are open to the public; Basin inhabitants are welcome. Agendas, past minutes and other information are available at: http://cwcb.state.co.us/water-management/ basin-roundtables/Pages/GunnisonBasinRoundtable.aspx

This "Gunnison River Basin Handbook for Inhabitants" was produced by the *Public Education and Outreach Committee of the Gunnison Basin Roundtable*, together with the *Water Center at Colorado Mesa University*. Funding for the Handbook was made possible with public-education grants from the *Walton Family Foundation* and the Colorado Water Conservation Board *Water Supply Reserve Account.* Many members of the Roundtable contributed information and advice for the Handbook; their help is much appreciated.