DEPARTMENT OF WATER

Service, Quality, Community

September 27, 2017

Irene Hoiby
Bureau of Reclamation
Financial Assistance Operations 84-27814
P.O. Box 25007
Denver, CO 80225

Subject: Agreement No. R16AP00113 Final Project Report & Closeout Documentation

Dear Ms. Hoiby,

The City of Big Bear Lake, Department of Water and Power (DWP) completed the Advanced Metering Infrastructure Program on March 23, 2017, prior to the June 30, 2017 project period end date. DWP submitted the final ASAP drawdown for this project on July 26, 2017. Reclamation's $300,000 Grant partially funded DWP's Advanced Metering Infrastructure Program. The completed project included the replacement of 5,000 manual read meters, some of which were 70 years old, with radio-read AMI meters that provide data on water usage every hour to DWP's office.

No equipment, real property, intangible, or intellectual property was obtained for the Advanced Metering Infrastructure Program, therefore there are no dispositions required or pending under 43 CFR 12.71, 12.72, 12.74, 12.932, 12.933, 12.934, 12.936 and/or 12.937. All materials acquired for the project by the DWP were used for the installation of the 5,000 meters and are in use, therefore no disposition of supplies is required under 43 CFR 12.73 and/or 43 CFR 12.935.

Attachments to this cover letter are as follows:

Final Project Report
SF – 425 Federal Financial Report
USBR Project Benefits Form
USBR Release of Claims Form

It has been a pleasure working with USBR on this project and we appreciate your assistance with this very important DWP project. Please let me know if you require additional information.

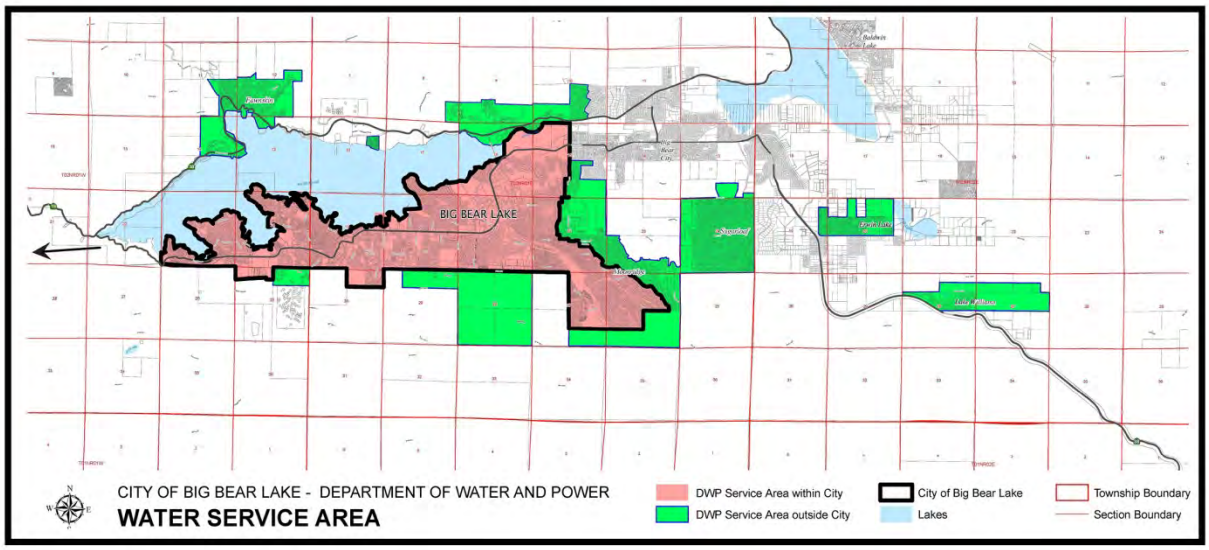
Respectfully,

Reginald A. Lamson
Recipient Project Manager
General Manager, DWP
(909) 866-5050 ext. 201

Advanced Metering Infrastructure Program

(5,000 various locations within DWP's service area)

