NOOSA INTEGRATED CATCHMENT ASSOCIATION

WATERWATCH

NOOSA RIVER WATER QUALITY

ANALYSIS AND REPORT

2005 – 2018

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NICA WATERWATCH ANALYSIS AND REPORT, JUNE 2018

SUMMARY

Water quality data for the lower reaches of the Noosa River measured since 2005 have been analysed, and it may be concluded that the Noosa River is a robust system but only in fair condition. With the exception of turbidity it is almost within the lowest level of compliance (80th percentile) of the DES water quality guidelines, therefore further improvements should be sought. Currently, it has the ability to absorb the levels of pollutants now entering the estuary below Lake Cootharabah such as suspended solids and breakdown products emanating from native forests as well as from human activities. There are warning signs from the data obtained from the tributary creeks which indicate that ongoing monitoring of those sites and greater control of those streams would be prudent.
The poor water quality at Eenie Creek indicates that urgent remedial measures are required there to remove pollutants and to re-oxygenate the water. It also indicates that a schedule of testing stormwater drain outlets should be revived.
Retention of a Waterwatch program is recommended, though modified from previous work. Changes suggested include the addition of sites in tributary creeks to more accurately identify and remediate potential pollution sources. Trial introduction of biological testing should be included.
Analysis of other catchment sites should be undertaken to assess all potential sources of pollution.
Summary reports are to be provided regularly to Noosa Shire Council for use in river management and remediation programs. A part time suitably qualified person should be employed for this important role.

ACTIONS RECOMMENDED

Urgent remedial action is required at Eenie Creek/Rene St to reduce solids entering and to restore oxygen levels. Construction of a bio-retention basin is suggested.
Waterwatch program should continue with emphasis on tests in tributary creeks and stormwater drains to more closely identify causes and sources of pollutants, particularly suspended solids.
A program should be implemented to reduce pollutants entering throughout the river system, in order to bring turbidity measurements and oxygen levels in particular within DES guidelines.
A survey of biological testing should be implemented to determine the value of such tests. In particular this should examine possible causes of Hincksia outbreaks in order to predict potential beach pollution leading to beach closure.
A more reliable measuring instrument should be obtained to replace existing Horiba instruments.
Regular summary reports with recommended actions to be submitted to Noosa Shire Council and to volunteer participants.
A part time suitably qualified person should be employed to manage the program, analysis, and reporting. Approximately five days per month could be appropriate.

PROJECT AIM

Prospective changes to the Waterwatch program resulting from the termination of NDLC's involvement, have necessitated re-evaluation of the value of the program in terms of its potential for management of the water quality of the Noosa River. Data has been derived from records held on the HLW Envirocoms program back to 2005 when Waterwatch commenced. These have been analysed to determine their compliance with proposed Dept. of Environment Water Quality Objectives (draft 2018) (ref 1), and whether there are any long term trends which could indicate steady deterioration and hence an environmental management issue.
Previous reports on Noosa River water quality are by P. Ryan (Ref 2, 3) for NDLC and E. Lockhart (Ref 4) for NICA. P. Ryan has investigated data collected from 2010 to 2017 and their variability in terms of compliance with existing Queensland Dept. of Environment and Science Water Quality Guidelines 2010 (Ref 5). The sites reviewed did not comply with any of the guidelines, although there were some improvements towards the end of the period. Lockhart evaluated data collected at stormwater drain discharges and compared them with ANZECC guidelines. Only one of those sites (Eenie Creek) coincides with those recorded in Envirocoms.

The project's aim is therefore to assess the compliance of the river with DES guidelines in 2018, to identify trends, and to recommend further actions to enhance water quality in the Noosa River. Extensions to the Waterwatch program to achieve these goals are proposed.

DATA INVESTIGATED

The properties measured are Temperature, pH (acidity), Conductivity, Turbidity, Dissolved Oxygen, Salinity, and Total Dissolved Solids as recorded by the Horiba test instruments supplied and maintained by NDLC. These properties are taken as proxies for other elements of stream health such as counts of macroinvertebrates, nutrients, bacteria, etc.

