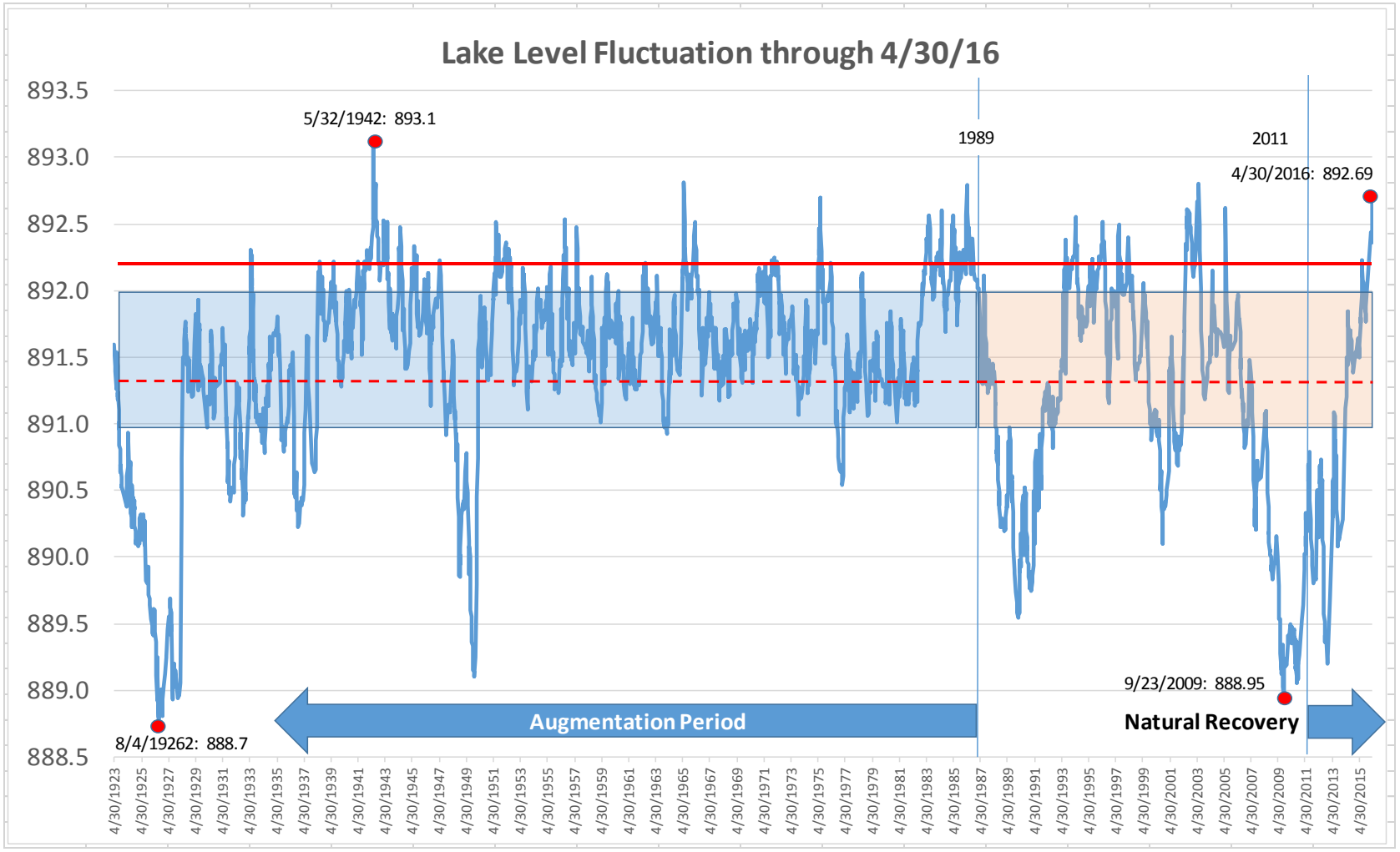
# Turtle Lake Augmentation
# Turtle Lake Homeowners Association

