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Fitzroy Partnership for River Health

Technical Review for the Development of an Ecosystem Health Index and Report Card for the Fitzroy Partnership for River Health

PART B: METHODOLOGY AND DATA ANALYSIS TO SUPPORT AN ECOSYSTEM HEALTH INDEX AND REPORT CARD FOR THE FITZROY BASIN

FRESHWATER (CATCHMENT)

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Centre for Environmental MANAGEMENT

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CQU acknowledges that the Science Panel assisted in the formulation of the report but did not undertake a final review and therefore is not in a position to endorse the final versions.

An additional peer review from an expert independent of both the research team and the Science Panel is pending.

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EXECUTIVE SUMMARY

CQUniversity was contracted to provide a technical review that would assist the Fitzroy Partnership for River Health to define an appropriate set of ecosystem health indicators and to develop a process to evaluate the condition of the Fitzroy system against the indicators in a simplified index system, which would then be conveyed in an ecosystem health report card for the 2010-11 water year.

This report forms part of the second volume (Part B) of the Technical Review, focusing on the freshwater component of the river system. Research undertaken in Part A of the review identified four categories of ecosystem health that can be used to summarise the health of the Fitzroy system. These categories are physical- chemical, nutrients, toxicants and ecology.

A list of ecosystem health indicators was also generated in Part A. These indicators are recognised as State and Impact indicators as per the Driving- Force-Pressure-State-Impact-Response framework that was recommended in Part A, as a framework suitable for defining indicators that could evaluate the condition of the Fitzroy System.

The list of potential indicators from Part A was then reduced to those indicators of greatest priority to the Fitzroy System. Prioritisation was performed by CQUniversity after advice from the FPRH Science Panel and with input from other members of the FPRH Science Team.

To assist in the indicator selection process, a set of indicator selection criteria was derived and used by CQUniversity. The resultant proposed Freshwater (catchment) indicators; the index scoring method, and the overall grading to be communicated to the public were then identified. These are discussed in this report.

So that each indicator could be included in the index, a standardised index scoring system was identified that allowed observations on each indicator to be scored between zero and one. The index scoring method that was chosen required the identification of numerical thresholds to define healthy ecosystem conditions (reference benchmarks) and, at the other end of the spectrum, the likely impaired situations (worst case scenarios). In the absence of other suitable data, reference benchmarks were identified using either the 2011 water quality objectives (WQO) set down for the Fitzroy in Schedule 1 of the EPP (Water) (where they applied), or the limits referenced in regional and national guidelines, i.e. the Queensland Water Quality Guidelines 2009 and the ANZECC Guidelines 2000. Determination of the Worst Case Scenario (WCS) followed the same methodology, except that limits reported in overseas literature and professional best judgement were used when the preceding two options provided no relevant information.

The index scoring method is summarised as follows:

- If an indicator monitoring result is equal to or better than the benchmark it is awarded a 1
- If a result is equal to or worse than the worst case scenario, then it is awarded a 0

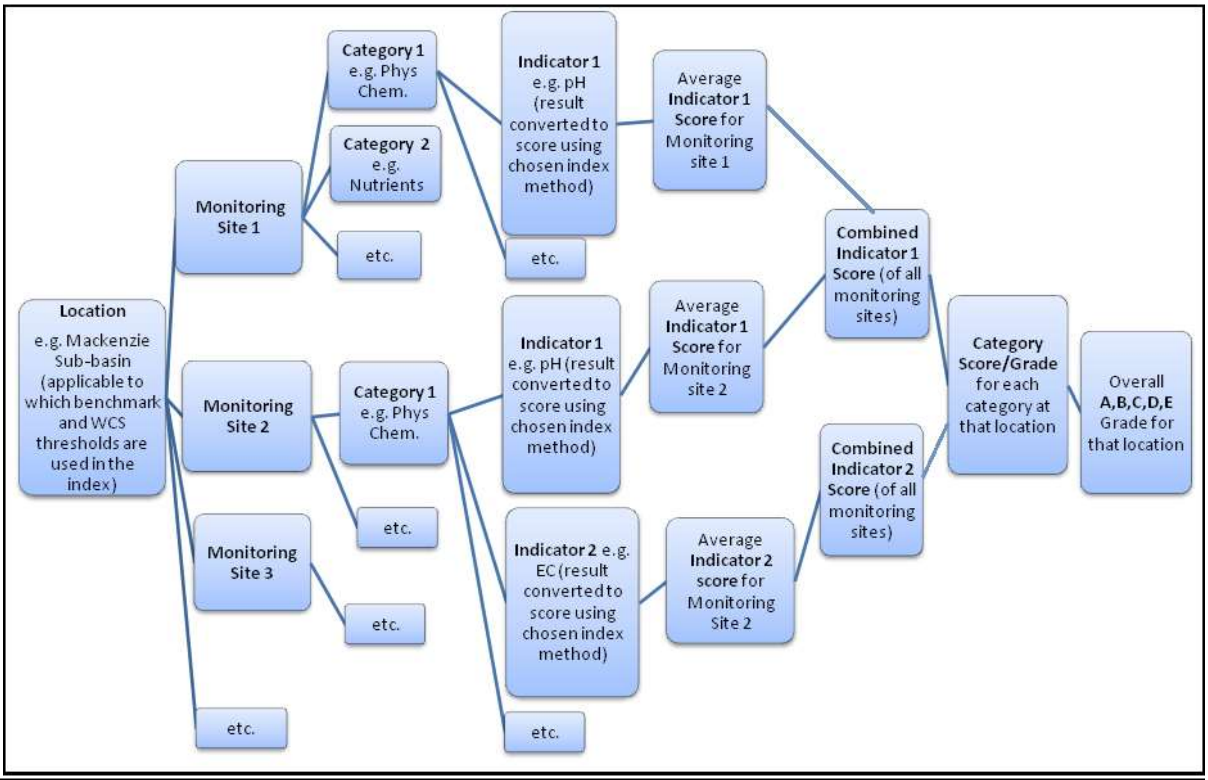
- For other results:

$$Score_i = 1.0 - \left| \frac{(x_i - Benchmark_i)}{(WCS_I - Benchmark_i)} \right|$$

Where, x_i = value of the indicator *i*, $Benchmark_i$ = ecosystem health guideline, objective, trigger value or expert opinion of healthy indicator *i* concentration *and* WCS_I = value of x_i at which ecosystem health would be compromised.

The indicator scores are summarised into communicable grades as follows:

Flow diagram of data combining and scoring process



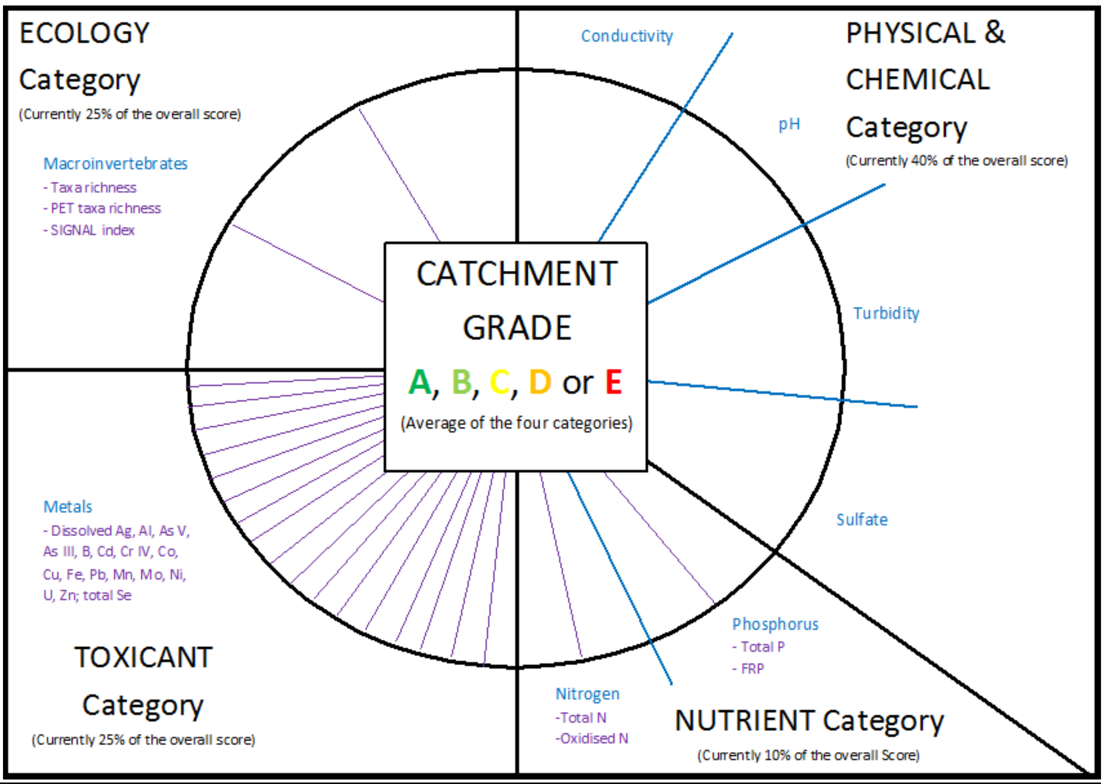
Whereby:

- Within one of the 11 freshwater reporting zones (e.g. the Mackenzie Sub-basin), multiple monitoring sites exist;
- The mean result of indicator observations at an individual monitoring site is scored.
- These site scores are then averaged to provide indicator scores at each site.
- Multiple indicator scores make up an ecosystem health category score;

- There are four categories and these are combined to give the overall location (catchment) score.
- The catchment score is then multiplied by 100 and displayed to the public as a percent
- Scores of 100 are given the grade 'A'; '99.9...>'B' > 66.6...; 66.6...> 'C' > 33.3...; 33.3...> 'D' > 0; and scores that equal 0 are 'E'
- These grades are colour coded **A B C D E**

The outcome of Part B was a Freshwater (catchment) Ecosystem Health Index (EHI) for the Fitzroy Basin that can be summarised by the following diagram.

Schematic of the Proposed Freshwater (catchment) EHI for the Fitzroy System



As shown in the schematic, the Ecology and Toxicant categories both contribute 25% to the overall grade; the Physical-Chemical category is responsible for 40% and the Nutrient category accounts for 10% of the overall grade. Indicators within the same category have default equal weightings.

The proposed EHI reflects a practical and pragmatic approach to measuring the ecological health of the Fitzroy basin, by using indicators for which FPRH partners monitored in the 2010 -11 water year. Indicators for future consideration have been listed and other aspirational measures of ecosystem health are also discussed. The current EHI is designed to be fluid and is predicted to evolve in future years.

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ABBREVIATIONS

AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
AUSRIVAS	Australian Rivers Assessment System
BAC	Best Attainable Condition
BI	Biological Integrity
BTEX	Benzene Toluene Ethylbenzene Xylenes
CQUniversity	Central Queensland University
DO	Dissolved Oxygen
DPSIR	Driving force-Pressure-State-Impact-Response
EC	Electrical Conductivity
EHI	Ecological Health Index
EHMP	Ecosystem Health Monitoring Program
ENSO	El Nino-Southern Oscillation
EPP (Water)	Environmental Protection (Water) Policy
FPRH	Fitzroy Partnership for River Health
HC	Historic condition
LDC	Least disturbed condition
MDC	Minimally disturbed condition
MEMC	Methoxyethyl mercury chloride
PDO	Pacific Decadal Oscillation
PET	Plecoptera Ephemeroptera Trichoptera
pH	a measure of acidity
QWQG	Queensland Water Quality Guidelines
RC	Reference Condition
SAR	Sodium Absorption Ratio
SEAP	Stream and Estuary Assessment Program
SIGNAL	Stream Invertebrate Grade Number Average Level
SoE	State of the Environment
SRA	State of the Rivers Audit
TN	Total Nitrogen
WCS	Worst Case Scenario
WQO	Water Quality Objective

1.0 INTRODUCTION

This report forms part of the second volume (Part B) of the Technical Review for the Development of an Ecosystem Health Index and Report Card for the Fitzroy Partnership for River Health (FPRH). This report outlines a freshwater (catchment) Ecosystem Health Index (EHI) for the Fitzroy Basin, and reviews the methodology and data analysis used to do so.

This report follows on from "*Part A: Review of Ecosystem Health Indicators for the Fitzroy System*". Part A included an overview of ecosystem health issues as well as a review of the relevant literature, guidelines, legislation and other ecosystem health monitoring programs and indices.

Part A also summarised the historical and current land uses and water quality of the Fitzroy Basin. That information was then used to develop a framework for identifying indicators of ecosystem health that could be included in an EHI and Report Card for the Fitzroy Basin.

As mentioned in Part A, the freshwater section of the Fitzroy is divided into 11 sub-basins or catchments. These are the FPRH reporting zones for the freshwater (catchment) EHI.

Parts A and B of the Technical Review for the Development of an Ecosystem Health Index and Report Card for the Fitzroy Partnership for River Health are summarised in a process diagram on the next page.

The research carried out in Part A identified a number of potential indicators, guidelines and objectives that could be suitable to incorporate into an EHI. This report will further review these indicators, benchmarks and the relevant FPRH monitoring data, in order to recommend an EHI for the 2010-11 water year.

The proposed EHI indicators are identified in this report (Section 3.3), and recommendations for other indicators that should be included or reviewed in future years are also made (Section 3.4).

This report proposes a method to score and index the FPRH monitoring data (Sections 4.2, 4.3 and 4.6).

This report provides some data analysis (Section 4.7 and Appendices), and where appropriate, data gap analysis that may guide future refinement of the index are also addressed (Section 5.0).

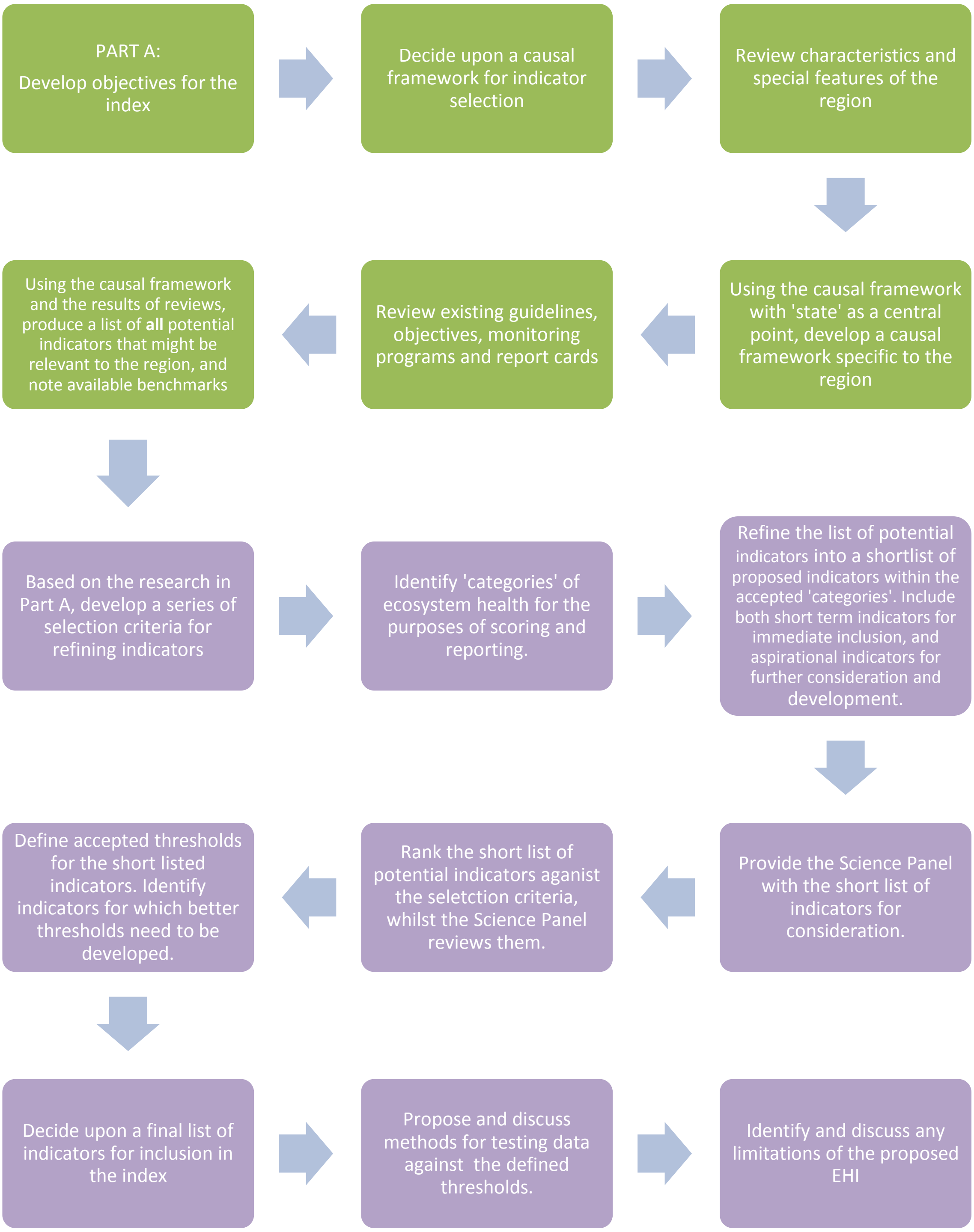


Figure 1 Process diagram for the development of an EHI for the Fitzroy System

2.0 ECOSYSTEM HEALTH CATEGORIES AND INDICATOR SELECTION CRITERIA FOR THE FITZROY

As discussed in Part A, an ecosystem health index (EHI) is a measure against which the condition of an ecosystem can be scored, and is formed by combining information from a variety of individual indicators. An EHI can be used to assess and communicate the effects of natural and anthropogenic activities on the environment and provides a summary mechanism to describe the health of ecosystems.

The causal framework approach 'Driving force-Pressure-State-Impact-Response' (DPSIR) was selected in Part A, as a means of conceptualising and designing an EHI for the Fitzroy Basin.

Using this DPSIR framework approach, with 'State' as a central point, a list of potential indicators of ecosystem health were generated (see Appendix IV of Part A).

For this list to be further refined it is important to define broader categories of ecosystem health and to describe selection criteria that allow the suitability of potential indicators to be ranked.

The following sub-sections detail the proposed ecosystem health categories and criteria for selecting ecosystem health indicators for the Fitzroy freshwater catchment.

2.1 Proposed ecosystem health categories

The DPSIR framework and the research carried out in Part A were utilised to propose ecosystem health categories suitable for the Fitzroy System. The categories are primarily for communication purposes and for structuring the "scoring" of indicators. Following meetings and discussions with the Science Team and Science Panel, the following four categories were finalised:

1. Physical and Chemical

   This covers the traditional water quality monitoring parameters, such as pH, conductivity and turbidity. Most long term monitoring data that exists can be classified in this group. Conductivity is of particular concern to some Fitzroy catchments due to industry discharges.

2. Nutrients

   Nutrient runoff is a significant consequence of Fitzroy Basin land use. Nutrients are important to assess because excess nutrients lead to increased weed and algal growth which can have negative impacts on ecosystems, and because of potential discharges to the Great Barrier Reef.

3. Toxicants

This covers chemicals such as herbicides, pesticides and metals in both water and sediments; Toxicants are highlighted as important to the Fitzroy due to land uses including mining and agriculture.

4. Ecology

This refers parameters such as water quantity, flow, algae, habitat, indicator species, fish and invertebrate assemblages. These indicators allow a more systems approach to understanding the health of the environment.

Two other categories were highlighted by the Science Panel, and could be addressed in the future through separate projects.

a.) Driving forces and pressures: Suggestions for potential indicators in this category include such issues as climate and episodic events. One of the major criticisms of the Ecosystme Health Monitoring Program (EHMP) program in south-east Queensland during the 2010 review was the lack of indicators to identify driving forces and pressures. This issue should also be addressed for the Fitzroy Basin but requires development beyond the scope of this report.

b.) Response indicators: By employing the framework to identify indicators, the *effects* of driving forces, pressures, state, impacts and responses are implicitly covered by the potential indicators suggested. However, due to known data limitations the indicators identified through this review mostly fall within state and impact classifications. Many potential response indicators will be covered by a separate process being run concurrently by FPRH (FPRH Review of Stewardship Measures) and may be added to future versions of the EHI.

2.2 Proposed indicator selection criteria

The combination of indicators chosen to form an Ecosystem Health Index must cover the full complexity of a system, or at least aim to do so as effectively as possible within current constraints whilst providing direction for future improvements. The balance of indicators selected also needs to be considered in terms of the total number of indicators – too many indicators would be costly to monitor and potentially complex to analsise and present, while too few indicators may result in avoidable knowledge gaps (Wicks et al., 2010).

In order to evaluate the suitability of a particular ecosystem health indicator to a specific system; indicators will sometimes need to be assessed against a set of selection criteria.

Criteria to select indicators for an Ecosystem Health Index for the Fitzroy Basin (Table 1) were developed for this purpose and is shown below. The criteria in this table were defined by using a combination of scientific literature, expert knowledge and review of other programs.

Table 1 Indicator selection criteria for an Ecosystem Health Index for the Fitzroy Basin

Category	Selection criteria	Descriptions and (scores)	Weighting of selection criteria within category	Weighting of category
Data	SC1 – Reliable data currently available for the Fitzroy Basin*	Yes (10) Probably (7.5) **Possibly (5)** **Probably not (2.5)** **No (0)**	25%	25%
	SC2 – Suitable interpretative algorithms are available	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	25%	
	SC3 – Errors, reliability and uncertainty in measurement are known and acceptable*	Yes (10) Probably (7.5) **Possibly (5)** **Probably not (2.5)** **No (0)**	25%	
	SC4 – Temporal and spatial variability can be accounted for	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	25%	
Interpretation and communication	SC5 – Guidelines/ objectives are in place and relevant to the region*	Yes (10) Probably (7.5) **Possibly (5)** **Probably not (2.5)** **No (0)**	25%	25%
	SC6 – Used in other monitoring programs (consistent with other regions, states, nations)	Yes, all (10) Most (7.5) Some (5) Few (2.5) No, none (0)	25%	
	SC7 – Scientific interpretation is straightforward and meaningful	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	25%	
	SC8 – Simple to communicate	Yes (10)	25%	

	and good public understanding	Probably (7.5) Possibly (5) Probably not (2.5) No (0)		
Relevance	SC9 – Important to ecosystem function (will exposure cause serious environmental effects?)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No/unknown (0)	25%	25%
	SC10 – Sensitive to changes in ecosystem function	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No/unknown (0)	25%	
	SC11 – Contributes to assessment of ecosystem resilience	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No/unknown (0)	25%	
	SC12 – Related to regional, state, national, international policies and management goals	Yes, all (10) Most (7.5) Some (5) Few (2.5) No, none (0)	25%	
Practicality and timeliness	SC13 – Feasibility and logistics to measure (monitor and analyse) are consistent with outcome benefits	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	25%	25%
	SC14 – Time requirements to measure (monitor and analyse) are consistent with outcome benefits	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	25%	
	SC15 – Costs to measure (monitor and analyse) are consistent with outcome benefits	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	25%	
	SC16 – Provides an early warning of ecosystem health decline	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No/unknown (0)	25%	
* For the three criteria indicated (SC1, SC3 and SC5) consideration should be given to automatically disqualifying a potential indicator which achieves a low score (5 or below – as indicated in bold type).				

3.0 SELECTING INDICATORS FOR INCLUSION IN AN EHI FOR THE FITZROY SYSTEM

Ideally a small number of very relevant indicators should be selected for inclusion in the EHI. By including a small number of indicators the effects of changes in those indicators is more apparent (as weightings within the EHI are higher for each indicator), interpretation of ecosystem health/condition is simplified, and some correlations between closely linked indicators can be avoided. The following sub-sections detail the process involved in prioritising the list of indicators.

3.1 Prioritisation of indicators listed in Part A

The list of ecosystem indicators identified through Part A (Appendix IV) was further evaluated by the Science Project Team (comprising the CQU researchers, the Science Coordintor and FBA staff) to refine the list in to a feasible number of indicators (Table 2) for consideration by the Science Panel (a group of science experts) in November 2012.

Table 2 Short listed Freshwater (catchment) indicators that were proposed to the Science Panel in November 2012 (for adoption in years 1 and 2 of the Report Card)

Physical and chemical	Nutrients	Toxicants	Ecology
pH	Ammonia as N	Tebuthiuron	Water storage capacity
Conductivity base flow	Nitrite as N	Atrazine	Algal composition
Conductivity high flow	Nitrate as N	Diuron	Algal concentration
Total suspended solids	Oxidised N	MEMC	Groundwater Levels
Turbidity	Total Nitrogen as N	Ametryn	Macroinvertebrates Taxa Richness, PET, SIGNAL index, % tolerant Taxa
Ions (Alkalinity, chloride, calcium, magnesium, sodium, potassium, total anions, total cations, ionic balance)	Dissolved Inorganic Nitrogen	Hexazinone	Freshwater Pest Plants (% cover)
SAR *or* Sodium concentration	Total Phosphorus	Dissolved metals/metalloids (Ag, Al, As(V), AS(III), B, Cd, Cr(VI), Co, CU, Fe, Pb, Mn, Hg, Mo, Ni, U, V, Zn)	Freshwater Pest Plants (Native: Exotic)
RA	Filterable Reactive Phosphorus	Total Se	Wetland cover
Sulfate	Chlorophyll- a concentration	Total coliform concentration	Riparian Vegetation Condition
Fluoride		*E. coli* concentrations Enterococci Hydrogen sulfide Sediment metals/metalloids	Riparian Vegetation Extent Riparian Vegetation Composition Riparian Vegetation Connectivity In stream connectivity Presence of Instream barriers Bank condition Category Bank condition value Native Fish Species (observed: expected ratio ≥1) Exotic Fish Species (present/absent)

Each Science Panel member was asked to label the indicators as: "do not include", "undecided", or "include". For those which were assigned to "include", members were asked to rank the indicators according to their significance as contributors to the overall quality of the index. The Science Panel members were also asked to identify any additional parameters that should be included.

3.2 Evaluating the suitability of potential catchment indicators

All the potential indicators that were presented to the Science Panel were also ranked by the CQUniversity researchers using the predetermined selection criteria outlined in Section 2.2. The overall indicator score obtained through this process can be considered an indicator suitability score (given as a percent). The results of the selection criteria rankings are shown in Appendix I.

The final list of proposed indicators (
Table 3) takes into consideration both the CQUniversity and Science Panel findings.

Those indicators from Table 2 that were given high priority by the Science Panel were:

- pH, turbidity, sulfate, conductivity base flow
- nitrate as N, total nitrogen as N, total phosphorus, filterable reactive phosphorus,
- chlorophyll-a, macroinvertebrates (PET, taxa richness, SIGNAL index and % tolerant taxa), riparian vegetation (condition, extent, composition and connectivity), instream connectivity, native fish species (observed:expected), exotic fish species (presence, size, distribution), bank condition, freshwater pest plant % cover and flow
- dissolved metals/metalloids, total Se

In addition to these indicators, the pesticides: MEMC and Ametryn, the herbicides: hexazinone, tebuthiuron, atrazine and diuron; sediment metals, and wetland cover were flagged by the Science Panel for future inclusion and potentially special reporting in years 1-2 of the report card. As identified below, data gaps preclude inclusion in the initial index.

Of the indicators given high priority by the Science Panel, CQUniversity researchers found that fish, macrophyte, instream connectivity, riparian vegetation, bank condition, chlorophyll-a and dissolved vanadium did not meet the selection criteria.

