Gary Woodard - Water Resources Consulting

Water Efficiency Audits for HOA Common Areas and Other Irrigation Customers

Tucson AMA
**Program/Project Title:** Water Efficiency Audits for HOA Common Areas and Other Irrigation Customers

**Brief Description:** Hundreds of commercial and institutional water audits conducted for Tucson and Scottsdale reveal that one-quarter of the sites with irrigation meters have substantial hidden leaks. This project will use monthly and hourly billing data and remote sensing data, including infrared and LIDAR, to identify irrigation meter customers with suspiciously high water use. These customers will be offered water efficiency audits to confirm, measure, and locate leaks, and to flag inefficient irrigation scheduling.

**Type of Program or Project:**
- [ ] Water Innovation & Technology
- [x] Infrastructure Water Efficiency
- [ ] Ecological Enhancement
- [ ] Public Outreach & Engagement

**Your level of commitment to maintenance of project benefits and capital improvements:**
- [ ] < 5 years
- [ ] 5-10 years
- [x] 11-15 years
- [ ] 16-20 years

**Applicant Information:**

<table>
<thead>
<tr>
<th>Name/Organization</th>
<th>Gary Woodard, Water Res Consulting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>1415 East Lind Road</td>
</tr>
<tr>
<td>City</td>
<td>Tucson</td>
</tr>
<tr>
<td>State</td>
<td>AZ</td>
</tr>
<tr>
<td>ZIP Code</td>
<td>85719</td>
</tr>
<tr>
<td>Phone</td>
<td>520-850-4249</td>
</tr>
<tr>
<td>Tax ID No.:</td>
<td></td>
</tr>
</tbody>
</table>

**AMA:**
- [ ] Phoenix
- [x] Tucson
- [ ] Prescott
- [ ] Pinal
- [ ] Santa Cruz

If the project is located outside of an AMA, it is not eligible for funding.

**Contact Person:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Gary Woodard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Principal</td>
</tr>
<tr>
<td>Phone</td>
<td>520-850-4249</td>
</tr>
<tr>
<td>e-mail</td>
<td><a href="mailto:Gary@GaryWoodard.com">Gary@GaryWoodard.com</a></td>
</tr>
</tbody>
</table>

**Does this project meet any of our priority criteria? If so, which?**
- [x] Additional contribution
- [ ] Innovative qualities
- [x] Demonstrate high impact
- [x] Demonstrate multiple benefits

**Water Management Assistance Program Grant Amount Requested:**

$75,234

**Additional Contribution Obtained and Secured:**

<table>
<thead>
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<th>Applicant/Agency/Organization</th>
<th>Amount ($)</th>
</tr>
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<tbody>
<tr>
<td>1. Applicant</td>
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<tr>
<td>2. Tucson Water</td>
<td>$???? + in kind</td>
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<td>3. CAGRD</td>
<td>$2,000 + in kind</td>
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<td>4. Comm. Water Green Valley</td>
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<td>5. Green Valley Council</td>
<td>In kind</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>$2,000 + in kind</strong></td>
</tr>
</tbody>
</table>

**Signature of the undersigned certifies understanding and compliance with all terms, conditions and specifications in the application. Additionally, signature certifies that all information provided by the applicant is true and accurate. The undersigned acknowledges that intentional presentation of any false or fraudulent information, or knowingly concealing a material fact regarding this application is subject to criminal penalties as provided in A.R.S. Title 13. The ADWR Director may approve Grant Awards with modifications to scope items, methodology, schedule, final products and/or budget.**
Project Map
APPENDIX 1. PROJECT MAP

The project will be located entirely within municipal water services areas in the Tucson Active Management Area. See map below.

The locations of HOAs and other irrigation customers that will be audited are currently unknown. As per ADWR instructions, the GIS coordinates of the office of Water Resources Consulting are provided here:

Office coordinates: 32° 16’ 1.11” N, 110° 56’ 58.26” W
Executive Summary
The proposers, Roger van Gelder and Gary Woodard, have performed over 300 commercial, industrial, and institutional (CII) water efficiency audits for Tucson Water and Scottsdale Water over the past five years. Audited properties are highly diverse, and their annual water demand ranges over nearly three orders of magnitude. Despite this diversity, certain patterns are apparent. On average, CII audits have identified potential water efficiency gains of 12%. The average payback period for recommendations other than repairing leaks is 5 months. No payback period is calculated for leaks, because costs are usually uncertain, and because water customers almost always move quickly to repair leaks. By contrast, CII customers often delay cost-effective upgrades to their water infrastructure for years, or indefinitely.

A statistical analysis of audits performed shows a strong correlation between significant leaks and irrigation meters. Closer analysis revealed that 15% of irrigation meters had significant leaks, and 26% of CII customers with one or more irrigation meter had leaks. No correlation was found between meter size and the likelihood of leaks, but there is a correlation between annual water use and leaks, with over 30% of facilities whose usage exceeds 750,000 GPY having leaks. On average, an irrigation leak increases flows by 37%. A related problem with many irrigation meters is failure to seasonally adjust watering schedules. Tucson Water has estimated that 30-50% of irrigation systems in its service area have significant leaks and/or irrigation scheduling problems.

HOAs in particular are more likely to have irrigation inefficiencies, due in part to the diffuse responsibility for their common area landscapes – typically split between the Association, a management company, and a third-party landscape company. Many municipal water providers have identified audits of HOA common areas as the low-hanging conservation fruit (see letters of support in Appendix 6), and the CAGRD, Tucson Water, and Scottsdale Water have pledged to support additional audits in their service areas.

