

RECLAMATION

Managing Water in the West

TR-2014-08

Travel to Yuma Area Office

Travel to Yuma Area Office; Yuma Irrigation District: Welton-Mowhawk Irrigation District (all in Arizona) and the Desert Research and Extension Center (near Holtville CA) to provide technical assistance to YAO Water Conservation Field Services Program on multiple on-going projects

Date(s) of Travel: September 7 - 19, 2014



**U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Hydraulic Investigations and Laboratory Services Group
Denver, Colorado**

BUREAU OF RECLAMATION
Technical Service Center
Denver, Colorado

TRAVEL REPORT

Code: 85-846000

Date: October 9, 2014

To: Manager, Hydraulic Investigations and Laboratory Services Group
From: Tom Gill, Hydraulic Engineer

Subject: Travel to Yuma Area Office Service Area.
Travelers: Tom Gill, Bryan Heiner and Mario Pereira

- 1. Travel period:** 07 September – 19 September, 2014
- 2. Places or offices visited:** Yuma Area Office; Yuma Irrigation District: Welton-Mowhawk Irrigation District (all in Arizona) and the Desert Research and Extension Center (near Holtville CA)
- 3. Purpose of trip:** Provide technical assistance to YAO Water Conservation Field Services Program on multiple on-going projects.
- 4. Synopsis of trip:** Tom began travel the evening of Sunday, 09/07 via government owned vehicle. He was joined in Yuma the following evening by Bryan and Mario who flew into San Diego Monday and then proceeded to Yuma. Prior to leaving San Diego they picked up an installation track designed for retrievable installation of a Sontek ultrasonic flow meter. The track and a flow meter were to be installed at the head of the Yuma Irrigation District (YID) canal during the trip.

On Tuesday Tom, Bryan and Mario began a checkup of each of the seven level monitoring stations along the Gila Gravity Main Canal (GGMC). Tasks performed at each site include checking level sensor offsets to produce readings in elevation above sea level in agreement with a survey of bench mark elevations at each station that had recently been performed by the YAO engineering department. In addition, physical dimensions were obtained for canal features that Dale Lentz had identified as needed information for the numeric model that is being developed as part of the GGMC daily operations tool.

The checkup of sites was continued on Wednesday. At two of the sites – GGMC Flume and at the “Y” bifurcation – the solar panels had been vandalized, apparently having been hit by rocks. The damaged panel at the flume was still providing sufficient output to keep the battery charged, so it was left in place. The solar panel at the Y no longer functioning and was replaced with a new panel. [If vandalism of this nature recurs, armoring solar panel installations with steel plates may need to be considered.]

Communications issues were discovered with the Control Design Inc. CD100 radio/control unit at the YID office. Commands from the Control Design software installed on the PC linked to the CD100 were apparently being transmitted through the serial port on the CD100 modem. Attempts to communicate with the modem using a laptop in place of the office PC were unsuccessful. The CD100 was able to communicate with each of the field sites using the program loaded on the CD100 with keypad input. This confirmed that the modem itself was functioning. Automated data collection for the GGMC monitoring system is driven by the Control Design PC software.

On Thursday (09/11) the CD100 was replaced with a CD110 – the updated version of the Control Design RTU. The operating program for keypad-input initiated communication was loaded on the CD110 using the unit's I/O port. After the program was loaded, the CD110 was connected to the display and keypad that had been installed with the CD100. This apparently locked up the processor on the CD110 I/O board. Jim Conley of Control Design was scheduled to be in the Yuma area the following week so the base unit at YID was left temporarily out of service pending Jim's arrival.

Plans were made with YID to shut down flow in the YID canal Thursday evening for installation of the retrievable track system for the Sontek flow meter the following morning. A visit was made to the installation site late Thursday evening to ensure we would have all needed tools and supplies on hand to install the track on the following morning. While at the site, the water level was low enough became apparent that the dimensions that had been supplied to the manufacturer of the track were inaccurate and the track would need to be modified.

