

Water Auditing 101

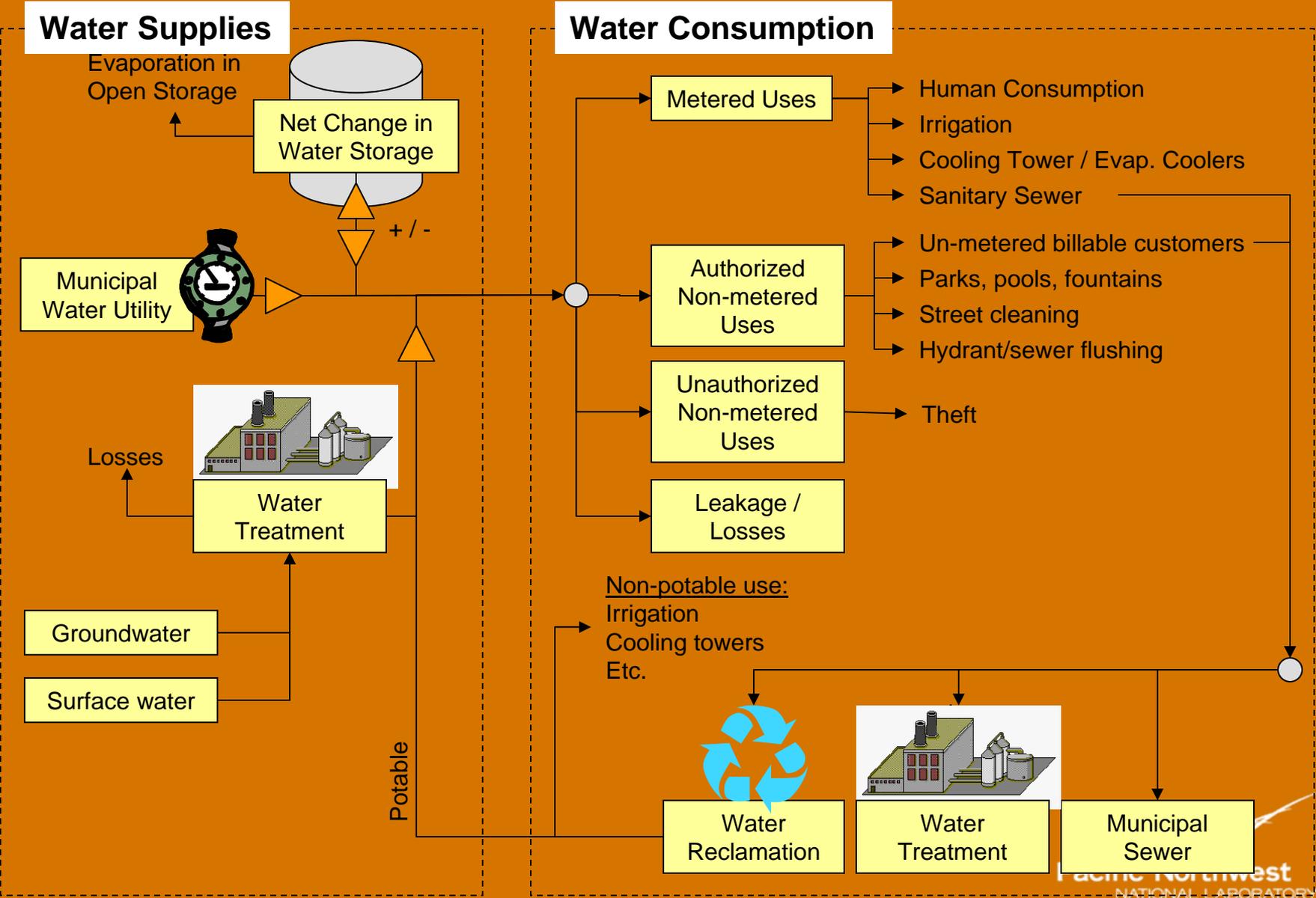
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Water Auditing Goals

- ▶ Basic goals: Identify -- Quantify -- Verify
 - water uses
 - water losses
- ▶ Specific goals:
 - Understand potable water use patterns
 - **Identify water resource efficiency opportunities**
 - Develop water management strategy
 - Eliminate losses, theft
 - Save dollars

Water Balance – Flow Chart Style



The process is a water balance

- Municipal Systems
- Surface water
- Well Water
- Reclamation

- Metered Uses
- Unauthorized Use
- Leaks
- Evaporation
- Meter Inaccuracies

Water Sources

Water Uses

What goes in must come out ... somewhere!!

Audit Approaches

▶ Top Down Approach

- Focuses on the total system to set priorities
- Comprehensive scope
- Goals, objectives, procedures are then pushed down to the individual parts.