The Science Panel gave nitrate as N high priority highly, however, as there is a Fitzroy WQO for total oxidised nitrogen (nitrate + nitrate as N), it scored better than nitrate in the selection criteria and as such CQUniversity propose it as a substitute indicator for nitrate.

Conductivity high flow scored well in the selection criteria, and since data and WQOs exist, CQUniversity proposed its inclusion as well as a Conductivity low flow indicator. However, following on from decisions made at the February 2013 Science Panel meeting, all conductivity data is to be included within a single indicator score and a flow correction will be applied to distinguish between low flow and high flow observations. The Science Panel also decided in February that flow should not be included in the actual index, but rather reported as additional information.

It has been highlighted by the Science Project Team that the number of dissolved metals (which currently stands at 17) may need to be reviewed annually and reduced if possible.[1]

3.3 Proposed freshwater (catchment) indicators for years 1 and 2 of the Fitzroy EHI

The final list of indicators proposed for years 1 and 2 of the Fitzroy Basin EHI are shown in Table 3. These indicators were given high priority for inclusion by the Science Panel and also scored at least 70 % in the indicator selection criteria (Appendix I).

Table 3 Final list of proposed catchment indicators for years 1 and 2 of the Fitzroy Basin EHI

Physical - Chemical Category	**Conductivity**	**pH**	**Turbidity**	**Sulfate**
Indicator descriptions from QWQG (2009), except sulfate which is from the British Columbia Water Quality Guidelines:	A measure of the amount of dissolved salts in the water, and therefore an indicator of salinity. In freshwater, low conductivity indicates suitability for agricultural use. In salt waters low conductivity	A measure of the acidity or alkalinity of the water. Changes to pH can be caused by a range of potential water quality problems (e.g. low values due to acid sulphate runoff).Extremes of pH (less than 5 or greater than 9) can be toxic to aquatic organisms, although some waterways (e.g. wallum streams) have naturally	A measure of light scattering by suspended particles in the water column. It can provide an indirect indication of both light penetration and suspended solids but the	Sulphates are discharged into the aquatic environment in wastes from industries that use sulphates and sulphuric acid, such as mining and smelting operations, kraft pulp and paper mills, textile mills and tanneries. Iron sulphides (e.g., FeS) may be exposed to water and atmospheric oxygen by mining or rock excavation, producing sulphuric acid, which contributes sulphate to ground and surface waters. Sulphates

[1] CQUniversity performed some very preliminary data analysis (e.g. metals graphs in Appendix IV) and suggest the list of dissolved metals included in the 10-11 reporting year *could* be refined as follows:

Yes – include in 10-11 reporting	**Maybe include- to be confirmed with the Science Panel in April 2013**	**No – do not include in 2010-11 reporting**
As Cd – noting one particularly high result Fe Pb Ni Zn Mo – removing obvious errors (total not dissolved data) Co	Cr- important but some LOR issues Cu – important but some LOR issues Total Se- important but some LOR issues U - important but some LOR issues B- All below guideline so relevance questioned Mn - All below guideline so relevance questioned Al- many/most above guidelines but guideline specifies pH and currently the coding can't link indicators to each other	Ag – too many LOR issues in this data set

LOR= Limit of Reporting

	indicates freshwater inflows such as stormwater runoff. Under natural conditions, conductivity is highly dependent on local geology and soil types.	acid waters (as low as pH 3.6) and ecosystems are adapted to these conditions.	relationships between turbidity and these other indicators vary in different waters.	are also released during blasting and the deposition of waste rock in dumps at metal mines. This is known as acid rock drainage. The burning of fossil fuels is also a major source of sulphur to the atmosphere. Most of man's emissions of sulphur to the atmosphere, about 95%, are in the form of SO2. Sulphate fertilizers are also a major source of sulphate to ambient waters.
Nutrients Category	**Nitrogen**		**Phosphorus**	
	Total nitrogen as N	Oxidised nitrogen (nitrate + nitrate as N)	Total phosphorus	Filterable reactive phosphorus
Indicator description from QWQG (2009):	Includes all forms of nitrogen in a sample	Sum of nitrate nitrogen (NO3) and nitrite nitrogen (NO2)	Includes all forms of phosphorus in a sample	Includes all forms of phosphorus that pass through a 0.45µm filter and react with molybdenum blue reagent – this fraction is usually very largely comprised of orthophosphate (PO4)
	The nutrients nitrogen and phosphorus are essential for plant growth. High concentrations indicate potential for excessive weed and algal growth. Nutrients in the water column are made up of an inorganic component which is in the dissolved form (e.g. nitrate plus nitrite, ammonia and filterable reactive phosphorus) and an organic component, which is bound to carbon (e.g. organic nitrogen). The organic component can be either dissolved or particulate.			
Toxicants	**Metals/metalloids (**dissolved Al (pH >6.5),dissolved As, dissolved Ag, dissolved B, dissolved Cd, dissolved Cr IV, dissolved Co, dissolved Cu, dissolved Fe, dissolved Pb, dissolved Mn, dissolved Hg (inorganic), dissolved Mo, dissolved Ni, dissolved U, dissolved Zn, total Se)			
Indicator description from ANZECC (2000):	Toxicants is a term used for chemical contaminants that have the potential to exert toxic effects at concentrations that might be encountered in the environment. For further detail on each individual metal see 8.3.7 of Vol 2 ANZECC (2000)			
Ecology	**Macroinvertebrates**			
	PET taxa richness	Taxa Richness	SIGNAL index	
Indicator description from QWQG (2009):	It is generally accepted that three orders of aquatic insects, the Plecoptera (stoneflies), Ephemeroptera (mayflies) and Trichoptera (caddis flies) – the PET taxa – are highly sensitive to human disturbance. PET richness is the total number of families in these three orders that are present in a sample.	Family richness is the total number of different aquatic macroinvertebrate families that are present in a sample.	The SIGNAL index (stream invertebrate grade number average level) allocates a sensitivity grade number based to macroinvertebrate families based on their sensitivity to various water quality changes (Chessman, 1995). SIGNAL values range from 1 (most tolerant) to 10 (most sensitive). The SIGNAL index value is calculated by averaging the sensitivity grade numbers of the taxa present in a sample.	

3.4 Aspirational indicators to be considered in years 3-5

In addition to those indicators proposed to the Science Panel for years 1- 2 of the EHI, CQUniversity proposed other aspirational targets for which data and/or reference thresholds (see Section 4.0) may not yet be available (Table 4).

Any additional indicators from Table 2 that were given high priority by the Science Panel but did not meet the indicator selection criteria (often due to limited data availability) were moved to the aspirational indicators list. The Science Panel recommended groundwater levels for future years; hence, this was also appended to table of aspirational indicators.

Table 4 Aspirational indicators for consideration and/or further development in years 3 to 5 of the Fitzroy freshwater (catchment) EHI

Physical and chemical	Toxicants	Ecology
Diel DO range	Hydrocarbons	Seasonal flow volume
DO minimum 24 hour	total BTEX (BTEXN/ BTEXS)	Rainfall Residual Mass
DO depth profiles	Mussel bioaccumulation	*Legionella pneumophila* Sg 1-14
Temperature	2,4-D-sodium (CITRUS)	*Legionella* species (not *pneumophila*)
	Gramoxine (COTTON)	Hyporheic
	Glyphosate (BROAD SPECTRUM)	Stygofauna
	Throttle (BROAD SPECTRUM)	Nekton (fish) diversity and health
	Dissolved vanadium (needs a suitable guideline/WCS)	Fish Tissue Contaminants index
		Fish tissue mercury, pesticides, PCB congeners, PBDE, % moisture and lipid content
		B – Biomass of fish caught in standardised sample;
		B/I - Average biomass per individual fish (I);
		TG1 - Biomass proportion of top predators (trophic group 1);
		TG2 - Biomass proportion of aquatic invertivores (trophic group 2);
		TG3 - Biomass proportion of terrestrial insectivores (trophic group 3);
		TG1/TG4 - Biomass ratio of top predators (TG1): detritivores (TG4)
		Fitzroy River Turtle Presence/Absence
		Fitzroy River Turtle change in abundance
		New macroinvertebrate indices that are more relevant to the Fitzroy Basin
		Groundwater levels (Science Panel recommendation to move to future)
		Native fish species (observed: expected ratio); Exotic fish species (present/absent), size distribution (requires data)
		Macrophyte cover freshwater pest plants (% cover) (requires data)
		Instream connectivity (requires data)

4.0 PROPOSING THE INDEXING METHOD

Once the indicators that make up an ecosystem health index are decided, a number of steps are required to generate an EHI score. First the indicator thresholds or benchmarks must be defined, and then a method to compare and evaluate the observations against the agreed threshold must be determined. Lastly the weighting and amalgamation of sub-indicators, indicators and categories must be decided to allow the generation of an overall score or grade.

4.1 Defining thresholds

Numerical thresholds can be used to define an indicator level that represents a healthy ecosystem (benchmark conditions). Similarly, thresholds exist above which ecosystem health is compromised. This report will refer to the latter option as the 'worst case scenario'.

4.1.1 Reference thresholds or benchmarks

Reference thresholds represent the best possible condition for ecosystem health. There are different options for choosing a reference condition, including (International Water Centre 2010):

- Pristine or natural conditions without human intervention, often termed as reference condition for biological integrity (RC(BI))
- Minimally disturbed condition (MDC)
- Historic condition (HC)
- Least disturbed condition (LDC)
- Best attainable condition (BAC)

The purpose of setting a reference condition is to establish a benchmark for evaluating condition data, where a site that met a reference standard could be classified as 'A' or in 'Excellent' condition. The reference benchmark can be determined in a number of different ways depending on the nature of the ecosystem, and the types of data available:

- Based on the range of conditions at reference sites: (e.g. EHMP, Sustainable Rivers Audit)
- Nationally recognised water quality guidelines (e.g. GUI River health report)
- Modelled values
- Professional best judgement (e.g. EHMP, Brown *et al* 1970)
- Combination of the above (e.g. Chesapeake Bay report card)

4.1.2 Thresholds above which ecosystem health is compromised

Values of ecosystem health indicators, above or below which there could be a negative effect on ecological health could be classified as 'E' or the 'worst case scenario' (WCS) condition.

Programs such as the South East Queensland Ecosystem Health Monitoring Program use the 10th or 90th percentile (depending on the indicator) of reference data as the WCS. However, in the absence of sufficient data, such as the current case for the Fitzroy Partnership for River Health, WCS may be set from literature or expert opinion.

4.1.3 Method for determining thresholds for the Fitzroy freshwater (catchments) EHI

To be consistent with the Queensland Water Quality Guidelines, indicator threshold values would be derived from the range of conditions that occur at the least impacted reference sites representative of the sub-catchment and different stream types within the catchment.

The Fitzroy catchment is significantly modified from natural condition, so it would be difficult to establish reference values based on pristine conditions. It is recommended that reference conditions are set in terms of minimally disturbed condition (MDC), consistent with the approach taken in the Queensland Water Quality Guidelines and the setting of Water Quality Objectives (WQO) for the Fitzroy.

Each sub-catchment already has a number of reference sites identified and the Queensland Government have used data from these sites to derive values for Water Quality Objectives for some indicators at the sub-catchment level. The existing WQOs are the best available, given the data limitations in the Fitzroy Basin. However, it should be noted that they are unlikely to be fully accurate or applicable, for several reasons:

- There are only one or two reference sites established in many sub-catchments, and this may not provide a full representation of the stream types and conditions that naturally occur within those sub-catchments
- WQOs have only been established for low flow (ambient) conditions, except for electrical conductivity (EC) which has been set for both low flow and high flow conditions
- The existing WQOs do not account for the influence of other factors that might influence ambient parameters across seasons and years, such as variations in climatic factors or ground water flows

Where WQOs are not available for specific indicators, the option is to defer to regional guidelines and then onto national guidelines, which is the default process identified in the EPP (Water). As such, the method for establishing benchmarks and WCS in this report will be, in order of preference (and in the absence of the appropriate monitoring data):

1. Existing water quality objectives for the Fitzroy for available indicators
2. Water quality guidelines and triggers based on, or referenced in regional guidelines
3. Water quality guidelines and triggers based on, or references in national guidelines
4. Professional best judgement to set indicator thresholds where guidelines do not exist

4.2 Proposed reference benchmarks and WCS for the freshwater EHI

The proposed EHI benchmarks and WCS identified through the research carried out during this review are listed and referenced in Table 5 below and/or on the graphs in Section 4.7. In brief, the reference benchmarks for indicators within the categories of physical-chemical, nutrient and macroinvertebrate relate to the Fitzroy WQOs, whereas the toxicant indicators refer to benchmarks from the ANZECC guidelines or other suitable reference. The WCS for macroinvertebrates, metals, conductivity, pH and sulfate are all based on published references.

In the absence of definitive basin-wide WCS for turbidity and nutrient indicators, WCS options, namely the 90th percentiles of the WQO data (supplied by Mary-Anne Jones), the WQO x 1.5 and the WQO x 10, will be presented to the Science Panel for these indicators at their next meeting in April 2013. Section 4.7 of this report shows these options plotted against catchment data.

Table 5 Benchmarks and worst case scenarios for the proposed freshwater (catchment) indicators

Physical-Chemical Indicators	**Benchmark**	**Worst Case Scenario (WCS)**	**Notes**
Conductivity	WQO Sub-basin and high/low flow specific e.g. Mackenzie base flow <310 µS/cm	>1500 µS/cm	>1500 µS/cm impact on fish reproduction as per: Fitzroy water quality site. >1500 µS/cm aquatic biota adversely affected as per Hart et al. (1991)
Turbidity	WQO All catchments <50 NTU	Option 1: 75 NTU (25 NTU above Objective). 'An increase of 25 NTUs may decrease primary production by 13-50% in shallow streams. Primary production in clear streams of depths greater than 0.5 m would be reduced even further' (Ryan 1991). See Graphs in Section 4.7 for alternative WCS options	Note: WQO is taken from the QWQG central coast region lowland streams, which is taken from ANZECC south –east Australia lowland rivers; 50 NTU is already the uppermost range of the ANZECC guide of 6-50 NTU. Realising that the Fitzroy can be a highly turbid system and that the WQO is already the maximum guideline recommended nationally, and that it is above many international recommendations; a WCS was difficult to reference. Note: Literature suggests rises between 5

			-25 units above thresholds can cause negative ecological effects. Since an increase in turbidity within naturally turbid streams is known to have a less pronounced affect (than in clearer waters), a rise of 25 NTU is proposed.
Sulfate	WQO Sub-basin specific e.g. Mackenzie <10 mg/L	100 mg/L	As per British Columbia Ambient Water Quality Guidelines (recommendation from ANZECC) http://www.env.gov.bc.ca/wat/wq/BCguidelines/sulphate/sulphate.html
pH	WQO pH 6.5-8.5 (All sub-basins)	Diminishing exponential function between 4.5 and 6.5 and 8.5 and 11, with a steeper weighting below 6.5	WCS is based on: Fabbro, L.D. (1999) Phytoplankton Ecology in the Fitzroy River at Rockhampton, Central Queensland, Australia. PhD Thesis, Central Queensland University, Rockhampton, as well as accumulated Fitzroy data from CSIRO and NHT projects

Nutrient Indicators	**Benchmark**	**Worst Case Scenario (WCS)**	**WCS Notes**
Total Nitrogen as N	WQO e.g. Mackenzie <775 µg/L	TBC	See graphs in Section 4.7 for WCS options
Oxidised nitrogen (Nitrate + Nitrate as N)	WQO All sub-basins <60 µg/L	TBC	See graphs in Section 4.7 for WCS options
Total Phosphorus	WQO e.g. Mackenzie <160 µg/L	TBC	See graphs in Section 4.7 for WCS options
Filterable Reactive Phosphorus	WQO All catchments <20µg/L	TBC	See graphs in Section 4.7 for WCS options

Toxicant Indicator	**Sub indicator**	**Benchmark** (ANZECC toxicant trigger values for slightly-moderately disturbed systems; 99% or 95% protection of species as per ANZECC table 3.4.1)	**Worst Case Scenario**	**WCS Source**
Metals (µg/L) #moderate reliability data Note: *No ANZECC	Dissolved Hg (inorganic)[B]	0.06 µg/L	5.4 µg/L	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved Al (pH >6.5)	55#	150	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved As	13	140	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved B	370	1300	As per ANZECC toxicant trigger value

guideline for Iron, have used Canadian guideline Note: ^Co, Mo, U and V, are ANZECC low reliability trigger values using chronic data B= bioaccumulation possible hence as per ANZECC 99% protection trigger value used **Suggest that literature regarding toxicants with medium and low reliability trigger values and/or international guidelines be reviewed annually** **Note: the number of metals included in the toxicant category could be reviewed and potentially reduced after each report card period.**				for 80 percent protection of species
	Dissolved Cd	0.2	0.8	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved Cr IV	1	40	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved Co	^2.8	^90	As per ANZECC (low reliability data trigger)
	Dissolved Cu	1.4	2.5	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved Fe	300*	1600	As per Acute toxicity maximum for macroinvertebrates (Warnick and Bell 1969)
	Dissolved Pb	3.4	9.4	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved Mn	1900#	3600	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved Mo	34^	73	Canadian Water Quality Guidelines for the Protection of Aquatic Life
	Dissolved Ni	11	17	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved U	^0.5	10	As per ranger uranium mine receiving water standard set by the Environmental Research Institute of the Supervising Scientist
	Dissolved Zn	8	31	As per ANZECC toxicant trigger value for 80 percent protection of species
	Total Se[B]	5	34	As per ANZECC toxicant trigger value for 80 percent protection of species
	Dissolved Ag	0.05	0.2	As per ANZECC toxicant trigger value for 80 percent protection of species

Ecology Indicator	**Sub indicator**	**Benchmark**	**WCS**	**Notes**
Macroinvertebrates	Taxa Richness (edge)	33	23	Fitzroy WQO is based on QWQG Central Coast regional biological WQG where, 'The values for these macroinvertebrate biological indicators are based on the QWQG Central Coast regional biological water quality guidelines. They apply to support waters at a moderately disturbed level of protection. Values are provided for 20th and 80th percentiles. The median value of biological indicators at test sites is to be compared and assessed against these values' Hence the 20 and 80 percentiles of this reference data was set as the benchmark and WCS
	PET taxa Richness (edge)	5	2	
	SIGNAL index (edge)	4.2	3.31	

4.3 Defining scoring methods

Individual parameters differ to one another in behaviour, unit of measure and range of values. To produce summary results the value of each indicator needs to be transformed into a single and consistent scale. This then allows the scores to be compared and consolidated. Typically this scale ranges between 0 and 1, but may be from 0 to 100 or a similar index. The evaluation occurs by comparing the value observed at a site to the value expected to occur (defined threshold or benchmark).

There are different ways of transforming the data into common units suitable for an index. Typically the evaluation is done in a way that transforms the results into a set of common units. The approach depends on the nature of the indicator, and the quality and quantity of data available and on the intended output.

4.3.2 Methods to compare and evaluate observations against thresholds for the Fitzroy EHI

After reviewing other local, national and international ecosystem health monitoring programs (Section 5.0 of Part A), two fundamentally different approaches to evaluating and transforming the data were proposed to the Science Panel. For simplicity, these two main approaches can be described as the transformation approach used in the EHMP freshwater project (the EHMP method) and the transformation approach used in producing the Chesapeake Bay report card (the Chesapeake Bay method). As well, a limited number of variations on these approaches are reviewed for potential application in the Fitzroy.

Specific issues of interest are how to treat data that are compared to benchmarks, how to treat data that are categorical or binary, and how different evaluations and transformations can be applied.

There are other approaches for evaluating and transforming data based on predictive functions dependent on the behaviour of multiple variables. Due to a limited data set, these approaches are beyond the scope of the current project.

Some of the programs reviewed for this project use more than on transformation approach. Although it is not necessary to use only one approach within an index, consistency between similar data types is strongly advised.

4.3.2.1 Summary of the EHMP Method

The EHMP approach evaluates an observed value against an upper expected value and a lower expected value. The score that is given to an observed value then relates to its position against that expected range.

In the EHMP approach the lower thresholds are defined as ecosystem health “guidelines” and the upper are the “worst case scenario”. The EHMP thresholds were defined for different stream types (determined from cluster analysis), with some variation in approach across the indicators:

- Guideline values were based on the 20th and/or 80th percentile of empirical data (depending on the variable) for minimally-disturbed reference sites or from theoretical limits.
- Guideline values indicate the expected values of each indicator for stream in a healthy condition.
- Worst case scenario values were derived from either the 10th and or 90th percentile of data (depending on the indicator) from all sites, or from the theoretical limits of the index.
- Worst case scenario values indicate the expected value of each index for streams in an unhealthy condition.

Calculation of the score for each indicator:

1. If the value of an indicator is equal to or better than the guideline then score =1

2. If the value of an indicator equal to or worse than the WCS then score = 0

3. For all other values

$$Score_{ij} = 1.0 - \left| \frac{(x_{ij} - Guideline_{ij})}{(WCS_{IJ} - Guideline_{ij})} \right|$$

x_{ij} = value of the index *i* at a site within stream class *j*

$Guideline_{ij}$ = corresponding “ecosystem health guideline” value

WCS_{IJ} = corresponding “worst case scenario value”

4.3.2.2 Consideration of the application of the EHMP method to the Fitzroy EHI project

The use of an EHMP approach has advantages because each individual score provides an evaluation of performance. This means that it is appropriate to drill down through an EHI to individual scores. Another key advantage of the EHMP approach is that the comparison against the threshold range can be by each data point, or by a summary of data points (such as a median or mean value), as the latter can be positioned in the relevant range for reference condition.

Example of how the EHMP method could be used for an indicator in the Fitzroy EHI:

- Guideline: WQO for conductivity (base flow) for the Comet Sub-basin = <375 µS/cm

- WCS for conductivity for the Comet (professional best judgement) = >1500 µS/cm

- Site A Conductivity = 300 µS/cm; Site B Conductivity = 3000 µS/cm; Site C Conductivity = 1000 µS/cm
- Score $_{siteA}$=**1**; Score $_{siteB}$= **0**; Score $_{siteC}$ = 1- (1000-375)/(1500-375)= 1- (625/1125) = **0.4**

4.3.3 Summary of Chesapeake Bay method

The Chesapeake Bay approach, in its simplest form, evaluates an observed value against a single threshold value. For the Chesapeake Bay Index, indicators are scored by calculating the proportion of observations meeting or exceeding a specific threshold or index value with a sub-region. Raw data is then transformed into binary data (yes or no), according to whether or not a data point is above the threshold.

For each indicator within the sub-region the ratio of *n* samples that pass the threshold to the total number of samples collected is calculated before averaging, aggregation and weighting to produce the final index.

4.3.3.1 Consideration of the application of the Chesapeake Bay method to the Fitzroy EHI project

- This is conceptually straight forward and simple to compute.
- If an EHI has a large number of component indicators and observations, there would be limited difference at the aggregate level between this and the other approaches.
- However, because this is pass-fail, there is no sensitivity to performance against the threshold value. It will not very suitable for drilling down through an EHI to the individual level.
- The proposed benchmarks may not be sensitive enough to give an accurate evaluation of the indicator. If the benchmarks are not accurate, it may have a large effect on performance of the index.
- The comparison relies on multiple data points being compared to the relevant threshold. It is not possible in this approach to compare the median or mean values of a set of observations against a threshold value.
- The method becomes less accurate when there are a small number of observations for each sub-catchment.

4.3.4 Summary of scoring options

Based on the research undertaken in Part A, and the preceding discussion, four main options were considered for scoring the indicators within the freshwater (catchment) EHI for the Fitzroy:

1. The EHMP approach, with thresholds set using WQOs and WCSs set from guidelines and the available (2010-11 water year) data only.
2. The EHMP approach with thresholds set using WQOs and WCSs set from guidelines or determined from best professional judgement.
3. The Chesapeake Bay approach in its simple form (only pass/fail scores), and
4. The Chesapeake Bay approach with a modification to include a measure of extent of failure or goodness. This could occur by comparing the distribution of observed values against the threshold value rather than a simple count of pass/fail.

Option 2 is expected to provide the most accurate and flexible scoring system, and is recommended by CQUniversity on this basis. Option 2 gives scope to modify the EHI for space and time variations by varying the worst case scenario. For example, in future EHIs predictive modelling could be used to determine worst case scenarios for conductivity (or other significant variables) in wet years, without having to derive completely new thresholds, so that variations in natural conditions are incorporated into the EHI.

4.4 Proposed indicator scoring method for the Fitzroy freshwater (catchment) EHI

After identifying appropriate benchmarks and worst case scenarios the following indicator scoring method, which is based on the EHMP method, is proposed for all indicators (except for pH):

- If an observation is equal to or better than the benchmark an indicator is awarded a 1
- If an observation is equal to or worse than the worst case scenario, then the indicator is awarded a 0
- For other results:

$$Score_i = 1.0 - \left| \frac{(x_i - Benchmark_i)}{(WCS_I - Benchmark_i)} \right|$$

Where, x_i = value of the indicator *i*, $Benchmark_i$ = water quality objective, ecosystem health guideline, trigger value or expert opinion of suitable indicator *i* concentration *and* WCS_I = value of x_i at which ecosystem health may be compromised.

The indicator pH is logarithmic and has a benchmark (WQO) range rather than a distinct value, hence, an adjusted scoring method which uses a diminishing exponential function is proposed (see Appendix II).

4.5 Weighting and aggregating the index

Individual indicator scores are combined through weightings and aggregation to produce an overall EHI score (e.g. an overall Fitzroy Basin sub-catchment score).

4.5.1 Weighting

Part A of this review identified that some programs assume equal weighting of all the indicators within an index, while other indexes are derived using indicators or groups of indicators with differing weights. The application of different weightings is subjective and dependent on a good understanding of the relationship of the indicator to catchment condition.

The most simple and straightforward approach is to apply equal weighting to each indicator within each category and apply equal weighting to each category in order to generate an overall score

The benefit of this approach is that, if in one sub-catchment there is insufficient data to calculate a score for a particular indicator, then that indicator can be removed and the weightings easily redistributed among the remaining indicators in the category. It is possible that this could be the case for some of the indicators within the Fitzroy sub-catchments for the current EHI. The downside of this approach is that it does not take into account the fact that some indicators may have a much greater impact on ecosystem health than others.

4.5.2 Aggregation

Indicators are aggregated to obtain the final index. The three most basic approaches are:

- Additive: the subindices are combined through summation and are represented as an arithmetic mean.
- Multiplicative: the subindices are combined through product operation (geometric mean).
- Logical: the subindices are combined through logical operation (such as minimum or maximum).

Additive frameworks are considered by some as simpler to use and understand, while multiplicative and logical frameworks may be useful where some components have priorities over others. Each of these approaches can summarise indicator scores into an overall score with values between 0 and 1.

There are data issues to consider during aggregation, although the extent of these issues will not be known until data is manipulated. Abassi and Abassi (2012) acknowledge four such issues:

- Ambiguity (exaggeration): is caused in an aggregation method when an index exceeds the critical level (unacceptable value) without any of its constituent sub-indices exceeding the critical level.

- Eclipsing is caused in an aggregation method when an index does not exceed the critical level (unacceptable value) despite one or more of its constituent sub-indices not exceeding the critical level.
- Rigidity: the aggregation function does not allow the addition of new variables without upsetting the index.

4.6 Proposed weighting, aggregation and rating for the Fitzroy freshwater (catchment) EHI

CQUniversity recommended that the proposed EHI use an additive approach to data consolidation and any prioritisation of indicators be addressed through weightings.

The proposed EHI is made up of four categories. As a default CQUniversity proposed that each category would be awarded 25 percent of the overall grade of the catchment and that each indicator within the categories would be awarded an equal percent of the category score.

