NEW MEXICO INTERSTATE STREAM COMMISSION

Preliminary Summary Report

The 2004 Arizona Water Settlements Act Proposals Evaluation

August 2014

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Introduction

This report presents a summary of the work completed to date by the New Mexico Interstate Stream Commission ("ISC" or "Commission") staff in its evaluation of project proposals for use of Arizona Water Settlements Act of 2004 ("AWSA") funds and/or water.

The Arizona Water Settlements Act of 2004

The AWSA became federal law in December 2004. It allocates to New Mexico up to $128 million in non-reimbursable federal funds and up to an annual average of 14,000 acre-feet of additional water from the Gila Basin. The additional water represents a 47 percent increase over New Mexico's current Gila Basin apportionment in the 1963 United States Supreme Court Decree in *Arizona v. California*.

Planning Process History

In 2005, the Gila San Francisco Coordinating Committee ("GSFCC") was formed. The GSFCC was composed of representatives of the Office of the Governor, the Bureau of Reclamation, the Gila San Francisco Water Commission, the U.S. Fish and Wildlife Service, the ISC, and, later, the New Mexico Department of Game & Fish. The purpose of the GSFCC was to develop baseline information, especially as to any impacts on endangered species, which might occur from development of the AWSA water. In late 2005, the Technical Subcommittee of the GSFCC, composed of government agencies and stakeholders, crafted a plan of integrated basic scientific studies. In 2006, the legislature appropriated full funding for those studies, but the appropriation was vetoed.

In September 2007, the Southwest New Mexico Stakeholders Group ("SWNMSG") was formed to reach a consensus among stakeholders on projects using AWSA water and/or funds. After several years of work, the SWNMSG could not reach consensus on a small number of projects.

In 2011, the ISC began a two-tiered evaluation process of forty-one project proposals submitted by stakeholders. The ISC established an Evaluation Panel that reviewed and ranked the 20 proposals that passed Tier-1. On February 29, 2012, the ISC approved sixteen projects for further assessment, integration, and/or refinement. One project has since been withdrawn.

Policy

In September 2004, the ISC adopted the following formal policy for the Gila Basin:

> The Interstate Stream Commission recognizes the unique and valuable ecology of the Gila Basin. In considering any proposal for water utilization under Section 212 of the Arizona Water Settlements Act, the

> Commission will apply the best available science to fully assess and mitigate the ecological impacts on Southwest New Mexico, the Gila River, its tributaries and associated riparian corridors, while also considering the historic uses of, and future demands for, water in the Basin and the traditions, cultures and customs affecting those uses.

In keeping with this policy, the ISC staff has pursued the best available science, while considering future demand and customs, in order to provide the Commission with the best information to base project and funding decisions upon.

Over fifty studies and engineering evaluations have been completed since the AWSA planning process began in 2001, including some not funded by the Commission. Studies and evaluation have addressed technical, hydrologic, geomorphic, geotechnical, geologic, engineering issues and concerns, and others. A large part of the work done so far has addresses environmental/ecologic concerns. Engineering studies and reviews have identified technical issues to be addressed, scientific studies have raised additional questions, there have been multiple delays and setbacks in contracting, and stakeholders have asked that additional items be investigated.

Staff anticipates the results of ongoing studies could provide important input to the informed and considered decision the Commission must make. Ongoing work is scheduled to be completed by October 1, 2014. At this time, staff makes no recommendation that any particular project or activity be funded under the AWSA.

The following summarizes the work completed to date.

Studies

Biological Survey (2013)

Goal

As part of the analysis of nine (9) canyons along the Gila River considered for AWSA water storage, in early 2013 the Interstate Stream Commission contracted with SWCA Environmental Consultants to survey the area for threatened or endangered species and their habitats.

Method

Using data from different federal and state agencies, SWCA first developed a list of 135 special status plant and animal species believed to be in the area. This included data from the US Fish and Wildlife, NM Department of Game and Fish, NM Energy, Minerals & Natural Resources Department, New Mexico Rare Plant Technical Council, Natural Heritage New Mexico. After compiling this list, SWCA analyzed the habitat needs of the species and compared them to the actual soil, vegetation and water conditions in the canyons. In this analysis, SWCA eliminated 62 species from the list because ground conditions would not support them.

SWCA then sent biologists to the canyons for on-site field surveys to confirm the desktop survey. In some canyons, they found conditions to be quite different than what the government agencies had reported. In each canyon, SWCA conducted a systematic search for habitat, or conditions that would support habitat, for any of the 73 species. To provide further documentation of the area in standard format, SWCA used methods developed by the NM Environment Department, the Army Corp of Engineers, and the Natural Resources Conservation Service to evaluate the ecological status and pasture conditions of the area.

Results

The final report of ecological conditions in 9 canyons indicates that, while there are habitats suitable for sensitive species in the area, there are none that cannot be mitigated.

Report can be found at

Link: http://nmawsa.org/ongoing-work/ecological-studies/biological-survey

Cultural Resources Survey (2013)

Goal

As part of the analysis of eleven (11)canyons along the Gila River and near Ft. Bayard that were being considered for AWSA water storage, in early 2013 the Interstate Stream Commission contracted with SWCA Environmental Consultants to perform a desktop survey of the area for the presence of archeological artifacts.

Method

The desktop records search included a search of the online New Mexico Cultural Resources Information System (NMCRIS) database and the General Land Office (GLO) land patents database maintained by the Bureau of Land Management (BLM). The NMCRIS database contains information on known archaeological sites, previous cultural resources surveys, and properties listed on the New Mexico State Register of Cultural Properties (SRCP) and the National Register of Historic Places (NRHP). The sensitivity analysis was conducted using a statistical model of cultural resource sensitivity for southwestern New Mexico created by the BLM in 2013.

Results

The results of the desktop records search were inconclusive. Very few cultural resource surveys have been conducted in the potential impoundment areas, and few archaeological sites—and no NRHP or SRCP properties—are located in within any of these areas.

The statistical analysis did indicate areas of probable cultural resource sensitivity throughout the northern Mimbres Basin and the Gila River valley.

Link not available

AWSA Diversion Model (2014)

Goal

Beginning in 2001, ISC staff hydrologists developed Excel spreadsheet models for use in AWSA negotiations. After many iterations and refinements, after conclusion of negotiations, a spreadsheet was completed that reflects all of the requirements of the AWSA.

Method

This model applies AWSA constraints to every day of available historical data for the USGS streamflow gauges on the Gila and San Francisco Rivers that are applicable to the CUFA. The model estimates that over the 75 years of historical data, an annual average of slightly more than 12,000 acre-feet could have been diverted from the Gila river while maintaining compliance with the AWSA.

A number of scientists have attempted to estimate the changes in streamflows due to climate change. Although the models used can diverge by large amounts, most scientists have converged on a reduction in upper Gila streamflow of 8%.

Results

Using the same Excel spreadsheet model, but reducing every daily value for streamflow and storage in San Carlos reservoir by 10% to simulate long term drought or climate change, the model estimated there would have been an annual average of ~11,790 acre-feet per year of AWSA water available for diversion, or a decrease of approximately 2.6%.

A decrease of 16% in streamflow and storage results in a decrease in average allowable AWSA diversions to 11,490 acre-feet per year, or a reduction of approximately 5%. The non-linearity of reductions is due to the many overlapping constraints in the AWSA.

Gila Flow Needs Assessment (2014)

Goal

In 2012, the Interstate Stream Commission wrote a letter to the Bureau of Reclamation in support of The Nature Conservancy (TNC) application for grant monies under the Desert Landscape Conservation Cooperative and WaterSMART Program. The grant was to study the Gila River to determine what flow volume is required to provide adequate water for the various ecological and environmental functions it supports.

While the NM ISC provided data for the study and staff attended the workshop, it did not participate in authoring the 527 page report that was generated in July 2014. Because the report references the ISC and some of our work, staff and consultants are reviewing the report.

Method

This effort requires detailed reading of the entire report.

Results

The review has not yet been completed.

Hydrological Study by John Shomaker & Associates, Inc. (JSAI) (2012)

Goal

As part of the feasibility analysis of the Grant County Tier 2 proposal, the NM ISC hired JSAI to evaluate and quantify the potential hydrologic effects associated with the creation of reservoirs on creeks near Ft. Bayard. As any of the proposed reservoirs could be located a short distance upstream of the Bayard well field, both quantity and quality of water could be adversely impacted.

Method

JSAI used a groundwater model to calculate potential reservoir seepage and hydraulic response of the aquifer to seepage from the reservoir. Then they calculated the travel velocity within the groundwater system.

Results

With this information, JSAI determined that the groundwater travel time from the recommended potential reservoir site to the Bayard Well Field is 3 years. An increase in recharge (60 ac-ft/yr) will occur if stormwater runoff is routed around the proposed reservoir. A 60 ac-ft/yr decrease in recharge will occur if stormwater is impounded in the proposed reservoir.

Link: http://nmawsa.org/ongoing-work/final-effluent-resuse-proposal-pers/grant-county-tier-ii-awsa-application/02-08-2013-jsai-bayard-hydrologic-analysis-report/view

Remote-Sensing-Based Comparison of Water Consumption by Drip-irrigated Versus Flood-irrigated Fields (2013)

Goal

In 2012, the Interstate Stream Commission contracted with Intera Geosciences Engineering to quantify the differences in water consumption between on farm irrigation methods, specifically comparing drip to flood irrigation in the Deming, NM area.

Method

Intera identified, located with GPS, and photographed fields planted in the same crops, but irrigated by different methods. Intera then used satellite imagery and the METRIC software to quantify and compare the surface temperatures and evapotransiration in the different fields through-out the growing season.

Results

Surface temperatures in drip irrigated fields are lower than in flood irrigated fields, indicating a higher water consumption and transpiration from plants. Using the METRIC software, consumption in drip-irrigated fields ranged 8% to 16% higher than in flood irrigated fields. More biomass is being produced (higher yield) and each plant is using more water. Less water is available for return to the aquifer.

http://nmawsa.org/ongoing-work/agricultural-water-use/comparison-of-water-consumption-by-drip-irrigated-versus-flood-irrigated-fields/view

Low Water Use Crop report (Best Use of the Arizona Water Settlement Act Water: Examples of High Value, Low Water Use Crops) (2012)

Goal

In 2011, the Interstate Stream Commission contracted with Competitive Advantage Consulting Ltd. (CACL) to identify crops that might lead to higher economic return and lower water use than those currently grown in the Cliff-Gila farming valley.

Method

Through a series of field interviews, site visits and research, CACL identified the crops currently under cultivation, the profits and the issues with them. CACL also researched other crops that could be grown in the area, their water use, and the profits they could generate.

Results

There are many crops, such as lavender, grapes and onions, that might produce higher economic return and use less water than current crops. However, to transition to them would require new equipment, local and regional infrastructure, and increased labor.

Link: http://nmawsa.org/ongoing-work/agricultural-water-use/examples-of-high-value-low-water-use-crops/view

Gila Work Group Drip Irrigation Study (2013)

Goal

Some residents of the Silver City area questioned the use of modeling as a valid method to prove the efficacy of drip irrigation in saving water. They endeavored to prove that

- drip irrigation does save water and increase farm profits
- that the US Geological Survey report claiming that the Mimbres basing aquifer is stable

Method

The authors did a desktop study and cited several studies found online. There is also some educated discussion of groundwater behavior. The report also quotes some farmers from the Mimbres basin.

Results

- Comparisons of crop yield from 4 types of irrigation indicate that crops grown with sub-surface drip irrigation produce higher yield than those grown by other methods.
- 85% of Luna County acreage has been converted to drip. Also, the number of irrigated acres in Luna County is decreasing. From this, the authors concluded that less water is being pumped because it is expensive and not needed with drip irrigation.
- It takes 70 years for water to travel from the ground surface to the aquifer 140 feet below. Water continues to evaporate from the surface even at a depth of 40 feet.
- Anecdotal stories from farmers indicate that some farmers are irrigating larger areas of land, some are irrigating smaller areas.
- Using records from the NM OSE, the authors used the depth to water for the initial installation of about 3000 wells from all around the Mimbres basin going back to 1945. No subsequent readings of the same wells were included in this study. From this, the authors conclude that the Mimbres basin aquifer is remaining at about the same level, thus confirming the USGS report from 2013.

For more detail, contact Gila Work Group.

Hydrosphere Hydrological Model (2007)

Goal

In 2007, the Interstate Stream Commission contracted with Hydrosphere Resource Consultants, Inc. of Socorro, NM to evaluate the effect of Silver City pumping on Gila River base flows

Method

Hydrosphere did a review of several models of the area and ran scenarios with the Balleau model.

Results

- Approximately 40% of base flow in the Gila between Mogollon and Redrock derives from the Mangas Trench where Silver City's Frank's well field is located.
- Estimates of total Mimbres basin recharge ranges from approximately 14,000 AF/Y to approximately 31,900 AF/Y.

The report can be found at

http://nmawsa.org/ongoing-work/hydrogeology

Geomorphology of the Upper Gila River within the State of New Mexico (2006)

Goal:

The ISC staff contracted Mussetter Engineering, Inc. to evaluate the existing dynamics of the Gila River, and the geomorphologic impacts of the AWSA diversions.

Method:

The consultant conducted field surveying, and hydraulic /sediment transport modeling to achieve the objectives of the study.

Results:

The results showed that maximum diversions under the AWSA are unlikely to have a significant effect on sediment transport, water-surface elevations, or durations of inundation for any of the geomorphologic surfaces. The study was conducted when an additional annual average of 18,000 acre-feet per year of AWSA water was envisioned. The final AWSA limits New Mexico to an additional annual average of only 14,000 acre-feet per year. Impacts would be even less than thought in the study.

Link: http://nmawsa.org/ongoing-work/geomorphology/geomorphology-of-the-upper-gila-river-within-the-state-of-new-mexico/view

Mimbres Basin Water Supply, and Silver City Water Demand (2009)

Goal:

The ISC staff contracted Intera to evaluate estimates of the Mimbres Basin water supplies, analyze groundwater availability in Silver City, and develop a water budget for the Silver City area.

Method:

The consultant did data analysis and model research for the purpose of this study.

Results:

The results indicated that it is likely that there is adequate groundwater to supply Silver City over the next 40 to 60 years. However, it may require deepening existing wells or adding new wells.

