# FY2013 WaterSMART Water and Energy Efficiency Grants: Performance Measures

All WaterSMART Grant applicants are required to propose a method (or "performance measure") of quantifying the actual benefits of their project once it is completed. Actual benefits are defined as water actually conserved, marketed, or better managed, as a direct result of the project. A provision will be included in all assistance agreements with WaterSMART Grant recipients describing the performance measure and requiring the recipient to quantify the actual project benefits in their final report to Reclamation upon completion of the project. Quantifying project benefits is an important means to determine the relative effectiveness of various water management efforts, as well as the overall effectiveness of WaterSMART Grants.

The following information is intended to provide applicants with examples of some acceptable performance measures that may be used to estimate pre-project benefits and to verify post-project benefits upon completion. **However, the following is not intended to be an exclusive list of acceptable performance measures. Applicants are encouraged to propose alternatives to the measures listed below if another measure is more effective for the particular project.** Reclamation understands that, in some cases, baseline information may not be available, and that methods other than those suggested below may need to be employed. If an alternative performance measure is suggested, the applicant must provide information supporting the effectiveness of the proposed measure as applied to the proposed project.

## I.A.1. Performance Measure No. A.: Projects with Quantifiable Water Savings

The performance measures included below are examples that may be helpful in estimating pre-project benefits and to verify post-project water savings for projects that are expected to result in quantifiable and sustained water savings or improved water management.

## Performance Measure No. A.1.—Canal Lining/Piping

Canal lining or piping projects are implemented to decrease canal seepage and evaporation.

**The following information may be helpful in estimating the pre-project benefits and to verify the post-project benefits of canal lining and piping:**

***Pre-project estimations of baseline data:***

To calculate potential water savings, physical measurements of seepage losses are necessary. Two testing procedures which can be used are listed below:

- Ponding tests: Conduct ponding tests along canal reaches proposed for lining or piping. At least two tests, one early and one late season, are suggested since seepage rates vary significantly during the irrigation season. Multiple years of data are also suggested.

- Inflow/outflow testing: Measure water flowing in and out of the canal reach. At least two tests, one early and one late season, are suggested since seepage rates vary significantly during the irrigation season. Multiple years of data are also suggested.

If ponding or inflow/outflow tests cannot be performed, document the estimated historical seepage and evaporation rates for the canal reach based on soils/geology conditions, flow rates, weather information and historical knowledge. A discussion should be included on why ponding or inflow/outflow tests cannot be performed.

***Post-project methods for quantifying the benefits of canal lining or piping projects:***

- Using tests listed above, compare pre-project and post-project test results to calculate water savings. For canal lining projects, evaporation should be calculated based on weather data and then subtracted from the total loss measured by testing.

- If ponding or inflow/outflow tests cannot be performed, benefits can be calculated by comparing the estimated historical seepage and evaporation rates for the canal reach to the post project seepage and evaporation (documentation of proposed method of measuring or estimating post-project seepage and evaporation should be provided).

- Results can be verified using a ratio of historical diversion-delivery rates if adequate data exists. This type of verification should also include a comparison of historical canal efficiencies and current canal efficiencies. For example, if an irrigation district needs to divert 6 acre-feet of water to deliver 2 acre-feet of water to a field through an unlined or unpiped canal, this would be a 33-percent efficiency ([100%-(2 acre-feet/6 acre-feet *100)]=33% efficiency). If after lining or piping the canal, the irrigation district only needs to divert 4 acre-feet of water to deliver the 2 acre-feet; this would be a 17-percent improvement in efficiency ([100%-(2 acre-feet/4 acre-feet *100)]=50% efficiency).

- Record reduction in water purchases by shareholders and compare to historical water purchases. Use of this method would require consideration and explanation of other potential reasons for decreased water purchases.

For more information regarding canal seepage monitoring and verification, visit <http://www.usbr.gov/pmts/hydraulics_lab/pubs/wmm>

## Performance Measure No. A.2.—Measuring Devices

Good water management requires accurate and timely water measurement at appropriate locations throughout a conveyance system. This includes irrigation delivery systems and municipal distribution systems.

### *Measuring Devices: a. Municipal Metering*

**For projects that install or replace existing municipal meters, the applicant should consider the following**:

- Whether the project includes new meters where none existed previously or replaces existing meters.

- Whether the project includes individual water user meters, main line meters, or both.