After further discussions it was concluded that this default approach over-represented the relative importance of individual nutrient indicators to the condition of the catchment. To reduce this bias, different weighting options were proposed to the Science Panel, who endorsed a redistribution of the weightings by increasing the weighting of the Phys-Chem. category to 40% and reducing the Nutrient category to 10%. The weightings of the proposed EHI are shown schematically in Figure 2

The final index needs to be put in the context of the report card, where the output is easily communicable to the public. It was agreed by the Science Team and endorsed by the Science Panel, that the score card method of assessing categories of A-E be used. As per the EHMP approach these grades are defined as follows:

A=Excellent: Conditions meet all set ecosystem health values; all key processes are functional and all critical habitats are in near pristine condition.

B=Good: Conditions meet all set ecosystem health values in most of the reporting region; most key processes are functional and most critical habitats are intact.

C=Fair: Conditions meet some of the set ecosystem health values in most of the reporting region; some key processes are functional and some critical habitats are impacted.

D=Poor: Conditions are unlikely to meet set ecosystem health values in most of the reporting region; many key processes are not functional and many critical habitats are impacted.

E=Fail: Conditions do not meet set ecosystem health values; most key processes are not functional and most critical habitats are severely impacted.

The grades are colour coded as an additional communication tool for the public and can be related to the proposed scoring method in the following manner:

Score (%)	100	$66.\dot{6}<B<99.\dot{9}$	$33.\dot{3}<C<66.\dot{6}$	$0<D<33.\dot{3}$	0
Grade	A	B	C	D	E

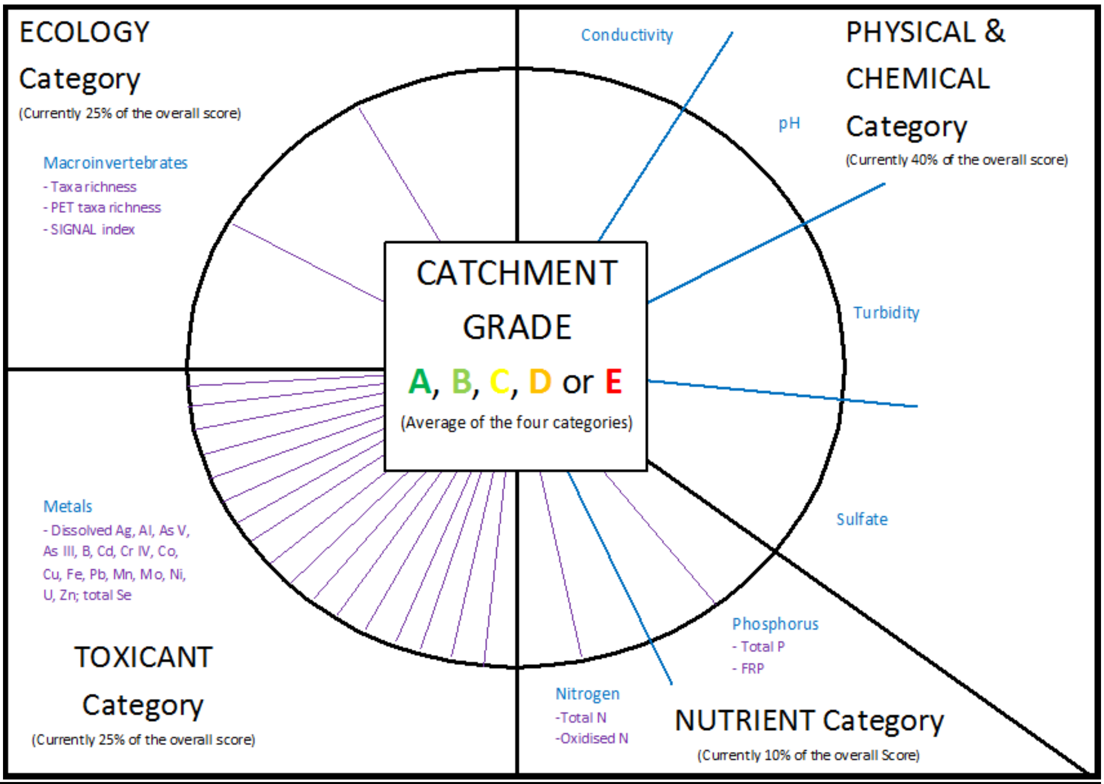


Figure 2 Proposed weightings of the Freshwater (catchment) EHI for the Fitzroy system

For each of the 11 freshwater reporting zones, the overall EHI grade is made up of the four weighted ecosystem health category scores, which are made up of the multiple equally weighted mean indicator scores from each monitoring location. Figure 3 provides a conceptual overview of the proposed data aggregation, scoring process and report card output[2].

[2] Note: Two additional options for aggregating the metals data are given in Appendix II, these are suggested as ways to account for the greater number of sub-indicators within the Toxicant Category.

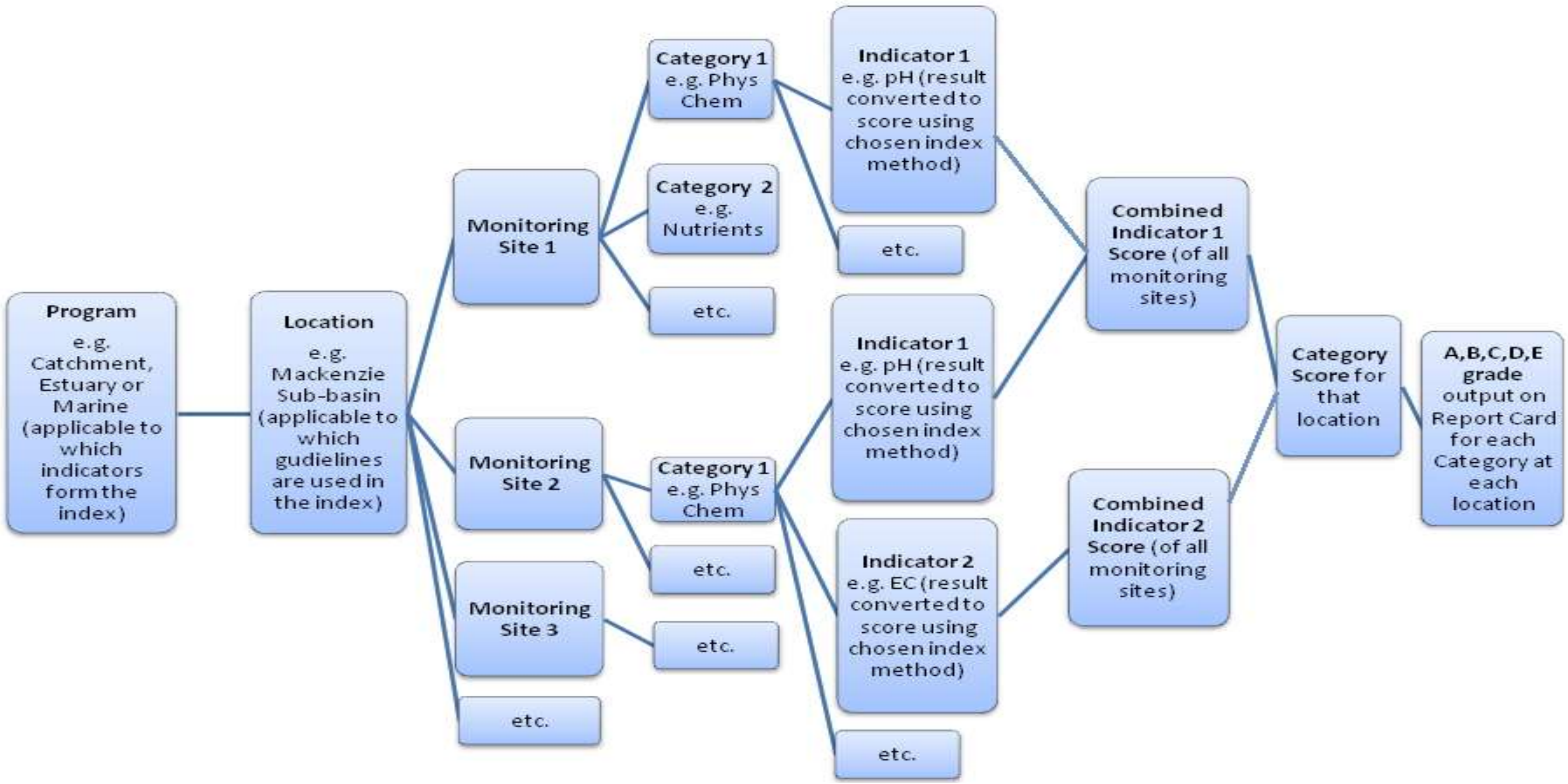


Figure 3 Summary of the proposed weighting, aggregation and rating for the Fitzroy freshwater (catchment) EHI

4.7 FPRH data – availability and comparison to benchmarks

One of the indicator selection criteria listed in Section 2.2 of this report relates to the availability of data. As such, CQUniversity was provided with access to the FPRH data set as it stood on the 14 August 2012. This data included all indicators that were monitored by members of the partnership during the 2010-11water year. The data was primarily used by CQUniversity to assess whether an indicator could be used in the 2010-11 report card i.e., if no data was available then it could not be incorporated at present, but it could still be proposed for future consideration.

Another consideration regarding the data was under which flow conditions it was collected. The figure below from the Queensland Water Quality Guidelines (QWQG) shows a generic Queensland ephemeral stream flow regime. Water quality changes under different flow conditions (QWQG).

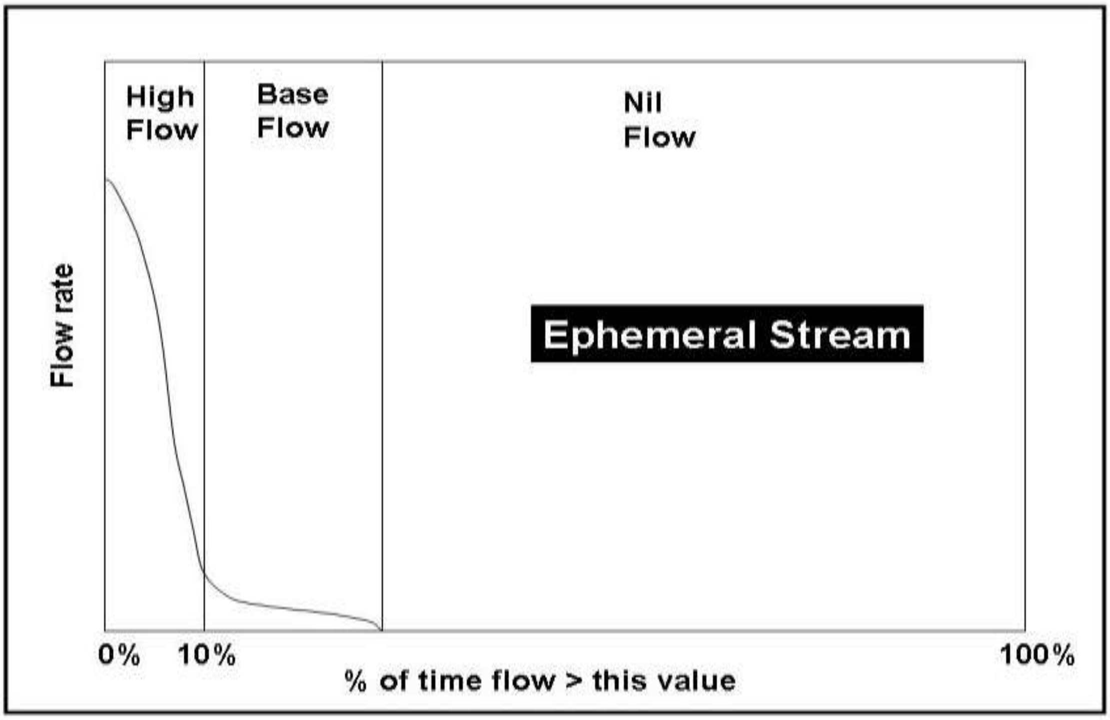


Figure 4 Queensland ephemeral stream flow regime (source: QWQG 2009)

Sub-basin flow volumes, used by the Department of Natural Resources and Mines as 'cut-offs' of high and low flow, were made available to CQUniversity. The FPRH data was provided to CQUniversity already separated into sub-basins; CQUniversity separated the data into high and low flow results and summary statistical operations were performed (Appendix III).

The proposed benchmark values of EC, pH, total P, total N and sulfate are based on sub-regional low flow water quality guidelines derived by DERM as part of the process to establish EVs and WQOs in the Fitzroy Basin. The values for oxidised N, FRP and turbidity scheduled in the Fitzroy WQOs are based on the QWQG Central Coast regional water quality guidelines. However, the QWQG central coast regional water quality guidelines have the superscript: 'In the absence of better data, the guidelines adopted for freshwaters are for the most part the default ANZECC 2000 Guidelines.'

The QWQG state that 'Water quality guidelines that are derived from reference data are generally representative of waterway condition under normal base flow regimes. It follows that guidelines should generally be applied under normal baseflow conditions. Under extreme high or low-flow conditions, guideline application requires careful consideration'

Initially, following discussions with members of the Science Team, it was determined that since most of the available reference benchmarks and worst case scenarios (WCS) were most relevant to low flow data, only low flow data was to be assessed in the EHI. However, because the 10-11 water year was a particularly wet year, this decision meant that the majority of the available partnership data could not be included (as it occurred during 'high flow').

On further reflection, the endorsed toxicant guidelines and WCS (usually the ANZECC toxicant trigger levels for protection of 95 and 80 % of species respectively), may be suitable for all flows. This statement is made based on the following quote taken from section 5.3 of the QWQG

> 'For pollutants that have direct toxic impacts on biota, it seems reasonable that guidelines should apply equally during flood events and during baseflow events as they can still have a significant effect on the biota.'

Discussions as to whether the low flow Fitzroy Water Quality Objectives and ambient flow QWQGs can be applied to all data (with a caveat) are ongoing (March 2013). For further information, CQUniversity has plotted graphs of these particular indicators under both conditions.

Notes:

- The following graphs are included for interest only, and they do not represent the most up to date FPRH data sets.
- 'no-flow' and 'low flow' data has been included in the low flow graphs, whereas the Fitzroy WQOs were determined for low flow only (not no-flow).
- The upper Isaac is not shown as data was not able to be split in to high and low flow, and not all proposed indicators could be analysed, due to data availability issues/ time frames.
- Following on from the February 2013 Science Panel meeting, WCS for turbidity, total N, oxidised N, total P and FRP have not been finalised at the time of the draft report. These graphs include some of the additional methods of determining the WCS as mentioned at the February meeting and will be put to the Science Panel in April 2013.

4.7.1 Conductivity (low flow)

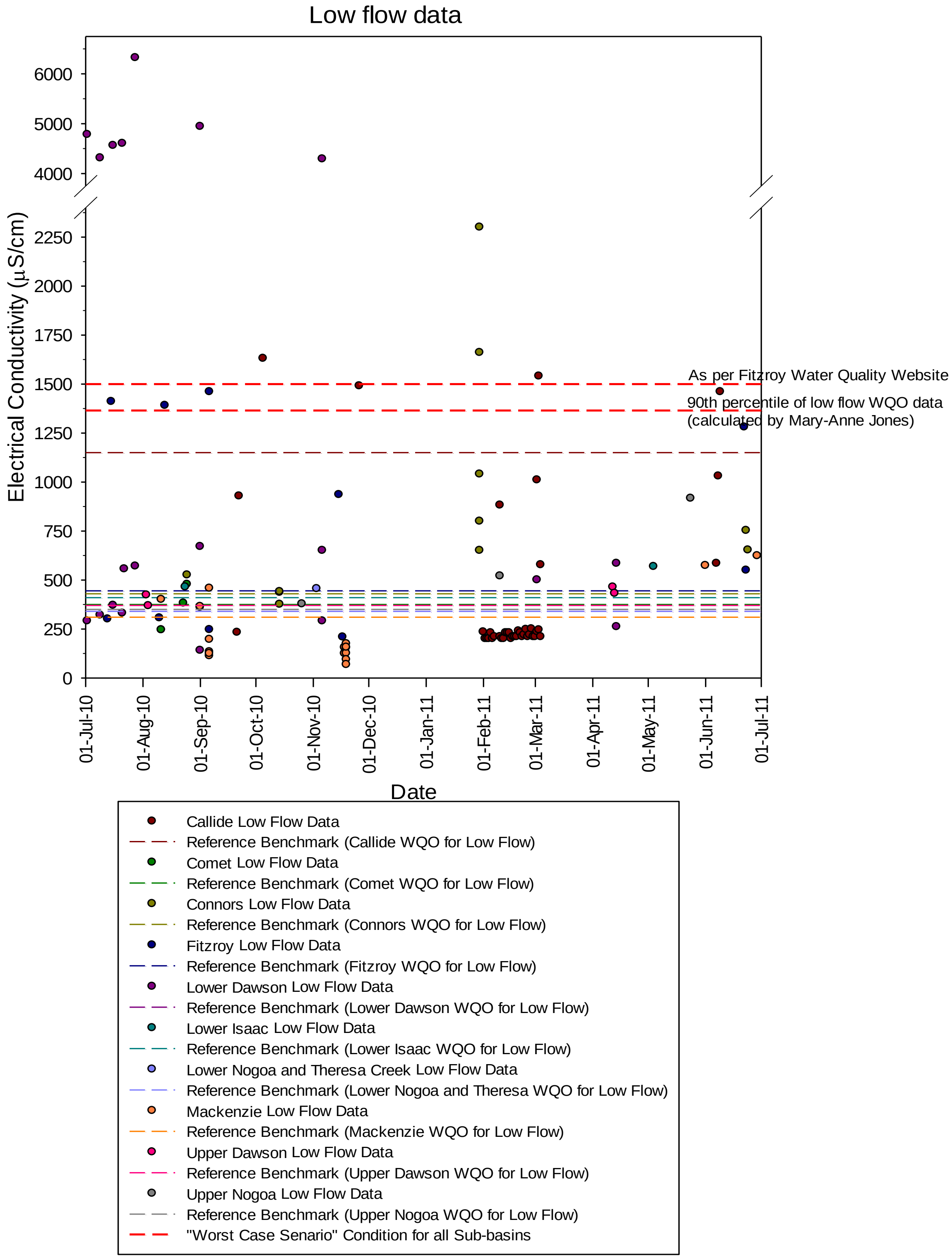


Figure 5 Example of FPRH low flow conductivity (µS/cm) data with reference benchmarks and worst case scenario options.

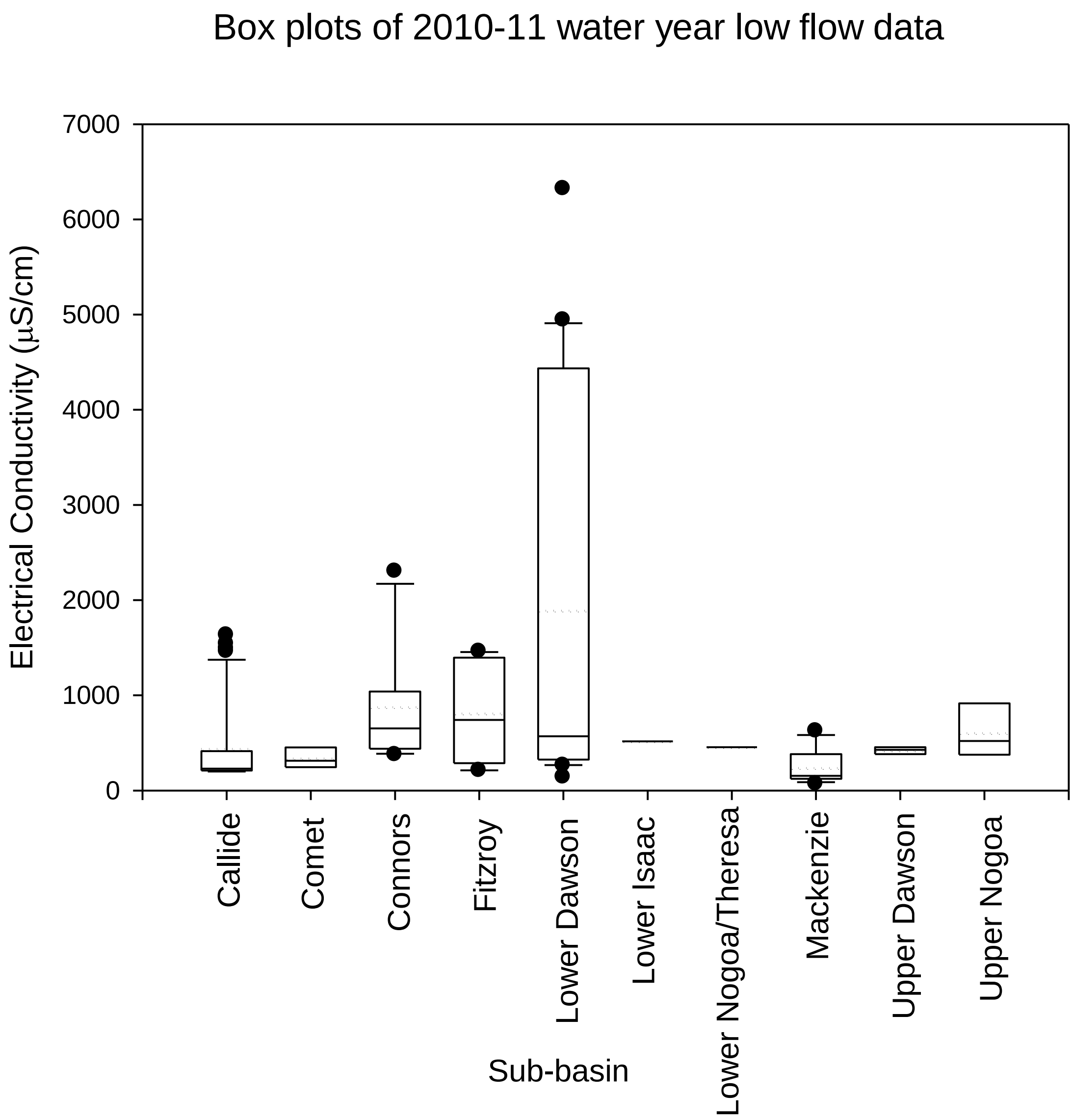


Figure 6 Box plots of the example low flow conductivity (µS/cm) data.

4.7.2 Conductivity (high flow)

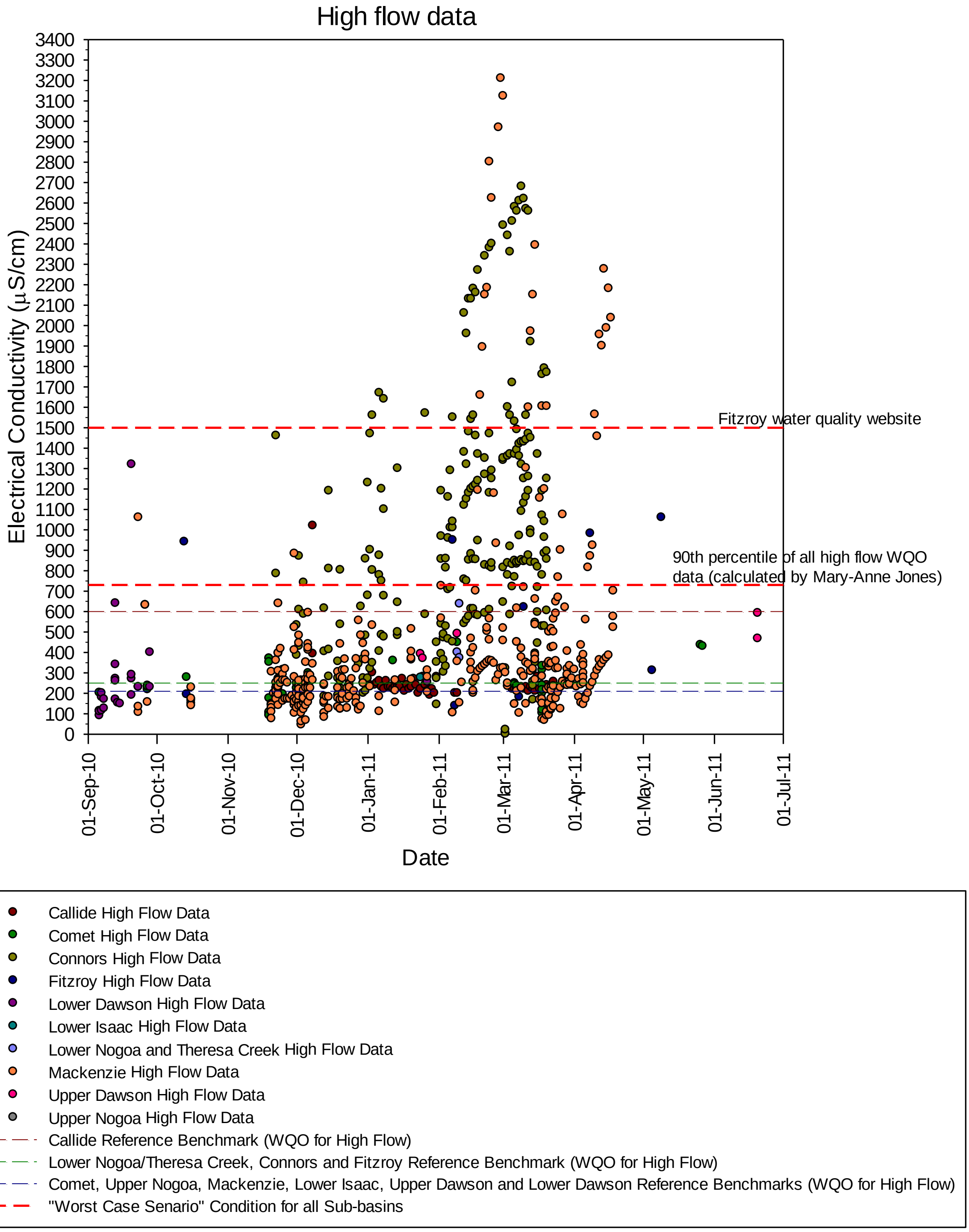


Figure 7 Example of FPRH high flow conductivity (µS/cm) data with reference benchmarks and worst case scenario options.