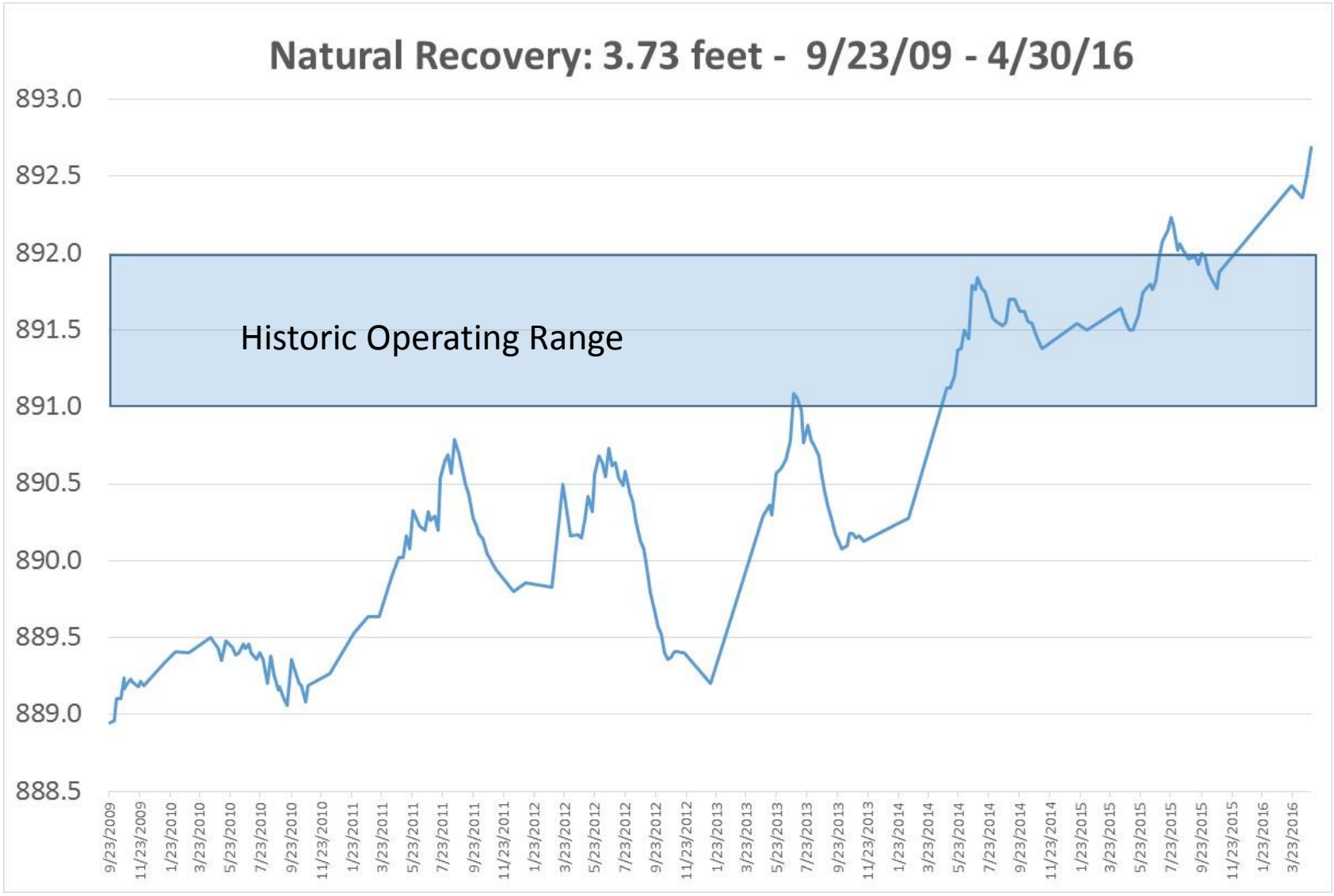
May 18, 2016

# Study Objectives

- Reduce cyclical low water levels on Turtle Lake between periods of normal to above normal rainfall through augmentation.
- Mimic the historic water level fluctuation during past periods of augmentation (1928 – 1989)
- Treat augmentation source water to preserve current lake water quality
- Implement cost-effective infrastructure to support augmentation
- Outline next steps, including LID formation

