Northfield Water System Study

Tuesday, September 17, 2021

BOLTON & MENK

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Introduction

- Purpose of Study
- Water Demand Projections
- Water Source, Treatment, Capacity and Water Quality Evaluation
- WTP Siting
- Space Needs
- Sustainability
- Staffing Review
- Recommendations

Purpose of Study

All water currently meets Primary Drinking Water Standards

Water from the wells have high manganese concentrations.

- Exceeding EPA secondary standard for all wells
- MDH health-based guidance
- 0.100 mg/l for infants
  - This standard is not met
- 0.300 mg/l for all other population
- Manganese is naturally occurring

Study purpose it to determine how to best remove manganese below health-based guidance

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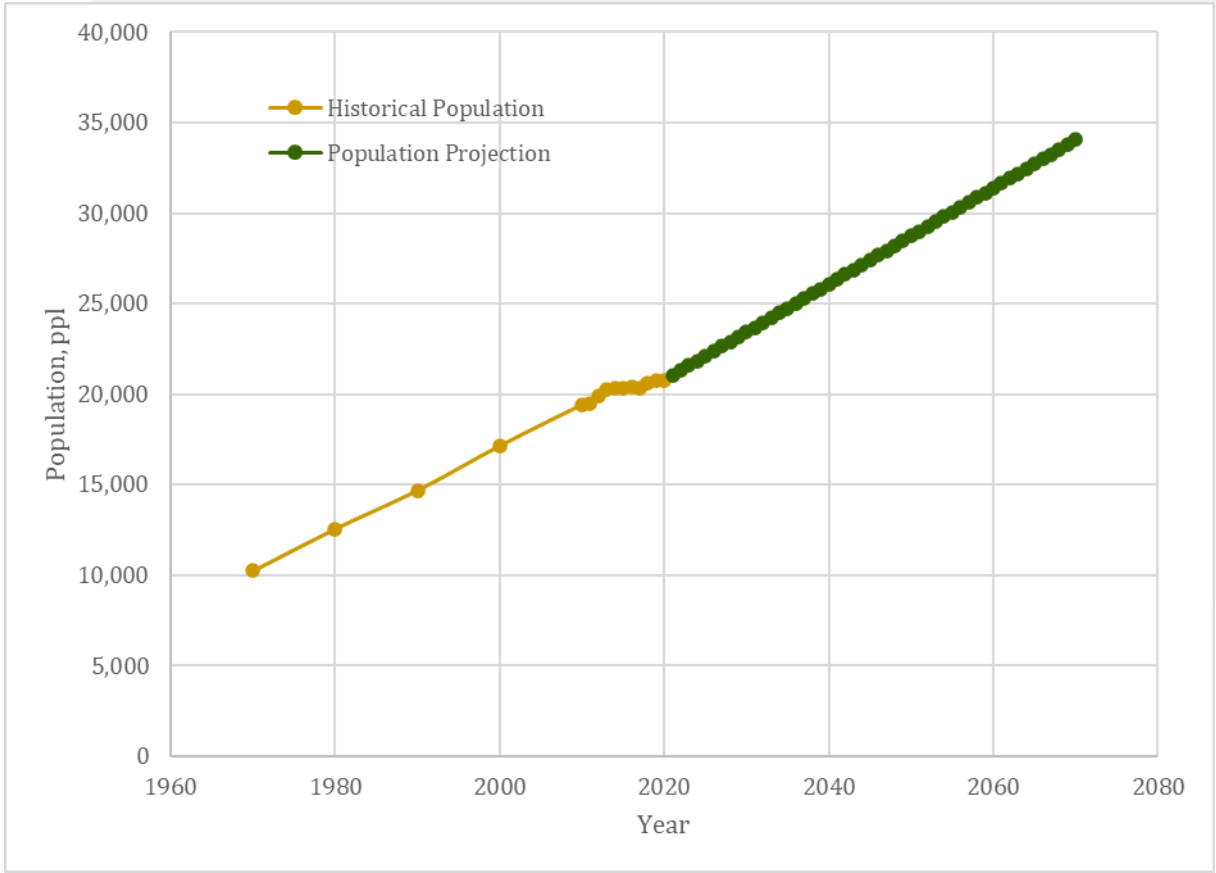
Water Demand Projection

Population used to determine future flows

Typically design for 20-year design life

Consider ultimate growth



Example:

- 2044 population – 26,500 (20-year population)