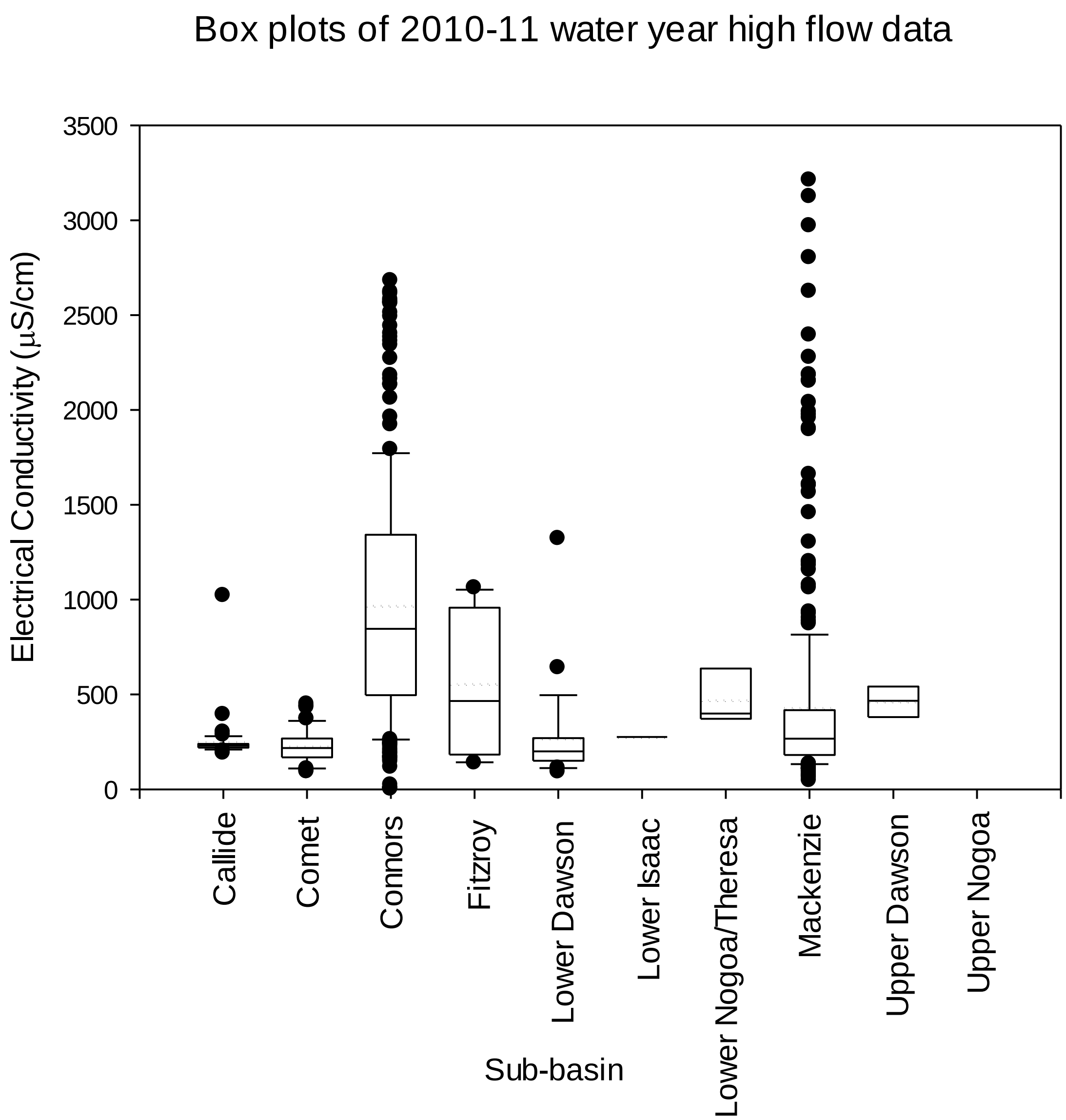


Figure 8 Box plots of the example high flow conductivity (µS/cm) data.

4.7.3 Conductivity (all flows)

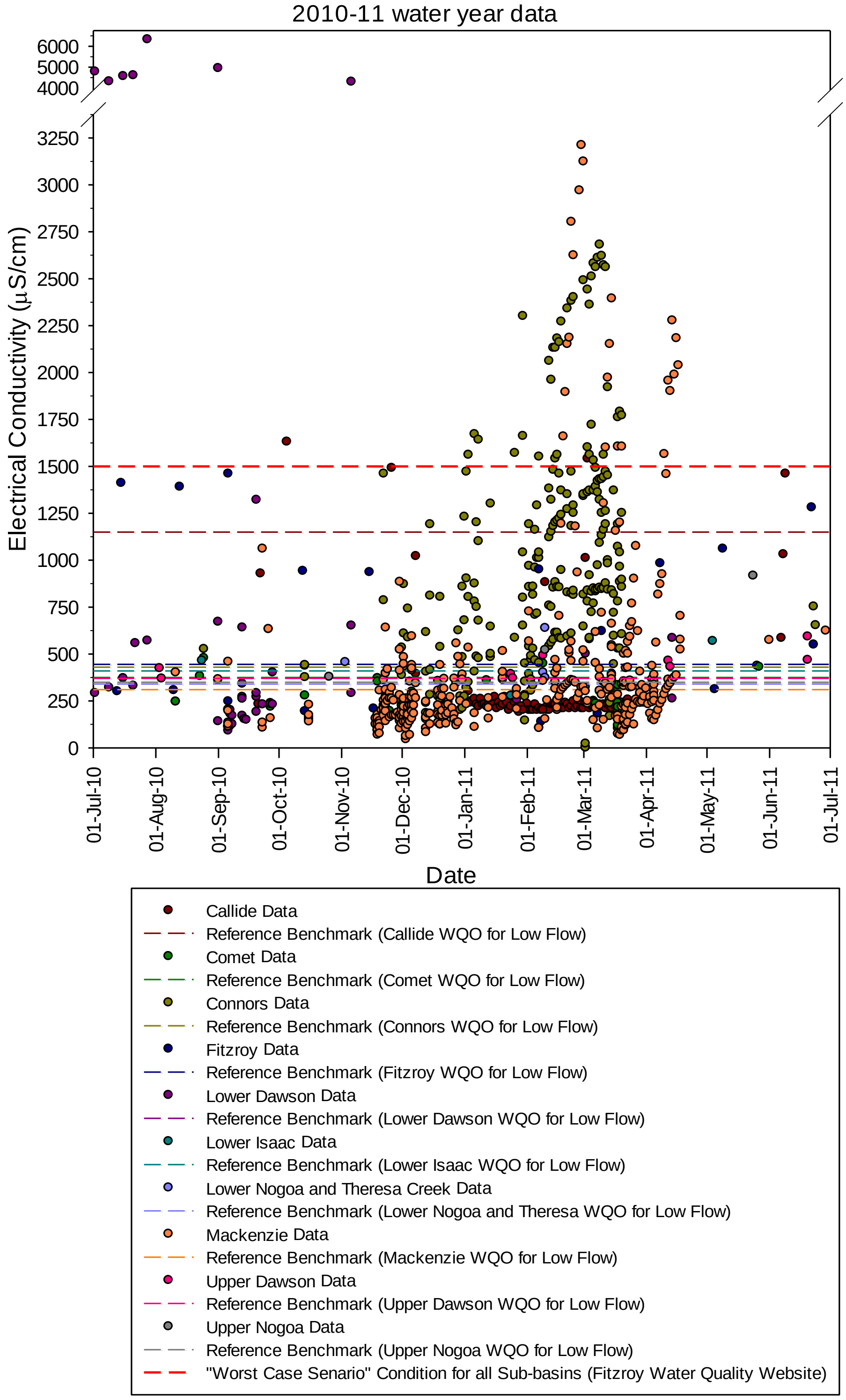


Figure 9 Example of FPRH all flows conductivity (µS/cm) data with reference benchmarks and worst case scenario.

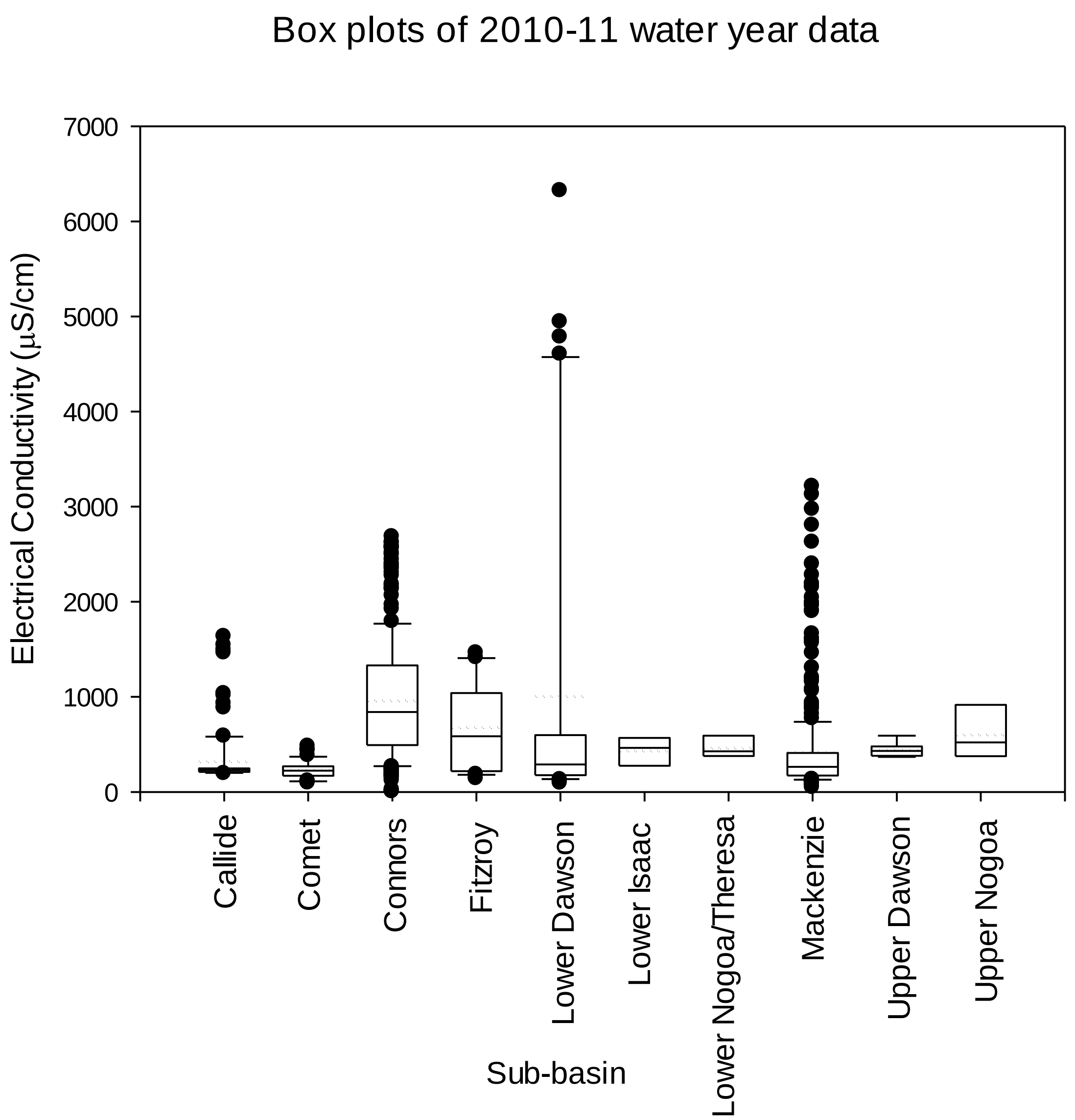


Figure 10 Box plots of the example all flows conductivity (µS/cm) data.

4.7.4 pH (low flow)

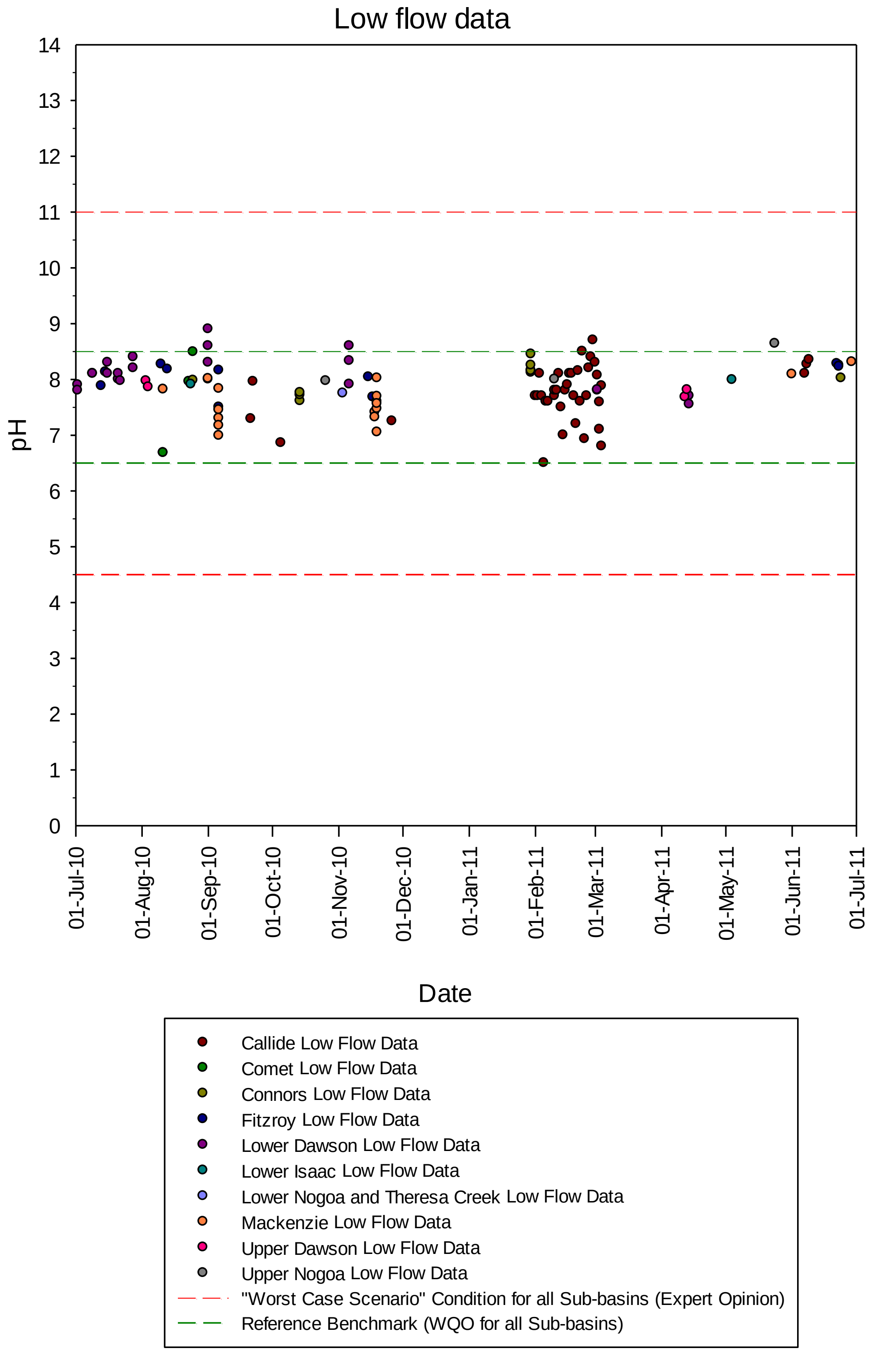


Figure 11 Example of FPRH low flow pH data with reference benchmark and worst case scenario

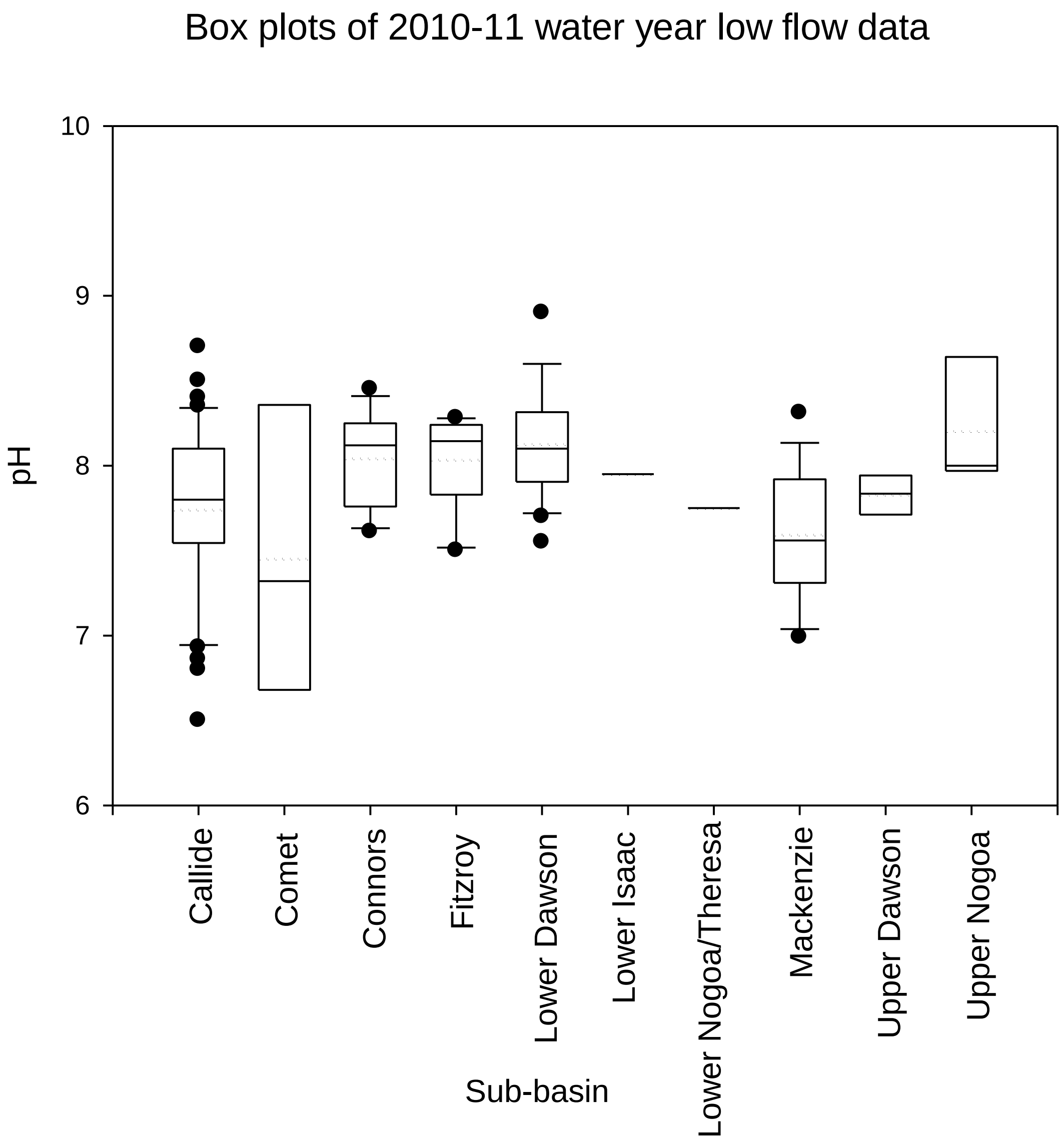


Figure 12 Box plots of the example low flow pH data.

4.7.5 pH (All flows)

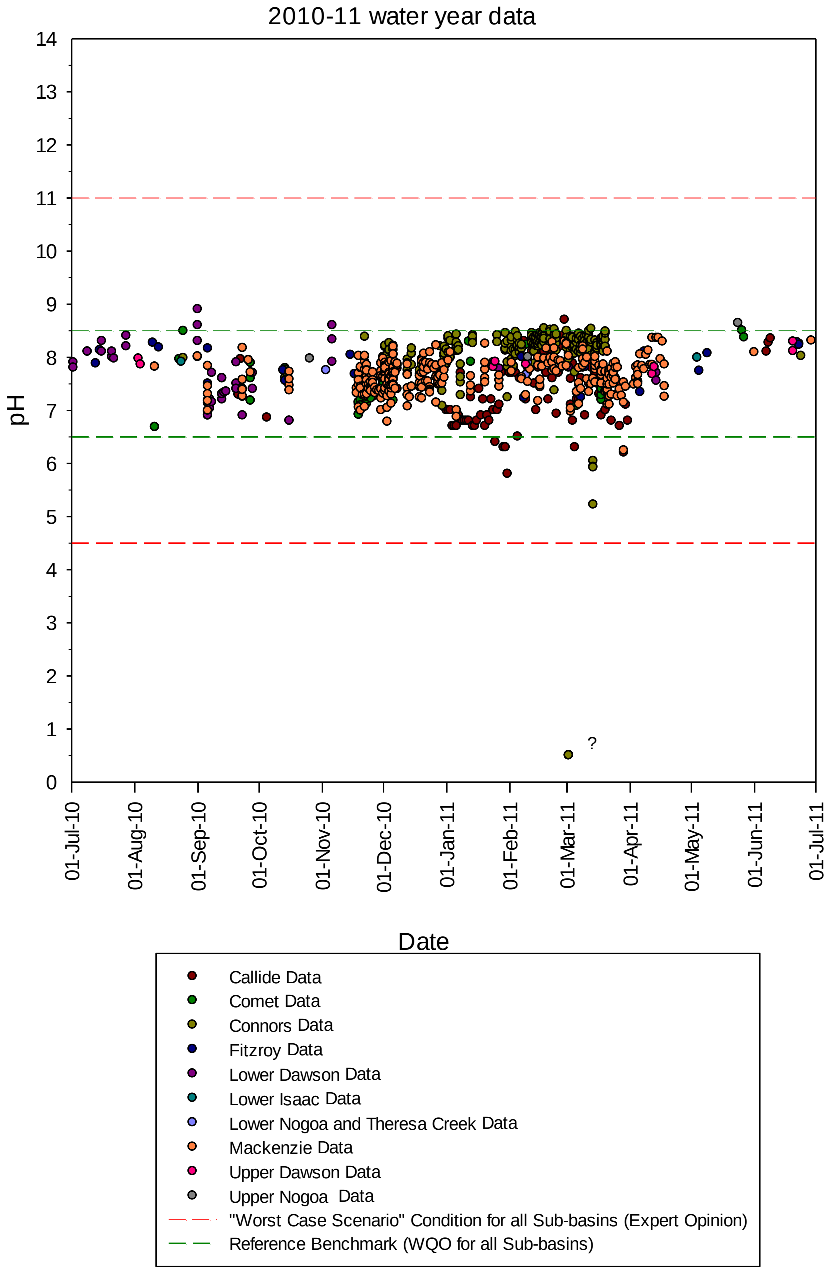


Figure 13 Example of FPRH all flows pH data with reference benchmark and worst case scenario.

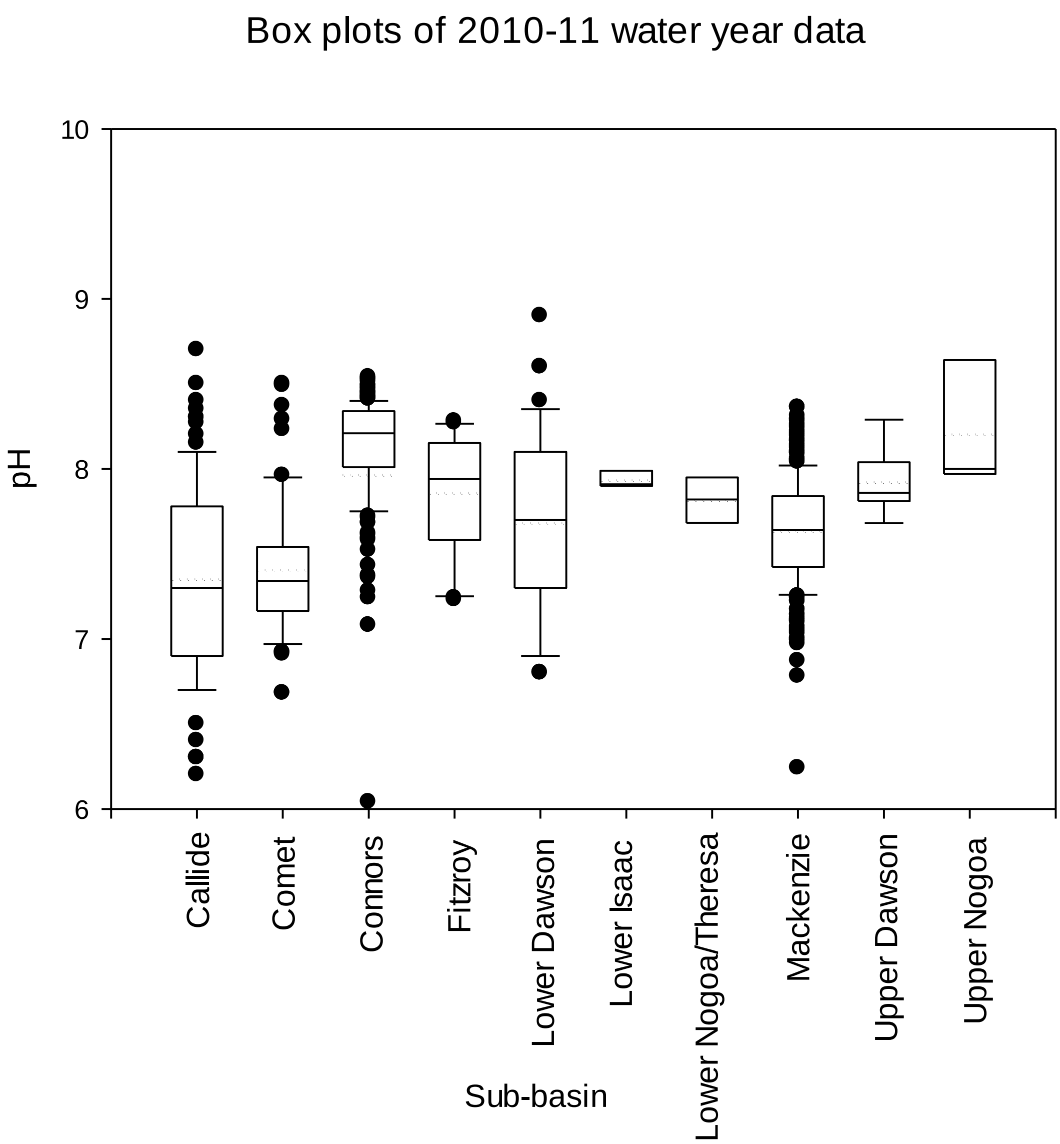


Figure 14 Box plots of the example all flows pH data.

4.7.6 Turbidity (low flow)

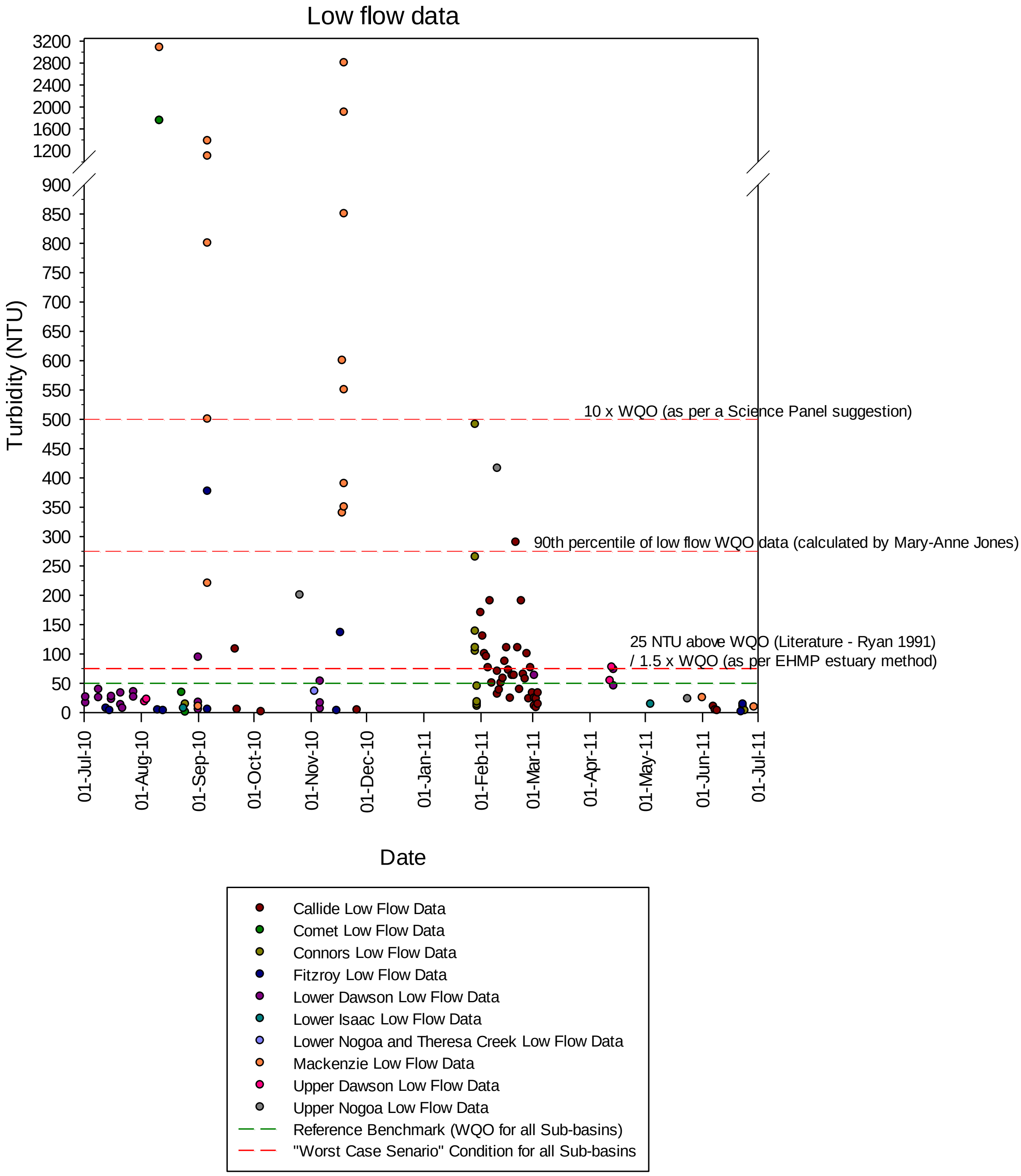


Figure 15 Example of FPRH low flow turbidity (NTU) data with reference benchmark and worst case scenario options.

