Is it 0.2 or 0.8? Flexible Limit Piloting for Phosphorus Removal on Lagoon Effluent

Village of Waterbury, Vermont

Jack Myers, PE

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November 18, 2015

Photo credit: http://www.fredmurphy.com/img/mtphilo.jpg

The Highlights

1 Waterbury Where?

2 Brief History of Phosphorus Removal in Vermont, the Status of the TMDL (this week), & Project History

3 Pilot Testing – Goals and Results

4 The Mystery Unveiled – Design Decisions

5 Construction

6 Performance

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1 Recognize these?

http://msmagazine.com/blog/2011/09/30/an-open-letter-to-ben-and-jerry/

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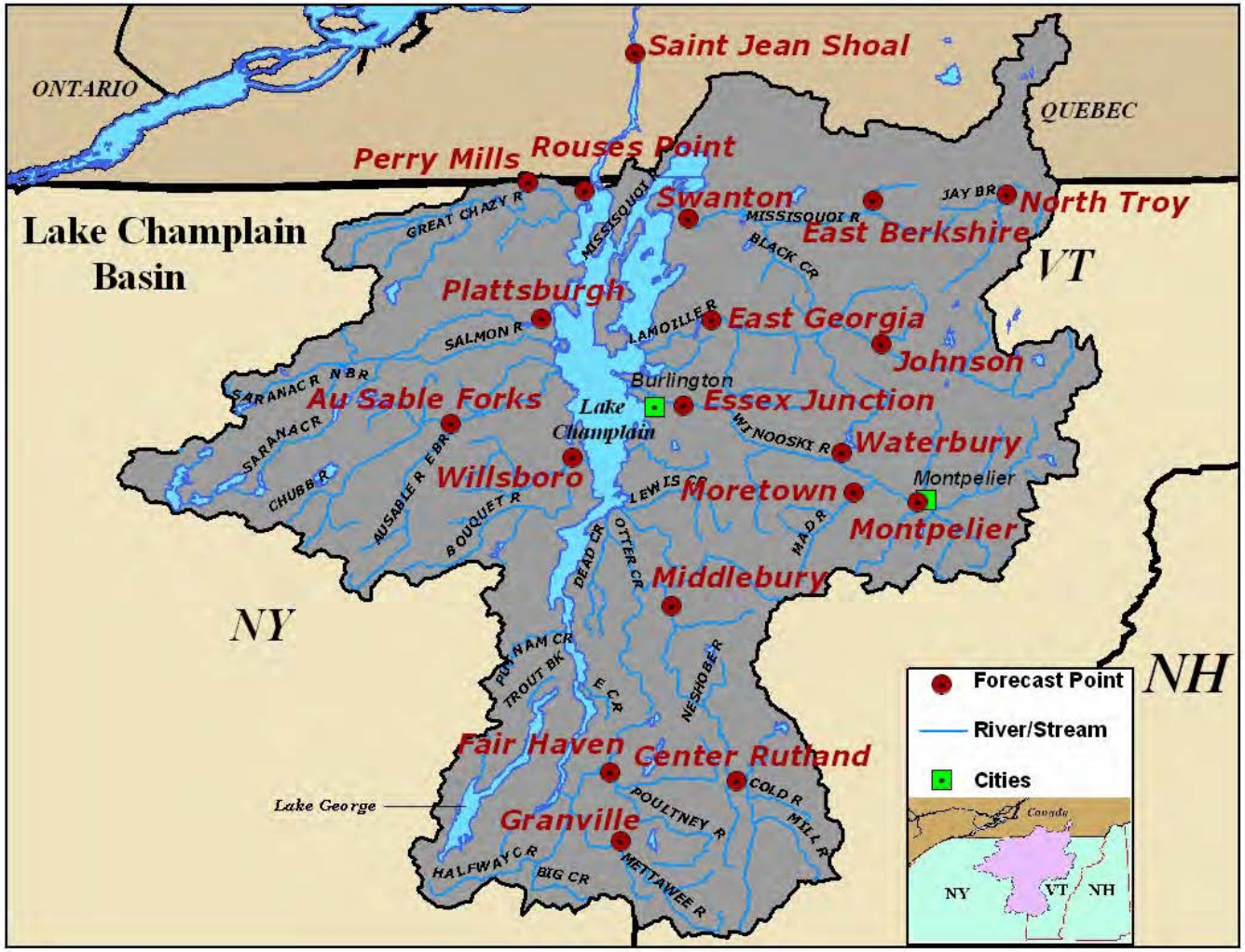
Waterbury, Vermont