- If the project replaces existing meters with new meters, whether new technologies (automatic meter reading/ information) will be employed.

- If main line meters are included, whether system leak detection may be improved.

Include a description of both pre and post-project rate structuring.

**The following information about municipal meter installation and replacement may be helpful in estimating the pre-project benefits and to verify post-project benefits:**

- Municipal water delivery meters are typically installed for each water user as well as at locations to measure production and/or supply and storage. Accurate measurement allows for demands assessment, customer billing, diagnostic testing, locating and quantifying leakage, and other management needs.

- Significant water savings can be achieved when meters are installed where none existed previously. In the case of individual water user metering, most customers use significantly less water when billed at a usage rate; and especially so when a tiered rate is applied (i.e.., higher rates for higher use). Installing new meters within the distribution system can also result in savings through improved leak detection/correction. Replacing existing meters can also result in water savings when new technologies are employed. For example, automatic meter reading/information (AMR/AMI) devices provide real time measurement to the operator and, in some cases, to the customer as well. This allows for improved management by the operator and more conscientious use by the customer.

- Quantifying savings associated with meter installation and/or replacement requires analysis of pre- and post-installation measurements from existing meters at strategic locations within the system. If the installing meters will result in conserved water, please provide support for this determination (including, but not limited to, studies and previous projects). A logical scheme should be developed that compares before and after installation flow quantities and that accounts for leakage and other considerations. The site-specific water savings verification plan should be as detailed as possible and clearly state all assumptions and the relative level of accuracy expected. In addition, please provide details underlying any assumptions being made in support of water savings estimates (e.g., residential users will reduce use once a more advanced billing structure is imposed).

### *Measuring Devices: b. Irrigation Metering*

Installing measuring devices may include, but is not limited to, the following:

- Flow meters (current or acoustic)
- Weirs
- Flumes
- Meter gates
- Submerged orifices
- Potential benefits from improved irrigation delivery system measurement include:
- Quantification of system losses between measurement locations
- Quantification of wasteway flows
- Accurate billing of customers for the actual amount of water delivered
- Facilitation of accurate and equitable distribution of water within a district
- Allow for implementation of future system improvements such as seepage reduction, remote flow monitoring and canal operation automation projects

**The following performance measures may be helpful in estimating the pre-project benefits and to verify the post-project benefits of improved irrigation delivery system measurement:**

***Pre-project estimations of baseline data:***

- Pre-project flows are difficult to estimate without a measuring device in place. However, the applicant may be able to use data from measurement devices located elsewhere in the delivery system (if available). Otherwise, the applicant may have to rely on other historical data and/or estimates based on soils/geology, flow data, and weather data.

***Post-project methods for quantifying the benefits of projects to install measuring devices:***

- Compare post-project water measurement (deliveries or consumption) data to pre-project water uses

- Compare pre-project and post-project consumptive use by crop via remote-sensing information—taking into account cropping patterns, irrigation methods, crop rotations, climatic variables, etc.

- Survey users to determine utility of the devices for decision making

- Document the benefits of any rate structure changes made possible by the installation of measuring devices (e.g., if districts that convert from nonmetered to metered are able to convert from billing water users at a flat rate to billing for actual water use using a volumetric or tiered water pricing structure)

## Performance Measure No. A.3.—SCADA and Geographic Information Systems (GIS)

Proposals may involve the installing or expanding a SCADA or combined SCADA/ GIS system that monitors flows in an individual district or in a basin including several districts. SCADA systems provide water managers with real-time data on the flow and volume of water at key points along a water delivery system Access to such data allows water managers to make accurate and timely deliveries of water, reducing over-deliveries and spillage at the end of the canal. SCADA/GIS systems can provide water users with real time delivery data to promote improved on-farm efficiencies.

**For projects that install or expand a SCADA and/or GIS system, the applicant should consider the following:**

- How SCADA or SCADA/GIS implementation will differ from pre-project operations in terms of how improved data availability will be incorporated into daily operational decisions.

- How will the SCADA or SCADA/GIS systems be maintained once implemented? Discuss balance of in-house expertise anticipated vs. reliance on third party service provider(s).

- The projected opportunities for improved operational efficiencies that could be realized through implementation of a SCADA or SCADA/GIS system (e.g., improved delivery equity, improved response to unanticipated events, reduced administrative spillage, enhanced productivity of human resources).

- The response process for SCADA or SCADA/GIS failures/outages.

