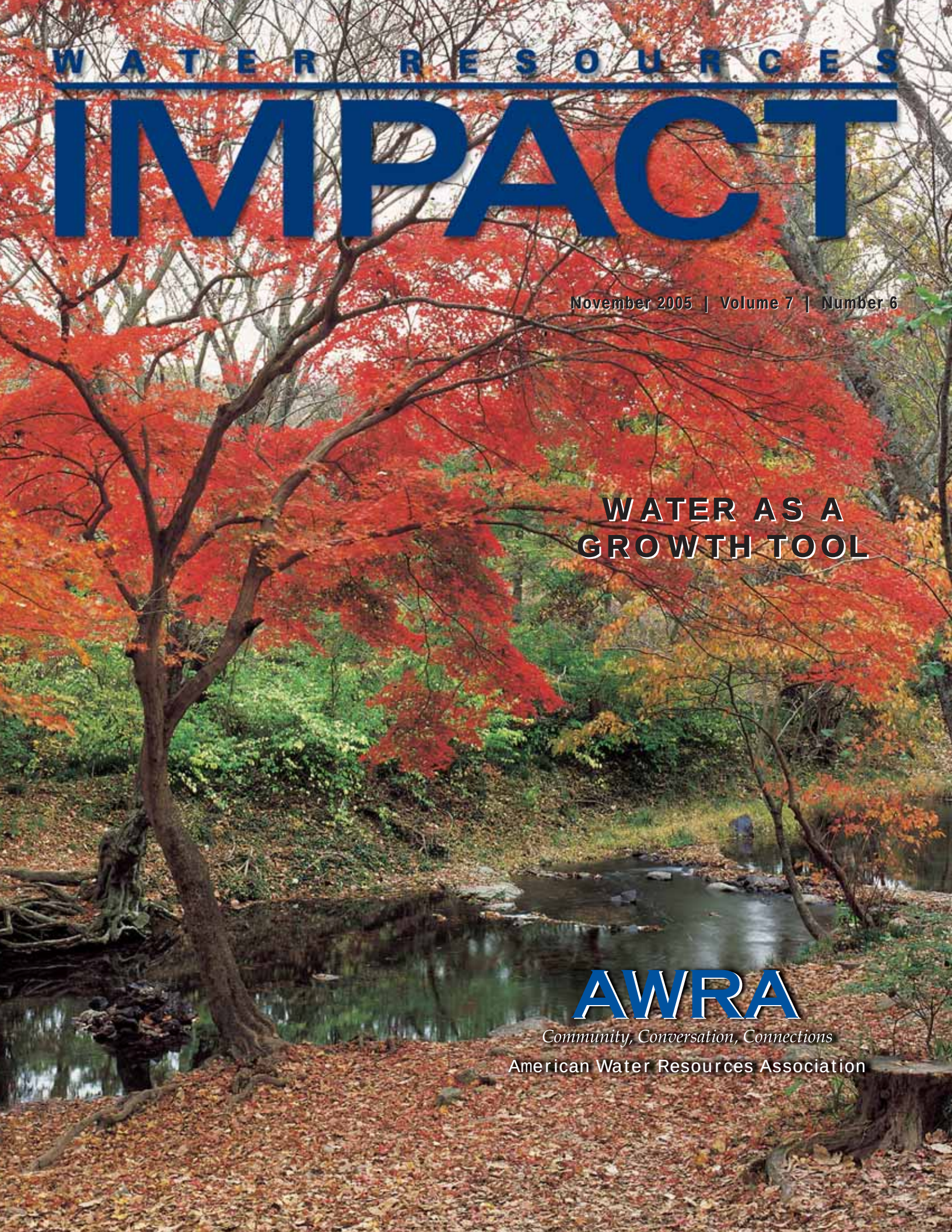

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IMPACT

November 2005 | Volume 7 | Number 6

WATER AS A GROWTH TOOL

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WATER AS A GROWTH TOOL

Associate Editor • MICHELLE HENRIE
mhenrie@rodey.com

"Growth." "Water." These are two words that are bound to evoke a reaction when they appear side by side. No matter how a person feels about growth and change, it happens. And when it happens to communities, water supplies are affected. This issue of *IMPACT* explores various water related concerns that communities face in trying to manage community growth. This issue shares novel approaches and solutions developed by community leaders in Santa Fe, New Mexico, and two water suppliers in Colorado and Utah. It discusses a huge legal problem for water resource managers (water forfeiture) as well as an important legal tool (moratoria). It also suggests that ground water resources may need to be better integrated into land use planning and decision making. Read together, the message from these articles is to plan ahead, be creative, and be on guard.

OVERVIEW

FEATURE ARTICLES

WATER RESOURCES
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Other features in this issue ...

Scheduled Topics for Future Issues ...

JANUARY 2006
HOMELAND SECURITY
ERIC J. FITCH (fitche@marietta.edu)

MARCH 2006
USING THE NATIONAL HYDROLOGY DATA SET
JEFFREY D. SIMLEY (GUEST EDITOR) (jdsimley@usgs.gov)

MAY 2006
ADAPTIVE MANAGEMENT
GERALD SEHLKE (GUEST EDITOR) (gerald.sehlke@inl.gov)

JULY 2006
SUSTAINABLE WATER RESOURCES ROUNDTABLE
HARRY ZHANG (GUEST EDITOR) (Harry.Zhang@parsons.com)

SEPTEMBER 2006
MANAGEMENT IMPLICATIONS OF CLIMATE CHANGE
JOHN FURLOW (GUEST EDITOR)

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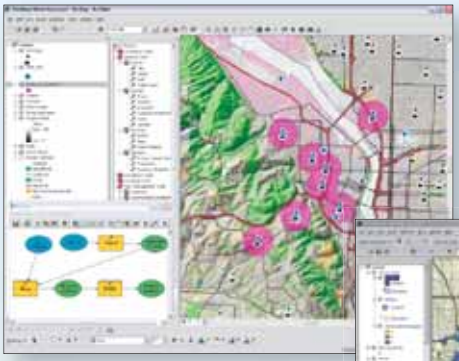

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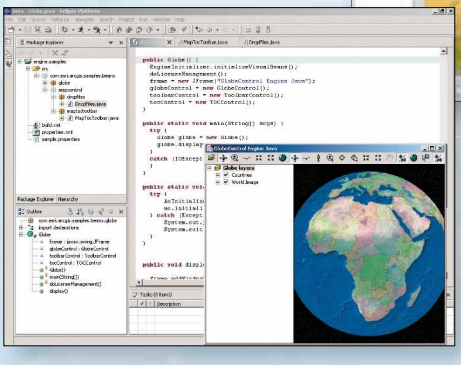

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WATER RESOURCES IMPACT

WATER AS A GROWTH TOOL – INTRODUCTION

Michelle Henrie

Growth happens. Here in the Western United States, growth is happening a lot. To many, it appears that growth is happening without regard for whether there is enough water to serve that new growth.

It is not uncommon to hear laments, concerns – even panic – about growth and water. It is not uncommon to read about how the West was founded on misguided policies and laws. And it is not uncommon to hear valid criticisms of experiments and strategies being attempted. The authors of the articles in this issue of *IMPACT* consciously avoided these topics because they are being addressed elsewhere.

Instead, this issue starts with a bias towards "techno-optimism." That is, let us have faith that solutions can be found in science, technology, and/or modification of human behavior (including human laws). In the case of water and growth, there probably is no one "silver bullet" solution. There probably is no cookie cutter approach that will work for everybody. Any solution that works today may not work for the next generation. Instead, we have a constant need to learn, experiment, and do better.

This issue starts with an article by the City of Santa Fe attorney who deals with water issues on a daily basis. The City found itself in a severe drought in 2002, just after it took over management of its water utility. In 2002, City leaders began wrestling with how to gain immediate control over water use in order to prevent an emergency, how to fulfill prior commitments for new water service, and how to bring new water sources online to prevent the problem from happening again. The City developed several innovative strategies that have worked. My personal favorite is the toilet retrofit program. This program of offsets was aimed at ensuring no new net loss to the City's water system from new development, and it was enacted in lieu of a building moratorium.

The second article describes two reservoirs developed in response to growing water needs by local communities in Colorado and Utah. These reservoirs are interesting in several respects. First, they both were sited specifically to allow aquifer enhancement. The expected result is increased yield from and better conjunctive management of water resources. Second, neither reservoir required the damming of a flowing watercourse. This unusual siting contributed to the permitability of these projects.

The third article discusses a Catch-22 situation that had been brewing in Oregon – but not unique to Oregon. Municipalities and water service providers are left in a terrible situation if they do not have the water needed to serve new customers. However, in "use it or lose it" states, water acquired for future use could be vulnerable to forfeiture. In Oregon, a new law balances these competing issues.

The fourth article is an overview of a legal tool that may be available to local governments if or when they face an inability to serve new water users: moratoria. This article describes the fine line between a moratorium and a "taking," provides hands-on suggestions for imposing a moratorium (including ordinance drafting tips), and discusses possible pitfalls.

The final article provides a summary of a report by the Center for Land Use Education in Wisconsin working in conjunction with Charles Dunning, a hydrologist with the U.S. Geological Survey and an Adjunct Professor for the University of Wisconsin-Madison. This article tracks the extent to which ground water resources are being addressed and protected by community comprehensive planning in Wisconsin.

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WATER RESOURCES IMPACT

THE EVOLUTION OF WET GROWTH REGULATIONS: CITY OF SANTA FE

Kyle Harwood

INTRODUCTION

The City of Santa Fe, the state capital of New Mexico, is located in the high desert of northern New Mexico and has an economy that is largely based on tourism, the arts, and state and local government. The Sangre de Cristo Water Division of the City of Santa Fe supplies nearly 30,000 residential and commercial meters and produces approximately 12,000 acre-feet of water per year. The city's water resources include two high mountain surface reservoirs, a wellfield located within the City limits, and the Buckman wellfield, which is located near the Rio Grande several miles west of the city. The planned Buckman Direct Diversion (BDD) project is a Rio Grande surface diversion project that will allow the city and two regional partners to conjunctively manage surface and ground water resources in order to provide long term sustainable water resources. It is expected to be operational in 2009.

The drought of 2002 highlighted the need for long term sustainable water resource planning and emphasized the vulnerability of existing water resources to meet current and future customer demand. Since 2002, the city has drilled additional ground water wells and implemented very aggressive water conservation regulations. Current planning and construction is focused on long term sustainable water supply and conjunctive use management of surface and ground water supplies. A comprehensive analysis of drought yield supply, commitments to existing and future customers, and conjunctive water resource planning has prompted changes to land and water regulation in which water resource yield informs the land use decisions that are before elected officials.

The term 'wet growth' has been used by some authors and academics to describe the regulations that result from the integration of water supply planning and land use decisions, and the City of Santa Fe is a case study of this emerging policy in the Southwest. The tension between rural and urban uses of water, changing federal water policy and funding, and the uncertainty of drought and climate change have required municipal water providers to evaluate the connections between land use decisions and the water resources that are needed to supply existing and future municipal demands.