Link: http://nmawsa.org/library/sw-nm-stakeholders/technical-memorandum-mimbres-basin-water-supplies-6-30-2009/view

Stream Flow Projections for the Upper Gila River (2013)

Goal:

The ISC staff contracted Dr. Gutzler from the Department of Earth and Planetary Sciences, University of New Mexico to estimate the effect of projected climate change on average peak-season flow in the upper Gila River.

Method:

He used two methods for his study: Dynamical and statistical modeling. The major assumptions for this study were as follow:

- [For the dynamical model]: The temperature increases over the next few decades to the point at which the long term temperature effect overwhelms the decadal variability of precipitation variability.
- Inter-annual and decadal variability is fixed.
- Flows only associated with snowpack were focused in this report, not summer flows.
- Built-in Uncertainties:
    - Projected increase in atmospheric greenhouse concentration
    - Future greenhouse gas forcing
    - Models (Decadal variability)

Results:

His conclusion was that there could be a reduction of approximately 8% by 2021 - 2050, relative to a baseline period of 1951 - 2012. The study also concluded that the timing of peak stream flow and the shape of the seasonal hydrograph are likely to change considerably over the next several decades.

Link: http://nmawsa.org/ongoing-work/streamflow-projections-for-the-upper-gila-river-considering-climate-change/draft-stream-flow-projections-for-the-upper-gila-river/view

Assessment of Potential Impacts on Gila River Fish Species from Diversions under the Terms of the 2004 Arizona Water Settlements Act (2014)

Goal:

The ISC staff contracted SWCA Environmental Consultants to quantify habitat change for fish species from the AWSA diversions.

Method:

The consultant applied Physical Habitat Simulation (PHABSIM) for this purpose. PHABSIM is the microhabitat modeling component of the Instream Flow Incremental Methodology (IFIM), and was originally developed and maintained by the U.S. Fish and Wildlife Service Instream Flow Group (now U.S. Geological Survey, Aquatic Systems and Technology Applications Group, Fort Collins Science Center). PHABSIM calculates a habitat index, in part based on simulation of river depths and velocities from 1-D hydraulic models that represent the river by cross-sections. For 1-D applications in this study, the hydraulic and habitat index simulations were derived from the computer program SEFA (System for Environmental Flow Analysis). SEFA is developed by Aquatic Habitat Analysis Inc. that implements the equivalent algorithms of PHABSIM.

Initially, 17 species of interest were mentioned in the scope of work: 11 fish (6 native fish species: Spikedace, Loach Minnow, Gila Chub, Desert Sucker, Sonora Sucker, and Longfin Dace; and 5 non-native species: Green Sunfish, Smallmouth Bass, Channel Catfish, Common Carp, and Red Shiner), 1 native bird (Southwest Willow Flycatcher), 2 native reptiles (Northern Mexican and Narrow-headed Garter Snakes), 2 amphibians (1 native frog: Chiricahua Leopard Frog; and 1 non-native frog: Bullfrog), and 1 non-native crustacean (Crayfish).

However, after doing research, the consultant concluded that the relationships between the species other than fish and flow are too uncertain to include in a PHABSIM-type analyses. Therefore, only fish species were evaluated in this process.

Results:

The results indicated that there was up to 5% positive and negative habitat changes for the fish species in their variant life stages (spawning, larvae/fry, juvenile, adult) under the AWSA diversions. The endangered species Spikedace and Loach Minnow had up to 3% positive habitat change. It also showed that releasing and maintaining 10 cfs in the river at

the time when the river goes dry/intermittent below the irrigation diversions in the Cliff-Gila Valley, would result in up to 11% habitat increase for all species.

Link: http://nmawsa.org/ongoing-work/ecological-studies/gila-fisheries-modeling-report/assessment-of-potential-impacts-on-gila-river-fish-species-from-diversions-under-the-terms-of-the-2004-arizona-water-settlements-act/view (Chapters 2, 3, 4)

Assessment of Potential Impacts on Gila River Fish Species from Diversions under the Terms of the 2004 Arizona Water Settlements Act (2014)

Goal:

The ISC staff contracted SWCA Environmental Consultants to quantify the probability of extinction for two endangered fish (Spikedace, Loach Minnow) from the AWSA diversions.

Method:

The consultant applied Population Viability Analysis (PVA) method for this purpose, an individual-based model for evaluating extinction risk in small fish populations subject to potentially strong density dependence in juvenile survival. These types of density-dependent responses are likely common in fish species from arid climates with highly fluctuating flow conditions.

The model can be used to run large numbers of stochastic simulations quickly to allow rapid screening of policy options and sensitivity analysis of the results to uncertainties about key population parameters.

Results:

The results indicated that under the drought conditions, the probability of extinction for Spikedace and Loach Minnow is 8.5% and 1.5%, respectively. The probability of extinction under the presence of non-native species would be 100% for both species.

However, upon releasing discharges up to 10 cfs back to the river at the time when the river goes dry/intermittent below the irrigation diversions in the Cliff-Gila Valley, the probability of extinction for both Spikedace and Loach Minnow becomes zero. In other words, a target baseline flow of about 10 cfs would provide beneficial habitat to native fish while not providing extensive habitat for non-native predators such as Smallmouth Bass and Channel Catfish. This flow augmentation scenario should potentially be considered to further reduce the risk of non-native fish colonization and habitat fragmentation in case of drought.

Robust monitoring efforts and surveys on abundance, diet, and prey overlap for the key native and non-native fish species in this reach should be undertaken to track fish

community response to any flow augmentations, and to assess predation potential. This type of information, taken over time can help to resolve uncertainties and refine understanding of the relationships between discharge and fish communities.

Link: http://nmawsa.org/ongoing-work/ecological-studies/gila-fisheries-modeling-report/assessment-of-potential-impacts-on-gila-river-fish-species-from-diversions-under-the-terms-of-the-2004-arizona-water-settlements-act/view (Chapter 5)

Review of USGS Mimbres Basin Groundwater Levels Report (2013)

Goal:

A 2013 USGS report on groundwater depletion in the United States shows water levels in the Mimbres Basin to be "generally stable" from 2000 to 2008 for the Mimbres Basin. A review study by the ISC staff was conducted to examine and verify the USGS study's input data and conclusion.

Method:

To estimate the trend in groundwater levels in the basin, field measurement data were analyzed from the sixty-seven wells that were spatially distributed throughout the basin, and were sampled regularly, following to USGS protocols, since 1997.

Results:

The review study revealed that the USGS report relied solely on water levels from fifteen Silver City wells, which are located in the northwest corner of the Mimbres Basin and the eastern portion of the Gila Basin. In addition, the results indicated continued water level declines in the Mimbres Basin for the 2000 – 2008 period (0.3 ft/yr on average). There are several other studies that confirm the declining water levels in the Mimbres basin for the same period.

Link: http://nmawsa.org/library/presentations/groundwater-levels-in-the-mimbres-basin-stable-or-declining/view

Estimates of Region-Wide and Deming Area Water Supplies (2009)

Goal:

The ISC staff contracted Daniel B. Stephens & Associates, Inc. to evaluate current and historical depletion rates in the Deming area, and estimate current water supplies in that area.

Method:

The consultant did a hydrological budget analysis for the purpose of this study.

Results:

The consultant concluded that the Deming area's groundwater supply is estimated to be at approximately 5 million AF. Secondly, groundwater levels showed to be declining at an average rate of 0.6 ft/yr, while demand is projected to be steady to increasing. Finally, Deming's supply wells were predicted to lose 50 ft of their water columns over the next 90 years.

Link: http://nmawsa.org/library/sw-nm-stakeholders/estimates-of-region-wide-and-deming-area-water-supplies-draft-6-30-2009/view

Regional Water Demand Study for Southwest New Mexico (2010)

Goal:

The ISC staff contracted AMEC Earth & Environmental, Inc. to assess the current water demand of key individual sectors in the four-county area such as agriculture, municipal, mining industry, and livestock, and estimate their future water demand by year 2050.

Method:

The consultant conducted a desktop analysis for the purpose of this study.

Results:

The results indicated that irrigated agriculture is the largest water demand across most of the region, historically 87% of total withdrawals and 76% of total depletions for the region in 2005. Conversion from flood to drip/sprinkler irrigation can result in more crop per acre and less water withdrawn per irrigated acre which equals to decreased pumping costs and increased farm profitability. However, it can increase aquifer depletions, as well. Thirdly, much of the study area has been identified by the US Department of Energy as having high potential for Green Energy generation (solar, wind, geothermal). Solar, in particular, can require significant quantities of water. Hence, industrial water demands are expected to increase.

There will be increases in total water demand in the region through 2050. Given the supply shortage in the region, the availability of AWSA water may help relieve that pressure.

Link: http://nmawsa.org/library/sw-nm-stakeholders/regional-water-demand-study-for-southwest-new-mexico-catron-grant-hidalgo-and-luna-counties-10-10-2010/view

Gila Wetlands Study (2014)

Goal:

The ISC staff contracted Dr. Mark Stone et al from the University of New Mexico to calculate the hydrologic budgets for two wetlands in the Cliff-Gila Valley, and evaluate groundwater-surface water interactions associated with the wetland systems under different AWSA diversion scenarios. Jeffrey Samson, Dr. Stone's PhD student, worked on this project. The study duration was 23 months.

Two wetland systems in the Cliff-Gila Valley were identified for the purpose of this study: One system with very little anthropogenic impact (between Mogollon Creek and the Upper Gila ditch diversion) and a second that is heavily influenced by human activities (downstream of the Ft. West ditch diversion).

Method:

The study was conducted through field monitoring effort including the installation of riparian monitoring wells and meteorological stations, and monthly field visits for data collection. Those data were used to parameterize and calibrate groundwater models that were developed to evaluate future flow scenarios. They used MODFLOW for their modeling purposes. MODFLOW is a three-dimensional groundwater model developed and supported by the USGS.

Results:

The results showed that the AWSA diversions decrease water levels in the wetlands from 1 to 5 inches, and then return to baseline conditions.

Link: Final report not yet reviewposted

Phase II Engineering Evaluation of the Diversion and Storage Proposals (2014)

Goal:

Based on the results of Phase I and RJH's technical review, the ISC staff tasked BHI with Phase II of the engineering evaluation for the combined diversion and storage proposal. The objectives of this study are:

- Refine design and configuration of the Phase I recommended alternatives and cost estimates through:
    - Geomorphologic modeling
    - Geophysical/Geotechnical field work
- Evaluate pumping options (including Solar power)
- Evaluate an alternative to divert the AWSA water to a side canyon near Virden valley (Hidalgo County)

Method:

The consultant is conducting the engineering design analysis through modeling, field surveys, and geotechnical field tests. BHI has hired subcontractors to help achieve the tasks mentioned above.

Results:

This study is underway. The final results will be available in September.

Value Engineering Study for the Combined Diversion and Storage Proposal (2014)

Goal:

The ISC staff has contracted RJH Consultants, Inc. to:

- Evaluate the proposed conceptual designs.
- Suggest improvements of current conceptual designs, and/or additional approaches or concepts.
- Recommend further studies and investigations.

Method:

The results of BHI's Phase I and II studies, as well as the US bureau of Reclamation's engineering evaluation will be available in September for a Value Engineering workshop which will be facilitated by a Certified Value Engineering Specialist. The participants of this workshop will be highly-qualified professionals with expertise in applicable technical areas.

Results:

This study is underway. The final results will be available in October.

Agricultural Economics in Southwest New Mexico (2014)

Goal:

The ISC staff has contracted Dr. Frank Ward et al from the New Mexico State University to estimate the potential economic advantages of providing the AWSA water to three farming areas in SWNM (Cliff-Gila, Deming, Virden).

Method:

The consultant is conducting the study through field interviews and optimization modeling.

Results:

This study is underway. The final results will be available in September.

Economic Evaluation of All AWSA Proposals (2014)

Goal:

The ISC staff has contracted Harvey Economics to provide benefit-cost analyses of all tangible and intangible items for all proposals, and forecast the costs and benefits to 2050.

Method:

The consultant is doing an economic analysis for the purpose of this study.

Results:

This study is underway. The final results will be available in September or October.

Review of Gila Conservation Coalition's Mimbres Basin Water Supply Study (2014)

Goal:

A 2014 report by John Ward, prepared for the Gila Conservation Coalition (GCC) indicates that conversion to drip irrigation has resulted in significant water savings in the Mimbres Basin, reduction in water withdrawals has diminished rate of groundwater depletion, and importing AWSA water will have little impact on Mimbres basin water supplies. A review study by the ISC staff was conducted to examine and verify the GCC study's input data and conclusions.

Method:

The staff conducted a desktop review analysis for the purpose of this study.

Results:

The review study revealed that there were questionable approaches, assumptions, and data usage for irrigated acreage, groundwater trends, and agricultural/consumptive water use. However, helpful and practical recommendations for better monitoring of Mimbres wells and further studies of return flows from flood irrigation are proposed in the GCC report.

Environmental Baseline Data (2013)

Goal
In calendar year 2012, ICS staff contracted with Tetra Tech to collect and format environmental baseline data and to provide these data on digital media.

Method
This is an initial assembly, organization, quality control, and formatting of data that characterizes the physical, human, and natural environment and, in some cases, the recent historical context in which these elements reside.

Results
The products have been used, where applicable, to support the more specific studies. For example, the 2009 and 2011 National Agriculture Imagery Program ("NAIP") aerial images have been used to examine the summer dry reaches of the Gila River and to identify point of diversion locations. The New Mexico Environment Department's benthic macroinvertebrate ("BMI"), or aquatic insect, sampling data was used for the BMI study conducted for the ISC by HDR Engineering, Inc.

The work also included a study of post-fire hydrology for the Upper Gila Watershed. Tetra Tech developed a model for ungaged reaches of the watershed in order to evaluate pre-fire and post-fire hydrology in those reaches. However, as the work progressed, the ISC staff determined that most of the model domain resided outside of the area of interest, and staff questioned the validity of many of the assumptions. Therefore, additional work on post-fire hydrologic modeling was not pursued.

