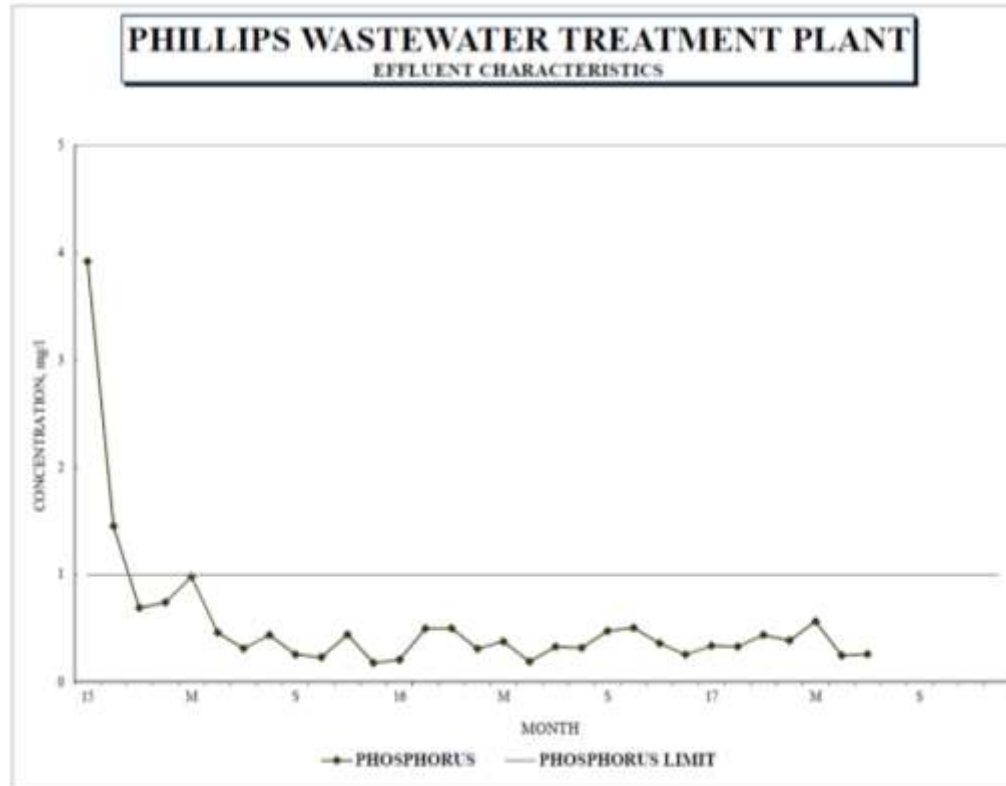




<1ppm Phosphorus – A BNR With No Chemical Addition Case Study



WWOA 51st Annual Conference October 2017

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<1ppm Phosphorus – A BNR With No Chemical Addition Case Study



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<1ppm Phosphorus – A BNR With No Chemical Addition Case Study



City of Phillips Price Co. WI WWTP

| <u>Plant Info</u> | <u>mgd</u> |
|-----------------------|------------|
| Avg. Annual Flow | 0.374 |
| Max. Daily | 1.2 |
| Peak | 1.4 |
| Discharge to Elk Lake | |