HISTORY

The history of water use in the Santa Fe area dates back several hundred years to the settlement of the town and the subsequent growth of the area under Spanish, Mexican, and American governments. Surface water from the Sangre de Cristo mountain range provided the water supply for the city through the middle of the 20th Century. In the 1940s and 1950s a series of wells were drilled along the alignment of the Santa Fe River to access ground water in the local aquifer. In the 1970s a series of wells were drilled 12 miles west of the city near the Rio Grande to tap into the regional aquifer that is hydrogeologically interconnected to the state's most important surface river system.

In the early 1990s the city sought the purchase of the Sangre de Cristo Water Division from the Public Service Company of New Mexico (PNM), a large utility provider with investments in gas, water, and electricity. The purchase agreement was finalized in 1995 and PNM continued to operate the water utility under a management contract with the city for several years. In contrast to the growing trend in the national and international economy towards the privatization of utility service, the City of Santa Fe acquired the water utility after the purchase and financing decision was approved by the City Council and the local electorate. This 'public-ification' of the Sangre de Cristo water utility resulted in the conveyance to the city of the utility assets, as well as the duty to serve the customer base, the discretion to establish water policies and the responsibility to prepare long term planning.

... the demand for potable water in the Santa Fe region had grown in the 1980s and 1990s to depend on a surface water yield that was not available in 2002

Analysis of existing and future water resources planning has traditionally used a three-part model. Some authors have called this model the 'three-legged stool' that supports the provision of municipal water supply. The three components include: the legal ability to divert a water resource (water rights), the physical availability of the water resource at a surface or ground water location (wet water), and the infrastructure to move and treat the water from its natural location to the rate paying customer (infrastructure). The drought of 2002 demonstrated that the failure of one of these components (the wet water yield from a surface reservoir during a severe regional drought) can put the whole system into jeopardy.

In a nutshell, the demand for potable water in the Santa Fe region had grown in the 1980s and 1990s to depend on a surface water yield that was not available in 2002. The watershed reservoirs will provide up to 40 percent of the annual demand under conditions of normal precipitation. However, the experience of recent droughts and the imperative of long term planning require new analytical tools, regulatory structures, regional agreements, investments in infrastructure, and planning efforts.

WET GROWTH REGULATIONS AND POLICIES

The drought conditions of 2002 severely stressed surface water resources and created a water resource crisis in the City of Santa Fe. A series of regulations and policies were then promulgated which tightly integrate land use, water conservation, annexation policy, rules for new construction, and water resources planning.

The first response of the City Council to these circumstances was to pass a resolution that restricts the connection of new customers outside the city limits, unless the future customer had a prior, valid agreement for service. In 2003 the Water Budget Administrative Ordinance was passed and requires all new construction inside and outside the city limits to offset the project's water budget through the retrofit of existing toilets with high efficiency low flow toilets. In 2005 the Water Right Transfer Ordinance was adopted, which requires new large construction projects to transfer water rights to the city before building permits may be issued. The scope and complexity of these wet growth regulations has evolved over time.

A NEW ANALYSIS OF DEMAND

The resolution passed in April 2002 restricts new connections to the city water utility outside the city limits and requires new requests to be subject to staff review and City Council approval. Uncertainty regarding the quantification of commitments to serve that had been made by the previous operator of the water utility have complicated long term planning.

A group of legal staff and outside consultants prepared a Utility Demand Analysis (UDA) in 2003 in order to evaluate and quantify existing commitments. The UDA describes an upper and lower estimate for water demand attributable to existing customers (subject to varying levels of water conservation regulation), new projects under construction, known and unknown commitments to future customers, a buffer for parks and recreation/quality of life needs, and new requests for service for which there is no existing commitment. In conjunction with demographic projections, the UDA provides an estimate of the water needed for long term water resources planning.

A Technical Review Team (TRT) was established by resolution to review new applications for water and wastewater service. The TRT includes staff from a variety of Divisions (planning, legal, water, wastewater ,and the city manager's office). From a municipal perspective, the resolution characterizes a request and commitment to provide water and wastewater service outside the city limits to be a contractual agreement subject to City Council approval. This policy functionally replaced the state regulated line extension policy that the previous operator had followed. The resolution has been amended on three occasions since the original implementation, most recently in July 2005, to adapt to the lessons learned from implementation, requests from regional entities, and staff recommendations. The TRT resolution contains an exemption for existing contractual agreements, an exemption for an existing single family dwelling with health and safety concerns and a process for demonstrating that a request for service is in the 'interest of the community as a whole.'

The combination of the TRT review of requests outside the city limits and the UDA estimate of utility customer water demand (inside and outside the city limits) provides the basis for a regional water budget and policies to address the gap between future demand and supply.

OFFSETS AND CONSERVATION REGULATIONS

In the summer and fall of 2002, the City Council considered several different water budget proposals as a way to integrate new construction review and building permit issuance with the increasingly severe drought conditions. The public debate and media coverage was intense.

The resulting Water Budget Administrative Ordinance (WBAO) requires that all new construction connecting to the water utility offset the site water budget demand through the savings credited to the conversion of older toilets to new high efficiency low flow toilets. In order for a retrofitted toilet to be eligible for the program as an offset it had to be at a location already served by the utility, had to be building construction that was permitted before the adoption of the revised Uniform Building Code (which mandates low flow fixtures) and was subject to an inspection review by planning staff. Different levels of water offset credit were assigned to commercial toilets based on the commercial type and estimate of usage. With respect to the site water budget for the new construction, Santa Fe specific averages were developed for over 30 categories of commercial use and three levels of domestic (single family home) use based on the parcel size. The increment of savings from each retrofitted toilet was estimated using U.S. Environmental Protection Agency national averages for toilets in the home, and Santa Fe estimates for the average number of people per home. As a point of reference, the smallest domestic use category retrofits eight existing toilets in order to offset the water budget demand for all uses of the new home. The basic theme behind the WBAO program is zero new net demand for new construction until the regional water budget and the utility's water resources can demonstrate long term sustainable supplies.

A wet growth incentive to support low income affordable housing was created when the city purchased and gave away over seven thousand low flow toilets in 2002. The low income affordable housing component of new construction may use the credit pool generated by the city's program to offset that portion of the new construction's project water budget.

The city also adopted a stage based water conservation and drought demand management program that ties short and medium term water supply forecasts to the level of conservation regulation. This water conservation program accomplished a significant reduction in peak demand and encouraged leak detection programs,

conversion of landscaping, customer water use behavior changes, and other innovative programs. The city estimates that current customer demand is 112 gpcd (gallons per capita per day), one of the lowest municipal demands in the Southwest.

WATER RIGHT TRANSFERS

In July 2005 the City Council passed an ordinance requiring projects with large new customer demand to transfer water rights to the City in order to offset a project's site water budget. Large new customer demand is characterized as projects with over 10 afy (acre-feet per year) of residential demand or those projects with over 5 afy of any other use, including mixed residential use. The regulations apply to projects below these thresholds. The ordinance is applicable to the next land use approval application for a project after the effective date of the ordinance and requires that water rights be tendered to the city for review and approval. If the tendered rights are approved, the city and developer become co-applicants in the State Engineer transfer process and the building permits may not be issued until the transfer is completed.

The ordinance proposal was initially discussed and drafted several years ago at the time the WBAO program was implemented and the limited nature of retrofitting existing toilets was recognized. In the spring of 2005 several large annexation proposals came forward to the City Council and a complimentary water offset policy was requested that would increase the techniques for providing water offsets. Those three annexations agreed to custom water offset provisions that included some toilet retrofit offsets and some water right offsets. After the annexation agreement negotiations, the Council adopted a Water Right Transfer Ordinance in July, 2005.

REGIONAL WATER AGREEMENTS

In the past two years the city has entered three significant agreements that further define the water resources future of the region. First, a historic intergovernmental contract for service with the Santa Fe County utility

incorporates the urban city limits and the increasingly urban extra-territorial zone that surrounds it. Second, a significant settlement agreement with a large upscale land development outside the city was reached after litigation over the applicability of city water policies to the delivery of water to the development. Third, a long term lease of Rio Grande water with a northern New Mexico Native American tribe provides the water resource for future conjunctive use planning as part of the BDD Project and other long range water resource plans.

Current efforts are focused on the development of a facility operations and procedures agreement for the BDD Project that will define the relative roles and responsibilities of the three partners in funding, construction, treatment and transmission, maintenance and repair, and low flow operations for the facility. A new governance structure to oversee the BDD Project was created by the two local government partners and includes elected officials from both governments and a citizen member.

CONCLUSION

City staff and consultants are currently evaluating dozens of new water resource policies and projects in order to plan for a sustainable water supply. The evolution of wet growth regulation in Santa Fe has been a combined reaction to the municipal acquisition of the water utility and the recent drought conditions. The city has adopted a range of resolutions, ordinances, and agreements that integrates land and water use and which are focused on long range water supply planning.

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WHY SOME WATER DISTRICTS DECIDED TO DAM IT

Tarrah Henrie

INTRODUCTION

Two reservoirs are the focus of this article. One is in Parker, Colorado, and the other near St. George, Utah. Both reservoirs were developed in response to rapid regional growth. Also, both reservoirs are examples of how communities have been able to increase water supply – and thereby allow community growth – through creativity, planning, conjunctive use, and sophisticated management of their water resources.

The rapidly expanding town of Parker is experiencing growing pains familiar to many bedroom communities across the nation. One of the main problems has been finding water to serve new residents. In 1985, advanced planning projected a water shortfall as the community continued to grow. Ground water is the current source of water, and the aquifer is losing 30 feet of head each year. The Parker Water and Sanitation District (PWSD) has begun constructing a dam that will solve these problems. The dam is being constructed on a tributary stream, and water will be transmitted to the new Rueter-Hess Reservoir from several sources. Building the reservoir on a tributary rather than the main creek eased the regulatory process and allowed the project to go forward. Some of the treated surface water will be pumped into the aquifer for storage.

The Washington County Water Conservancy District (WCWCD), near St. George provides water to St. George and six other communities. The St. George area has nearly tripled in population in the last 20 years, and the municipalities were relying on springs and ground water. Ground water rights are assigned in this area, and these communities were using all of the water that they were allowed. The WCWCD, which already provides water from one reservoir, decided to build another. The new Sand Hollow Reservoir will enhance natural recharge, but no water will be injected into the aquifer. Five wells have been drilled to extract the water from the aquifer.

RUETER-HESS RESERVOIR

Parker is located about 30 miles southeast of Denver. The Parker Water and Sanitation District (PWSD) currently serves 12,000 connections, and 1,000 connections are being added each year. It is estimated that the system needs to be able to serve about 40,000 connections.

