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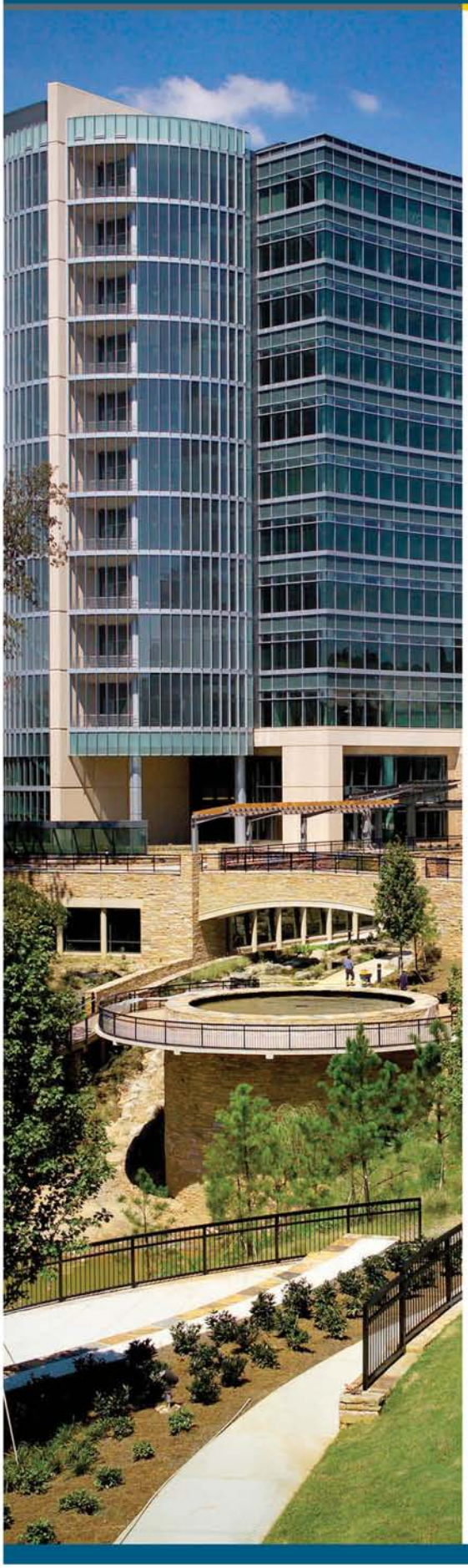

Template for a Comprehensive Water Assessment Statement of Work

Prepared for the U.S. Department of Energy

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Template for a Comprehensive Water Assessment Statement of Work

Federal agencies are subject to requirements for water conservation and efficiency established by statute and Executive Order. Energy Independence and Security Act of 2007 (EISA), Section 432, requires Federal agencies to conduct energy and water evaluations at their facilities and meet performance targets for water conservation.

This document was prepared by the Energy Department with the objective to outline the major elements of a comprehensive Statement of Work (SOW) for a facility-level water assessment. It includes a template that Federal facilities can use to develop their own tailored SOWs for:

- Contracting water management firms to perform comprehensive water assessments
- Including water assessment components in a combined energy and water evaluation.

This template contains detailed requirements for major water-using processes and equipment, some of which may not be applicable to all Federal facilities. It should be used as a "menu of ingredients" for a comprehensive SOW, reviewed carefully, and edited as necessary to fit the specific needs of each facility.

Essential elements of a well-formed water assessment SOW should include: the project scope, contractor qualifications, distinct phases of the project, required deliverables, and the project schedule. Essential elements are outlined below, and the SOW Template is provided on page 7.

Project Scope

The scope of the SOW should clearly define the objectives of the water assessment and set the foundation for the contractor to fulfill the work required. Typically, the purpose of a water assessment is to develop a comprehensive understanding of a facility's current water consumption and provide direction for future efficiency improvements. The scope of this SOW covers facility water assessment and does not cover the distribution system audit. A distribution system audit that locates leaks can be complimentary to a facility water assessment, but should be contracted by a firm that specializes in the distribution system audits and leak detection services.

An effective SOW should include the intent of the assessment and identify the founding regulations or mandates that drive the work. For example, a water assessment can help to meet the EISA Section 432 requirement for water evaluations, as well identify water reduction opportunities, in accordance with the Executive Orders 13423 and 13514 requirements.

If the facility has other site-specific goals beyond Federal water policy, language that details these water assessment intentions can also be included in the SOW. For example, an objective of the assessment may be to perform a system-wide irrigation audit. This should be described in the scope of the SOW and also be detailed in the other areas of the SOW.

