


FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

# STRATEGIC WATER MANAGEMENT PLANNING

Kate McMordie Stoughton  
C.E.M., LEED AP  
Pacific Northwest National Laboratory



1 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

## Water Management Process

1) Where are you coming from?

2) Where are you now?

3) Where are you going and how will you get there?



4) What to do if...

4 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

## Conservation vs. Efficiency?

**Conservation:** reducing water use in the existing equipment or process

**Efficiency:** utilizing new equipment that performs the same function with less water

2 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

## Water Management Process

1) Where are you coming from?

2) Where are you now?

3) Where are you going and how will you get there?



4) What to do if...

5 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

## Potable vs. Non-potable?

**Potable:** Sufficient quality and permitted for human consumption

**Non-Potable:** *Not* sufficient quality nor permitted for human consumption

3 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

## 1) Where are you coming from?

*Set the stage for your plan...*

- Form your team – include many stakeholders: such as operations and maintenance, environmental, and energy
- Identify goals and requirements
- Set your study period
- Choose a unit of measure – be consistent!

6 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### 1) Where are you coming from?

**EO 13423**  
Potable water use intensity reduction 2% annually through FY2015 based on FY2007 baseline

**EO 13514**  
Potable and non-potable water use reduction, water reuse, and stormwater management

**EISA**  
Facility evaluations of 25% of covered facilities annually to identify water efficiency measures

7 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### EO 13514 Proposed Guidance – “ILA” Water Use

- Reduction for total volumetric use
- Only sources of ILA water use **NOT** currently tracked as part of potable water consumption intensity reduction will be tracked in this new category.
- Helps to avoid changes in FY07 baseline and redundant or overlapping reporting

10 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### 1) Where are you coming from?

2% annual potable water use intensity through FY20 based on FY07 baseline

2% water use reduction for ILA\* water use through FY20 based on FY10 baseline

Follow EPA Stormwater Management Guidance

Implement water reuse strategies

\* Industrial, Landscaping, and Agricultural Water Use

8 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Stormwater Guidance

- EPA developed guidance on stormwater management for Federal facilities per EISA 2007

For more information:  
<http://www.epa.gov/owow/nps/lid/section438>

11 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### EO 13514 – “ILA” Water Use

ILA Water Use	Definition
Industrial	Aids in processes such as cooling, washing, manufacturing
Landscaping	Applied to outdoor spaces for socio-behavioral, environmental, or aesthetic benefit not satisfied by rainfall
Agricultural	Irrigation and related uses for agriculture including food, animal and livestock, and agricultural research

9 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Source for More Information

- Alliance for Water Efficiency resource for state by state info on conservation and regulatory issues:  
<http://allianceforwaterefficiency.org/water-efficiency-US.aspx>

12 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Water Management Process

- 1) Where are you coming from?
- 2) Where are you now?
- 3) Where are you going and how will you get there?
- 4) What to do if....

13 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Collect Background Information

- Identify all sources of water both potable and non-potable
- Utility Information (if water/wastewater service is purchased)
- Water Generation Information (if produce own water)

16 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Facility Water Cycle

Water Utility → Consumer → Distribution System Leaks → End-Use → Sewage Treatment Facility → Discharge → Water Utility (via Recycle/Reuse)

14 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Collect Background Information

- Facility Information
  - Building inventory (sq ft, bldg type)
  - Current water end-use technologies
  - Operating schedules
  - Equipment inventory
  - Meter locations/reports
  - Distribution system – length, type, pipe type and condition

17 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Perform a Water Balance

Identify where it goes

Water Sources → Water Uses

What goes in must come out...Somewhere!

