Comprehensive Environmental Inc.

Overview

Background Information

Design Considerations and Challenges

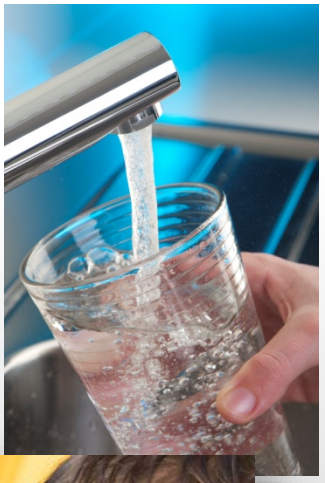
Construction and Facility Operation

Aesthetic Issues

- Discolored Water
- Stained Laundry / Fixtures
- Leaves Dark Brown to Black Stains
- Unpleasant Taste (metallic)
- Customer Dissatisfaction

Health Issues

- Neurological Impacts
- Hyperactivity (2007)
- Intellectual Impairment (2011)
- Sensitive Population (Children)



Recent Studies by Boucher et al. (Quebec and Boston)

Health Issues (cont.)

Research | Children's Health

Intellectual Impairment in School-Age Children Exposed to Manganese from Drinking Water

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"The findings from our study support the hypothesis that low-level, chronic exposure to manganese from drinking water is associated with significant intellectual impairments in children."

BACKGROUND: Despite the co… of exposure ar…

OBJECTIVES: … ing water and… manganese ex… concentration…

METHODS: Th… supplied by g… children's hair… food frequency…

RESULTS: The … MnH increased with manganese intake from water consumption, but not with dietary manganese intake. Higher MnW and MnH were significantly associated with lower IQ scores. A 10-fold increase in MnW was associated with a decrease of 2.4 IQ points (95% confidence interval: –3.9 to –0.9; $p < 0.01$), adjusting for maternal intelligence, family income, and other potential confounders. There was a 6.2-point difference in IQ between children in the lowest and highest MnW quintiles. MnW was more strongly associated with Performance IQ than Verbal IQ.

CONCLUSIONS: The findings of this cross-sectional study suggest that exposure to manganese at levels common in groundwater is associated with intellectual impairment in children.

KEYWORDS: children, intellectual quotient, manganese, neurotoxicity, water. *Environ Health Perspect* 119:138–143 (2011). doi:10.1289/ehp.1002321 [Online 20 September 2010]

…ater containing …resenting with …ments (Woolf …th neurologic …tive stuttered …tion, and fine …

…n in drinking … United States …delines for the …ese in drink- …L by the U.S. Environmental Protection Agency (EPA) (2004) and at 400 µg/L by the World Health Organization (WHO) (2008).

To date, no epidemiologic study has examined possible neurotoxic effects at manganese concentrations common in North American aquifers. In the present study, we assessed the relationship between exposure to manganese from drinking water and IQ of school-age children living in communities relying on groundwater. In addition, we

Regulatory Issues

- MassDEP and MassDPH issue notice to Health Professionals on Manganese Concerns in 2013
- MassDEP adds baseline monitoring for manganese to 2014-2016 sampling schedules
- MassDEP issues CCL language specific to manganese health concerns in 2014

Regulatory Issues (cont.)

Manganese
Consumer Confidence Reporting Required Health Language (if over 50 ppb)

How do I report manganese in my Consumer Confidence Report?
If you are a community system you must make and provide to your consumers a Consumer Confidence Report (CCR) annually. If your community system detects manganese concentrations greater that 50 ug/L in any finished water sample, you must report these concentrations in your CCR in the following ways:

1. **For manganese concentrations greater than 50 ug/L**
   You must report the concentration (s) in the unregulated/secondary contaminant table of your report as follows. Please use the parts per billion (ppb) unit of measure when referencing manganese in your CCR (50 ug/L = 50 ppb).