Contractor Qualifications

To ensure the water assessment is conducted properly, the SOW should require specific water management qualifications of the assessment team. Often, water assessments are rolled into energy assessments. It is common that while the SOW clearly defines qualifications required by the energy team, the water portion of the assessment is poorly defined or missing altogether. In this case, a team is formed that focuses on energy, with little to no experience with water-related processes and equipment. The end result can be a poorly executed water assessment.

Assessment Phases

It is important that the SOW define the distinct phases of the water assessment. Depending on the needs of the facility, some or all of these recommended phases might be included. Note that each individual element included in the accompanying SOW Template may not be necessary, depending on the facility's water-using equipment and overall objective of the water assessment. Therefore, consider the phases and detailed elements below as recommended options, and include only the elements that are relevant to the specific requirements of the facility.

The following sections provide a general description of water assessment phases:

Phase I: Background Development and Preparation

The first step of a comprehensive water assessment is to build a strong foundation by collecting background information on the site and preparing for the assessment. This includes gaining a thorough understanding of the goals and intent of the assessment, forming a team that will perform and support the assessment, and gathering important data to help prioritize the plan. As part of this phase, the facility should provide the contractor with data such as building square footage, building type, occupancy, and sub-metered data, for example. This data will be used to develop a basic understanding of water use at the facility and a list of prioritized buildings and processes for the walk-through audit phase of the assessment. The SOW Template contains a detailed list of information that the facility will provide to the contractor to support a successful comprehensive water assessment.

Another important step of this phase is to develop a thorough understanding of the costs of the potential efficiency projects, to help prioritize and direct the assessment. For example, if wastewater rates are high, but water rates are low, the assessment team should investigate projects that reduce wastewater discharge. The SOW Template includes a list of cost analysis elements that might be included.

Phase I should also include development of a baseline for potable and industrial, landscaping, and agricultural (ILA) water use. The baseline provides a means for the contractor to estimate overall water and cost savings of recommended efficiency improvements. The contractor should be required to provide a description of the method used to develop the baselines. Note that the baselines may be the same ones the site uses for meeting reduction requirements, i.e., fiscal year (FY) 2007 baseline for potable water use and FY 2010 for ILA water use. However, it is recommended that the SOW does not require the use of these baselines because other historic water use baselines may be more appropriate, depending on the site's past water consumption and previous water efficiency projects.

In addition, the SOW should include aspects of team coordination. In this phase of the assessment, the contractor should establish a strong relationship with the facility team. The contractor should work very closely with key staff at the facility that has a working knowledge of water-consuming equipment and understanding of the interconnected issues regarding water supply and wastewater discharge. The team may include members from organizations such as engineering, environmental, facility management, maintenance, janitorial, and plumbing.

Phase II: Walk-Through Audits

The second phase of the assessment allows the assessment team to get a full understanding of the water using equipment and processes. The minimum requirements of walk-through audits should include gathering enough data to estimate the equipment's current water consumption. The auditors should also investigate initial ideas for water efficiency opportunities, as well as identify opportunities to access alternate water sources to offset the use of freshwater sources. Alternate water sources include grey water, rainwater harvesting, and air conditioning condensate capture for example.

Note that walk-through audits are typically targeted at facility equipment and processes and not a distribution system audit. A distribution system audit that locates leaks can be complimentary to a facility water assessment and should likely be contracted by a firm that specializes in these services.

The SOW Template provides the important elements of a walk-through audit for major water-using equipment. Note that the information provided in the template below may not be applicable for all Federal facilities and should be carefully selected based on the needs of the site.

Phase III: Water Balance Development

The third phase of assessment is to quantify water use of equipment and processes with the data gathered in Phases I and II. The end result of this phase is a water balance that tracks water from supply, to each end-use application, to the ultimate discharge wastewater. The water balance identifies the largest water consumers and can also identify problem areas, such as high leak rates or inefficient applications that require attention. If an installation has a wastewater treatment plant on the site, there may be reclaimed water used in non-potable applications such irrigation or cooling tower makeup. This reclaimed water should also be included in the water balance. An example of how a water balance can be specified is included in the SOW Template.

Phase IV: Water Efficiency Investigation and Economic Analysis

The fourth phase of the assessment is to identify cost-effective water efficiency opportunities. The core objective of a facility water assessment is to help the facility identify areas for water efficiency improvements, and ultimately, to provide the framework for water reduction. Opportunities should include both recommendations of efficient technologies and processes, as well as the use of alternate water sources such as water reuse, grey water, rainwater harvesting, and wastewater reclaim, where appropriate. Note that an in-depth examination of alternate water sources is likely out of the assessment's scope, but general recommendations can help direct the facility to next steps on future projects. The assessment should also provide recommendations on applications and process that would benefit from sub-metering. The SOW Template provides an example of how these elements could be defined.