15 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Measure the Total Supply

Monthly Use

Annual Total Supply Curve

Jan-09 Feb-09 Mar-09 Apr-09 May-09 Jun-09 Jul-09 Aug-09 Sep-09 Oct-09 Nov-09 Dec-09

18 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

### Measure Metered and Unmetered Uses

- Estimate submetered uses
  - Buildings
  - Processes
  - Irrigation
- Estimate unmetered uses
  - Fire fighting drills
  - Storm main flushing
  - Construction

19 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

### Now What?

**Estimate End-Uses**

22 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

### Estimate Losses

Loss Type	Cause of Loss	
<b>Leaks ("real")</b>	<ul style="list-style-type: none"> <li>• poor installation</li> <li>• aging materials</li> <li>• incorrect backfill</li> <li>• vibration</li> </ul>	<ul style="list-style-type: none"> <li>• pressure fluctuations</li> <li>• excess pressure</li> <li>• corrosion</li> <li>• loose or damaged parts in valves and meter boxes</li> </ul>
<b>Meter Reading Errors ("paper")</b>	<ul style="list-style-type: none"> <li>• aging meters</li> <li>• water quality impacts</li> <li>• extreme heat/cold</li> </ul>	<ul style="list-style-type: none"> <li>• installation errors</li> <li>• incorrect sizing</li> <li>• wrong type for application</li> <li>• non-calibrated meters</li> </ul>
<b>Accounting Errors ("paper")</b>	<ul style="list-style-type: none"> <li>• overlapping billing cycles</li> <li>• conversion factor errors</li> <li>• mistakes in billing procedures</li> </ul>	<ul style="list-style-type: none"> <li>• changes in buildings such as renovations where new service lines are in place but not metered</li> </ul>

20 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

### End-Use Breakout: Office

End-Use	Percentage
domestic plumbing fixtures	37%
cooling and heating	33%
landscaping	20%
misc equipment	10%

23 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

### Put It All Together...

21 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

### End-Use Breakout: Hospital

End-Use	Percentage
cooling and heating	31%
domestic plumbing fixtures	27%
process	15%
landscaping	9%
kitchen	6%
laundry	6%
other	6%

24 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

**Perform a Walk-Through Survey**

- Estimate gender split in each building – occupants have a big impact on water use
- List all water using equipment
- Record hours of operation and operating schedule
- Measure equipment water consumption

**GOAL: Estimate water use at end-uses**

25 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

**Compile Your Results**

What goes in must come out...Somewhere!

28 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

**Perform a Walk-Through Survey**

- Inventory equipment such as:
  - Restroom fixtures
  - Boilers
  - Single-pass cooling
  - Cooling towers
  - Irrigation
  - Vehicle wash station

**Things to note during survey: equipment age, condition, flow rate, model number, operating schedule**

26 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

**Compile Your Results**

$\Sigma$  Total End-Use Water  $\leq$  Total Water Supply

Category	Percentage
Laboratory Use	74%
Domestic Use	13%
City Water Irrigation	6%
Cooling Towers	6%
Housing	1%

29 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

**Perform a Walk-Through Survey**

- Inventory equipment:
  - Laundry
  - Kitchen equipment: fixtures, dishwashing, ice machines
  - Hose bibs
  - Maintenance faucets

