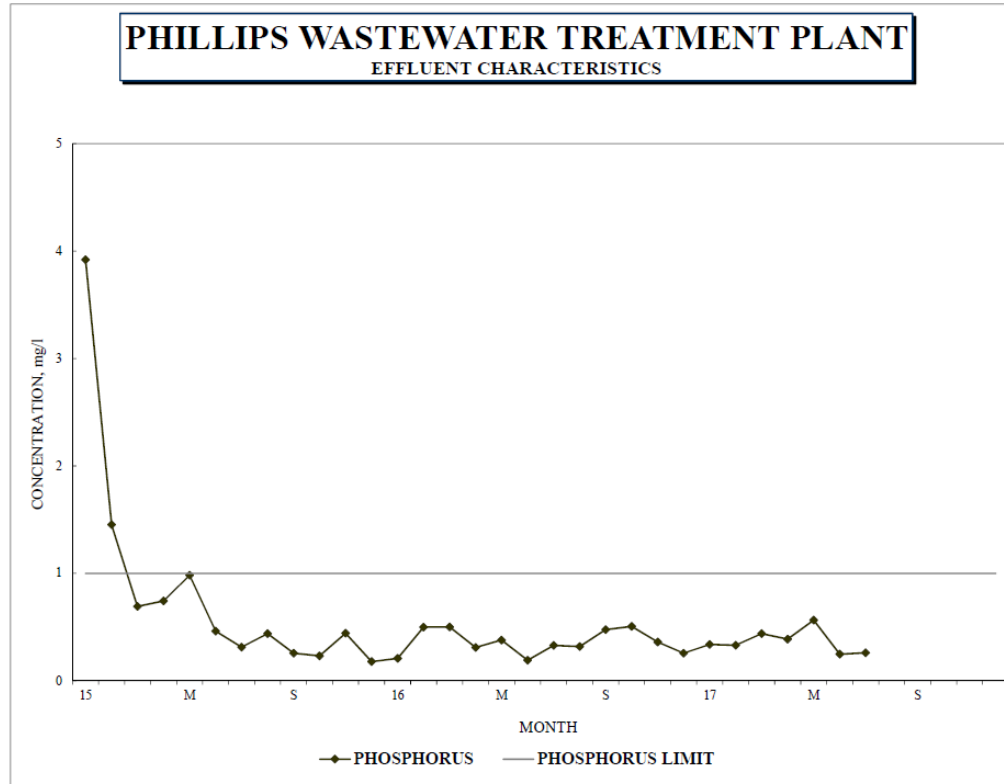




# <1ppm Phosphorus – A BNR With No Chemical Addition Case Study



**WWOA 51<sup>st</sup> Annual Conference October 2017**

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



### Acknowledgements:

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Oconto Falls, WI

Donald J. Heikkila, P.E.  
Ruekert & Mielke, Inc.  
Oconto Falls, WI

Jeff Simpson & Karen Harter – WWOA



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### 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