URL: http://nmawsa.org/ongoing-work/gila-watershed-data

Indicators of Hydologic Alteration (2013)

Goal

In 2013, S.S. Papadopulos & Associates, Inc. ("SSPA"), reviewed the *Indicators of Hydrologic Alteration* ("IHA") software as applied to Gila River flows and simulated AWSA diversions.

Method

SSPA compared the IHA results for the Gila's historical record to the historical record minus diversions under the AWSA's legal constraints.

Results

The IHA software was developed, and is distributed, by the Nature Conservancy. The software calculates a set of 33 descriptive statistics derived from stream gage records to express pre- and post-alteration hydrologic conditions. The 33 statistics are organized into five parameter goups: (1) magnitude of monthly water conditions; (2) magnitude and duration of annual extreme water conditions; (3) timing of annual extreme water conditions; (4) frequency and duration of high and low pulses; and (5) rate and frequency of water condition changes.

One way that IHA expresses change in hydrologic condition is deviation factor. More specifically, the deviation factor expresses the difference between metrics for the pre- and post-AWSA flow sequences and is calculated as the ratio of the absolute value of change to the historical value: *(post-impact value - pre-impact value)/ pre-impact value*. A value of zero equals no effect, and a large deviation factor, i.e., close to one, means that the effect is great.

In the parameter group for monthy median Gila flows, only the month of March shows a deviation factor greater than zero. The median flow drops from 188 cubic feet per second ("cfs") to 159 cfs. The deviation factor is 0.16.

In the second parameter group, magnitude and duration of annual extreme water conditions, the seven-day maximum flow showed the greatest deviation factor: 0.24. The historical median seven-day maximum is 759 cfs. Under the AWSA scenario it is 576 cfs.

The third and fourth parameter groups show no deviation factors greater than zero.

The fifth parameter group, rate and frequency of water condition changes, has small deviation factors for change in fall rate and number of reversals.

The IHA software also calculates Environmental Flow Components ("EFCs"). EFCs are an attempt to divide the hydrograph into repeating sets of annual hydrographic patterns that are ecologically relevant. Their differences between pre- and post-alteration EFCs are also expressed as deviation factors.

Large flood (>8,264 cfs) duration saw the highest deviation factor, 0.41, with the duration dropping from 66 day to 39 days. Large flood recurrence is 10 years.

IHA software can be used to highlight the more sensitive elements of flow alteration, e.g., by examining the deviation factor. To this end, IHA results were helpful in identifying scenarios to examine using the three-dimensional Gila-Cliff hydrologic model developed by SSPA.

In applying IHA to the Gila River, however, one should view the results cautiously, as the software relies on means and medians, and the flashy nature of Gila flows can render such statistics unsuitable given the magnitude of the extremes. In addition, the output addresses neither the nature nor degree of ecological impacts.

URL: http://nmawsa.org/ongoing-work/indicators-of-hydrologic-analysis

Analysis of Flow and Water Use Alternatives on Hydrologic Conditions in the Riparian Corridor of the Gila-Cliff Basin (2014)

Goal

The ISC contracted with SSPA to model surface water-groundwater interactions along the Gila River in the Cliff-Gila Valley in order to quantify the resultant hydrolgic impacts to the system from diverting AWSA water.

The ISC requested four model runs to simulate a variety of hydrologic conditions.

Method

SSPA constructed the three-dimensional Gila-Cliff Model for the purpose of modeling the near-river surface water-groundwater interactions under existing conditions and under AWSA diversion scenarios. The model domain extends from above the confluence of Mogollon Creek to below the confluences Duck and Bear Creeks **(Figure 1)**.

SSPA calibrated the model using water level data from piezometers and stage gages, three seepage runs on the Gila River, ditch diversion records, and other data.

The ISC staff selected four scenarios for evaluation, based upon SSPA's review of IHA results. A brief description of each scenario follows:

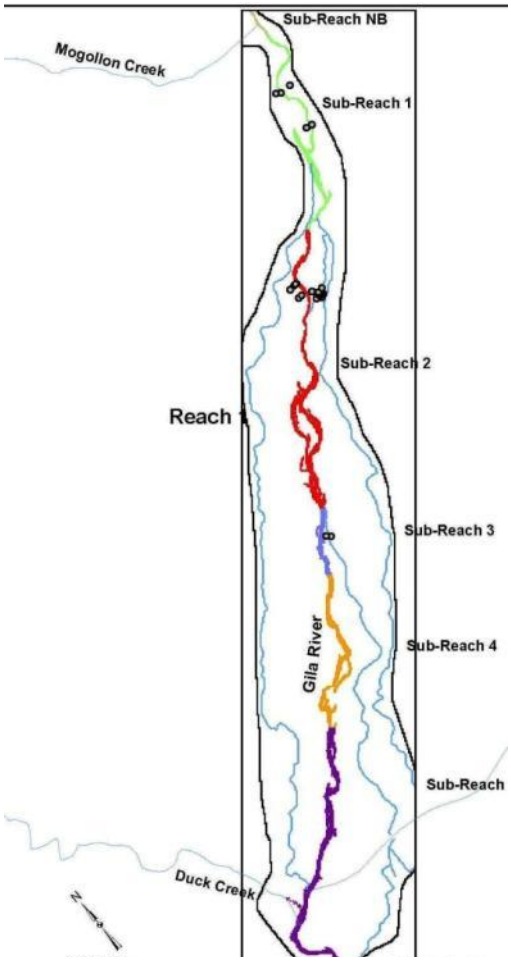


Figure 1: Gila-Cliff Model domain

Scenario 1 shows the impact of small diversions in a lower flow year. Most diversions occur in March. Simulated river flows are patterned after water year 1965.

Scenario 2 shows the impacts of high diversions in a year of average annual flow. AWSA diversions occur in early spring months with additional small diversions in August and September. This simulation represents the impacts of higher AWSA diversions in a higher flow year than simulated in Scenario 1. Simulated river flows are patterned after water year 2007.

Scenario 3 is a two-year scenario, patterned after water years 2010 through 2011, and shows the impacts of diverting during a wet year that is followed by a dry year. This scenario examines whether or not effects of diversions would persist into a subsequent drought year. Annual Gila flow and AWSA diversions are above long-

term median and mean values for the first year. Diversions occur in late winter and early spring of the first year. The second year is a drought year with no diversions.

Scenario 4 is patterned after water years 1999 through 2000 and examines effects of a low-flow year with low AWSA diversions followed by a drought year.

Results

Since the shallow aquifer and the Gila River are hydrologically connected, high river flows result in a losing stream and gaining aquifer. The model results for the four scenarios show that AWSA diversions would result in short-term, localized decreases in groundwater gains. The groundwater level is not drawn down; rather, the increase in water level is not as great as under existing conditions.

The magnitudes of the decreases range from one-quarter foot to one foot, depending upon location and scenario. Starting water levels in spring range from approximately seven to nine feet below land surface. Recovery to non-diversion water levels takes no longer than one to two weeks.

For the multi-year scenarios, the simulations show no long-term effect of diversions on groundwater.

URL: http://nmawsa.org/ongoing-work/groundwater-modeling/analysis-of-flow-and-water-use-alternatives-on-hydrologic-conditions-in-the-riparian-corridor-of-the-gila-cliff-basin-june-2014/view

Gila River Flow and Riparian Vegetation Health in the Cliff-Gila Valley (2014)

Goal

The ISC staff hired INTERA to compare riparian vegetation health with Gila River flows in the Cliff-Gila Valley. The staff's hypothesis was that vegetation health increases with stream flow.

The impetus for the study was staff's observation of dead and/or dying Fremont cottonwood trees below the upstream agricultural points of diversion, where the Gila River routinely dries in the summer. If a positive correlation between flow and vegetation health were to exist, there could be environmental benefit to releases of stored water in the summer, as posed by diversion and storage project proponents.

Method

In order to complete the study, INTERA cond ucted field work to identify vegetation communities and examined aerial imagery in order to estimate vegetation extent.

INTERA then examined satellite imagery and created a Normalized Difference Vegetation Index ("NDVI") in order to estimate vegetation health. NDVI is calculated from the the visible and near-infrared light reflected by vegetation **(Figure 2)**. Simply put, NDVI is a measure of plant greenness. Healthier plants result in higher NDVI values.

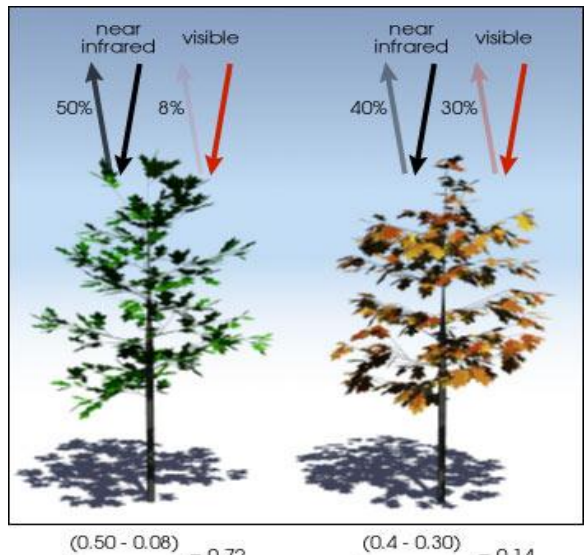


Figure 2: Illustration of how NDVI is calculated: Difference between reflected infrared and visible light divided by the sum of reflected infrared and visible light.

Source: earthobservatory.nasa.gov

INTERA concurrently estimated flow into and out of subreaches in order to compare vegetation health in each of those subreaches with flow. The hydrologist modeled the flow using gaged flow data, contributing watershed area, and ditch diversion records.

The NDVI analysis and the hydrology were used to perform the correlation analysis.

Results

The correlation analysis shows generally that as streamflow increases, riparian health increases, and the response is rapid.

The reach with the majority of the valley's agriculture is more complex.

The NDVI results for that reach show that the vegetation just downstream of the two uppermost diversion structures is less robust than in other areas. SSPA's three-dimensional modeling shows existing, steep groundwater declines in this areas. INTERA's and SSPA's work, taken with the body of literature on cottonwood response to groundwater fluctuations, appear to indicate that the summer low flows coupled with the exercise of water rights have negative effects on cottonwood health.

In contrast, the results of the study show that, just downstream, agricultural return flows are supporting the adjacent riparian vegetation.

URL: http://nmawsa.org/ongoing-work/flow-and-riparian-health-correlation-project-1

Modeling Benthic Macroinvertebrate Responses to Proposed Diversions Under the Arizona Water Settlements Act of 2004 (2014)

Goal

In order to complement the fish physical habitat simulation, which modeled physical habitat suitability for fish, the ISC staff hired HDR Engineering, Inc., to study the effects of Gila River flow on aquatic insects, which the native spikedace and loach minnow prey upon. This study had three goals:

1. Develop flow-ecology relationships for benthic macroinvertebrates ("BMI"), or aquatic insects;
2. Predict BMI productivity, i.e., biomass production, as a function of flow and wetted area; and
3. Characterize BMI community metric responses to low flow and interrupted flow.

Method

In order to accomplish the goals for the study area, HDR and ISC staff selected specific study sites. HDR staff collected BMI samples, mapped habitat, collected flow data, and used existing data. They developed the study area hydrology and then developed reach-specific two-dimensional hydraulic models.

HDR used the RIVBIO biomass model to predict BMI productivity as a function of flow and wetted area and/or perimeter. Using IHA hydrologic metrics and BMI community metrics, HDR characterized BMI community metric responses to low and interrupted flows.

Results

Modeling shows that during years with high spring flow, BMI productivity below agricultural diversions was reduced, but it quickly recovered. In years with little or no spring flow, productivity below the diversions dropped to zero and did not recover until resumption of continuous flow later in the year.

BMIs dessicate on a five-day decay curve once habitat dries. Short-term inundation has little to no effect on BMI productivity, as the BMIs do not have sufficient time to recolonize the areas.

As to AWSA diversion scenarios, AWSA diversions would result in less than a 0.5 percent reduction in benthic productivity, as the high flow conditions under which diversions would be authorized result in only short-term inundated area. The lag in BMI colonization, coupled with the short duration of inundation, means that the slight reduction in inundated area will not affect BMI productivity.

HDR also examined the effects of releasing water from storage at times when the river channel is dry. HDR modeled environmental flows of 10, 20, 30, and 40 cfs. While BMI productivity increased with each increment of flow, the greatest percentage increase was

from zero to 10 cfs. Such flow would be sufficient to maintain BMI productivity until natural flow resumed in the reach.

URL: http://nmawsa.org/ongoing-work/benthic-macroinvertebrate-study

Fish Habitat Simulation (2014)

Goal
The ISC staff contracted with HDR Engineering, Inc., to determine the effects of a diversion project on fish habitat in the vicinity of the Ft. West Ditch point of diversion and vicinity of a potential AWSA diversion site. This habitat modeling covers areas not considered by similar work conducted by SWCA.

Method
HDR has begun the work by reviewing habitat suitability criteria developed by SWCA and its subcontractors. In addition, HDR staff conducted a bathymetric survey and habitat mapping earlier this summer. HDR staff will conduct additional habitat mapping as well as collect flow measurements and water surface elevations this month.

The habitat modeling will be accomplished using a habitat component for the two-dimensional hydraulic model River-2D. HDR staff will then provide a habitat time series for native and non-native fish species under both historical flows and AWSA diversion scenarios.

Results
The results of the study will be available in October 2014.

Digital Hydrogeologic-Framework Model of the San Francisco River Basin, West-Central new mexico and East-Central Arizona (2009)

Goal
The goal of this effort was to create a digital hydrogeologic framework model of the San Francisco River Basin aquifer systems and to provide information on the water-bearing and water-transmitting properties of geologic units.

Method
The model and maps were completed using geologic mapping, literature review, and and general geologic principles.