- Population = 4900

Source: ESRI By Janet Loehrke, USA TODAY

Waterbury, Vermont



http://www.erh.noaa.gov/nerfc/webmaps/LCH_webmap2.jpg

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The Facility (Pre-Upgrade)

Main PS → Influent Box →Aerated Lagoons → Chlorination → Winooski River

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The Facility - Stats

Influent Characteristics

- ADF = 0.51 MGD
- Max = 1.02 MGD
- BOD_5 = 250 mg/L
- TSS = 260 mg/L
- TP = 7 mg/L

Effluent Characteristics

- BOD_5 = 15 mg/L
- TSS = 15 mg/L
- TP = 4± mg/L

Typical Lagoon Operational Challenges

- Seasonal Turnover
- Lagoon Chemistry Changes
- Algae and Duckweed

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2 History

- TMDL for Lake Champlain
- History of the Project
- Status of the TMDL (this week)
- TMDL and Waterbury

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The Lake Champlain TMDL

(Total Maximum Daily Load)

- Where is Lake Champlain?
- Why the TMDL?

http://www.vtwinecruise.com/

http://www.soea.com/get-away-to-lake-champlain/

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The TMDL & Lagoons

How did the initial TMDL affect Waterbury's WWTP?

- Lagoons initially exempt
- …Lagoon exemption removed, must achieve 0.8 mg/L compliance by 12/31/2007
- The Village signed an AOD agreement

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Timeline of the TMDL

11/2002 - USEPA approves Lake Champlain TMDL: All WWTP in basins must achieve 0.8 mg/L TP, lagoons exempt.

10/2008 – CLF files suit against EPA to set aside 11/2002 approval & establish new TMDL.

CLF & EPA sign settlement to allow reconsideration of 2002 TMDL.

1/2011 – 2002 TMDL approval withdrawn by EPA

Draft TMDL issued in August

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

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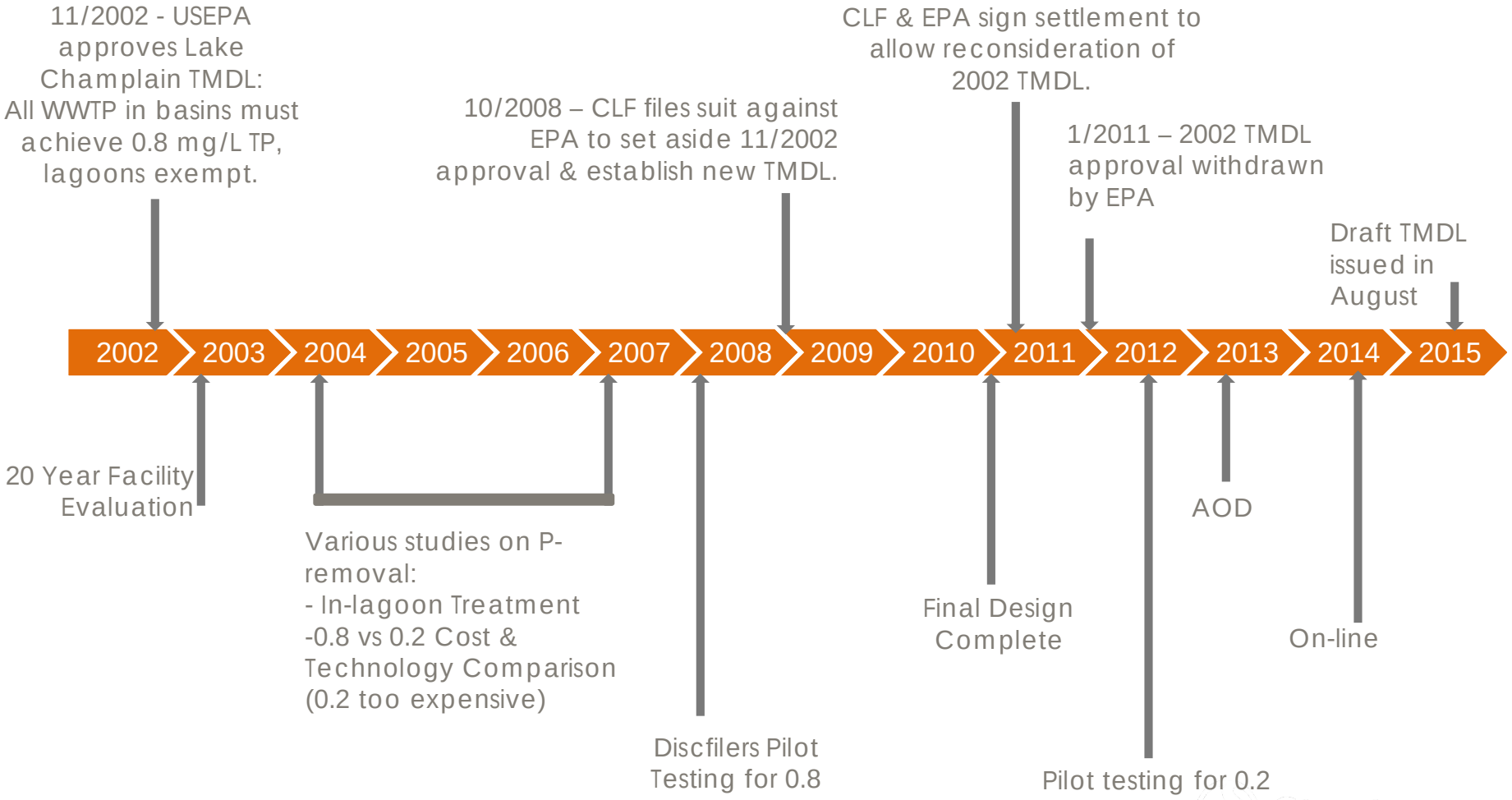
Timeline of the Project