Unregulated or Secondary Contaminant	Date Collected	Result or Range Detected	Average detected	SMCL	ORSG or Health Advisory	Possible Sources
Manganese (ppb)	__/__/2013			50	300*	Erosion of natural deposits

*US EPA and MassDEP have established public health advisory levels for manganese to protect against concerns of potential neurological effects.

2. **For manganese concentrations above 300 ug/L,** in additio
   following educational statement on manganese in the CCR re
   system is doing to reduce manganese levels below 300 ppb.

You may use the educational statement below or get MassDEP's
educational statement for manganese should explain the signific
to be concerned by its presence. ***The bolded required language i***
written in the CCR.

Manganese: Manganese is a naturally occurring mineral found in
Manganese is necessary for proper nutrition and is part of a healt
sensitive populations at elevated concentrations. The United Stat
MassDEP have set an aesthetics-based Secondary Maximum Con
(micrograms per liter), or 50 parts per billion. In addition, MassD
drinking water guideline for manganese (ORSG), which closely fo
Drinking water may naturally have manganese and, when conc
discolored and taste bad. Over a lifetime, the EPA recommends
than 300 µg/L and over the short term, EPA recommends that p
1000 ug/L, primarily due to concerns about possible neurologica
given water with manganese concentrations over 300 ug/L, nor
for longer than 10 days. *The ORSG differs from the EPA's health*
lower manganese concentration applies from children less than 6
address concerns about children's susceptibility to manganese to
Manganese
http://www.epa.gov/safewater/ccl/pdfs/reg_determine1/suppo
Research and Standards Guideline (ORSG) for Manganese
http://www.mass.gov/eea/agencies/massdep/water/drinking/m

MassDEP Policy

- Sampling all sources (entry point to system)
- Report all results greater than 0.05 mg/L
- Advisory language if greater than 0.3 mg/L with water supplier's action plan
- Acute exposure limit of 1.0 mg/L for adults
- Acute exposure limit of 0.3 mg/L for infants

Mitigation Efforts

- Flushing Water Mains
- Cleaning Wells
- New Source Development
- Blending Source Waters (2 service zones)
- Resting Wells (6 active sources)
- Reduced Pump Rates (1000 gpm to 300 gpm)