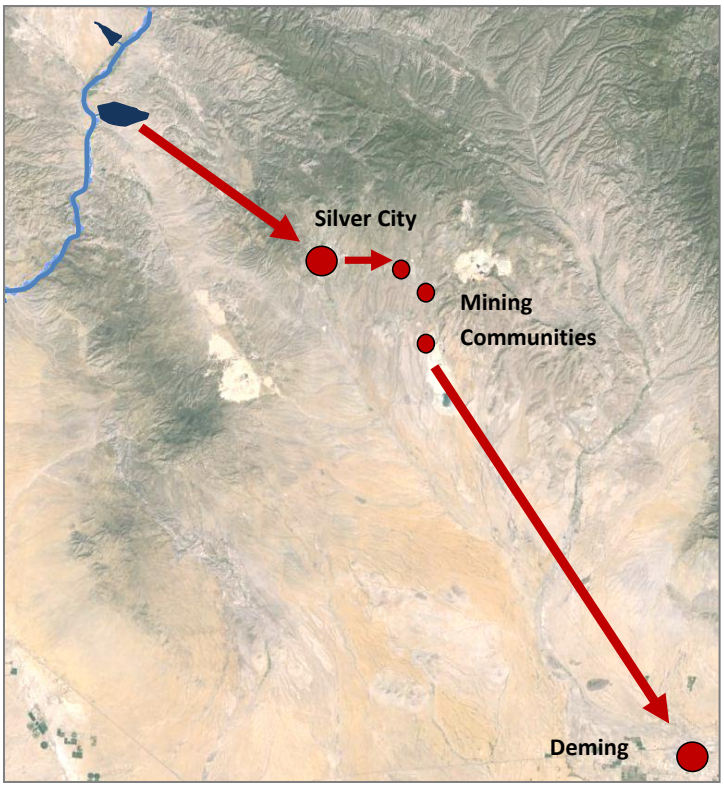
Results
A geologic report with accompanying map plates were produced as part of this effort. However, since the only Tier 2 project proposals in the San Francisco River Basin are ditch and watershed improvement projects, the knowledge has not been applied.

URL: http://nmawsa.org/library/sw-nm-stakeholders/digital-hydrogeologic-framework-model-of-the-san-francisco-river-basin-west-central-new-mexico-and-east-central-arizona-6-2009/view

Proposals

Southwest Regional Water Supply (Diversion and Storage)

Background:
The City of Deming, Hidalgo County and Gila Basin Irrigation Commission have (GBIC) proposed proposals to divert and store the Gila River water available under the 2004 Arizona Water Settlements Act (AWSA). GBIC's proposal is comprised of storage and irrigation diversion components. The Commission approved the staff's recommendation to efficiently optimize the proposals at its December 2013 meeting. The storage component of this proposal has been combined with the other two proposals from Hidalgo County and the City of Deming to create one integrated diversion and storage proposal called the "Southwest Regional Water Supply" (SWRWS).



The irrigators in the Gila Basin have senior rights, established in the 1860s. Their irrigation diversions at low flows may dry the Gila River for miles in the Cliff-Gila Valley. This results in long dry reaches of the river downstream of those irrigation diversions and is detrimental to the unique and valuable ecology of Gila River. In addition, timing and variability of flows leave farmers with unreliable source of water, and little choice for crop selection.

The river goes dry for even longer stretches in Gila river above the Virden Valley, forcing the irrigators to pump wells to supplement surface water.

On the other hand, communities in the Mimbres Basin rely on groundwater. Silver City even pumps part of its water from the Gila Basin (Frank's Well Field). The studies show that there is a groundwater deficit in this area, while demand is projected to be increasing in the future. Moreover, groundwater levels appear to be declining in this basin.

Description:
This combined proposal would divert AWSA water from the Gila River, store it in off-stream storages in the Cliff-Gila Valley, release it for environmental and agricultural needs during low flows, and pump the water over the continental divide to communities in the Mimbres Basin. Potential uses of this water are municipal & industrial, environmental and

agricultural interests. The SWRWS pipeline is proposed to be constructed along the right-of-way for Highway 180.

Technical Evaluation:

The ISC contracted Bohannan-Huston, Inc. (BHI) to identify best locations for diversions and storage sites in the Cliff-Gila Valley, and design diversion structures, conveyances, and pipeline to Mimbres Basin at an appraisal (10%) level. Using field investigations and desktop analyses, the consultant came up with five alternatives for diversion and storage in their preliminary engineering report (PER). The recommended alternative included the following components:

- Diversion:
  - Location: From the Gila river between Turkey Creek & Mogollon Creek (Gila National Forest)
  - Method: Coanda Screens (surface diversion structure)
  - Amount: Maximum 350 cfs
- Storage:
  - Four canyons: Winn, Pope, Sycamore, Dix (Maximum Storage Capacity: 64,303 AF)
- Conveyance:
  - 1-mile tunnel and a 108'' buried pipe to Winn Canyon by gravity
  - 84'' buried pipes to Pope, Sycamore and Dix Canyons by gravity
- Pumping/Pipeline:
  - Alignment: Highway 180 right-of-way
  - 36'' pipeline from Pope reservoir to Hurley
  - 16'' pipeline from Hurley to Deming
  - 5 booster stations, each with 750 horsepower of pumping capacity (three horizontal split-case 3,100 gpm pumps for each station)
  - An equalization tank with 375,000 gallon capacity

The ISC staff also contracted RJH Consultants, Inc. to conduct an independent technical review of BHI's Phase I study, identify any significant technical issues, and provide recommendations for improvements. RJH's review showed that BHI had applied an appropriate level of investigation, data collection, and analyses for the 10% level, although there were some major issues such as AWSA water yield, storage sites geology, and sedimentation that were inadequately addressed in the PER, and could potentially create significant technical challenges. RJH recommended that those issues be addressed in a future phase of study.

BHI is now considering those issues in their Phase II of engineering evaluation which is underway. The results will be available in September for a Value Engineering workshop which will be administered through RJH and facilitated by a Certified Value Engineering Specialist, to evaluate the proposed conceptual designs, suggest improvements of current conceptual designs and/or additional approaches or concepts, and recommend further studies and investigations. The participants of this workshop will be highly-qualified

professionals with expertise in applicable technical areas. The final results will be submitted to the ISC in October.

Environmental Impacts:

During all modeling efforts, the ISC has applied a minimum bypass of 150 cfs on the Gila River (double the median flow) before any diversion would take place, even though the AWSA does not require this minimum bypass.

The AWSA diversions happen on only 10% of days, 7% of flows, from the highest 17% of flows. Because diversions will reduce higher flows to lower magnitudes, diversions under the AWSA would actually increase the number of flows in the to 300 cfs by 3%. Flows in this range comprise approximately 90% of the flows on the Gila river.

The diversions would result in short-term, localized decreases in groundwater gains (1/4 to 1 foot) under losing conditions. Because diversions under the AWSA occur only at higher flows, the reductions in groundwater levels would be a decrease in gains during those flows.

Geomorphic investigations have indicated that diversions are also unlikely to have a significant effect on sediment transport, water-surface elevations, or durations of inundation on any geomorphologic surfaces under the AWSA diversions.

The AWSA diversion would result in up to 5% positive and negative habitat change on the fish species in their variant life stages. The endangered species Spikedace and Loach Minnow would experience up to 3% positive change in their preferred habitat.

No species or habitats were identified that could not be mitigated. Furthermore, there will be no AWSA diversion or storage either in the Gila Wilderness or the Birds Area.

Riparian health/flow correlation studies, benthic macroinvertebrate modeling, aquatic physical habitat simulations, and population viability analyses indicate that maintaining and/or releasing at least 10 cfs in the river at the time when the river goes dry/intermittent in the Cliff-Gila Valley below the irrigation diversions, would result in riparian vegetation robustness, increased benthic macroinvertebrate productivity (food source for fish), zero probability of extinction for Spikedace and Loach Minnow, and up to 11% habitat increase for all fish species. This low flow augmentation scenario could potentially be considered to further reduce the risk of non-native fish colonization and habitat fragmentation in case of drought.

Cultural Impacts:

No “show stoppers” were identified through desktop archeological survey. Further field archeological surveys and social studies will be required.

Access to public lands would not be impaired.

Water Supply:

Based on the ISC's AWSA diversion model, an annual average AWSA diversion of up to about 12,000 AF/Y would be available based on historical data since 1937. Depending on storage capacity, seepage, and storage topography, safe yield could range to 900 acre-feet per month but can not be confirmed until 30% design or later. Under a drought reduction of approximately 10% in stream flow by 2050, there will be only 2.6% reduction in AWSA diversions.

Economics:

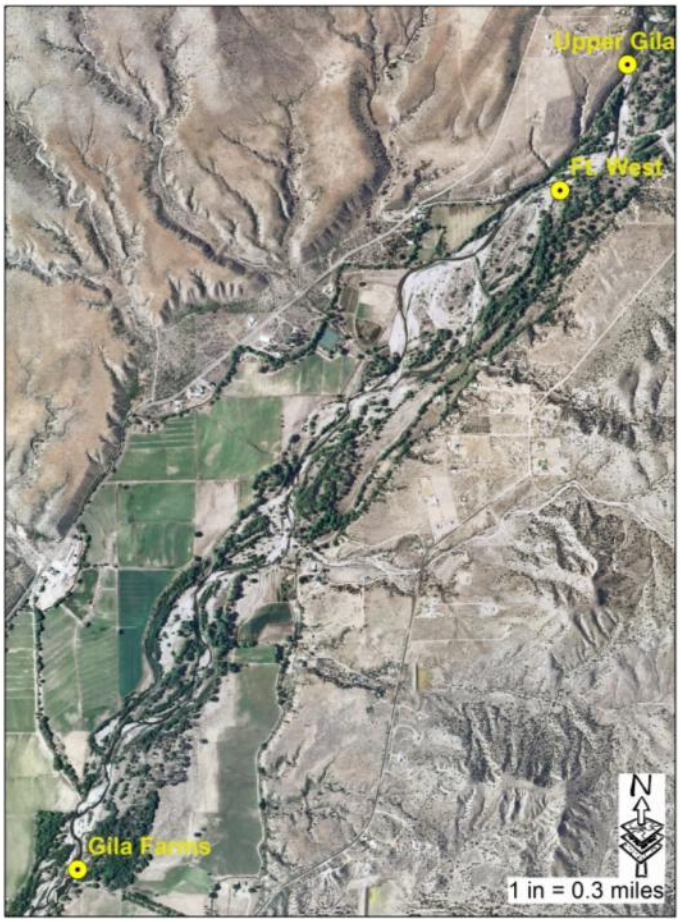
The total estimated cost for engineering and construction is $437.7 million. The estimated annual O&M cost is $2.3 million. Additional benefit-cost analysis is still underway.

It should be noted that the attributes that make the Gila so important to protect, also make it very attractive to development and increased domestic uses will need wells of some type that can jeopardize the ecology of the Gila River. Finally, the AWSA water would be an dditional renewable water source, since all the water rights in the region are already adjudicated. The availability of AWSA water may help relieve pressure on the groundwater sources in the region.

Link to PER and Technical Review: http://nmawsa.org/ongoing-work/diversion-and-storage-proposals

Gila Basin Irrigation Commission (Diversion Component)

Background:
Gila Basin Irrigation Commission's (GBIC) Diversion and Storage proposal is comprised of Storage component, and Irrigation Diversion component. The Commission approved the staff's request to efficiently optimize the proposals at its December 2013 meeting. The storage component of this proposal has been combined with two other proposals to create one integrated diversion and storage proposal called "Southwest Regional Water Supply", and the pertinent information is provided in Proposal XX. The irrigation diversion structure component is presented here.



The irrigators in the Cliff-Gila Valley have senior rights to divert water from the Gila River, established in the 1860s. The U.S. Supreme Court *Arizona v. California* decree permited 5,314 irrigated acres in the Cliff-Gila Valley. The ISC's records indicate 1743 irrigated acres in the valley in 2012. The irrigators use three community ditches (acequias) in the Cliff-Gila Valley to divert the Gila River water for their agricultural/ranching purposes. Those ditches are Upper Gila, Fort West, and Gila Farms. The primary crop is unimproved pasture, which is used for cattle grazing.

Description:
The irrigators construct push-up earthen berms as the diversion points of the ditches. Those berms are subject to washing out in Gila River's normal flow fluctuations. Reconstruction may occur multiple times per year. There is a need to enhance and improve the existing diversion points to withstand high flows and to transport sufficient flow, as well as cost-effective to maintain. The GBIC proposal requests more permanent diversion structures that would be built in the same general location where earthen diversions exist today.

One diversion would be located at or upstream of the current Upper Gila and Fort West Ditch diversions. The second diversion would be located where it can provide water to the Gila Farm Ditch. Water diverted during times of adequate flow would be conveyed by

unlined ditches to beneficial uses downstream. GBIC requests $3.27 million in AWSA funds for engineering and construction.

Technical Evaluation:
The ISC staff contracted Bohannan-Huston, Inc. (BHI) to assess the GBIC diversion proposal. BHI staff visited the ditches and the diversion points, and produced a preliminary engineering assessment ("PER") containing two design alternatives and cost estimates.

The first alternative would consolidate the Upper Gila and Fort West Diversion into a single structure (approximately 300 ft upstream of Upper Gila existing diversion point) reducing construction and maintenance costs. Gila Farms ditch would also be eliminated and replaced with a connecting ditch to the Ft. West ditch. Alternatively, the two existing diversions points could be replaced with the permanent structures, and a new connecting ditch from Ft. West to Gila Farms ditch would eliminate the need for Gila Farms diversion point.

In both cases, the permanent diversion structure concept entails establishing a grouted boulder weir that directs water to one side of the river allowing diversion of flow through a series of gates and an outlet ditch. The grout will make this weir more permanent than a rock cross vane weir and will prevent water from passing between the boulders (causing "leakage"), possibly preventing irrigators of their full water right. The structure could provide adequate head to the intake structures during low flow conditions.

Environmental Impacts:
A fish passage would also be built into the design to address native fish movement up and down stream. Currently, native vegetation is removed for a reach of several hundred feet when the earthen push-up dams are built. This activity has water quality and other impacts. This proposal and design would also eliminate the need for regular disturbance of the floodplain and the riparian zone and the negative sediment deposition that now takes place every time the push-up diversion dams require rebuilding or maintenance.

Cultural Impacts:
Periodic floods or very high flows can wash out the existing push-up berms requiring rebuilding the diversions, sometimes multiples times per year. Continuing high flows can prevent reestablishment of the diversions, and irrigators can be without water for many weeks at a time, preventing establishment of more varied crop types and limiting the ability of the farming community primarily to pasture and alfalfa crops. The improved diversions, coupled with storage, could also enhance the opportunity to expand irrigated acreage to more fully realize adjudicated rights. This would support the farming communities and cultures.