Current WPDES Limit mg/l

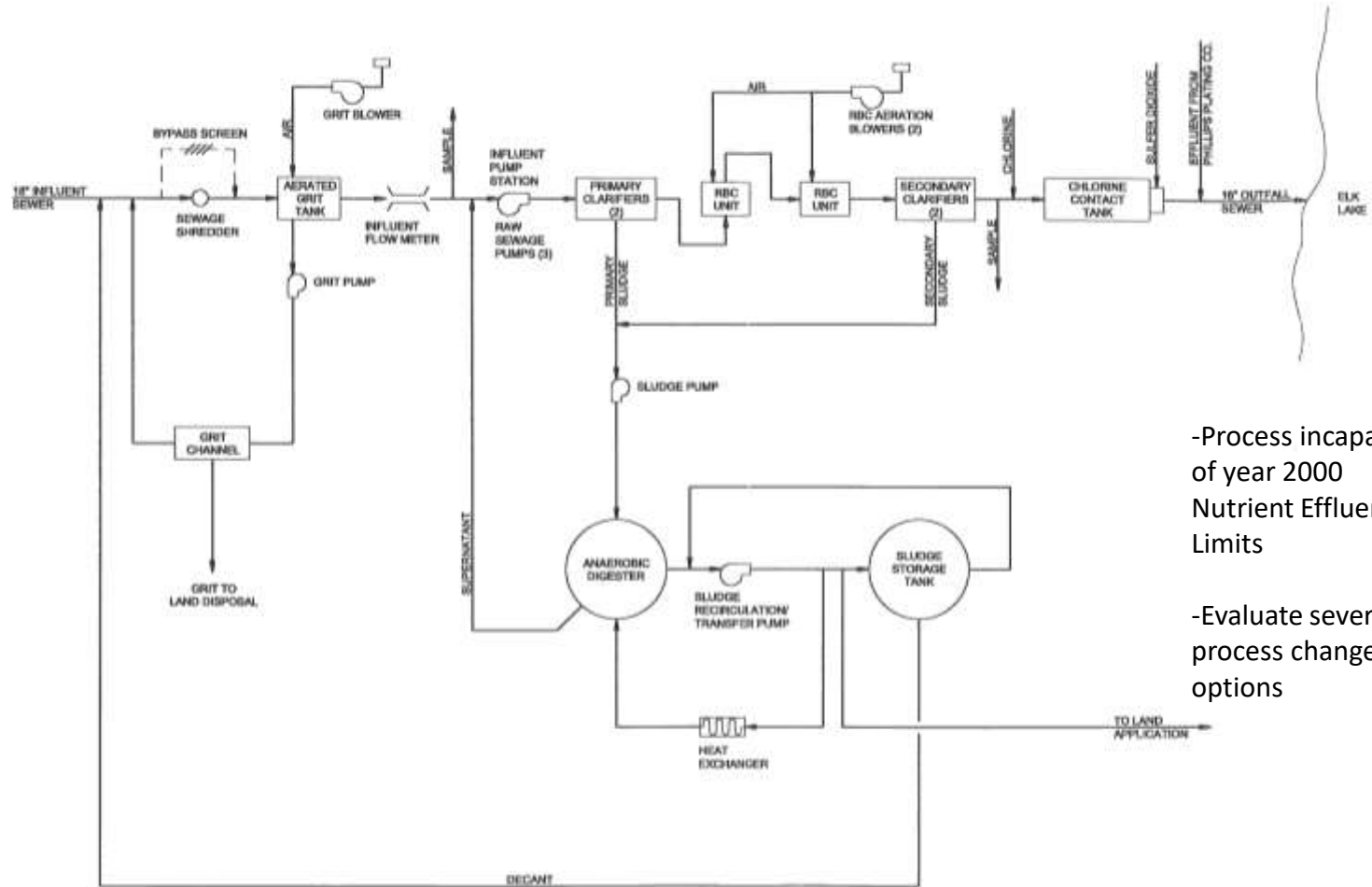
| | |
|-------------------------------------|-----|
| CBOD – Mo. Avg. | 25 |
| CBOD – Wk. Avg. | 40 |
| SS – Mo. Avg. | 30 |
| SS – Wk. Avg. | 45 |
| Tot Phos. – 6-mo. Avg May – Oct. | 0.7 |
| Tot Phos. – Mo. Avg | 1.0 |