Deliverables and Schedule

Identifying key deliverables that are expected of the contractor and the length of time to accomplish these deliverables are critical elements of a sound SOW and successful assessment. The assessment should provide interim deliverables that can be used to measure progress. A final report should be required that provides key information the facility needs to accomplish its objectives or meet requirements. The final report may be the most important deliverable because it presents the ultimate results of the water assessment and provides efficiency recommendations. The SOW Template can be used to specify requirements for the final report.

Additional Considerations

The following additional items to consider as part of a water assessment contract will help to precipitate high quality work from the water management firm. Consider including these elements in the SOW:

- Allow for voluntary pre-bid walk-through of a sample facility to allow contractors to get a feel for the scope of the assessment.
- Include enough time in the solicitation process to fully address questions from contractors bidding on work (this will ensure that there is an adequate selection of contractors to select).
- In the pre-award and post-award phases of the project, incorporate a mechanism for contractors to receive technical feedback through the contracting officer at the installation (to make sure the contractor understands the needs of the installation).

Resources

The following resources provide additional information on water assessments and management:

- FEMP Web-based Water Management Training course – Provides a comprehensive overview of Federal water management planning and implementation: http://femptraining.labworks.org/
- Federal Guidebooks on Water Management – Lists several useful guidebooks on the FEMP Water Efficiency Resources page: www.femp.energy.gov/program/waterefficiency_resources.html#fg
- Y-12 National Security Complex Case Study – Details a comprehensive water assessment performed in FY 2010 that provides an overview of the process and key lessons learned: www.femp.energy.gov/program/waterefficiency_csstudies.html
- Alliance for Water Efficiency – Offers extensive information on water management and efficiency: allianceforwaterefficiency.org

Model Facility Water Assessment Statement of Work Template

The following section provides sample language for a SOW that can be used to contract with water management firms to perform comprehensive water assessments; or include water assessment components in a combined energy and water evaluation. The information is intended to aid in the development of a SOW and should be tailored for the facility's specific needs. Items in *[brackets and italics]* indicate notes to provide clarification, or areas to be completed by the facility.

1 Scope

The objective of this water assessment is to develop an understanding of *[facility name's]* water consumption and identify cost-effective water efficiency measures that will help to achieve the site's required water reductions and meet the comprehensive water evaluation requirements of the Energy Independence and Security Act of 2007.

The following elements are required as part of the water assessment:

1. Evaluation of current water use and costs associated with water supply and wastewater discharge
2. Development of a water balance that provides a detailed breakdown of water use by end-use/process
3. Evaluation of efficiency opportunities and identification of life-cycle cost-effective measures
4. Strategic plan for meeting water reduction goals.

2 Contractor Qualifications

The contractor shall meet the following qualifications:

- Sufficient knowledge in facility water efficiency, with at least 5 years experience that includes in-field expertise
- A bachelor's degree in engineering or equivalent is preferred; training, active membership in relevant fields, and ample field experience will also be considered; applicable certification such as Environmental Protection Agency (EPA) WaterSense Partner or the Irrigation Association Certified Landscape Irrigation Auditor will also be taken into consideration
- Demonstrated knowledge of Federal water conservation policy; documented contractor experience conducting facility level water assessments at Federal facilities is preferred.

3 Assessment Phases

3.1 Phase I: Background Development and Preparation

In Phase I of the water assessment, the contractor shall perform the following:

1. **Historical water consumption analysis** – Understanding the historic water use is vital to an effective water assessment, so trends in water use can be understood and a baseline can be established. To accomplish this, the contractor shall:
    A. Collect and analyze at least 2 years of data for total supply, wastewater discharge, and all sub-metered water data
    B. Estimate system losses based on system condition and age, and document the method used for determining system losses
    C. Develop annual distribution curve (water use over time) to show seasonal variations of water use, including sub-metered and estimated losses
    D. Develop baselines for both potable water, and industrial, landscaping and agricultural (ILA) use, accounting for consumptive use from both potable and non-potable sources. Document the method used to develop the baseline.
2. **Cost data analysis** – The contractor shall:
    A. Calculate marginal cost of water and wastewater
    B. Verify whether the facility is on proper water and wastewater rate schedules
    C. Estimate the potential future water and wastewater rate escalation (to be used in life-cycle cost analysis of efficiency measures).
3. **Team coordination** – The contractor shall:
    A. Hold a kick-off meeting to state the goals and objectives of the assessment to the facility team
    B. Provide interim progress reports on the preliminary findings of the audits
    C. Hold a final meeting to present results of the assessment *[specify the specific date of the meeting here or in the schedule section of the SOW]*.

