

Rainwater Harvesting in the Southwestern United States

A policy review of the Four Corners states

A research paper
by
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Abstract

With the passage of the nation's first municipal rainwater harvesting ordinance for commercial projects, Tucson placed itself at the forefront of the national rainwater harvesting movement. The ordinance calls for 50 percent of water used for landscaping on new commercial properties to come from harvested rainwater. Looking forward, the law will require this proportion of water used in landscaping to be increased to 75 percent within three years of the property being legally occupied. The only U.S. law exceeding this scope in required rainwater harvesting is in the U.S. Virgin Islands, where no reliable underground fresh water source is available.

Western states' water law has not always allowed municipalities to be so welcoming to rainwater harvesting. Until 2009 the state of Colorado deemed it illegal to capture rainwater off of one's rooftop, as it infringed on the supply of senior water rights holders downstream. Since then, state law now allows for residences with private well entitlements to harvest rainwater. Many in the state legislature are looking to expand the scope of permitted rainwater harvesting based on recent studies showing that most precipitation never makes it to waterways, thereby challenging the "rooftops are tributaries" assumption that has pervaded Colorado state water law for the last century.

The state of Colorado was not alone in its banning of rainwater harvesting. Utah and Washington State had similar laws as of 2009. "Prior appropriation" has dominated western water law since the 19th century, but each state adhering to the doctrine takes a unique approach to water rights concerning precipitation. With the realities of prolonged drought, growing population pressures, and the unpredictability of climate change, the 21st century presents a gamut of water shortage issues for southwestern states in particular. It is not a surprise then that many southwestern states have shown a willingness to review current rainwater harvesting policies.

This paper reviews past and current water law and resultant rainwater harvesting policies in the Four Corners states: Arizona, Colorado, New Mexico, and Utah. State and local municipal policies, along with their legal foundations, are compared and contrasted with the intent of identifying a trend concerning this issue in the southwestern United States. Policy recommendations for the furthering of, or adoption of, rainwater harvesting policies are made based on this analysis. A background of rainwater harvesting is provided including a look at different techniques, the benefits and costs, and a brief history.

I. Introduction

A simple and effective way to increase usable water supply and to decrease demand on ever stressed freshwater resources is rainwater harvesting. For millennia, civilizations have recognized and reaped the benefits of harvesting rainwater. Any region that receives precipitation is a candidate to benefit from rainwater harvesting. Even a 2,000 square foot rooftop in the Mojave desert that receives five inches of rain annually experiences over 6,000 gallons of runoff (NM OSE, 2005). This can account for over five percent of average household water needs and nearly 15 percent of outdoor water needs (Rotstein, 2009). This research paper will look at rainwater harvesting in the Four Corners states – Arizona, Colorado, New Mexico and Utah – all of which receive (on average) at least ten inches of precipitation annually.

The entire water scarce western US would benefit from rainwater harvesting. A number of states have embraced rainwater harvesting as a serious water conservation practice and an augmentation to domestic water supply. Multiple municipalities, such as Tucson and Santa Fe County, have incorporated rainwater harvesting into their land use codes. Despite the potential benefits of promoting, or simply permitting, rainwater harvesting, there are a few states that have historically banned the practice. The concern of these states is that rainwater harvesting will impinge upon the rights of senior water right holders. To fully understand this concern, and why it is not expressed to the degree of a ban in other western states, an overview of western water law is necessary and subsequently provided. To further elucidate the varied approaches to rainwater harvesting policy amongst western states, this paper will then focus on water law particular to four states: Colorado, Arizona, Utah and New Mexico. Finally, a summary comparison of the four states' policies and their effectiveness will be provided, followed by recommendations for the furthering of, or adoption of, rainwater harvesting policies.

II. Background

Rainwater harvesting is the diversion or collection of precipitation in order to utilize it for some desired purpose. The vast spectrum of what constitutes rainwater harvesting encompasses structures as simple as a rain barrel, to structures large enough for underground boat tours, and even structure-less systems such as diverting rainwater to a vegetable garden (Perino, 2010).

Generally, rainwater harvesting techniques are segregated into two categories, passive systems and active systems. Passive systems use no moving parts and generally use earthworks and landscape modifications for rainwater diversion to a desired location. Essentially, passive systems store water in the soil rather than a containment structure (Perino, 2010). Some examples of passive systems are curb cuts, rain gardens, and permeable pavements.

Active rainwater harvesting systems use containment structures to store rainwater for use at a later time. Such uses might range from irrigation of a lawn, crops or garden, to potable water uses in the household. Active systems can have intricate piping, pumping, and filtering systems, and are generally much more expensive than passive systems. Common examples of active systems are rain barrels, underground storage tanks, and large above ground storage cisterns.

Rainwater harvesting has been utilized for millennia as a means to procure freshwater for human use. Ancient Romans constructed underground rainwater reservoirs in present day Turkey that are large enough for boat tours (Hasse, 1989). Many individual Roman residences had smaller cisterns to augment water supply from the aqueduct system. These Roman systems were influenced by the rainwater harvesting infrastructure observed at the Palace of Knossos, among other ancient Minoan locations on the island of Crete, dating back to 1700 BC. Predating even the Minoans' impressive undertakings, farmers in Gujarat, India in the third millennium BC impounded rainwater and used it for irrigation (International Hydrological Programme, 2000).

Rain barrels were once a common sight for agriculturalists as well as townsfolk. In the western world of the early 20th century, rainwater harvesting suddenly became the exception rather than the norm. The trend of urbanization and subsequent centralized water infrastructure led to the near disappearance of basic rainwater harvesting techniques from densely populated areas. The advent of powerful mechanized pumps, improved well drilling technology, and large-scale water works projects led to the near disappearance of these techniques in pastoral settings (Humphries, 2003).