Water Demand Projection in 2044

Average Day Demand

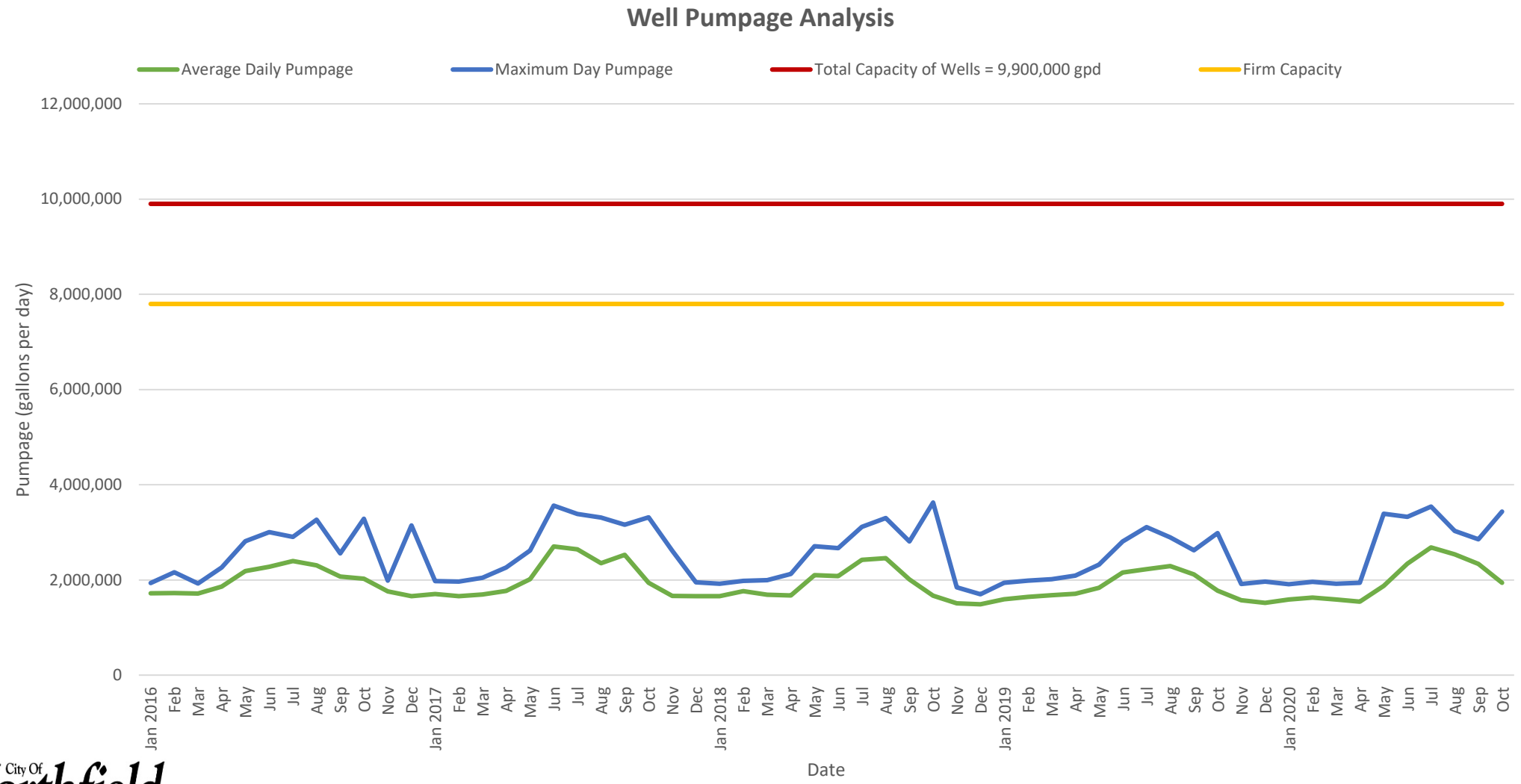
- 3.48 mgd (20 year)

Max Day Demand

- 4.96 mgd (20 year)

*Includes residential, commercial and industrial growth. Also includes Dundas and Carleton for both avg and max day demands.

Well Pumping Capacity



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Current Water Source, Treatment, & Capacity Evaluation

Raw Water Well Manganese Concentrations			
Well Name	**Unique Well #**	**Aquifer**	**Average Manganese Concentration, mg/L**
Well 2	217748	Prairie du Chien-Jordan	0.064
Well 3	219064	Jordan	0.152
Well 4	110465	Jordan	0.200
Well 5	559422	Jordan	0.087
Well 6	767886	Jordan	0.112
Water samples were averaged from 2019 to 2020			

Note: All wells are above the EPA secondary standard. Three wells are above the MDH health advisory standard

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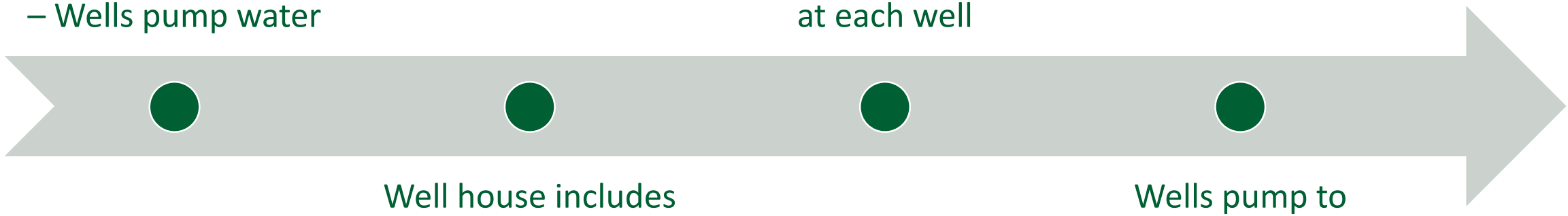
Current Water Treatment Process

Water treatment occurs at each well – Wells pump water

Well house includes well, chemical feed and electrical/controls

Feed Chlorine, Fluoride and Polyphosphate fed at each well

Wells pump to distribution system



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Current Water Storage Capacity

Water Storage Tanks				
Tank	**Elevation of Overflow (ft)**	**Capacity (gallons)**	**Type**	**Location**
Ground Storage 1	1121.25	1,000,000	Steel above-ground storage tank	1624 Forest Ave.
Ground Storage 2	1121.25	1,000,000	Steel above-ground storage tank	1624 Forest Ave.
Elevated Storage 1	1120.00	1,000,000	Spheroid elevated storage tank	10353 Hall Ave.
Total Storage Capacity		**3,000,000**		
Firm Storage Capacity		**2,000,000**		

Note: Additional water storage capacity needed in next 10 years

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Water Quality

All water meets Primary Drinking Water Standards

Water from the wells have high manganese concentrations.