LIMITATIONS ON DATA

This analysis cannot be regarded as very rigorous for a number of reasons:
Older data, especially prior to 2015, is not very complete: some parameters are missing, and records have been intermittent for many months
Dissolved oxygen has previously been recorded as concentration in mgm/l, whereas DES guidelines require temperature and salinity corrected % saturation. However inadequate recording of both these parameters over time means long term comparisons of DO are limited.
The Horiba instruments have poor reproducibility. In series of tests on the same sample rogue measurements are frequently observed. It is unknown whether such rogue results have been recorded, or whether tests have been repeated and more consistent figures retained.
It is unknown whether single observations for older measurements have been retained or whether average results were determined and recorded. The former may include erroneous entries. Since September 2015 all results are averages of those measurements which appear reasonably consistent.
Despite the regular calibration of the Horiba instruments by NDLC we are aware that some tests are just plain wrong, especially for Turbidity when the instrument has consistently measured zero for obviously murky water. These results have been included, even though they have probably contributed some reduced accuracy to the conclusions.
Many monthly measurement have, in the past, been made near high tide to permit access to some sites. In retrospect this was wrong, as the water then is mostly incoming clean sea water, rather than outflowing river water containing any potential pollutants flowing down from upstream.
Due to intermittence of some records, seasonal variations may inadvertently sway some conclusions. Typically, temperatures vary between 16 and over 30° which can affect stream flow and hence turbidity and oxygen demand.

RAIN EVENTS

Significant variations, particularly in conductivity are evident after heavy rain events leading to flooding of the river. From BOM records for Coroibah – Noosaville since 2005 localised rainfall (mm) of such events have been as listed below. No adjustment for these events has been possible.

August 2007	Dec 2012– Jan 2011	Jan – March 2012	Jan – March 2013	March 2017
> 600	> 1200	> 1200	> 1000	> 600

OBSERVATIONS & ANALYSIS

Older data from Envirocoms and post-2015 data held by the author have been transferred to an Excel spreadsheet to facilitate statistical assessment and comparisons. This will be available to NICA as well as other users where it can be updated regularly (Ref 6). Envirocoms does not accommodate any analysis of results.
In accordance with DES WQO guidelines 80th percentiles have been calculated to compare the 2017/18 data with those from the first five years and with the long term medians. The results are in the Appendix and compared with the WQO guidelines. The current (2018 proposed) WQO Guidelines differ in some regards from earlier (2010) ones. Inadequate recording over time means long term comparisons of DO in particular are limited. Both 2010 and 2018 guidelines have been used.

COMPARISON OF MEASUREMENTS

Temperature

Seasonal variation of temperature is 16 to 30°C in the river, slightly cooler in the creeks and warmer in the open lakes, with a long term average of 26.8°C. Temperature trends have varied between sites but overall only a long term 13-year change of 0.09°C has been apparent.

Acidity (pH)

Site variations in pH are from 4.5 to 8.5 with the more acidic readings in the upper creeks, and median pH is a near neutral 7.58, remaining almost constant over the period. Eenie Creek is an exception, its acidity has increased noticeably from pH 8.0 to 6.2 during the measurement period. All sites are WQO compliant except Murdering Creek, where high tannin content has moved pH well below the guidelines.

Conductivity

Conductivity is a measure of the total conductive ions in solution, therefore includes both tidal salt ingress, acidity, and soluble solids entering from upstream by erosion and other sources. It is strongly sensitive to rain events and therefore highly variable. All measurements fall between 1.0 and 55 units corresponding to salinity content between slightly brackish and fully seawater (1 – 35 ppt). There are no WQO guidelines for conductivity per se, but data can be compared after conversion to Total Dissolved Solids which = conductivity x 0.65. Therefore the TDS of seawater is approximately 35 mgm/litre.