Rainwater harvesting has experienced a resurgence of popularity in recent decades, especially in water scarce regions. Parts of Australia and the southwestern United states have embraced rainwater harvesting as a serious way to augment sparse and irregular water supplies (Lancaster, 2010). It is no coincidence that the rapid adoption of water conservation technologies in the southwestern United States comes during an era marked by prolonged drought and explosive population growth. The prospect of global climate change rendering arid regions more rain deprived has also contributed to the growing interest in water conservation.

Aside from the recognition of water scarcity and climate uncertainty, there are numerous other reasons for rainwater harvesting's renewed attractiveness. Individuals that have a preference for soft water but live in a region of only hard water wells or domestic supply can harvest rainwater and filter it for household use (Lancaster, 2010). Rainwater is naturally distilled and contains only the additions it picks up through atmospheric and rooftop exposure. Advanced filtration systems easily bring harvested rainwater up to or in exceedance of potable water standards. Individuals that prefer to live wholly or partially independent of centralized infrastructure, either for cost aversion or out of principal can also use rainwater harvesting to augment their water supply. At the municipal level, cities and counties can promote rainwater harvesting to decrease stormwater runoff and sewage treatment plant loads.

There are some risks and costs involved with rainwater harvesting, especially with active systems designed for potable use. In regions of high atmospheric pollution, rainwater often picks up

some of these contaminants. It is worth noting that sulfur dioxide and nitrogen dioxide levels in the atmosphere over some major cities has created rainwater with a pH as low as 4.3 (US EPA, 2007). Acidic rainwater can also be corrosive to metal roofs, especially those that contain copper, zinc, and lead, exacerbating the potentially dangerous condition (Daniel B. Stephens, 2005). Roof debris can render rainwater unsuitable for various uses without considerable treatment. A common technique to address this problem is called “first flush”, which calls for allowing the first portion of a rain event to runoff without capture or diversion (Perino, 2010).

Costs associated with passive rainwater harvesting are generally much less than those associated with active systems. The construction of some passive rainwater harvesting systems might call for little more than a shovel. This is not always the case, however, as some extensive passive rainwater harvesting systems require the use of excavators for trenching and leveling, jackhammers for curb cuts, and the addition of large quantities of stone to decrease water flow energy, among other potential costs. Not surprisingly, most rainwater harvesting practiced in Tucson is by means of low-cost passive systems (Perino, 2010).

Large metal cisterns for active rainwater harvesting systems can run in the thousands of dollars, as can filtration systems if a higher quality of water is desired. Underground storage tanks require heavy equipment for installation, but costs can be minimized if the project is planned during new home construction. Pumping systems, roof coatings, and permitting fees are some other costs commonly incurred for installing a complex active rainwater harvesting system. Lastly, a cost incurred regardless of the system decided upon is the time that must be put into planning, permitting, and installing the system (Perino, 2010).

III. Methodology

To understand a state's stance on the legality of rainwater harvesting, one must first have an understanding of the state's water law. A basic understanding of the water law in the western US is necessary to appreciate how western water law differs from the rest of the country.

The approach taken in researching western US water law is a literature review of reports concerning the subject, knowledge drawn on from *Arizona Water Policy*, and state constitutions and statutory law. Researching individual states' interpretation of prior appropriation and the consequence for respective rainwater harvesting policies involved an intensive case review of each state's Supreme Court, a review of each state's constitution and statutory law, and a literature review.

To gain current insight pertaining to Colorado's water law and rainwater harvesting policies, a telephone interview was conducted with Kevin Rein, P.E., an Assistant State Engineer for the Colorado Division of Water Resources. Tucson Land Use Code and rainwater harvesting policies were explained in detail during a phone interview with Joe Linville, the Lead Planner for the City of Tucson's Planning and Development Services.

IV. Western United States surface water law

Surface water law in the western United States is governed by the doctrine of prior appropriation. This system is commonly explained as "first in time, first in right" or "first in time, first in line." Prior appropriation doctrine dictates "who uses how much water, the types of uses allowed, and when those waters can be used." (Waskom, 4/03. Reviewed 7/09.) An appropriation is made when a party physically diverts or removes water from a stream and puts that water to some type of beneficial use, though this is only clearly defined in particular states' water law. The first party to make this appropriation has the first right to the water within that water system and becomes the senior water right holder or "senior appropriator".

The roots of Prior appropriation can be traced to the California Gold Rush in the late 1840's. The concept was adapted from the already existent laws establishing ownership of raw minerals. Water diversions for mining purposes established a "right" that was recognized by other miners and later by state laws (Fort).

Western surface water law differs from that of eastern states, which generally adhere to the riparian doctrine. Under the riparian doctrine: "owners of land adjacent to a stream or other water body may use that water, but only as long as their usage does not interfere with the other landowners' reasonable usage of the water." (NDMC, 2006) This, in effect, means that owning property adjacent to or containing some flowing body of water is an entitlement to use a reasonable amount of that water, regardless of downstream users' history utilizing that water. Prior appropriation would deem this upstream use of water illegal if the downstream users are senior appropriators and have put all of the water to beneficial use.

It is important to note that the doctrine of prior appropriation is interpreted differently by each western state. Consequently, each western state uniquely determines the legality of, and limitations to, rainwater harvesting. The Four Corners states have been chosen for detailed water law and rainwater harvesting policy analysis due to their proximity to one another, their relative climate similarities and their interestingly divergent approaches to rainwater harvesting policy.

V. Four Corners' water law and consequent rainwater harvesting policy implications

Colorado

Colorado's interpretation of prior appropriation is among the most restrictive for rainwater harvesting. The Colorado Revised Statutes states:

A stream system which arises as a natural surface stream and, as a natural or man-induced phenomenon, terminates within the state of Colorado through naturally occurring evaporation and transpiration of its waters, together with its underflow and tributary waters, is a natural

surface stream subject to appropriation as provided in subsection (1) of this section (C.R.S. § 37-82-101, 2010).