- Exceeding EPA secondary standard for all wells
- MDH health-based guidance
- 0.100 mg/l for infants
  - Exceed this parameter
- 0.300 mg/l for all others
- Manganese is naturally occurring

Water from the wells water have high hardness.

- Exceeds 300 mg/l as $CaCO_3$

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Note: Water meets all primary standards but exceeds secondary standards and health-based value for manganese

Water Treatment Options

Alternative Treatment Technology Summary			
Contaminant	Primary Treatment (Removal)		
	Gravity Filtration	Lime Softening with Filtration	Gravity Filtration and Reverse Osmosis (RO)
Iron and Manganese Removal	X	X	X
Hardness Removal		X	X
Chloride Production to WWTF	Residential Waste	Some Waste (mostly removed as sludge to offsite)	Blended Concentrate Waste
Note: X = Process will achieve or aid in achieving the treatment goal for the indicated parameter			

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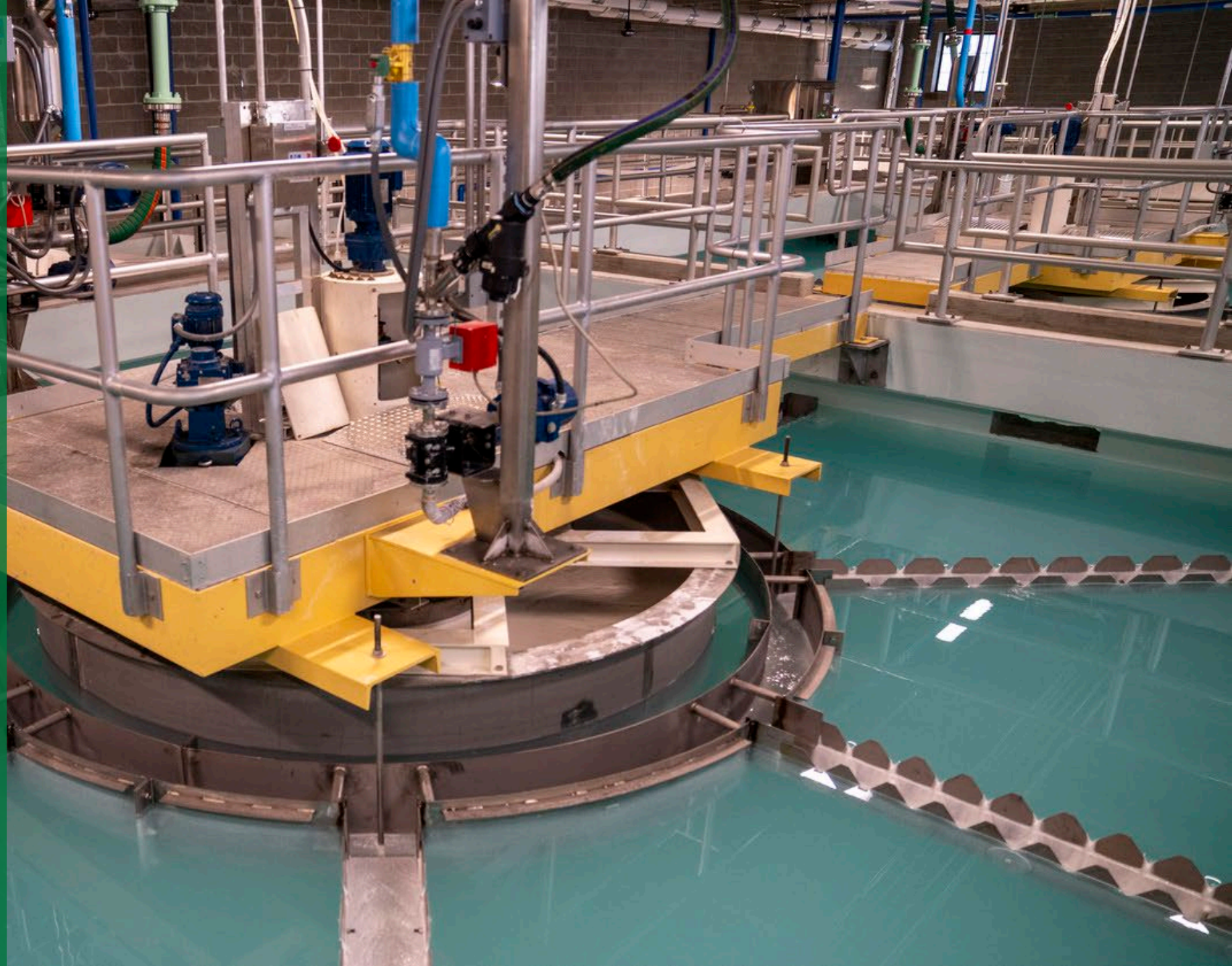
Water Treatment Options

- Improvements related to all options
- New finished water storage
  - Need additional storage in the future
- New raw and finished water mains
- Integration into existing SCADA system
- Plate Settlers for water reclaim
  - Results in significant water savings