# A History of Lake Level Fluctuation




Natural Recovery: 3.73 feet - 9/23/09 - 4/30/16
893.0
892.5
892.0
891.5
891.0
890.5
890.0
889.5
889.0
888.5
Historic Operating Range
9/23/2009
11/23/2009
1/23/2010
3/23/2010
5/23/2010
7/23/2010
9/23/2010
11/23/2010
1/23/2011
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7/23/2015
9/23/2015
11/23/2015
1/23/2016
3/23/2016

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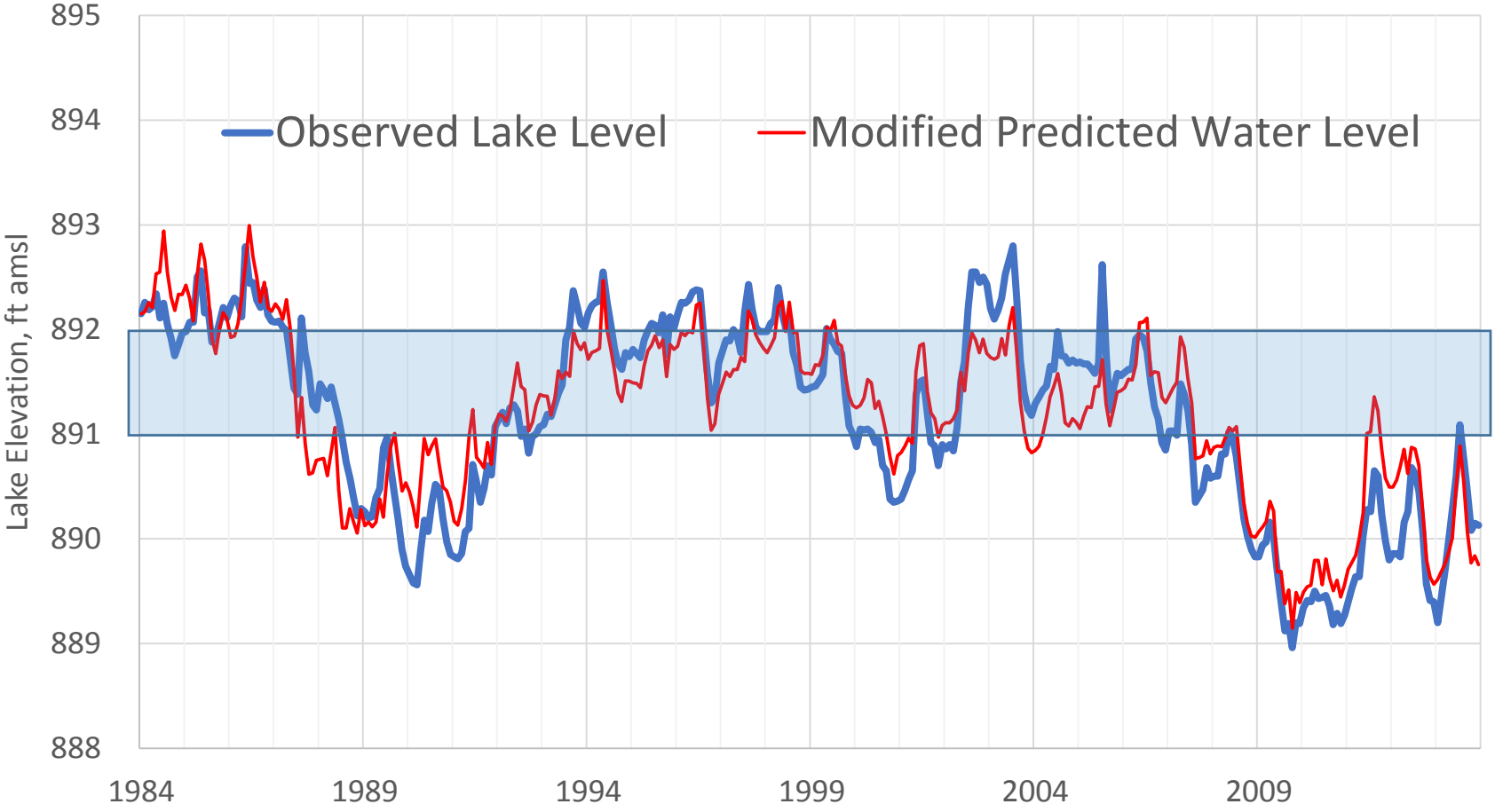
# Study Approach