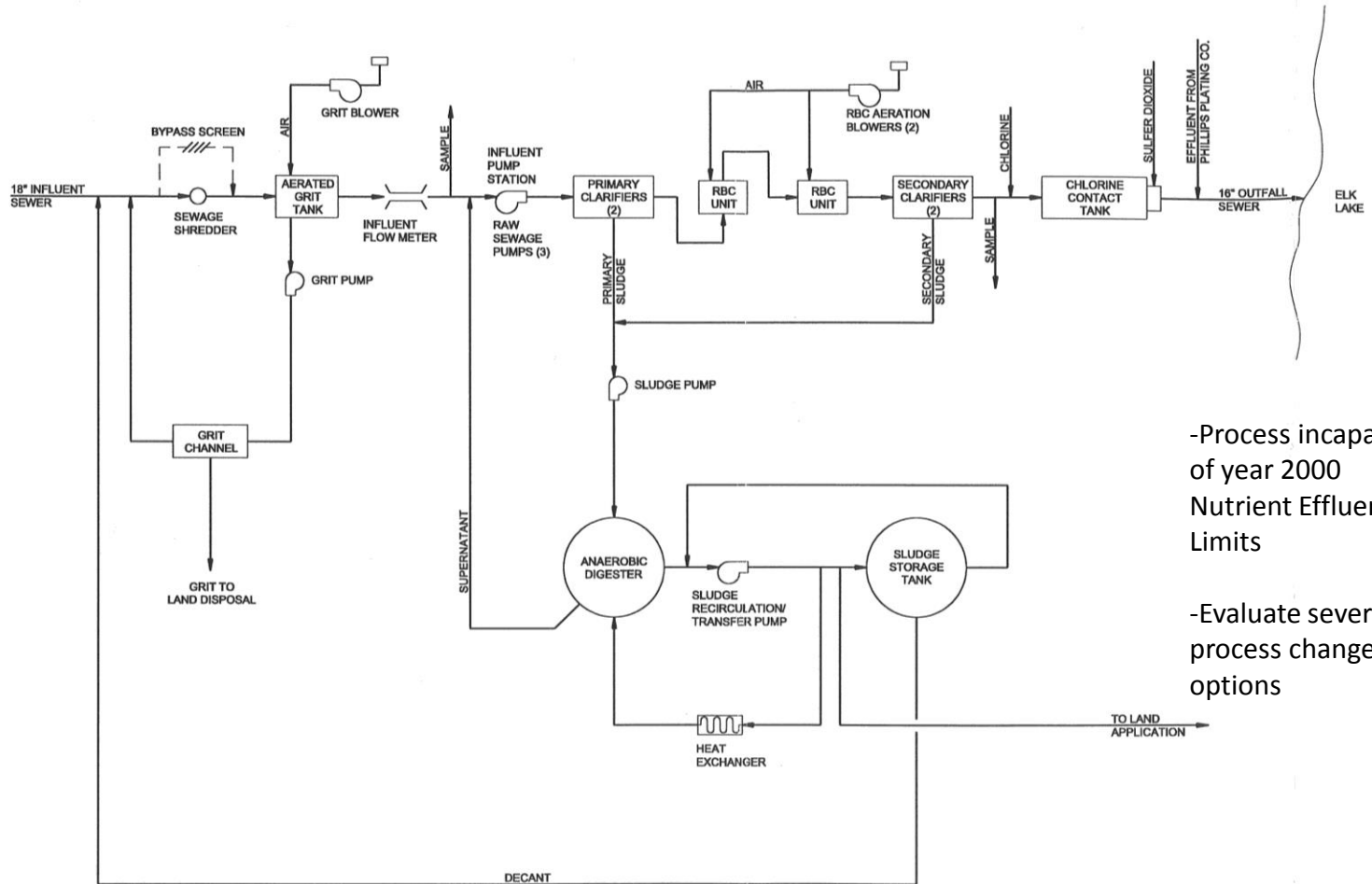
CBOD – Mo. Avg.	25
CBOD – Wk. Avg.	40
SS – Mo. Avg.	30
SS – Wk. Avg.	45
Tot Phos. – 6-mo. Avg May – Oct.	0.7
Tot Phos. – Mo. Avg	1.0



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## 1980's Plant Process Flow