▶ Bottom Up Approach

- Focus on the specifics of each end-use
- Sum the parts to define the whole
- Goals, objectives, procedures are developed at the lower levels and pushed upward

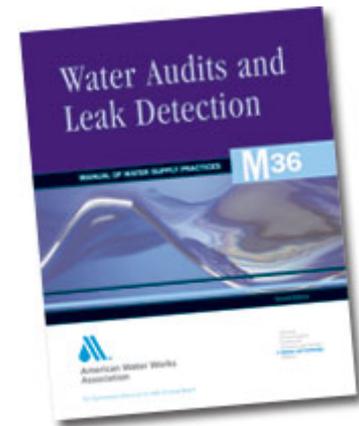
AWWA Water Audit Methodology:

<http://www.awwa.org/Resources/Content.cfm?ItemNumber=588>

Water Auditing Steps: Prepare, Audit, Analyze



- Prepare
 - 1. Prepare for Audit
 - 2. Measure Supply
 - 3. Measure Metered Use
 - 4. Measure/Estimate Unmetered Use
 - 5. Measure/Estimate Losses
- Audit
 - 6. Assemble Walk-Through Audit Team
 - 7. Perform Walk-Through of Facility
- Analyze
 - 8. Determine Water Costs
 - 9. Compile Audit Results
 - 10. Evaluate Water Efficiency Opportunities
 - 11. Develop Water Management Plan



GSA Water
Management
Guide

Prepare for audit: metered uses

- ▶ Quantify Supply - collect metered data
 - A. Identify all water sources
 - B. Map distribution of sources
 - C. Account for any water storage
 - D. Adjust figures (accuracy or varying time periods for readings)
- ▶ Quantify Metered Users
 - Identify all metered uses
 - Test calibration on sampling of meters
 - Check for accounting errors

Prepare for audit: unmetered uses

▶ Unmetered Users

- Estimate usage
 - Batch procedure
 - Discharge procedure
 - Comparison procedure
 - Engineering method
 - Federal water use indices

▶ Estimated Unauthorized Losses

- Identify potential water losses

Prepare for audit: Information to acquire before visiting the building

- building floor plan
- typical facility operating schedules
- Facility **use type** (e.g., office, lab, mixed)
- numbers of **employees** and visitors
- maintenance and janitorial schedules
- lists of all water-using equipment and/or drawings
- HVAC inventory (e.g., cooling towers or evap. coolers)
- number of plumbing fixtures
- outdoor water use applications (quantity & schedule)
- any prior water and energy surveys
- names of energy, water, and wastewater utilities
- water and sewer bills (for two years)
- anticipated water and sewer billing rates

Audit: Performing walk-through audits

▶ Tools for Auditing:

- Audit forms and clip board
- Digital camera
- Microweir pitcher
- Pressure gauge
- Infrared temperature gun
- Portable metering (short-term)