Water Supply:
The amount of water conserved is unknown at 10% appraisal level.

Economics:
The total estimated cost for engineering and costruction is $1.77 million for Alternative 1, which is the preferred alternative. The annual O&M costs are estimed to be $36,250. Additional benefit-cost analysis of all proposals are underway. Better diversions, coupled with storage, would permit possible transition to higher economic return and low water use crops. Such transitions would require corresponding improvements in farming equipment, labor, and regional infrastructure such as transportation improvements and storage facilities.

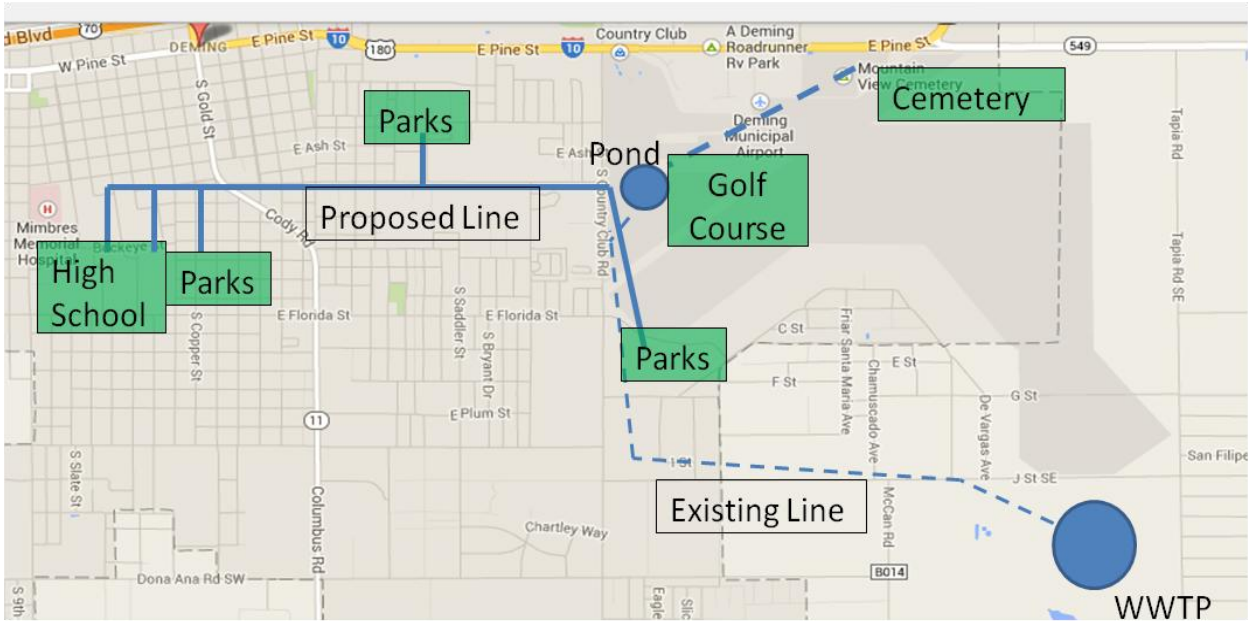
Link to PER: http://nmawsa.org/ongoing-work/diversion-and-storage-proposals/bhi-final-preliminary-engineering-report-4-11-2014 (Pg. 26-27 & 30-32, Figures 19-24)

Deming Effluent Reuse

Background:
The City of Deming is located in the high plains desert of southern New Mexico. The City currently expends up to 20% of its annual water consumption irrigating parks and recreational facilities. The U.S. Geological Survey (USGS) has eight monitor wells within 4 miles of Deming. Water levels in these wells have decreased at an average rate of 0.74 foot per year (ft/yr) for several decades. The City desires to expand an existing effluent reuse system to reduce stress on the aquifer.

All of the parks are owned by the city. The ball fields at the high school are owned by the public school system and, because the city charges one half the price of new water for effluent, this would reduce the costs to the schools.

Description:
The City of Deming Tier 2 Proposal for AWSA funding would expand an existing effluent reuse system with three miles of piping to water ball fields and parks with treated effluent instead of clean groundwater. The existing system provides treated effluent to water the golf course and cemetery. Souder Miller Engineers from Las Cruces designed and evaluated the project.



WWTP = Waste Water Treatment Plant

Technical Evaluation:
Souder Miller identified these projects elements:

- Higher capacity pumps at the WWTP and golf course
- Treatment at WWTP must be enhanced
- Storage ponds at WWTP are adequate
- Existing pipelines are OK
- Main trunk line- 2 miles of 10-12 inch "purple pipe" required
- 1 ½ miles of 6 inch "purple pipe" required to service park areas

Environmental Impacts:
The project would be entirely on Deming city owned property. As such, no ecological obstacles are anticipated and NEPA is not required.

Cultural Impacts:
No archaeologically sensitive obstacles are anticipated.

Water Supply:
The proposed new areas served by the proposal currently deplete up to 30.37 acre feet per month of pumped groundwater for up to 6 months per year. The areas proposed for refurbishment deplete up to 37 acre feet of groundwater per month for up to 6 months per year. This project would replace the pumped groundwater with treated effluent, resulting in a total savings of up to 400 acre feet per year in groundwater pumping.

To put this in perspective, the water budget of the Deming Area is:

<u>DEBITS</u>
Agricultural: 24,000 acres irrigated
Pumping @ 3 AF/Y = 72,000 AF/Y
Deming Municipal Use = 2,850 AF/Y to 4,000 AF/Y
<u>CREDITS</u>
15% Traditional Irrigation = 3,600 acres
= 5,400 AF/Y return flow
85% Drip Irrigation = 20,400 acres
= 0 AF/Y return flow
Municipal = 500 AF/Y effluent reuse
Natural recharge = 31,100 AF/Y
BALANCE = -37,850 acre-feet/year

NOTE: Deming owns 6,103 AF/Y of groundwater rights, but use has dropped in the last few years with conservation efforts and the closure of a major food processing facility.
While 400 AF/Y is only 1% of the debit, the people of Deming are very concerned about the water levels in their wells dropping.

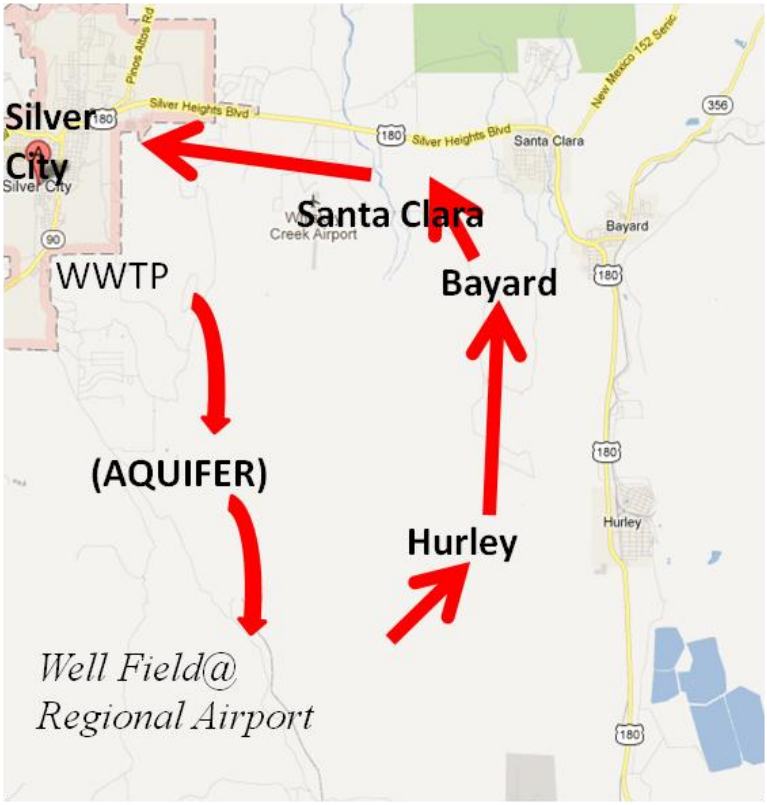
Economics:
The estimated cost of the project would be $4.4 million. Deming has received a grant from the NM Water Trust Board for $800,000, which is being applied specifically to upgrading the pumps. Deming provided matching funds of $141,000. This leaves the request for AWSA funds at $3.5 million. The annual O&M costs will be about $75,000.

To date, the only economic evaluation of Deming's proposal is the one included in the United States Bureau of Reclamation's ("Reclamation") *Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations*.

Link to the PER by Souder Miller: http://nmawsa.org/ongoing-work/final-effluent-resuse-proposal-pers/deming-wastewater-reuse/deming-effluent-reuse-per/view

Link to the Bureau of Reclamation report with some benefit-cost analysis: http://nmawsa.org/ongoing-work/united-states-bureau-of-reclamation/appraisal-level-report-on-the-awsa-tier-2-proposals-and-other-diversion-storage-configurations-july-2014/view

Grant County Water Commission Infrastructure and Reuse (Well Field and Pipeline)



Background

The Grant County Water Commission was formed under a Joint Powers Agreement with the State of New Mexico to create a regional water supply. It proposes to provide an additional 950 AF/Y to the Mimbres mining communities and Silver City from a well field near the regional airport. It has support from Bayard, Hurley, Sta. Clara, Silver City and Grant County.

Grant Co Water Commission has hired Engineers, Inc of Silver City to do a 30% engineering evaluation (100% PER) for the entire project with a $100K grant from the NM Colonias Infrastructure Fund. Hurley has hired Engineers, Inc to do a complete design of the segment from the airport to Hurley with a $519K grant from the NM Colonias Infrastructure Fund. Hurley has also paid for a 1000 foot deep test well at the airport, which yielded good quantity and quality of water.

Silver City already owns rights to 193 AF/Y at the Grant County Airport. That water is currently undeveloped. The remainder of the water is contingent upon NM OSE approving the Silver City Application to Increase Diversion of Groundwater by 750 AF/Y that was submitted in April 2013. This application seeks a Groundwater Credit due to decades of discharging effluent to the aquifer. Regardless of the decision by the NM OSE, Silver City has offered the 193 AF/Y to Hurley.

While it was Silver City that applied for the extra water rights, the small mining community of Hurley is in the direst need of water. Hurley owns no water rights. Currently, Freeport McMoran (or Phelps Dodge before them) provides water to Hurley. Freeport has said that it will stop this service in 2018.

Silver City has diversion rights for a total of 4,567 acre feet per year. Bayard has rights for 742 acre-feet per year. Santa Clara has rights totaling 515 acre-feet per year. Bayard and Santa Clara experience occasional water shortages. Silver City's wells are located near the continental divide where they can tap into the Gila River basin. The other towns are relying on the Mimbres Basin aquifer which is thinner and less productive in the north than it is near the airport.

Each town has its own infrastructure of treatment facilities, pumps and tanks, most of which is in fair to good condition. During the summer, Silver City uses treated effluent to water the golf course and some parks. Any remaining effluent is sold to a farm. However during the winter, there is no place to use or store the effluent, so it is dumped to an arroyo and allowed to soak into the aquifer.

Description:
The Grant County Water Commission Tier 2 Proposal for AWSA funds would install a well field near the Grant County Airport and a pipeline 15 miles long that would pump 950 AF/Y of water to the towns of Hurley, Bayard, Santa Clara and Silver City. The ISC contracted with William J Miller Engineers to do a 10% appraisal level evaluation of the project

Technical Evaluation:
Miller Engineers' 10% appraisal level report determined the following items would be needed to achieve the goals of the proposal:

- Two new groundwater wells up to 1,500 feet deep
- Two 125 horsepower well pumps
- Water treatment system
- One 850,000 gallon water storage tank
- Two 100 horsepower and one 25 horsepower booster pumps
- Approximately 16.4 miles of 12" PVC pipeline
- Electric power line construction
- Access road construction and site development
- Acquisition of easements and right-of-way.

The original proposal listed many items that were not required to achieve the desired goal. These items were eliminated during the Miller Engineers' evaluation. While the volumes required by this proposal could be achieved with the 12" line, the proponent requested 16" line to allow for future growth.

Environmental Impacts:
While no ESA issues are anticipated in the construction of this project, it is possible that they could be encountered. Also, as the alignment of the pipeline could cross federal property, NEPA could be required. Costs for this are included in the estimates.

Cultural Impacts:
Archeological artifacts will probably be encountered during the construction of this project.

Water Supply:
This project would allow increased access to groundwater for nearly 26,000 people.

Economics:
The cost of the project with 12" lines would be $12.5 million. The cost of the project with 16" lines would be $16.4 million. Minus the grants already received, this request is for $15.8 million**.** Annual O&M would be $505,000.

To date, the only economic evaluation of the GCWC's proposal is the one included in the United States Bureau of Reclamation's ("Reclamation") *Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations*.

A breakdown of the population (2010 Census) by water system is as follows:

	Population
Hurley, North Hurley	1,297
Bayard, Hanover	2,328
Santa Clara	1,686
Silver City, Tyrone, Pinos Altos, Arenas Valley and Rosedale	20,310

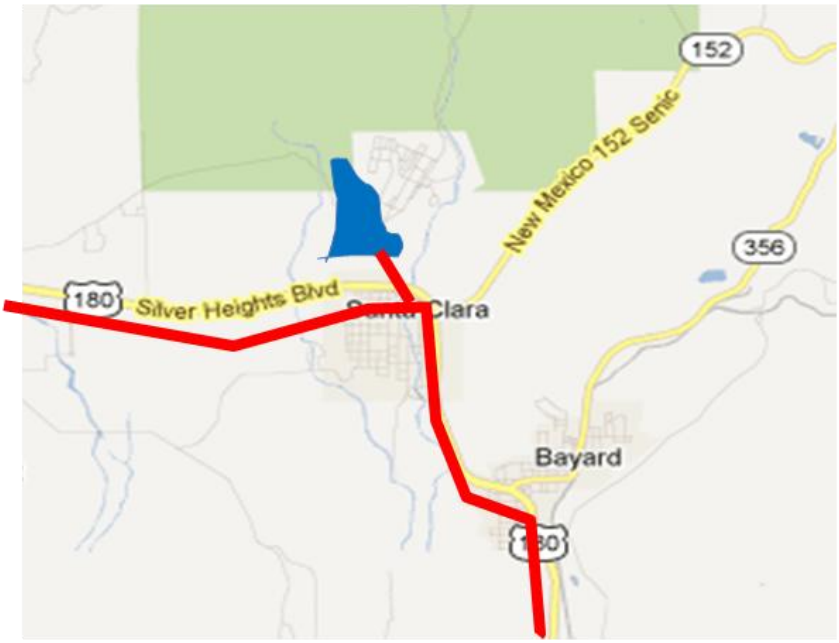
Total population = 25,624, anticipated to grow 35% in the next 40 years.

