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Report

Date: February 23, 2018

To: IEPA DWPC CAS #19 Email: EPA.PrmtSpecCondtns@Illinois.gov
1021 N. Grand Ave. East
Post Office Box 19276
Springfield, IL 62794-9276

Re: City of Braidwood NPDES Permit #IL0054992
Special Condition #18 Phosphorus Reduction Feasibility Study

Dear Sirs:

The city of Braidwood has done some preliminary investigations to determine the feasibility of further reducing the phosphorus levels in its effluent.

Braidwood's Phosphorus Discharge Optimization Plan is in its early stages of implementation. It appears that as the optimization is fully implemented, the current plant will likely continue meeting the current 1.0 mg/l Phosphorus effluent level limit.

Since Braidwood began monitoring Phosphorus (P) in its effluent in 2016, the current plant has reduced the level of P in its effluent to near or below 0.5 mg/l several times. As the city's optimization plan is further implemented this coming year and with another year of data collected, a better determination can be made if it is reasonable for the city to reach a goal of less than 1.0 mg/l without a major change in the treatment train.

Costs associated with Braidwood's Phosphorus Optimization Plan include:

Plan Development:	$10,000
Advertising:	$ 2,000
Investigate individual potential P sources	$10,000
Testing of individual Phosphate sources	$ 2,000
Legal, Ordinance changes, etc., if required:	$ 5,000
Total, 1st year, not including STP operating costs:	$29,000

Recurring Annual Optimization Costs:

Advertising:	$1,000

Investigate individual potential P sources	$5,000
Testing of individual Phosphate sources	$1,000
Annual total, Not including STP operating costs:	$7,000

Phosphorus removal in the Wastewater Treatment Plant is accomplished generally by either Biological Nutrient Removal (BNR), aka Enhanced Biological Phosphorus Removal (EBPR), chemical addition, or both. To consistently reach goals of less than 0.5 mg/l, generally both processes must be used simultaneously.

Efficient use of chemical addition for phosphorus removal would require the ability to add chemical at two locations at the WWTP. Currently the Braidwood plant design only has one point of chemical addition, i.e. before the final clarifier.

Typically, when chemical phosphorus removal is instigated, sludge production has been noted to increase 26 to 40% Since Braidwood started chemical addition two years ago, their sludge production records show a similar production increase. Since the Braidwood plant already has very limited sludge storage, the cost of additional sludge storage must be considered if further Phosphorus removal is desired.

Capital costs to chemically consistently meet a goal of 0.5 mg/l P in effluent:

Add second chemical injection point:	$50,000
If second pump, tank, and building are needed:	$200,000
Sludge storage tank with Aeration equipment:	$650,000
SCADA updates to operate new equipment:	$50,000
Total capital cost to meet 0.5 mg/l goal:	$950,000

O & M costs to chemically treat to 0.5 mg/l P goal in Effluent:

Chemical Costs:	$25,000
Sludge treatment, storage, and disposal;	$20,000
Maintenance, Labor:	$ 5,000
Total annual O&M costs:	$50,000

Enhanced Biological Phosphorus Removal (EBPR) generally requires a dedicated Anaerobic zone at the head of the treatment process. Additionally the nutrient levels in all parts of the treatment train must be closely monitored to allow the Phosphorus Accumulating Organisms (PAO's) to compete, thrive, and function properly to achieve desirable treatment levels.

Because the design of the Braidwood STP includes the ability to separately control the level of mixing and aeration in the Oxidation ditch with the Triton Aerator-mixers, the city is able to obtain anaerobic conditions in the outer ditch during certain periods of the day. This helps significantly with Phosphorus removal but the Braidwood plant does not have enough excess capacity to allow the outer ring to be a dedicated zone for optimal phosphorus removal without significantly limiting the capacity of the plant to remove other nutrients.

Capital costs to expand the plant for Enhanced Biological Phosphorus Removal (EBPR):

Add a fourth partial ring to the oxidation ditch for a dedicated anaerobic zone:	$300,000
Plumbing additions and structural modifications to existing Headworks building and Oxidation ditch to accept flow to new ring:	$250,000
Instrumentation and aeration equipment:	$ 75,000
SCADA updates to operate new equipment:	$100,000
Total capital cost to add an EBPR treatment train:	$725,000

O & M costs to operate EBPR process train:

Power Costs:	$25,000
Maintenance, Labor:	$ 5,000
Total annual O&M costs:	$30,000

Summary:

Very preliminary initial costs to meet a goal of 0.1 mg/l Phosphorus in effluent:

1st year Phosphorus optimization Plan costs:	$ 29,000
Capital cost for Chemical addition improvements:	$950,000
Capital cost to add EBPR treatment train:	$725,000
Estimated Improvements Total:	$1,700,000

Additional Annual Operating Costs to meet 0.1 mg/l goal:

Phosphorus Optimization Plan annual costs:	$ 7,000
Annual Chemical addition O&M costs:	$50,000
Annual EBPR O&M costs:	$30,000
Estimated Improvements Total:	$87,000