The project will begin by developing a database of irrigation meter customers in the cooperating service areas that includes monthly, and where available, hourly water use, and remotely sensed landscape coverages. Usage data will be examined for trends, spikes, continuous flows, and lack of expected seasonality. Rough irrigation efficiencies will be calculated. Based on this, customers with suspected leaks and/or scheduling problems will be identified and offered audits, with a priority given to HOAs. Those sites agreeing to audits will have high-frequency loggers attached to the irrigation meters for at least one week. The data will be downloaded and analyzed during a follow-up visit. In addition, the site will be visually inspected and conductivity readings will be taken of all decorative water features. Ultrasonic meters may be briefly deployed to pinpoint the location of leaks. For HOA common areas with a swimming pool, additional inspections will be undertaken. Findings will be summarized in a brief audit report. Follow-up will verify that necessary repairs and irrigation adjustments have been made.
Water savings will be calculated using both estimates of leaks found and on before-and-after billed water usage.
Project Overview
WATER EFFICIENCY AUDITS FOR HOA COMMON AREAS AND OTHER IRRIGATION CUSTOMERS
Submitted by Gary Woodard – Water Resources Consulting

3. PROJECT OVERVIEW

The Problem addressed by this proposal is high rates of leakage in irrigation meters supplied by municipal providers. A related problem is irrigation scheduling, which can take several forms, including chronic over-irrigation, failure to adjust irrigation for precipitation, and failure to seasonally adjust the schedule.

The proposers, Roger van Gelder and Gary Woodard, have performed over 300 commercial, industrial, and institutional (CII) water efficiency audits for Tucson Water and Scottsdale Water over the past five years. Audited properties are highly diverse, and their annual water demand ranges over nearly three orders of magnitude. Despite this diversity, certain patterns are apparent. On average, CII audits have identified potential water efficiency gains of about 12%. The average payback period for recommendations other than repairing leaks is 5 months. Nevertheless, CII customers often delay cost-effective upgrades to their water infrastructure for years, or indefinitely, due to a combination of budget issues, staff turnover, and inertia. By contrast, no payback period is calculated for leaks, because costs are usually uncertain, and more importantly, because water customers almost always move quickly to repair leaks.

A statistical analysis of audits performed shows a strong correlation between significant leaks and irrigation meters. Closer analysis revealed that 15% of irrigation meters had significant leaks, and 26% of CII customers that have one or more irrigation meter had leaks. The average leak volume per facility with one or more leaks was 1.8 million GPY, or 5.6 AFY. When these numbers are multiplied by the total number of irrigation meters in a service area, the water lost due to irrigation system leaks is remarkable.

No correlation was found between meter size and the likelihood of leaks, or even between meter size and the size of the leak, with some one-inch meters produce very large leaks. There is, however, a correlation between annual water use and leaks, with over 30% of facilities whose
usage exceeds 750,000 GPY having leaks. On average, an irrigation leak increases flows by 37%. A related problem with many irrigation meters is failure to seasonally adjust watering schedules. Tucson Water has estimated that 30-50% of irrigation systems in its service area have significant leaks and/or irrigation scheduling problems.

HOAs in particular are more likely to have irrigation inefficiencies, due in part to the diffuse responsibility for their common area landscapes – typically split between the association, a management company, and a third-party landscape company. Many municipal water providers have identified audits of HOA common areas as the low-hanging fruit (see letters of support from several in Appendix 6). In particular, the CAGRD, Tucson Water, and Scottsdale Water have pledged to support additional audits in their service areas through monetary contributions to the project, as well as substantial in-kind support.

The project will begin by developing a database of irrigation meter customers in the cooperating service areas that includes monthly, and where available, hourly water use from AMR-equipped meters (generally 100 days of hourly readings). In addition, remotely sensed landscape coverages will be obtained. Scottsdale and Tucson have high-resolution visible, infrared and LIDAR images of their service areas, and have pledged to estimate amounts and types of landscaping. For other service areas, Google Earth data will be utilized. Usage data will be examined for trends, spikes, continuous flows, and lack of expected seasonality. Rough irrigation efficiencies will be calculated. Based on this analysis, customers with suspected leaks and scheduling problems will be identified and offered free audits, with a priority given to HOAs.

Those sites agreeing to audits will receive an initial visit during which high-frequency loggers will be attached to the irrigation meters for at least one week. During a follow-up visit, the data will be downloaded and analyzed. In addition, the site will be visually inspected for signs of leaks. Conductivity readings will be taken of all decorative water features and their source water, and ultrasonic meters may be briefly deployed to help pinpoint the location of leaks. For HOA common areas with a swimming pool, additional inspections will be undertaken.
Audit findings will be summarized in a succinct 3-page report. Follow-up contact will verify that necessary repairs and irrigation adjustments have been made. Water savings will be calculated using both estimates of leaks found, and on before-and-after billed water usage.

**Groundwater will be conserved** by reducing water wasted through leaks and irrigation scheduling issues at audited properties. Data from previous CII audits suggests average losses of 5.6 AFY per irrigation leak. Lowered demand will result in less groundwater pumped, or additional surface water available for recharge. The streamlined auditing approach developed for this project will result in marginal per-audit costs of less than $1,000.

