Improved Water Management Measurement and Accounting for the Carlsbad Irrigation District

Carlsbad Irrigation District

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Executive Summary

Background Data

The Spanish started irrigating the land when they settled in the Pecos River Basin around 1600. Irrigation in the early 19th century flourished under the Spanish land grant colonization system and was continued after 1850 by the American settlers. The early irrigation systems were community ditches which diverted the normal flow of the river without the benefit of permanent diversion structures. In 1888, a large ranch was located in the general area of the present Carlsbad Project. The ranch manager initiated the first large-scale irrigation attempt. Since the natural characteristics of the area required a more comprehensive treatment than the enterprise could afford, it failed. For the next 17 years, various private interests attempted to make this project financially profitable, but without success.

During this period, project facilities were built, including McMillan Dam for water storage. Avalon Dam, for storage and diversion, the Main Canal, and a distribution system which irrigated 15,000 acres. Private operation of the project ended in 1904 when a Pecos River flood destroyed the central canal and much of the irrigation system and swept away Avalon Dam. Without water for the land, the project settlers faced complete ruin. Upon their request, in 1905 the Reclamation Service was authorized to purchase the system. Reclamation then began investigations prior to rehabilitating the project.

Investigations

By 1907, the system was repaired and extended to permit the irrigation of approximately 25,000 acres. McMillan Dam was rehabilitated in 1908, but by 1932 silt accumulation had reduced the storage capacity of the reservoir and leakage through gypsum and limestone strata had reduced its effectiveness. As siltation advanced, about 13,000 acres of salt cedars grew in the upper reservoir area. After a careful analysis of all factors involved, it was decided to construct a new reservoir at a different site rather than to attempt correction of the defective conditions at Lake McMillan. Detailed investigations resulted in the selection of Alamagordo Dam, now the Sumner Dam site.

Authorization

The original Carlsbad Project was authorized by the Secretary of the Interior on November 28, 1905. Sumner Dam was authorized for construction by the President on November 6, 1935, initial funds having been approved on August 14, 1935, under the Emergency Relief Appropriations Act of 1935. Section 7, Flood Control Act of August 11, 1939, declared Sumner Dam and Lake Sumner were to be used first for irrigation, then for flood control, river regulation, and other beneficial uses.

Brantley Dam and Reservoir of the Brantley Project was authorized on October 20, 1972, by Public Law 92-514, for the purposes of irrigation, flood control, fish and wildlife, recreation benefits, and to provide protection for Avalon Dam and as a replacement of McMillan Dam which was determined to be unsafe.

Construction

Avalon Dam was rebuilt and the project distribution system repaired and extended by 1907.

Sumner Dam was built during 1936-1937. Sumner Dam was raised 16 feet, the service spillway capacity increased, and an emergency spillway constructed during the 1954-1956 reconstruction.

McMillan Dam was rehabilitated in 1908 and breached in 1991. Sinkholes have been an ongoing problem along the eastern edge of McMillan Reservoir causing extensive water losses. The east dike was extended about 1,600 feet in 1934-1935, and construction of an extended dike 10,700 feet long was initiated in 1954 to cut off additional sinkholes. The dike was extended an additional 1,000 feet in 1968.

In 1967, the Carlsbad Irrigation District (CID) entered into a rehabilitation and betterment program with the Bureau of Reclamation for concrete lining and improvement of the irrigation distribution system. This program resulted in concrete lining and improvements to some 79 miles of laterals, which significantly reduced water losses and provided a more efficient delivery of water. The Carlsbad Irrigation District also received an extension of the rehabilitation and betterment program to line another 16 miles of laterals and about 9 miles of canals with concrete.

Benefits

Irrigation: A long growing season, good soil, favorable markets, and irrigation facilities make intensive diversified farming practices attractive and profitable. Cotton and alfalfa are the principal crops, although wheat, barley, oats, and vegetables are produced in abundance.