Ground water is the only source of water at this time. The main water bearing aquifer is the Arapahoe Aquifer. It is pressurized, which means that when a well is drilled, the well draws water from the aquifer even though the well is higher than the top of the surrounding aquifer. Water is being taken out of the aquifer faster than it is being replaced, and consequently the pressure in the aquifer is declining by 30 feet of head per year.

Although there is generally a connection between the surface water and ground water systems, the legal structure of water rights tends to treat ground water differently from surface water

Pressurized aquifers should maintain no pressure loss to be sustainable. A pressurized aquifer with declining pressure is being used in an unsustainable way. This issue is in no way unique to Colorado. In many areas across the nation ground water is being used unsustainably.

The PWSD began advanced planning 20 years ago. Surface water was the recommended solution, and the PWSD initially considered three dam sites. Conservation has played an important role in stretching PWSD's existing resources during this planning period. A tiered pricing schedule went into effect in 1986, and it has resulted in a 40 percent reduction in water use. Because this project has taken nearly 20 years to complete, the importance of planning becomes clear.

The first choice site was in the Castlewood Canyon State Park with a dam on the headwaters of Cherry Creek. The Colorado Parks and Outdoor Recreation Board denied the request to build the dam in the park. The case ended in the Colorado Supreme Court, which, in November of 1993, declared that PWSD would not be allowed to move forward with a dam at that site. The second choice site of PWSD was successful, and it will be the location of the Rueter-Hess reservoir.

Often the word "dam" evokes images of big dams in major rivers. The Rueter-Hess Reservoir will not have that kind of a dam. Its dam will be built in Newlin Gulch, a tributary stream that does not run year round. Newlin Gulch flows to Cherry Creek, which does run year round. Because Newlin Gulch does not run year round there are fewer regulatory hurdles that need to be overcome.

The PWSD was creative in finding source water to fill the reservoir. This kind of creativity can be important in areas where attaining new water rights is difficult. Water to fill the dam will come from some unusual places – high flow from Newlin Gulch, high flow from Cherry Creek, shallow wells near Cherry Creek, and water from Cherry Creek exchanged for wastewater treated at the advanced water treatment plant.

Using shallow wells near a stream can be a great source of water in the West. These wells often produce a lot of water of good quality. Although there is generally a connection between the surface water and ground water systems, the legal structure of water rights tends to treat ground water differently from surface water. This legal situation has its pros and cons. For PWSD, it created the ability for conjunctive use and management between the two systems. Obviously, one's ability to do likewise will depend on the laws and regulations of his or her state, as well as facts such as whether a ground water basin has been adjudicated.

In association with the Rueter-Hess Reservoir dam, a surface water treatment plant is being constructed. From the surface water treatment plant, treated water will be pumped for storage in the aquifer through two wells located near the treatment plant. As PWSD realizes, it is important to treat surface water before injecting it into the aquifer because surface water contains bacteria, viruses, and other harmful pathogens such as *giardia* and *cryptosporidium*. Ground water does not contain these pathogens, and to avoid contamination of the ground water, the surface water needs to be sanitized.

SAND HOLLOW RESERVOIR

The Washington County Water Conservancy District (WCWCD) provides additional water for St. George and the communities of Washington City, Hurricane, Ivans, Toquerville, LaVerkin, and Virgin. In the future this water may serve Santa Clara as well. Historically these municipalities relied mainly on ground water and springs to serve their customers. Ground water rights are assigned in this area, and these communities faced a need for more water because they were at the limit of their water rights due to community growth.

The WCWCD already owned and operated one reservoir and surface water treatment plant, and the treated water was sold to these communities. The WCWCD wanted to provide additional water, so it conceived the idea of the Sand Hollow Reservoir. At the Sand Hollow Reservoir, the water will be allowed to percolate into the Navajo Sandstone that is underneath it.

Over a decade ago the WCWCD began working on this project. First it had to secure land for the reservoir. This was done through a federal land swap in 1996. An environmental report was prepared and archeology at the site was a concern. Important archeological artifacts were recovered, and the project was on its way.

The Sand Hollow project cost approximately 32 million dollars. It includes two earthen dams: one is 3,000 feet long and the other is 7,500 feet long. The reservoir covers over 1,000 acres, and will provide between 4,500 and 11,000 acre-feet of recharge to the aquifer in a year. Figure 1 is a photo of the reservoir. It is now a hotspot for recreation, and it is part of Utah's newest state park.

Water for the reservoir comes through the Quail Creek diversion via a 54-inch pipe. This reservoir, like the Rueter-Hess Reservoir, is not on a main waterway, which makes regulatory approval an easier process. Five wells have been constructed to collect the recharge water, and this extra water is being used to help the fast growing communities. It is also possible to transport the reservoir water back to the existing Quail Creek Reservoir where it can be treated at the surface water treatment plant.

Figure 1. Sand Hollow Reservoir.

ISSUES RAISED AND LESSONS LEARNED

Aquifer Injection Versus Enhancing Natural Ground Water Recharge

There are two advantages to aquifer storage and recharge through injection: it increases recharge to the aquifer, and it can provide long term storage for water without evaporative losses. Using aquifers to store surface water is a tactic used by many communities across the nation.

An advantage to aquifer injection is that if the ground water contains elevated concentrations of total dissolved solids or a trace contaminant, such as arsenic, the injected surface water will dilute the contaminant and improve the overall quality of the water in the aquifer.

However, there are concerns associated with aquifer injection. In California, aquifer injection is coming under increased regulatory scrutiny as the Department of Health Services becomes more concerned with contaminants from the surface water affecting the quality of the ground water. In areas near Los Angeles, treated water from the Colorado River has been injected into the aquifer for storage. The Colorado River is high in organic matter, and, when treated with chlorine, the organic matter reacts with the chlorine to form trihalomethanes. Ground water is generally low in organic matter, and does not usually form high levels of trihalomethanes when treated with chlorine. The water in the aquifer has higher levels of trihalomethanes than it would if there were no injected surface water.

Another area of concern in California is emerging contaminants. When Colorado River water was first injected into the ground water, a compound called perchlorate was unregulated. Even though the State of California now is adopting a maximum contaminant level (MCL) for percholate (and, even though in this specific case the ground water probably will still meet the standards), this situation points to a possible problem with other unregulated compounds.

There are some advantages to enhancing natural ground water recharge, as opposed to injecting surface water. Surface water that naturally recharges the aquifer does not need to be treated first. The ground will act as a filter, and remove sediment, and pathogens. When this water is recovered, it is regulated as ground water, so it will probably just need to be chlorinated to prevent microbial growth in the water system. Also, it usually is less expensive to drill ground water wells than to construct a surface water treatment plant.

On the other hand, the ground water may not be amenable to enhanced natural recharge. Navajo Sandstone, which underlies the Sand Hollow Reservoir is very porous and can absorb a lot of water. In areas where there is a significant clay layer between the surface and the aquifer, enhancing natural recharge may not be very effective.

Location and Timing

Dam construction takes a significant amount of advanced planning. The Rueter-Hess Reservoir took 20 years from conception to completion, and Sand Hollow took over a decade. Several regulatory agencies may become involved including several state agencies, the U.S. Environmental Protection Agency, the U.S. Department of Fish and Wildlife, State Department of Natural Resources, and U.S. Corps of Engineers. As part of the National Environmental Policy Act (NEPA) the water utility, or one of the regulatory bodies, will conduct an Environmental Assessment (EA).

As illustrated by the Rueter-Hess Reservoir and the Sand Hollow Reservoir, site selection can greatly affect the ability to gain needed approvals in a timely fashion. A dam on a river may be opposed very strongly by citizen groups, and may be delayed significantly, or canceled due to their actions. The EA for a dam may find significant damage to fish populations that swim upstream to spawn, or that need seasonal flows to maintain healthy populations. In some cases these concerns may be mitigated by fish ladders that allow the fish to move up successive ponds until they reach their natural spawning areas. Alternatively, if the proposed dam site is on a seasonal stream, or not on a stream at all, then the EA has a good chance of finding no significant environmental damage from the project.

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WATER RESOURCES IMPACT

OREGON'S MUNICIPALITIES CAN TAKE THE TIME THEY NEED TO GROW

Michelle Henrie

INTRODUCTION

For municipalities and other water service providers, there is an art of timing inherent in gathering the resources you know you will need in the future, such as water rights and wet water, and in developing those resources in a way that makes sense for the community. This art requires dexterity. One must successfully balance money, politics, community values, aging infrastructure, and other concerns ... including the law.

In Oregon, a recent change in the law caused a huge shift in how these factors have to be balanced. This change would have been particularly difficult for small municipalities. Small municipalities would have needed to build out infrastructure in a timeframe that was practically impossible – or lose their water permits. For these small municipalities, one could only hope that they would recoup revenues and cost reimbursements (if you build it, will they come?). And one can only imagine how difficult it would be for a community to make the needed decisions in a forced timeframe. Should we jeopardize the resource investments we have already made? Should we gamble on growth? If so, do we place our bets on becoming as big as we can become? Do we care what our neighbors think?

Fortunately for small town Oregon, the law changed a second time. The second change restores the balance and allows Oregon's municipalities to take the time they need to grow.

WALDPORT, OREGON: A CASE STUDY

Waldport, Oregon, population 2,100, is an incorporated city located in Lincoln County on the central Oregon coast. The town is next to Alsea Bay, a large, pristine estuary formed by the opposing forces of the Alsea River and the tides of the Pacific Ocean. Waldport includes a historic townsite, which is located on a sand spit at sea level, but also includes new development on the hillsides that rise above the bay.

The town's traditional economic bases – timber and commercial fishing – are now largely defunct, so the leaders of Waldport are working hard to attract new businesses. While they hope to maintain Waldport's small-town charm, they also welcome growth and development that will make it more prosperous and economically diverse. Without a secure water supply, Waldport would be unable to attract the kind of clean, light industry businesses it hopes will form its new economic base.

Waldport's water is currently supplied with certificated water rights on two streams – Eckman Creek and Weist Creek – both located about three miles east of Waldport, and both tributaries of the Alsea River. These two streams provide adequate amounts of water for Waldport's needs currently. But eventually, as the city grows, it will need its permits on Southworth Creek, located further east. Between the two existing sources and the permit for future use, Waldport hoped to provide more than enough water for at least the next 100 years, says its mayor, Scott Beckstead.

Then the Oregon Court of Appeals clouded Waldport's plans for its future. "Unfortunately, we've been pretty nervous about our rights on Southworth Creek ever since the Court of Appeals issued its decision in April 2004," says the mayor. He explains that in that case, titled *WaterWatch of Oregon, Inc. v. Water Resources Commission*, the court decided that a municipality that owns a permit, but not a certificated water right, must develop the infrastructure on the permitted water source within five years from the date the permit is issued. Otherwise, the town loses the permit.