Final Project Report



R16AP00113

City of Big Bear Lake, Department of Water and Power
41972 Garstin Drive / P.O. Box 1929
Big Bear Lake, Ca. 92315

September 27, 2017

1. **Recipient Information:**

Recipient Name:
City of Big Bear Lake, Department of Water and Power (DWP)
Reginald A. Lamson
P.O. Box 1929
Big Bear Lake, CA 92315
909-866-5050, Ext. 201
rlamson@bbldwp.com

Project Name: Advanced Metering Infrastructure Program

Assistance Agreement No.: R16AP0013

Date of Award: July 31, 2016

Estimated Completion Date: March 31, 2017

Actual Completion Date: March 23, 2017

2. **Final Funding Information:**	**Funding Amount:**
Non-Federal Entities: DWP	$721,522.82
Non-Federal Subtotal:	$721,522.82
Requested Reclamation Funding:	$300,000.00
Total Project Funding:	$1,021,522.82

3. **Project Summary:**

DWP began implementing the Advanced Metering Infrastructure Program in October of 2014. The Advanced Metering Infrastructure (AMI) Program's ultimate goal is to replace DWP's approximately 15,500 existing aging manual read meters with Sensus AMI meters and radios. DWP also is placing frost mats in each new AMI installation to prevent the new meter from freezing. The scope of this project is the five thousand meters and radios that were installed between July 1, 2015 and March 23, 2017. DWP staff installed and programmed the AMI installations, which saved the DWP rate payers over $200,000 in installation costs. DWP is requesting reimbursement for only AMI material costs. Labor costs are not included in the scope of this project.

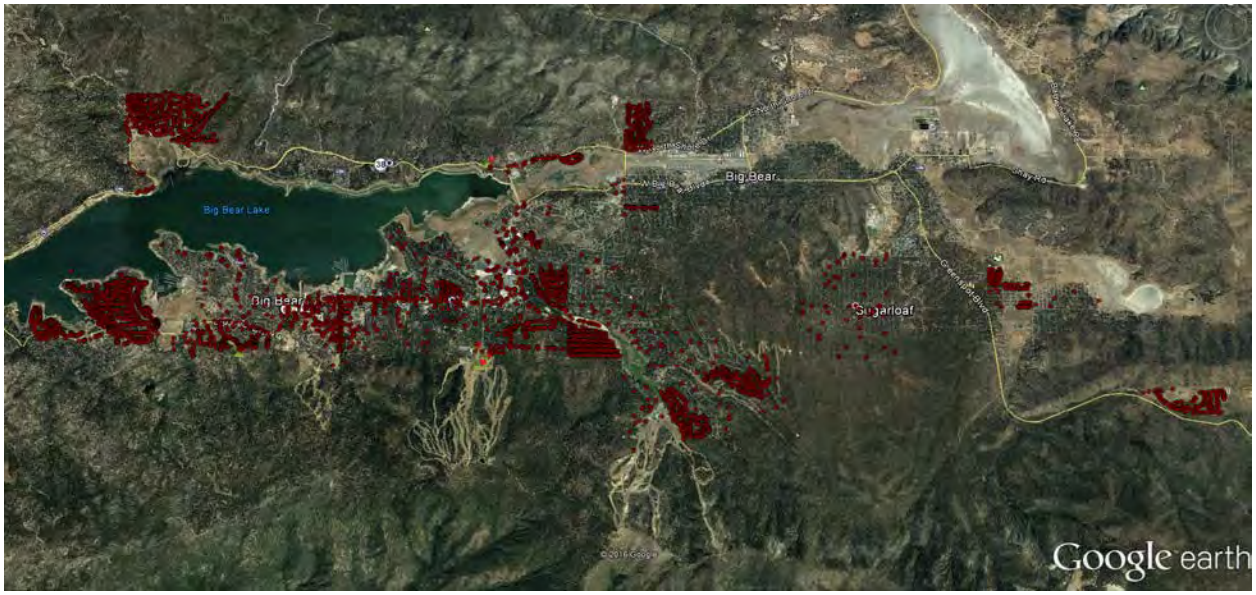
4. Final Project Description:

The DWP has approximately 15,500 meters within its service area. Some of the meters are over 70 years old. The typical warranty on a meter is 10 years on moving parts and 20 years on the meter body.