Flood Control: Sumner Dam contributes materially to the economy of the area by controlling seasonal floods of the Pecos River. Brantley Dam of the Brantley Project, about 13 miles north of Carlsbad, New Mexico, also provides flood control benefits and also helps project Avalon Dam. Brantley Dam has 335,054 acre-feet capacity assigned to flood control functions.
The Carlsbad Project has provided an accumulated $639,000 in flood control benefits from 1950 to 1999.

Recreation: Lake Sumner is in a semi-desert area and furnishes year round recreation benefits. There are camping and picnic grounds, cabin sites, and boat docks with small boats for hire. The reservoir provides good bass and catfish fishing in season.

The District

CID is a political subdivision entity of the state of New Mexico. The district operates under New Mexico statutes §73-10-1 through §73-10-47 Irrigation Districts Cooperating with United States under Reclamation Laws; Formation and Management, and §73-11-1 through §73-11-55 Irrigation Districts Cooperating with United States under Reclamation Laws; Fiscal Affairs; Local Improvements and Special Powers.

A five-member board of directors manages CID. Each member is elected for a four-year term and represents one of the District's five polling precincts. The board hires a secretary/treasurer-manager to oversee CID's daily operations and carry out the board's directives. Dudley Jones has served as the secretary/treasurer-manager for the past 3 years.

CID operations are broken down into four major departments: operations, maintenance, general/administration and dam operations. The operations department is in charge of receiving orders and scheduling water deliveries. Maintenance maintains the canals, laterals and ditches owned and used by CID to deliver water. Administration follows the board's directives and controls the accounting and billing. Dam operations are responsible for the operation and maintenance of the Reclamation structures in the system; Sumner Dam, Brantley Dam and Avalon Dam. Administration works closely with the State Engineers office to help Members with any water rights under adjudication in the Pecos River Stream Adjudication.

Water Ownership: Under Article 16, Section 2 of the NM Constitution, all the waters (surface and ground) belong to the state of New Mexico. The state through a permitting system allows individuals to appropriate and place water to beneficial use. Individuals do not own the water but merely acquire a right to use water under terms and conditions governed by state law. . New Mexico follows the "first in time, first in right" principle known as the law of prior appropriation. New Mexico law uses the prior appropriation system based on the idea that the person who first puts water to beneficial use should have the better right to use against subsequent junior users.

Assessments: The CID Board of Directors sets the yearly charges for water right holders. Assessments are levied on lands that are capable of receiving water through CID's water delivery system. Assessments are charges for general operating and maintenance (O&M) of the CID system, USBR reimbursable O&M fees and CID's share of USBR structure O&M charges. The operating and maintenance fee, set each year by the board, supports maintenance and operation that pertains to landowners receiving water at their farm ditch gate. This can include such expenses as repair and maintenance of canals, laterals and sub-laterals owned by CID, equipment, salaries and legal and other expenses that result from water deliveries.

Maintenance: CID has 212 miles of irrigation canal, laterals and sub-laterals within its delivery system. It has a scheduled maintenance program during the irrigation season, which includes burning, spraying and grading of the water delivery system. Before the irrigation season begins, canals and laterals are cleaned for silt buildup, burned and/or sprayed for weeds, head gates and turnouts repaired and coated, concrete canals and structures repaired and sealed. During the irrigation season, maintenance work continues moving in a rotation from north to south. Spraying canals requires herbicides approved for use over water. Burning takes place only when weather conditions permit. Ditches within the system are cleaned on an ongoing basis. Cleaning or repairing farm gates on ditches not owned by CID are the landowners' responsibility. CID requires that farm ditches are clear of debris and weeds before water is delivered.

Conservation Water: During the irrigation season, users may have some conserved (unused allocated) water. This water remains in the conservation pool, which is located at the Brantley Dam and Reservoir. Users can broker their personal conserved water during the season or it will revert to the CID conservation pool on October 31. Water users have two options available for

purchasing conserved water (when water is available). The first option is to purchase the conserved water by the acre foot from another water user. The second method is to purchase the annual allotment by the acre from another water user. These transactions require a temporary transfer to be completed by CID. There is a $10 per transaction fee for this service.