Link to the PER by William J. Miller Engineers: http://nmawsa.org/ongoing-work/final-effluent-resuse-proposal-pers/grant-county-water-commission-final-per

Link to the Bureau of Reclamation report with some benefit-cost analysis: http://nmawsa.org/ongoing-work/united-states-bureau-of-reclamation/appraisal-level-report-on-the-awsa-tier-2-proposals-and-other-diversion-storage-configurations-july-2014/view

Grant County Recharge and Reservoir

Background:



Grant County desires to construct a recreational reservoir for recreational fishing and swimming in order to enhance the quality of life in the area and stimulate the local economy. The original Tier 2 proposal for AWSA filled the reservoir with treated effluent from the Bayard wastewater treatment plant. Due to a number of issues, the Bayard effluent was not available for use. During design optimization, the water source was changed to the AWSA water. These changes were approved by the Interstate Stream Commission.

Description:

The Grant County project proposed for AWSA funding is to build a reservoir for recreational fishing and swimming on one of the creeks near Fort Bayard. The NM ISC contracted with Bohannon Huston Incorporated (BHI) to evaluate the project to a 10% appraisal level.

Technical Evaluation:

The reservoir would be located on Twin Sister's Creek and filled with AWSA water from the Southwest Regional Pipeline that would pass nearby on Highway 180 as presented in the Southwest Regional Supply System proposal. This project would require a connection into the Regional Pipeline, a pump station and pipeline to carry the water north to the reservoir, a dam and outlet works to hold the water, and, further upstream, a second, smaller, sediment dam to capture storm run-off and let the sediment settle out. According to state law, this smaller sediment dam would release all its water within 96 hours. Twin Sisters Creek has a smaller watershed than the other creek suggested and the flood waters would be more easily managed.

Environmental Impacts:

This project would be built entirely on federal property, whether US Forest Service or Fort Bayard Military Reservation. Hence, NEPA would be required. Also, the Gila National

Forest office at Silver City manages the right of way along Highway 180. The creek is usually dry, and no ecological obstacles are anticipated, but might have to be accommodated in final design. Costs for NEPA and permitting were included in the BHI estimates.

Cultural Impacts:
Many archaeologically sensitive sites may be in this area.

While very near the historical Fort Bayard, the final recommended location for a reservoir is separated from it by the hospital. There is a recreational facility already in the area, with ball fields and picnic tables. County planners anticipate adding more facilities, such as an archery range.

Water Supply:
Two separate studies were done by John Shomaker LLC to determine whether there would be any adverse effect on downstream wells if either of the creeks was dammed. The conclusion was that if storm water is by-passed, seepage from the reservoir would add about 60 AF/Y recharge to the aquifer.

Economics:
After considerable analysis of water capacity, surface area, dam fill volumes, storm run-off, and construction challenges, BHI offered a choice of three different configurations of reservoirs on Twin Sisters Creek ranging from 1,636 AF at $13 million to 14,103 AF at $25 million. BHI selected a mid-sized option at 3,000 AF (130 acres) for the final recommendation at a cost of $18 million.

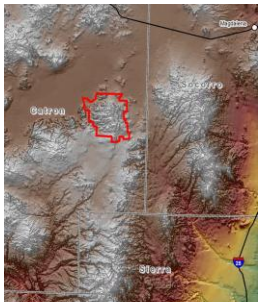
To date, the only economic evaluation of Grant County's proposal is the one included in the United States Bureau of Reclamation's ("Reclamation") *Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations*.

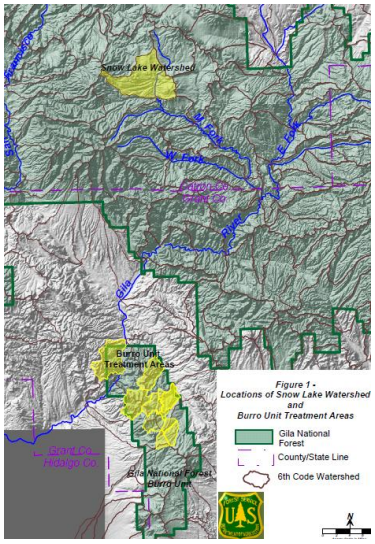
Other Economic analyses are ongoing.

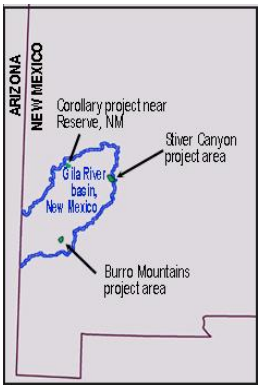
Link to the Bureau of Reclamation report with some benefit-cost analysis:
http://nmawsa.org/ongoing-work/united-states-bureau-of-reclamation/appraisal-level-report-on-the-awsa-tier-2-proposals-and-other-diversion-storage-configurations-july-2014/view

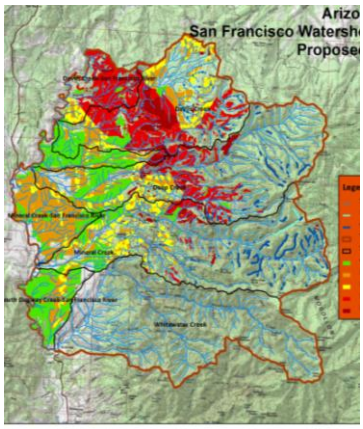
Link to the PER by BHI: http://nmawsa.org/ongoing-work/final-effluent-resuse-proposal-pers/grant-county-tier-ii-awsa-application/grant-county-proposal-per/view

Report Watershed Work group - Watershed Restoration Proposals









Background:

Stakeholders proposed five watershed treatments. Briefly, three are academic studies and two are utilitarian operations:

Description:

NM State University requested $2.2 million for a 10-year nested watershed study treating 2.3 square miles.

NM Forest Industries Association requested $2.3 million for a 10-year paired watershed study treating 2 square miles.

Grant County Soil and Water Conservation District requested $12 million for a 10 year paired watershed study treating 6.3 square miles.

Catron Co requested $7 million for evaluation, planning, designing and implementing mitigation after fire damage over 800 square miles. The mitigation would include rehabilitation and thinning, possibly with monitoring, but no specific plan.

US Forest Service (Gila National Forest) requested $8.4 million over 10 years to rehabilitate 50 square miles of post-fire damage and thin another 105 square miles using FS standard fire prevention methods making no effort to measure the effects.

Technical Evaluation:

As ISC staff researched the science behind the proposals, considerable disagreement regarding a number of questions surfaced. In an effort to find some foundation for consensus and direction regarding the proposals, staff convened a work group of eight respected watershed scientists and managers. There was no discussion of actual proposals during the meeting. Each participant presented his/her own recent work or study. At the end of the day, there was no consensus regarding whether to thin a forest for water yield, how to thin a forest, why to thin a forest, whether to extract natural resources from the forest for profit, or how to measure the water yield of forest thinning.

The U.S. Forest Service, along with NM Energy, Minerals and Natural Resources Department, maintains that forest thinning aids with fire prevention, improves wildlife habitat, improves forest health, and generally improves watershed function. They believe that thinning may increase water yield, but that yields are hard to measure and highly dependent on the altitude and climate of the forest. Other reasons for thinning a forest include acquiring wood for lumber or improving grassland for livestock.

The U.S. Forest Service representative who attended the ISC workgroup cited the "Fool Creek Study" which took place near Denver, Colorado and lasted nearly 60 years. His final take-away from that study was

- Water yield increases only when the thinning is done at very high altitudes when there is a lot of snowfall.
- The thinning must be maintained.

The methods for measuring the effects of thinning were discussed at length by each presenter. Other scientists discussed ET towers, chlorine mass balance comparisons, soil moisture gauges, remote sensing (satellite imagery), comparing areas of burn scars after large fires and measuring the dry weight of grasses that grow. One presenter mentioned pounding rods into the ground all over his test site to measure the depth to rock so he would have an idea of how much moisture the soil could hold. All of the presenters discussed the damage done to equipment by bears, elk, fire, floods and other natural hazards.

There was no consensus reached that would help the ISC determine a proper assessment of the watershed restoration proposals in the AWSA funding

Outside the confines of the work group, there is more commentary on the topic. E.g., the 2003 Jemez y Sangre Water Plan, State of New Mexico, Appendix F weighs in on the question of whether water yield will increase after forest thinning concluding:

- Little to no water yield increases can be expected in areas where annual precipitation is less than about 18-20 inches (piñon – juniper forest).
- Water yield increases would be least in dry years, when they are most needed.
- The smallest potential for increasing water yields is in a ponderosa pine forest.
- Prescribed burns are designed to remove only the brush, not to kill the large overstory trees. Therefore, they are not likely to cause an increase in water yields.
- Thinning a piñon-juniper forest might slow the run-off, making it more useable, but not actually increase the water yield.

An issue that permeates all discussions of forest thinning as a means to increasing water yield is longevity. In order for any water yield increases to last, the thinning treatments must be maintained. The cost of maintenance should be included in the initial calculations.

Three AWSA watershed proposals that suggest "thinning for water yield" are academic in nature and they are more costly per acre than if they were simply thinning without study. This did raise the question, "If you are certain that there will be water yield increase, why go to the expense of studying it? Why not use the money to thin a larger area?" This

question was posed to NM EMNRD foresters and AWSA project proponents, outside of the work group. The response was that the studies upon which the anticipated yields were based were many miles away, and the results from any approach are highly site specific.

Environmental Impacts:

As each proposal is in a different area, the environmental issues and need for NEPA varies. The Gila National Forest proposal has already completed NEPA.

Cultural Impacts:

Each of the proposals would probably encounter archeological artifacts and, therefore, a cultural resources survey would need to be completed.

Water Supply:

See discussion above.

Economics:

To date, the only economic evaluation of these proposals was included in the United States Bureau of Reclamation's ("Reclamation") Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations.

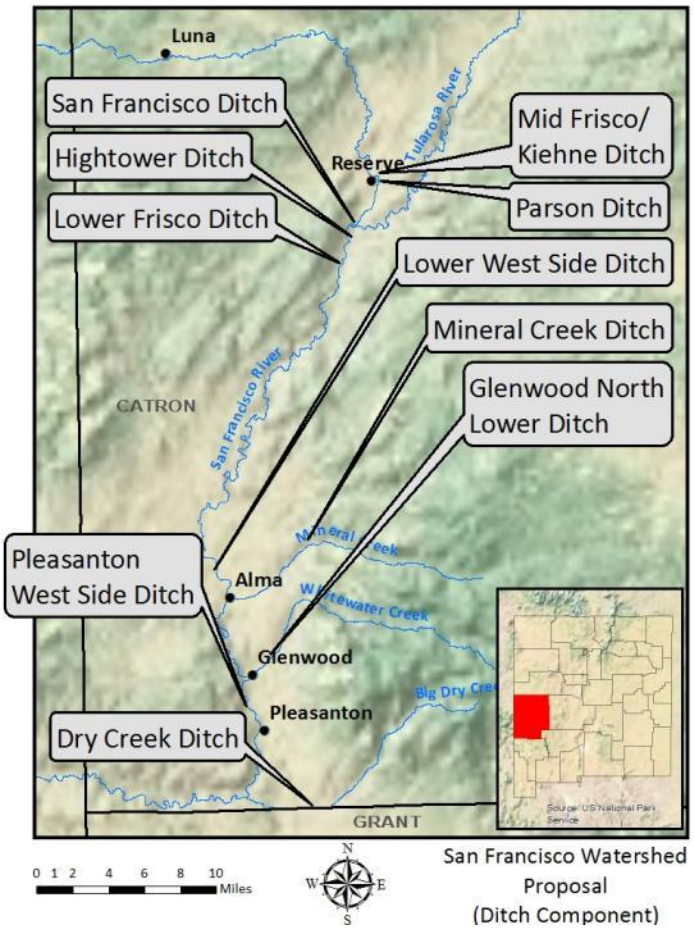
Link to the Bureau of Reclamation report with some benefit-cost analysis: http://nmawsa.org/ongoing-work/united-states-bureau-of-reclamation/appraisal-level-report-on-the-awsa-tier-2-proposals-and-other-diversion-storage-configurations-july-2014/view

Link to the Watershed Workgroup notes: http://nmawsa.org/ongoing-work/watershed-restoration-research/watershed-workgroup-notes-april-4-2014/view

Catron County Modified San Francisco Watershed (Ditch Component)

Background

The Catron County San Francisco Watershed Proposal was submitted by the Catron County Commission. The ISC accepted amendments to the proposal after the Whitewater-Baldy Complex Fire burned more than 297,845 acres in the Gila National Forest and effectively negated the original watershed project proposal. Amendments to the proposal include improvements to community and private irrigation ditches that divert water from the San Francisco River and its tributaries. Specifically, Catron County proposes improvements on the ten ditches labeled on the map at right.



The U.S. Supreme Court *Arizona v. California* decree permits 725 irrigated acres in the Reserve area and 1,003 acres in the Glenwood area, including lands on tributary streams. The proposal does not include ditches in the Luna area or the Apache Creek-Aragon area, which are allowed 225 and 316 irrigated acres, respectively. The primary crop is unimproved pasture.

Some ditches are not presently in use, such as the Pleasanton West Side Ditch. The proposal author communicated to ISC staff that the non-use is the result of the repeated washouts of the diversion structure.

Description

Catron County proposes to improve community and private ditches in order to divert water at higher flows, filter sediment, and improve efficiency. The county proposes to accomplish these goals through construction of infiltration galleries in lieu of conventional earthen dams or weirs; on-farm ponds to store water and to provide a faster water application rate; and replacement of earthen ditches with pipe in order to reduce conveyance losses.

