This is a guidance document with sample specification language intended to be inserted into project specifications on this subject as appropriate to the agency's environmental goals. Certain provisions, where indicated, are required for U.S. federal agency projects. Sample specification language is numbered to clearly distinguish it from advisory or discussion material. Each sample is preceded by identification of the typical location in a specification section where it would appear using the SectionFormat™ of the Construction Specifications Institute; the six digit section number cited is per CSI Masterformat™ 2004 and the five digit section number cited parenthetically is per CSI Masterformat™ 1995.

SECTION 32 84 00 (SECTION 02810) – PLANTING IRRIGATION

SPECIFIER NOTE:

resource management: The average American household uses about 30% of its water outdoors, while in some parts of the country, this can be as high as 70%. Experts estimate that as much as 50% of landscape water use goes to waste due to evaporation, wind, or runoff caused by over watering.

toxicity/IEQ: Water quality for most buildings is largely determined by the municipal water treatment facility. Most water treatment facilities rely upon chemicals, including chlorine, to combat pathogens. Chlorine is highly reactive and readily forms chlorinated compounds, many of which are considered to be dangerous. Chlorinated hydrocarbons, such as DDT, have been and are used as pesticides.

Landscape irrigation systems may be supplied by reclaimed, grey water, or rainwater harvesting systems. If non potable water is used, spray heads should be avoided in order to minimize potential for airborne pathogens. It may also be appropriate to consider a system design the minimizes physical contact with the public (and potential contact with or ingestion of non potable water).

performance: Landscape irrigation wastes water—up to 1.5 billion gallons every day across the country. According to the U.S. DOE Federal Energy Management Program (FEMP), water efficiency for landscape irrigation must be considered from the initial irrigation system design phase through installation to ensure optimal performance. Consistent management and maintenance are also essential. Failure to do so can result in losing more than 50% of irrigation water due to evaporation, wind, poor management, and/or improper system design, installation, or maintenance.
Drip irrigation systems use 20 to 50 % less water than conventional in-ground sprinkler systems by delivering a low volume of water slowly. This minimizes evaporation, runoff, and overspray. EPA GreenScapes provides a Sub-Surface Drip Irrigation Cost Calculator available online that compares the cost of landscaping irrigation with a water-saving sub-surface drip irrigation system to the cost of irrigation with a conventional sprinkler system. The calculator demonstrates that environmentally preferable sub-surface drip irrigation methods are very cost competitive compared with conventional sprinkler methods.
http://www.epa.gov/epawaste/conserve/rrr/greenscapes/tools/index.htm

Consider installing the following components for optimal water efficiency:
- Drip/micro irrigation for all areas suitable for such technology.
- Check valves in all sprinklers to retain water in lateral pipes between cycles.
- Demand based irrigation controls (i.e., weather or sensor based controls).
- Rain, freeze, and wind sensors to interrupt irrigation during unfavorable weather conditions.
- Flow rate monitoring equipment that can interrupt irrigation if excess flow is detected. (i.e., caused by broken pipes, fittings, nozzles, emitters sprinklers, etc.).

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Landscape irrigation systems.
   2. Irrigation controllers and accessories.

SPECIFIER NOTE:
Coordinate requirements specified under this section with work specified under related sections. Edit below to suit project.

B. Related Sections:
   1. 32 90 00 (02900) - Planting

1.2 DEFINITIONS

A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified herein.

B. Controllers, Climate-based: Weather-based irrigation controls that use real-time or historical weather information along with landscape parameters entered by the vendor to schedule or allow for irrigation when plants need water.

C. Controllers, Sensor-based: Soil-moisture-based irrigation controls that are inserted into the soil to measure moisture enabling irrigation when the plants need water.

D. Rain Sensors: A rain shut-off device designed to interrupt a scheduled cycle of an automatic irrigation system controller (i.e. timer) when a certain amount of rainfall has occurred.