- Complete Water Budget to predict water level fluctuation
- Calculate Augmentation Volume
- Identify Augmentation Source Infrastructure
- Identify Augmentation Source Quality
- Determine Water Quality Treatment to prevent negative lake response to augmentation
- Estimate Construction Costs

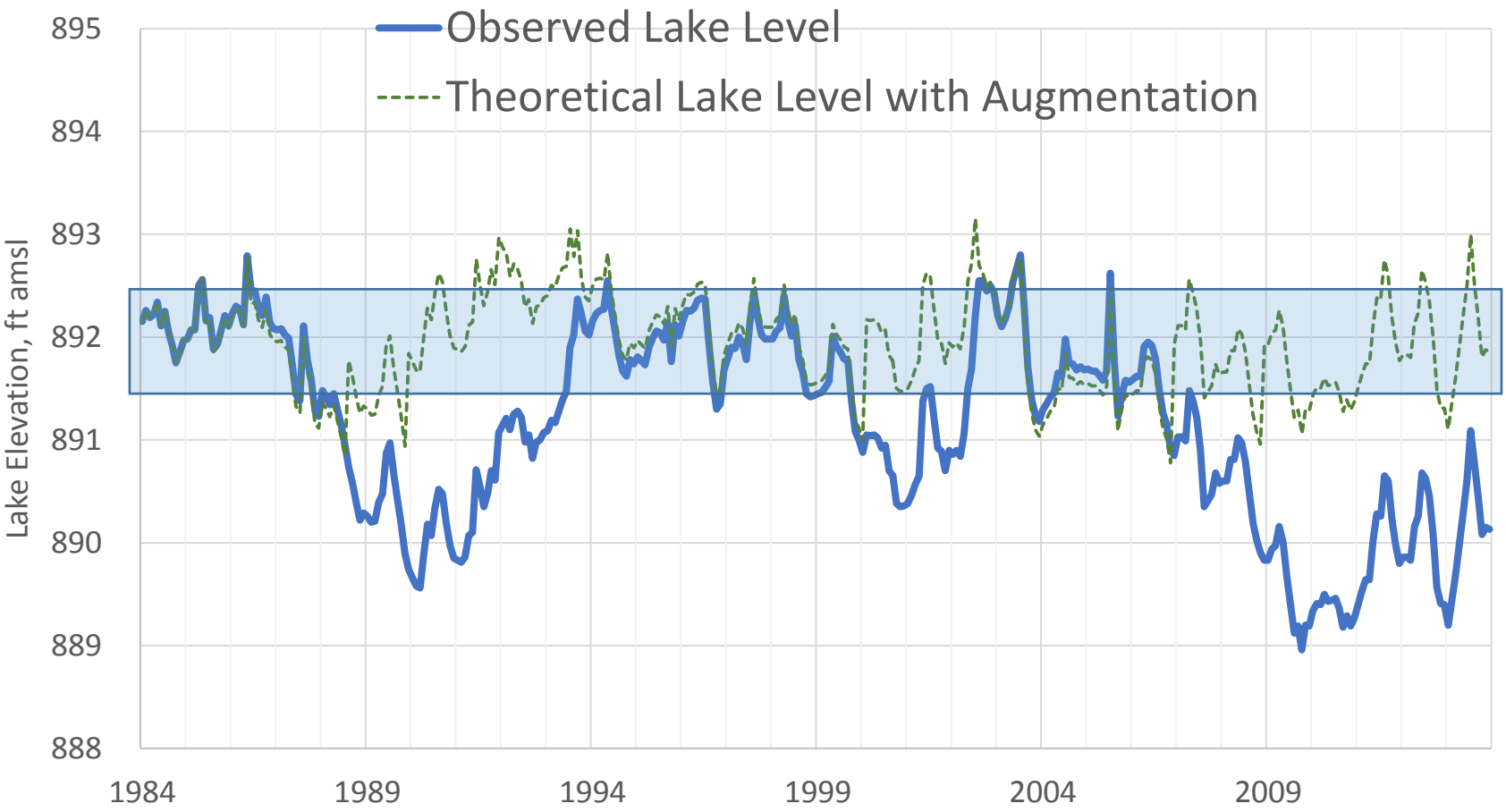
