Geraldton CSBP testing.

TWC Field trials
CSBH Trial 1 – Effects of *TWC* on nutrient levels in a fertilizer factory.
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Aim

The aim of the trial is to evaluate the possible effectiveness of ***TWC*** product, buy Marine Easy Clean Pty Ltd, on an overflow and reuse production pond used for the production of fertilizers. During the trial period there were small amounts of nitrogen based fertilizers produced and large amounts of phosphorus based fertilizers produced. Whilst this product is successfully used on organic nutrients it is not certain if it can maintain inorganic nutrient loads. There was also concern raised over the products' possible ability of breaking down critical elements of the production of the fertilizers, affecting the quality of the end product.

Method

A 2-stage process to lower ammonia, nitrite, nitrate and overall nutrient levels. Stage 1 was to complete the nitrogen cycle and get a rise in nitrate which is NO3-N, which will allow stage 2 to be implemented for the overall removal of ammonia, nitrite, nitrate and nutrient levels.

Stage 1
3/8/2016 –9 x ***TWC*** Media blocks were put into the dam 2 weeks prior to bug addition. 8 blocks on the bottom and 1 floating. Unfortunately, the floating one disappeared after the dam overflowed.

18/8/2016 Bugs added to Dam – Hydrocarbon Digester Crystals (5kg) - were distributed evenly all around the outer perimeter of the dam water. 1kg of crystals mixed with 9kg of fresh water in 5 batches and then introduced into the dam via a funnel and hose.

21/9/2016 Conditioner Bacteria added to the dam - 5 weeks after the bugs (10 liter container)
Dam water sampling is being performed at locations around the dam to provide a representative sample (1 at the entrance to the dam, 1 at the mid-point of the West wall and 1 near the overflow outlet).

Stage 2
28/11/2016 – 6 x ***TWC Plus*** and 2 x ***TWC*** Media blocks were put into the dam.

Results

1st Stage
First stage of the experiment was conducted going into winter with water temperature under 18 degrees. Bacillus ssp, can be populated at these lower temperatures but they do not produce high quantities of proteases, anylases and lipases needed to break down the nutrients for the nitrogen cycle bacteria and create APT energy. Nitrite slowly rose through the cold water especially at 14 degrees and started lowering after a warm weather spike on the 18/10. This was followed by another cooling event before the water temperature was constantly over 20 degrees in mid November. Marine Easy Clean inspected the pond on the 16th of November to be informed that the experiment wasn't working. We looked at the results to date. Main outcome overwinter was to see the rising of nitrate. The doubling of nitrate NO3 shows the conversion to NO3-N. This is the release of nitrogen as gas and food for wetlands. In lakes and rivers this result lowers as the wetlands use NO3-N as food. In enclosed pond systems there is nothing to intake it so readings must rise. The conversion of NO3 to NO3-N gives a false reading and must be divided by 4.4 for the true nitrate result.

2nd Stage

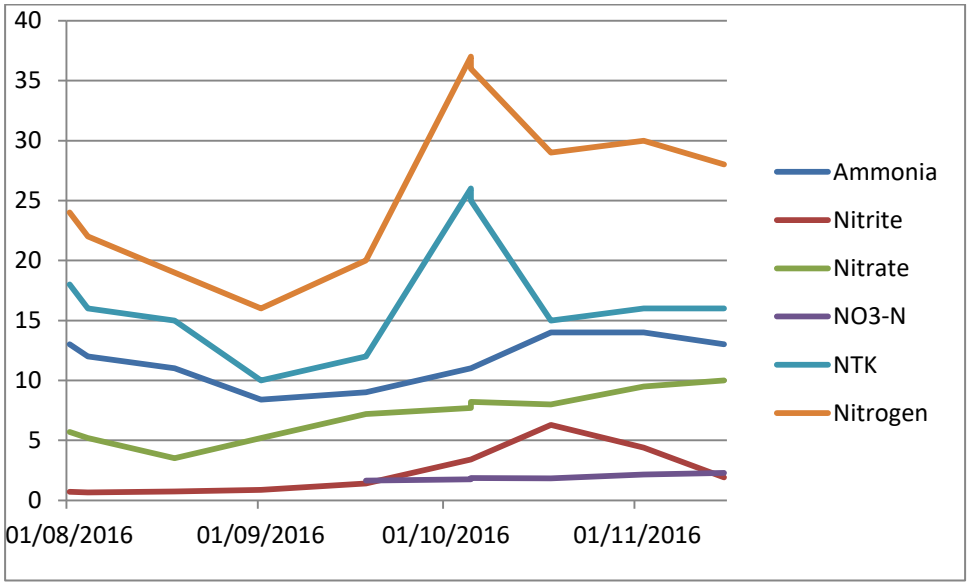
Implementation of ***TWC Plus*** and another dose of ***TWC*** on the 28/10. ***TWC Plus*** enhances nitrate consuming bacteria and phosphate accumulating bacteria which needs soil to deposit it.