1.3 SUBMITTALS

A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

SPECIFIER NOTE:
Green building rating systems often include credit for materials of recycled content. USGBC-LEED™ v3, for example, includes credit for materials with recycled content, calculated on the basis of pre-consumer and post-consumer percentage content, and it includes credit for use of salvaged/recovered materials.
Green Globes US also provides points for reused building materials and components and for building materials with recycled content.

   1. Recycled Content:
      a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
      b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
      c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
      d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

SPECIFIER NOTE:
Specifying local materials may help minimize transportation impacts; however it may not have a significant impact on reducing the overall embodied energy of a building material because of efficiencies of scale in some modes of transportation.
Green building rating systems frequently include credit for local materials. Transportation impacts include: fossil fuel consumption, air pollution, and labor.

USGBC-LEED™ v3 includes credits for materials extracted/harvested and manufactured within a 500 mile radius from the project site. Green Globes US also provides points for materials that are locally manufactured.

2. Local/Regional Materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
   b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
   d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

SPECIFIER NOTE:
USGBC-LEED™ v3 includes credit for water efficient landscaping and for water use reduction. Limiting or eliminating the use of potable water for landscape irrigation can earn LEED credit.
Green Globes – US also includes credit for strategies for minimal use of water for irrigation. Points are awarded for landscaping that integrates plants that are able to withstand extreme local weather conditions and that require minimal irrigation. And, water-efficient irrigation system (e.g. high efficiency technology, rain sensors) are also recognized.

3. Water efficiency:
   a. Indicate water consumption rates in gallons per day (gpd) per unit for the following:
      1) Irrigation Systems.

SPECIFIER NOTE:
Federal Water Efficiency Best Management Practices (BMPs) provide guidance for water efficient facility design, construction, and operation. http://www1.eere.energy.gov/femp/program/waterefficiency_bmp.html
Recommendations include use of a water budget which can be used as a performance standard for water consumption. A vendor calculates the water needs for the project and uses that information to plan an irrigation schedule to meet those needs.

FEMP originally developed the BMPs in response to EO 13123 requirements, which required Federal agencies to reduce water use through cost-effective water efficiency improvements. EO 13423 supersedes EO 13123. To account for the superseded requirement changes, water use patterns, and advancing technologies, the Environmental Protection Agency's WaterSense Office updated the original BMPs.

   b. Water Budget: Submit water budget statement; **[include calculations used in development of water budget]** and, indicate how irrigation system complies with approved water budget.

B. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

C. Submit evidence of installer certification as a WaterSense Certified Irrigation Contractor.

1.4 QUALITY ASSURANCE

A. Water flow and consumption rates:
   1. Water Budget: Provide irrigation system in accordance with approved water budget for landscape.

a. Water schedule: Provide two irrigation watering schedules consistent with overall project Water Budget. One schedule shall address the initial establishment phase of the landscape and the second schedule shall be designed to address an established landscape. Both schedules shall be seasonal in nature. Post both schedules on controller.

SPECIFIER NOTE:
The EPA WaterSense partnership program develops criteria for water efficient products and services. Products bearing the WaterSense label are generally 20 percent more water-efficient than similar products in the marketplace. Independent, third-party licensed certifying bodies certify that products meet EPA criteria for water efficiency and performance by following testing and certification protocols specific to each product category. Products that are certified to meet EPA specifications are allowed to bear the WaterSense label.

As of November 1, 2009, WaterSense labels are available for faucets, toilets, and flush urinals. Draft criteria is under development for pre-rinse spray valves, irrigation controls, and showerheads.

[2. Provide WaterSense labeled products for:
a. Irrigation controls.]

SPECIFIER NOTE:
EPA established specifications on October 27, 2006, to recognize certification programs for irrigation professionals in three areas: system design, installation and maintenance, and system auditing. Any certification program that meets the criteria outlined in the specification for one of these areas will be eligible for the WaterSense label.

B. Installer Qualifications: Engage an experienced Installer with minimum 3 years experience with work similar in material, design, and extent to that indicated for this Project and certified as a **Certified Irrigation Contractor (CIC)** through a WaterSense labeled program.