... there is an art of timing inherent in gathering the resources you know you will need in the future, such as water rights and wet water ... one must successfully balance money, politics, community values, aging infrastructures, and other concerns ... including the law

"That ruling had many small towns in Oregon scrambling to find ways to build water infrastructure that might not be needed for decades," says Beckstead. "And here in Waldport, we simply don't have the money to build an expensive system that would basically sit idle for the next fifty years." The mayor says that the City is in the earliest stages of planning that infrastructure – crews are mapping the area where the pump and pipelines would be located – but that actual construction will not happen for many years to come.

Fortunately, the Oregon Supreme Court and the state legislature apparently recognized the harsh consequences of the Court of Appeals' decision in the *WaterWatch* case. On September 9, 2005, the Oregon Supreme Court vacated the *WaterWatch* decision by the Court of Appeals. It did so in part because of a bill passed by the legislature and approved by the governor – a bill that was written as a direct response to the Court of Appeal ruling in the *WaterWatch* case. The bill provided that all water rights for municipal use issued before 2005 are not subject to administrative or legal challenge with respect to completion of construction of infrastructure within a specified period of time. In other words,

Waldport can grow at a pace that makes sense for Waldport. How did this *WaterWatch* roller coaster ride happen?

THE CONTROVERSY OVER TENMILE CREEK

In 1990, the Coos Bay North Bend Water Board ("Coos Bay") applied to the Oregon Water Resources Department for a permit to appropriate water from Tenmile Creek for its projected growth and water needs through 2050. The Department issued Coos Bay a permit in 1997. The permit was protested by *WaterWatch*, a river conservation group, and by a neighboring municipality, Lakeside, whose tourist based economy depends on recreational fishing. The protest was heard by the Oregon Water Resources Commission. The Commission also approved the permit. *WaterWatch* appealed the Commission's decision to the Oregon Court of Appeals.

THE COURT'S *WATERWATCH* RULING

The key issue before the Court of Appeals was the interpretation of an Oregon statute, ORS 537.230. This law required construction of water projects to "be prosecuted with reasonable diligence and be completed within a reasonable time, as fixed in the permit …, not to exceed five years from the date of approval."

At the administrative level, the Commission agreed with the Department and focused on the "reasonable diligence" prong of the statute, not the five-year time limit for construction. It noted that the statute allowed extensions of the five-year limit. In addition, the Commission recognized that the five-year limit on construction was not realistic for this project whereas "reasonable diligence" was. The timeframe for the project included:

- One to two years to have a stream gauging station functioning properly and providing meaningful data.

- Up to three years to tie together flow and water quality data. Coos Bay needed this data to know whether it could use Tenmile Creek water in its raw state or whether it would need to construct a treatment facility. This data also would assist Coos Bay in locating the waterworks and in developing alternatives for the NEPA process.

- Five to ten years to conclude the NEPA process. This timeframe could be affected by concurrent issues such as land acquisition, resolving any fisheries and/or wetlands issues, and discussions with the United States Forest Service regarding Wild and Scenic River designation for Tenmile Creek.

- Depending on the alternative selected, Coos Bay's design of the system could take up to two years, and construction could take an additional two to three years.

In the administrative proceedings, the Commission concluded that the process would require ten years, at best. Given the legal constraints on developing the Tenmile Creek water right, the Commission found (1) that Coos Bay "could not possibly apply water to beneficial use in a five year period;" (2) that a resolution passed by Coos Bay ensuring that it would use due diligence in developing the permit "evinces an intent to develop its permit with due diligence under the circumstances;" and (3) that, if Coos Bay did not proceed to develop its water right with the appropriate diligence under the circumstances, the Department "may refuse to grant an extension."

WaterWatch disagreed with this interpretation. It argued to the Court of Appeals that the Coos Bay was not exercising "reasonable diligence" by collecting data within the statutory five-year time period. Instead, it needed to begin construction during this time period.

Before the Court of Appeals, Coos Bay and the Commission responded to *WaterWatch* by highlighting the issues municipalities face in anticipating and planning for future growth. While *WaterWatch's* interpretation may be justified for nonmunicipal water users, they argued that the five-year time limit should be treated as a "guideline" for municipalities because of their unique status.

In April of 2004, the Court of Appeals ruled. It conducted a close reading of the statute, and agreed with *WaterWatch*: even for a municipality, construction must begin within the five-year time limit. The Court reversed the Commission's decision, thus revoking the permit.

NEW LEGISLATION

While the Court of Appeals' decision was pending before Oregon's Supreme Court in the spring of 2005, the Oregon legislature added to the debate by amending ORS 537.230. Representative Bob Jenson introduced House Bill 3038 in April in response to the policy concerns raised by Coos Bay – and echoed by municipalities throughout Oregon. The proposed amendment (as amended) did not require municipalities to begin construction of waterworks at any particular time so long as waterworks construction was completed within 20 years or an extension had been granted.

WaterWatch raised concerns that the amendment would allow municipal water permits to linger, undeveloped, for decades. If so, it argued, analyses relating to the withdrawal would become outdated by the time the water was actually diverted. The municipalities, however, felt that they needed the ability to hold water rights that may be larger than their current need in order to plan for their future growth. Because the permitting and construction process can take decades, municipalities feared that they would lose water rights needed for future growth due to nonuse without the protections provided by the proposed amendment.

The amendment to ORS 537.230 passed both houses and was signed by the Governor in June of 2005. In September, the Oregon Supreme Court vacated the Court of Appeals' *WaterWatch* decision.

WHAT IT ALL MEANS TO WALDPORT

With the amendment to ORS 537.230, Waldport's future water rights appear secure. Waldport can grow at a pace that makes sense for Waldport. In fact, the benefit of this security may extend beyond Waldport. There is discussion about the possibility of sharing water resources. For example, Waldport's sister city to the south, Yachats, does not share its water fortunes. Because its primary water source, the Yachats River, is also important spawning habitat for endangered salmon, a conflict could be brewing that could threaten that city's plans for future growth. With its water rights secured and the future of its water resources bright, Waldport could be in a position to sell some of its water to Yachats if the need arises.

Mayor Beckstead said there has been talk in recent years of some sort of collaboration between the three main water producing entities in south Lincoln County, namely the City of Waldport, the City of Yachats, and the Southwest Lincoln Water District, which serves the area between the two cities. At this point, the discussion has been limited to the concept of integrating water infrastructure in a way that would allow the sharing of water among the three entities.

"I don't want to see Waldport give up its water rights, or even any authority over how it uses its water, to anyone else," says Beckstead. "But by working in cooperation with these other entities, perhaps we will be able to help our neighbors if the need ever arises, and gain some revenues for Waldport in the future."

Beckstead explains that the communities in south Lincoln County are often subject to the whims of what he calls the "two four-hundred pound gorillas to the north," the Cities of Newport and Lincoln City, both of which are many times larger than Waldport. "In the face of pressures from these bigger towns, it is crucial for the smaller entities to stick together in order to maintain any sort of influence over our own destinies," he said. "So even though Waldport and Yachats are vastly different in terms of economics and demographics, we stick together like bosom buddies in order to impose some balance in the county-wide equations."

"It makes sense for these three water entities to work together and start working on a plan to share water in the future if necessary," the mayor remarked. "And with Waldport's water rights secure, it makes it that much easier to start talking about how we can share our fortunes with our neighbors in a way that benefits everybody."

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▲ Employment Opportunity

DON'T MISS THE ARTICLE ON PG. 26 ABOUT THE AVAILABILITY OF FEMA DISASTER JOBS

AND

THE ARTICLE ON PG. 27 CONCERNING "NATURAL DISASTERS AND SCIENCE: A CHALLENGE TO THE SCIENTIFIC COMMUNITY"

WHAT'S YOUR OPINION? ... SEE PG. 28
SEND THE EDITOR YOUR FEEDBACK!

WATER RESOURCES IMPACT

BUILDING MORATORIA: STRATEGIES AND TOOLS FOR GOVERNING BODIES

Diane Albert

INTRODUCTION

Governing bodies often are faced with difficult decisions. Few may be as difficult as imposing building moratoria in the face of water shortages. Yet there are times when a moratorium is not only legally justifiable, but also practically necessary. Governing bodies' primary duties are to ensure the safety and security of citizens and to ensure the historical and expected levels of service for basic needs such as water at a reasonably affordable cost. It is also the duty of elected officials to set policy, plan, and communicate effectively with stakeholders about possible water shortages well before the possibility of spigots running dry becomes reality. Moratoria are tools to aid governing bodies in balancing these duties. This article discusses the general legal requirements for moratoria and strategies for enacting and managing a moratorium.

WHAT IS A MORATORIUM, AND WHEN IS IT LEGAL?

A moratorium is a tool whereby a law is imposed to suspend or postpone some governmental activity (utility service, zoning approval, annexation, land subdivision, site plan approval, building permit, certificate of occupancy, etc.) for a specified period of time. Courts have found moratoria lawful when a moratorium is based on a problem faced by the community and the moratorium lasts only for a reasonable period of time. When properly used, moratoria should provide the government time to address and solve a problem.

Growth can trigger many water related challenges for communities, including water quality issues, water shortage issues, lack of capacity issues, and the problem of needing water for a higher or better use. Resolving these water related challenges is neither quick nor easy. One seemingly easy solution is to just stop allowing new water hook-ups through a building moratorium.

However, be careful. Governing bodies should consult with their attorneys prior to considering a moratorium because moratoria have drawn legal challenges of "takings." "Takings" involve a governmental entity either (1) actually taking privately owned land for public use through eminent domain (condemnation) or (2) enacting a restriction or regulation that takes all beneficial uses away from the land owner (known as "inverse condemnation"). Moratoria can fall in this second category. A "taking" may be allowable so long as it benefits the public and the property owner receives fair payment for his or her property – but what community wants to pay cash for a "taking" when it doesn't need to pay anything for a moratorium?

The United States Supreme Court has held that a moratoria on new development, covering a specific time period, ordered by a governmental agency, with the purpose of maintaining the status quo while studying the impact of development and while designing a strategy for environmentally sound growth, did not constitute a "taking." Thus, generally speaking, a building moratorium imposed in response to water challenges created by new growth can avoid being deemed a "taking" (i.e., no dollars need to be paid to affected property owners) so long as there are good reasons for the moratorium and for the length of the moratorium.

Keep in mind ... *moratoria are not meant to be permanent.* While some land owners are happy to hold land for a period of time so long as land values go up, practically no land owner would want to see a government imposed perpetual moratorium on her property. Land owners must carry the costs of holding land (mortgage payments, taxes, insurance, etc.). For some people, land serves the role of a retirement fund or a safety net. For others, it is meant to be a short term investment. Some are able to buy land and place it into a voluntary conservation easement or program – and receive the tax benefits for having done so. The point is that land owners make decisions to purchase or to hold or to donate land based on certain expectations: whether it can be subdivided, how quickly a home can be built on it, whether it meets certain criteria, etc. It is unfair to tie up those expectations permanently under the guise of a moratorium. Moratoria may lead to a permanent change (e.g., zoning), but a moratorium is not a permanent solution. It is only legitimate until such time as the government can rectify the underlying problem. The longer it takes, the more likely it is to become a "taking."