Turbidity

Turbidity measures the amount of suspended solids in the water ("murkiness") and like conductivity it is highly sensitive to rain events. At most sites rain appears to have flushed the system, resulting in higher turbidity and simultaneously lower conductivity. Regrettably, turbidity measurements often appear erroneous and inconsistent on the Horiba instrument, so may not be highly reliable. The only site falling within WQO guidelines is at Murdering Creek (Clarendon Rd) where still water allows solids entering from upstream to settle and clarify. All other sites are non-compliant having turbidity greatly above guidelines. The trend however is to lower figures although this must be qualified by recent lower rainfall.

Dissolved oxygen

DO has only been recorded since 2011. It is a measure of the health of the water for survival of all living organisms. Data throughout the river have remained fairly steady, between 4 and 9 mgm/l, average 5.68 mgm/l, with very occasional variations down to 1 mgm/l.(possible instrument error). All the river and lake sites are now close to compliance while creeks have DO concentration consistently below guidelines. Eenie Creek and Murdering Creek stand out having low DO less than 40% of the guidelines.

Total Dissolved Solids

TDS as a salt equivalent is calculated by multiplying conductivity measurements by 0.65. At some of the estuarine sites the TDS guidelines appear too low to allow for partly or mostly saline conditions.

Salinity

Salinity as NaCl equivalent is calculated internally in the Horiba from conductivity measurements, therefore it should follow them exactly. Obviously this does not occur. Salinity is not a WQO guideline.

Biological tests

Trial biological sampling has been commenced to evaluate the relevance or necessity for such data. Bacteria levels tested using dipslides varied from 10 – 100 CFU/ml (slight growth) in the river to 100,000 CFU/ml (moderate growth) in creeks. Further testing in the future is warranted.

COMPARISON OF SITES

(i) Kinaba : complies well with guidelines for pH TDS and DO. While turbidity is high it is decreasing, indicating silt still entering from Kin Kin creek, though improved.

(ii) Boreen Point : pH TDS and DO comply well with guidelines. Its high turbidity reflects the natural disturbance of the relatively shallow lake, and recently has dropped to within compliance.

(iii) Cooloothin Creek : pH and TDS comply with guidelines and DO is only marginally low. Turbidity has been high but has now trended almost to compliance.

(iv) Tronsons Canal : connects Ringtail Creek to the river: pH 7.8 is normal. Conductivity is of brackish water, Salinity about 16 ppt. Conductivity and turbidity both respond strongly to rain events, normal levels are restored for both parameters after 2 – 3 months. Turbidity remains higher than guidelines and is increasing, suggesting further remediation is required. DO is lower than guidelines.

(v) Lake Coroibah : pH TDS and DO are all satisfactory. High turbidity together with high oxygen concentration reflects shallow lake wind disturbance. The water is fully saline. Turbidity is trending lower.

(vi) Coroibah Creek : pH TDS and DO are all satisfactory. Turbidity is high but only improving slightly.

(vii) Wooroi Creek : is at the junction of the creek and the river: pH is slightly acidic and has varied very little. Following rain events conductivity drops and turbidity rises with increased creek discharge, both return to normal levels after 2 – 3 months. DO is slightly below guidelines. TDS and turbidity are both consistently high.

(viii) Lake Doonella : pH is compliant. DO has been low in the past but is now verging on compliance. TDS and turbidity are both consistently high.

(ix) Cranks Creek : pH is fully compliant. DO complies with old guidelines (mgm/l) but is lower than newer proposed ones (DO %) and is reducing. Turbidity is high, greater than at its outlet at Lake Doonella, but has reduced most recently. TDS is the same as in Lake Doonella, indicative of their estuarine nature.

(x) Noosa Canal entrance: pH and DO are both compliant. Turbidity data are remaining high, but are closer to guideline figures than sites further upstream, reflecting greater influx of cleaner tidal water.