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1980's Plant Process Flow



-Process incapable of year 2000 Nutrient Effluent Limits

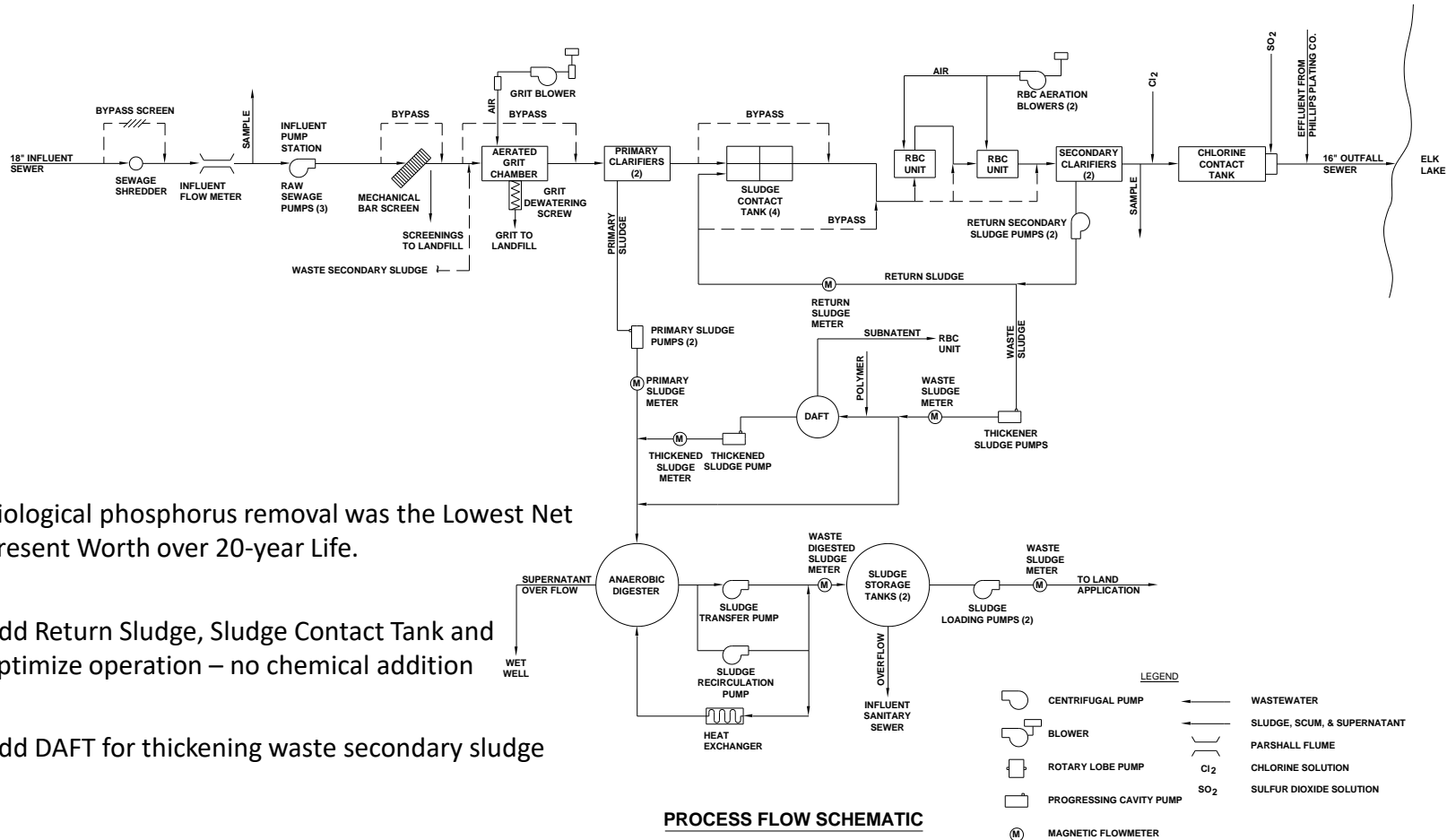
-Evaluate several process change options



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SR/RBC Process



PROCESS FLOW SCHEMATIC

- Biological phosphorus removal was the Lowest Net Present Worth over 20-year Life.
- Add Return Sludge, Sludge Contact Tank and optimize operation – no chemical addition
- Add DAFT for thickening waste secondary sludge



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- SCT design allows RSS to be added to any of 4 compartments and primary effluent to enter either half of the tank. Primary clarifier effluent presently mixes with RSS in the 1st compartment for anoxic reaction favorable for denitrification and $SBOD_5$ removal.
- Flow then passes into anaerobic compartment with conditions favorable for phosphorus accumulating organisms (PAO), allowing phosphorus release and $SBOD_5$ removal.
- Reactor compartments are mixed. Mechanical aeration is provided for any compartment to be aerated if additional aerobic treatment is needed.