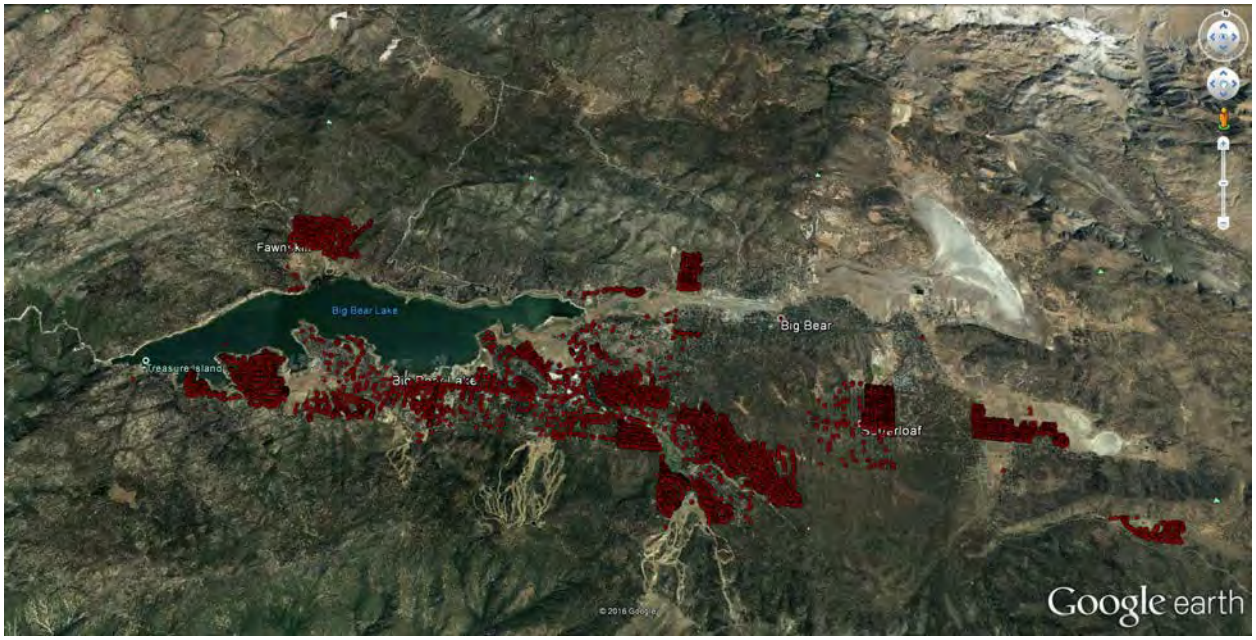
The DWP has completed random accuracy testing of the meters and found that of 60 meters tested, only five passed the 98% accuracy standard. Two of the 60 meters tested were not registering flow due to inoperable internal parts. Additional meter field testing found additional inoperable meters and DWP's staff estimated that there are potentially 540 such inoperable meters within the system. Because approximately 70% of the DWP's customers are part-time residents, it is not unusual for meters to have no usage for months or even years, so it is difficult to identify inoperable meters. Many of the inoperable meters were damaged due to freezing.

Based upon the water meter testing data from July 2014, the DWP's Board of Commissioners approved an AMI project to replace all of the meters in the system with new meters and radio read technology. The DWP evaluated five different meter manufacturers (eleven different meter models) and five different radio manufacturers. Each meter was tested for accuracy at low, medium, and high flow rates. Staff then filled each meter with water, capped the inlet and outlet and froze the meter for one to two hours and then thawed them out (light freeze). If the frost bottoms broke, they were repaired and then the meters were retested. If the meters tested 98% accurate or better, they were frozen a second time, for about 24 hours (hard freeze). Only the Sensus AccuSTREAM meters passed all of our testing and fortunately it was one of the least expensive meters, so it was selected. The Sensus 520M MXU radio and antenna can be mounted within the meter box, under the lid, and only requires two base stations (collectors), for the DWP's entire service area, to transmit real time meter information to the DWP's office. Because the Sensus 520M MXU radios do not need external antennas and only need two base stations to transmit meter information, the DWP selected the Sensus 520M MXU radio.