-Process incapable of year 2000 Nutrient Effluent Limits

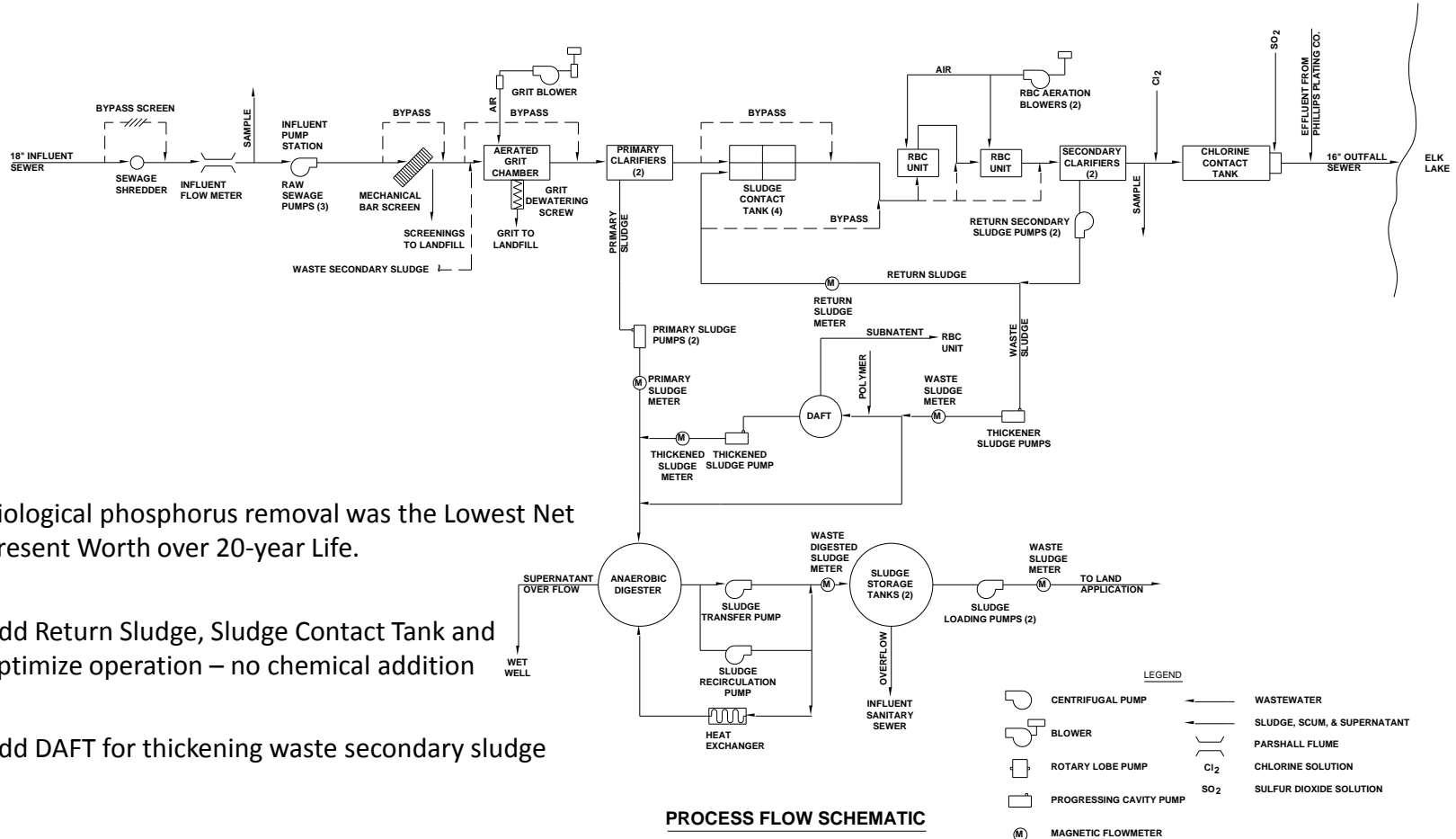
-Evaluate several process change options



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



## SR/RBC Process



- 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

**PROCESS FLOW SCHEMATIC**



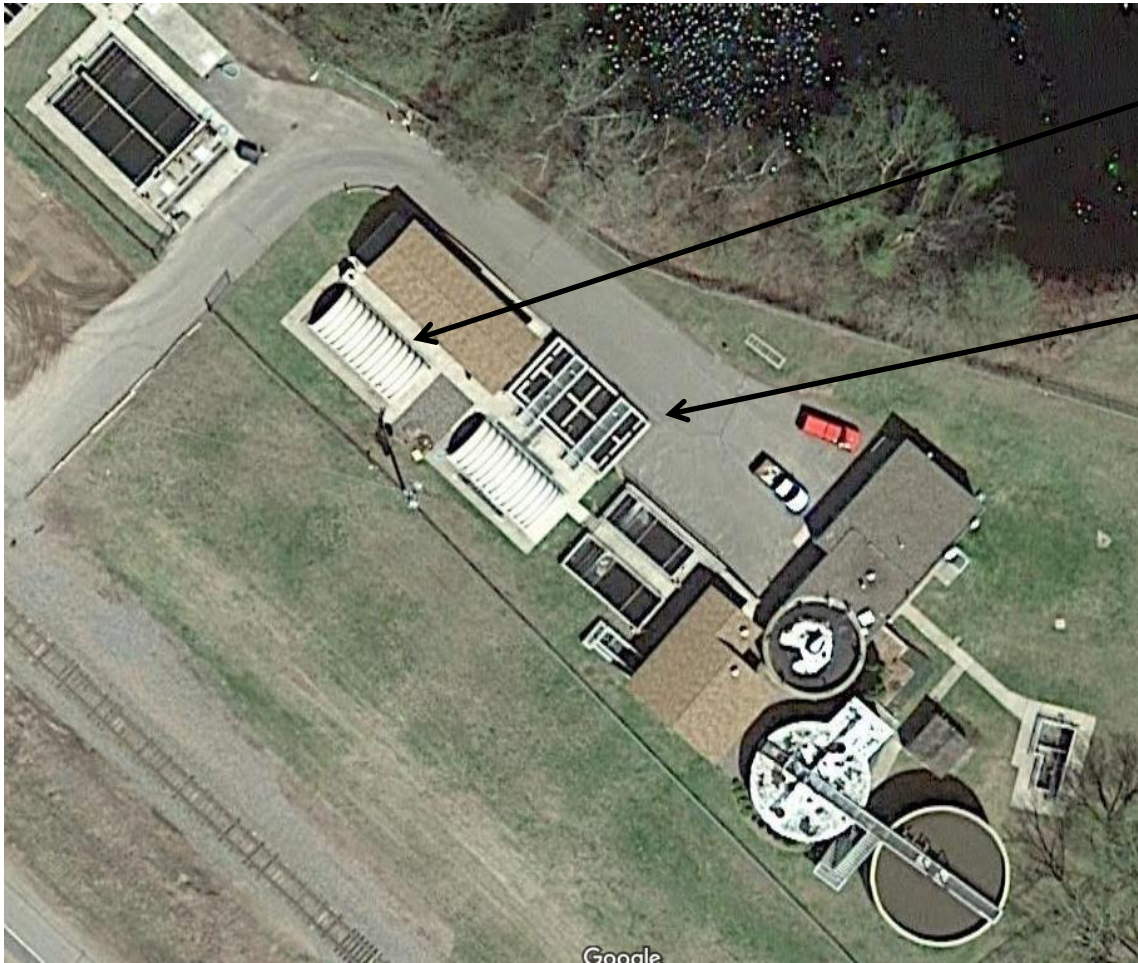
## <1ppm Phosphorus – A BNR With No Chemical Addition Case Study