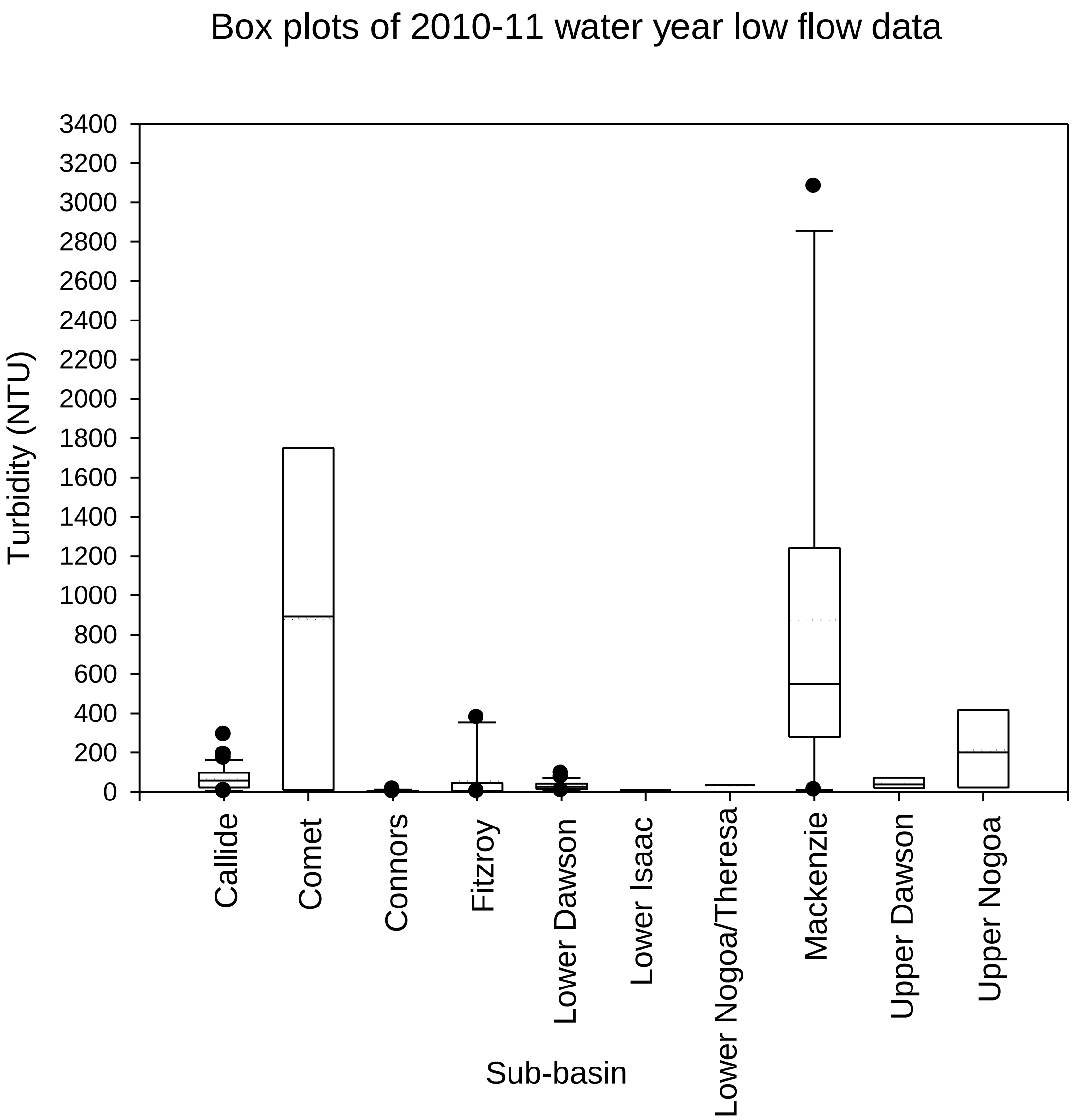


Figure 16 Box plots of the example low flow turbidity (NTU) data.

4.7.7 Turbidity (All flows)

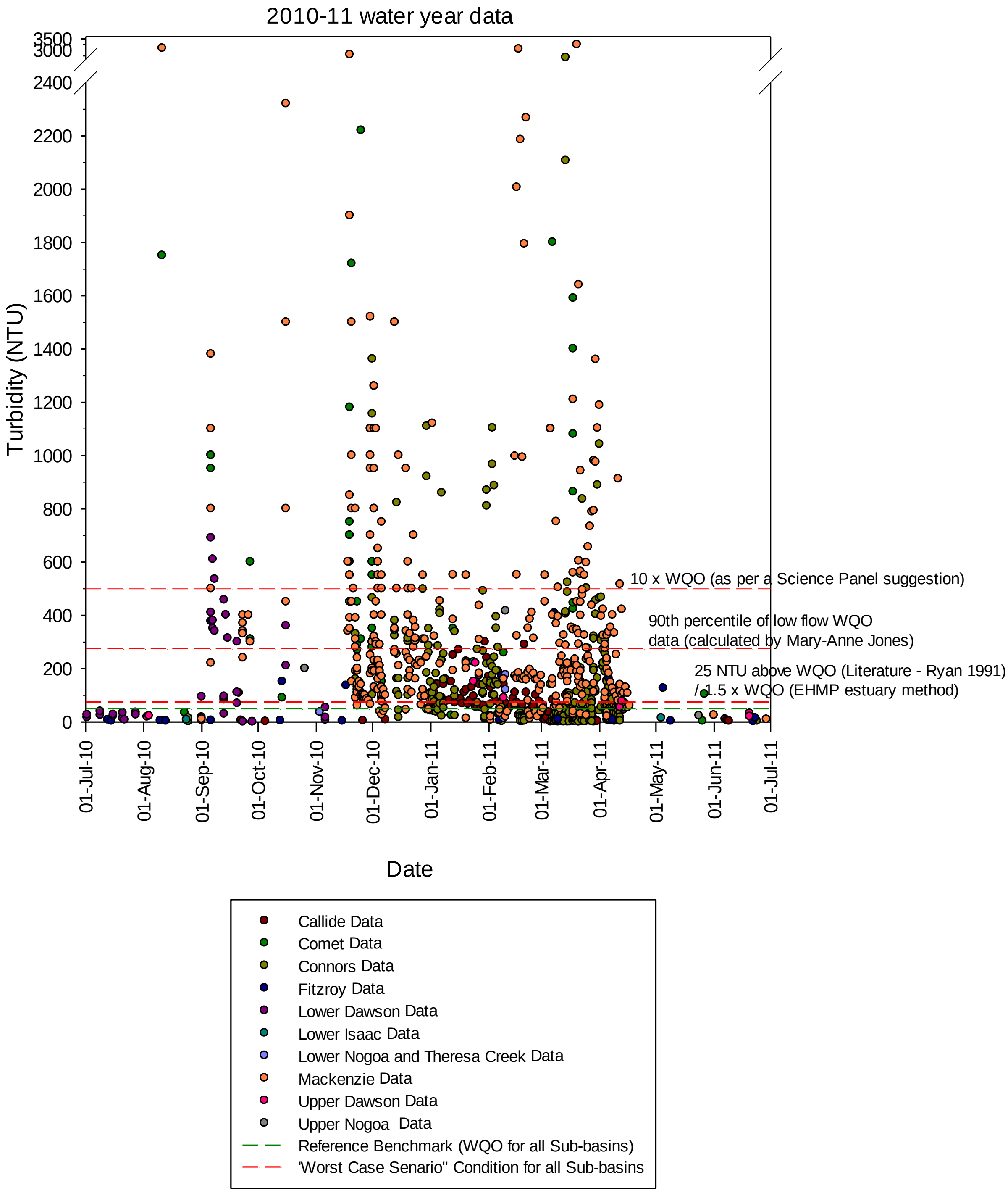


Figure 17 Example of FPRH all flows turbidity (NTU) data with reference benchmark and worst case scenario options.

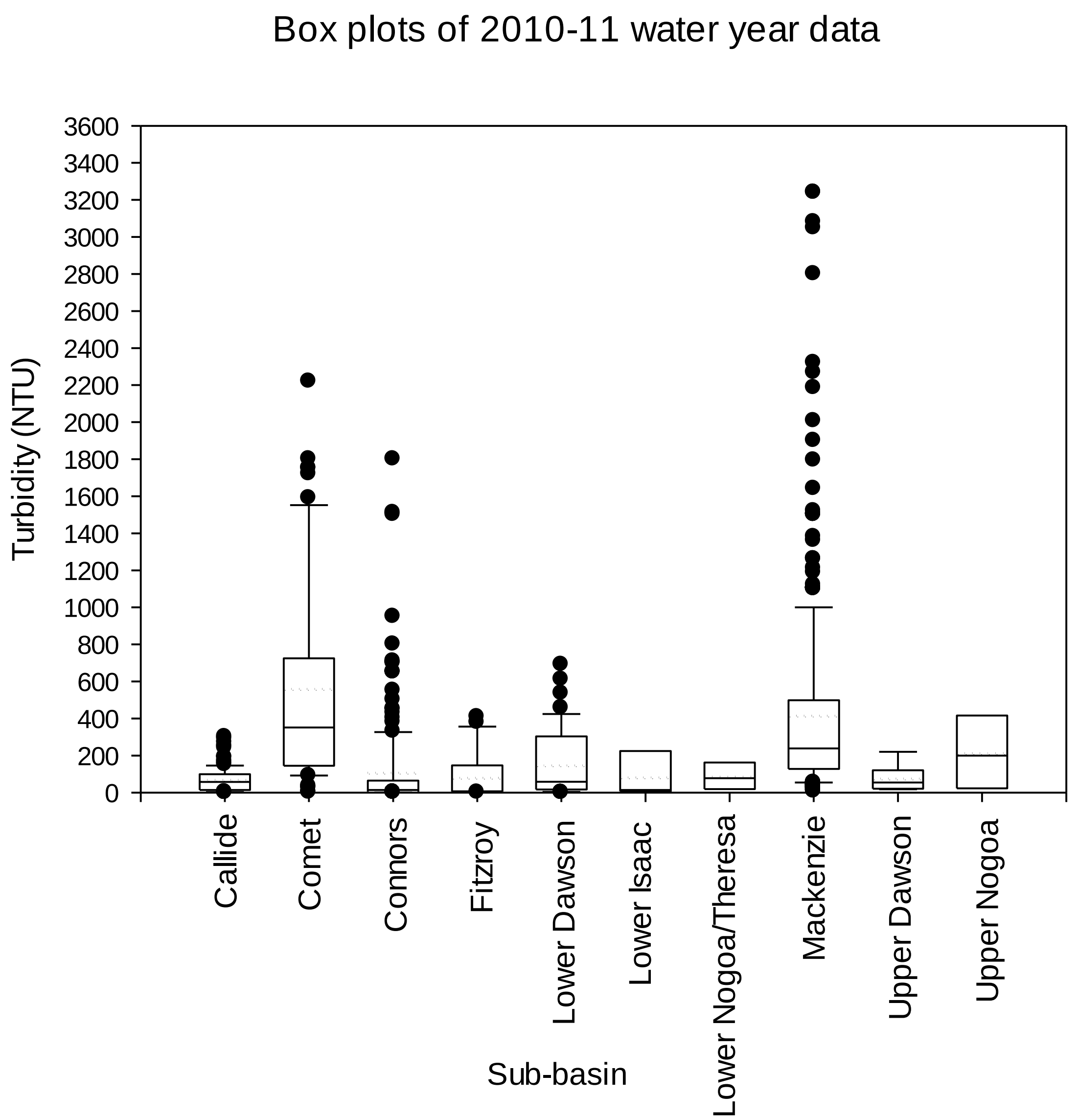


Figure 18 Box plots of the example all flows turbidity (NTU) data.

4.7.8 Sulfate (low flow)

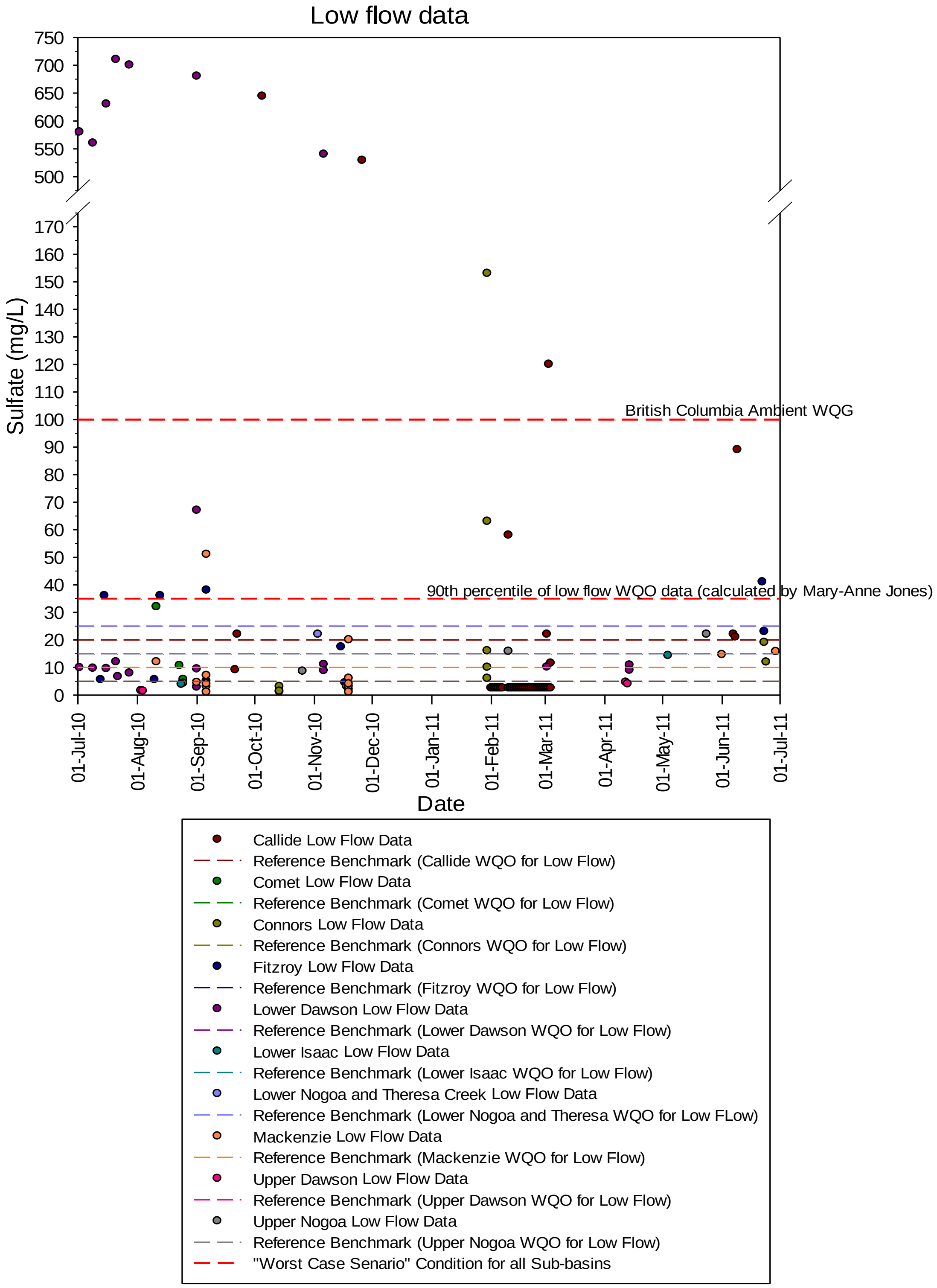


Figure 19 Example of FPRH low flow sulfate (mg/L) data with reference benchmarks and worst case scenario options.

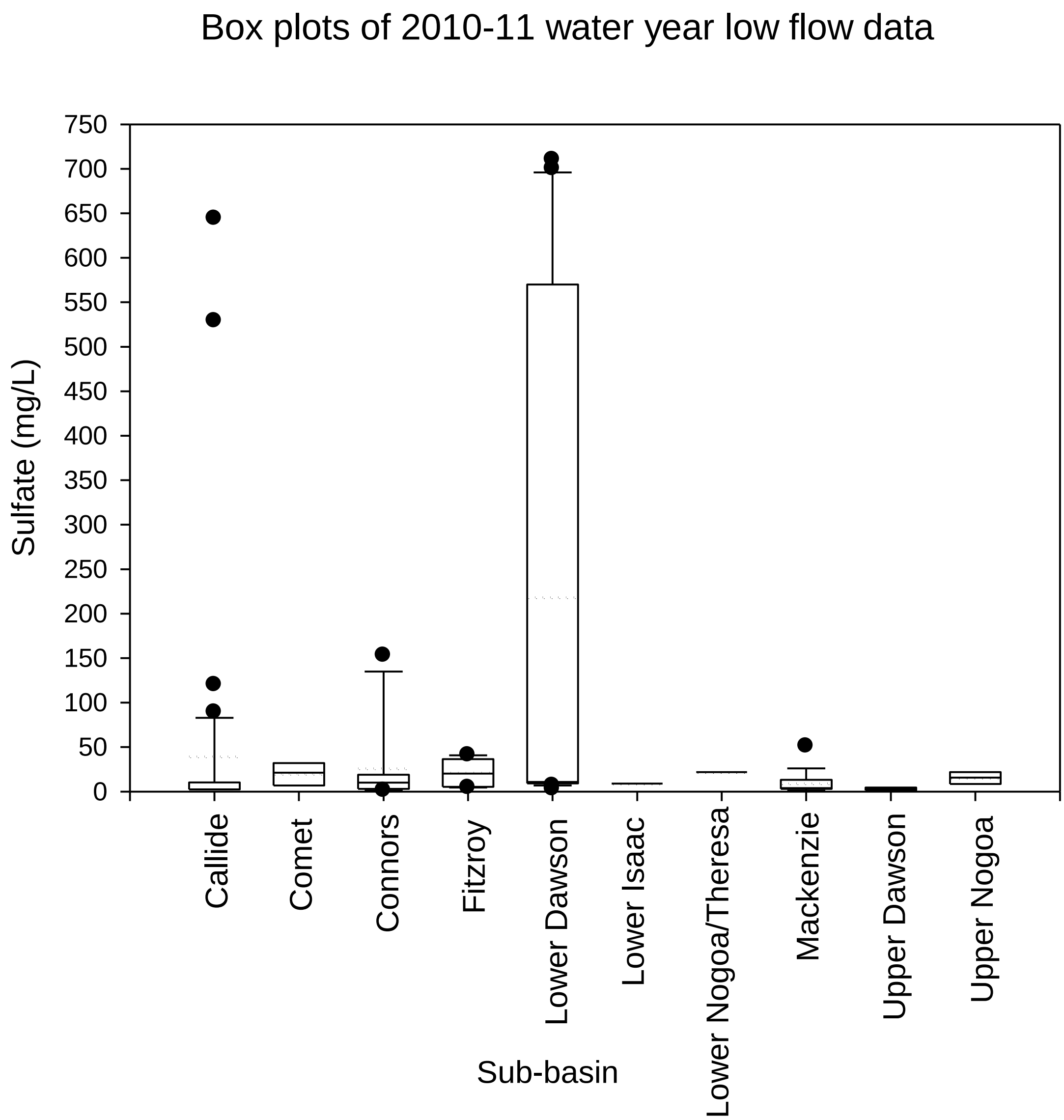


Figure 20 Box plots of the example low flow sulfate (mg/L) data.

4.7.9 Sulfate (All flows)

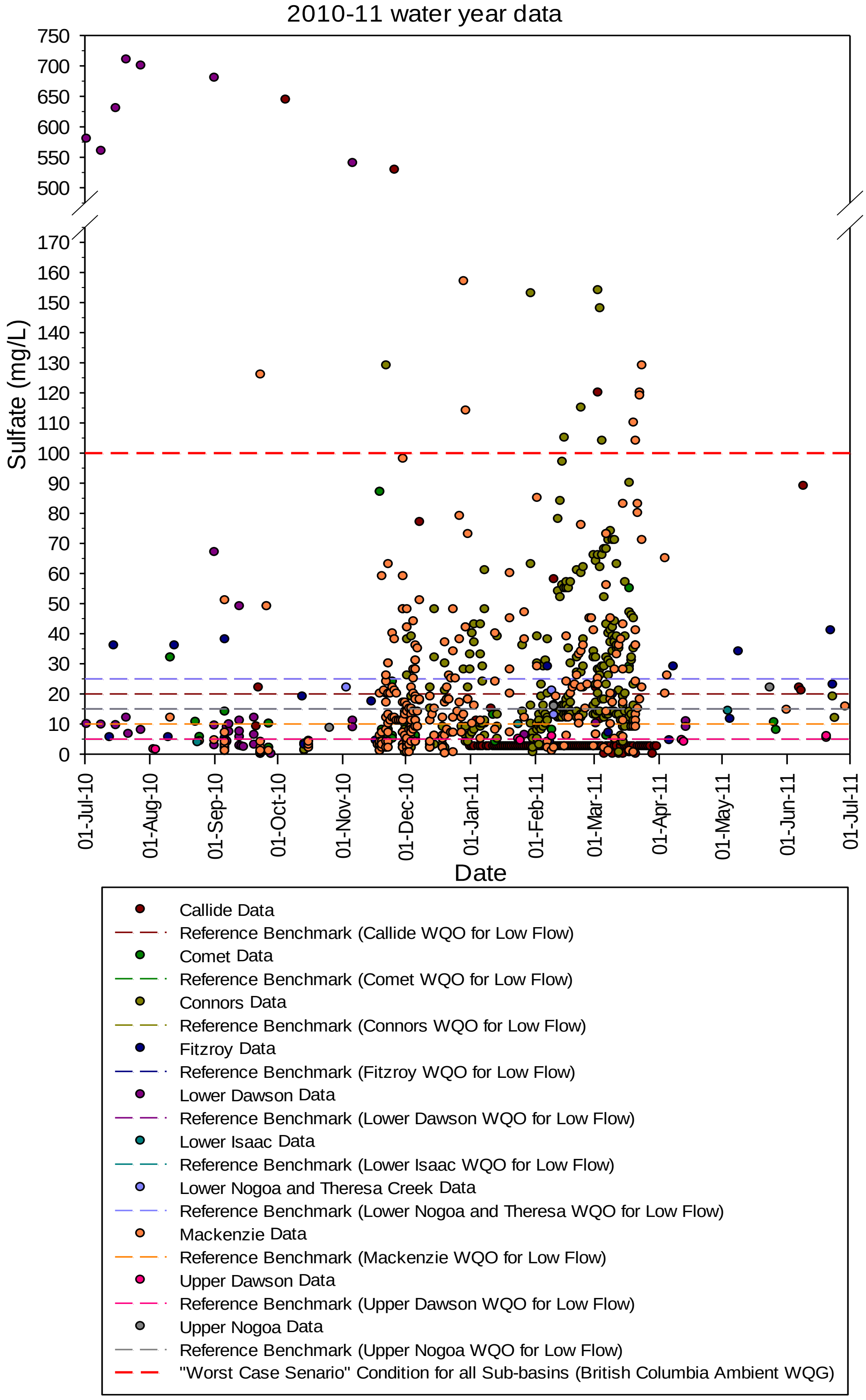


Figure 21 Example of FPRH all flows sulfate (mg/L) data with reference benchmarks and worst case scenario options.

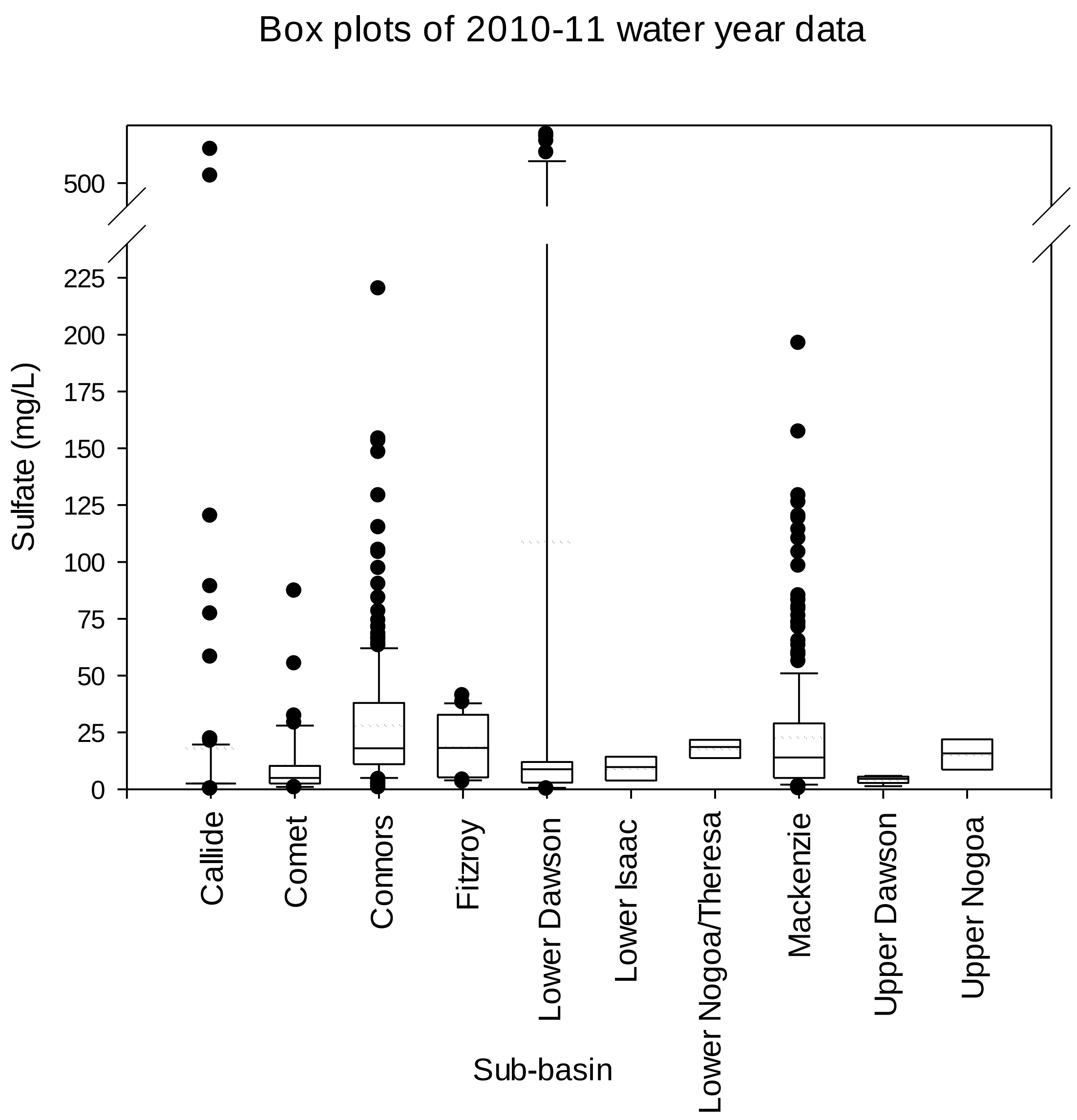


Figure 22 Box plots of the example all flows sulfate (mg/L) data.

