

Groundwater Challenges

by Charles M. Burt, Irrigation Training & Research Center, California Polytechnic State University, San Luis Obispo, California

There are some old lessons that continue to repeat themselves throughout the history of irrigation. For example, it has become a common understanding that accumulated salinity from irrigation spelled the doom of some ancient civilizations in the Middle East. Despite this ancient knowledge, today we still have numerous irrigated basins in which there is no outlet for high salinity drainage flows.

Likewise, groundwater is something that traditionally has not been well understood, and is often treated as an ever-present backup plan for irrigation. The "water rights" laws in the western U.S. and elsewhere almost exclusively formalized rules about and concentrated on surface water flows, while simultaneously ignoring the problem of groundwater depletion. One could say that many of today's groundwater modeling projects contain strong elements of "voodoo" science — especially when looking at how the boundary conditions are estimated.

Making changes to surface water supply routes often brings public attention to water shortage problems. The development and O&M of flexible, dependable surface water supplies (dams, canals, irrigation districts) is extremely expensive, sometimes at thousands of dollars per acre. Surface
(continued on page 6)

Conferences to Focus on Groundwater

USCID will join with the Groundwater Resources Association of California Conferences on groundwater issues. The theme of both Conferences will be *Groundwater Issues and Water Management — Strategies Addressing the Challenges of Sustainability*, and will be held in Sacramento, California, on March 4-7, 2014. The GRA Conference will be held on March 4-5.

The co-located Conferences will include a common field trip, plenary session, exhibition and meals. Speakers from both organizations will cover a wide range of technical and water management topics providing an excellent comprehensive program. In addition to USCID sessions, USCID participants will be able to attend GRA sessions and GRA participants will be
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Ag/Urban Issues Discussed in Denver

by Conference Co-Chairs Gerald A. Gibbens, Northern Colorado Water Conservancy District; and Luis A. Garcia, University of Vermont

From water supply and demand issues in the Colorado River Basin, to water transfer strategies, to measurement of consumptive use, the USCID Conference, *Urban Water Interface — Conflicts and Opportunities*, held October 21-25 in Denver, examined a wide variety of issues and opportunities
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President's Message

As I sit here on another warm, sunny winter day, I am reminded of the timeliness of the upcoming Conferences on *Groundwater Issues and Water Management — Strategies Addressing the Challenges of Sustainability*. This Conference will be co-located with the Groundwater Resources Association spring conference, and USCID attendees will be able to attend the GRA sessions.

When it is dry, irrigation managers look to groundwater to close the gap between supply and demand. It is certainly dry in California and many other parts of the West. In California, the calendar year 2013 will likely be the driest year for the Northern Sierra 8-Station Index since record-keeping began in 1921. In mid-December, the index stood at 15.5 inches, more than two inches below the previous low, and 26.1 inches below the calendar year average of 41.6 inches. [LAST MINUTE UPDATE, January 17, 2014: This morning the Governor of California declared a drought emergency, noting that 2013 was the driest year on record for much of the state; no rain yet in 2014 for the vast majority of the state and no rain in the forecast.]

In other areas of the country, the drought in Texas resulted in 73 percent
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USCID

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The United States Committee on Irrigation and Drainage is a
National Committee of the International Commission on Irrigation and Drainage.



Mission Statement

The Mission of the United States Committee on Irrigation and Drainage is to foster sustainable, socially acceptable and environmentally responsible irrigation, drainage and flood control systems and practices for providing food, clothing and shelter to the people of the United States and the World.

USCID Newsletter and Membership

The *USCID Newsletter* is published in Winter, Spring and Fall for USCID Members. News items and technical articles of interest to the irrigation community are invited. Membership information is available on the USCID website.

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The most recent Membership Directory is online in the Members Only section of the USCID website — www.uscid.org. In addition to contact information for each Member, the Directory includes member listings by state and organization, as well as information about USCID and ICID work body memberships.

ICID News and Activities



ICID Meets in Mardin, Turkey

The First **ICID World Irrigation Forum**, together with the **64th International Executive Council Meeting** took place September 29 – October 5, 2013 in Mardin, Turkey. The Forum was organized and hosted by the Turkish National Committee in cooperation with several international partners such as FAO and IWMI. About 750 participants from 61 countries and 12 international organizations attended the Forum, which featured technical sessions, workshops, roundtables, panel discussions and an exhibition.

The World Irrigation Forum was followed by the IEC Meeting. USCID Executive Vice President Larry D. Stephens was the voting representative for USCID. During the IEC Meeting, three Vice Presidents were elected — Basuki Hadimoeljono (Indonesia),



Larry Stephens, USCID, Denver, Colorado; Serpil Köylü Dalgın, DSI, Ankara, Turkey; Laurie Tollefson, Agriculture and Agri-Food Canada, Outlook, Saskatchewan, Canada; and Mark Svendsen, Water Resources Consultant, Philomath, Oregon.

Kadhim Mohsin Ahmed (Iraq) and A. B. Pandya (India).

The WatSave Technology Award was given to Yi Yongqing (China) for *Thin and Exposed Irrigation for Paddy Rice*; and the Innovative Water Management Award went to Zhang Xuehui (China) for *Innovations and Reforms for Modern*

Irrigation Management in Large Irrigation Schemes. The Best Paper Award was presented to P.J.G.J. Hellegers, H.C. Jansen and W.G.M. Bastiaanssen (The Netherlands) for their paper, *An Interactive Water Indicator Assessment Tool to Support Land Use Planning*, published in issue 61.2 of *Irrigation and Drainage – the Journal of ICID*. The paper can be accessed at www.icid.org/best_pap2013.pdf.

22nd ICID Congress

September 14-20, 2014

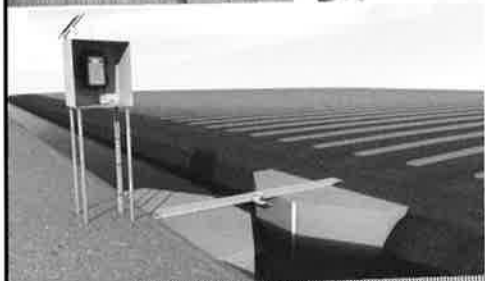
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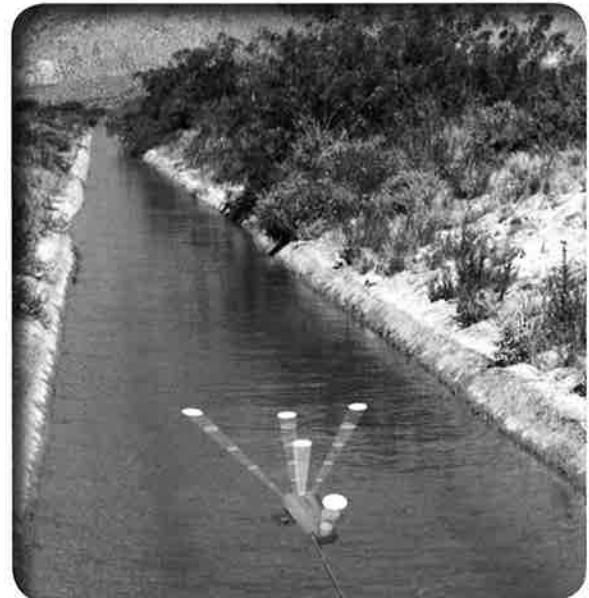
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Groundwater (continued)

water management also calls for environment impact studies (in-stream flows and quality). In contrast, wells are often relatively inexpensive to construct, energy costs have historically been relatively low, and by putting a well on each field it isn't necessary to build an extensive water distribution system because the aquifer is the distribution system.