Gravity Filtration

Gravity Filtration with Lime Softening



Gravity Filtration with Reverse Osmosis

Treatment Alternatives

Decision Matrix			
	Construct New Water Treatment Facility		
Item	Alternative 1: Gravity Filtration	Alternative 2: Gravity Filtration and Lime and Soda Ash Softening	Alternative 3: Gravity Filtration and RO
Minimum Estimated Land Requirement	4 acres	5 acres	4 acres
Overall Ability to Meet Water Quality Goals	Good	Excellent	Excellent
Expandability Potential	Excellent	Excellent	Excellent
Ability to Meet 2044 Design Average and Peak Design Flows	Excellent	Excellent	Excellent
Ability to Meet Future (beyond 2044) Average and Peak Design Flows	Excellent	Excellent	Excellent
Ease of Operations	Excellent	Okay	Okay

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New WTP Siting

Multiple items to consider when siting:

- Available land for current facility and future expansion
- Fit renewable energy and storm water requirements
- Location of wells and amount of raw watermain needed
- Location to residents/fit into neighborhood
- Topography – wetlands, soils, etc.

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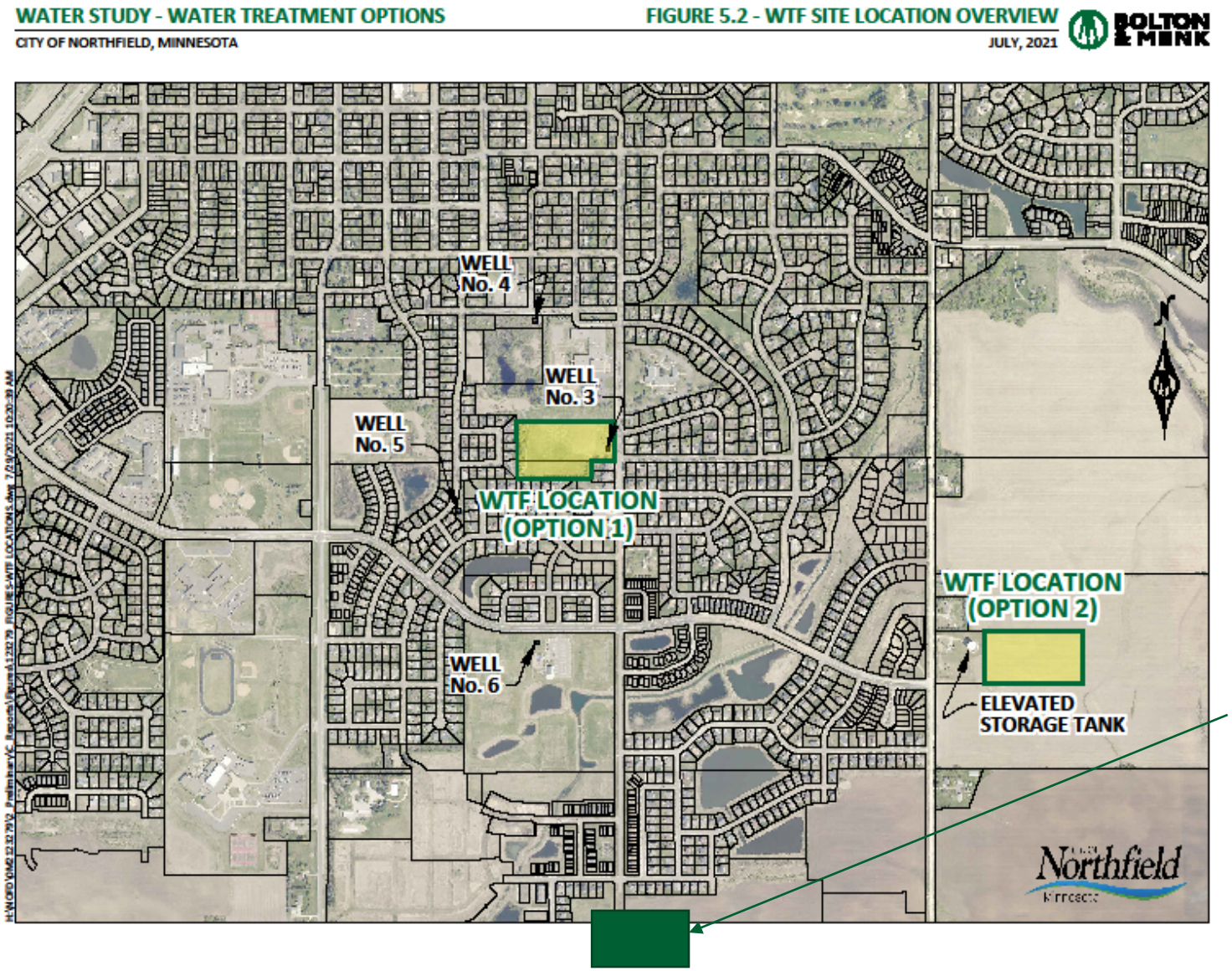
Water Treatment Siting