(xi) Weyba Creek : has the highest conductivity, TDS and salinity, and lowest turbidity, showing its greater tidal effects. This is possibly due to readings being made on incoming near high tides, necessary for access to this shallow water site. pH is compliant and DO, originally low, has now reached compliance. Turbidity is a little high but trending downwards.

(xii) Eenie Creek : is the coldest and most acidic site, with pH reducing and now below the guidelines. Turbidity is high and increasing considerably over time. DO is drastically low. There has been a marked change in conductivity readings in mid-2010 which might reflect a change in the site location, but the reason for this is unrecorded. Since this the conductivity has been highly variable, ranging from near fresh water to nearly tidal salt water. Such saltiness is unexpected at this distance from the main estuary. Turbidity is strongly affected by rain events, and it takes up to 6 months for it to return to more normal conditions. Its extremely low DO is cause for concern, indicating the potential for eutrophication of the stream, and this suggests remedial action should be undertaken to remove pollutants from this source.

(xiii) Murdering Creek (Woodland Rd) : this is a near pristine site of creek drainage from unperturbed Wallum plain and woodland, continuing to flow after prolonged dry weather. Its pH is quite low and stable, its DO is also low but variable. Turbidity has been surprisingly high, but is now within guidelines.

(xiv) Murdering Creek (Clarendon Rd) : this is semi-estuarine where the freshwater creek discharges into the tidal lake. pH is fully compliant. DO is low and reducing over time. This is the only site where turbidity remains low and within guidelines, presumably the very still water here allows settlement of particles entering from upstream, and this may also cause the low oxygen readings. The water is quite saline so TDS is higher than guidelines

CONDITION OF THE RIVER

It may be concluded that the Noosa River is a robust system though only in fair condition, which currently has the ability to absorb the levels of pollutants now entering the estuary below Lake Cootharabah such as suspended solids and breakdown products emanating from native forests as well as from human activities. With the exception of turbidity it is almost within the lowest level of compliance (80^{th} percentile) of the DES water quality guidelines, therefore further improvements should be sought. There are warning signs from the data obtained from the upper reaches of feeder creeks that indicate that ongoing monitoring of those sites and greater control of those streams would be prudent.

The quantity of assumed contaminants entering and progressing down those streams becomes diluted by the large volume of water flowing down the river, which thereby reduces it to a level more difficult to differentiate from general river data. This implies that measurements of river water alone would be of little practical use as a tool for river quality management other than as a response to major deterioration. Monitoring closer to likely sources of pollution in smaller flowing streams would therefore be a more practical management tool. This is clearly evident in the readings from Eenie, Cranks and Wooroi creeks.

The two most critical parameters for river health are turbidity and dissolved oxygen. Throughout the system turbidity has been outside the assumed guidelines, though some improvements are evident. Of most concern for oxygen level are the tributary creeks leading from habitation, Wooroi, Cranks, and Eenie creeks. These require measures to either reduce pollutants at their sources or to reduce their effects before reaching the river.

The poor water quality at Eenie Creek indicates that urgent remedial measures are required there to remove pollutants and to re-oxygenate the water. It also indicates that a testing schedule of stormwater drain outlets should be revived. This work has not been undertaken since 2014, so a program of quarterly testing for 1 – 2 years could be appropriate to determine whether stormwater is a significant source of pollution and what remedial work should be undertaken.

FUTURE WATERWATCH

The conclusion to be drawn from this analysis is that a continued but modified Waterwatch program is necessary to maintain and improve the water quality of the Noosa River. Suggested changes are:

(i) The frequency of testing might be reduced from monthly to bi-monthly for marginal economy, although this would be at the expense of reduced statistical validity of the results
(ii) Do additional measurements in response to major rain events to check the response of the river system over the ensuing two to three months
(iii) Discontinue some of the existing river sites
(iv) Concentrate more data collection on feeder creeks to identify potential polluting sources, and to give greater sensitivity to changes in water quality
(v) Utilise the resulting data to implement more extensive contaminant reduction measures such as retention basins.
(vi) Maintain ongoing data records and provide regular summaries to relevant authorities such as Noosa Shire Council, and Healthy Land & Water as well as volunteer participants in the

program. A paid part time position should be created to manage the program and for this important communication role, possibly requiring up to 5 days per month.

