"No-Cost"
Nitrogen & Phosphorus Removal
Five Case Studies

Grant Weaver, PE & WWTP Operator
President
The Water Planet Company

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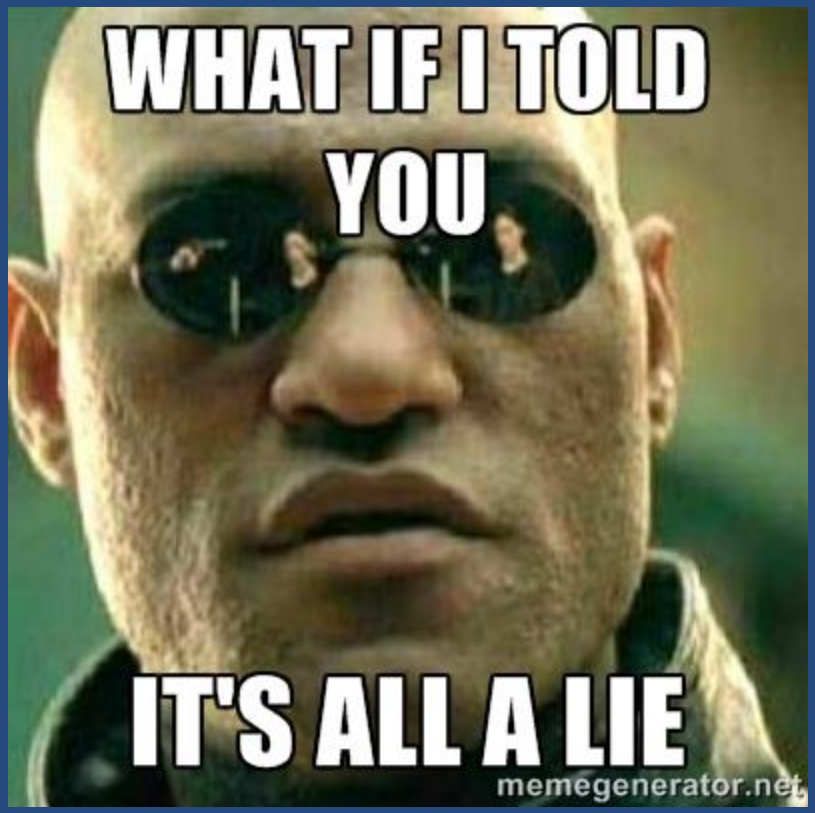
Plants receiving Nutrient Removal O&M support

Amherst, Massachusetts Athens North Mouse Creek, Tennessee Athens Oostanaula, Tennessee Barnstable, Massachusetts Bartlett, Tennessee Big Sky, Montana Billings, Montana Bozeman, Montana Chinook, Montana Colchester-East Hampton, Connecticut Columbia Falls, Montana Conrad, Montana Cookeville, Tennessee Crossville, Tennessee Dillon, Montana East Haddam, Connecticut East Helena, Montana Easthampton, Massachusetts Farmington, Connecticut Greenfield, Massachusetts Hamilton, Montana Hardin, Montana Helena, Montana Kalispell, Montana Keene, New Hampshire Lewistown, Montana Libby, Montana Livingston, Tennessee Lolo, Montana McKinleyville, California Missoula, Montana Montague, Massachusetts Newburyport, Massachusetts New Hartford, Connecticut Northfield, Massachusetts Nottingham MUD, Texas Palmer, Massachusetts Plainfield North, Connecticut Plainfield Village, Connecticut Portland, Connecticut South Deerfield, Massachusetts South Hadley, Massachusetts Suffield, Connecticut Sunderland, Massachusetts Upton, Massachusetts Westfield, Massachusetts Windham, Connecticut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IT'S ALL A LIE
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"No-Cost" Nutrient (N&P) Removal

To Get Plants not Designed to Remove Nutrients …

Experiment with Day-to-day Operations in order to ...

Create Optimal Habitats using Existing Equipment.