Proactive Decision to Remove Fe/Mn

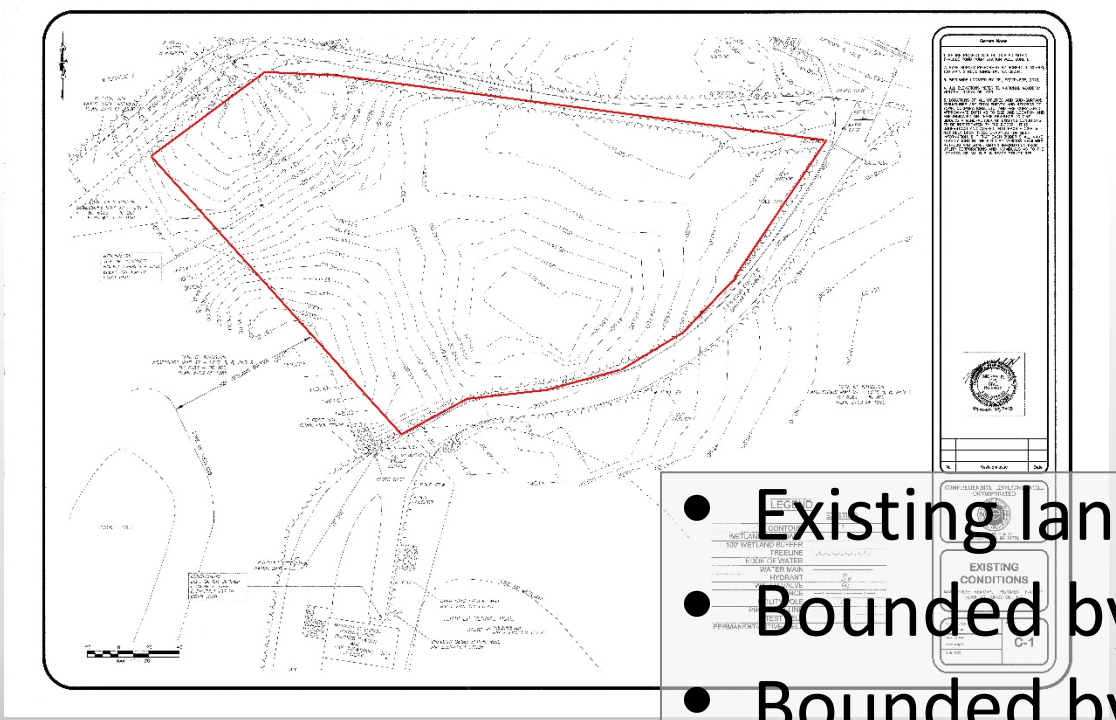
Design Challenges

- Aggressive Design Schedule
- Site Constraints
- Planning for Future
  - Future filter for additional source
  - Future clearwell
  - Future booster pump station

Schedule Constraints

- Piloting completed in May 2012
- RFQ/Proposals in August 2012
- CEI selected in September 2012
- Design documents submitted October 15th (SRF)
- Archeological Survey in Nov/Dec 2012
  - Notified in Nov 2012 by MHC of status (sensitive area)
  - MHC approval of report in March 2013
- Bid as 2 separate contracts in early 2013
  - Solar Panels (bid Jan/Feb, NTP by March 30th)
  - Treatment Facility (bid March/April)