Large areas of the world have seen almost explosive irrigation development as a result of groundwater pumping. In India, for example, many of the public irrigation systems have reputations for being close to dysfunctional, if traditional measures of the quality of delivery service are used. However, farmers can still control their own destinies by installing small "tubewells," which also don't show any quick, obvious evidence of environmental damage.

Here in the U.S., conjunctive use (use of both surface and groundwater supplies) has allowed irrigators to obtain relatively inexpensive water (in many but not all cases) and has also enabled them to weather the ups and downs of surface water availability. This is of huge importance, especially in California where there is a strong shift towards permanent crops (e.g., almonds, pistachios, vines, citrus and walnuts). Elasticity disappears with permanent crops; before this, farmers could grow wheat during a dry year, rather than grow a more water-intensive crop such as alfalfa.

Suddenly, however, groundwater challenges are becoming noticeable to the wider public. It's not as if this is magical or new — a realistic look at basin-wide water balances has shown a crisis coming in the San Joaquin Valley from a long way off. I've been preaching this for years. History is repeating itself; in the 1930s in the San Joaquin Valley, groundwater levels started to drop at alarming rates due to irrigation. Ground subsidence was evident in many areas — with the area of Three Rocks being the classic example in textbooks.

As a result of public concern in the middle of the 20th century, several

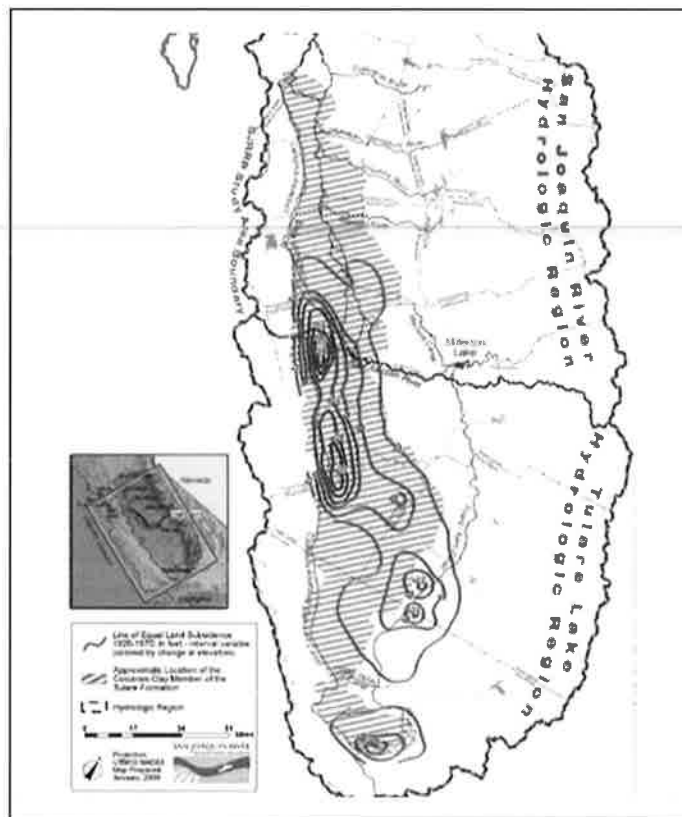


Figure 1. Land subsidence in the Central Valley (from SJRRP 2011)

major water projects were developed. The Friant system was constructed by the USBR to replenish groundwater on parts of the east side of the San Joaquin Valley. Irrigation districts with independent supplies on the east side increased the sizes of their dams/reservoirs. The California Aqueduct was finished in the early 1970s to bring water to agriculture on the west side of the San Joaquin Valley. Groundwater levels returned to earlier higher levels.

Subsidence stopped. People were happy. Farmers kept expanding irrigated acreage,

and converting to crops with higher evapotranspiration. Improved irrigation efficiencies increased the ET per acre (due to healthier crops, better uniformity and less stress). So as people began to forget the lessons of the past, the groundwater trends slowly began to reverse. Groundwater cones of depression started to show up in some areas such as the Tulare Lake Basin. For perhaps 20 years we have said that "there is an annual groundwater overdraft of about 2 million acre-feet in the San Joaquin River." Ho-hum. No big deal. Pumping costs got a bit higher

for some people, but popular opinion was that we could just use more efficient (i.e., higher ET) irrigation and somehow overcome this.

Of course, this is not unique to the United States. The expansion of irrigation throughout the world has been helped by groundwater development. Look at Saudi Arabia as an obvious example. I've also seen serious overdraft issues in numerous countries such as Mexico, Chile, China and India.

Here in California a number of things have happened almost simultaneously to raise public (or at least, irrigation district-level) awareness of the problem. Yes, there has been some mumbling about problems with water quality, about the need to deepen wells, and increased power costs. But those details just didn't catch the attention of most people.

First, about two years ago, during the highly debatable process of restoring "natural" flows in the San Joaquin River, it was noticed that groundwater subsidence is occurring at a key point at the rate of about a half a foot/year. Planners found that it is tough to



Figure 2. Illustration of maximum subsidence at a site 10 miles southwest of Mendota, showing 29.6 feet of subsidence between 1925 and 1977 (from Galloway, et al.)