Ordering and Scheduling Water: Irrigators decide when they need to order water for their fields. To order water, irrigators call their CID ditch rider. The ditch rider will relay the water order to the water master. The water master tallies up all orders for water within the 25,055 acres of the project which includes five ditch rider divisions. The Water master then compares the water delivery orders to CID Board established operation guidelines and requests a corresponding release plus losses from Avalon Dam. Ditch riders will tally irrigation water delivered by head size and length (time) of delivery. They are on call 24 hours a day during the irrigation season. Once water is released from Avalon Dam by the dam tender, the water master releases water at various diversion points along the canal system and notifies the ditch riders of the times and amounts of the water releases. The water master then contacts the ditch riders who receive the water. Ditch riders typically notify irrigators four to six hours prior to delivery. A number of factors can cause delivery delays and are beyond the ditch rider's control: system limitations, water demands build-up time, carriage and turnout location.

Ditch Associations: Many of CID's irrigation systems were built in the early 1900s to provide water for farms. As population increased, many of these farms were subdivided into smaller parcels. Today, an irrigation head gate that originally delivered water to a 40-acre farm may be serving more than 40 separate landowners in a subdivision on the same acreage. In today's 40-acre subdivision, water users have the same amount of water as the farmer did. If all water users try to irrigate on the same day, there will not be enough water for everyone at the same time. Irrigators may need to manage their water to ensure that everyone gets their fair share when they need it. Small tract irrigators also may need to organize as a group in order to equitably share the responsibilities and costs of ditch maintenance and repairs. Chapter 73 of the New Mexico Statutes enables irrigators to form water user associations. These associations can be formed by owners of lands or irrigation ditches to enter into mutual undertakings such as the construction or maintenance of irrigation ditches and canals to improve and enlarge them for their mutual advantage. (§ Statute 73-5-1)

Recent Studies

In 2005, the Interstate Stream Commission prepared the Carlsbad Project Water Operations and Water Supply Conservation Environmental Impact Statement (EIS), which was intended to evaluate and relate to the public the potential environmental, economic, and social consequences that could result from implementing different operational procedures for the dams and reservoirs on the Pecos River system. These alternative operation procedures were designed to the benefit the Pecos bluntnose shiner. Overall, the draft version of the Carlsbad Project Water Operations and Water Supply Conservation EIS does a good job of describing the problem and presenting the results. WEST Consultants reviewed the manual and suggested improvements in the document.

In 2010, CID and the Interstate Stream Commission sere concerned about potential in the CID's unlined canal sections. According to their records, there was a 28% difference between the

measured volume of water entering the CID Main Canal from Avalon Dam and the water volumes indicated by the CID water order records. CID had suggested that most of this difference is due to leakage. At the request of the New Mexico Interstate Stream Commission (NMISC), WEST Consultants, Inc. (WEST) conducted a site visit and reviewed some of the measurement devices in use. WEST suggested that much of the apparent water loss might be the result of poor water measurement. Many of the observed water measuring devices were in poor condition and several may have been submerged.

Technical Project Description

The intent of this project is to improve CID's ability to manage their irrigation water deliveries to users. CID does not have remote monitoring of water levels or flows within the system. This makes it difficult for CID managers to evaluate the performance of their operators at delivering water to users. The structures that are used to measure water are in bad repair and are not accurate. All this makes it difficult for management to determine locations where canal losses occur, and whether those losses are from seepage, excess delivery, or spills. In addition, the main canal has several locations where water levels are controlled by channel contractions rather than check gates. The result is that operators are not able to maintain constant water levels within the canal. This makes maintaining constant flow to lateral canals difficult.

This project will give the district some basic tools, from which they can begin to improve operations. The main features of this project include:

1. Improvement in current water measurement structures (Approx. 19)
2. SCADA System
3. Remote monitoring at key locations
    a. Approx. 20 Flow Measurement Sites
    b. Approx. 11 Canal Water Levels
4. New overshot gates (2) for water control
5. GIS Inventory of District Structures
6. Analysis of System losses based on new information provided from modified structures above

1. **Improvement in current water measurement structures**

Parshall flumes are used almost exclusively in this district. Most of these fumes were poorly constructed. Many have incorrect dimensions (e.g., throat length, amount of drop in the throat, etc.), many are cracked or have settled, and/or many have submergence problems. An example at a lateral heading is shown in Figure 1. This is one of the better looking flumes.