TMDL Status Going Into Design

- Uncertain!

Proceeding without a Goal

To avoid lawsuits and in good faith, Waterbury proceeded with pilot testing for technologies that can meet 0.2 mg/L effluent TP.

- Can the existing design reliably and consistently meet 0.2 mg/L?
- Other treatment processes?
- Village signs the Assurance of Discontinuance (AOD).

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3 Pilot Testing

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Piloting Goals

- Meet 0.2 mg/L effluent TP
- Determine coagulant and polymer types and doses.
- Estimate solids production.
- Estimate electrical costs, ballast losses.
- Ability to respond under high-flow, high-load conditions.

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Piloting Outcomes

Both technologies produced similar quality effluent including:

- TP <0.2 mg/L
- BOD_5 < 3 mg/L
- TSS < 5 mg/L
- E. *Coli* < 2 colonies/100 mL

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Decisions, Decisions

Compared based on the following items, among many:

- Efficiency of Coagulant Use
- pH Adjustment
- Solids Production
- Degree of Operator Attention Required
- Ease of Maintenance
- Ability to handle algae and duckweed

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4 Mystery Unveiled – Design Decisions

CoMag

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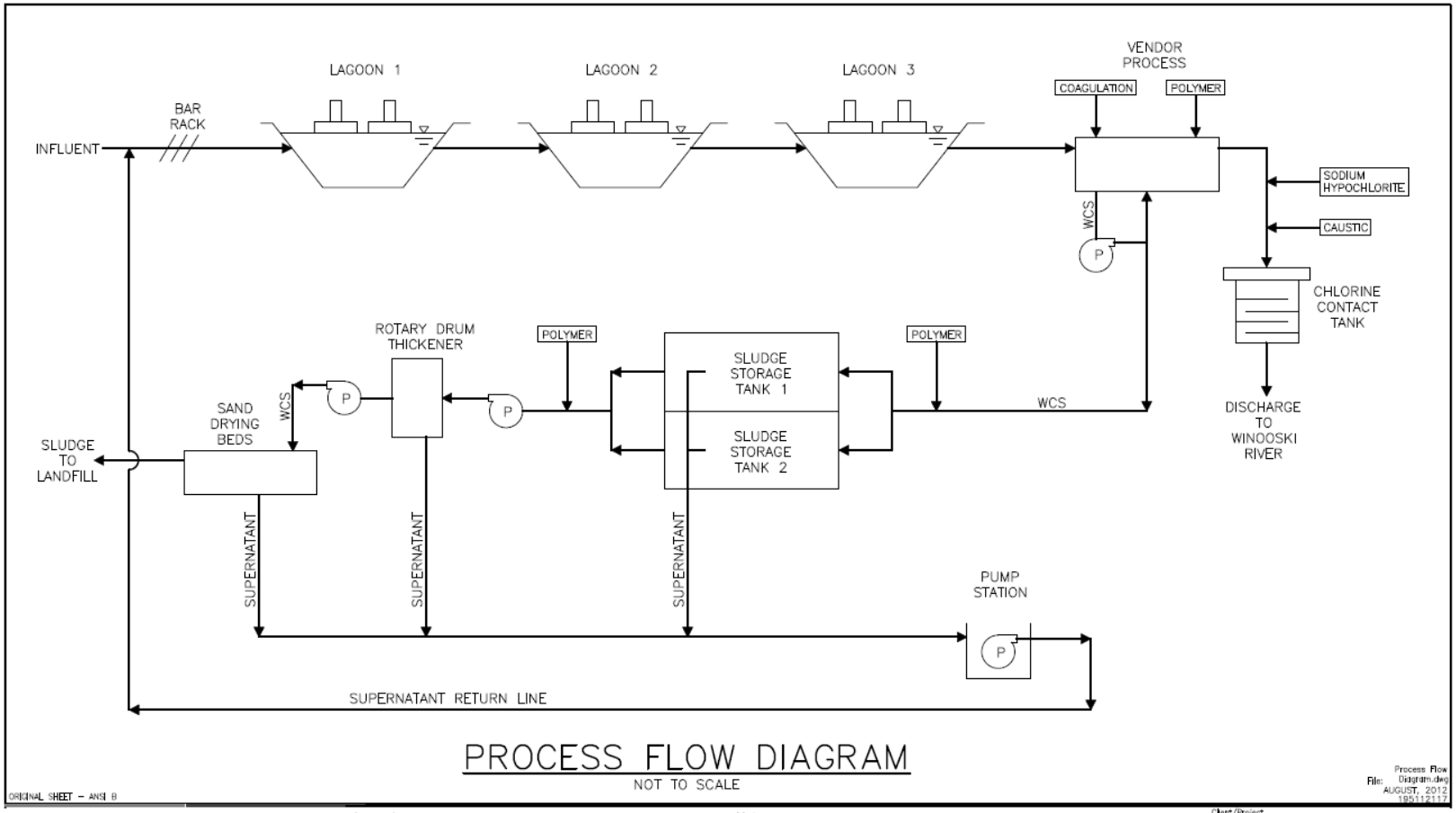
Process Flow Diagram



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Legend

Notes

Client/Project
VILLAGE OF WATERBURY
WASTEWATER TREATMENT PLANT
PHOSPHORUS REMOVAL UPGRADE

Figure No.
1.0

Title
PROCESS FLOW DIAGRAM

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5 Construction

- Construction began October, 2013.
- The CoMag process went online in July, 2014.
- Currently at substantial completion.
- Virtual Tour!