**Keep an eye out for efficiency opportunities!**

27 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

**Understand Your Water Bill**

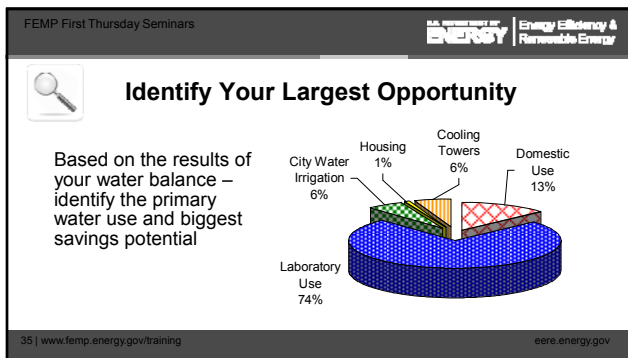
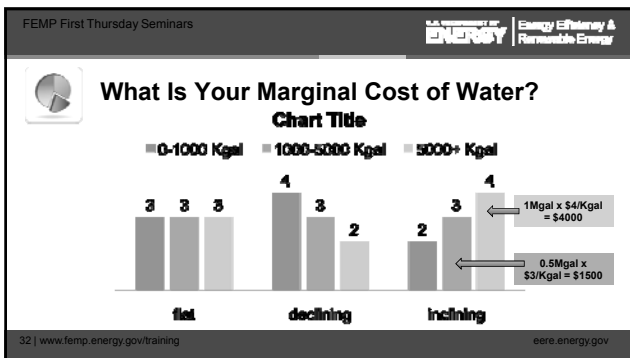
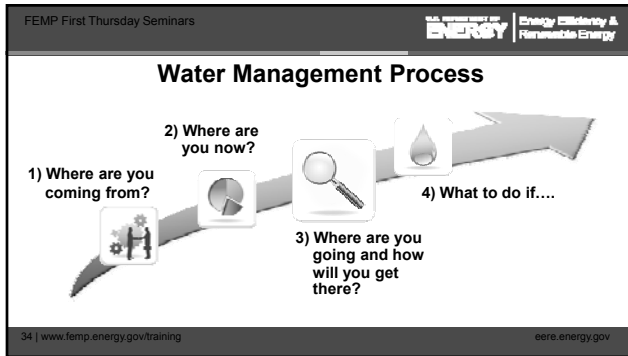
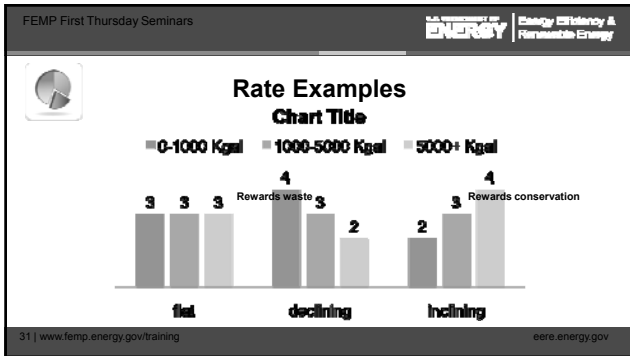
**Rate Structures**

- Flat or uniform rate
- Declining block rate
- Inclining block rate
- Seasonal rate

**Other things to note on your bill:**

- Meter and service fees
- Billing periods
- Wastewater/sewer charges

30 | www.femp.energy.gov/training eere.energy.gov



- FEMP First Thursday Seminars
- U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy
- ### Determine Your Water and Wastewater Costs
- Determine other associated costs
- Energy to heat water
  - Treatment and chemical costs
  - Operations and maintenance costs
- 33 | www.femp.energy.gov/training eere.energy.gov

- FEMP First Thursday Seminars
- U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy
- ### FEMP's 14 Best Management Practices Include:
- Water-Efficient Landscaping
  - Water-Efficient Irrigation
  - Toilets and Urinals
  - Faucets and Showerheads
  - Boiler/Steam Systems
  - Single-Pass Cooling Equipment
  - Distribution System Audits, Leak Detection, and Repair
  - Cooling Tower Management
  - Laboratory/Medical Equipment
- 36 | www.femp.energy.gov/training eere.energy.gov


FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

**Facility Indoor Water Efficiency**

**High efficiency toilets (HET)**

- Consume no more than 1.28 gallon per flush (gpf)
- Tank toilets – EPA WaterSense labeled
  - Pressure assisted
  - Dual flush
- HET Flush Valve




37 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

**Facility Indoor Water Efficiency**

- **Faucets:**
  - Public -- UPC/IPC: 0.5 gpm
  - Private -- EPA WaterSense labeled: ≤ 1.5 gpm
- **Showerheads:** *(recently released specification)*
  - EPA WaterSense labeled: ≤ 2.0 gpm
- Get more information at WaterSense: <http://www.epa.gov/watersense/products/index.html>



40 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

**Facility Indoor Water Efficiency**

**Toilet Performance**

- Maximum Performance (MaP) Testing: "real life" test medium for flushing performance