YID manager Rex Green was contacted to advise him that it would not be possible to go forward with the track installation the following morning. Rex suggested we meet at the site on Friday morning (with the water level dropped lower) to obtain dimensions of suitable accuracy to get the track modified for installation at a future date. Dimensions were obtained the following morning as per these arrangements. Following our meeting on-site, Rex searched through District records and found design drawings of the lined canal section on which dimensions agreed closely with the measurements that had just been taken.

Following the meeting at the YID office, Bryan and Mario departed en route to San Diego to return the track to the manufacturer for modification. Bryan returned to Denver. Mario proceeded to Las Vegas to start another project with Josh Mortensen. Tom returned to the head of the YID canal and installed an electrical enclosure with relays mounted in it in preparation for planned future automated (or remote operation) of the YID gate. During the weekend, Tom had the government owned vehicle serviced at the Ford dealership. New shock absorbers were installed and a new alternator was installed at this time.

On Monday and Tuesday of the following week (09/15 & 16) Tom worked at the DREC experiment farm on the automated surface irrigation project. A small trapezoidal flume had been installed during the previous trip to measure runoff from the first field section into the runoff collection canal. Panels were fabricated and installed across each end of the flume in order to calibrate the bubbler level sensor installed with the flume. Electronic signal levels corresponding to eight water levels were recorded to determine appropriate sensor slope and offset.

Also at DREC modifications were made to the previously assembled field advance sensor station. A new water sensing mechanism was assembled using brass cap screws with nuts and 1" PVC pipe fittings. A 12 Volt excitation is supplied through a wire connected to a brass screw installed in one side of the PVC pipe. A wire connected to the second brass screw is connected to current loop analog input port on the station RTU.

In testing, when the brass screws are submerged the current loop output was a value of approximately 25% of saturation (maximum) value. When the brass screws are raised above the water level the output immediately drops to near zero.

A second modification was to replace a 12 volt system battery and plug-in charge equipment with an 18 volt DeWalt cordless tool battery. The field advance sensor system was initially configured as a fixed location station with solar charging system. As the project has developed it became apparent that a portable station would be more practical and compatible with farming practices. A plug-in battery charging system was opted for in place of a solar charging system to reduce bulk and enhance portability (and to eliminate need to position the station in sunlight between irrigations). Plugging in the charger proved to be a task easily overlooked following an irrigation. Use of a cordless tool battery was seen as a means of increasing the likelihood that a charged battery would be available as an irrigation is being started.

On Wednesday and Thursday (09/17-18) Tom worked on a remote monitoring demonstration project at the Welton-Mohawk Irrigation District (WMID) and linkage of this project to the GGMC data collection network. Prior to a YAO visit in August (2014), Kenny Baughman of WMID had inquired whether Control Design equipment might be available for an evaluation of communications between the WMID office and a trash screen site approximately 18 miles from the office. During a previous visit during August 2014, Tom had accompanied WMID staff to view the remote site, a repeater site, along with a graphic of the direct line topography.

During the August visit, Tom left RTUs with WMID for a field demonstration, and contacted Jim Conley of Control Design to see if Jim could schedule travel to the Yuma area to set the equipment up. While Tom was working at DREC on Monday and Tuesday, Jim and the WMID staff had installed a base at the WMID office and a remote RTU at the trash screen site.

On Wednesday morning, Tom and Jim met at the YID office where Jim addressed and corrected problems with the CD110 installed the previous week. Tom and Jim proceeded to the WMID office to visit with Kenny Baughman about linking the base installed at WMID to the Gila Gravity Main monitoring network. From the WMID office in Welton, AZ, Tom and Jim traveled upstream along the WMID canal system to check radio signal strength using a mobile radio system in a vehicle. From the WMID #1 Pump Station, a strong contact signal was possible between the mobile unit and each the WMID office base and with the Imperial Dam location on the GGMC data collection network.

As initially set up, field measurements for the GGMC data collection network were polled by the YID base and stored on the base PC. From there it was designed to be available via internet linkage. Internet service to the YID office proved to be intermittent at best and remote access of

the GGMC data sporadic and unreliable. Following conversations with both Rex Green of YID and Kenny Baughman of WMID it was agreed to try shifting the data collection for the GGMC monitoring system from the YID office to the WMID office.