C. Pre-Installation Meetings:
1. Convene a pre-installation meeting minimum one week prior to commencing work of this Section.
2. Require attendance of parties directly affecting Work of this Section.
   a. Coordinate with installation of planting materials.
3. Review conditions of operations, procedures and coordination with related Work.
4. Agenda:
   a. Tour, inspect, and discuss conditions of planting materials.
   b. Review planting schedule and maintenance.
   c. Review required inspections.
   d. Review environmental procedures.

SPECIFIER NOTE:
A full audit of the irrigation system is recommended at least every three years by a qualified auditor, such as a WaterSense partner. A listing of irrigation partners by state can be found at www.epa.gov/watersense/pp/lists/irr_partners.htm

D. Post-Installation Audit: Conduct an audit of the irrigation system **[immediately after installation] [after one year of operation] [and three years thereafter]** by a WaterSense Irrigation Partner.
1. Performance: Assess system performance; verify proper scheduling; identify deficiencies including deficiencies due to damage or modification of system, growth of landscape, or an aging system; identify opportunities to employ new technologies
2. Review maintenance documentation.
3. Leaks: Check for leaks during the post-installation audit.
4. Runoff/overspray: Irrigation systems shall be designed to sustain the landscape without creating runoff or direct overspray during a minimum operating duration. Verify that there is no runoff or overspray during the post-installation audit.

Determine the minimum operating duration based on landscape conditions and irrigation system design.

5. Distribution uniformity: Irrigation systems shall achieve a lower quarter distribution uniformity (DULQ) of 70 % or greater. Measure distribution uniformity during the post-installation audit.

E. Operation and Maintenance Manuals Submittals:

1. Instructions indicating procedures for routine operation and maintenance of the irrigation system, including controllers:
   a. During first year of plant establishment.
   b. During one typical year including variations of maintenance for climatic conditions throughout the year.

1.4 MAINTENANCE

A. Provide regular maintenance for minimum one year from date of **[Substantial Completion] [initial acceptance] [xxxx].**

1. Monitor system **[monthly] [quarterly] [xxxx]** to assess effectiveness. Verify water consumption is consistent with water budget. Verify components are adjusted and functioning properly. Verify that irrigation system pressure is within manufacturer specifications.
2. Document all irrigation water use.
3. Make and document minor adjustments, if any, as necessary.
4. Provide recommendations for improvements to the system.

PART 2 - PRODUCTS

SPECIFIER NOTE:
EO 13423 includes requirements for Federal Agencies to use “sustainable environmental practices, including acquisition of biobased, environmentally preferable, energy-efficient, water-efficient, and recycled-content products”

EO 13423 directs Federal Agencies “… beginning in FY 2008, reduce water consumption intensity, relative to the baseline of … year 2007 … by 2 percent annually through the end of fiscal year 2015 or 16 percent by the end of fiscal year 2015”

Specifically, under the Sustainable Building requirements per Guiding Principle #3 Protect and Conserve Water, EO 13423 directs Federal agencies to "Use water efficient landscape and irrigation strategies, including water reuse and recycling, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities)."

Executive Order 13514; *Federal Leadership in Environmental, Energy, and Economic Performance*; was signed on October 5, 2009. http://www.ofee.gov/execorders.asp It expands upon the energy reduction and environmental performance requirements of EO 13423.
http://www1.eere.energy.gov/femp/regulations/printable_versions/eo13423.html
EO 13514 sets numerous Federal requirements in several areas, including:

- Reducing potable water consumption intensity 2% annually through fiscal year 2020, or 26% by the end of fiscal year 2020, relative to a fiscal year 2007 baseline.
- Reducing agency industrial, landscaping, and agricultural water consumption 2% annually, or 20% by the end of fiscal year 2020, relative to a fiscal year 2010 baseline.
- Identifying, promoting, and implementing water reuse strategies consistent with state law that reduce potable water consumption.

2.1 WATER

A. Water: **[Potable] [Rainwater] [Grey water] [Reclaim water]**.

2.2 IRRIGATION SYSTEMS

A. Micro-irrigation system: Equip with pressure regulators, filters, and flush end assemblies. Provide one of the following:
   1. Drip irrigation.
   2. Micro-spray jets
   3. Micro-sprinklers.
   4. Bubbler-style watering system.