**Project effectiveness will be measured** by a number of metrics, including:
- Estimates of water savings based on quantified leaks
- Estimates of water savings based on adjusted irrigation schedules
- Statistical estimates of water savings based on pre- and post-audit billing data

Non-quantifiable measures of effectiveness include opportunities to build or strengthen working relationships between HOAs and their municipal water providers.

**Management goals** as laid out in the TAMA’s current groundwater management plan include enhanced conservation efforts, reduced outdoor demand, and reduced groundwater pumping and/or increased recharge of CAP water. Eliminating irrigation system leaks and improving irrigation scheduling furthers each of these goals.

**Project benefits will accrue** to the HOAs and other irrigation meter customers, as well as to their water providers. Letters of support from local water providers and the CAGRD are attached. Other municipal providers will be invited to participate.

**The project leverages** the previous CII audits done in the PhAMA and TAMA, allowing the auditors to use tried-and-true approaches. In addition, the CAGRD has pledged $10,000 to increase the number of HOAs audited in the two AMAs, and other water providers have pledged similar but unspecified amounts of support.
Long-term effectiveness of the project requires follow-up by both water providers and customers. The database on irrigation metered customers developed for the project will make such follow-up easier, creating a baseline of water usage.

This project could be duplicated in other AMAs, particularly the Pinal AMA, or expanded within the Phoenix and Tucson AMAs.
Scope of Work
4. SCOPE OF WORK
This project is divided into eight main tasks. Each is described below, along with deliverables.

Task 1: Coordinate with water providers; conduct kick-off meeting
The purpose of this task is to meet with participating municipal water providers and the CAGRD to facilitate gathering data for the irrigation meter database and to review protocols for scheduling and conducting audits.

Consultants will:
- Recruit additional water providers
- Hold a kick-off meeting
- Review data needs from the water providers
- Develop protocols for all participating water providers

Gary Woodard will be primarily responsible for this task;
Roger van Gelder will be responsible for explaining audit site visit protocols.

Task deliverable consists of the kick-off meeting and a letter memo summarizing data needs and auditing protocols
Deliverable will be complete within 2 months of project start.

Task 2: Develop water use/irrigation demand database for HOAs, other customers with irrigation meters
The purpose of this task is to develop the database of water demand and remote sensing data needed to identify audit targets.
Consultants will:

- Work with providers to identify all HOAs with 1 or more irrigation meters and other irrigation meters with large usage
- Work with providers to obtain 4 years of monthly billing data, and hourly data where available from Itron-equipped meters
- Obtain remote sensing analysis of landscape covers from providers that have this ability, or from Google Earth analysis for other providers
- Estimate areas of turf, trees, other landscaping, water features, pools

**Gary Woodard will be responsible** for working with the water providers and will supervise construction of the databases.

**Task deliverable** consists of a letter memo describing the completed database  
**Deliverable will be complete** 4 months after project start.

**Task 3: Analyze data for evidence of leaks and/or excessive irrigation application rates**

The purpose of this task is to identify irrigation metered customers that likely have leaks and/or irrigation scheduling problems.

Consultants will:

- Integrate the databases and identify outliers with suspiciously large water use
- Examine monthly data for seasonality, spikes, trends; examine hourly data, if available, for continuous flows, spikes
- Estimate ET; compare with usage data to calculate annual, seasonal irrigation efficiencies

**Gary Woodard will be responsible** for estimating ET and irrigation efficiencies;  
**Roger van Gelder will be responsible** for examining monthly and hourly data.

**Task deliverable** consists of a brief letter memo  
**Deliverable will be complete** 6 months after project start.
Task 4: Prioritize sites to audit and coordinate with providers to schedule initial visits

The purpose of this task is to prioritize and select irrigation meter customers to offer audits and work with providers to schedule initial site visits.

Consultants will prioritize sites based on evidence of leaks, evidence of irrigation scheduling problems, annual water usage, and whether they are an HOA. Based on this, and in consultation with participating water providers, sites will be selected and offered free water efficiency audits. Initial visits will be scheduled in coordination with the providers.

Gary Woodard will be primarily responsible for activities in this task.

Task deliverables consist of a prioritized list of irrigation customers, and a list of customers who have agreed to be audited.

Deliverable will be complete 7 months after project start.

Task 5: Conduct initial facility visits

The purpose of this task is to visually inspect the site and begin high-frequency data collection.

Consultant will visit the sites, walk the sites, preferably with the landscape or irrigation manager, and deploy high-frequency loggers on the irrigation meters.

Gary Woodard will be responsible for overseeing deployment of the meter loggers.

Task deliverable consists of summary notes from the site visits.

Deliverable will be complete in stages, with the first set of loggers deployed by 8 months from project start.

Task 6: Conduct follow-up facility visits and calculate achieved savings at individual sites

The purpose of this task is to revisit the sites, download the logger data, and conduct a thorough audit of the irrigation system, any water features, and any swimming pools.
Consultant will:

- Download meter logger data and examine
- Potentially measure and compare conductivity of decorative water features with tap water
- If evidence of problems, walk the site, preferably with landscape/irrigation manager
- Possibly briefly deploy ultrasonic meters; possibly use IR to scan for temperature anomalies
- Check swimming pools at HOAs for water waste

Roger van Gelder will be responsible for activities in this task.

Task deliverable consists of summary of sites visited, instruments deployed and data gathered. Deliverable will be complete in stages, with the first set of audit visits completed by 8 months from project start.