On Thursday (09/18) Tom and Jim Conley worked with the WMID staff to set up a repeater station for the Control Design equipment at the WMID pump station #1. This involved replacing a directional antenna installed at the WMID office base earlier in the week (as part of the performance evaluation demonstration with the WMID trash rack site) with an omni antenna in addition to installing an antenna system and an RTU at the pump station. As the repeater station was brought online, it became apparent that a noise source was causing significant disruption on the WMID licensed radio frequency that both the GGMC monitoring system was operating on as well as the WMID demonstration project were operating on. It was not apparent what the noise source might be, however activities at the nearby Yuma Proving Ground military facility may be a candidate source.

Jim Conley changed the radio signal frequency to one that his Control Design company is licensed to use nation-wide for demonstration purposes. Once the frequency had been changed a strong signal strength was observed for communications between the pump station and both the GGMC Imperial Dam station as well as with the WMID office base. Tom and Jim subsequently traveled to the rest of the GGMC stations as well as to the YID office base to set all radios to operate on the Control Design demonstration frequency for present operations. At most of the GGMC sites (and at the WMID trash rack site) Jim was able to reset the radio frequency via wireless communication as the Control Design demonstration frequency had been pre-loaded as an optional channel in most of the RTU units.

On Thursday afternoon, Tom began the drive back to Denver. On Friday, Jim Conley worked with Kenny Baughman to install a dedicated PC linked to the WMID base unit. Control Design software loaded on the PC is directing periodic polling and data retrieval from all system field sites. Retrieved data is written to the PC hard drive. Kenny Baughman will be setting up a link to make the data accessible to Reclamation via the internet.

5. Conclusions: Multiple items were accomplished during this trip. The WMID assessment demonstration project with the Control Design equipment is apparently working well. With the spread spectrum radio WMID was previously using, a repeater station was needed to establish a line-of-sight signal path around a mountain approximately midway between the office and the trash rack site in the field. Even with the repeater site, Kenny Baughman indicated that the success rate for radio transmissions was below 30%. With the Control Design equipment, radio communication between the WMID office and the trash rack is direct via a not-line-of sight pathway. During a 24 hour test period during which the field site was polled at 3 minute intervals operating on the Control Design demonstration radio frequency, success rate was 100%.

Shifting data collection for the GGMC monitoring system from the YID office to the WMID office may significantly improve remote access to this data. WMID is a considerably larger entity than YID and has an existing SCADA system with a highly capable technical staff that

maintains the system. More reliable internet service at WMID their staff resources with regard to technical capabilities and experience should both be key factors in improved remote data accessibility. Given the noise issues seen with the WMID licensed radio frequency, WMID indicated that they would look into getting a license for a frequency that had less interference in their location. While that is pending WMID will operate the data collection system on the Control Design demonstration frequency.

As other YAO Water Conservation related tasks are being wrapped up, greater focus will be placed on getting the South Gila (YID) turnout set up for automated (or remotely adjusted) operation. A key step in moving forward on this will be to get the Sontek flow meter installed and measured flows transmitted to the YID office. As per discussions with YID Manager Rex Green, it is planned to have the meter in operation for a period of time to allow YID to assess measurement reliability and achieve a level of comfort with performance prior to establishing automated operation or remote adjustment capability for the YID head gate.

The Automated Surface Irrigation project at DREC has been equipped with what is expected to be the final hardware modifications with the recent installation of the field runoff measurement station and updates made to the field advance sensing station. Remaining work for this project will focus on refining identification of appropriate target water volume to be applied to each field section and to simplify human-machine interactions for system operation.

6. Action correspondence initiated or required: Dr. Khaled Bali at DREC has indicated that early November would be a good target for irrigation testing with the Automated Surface Irrigation project. In contact with Rex Green of YID subsequent to this trip, a tentative schedule for installing the modified instrument track and Sontek flow meter has been set for a date to be determined during the last week of October. Kenny Baughman of WMID has indicated that he expects to have a system in place by 10/03/2014 to enable remote accessibility of data collected from the GGMC monitoring network via internet for Reclamation use.

7. Client feedback received: N/A

cc:

Charles McCaughey (YAO)

SIGNATURES AND SURNAMES FOR:

Travel to: Yuma Area Office service area

Dates of Travel: 7 – 19 September 2014

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