# Water Budget Matches Observed



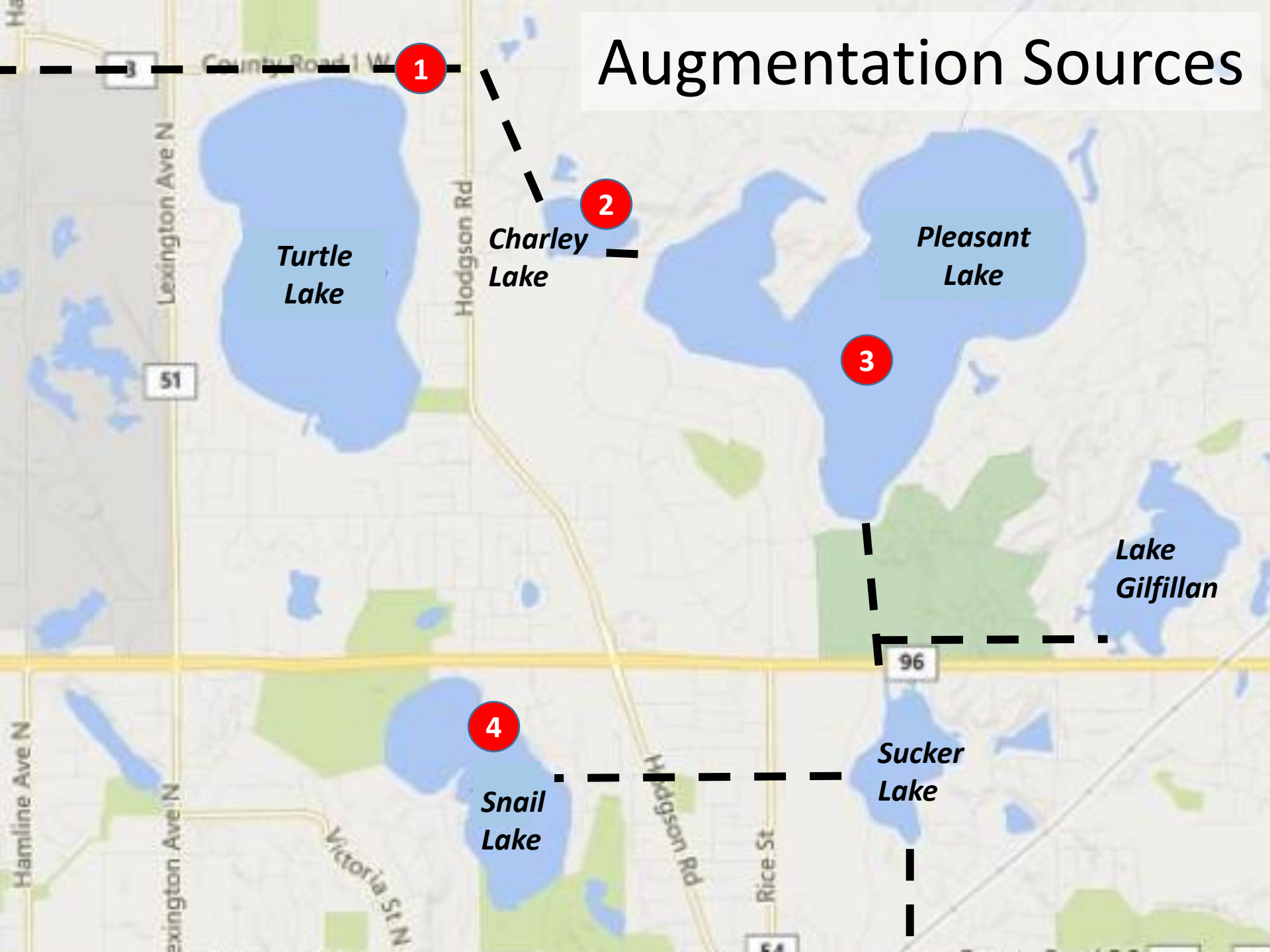
# Augmentation Volume

| | Average | Maximum |
|---|---|---|
| **Volume per year augmented** | 174 million gallons | 195 million gallons |
| **Volume per year augmented** | 17.0 inches | 19.1 inches |
| **Portion of Turtle Lake augmented** | 10 percent | 12 percent |