[http://allianceforwaterefficiency.org/Maximum\\_Performance\\_\(MaP\)\\_Testing.aspx](http://allianceforwaterefficiency.org/Maximum_Performance_(MaP)_Testing.aspx)

**Note to Remember:**  
Standard toilets use 1.6 gpf set by EPCa '92. These are NOT considered high efficiency!

38 | www.femp.energy.gov/training eere.energy.gov


FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

**Facility Indoor Water Efficiency**

**Commercial Kitchen Efficiency Options**

- Energy Star rated dishwashers/ware-washers
- Connectionless food steamers
- Air-cooled ice machines
- Water recycling system for food disposals
- High efficiency pre-rinse spray valves – FEMP purchasing spec ≤ 1.25 gpm



41 | www.femp.energy.gov/training eere.energy.gov


FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

**Facility Indoor Water Efficiency**

**High Efficiency Urinal (HEU)**

- Consumes no more than 0.5 gpf
- Flushing urinals: EPA WaterSense labeled 0.5 gpf, 1 quart per flush, 1 pint per flush
- Non-Water Urinal
- Get more information at WaterSense: <http://www.epa.gov/watersense/products/urinals.html>



**Note to Remember:**  
Standard urinals use 1.0 gpf set by EPCa '92. These are NOT considered high efficiency!

39 | www.femp.energy.gov/training eere.energy.gov


FEMP First Thursday Seminars

**ENERGY** Energy Efficiency & Renewable Energy

**Facility Outdoor Water Efficiency**

**Landscaping and Irrigation Resources**

- Consider working with a contractor that has been certified through a WaterSense labeled program
- Certified Irrigation Auditor through the Irrigation Association
- Alliance for Water Efficiency



42 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

 **Cooling Tower Water Management Innovative Strategies:**


- Green chemicals
- Chemical free platforms
- Automation and controls
- Reuse systems



43 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

 **Water Reuse**  
**How can water be “reused”?**

- Water recycle: use again in same system
- Industrial reuse: untreated water reused in another process
- Wastewater reclaim: treated effluent reused in another process


**Possible sources of “reused” water:**

- Wastewater effluent
- Gray water
- Condensate capture
- Reject water from water purification systems


46 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

 **Single-Pass Cooling**  
**Common equipment to watch for:**


- Hydraulic equipment
- Condensers
- Air compressors
- Vacuum pumps
- Ice machines
- X-ray equipment




44 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

 **Applications and Strategies for Water Reuse**


- Gray water package units:  
[http://allianceforwaterefficiency.org/Package\\_Graywater\\_Recovery\\_and\\_Treatment\\_Systems.aspx](http://allianceforwaterefficiency.org/Package_Graywater_Recovery_and_Treatment_Systems.aspx)
- Vehicle wash stations
- Laundry
- Cooling tower make-up
- Toilet and urinal flushing
- Irrigation
- Ornamental fountains




47 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

 **Lab and Medical Equipment**


- Water purification systems: choose high recovery rate, reuse reject water
- Disinfection/sterilization systems: auto shut down, efficiency retrofit kit
- Photographic and x-ray equipment: go digital!
- Glassware washers: consider recycling systems




45 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

 **Case Study: Sandia National Laboratory Microelectronics Plant**

- Large micro-electronics plant with large ultra-pure water needs
- HERO system in place with 90% recovery rate
- Recycle water in HERO system
- Reclaim reject water for use in cooling tower make-up
- Annual savings is over 140 million gallons



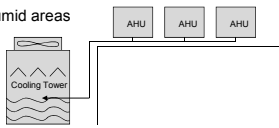
48 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**U.S. DEPARTMENT OF ENERGY** | Energy Efficiency & Renewable Energy

**Case Study: EPA Condensate Capture**

- Athens, GA Science and Ecosystem Support Division
- Installed condensate capture of air handling unit to feed nearby cooling tower make-up water
- From May-Dec 08 collected over 540 Kgal
- 16% reduction in water use for site
- Duplicating projects in other humid areas