Site Constraints/Considerations

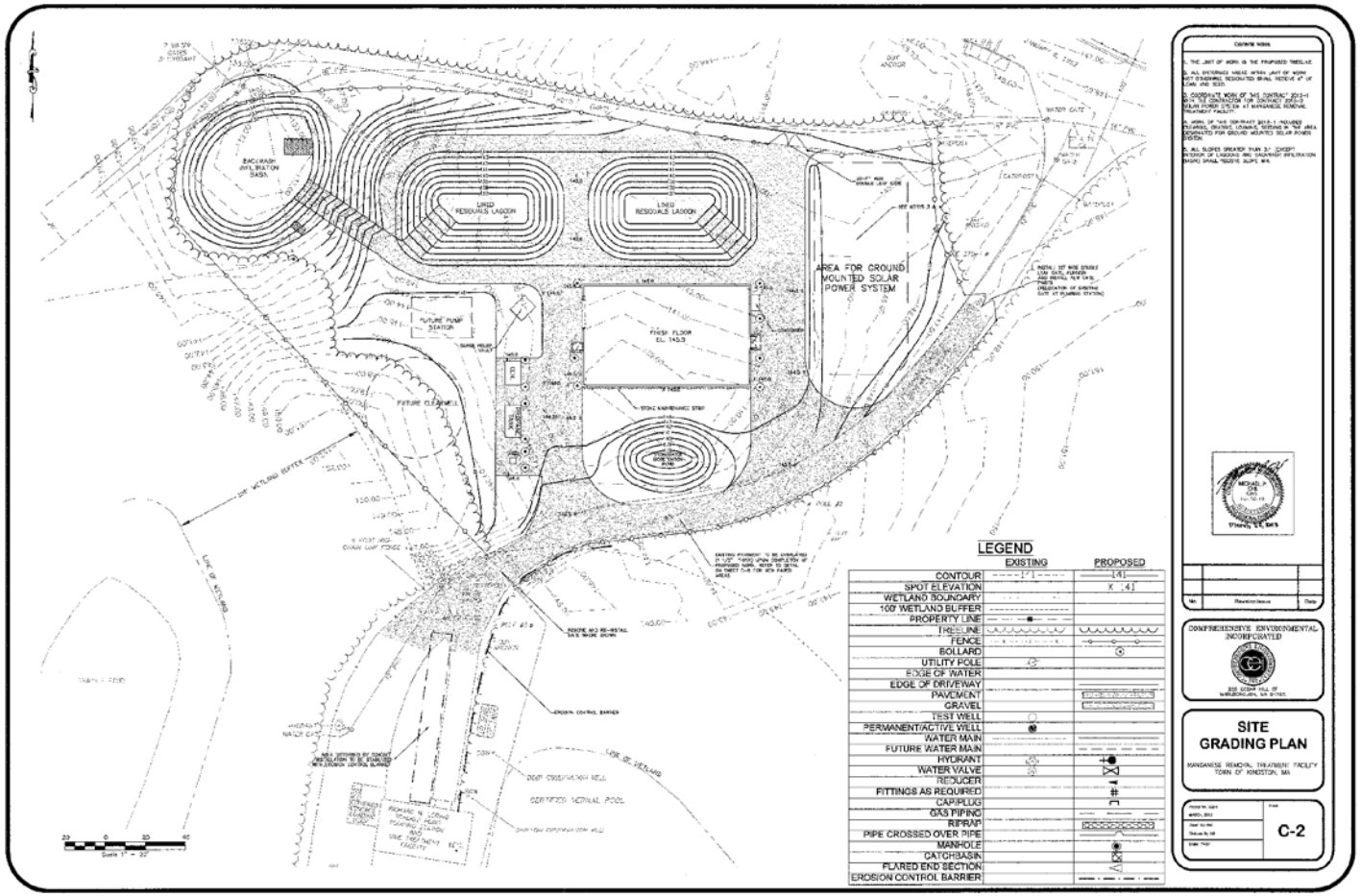


- Existing land adjacent to PS
- Bounded by roads/driveways
- Bounded by wetland buffers
- Usable area limited to 1 acre
- Building orientation for PV

Planning for Future

- Future filter for additional source (capacity increase 1.5 MGD to 3.0 MGD)
- Future clearwell tank and booster PS (potential future GWUDI and GWR issues)
- Additional PV panels (ground mounted)

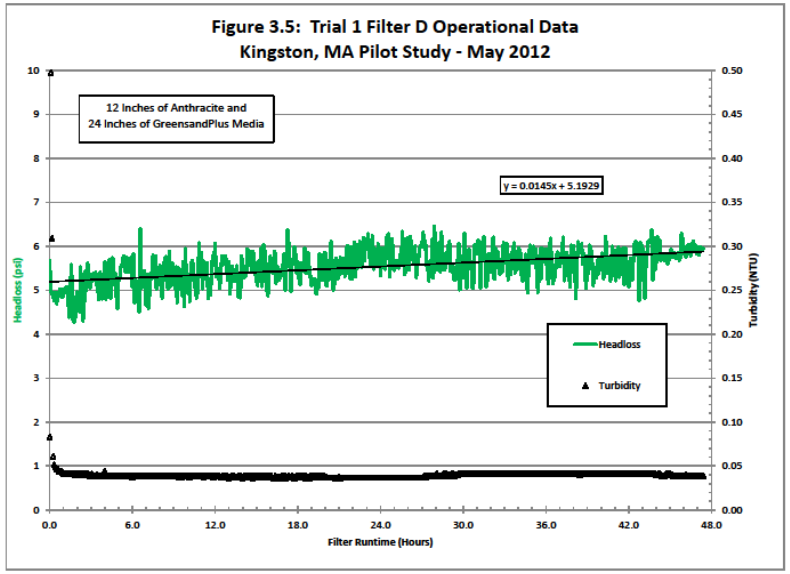
Planning for Future (cont.)