When properly used, moratoria should provide the government time to address and solve a problem ... keep in mind ... moratoria are not meant to be permanent

STRATEGIES FOR ENACTING AND MANAGING A MORATORIUM.

Let's assume that a community has found itself in a water shortage, and that its governing body is considering a building moratorium. How would it gather public support for a building moratorium? The following are some strategies.

Before Taking Action

First, plan ahead. As we all know, thinking about shortages and responses to shortages must begin well before there is an actual crisis. Plan so as to preclude overdevelopment. Also, plan alternatives to a moratorium due to a water shortage. Some tools that have been used for encouraging or requiring water conservation include:

- Declaring a water emergency.
- Transferring "Development Rights" to shift development plans out of the affected area.
- Changing zoning anywhere possible.
- Seeking supply increases, including new water sources and water rights.
- Revisiting community planning documents such as Master Plans.
- Prohibiting the issuance of building permits unless the water supply system is adequate to serve proposed construction.
- Requiring developers to provide proof of an independent water supply or to acquire and donate water rights to a water system prior to development.

Second, understand who does what. Determining a level of water reliability appropriate for the community is a policy question. For example, how much risk can be tolerated when estimating and balancing water supply and water demand? Generally speaking, policy decisions and community planning decisions need to be made by a legislature or a governing body whose duty is to develop and implement policy – or they must be properly delegated to someone else (e.g., a department, a board, or an appointed official). By contrast, utility companies have a general duty to provide service – but not to make policy decisions or to do community planning. If a utility company unilaterally decides to refuse new hook ups within its service area, it may draw arguments that it has failed to perform its duty, it acted in an "arbitrary and capricious" (i.e., inconsistent) manner, or it acted in an unauthorized (*ultra vires*) manner by assuming a role that it has not been given. These roles can be less rigid when a quasi-government entity has been created by statute for the express purpose of serving water (e.g., a sanitary authority or court declared water district). In some jurisdictions, state agencies have taken the lead on – or at least consented to – moratoria decisions. Thus, know the allowed scope of authority for each involved entity. Consult an attorney if the scope of authority is unclear.

Third, know the facts. A moratorium will need to bear a provable relationship to the problem at hand. It should not be imposed more than needed – geographically or time wise. And it should be a last resort. One approach is to develop a "Water Shortage Contingency Plan" that lists mechanisms and strategies to decrease water demand, and then implement these strategies before moving to a moratorium. Such strategies can be implemented in stages (e.g., imposing rate increases and prohibiting certain uses, such as car washing or outdoor watering) as supply diminishes beyond certain stages. Alternately, determine and demonstrate that increased water supply is not physically or legally possible – or that it will take a certain amount of time to obtain "wet" water. If you realize that a moratorium must be considered, designate a geographical area a "Water Management Area" so citizens know the exact boundaries where the contemplated moratorium will be implemented. Develop in advance a water management plan that contains a list of prioritized uses in the event that some uses need to be curtailed in order to allocate the full amount of needed water to critical uses, such as hospitals, schools, employment centers. What amount of water needs to be put aside for public use or emergencies such as fire control? Know the answers to hard questions, such as: "Will a moratorium be counter-productive because it will force growth outside of our city boundaries, but that growth will still be inside our watershed and using our aquifer?"

Fourth, recognize counter-effects ahead of time. For example, plan how to guard against panicked people filing for building permits prior to implementation of the moratorium. How will the governing body treat permits that have been granted but not constructed? How will it treat applications completed and filed prior to effective date of ordinance? Governing bodies should consult with their attorneys on these issues. These decisions are better made beforehand. For example, New Hampshire allows building permits to be held "in abeyance" for a specific number of days when changes to the building code or to a zoning ordinance would, if adopted, justify refusal of such permit. Having a known, uniformly applied procedure on the books prior to enacting a moratorium is not only fair to those seeking permits, it also puts a governing body in a better position to defend against claims of "takings," retroactive application of laws, targeted legislation, and violation of equal protection. Also, be aware that permits, once issued, may not be revocable – even if the presumptions on which that permit was granted (such as water supply) have changed. At some point in time, permitees may have an irrevocable vested right to complete that which they were permitted to do. In other words: know what is "in the works," not just what is being used.

Finally, and most importantly, communicate effectively, openly, and honestly with all water users about the reasons for a building moratorium. Communicate that the moratorium can be partially lifted as circumstances warrant.

When It Is Time to Take Action

When drafting a written ordinance, resolution, or legislative action enacting a moratorium:

- Specify the public health, safety, and/or welfare issue that is being addressed by the proposed moratorium (e.g., state facts that demonstrate a water shortage).

- Explain how the changes resulting from the proposed moratorium are related to the public health, safety, and/or welfare issue that is being addressed.

- Specify a concrete end date that is appropriate to address the problem; i.e. moratoria should not be open-ended.

- Offer proof of an emergency situation.

These drafting tips would also be applicable for alternative approaches, such as preparing a citizens' petition to put a moratorium on the ballot or preparing a municipal resolution requesting authority from the state (e.g., the Governor or a legislature) to take whatever action was necessary to protect water supplies if capacity did not improve.

Most importantly, educate the public – particularly the affected parties. Conduct public meetings as well as any required hearings. Provide written information. Include scientific facts and hydrologic data. Convincingly demonstrate that water demands exceed water supplies and that the governing entity must intervene and moderate its water demands or increase its water supply. Be prepared to address whether there is any possibility or any mechanism to increase supply (drill deeper wells, desalination, etc.) and, if so, the time frames for doing so. Also be prepared to address the question of whether neighboring jurisdictions are in a similar situation, and, if so, whether there is collaboration among the jurisdictions in addressing the water shortage.

After Taking Action

If the moratorium needs to be extended, follow the steps, criteria, and ordinance drafting tips described above. Continuously monitor the effect of the water moratorium, both for information that can be used to justify an extension and for information that can be used to justify a lifting or partial lifting of the moratorium.

A moratorium must end when the public health, safety, and/or welfare issue addressed by the moratorium has been resolved. Should a new public health, safety, and/or welfare issue arise during the moratorium, impose a second moratorium. For example, one moratorium might be in place while a strategy is developed and a second moratorium might be in place while that strategy is carried out.

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WATER RESOURCES IMPACT

COMPREHENSIVE PLANNING IN WISCONSIN: ARE COMMUNITIES PLANNING TO PROTECT THEIR GROUND WATER?

Bobbie Webster, Chin-Chun Tang, Lynn Markham, and Charles Dunning

INTRODUCTION

Ground water, lakes, rivers, streams, and wetlands are among Wisconsin's greatest natural resources. Fish, wildlife, and plants depend on these water resources to give them life. People depend on these waters for many things, including drinking water, waste assimilation, and recreation. In order for communities to plan for the future, it is essential that both the quantity and quality of ground water be protected (WDNR, 2002b). Land use decisions can have significant and unanticipated consequences for ground water resources. Most ground water impacts result from local actions. Declining water levels and reductions in water quality have already occurred in many parts of the state (Meine, 2003).

Legislation adopted in 1999 and amended in 2004 (s. 66.1001, Wisconsin Statutes) requires that by January 1, 2010, all communities (towns, villages, cities, and counties) that make specified land use decisions base those decisions on a comprehensive plan.

Despite numerous publications by state and university groups that provide a thorough discussion of ground water as part of the comprehensive planning process (WDNR, 2002a, 2002b, 2002c; URPL *et al.*, 2002; University of Wisconsin Cooperative Extension and Wisconsin Department of Agriculture, Trade and Consumer Protection, 2002), this is the first study to track how ground water is being addressed in the plans, particularly since adoption of the comprehensive planning law in 1999. The objectives of this project are to improve local ground water planning efforts and, more importantly, implementation efforts by providing examples of high quality plans. The full research report, including five community case studies highlighting rural Wisconsin communities that have implemented ground water protection and/or remediation measures, is available at http://www.uwsp.edu/cnr/landcenter/groundwater/index.html.

WHAT DO COMPREHENSIVE PLANS SAY ABOUT GROUND WATER?

From a pool of 79 plans, we selected the 29 plans that mentioned the word "ground water" most frequently. All of these communities rely on ground water for drinking water. In these 29 plans, we analyzed the types of ground water related goals, policies, and data.

A goal is a general statement describing a desired outcome in a community (CLUE, 2005). The number of ground water related goals mentioned in these plans was limited. On average, each plan contained 1.4 ground water related goals. Policies describe courses of action used to ensure plan implementation and to accomplish goals (CLUE, 2005). Often one goal will have two or more policies listed under it, which would help achieve that goal. For instance, if a community goal is "protect ground water quality," an associated policy may be "develop a manure storage ordinance." On average, each plan contained 8.5 ground water related policies.

As shown in Figure 1, the most common ground water related policy category was waste management while the least common category was remediation. Only a few of the plans had ground water related policies that provide clear information about who will implement the policy and by when.

The most common ground water data found in plans included surface watersheds, soil types, and ground water susceptibility. The least common ground water data included impervious surface inventory, changes in water table depth, and estimated community ground water pumping rate.

Planning for ground water is a long term community endeavor with many valuable and indispensable benefits

CONCLUSIONS

Importance of Ground Water Varies by Community

The extent to which ground water is addressed in comprehensive plans varies significantly. Some plans contain extensive ground water data and policies, while others have little. Plans prepared by the same plan writers but for different communities are found to be generally consistent in the type of data and policies included.

Communities with moderate or high ground water susceptibility had included more ground water related goals in their plans than communities with low susceptibility. However, these same communities do not include more ground water related policies in their plans. This fact suggests that communities with moderate or high ground water susceptibility are aware of potential ground water problems, yet they may be unsure how to achieve their goals, may perceive barriers to achieving their goals, or are unwilling to commit to policies in their plan.