The Catron County Commission proposes to administer the funds. The San Francisco Soil & Water Conservation District would be the fiscal agent for private ditch projects, as such districts have authority to provide assistance to private landowners.

Technical Evaluation
In order to assess the technical feasibility of the proposal, the ISC staff contracted with Portage, Inc., to select two representative ditches and provide conceptual design alternatives and cost estimates.

I. Mid Frisco/Kiehne Ditch

Portage staff met with representatives of the Mid Frisco/Kiehne Ditches on site. After viewing the existing infrastructure and discussing the needs on the ditch, Portage produced a PEA with two design alternatives and cost estimates that include materials, installation, tax, and a 15 percent contingency. Though the PEA does not contain annual O&M costs, Portage assumes 5 percent at this level of assessment.

The alternatives consists of a infiltration gallery, pipeline, regulating structure for the point where the ditch splits into two, five holding ponds and other infrusture. The size of the dual-wall HDPE pipe is the only difference (30- and 24-inch vs. 24- and. 18-inch pipe) between the two alternatives.. The cost estimate for Alternative 1 is $1,650,014.

The cost estimate for Alternative 2, with the smaller pipe sizes, is $1,321,768.

II. Glenwood North Lower Ditch

The Glenwood North Lower Ditch diverts water via subsurface water collection pipe (like an infiltration gallery) along Whitewater Creek, a tributary of the San Francisco River. Water is used for pisciculture at the Glenwood Fish Hatchery operated by the New Mexico Department of Game & Fish. Water that exits the hatchery is used for agriculture. Though not verified, it is suspected that the perforated collection pipe has accumulated sediment and has been infiltrated by tree roots.

According to ISC records and reports, the Glenwood North Lower Ditch experiences no physical water supply shortage due to the large quantities of water diverted into the fish ponds.

Portage staff met with representatives of the Glenwood North Lower Ditch. After viewing the existing infrastructure and discussing the needs on the ditch, Portage produced a PEA with four design alternatives and cost estimates that include materials, installation, tax, and a 15 percent contingency. Though the PEA does not contain annual O&M costs, Portage assumes 5 percent of capital costs at this level of assessment.

The differences in the alternatives are accounted for by pipe material and size. The respective costs of the alternatives are: $556,017; $454,393; $571,769; and $447,287.

A potential cost that is not accounted is the special removal and disposal of an existing segment of transite pipe. Transite is a cement-fiber compostite material, and early manufacturers used asbestos as part of the fiber composition.

Environmental Impacts
The ISC staff also hired Portage, Inc., to assess the potential environmental impacts of Catron County's proposal. Since Portage looked at the "human environment," impacts to cultural resources and socioeconomics are included in the environmental evaluation.

Portage evaluated nine resource areas under "No Action" and "Proposed Action" scenarios. Those nine resource areas are as follows: land use; geologic environment/soils; water resources; ecological resources; historical and cultural resources; air quality; aesthetics; noise; and socioeconomics. Each resource area had its own evaluation criteria. Impacts were categorized as either "no impact," "less-than-significant impact," or "potentially significant impact."

Portage identified no impact or a less-than-significant impact to all resource areas should the project be constructed.

If the project is not constructed, Portage identified potentially significant impacts to water resources and socioeconomics. Portage states that continued system degradation would be expected to result in continual and increasing impacts to the water users with impacts to hatchery operations and agricultural water supply.

Cultural Impacts
Cultural impacts are addressed in the "Environmental Impacts" section. One additional consideration is that *acequias* and community ditches are themselves regarded as a cultural resource and a part of New Mexico's heritage.

Water Supply
The water supply for community ditches in Catron County is variable. Most experience at least some water shortage due to the timing and variability of flows on the San Francisco River and its tributaries. All have conveyance losses, but these losses will vary by location, as they are a function of such variables as soil permeability and wetted area.

The proposed on-farm ponds may ameliorate the shortages and increase the on-farm efficiency. The ditch linings may increase water deliveries to the farm headgates, especially when diverting at low river flows.

Economics
To date, the only economic evaluation of Catron County's proposal is the one included in the United States Bureau of Reclamation's ("Reclamation") *Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations*. Reclamation considered the costs and benefits of both the watershed and ditch components together.

Other economic evaluation of the proposal is in progress.

Mid Frisco/ Kiehne PEA URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/preliminary-engineering-assessment-mid-frisco-keihne-ditch/view

Environmental Assessment URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/environmental-assessments/mid-frisco-keihne-ditch-environmental-assessment/view

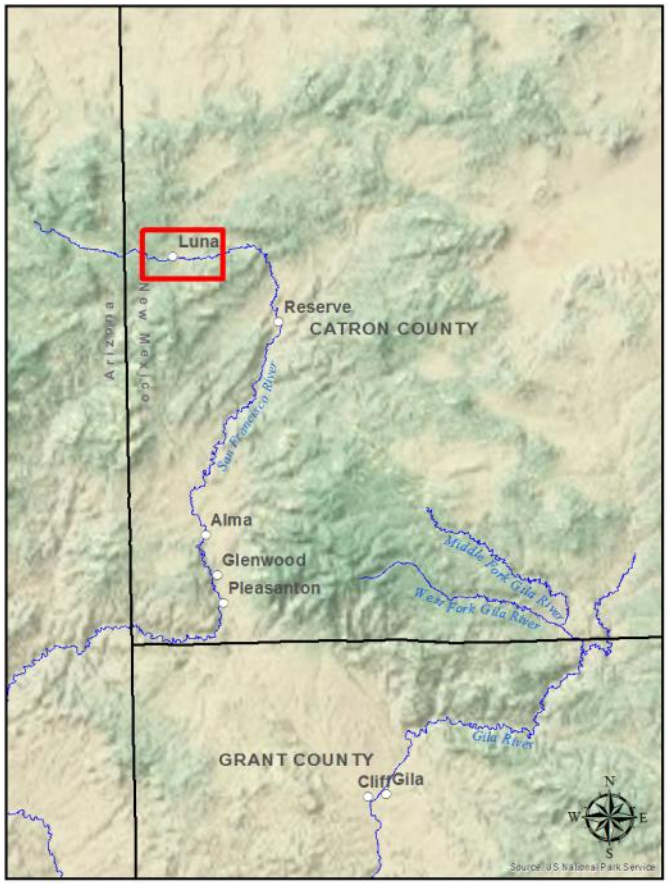
Glenwood North Lower Ditch PEA URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/preliminary-engineering-assessment-glenwood-north-lower-ditch/view

Environmental Assessment URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/environmental-assessments/glenwood-north-lower-ditch-environmental-assessment/view

1892 Luna Irrigation Ditch Association

Background

The 1892 Luna Irrigation Ditch Association ("Luna" or "Association") diverts water from the San Francisco River in western Catron County. The U.S. Supreme Court *Arizona v. California* decree permits 225 irrigated acres in the Luna area, which includes land on tributary streams. The Association has storage rights in Luna Lake, Arizona, and a water bank established pursuant to NMSA 1978, § 73-2-55.1. The ISC's records indicate 188.5 irrigated acres in the Luna area in 2012. Of that, 26.94 acres were irrigated from the North Side Ditch. The primary crop is unimproved pasture.



Description

Luna requests $1,363,000 in AWSA funds over five years for construction of permanent diversion structures for four ditches and replacement of earthen ditches with closed pipe. This figure does not include National Environmental Policy Act ("NEPA") costs. (The point of diversion is located on U.S. Forest Service land.) Luna estimates annual operations and maintenance ("O&M") costs of $17,500, which includes $15,000 worth of donated time and equipment from Association members.

Technical Evaluation

The ISC staff hired Portage, Inc., to assess Luna's proposal. Portage staff visited the Luna North Side Ditch with a representative of the Association and produced a preliminary engineering assessment ("PEA") containing two design alternatives and cost estimates that include materials, installation, tax, and a 15 percent contingency. Though the PEA does not contain annual O&M costs, Portage assumes 5 percent of capital costs at this level of assessment.

The first alternative consists of a weir, headgate structure, cleanout structure, and 24-inch diameter dual-wall high-density polyethylene ("HDPE") pipe. Portage provided costs only for HDPE, as its strength, flexiblity, imperviousness to corrosion, and weight make it a

preferred alternative to other pipe material. The cost estimate for Alternative 1 is $1,363,713.

The second alternative consists of a subsurface infiltration gallery and 24-inch diameter HDPE pipe. The cost estimate for Alternative 2 is $1,365,348.

The infiltration gallery may be less prone to flood damage, provided that it is constructed below the scour level. The challenge would be to construct it at an elevation adequate to deliver water into the ditch.

Environmental Impacts
The ISC staff also hired Portage, Inc., to assess the potential environmental impacts of Luna's proposal. Since Portage looked at the "human environment," impacts to cultural resources and socioeconomics are included in the environmental evaluation.

Portage evaluated nine resource areas under "No Action" and "Proposed Action" scenarios. Those nine resource areas are as follows: land use; geologic environment/soils; water resources; ecological resources; historical and cultural resources; air quality; aesthetics; noise; and socioeconomics. Each resource area had its own evaluation criteria. Impacts were categorized as either "no impact," "less-than-significant impact," or "potentially significant impact."

Portage identified no impact or a less-than-significant impact to all resource areas should the project be constructed.

If the project is not constructed, Portage identified potentially significant impacts to water resources and socioeconomics. Portage states that "…continued decline of the system would be expected to result in continual and increasing impacts to the water users" with a resultant "measurable change of the existing socioeconomic environment."

Cultural Impacts
Cultural impacts are addressed in the "Environmental Impacts" section. One additional consideration is that *acequias* and community ditches are themselves regarded as a cultural resource and a part of New Mexico's heritage.

Water Supply
Due to storage, water banking, and low demand from non-resident landowners, physical water supply has not been an issue in Luna.

However, infrastructure and maintenance issues on the Luna ditches affect water supply. First, floods on the San Francisco River destroy the temporary earthen diversion dam. The result is that the irrigation supply is cut off until the dam can be reconstructed. Secondly, the earthen and concrete-lined ditches fill with sediment after floods, and they are prone to erosion and/or washout. Finally, the ditches suffer unquantified conveyance losses.

Economics
To date, the only economic evaluation of Luna's proposal is the one included in the United States Bureau of Reclamation's ("Reclamation") *Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations*. Reclamation relied on Portage's cost estimates and Luna's estimated water savings and OM&R estimates.

Other economic evaluation of the proposal is in progress.

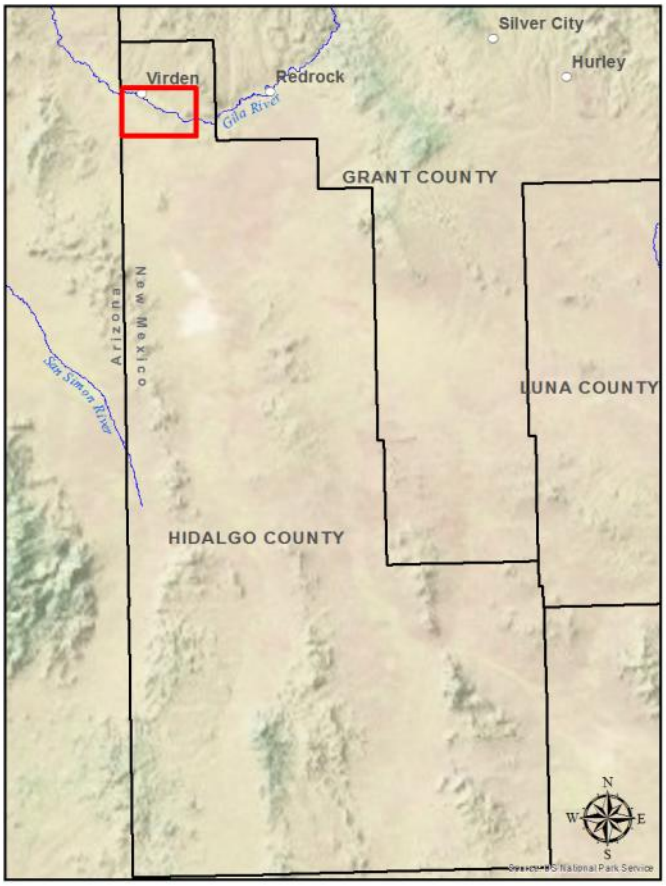
PEA URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/preliminary-engineering-assessment-1892-luna-irrigation-ditch/view

Environmental Assessment URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/environmental-assessments/1892-luna-irrigation-ditch-environmental-assessment/view

Sunset Canal & New Mexico New Model Canal

Background

The Sunset Canal and the New Mexico New Model Canal divert water from the Gila River near Virden in northwestern Hidalgo County. The ditches serve irrigators in Virden before crossing the border to serve water users in Arizona. Water in the canals is administered by the Gila Water Commissioner in Safford, Arizona, in accordance with the U.S. District Court of Arizona *Globe Equity No. 59* decree (1935). The Sunset Canal serves 2,236 acres in New Mexico; New Model serves 315 acres. Corn, cotton, and small grains are the predominate crops.



Description

Sunset and New Model Canals request AWSA funds to line the canals with HDPE pipe, install plug valves on farm turnouts, and meter the farm turnouts. The goals are to reduce conveyance losses for more preferable water accounting and to better monitor water distribution to users.

Technical Evaluation

The ISC staff hired Portage, Inc., to visit the ditches with ditch representatives and produce a preliminary engineering assessment ("PEA") containing design alternatives and cost estimates. The cost estimates include materials, installation, tax, and a 15 percent contingency. Though the PEA does not contain annual O&M costs, Portage assumes 5 percent of capital costs at this level of assessment.

I. Sunset Canal

Portage produced two alternatives for the Sunset Canal. The first alternative consists of a 27,800 feet of 42-inch HDPE pipe above town and 22,000 feet of 36-inch HDPE pipe below town, as well as other infrastructure. The cost estimate for Alternative 1 is $9,110,125.

The second alternative consists of a 27,800 feet of 48-inch HDPE pipe above town and 22,000 feet of 42-inch HDPE pipe below town, as well as other infrastructure. The cost estimate for Alternative 2 is $11,305,945.

II. New Mexico New Model Canal

Portage also produced two alternatives for the New Model Canal. The first alternative consists of a 24,000 feet of 36-inch HDPE pipe and other infrastructure. The cost estimate for Alternative 1 is $3,792,518.