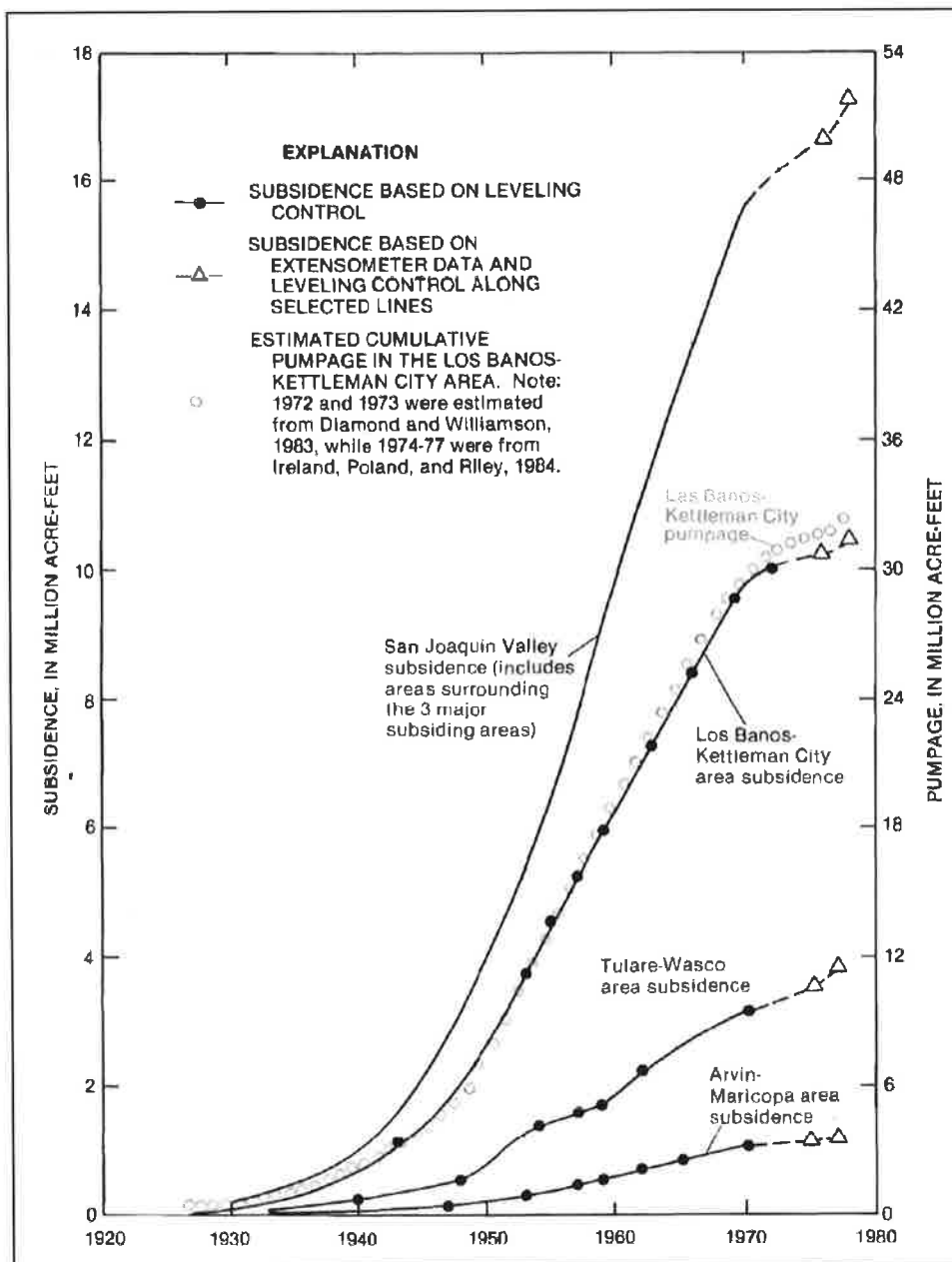


Figure 3. By 1977, the volume of subsidence was more than 17 million acre-feet in the San Joaquin Valley. In the Los Banos – Kettleman City area, one-third of the volume of groundwater withdrawn came from water that had been stored in the fine-grained sediments (from Williamson, et al., 1989).

construct large fish screens at canal inlets where there was almost no head available before subsidence started.

Second, it became more evident that there is also subsidence close to the California Aqueduct. That catches attention, because the California Aqueduct conveys a major percentage of the water supply for the Los Angeles basin, and failure of the Aqueduct is not a very attractive option. I have been saying for years that nothing would happen until subsidence threatened the

California Aqueduct. Recall that past subsidence problems were halted in many areas because the groundwater levels were restored. However, now those levels are back to the historical lows, and of course the subsidence process is just picking up where it left off.

Third, California has been in a drought for several years. Water allocations for many districts are in the 20 percent range. Everyone has turned on the well pumps.

Fourth, people along the east side of the San Joaquin Valley have started to notice that all those new almond trees planted outside the irrigation district boundaries actually have an impact on groundwater levels. Simultaneously, a large group of people in Sacramento and elsewhere are declaring that the flows in the San Joaquin River should be substantially increased to restore fisheries or water quality or recreation, or many other uses. Unfortunately, that water is the only water that could possibly restore depleted groundwater. This is referred to as a problem with “competing interests.”

The bottom line is that we just have too many irrigated acres in California. Questions about environmental allocations aside, we are consuming more water than we have available. Supposedly, climate change is not going to help the situation. It makes for some very interesting questions about who will give up what. Obviously, many of the decisions will be related to value judgments (e.g., fish vs. crops, agriculture vs. urban). For irrigation professionals, there is great opportunity for removing as much of the “art” as possible in what we do, so that we have a clear idea of how to best use what water we have.

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Irrigating for Rainbows

Remembering Jack Keller, 1928 – 2013

*by Bryan Thoreson, USCID President;
and Grant Davids, USCID Past
President*

The irrigation community lost a pioneer, leader and friend when **Jack Keller** passed away at the age of 85 in November. Jack coined the phrase “Irrigating for Rainbows” for his Faculty Honor Lecture at Utah State University in 1980. Jack spent his life “Irrigating for Rainbows.” Ever curious, creative, and always concerned about his fellow human beings, Jack dedicated his life to improving the human condition. Jack saw irrigation as a way for small-scale farmers to improve their livelihood and spent much of his life working on creative, affordable irrigation methods that small farmers could use. In pursuit of this goal, Jack spent time in more than 60 countries in the Americas, Africa, Europe and Asia. For the past 15 years, he worked with International Development Enterprises as a Board member and technical consultant.

Jack understood that offering truly appropriate, sustainable technology meant crafting technical solutions in local social, political and cultural context. He believed that human behavior is inherently rational and that if it seemed otherwise, he had not yet achieved an adequate understanding of local conditions. So, he spent time talking to people wherever he worked to understand their values, beliefs and economic circumstances, all to provide a basis for technical problem solving.

Jack had a knack for pointing out inconvenient truths in a non-threatening way. “You can’t not know what you already know” and “It is incredibly difficult to get someone to understand something that is to their disadvantage to understand” are both phrases that he often used. Delivering these truisms with a broad smile and a twinkle in his blue eyes, Jack could disarm the toughest audience. Jack had the rare ability to work with equal effectiveness with people ranging from educated professionals to illiterate small-scale



Jack enjoys a game of croquet with his grandsons. Note the kneepad suspenders, crafted from USCID nametag lanyards.

farmers. And everyone he worked with recognized his ability to make highly complex technical concepts understandable to all audiences.

Jack was the recipient of the USCID Service to the Profession award. He received numerous other professional awards and honors including the Scientific American 50 Award, which recognizes “visionaries from the worlds of research, industry and politics whose recent accomplishments point toward a brighter technological future for everyone.” Jack was a dedicated member of the National Academy of Engineering and willingly fulfilled member responsibilities for more than 25 years. He received four U.S. patents and authored more than 100 technical papers and reports and two textbooks.

Jack started his career in irrigation with the W.R. Ames Company before joining the engineering faculty at Utah State University in 1960. He served as department head of Agricultural and Irrigation Engineering from 1980-1986. Through his teaching and research at USU, Jack mentored individuals from all over the world who would go on to become leaders in irrigation engineering and water resources management in their home countries. He founded and served as CEO of Keller-Bliesner Engineering LLC, an irrigation and water resources engineering firm based in Logan, Utah, providing consulting services to clients in the U.S. and internationally.

We had the great privilege of working with Jack off and on for the last 20-plus years. During Jack’s trips to Davis, he often stayed with one of us and our families. This was typical Jack; he preferred staying with a family, spending time with them and getting to know them, rather than staying in a hotel. When he did stay in a hotel, Jack always took time to get to know the hotel staff. Jack was the consummate family man and always found time during his travels to visit his family. Typically, he planned his travel itineraries to include short stays with friends and relatives.

Jack will be greatly missed, but his work will live on through the thousands of lives he impacted through his work and travel.