- 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<sub>5</sub> removal.
- Flow then passes into anaerobic compartment with conditions favorable for phosphorus accumulating organisms (PAO), allowing phosphorus release and SBOD<sub>5</sub> removal.
- Reactor compartments are mixed. Mechanical aeration is provided for any compartment to be aerated if additional aerobic treatment is needed.



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



30 year old  
RBC's replaced

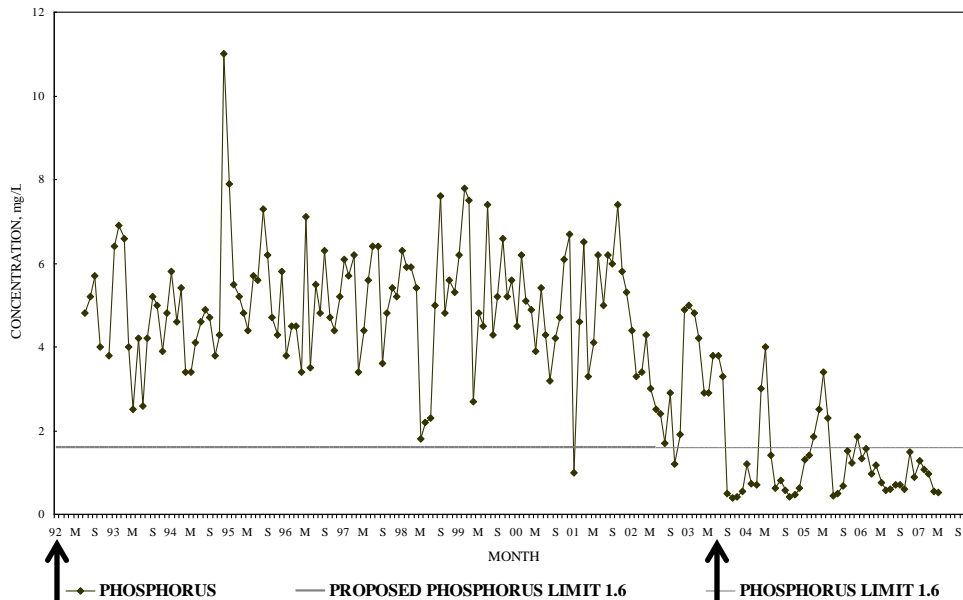
4 compartment  
Sludge Contact  
Tank (SCT)  
-approx. 10,000  
gal each