The map below depicts the AMI meter installations as of the time when DWP submitted its grant application to USBR in January of 2016.



The map below depicts the AMI meter installations when DWP completed installation of the 5,000 AMI meters, which were partially funded by the USBR grant, March of 2017. About 3,400 meters were installed between January of 2016 and March of 2017.



The primary benefit of the AMI system are better tracking of water system demands in real time to measure effects of conservation measures. By tracking real time data of water system demands, the DWP will be able to educate customers regarding water use, accelerate the identification of customer-side leaks, and identify other areas where additional conservation may be possible. The DWP is currently using the AMI system to improve the following areas of conservation:

- ***Leak Alerts*** – One very important benefit of improved data collection is the ability to identify customer leaks. AMI systems can detect two types of leaks. First, AMI software can be programmed to recognize large sustained increases in flow departing from normal use patterns. This is indicative of catastrophic customer water system failures. When this type of break is detected, home or business owners are notified in case they are away at work or out of town, allowing the customer and the DWP's staff to respond to the leak as quickly as possible. In Big Bear this is particularly important as many homeowners are not full time residents and the freezing conditions make homes more susceptible to ruptures from frozen pipes, potentially causing catastrophic property damage and significant water loss. A second type of leak that can be identified by the AMI system is recognizing when a small amount of flow is consistently being detected at the meter. This is indicative of a small leak somewhere in the home or business or between the meter and the building. In this case, the DWP can contact the customer to identify the issue and encourage the customer to investigate. In both cases, AMI can save water for the DWP and money for its customers. In addition, once a customer reports that a leak has been repaired, the AMI interface allows staff to confirm that fact. Knowing the amount of water that is being used also helps customers and their chosen contractors get an idea of where a leak may be originating.

- ***Time of Day Audits*** – Evapotranspiration is a calculated estimate of the water that evaporates from soil and plant surfaces and the water plants lose through their leaves. Evapotranspiration rates in this arid mountain region can be as high as 7.06 inches of water loss per month. To address evapotranspiration, in 2004 the City adopted an ordinance restricting outdoor irrigation to April through October and prohibited outdoor irrigation between 9:00 a.m. and 6:00 p.m. for all water users. The AMI system has the ability to provide notifications to the DWP when water uses indicate possible irrigation occurring during prohibited time frames. Violations are generally addressed with friendly visits and written reminders. However, the ordinance does allow the DWP to assess fines to chronic violators.

- ***Peak Use Data*** – With the DWP's new AMI system, it is possible to educate customers regarding peak usage. For example, the DWP is able to alert customers to key periods of high demand that may be indicative of water waste. By identifying peak demand periods, customers can be made aware of times of day or times of year when water is potentially being wasted.

- ***Water Audits*** - In addition to time of day and leak alerts, it is also possible to identify the largest users of water on a regular basis, as wells as peak instantaneous demand basis. The new AMI system will also be able to identify the highest users by peak day and peak hour. This may help identify users that have less efficient fixtures or sprinkler systems. For those users with excessive water use, the DWP provides information and resources to help in their efforts to save water.

- ***Expanded Public Education*** - The DWP has an extensive public education program that includes indoor water conservation surveys, outdoor water conservation surveys, a retrofit on change of service program, hospitality industry outreach, regular radio, turf buyback program, newspaper advertising, educational outreach to schools, and more. By referencing AMI data, the conservation department can show customers their peak usage times as well as historical or seasonal comparisons. With live data the DWP can modify marketing to notify the community if they are not meeting conservation targets and update them on their progress. The AMI system can further extend the potential for public education in the future through a web portal which is pending implementation. In the customer portal, customers will be able to view their own water use. This feature will be especially useful in handling the high rate of second and vacation rental homeowners as it allows them to actively monitor their water use. If they detect abnormal activity they can alert the DWP and request a courtesy turn off to immediately stop water waste until they identify the issue. Continued public education within DWP's service area is important because we have about 150 new customers every month, that need to be educated about water conservation in our arid mountain community.