# Lake Levels with Augmentation



# Augmentation Sources

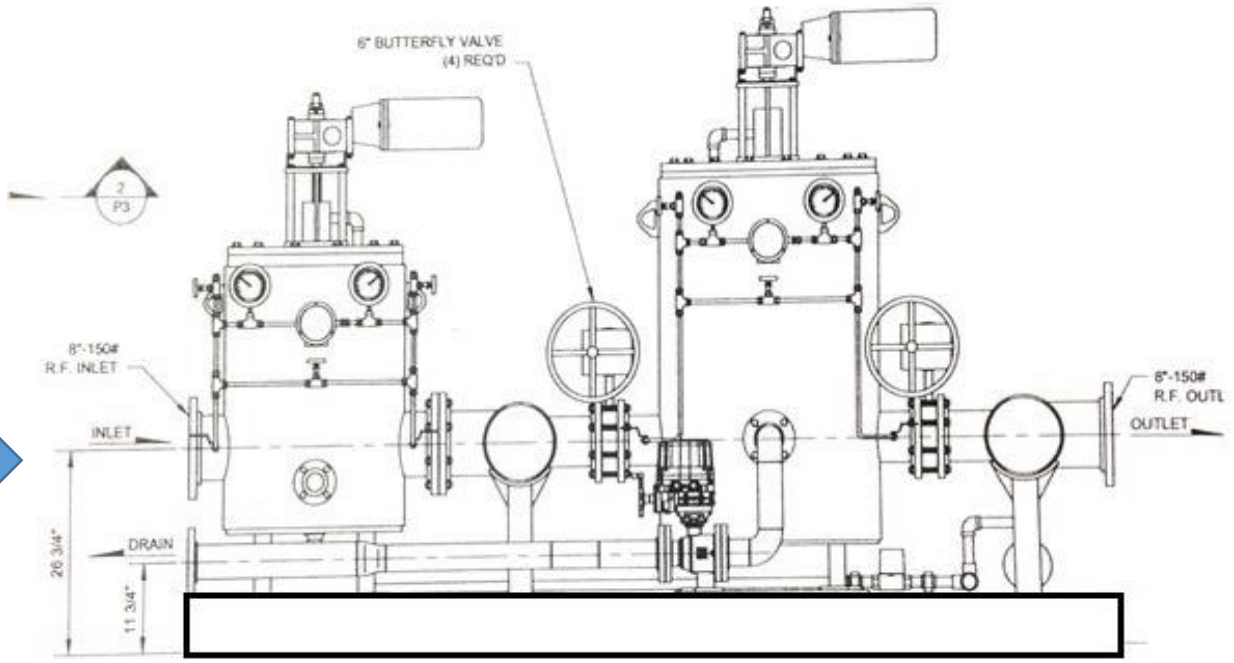


# Required Source Water Phosphorus Reduction Removal

| Source | Average – 174 million gallons | Maximum, 195 million gallons |
|---|---|---|
| Snail Lake | 0% | 0% |
| Pleasant Lake | 0% | 0% |
| Charley Lake | 37.4% | 38.3% |
| SPRWS | 46.7% | 47.4% |

# Base Project Infrastructure

- 1000 gallon per minute pump
- Augmentation transmission piping (force main and gravity pipe), and restoration
- Zebra mussel screening system
- Screening Facility and Site Work
- Electrical, Plumbing, HVAC
- Chemical
- Mechanical