**The following performance measures may be helpful in estimating the pre-project benefits and to verify post-project benefits of installing a SCADA or SCADA/GIS system:**

***Pre-project estimations of baseline data**:*

- Collect data on diversions and deliveries to water users, making estimates if necessary

- Document employee pre-project time spent on ditch/canal monitoring and water control

***Post-project methods for quantifying benefits of SCADA or SCADA/GIS system projects:***

- Calculate amount of increased carryover storage in associated reservoirs. This is a long-term measure which will be more meaningful over a period of years.

- Track and record the diversions to water users and compare to pre-project diversions. This would show results of improved management if yearly fluctuations in weather are accounted for.

- Report delivery improvements (e.g., changes in supply, duration, or frequency that are available to end users because of SCADA/GIS).

- Document other benefits such as less mileage by operators on dusty roads (which saves time and influences air quality) and less damage to canal banks.

## Performance Measure No. A.4.—Automation

Proposals may include system automaton projects aimed at *preventing* spillage from canals, or drainage capture/reuse projects focused on *intercepting* spills and redirecting them to drains, canals, or reregulation reservoirs for reuse.

**For projects that automate a system, the applicant should consider the following:**

- The rationale of long-term automation plans (e.g., system-wide project vs. incremental implementation).

- Whether automation at given sites will result in heightened operational issues in other parts of the system (e.g., passing of supply/demand mismatches downstream).

- How automation technologies will be maintained (e.g., discuss balance of in-house expertise anticipated vs. reliance on third party service provider[s]).

- The anticipated net benefits of implementing an automation project.

**The following performance measures may be helpful in estimating the pre-project benefits and to verify post-project benefits of automating a system:**

***Pre-project estimations of baseline data:***

- Establish baseline data by measuring existing spillage or document historical spillage. A rated measuring device should be positioned to measure spillage losses. To account for temporal variations, a minimum of a one-year history of pre-project measurements is desirable for future comparison to post-project water usage. Spillage volumes can vary substantially between wet and dry years; therefore, some multiyear estimates of spillage may be necessary.

- Track pre-project water diversions using district or State diversion records.

***Post-project methods for quantifying benefits of spillage reduction projects:***

- Using rated devices, measure post-project flows. Gather enough data to account for seasonal and temporal variations. Using baseline and post-project data, calculate savings using the following calculation: Savings = (Spillage without project) **–** (Spillage with project).

- Track post-project changes in the amount of water diverted and compare to pre-project diversion data.

- Compare estimated historical spills from district/project boundaries to post-project spills.

- Document how the additional water resulting from the reduction in spillage was used (e.g., water retained in the river to support riparian habitat, transferred for another use, or used to meet normal water demands in times of drought).

- Report specific volume changes to spills, diversions, or deliveries due to system automation.

For more information regarding canal seepage monitoring and verification, visit <www.agwatercouncil.org/images/stories/monitoring_and_verification_canal_seepage.pdf>

## Performance Measure No. A.5.—Groundwater Recharge (Conjunctive Use)

Some districts are implementing programs regarding groundwater banking to control water quantity and quality issues.

**For projects that implement groundwater recharge, the applicant should consider the following:**

- Rules regulating groundwater deposits and withdrawals including production limits
- The aquifer being recharged and source of recharge water
- The availability and timing of surface water for recharge to the groundwater
- Recoverability of recharged water (e.g., how much can be recovered, where it can be recovered, who can recover it, who benefits from the recharged waters)
- The energy usage involved in the recharge and recovery of recharged water
- Pricing incentives for users to use conjunctive use of water supplies
- The cost to treat the recovered water and the cost to operate/maintain the facility

**The following performance measures may be helpful in estimating the pre-project benefits and to verify the post-project benefits of groundwater recharge:**

***Pre-project estimations of baseline data:***

- Establish a baseline with historical data from existing wells, including pumping volumes (i.e., amount, duration, and timing) and depth to groundwater elevations

- Document streamflows and spring discharges

***Post-project methods for quantifying the benefits of groundwater banking projects:***

- Compare pre-project and post-project recharge and/or pumping volumes

- Compare pre-project and post-project changes (i.e., amount, duration, and timing) in affected streamflows or in spring discharge related to groundwater banking

- Compare pre-project and post-project depth to groundwater elevations

- Determine changes in net groundwater use through a water table-specific yield method coupled with a detailed sub-basin hydrologic balance

## Performance Measure No. A.6.—Irrigation Drainage Reuse Projects

Drain water reuse can be a district level or regional conservation effort that consists of recovering residual irrigation water from drains and returning it to the water supply system for delivery to users.