CID proposes to convert these Parshall flumes into modified long-throated flumes. This can be done by pouring concrete to create a flat floor (crest) and extension of the throat to make it sufficiently long (typically on downstream side). The water level measurement is moved upstream to the straight channel section and the entrance to the flume is smoothed. For conditions where submergence is high, the bottom would be raised to make it into a Replogle or ramp flume. The same hydraulic theory applies for a side contraction, a bottom contraction

or a combination. These modified flumes would then be calibrated with the Bureau of Reclamation Software *WinFlume*. The bottom contraction will only be included if necessary since it makes the canal harder to drain.

CID identified 18 major laterals which deliver water to a majority of their service area, and thus will constitute a majority of the delivered volume. Additional flumes will be modified in future modernization effort, if necessary.

Figure 1. Parshall flume off of Eastside Canal near Callaway Drive and Loretta Lane.

Figure 2. Side contracted flume near head of Eastside Canal.

At the head of the Eastside Canal, there is a side contracted flume (see Figure 2). This flume can also be calibrated by *WinFlume* because it is essentially a long-throated or Replogle flume contracted from the side instead of the bottom. There is a stilling well already installed at the site. Without much effort, this flume could also be operational by careful measurement of dimensions and recalibration with *WinFlume*. A bottom contraction may also be needed for this flume since there does not appear to be much drop in water level. This flume can be evaluated during the 2012 growing season to determine if a bottom contraction is needed, and its depth.

The Replogle flume on the CID Main Canal lies just downstream from the offtake to the Eastside Canal (see Figure 3). This flume was designed by the USBR in Denver and installed in February of 2006. During our field visit, quick measurements of the flume were taken and shared with the designers of the flume in Denver. The flume appears to be built as designed except for the throat length. The throat length is 41 inches, while the designs were prepared for 6 and 60 inches. A new calibration is required for this new throat length, which can easily be accomplished in *WinFlume*. About 50 feet upstream from the flume is a stilling well, which appears to be in good condition. Without much effort, this flume could be operational. Submergence does not appear to be a problem.

Figure 3. Replogle flume on the CID Main Canal downstream from Callaway Drive.

2. SCADA System

A Supervisory Control and Data Acquisition SCADA System will allow the water master to keep track of flows within the system. Water flow to individual lateral canals can be compared with water order and any discrepancies identified in real time. This can give the water master real

time control over canal operators. In addition, the SCADA System will keep historical information on flows and water levels.

In the long run, the district will be able to control check gates or lateral canal headings from the SCADA system. This central control will allow the water master provide better water level control throughout the main canal.

3. Remote monitoring at key locations

Water level sensors will be installed at 20 key flow measurement structures within the district. In addition, remote terminal units (RTUs or PLCs) will be installed to record the readings from the water level sensors and radios will be used to transmit these water levels/flow to the SCADA system so that the water master can see the major flow in the system from the headquarters.

The flow measurement sites include:

- Flow to the main canal just downstream from the East Main turnout
- Flow to the East Main Canal (These first two provide the total inflow to the district)
- Flow at the downstream end of the main canal before water enters the Black River Reservoir
- Flow at the head of the Black River Canal
- Flow to approximately 16 lateral headings (These laterals serve the largest land areas and thus will deliver the largest amount of water. This is less than half the total number of laterals in the district.)

In addition to flow measurements, remote sites (water level sensors, RTU, and radios) will send canal water levels to the SCADA system at 11 sites. These include the water level upstream from the East Main Canal Heading, the water level in the Black River Reservoir, water levels at approximately 9 check gates within the main canal. Where possible, one RTU will monitor a canal water level sensor and a lateral flow measurement sensor.