(vii) For an ongoing program it is recommended that instruments should be re-evaluated to obtain a more reliable instrument than the Horiba.

(viii) Biological tests should be included more routinely in future work. A particular feature would be to investigate the sources of Hincksia algae, with the hope of predicting possible outbreaks which can lead to beach pollution and closure.

(ix) This analysis should be extended to all other sites in the Noosa River catchment to define other pollution sources feeding into the upper part of the catchment and also into Lake Weyba.

(x) Quarterly testing of stormwater outlets should be revived to assess whether further treatment could be required prior to discharge into the river.

(xi) New guideline ranges should be agreed for the measurement sites, particularly for those in feeder creeks which may vary from brackish to fully saline. Some comparisons in previous sections entirely depend on attempted identification of a site with those classifications listed in the DES Water Quality Objectives (ref 1).

REFERENCES

1. Queensland Dept. of Environment and Science, Queensland Water Quality Guidelines Consultation Draft, July 2018.
2. P. Ryan, Water Quality Report: Noosa River Catchment, NDLC November 2016.
3. P. Ryan, Water Quality Report: Noosa River Catchment, NDLC June 2018
4. E. Lockhart, Noosa Stormwater Monitoring and Education Program, NICA 2014.
5. Queensland Water Quality Guidelines 2009, see: http://www.ehp.qld.gov.au/water/pdf/wq-guidelines2010.pdf
6. Contact NICA at admin@noosariver.com.au to be provided with copy of data.

APPENDIX : STATISTICAL SUMMARIES AND WQO GUIDELINES

SITE	TIME PERIOD	TEMP	pH	CONDY	TURBIDITY	DO mgm/l	DO %	SALINITY	TDS	Δ T
MUR 050	Guidelines		6.5 - 8.0		< 5	6 - 9	85 - 110		1 - 5	
Murdering Creek	13 year	24.68	5.73	0.28	15	4.38	40.7	0.1	0.182	
Woodland Rd	2005/2010	24.58	5.8	0.26	18.6	2.18			0.169	
	2017/2018	24.75	5.7	0.233	1.37	3.63	28.18	0.1	0.15145	0.17
MUR 060	Guidelines		6.5 - 8		< 10	6 - 9	85 - 110		< 8	
Murdering Creek	7 year	27.03	7.25	42.4	8.88	4.8	39.72	19.22	27.56	
Clarendon Rd	2011/2016	27.36	7.13	42.94	6.56	5.36			27.911	
	2017/2018	26.17	7.29	40.5	7.32	3.2	35.2	19.22	26.325	-0.81
EEN 010	Guidelines		6.5 - 8.0		< 10	6 - 9	85 - 110		3 - 11	
Eenie Creek /Rene St	13 year	25.06	7.02	35.42	27.52	3.84	38.88	24.8	23.023	
	2005/2010	27.64	8	44.26	19.6	3.32			28.769	
	2017/2018	23.81	6.13	9.49	32.86	4	38.88	5.08	6.1685	-3.83
WEY 900	Guidelines		8.0 - 8.3		< 4	7 - 9	85 - 105		5 - 14	
Weyba Creek /	13 year	27.14	8.17	51.34	10	7.11	99.08	30.5	33.371	
Keyser Island	2005/2010	27.6	8.16	49.8	10	4.84			32.37	
	2017/2018	27.4	8.16	51.6	8.02	6.96	99.08	32.96	33.54	-0.2
NOO 780	Guidelines		8.0 - 8.4		< 4	7 - 9	85 - 105		3 - 11	
Canal entrance	13 year	27.3	8.14	47.3	12.2	7.48	86.72	30.82	30.745	
	2005/2010	26.36	8.1	44.62	11.2				29.003	
	2017/2018	27.96	8.26	47.06	12.68	7.04	86.72	30.34	30.589	1.6