Jack’s family suggests memorial contributions in his name be given to Expanding Lives, www.expandinglives.org, 5541 North Saint Louis Avenue, Chicago, IL 60625; and Intermountain Bioneers, www.intermountainbioneers.org, c/o Wells Fargo Bank, 5 South Main Street, Logan, UT 84321.☐

Sacramento (continued)

able to attend USCID sessions, providing a rare opportunity for members of both organizations to interact. **Bryan P. Thoreson**, Davids Engineering, Inc., and **Steve Macaulay**, Macaulay Water Resources, are the Conference Co-Chairs.

The Conference will open with a Tuesday morning field tour to the offices of the Sacramento Regional Water Authority, featuring presentations on the following topics:

- Water Forum Agreement and Importance of Groundwater Management
- Sacramento Groundwater Authority, Institutional and Technical Framework
- Aquifer Storage and Recovery

David Guy, President of the Northern California Water Association, will be the Tuesday lunch speaker. The Tuesday afternoon joint USCID/GRA Plenary Session will begin with a Panel Discussion on California's current debate over facilities and ecosystem investments that are critical to long-term surface and groundwater reliability and sustainability. The Panel Discussion will be followed by presentations of broad interest to irrigation managers and groundwater experts.

Focused oral presentations during parallel USCID and GRA Technical Sessions will occur on Wednesday. The USCID Conference will continue on Thursday and Friday. Conference participants from both USCID and GRA are free to attend any of the Wednesday parallel Technical Sessions, to assure maximum value to the membership of both organizations.

The USCID Technical Sessions on Wednesday will address

Evapotranspiration and Irrigation and Drainage Technology. The Thursday program will feature concurrent technical sessions; one track will focus on **Groundwater Banking** and other groundwater issues, and one track will focus on issues related to **Irrigation Water Management.**

Valerie C. Kincaid, partner of the Sacramento law firm O'Laughlin & Paris LLP, will be the Wednesday lunch

speaker, and Jay R. Lund, Director of the Center for Watershed Sciences at the University of California, Davis, will give a presentation during the Wednesday dinner. The Thursday lunch speaker will be David Murillo, Regional Director, Mid-Pacific Region, Bureau of Reclamation.

The Conference will conclude on Friday with a day-long field tour to the South San Joaquin Irrigation District and the Oakdale Irrigation District. The Tour will focus on irrigation distribution system modernization with a visit to the South San Joaquin Irrigation District Division 9 Irrigation Enhancement Project, near Ripon. The project consists of the design, construction and operation of a pressurized irrigation water system, including a 19-mile network of pressurized pipeline, a water storage basin, a pumping station, a turnout at each participating parcel containing a flow control valve and meter, and a radio-based SCADA system. The project will enable the District to more efficiently deliver water to the farmers and monitor its usage, while eliminating operational spills. Following lunch, the tour will visit Oakdale Irrigation District's new Northside Reservoir and automated lateral demonstration project. The project involved the replacement of 28 check structures and the design and installation of 31 gates on the 6.5-mile Claribel Lateral and the 8.5-mile Cometa Lateral to demonstrate Rubicon's Total Channel Control (TCC). The goal of the demonstration project was to improve distribution efficiency and enhance service levels to farmers by providing a near on-demand supply.

Registration details and other information, including exhibition and sponsorship reservations, are online at www.uscid.org/14caconf.html.

Johannes DeVries, 1936-2013

Johannes Joost DeVries, a world-renowned engineer and professor whose engineering career spanned 50 years in the fields of hydraulic engineering, irrigation system analysis and hydrology, passed away on December 7, 2013, at the age of 77. He received a BS degree in Engineering Science from Calvin College (1960), BS and MS degrees in Civil Engineering from the University of Michigan (1959 and 1961), and his PhD from the University of California, Davis (1978).

From 1961 to 1971, Dr. DeVries was employed by the California Department of Water Resources as an Associate Engineer in the Aqueduct Design Branch. He was a Research Engineer and Engineer-in-Charge of the J. Amorocho Hydraulics Laboratory at UC Davis from 1972 through 1993. At UC Davis, he had concurrent appointments as Northern Regional Coordinator, Associate Director of the Water Resources Center, and Lecturer in the Department of Civil and Environmental Engineering and Department of Land, Air and Water Resources. He taught courses at UC Davis in the fields of hydraulics, hydrology, open-channel flow, and irrigation principles and practices from 1978 through 1993. From 1993 through 2000 he was a consulting engineer with various private engineering firms and state and federal agencies. From 2000 through 2012 he was a Principal Engineer with David Ford Consulting Engineers, Inc. in Sacramento, California.

Carlos S. Ospina, 1920-2013

Carlos S. Ospina died October 19, 2013. Mr. Ospina was a Civil Engineer and President of the consulting firm Ingetec S.A. in Bogota, Colombia. He was known as the father of "engineering consultants" in Colombia for his innovations in hydroelectric and other infrastructure projects. Mr. Ospina was an active participant in ICID and ICOLD for many years.☐

Cal Poly Student Receives USCID Scholarship

Hilary Olsen, an undergraduate majoring in BioResource and Agricultural Engineering at California Polytechnic State University, is the recipient of the 2013 *USCID/Summers Engineering Scholarship*. The Scholarship was presented at the USCID awards dinner during the recent Denver Conference. The award included \$1,000, Conference registration, and travel and hotel expenses.

In addition to her course work, Olsen is an engineering technician for the Irrigation and Training Research Center at Cal Poly, where she has been instrumental in updating the new Cal Poly weather station and working with NWS/NOAA personnel to get the system operating correctly, according to her supervisor and academic advisor **Stuart Styles**. She has also served as an engineering intern for Geo-Logic Associates and the Placer County Water Agency.



USCID President Bryan Thoreson congratulates Hilary Olsen.

Olsen is active in Cal Poly and community activities. She is President of the Agricultural Engineering Society; President of ASABE, Cal Poly branch; and a member of the Society of Women Engineers. She has been a Member of USCID since 2011.


Upon graduation in December 2014, Olsen hopes to pursue a career in water resources engineering, with a focus on salt water intrusion and reclaimed water. "California's water is depleting as our population is increasing, and I hope to be an active participant in finding innovative ways to manage water policies and ensure water quality," she wrote in her scholarship application.

The USCID/Summers Engineering Scholarship was endowed by the late

Joseph B. Summers, founder of Summers Engineering, Inc., Hanford, California. Applications for the 2014 scholarship will be accepted during late spring or early summer 2014. □

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USCID Awards and Presented in Denver

The 2013 USCID Awards were presented during the recent **Water Management Conference** in Denver.

The USCID *Service to the Profession* Award was given to **Mark A. Limbaugh**, Managing Partner for Business Practices, The Ferguson Group, Washington, DC. He was honored for more than 30 years of accomplishments in agriculture and water management.



USCID President Bryan Thoreson congratulates Mark Limbaugh.

In his nomination, **Darell D. Zimbelman** stated, "Limbaugh's experiences in managing water at the local, state and federal levels have demonstrated that he is keenly aware of the importance of modern and well maintained water and power infrastructure."

Limbaugh was raised on an 800-acre family farm in Idaho. He received a Bachelor of Science degree in Accounting from the University of Idaho in 1978. After graduation, Mark continued to be involved in the ownership and operations of the family farm. He furthered his career in irrigated agriculture as a State water master, as executive director of a water user organization, president of the Family Farm Alliance, and as Deputy Commissioner of the Bureau of Reclamation in Washington, DC.