The implications to rainwater harvesting originate from the inclusion of “underflow and tributary waters” as appropriable. The burden of proof is placed on landowners to demonstrate that water originating on their property does not ultimately reach a natural stream, as it is then classified as a tributary. All precipitation in the state of Colorado is assumed to contribute to stream flow and therefore private properties, and even rooftops, are considered tributaries to water bodies that have already been appropriated to senior water right holders (DeHaas v. Benesch, 1947)

In 1928, the Supreme Court of Colorado affirmed the water right of downstream senior appropriators despite the origination of the water on another’s private property. A key point concerning appropriation reads:

An appropriator of spring and seepage water who has a valid decree therefor has the right to its use superior to that of the owner of the land upon which the water arises, when such water would ultimately reach, and become a part of, a natural stream (Nevius v. Smith, 1928).

These precedents were affirmed numerous times throughout the 20th century, while subsequent rulings used language still less favorable to the prospect of rainwater harvesting. In a 1962 case the Supreme Court of Colorado ruled against the plaintiff, Mildred Cline, in an action against the state engineer, Eugene Whitten. Whitten asserted that a reservoir on Cline’s property precluded spring and flood waters from reaching a nearby creek. Because this creek is a tributary of an appropriated river, Whitten deemed the reservoir illegal and ordered that it be removed. Confident that water from her property would not reach the nearby creek, Cline opted to take the matter to court. The court acknowledged that before the existence of the reservoir, water from a spring originating on Cline’s property as well as floodwaters did not directly reach the creek; rather it drained to a field where it percolated into the soil. The plaintiff could not surmount the burden of proof by proving that there was no subsurface flow to the creek and was therefore found by the court to be in violation of the law. Even more pertinent for

the purposes of rainwater harvesting, the court ruled that diversion of water and its storage in a reservoir is not an appropriation of such water (Cline v. Whitten, 1962).

Colorado law does allow for capture or diversion of upstream water by a junior appropriator under the condition that 100% of the captured amount is replaced in "...like time, place and amount" (C.R.S. 37-92-302), (Rein, 2010). To replace all captured water in real time and at the same location would clearly defeat the purpose of rainwater harvesting operations.

While recent decades have seen rainwater harvesting gain popularity in the southwest, Colorado residents with such intentions have been stifled by state law. A release from the Colorado Division of Water Resources concerning rainwater harvesting within the state asserts that: "...a person cannot divert rainwater and put it to a beneficial use without a plan for augmentation that replaces the stream depletions associated with that diversion." (Waskom, 4/03. Reviewed 7/09.), (Rein, 2010).

In June 2008, the Denver Post reported on a family living in rural Colorado on a mesa 9,000 feet above sea level. To augment their intermittent water supply, the household applied to the state for a water right to collect precipitation. Their right to collect precipitation was denied on the grounds that other water users had already locked up the right to use the precipitation (Fitzgerald, 2008). Such cases have led many Coloradoans to set up rainwater harvesting systems in their backyards, hidden from view (Johnson, 2009). This is done at considerable risk, as being caught harvesting rainwater could result in fines of up to \$500 a day, though this penalty has been rarely, if ever, imposed (Moseman, 2009) (Brady, 2009)

Passive rainwater harvesting in Colorado is technically illegal, as it is a diversion of rainwater being put to beneficial use, however, there is no documented case of passive rainwater harvesting being prosecuted. This is likely due to most passive rainwater harvesting techniques being slight landscape modifications that are not always clearly discernible and don't require a permit. Kevin Rein, Assistant State Engineer with the Colorado Division of Water Resources, states that the legality of passive

rainwater harvesting depends on “intent”. He clarifies this by explaining that it is okay for a homeowner to channel water away from their home to prevent structural damage, but if the intent is strictly to increase irrigation to a lawn or garden the homeowner is violating the law (Rein, 2010).

In 1973, Colorado recognized the maintenance of instream flows as a beneficial use and established the Colorado Water Conservation Board (CWBC) as the sole entity that may hold instream flow rights. Since 1983, the CWBC has been able to acquire senior water rights through lease, purchase, or donation (BLM, 2001). Notwithstanding the many positive implications of instream flow rights, this may have further limited the ability of would-be-rainwater harvesters to secure any unappropriated precipitation.

A landowner in Colorado has the legal right to purchase a water right from a senior appropriator for the purposes of rainwater harvesting. However, no such case is documented, likely due to the high transaction costs involved for such a sale. Kevin Rein explains that such a transaction would be a lengthy process in a water courts. Secondly, the landowner would need to demonstrate to a water court that all streamflow depletions are accounted for by the purchased water right (Rein, 2010).

The assumption that all flowing water reaches a natural stream was investigated in a 2007 study conducted under a CWCB Water Efficiency Grant for Douglas County, CO. The study found that on an undeveloped (native vegetation) site in northwest Douglass County about 3% of precipitation made its way to streams or groundwater in a year of average precipitation. Furthermore, in dry years, when senior appropriators might be most concerned about upstream diversions, less than 1% of precipitation made its way to streams or groundwater. During wet years this number rises up to 15%. Being that the Colorado Supreme Court has historically ruled against attempts to assert water rights by eliminating water consuming vegetation, it is clear that all flowing water does not reach a natural stream (Courtney, 2008).

This study proved crucial in convincing Colorado lawmakers that rainwater harvesting would not deprive senior appropriators of their rights (Johnson, 2009). 2009 saw the passage of House Bill 09-1129 and Senate Bill 09-080, both permitting some capture and beneficial use of precipitation. The passage of these bills elicited both excitement and disappointment from Colorado rainwater harvesting hopefuls and the environmental community.