- ***Drought and Water Emergency Measures*** - In addition to its efforts to achieve long-term water use reductions through conservation, the DWP also has a plan for reducing water consumption in times of drought or other water emergency (such as a line break). The DWP Water Shortage Contingency Plan includes the restriction of water use by large users, stricter enforcement of existing DWP conservation practices, voluntary reduction of water use, with mandatory reductions of water through enforcement as a last resort. The AMI system will be capable of quickly identifying large water users in the case of a water emergency and enforcing conservation restrictions if necessary.

- ***California Senate Bill No. 555 Compliance*** - California Senate Bill No. 555 requires each urban retail water supplier, on or before October 1, 2017, and on or before October 1 of each year thereafter, to submit a completed and validated annual water loss audit report. The addition of AMI, and project completion, will greatly assist the DWP in completing the annual audit.

Existing meter prior to AMI installation.

Installation of the Sensus AMI meter.

Programming new AMI radio to link the AMI installation to customer's account.

Completed AMI radio and meter installation. A protective frost pad is installed above the meter to help prevent freezing.

There were no changes to the AMI Program scope of work.

5. Accomplishment of Project Goals:

The main goal of the AMI Program was to reduce water waste associated with customer leaks through early detection, reducing customer usage through education with hourly usage data obtained from the AMI meter, measuring flow that was previously lost while flowing through an inoperable meter, and accurately measuring all customer usage with the new AMI meters. Also, DWP will reduce pumping power usage associated with reduced customer usage.

The DWP reads its residential meters every other month. During the winter months, many of DWP meters are covered with snow and cannot be read. DWP staff has to estimate customer usage and a leak can go undetected for months. The AMI meters send hourly usage information to DWP's office. If there is high or continuous usage, DWP staff receives an automatic notification and the potential leak is investigated within hours, instead of months.

With the hourly usage data mentioned above, DWP's staff creates graphs of the hourly data and uses the graphs to educate the customer. When the customers see the actual amount of water used and when it is being used, they tend to adjust their irrigation timers and reduce their usage. If a customer has continuous usage of 7.5 gallons per hour or more, DWP staff notifies the customer that they have a leak and the customer repairs it promptly.

Prior to implementing the AMI Program, DWP staff tested over 300 existing meters to verify their performance. Based on the test data, DWP estimates that the existing meters are under-registering usage by 3.3% and about 3% of the exiting meters had failed and were not registering any usage.

DWP estimated that early customer leak detection, customer usage education, and accurate meters would result in a significant reduction in customer water waste. As stated in Section 4.1.1 of DWP's grant application, we estimated that we would save about 34 AF per year (4.7% times 2,228 AF/year times 5,000 meters divided by 15,464 meters) or 11,000,000 gallons per year by installing 5,000 AMI meters.

After the AMI meters had been installed for a year, DWP evaluated usage data for about 20% of the 5,000 AMI meters. Usage data indicates that DWP's AMI customers have reduced their usage by at least 5.953%, which results in a reduction in customer water waste of 42.9 AF per year (5.953% times 2,228 AF/year times 5,000 meters divided by 15,464 meters) or 14,000,000 gallons per year, which exceeds DWP staff's original estimate. The reduction in customer water waste has resulted in a reduction in pumping power usage of 39,300 KWh per year (42.9 AF/year divided by 2,228 AF/year times 2,044,062KWh/year).

During January and February of 2017, Big Bear received significant snow fall.

DWP staff was not able to install AMI meters for about six weeks. DWP requested and was granted a project completion extension to June 30, 2017.

The original material cost estimate for the 5,000 AMI meter installations was $1,089,108. The actual material cost was $1,021,522.82, which was below the original estimate.