**250 Micron Screen**

**25 Micron Screen**

# ZEBRA MUSSEL SCREEN – SECTION VIEW

| | | | | | | |
|---|---|---|---|---|---|---|
| SHEET A1 | SHEET TITLE: PRELIMINARY<br>WTP FLOOR PLAN | SEH FILE NO. XXX<br>PROJECT NO.<br>ISSUE DATE MONTH, YEAR<br>DESIGNED BY XXX<br>DRAWN BY XXX<br>Short Elliott Hendrickson, Inc. © (SEH) | MARK DATE DESCRIPTION<br>REVISIONS | TURTLE LAKE AUGMENTATION<br>SHOREVIEW, MN | | SEH<br>10 NORTH BRIDGE STREET<br>CHIPPEWA FALLS, WI 54729<br>PHONE: 715.720.6200<br>FAX: 715.720.6300<br>TOLL FREE: 800.472.5881<br>www.sehinc.com |


Zebra Mussel Screens could remove up to 50% of phosphorus from source water

# Construction Cost

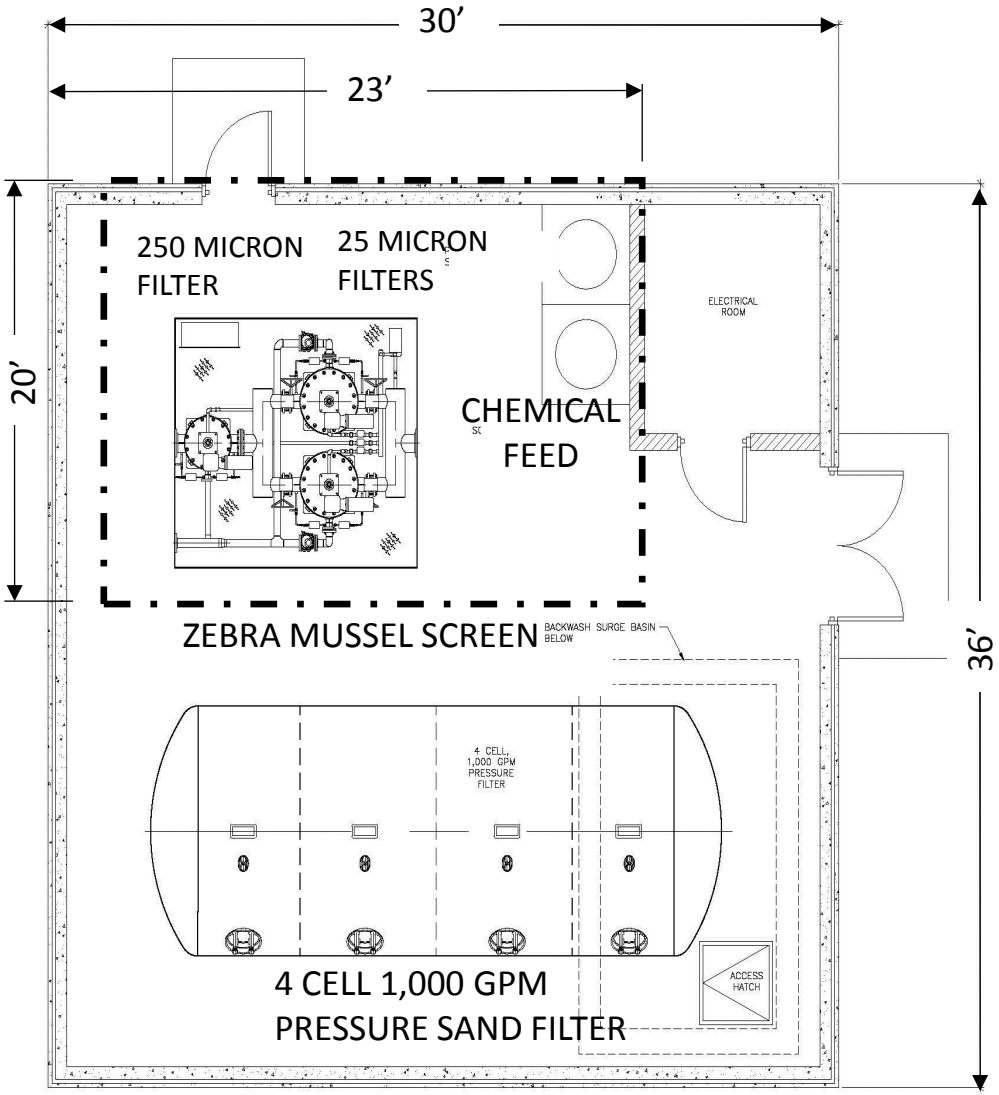
| | SPRWS | Charley Lake | Pleasant Lake | Snail Lake |
|---|---|---|---|---|
| Base Cost | $845,000 | $1,550,000 | $1,710,000 | $3,000,000 |
| Construction Contingency | $127,000 | $233,000 | $256,000 | $450,000 |
| **Estimated Construction Cost** | **$972,000** | **$1,783,000** | **$1,966,00** | **$3,450,000** |
| Maximum Required Phosphorus Removal | 47.4% | 38.3% | 0% | 0% |
| Sand Filter Treatment | $765,000 | $765,000 | $0 | $0 |
| **Total Estimated Construction Cost** | **$1,737,000** | **$2,548,000** | **$1,966,000** | **$3,450,000** |