The second alternative consists of a 24,000 feet of 42-inch HDPE pipe and other infrastructure. The cost estimate for Alternative 2 is $4,777,488.

Environmental Impacts

Portage, Inc., also assessed the potential environmental impacts of the Sunset and New Model proposal. Since Portage looked at the "human environment," impacts to cultural resources and socioeconomics are included in the environmental evaluation.

Portage evaluated nine resource areas under "No Action" and "Proposed Action" scenarios. Those nine resource areas are land use; geologic environment/soils; water resources; ecological resources; historical and cultural resources; air quality; aesthetics; noise; and socioeconomics. Each resource area had its own evaluation criteria. Impacts were categorized as either "no impact," "less-than-significant impact," or "potentially significant impact."

Portage identified no impact or a less-than-significant impact to all resource areas should the project be constructed.

If the project is not constructed, Portage identified potentially significant impacts to water resources and socioeconomics. Portage states that "…continued decline of the system would be expected to result in increasing impacts to the water users" with a resultant "measurable change of the existing socioeconomic environment."

Cultural Impacts

Cultural impacts are addressed in the "Environmental Impacts" section. One additional consideration is that *acequias* and community ditches are themselves regarded as a cultural resource and a part of New Mexico's heritage.

Water Supply

Irrigators on the two canals typically suffer from surface water shortages during the summer months, when the Gila River can go dry. Under such circumstances, most farmers resort to pumping supplemental wells, which are regulated by the New Mexico Office of the State Engineer.

Sunset Canal infrastructure includes approximately 54,000 feet of unlined canal. New Model Canal infrastructure includes approximately 24,000 feet of concrete-lined or unlined canal. Flow is metered at both ends for water accounting by the Gila Water Commissioner, and conveyance losses and storm flows are charged against the water users' allocation of six acre-feet per acre.

While the proposed project would increase the overall system efficiency and, perhaps, lead to some more favorable water accounting, without a storage component it would not alleviate the summer reliance on supplemental wells.

Economics
To date, the only economic evaluation of this proposal is included in the United States Bureau of Reclamation's ("Reclamation") *Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations*. Reclamation relied on Portage's cost estimates.

Other economic evaluation of the proposal is in progress.

Sunset Canal PEA URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/preliminary-engineering-assessment-sunset-canal/view

Environmental Assessment URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/environmental-assessments/sunset-canal-environmental-assessment/view

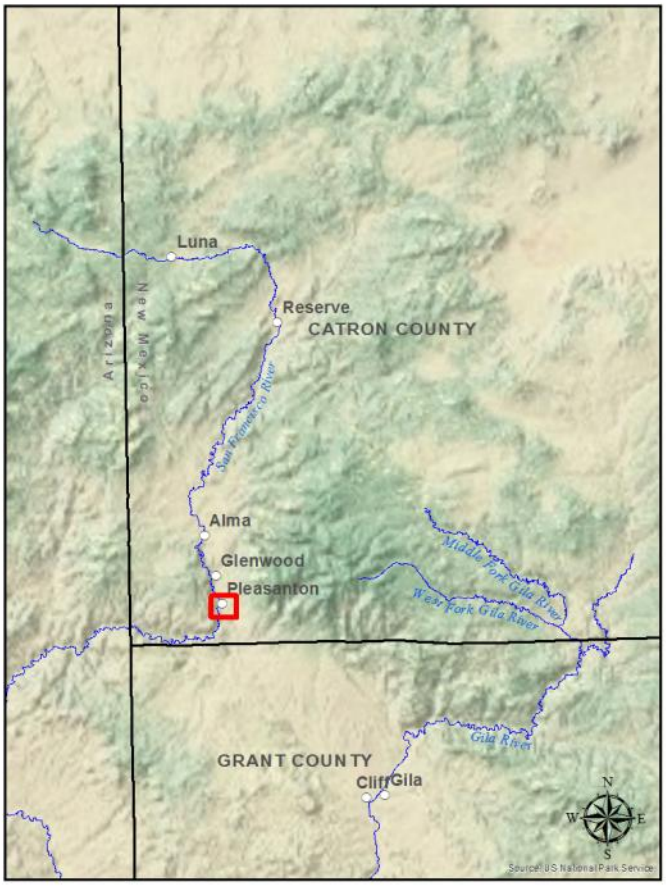
New Model Canal PEA URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/preliminary-engineering-assessment-nm-new-model-canal-1-10-2014/view

Environmental Assessment URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/environmental-assessments/new-mexico-new-model-canal-environmental-assessment/view

Pleasanton East-Side Ditch Company

Background

The Pleasanton East-Side Ditch Company ("Pleasanton") diverts water from the San Francisco River in western Catron County. The U.S. Supreme Court *Arizona v. California* decree permits 1,003 irrigated acres in the Glenwood area, within which Pleasanton lies. The ISC's records indicate 185.35 acres irrigated from the Pleasanton ditch in 2012. The primary crop is pasture, but there are some truck crops grown.



Despite being the last New Mexican water user on the San Francisco River, ISC records indicate that Pleasanton does not experience water shortages. This is likely due to the agricultural return flows and tributary discharge above Pleasanton.

However, infrastructure and maintenance issues on the 20,000-foot Pleasanton ditch affects water supply to users at the end of the ditch, according to the proposal. The earthen ditch segments and 50-year-old deteriorating concrete ditch result in unquantified conveyance losses.

Description

Pleasanton requests AWSA funds to re-line the ditch or replace it with pipe.

Technical Evaluation

The ISC staff hired Portage, Inc., to assess Pleasanton's proposal. Portage staff visited the ditch with its representatives and produced a preliminary engineering assessment ("PEA") containing four design alternatives and cost estimates that include materials, installation, tax, and a 15 percent contingency. Though the PEA does not contain annual O&M costs, Portage assumes 5 percent of capital costs at this level of assessment.

1. Alternative 1 is priced for 17,000 feet of 30-inch HDPE pipe at $2,040,718.
2. Alternative 2 is priced for 17,000 feet of 36-inch HDPE pipe at $2,661,806.

3. Alternative 3 is priced for 17,000 feet of 36-inch corrugated metal pipe at $1,830,656.
4. Alternative 4 is priced for 13,500 feet of 36-inch HDPE pipe and 3,500 feet of concrete liner at $2,536,236. This alternative is preferred by at least some ditch members, as they prefer the aesthetics of a more traditional *acequia* through the residential part of Pleasanton.

Environmental Impacts
The ISC staff also hired Portage, Inc., to assess the potential environmental impacts of Pleasanton's proposal. Portage looked at the "human environment." Thus, impacts to cultural resources and socioeconomics are included in the environmental evaluation.

Portage evaluated nine resource areas under "No Action" and "Proposed Action" scenarios. Those nine resource areas are as follows: land use; geologic environment/soils; water resources; ecological resources; historical and cultural resources; air quality; aesthetics; noise; and socioeconomics. Each resource area had its own evaluation criteria. Impacts were categorized as either "no impact," "less-than-significant impact," or "potentially significant impact."

Portage identified no impact or a less-than-significant impact to all resource areas should the project be constructed.

If the project is not constructed, Portage identified potentially significant impacts to water resources and socioeconomics. Portage states that "…continued decline of the system would be expected to result in continual and increasing impacts to the water users" with a resultant "measurable change of the existing socioeconomic environment."

Cultural Impacts
Cultural impacts are addressed in the "Environmental Impacts" section. One additional consideration is that *acequias* and community ditches are themselves regarded as a cultural resource and a part of New Mexico's heritage.

Water Supply
As previously stated, ISC records indicate that Pleasanton rarely, if ever, experiences water shortage. However, pipe may improve water conveyance to the most downstream water user(s) on the ditch.

Economics

To date, the only prepared economic evaluation of Pleasanton's proposal is in the United States Bureau of Reclamation's ("Reclamation") *Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations*. Reclamation relied on Portage's cost estimates and Pleasanton's estimated water savings.

Other economic evaluation of the proposal is in progress.

PEA URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/preliminary-engineering-assessment-pleasanton-east-side-ditch-co/view

Environmental Assessment URL: http://nmawsa.org/ongoing-work/ditch-improvement-assessments/environmental-assessments/pleasanton-east-side-ditch-co.-environmental-assessment/view

Gila Conservation Coalition Municipal Conservation to Reduce Net Depletions to Groundwater

Background

The Gila Conservation Coalition ("GCC") is a partnership of environmental and conservation groups and individuals in southwestern New Mexico with the self-described mission of promoting conservation of the Upper Gila River Basin and surrounding lands.

Description

GCC proposes to establish a fund to finance municipal water conservation programs in southwestern New Mexico. Under the proposal, the ISC would endow the fund with $7.742 million to $10.4 million of AWSA money. The fund would be administered by the New Mexico Finance Authority ("NMFA") or a state agency. The proponent compares the proposed fund to the Water Project Fund, which has disbursed over $44 million for water conservation, treatment, recycling, or Reuse statewide for the period 2002 to 2012.

GCC proposes specific water conservation programs for each county, as shown in **Table 01** below.

Table 01

Conservation Method	**COUNTY**			
	Catron	**Grant**	**Hidalgo**	**Luna**
Toilet rebates	X	X	X	X
Clothes washer rebates	X	X	X	X
Showerhead giveaway	X	X	X	X
Increasing block rate structure			X	X
Outdoor watering ordinances		X		
Leak detection and repair		X	X	

Technical Evaluation
As part of its evaluation of the proposal, the ISC elected to fund two $50,000 water conservation pilot projects – one in Silver City and one in Deming – in February 2012. The grant agreements were signed in spring 2013, and the individual programs began in summer 2013. The agreements required the municipalities to provide a cost share of 30 percent.

I. Silver City Conservation Pilot Project

For its pilot project, Silver City replaced its irrigation system on the ball fields at the Altamirano Sports Complex with a U.S. EPA WaterSense weather-based smart irrigation system.

The Altamirano Sports Complex consists of 11.5 acres of cool-season turfgrass. The Town of Silver City pays for the irrigation of the ball fields, but school district staff operate the system and conduct the maintenance.

Annual irrigation water usage by the Altamirano Sports Complex for the period 2008 to 2012 ranged from 48 to 62 acre-feet. The complex was Silver City's top single water user in 2011 and 2012. In 2012, its use was 61 acre-feet, or 2.4 percent of Silver City's water production.

Post-installation water usage for the period August 2013 through June 2014 totaled 32 acre-feet. Annual usage for the past five years, disregarding July of each year, ranged from 39 to 52 acre-feet by comparison.

II. Deming Conservation Pilot Project

Whereas Silver City targeted a specific water user, Deming targeted a specific sector. Deming's pilot conservation project focused on the residential sector, which demands 49 percent of Deming's water production. The difference between average January and June residential consumption in Deming is approximately 153 acre-feet as illustrated by Fig. 01.

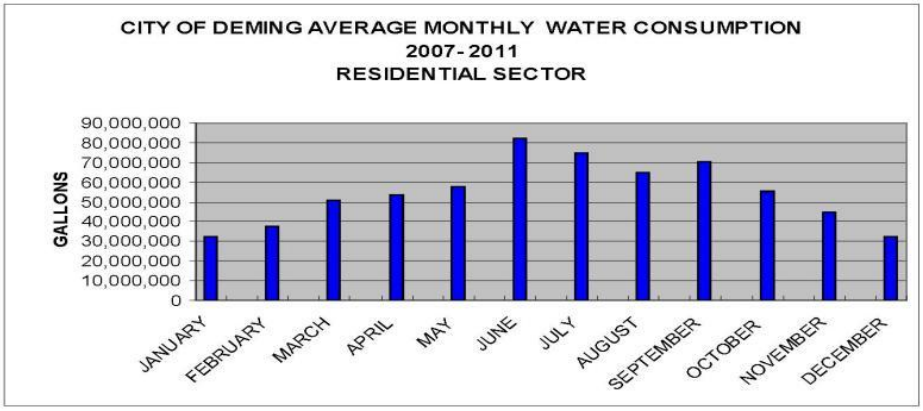


Fig. 1

Therefore, Deming specifically targeted residential summer demand by offering rebates for conversion of turfgrass landscaping to xeriscaping and for replacement of evaporative coolers with refrigerated air units.

Deming offered rebates of $1.00 per square foot of turfgrass replaced and $1,000 for refrigerated air units. To inform the public of the program, Deming officials met with local landscape and HVAC contractors, advertised in the local newspaper and government buildings, and partnered with Public Service Company of New Mexico ("PNM") for a radio and newspaper advertisement campaing.

The results included two landscape conversions of 1,210 square feet and eight refrigerated air units. Consequently, Deming expended only 16 percent of the grant funds. (The balance reverted to the New Mexico Unit Fund, which is where AWSA funds are deposited.)

However, Deming identified lessons for future conservation programs. Those lessons include tailoring programs to fit the local community and its economy.

Environmental Impacts
The environmental impacts of the proposal were not specifically evaluated.

Cultural Impacts
The cultural impacts of the proposal were not specifically evaluated. However, one may presume that conservation programs will lead to lifestyle change for high-usage customers.

For low-usage customers, programs will have either little effect or be somewhat adverse. For example, a clothes washer rebate program can be anticipated to have no effect on a customer who already has a new, high-efficiency front loading washer. However, if such programs result in a reduction of system revenues that must be offset by rate increases, the rate increases incurred by a customer on water may reduce spending in other areas, such as entertainment.

Water Supply
Water conservation programs are components of water supply management in southwestern New Mexico. GCC's proposal can either be seen as duplicative of the Water Project Fund or as a supplemental funding source for programs in the southwestern counties.

Actual water savings depend on multiple factors, including present usage, income (for the residential sector), and enforcement (of ordinances). Calculation of water savings post-implementation will depend upon long-term data collection and record keeping.

Economics
To date, the only economic evaluation of this proposal is included in the United States Bureau of Reclamation's ("Reclamation") *Appraisal Level Report on the Arizona Water Settlements Act Tier-2 Proposals and other Diversion and Storage Configurations*.

Other economic evaluation of the proposal is in progress.

URL: http://nmawsa.org/ongoing-work/municipal-water-conservation/municipal-conservation-pilot