Several types of projects can focus on drainage and reuse, including:

- Pump stations with constant flow rates

- Variable speed pump stations without SCADA controls

- Variable pump stations with SCADA controls

- Storage reservoirs with pump stations and constant flow rate

- Storage reservoirs with variable speed pump stations and SCADA controls

**The following performance measures may be helpful in estimating the pre-project benefits and to verify the post-project benefits of drainage reuse projects:**

***Pre-project estimations of baseline data:***

- A rated measuring device should be positioned to measure drain water losses.

- To account for temporal variations, a minimum of a one-year history of pre-project measurements is desirable for future comparison to post-project water usage.

- Drainage volumes can vary substantially between wet and dry years; therefore, some multiyear measurements of drain water losses may be necessary.

***Post-project methods for quantifying benefits of drainage reuse projects:***

- Using rated devices, measure post-project flows.

- Gather enough data to account for seasonal and temporal variations.

- Using baseline data and post-project data, calculate savings using the following calculation:

    Savings = ([Drainage without project] –[Drainage with project]) + ([Spillage without project] –[Spillage with project]).

- Take readings from measuring devices positioned to measure drain water loss. A system analysis can be done with the following calculation:

    Drainage with project = (1 - %Reuse)*Drainage without project

- Measure and record post-project water deliveries to fields, tailwater volumes entering reservoirs and tailwater volumes recycled to fields. Compare these data to historical data.

- Survey farmers and estimate any benefits to farmers, such as improved flexibility in water management, reduction in shortages of supply to tailenders, etc. If it is not possible to quantify these benefits in acre-feet, a narrative explanation is acceptable.

For more information regarding drainage reuse monitoring and verification, visit <www.usbr.gov/pmts/hydraulics_lab/pubs/wmm/>.

## Performance Measure No. A.7.—Landscape Irrigation Measures

Municipal water providers can promote savings in outdoor water use by encouraging turf removal and installation of Smart irrigation controllers and high-efficiency irrigation nozzles (sprinkler heads). This is typically accomplished through rebate or direct installation programs.

### *Landscape Irrigation Measures: a. Turf Removal*

For turf removal projects, the applicant should consider the total estimated quantity of turf to be removed and the estimated historical annual average quantity of water applied per unit area of turf. The product of these provides the estimated water savings.

***Pre-project estimations of baseline data:***

The historical average amount of water applied for turf irrigation should be estimated based on actual water consumption data or weather-based theoretical irrigation requirement estimates. Potential methods include the following:

- **Dedicated meter data.** Municipal water delivery entities often have users where dedicated irrigation meters exist (e.g., parks, home owners associations, and golf courses). If so, metered water use can be divided by the irrigated area to calculate the average annual irrigation rate per unit area of turf. The greater the number of years of data used, the better the averages should be with regard to varying weather conditions. Also, when using this information, consider that parks and golf courses irrigation is typically more efficient relative to residential irrigation, so the actual turf removal savings for all types of users would be expected to be higher than for the average for these.

- **Winter/summer use data.** In the absence of dedicated irrigation meter data and in areas where irrigation ceases during winter months, an analysis of summer versus winter use data can be performed to estimate irrigation use. This can be performed for a sample of users and combined with an estimate of the total area irrigated and an average turf irrigation rate can be calculated.

- **Theoretical irrigation requirement.** In areas where winter irrigation occurs and dedicated irrigation meter data are not available, weather data can be used to estimate theoretical irrigation demand. These calculations consider reference evapotranspiration (ET) values from local weather stations, a crop coefficient for the type of grass, and an assumed average irrigation efficiency rate.

- **Assumed domestic use rate.** An alternative method for calculating theoretical irrigation demand uses assumed domestic (indoor) water use rates that are subtracted from total use. Domestic water use can be estimated based on household size and an assumed per person indoor usage rate. The age of the community and existence of high-efficiency appliances and fixtures should be considered in the per person domestic use rate.

***Post-project methods for quantifying benefits of drainage reuse projects:***

- Site audits should be performed to measure the amount of turf removed at each location.

- Preliminary estimated water savings for each site should be calculated as the product of the annual average turf irrigation application rate estimate established pre-project and the area of turf removed.

