Sustainable Water Supply
City Engineers Association of Minnesota
January 29, 2015

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Water Supply Policy

Bryan Bear
City of Hugo
Municipal Water Use in Seven-County Twin Cities Metropolitan Area, Minnesota

- % Groundwater
- %Surface Water

<table>
<thead>
<tr>
<th>Period</th>
<th>% Groundwater</th>
<th>% Surface Water</th>
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<tbody>
<tr>
<td>1941-1950</td>
<td>80</td>
<td>20</td>
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<td>1951-1960</td>
<td>70</td>
<td>30</td>
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<td>1961-1970</td>
<td>60</td>
<td>40</td>
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<td>1971-1980</td>
<td>50</td>
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<td>1981-1990</td>
<td>40</td>
<td>60</td>
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<td>1991-2000</td>
<td>30</td>
<td>70</td>
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<tr>
<td>2001-2010</td>
<td>20</td>
<td>80</td>
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</tbody>
</table>
CHANGE IN FUTURE GROUNDWATER DRAWDOWN

- Less than 5 feet
- 5.1 to 10 feet
- 10.1 to 20 feet
- 20.1 to 30 feet
- 30.1 to 40 feet
- 40.1 to 45 feet

AREAS MOST AFFECTED

- Drawdown exceeds 50% of available head

*Available head in a well is the height water rises above the physical top of the aquifer, the 50 percent mark is when it becomes the greatest concern.

Note: Model 1 results assume long-term average conditions and continued development of traditional water supplies. Models 2 and 3 assume that some communities adopt different water supplies than they currently use.

Source: Water Supply Planning, Metropolitan Council

Source: Star Tribune February 23, 2013
USGS Report - 2011

- Conclusions:
  - Interactions likely exist between WBL and underlying aquifer
  - Municipal pumping may be impacting the lake level
- Theory is unproven
- More advanced study to be released in 2016
  - If the theory is true...
  - How much interaction is there?
  - Do other factors (like climate) matter more?
  - Which wells are most responsible?
Lawsuit - 2014

- WBL Restoration Association - vs - DNR
- MERA
- DNR mismanaged the resource by allowing too much pumping
- Order DNR to restore the lake
  - Stop groundwater pumping
  - Augment the lake
- Settlement Agreement has been reached...
- Main take away – stop using ground water. Use surface water
WBL Settlement Agreement

- Support for NE Metro surface water supply project
  - Requires legislative approval/funding
  - New taxing district for operation
- Set protective elevation for WBL
  - Impacts all appropriation permits in region
- Plaintiffs granted review of all appropriation permits
- Conservation
  - 17% reduction in water use
- Requires NE GWMA Plan to be implemented in 2015
  - Vehicle for implementing settlement provisions
DNR Role - Groundwater Management Areas
Groundwater Management Areas

- Develop specific plan within each area
  - Focus on sustainability and management of water resources

- Outcomes
  - It will be harder to get appropriation permits
  - It will be harder to maintain existing permit provisions
  - “Goals” for conservation, etc. will become requirements
  - Plan for lots of extra time and budget extra $$$

- Main take aways
  - Emphasize surface water use
  - More GWMA’s coming
Met Council Role

- Water is not a regional system regulated by the Met Council
- Many studies, models, etc. are being done regionally
- Issue = “sustainability”
  - NE Metro Feasibility Study – regional water supply system
    - Connects 13 cities to the waters of the Mississippi
    - $623 million construction
    - $30 million annual operating costs
    - No guarantee White Bear Lake will rise
- Legislature now being asked to fund it
- Main take away: Use surface water
Legislature

- Directing/funding Met Council Efforts
- Agricultural use discussion
- Legislative Water Commission
  - Consolidate statewide water discussion into one body
  - 5 of 10 legislators represent WBL area
- Will consider funding NE metro surface water supply system
  - Communities required to connect
- Will consider new taxing system
  - New layer of government... “Groundwater Districts”
Water Supply is More Important Than Ever

- Not just a White Bear Lake thing
- State-wide issue
- Municipal water supply systems being challenged
- All sources of water are interconnected
- Pumping water = impacts the resource
- More regulation is coming
- Start budgeting time and money
Water Supply is More Important Than Ever

- NE Metro is the guinea pig
- Framework is being created for statewide implementation
- Expensive projects
- New taxing districts
- Appropriation permits
- Get it on your radar – and get organized
  - As important to City Engineers as transportation? Why not?
Metro Model: tool for evaluating future sustainable groundwater use

Funded By: Barr Engineering Company
what is the “Metro Model”

- developed under contract with Met Council
- computer simulator of groundwater flow, recharge, and surface-water – groundwater interaction
- 3rd Generation model
- used by Met Council, DNR, MDH, academia, consultants
what is the Metro Model? (cont.)