NOO 650	Guidelines		8.0 - 8.4		< 4	7 - 9	90 - 105		3 - 11	
Lake Doonella	13 year	27	8.15	47.36	20	7.9	83	32.6	30.784	
	2005/2010	27.2	8.2	46.24	21.8	4.9			30.056	
	2017/2018	27.9	8.19	46.58	21.42	7.35	89.24	30.2	30.277	0.7
CRA 900	Guidelines		6.5 - 8.0		< 5	6 - 9	85 - 110		< 8	
Cranks Creek	8 year	28.14	7.63	46.92	29.12	6.4	77.6	27.66	30.498	
	2010/2015	26.2	7.51	48.9	38.8	6.06			31.785	
	2017/2018	27.69	7.92	47.7	23.3	6.09	69	30.1	31.005	1.49
WOO 980	Guidelines		8.0 - 8.3		< 7	7 - 9	85 - 105		5 - 14	
Wooroi Creek mouth	13 year	26.66	8	41.4	24	7.38	82.26	20.1	26.91	
	2005/2010	26.04	8	42.64	20	6.1			27.716	
	2017/2018	28.42	7.74	40.8	25.88	6.63	82.26	25.64	26.52	2.38
CBH 050	Guidelines		8.0 - 8.3		< 17	6 - 9	85 - 105		10 - 31	
Lake Coroibah	13 year	28.6	8.09	43.04	52.7	7.76	113.8	29.18	27.976	
	2005/2010	29.5	8	38	52.8	6.28			24.7	
	2017/2018	27.23	8.4	46.6	39.3	8.58	114	29.18	30.29	-2.27
CBH 020	Guidelines		6.5 - 8.0		< 5	6 - 9	85 - 110		10 - 31	
Coroibah Creek	8 year	28	7.67	42.08	25.3	5.9	114	29.42	27.352	
	2010/2014	27.96	7.6	33.88	29.4	4.7			22.022	
	2017/2018	28.43	8.11	43.8	25	5.76	115	29.42	28.47	0.47
NOO 400	Guidelines		7.5 - 8.2		< 19	7 - 9	85 - 105		8 - 24	
Tronsons Canal	13 year	25.74	7.8	24.84	25	6.43	78.24	16.38	16.146	
	2005/2010	25.44	7.8	21.12	25	2.8			13.728	
	2017/2018	26.56	7.78	29.14	29.54	6.28	78.24	16.9	18.941	1.12

COT 200	Guidelines		7.5 - 8.2		< 30	7 - 9	85 - 105		8 - 24	
Boreen Point	13 year	26.91	7.87	19.2	58.5	8.92	104.16	8.72	12.48	
	2005/2010	26.88	7.7	16.04	60	7.7			10.426	
	2017/2018	28.04	8.1	24.9	20.6	9.11	105.6	8.72	16.185	1.16
COO 050	Guidelines		6.5 - 8.0		< 5	4 - 9	85 - 110		3 - 24	
Cooloothin Creek	13 year	26.59	7.18	26	16.38	6.7	82.7	13.02	16.9	
	2005/2010	26.86	7	26	20				16.9	
	2017/2018	26.07	7.44	31.34	6.66	7.25	83.76	13.02	20.371	-0.79
KIN 997	Guidelines		6.5 - 8.0		< 5	7 - 9	85 - 110		3 - 24	
Kinaba jetty	6 year	25.93	7.06	13.5	9.88	7.14	90	4.22	8.775	
	2012/2014	25	6.98	13.2	18.88	7.37			8.58	
	2017/2018	25.12	7.38	15.42	9.64	8.11	93.08	4.22	10.023	0.12