Key Design Issues

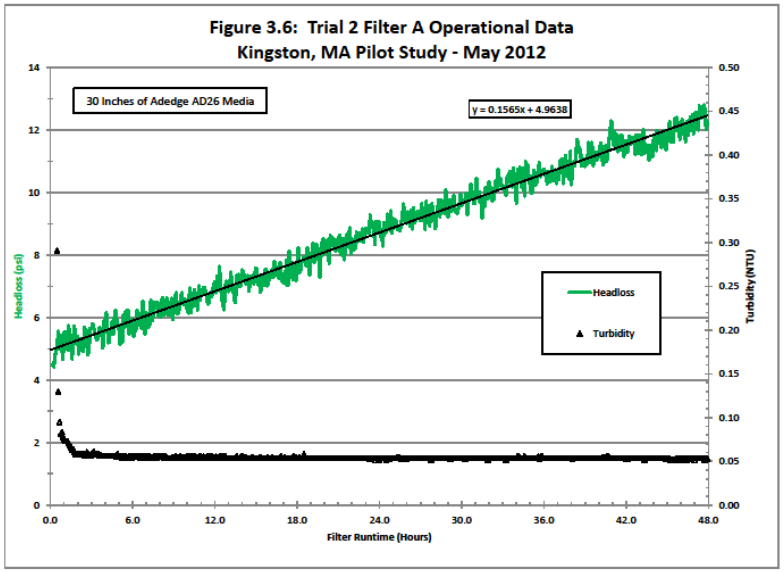
- Media Selection
- Building Type (structure and materials)
- Conversion of existing facilities (NaOCl feed)

Media Selection



Selection criteria included:

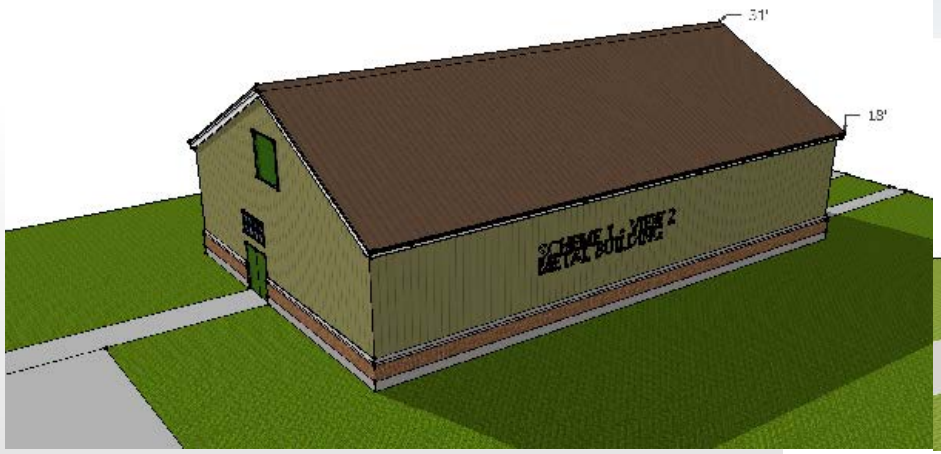
- Pilot performance
- Proprietary vs competitive
- Best return on investment



Final selection:

- Anthracite
- Greensand Plus

Building Type



Salt-box style benefits:

- Optimum PV angle
- Optimum ceiling heights

Design Details

- Pump-through Facility (upgrade 75 HP to 100 HP)
- Slab-on-grade (approx. 4,500 sf)
- Oxidation/disinfection (NaOCl)
- pH adjustment
  - Convert from lime to KOH
  - Raw 5.8 / Pre-filter 6.8 / Finished 7.5
- SCADA upgrade (shift from proprietary system)
- Overhead door (installation of future filter)

Construction

- Solar PV System (Green Community)
  - 20 kW roof mounted system $90K
  - Additional 30 kW planned (ground mounted)
- Treatment Facility
  - Bid Price $3.96M
  - Final Construction Cost $3.95M
- Start Summer 2013, Complete Fall 2014

Construction

Construction

Construction

Construction

Completed Facility

Completed Facility

Completed Facility

Facility Operation

- Online in November 2014
- Facility increased system classification to T-2
- Finished Water non-detectable Fe and Mn

Questions?

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