- simulates groundwater flow in 11-County metro area
- includes all major aquifers (including glacial drift aquifers)
- calibrated to current and historical pumping conditions and water levels
- substantial enhancement to the 2009 Metro Model 2
purpose of the Metro Model

• What are the cumulative aquifer impacts of planned growth & water demand in the Twin Cities metropolitan area?
area covered by the Metro Model

- Model area was expanded to account for regional growth areas
includes 10 major aquifer and aquitard systems in the metro area
“Quaternary” (glacial) aquifers included in extensive detail

- "Slice" every 20 feet vertically
- 250 meter grid
Soil Water Balance (SWB) model simulates infiltration.

Average Infiltration 1988-2011
what is “sustainable” groundwater use (and can that it be predicted for future conditions)?

• sustainable use << pumping capacity
• there are many groundwater-dependent resources
  — human consumption/well yield
  — wetlands (ecological)
  — lake levels (ecological and recreational)
  — stream flow (ecological and recreational)
• protection of “buffer storage” in aquifers
when it comes to groundwater pumping, there is no free lunch

- **ANY** amount of pumping reduces flow to a surface-water feature
- pumping location and proximity to surface water is important
- recharge from precipitation is the most important source of water – and it is (mostly) independent of pumping
what will be the likely factors that control groundwater use in the future?

• groundwater component to the baseflow of streams
• lake levels
• groundwater levels at many wetlands
• elevation of the water table above the top of bedrock
drawing down the phreatic surface into bedrock loses our “shock absorber”
importance of a “transient simulation” for predicting effects of future water demand

• “steady-state” is only applicable to average pumping conditions
• “steady-state” conditions may take years to decades to occur
• “steady-state” does not account for use of aquifer storage
• “steady-state” is typically “worst case”
• “steady-state” simulations CANNOT be used to predict the effects of seasonal high-demand periods
Simulation of Jordan Aquifer Water Levels: 1995-2011

Jan. 1995 Baseline

Jan. 1995 Baseline

Jan. 1995 Baseline
Where will our water come from?
2030 Groundwater Drawdown

2030 Model - Projected Drawdown in the Prairie Du Chien - Jordan Aquifer

Change in Future Groundwater Drawdown

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Areas Most Affected

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Source: Water Supply Planning; Metropolitan Council

Source: Star Tribune February 23, 2013
Metropolitan Council Regional
Feasibility Assessment
Southeast Metro

- Updated groundwater model
- Options evaluated
  - Alternative Drinking Water Supply
  - Enhanced Recharge
  - Stormwater Capture and Use
- Estimated capital and O&M costs
Southeast Metro Groundwater Group Comments

- Update groundwater model with accurate projections (2040)
- Model scenario with 20% reduction
- Model scenario without demand from two private water users (16 MGD)
Proposed UMore Development
Treated Effluent Water

- MCES Empire Treatment Data
  - Gravity outfall adjacent to UMore Park property
  - Existing discharge - 10 MGD
  - Ultimate discharge - 60 MGD
  - UV disinfection process at effluent discharge
  - Discharge limits are monitored at discharge to Mississippi River
Estimated Water Demand in UMOR (in millions)

Monthly average for potable uses (60,100,000 gal)

Total estimated non-potable use 43%
Estimated Total City Water Demand (in millions)

- 19% Reuse

Monthly average for potable uses (101,265,000 gal)

Chart showing estimated total city water demand with monthly consumption and groundwater demand.
Integrated Water Management
UMore Park Goal: Zero storm water discharge for all conditions

Key: Types of Water
- Surface Water
- Wastewater
- Groundwater
- Treated effluent

Issues:
1. On-Site Contamination
2. Reservoir Development
3. Distribution System (4th Utility)
4. Public or Private Ownership
5. Utility Usage Rate Structure
6. MCES Treated Effluent Augmentation
7. Treated Effluent Characteristics
8. Groundwater Recharge
9. Storm Water Emergency Overflow
10. Policy (Plumbing Codes, Implementation on Large Scale, MDH and MPCA Water Reuse Regulations)
Project Partners/Stakeholders

Dakota County
MDH Department of Health
Vermillion River Watershed
Minnesota Pollution Control Agency
Empire Township

Minnesota Department of Natural Resources
Metropolitan Council
Thank you!

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There are risks and costs to a program of action. But they are far less than the long-range risks and costs of comfortable inaction. - John F. Kennedy