6. Discussion of the Amount of Water Conserved:

A. Recipient's Total Annual Average Water Supply: 2,228 AF/year

B. Amount of Water Conserved: 42.5 AF/year

C. Describe how 6.B was Calculated:

1) Data and Calculation of Project Benefits: In 2014 customer usage was very close to the five year usage average, so this is an appropriate base year to compare usage patterns. Between July 1, 2015 and December 31, 2015, about 1,500 AMI meters were installed in the Moonridge area and they were partially funded by the USBR grant. DWP staff then randomly selected about 1,000 of these meters to compare customer usage in 2014 (using conventional manual read existing meters) to customer usage in 2016 (using AMI meters). These customers used 49,874 CCF's in 2014 (measured with conventional meters) and 48,066 CCF's in 2016 (measured with AMI meters), a reduction of 3.625%.
DWP staff then randomly selected about 1,000 additional customers, also in the Moonridge area, to see what their usage was in 2014 and 2016. These customer meters have not been upgraded to AMI meters. These customers's usage in 2014 was 49,236 CCF's, which is very similar to the first test group. The two test groups had similar usage in 2014, which indicates that the two test groups have similar usage patterns. In 2016, the second test group (with conventional meters) used 50,382 CCF's, an increase of 2.328%. Comparing the AMI meter test group with the conventional meter test group, the AMI meter test group reduced their usage by 5.953% (3.625% + 2.328%) in 2016. DWP believes a large portion of this reduction is related to early leak detection.
On average, in 2016, DWP had about 6,000 AMI installations in service. DWP staff notified about 800 (about 13%) of these customers that they had a leak and staff followed up with the customers to ensure the leaks were repaired promptly. The 1,000 customer AMI test group above had 138 (about 13%) radio read detected leaks. So DWP believes that the 1,000 customer AMI test group is very representative of the average usage patterns of 5,000 customers who received AMI meters that were partially funded by the USBR grant.

2) Reliability of Data: The above computations do not take into account that the 1,000 customer AMI test group's 2014 usage was probably understated by 3.3% (the calculated average accuracy of the conventional meters that was determined during the DWP's 2014 meter testing). DWP did not include this in the calculations to be conservative.

3) Attach Relevant Data: Attached are two Excel spread sheets which include the customer usage data for the AMI meter test group and the conventional meter test group.

4) Use of Conserved Water: The conserved water remains in the Bear Valley's

aquifers for future use.

5) Future Tracking of Project Benefits: DWP will continue to track annual system wide usage, notify customers of AMI detected leaks, and educate customers about their water usage patterns.

7. Discussion of Renewable Energy Added: N/A

8. Describe how the Project Demonstrates Collaboration:

DWP staff has shared the above information with Sensus representatives and other water agencies. One of those agencies is now implementing an Advanced Metering Infrastructure Program. Also, DWP offered to share the two radio collector base stations with the other Bear Valley water purveyor, so they can economically convert their touch pad Sensus meter system into an AMI system.

9. Describe Other Pertinent Issues Regarding the Project:

DWP tracked the number of radio read detected leaks each month during 2016. On average, 1% of DWP's customers had a radio read detected leak in 2016. On average, 1% of DWP's customers discontinue service and new customers initiate service. So the educational benefits of the Advanced Metering Infrastructure Program will continue to be helpful in educating the new customers and identifying their leaks.

10. Feedback Regarding the WaterSMART Program:

DWP greatly appreciates the support that the 2016 WaterSMART Program provided our Advanced Metering Infrastructure Program and look forward to the support that the 2017 WaterSMART Program will provide. The Advanced Metering Infrastructure Program has exceeded DWP's expectations and will continue to benefit our customers for the foreseeable future. USBR's staff was great to work with and they accommodated our aggressive project schedule. USBR's staff always responded promptly, sometimes during weekends, early morning, and late evening. DWP looks forward to working with USBR's staff on 2017 WaterSMART projects.

11. Attachments:

A. AMI Meter 2014 – 2016 Test Data
B. Conventional Meter 2014 – 2016 Test Data
C. Summary of Eligible Materials Installed
D. Reconciliation of Eligible Materials to Installations
E. Meters Installed by Location