Aquifer Storage and Recovery (ASR)
ALTERNATIVE USE IN A WATER SYSTEM

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Water Treatment Plant Service Areas

• Sweeney Water Treatment Plant (Surface Water)
  – Largest in System
  – Supplies 80% of Service Area

• Nano Filtration Plant (Groundwater)
  – Northern 17% of Service Area

• Groundwater (Well System)
  – 2 Small Systems Comprising 3% of Southern and Western Service Area

• Aquifer Storage and Recovery
  – Eastern Area Near Wrightsville Beach (Sweeney Service Area)
What is ASR?

ASR - Aquifer Storage and Recovery

Three Step Process = 1 Cycle:

1. Treated water is placed into an existing groundwater aquifer through a well casing – **RECHARGE**

2. The water is **STORED** in the aquifer for future use

3. Water is **RECOVERED** through a well and pumped back into distribution system
Process of Recharge

- Open valve to provide desired recharge rate
- Monitor flow and pressure
- End when desired volume has been achieved
Storage Phase

- Allow water to sit in aquifer
- Test for quality
- Recovery to begin when predetermined criteria are met
- Emergency recovery can begin anytime
Recovery Phase

• Aquifer is Full but Half Full…
  – Can only Recover about Half of Recharge

• Determine optimum recovery rate
  – Factors: Neighboring wells, Turbidity

• At start of recovery, flush system of sand. First 1,000 Gallons or so…

• Recover at predetermined rate

• Dose with disinfectant
Getting Started with an ASR

Cross Section of NC Aquifers

(Storage zone for CFPUA's ASR-1 well)

(modified from Winner and Coble, 1996)
Aquifer Storage Recovery Program, Westbrook Site
All ASR Wells and Monitor Wells
November 2007

NOTE:
MW-300' = monitor wells at 300-ft radius from ASR wells.
Getting Started with an ASR

Cycle Testing

• Smaller scale recharge/storage/recovery volume

• Testing for Permitting Agencies
  – Dictated by Injection Permit
  – Almost all treated water and groundwater constituents to be tested
Getting Started with an ASR

Water Quality Monitoring

• Baseline for Groundwater from Monitoring Well

• Water quality testing (Treated Water)
Getting Started with an ASR

Cycle Testing

• Recovery testing
  – Test “Tap” Water to Determine Where Influence Area Boundaries Are
  – Tracer
CFPUA’s ASR

• Concept/Design/Permitting – 2004 – November 2011
• Construction – 2012
• Cycle Testing
  – Cycle 1 – 2013
  – Cycle 2 – 2016
  – Well rehab for sand issues - 2015
  – Full Operation – 2016

• GOAL – Water Quality and Emergency Supply
CFPUA – Cycle Testing

• Cycle 1
  – Recharge - From March to May 2013 – 26 Million Gallons
  – Storage – From May to September 2013
  – Recovery – October 2013

• Findings
  – Reduced THM’s from 80 PPM to 10 PPM (95 Days of Storage)
  – Area of Influence Different than expected *Fluoride Tracer
  – Higher volume of sand recovered
  – Allows Sweeney to operate more efficiently at lower demand times
CFPUA – Cycle Testing

• Cycle 2
  – Recharge – Began March 2014
  – Sand issues – screen well Nov 2015
  – Storage – TBD
  – Recovery – TBD

• Findings (so far)
  – Start-up smoother
  – Operator familiarity
How Can This Help Operation of a Water System?

• Cost Effective Seasonal Storage of Finished Water
  – No physical tank to maintain
  – Fluoride remains in stored water
  – May allow the Water Treatment Plant to operate more efficiently during lower demand periods
  – Can Leave it “Empty”

• Assist with Peak Demands
  – Dependable/Efficient Volume for Peak Usage Periods

• Enhanced Water Quality
  – THM attenuation
  – Same quality as plant output
How Can This Help Operation of a Water System?

- Emergency Supply
  - Can enhance supply to neighboring systems with issues
  - Enough volume to supply short term during storms
  - Could use during line breaks
How Can This Help Operation of a Water System?

- Could slow/reverse salt water intrusion into aquifer

(modified from Winner and Coble, 1996)
Where to install your ASR

• Locate near larger/artery type mains to reduce infrastructure improvements where possible

• Locate at point in system with highest water age to allow for blending to improve quality

• Consider Topography
Operational Resources/Activities

• Recharge
  – Daily Site Visit to Observe System
  – Weekly/Bi-weekly Water Quality Testing
Operational Resources/Activities

• Storage

  – Daily Site Visit

  – Bi-Weekly Testing for THM’s
Operational Resources/Activities

• Recovery
  – Daily Site Visit to Observe System
    • Chemical Feed
    • Pump Rate
    • Sand Separators
  – Weekly and Bi-weekly Water Quality Testing
  – Monthly Reporting
Questions?

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