Audit: Performing walk-through audits

****Understand and identify how water is being used****

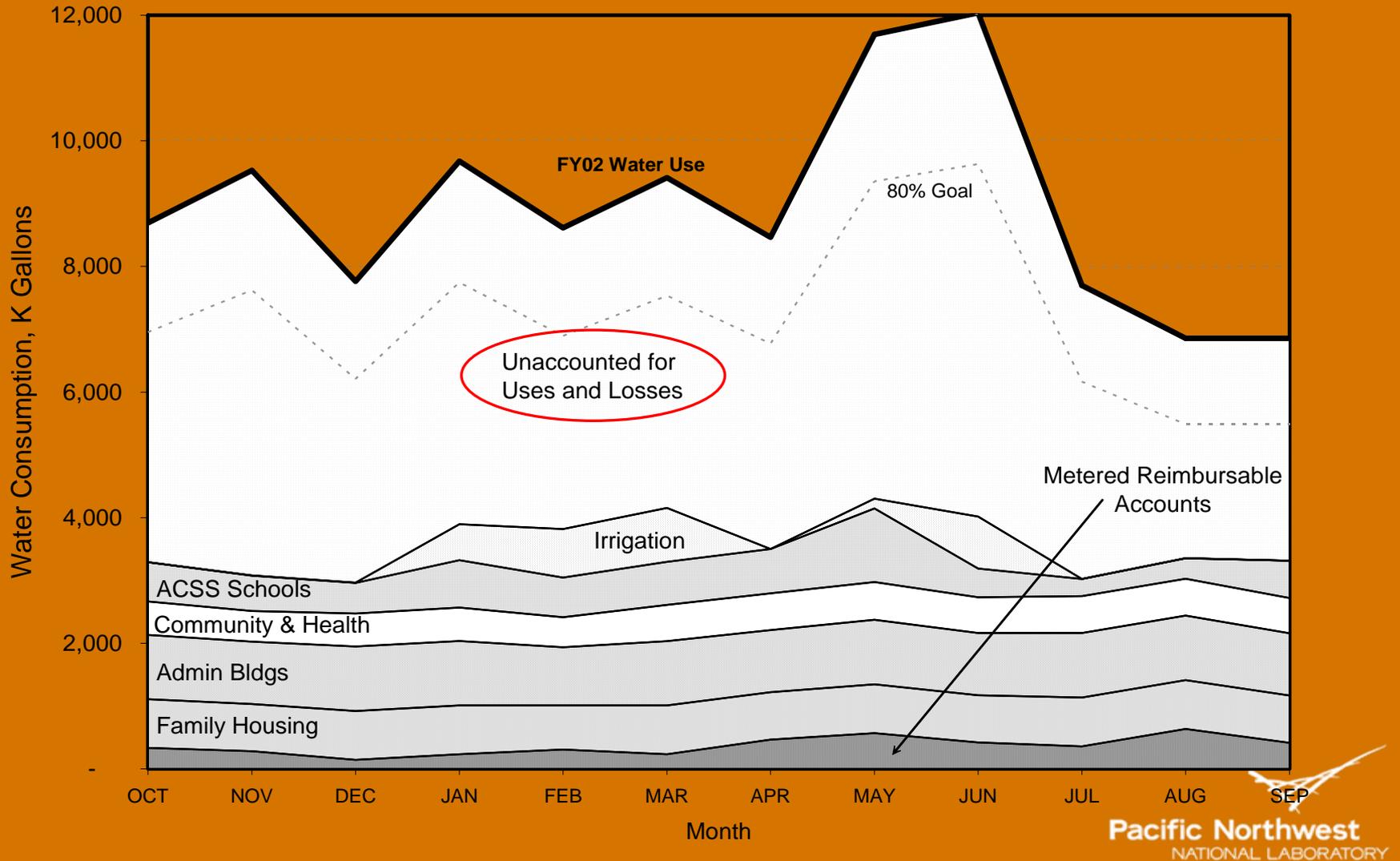
- ▶ Interview staff responsible for equipment operation
- ▶ Get understanding of gender split in each building
- ▶ List all water-using equipment and record hours of operation
- ▶ Measure water consumption for each piece of equipment
- ▶ Compare flow rates with manufacturer's recommended
- ▶ Compare actual conditions with floor plans
- ▶ Describe and check all meters, valves, and hydrants
- ▶ Note appropriate technologies or retrofits – get input from maintenance staff

Audit: Performing walk-through audits

Identify / Inventory:

- ▶ Restroom fixtures
- ▶ Laundry
- ▶ Vehicle wash station
- ▶ Kitchen equipment: fixtures, dishwashing, ice machines
- ▶ Hose bibs
- ▶ Maintenance faucets
- ▶ Cooling towers
- ▶ Boilers
- ▶ Once-through cooling
- ▶ Landscape watering
- ▶ Firefighting- training and hydrant-flushing

Analyze Data: Filling in the gaps...