House Bill 09-1129 allows for up to ten new residential or mixed-use developments that will conduct individual pilot projects to collect precipitation from rooftops and impermeable surfaces for non-potable uses. The purpose of the pilot projects is to evaluate water conservation potential and to collect information pertaining to water rights protection. The pilot projects duration will be ten years with detailed reporting required at the end of each year and a comprehensive report at the close of the tenth year. Upon conclusion of the ten year period, the applicants will have the option to either apply for a permanent augmentation plan to harvest no more precipitation than evidenced by the pilot projects' data, or to retire the system (HB09-1129, 2009).

Senate Bill 09-080 concerns limited exemptions for water collected from certain residential rooftops. This bill allows for the state engineer to approve permits for rooftop precipitation collection systems in designated groundwater basins where the residence is legally entitled to a well for domestic uses and no water supply is available from a municipality or water district. Further, precipitation can only be collected from the rooftop, the harvested water can only be used for the purposes identified on the well permit, and the residence must apply for a permit to do so (SB09-080).

The Colorado Division of Water Resources has provided a citizen's guide to Senate Bill 09-080 that includes frequently asked questions. An interesting and representative question is:

Question: I have checked my valid well permit and it states that the use of my well is limited to household uses. Can I collect rainwater and snowmelt from my roof and use it to water a very small vegetable garden in the backyard or in a greenhouse? How about for my hot tub?

Answer: No, water for a vegetable garden outside the home or in the greenhouse is not an ordinary household use and it consumes the water in a way that is inconsistent with the permitting statutes. The use of the precipitation in this case is limited to drinking and sanitary

uses inside the home. This same answer applies to using the water for a hot tub, it is not allowed in this permitting situation (CDWR, 2009).

The obvious limitations to rainwater harvesting that these bills leave intact has left many rainwater harvesting advocates unimpressed, but consensus in the rainwater harvesting community is that it is a step in the right direction. In a 2009 interview with the New York Times, water lawyer Jeff Kray commented: "Colorado is saying, 'We're opening the door to rainwater catchment.' Not really," Mr. Kray said. "They're cracking the door." (Vestel, 2009)

The rigid data keeping requirements of the pilot study commissioned by House Bill 09-1129 may prove to be a blessing to the would-be Colorado rainwater harvesting community. If the results demonstrate that downstream water right holders do not experience a dearth in supply due to the harvesting activities, ten years down the road Colorado will have reason to further deregulate rainwater harvesting. One noteworthy drawback to the length of this pilot is that further relaxation of rainwater harvesting restrictions in Colorado might be a decade away.

Arizona

Arizona water law differs from that of Colorado in that it defines appropriable waters as those flowing in any natural channel, while not explicitly including tributaries of these natural channels. The statute concerning prior appropriation states:

The waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, whether perennial or intermittent, flood, waste or surplus water, and of lakes, ponds and springs on the surface, belong to the public and are subject to appropriation and beneficial use as provided in this chapter (A.R.S. § 45-141, 2010).

Rainwater harvesting, whether passive or active, might procure precipitation before it reaches a "natural channel", depending on the definition of this term. Some clarity is given in a 1926 court case in which the Arizona Supreme Court defines the term:

"natural channel" being floor or bed on which water flows and banks on each side thereof as carved out by natural causes (Pima Farms Co. v. Proctor, 1926).

Being as rooftops, landscaped yards, and artificial impermeable surfaces have not been carved out by natural causes, the capture of rainwater from these surfaces cannot legally impinge on a senior appropriator's water right.

Furthermore, the Supreme Court of the Territory of Arizona declared that "...percolating water oozing through the soil beneath the surface in an undefined and unknown channel excludes the idea of a river, creek or stream of running water" (Howard V. Perrin, 1906). This affirms that the soil pore spaces – the route that water follows by percolating through soil – are not natural channels as defined by the law. This finding is significant in demonstrating the legality of passive rainwater harvesting through landscape modification in Arizona.

Statutory law in Arizona has been interpreted to permit the harvesting of rainwater and consequently there has been no successful legal challenge to rainwater harvesting in the state. Further affirmation of the legality of rainwater harvesting in the state is the creation of a tax credit for water conservation systems that includes rainwater harvesting structures. Beginning January 1, 2007, the statewide legal mandate offers taxpayers a one-time tax credit of 25% of the cost of the system up to \$1000 (WRRC, 2008). The state allocates \$250,000 per year for this program, but in the four years of its existence, it is yet to approach this maximum limit. In 2009, 250 credits were redeemed for a total of \$120,000; in 2008, 250 credits were redeemed for a total of \$155,000; and in 2007 – the program's inaugural year – 100 credits were redeemed for less than \$100,000 (Linville, 2010).

Residents of Marana, Arizona can receive an additional \$50 beyond the 25% tax credit offered by the state of Arizona. Metro Water District offers this rebate when a resident installs a graywater or water harvesting system (MWD, 2003). This rebate offer was established in 2002, five years before the statewide tax credit. The trend of water conservation policies starting at the local level and moving up the governmental hierarchy to the state level is not uncommon. A notable example was the legalization

of residential graywater use in Santa Barbara, CA in 1989. Within three years the state of California, among 16 other western states, followed suit (Oasis Design, 2009).

While at the state level Arizona is using strictly an incentives approach to stimulate the adoption of rainwater harvesting technologies, some municipalities around the state have developed rainwater harvesting policies that are not optional. On October 14 2008, the city of Tucson adopted ordinance number 10597, becoming the first city in the continental United States to require rainwater harvesting for commercial projects. The only US law exceeding this scope in required rainwater harvesting is in the U.S. Virgin Islands, where no reliable underground fresh water source is available (Pushard T. S., 2008). The law goes into effect June 1, 2010 and calls for 50 percent of water used for landscaping on new commercial properties to come from harvested rainwater. Looking forward, the law will require this proportion of water used in landscaping to be increased to 75 percent within three years of the property being legally occupied (Ord. #10597, 2008). In the lethargic economic climate of 2010, new commercial buildings are not being planned at the rapid pace of the previous decade, but as the economy of Southern Arizona recovers, the ordinance has the potential to conserve a significant amount of water (Linville, 2010).