Availability of Ground Water Data and the Ability to Interpret it Varies

The type, format, and extent of ground water information in comprehensive plans are generally limited. When ground water data or maps are included in plans,

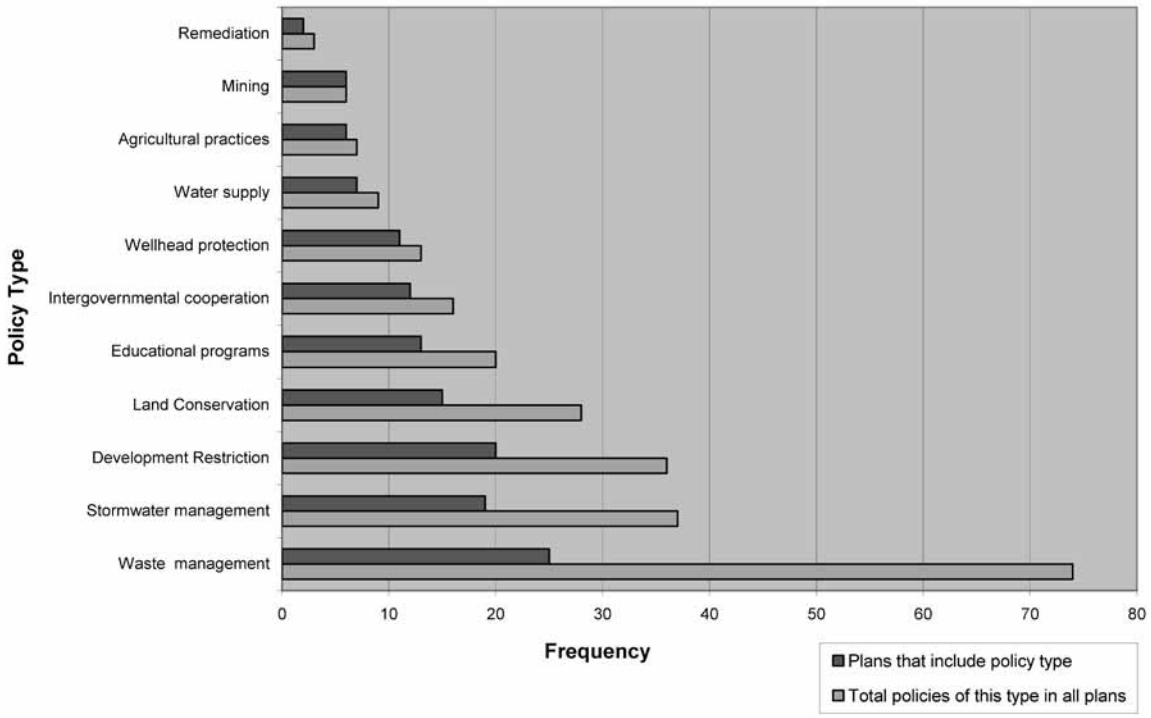

Figure 1. Policy Appearance in Plans.

little or no attempt is made to interpret the data. This result may be explained in part by the fact that ground water data are incomplete or inaccessible locally or on a state-wide level. Also, when data are available, plan preparers may not know how to interpret it.

In those communities where ground water data are available, communities generally made an attempt to incorporate it into local comprehensive plans. We found, for example, that communities located in counties that have produced a ground water protection plan incorporated more ground water information in their comprehensive plans. In addition, communities with municipal water systems (and, therefore, at least one person responsible for water testing and reporting) included significantly more ground water data in their plans than communities without municipal water systems.

Policy Frequency Depends on Regulations and Local Land Uses

Ground water related policies that are required by state or federal law appeared more frequently in local plans than other policies. Conversely, policies that are resource or issue dependent, such as those related to remediation, mining, or agriculture appear less frequently.

Weak linkages exist between data, goals, and policies The ground water data scores did not correlate with goal or policy scores achieved by local communities. This fact suggests that communities do not consistently require a minimum level of ground water data before developing goals and policies. We also found that the ground water goal scores do not correlate with the policy scores. Some communities are including ground water goals, but are not taking it to the next step by developing associated policies. At the opposite end of the spectrum, some plans include multiple ground water policies yet include no ground water goals.

These findings may result from the very expansive nature of comprehensive planning. Communities can easily overlook ground water issues when developing their comprehensive plans, particularly if there is no local champion willing to speak out about ground water. These findings may also be related to the fact that ground water planning is complex and new to many communities and planners.

RECOMMENDATIONS

Based on our review of comprehensive plans and discussions with key players in ground water planning, we provide the following recommendations for improving the ground water component of comprehensive plans in Wisconsin.

1. **Increase Citizen Involvement to Heighten the Priority of Ground Water in Local Communities.** The development of a comprehensive plan is steered heavily by local participation. One way to ensure that a comprehensive plan addresses ground water issues is to invite residents with a strong interest in ground water to actively participate in the process.

2. Improve the Accessibility of Ground Water Data to Plan Writers. Data collection during a comprehensive planning process may be overwhelming. Ground water data that are convenient, easily accessible, and in a format that can be directly utilized in a plan will be much more likely to be included by plan writers and citizen planners. Additionally, scientists will need to find ways to better translate scientific information into jargon free language understandable by the public.

3. Provide Education to Help Plan Writers Better Interpret and Use Ground Water Information. Most professional planners and community members lack training in ground water planning. Outreach workshops designed to educate professional and citizen/volunteer planners on how to interpret and use ground water information would address this need.

4. Provide Funding Assistance to Support Further Ground Water Studies. Based on the plan review, data related to impervious surfaces, change in depth of water table, community ground water pumping rate, and water quality and ground water time of travel maps are lacking. These types of information require additional funding to research and investigate.

FINAL THOUGHTS

The Wisconsin comprehensive planning law adopted in 1999 requires plans to include goals, objectives, policies, maps, and programs for the conservation and effective management of ground water. While most of the plans we reviewed contained basic ground water related data and a smattering of ground water goals and policies, much remains to be done. Planning for ground water is a long term community endeavor with many valuable and indispensable benefits.

ACKNOWLEDGEMENTS

We thank both the University of Wisconsin System for funding this project and the advisory committee for their constructive advice and encouragement. Helpful comments were provided by David Lindorff, Kevin Masarik, Anna Haines, and Rebecca Roberts.

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WATER RESOURCES IMPACT

THE NEW ECONOMY OF WATER

Clay J. Landry and Rachel Cardone

INTRODUCTION

Over the last few years, as we have reported in this space, the water sector market has shifted from one dominated by private sector utilities towards more niche markets, opening up interest from a wider group of stakeholders. Through this process, the 'private sector' has come to mean any range of different actors, from larger business through to foundations, private international and/or domestic banks, export credit agencies, small-scale private service providers, manufacturers of supplies and spare parts, nongovernmental organizations, and, at a very small scale, even users.

At an international level, different organizations, such as the World Business Council for Sustainable Development and the World Economic Forum, have worked to impress on their members the benefits of engaging in the water sector through activities such as water auditing – to increase resource efficiency – and also through corporate social responsibility (CSR) principles, such as community investment programs. In addition to industry leaders, these organizations, as well as the UNEP Finance Initiative, are also working to raise awareness within the financial services sector about water scarcity risk, with a goal to attract new sources of capital for water sector related activities.

Another potential source of investment funding is foundations, whether private (e.g., the Ford or Rockefeller Foundation), or industry related. The new 'strategic philanthropy' whereby company foundations view their charitable giving as a means to build brand recognition (particularly in emerging markets) may also create a new 'player' for water sector finance.

Finally, export-credit agencies, which previously lacked a strong role in developing country water sector projects, are emerging as key innovators, promoting equipment, material, and skills tied to the agency's country of origin. These export credit agencies are also at the forefront of implementing risk mitigation mechanisms to support and stimulate domestic finance in developing countries, which can strengthen deals involving international private finance.

SETTING THE STAGE

Another trend we have reported in this space is the growth of project preparation and financing facilities, which aim to stimulate a project pipeline, promote good projects, and broker finance. What has become interesting is the range of ideas considered for projects. Moving beyond the concept of an international concession, water investments have been funded through local capital markets (e.g., in Tamil Nadu, India, and Johannesburg, South Africa). Industry is considered a potential 'private' partner for a public-private partnership. In Uganda, for example, the U.S. Trade and Development Agency currently announced a Request for Proposals for a feasibility study that would help to create a partnership between a local brewing company (which is part of a larger international firm) and other industrial partners with the municipality to build an effluent treatment works that would meet new environmental regulations in a cost-effective way. This potential PPP perhaps builds on the success in South Africa, where Umgeni Water, Mondi Paper and Pulp, and other industry developed a partnership where municipal effluent was used as an industrial input, resulting in a lower tariff for business, and greater capacity for the municipality to extend sewer connections to new households.

REALITIES

While these types of arrangements are innovative and represent a real source of additional, nongovernmental (meaning either from the public budget or from donor agencies), they might not be viable in many countries. For example, systems of accountability and levels of transparency within governance are often required to attract export credit agency attention, or even private sector attention, otherwise the risk profile will not match the expected return for investors (whether purely financial, or even a mix of financial and/or economic/social benefits).

For example, many countries lack the capacity to enforce their wastewater regulations, and the independence and strength of the regulatory agency may be questionable. The availability of domestic banks to engage in the water sector may be minimal, as a result of the sector's perceived high credit risk, and historic poor governance and high political risk within the sector. Here, a range of donor agencies, foundations, and social venture capital firms, are working in different countries throughout Latin America/Caribbean, Asia, and Africa to build capacity within the public sector (meaning public administration, including legal/regulatory, and financial management), and with domestic entrepreneurs. Current thinking suggests that by timing capacity building efforts with performance based finance (whether grants that detail targets, or debt), projects have a stronger potential for succeeding.

THE DISCUSSION

At this year's Stockholm Water Week, held in late August, there were several discussions relating to this new paradigm for water finance. One seminar, entitled "Finance for Water Solutions," addressed the need for innovative approaches to address the often complex challenge of financing both water and sanitation. (Rachel Cardone, AWRA's Business Correspondent, was one of the moderators for this session.)

For example, despite the important role finance plays in planning – in that finance is required to implement ideas that emerge from planning sessions – many countries' investment plans do not match their national development strategies. With the emergence of Poverty Reduction Strategy Papers (PRSPs) as a key planning tool for development, different sectors are asked to identify activities that will lead to poverty reduction, and then estimate their costs. Because of resource constraints and different priorities at different levels of governance (and, beyond the sovereign level, among the donor community as well), the final budgeting framework may not look anything like the development plans submitted by different sectors. In many developing countries, the budget process is ad-hoc and poorly timed, resulting in delays of fiscal transfers to support actual activities, and rerouting of funds for other, nonplanned activities that emerge.

Still, a lot of finance is needed to achieve development targets (the Millennium Development Goals call for halving the proportion of people lacking sustainable access to safe water and basic sanitation). While public funds and donor grants and loans have typically provided finance, more is needed (estimates range from an additional US$7.5 million to US$75 million, depending on levels of technology and other assumptions). The scope for private finance is considerable, for those willing to take on the challenge.

OPPORTUNITIES

So where are the opportunities? Markets and needs and contexts within different countries can differ widely. What may be possible in Uganda may only be a pipedream in Rwanda, its neighbor. Perhaps the greatest opportunity is for business as well as private entrepreneurs who already operate in developing countries, to help support efforts to build markets. Industry, increasingly aware of its business risks in emerging markets, are developing corporate strategy and policies around water issues, which may be applicable regardless of where the company operates, or the strength of a country's regulatory framework. International banks that support the micro-finance may find opportunities developing guidelines and/or promoting finance for small and medium sized infrastructure providers. Because the market is increasingly seen as part of a bigger picture – whether from an economic development perspective or as part of poverty reduction efforts, a much broader range of actors can play a part.