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30 year old
RBC's replaced

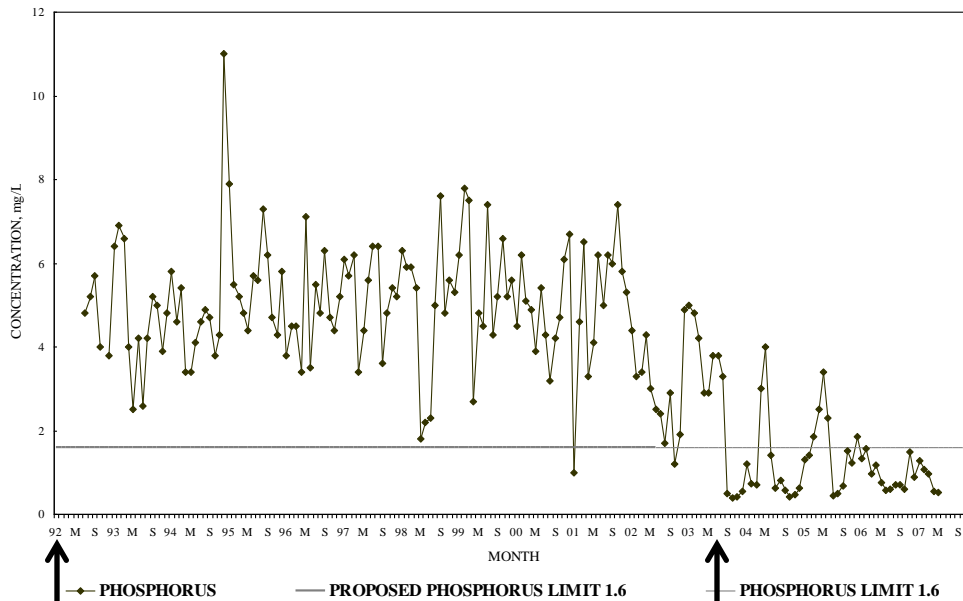
4 compartment
Sludge Contact
Tank (SCT)
-approx. 10,000
gal each



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PHILLIPS WASTEWATER TREATMENT PLANT EFFLUENT CHARACTERISTICS



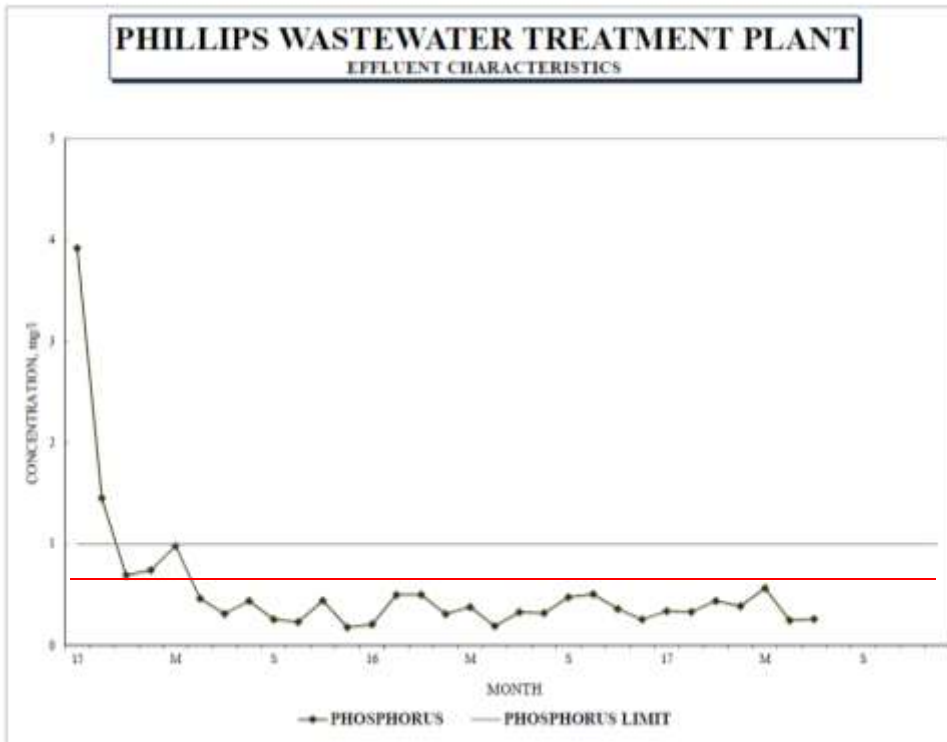
1992

2002: SR/RBC BNR process operational,
Phosphorus limit permitted at 1.6 mg/l

- Historical BOD and SS effluent levels well below limits
- Historical Phosphorus effluent shown
- Phosphorus Limit lowered to 1.0 mg/l and 0.7 mg/l in 2013



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Jan. 2015 thru mid 2017 Phosphorus consistently <1 mg/l year-round and < 0.7 on 6-mo. avg. May-Oct.