4. New overshot gates (2) for water control

Overshot gates are commonly used to replace sluice gates because they are better for maintaining constant upstream water levels or for maintaining constant discharge. These gates are commercially available, however they are extremely expensive, and thus usually not an option for small districts. Dr. Blair Stringam from New Mexico State University and Tom Gill from the Bureau of Reclamation have been working on new designs for overshot gates and plans so that they can be manufactured by irrigation district employees. Dr. Stringam received a research grant from USDA to test his new designs. The grant includes materials for two of these gates, but since this is a Federal source is not included in this grant. The district will manufacture these gates and install them on their system. The location of these gates is yet to be determined. Automatic control of these gates will not be part of this grant, unless other sites described above prove to be less useful to the district.

5. GIS Inventory of District Structures

The district has started to determine the physical location of all their structures so that the can document the location of all their canals and structures, including all the small lateral canals and farm turnout. Since there has been significant urbanization, it has become difficult to locate all the small structures within the system. With this grant, the district will complete their GIS inventory of all structures. WEST consultants will put this data into a GIS system so that the district can access the data. This should help the district locate structures for maintenance and other activities.

6. Analysis of System losses

With the data collected by the SCADA system, the district will be able to analyze systems losses and identify the locations within the district where water diverted does not match water delivered to users. West Consultants with conduct a water-balance study with this data to determine possible sources of water losses. This study will consider the accuracy of measurements in determining the accuracy of these estimates, and whether they are statistically significant. These results will lead to future studies or activities to reduce these losses.

Evaluation Criteria

Evaluation Criteria A: Water Conservation

Subcriterion No. A.1- Water Conservation

Subcriterion No. A.1(a)-Quantifiable Water Savings

Average Annual Acre-feet of water supply = 60,700 ac-ft per year

Where is the water going: canal seepage, unaccounted for water delivery, unpredictable spills

Conserved water will remain in the reservoir

3. Irrigation Flow Measurement:

Table of Water losses (Loss = Diverted - Delivered)

Water Loss Analysis

Year	AcFt Delivered	AcFt Loss	% Loss
2007	56510	13250	23%
2008	50888	13205	26%
2009	46311	12224	26%
2010	49096	15395	31%
2011	34375	12333	36%
Total	237180	66407	28%

District outflow measurements (deliveries to users) are only 72% of project diversions. While there is some canal seepage, a substantial amount of water is improperly delivered to users. We expect that half of the losses are improper deliveries or spills. We expect that proper measurement will allow CID to capture almost half of that amount, or about 4,000 ac-ft (6.6%). Additional water may be saved, but may not be quantifiable (see Subcriteria No. A 1b, below).

Accuracy of existing flow measurement devices is very poor. Structures were improperly constructed and thus calibration accuracy is not known. No records exist on their construction and calibration. These are Parshall flumes and their basic measurements do not match any known Parshall flumes. Some flumes are cracking or are submerged. Measurement accuracy is likely less than ± 20%.

All new devices will meet the criteria of long-throated flumes as specified for calibration with WinFlume, the Bureau of Reclamation software. Accuracy should be roughly ±3-5%.

Project water saving will be verified by continuous monitoring of water deliveries. Discrepancies between water delivered to lateral canals and water charged to users will be identified.

4. SCADA and Automation:

District records indicate that water delivered to users is only 72% of water diversion.

ID does not have sufficient data to estimate operational losses. With the SCADA system in place, and new measuring devices, CID will simply monitor existing canal operations; and determine the ratio of delivered to diverted water. Then the new measuring devices and SCADA will be used to augment operations, and the same ratio determined. The difference will be conserved water.

Annual farm delivery volumes will be reduced as indicated above.

We know that canal seepage is an issue, but CID is not sure whether or not improved operations will reduce seepage substantially.