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6 Performance

- How is the CoMag process performing?

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During Startup

- During the 7-day Performance Demonstration:
- Effluent TP ranged from 0.079 mg/L to 0.798 mg/L.

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During First Year of Operation

- Experienced some challenges, but still met permit
  - Equipment and Programming Bugs
  - Highest algae and duckweed bloom in years (influent TSS to CoMag >200 mg/L

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7 TMDL Redux

(bonus section)

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Draft TMDL – Vermont

- This Plan does **not** allocate any additional phosphorus reductions to wastewater treatment plants in the Lake Champlain basin.

- Any further reductions in wastewater allocations should be targeted only to facilities in those lake segment watersheds where the currently permitted wastewater load represents a higher proportion of the total phosphorus load from all Vermont sources, and where wastewater upgrades would meaningfully reduce the phosphorus reduction burden placed on non-wastewater sources.

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Draft TMDL – EPA

- Further WWTF load allocations are appropriate in the following segments: Main Lake, Shelburne Bay, Burlington Bay, St. Albans, South Lake A and B, and Missisquoi Bay.

- Factors determining allocations:

    - Design flow <0.1 MGD: no action
    - Design flow 0.10 MGD – 0.20 MGD: Limit of 0.8 mg/L at design flow
    - Design flow >0.2 MGD: Limit of 0.2 mg/L at design flow

- Permits will have limits expressed in total annual mass loads, NOT daily max mg/L.

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Questions?

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