Hydrogeologic Evaluation of a Radial Collector Well
City of Manchester, New Hampshire

Project History

Need
Population of 160,000
Average Daily Demand = 18 MGD
Maximum Daily Demand = 31 MGD

Supply
Lake Massabesic
Maximum “Safe Yield” 20.2 MGD

Problem
Use near 90% of “Safe Yield”
Inadequate for projected future growth
2016 drought

Solution
MWW selected use of the Merrimack River as a potential supply

Options

Direct Intake
Inconsistent raw water quality
More residuals (sludge) produced

Riverbank Filtration Using a RCW
“Natural” filtration – TOC, turbidity, microbial, color, taste & odor removal
More consistent raw water quality = lower operating costs
Feasibility dependent upon geology

Exploration Program

Selected RCW Location

RCW Construction

RCW Construction
Withdrawal Testing and NH Permitting Process

8-Hour Step Drawdown Test (May 20, 2016)
30-Day Warm Water Condition Withdrawal Test (August 1 - 30, 2016)

New Hampshire Large Withdrawal Permitting
- Groundwater Withdrawals >= 57,600 GPD
- Preliminary Application – includes proposed withdrawal testing program at maximum proposed volume (7.2 MGD/5,000 gpm)
- Withdrawal Testing
- Final Report
- Public Hearings
Monitoring Locations
- Caisson
- 5 monitoring wells triplets
- 9 single level wells (1 Background)
- 3 riverbed triplet piezometer nests
- 3 Private bedrock WSWs
- Wetlands staff gauge
- River gauging station
- Weather station

Distance Drawdown Summary - Deep Overburden Wells

Radial Collector Well Caisson – Warm Water Condition

Gradually increasing temperature trend from 22.8°C at end of WWC to 14.6°C

Radial Collector Well Caisson – Cold Water Condition

Gradually decreasing temperature trend from 22.8°C at end of WWC to 14.6°C

Radial Collector Well Caisson – Warm and Cold Water Condition Comparison

Gradually increasing temperature trend from 22.8°C at end of WWC to 14.6°C
Summary
7.2 MGD (5,000 gpm) sustainable cold and warm conditions
Temperature/viscosity effects significant (yield ~ 50% lower under cold-water conditions)
Hydrogeologic system dominated by river (level and quality)
- 75% induced surface water under cold water conditions
- 85% induced surface water under warm water conditions
$V_e \approx 3$ – 30 ft/d
$T \approx 117,000$ gpd/ft
$K \approx 10^{-1}$ cm/sec (150 to 250 ft/d)
Temperature data useful