Optimal Habitats for Nitrogen & Phosphorus Removal

Aerobic Conditions:

NH_4 conversion to NO_3
PAO uptake of ortho-P

Process Control: DO/ORP, MLSS

Anoxic Conditions:

NO_3 conversion N_2

Process Control: ORP, BOD

Anaerobic (Fermentive) Conditions:

VFA formation
PAO uptake of VFA & ortho-P release

Process Control: ORP, BOD

"No-Cost" Nutrient (N&P) Removal

Biggest Barrier to Optimization is Regulatory:

"Follow Operations & Maintenance Manual"

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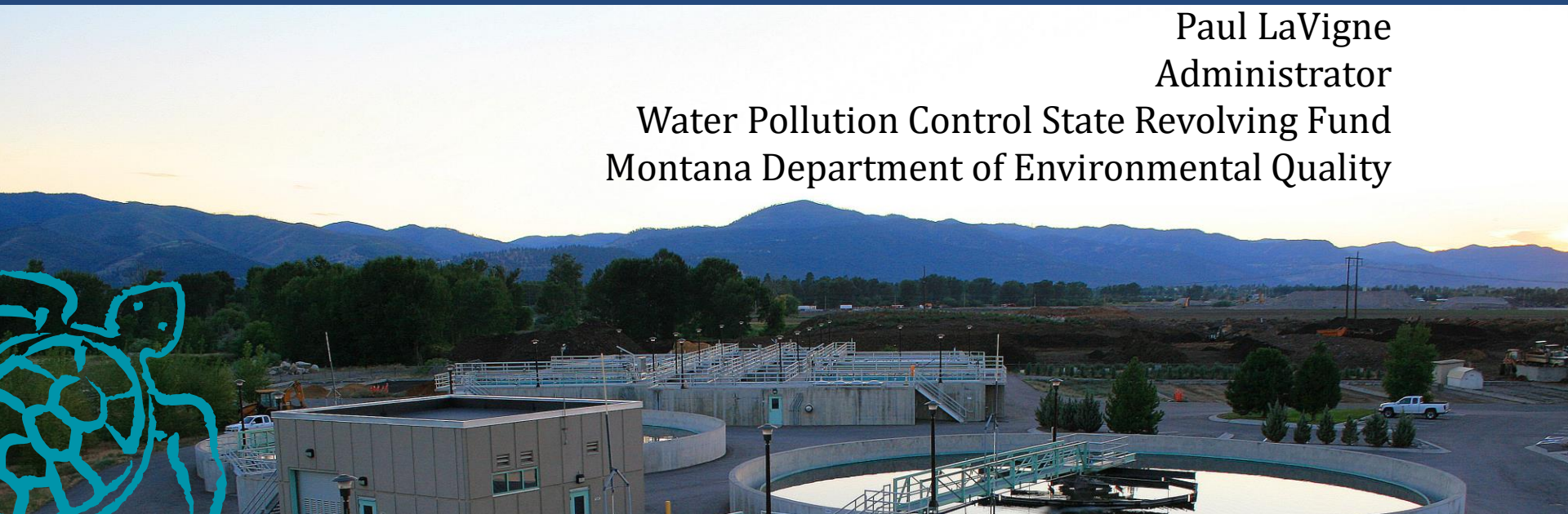
Regulatory Support Encourages Optimization:

"*Basically, we are training operators to hide their O&M Manuals in a dark corner somewhere and start operating their systems differently than they were originally designed for…*"

Paul LaVigne
Administrator
Water Pollution Control State Revolving Fund
Montana Department of Environmental Quality