# Recommendations

- SPRWS as Source
- Utilize Carlson Road Storm Sewer
- Rapid Sand (Coarse) Filter and Zebra Mussel Screening to protect water quality
- Allocate $1.74 million for Construction
- Lake Improvement District (LID) as implementation mechanism


County Road I to Turtle Lake via Carlson Road is shortest route
County Road I
Carlson Road


Screening and Treatment
Facility might be similar
to Snail Lake




# TREATMENT AND SCREENING FACITLITY – PLAN VIEW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TURTLE LAKE AUGMENTATION
SHOREVIEW, MN

MARK | DATE | DESCRIPTION
REVISIONS

SEH FILE NO. XXX
PROJECT NO. MONTH, YEAR
ISSUE DATE XXX
DESIGNED BY XXX
DRAWN BY


SHEET TITLE
PRELIMINARY
WTP FLOOR PLAN

SHEET
A1

# Future Considerations

- Lake Improvement District Formation
- Property Acquisition
- Permits, Approvals and Agreements
- Final Design, including treatment elements
- Final Project Costs, including engineering, legal, administrative, operations and maintenance
- Cost Recovery
- Construction

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May 18, 2016

| | SPRWS | Charley Lake | Pleasant Lake | Snail Lake |
|---|---|---|---|---|
| Augmentation Pump [1] | $13,500 | $36,000 | $45,000 | $45,000 |
| Augmentation Piping and Restoration [1] | **$187,150** | **$867,000** | **$1,047,700** | **$2,338,100** |
| Zebra Mussel Screen [3] | $255,000 | $255,000 | $255,000 | $255,000 |
| Screening Facility - Site Work [3] | $203,500 | $203,500 | $203,500 | $203,500 |
| Screening Facility - Structure [3] | $84,500 | $84,500 | $84,500 | $84,500 |
| Electrical HVAC, Plumbing [3] | $70,000 | $70,000 | $70,000 | $70,000 |
| Chemical Feed [3] | $31,000 | $31,000 | $0 | $0 |
| Subtotal | **$844,650** | **$1,547,000** | **$1,705,700** | **$2,996,100** |
| Construction Contingency | $126,698 | $232,050 | $255,855 | $449,415 |
| Estimated Construction Cost | **$971,348** | **$1,779,050** | **$1,961,555** | **$3,445,515** |

| | SPRWS | Charley Lake | Pleasant Lake | Snail Lake |
|---|---|---|---|---|
| Treatment Facility –Sand Filter [3] | $471,000 | $471,000 | $0 | $0 |
| Treatment Facility - Structure [3] | $109,950 | $109,950 | $0 | $0 |
| Electrical HVAC, Plumbing [3] | $83,500 | $83,500 | $0 | $0 |
| **Subtotal** | **$664,450** | **$664,450** | **$0** | **$0** |
| **Construction Contingency** | $99,668 | $99,668 | $0 | $0 |
| **Estimated Construction Cost** | **$764,118** | **$764,118** | **$0** | **$0** |
| **Base Project Cost (Table 24)** | $971,348 | $1,779,050 | $1,961,555 | $3,445,515 |
| **Maximum Construction Cost** | **$1,735,465** | **$2,543,168** | **$1,961,555** | **$3,445,515** |