In 2005, Limbaugh was appointed by the President and confirmed by the Senate as Assistant Secretary for Water

and Science at the Department of the Interior. He joined The Ferguson Group in 2007, where he provides strategic policy and legislative guidance to clients on water, irrigation, energy and natural resource management issues.

Limbaugh served as a USCID board member and has continued to actively support USCID programs and activities.

Guy Fipps, Texas A&M University, College Station, Texas, received the USCID *Merriam Improved Irrigation Award*. The award was endowed by the late **John L. Merriam**, Professor Emeritus, California Polytechnic State University

The award was presented by USCID President Bryan Thoreson, who stated, "USCID is pleased to present Dr. Guy Fipps with the Merriam Improved Irrigation Award, in recognition of his many contributions to improving irrigation practices in Texas, the U.S. and throughout the world."

In Texas, Fipps is known for his development of a combination of tools, including geographic information, land surveys and databases, used by irrigators to improve efficiency and reduce irrigation water losses.



Guy Fipps receives the Merriam Award from Bryan Thoreson.

Fipps received a bachelor's in liberal arts from the University of Texas in 1977, a bachelor's in agricultural engineering from Texas A&M University in 1979, and a master's and a doctorate from North Carolina State University in 1984 and 1988, respectively. He has been an AgriLife

Extension specialist and a Texas A&M faculty member since 1988.

Internationally, Fipp's work has targeted improvement of irrigation — including surface irrigation — through project consultation/advisory efforts and educational program development and support in China, Mexico, Jordan and Uzbekistan. He is also the founder and director of the Texas A&M Irrigation Technology Center.[®]

Previous USCID Award Recipients

USCID Merriam Improved Irrigation Award

Joseph B. Summers, 1999
E. Gordon Kruse, 2001
John A. Replogle, 2002
Grant G. Davids, 2003
Jesse Silva, 2004
Charles M. Burt, 2005
Arnold K. Dimmitt, 2006
Marshall J. English, 2008
Albert J. Clemmens, 2009
Steve Knell, 2010
Thomas J. Trout, 2011
Stuart Styles, 2012

USCID Service to the Profession Award

Marvin E. Jensen, 2000
Maurice L. Albertson, 2001
Richard G. Allen, 2002
Jack Keller, 2003
Walter J. Ochs, 2004
Darell D. Zimbelman, 2005
John W. Keys III, 2006
Larry D. Stephens, 2007
Kenneth and Ruth Wright, 2008
Allen R. Dedrick, 2009
Rick L. Gold, 2010
Joseph I. Burns, 2011
Clifford I. Barrett, 2012

USCID Water Management Meeting



Conference Co-Chair Luis Garcia, University of Vermont.



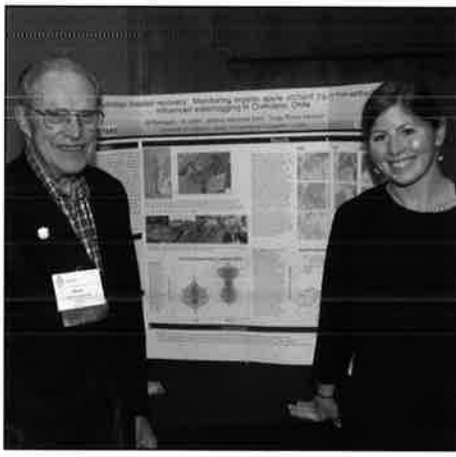
Meinter Vierstra, Mobile Canal Control, Delft, The Netherlands; and Tamara Borden, USCID.



Keynote Speaker Mark Limbaugh, The Ferguson Group.



Laura Schroeder, Schroeder Law Offices, Portland, Oregon.



Marvin Jensen and Jenna Rodriguez, University of California, Davis.



Opening Lunch Speaker Gregory Hobbs, Colorado Supreme Court.



Ron Davis, Coletanche (left); and Robert LeGrande, ASABE.

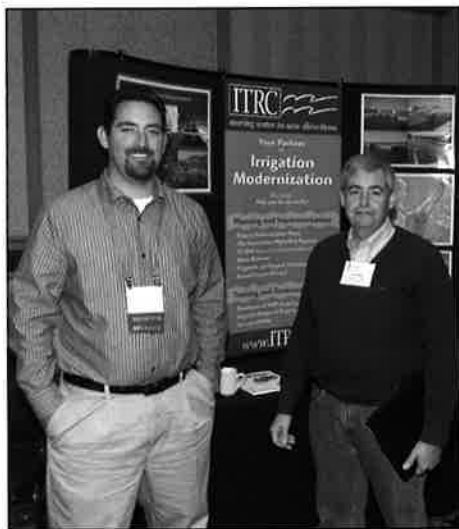


Brenna Mefford, Colorado State University; and Tony Wahl, Bureau of Reclamation.



Fred Holloway, Stevens Water Monitoring Systems.

Denver, Colorado — October 22-25, 2013



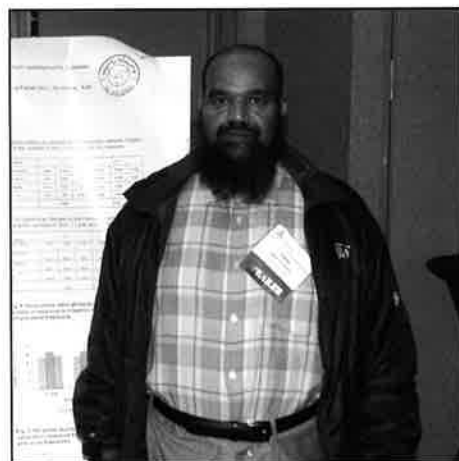
Dan Howes, Irrigation Training & Research Center; and Alejandro Paolini, Henry Miller Reclamation District.



Conference Co-Chair Jerry Gibbens, Northern Water (left); and Brian Wahlin, WEST Consultants.



Dinner Speaker Jeffrey Lakas, Western Water Assessment.



Poster presenter Sami Al-Thabet, King Faisal University, Saudi Arabia.



Sam Schaefer, GEI Consultants; and Scholarship Recipient Hilary Olsen.



Tess Thomas, University of Texas-Pan American; and Tabitha Cairo, George Cairo Engineering.



David Bradshaw, Imperial Irrigation District (left) and Robert Creel, Huesker.



Amy Johnson, Northern Water and Brian Wahlin, WEST Consultants, Inc.



Joel Irving, International Water Screens.

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Denver (continued)

opportunities, related to the future of irrigation water supplies. The Conference featured more than 50 oral presentations and posters, two panel discussions, a pre-Conference Workshop, two study tours and more than 20 exhibitors and sponsors. The Rocky Mountain Section of the American Society of Agricultural and Biological Engineers was a cooperating organization.



ASABE Executive Director Darrin Drollinger.

Colorado Supreme Court Justice Gregory Hobbs kicked off the Conference with an entertaining historical perspective on water use in the Southwestern U.S. His presentation led nicely into a Keynote Address by former Assistant Secretary of the Interior for Water and Science **Mark Limbaugh**, The Ferguson Group, Washington, DC.