Within 4 weeks of water temperatures in excess of 20 degrees there was a massive drop in ammonia, nitrite, nitrate, nitrogen and kieldahl nitrogen. With continuing phosphorus input, phosphate accumulating bacteria managed to decrease phosphorus total and reactive filterable phosphorus levels. With minimal storage capability, being a concrete pond with no soils, we saw the level rise again.

There was no effect from the treatment on the fertilizer chemicals.
All hydrocarbon C levels were tested for with only small readings detected, which dropped out within two weeks.

Stage 1 Water Temp under 20C

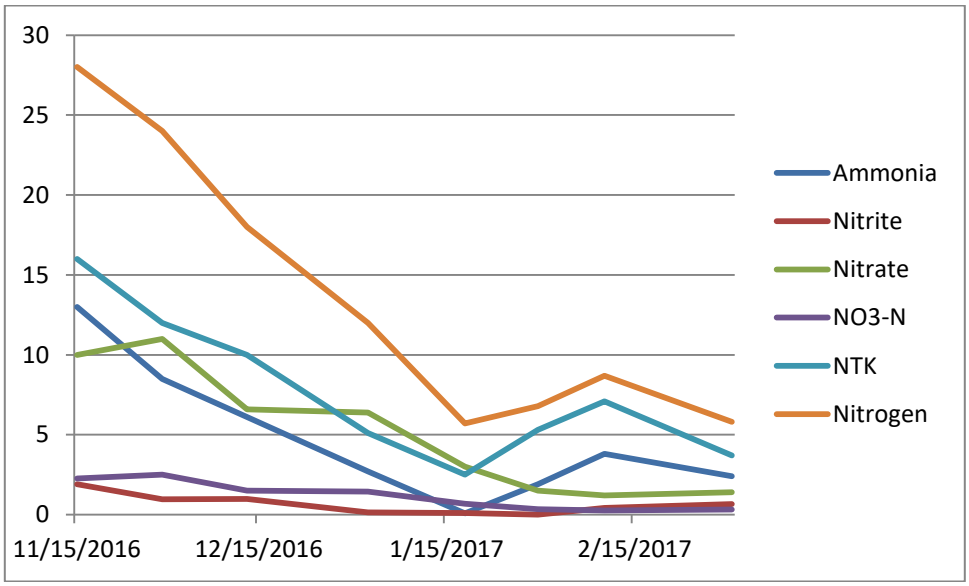
Sample	(Deg C) Temperature	Ammonia as	Nitrite as	Nitrate as	Nitrate as True	Nitrogen Total	Nitrogen	pH Lab
Date	Field	Nitrogen	Nitrogen	Nitrogen	NO3-N	Kjeldahl	Total	pH units
01/08/2016		13	0.72	5.7		18	24	7.6
04/08/2016	14.7	12	0.65	5.2		16	22	7.6
18/08/2016	17.3	11	0.74	3.5		15	19	7.1
01/09/2016	14.9	8.4	0.86	5.2		10	16	7.1
18/09/2016	17.3	9	1.4	7.2	1.64	12	20	6.9
05/10/2016	14	11	3.4	7.7	1.75	26	37	7.6
05/10/2016	14	11	3.4	8.2	1.86	25	36	7.1
18/10/2016	22	14	6.3	8	1.82	15	29	6.8
02/11/2016	14	14	4.4	9.5	2.16	16	30	6.5
15/11/2016	24	13	1.9	10	2.27	16	28	7.8



The rising of nitrate was the only good result in cold water, allowing stage 2 to begin.