Task 7: Prepare brief audit reports with findings; follow up to verify actions, quantify savings

The purpose of this task is to analyze and summarize the audit findings, convey them to the customers via brief audit reports, and subsequently follow up to verify that the audit findings have been acted upon.

Consultant will:

- Prepare audit reports;
- Send the reports to both the water provider and the facility;
- Follow up to verify leaks repaired, irrigation schedules adjusted, etc.

Roger van Gelder will be responsible for analysis and draft report writing;

Gary Woodard will be responsible for final report preparation and distribution; both parties will participate in follow-up contacts in coordination with the water providers.

Task deliverable consists of the audit reports
Deliverable will be completed in stages, with each set of reports going to facilities and water providers within one month of second facility visit.

Task 8: Prepare final report and make presentation

The purpose of this task is to make project results known to the GUAC and to other interested parties, such as water conservation professionals.

Consultant will statistically analyze all project findings and summarize in a letter memo report. Consultant will also prepare and present project results to the GUAC.

Gary Woodard will be responsible for preparing the final report and making presentations
Roger van Gelder will be responsible for assisting in report preparation.

Task deliverable consists of the final report and presentation
Deliverable will be complete at end of project or, if ADWR prefers, after three sets of audits are complete and the audit reports written.
Budget Breakdown
## APPENDIX 4: WATER EFFICIENCY AUDITS FOR HOA COMMON AREAS AND OTHER IRRIGATION CUSTOMERS IN THE TUCSON AMA

### Budget Breakdown & Narrative

#### Budget Breakdown Sheet

<table>
<thead>
<tr>
<th>Budget Categories</th>
<th>Task 1: Coordinate with Water Providers; Conduct Kick-off Meeting</th>
<th>Task 2: Develop Water Use/Irrigation Demand Database for HOAs, Irrigation Meters</th>
<th>Task 3: Analyze Data for Evidence of Leaks and/or Excessive Irrigation Application Rates</th>
<th>Task 4: Prioritize Sites to Audit &amp; Coordinate with Providers to Schedule Initial Visits</th>
<th>Task 5: Conduct Initial Facility Visits &amp; Deploy Meter Loggers</th>
<th>Task 6: Conduct Follow-up Facility Visits and Calculate Achieved Savings at Individual Sites</th>
<th>Task 7: Prepare Brief Audit Reports with Findings; Verify Actions, Quantify Savings</th>
<th>Task 8: Prepare Final Report and Make Presentation</th>
<th>Total</th>
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<td>a. Personnel</td>
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<td>$9,000</td>
<td>$4,200</td>
<td>$3,000</td>
<td>$29,520</td>
<td>$10,560</td>
<td>$4,920</td>
<td>$69,120</td>
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<td>g. Construction</td>
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<td>h. Other</td>
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<td>$10,560</td>
<td>$4,943</td>
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<td>j. Indirect Charges</td>
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<td>$-</td>
<td>$-</td>
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<tr>
<td><strong>Total ADWR Budget</strong></td>
<td><strong>$5,481</strong></td>
<td><strong>$2,520</strong></td>
<td><strong>$9,000</strong></td>
<td><strong>$4,200</strong></td>
<td><strong>$7,930</strong></td>
<td><strong>$30,600</strong></td>
<td><strong>$10,560</strong></td>
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<td>Additional Contributions</td>
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<td>$-</td>
<td>$-</td>
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<td>$2,520</td>
<td>$9,000</td>
<td>$4,200</td>
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<td>$32,100</td>
<td>$10,560</td>
<td>$4,943</td>
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</tr>
</tbody>
</table>

### Budget Breakdown & Narrative

**Tasks:**

- **Grant Program, Function, or Activity (provide a brief description):**

#### Total ADWR Budget

$75,234

#### Additional Contributions

$2,000

#### Total Project Budget

$77,234
Budget Narrative
5. BUDGET NARRATIVE

Note – Budget Breakdown Sheet is included as Appendix 4.

The proposed project will develop a database on irrigation meter customers and identify those with potential water waste. This will be used to select facilities that undergo water efficiency audits. The total budget is $75,234 plus $2,000 in additional funds from CAGRD and unspecified funds from Tucson Water. Significant in-kind support including data provision, coordination with HOAs and other irrigation customers, and landscape analysis will be contributed by all participating water providers.

The total award will be spent on the eight task areas as follows:

<table>
<thead>
<tr>
<th>Task</th>
<th>Description of task activities, deliverables</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coordinate with water providers; conduct kick-off meeting</td>
<td>5,481</td>
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<tr>
<td>2</td>
<td>Develop water use/irrigation demand database for HOAs, irrigation meters</td>
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<tr>
<td>3</td>
<td>Analyze data for evidence of leaks, excessive irrigation application rates</td>
<td>9,000</td>
</tr>
<tr>
<td>4</td>
<td>Prioritize sites to audit, coordinate with providers to schedule initial visits</td>
<td>4,200</td>
</tr>
<tr>
<td>5</td>
<td>Conduct initial facility visits</td>
<td>7,930</td>
</tr>
<tr>
<td>6</td>
<td>Conduct follow-up facility visits &amp; calculate achieved savings at each site</td>
<td>30,600</td>
</tr>
<tr>
<td>7</td>
<td>Prepare brief audit reports; follow up to verify actions, quantify saving</td>
<td>10,560</td>
</tr>
<tr>
<td>8</td>
<td>Prepare final report and make presentation</td>
<td>4,943</td>
</tr>
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<table>
<thead>
<tr>
<th></th>
<th>Budget Request from ADWR</th>
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<tbody>
<tr>
<td></td>
<td>75,234</td>
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<tr>
<td></td>
<td>CAGRD Additional Contribution*</td>
</tr>
<tr>
<td></td>
<td><strong>Total Budget</strong></td>
</tr>
</tbody>
</table>

*Additional contribution used in Tasks 5, 6, and 7.

