Hornsby Shire Council's creek and estuary water quality

Hornsby Shire Council monitors consistently in a monthly basis 36 sites across freshwater and estuarine sites in addition to 5 real-time water quality monitoring stations. This program has been running for 20 years. Annual reports have been produced since 2001. In 2012 Council developed a waterway health grading system reporting using three categories of indicators:

- physical-chemical stressors
- microbial indicators
- aquatic biota indicators:
  - freshwater sites: macroinvertebrate community structure
  - estuarine sites: chlorophyll *a*

Council is currently reviewing the location of the sampling sites and frequency of monitoring as some of them are no longer relevant to baseline monitoring or this type of reporting. In addition we would like to include geomorphology, especially of the freshwater creeks, and riparian vegetation of the sites we will be selecting for future monitoring and reporting.

The water quality report health card involved determining an Indicator Health Grade, Site Health Grade and subsequent overall Waterway Health Grade for each monitoring site. Measurements of physical, chemical and biological indicators at suitable reference sites provided benchmarks for assessing water quality of waterways in local regions. Regional Environmental Health Values (REHVs) for freshwater sites were derived from water quality data collected between 2002 and 2010 at two local reference creeks. Due to the nature of development in Hornsby Shire the water quality monitoring program does not include estuarine reference sites. In the absence of reference estuarine data for determining REHVs, ANZECC (2000) and NHMRC (2008) trigger values were used instead (see Table1).

Table 1. *Trigger values for physical-chemical, microbial and biotic parameters for freshwater and estuarine waterways. Concentrations of parameters detected in breach of trigger values indicate the degradation of water quality.*

Parameter	Units	Freshwater Trigger Values (REHVs)	Estuarine Trigger Values (REHVs)
Turbidity	NTU	8	10
Suspended Solids	mg/L	7	6
Total Phosphorus	mg/L	0.01	0.03
Total Nitrogen	mg/L	0.32	0.3
Oxidised Nitrogen	mg/L	0.05	0.015
Ammonia Nitrogen	mg/L	0.02	0.015
pH (Lower)	unit	4.8	7
pH (Upper)	unit	7	8.5
Electrical Conductivity	mS/cm	0.32	
Dissolved Oxygen (Lower)	% sat	75	80
Dissolved Oxygen (Upper)	% sat	118	110
Chlorophyll *a*	µg/L		4
Faecal Coliforms (Median)	CFU/100 mL	150	150
Faecal Coliforms (80th Percentile)	CFU/100 mL	600	600

Physical and chemical parameter grades were calculated by combining indicator grades for turbidity, dissolved oxygen, pH, suspended solids, ammonia, oxidised nitrogen, total nitrogen and total phosphorus for each site.

Microbial Site Grades were determined using box and whisker plots based on the median and 80th percentile except for estuarine sites in we only have one reference indicator so the grade is calculated as per the physical-chemical indicator health grade.

Indicator Health Grades for physical-chemical parameters were determined by using box and whisker plots [median, 80th and 20th percentile, maximum and minimum] as a tool to compare observed values of each parameter at different sites against values at reference sites in the form of REHVs (Figure 1). Poor grades result from consistent REHV exceedance, and are indicative of an unhealthy and stressed system.

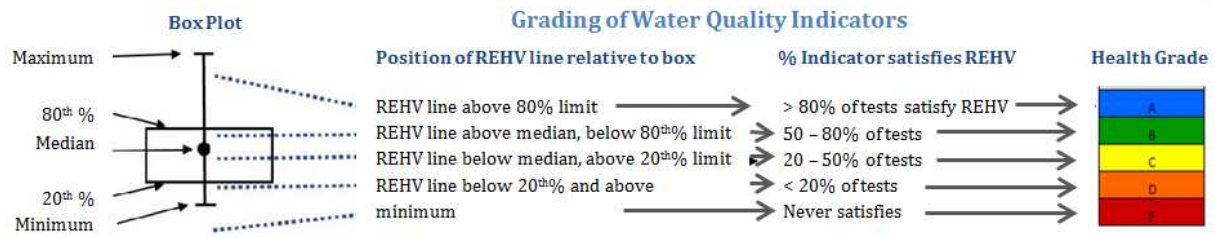

Figure 1: *Method for indicator health grading using boxplots. The REHV is plotted with the boxplot, allowing the assessment of each site against the trigger values*

Site Health Grades are calculated by combining indicator grades as follows (Figure 2):

1. Each individual indicator grade is given an indicator score
2. Scores for all physical-chemical parameters are then averaged
3. The average score is compared to average score categories
4. Assign corresponding site health grades

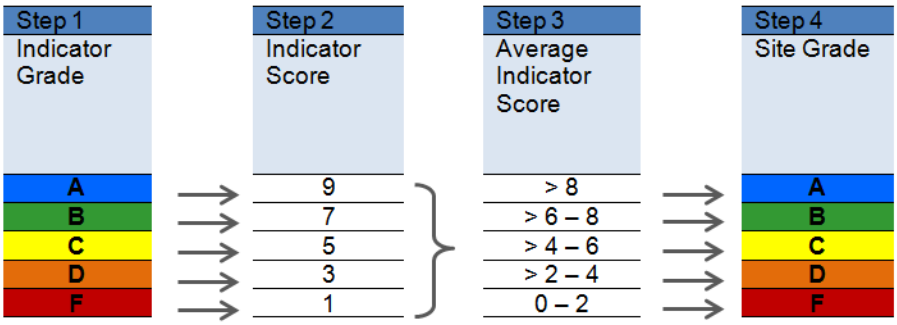

Table 1*: Indicator Grades for each site are scored and averaged to determine the overall physical-chemical Site Grade*

Overall Waterway Health Grade interpretation:

Health Grade	Percentage of occurrences whereby phys-chem indicators satisfy REHVs	Health Description	Cleanliness Description	Probable impact on native aquatic biota
A	Over 80%	Excellent	Clean	Healthy
B	50 – 80%	Good	Slightly degraded	Mild impairment
C	20 – 50%	Poor	Moderately degraded	Moderate impairment
D	Less than 20%	Very poor	Seriously degraded	Serious impairment
F	Never satisfies REHVs	Fail	Severely degraded	Severe impairment

Table 2: *Grading system and interpretation used to categorise water quality physical-chemical stressors*

References:

http://www.hornsby.nsw.gov.au/environment/water-catchments/water-quality