Potential 3rd site – Maple St. south of Meadows Park

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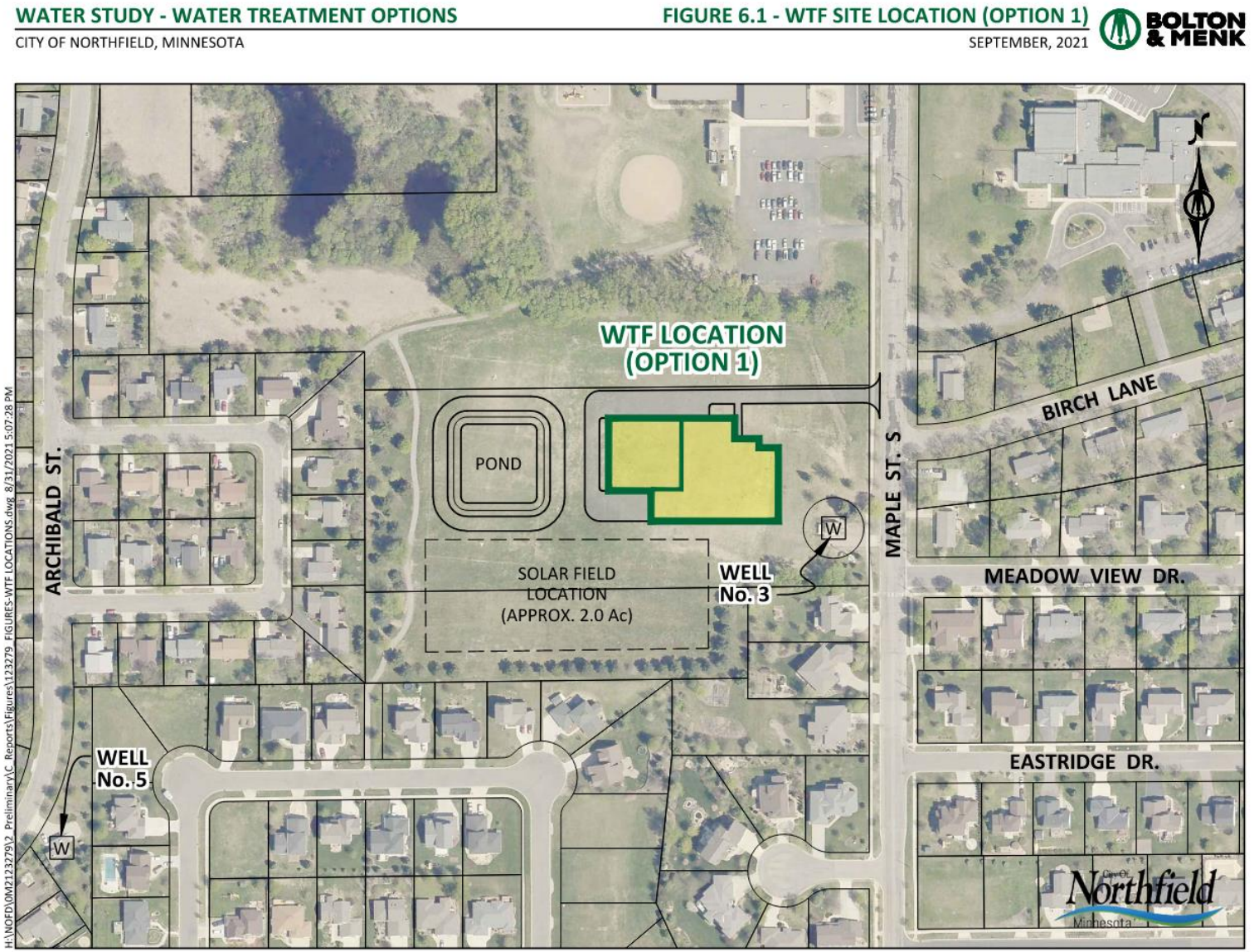
New WTP Siting



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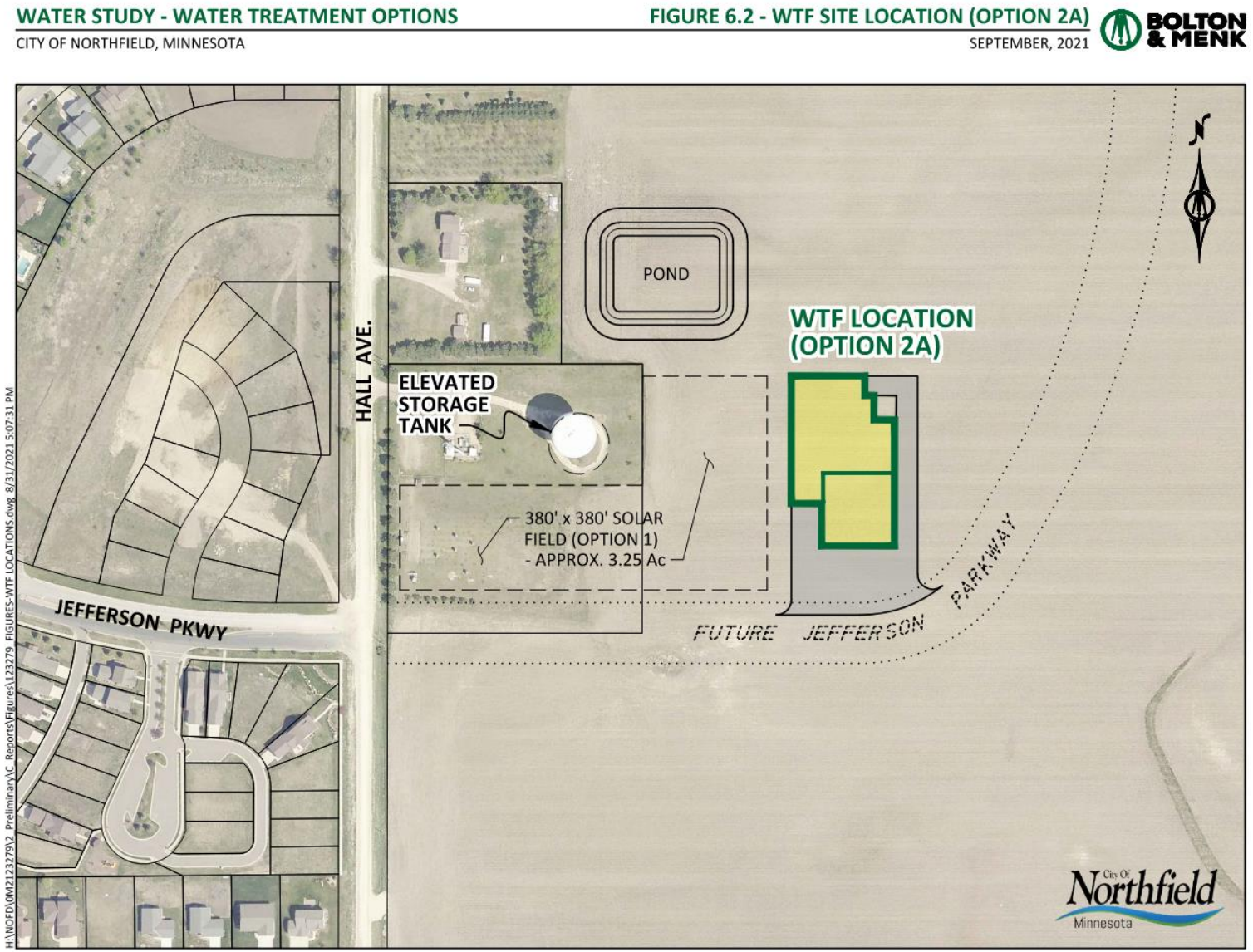