Federal Water Use Indices

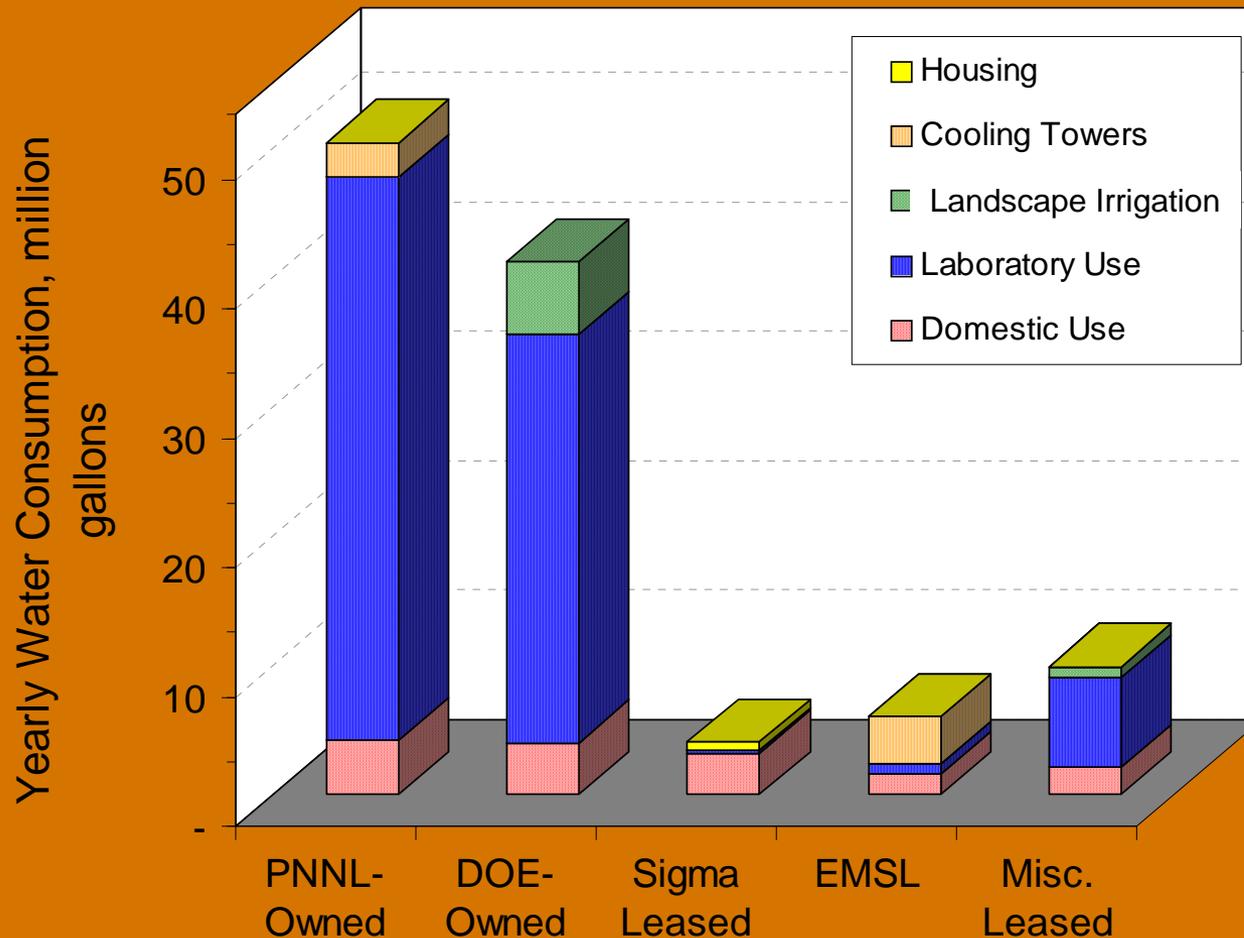
http://www1.eere.energy.gov/femp/water/water_useindices.html

- Use water use indices to estimate water usage in various buildings where metering isn't present
- Can also be used to estimate end uses in metered buildings

Sample for office buildings		Gallons/unit/day	
User	Unit	Range	Typical
Office	employee	8-20	15
Landscape, turf	acre		1,571
Landscape, non-turf	acre		785

Water Consumption By End-Use

Combination of metered data (whole building), water indices (human consumption, irrigation), and engineering estimates (cooling towers) used to create a water profile for PNNL-occupied buildings.



Compile Audit Results

- ▶ Collate data into audit report
 - Equipment list
 - Operating schedule
 - Landscape irrigation schedule
 - Water flow chart
 - Breakout of all water costs
- ▶ Determine MARGINAL cost of water on utility bill
- ▶ Determine other associated costs:
 - Heating/cooling
 - Pumping
 - Pretreatment
 - Chemical treatment (cooling tower/boiler)
 - Sewer discharge

Evaluate Water Efficiency Opportunities

- ▶ Determine areas of improvement
- ▶ Conduct life-cycle costs analyses
- ▶ Explore financing options
- ▶ Identify areas for water efficiency improvement
 - Maintenance improvements
 - Plumbing fixtures
 - HVAC systems
 - Landscape irrigation
 - Laundry
 - Processes

*****Use FEMP Best Management Practices as Guide*****

FEMP Water Activities: 2008 ...and Beyond

Fresh Look at Federal Water Efficiency:

- ▶ Establishing Baseline and Meeting Water Conservation Goals of Executive Order 13423
 - Guidance for water reduction goals of E.O. 13423
 - Released Jan. 2008 available FEMP web site
- ▶ Updated Best Management Practices
 - FEMP and EPA WaterSense updated
 - 14 BMPs
 - “Planning” to “Alternate Water Sources”
 - “Irrigation” to “Commercial Kitchens”

FEMP Water Activities: 2008 ...and Beyond

Planned Programs and Activities

- ▶ Update of the FEMP Water Web site
 - Current information
 - Case studies
 - Downloadable “awareness” materials
- ▶ Development of Web-based water training
 - Self-paced learning modules
 - Module considerations:
 - Water management planning
 - Water auditing
 - Baseline development