4.7.10 Total Nitrogen (low flow)

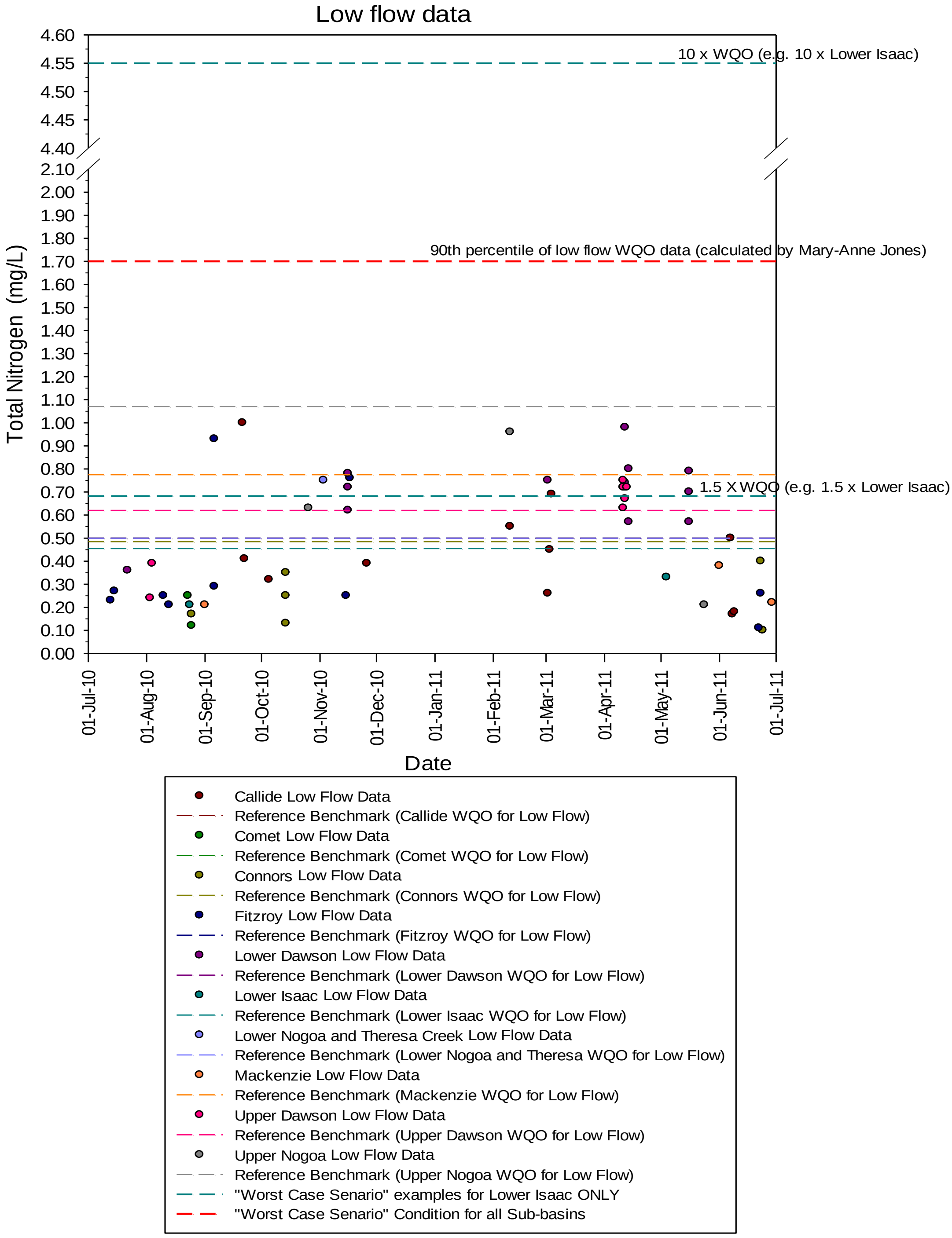


Figure 23 Example of FPRH low flow total nitrogen (mg/L) data with reference benchmarks and worst case scenario options.

Note: WQOs were converted to mg/L; there are different WQO for different sub-basins, so the 1.5 x WQO and 10 x WQO (aqua dashed line) examples given here are only applicable to data corresponding to that basin (specified in the legend).

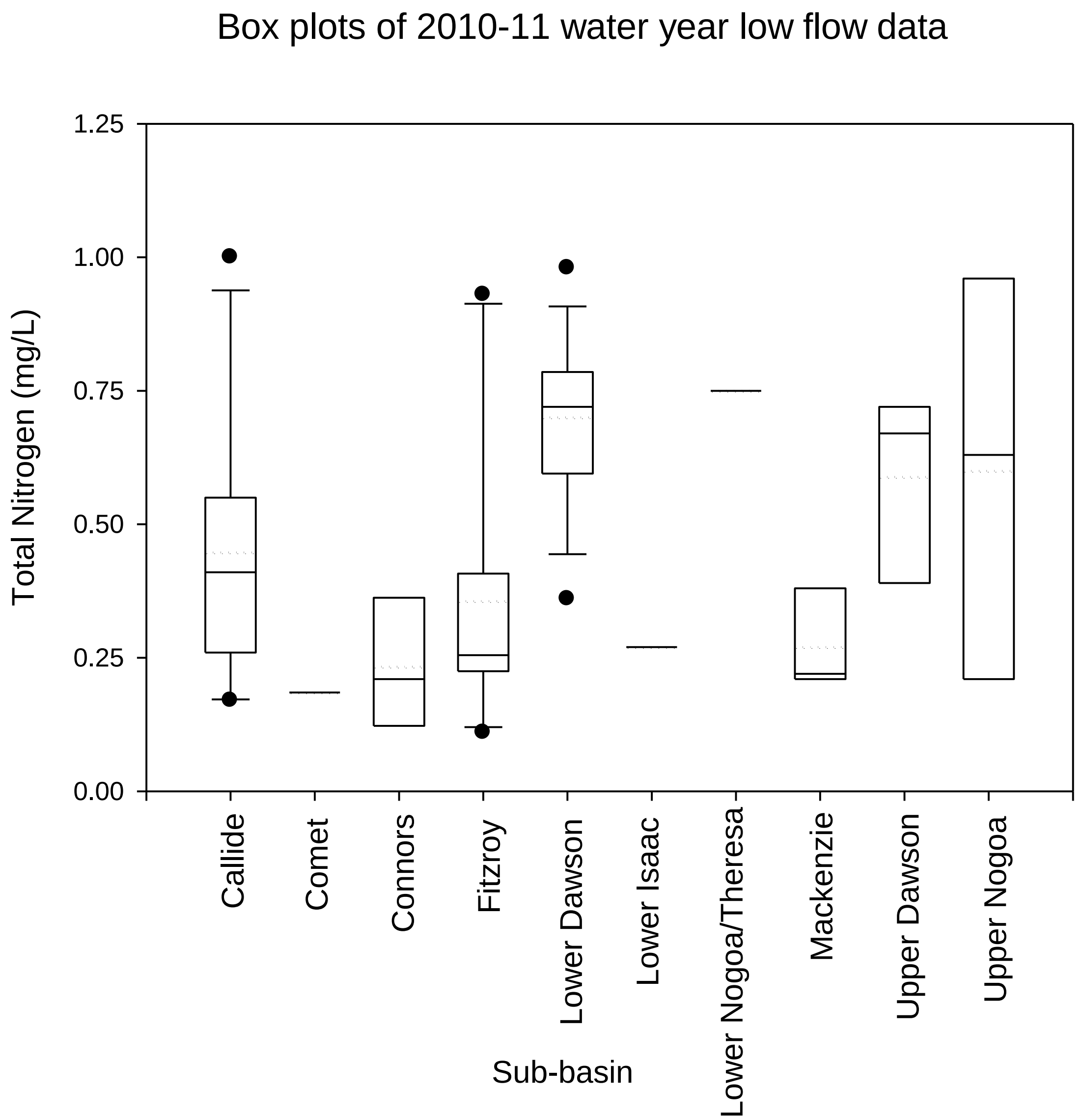


Figure 24 Box plots of the example low flow total nitrogen (mg/L) data.

4.7.11 Total Nitrogen (All flows)

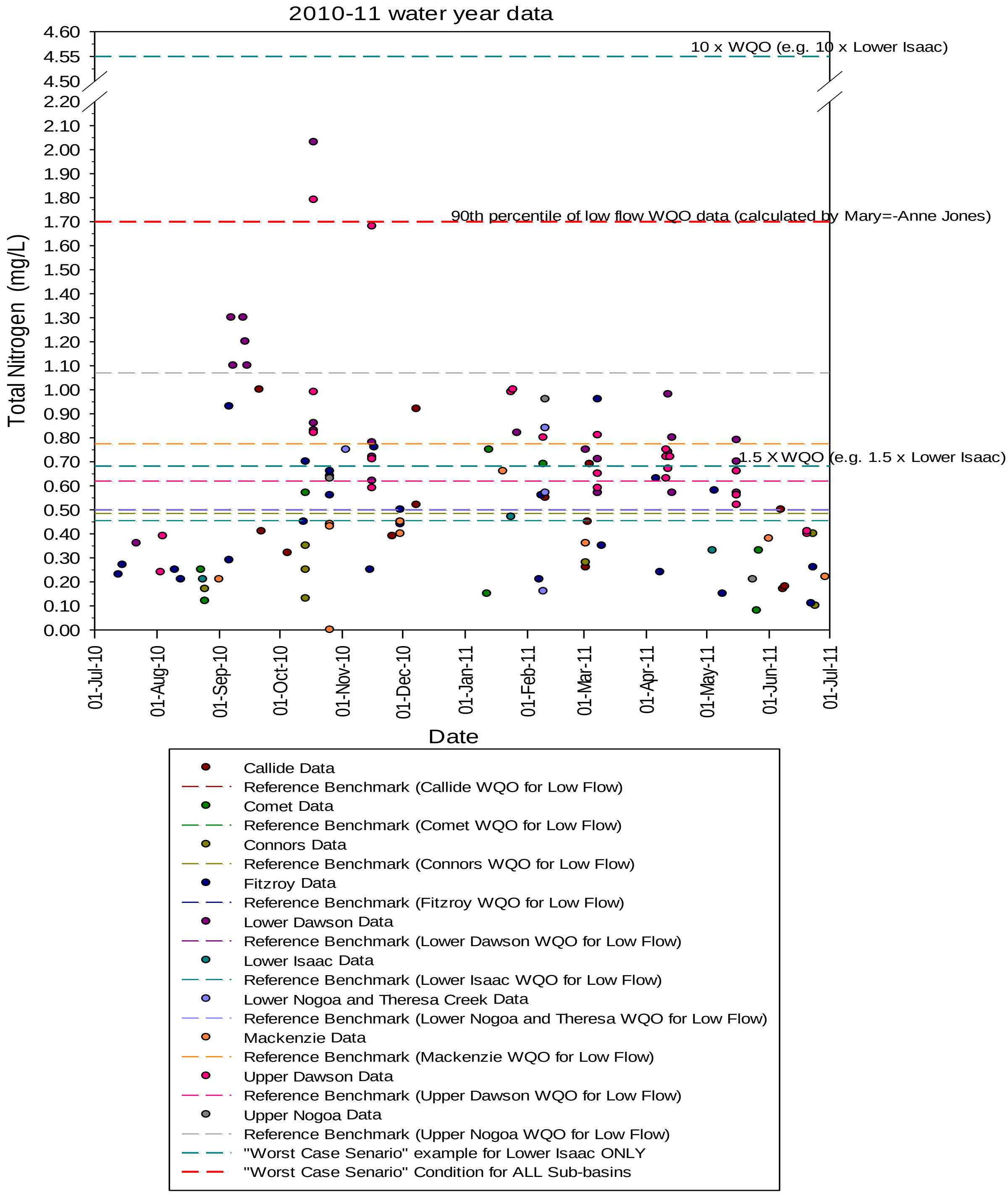


Figure 25 Example of FPRH all flows total nitrogen (mg/L) data with reference benchmarks and worst case scenario options.

Note: WQOs were converted to mg/L; there are different WQO for different sub-basins, so the 1.5 x WQO and 10 x WQO (aqua dashed line) examples given here are only applicable to data corresponding to that basin (specified in the legend).

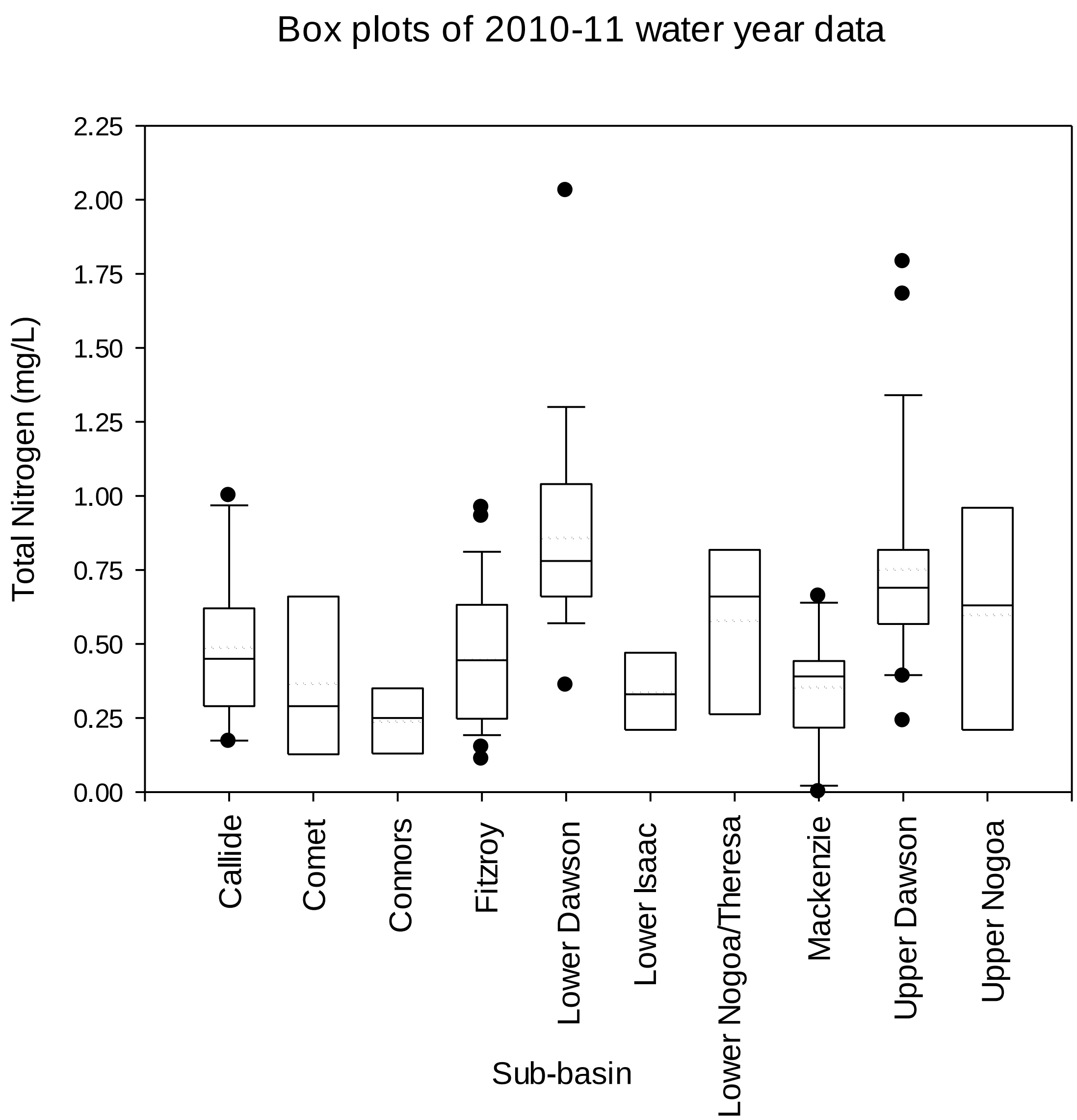


Figure 26 Box plots of the example all flows total nitrogen (mg/L) data.

4.7.12 Nitrate + Nitrite as N (low flow)

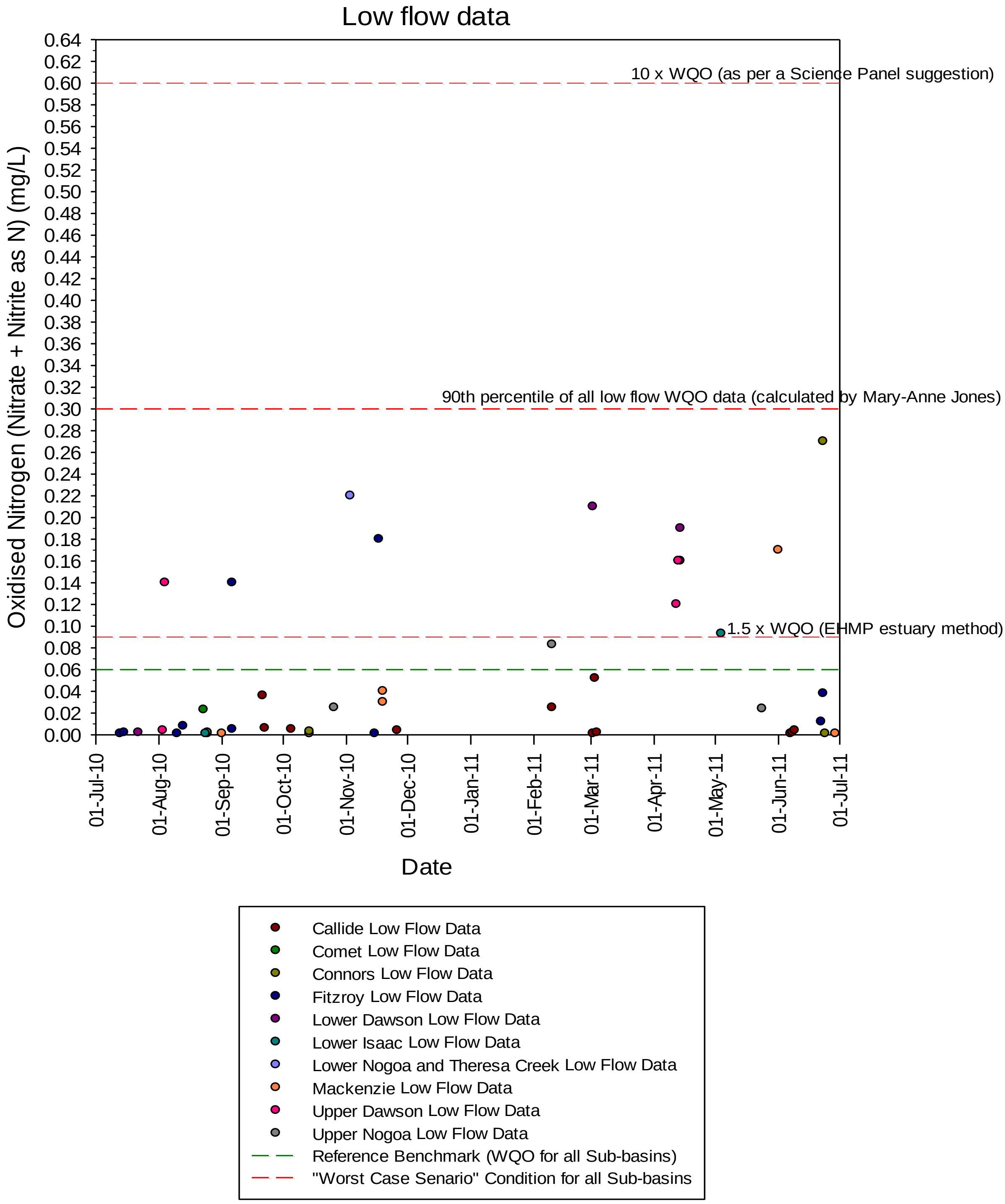


Figure 27 Example of FPRH low flow oxidised nitrogen (mg/L) data with reference benchmarks and worst case scenario options.

Note: WQOs were converted to mg/L.

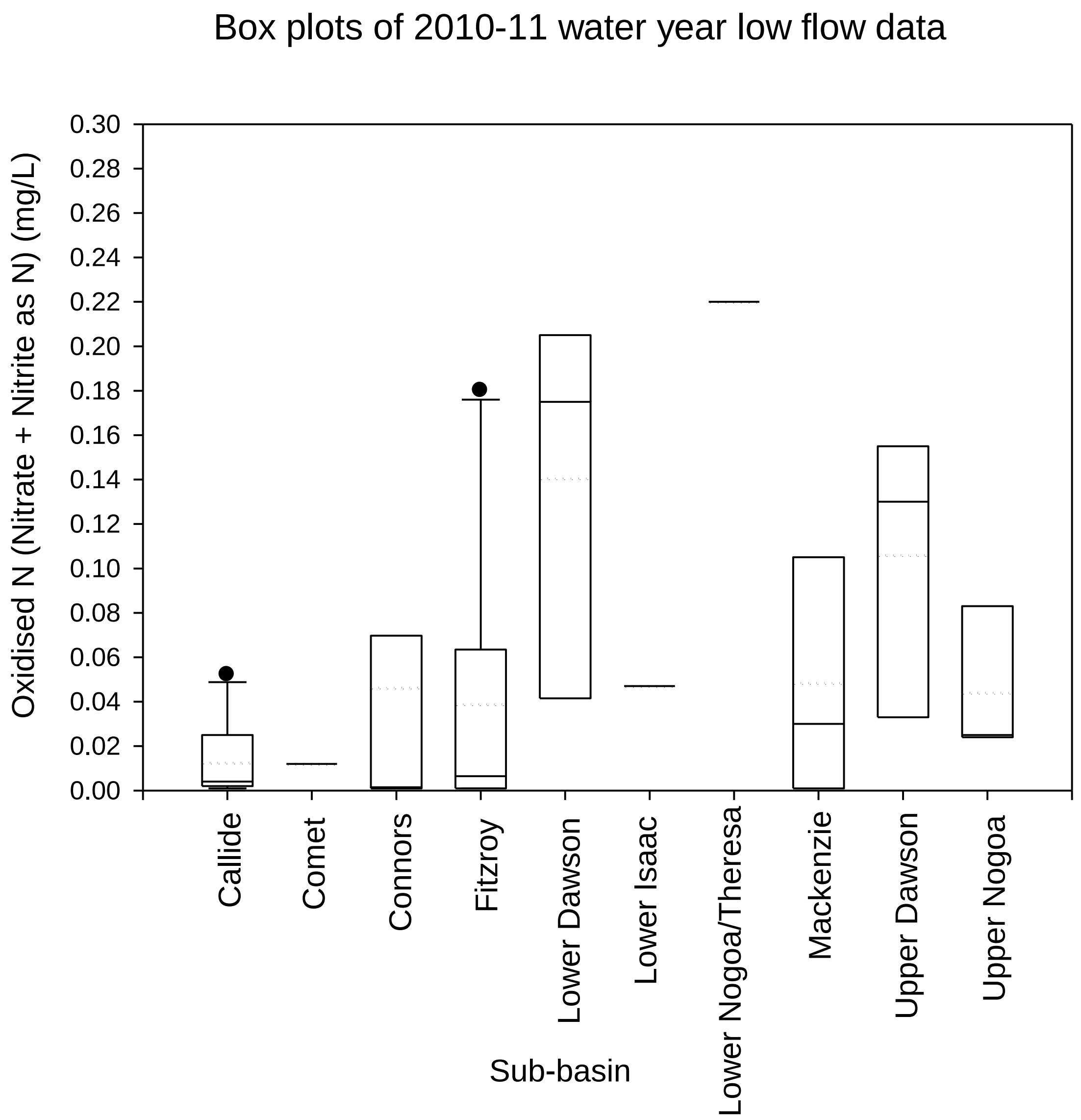


Figure 28 Box plots of the example low flow oxidised nitrogen (mg/L) data.

4.7.13 Nitrate + Nitrite as N (All flows)

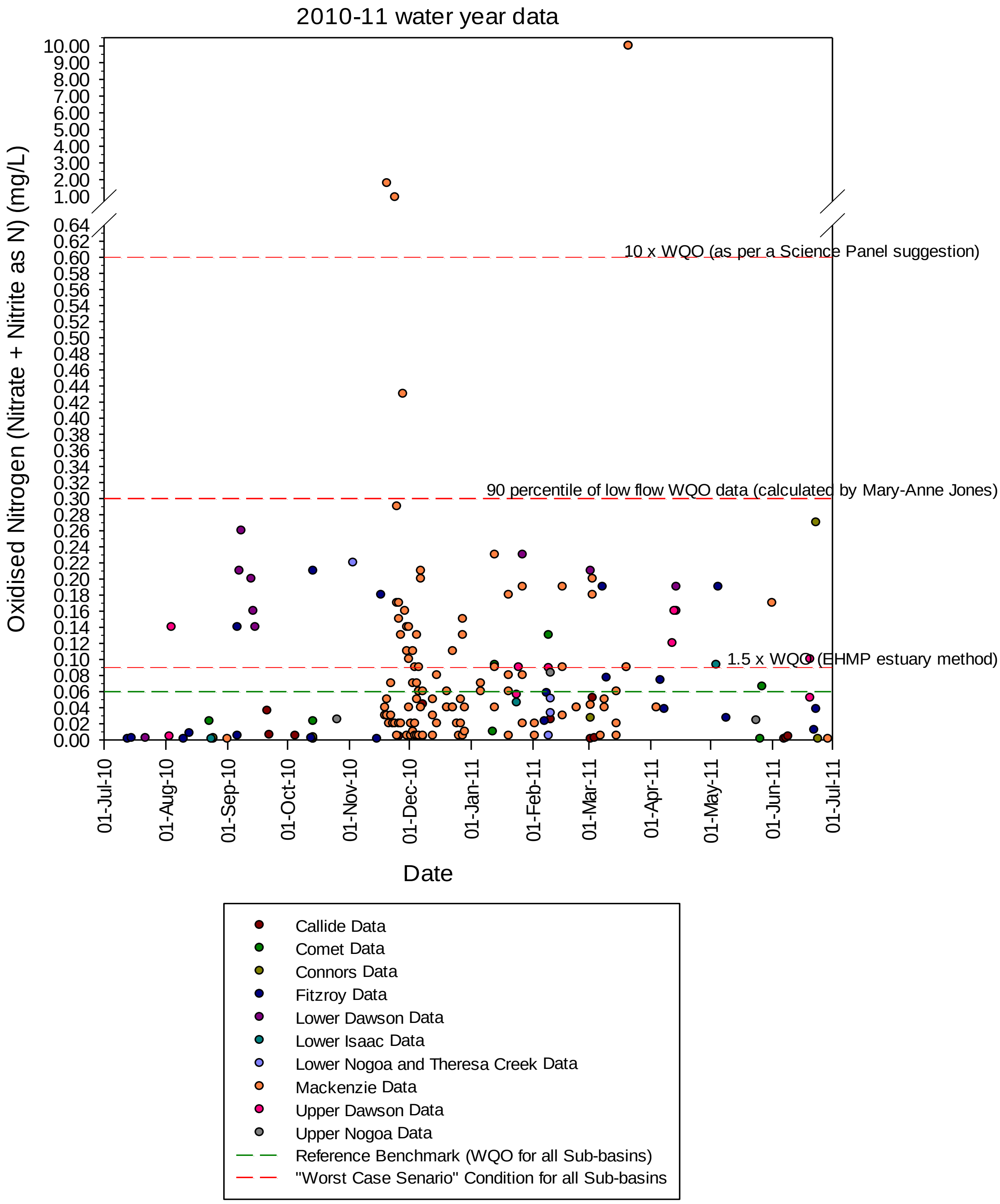


Figure 29 Example of FPRH all flows oxidised nitrogen (mg/L) data with reference benchmarks and worst case scenario options.