A citywide mandate such as Tucson's might be expected to have some economic repercussions. One scenario would be a business planning their new building just outside of city limits to avoid the costs associated with adhering to the new ordinance. A second scenario might be that a business does not construct a planned new building at all. To date, the city of Tucson is not aware of any such cases and on the contrary has witnessed some businesses building to the code before its official inception date (Linville, 2010).

Oro Valley, Arizona recently implemented a new landscaping code with some similarities to the Tucson rainwater harvesting ordinance. Under the new code, commercial properties and common areas in housing developments are required to use rainwater harvesting techniques, among other water

conserving technologies. The town's goal is to reduce overall water consumption by 5,500 acre-feet of water per year (McNamara, 2009). Though much less specific and perhaps less rigorous than the Tucson ordinance, this code is a sign that more municipalities in the southwest are embracing the water savings potential of rainwater harvesting.

Such ordinances, Tucson's especially, have inspired numerous other Arizona communities to consider such an approach (Rotstein, 2009). If the ordinance proves successful in conserving a significant amount of potable water, while adding only minimal financial burden to commercial building construction costs, in a few years many other Arizona municipalities might adopt similar laws. Such an ordinance eventually being mandated statewide does not seem very farfetched considering the water scarcity issues the state faces.

Utah

A discussion of Utah's rainwater harvesting policy is serendipitous for the timing of this research paper. Starting May 11, 2010 rainwater harvesting without a water right will be legal in the state of Utah. This is owed to the passage of Senate Bill 32 in the 2010 session of the Utah State Legislature. Senate Bill 32 allows for the collection and use of precipitation without obtaining a water right. The limitations set forth by the legislation are that storage is limited to one underground 2,500 gallon container or two above ground 100 gallon containers (S.B. 32, 2010)

Such a bill being passed in the state of Utah might have seemed unthinkable only a couple of years ago. Similar legislation has been soundly defeated as recently as 2009 (Pushard D. , 2010). Like Colorado, Utah has a long history of upholding a rigid and restrictive interpretation of the prior appropriation doctrine. The Utah State Code addresses prior appropriation as follows:

The appropriation must be for some useful and beneficial purpose, and, as between appropriators, the one first in time shall be first in rights; provided, that when a use designated by an application to appropriate any of the unappropriated waters of the state would materially interfere with a more beneficial use of such water, the application shall be dealt with as

provided in Section 73-3-8. No right to the use of water either appropriated or unappropriated can be acquired by adverse use or adverse possession (Utah Code § 73-3-1 , 2009).

It is notable that there is no mention of tributaries, the key language in Colorado law that has established harvesting rainwater as illegal. The Utah Office of the State Engineer has consistently interpreted the law to mean that precipitation is appropriable by water right and that its collection by those without a water right is an acquisition by “adverse use or possession” (Utah Code § 73-3-1 , 2009).

This interpretation has been upheld in the Utah Supreme Court. Chief Justice Wolfe stated in 1952:

I concur, but I reiterate what I said in my concurring opinion in the case of *Riordan v. Westwood*, that all rain and snow water belongs to the public regardless of whose land it falls upon. Like all fugitive substances, it can belong to no one else except the public (*McNaughton v. Eaton*, 1952).

This ruling clearly establishes that precipitation belongs to the public and is thereby appropriable. This ruling also explicitly states that, like Colorado water law, the land upon which the precipitation falls is irrelevant to who has the right to the water. Markedly absent from the law and ruling is the burden of proof on a private property owner to show that precipitation falling on their land never makes it to a natural water body. This is because since 1935 the state of Utah has considered precipitation public property regardless of the water’s destination.

There was early reconsideration on the issue of precipitation falling on private property:

Prior to 1935 diffused seeping and percolating waters, not shown to be the source of supply of any stream flowing on the land of others, was considered a part of the soil and belonging to the owner thereof and therefore not public waters nor subject to appropriation (*Riordan v. Westwood*, 1949).

With the enactment of Sec. 100-1-1, U.C.A; after 1935 precipitation became public property and the law has served as the partial basis for the illegality of rainwater harvesting until the present.

The Utah state law and court rulings do not, however, clearly indicate the legality of passive rainwater harvesting. If landscape modifications cannot be shown to detain precipitation, but rather guide the water over particular areas, the landowner might be in compliance with the law. Due to the

lack of clear definitions for what is a stream, channel or tributary in Utah water law, such a case would depend almost solely on the discretion of the courts.

Senator Scott Jenkins introduced Senate Bill 32 after he learned of a Salt Lake City car dealer who was denied a permit to store runoff precipitation in an underground cistern to be used for washing cars. Ironically, despite this inspiration, the bill will not allow for commercial uses of precipitation without a water right. To resolve this issue, the Utah State Engineer is developing a protocol for commercial properties to acquire or lease a water right through municipalities for such practices (Speckman, 2008).

Utah Senate Bill 32 affords much more flexibility for rainwater harvesting than does Colorado Senate Bill 09-080. Though there is a limit on storage container size and the number of such containers, the Utah bill allows for rainwater harvesting to be practiced by any residence in the state, rather than just those with a domestic well permit as in Colorado. The overriding difference here is that the Utah bill does not require the rainwater harvester to have a water right, while the Colorado bill makes such a requirement via the stipulation that the residence has an entitlement to a domestic well permit.

New Mexico

The statutory law concerning prior appropriation of water in the state of New Mexico is most like Arizona's among the four corners states, though somewhat less specific. Resultantly, it is difficult to interpret the implications of state law on rainwater harvesting. As in Utah, the task of interpreting and dictating water law is left up to the Office of the State Engineer. In New Mexico the State Engineer is vested by statutory law with "...general supervision of waters of the state and of the measurement, appropriation, distribution thereof and such other duties as required" (N.M. Stat. § 72-2-1, 2010).