The plenary session, extending from Tuesday afternoon through Wednesday morning, featured presentations and panel discussions of issues facing the Colorado River Basin water users, especially in response to findings of Reclamation's *Colorado River Basin Water Supply and Demand Study*. The panelists, representing water users within the basin and state representatives, had respectful discussions of the Basin Study and next steps, including responding to questions regarding the irrigation water conservation, data and modeling and other important issues.

The Wednesday dinner featured a presentation by Jeffrey Lucas, Western Water Assessment, on the catastrophic flooding that occurred along the Colorado Front Range in September.



A large contingent of Chinese engineers attended the Conference.

Lucas blended the surreal photographs of flooding and damage with a more technical assessment of the meteorologic conditions, rainfall and streamflow reports and frequency analyses. The flooding had significant impact on irrigation and other infrastructure throughout northeastern Colorado, with damages likely to approach or exceed \$1 billion.

Thursday's luncheon was highlighted with a presentation by Darrin Drollinger, Executive Director of the American Society of Agricultural and Biological Engineers. With the many similarities in membership and directives between ASABE and USCID, it was interesting to hear Drollinger discuss the status and direction of the ASABE organization. We very much appreciate the ASABE contingent attending the Conference and engaging in very meaningful dialogue with the USCID membership.

Thursday also featured the 2013 Meeting of Members, which took place during the morning breakfast. USCID President Bryan Thoreson and the Board Members in attendance briefly reviewed the current status of USCID membership, finances and activities, including upcoming conferences. One of the take home messages from the meeting is the importance of conferences to the financial health of the organization, including participation through registration, sponsorship and exhibition.

A pre-Conference Workshop on Monday focused on *Applications of Mobile Devices for Water Management*. The Conference began with a Wednesday morning field tour of Bureau of Reclamation's hydraulics and



Sajid Ali Bhutto, Bakkhshal Lashari and Fathe Muhammad Mari, Pakistan.

materials engineering laboratories at the Denver Federal Center. An all-day field tour on Friday included a visit to the United States Air Force Academy and the Garden of the Gods in Colorado Springs, and a tour of Pueblo Dam and Reservoir west of Pueblo.

Thanks to the exhibitors and sponsors, and the planning committee and moderators, for making this Conference a success. A special thanks to Larry Stephens and Tamara Borden of USCID for doing the brunt of Conference coordination and planning, and once again, helping the Conference proceed smoothly and efficiently. ☐

Exhibitors

- » Aquatic Informatics Inc.
- » Axter Coletanche
- » Huesker Inc.
- » International Water Screens
- » Irrigation & Training Research Center
- » Mobile Canal Control
- » Stevens Water Monitoring
- » WEST Consultants, Inc.
- » YOOIL Engineering

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- » Davids Engineering, Inc.
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- » WEST Consultants, Inc.

News of Members

Nadya Alexandra is working on her PhD in Biological Systems and Agricultural Engineering at the University of California, Davis. She received the USCID/Summers Engineering Scholarship in 2009 while a student at Cal Poly.

Paul DeMaggio is affiliated with Jackson Soil and Water Conservation District, Central Point, Oregon.

Saleh Taghvaeian is now associated with Oklahoma State University in Stillwater.

Jordan Varble, following studies at **Colorado State University**, is serving with the Peace Corps in Panama's Water, Sanitation and Hygiene Sector.✉

Missouri Report

Based on the current soil moisture and snowpack conditions, runoff in the Missouri River Basin above Sioux City, Iowa, is forecast to be 26.1 million acre feet in 2014, up slightly from the 25.1 MAF recorded in 2013. Normal runoff is 25.2 MAF.

Although drought conditions in the Missouri River Basin improved significantly in 2013, the Missouri River mainstem reservoir levels remain below normal due to the lingering effects of the 2012 drought," said Jody Farhat, Corps of Engineers, Northwestern Division. "Improved runoff into the reservoir system in 2013, in combination with the drought conservation measures that were implemented, increased the total volume of water stored in the reservoirs by two million acre-feet since last year at this time. However, the upper three reservoirs, Fort Peck in eastern Montana, Garrison in North Dakota, and Oahe in South Dakota, remain five to 11 feet below the desired operating levels." The near-normal runoff in 2013 was the

product of below normal plains and mountain snowmelt runoff offset by above normal summer and fall precipitation in the Dakotas and eastern Montana.


As of January 1, the mountain snowpack was 110 percent of normal in the reach above Fort Peck and 113 percent of normal in the reach from Fort Peck to Garrison. Light-to-moderate plains snowpack has accumulated over much eastern Montana, North Dakota, and eastern South Dakota.

The six mainstem power plants generated 491 million kWh in December. Average power generation in December is 689 million kWh. The 2013 total power generation was 7.6 billion kWh. The power plants are projected to generate 8.4 billion kWh of electricity this year, compared to the normal of 10 billion kWh.✉

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Review of Corps of Engineers Drought Contingency Plans

by Kevin Fagot, P.E., WEST Consultants, Inc., Bellevue, Washington

Background

In 1981, the Corps of Engineers published Engineering Regulation 1110-2-1941. This ER provides policy and guidance for the preparation of Drought Contingency Plans in the context of water control management. These DCP were directed to be prepared for each Corps project or system of projects having controlled reservoir storage. A Corps project can be any feature that the Corps has built and/or maintains such as a levee or diversion structure. For this article, the use of the term Corps project refers to dams. Many of the DCP were developed in the late 1980s and early 1990s. Due to changes that have occurred since this time, some of these DCP are in need of updating. Additionally, the Corps is planning to address the impacts to the projects from climate change in the updated DCP.

Since March 2012, WEST Consultants and the Corps have been assessing the state of existing DCP, developing update strategies, and prioritizing needed updates. WEST reviewed and summarized 140 DCP. Since some DCP cover an entire river system, over 300 dams were covered in the review. As seen in Figure 1, most of the 540 Corps dams are located in the eastern half of the country. The dots show the dams that were reviewed for this study. The plus signs represent projects where it was determined that a DCP was not necessary, typically because there is no controlled reservoir storage. Many of these are lock and dam projects that do not store water, but instead are operated as run of river projects providing necessary navigation draft.

The DCP cover multiple topics to varying extents depending on the needs of the Corps district. Some of the topics included in the DCP are as follows:

- Historical drought information including historic low flows, Palmer Drought Severity Index (PDSI) values, critical dry periods used to determine water supply yield or firm energy, and impacts that occurred during historic droughts.



Figure 1.

- Variables that are tracked to indicate the severity of a current drought.
 - Description of the drainage basin and of the project.
 - A listing of the contracted water users and their contracted amounts.
 - Quantity of inactive storage and uncontracted water supply storage
- that could be accessed during a drought.
 - Water law issues such as riparian and appropriation water rights and compacts between states.
 - The drought management plan including drought level triggers and the actions that take place during specific drought levels.