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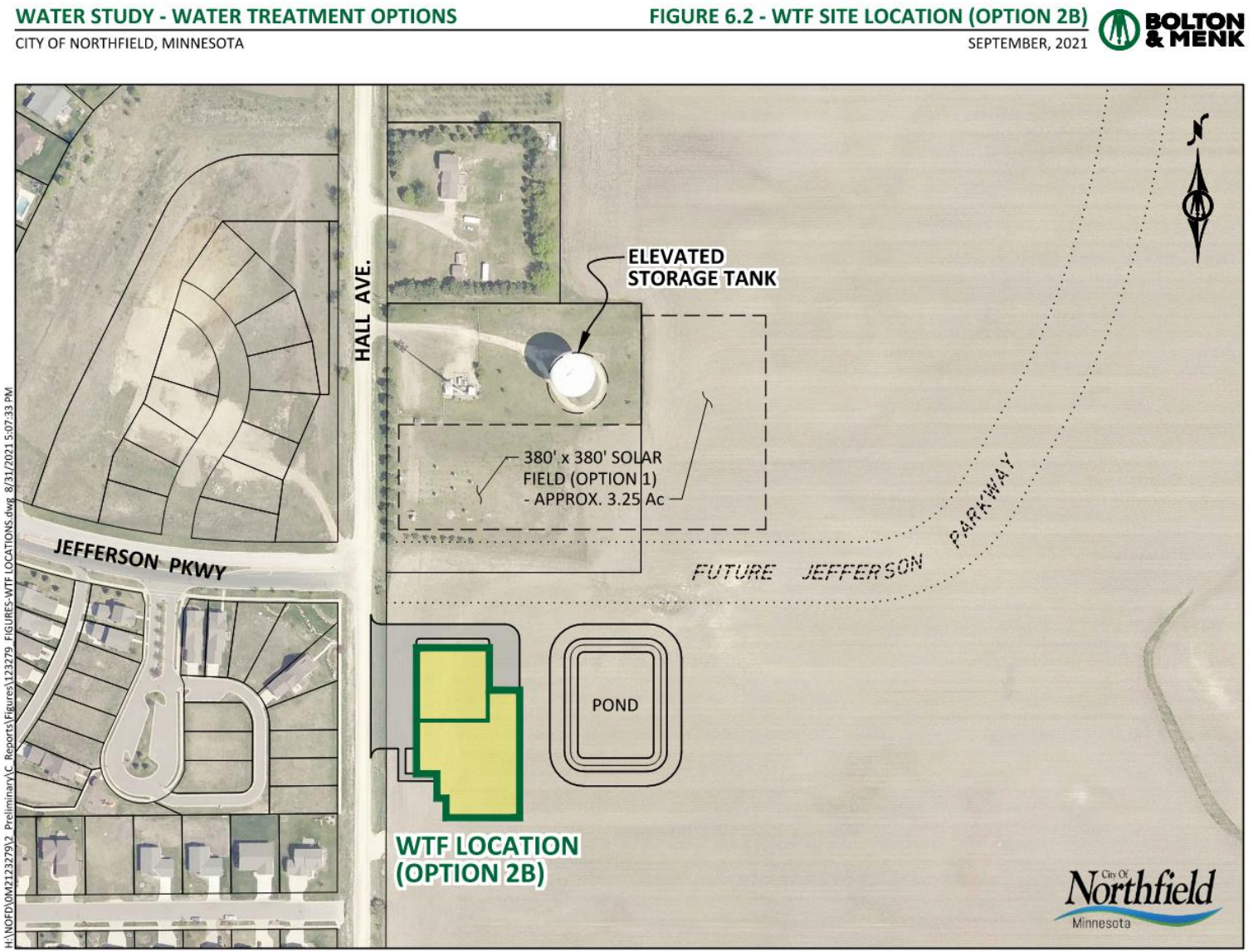
New WTP Siting