1983 vintage Autotrol RBC's replaced 2015 with Walker Process Equipment EnviroDisc RBC's.

| Secondary Treatment Characteristic | % Removal from Primary Effluent |
|------------------------------------|---------------------------------|
| SBOD ₅ | 96 |
| TSS | 92 |
| TKN | 81 |
| N-NH ₃ | 77 |
| TP | 90 |
| Orthophosphate | 91 |



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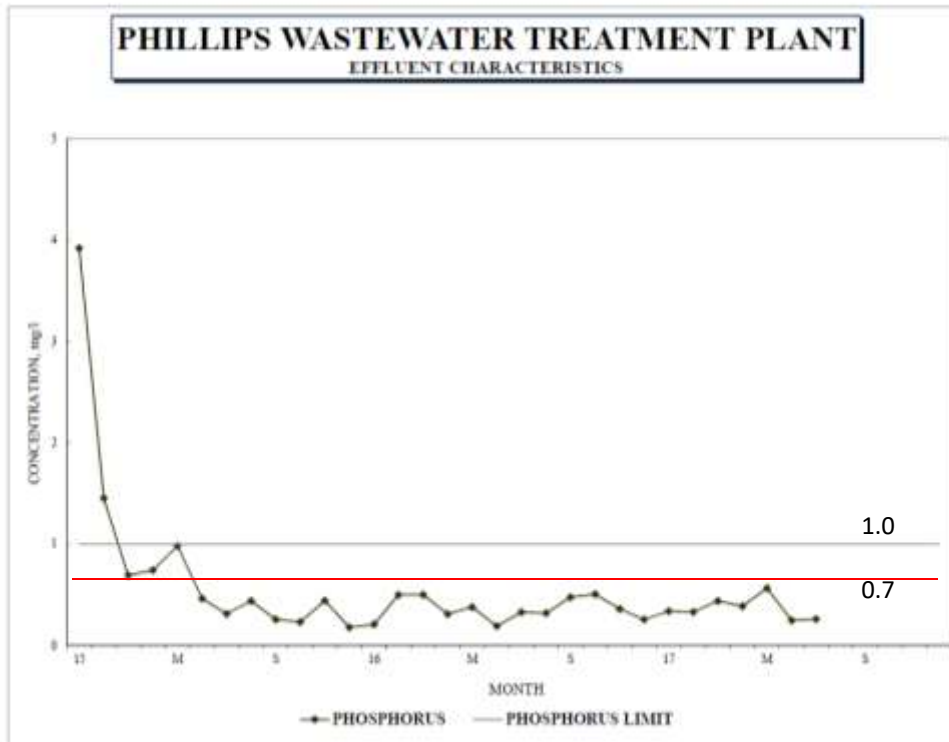


Additional sampling and analysis was done during cold-water Winter months of 2016 along with Volatile Fatty Acid addition in the SCT to explore the relationship between low temperature/primary sludge fermentation organism dormancy and 'artificial' VFA augmentation to feed the PAO.

Somewhat surprisingly, the BNR did not deteriorate in colder water conditions. Thus the VFA addition had little effect.



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SUMMARY

-BNR with RBC's and well engineered, modest investment process addition meet current Phosphorus standards

-Potential Final Limit of 0.04 mg/l Total P would require new Tertiary Treatment



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For More Information:

COMPLETE CASE STUDY REPORT:

www.walker-process.com

Select: *Literature*

Select: *Featured Articles*

[1ppm EFFLUENT PHOSPHORUS FROM SR/RBC PROCESS -
PLANT TRIAL RESULTS](#)

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