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▲ President's Message

Over the last few weeks, I have been reminded again of both the professional dedication and compassion so frequently exhibited by our AWRA members. Following the devastation of large areas of the Gulf Coast by Hurricanes Katrina and Rita, I have heard numerous accounts of individual members volunteering their time and expertise to help affected areas sort out complicated water resources and environmental problems. Several state sections have also made commitments of time and money to assist emergency volunteer organizations in providing services to the region. This spirit of community is an integral part of AWRA, and is to be commended!

In light of these recent volunteer efforts, it is especially appropriate that the organizing committee for our 2005 Annual Conference in Seattle added a special Volunteer's Day segment to the program. Community spirited activists in the water resource field will have an opportunity to learn about innovative stream, wetland, and estuarine restoration projects, nation-wide. I think this is very much in keeping with AWRA's mission to advance multidisciplinary water resources education, management, and research, and hope it can become a regular feature of our annual conferences.

By the time you read this message I hope to be enjoying your company in Seattle at AWRA's Annual Water Resources Conference! In addition to participating in the outstanding field trips, workshops, and technical sessions the conference committee has planned, please make time to join in the opportunities for community, conversation, and connections that set AWRA apart from other professional organizations. Thank you for your continued support and participation. AWRA would not be the same without YOU!

Mindy Lalor, AWRA President, 2005

AWRA's 2005 ANNUAL WATER RESOURCES CONFERENCE

November 7-10, 2005
Red Lion Hotel
Seattle, Washington

I hope to see YOU in Seattle!

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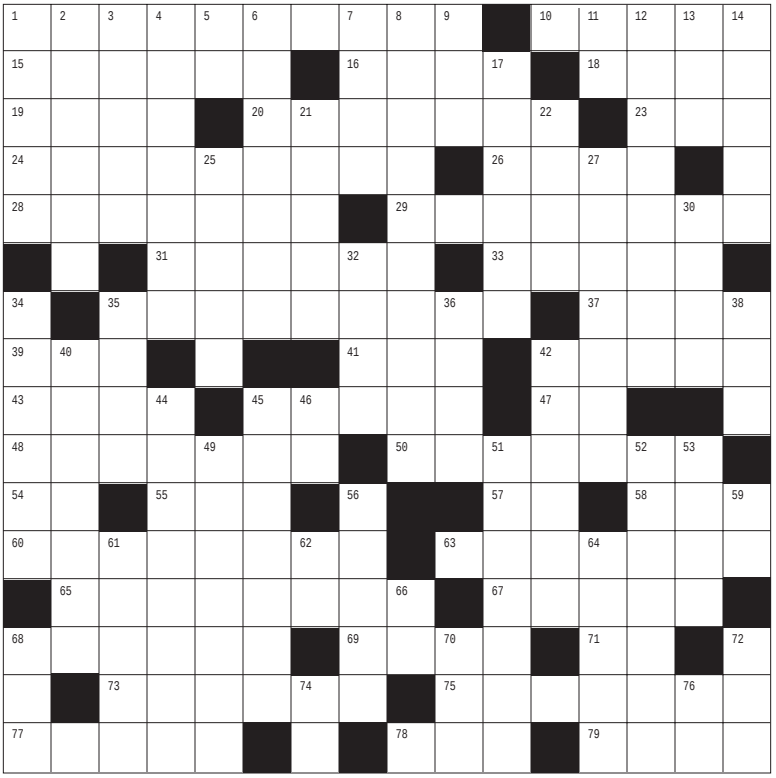
Water Resources Puzzler (answers on pg. 28)



ACROSS

1 Hugo and Ivan
10 followed by butterfly or finch
15 restless
16 apiece
18 animal's den
19 monthly outlay
20 curved trumpet
23 decay
24 awoke at noon
26 board's partner
28 amateur?
29 cousin of squash?
31 type of dress
33 uncanny
35 USMA
37 result of mental activity
39 _____-night stand
41 dir. from St. Louis to Chicago
42 furniture in dorm rooms
43 valley in California
45 blockade
47 light switch setting
48 followed by police or sink
50 patron
54 hosp. room
55 before a vowel
57 _____ and Ma Kettle
58 friend of Shemp and Larry
60 _____ National Park
63 forced withdrawal
65 Spad and Sopwith Camel
67 kingdom
68 organ of a flower
69 capital of Latvia
71 Atomic No. 52
73 smell and touch
75 provoker
77 Bonnie's partner
78 followed by zone or table
79 cold capital?

DOWN

1 one of HOMES
2 tilted
3 renovate
4 a hectic life
5 Newf. or G.B.
6 Lance Armstrong
7 a tide
8 mortals
9 school subj.
11 _____ Paso
12 women saloon keepers
13 SE Brazilian seaport
14 peasants' cooperative
17 a stinging wasp
21 ease off
22 a joint
25 put away
27 Pat and Margaret
30 cousin of an onion
32 top notch
34 party animal?
35 cried
36 a turnip
38 an onager
40 capital of Kenya
42 give
44 received
45 anagram of airless
46 loc. of Wabash R.
49 mini or maxi
51 a math quantity
52 egg dishes
53 wander
56 bar orders
59 and (Lat.)
61 a cowardly person
62 loc. of Cumberland R.
64 proportional relation
66 syst. of units
68 a thermoplastic resin (abbr.)
70 tonic's partner
72 _____-Am golf
74 printer's space
76 _____-Cid

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JAWRA Technical Papers
October 2005 • Vol. 41 • No. 5

TECHNICAL PAPERS

- Evapotranspiration Conceptualization in the HSPF-MODFLOW Integrated Models
- Estimated Impacts of Climate Warming on California Water Availability Under Twelve Future Climate Scenarios
- Screening the Relocation Strategies of Water Quality Monitoring Stations by Compromise Programming
- Historical Trends in Sedimentation Rates and Sediment Provenance, Fairfield Lake, Western North Carolina
- Sensitivity Analysis, Calibration, and Validations for a Multisite and Multivariable SWAT Model
- Evaluation of the Sustainability of Water Withdrawals in the United States, 1995 to 2025
- Algal Productivity and Nitrate Assimilation in an Effluent Dominated Concrete Lined Stream
- Modeling the Distribution of Diffuse Nitrogen Sources and Sinks in the Neuse River Basin of North Carolina, USA
- Assessing Satellite-Based and Aircraft-Based Thermal Infrared Remote Sensing for Monitoring Pacific Northwest River Temperature
- Accuracy of Lake and Stream Temperatures Estimated From Thermal Infrared Images
- Base Flow Recession Rates, Low Flows, and Hydrologic Features of Small Watersheds in Pennsylvania, USA
- Die-Off of Pathogenic *E. Coli* O157:H7 in Sewage Contaminated Waters
- Predicting Fecal Coliform Bacteria Levels in the Charles River, Massachusetts, USA
- Development of Empirical, Geographically Specific Water Quality Criteria: A Conditional Probability Analysis Approach
- Sources of Variability in Conducting Pebble Counts: Their Potential Influence on the Results of Stream Monitoring Programs

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AMERICAN WATER RESOURCES ASSOCIATION
OCTOBER 2005 • VOL. 41 • NO. 5 • PP. 1013-1258

Book Reviews (JAWRA)
October 2005 • Vol. 41 • No. 5

The following books are reviewed in the October 2005 issue of the *Journal of the American Water Resources Association* (*JAWRA*), pgs. 1243-1248.

Flood Risk Simulation – F.C.B. Mascarenhas *et al.*

The Economics of Everglades Restoration – R. Weisskoff

Integrated Resource and Environmental Management: The Human Dimension – A.W. Ewert, D.C. Baker, and G.C. Bissix

The Price of Water: Studies in Water Resource Economics and Management – S. Merrett

Stormwater Management for Smart Growth – A.P. Davis and R.H. McCuen

Mechanism and Design of Sequencing Batch Reactors for Nutrient Removal – N. Artan and D. Orhon

Brining Groundwater Quality Research to the Watershed Scale – N.R. Thomson (Editor)

Instrumentation, Control, and Automation in Wastewater Systems – G. Olsson *et al.*

Water and Wastewater Management in the Tropics – J. Lonholdt (Editor)

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AWRA Future Meetings

2006 MEETINGS

MAY 8-10, 2006
HOUSTON, TEXAS
RENAISSANCE HOUSTON HOTEL GREENWAY PLAZA
AWRA's SPRING SPECIALTY CONFERENCE
"Geographic Information Systems (GIS) and Water Resources IV"
(SEE CALL FOR ABSTRACTS ON PG. 28)

JUNE 26-28, 2006
MISSOULA, MONTANA
HOLIDAY INN MISSOULA PARKSIDE
AWRA's SUMMER SPECIALTY CONFERENCE
"Adaptive Management of Water Resources"
(SEE CALL FOR ABSTRACTS ON PG. 18)

NOVEMBER 6-9, 2006
BALTIMORE, MARYLAND
SHERATON INNER HARBOR HOTEL BALTIMORE
AWRA's ANNUAL WATER RESOURCES CONFERENCE

ADDITIONAL INFO – www.awra.org

NOTICE OF IMMEDIATE AVAILABILITY OF FEMA DISASTER JOBS

The recent hurricanes and flooding in Louisiana and the southeastern States have generated the need for additional staff to support the Federal recovery efforts. FEMA is looking for qualified individuals to add to its disaster assistance reservists mitigation cadre. Disaster hazard mitigation provides information, guidance, and technical assistance to individuals, businesses, and communities to identify resources and techniques to rebuild safer and stronger. Reservists are intermittent, on-call employees who provide support during presidentially declared disasters. They require knowledge and experience in a variety of disciplines: building science and architecture, public education, planning, environmental and historic preservation, property and casualty insurance, floodplain management, and grants management.

If you would like to help the citizens and communities impacted by the recent hurricanes rebuild to a more disaster resistant standard, you may be interested in these job opportunities. Candidates must be immediately able to work in Louisiana and other southeastern states for an extended period of time. The work environment will be stressful and the hours long. Do not expect air conditioning or a room with a view. Do expect a rewarding job experience, in public service to the communities and citizens rebuilding their lives.

We are looking for highly motivated and flexible individuals with the following qualities:

- customer service oriented; able and willing to work within culturally diverse audiences, communities and groups;
- sensitive in assisting people who have been through traumatic events;
- possessing technical background with the ability to explain technical matters to nontechnical audiences and individuals; and
- able to perform consistently at a highly functioning level in a stressed and ever changing environment.

Salary will be based on demonstrated experience and the technical difficulty of the position. Travel and per diem are paid at the government rate. Before personnel processing can be completed, applicants will undergo security and credit card background checks. Job specific training will be provided.