- Before and after water consumption data for each site should be evaluated using at least one-year of post project data. Weather conditions for the pre- and post-project data evaluation periods should be considered and adjustments should be made if conditions were significantly different for the pre- and post-periods. The best measure to use for this is the theoretical net irrigation requirement that can be calculated from local weather station data. The annual or irrigation season net irrigation requirement is calculated as the difference in the total ET for the period and the total effective precipitation for the period.

- The project total savings should be calculated by summation of the individual site savings.

### *Landscape Irrigation Measures: b. Smart Irrigation Controllers*

A Smart irrigation controller automatically adjusts the amount of water applied to landscaped areas based on weather or soil moisture conditions. Weather based controllers receive weather information from either onsite sensors or from remote weather stations via radio, pager or Internet signals. Soil moisture based controllers receive soil moisture information from one or more onsite sensors. With Smart controllers, watering is limited to replacing of only the moisture that the landscape lost due to ET since the last irrigation.

**The following performance measures may be helpful in estimating the pre-project benefits and to verify the post-project benefits of installing Smart controllers:**

***Pre-project estimations of baseline data:***

The historical average annual amount of water applied for landscape irrigation for each project site should be estimated based on actual water consumption data or weather-based theoretical irrigation requirement estimates. Suggested methods include the following:

- Site audits should be conducted at each location within the project to measure landscape area and estimate the irrigation system's efficiency. Site audit-based recommendations for system efficiency improvement are strongly recommended.

- Unless a dedicated irrigation meter exists, the historical average annual landscape irrigation rate per unit area should be estimated using one of methods discussed under turf removal (i.e., dedicated meter data, winter/summer use data, theoretical irrigation requirement, or assumed domestic use rate).

- The total annual average water irrigation amount for each site should be calculated as the product of the landscape area and annual average application rate, and these should be summed for the project total.

- A preliminary water savings estimate can be calculated by applying an average water use reduction factor for the Smart controller being installed (as reported by the manufacturer and/or from published water savings study findings).

***Post-project suggested methods for quantifying benefits of ET controllers:***

Total project water savings can be estimated as the difference in annual pre- and post-project total metered water use or the difference in estimated annual outdoor water use. For the latter, irrigation use should be calculated at each site based on pre- and post-project meter data using the methods described under turf removal. Regardless of whether total metered usage or estimated outdoor use is used, weather conditions during the data periods should be considered (as also discussed under turf removal).

- Compare annual meter reading totals or estimated outdoor use prior to ET controller installation and post installation for each site and sum all for project total.

- If results are required earlier, the calculations can also be performed one a monthly time-step.

General information on Smart controllers and water savings studies can be found under "reports" at <www.usbr.gov/waterconservation/publications.html>.

### *Landscape Irrigation Measures: c. High-Efficiency Nozzles*

High-efficiency landscape irrigation nozzles (sprinkler heads) apply water more uniformly and at a lower rate relative to conventional pop-up type nozzles. This reduces runoff and improves the overall efficiency of the irrigation system to yield water savings.

***Pre-project estimations of baseline data***

Total irrigation water use for the project should be estimated using the same methods described above for turf removal and Smart controllers. Then a preliminary water savings estimates can be calculated using manufacturer data on reduced application rates relative to typical pop-up type nozzles.

***Post-project suggested methods for quantifying benefits of ET controllers:***

Site audits should be conducted to verify correct installation and water savings can be verified using the same methods as described above for Smart controllers (i.e., pre-project minus post-project total use or irrigation use from meter data). Site audits should include evaluation of irrigation system operation to verify adjustments have been made to compensate for the new nozzles.

## I.A.2. Performance Measure No. B.: Projects with Quantifiable Energy Savings

The performance measures included below are examples that may be helpful in estimating pre-project benefits and post-project energy savings for projects that are expected to increase the use of renewable energy sources in the management and delivery of water and/or are upgrading existing water management facilities resulting in quantifiable and sustained energy savings.

Energy efficiency projects are intended to increase the use of renewable energy and increase overall energy efficiency in the management and delivery of water. Applicants should address the following subsections as part of the performance measures they submit with their applications.