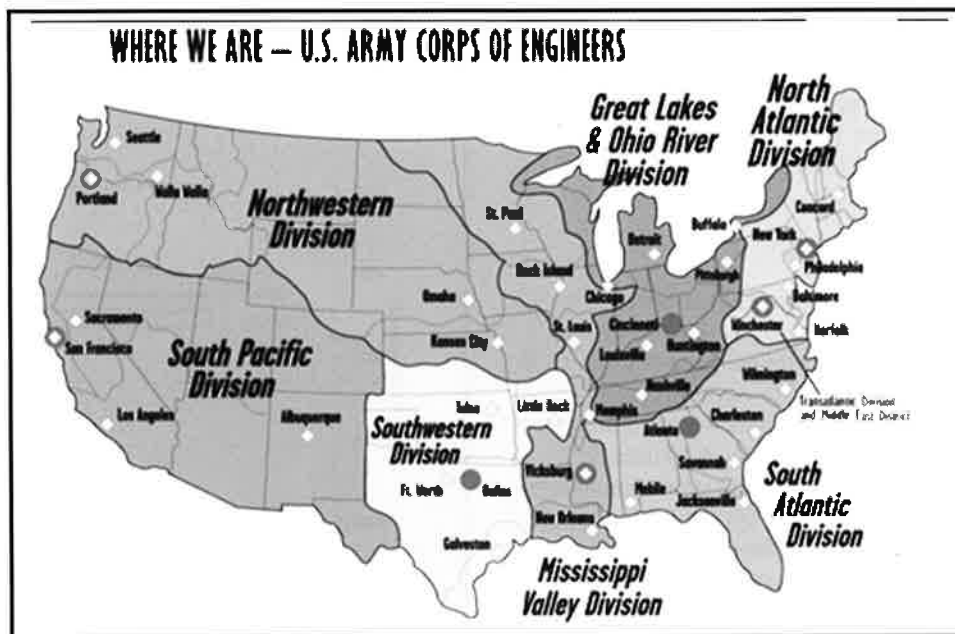


Figure 2.

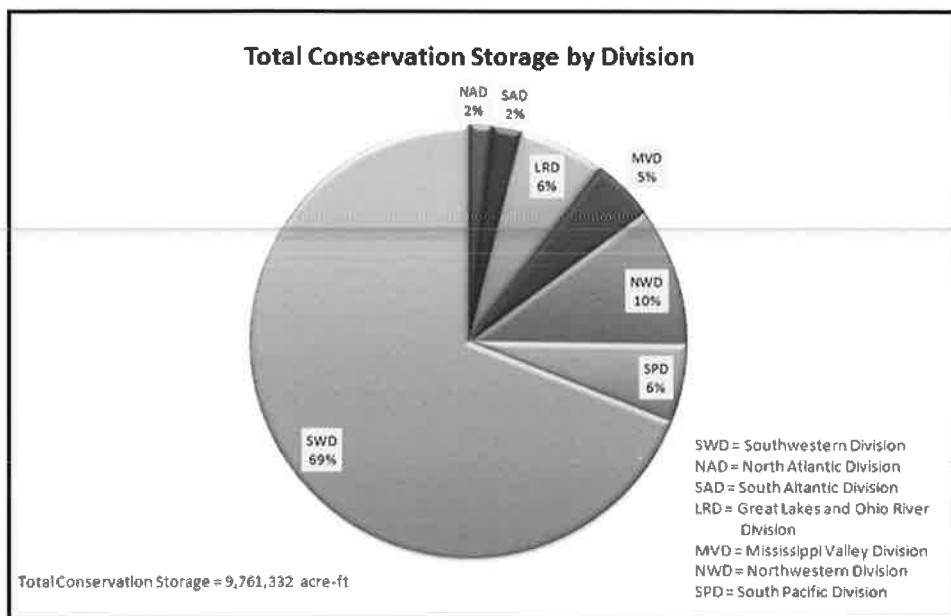


Figure 3.

- Internal and external coordination and dissemination of information to the general public.

Water Supply Storage

The Corps has seven main divisions in the contiguous United States. The division map is shown in Figure 2. As shown in Figure 3, the Southwestern Division has the greatest amount of municipal and industrial water supply storage with 6,734,829 acre-feet (69 percent). The other six divisions have a combined 3,026,503 acre-feet (31 percent). By comparison, the state of Texas (located in the Southwestern Division) has 4,509,511 acre-feet of M&I storage in Corps projects. Only about four percent of the total M&I storage in Corps projects is uncontracted.

Water Law

Water law information is covered to varying degrees in the DCP. For example, the Albuquerque District DCP discusses the prior appropriation doctrine that governs water rights in the state of New Mexico. Additionally, compacts between the states can also be included. For example, the Rio Grande Compact is described in the DCP for Abiquiu, Cochiti and Jemez Canyon Reservoirs in the Albuquerque District. This compact is used to equitably apportion the water of the Rio Grande

among the states of Colorado, New Mexico and Texas.

Irrigation

The South Pacific Division, which includes all or portions of the states of California, Nevada, Utah, Arizona, New Mexico, Colorado, and the western edge of Texas, has only four Corps projects with water supply agreements. In the state of New Mexico, the only water supply contract that exists is for 178,000 acre-feet contracted to Albuquerque Bernalillo County Water Utility

Authority from Abiquiu Reservoir in the Rio Grande basin. The largest water use in the Pecos River Basin is irrigation; however, the Bureau of Reclamation administers the conservation storage for the Carlsbad Irrigation District.

Drought Level

At many of the Corps reservoirs, the drought level is determined by the drought duration as well as the pool elevation. Some Corps districts have indicated that these parameters are too simplistic for adequately describing the drought conditions and recommend the development of a more sophisticated approach. Drought action levels at Conchas Lake based on pool elevation are shown in Figure 4. Conchas Lake is located on the Canadian River and it is operated by the Albuquerque District. The drought zone determines the actions and level of coordination that will occur.

Conchas Lake drought level is also determined by the duration of drought. Droughts occurring for one year or less are assigned Level 1, one year to two years is assigned Level 2, two years to three years is assigned Level 3, and drought durations exceeding 3 years are assigned Level 4.

Since the pool level and the drought duration are each determining factors in the drought level, the assignment of a specific drought level can be subjective.

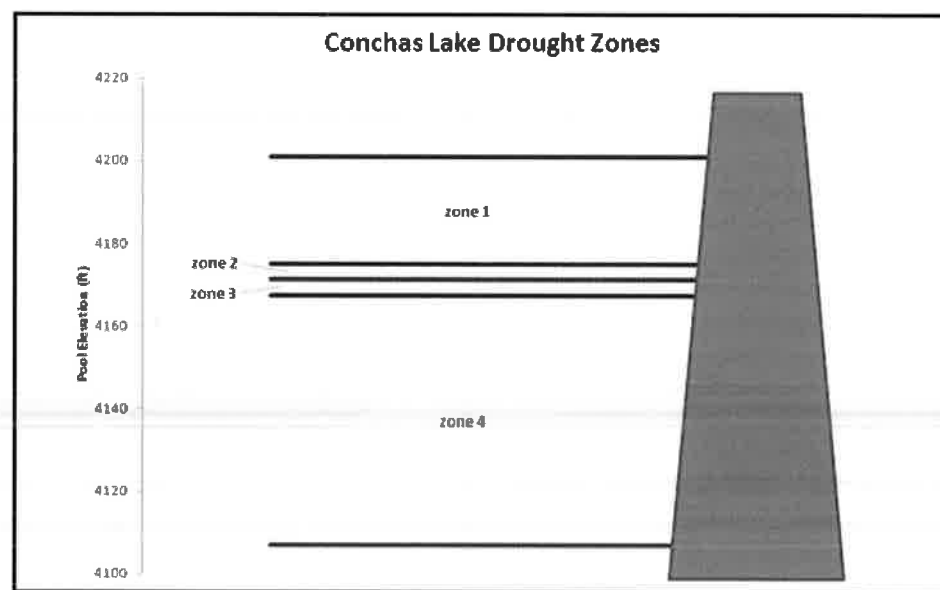


Figure 4.