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Space Needs Assessment

Additional Space Needs

- ✓ Current water department garage and office space too small
- ✓ Equipment currently housed at 5 different locations
- ✓ Recommend new office/garage with water treatment plant

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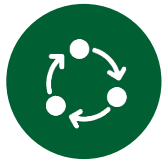
Sustainability

Including public spaces



Life cycle assessments

Energy consumption

Utilizing renewable energy

Water usage

The guidance for sustainability is based on general industry practices, the City's Climate Action Plan, and the Institute for Sustainable Infrastructure (ISI) Envision™ sustainable infrastructure rating system.

By using Envision, we are meeting the most state of the art, energy efficient water treatment plant design.

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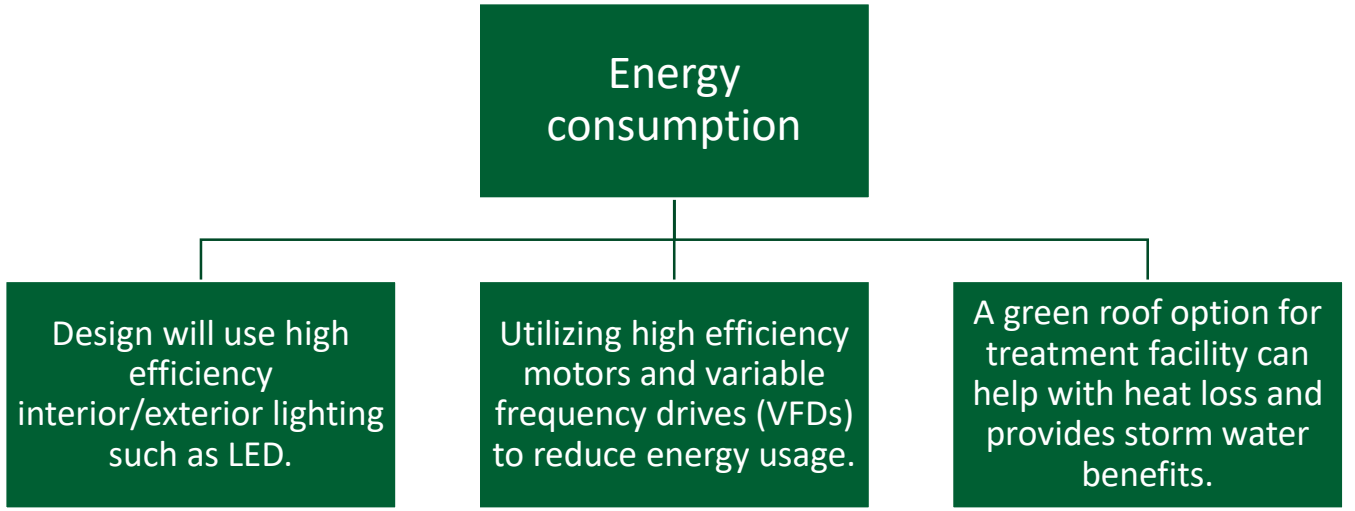
Sustainability

- Including public spaces
- Life cycle assessments
- Energy consumption
- Utilizing renewable energy
- Water usage



Utilizing Renewable Energy

- The facility would use appx. 3 million kWhr/year
- Placing solar on roof tops of the new treatment facility would generate 200 kWhr/year, accounting for 3-5% of the annual energy usage ($300,000 -$400,000 est. capital cost)
- Area of approximately 3.25 acres needed for solar field to offset entire treatment facility ($5,000,000 est. capital cost)

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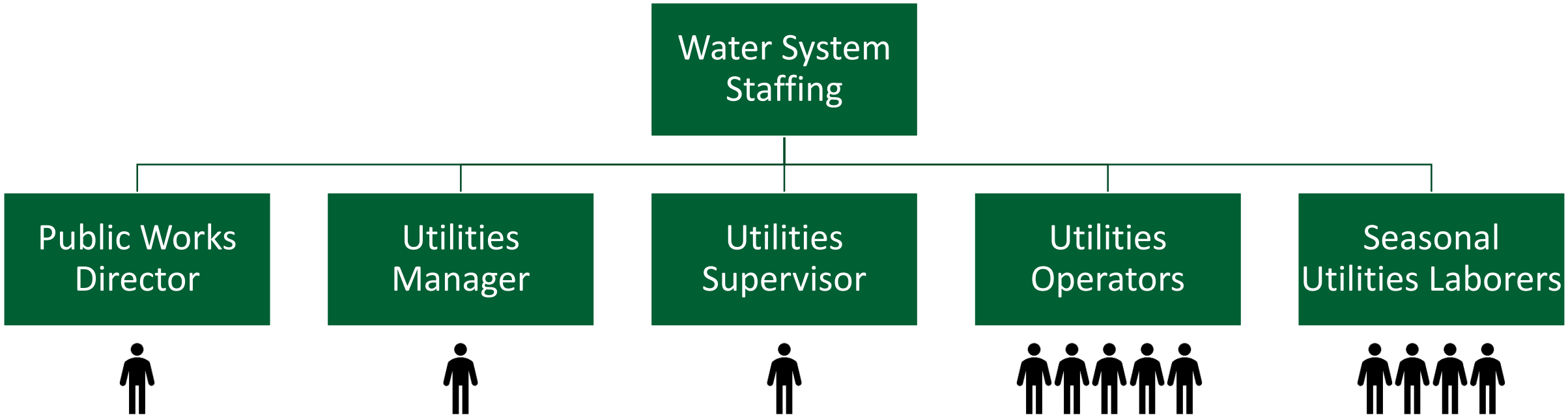
Current Staffing Structure