Note: WQOs were converted to mg/L.

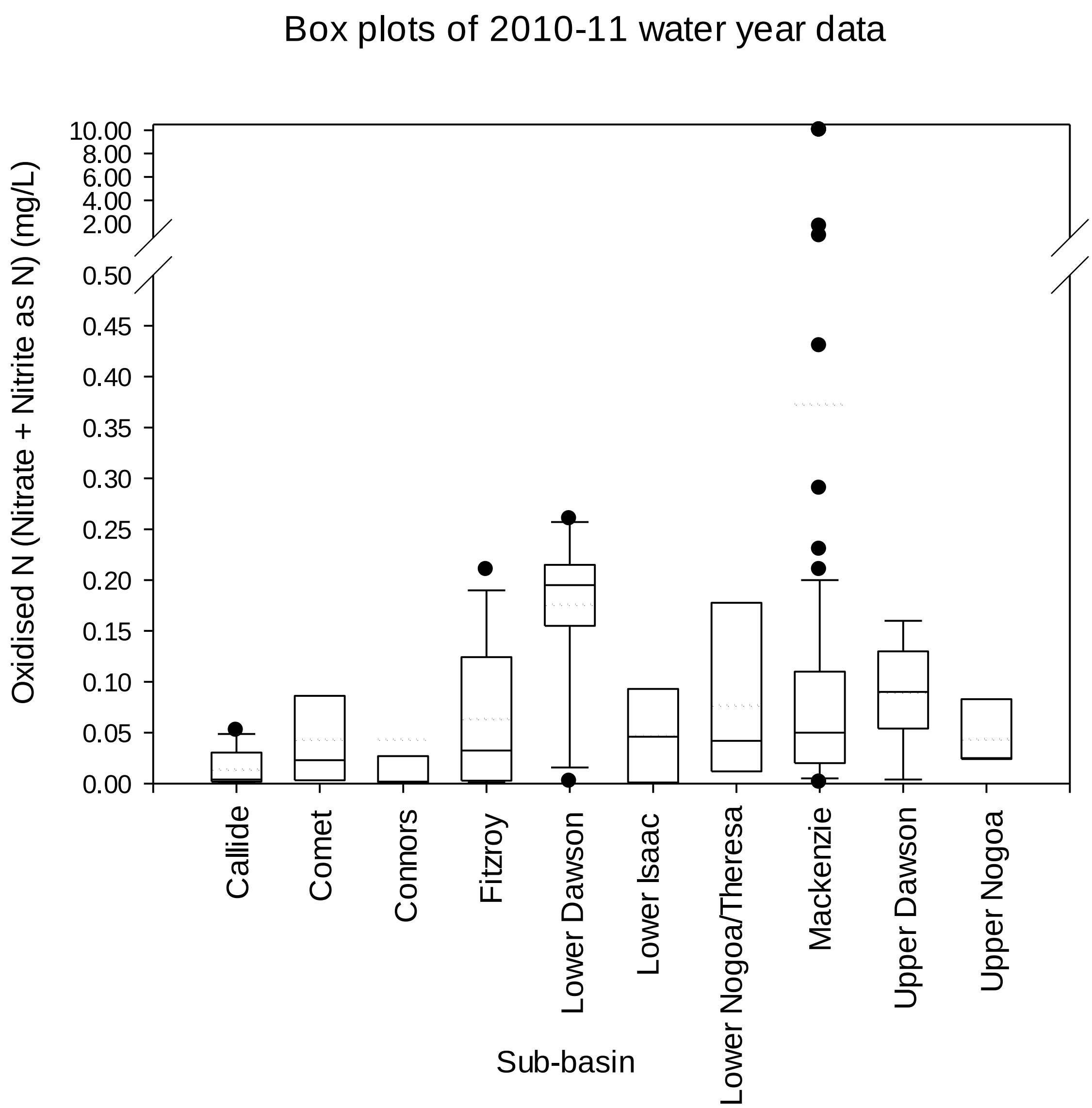


Figure 30 Box plots of the example all flows oxidised nitrogen (mg/L) data.

4.7.14 Total Phosphorus (low flow)

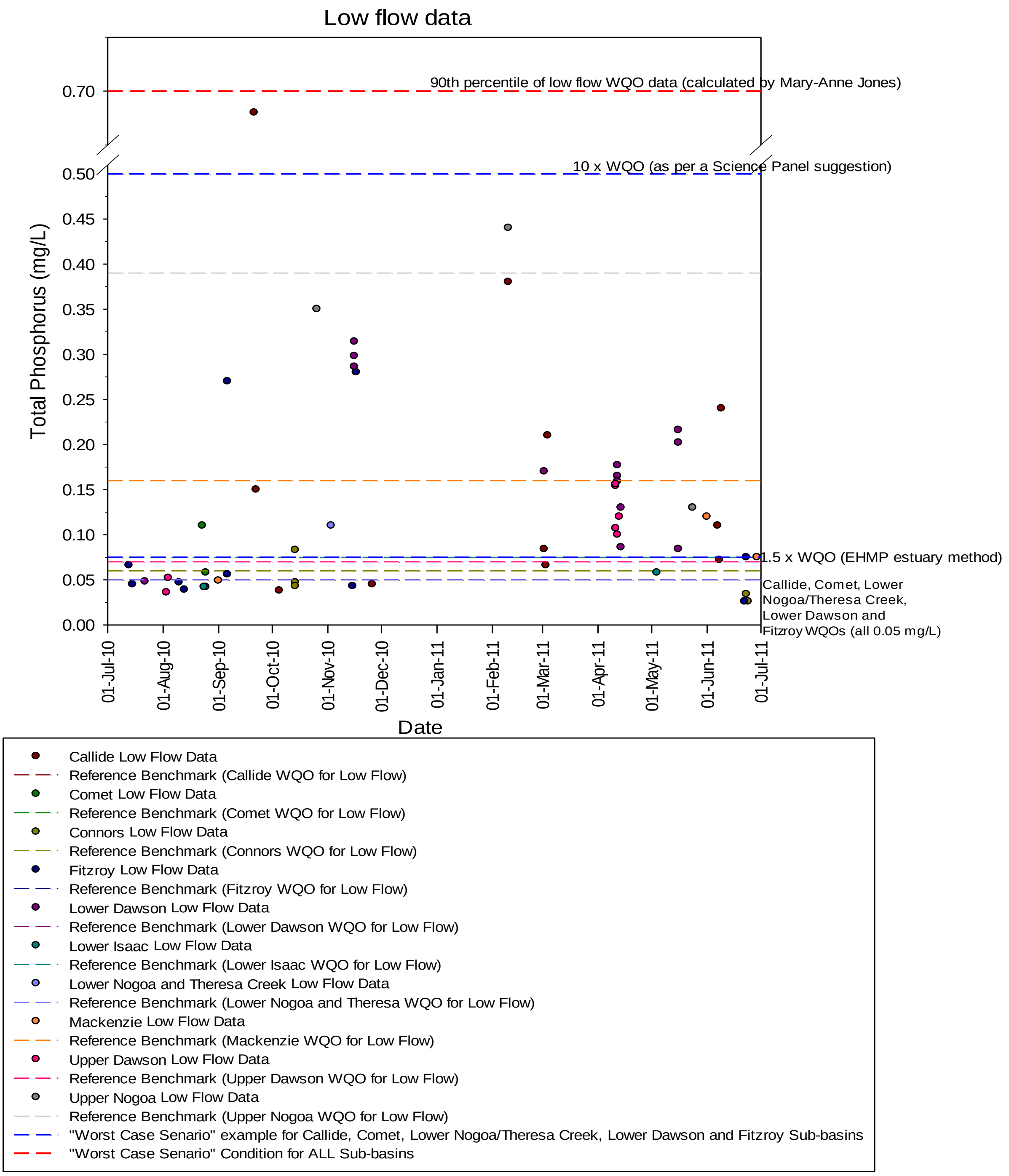


Figure 31 Example of FPRH low flow total phosphorus (mg/L) data with reference benchmarks and worst case scenario options.

Note: WQOs were converted to mg/L; there are different WQO for diff sub-basins, so the 1.5 x WQO and 10 x WQO (blue dashed line) examples given here are only applicable to data corresponding to basin (specified in the legend).

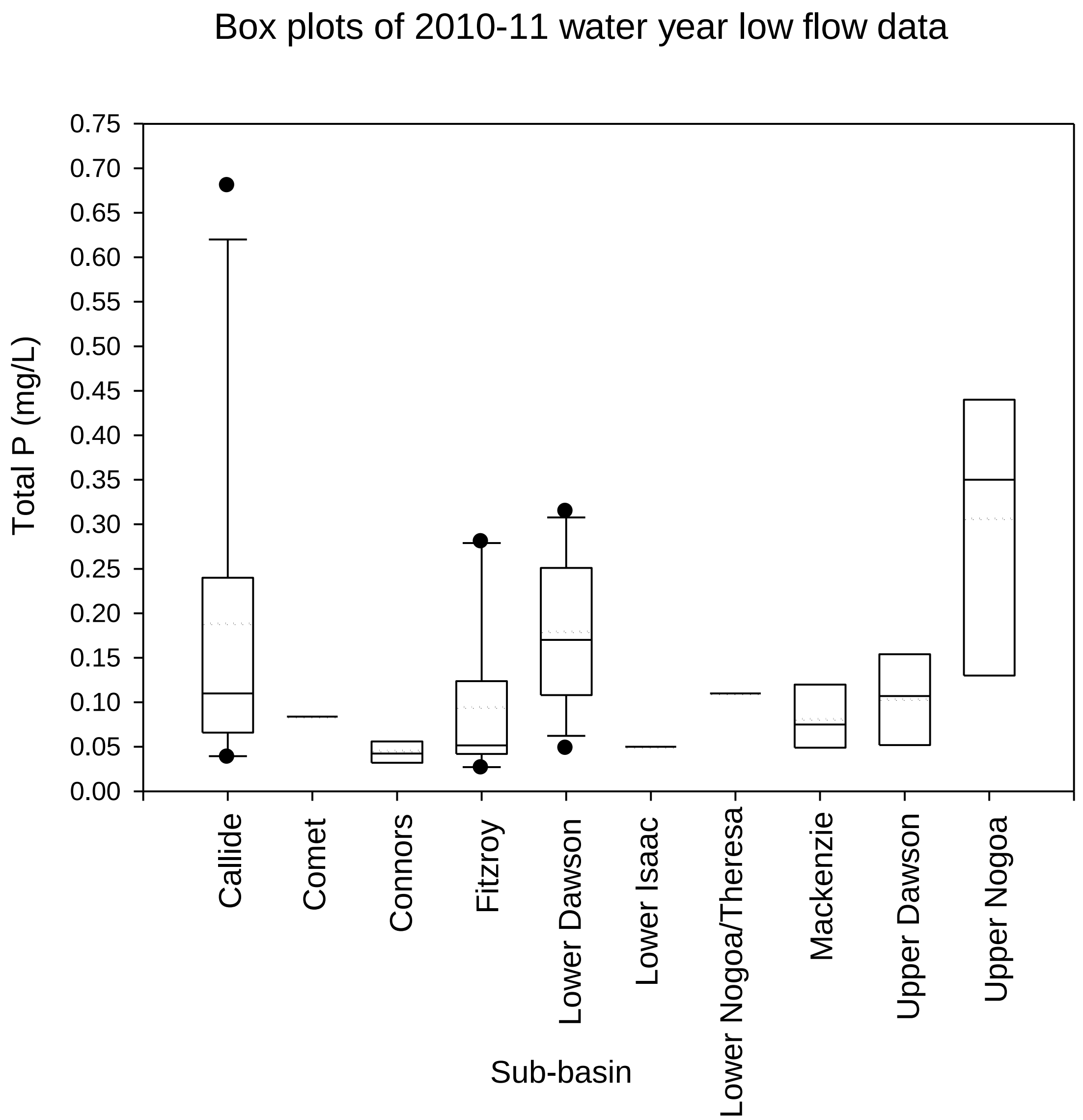


Figure 32 Box plots of the example low flow total phosphorus (mg/L) data.

4.7.15 Total Phosphorus (All flows)

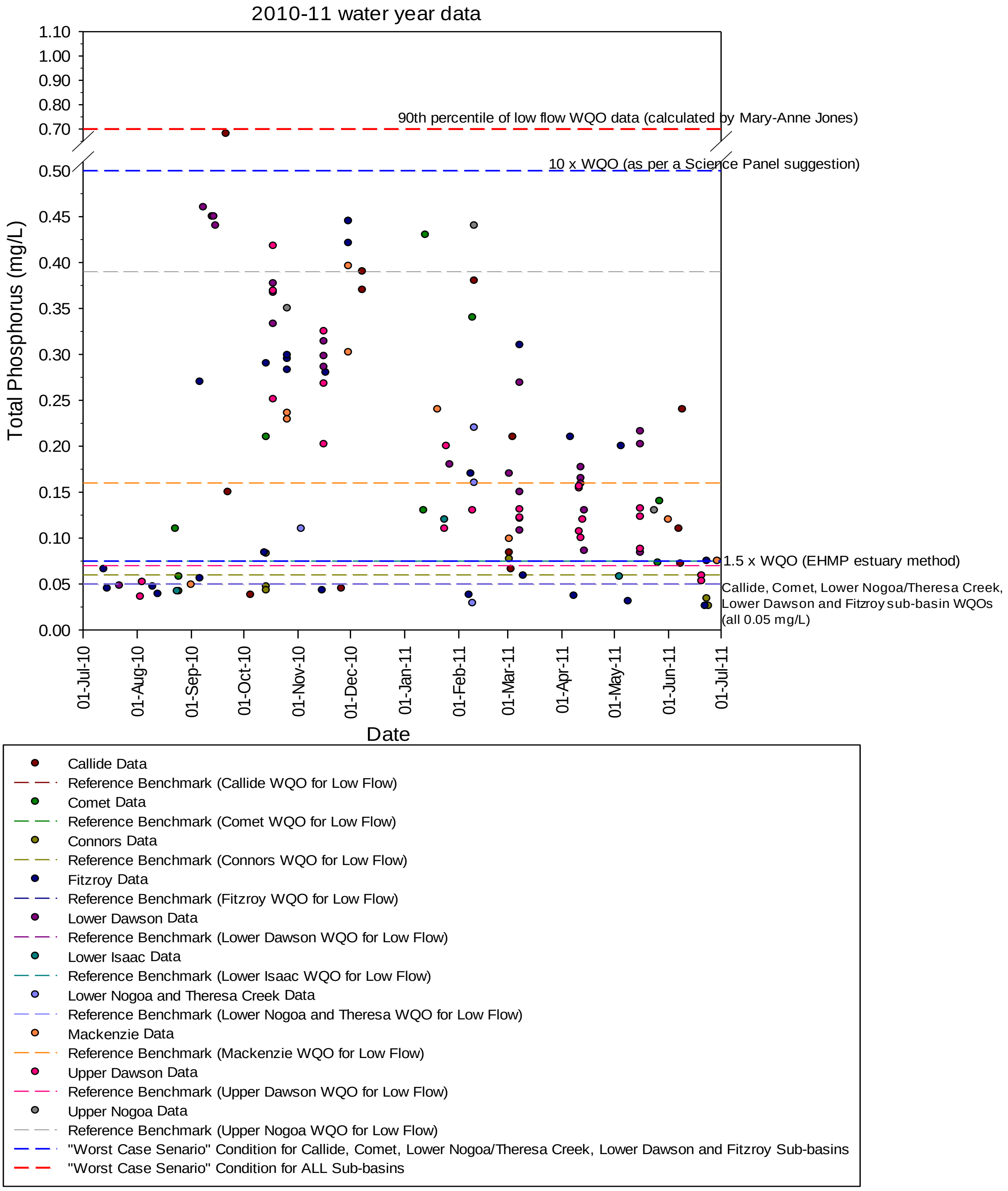


Figure 33 Example of FPRH all flows total phosphorus (mg/L) data with reference benchmarks and worst case scenario options.

Note: WQOs were converted to mg/L ; there are different WQO for diff sub-basins, so the 1.5 x WQO and 10xWQO (blue dashed line) example given here is only applicable to data corresponding to basins (specified in the legend).

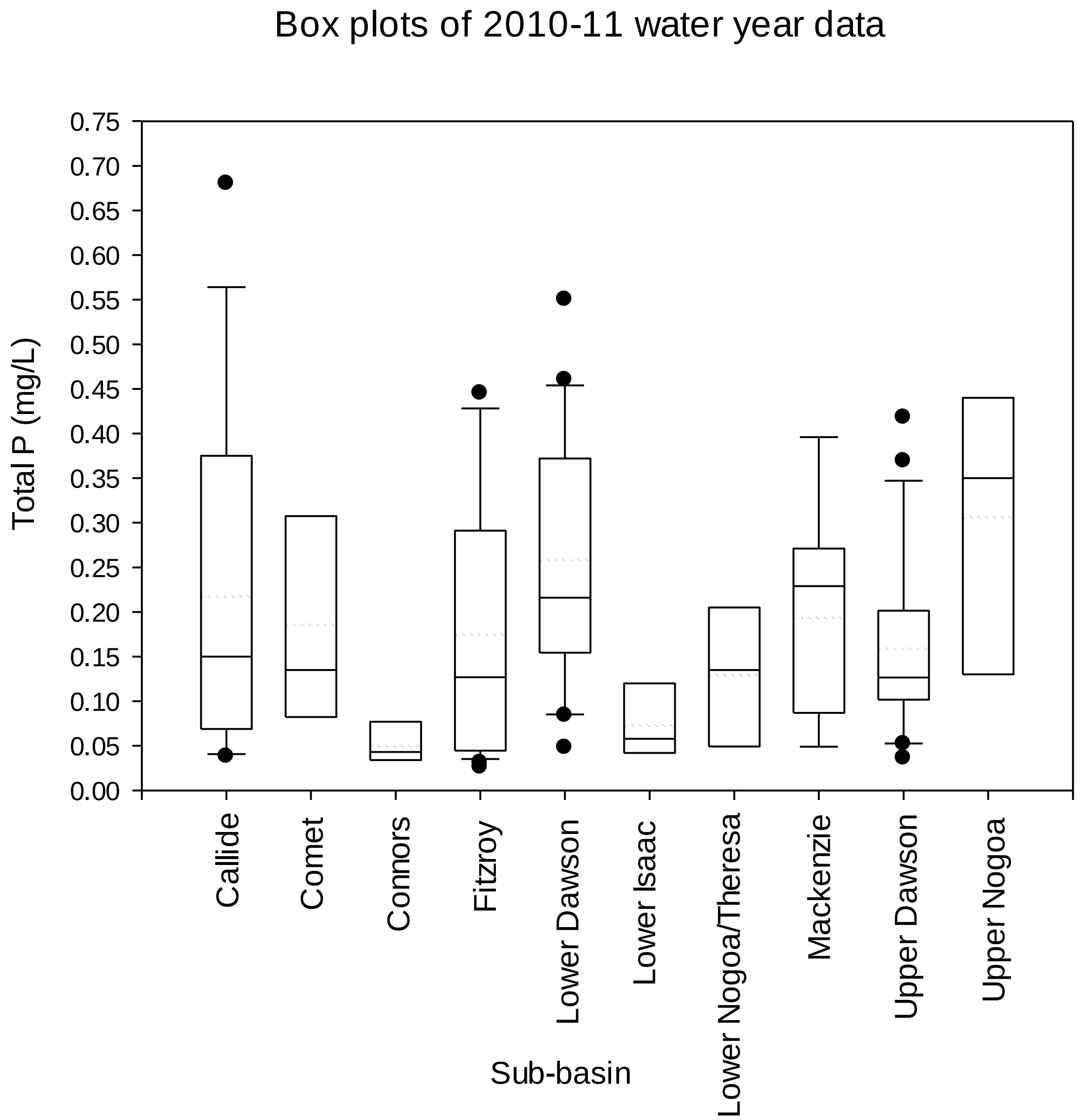


Figure 34 Box plots of the example all flows total phosphorus (mg/L) data.

4.7.16 FRP (low flow)

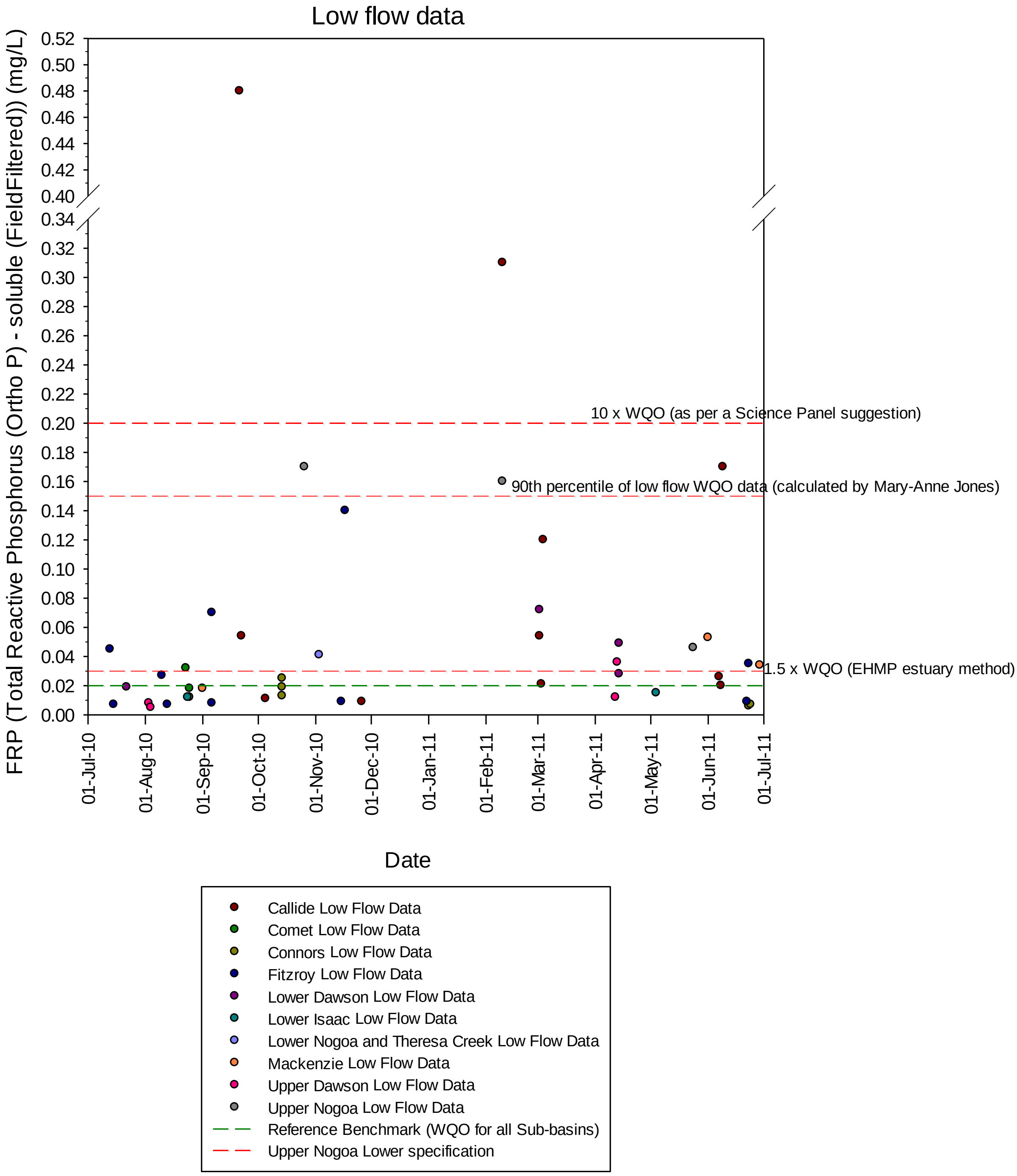


Figure 35 Example of FPRH low flow FRP (mg/L) data with reference benchmarks and worst case scenario options.

Note: WQOs were converted to mg/L

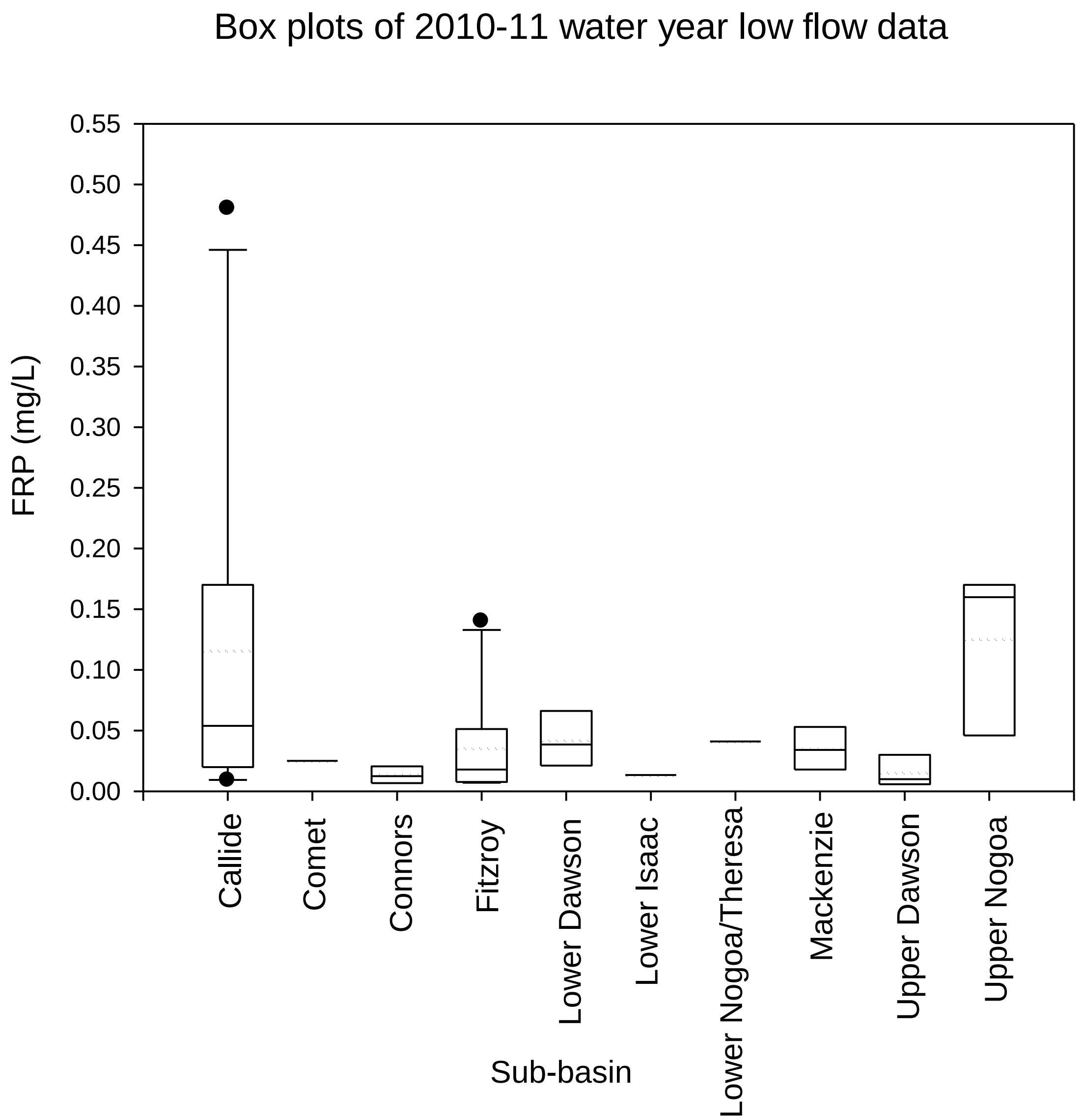


Figure 36 Box plots of the example low flow FRP (mg/L) data.