Subcriterion No. A.1(b)

The project will support improved water management through the use of improved water measurement devices and SCADA. About half of the water lost through poor regulation will be quantifiable and half will be considered better managed.

$$\frac{\text{Estimated amount of water better managed}}{\text{Average annual water supply}} = \frac{4500 \text{ ac-ft}}{60700 \text{ ac-ft}} = 7.4\%$$

Subcriterion No. A. -2 Percentage of total supply

$$\frac{\text{Estimated amount of water conserved}}{\text{Average annual water supply}} = \frac{4000 \text{ ac-ft}}{60700 \text{ ac-ft}} = 6.6\%$$

Subcriterion No.A.3-Reasonableness of costs

The design life for rebuilt concrete flumes is more than 30 years. The design life for SCADA systems is about 10 to 12 years. This is based on our experience with existing Irrigation Projects. Design life for remote terminal units (RTUs) is also about 10 to 12 years. Again this is based on our field experience. Design life for water level sensors is about 5 years. However, these are a small fraction of the total cost spent on this project (less than 5%). Design life for overshot gates is more than 20 years. This is based on our experience with existing structures that are still in service after 20 years. To be conservative, we use 10 years for the overall expected life.

$$\frac{\text{Total Project Cost}}{\text{Acre-Feet Conserved or Better Managed x Improvement Life}} = \frac{\$307{,}559}{85{,}000\ ac-ft}$$
$$= \$3.62 \text{ per ac-ft}$$

Evaluation Criteria B: Energy-Water Nexus-- not included in this project

Evaluation Criteria C: Benefits to Endangered Species- not included in this project

Evaluation Criteria D: Water Marketing -- Improved water management through the use of improved water measurement devices and SCADA will result in conserved surface water. Any additional conserved surface water can be used within the CID through increased water allotments and temporary or permanent water transfers to help meet demands during low water availability seasons or drought. This could also reduce the demand on supplemental ground water pumping for CID members with supplemental and ground water wells.

Evaluation Criteria E: Other Contributions to Water Supply Sustainability –Not included in this project.

Evaluation Criteria F: Implementation and Results— Not included in this project.

Evaluation Criteria G: Connection to Reclamation Project Activities – Not included in this project.

Environmental Compliance

1. The project will have no impact on the surrounding environment. Construction will be minor and entirely within district canals and right of way.

2. CID is not aware of any listed species in the areas affected by this project.

3. The Pecos River and Black River lie within the project boundaries. This project will not have any adverse impact on these water bodies.

4. 1907

5. This project will modify existing water measurement structures. Most of these are more than 40 years old.

6. CID does not know of any structures that are listed on the National Register of Historic Places.

7. There are no known archeological sites within the proposed construction sites.

8. The project will have no impact on low income or minority population.

9. The project will not limit access to have any impact on tribal lands.

10. The project will have no impact on noxious weeds or invasive species.

Required Permits or Approvals

No permits or approvals are required for this project.

Funding Plan and Letter of Commitment

A majority of the non-Reclamation costs will be borne by the Carlsbad Irrigation District. Additional funding will be contributed by Dr. Blair Stringam, New Mexico State University. Dr. Stringam will provide materials for the construction of 2 overshot gates, student labor ($10,000), and his time ($5,000). These are in-kind expenses and will be available once the project starts. There are no other constraints or contingencies.

Funding Plan

1. CID will provide labor to rebuild flumes, build and install gates, install remote monitoring sites, locate district structures with GIS, and provide input to the SCADA system. This is in addition to in-kind labor provided by New Mexico State University. CID will also pay for professional services (WEST Consultants) to redesign flumes, install initial monitoring sites, and install the SCADA system.

2. The district plans to continue development of the GIS inventory and will document water surface conditions at flumes to aid in flume design. This has to be done during the summer while water is running. Failure to document flume conditions this summer would delay the project. This cost is estimated at roughly $10,000.

3. n.a.

4. n.a.

5. n.a.

Summary of Non-Federal and Federal Funding Sources

Funding Source	Funding Amount
Non-Federal Entities	
1. Carlsbad Irrigation District	*$90,760 $48, 020
2. New Mexico State University	*$15,000
Non-Federal SubTotal	$153, 780
Other Federal Entities	$0
Requested Reclamation Funding	$153,779
Total Project Funding	$307,559

* In-Kind contributions

Official Resolution

Attached.

Budget Proposal

For each task in this project, the in-kind hours and cost of equipment and supplies is described in the paragraphs below. These cost are summarized in the attached table.