Items Furnished by the Facility

Background data – The facility will provide background information to the assessment team for prioritization of the walk-through audits. This background data includes:

1. Historic water and wastewater bills or data from supply generated and/or treated onsite
2. Sub-metered data on water processes and buildings
3. Building floor space by building type
4. Occupancy data
5. Equipment lists
6. Maintenance schedules
7. Site and individual building maps
8. Distribution system maps

3.2 Phase II: Walk-Through Audits

The contractor shall perform walk-through audits of buildings and applications that were identified in Phase I of the water assessment. The basic documentation requirements for water end-uses are described below: *[Only include end-uses and processes that pertain specifically to the site.]*

1. **Domestic plumbing fixtures** – Document the following items for toilets, urinals, faucets, and showerheads:
    A. Audit approximately 10% of the restrooms at the facility to obtain a gauge on the general age and condition of fixtures, ensuring that the sample represents the range of fixtures currently in operation at the facility
    B. Document the flow/flush rate of the audited fixture, noting brand and model number
    C. Measure the flow rate of 10% of the faucets and showerheads in the audited restrooms
    D. Collect information on usage patterns of faucets and showers to determine total water used and hot water usage
    E. Estimate the flush rate of 10% of the toilet and urinals in the restrooms that are audited
    F. Document leaks and note if there are leak detection/reporting protocols.
2. **Commercial kitchens** – Document the following items for ice machines, dishwashing machines, tray conveyor systems, garbage disposals, pre-rinse spray valves, convection steamers, steam kettles and other water consuming appliances:
    A. Note the brand and model number of the appliance
    B. Measure the flow rate of the appliance if applicable
    C. Document the operating schedule of the appliance
    D. Identify overall condition of the appliance
    E. Document the maintenance schedule of the appliance.
3. **Irrigation and landscaping**
    A. Measure system pressure
    B. Note if there is an irrigation meter
    C. Document the operating schedule (noting time of day) and hours per day or week during irrigation season
    D. Document the irrigation technology type (make and model of equipment)
    E. Estimate the number of sprinkler heads
    F. Identify the overall system condition, noting leaking/maladjusted heads
    G. Identify controls (type of controls and how they are used)

H. Estimate the amount of irrigated land (square feet/yards/acres)

I. Document the maintenance schedule/procedures

J. Document the landscape type (turf, flower beds, xeriscape, etc…)

K. Perform a system-wide irrigation audit in accordance with the Irrigation Association audit guidelines (available at: http://www.irrigation.org/Certification/CLIA/Audit_Requirements.aspx)
[Note: This should be required only if irrigation is a primary water consumer and an irrigation audit is the main goal of the water assessment. Specific contractor qualifications for irrigation auditing should also be required in the contractor qualification section of the SOW.]

4. Evaporative cooling systems

A. Determine the size of the system (this may be in terms of cooling tonnage or recirculation rate)

B. Determine how many days the system operates per year

C. Determine if make-up water is metered. If it is not metered, verify whether system water use is tracked by other means

D. Determine if cycles of concentration are tracked routinely. If they are not tracked routinely, determine if there are operator logs available that include routine measurement of blowdown and make-up conductivity

E. Determine if the system blowdown is automated or done manually

F. Verify that level controls and water supply/water discharge valves are operating properly

G. If possible, walk the system to see if leaks or losses are apparent. For any leaks or losses found, measure and quantify the loss.

5. Closed-loop cooling systems

A. Determine whether system losses are known and measured

B. If possible, inspect the system piping to see if leaks or losses are apparent. If leaks or losses are found, measure and quantify the loss.

6. **Single-pass cooling**

A. Determine how many days the system operates monthly or annually

B. Determine flow rate of system.

7. **Steam/boiler systems**

A. Determine the size of the system (this may be in terms of steam generation or boiler horsepower)

B. Determine how many days the system operates per year

C. Determine whether the make-up water is metered. If it is not metered, verify if the system water use is tracked by other means

D. Determine if cycles of concentration are tracked routinely. If they are not tracked routinely, determine if there are operator logs available that include routine measurement of blowdown and make-up conductivity

E. Determine whether the system blowdown is automated or done manually

F. Verify that steam traps are operating properly and are leak free

G. Determine whether the system returns condensate and where condensate losses may be occurring.

8. Hot water (closed-loop) heating systems

A. Determine if system losses are known and measured

B. If possible, inspect the system piping to see if leaks or losses are apparent. If any leaks or losses are found, measure and quantify the loss