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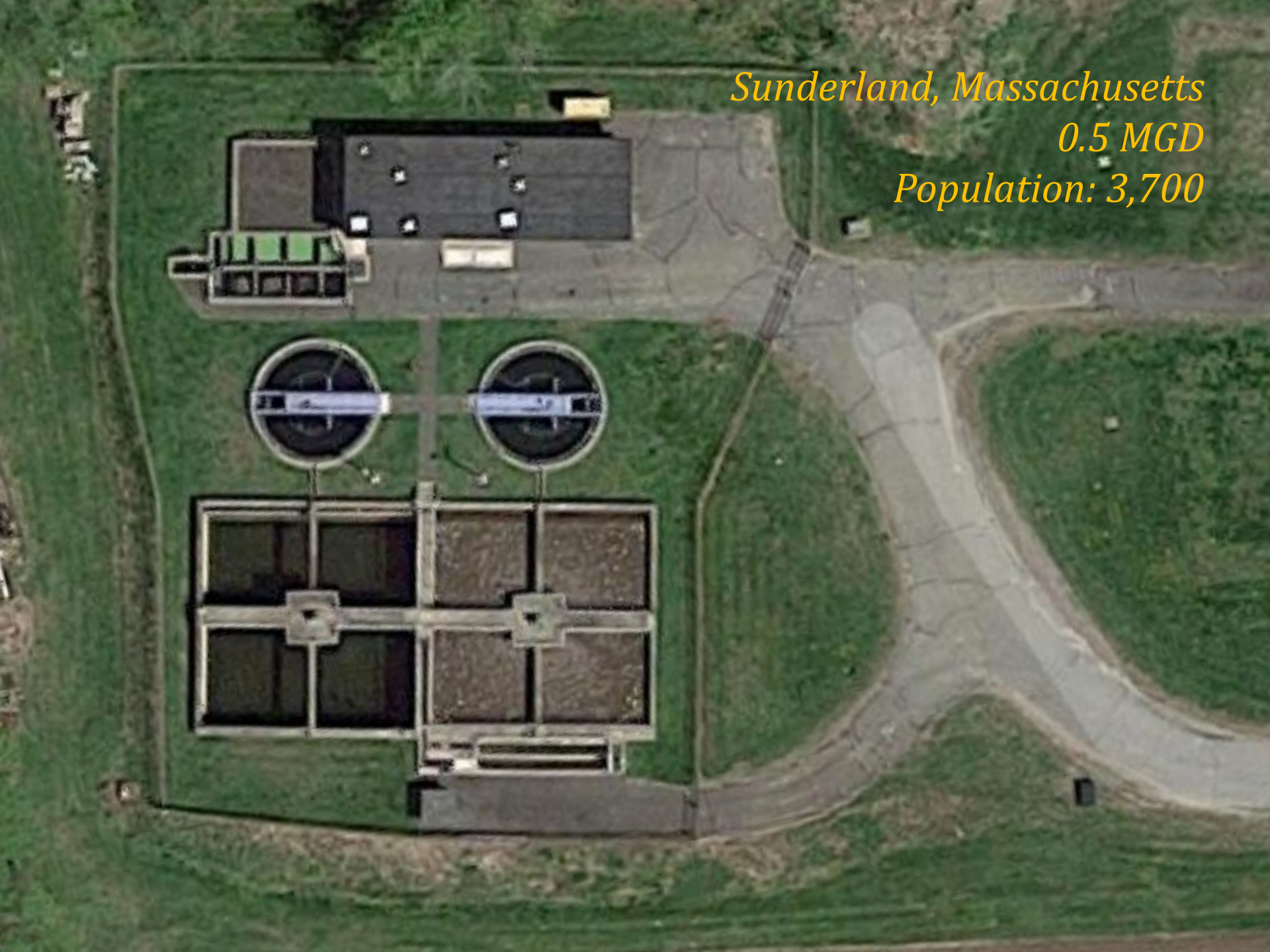
Case Studies

	total-N (mg/L)		total-P (mg/L)	
	Before	After	Before	After
Sunderland, Massachusetts	20	8.0	3.0	3.0
Upton, Massachusetts	22	6.0	0.2	0.2
Conrad, Montana	25	2.5	2.5	0.3
Chinook, Montana	25	4.0	2.5	0.5
Montague, Massachusetts	20	8.0	2.5	0.7


Sunderland, Massachusetts
0.5 MGD
Population: 3,700

Sunderland, Massachusetts

	Before	After
total-Nitrogen:	20 mg/L	8 mg/L
total-Phosphorus:	3.0 mg/L	3.0 mg/L

Sludge production cut in half

Process changes:

- Increased MLSS to 3500 mg/L
- Mechanical aerator is cycled on and off


Upton, Massachusetts
0.4 MGD
Population: 5,700

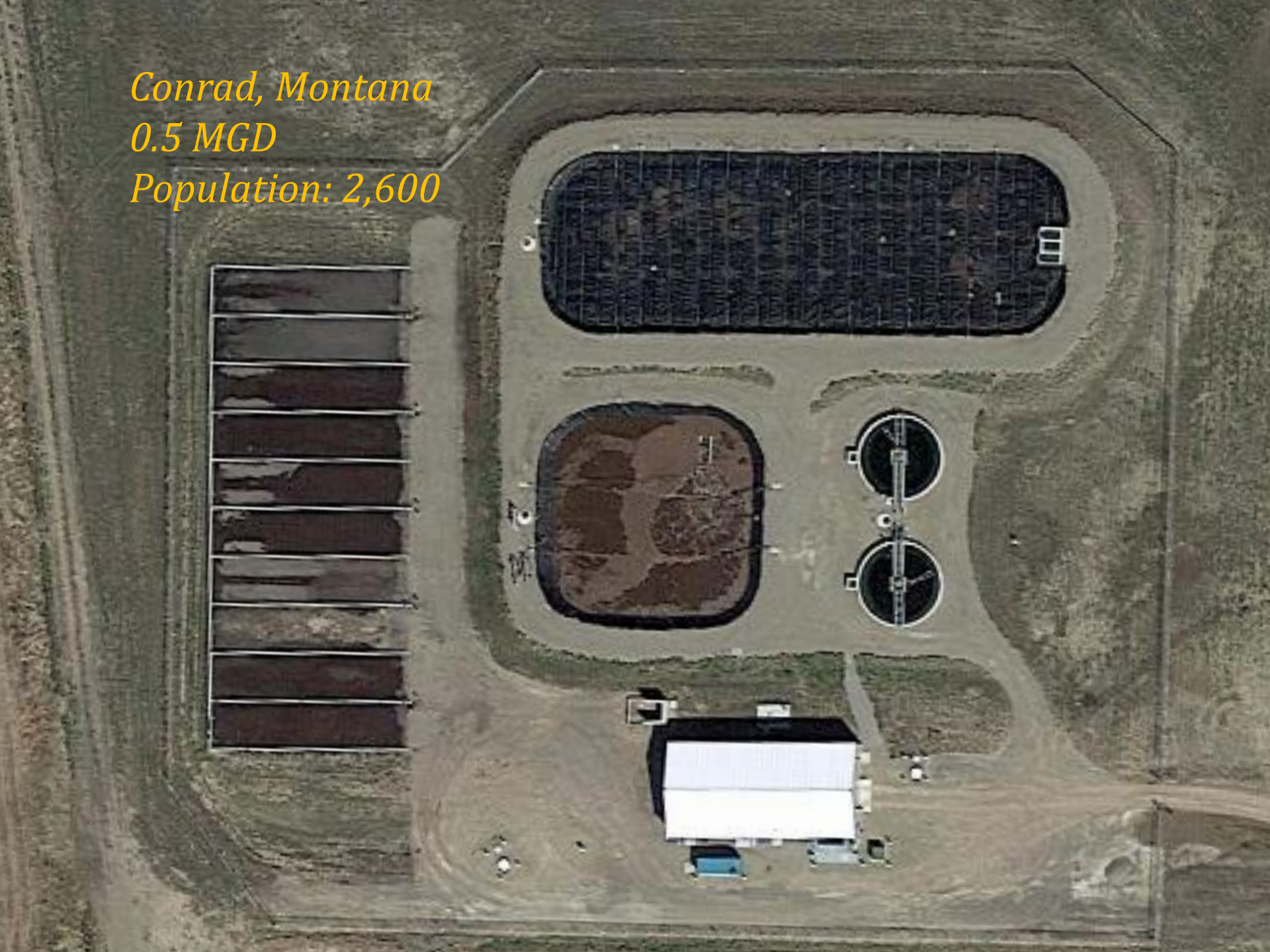
Upton, Massachusetts

	Before	After
total-Nitrogen:	22 mg/L	6 mg/L
total-Phosphorus:	0.2 mg/L	0.2 mg/L

Fewer chemicals: PAC and sodium aluminate

Process changes:

- Air turned off in front one half of both aeration basins
- RAS rate increased to 2Q (200% of influent flow)


Conrad, Montana
0.5 MGD
Population: 2,600

Conrad, Montana

	Before	After
total-Nitrogen:	25 mg/L	2.5 mg/L
total-Phosphorus:	2.5 mg/L	0.3 mg/L

Sludge production cut in one-third

Less electricity

Process changes:

- Increased MLSS
- Return a portion of WAS to aeration
- Aeration Basin and Sludge Pond air is cycled off and on


Chinook, Montana
0.5 MGD
Population: 1,300

Chinook, Montana

	Before	After
total-Nitrogen:	25 mg/L	4.0 mg/L
total-Phosphorus:	2.5 mg/L	0.5 mg/L

Process changes:

- Increased MLSS
- One of Two Oxidation Ditch Aeration Rotors is cycled off and on
- One of Two Oxidation Ditch Submerged Mechanical Aerators operates
- Daily average DO target: 1.0 mg/L

Montague, Massachusetts

1.8 MGD

Population: 8,400

Montague, Massachusetts

	Before	After
total-Nitrogen:	20 mg/L	8.0 mg/L
total-Phosphorus:	2.5 mg/L	1.0 mg/L

Almost zero sludge is produced

Process changes:

- Increased MLSS
- Waste Sludge from 22 wwtps is added to influent
- Primary Clarifiers Operated as Anaerobic Fermenters
- Air to Aeration Tanks cycles off and on

Case Studies

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