Stage 2 Water Temp above 20C

Sample	(Deg C) Temperature	Ammonia as	Nitrite as	Nitrate as	Nitrate as True	Nitrogen Total	Nitrogen	pH Lab
Date	Field	Nitrogen	Nitrogen	Nitrogen	NO3-N	Kjeldahl	Total	pH units
15/11/2016	24	13	1.9	10	2.27	16	28	7.8
29/11/2016	22.4	8.5	0.96	11	2.5	12	24	6.6
13/12/2016	22.7	6.1	0.98	6.6	1.5	10	18	7.4
02/01/2017		2.7	0.15	6.4	1.45	5.1	12	7.5
18/01/2017	23.4	0.08	0.11	3	0.68	2.5	5.7	7.9
30/01/2017	23	1.9	< 0.05	1.5	0.34	5.3	6.8	7
10/02/2017	20.6	3.8	0.42	1.2	0.27	7.1	8.7	7.2
03/03/2017	26.3	2.4	0.66	1.4	0.32	3.7	5.8	7.5

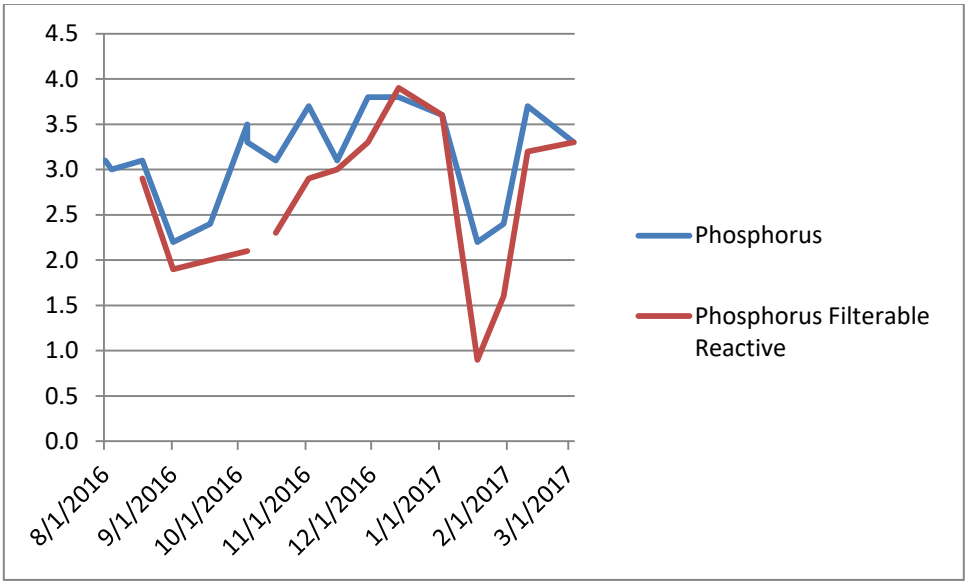


Once the water temperature rose above 20C the second treatment saw the lowing of all parameters

- **82% reduction in Ammonia**
- **66% reduction in Nitrite**
- **86% reduction in Nitrate**
- **77% reduction in Kjeldahl Nitrogen**
- **80% reduction in Nitrogen**

No effect on fertilizer chemicals

Sample	Potassium	Sodium	Magnesium	Sulphate	Sulphate	Sulphur	Sulphur
Date	Dissolved	Dissolved	Dissolved	as S	SO4-	Dissolved	total
01/08/2016				13	40		16
04/08/2016				12	36		15
18/08/2016	9.2	8.5	2	12	37	12	13
01/09/2016	7.4	6.6	1.7	11	34	9.4	13
18/09/2016	8.4	8.1	2.1	11	32	11	12
05/10/2016	9.5	9.7	2.2	11	32	12	12
05/10/2016	9.6	9.3	2.1	11	32		11
18/10/2016	11	10	2.2	12	36	11	11
02/11/2016	10	10	2.4	12	36	10	12
15/11/2016	12	11	2.6	11	33	10	11
29/11/2016	13	12	2.9	13	38	12	13
13/12/2016	14	16	3.1	15	44	14	13
02/01/2017	16	16	3.5	14	42	13	14
18/01/2017	17	19	4.2	15	45	14	14
30/01/2017	11	11	2.5	15	44	15	15
10/02/2017	14	9.9	2.4	14	41	16	18
03/03/2017	16	10	2.6	15	44	15	15



No real result in phosphorus levels with the concrete pond (no soil to absorb phosphorous)

Conclusion

The cold water slowed the speed of the process of reducing levels. Nitrate slowly rose which shows the nitrogen cycle re-establishing even with limited ability due to cold water. **October:** a major nutrient event which saw nitrogen levels rise dramatically. Once we had the first warm water spike at the end of October the nitrogen cycle started to function at a progressive pace. At this stage we implemented Stage 2 which saw an average 80% reduction in all levels of inorganic nutrient.

The comparison to 2016 winter starting levels to 2017 winter starting levels is very dramatic, showing that ***TWC*** can maintain the inorganic nutrient levels in the water via bio-stimulation.

The project also confirms the need to investigate the development of solar water warming boxes in winter so Bacillus sp can produce the critical enzymes needed to assist the nitrogen cycle in winter.