East Bethel – Case Study in Water Reclamation and Recycle

For Minnesota Groundwater Association Conference April 22, 2014

By

William (Bill) Cook, PE Manger, Technical Services – Engineering Services Metropolitan Council



Presentation Outline

- Project Need
- Regulatory Acceptance
- Existing Conditions
- Project Technical Issues
- Project Description
- Community Acceptance









East Bethel Proposed Service Area

"City's Approved Comprehensive Plan 2007"



Project Need

- Growth Anticipated in Area
- Surface discharge of treated effluent not being an option
 - Reuse option "if you build it they will come"
- Lack of information in-house on hydrogeology of the area
 - Surface water discharge not available
 - High groundwater
 - Surface waters and wetlands
 - Unique biological communities



Identified Permitting Process

- Absence of surface water in which to discharge
- MPCA SDS Permitting Process for RIBs
 - Multiple discussions
 - Submit proposed facility plan, site soils and hydrogeologic work plans and reports
 - Preliminary approval
 - Submit final plans, specifications and supporting documents
- Other Agencies
 - MnDNR
 - MnDOH



- Obtain limited field data to verify site conditions
- Obtain property rights
 - Sale or agreement
- Focus on two sites for initial development
- Obtain detailed field data on selected sites



Site Selection Criteria Were Chosen to Protect Groundwater

- Conduct a desktop study on sites meeting criteria
 - Out of 100 year flood zone
 - Out of parks and natural areas
 - Out of wetlands
 - 15 feet above the groundwater level
 - Within an economic radius of the plant
 - Proximity to existing wells



Land outside 100-year Flood Plain and Wetlands with Unsaturated Zone at least 15-feet thick



- Obtain limited field data to verify site conditions
 - Measured groundwater levels
 - Reviewed data on water quality and well logs
 - Soil Borings and Cross Sections







- Conduct a desktop study on sites meeting criteria
- Obtain limited field data to verify site conditions
- Obtain property rights
 - Purchase
 - Easement Agreement







- Obtain limited field data to verify site conditions
- Obtain property rights
 - Sale or agreement
- Focus on two sites for initial development
 - Site A
 - Site E



Hydrogeologic Program at Sites A and E

- Obtain detailed field data on selected sites
 - Emerging contaminants
 - Permeability Testing
 - Additional wells Total of four at each site
 - Groundwater flow modeling
 - Multi-Layer Analytical Element Model
 - Infiltration tests and travel times



Emerging Contaminants

Contaminant	MW-A2	MW-A3	MW-E3	MW-ED3	Limit	Units
Camphor			0.032		0.06	ug/L
Caffeine		0.0025			0.06	ug/L
Deet	0.018		0.013	0.072	0.14	ug/L
p-Cresol			0.14	0.026	0.18	ug/L
1-methylnaphthalene			0.0074	0.0086	0.04	ug/L
2-methylnaphthalene			0.012	0.012	0.04	ug/L
4-Nonylphenol				1.4	2	ug/L
4-Nonylphenol Diethoxylate				0.26	5	ug/L
Indole			0.011		0.08	ug/L
Isophorone			0.06	0.017	0.08	ug/L
Naphthalene			0.011	0.015	0.04	ug/L
Phenanthrene			0.0058	0.0049	0.04	ug/L
Phenol	0.31			0.099	1.4	ug/L
Pyrene			0.0075		0.04	ug/L
Tributyl Phosphate			0.0042	0.024	0.2	ug/L



Site A - Groundwater Flows and Wells



Site E - Groundwater Flows and Wells



Site A – Travel Times



Site A – Travel times from RIB to groundwater discharge points (in days)

Site E – Travel Times



Site E - Travel times from RIB to groundwater discharge points (in days)

Design

- Overall Layout
- Plant Process
- Effluent Characteristics
- Land Application Basins
- Reuse





EAST BETHEL WASTEWATER FACILITIES











Effluent Design Targets Surpass Permit Requirements to Protect Groundwater Quality

- Initial Construction 0.41mgd
- 2030 Design Capacity 1.22 mgd
- Reclaimed Water Planning and Design Targets

Parameter	Effluent Target	SDS Permit		
CBOD5	5 mg/L	25 mg/L		
TSS	5 mg/L	30 mg/L		
Total N	5 mg N/L	10 mg/L		
Total P	0.5 mg P/L	1.0 mg/L		
Disinfection	<2.2 total coliform/100 mL	≤2.2 total coliform/100 mL		



5 Stage Process with MBRs Protects Groundwater Quality



OFFSITE DISPOSAL



Land Application Site A







Land Application Site E





CTIMO CITE DI ANI

Insulated and Perforated Laterals Provide Even Distribution Year Round









1 SECTION CUT





Start-up Plant Effluent Flow (50,000 gpd) – Changes in Groundwater Head (C.I. = 0.2 ft)





Expected Operational Maximum Plant Flow (205,000 gpd) – Changes in Groundwater Head (C.I. = 0.2 ft)





Maximum Plant Effluent Capacity (410,000 gpd) – Changes in Groundwater Head (C.I. = 0.2 ft)







Public Communications

- City Council Meetings
- Public Meetings
- Public Hearings
- Neighborhood Meetings
- School Board Meetings
- Met Council Meetings



Public Communciations

- Groundwater quality
 - Background testing
 - Future monitoring
 - Advanced treatment at water reclamation plant
 - Enhancement of groundwater quality
- Load/rest cycles
 - Individual basins not continuously loaded
 - Loading cycles approximately one week long possibly longer during winter
 - Flexibility provided by two separate rapid infiltration areas



Long Term Reuse

- Dual potable and reclaimed water distribution systems
- Reclaimed water for
 - Irrigation in new development
 - Commercial and industrial non-potable reuse
 - Water features in new development ponds and fountains



Conclusion

- E. Bethel is MCESs first water reuse treatment plant in the region.
- Start-up planned this June
- Questions.