New Mexico's statutory law concerning prior appropriation is:

All natural waters flowing in streams and watercourses, whether such be perennial, or torrential, within the limits of the state of New Mexico, belong to the public and are subject to appropriation for beneficial use. A watercourse is hereby defined to be any river, creek, arroyo,

canyon, draw or wash, or any other channel having definite banks and bed with visible evidence of the occasional flow of water (N.M. Stat. § 72-1-1, 2009).

This can be most likened to the law of Arizona because it defines appropriable waters as those in “streams and watercourses”, with no mention of tributaries to such water bodies. The language defining what a watercourse is narrows the state’s appropriable waters considerably. Again, like Arizona, the law describes a channel with definite banks and a bed, apparently excluding runoff on landscapes and artificial surfaces. Therefore, the capture or diversion of water before it reaches a “watercourse” is legal and cannot impinge on a senior appropriator’s water right.

Despite the lack of a statutory obstruction to rainwater harvesting, the Office of the State Engineer imparts some restrictions on rainwater harvesting in the state. A 2004 policy statement displayed on the current website of the State Engineer details the official stance on rainwater harvesting:

The New Mexico Office of the State Engineer supports the wise and efficient use of the state’s water resources; and, therefore, encourages the harvesting, collection and use of rainwater from residential and commercial roof surfaces for on-site landscape irrigation and other on-site domestic uses.

The collection of water harvested in this manner should not reduce the amount of runoff that would have occurred from the site in its natural, pre-development state. Harvested rainwater may not be appropriated for any other uses (NM OSE, 2004).

The second paragraph seems to present a technical challenge to rainwater harvesters in New Mexico. To calculate the amount of runoff that would have occurred on a site’s pre-developed state might be a daunting task for any homeowner. However, there is no documented prosecution of a party that has harvested more rainwater than allowed by the stated policy, indicating that the policy statement is generally a guideline. The statement might also serve as a precautionary litigation tool in the event that a party blatantly exceeds the guidelines laid out by the policy.

A statement released the subsequent year moderates the tone of the policy, especially toward residential homeowners. It states:

Most homeowners can install and use a rainwater harvesting system for landscape irrigation without public health and water rights concerns. For larger-scale commercial projects, it is a good idea to check with the local OSE Water Rights Division to make sure the project does not inappropriately affect rainwater runoff into a stream system, therefore impacting a public water supply (NM OSE, 2005).

This language is encouraging to homeowners wishing to install rainwater harvesting infrastructure while still preserving the power of the State Engineer to prevent, or have deconstructed, projects found to be too extensive.

Such policy statements from the Office of the State Engineer may be the middle ground settled upon between the interests of senior water right holders and a statewide interest in promoting conservation measures. Even the Governor's office has weighed in on the side of promoting water conservation measures. In May 2003, Governor Bill Richardson signed an executive order creating a twelve member New Mexico Drought Task Force. The third point of the Task Force's resulting recommendations report is: "Provide market-based incentives for water conservation actions such as rainwater harvesting, gray-water re-use, installation of water-efficient fixtures and appliances, and turf replacement" (NMDTF, 2003). The report goes on to suggest that the state provide grants and tax credits to incentivize the implementation of such water conservation technologies. Further, local governments are advised to purchase water conservation products in bulk to be offered to residents at little or no cost and to provide rebate programs to support individual conservation measures (NMDTF, 2003).

To date, New Mexico has passed some of the most progressive rainwater harvesting policies in the country. The state legislature passed House Bill 197 in 2004 which provided minimum standards for the collection of precipitation from commercial buildings (Humphries, 2003). The state also provides a tax credit for new green buildings through Senate Bill 463, which could include rainwater harvesting. The tax credit is based on square footage for new homes that meet the Build Green New Mexico "Gold

level”, the maximum possible credit is \$11,000 and for new LEED for homes, the maximum possible tax credit is \$22,450.00 per house (SB 463, 2007).

Two major municipalities have taken further measures to promote rainwater harvesting. The city of Albuquerque provides a rebate of \$1.50 per square foot of passive rainwater harvesting landscapes. Santa Fe County has mandated rainwater-tank and water-harvesting-earthwork installation on new residential and commercial construction through Ordinance 2003-6. This addition to the land-use code might be the most encompassing in the country. Residences with 2,500 square feet or less of heated area must utilize rain barrels, cisterns, or other catchment basins, while residences 2,500 square feet or more of heated area must install an active rainwater catchment system comprised of cisterns. All commercial development is required to collect all roof drainage use it for landscape irrigation (Ord. #2003-6, 2003).

VI. Summary and recommendations

With regard to the definition of appropriable waters for the Four Corners states, Colorado water law is the most specific and Utah water law is the least. The well developed idea of all flowing waters as tributaries in Colorado state law gives the State Engineer clear language to prohibit the harvest of rainwater; conversely, the lack of specific language in Utah law has allowed for the Office of the State Engineer to set a restrictive interpretation as the precedent and therefore ban the practice. The moderately descriptive statutory language regarding appropriable waters in both Arizona and New Mexico has evidently proven to be the friendliest to the prospects of rainwater harvesting.

The flexibility offered through Utah Senate Bill 32 allows Utahans the freedom to harvest rainwater in similar fashion to residents of most other western states. The author recommends that Utah policy makers consider a tax rebate similar to Arizona’s to promote the adoption of rainwater harvesting. Densely populated areas of the state could realize decreased stormwater management costs and less strain on municipal water supplies.

The 2009 Colorado legislation opening the door to limited precipitation collection for a select few maintains Colorado's status as the least friendly to the rainwater harvesting. The author recommends that the Colorado legislature and Division of Water Resources heeds the results of the scientific study (funded in part by the state) focusing on the destination of precipitation in Douglass County. This strong evidence that rainwater harvesting will not deplete streamflows to senior appropriators is grounds for the allowance of residential rainwater harvesting without a water right. This is the basis for the further recommendation that the state of Colorado pass legislation similar to Utah Senate Bill 32.