Detailed budget data for each task are provided below. Note that this proposal includes no fringe benefits or construction. In addition, an indirect charge rate of zero is used.
Detailed Budget, Task 1: Coordinate with water providers; conduct kick-off meeting

Task 1 will require an estimated 72 hours of labor at the rates indicated below. In addition, $345 is budgeted for travel.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.a</td>
<td>Recruit additional water providers</td>
<td>GW</td>
<td>120</td>
<td>6</td>
<td>720</td>
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<tr>
<td>1.b</td>
<td>Assist with kick-off meeting</td>
<td>LE</td>
<td>30</td>
<td>12</td>
<td>360</td>
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<tr>
<td>1.c</td>
<td>Hold kickoff meeting</td>
<td>GW</td>
<td>120</td>
<td>4</td>
<td>480</td>
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<tr>
<td>1.d</td>
<td>Develop protocols for all participating water providers</td>
<td>GW</td>
<td>120</td>
<td>16</td>
<td>1,920</td>
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<tr>
<td>1.e</td>
<td>Provide ongoing coordination as needed</td>
<td>GW</td>
<td>120</td>
<td>16</td>
<td>1,920</td>
</tr>
</tbody>
</table>

**Task 1 Subtotal**  
54  5,400

*GW = Gary Woodard; LE = Lori Emler

Detailed Budget, Task 2: Develop water use/irrigation demand database for HOAs, irrigation meters

Task 2 will require an estimated 120 hours of labor at the rates indicated below.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.a</td>
<td>Identify all HOAs with 1 or more irrigation meters and other irrigation meters with large usage</td>
<td>LE</td>
<td>30</td>
<td>8</td>
<td>240</td>
</tr>
<tr>
<td>2.b</td>
<td>Obtain 4 years of monthly billing data, 100 days of hourly Itron data, if available</td>
<td>GW</td>
<td>120</td>
<td>8</td>
<td>960</td>
</tr>
<tr>
<td>2.c</td>
<td>Obtain remote sensing analysis from providers, or from Google Earth analysis</td>
<td>LE</td>
<td>30</td>
<td>20</td>
<td>600</td>
</tr>
<tr>
<td>2.d</td>
<td>Estimate areas of turf, trees, other landscaping, water features, pools</td>
<td>LE</td>
<td>30</td>
<td>24</td>
<td>720</td>
</tr>
</tbody>
</table>

**Task 2 Subtotal**  
60  2,520

*GW = Gary Woodard; LE = Lori Emler
Detailed Budget, Task 3: Analyze data for evidence of leaks and/or excessive irrigation application rates

Task 3 will require an estimated 176 hours of labor at the rates indicated below.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.a</td>
<td>Integrate data and identify outliers</td>
<td>LE</td>
<td>30</td>
<td>28</td>
<td>840</td>
</tr>
<tr>
<td>3.b</td>
<td>Examine monthly data for seasonality, spikes, trends; hourly data for</td>
<td>RvG</td>
<td>135</td>
<td>32</td>
<td>4,320</td>
</tr>
<tr>
<td></td>
<td>continuous flows, spikes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.c</td>
<td>Estimate ET; compare with usage data to calculate annual, seasonal</td>
<td>GW</td>
<td>120</td>
<td>32</td>
<td>3,840</td>
</tr>
<tr>
<td></td>
<td>irrigation efficiencies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Task 3 Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>92</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>9,000</strong></td>
</tr>
</tbody>
</table>

*GW = Gary Woodard; RvG = Roger van Gelder; LE = Lori Emler

Detailed Budget, Task 4: Prioritize sites to audit and coordinate with providers to schedule initial visits

Task 4 will require an estimated 88 hours of labor at the rates indicated below.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.a</td>
<td>Prioritize based on HOA, evidence of leaks, annual &amp; seasonal application</td>
<td>GW</td>
<td>120</td>
<td>24</td>
<td>2,880</td>
</tr>
<tr>
<td></td>
<td>rates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.b</td>
<td>Select sites to offer audits in coordination with providers</td>
<td>GW</td>
<td>120</td>
<td>28</td>
<td>960</td>
</tr>
<tr>
<td>4.c</td>
<td>Assist with scheduling of initial facility visits</td>
<td>LE</td>
<td>30</td>
<td>12</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td><strong>Task 4 Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>44</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>4,200</strong></td>
</tr>
</tbody>
</table>

*GW = Gary Woodard; LE = Lori Emler
Detailed Budget, Task 5: Conduct initial facility visits

Task 5 will require an estimated 328 hours of labor at the rates indicated below. In addition, $920 is budgeted for travel and $8,700 for equipment rental and maintenance.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.a</td>
<td>Travel time &amp; mileage to and from audit sites</td>
<td>LE</td>
<td>30</td>
<td>12</td>
<td>360</td>
</tr>
<tr>
<td>5.b</td>
<td>Meet landscape/irrigation manager &amp; scan site</td>
<td>LE</td>
<td>30</td>
<td>40</td>
<td>1,200</td>
</tr>
<tr>
<td>5.c</td>
<td>Check for continuous flows and deploy high-frequency meter loggers for 1-2 weeks</td>
<td>LE</td>
<td>30</td>
<td>48</td>
<td>1,440</td>
</tr>
</tbody>
</table>