### Performance Measure No. B.1.—Implementation of Renewable Energy Improvements Related to Water Management and Delivery

- Explain the methodology used for quantifying the energy generated from the renewable energy system
- Explain the methodology for calculating the quantity of energy savings resulting from the activity
- Explain anticipated cost savings for the project
- Include an estimate of energy conserved

### Performance Measure No. B.2.—Increasing Energy Efficiency in Water Management

- Explain the methodology for calculating the quantity of energy savings resulting from the water management improvements or water conservation improvements
- Explain anticipated cost savings

## I.A.3. Performance Measure No. C.: Projects that Benefit Endangered Species and/or Critical Habitat

**For projects that benefit federally listed species (threatened or endangered), federally recognized candidate species, or designated critical habitat that are affected by a Reclamation facility, the applicant should consider the following:**

- The methodology used for determining the recovery rate of the threatened and/or candidate species
- How their projects will address designated critical habitats, including acres covered, species present, and how the water savings or transfers are expected to benefit the habitat(s)
- Unavoidable negative impacts to endangered, threatened, or candidate species and/or the critical habitat(s)

## I.A.4. Performance Measure No. D.: Projects that Establish a Water Market

Water marketing is the temporary or long-term transfer of the right to use water from one user to another, by sale, lease, or other form of exchange, as allowed under State laws. Water marketing is a method of moving water supplies to areas of greatest financial value and can be a useful mechanism to increase the beneficial use of existing water supplies. Depending on the State laws, there are various methods in which a seller can make water available for transfer.

Examples include:

- Groundwater substitution is one method in which a seller uses their groundwater resources in-lieu of receiving surface water. This frees up the surface water for transfer.

- Crop idling or shifting, whereby sellers agree to idle fields or shift from higher to lower water using crops, can make water available for transfer. The seller is then able to transfer water based on the difference in crop consumption that is realized from the idling or shifting.

- Conserved water made available through canal modernization or other conservation projects may also be available for transfer, depending on State laws.

To identify other methods that can be used by a seller to transfer water, consult State law.

**For projects that implement or use water markets to make water available to meet other existing water supply needs or uses (e.g., agricultural, municipal, or dedication to instream flows), the applicant.should consider the following performance measures that may be helpful in estimating pre-project benefits and to verify post-project benefits:**

***Pre-project estimations of baseline data:***

Collect pre-project monthly groundwater pumping, water consumption, water quality, diversion, and cropping information, using measuring devices and/or historical data.

***Post-project methods for quantifying benefits of water marketing projects include the following performance measures.***

## Performance Measure No. D.1.—Groundwater Substitution Transfers

- Track monthly diversions, by year and type of use (e.g., agriculture, municipal, environmental, etc.), for both the buyer and seller of the marketed water and compare to pre-project diversions.

- For all wells used in the transfer, track monthly groundwater pumping, by year and type of use and compare to pre-project pumping volumes. This should be done with inline flowmeters.

- Track groundwater levels in area to ensure that the aquifer is not being depleted or harmed.

- Provide a map indicating location of groundwater wells and all features of the underlying aquifer to ensure that the groundwater is not impacting streamflows.

- Compare post-project groundwater pumping costs, including capital and O&M costs, to pre-project costs.

## Performance Measure No. D.2.—Crop Shifting or Idling Transfers

- Track monthly diversions by year, type of use and/or crop, and before and after project implementation for both the buyer and seller of the marketed water.

- Compare cropping records by year and crop type and compare pre-project and post-project records for seller of the marketed water.

- Devise a field monitoring procedure to verify that fields remain fallowed.

- Use remote-sensing technology to verify fallowed fields, crop water consumption, and uniformity of crop water consumption on seller(s)' fields.

## Performance Measure No. D.3.—Other Transfers

- Compare pre-water market streamflow measurements with streamflow measurements during the water market period.

- Compare pre- and post-water market effects in terms of the length of the irrigation season. Determine whether or not water marketing helped extend the irrigation season.

- Compare pre- and post-water balances that are associated with the seller(s)' transfer where the differences were used or stored. The water balance should include all water supplies, uses, and losses associated with the water that was transferred.

- Measure the benefits resulting from the application of the transferred water. For example, state how many acres were irrigated that could not otherwise have been irrigated or whether the transfer had environmental benefits, such as providing flows for endangered fish or aquatic species or maintaining wetland areas.

- Compare pre-water market stream water quality measurements with measurements during the water market period. This may include pre/post changes in water temperature during critical months, pathogens, bacteria count, etc.

- Document local economic impacts of the transfer.