2.3 CONTROLLERS

SPECIFIER NOTE:
There are many available technologies that use weather or soil moisture information to schedule irrigation according to plant needs. WaterSense has not yet developed water-efficiency criteria for irrigation controllers.

As of January 2008 The overall goal for performance testing of weather- or sensor-based irrigation control technologies is to have quality test protocols that can be performed at any qualified laboratory in the country. Products that score well on the performance test should perform well nationwide. As stated in the Notification of Intent, WaterSense would like to use existing test protocols. At this time, the only protocols for this product category are the Smart Water Application Technology (SWAT) protocols drafted by industry and water utilities.
Smart Water Application Technologies, or SWAT, is a national partnership initiative of water purveyors and irrigation industry representatives created to promote landscape water use efficiency through the application of state-of-the-art irrigation technologies.

A. Irrigation systems shall be equipped with irrigation controllers that contain the following features:
   1. Multiple programming capabilities – shall be capable of storing a minimum of three different programs to allow for separate schedules.
   2. Multiple start times (cycling, cycle/soak, stackable start times) – shall be capable of a minimum of three different start times to allow for multiple irrigation cycles on the same zone for areas prone to runoff.
   3. Variable run times – shall be capable of varying run times, for example one minute to a minimum of one hour.
   4. Variable scheduling – shall be capable of interval scheduling (minimum of 14 days) to allow for watering on even day scheduling, odd day scheduling, calendar day scheduling, and interval scheduling.
   5. Percent adjust (water budget) feature – shall include a “Percent Up/Down Adjust” feature (or “Water Budget” feature) such as a button or dial that permits the user to increase or decrease the run-times or application rates for each zone by a prescribed percentage, by means of one adjustment without modifying the settings for that individual zone.
   6. Capability to accept external soil moisture and/or rain sensors.
   7. Non-volatile memory or self-charging battery circuit.
   8. Complete shutoff capability for total cessation of outdoor irrigation.

B. Smart Water Application Technologies (SWAT): Provide controllers that comply with the most current definitions and testing protocols published by SWAT for:

SPECIFIER NOTE:
Weather- or climate-based irrigation control technology uses local weather and landscape conditions to tailor irrigation schedules to actual conditions on the site or historical weather data. Instead of irrigating according to a preset schedule, advanced irrigation controllers allow irrigation to more closely match the water requirements of plants. As of November 2009, WaterSense plans to label weather-based irrigation controllers and soil moisture sensors.

1. Controllers, Climate-based

SPECIFIER NOTE:
Soil moisture sensors and weather-based controllers automatically adjust your irrigation schedule based on soil moisture or weather conditions so your landscape gets only what it needs when it needs it. For a more inexpensive option, install a rain shutoff switch. Required by law in many states, this sensor will turn off your sprinklers in rainy weather and can be retrofitted to almost any system.

2. Controllers, Sensor-based

C. Rain Sensors: Equip irrigation systems with rain sensors.

2.4 METERS

SPECIFIER NOTE:
Irrigation meters, sometimes known as a "deduct meter", can help with monitoring and reporting efforts. Refer to Section 01 92 00 (01800) – Facility Operation for additional information on metering and reporting of water usage. Some water utilities offer an interruptible rate for the service or will provide a credit to the sewer charges

A. Provide an irrigation meter to measure the amount of water applied to the landscape.

PART 3 - EXECUTION

3.1 PREPARATION

3.X FIELD QUALITY CONTROL

A. Water: Coordinate with work specified in Section 01 57 19.13 (01354) – Environmental Management to provide water monitoring for surface and groundwater.

SPECIFIER NOTE:
The erosion potential of a soil is of concern in vegetated channels, road embankments, dams, levees, spillways, construction sites, etc.

1. Assess potential effects of soil management practices on soil loss in accordance with ASTM D6629. Assess erodibility of soil with dominant soil structure less than 7 to 8 cm in accordance with ASTM D5852.

END OF SECTION