**Task 5 Subtotal**

<table>
<thead>
<tr>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE</td>
<td></td>
<td>100</td>
<td>3,000</td>
</tr>
</tbody>
</table>

LE = Lori Emler

Detailed Budget, Task 6: Conduct follow-up facility visits and calculate achieved savings at individual sites

Task 6 will require an estimated 560 hours of labor at the rates indicated below. In addition, $460 is budgeted for travel.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.a</td>
<td>Schedule follow-up site visits</td>
<td>LE</td>
<td>30</td>
<td>12</td>
<td>360</td>
</tr>
<tr>
<td>6.b</td>
<td>Travel time to and from audit sites</td>
<td>RvG</td>
<td>135</td>
<td>12</td>
<td>1,620</td>
</tr>
<tr>
<td>6.c</td>
<td>Download meter logger data and examine</td>
<td>RvG</td>
<td>135</td>
<td>120</td>
<td>16,200</td>
</tr>
<tr>
<td>6.d</td>
<td>Potentially measure and compare conductivity of decorative water features with tap water</td>
<td>RvG</td>
<td>135</td>
<td>20</td>
<td>2,700</td>
</tr>
<tr>
<td>6.e</td>
<td>If evidence of problems, walk the site, preferably with landscape/irrigation manager</td>
<td>RvG</td>
<td>135</td>
<td>24</td>
<td>3,240</td>
</tr>
<tr>
<td>6.f</td>
<td>Possibly briefly deploy ultrasonic meters; possibly use IR to scan for temperature anomalies</td>
<td>RvG</td>
<td>135</td>
<td>20</td>
<td>2,700</td>
</tr>
<tr>
<td>6.g</td>
<td>Check swimming pools at HOAs for water waste</td>
<td>RvG</td>
<td>135</td>
<td>20</td>
<td>2,700</td>
</tr>
</tbody>
</table>

**Task 6 Subtotal**

<table>
<thead>
<tr>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RvG</td>
<td></td>
<td>228</td>
<td>29,520</td>
</tr>
</tbody>
</table>

*RvG = Roger van Gelder; LE = Lori Emler
Detailed Budget, Task 7: Prepare brief audit reports with findings; follow up to verify actions, quantify savings

Task 7 will require an estimated 208 hours of labor at the rates indicated below.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.a</td>
<td>Prepare audit reports; send simultaneously to provider and facility, or to provider to forward</td>
<td>GW</td>
<td>120</td>
<td>40</td>
<td>4,800</td>
</tr>
<tr>
<td>7.b</td>
<td>Follow up to verify leaks repaired, irrigation schedules adjusted, etc.</td>
<td>GW</td>
<td>120</td>
<td>48</td>
<td>5,760</td>
</tr>
<tr>
<td><strong>Task 7 Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>88</strong></td>
<td><strong>10,560</strong></td>
</tr>
</tbody>
</table>

*GW = Gary Woodard

Detailed Budget, Task 8: Prepare final report and make presentation

Task 8 will require an estimated 72 hours of labor at the rates indicated below. In addition, $115 is budgeted for travel.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Lead*</th>
<th>Rate</th>
<th>Hrs.</th>
<th>Amt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.a</td>
<td>Summarize data, visualize data</td>
<td>LE</td>
<td>30</td>
<td>16</td>
<td>480</td>
</tr>
<tr>
<td>8.b</td>
<td>Assist in report, presentation preparation</td>
<td>RvG</td>
<td>135</td>
<td>8</td>
<td>1,080</td>
</tr>
<tr>
<td>8.c</td>
<td>Prepare final report</td>
<td>GW</td>
<td>120</td>
<td>16</td>
<td>1,920</td>
</tr>
<tr>
<td>8.d</td>
<td>Prepare, make presentation</td>
<td>GW</td>
<td>120</td>
<td>12</td>
<td>1,440</td>
</tr>
<tr>
<td><strong>Task 8 Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>52</strong></td>
<td><strong>4,920</strong></td>
</tr>
</tbody>
</table>

*GW = Gary Woodard; RvG = Roger van Gelder; LE = Lori Emler
Additional Contributions

Additional contributions from the CAGRD and Tucson Water are detailed in Appendix 6.

CAGRD has pledged $10,000 for additional HOA audits, including $2,000 for audits in the Tucson AMA. Tucson has pledged an unquantified amount for additional HOA audits, and has offered to perform the remote sensing analysis of landscape areas and types within its service area.

In addition, all participating water providers will provide in-kind assistance in the form of data sharing, coordination with audited customers, review of audit reports, and assistance with follow-ups to verify that recommendations were acted upon.
Additional Contribution Breakdown
APPENDIX 6

ADDITIONAL CONTRIBUTIONS BREAKDOWN AND LETTERS OF SUPPORT

Direct Support
CAGRD has pledged $10,000 for additional HOA audits, including $2,000 for audits in the Tucson AMA. Tucson has pledged an unquantified amount for additional HOA audits, and has offered to perform the remote sensing analysis of landscape areas and types within its service area.

In-kind Support
All participating water providers will provide in-kind assistance in the form of data sharing, coordination with audited customers, review of audit reports, and assistance with follow-ups to verify that recommendations were acted upon.