C. Assess domestic hot water heaters for temperature setting and possible leaks.

9. **Laboratory and medical facilities** – Document the following items for disinfection/sterilization systems, vacuum pumps, water purification systems, photographic and x-ray equipment, glassware washers, vivarium equipment, and other water-using equipment**.**

A. Note the brand and model number of the equipment

B. Measure the flow rate of the equipment, if applicable

C. Document the operating schedule of the equipment

D. Identify the overall condition of the equipment

E. Document the maintenance schedule of the equipment.

10. **Laundry facilities**

A. Determine type of washing machines (note make and model number)

B. Estimate the number of loads washed per day or week

C. Identify the overall condition of the equipment.

11. Vehicle wash stations

A. Determine the type of wash station and note information on nozzle types so flow rate can be estimated

B. Determine the number of vehicles washed per day or week

C. Identify whether the system recycles water.

12. **Alternate water sources investigation** – Investigate opportunities to access alternate water sources for process on the facility premises to provide a high level recommendation including (but not limited to): *[Note a detailed assessment of alternate water sources is outside the scope of a typical facility water assessment.]*

A. Rainwater harvesting

B. Grey water

C. Water reuse (discharge from one process to be used in another process)

D. Air conditioning condensate capture

E. Wastewater reclaim.

3.3 Phase III: Water Balance Development

The contractor shall develop a water balance that provides water consumption by major end-use categories (as defined in the SOW in Phase II) and system losses. The contractor shall complete the following elements:

1. **Water balance** – Develop a water balance that estimates current equipment and process water use by major end-use categories and system losses and compares this total to water supply and ultimate discharge or reclaim of wastewater
2. **Graphical elements** – Show water balance in graphical form in a flow chart and/or pie chart that breaks out water use by major end-use categories and estimated losses.

3.4 Phase IV: Water Efficiency Investigation and Economic Analysis

The contractor shall investigate and analyze water efficiency opportunities that include the following elements:

1. **Efficiency opportunity assessment** – Assess opportunities for water efficiency improvements in each major end-use, including technologies that are detailed above in Phase II of the assessment. Include a consideration for retrofit, replacement, operation and maintenance improvements, and applications for sub-metering
2. **Alternate water sources identification** – Identify alternate water sources to offset the use of freshwater sources and provide estimated potential of annual water volume, as well as potential applications where the alternate source could be utilized
3. **Life-cycle cost analysis** – Perform life-cycle cost (LCC) analysis of all measures – the preferred tool for analysis is the Building Life-Cycle Cost (BLCC) analysis program for this analysis activity (available at: www.femp.energy.gov/information/download_blcc.html.

The LCC analysis shall include the following parameters:

1. Water and wastewater costs and other ancillary costs of water-consuming equipment, such as energy, operations and maintenance (O&M), and chemicals
2. Estimated water and wastewater escalation rates
3. Available utility rebates for installed measures, if applicable
4. Prioritization of efficiency opportunities – Rank each measure based on LCC effectiveness and installation cost, addressing both short-term and long-term investment opportunities.

4 Deliverables and Schedule

The contractor shall deliver the following items by noted the due dates:

Phase I: Background Development and Preparation

- *[Date]*: Kick-off meeting summary that documents key items addressed by facility team
- *[Date]*: List of prioritized buildings for walk-through audits

Phase II: Walk-Through Audits

- *[Date]*: Summary report of walk-through audits that includes major issues or problems encountered during the surveys

Phase III: Water Balance Development

- *[Date]*: Interim water balance shown in graphical form that shows all major water uses by end-use (as defined in Phase II) and comparison to incoming supply and discharged wastewater that reveals estimated losses of the system

Final Report

- *[Date]* Executive summary – Provide a concise overview of the major results of the assessment that includes the following:
    - Prioritized list of water efficiency opportunities
    - Baseline water use and method used to determine this value
    - Water and wastewater rates, marginal costs of water and wastewater, and other associated costs, such as energy
    - Water distribution curve that provides water use over time showing historic seasonal fluctuations
    - Water balance shown in graphical form that shows all major water uses by end use and comparison to incoming supply and discharged wastewater that reveals estimated losses of the system. Include general methods used to estimate end-use consumption
    - Detailed information on efficiency opportunities that include O&M, retrofit, and replacement options for each major water-using piece of equipment, as well as recommendation for sub-metering
    - Prioritized list of water efficiency opportunities that provides total water, energy, and cost savings and life-cycle cost effectiveness indicator (such as savings to investment ratio or adjusted internal rate of return)
    - Alternate water sources with estimated potential of annual water volume, as well as potential applications where the alternate source could be utilized
    - Plan for meeting annual water reduction goals.

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