The states of Arizona and New Mexico are currently two of the national leaders in rainwater harvesting policy and adoption rates (Lancaster, 2010). It is interesting to note that major population centers in these two states generally receive less annual precipitation than equivalent population centers in Utah and Colorado (NOAA, 2010); yet no legal action over water rights has been taken particular to rainwater harvesting in either Arizona or New Mexico. The commitment that these two states have shown to embracing rainwater harvesting, and adopting policies to promote it, will provide other western states with invaluable data over the next few years. Resulting water savings and decreased stormwater management costs in Arizona and New Mexico could inspire other states to adopt similar policies. The author recommends that Arizona and New Mexico raise more public awareness to the benefits of rainwater harvesting, and better advertise their rebate programs. Secondly, the author recommends that the city of Phoenix adopt a mandate similar to Tucson's for commercial building rainwater harvesting. Despite receiving less rain than Tucson, commercial buildings in Phoenix can sustain desert landscaping using 50 percent harvested rainwater. This would at least slightly ease the strain on the Phoenix's water supply, as "Landscaping needs account for about 40 percent of water use in commercial development" (Rotstein, 2009).

VII. Conclusions

The relaxing of rainwater harvesting restrictions in both Colorado and Utah, and promotion of rainwater harvesting in Arizona and New Mexico, coincides with a west-wide trend to embrace the practice. The city of Seattle has recently adopted an official stance of looking the other way despite rainwater harvesting's technical illegality in Washington State (Johnson, 2009). The cities of San Francisco and Austin offer considerable rebates for rainwater harvesting equipment, and in 2009 the State of California passed two bills supporting the adoption of rainwater harvesting (Pushard D. , 2010). It is clear that concerns about climate change and declining future water availability have made an impact. Colorado's and Utah's concerns about rainwater harvesting impinging on senior water appropriators seem to slowly be giving way to a number of factors: concerns of water demand outstripping supply, popular calls for rainwater harvesting's legality, and scientific studies demonstrating that appropriated water will only be minimally affected, at most, by rainwater harvesting.

A fundamental question that needs to be studied more closely is whether incentives (such as tax rebates) or mandates (such as building requirements) are more effective in promoting rainwater harvesting. Some of the specific issues that need to be addressed in such studies are: the tax burden associated with subsidies and rebates, the increased capital costs and associated pushback against mandates, and the effects each tactic would have on the progression of rainwater harvesting technology and related consumer costs. The question might ultimately come down to local preference, exemplified by the different approaches taken by Tucson and Albuquerque.

Bibliography

- A.R.S. § 45-141. (2010). *Arizona Revised Statutes*. Retrieved April 2010, from Arizona State Legislature: <http://www.azleg.state.az.us/FormatDocument.asp?inDoc=/ars/45/00141.htm&Title=45&DocType=ARS>
- A.R.S. § 43-1090. (2010). *Arizona Revised Statutes*. Retrieved April 2010, from Arizona State Legislature: <http://www.azleg.state.az.us/FormatDocument.asp?inDoc=/ars/43/01090-01.htm&Title=43&DocType=ARS>
- BLM. (2001, August 15). *Colorado Water Rights Fact Sheet*. Retrieved April 2010, from Western States Water Laws: <http://www.blm.gov/nstc/WaterLaws/colorado.html>
- Brady, J. (2009, June 1). *Water Wars Out West: Keep What You Catch!* Retrieved April 2010, from NPR: <http://www.npr.org/templates/story/story.php?storyId=104643521>
- C.R.S. § 37-82-101. (2010). *Colorado Revised Statutes*. Retrieved April 2010, from Mitchie's Legal Resources: <http://www.michie.com/colorado/lpext.dll?f=templates&fn=main-h.htm&cp=>
- CDWR. (2009, July 1). *Rainwater Bills*. Retrieved April 2010, from Colorado Division of Water Resources: <http://water.state.co.us/pubs/pdf/RainWaterBills.pdf>
- Cline v. Whitten, 150 Colo. 179 (Supreme Court of Colorado May 21, 1962).
- Courtney, B. (2008). *Rainwater and Snowmelt Harvesting in Colorado*. Douglass County, CO: Headwaters Corp., CWBC Water Efficiency Grant.
- Daniel B. Stephens, L. J. (2005). *Roof Water Harvesting for Artificial Recharge in the Americas*. Daniel B. Stephens & Associates, Inc.
- DeHaas v. Benesch, 116 Colo. 344 (Supreme Court of Colorado May 5, 1947).
- Fitzgerald, D. (2008, June 29). Can you own the rain?: Make harvesting the resource legal. *The Denver Post* .
- Fort, D. D. (n.d.). *Prior Appropriation*. Retrieved April 2010, from Water Encyclopedia: <http://www.waterencyclopedia.com/Po-Re/Prior-Appropriation.html>
- Hasse, R. (1989). *Rainwater Reservoirs Above Ground Structures for Roof Catchment*. Antwerp: Humanity Development Library.
- HB09-1129. (2009). *Colorado House of Representatives*. Retrieved April 2010, from Colorado General Assembly: http://www.leg.state.co.us/clics/clics2009a/csl.nsf/fsbillcont3/7EBE1FD8BEB4A0088725753C0061EF02?Open&file=1129_enr.pdf
- Howard V. Perrin, 200 U.S. 71 (Appeal from the Supreme Court of the Territory of Arizona January 2, 1906).
- Humphries, C. (2003). *Rural Sustainability Using Rainwater Harvesting: From Rainwater to Tap Water in Alto, New Mexico*. University of New Mexico.
- International Hydrological Programme. (2000). *Rain Water Harvesting and Artificial Recharge to Ground Water*. UNESCO.
- Johnson, K. (2009, June 28). It's Now Legal to Catch a Raindrop in Colorado. *The New York Times* .