The following types of hazard mitigation positions are available in our field offices:

Floodplain Management Specialists
Insurance Specialists
Hazard Mitigation Community Planners
Grants Managers and Specialists: Hazard Mitigation Grant Program
Civil Engineers (Structural or Hydrology and Hydraulics)
Hazard Mitigation Public Outreach and Education Specialists
Hazard Mitigation Advisors
Disaster Recovery Center (DRC) Mitigation Supervisors
Hazard Mitigation Economic Analysis
Architects
Writers – Technical and Consumer Product Development
Environmental Liaison Officers (ELO) and Environmental/Historic Preservation Specialists
Hazard Mitigation GIS Specialists
Computer Graphics Technicians and Media Production
Publications Development and Distribution Management

If you are interested in applying for one of the positions, position descriptions are available on the web at
http://www.fema.gov/fima/recoveryemployment.shtm

Please fax your resume and a cover letter explaining your qualifications for the position as soon as possible to (540) 542-2484 or (540) 542-2482. Adherence to the following four items will expedite your application:

1. Write in big letters MITIGATION across the top of your application. Be sure to capture any experience you have had in emergency management and specifically hazard risk reduction activities.
2. Please note the degree to which you possess bilingual, multilingual, multicultural, and ADA skills. We especially would like to know if you possess French and Cajun/Creole language skills.
3. Include your social security number, citizenship (applicants must be U.S. citizens), date of birth, and place of birth.
4. Please provide documentation on any professional licenses or certifications as related to positions posted.

▲ Opinion-Editorial ... Richard A. Engberg, Technical Director, AWRA

NATURAL DISASTERS AND SCIENCE: A CHALLENGE TO THE SCIENTIFIC COMMUNITY

As I write this, Hurricane Rita is taking aim at the Texas coast while the devastation of Hurricane Katrina is still fresh in mind. Will Katrina's impact enable us to be better prepared for Rita? The answer has to be Yes and No.

Yes, for short term considerations – While not very smooth, the evacuation of Galveston and other Texas coastal cities, will, in all likelihood, make the loss of life insignificant compared to that of Katrina.

No, for long term considerations – Responsible scientists have warned for years and continue to warn that natural phenomena coupled with our aging infrastructure will dramatically worsen the consequences of major disasters. Natural phenomena may be drastic events as hurricanes, floods, tsunamis, earthquakes, or volcanic eruptions, or long term events as the prolonged periods of drought frequently faced by different areas of the country.

When these natural phenomena cause failure of man-made structures such as dams, levees, water distribution and removal systems, electrical grids, drilling platforms, refineries, or entire cites, the problems are compounded. Essentially a domino effect happens, affecting the nation's economy through the impacts on ecology and on industries as transportation, tourism, insurance, etc., not to mention the drastic consequences for the nation's human resources.

Sure, there were failures in dealing with Katrina. One of the most obvious and saddest was the failure of FEMA, the once proud and independent federal agency but now a second-class citizen in the massive Department of Homeland Security. It failed to mount an early, effective relief effort to the entire Katrina-afflicted area. And when FEMA did arrive on the scene, it bickered with State and local officials over primacy.

How do we Americans react to such natural disasters when they happen? Nationally, and most importantly, we open our hearts and pocketbooks to relief agencies and humanitarian efforts. At the same time, we wring our hands and wonder how or why this could happen to us. Inevitably, however, we point our fingers at government agencies, at all levels, and trumpet their failures. Government officials also wring their hands, point fingers and look for scapegoats, take advantage of photo-ops, and throw large amounts of money toward rebuilding devastated areas, strengthening levees, reforestation, etc. Unfortunately, this is all after-the-fact.

Usually when the rebuilding or replanting efforts are complete, and the devastated area rises like a phoenix from the dust, residents and businesses of the area often are saddled with large debt and increased insurance costs. We discuss the need for better evacuation plans, better ways to protect vital parts of the infrastructure, better warning systems, and better cooperation between local, state and federal officials and organizations. Plans are developed and cooperation is promised.

But then what happens? As the years pass, the disaster in question fades in the memories of most who were not directly affected by it. Plans become outdated as population dynamics change, and often are not updated based on new demographic information. Agencies and organizations move on to other considerations and the levels of cooperation wane. Collectively, we sit back and wait until the next disaster strikes and the process begins over again. What we don't have as a nation is a cohesive plan to be better prepared for any and all natural disasters.

Chip Groat, former director of the U.S. Geological Survey, and currently Professor at the University of Texas said the following in the September 20 volume of EOS, "The disastrous effects of Hurricane Katrina on New Orleans and the U.S. Gulf Coast communities ... provide an unparalleled opportunity for the scientific community to say 'I told you so.' It would be easy for those scientists to react with a grim satisfaction in being right..."

Groat continues, "The opportunity here is for those who treated scientific understanding as a minor ingredient in the planning ... to listen more carefully to scientists and act more responsibly as they seek better protection of life and property. The challenge for the scientific community is to be organized, responsible in its expectations, effective in its communications, and persistent in engaging those responsible for next steps in the recovery and rebuilding..."

Groat makes excellent points. We, as responsible members of the scientific community, need to be more active in pushing the need for good science to deal not only with the inevitable natural disasters, but, and even more importantly, in our preparation for such disasters.

Would it not be better for the government to anticipate and plan for disasters by incorporating our wealth of scientific knowledge to upgrade our infrastructure over the next 20 to 30 years? How about zoning? Does it make sense to build and rebuild in areas known to be natural disaster-prone without providing adequate methods of protection? Good science can aid in these planning efforts by providing up-to-the-minute information on infrastructure improvement, and by using latest technologies to aid zoning efforts and other needed protections. Where water is an ingredient in the disaster, (and one way or the other it is in nearly every natural disaster), do our national water policies need to be overhauled to allow us to react more quickly and more reasonably to natural disasters?

Whoops, can't do those things – as we know, it is politically difficult (if not un-expedient) for our elected representatives to choose higher taxes over their favorite pork barrel projects!

But why not? Doesn't it make sense to spend smaller amounts over time to prepare, rather than large amounts when the disaster happens? I'm not naïve enough to think that all the preparation possible would have eliminated the problems caused by Katrina – but if adequate preparation could have halved the problems, wouldn't that have been a worthwhile investment?

With those considerations in mind, I offer the following suggestions. These are random thoughts, and not all may be practical or doable. But I offer them as a starting point to a more cohesive and cooperative approach to natural disasters.

Congress and the administration should:

1. Rethink their approach to natural disasters by providing the money over time to bring our aging infrastructure into the 21st century.
2. Fully fund or expand programs that assist in predicting natural disasters. These include earthquake predictive tools, further study of tornadoes, tsunami (and storm surge) warning systems, hurricane direction predictability programs, and enhanced streamflow and water quality monitoring, to name a few.
3. Assist FEMA by either strengthening its position in the Department of Homeland Security or removing it from the Department and restoring it to its independent agency status.
4. Revamp U. S. water policies to be more proactive regarding natural disasters and to be more responsive to the changing water needs of the country.
5. Be certain that the needs of the environment are not overlooked while the infrastructure is improved.

What can the scientific community (and AWRA) do?

1. The scientific community needs to interact better with political leaders at all levels of government.
2. The scientific community needs to ramp up its ability to communicate succinctly with our political leaders – and stay on message.
3. Cooperation between government science, management, and environmental agencies, NGOs, and the public needs to be improved regarding natural disasters.

These suggestions are not a panacea. Hopefully they would serve a dual purpose – be a step in the direction of better preparedness for natural disasters, as well as afford science a greater voice in how this preparation is accomplished.

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HAVE SOME COMMENTS ABOUT THIS ISSUE OF IMPACT?

(COMMENTS ON PREVIOUS ISSUES ARE ALSO WELCOME)

SEND US YOUR FEEDBACK

Water Resources IMPACT is in its seventh year of publication and we have explored a lot of ideas. We hope we've raised some questions for you to contemplate. "Feedback" is your opportunity to reflect and respond. We want to give you an opportunity to let your colleagues know your opinions ... we want to moderate a debate ... we want to know how we are doing.

Send your letters by land-mail or e-mail to Michelle Henrie (mhenrie@rodey.com) (for this issue), or to Earl Spangenberg (Editor-In-Chief) (espangen@uwsp.edu). Either way, please share your opinions and ideas. Please limit your comments to approximately 350 to 400 words.

Your comments may be edited for length or space requirements.

▲ Water Resources Continuing Education Opportunities

DECEMBER 2005

2/Stormwater Funding & Utility Development, BMPs: Pollutants, Selection, & Maintenance, & Complete NPDES Program From Design to Implementation Workshops. Nashville, TN. **Contact** w: www.stormcon.com/nashville

JANUARY 2006

21-28/25th Annual Water Mgmt. Conf – "Technical, Legal, & Financial Issues in Water Mgmt. Vail, CO. **Contact** Bob Higgins, President, Water Mgmt. Inst.; 561/439-7807; f: 561/439-0026; e: bhiggins@higgins-eng.com

FEBRUARY 2006

20-22/USEPA, SWMM, & PCSWMM 2006 Stormwater Modeling Workshop. Toronto, Ontario. **Contact** (w: www.computationalhydraulics.com)

23-24/International Conf. on Stormwater & Urban Water Systems Modeling. Toronto, Ontario. **Contact** (w: www.computationalhydraulics.com) – CALL FOR ABSTRACTS for Conf. – Deadline **January 30, 2006**. **Contact** Bill James (519/767-0197; f: 519/489-0695; e: bill@computationalhydraulics.com)

MARCH 2006

28-30/Kuwait 1st International Water Conf. & Exhibit. Kuwait. **Contact** (e: http://promedia-international.com/Water/index.html

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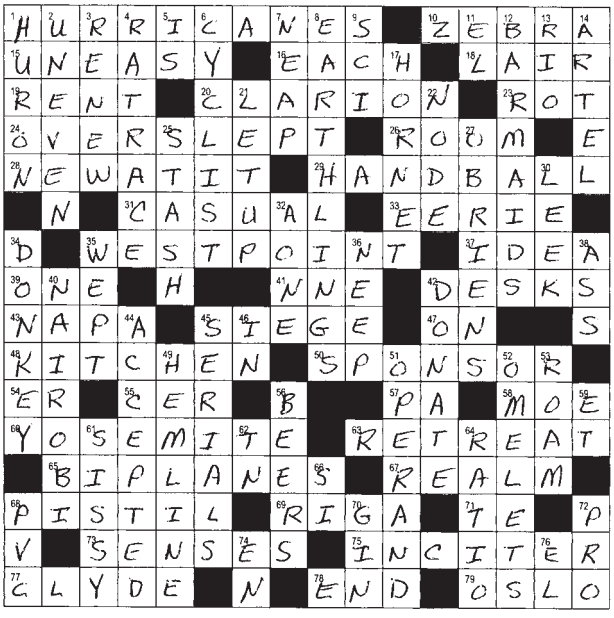
Solution to Puzzle on pg. 24



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