49 | www.femp.energy.gov/training | eere.energy.gov

FEMP First Thursday Seminars

**U.S. DEPARTMENT OF ENERGY** | Energy Efficiency & Renewable Energy

**Federal Financing Options**

- Operations and Maintenance
- Military Construction (MILCON) – DoD only
- Energy Conservation Investment Program (ECIP) – DoD only
- Sustainment, Restoration, and Modernization (SRM) – DoD only
- Pollution Prevention


52 | www.femp.energy.gov/training | eere.energy.gov

FEMP First Thursday Seminars

**U.S. DEPARTMENT OF ENERGY** | Energy Efficiency & Renewable Energy

**Leak Detection**

- Zone flow analysis
- Acoustic listening equipment
- Permanent monitoring
- Thermal imaging
- Requires specialized equipment and training



50 | www.femp.energy.gov/training | eere.energy.gov

FEMP First Thursday Seminars

**U.S. DEPARTMENT OF ENERGY** | Energy Efficiency & Renewable Energy

**Develop Financing Options**

**Alternative Financing and other options:**

- Energy Savings Performance Contracts (ESPC)
- Utility Energy Service Contracts (UESC)
- Utility rebates and conservation incentives


53 | www.femp.energy.gov/training | eere.energy.gov

FEMP First Thursday Seminars

**U.S. DEPARTMENT OF ENERGY** | Energy Efficiency & Renewable Energy

**Case Study: Kirtland AFB Leak Detection and Repair**

- Surveyed 108 miles of distribution lines
- Found 31 leaks accounting for 16% of the base' water use
- Saving the base over \$330K per year
- 1.75 year payback
- FEMP award winning project

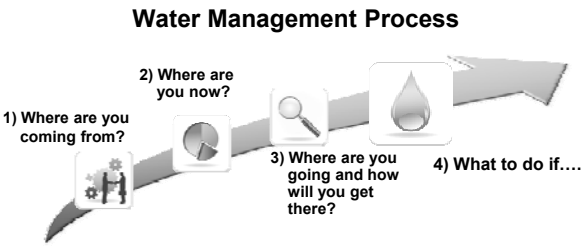


51 | www.femp.energy.gov/training | eere.energy.gov

FEMP First Thursday Seminars

**U.S. DEPARTMENT OF ENERGY** | Energy Efficiency & Renewable Energy

**Water Management Process**



54 | www.femp.energy.gov/training | eere.energy.gov

FEMP First Thursday Seminars

U.S. Drought Monitor February 16, 2010

### Drought Management Planning

Released Thursday, February 18, 2010

Author: Brian Fuchs, National Drought Mitigation Center

55 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

### Where To Find More Information

FEMP: <http://www1.eere.energy.gov/femp/program/waterefficiency.html>

- Federal directives and guidance
- Best Management Practices
- Training: <http://femptraining.labworks.org/>
- Resources
- Case Studies

EPA WaterSense: <http://www.epa.gov/watersense/>

Alliance for Water Efficiency: <http://allianceforwaterefficiency.org>

American Water Works Association: <http://www.awwa.org/>

California Urban Water Conservation Council: <http://cuwcc.org/>

58 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

### Drought Management Planning

U.S. Drought Monitor July 2009

56 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**Federal facilities have a tremendous opportunity to lead by example within their communities to showcase innovative and cost-effective water efficiency strategies.**

59 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

### Drought Management Planning

U.S. Drought Monitor July 2008

57 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

### Web-based Water Management Training

<http://femptraining.labworks.org/>

60 | www.femp.energy.gov/training eere.energy.gov

FEMP First Thursday Seminars

**ENERGY** | Energy Efficiency & Renewable Energy

## Strategic Water Management Planning

Seminar Evaluation and the Open Book Quiz

***Almost done . . .***

The link below will take you to the brief open-book Quiz and Evaluation.

***Earn a Certificate of Completion for your records!***

**<http://apps1.eere.energy.gov/femp/training/quiz/water.cfm>**

61 | www.femp.energy.gov/training eere.energy.gov