Lancaster, B. (2010). *Rainwater Harvesting*. Retrieved April 2010, from Rainwater Harvesting for Drylands and Beyond by Brad Lancaster: <http://www.harvestingrainwater.com/rainwater-harvesting-inforesources/>

Linville, J. (2010, April 28). Lead Planner, City of Tucson Planning and Development Services. (T. L. Gaston, Interviewer)

McNamara, P. (2009, November 11). Council OKs landscape code. *The Explorer Newspaper* .

McNaughton v. Eaton, 121 Utah 394 (Supreme Court of Utah March 25, 1952).

Moseman, A. (2009, April 22). Who Owns the Rain? Hint: It's Not Always Homeowners. *Popular Mechanics* .

MWD. (2003). *Graywater/Water harvesting Rebate Program*. Retrieved April 2010, from Metropolitan Domestic Water Improvement District : <http://www.metrowater.com/greywater.htm>

N.M. Stat. § 72-1-1. (2009). *Statutory Chapters in New Mexico Statutes Annotated 1978*. Retrieved April 2010, from State of New Mexico: <http://www.conwaygreene.com/nmsu/lpext.dll?f=templates&fn=main-h.htm&2.0>

N.M. Stat. § 72-2-1. (2010). *Statutory Chapters in New Mexico Statutes Annotated 1978*. Retrieved April 2010, from State of New Mexico: <http://www.conwaygreene.com/nmsu/lpext.dll?f=templates&fn=main-h.htm&2.0>

NDMC. (2006). *Managing Water: Policies and Problems*. Retrieved April 2010, from Planning for Drought: <http://www.drought.unl.edu/plan/managewater.htm>

Nevius v. Smith, 86 Colo. 178 (Supreme Court of Colorado February 27, 1928).

NM OSE. (2004, 24 November). *Water use and Conservation*. Retrieved April 2010, from New Mexico Office of the State Engineer: http://www.ose.state.nm.us/wucp_policy.html

NM OSE. (2005). *Water Use and Conservation*. Retrieved April 2010, from New Mexico Office of the State Engineer: http://www.ose.state.nm.us/wucp_RainwaterHarvesting.html

NMDTF. (2003). *Framework for a Comprehensive Statewide Municipal & Industrial Water Conservation Program*. New Mexico Office of the State Engineer.

NOAA. (2010, May 5). *Precipitation Analysis*. Retrieved May 5, 2010, from National Oceanic and Atmospheric Administration: http://www.srh.noaa.gov/rfcshare/precip_analysis_new.php

Oasis Design. (2009, February 2). *History of Graywater Regulation*. Retrieved April 2010, from Oasis Design: <http://www.oasisdesign.net/greywater/law/history/index.htm>

Ord. #10597. (2008, October 14). *Rainwater Ordinance*. Retrieved April 2010, from City of Tucson: <http://www.tucsonaz.gov/water/docs/rainwaterord.pdf>

Ord. #2003-6. (2003). *Water conservation*. Retrieved April 2010, from Santa Fe County: http://www.santafecounty.org/userfiles/file/waterconservation/Water_Harvesting_Ordinance.pdf

Perino, L. (2010, April 26). Manager of Water Harvesting Operations. (T. L. Gaston, Interviewer)

Peterson v. Reed, 149 Colo. 573 (Supreme Court of Colorado March 26, 1962).

Pima Farms Co. v. Proctor, 30 Ariz. 96 (Supreme Court of Arizona April 19, 1926).

Pushard, D. (2010, May). *Regulations and Statutes*. Retrieved April 2010, from HarvestH2O.com:
http://www.harvesth2o.com/statues_regulations.shtml

Pushard, T. S. (2008, Fall). The State of Rainwater Harvesting In The U.S. *On Tap* , pp. 20-22.

Rein, K. G. (2010, May 5). Assistant State Engineer, CDWR. (T. L. Gaston, Interviewer)

Riordan v. Westwood, 115 Utah 215 (Supreme Court of Utah March 11, 1949).

Rotstein, A. H. (2009, July 5). Tucson rainwater harvesting law drawing interest. *The Arizona Daily Sun* .

Rutherford, R. (2010). *Water Harvesting: An Overview (working paper)*. Johannesburg: African Water Issues Research Institute.

S.B. 32. (2010). *Legislation - 2010 General Session*. Retrieved April 2010, from Utah State Legislature:
<http://le.utah.gov/~2010/bills/sbillenr/sb0032.pdf>

SB 463. (2007). *Bill Finder*. Retrieved April 2010, from New Mexico Legislature:
<http://www.nmlegis.gov/lcs/BillFinderNumber.aspx>

Speckman, S. (2008, December 21). Legislator to sponsor bill allowing rainwater collection by residents. *Deseret News* .

Tarlock, A. D. (2001). The Future of Prior Appropriation in the New West. *Natural Resources Journal* , 41, 769-793.

US EPA. (2007, June 8). *Measuring Acid Rain*. Retrieved April 2010, from U.S. Environmental Protection Agency:
<http://www.epa.gov/acidrain/measure/index.html>

Utah Code § 73-3-1 . (2009, December 21). *Utah Code*. Retrieved April 2010, from Utah State Legislature:
http://le.utah.gov/~code/TITLE73/htm/73_03_000100.htm

Vestel, L. B. (2009, June 29). The Legalities of Rainwater Harvesting. *The New York Times* .

Vranesh, G. (2004). *Colorado Water Law, Revised Edition*. Boulder: University Press of Colorado.

Waskom, R. a. (4/03. Reviewed 7/09.). *Graywater Reuse and Rainwater Harvesting*. Colorado State University.

WRRRC. (2008, October 1). Laws Inconsistent in Their Support of Rainwater Harvesting. *Arizona Water Resource* , 17 (1).