If both the drought duration and the pool level are indicating a Level 2 drought, the decision is straightforward. For a Level 2 drought duration and a Level 1 pool elevation, the forecasting of conditions can determine how the drought is described.

The drought level determines the actions that take place at the projects. For the Albuquerque District projects, some of the actions that take place at various drought levels are given below:

Level 1

- Alert phase where conditions are monitored
- Normal operational procedures continue
- Corps reservoirs should be able to meet irrigation water supply

Level 2

- Corps Drought Management Committee is established
- Requests for drought related actions forwarded to CDMC

Level 3

- Efforts in drought management coordination and operations are intensified
- Interagency Drought Management Committee is established

Level 4

- All storage in the reservoirs must be considered
- Water rationing and apportionment may be required
- Water management objectives established by CDMC and IDMC are carried out

Summary

The information presented in this article is a small sample of the data extracted from the review of the 140 Corps DCP. From this review and discussions with Corps personnel, a recommended outline was developed for updated DCP. Topics to be considered in the updated DCP were also included. Flexibility in the development of the DCP, however, is necessary due to the varying requirements that exist between the projects.☐

President's Message (continued)

of voters supporting a transfer of \$2 billion from the state's Economic Stabilization Fund (a "rainy day" fund) to a State Water Implementation Fund for Texas. Despite some welcome rain in September, New Mexico also remains dry. To respond most effectively to the continuing drought conditions, it is important for water managers to share their experiences with different water management tools in different physical, social, cultural and political situations.

Switching from droughts to floods, the dinner speaker at the recently concluded Conference in Denver gave an interesting presentation about the floods this past September in the Boulder and Denver areas. One interesting fact was that, although initial reporting called the floods a thousand year event, a careful review of previous records found three similar flooding events in the preceding one hundred years. See the accompanying article in this newsletter for a recap of the successful Denver Conference.

Finally, on a sad note, the irrigation industry lost a giant when Jack Keller suddenly passed away last month in Denver. I had the privilege and pleasure of working with Jack on water conservation projects over the last 20 years. Jack was a friend and colleague and he will be missed.

Bryan Thoreson
President, USCID☐

Necrology

Ralph R. Ross, Washington, DC, died September 28, 2013, at the age of 86. A graduate of Oklahoma State University, he retired as the Chief of Contracting of the National Capitol Region for the National Park Service, where he spent 40 years in government service.

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CSU Water Resources Archive Offers Online Reports, Images

Thanks to a grant from the Colorado Water Conservation Board, more than 43,000 pages of primary source materials related to water use and history in Colorado are now available online. The Colorado State University Water Resources Archive recently posted the items that include reports, images, oral histories and data. Digitization also preserved more than 200 rare glass plate images of Colorado and several thousand slides of dams and waterways in the western United States.

The Water Resources Archive is Colorado's only repository dedicated specifically to preserving the history of water in the state and the American West. Most of the documents are unique and unavailable elsewhere.

The Archive's website is
www.lib.colostate.edu/archives/water☐

New Members

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ASABE to Host ET Symposium

The American Society of Agricultural and Biological Engineers, along with the Weyerhaeuser Company and the USDA Forest Service, will sponsor a Symposium, *Evapotranspiration: Challenges in Measurement and Modeling from Leaf to the Landscape Scale and Beyond*, April 7-10, 2014, in Raleigh, North Carolina.

The purpose of the Symposium is to bring together those interested in understanding, measuring, and modeling ET to report on advances in basic science, technology, applied methods, ecological, and socio-economic implications of ET processes and changes at all scales.

USCID is one of many national and international institutions, private companies and government agencies that have endorsed the Symposium. For more information, visit www.asabe.org.



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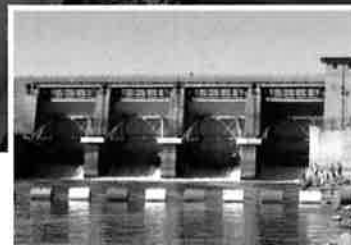
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USCID Notes

by Larry D. Stephens,
Executive Vice President

As we finish one year and begin another, I note with sorrow the passing of four Members who were leaders of our profession. Jack Keller was truly an icon in irrigation engineering and, at a young 85 years of age, was still actively working when he passed away. And, while not as well known as Jack, Joe DeVries, Carlos Ospina and Ralph Ross were friends of mine who also made important contributions to our world. May they all rest in peace!

This would be an excellent time for USCID Members to become involved in ICID, as upcoming meetings will be held in very attractive venues — the 12th Drainage Workshop in St. Petersburg, Russia; the 22nd Congress in Gwangju, Korea; followed by ICID Executive Council Meetings in Montpellier, France, and in Thailand. In addition to technical presentations by international irrigation experts, each ICID meeting includes committee and workbody meetings and study tours. Several of the ICID workbodies need representatives from the U.S. to bring our expertise and technology to irrigation professionals from around the world. You may visit the ICID website (www.icid.org) and take the link to Workbodies to see the scope of these activities. And, feel free to contact me at stephens@uscid.org for more information about participating in the ICID workbodies. I assure you that you will find involvement in ICID to be professionally and personally rewarding!

Speaking of involvement — plan to attend the upcoming USCID conferences. The upcoming March Conference in Sacramento will address groundwater issues and will be held in conjunction with a conference organized by the Groundwater Resources Association of California. California and other places in the western U.S. are facing severe droughts. Use of groundwater is helping irrigators to survive the droughts, but there are short-term and long-term consequences that must be addressed. Also, I recommend that you read the page 1 article by Charles Burt on groundwater issues.

The Fall Conference will be held in the Phoenix area. An invitation to join the Phoenix Conference Planning Committee will be sent to USCID Members soon. The theme of the Conference focuses on irrigation automation, a topic that should be of great interest to all irrigation engineers! Participating in a conference planning committee is the best way to become more involved in USCID.

Finally, congratulations to the winners of USCID awards, presented during the Denver Conference during October.

Mark Limbaugh and **Guy Fipps** certainly deserved recognition for the professional contributions to the irrigation profession! Congrats also to **Hilary Olsen**, a student at California Polytechnic State University, who was selected by the USCID Board of Directors to receive the 2013 USCID/ Summers Engineering Scholarship. □

USCID Meetings

March 4-7, 2014, Sacramento, California. *Groundwater Issues and Water Management — Strategies Addressing the Challenges of Sustainability*

Fall 2014, Phoenix, Arizona. *Planning, Operation and Automation of Irrigation Delivery Systems.*

ICID Meetings

June 23-26, 2014, 12th International Drainage Workshop, St. Petersburg, Russia.

September 14-20, 2014, 65th IEC Meeting and 22nd Congress, Gwangju, Korea.

October 11-16, 2015, 66th IEC Meeting, Montpellier, France.

2016, 67th IEC Meeting and 9th Asian Regional Conference, Thailand.