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



## PHILLIPS WASTEWATER TREATMENT PLANT EFFLUENT CHARACTERISTICS



- 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

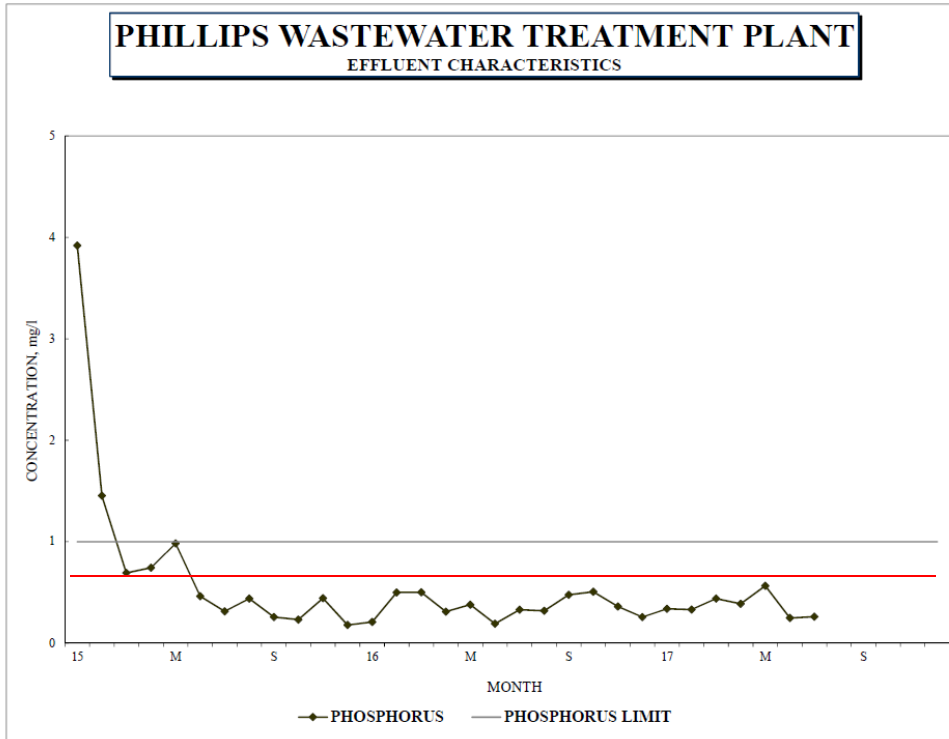
1992

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





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



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

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

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



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

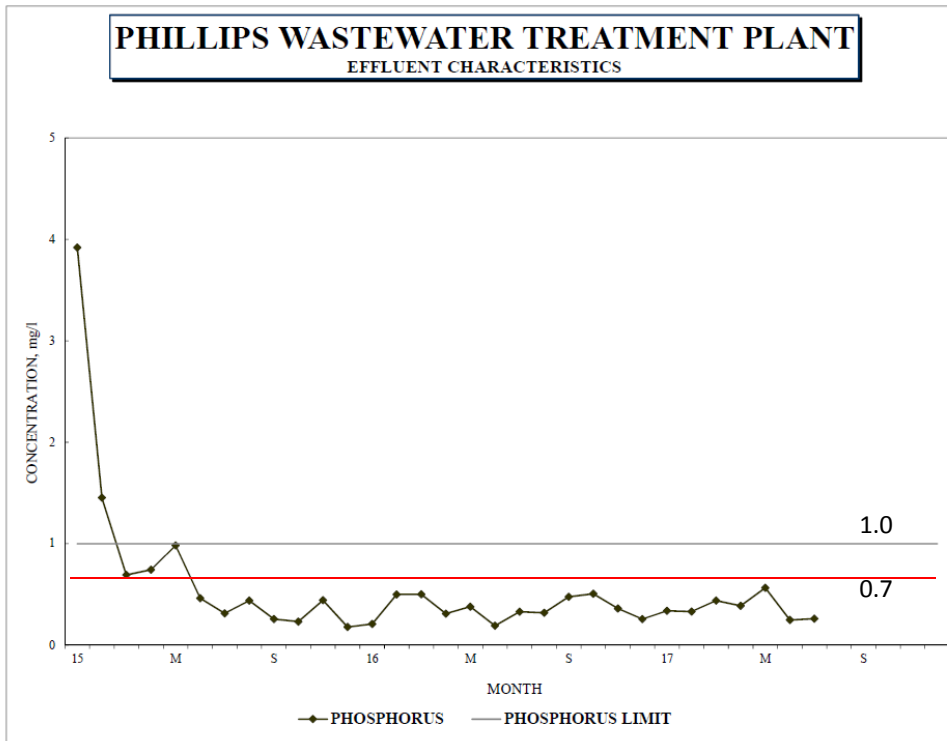


Additional sampling and analysis was done during cold-water Winter months of 2016 along with Volatile Fatty Acid addition in the SCT to explore the relationship between low temperature/primary sludge fermentation organism dormancy and 'artificial' VFA augmentation to feed the PAO.

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



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



## 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



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



For More Information:

### COMPLETE CASE STUDY REPORT:

[www.walker-process.com](http://www.walker-process.com)

Select: *Literature*

Select: *Featured Articles*

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

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