The current staffing for the water system consists of the following structure:



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Staffing Review and Conclusions

Additional staff members needed for the following water treatment options:

- Gravity Filtration 
- Lime Softening with Gravity Filtration 
- Gravity Filtration with Reverse Osmosis 

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Costs

Annual Cost Breakdown						
Item	Alternative 1 Gravity Filtration		Alternative 2 Lime and Soda Ash and Filtration		Alternative 3 Filtration and RO	
	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
WTF Cost	$ 20,000,000	$ 20,000,000	$ 30,000,000	$ 30,000,000	$ 22,000,000	$ 22,000,000
Garage	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000
Raw Water Main	$ 550,000	$ 1,200,000	$ 550,000	$ 1,200,000	$ 550,000	$ 1,200,000
New Water Supply	$ 1,500,000	$ 750,000	$ 1,500,000	$ 750,000	$ 1,500,000	$ 750,000
Solar Field Option	$ 5,000,000	$ 5,000,000	$ 5,000,000	$ 5,000,000	$ 5,000,000	$ 5,000,000
Added Site Work, Land Costs, Etc.	$ 250,000	$ 500,000	$ 250,000	$ 500,000	$ 250,000	$ 500,000
Total Est. Construction Cost	**$ 31,300,000**	**$ 31,450,000**	**$ 41,300,000**	**$ 41,450,000**	**$ 33,300,000**	**$ 33,450,000**
Estimated Annualized Cost (20 years at 2%)	$ 1,914,205	$ 1,923,379	$ 2,525,772	$ 2,534,946	$ 2,036,519	$ 2,045,692
Estimated Change in Annual OM&R Cost	$ 700,000	$ 700,000	$ 1,000,000	$ 1,000,000	$ 900,000	$ 900,000
Total Annual Cost	**$ 2,614,205**	**$ 2,623,379**	**$ 3,525,772**	**$ 3,534,946**	**$ 2,936,519**	**$ 2,945,692**

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Financing

Various options for financing the WTP improvements

- Bonding
- Drinking Water Revolving Fund (DWRF)
  - Low interest loans
  - Some grant possibilities
- USDA Rural Development
  - Loans
  - Grants based on affordability
  - Likely not an option for Northfield

Limited grant options available for water treatment

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User Rates

Proposed Monthly Water Charge Increase			
	Alternative 1 Gravity Filtration	Alternative 2 Lime and Soda Ash and Filtration	Alternative 3 Filtration and RO
Item	Cost	Cost	Cost
Project Cost	$31,450,000	$41,450,000	$33,450,000
City Cash Reserves	$3,000,000	$3,000,000	$3,000,000
Loan Amount	$28,450,000	$38,450,000	$30,450,000
Annualized Cost (20 Years @ 2.0 %)	$1,739,909	$2,351,476	$1,862,222
Increase in OM&R	$700,000	$1,000,000	$900,000
Revised Annualized Cost (20 yrs @ 2.0%)	$2,439,909	$3,351,476	$2,762,222
Annualized Industrial Cost (26.2%)	$639,256	$878,087	$723,702
Annualized Commercial Cost (26.2%)	$639,256	$878,087	$723,702
Annualized Residential Cost (47.6%)	$1,161,397	$1,595,302	$1,314,818
Monthly Increase per Industrial User	$720	$989	$815
Monthly Increase per Commercial User	$171	$235	$194
Monthly Increase per Residential User	$16	$22	$18
Monthly Increase per Household of 4 Persons	$64	$89	$73

* Table assumes about 74 industrial connections, about 311 commercial connections, and about 5,968 residential connections per the Comprehensive Water Plan and 2019 Comprehensive Annual Financial Report.

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Benefits of Softened Water

- Water softeners can be removed from homes or reduced run time
  - Saves on salt usage
  - Less water used
- Cost benefit of centrally softened water
  - Save approximately $40/year – salt costs
  - Use less water - approximately 2,500 – 4,000 gal/water per household

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Recommendations

- Option 3 – Gravity Filtration with Reverse Osmosis
  - Achieve lower manganese concentrations
  - RO enhances treatment and adds resiliency to treatment process
- Hall Ave. site or Maple St. south of Meadows Park for improvements
  - Fit all improvements including renewable energy
  - Requires purchase of land
- Conduct public engagement related to recommendations

Schedule

Sample Implementation Schedule	
Task	**Month #**
Initiate Preliminary Design	0
Initiate Final Design	6
Submit Plans/Specs to MDH	10
Council Approval of Plans and Specs for Bidding	14
Advertisement for Bids	15
Bid Project	16
Award Contract	17
Start Construction	18
Project Completion	36
Note: Month that each activity is shown to occur is approximate.	

Note: This is the fastest this schedule can occur

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Next Steps

- Preliminary discussion with City Council (Sept. 14th)
- Public Engagement Process
- Discussion with City Council
  - Review Public Engagement Process
- Adopt Report and Recommendations
- Begin Design of Water Treatment Facility

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Questions?

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