1. **Improvement in current water measurement structures**

The district will provide details on the conditions for each Parshall flume to WEST Consultants. West Consultants will redesign these flumes through a service contract, with an estimated cost of $20,000. The district will rebuild these structures with concrete to level the floors and smooth out the existing contraction. Estimated time required to rebuild these flumes is 40 man hours. Stilling wells will be installed for the water level sensors. The time for this task is estimated at 800 man hours for the district operation and maintenance staff (district workers). The district manager's time in overseeing this work is 10% of that time, or 80 hours.

2. SCADA System

The SCADA System will be installed by WEST Consultants through a service contract. The estimated cost of this contract is $45,000, which includes setting up the SCADA software, developing SCADA screen, and providing connections to field sites. Several district staff member, including the manager, will be operating the system. These district staff members will interact with WEST in developing the system, particularly the District manager, so that the system will serve their needs. They will also require training in order to become familiar with the system. The intent is to train the district staff so that they can install additional sites in the future without outside assistance. The time required for district workers is 200 man hours and 80 hours for the district manager.

3. Remote monitoring at key locations

WEST consultants will develop the procedure for the district in setting up remote monitoring sites, as part of the above contract. This includes setting up the field RTUs in the office. District staff will install as the monitoring equipment with help from NMSU students, when available. The total time require for district worker is estimated at 600 man hours, with 60 hours for the manager. Students and Dr. Stringam from NMSU will assist in this work, approximately 160 and 20 hours, respectively.

4. New overshot gates (2) for water control

Construction of new overshot gates is expected to take 300 hours for district workers with 220 hour of student help. Oversight by the district manager is 30 hours and by Dr. Stringam 40 hours.

5. GIS Inventory of District Structures

It is anticipated that there are more than several hundred district structures that need to be located and entered into a GIS system. Some have already been located. District workers will locate the remaining structure. NMSU students will create a GIS system for collecting and displaying this information. Time for district workers is estimated at 200 hour and student labor at 287 hours. Oversight by the district manager is 20 hours and by Dr. Stringham 24 hours.

6. Analysis of System losses

The analysis of water losses in the system will primarily be conducted by district staff. This will also include preparation of reports for Reclamation. Total time for this activity is estimated at 80 hours for district workers and 80n hours for the district manager.

Table of times

Employee	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Total
District workers	800	200	600	300	200	80	2180
District manager	80	80	60	30	20	80	350
NMSU student			160	220	287		667
NMSU Professor			20	40	24		83

Materials and Equipment

Materials are need for the modification of flumes and for the installation of the RTUs and equipment. The SCADA system costs include the SCADA software itself, the SCADA database, and a base station and radio to transmit to the remote sites. There are a variety of vendors and all have similar costs, but the details vary. This is a good estimate for the whole package. Similarly, the remote sites include; RTU, water level sensor, solar charger, radio, instrument

housing, etc. These costs also vary by manufacturer, but our experience suggest $4,500 per siteis a good estimate.

Item	Cost
Concrete 30 yards at $90/yd	$2,700
Forming materials 19 * $150	$2,875
Stilling well materials 25 * $200	$5,000
Electrical connections 25 * $50	$1,250
SCADA software and base station	$12,500
Remote monitoring sites 25 * $4,500	$112,500

Travel

No travel is budgeted under this proposal.

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January 18, 2012

Dudley Jones
Carlsbad Irrigation District

Re: Bureau of Reclamation Water Smart Grant

Dear Mr. Jones:

WEST Consultants, Inc. (WEST) is looking forward to working with the district on your Water Smart Water and Energy Efficiency Grant for 2012. We are encouraged that you plan to redesign you flow measurement structures and we plan to prepare new designs for you with WinFlume.

We are also excited about the possibility to install a new SCADA system for you so that you can remotely monitor water levels and flows within the district.

This looks like an exciting opportunity to improve your operations and save water, all at a nominal cost.