Letters of Support
Letters of Support from CAGRD, Tucson Water, and the Green Valley Council are attached.
February 13, 2020

Thomas Buschatzke, Director  
Arizona Department of Water Resources  
1110 W Washington Street, Suite 310  
Phoenix, AZ  85007  
C/O Melissa Sykes, Water Resources Specialist

Dear Director Buschatzke:

The Central Arizona Groundwater Replenishment District (CAGRD) is pleased to support the proposal, "Water Efficiency Audits for HOA Common Areas and Other Irrigation Customers." We understand that the proposal is being submitted in both the Phoenix AMA and Tucson AMAs.

The CAGRD meets the needs of our enrolled properties by replenishing the groundwater they pump with renewable supplies. We currently are re-invigorating our conservation efforts and more specifically are focusing on determining how best to use our water conservation resources to reduce groundwater pumping by our members. We believe the most effective approach is through working with other water providers, particularly those with a proven track record in conservation, such as the City of Scottsdale, Tucson Water and Community Water of Green Valley, who also support these twin proposals.

We will cooperate with the consultants and local water providers by sharing data, facilitating contact with HOAs, and by contributing additional funds ($10,000) to increase the number of audits performed for HOAs on member lands.

The housing stock for which we replenish consists mostly of residential developments, many of which have HOAs responsible for irrigating common area landscapes. This proposal aims to assist these HOAs in detecting, locating, and eliminating leaks, as well as identifying water waste associated with some common area swimming pools. We believe this will prove to be an effective, and cost-effective approach to achieving CAGRD’s and ADWR’s goal of reducing demand on our aquifers.

Sincerely,

Laura Grignano, Manager  
Central Arizona Groundwater Replenishment District
February 13, 2020

Thomas Buschatzke, Director
Arizona Department of Water Resources
1100 W. Washington Street, Ste. 310
Phoenix, AZ 85007
C/O Melissa Sykes, Water Resources Specialist

SUBJECT: Water Efficiency Audits for HOA Common Areas and Other Irrigation Customers in the Tucson AMA

Dear Director Buschatzke:

This letter is in support of the proposal from Gary Woodard – Water Resources Consulting to identify and address water leaks in the irrigation systems of HOA customers in the Tucson AMA. Tucson Water, a department of the City of Tucson, serves over 230,000 accounts and nearly three-quarters of our region’s population, including about 15,000 commercial and industrial customers. With nearly 1,000 HOA commercial customers in our service area, these organizations account for a measurable amount of our community’s annual water use and represent a significant savings opportunity.

HOAs face the particular challenge of representing owners of units or properties in the association, while usually depending on property management companies to administer HOA oversight and contracting landscape companies to maintain common landscapes and irrigation schedules. These multiple decision-makers can make it difficult to agree on water efficiency practices and implement changes in the landscape. One of the most effective approaches that requires little to no buy-in from HOAs is to identify irrigation system leaks using a combination of billing data, GIS and data logging technology. Previous audit work has shown that 30-50% of irrigation systems are either leaking or not adjusted to seasonal watering schedules.

Combining a direct approach to HOA engagement with technology tools that simplify the on-the-ground work ensures that changes are more likely to be adopted. When customers can immediately address leaking irrigation systems or seasonal schedule adjustments, they quickly save water and money. Tucson Water is very interested in supporting water conservation efforts for HOAs throughout our region and we believe that this proposed approach will yield greater engagement with the HOAs, as well as actual groundwater savings.

To support this regional effort, Tucson Water will provide data to the consultants as requested, particularly monthly usage for HOA customers and GIS data. The City of Tucson has recently acquired land use – land cover data that provides parcel-level percentage coverage of different land use types. City staff will work with the consultants to provide parcel-level analyses of landscape types for the prioritized customers identified to receive water audits. Tucson Water also intends to contribute funds to support audits of some of our HOA and irrigation customers.
We are eager to support this project by working with Gary Woodard and his team, and other local water providers, to target HOA water conservation with analytics that improve decision-making for our customers. We have worked with the consultant on several projects previously, including most recently, commercial facility water audits. We are confident that the team’s experience and rapport with our commercial customers will yield positive results with our HOA customers and will result in water savings.

Improving our commercial conservation offerings is a priority for Tucson Water over the next decade and this proposal will help us get a jumpstart toward measurable water savings with our HOA customers. We are committed to working with providers throughout the Tucson and Phoenix AMAs to achieve a reduction in outdoor, consumptive water use that will sustain local groundwater supplies into the future, while providing a valuable service for our HOAs.

Sincerely,

Timothy Thomure, P.E., ENV SP
Director
City of Tucson Water Department
February 13, 2020

Thomas Buschatzke, Director
Arizona Department of Water Resources
1110 W Washington Street, Suite 310
Phoenix, AZ 85007

C/O Melissa Sykes, Water Resources Specialist

Dear Director Buschatzke:

The Green Valley Council would like to express its support for the proposal, “Water Efficiency Audits for HOA Common Areas and Other Irrigation Customers in the Tucson AMA”. The Council represents some 76 HOAs in Green Valley, most of which have irrigated common areas.

Offering water efficiency audits to HOAs with irrigated common areas could substantially reduce our water usage. We understand that the project will focus on finding leaks and otherwise reducing water waste.

The Green Valley Council will support the project by encouraging HOAs to participate. In addition, we will act as a liaison between individual HOAs and the auditors.

We are excited about this opportunity to make our member HOAs even more water efficient, and hope you decide to fund the project.

Sincerely,

Thao Tiedt
President
Supplemental Information:

Evidence of Physical and Legal Availability of Water
Evidence of Physical and Legal Availability of Water for:
Water Efficiency Audits for HOA Common Areas and
Other Irrigation Customers in the Tucson AMA

This project does not require any available water. Therefore, this form is not applicable.
Evidence of Control and Tenure of Land
Evidence of Control and Tenure of Land for
Water Efficiency Audits for HOA Common Areas and
Other Irrigation Customers in the Tucson AMA

This project does not require any control or tenure of land. Therefore, this form is not applicable.
State Historic Preservation Office (SHPO) Review Form
In accordance with the State Historic Preservation Act (SHPO), A.R.S. 41-861 et seq, effective July 24, 1982, each State agency must consider the potential of activities or projects to impact significant cultural resources. Also, each State agency is required to consult with the State Historic Preservation Officer with regard to those activities or projects that may impact cultural resources. Therefore, it is understood that recipients of state funds are required to comply with this law throughout the project period. All projects that affect the ground-surface that are funded by AWPF require SHPO clearance, including those on private and federal lands.

The State Historic Preservation Office (SHPO) must review each grant application recommended for funding in order to determine the effect, if any, a proposed project may have on archaeological or cultural resources. To assist the SHPO in this review, the following information MUST be submitted with each application for funding assistance:

- A completed copy of this form, and
- A United States Geological Survey (USGS) 7.5-minute map
- A copy of the cultural resources survey report if a survey of the property has been conducted, and
- A copy of any comments of the land managing agency/landowner (i.e., state, federal, county, municipal) on potential impacts of the project on historic properties.

NOTE: If a federal agency is involved, the agency must consult with SHPO pursuant to the National Historic Preservation Act (NHPA); a state agency must consult with SHPO pursuant to the State Historic Preservation Act (SHPA), OR

- A copy of SHPO comments if the survey report has already been reviewed by SHPO.

Please answer the following questions:

1. Grant Program: **ADWR WMAP Conservation Grants, FY2020**
2. Project Title: **Water Efficiency Audits for HOA Common Areas and Other Irrigated Customers**
3. Applicant Name and Address: **Gary Woodard, 1415 E. Lind Road, Tucson, AZ  85719**
4. Current Landowner/Manager(s): **N/A**
5. Project Location, including Township, Range, Section: **N/A**
6. Total Project Area in Acres (or total miles if trail): **N/A**
7. Does the proposed project have the potential to disturb the surface and/or subsurface of the ground?  
   - [ ] YES  [X] NO
8. Please provide a brief description of the proposed project and specifically identify any surface or subsurface impacts that are expected: **Utility records and remote sensing data will be used to estimate irrigation efficiencies for municipal water customers with irrigation meters in the Tucson metropolitan area. Those with low irrigation efficiencies will be offered water audits to identify leaks and problems with irrigation controllers. No surface or subsurface impacts are expected, other than repair of leaks.**
9. Describe the condition of the current ground surface within the entire project boundary area (for example, is the ground in a natural undisturbed condition, or has it been bladed, paved, graded, etc.). Estimate horizontal and vertical extent of existing disturbance. Also, attach photographs of project area to
document condition: We will only be examining developed commercial and multi-family properties where there is landscaping. These sites will be scattered across the metropolitan area. There will be no disturbance of the surface.

10. Are there any known prehistoric and/or historic archaeological sites in or near the project area? ☒ YES ☐ NO

11. Has the project area been previously surveyed for cultural resources by a qualified archaeologist? ☐ YES ☒ NO ☐ UNKOWN

   If YES, submit a copy of the survey report. Please attach any comments on the survey report made by the managing agency and/or SHPO

12. Are there any buildings or structures (including mines, bridges, dams, canals, etc.), which are 50-years or older in or adjacent to the project area? ☐ YES ☒ NO

   If YES, complete an Arizona Historic Property Inventory Form for each building or structure, attach it to this form and submit it with your application.

13. Is your project area within or near a historic district? ☐ YES ☒ NO

   If YES, name of the district:

Please sign on the line below certifying all information provided for this application is accurate to the best of your knowledge.

[Signature]
Feb. 14, 2020
Gary C. Woodard
Applicant Signature /Date Applicant Printed Name

<table>
<thead>
<tr>
<th>FOR SHPO USE ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHPO Finding:</td>
</tr>
<tr>
<td>☐ Funding this project will not affect historic properties.</td>
</tr>
<tr>
<td>☐ Survey necessary – further GRANTS/SHPO consultation required (grant funds will not be released until consultation has been completed)</td>
</tr>
<tr>
<td>☐ Cultural resources present – further GRANTS/SHPO consultation required (grant funds will not be released until consultation has been completed)</td>
</tr>
<tr>
<td>SHPO Comments:</td>
</tr>
</tbody>
</table>

For State Historic Preservation Office:   Date:
Application Checklist
ARIZONA DEPARTMENT OF WATER RESOURCES
WMAP Groundwater Conservation Grant Application Checklist

☑ Project Proposal
  ☑ Cover Letter
  ☑ Executive Summary
  ☑ Project Overview
  ☑ Scope of Work
  ☑ Budget Breakdown & Narrative
  ☑ Additional Contribution Breakdown (if applicable)
  ☑ Project Map
  ☑ Supplemental Information
    ☑ Evidence of physical and legal availability of water
    ☑ Evidence of Control and Tenure of Land
    ☑ State Historic Preservation Office Review Form