If I can provide any further information, please feel to contact me at (480) 345-2155 or bclemmens@westconsultants.com

Sincerely,

Bert Clemmens

Bert Clemmens, Ph.D., P.E., D.WRE
Senior Hydraulic Engineer

NM STATE UNIVERSITY

College of Agricultural, Consumer & Environmental Sciences
Plant & Environmental Sciences
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New Mexico State University
P.O. Box 30003
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To whom it may concern,

I am writing this letter to acknowledge my support to Carlsbad Irrigation district and WEST Consultants on this Water Conservation project. We plan to provide a student to work on this project throughout the summer to collect data and complete engineering field work. In addition we will be providing design drawings and parts so that Carlsbad Irrigation district will be able to construct and install safer more efficient overshot gates. I will also be contributing my time to assist in the installation of the overshot gates as well as assist the summer student and WEST Consultants in their work. The student's time will amount to about $10,000 and my time will come to about $5,000.

Sincerely,

Blair L. Stringam, PhD.

blairs@nmsu.edu
p. (575)646-7665

CARLSBAD IRRIGATION DISTRICT

CO-OPERATING WITH DEPARTMENT OF INTERIOR
25,055 ACRES UNDER IRRIGATION
5117 GRANDI ROAD • PHONE 575/236-6390
CARLSBAD, NEW MEXICO 88220
FAX 575/236-6396
EMail – cid@plateautel.net

DUDLEY C. JONES
MANAGER
SECRETARY/TREASURER
ASSESSOR/COLLECTOR

BOARD OF DIRECTORS
CHARLES H. JURVA, PRESIDENT
GARY WALTERSCHEID, VICE-PRESIDENT
RICHARD J. FORREST, DIRECTOR
JOHNNY L. REID, DIRECTOR
OSCAR F. VASQUEZ, DIRECTOR

Resolution 2012-1

A RESOLUTION ADDRESSING CRITERIA FOR THE WATERSMART GRANT FINANCIAL ASSISTANCE PROGRAM

WHEREAS, the Board of Directors for the Carlsbad Irrigation District (District) has applied for WaterSMART Grant Financial Assistance; and

WHEREAS, a requirement of the assistance application requires the Board to commit to the financial and legal obligations associated with receipt of WaterSMART Grant Financial Assistance;

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors for the Carlsbad Irrigation District, as follows:

Section 1. The Board hereby delegates authority to its President, Charles H. Jurva or Manager, Dudley C. Jones to enter into the agreement with the Bureau of Reclamation, if the District is awarded WaterSMART Grant Financial Assistance.

Section 2. The Board of Directors has reviewed and supports the WaterSMART Grant Financial Assistance application, as submitted by the Board on behalf of the District.

Section 3. The District has the capabilities to provide needed financial assistance and/or in-kind contributions, as specified in the District's application proposal.

Section 4. The Board, on behalf of the District, will work with the Department of the Interior's Bureau of Reclamation to meet deadlines established for entering into a cooperative agreement, if the District receives WaterSMART Grant Financial Assistance.

DATED this 10th day of January, 2012.

APPROVED BY:

Charles H. Jurva
President, Board of Directors

ATTEST:

Dudley C. Jones
Secretary/Treasurer, Carlsbad Irrigation District

Table Budget Proposal

Budget Item	$/Unit	Quantity	Recipient Funding	Reclamation Funding	Total
Salaries and wages					
District workers	$20.26/hr	2180	$44,167		$44,166
District manager	$37.98/hr	350	$13,293		$13,293
District Fringe benefits	36.7%		$33,300		$33,300
NMSU Student labor	$15/hr	667	$10,000		$10,000
NMSU Professor	$60/hr	83.3	$5,000		$5,000
Supplies					
Concrete	$90/yd	30	$2,700		$2,700
Forming materials	$150/site	19	$2,850		$2,850
Stilling well materials	$200/site	25	$5,000		$5,000
Electrical connections	$50/site	25	$1,250		$1,250
Equipment					
SCADA software and base station		1		$12,500	$12,500
Remote monitoring sites	$4,500/site	25		$112,500	$112,500
Contracts					
WEST Flume Design			$20,000		$20,000
WEST SCADA Deployment			$16,221	$28,779	$45,000
Total Project Costs					$307,559