4.7.17 FRP (All flows)

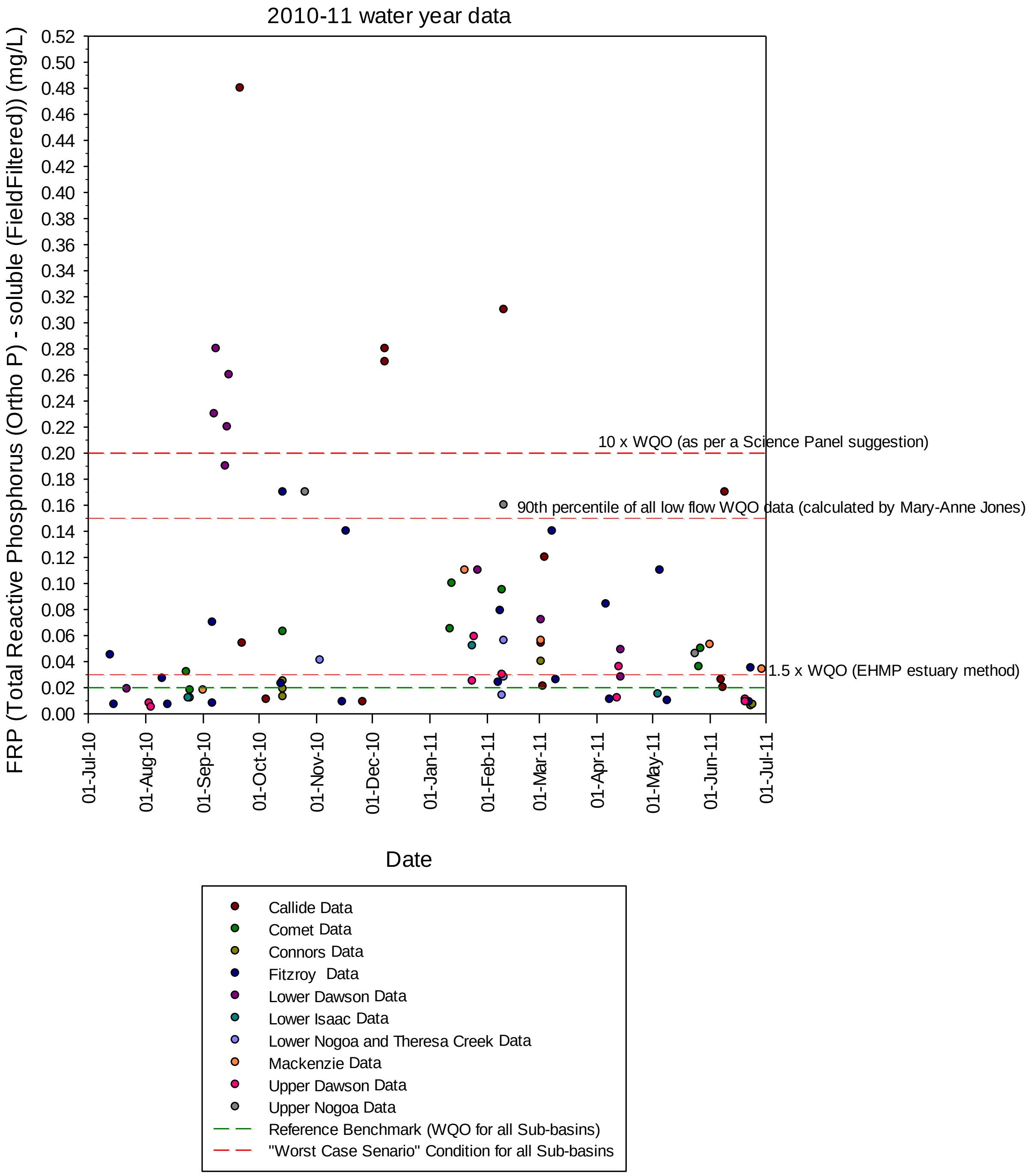


Figure 37 Example of FPRH all flows FRP (mg/L) data with reference benchmarks and worst case scenario options.

Note: WQOs were converted to mg/L.

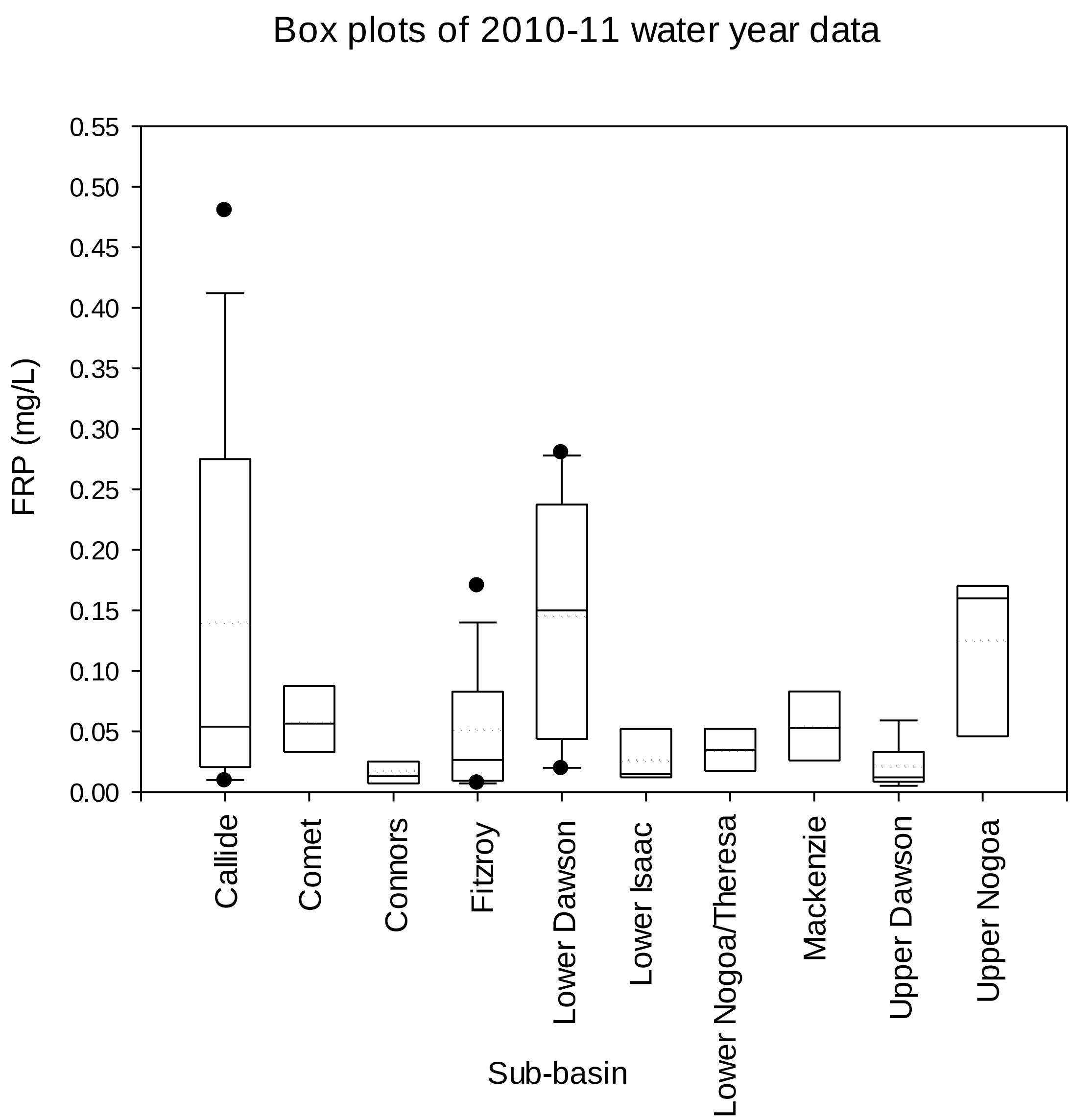


Figure 38 Box plots of the example all flows FRP (mg/L) data.

5.0 DISCUSSION OF FITZROY SPECIFIC EHI CONSIDERATIONS

As discussed in section Part A the Fitzroy Basin is unique in its size and complexity. Some aspects of the nature of the Fitzroy as well as limited published information on ecosystem function in this region raise some additional considerations when choosing indicators and establishing benchmarks for the Fitzroy EHI.

5.1 Variation in physical and chemical parameters including with flow

Variability within the Fitzroy Basin makes assessing ecosystem health in freshwater catchment areas more complicated than would be the case for a more homogeneous system. Significant natural variations in geography, geology, climate and soil types between and also within the catchments of the basin mean that it is necessary to take account of natural differences between sampling sites when identifying and managing perturbations from the natural state of the environment (e.g. to account for differing driving forces). Benchmarks for many potential indicators need to differ between catchments and even between aquatic habitats within catchments (e.g. ephemeral streams vs. permanent streams vs. major river channels) which means that when using a reference-site approach to determining benchmarks it is necessary to ensure reference sites are relevant.

In some areas altitude (highland vs. lowland) is used as a proxy for delineating stream types (e.g. the ANZECC Guidelines). However the guideline default elevation of 150 m AHD for separating these water types does not adequately describe streams in the Fitzroy Basin which would be classified as 'upland' despite the predominance of low relief (Jones and Moss, 2011), meaning this proxy is not as relevant as for other regions.

The Environmental Values and Water Quality Objectives (WQOs) for the Fitzroy Basin, scheduled under the Queensland Environmental Protection (Water) Policy 2009, attempt to deal with some of the variability within the basin by providing different WQOs for each sub-basin/catchment (see Section 5.1 of Part A). Variations within catchments are dealt with in the WQOs by splitting (where possible) the sub-basins into separate water areas/types. Unpredictable patterns of flow and runoff are handled by separating high and moderate flow data such that the WQOs are based on low flow data for most parameters, with additional WQO values provided for electrical conductivity under high flow conditions (Jones and Moss, 2011).

This splitting of the data was undertaken because large differences in physical, chemical and biological parameters were experienced during different flow scenarios (Jones and Moss, 2011), see also section 4.1). One difficulty with this approach to dealing with flow variability is that the WQOs have not been developed for moderate or high flow scenarios, and it is during high flows that the impacts of agricultural land use will likely be most evident (e.g. increased sediment and pesticide runoff) and that coal mine pit water is typically released (to minimise any impacts of these waters through dilution). As a result there are no thresholds against which to measure natural vs. anthropogenic changes that result from high flow events, except EC, at a time during which aquatic ecosystems are most vulnerable. A second difficulty with the data splitting approach is that it may sometimes be difficult to differentiate between low, moderate and high flow events.

5.2 Accounting for differences in flow

There are at least two possible methods of accounting for differences in flow when interpreting physical and chemical data. The first is to develop different benchmarks or threshold values for each flow scenario – high, moderate, low and nil flow. The complication with this approach is that single values for high and moderate flow scenarios may themselves be difficult to identify and may incorporate too much variation/error to be meaningful.

An alternate method of dealing with flow variability is to use predictive functions, such as mixing models, rather than static benchmarks for ecosystem health indicators. This would allow the indicator level to adjust with flow levels. This approach has been suggested in a short paper from the Murray-Darling Independent Audit Group for Salinity which describes a methodology and algorithm for analysis of flow hydrographs (Shaw, 2009). The resulting relationship can be used to determine baseflow ions (in this case electrical conductivity is described) and the shape of the relationship with stream flow. The approach overcomes the difficulties of using just high and/or low flow measures which make it difficult to compare flow periods or determine between advancing versus receding flows which give different readings (R. Shaw, 2012, pers. comm.).

Attention needs to be given to considering appropriate trending benchmarks or mixing models that can allow for the interpretation of catchment monitoring data in relation to local/regional trends. In the meantime the best available option and a realistic starting point is the suite of benchmarks provided by the WQOs for the Fitzroy in combination with the Queensland Water Quality Guidelines and the ANZECC Guidelines.

5.3 Understanding and assessing ecosystem resilience

Ecosystem resilience is an emerging science in the fields of marine and aquatic ecology. Walker et al. (2011) describe resilience as "...the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks." To attempt to address the question of how effectively the ecosystem might recover from stress, the proposed criteria for selecting indicators to include in an Ecosystem Health Index for the Fitzroy Basin (Section 2.2 of this report) incorporates a criterion that considers the ability of an indicator to contribute to an assessment of ecosystem resilience. For some indicators this will be possible to determine but for others not enough is yet known on this subject to make an accurate assessment. Defining ecosystem health indicators in a way that will provide insight into the resilience of an ecosystem and interpreting benchmarks in relation to ecosystem resilience are tasks that require application of the concepts of resilience and indicators to the Fitzroy.

As described in section 4.0 of Part A, the Fitzroy Basin is characterised by a highly variable flow regime with ephemeral streams in its upper reaches (Hart, 2008). Periods of drought and seasonal drying are likely equally important as flood events in driving ecosystem function. The prevalence of ephemeral streams in the basin makes application of some aquatic ecosystem health indices (such as SIGNAL scores, see Section 5.2 of Part A) problematic. This issue is particularly relevant in relation to biotic indices and biological indicators in general. A research project to develop an AUSRIVAS model and test some biotic (macroinvertebrate) indices that are applicable to the Fitzroy Basin is currently underway at CQUniversity. This project runs until 2014 and will be available to contribute to future revisions of the Ecosystem Health Index.

5.4 Causality of changes in the state of the environment

This review has used the DPSIR framework to identify possible indicators for inclusion in the Ecosystem Health Index for the Fitzroy Basin (Section 4.4 of Part A). This framework has been suggested as a means of allowing the interpretation of causality and differentiation between natural variation and anthropogenic impacts on ecosystem health. By employing the framework to identify indicators, the *effects* of driving forces, pressures, state, impacts and responses are implicitly covered by the potential indicators suggested. However, due to known data limitations the indicators chosen in this report mostly fall within the classifications of state and impact. Many potential response indicators will be covered by a separate process being run concurrently by FPRH (FPRH Review of Stewardship Measures). Potential indicators within the remaining categories, driving forces and pressures, have not yet been proposed.

The recent review of the EHMP included a recommendation to add a “Drivers and Pressures Monitoring Program” to collect information about key drivers of water quality and ecosystem health and pressures on water quality and ecosystem health at a catchment or waterway scale (FBA, 2011). The additional monitoring program would also aim to add to interpretation of data and help to inform and prioritise future management actions (FBA, 2011).

Ideally this recommendation to EHMP should be taken into account in developing an Ecosystem Health Index for the Fitzroy Basin. While the use of the DPSIR framework to select potential indicators provides some indication of causality there remains a need to develop meaningful indicators of driving forces and pressures in the Fitzroy Basin based on causal relationships. The lack of baseline and/or reference data on which to base assumptions about natural variations in ecosystem health within the basin, in combination with the large variety of possible anthropogenic pressures and the diffuse nature of many of these pressures, currently limit the possibility of tracing causality from state and impact indicators back to driving forces and pressures. For this reason the most effective means of approaching causality will be to develop indicators that directly relate to driving forces and pressures in the basin, and upon which assumptions of possible changes to the state of the environment can be based.

5.5 Ecological relevance of indicators and available data

As for any index, one complexity in relation to interpretation of benchmarks is the selection of indicators for a particular parameter. It is necessary to carefully consider the relevance and reliability of the data collected in the Fitzroy for particular parameters in order to make ecologically relevant indicator choices. Some parameters need to be treated carefully, understanding the ecological significance of the data that are currently available.

As an example, the South East Queensland EHMP includes the parameter dissolved oxygen (DO) within the Physical and Chemical category of the index. However, the EHMP monitors diel DO concentrations by logging the ambient DO concentration every 10 minutes over a 24 hour period. The actual indicators of DO that are included in the index are diel minimum (5^{th} percentile) and diel (24 hour) range. While DO data are available in the Fitzroy Basin, it is probable that most readings are static “spot checks” and do not take account of the significant diel fluctuations in DO that may occur over a 24 hour period due to chemical and biological functions of the ecosystem. DO concentration is influenced by temperature and in some conditions, such as during periods of low flow and high biological oxygen demand, DO may undergo extreme fluctuations over 24 hours. In some water bodies DO concentration can vary from almost anoxic conditions at dawn (which would be lethal to some biota) to normoxic conditions in the evening (e.g. (Flint et al., 2012, Pearson et al., 2003). In such situations the diel DO cycle may have deleterious impacts on aquatic biota which cannot be identified unless 24 hour monitoring is undertaken. A spot check measure of DO taken in the afternoon in such a scenario would be much higher than a measure taken at dawn, and would therefore give a much better than realistic signal of ecosystem health.

5.6 Double counting of changes in ecosystem health

The selection of appropriate parameters to be used as indicators of ecosystem health in the Fitzroy is complicated by the potential for “double counting” of impacts, particularly in cases where (known or unknown) causal correlations exist between indicators. For example, some of the potential indicators within the proposed Ecology Category, Invertebrates and Fish are likely candidates for double counting of impacts due to the effects of indicators within the Physical/Chemical and Toxicants categories. In the Dee River there are no fish living in waterways for some distance downstream of Mt Morgan Mine (Taylor et al., 2002). It is highly probable in this scenario that a poor result for the indicator Observed/Expected fish assemblages is being caused by a combination of Physical/Chemical and Toxicant indicators such as pH and heavy metals. By providing scores for the Physical/Chemical and Toxicant indicators, as well as biotic indices, the cause and effect of one issue are being counted twice.

It may be possible to deal with double counting by means of the scoring methodology that is developed. By carefully considering the weighting of each indicator within each category, and within the Ecosystem Health Index as a whole, the impact of double counting may be minimised. Another approach would be to avoid double counting by excluding some indicators. However excluding indicators solely to avoid double counting is not ideal, as the synergistic effects of multiple stressors may be missed by excluding process and taxa indicators, while the exclusion of physical and chemical indicators may cut out valuable links in the causal chain of changes in the state of the ecosystem. For known causal correlations between indicators such as the example of the Dee River described above it may be possible to employ expert knowledge to effectively manage the potential for double counting using the scoring methodology. The most elusive aspect of this issue is when causal correlations are unknown or when there are a large number of indicators interacting within an ecosystem in a very specific and complex manner. The double counting issue is one reason that the combinations of parameters included within the Ecosystem Health Index need to be carefully selected to provide an assessment at a whole of system level.

5.6 Scoring indicators within the Ecosystem Health Index

Important aspects of the methodology for consideration in the context of this report include the complexities relating to the weighting of categories and indicators within the Ecosystem Health Index, weighting of indicators within categories, and differences between indicators depending on the aquatic environment in question (fresh vs. estuary vs. marine waters). There is also a need for alternative weightings for different habitats within each environment, particularly in freshwaters, for example ephemeral vs. permanent streams.

As described above the scoring methodology may be used to deal with issues such as the potential for double counting. Other ways in which weightings may be used to account for complexities in the Fitzroy Basin include by assigning higher weightings to indicators that have a higher contribution to ecosystem health, or by giving lower weightings to indicators that are known to vary naturally (e.g. some metals are naturally higher in some catchments) and higher weightings to indicators that are only affected by anthropogenic disturbances. This may be hampered to some degree by the current lack of knowledge on ecosystem function in the Fitzroy, and by the possibility that the importance of some indicators will vary significantly with factors such as flow, season and locality or even in the presence of other indicators. The correct weighting may be difficult to determine in these instances but priority could be given to research that will help to improve weighting methodology in the future. However, more data may be needed in order to fully determine and account for variability.

5.7 Predicting changes in ecosystem health

Information and data sufficient to develop suites of predictive models to act as benchmarks are also currently limited for the Fitzroy Basin. This was discussed in relation to flow in Section 5.2 above. Another more complex example is that consideration of historical weather patterns shows a clear pattern between drought/flood cycles and the ENSO and PDO phenomena (see Section 3.2 of Part A). Incorporating this information into a model that predicts fluctuations in ecosystem health indicators based on variables such as flow would potentially allow for the development of predictive functions of ecosystem health that could be used to inform management decisions in advance of deleterious impacts on the state of the environment. Using the information available at this time (including all available historical monitoring data) it may be possible to begin to develop such a model for use in the Fitzroy Basin.

6.0 CONCLUSION

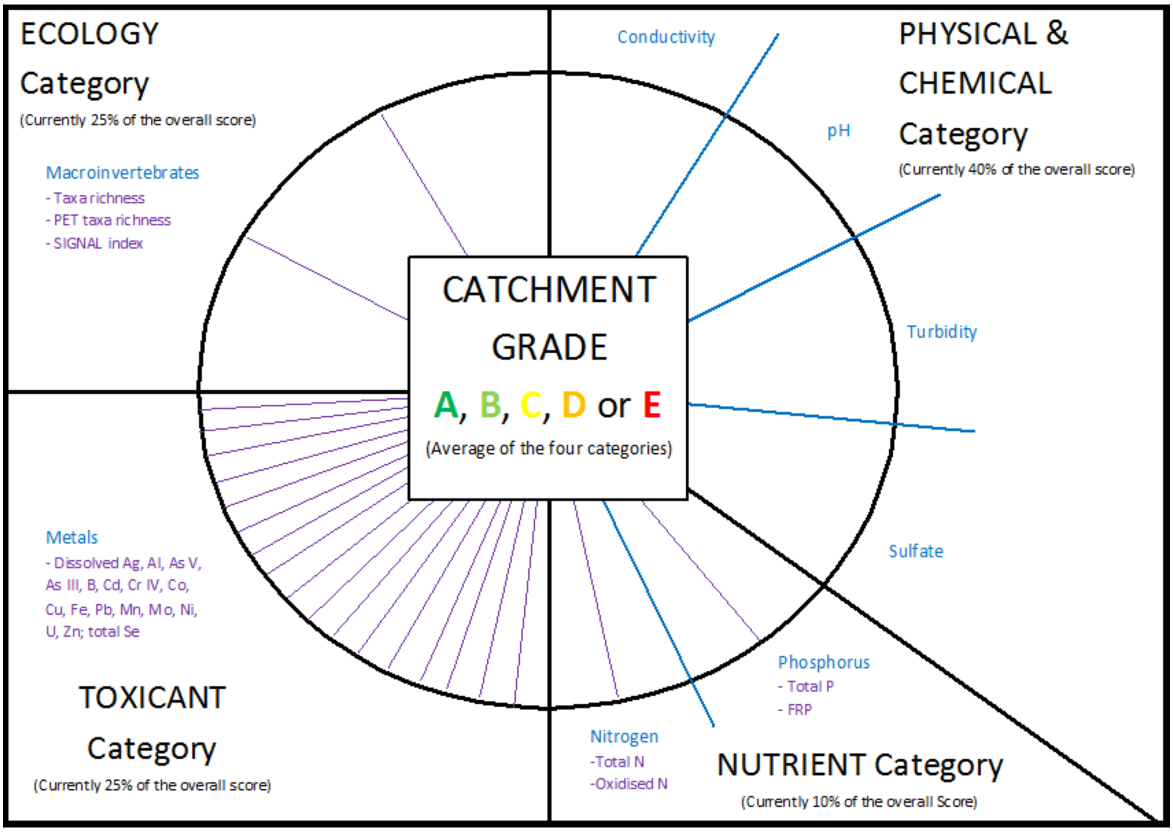
This report is part of the second volume (Part B) of the Technical Review for the Development of an Ecosystem Health Index and Report Card for the Fitzroy Partnership for River Health. This report discussed the methodology and data analysis used to propose an Ecosystem Health Index (EHI) for the freshwater (catchement) component of the Fitzroy Basin.

This report followed on from "Part A: Review of Ecosystem Health Indicators for the Fitzroy System". Part A included an overview of ecosystem health as well as a review of the relevant guidelines and other ecosystem health monitoring programs and ecosystem health indices. Part A also summarised the historical and current land uses and water quality of the Fitzroy Basin. That information was then used to develop a framework for identifying indicators of ecosystem health that could be included in an EHI and Report Card for the Fitzroy Basin.

Based on the reserach undertaken in Part A a list of potential indicators was generated. This list was then reduced to those indicators of gretest priority to the Fitzroy Basin. Prioritisation was performed by CQUniversity, the FPRH Science Team and the FPRH Science Panel. A set of indicator selection criteria was derived and used by CQUniversity. The resultant indicators were identified in this report and the proposed method to score and index the FPRH monitoring data was discussed.

The research also identified a number of suitable benchmarks to incorporate into an EHI and provided methodological advice on scoring and weighting of indicators within the final index. Data gap analysis that may guide future refinement of the index was addressed and recommendations for other indicators to be included or reviewed in future years was also be made.

The final proposed Freshwater (catchment) EHI for the Fitzroy System was summarised by the following diagram:


ECOLOGY
Category
(Currently 25% of the overall score)
Macroinvertebrates
- Taxa richness
- PET taxa richness
- SIGNAL index
Conductivity
pH
PHYSICAL & CHEMICAL Category
(Currently 40% of the overall score)
Turbidity
Sulfate
CATCHMENT GRADE
A, B, C, D or E
(Average of the four categories)
Metals
- Dissolved Ag, Al, As V, As III, B, Cd, Cr IV, Co, Cu, Fe, Pb, Mn, Mo, Ni, U, Zn; total Se
TOXICANT Category
(Currently 25% of the overall score)
Phosphorus
- Total P
- FRP
Nitrogen
-Total N
-Oxidised N
NUTRIENT Category
(Currently 10% of the overall Score)

APPENDIX I POPULATED MATRIX OF POSSIBLE INDICATORS AND THEIR SUITABILITY FOR APPLICATION IN THE FRESHWATER (CATCHMENT) EHI FOR THE FITZROY SYSTEM

Every indicator was assessed against the three critical selection criteria (SC1, SC3, SC5) first but was only assessed against the remaining 13 criteria it scored higher than 5 in all three critical criteria. Note: that the answers to the selection criteria may be slightly subjective, but have been filled out in good faith to the best knowledge and information available to the authors.

Category	**Data**				**Interpretation and communication**				**Relevance**				**Practicality and timeliness**				**Total score (%)**
Selection criteria (SC)	SC1 – Reliable data currently available for the Fitzroy Basin*	SC2 – Suitable interpretative algorithms are available	SC3 – Errors, reliability and uncertainty in measurement are known and acceptable*	SC4 – Temporal and spatial variability can be accounted for	SC5 – Guidelines/ objectives are in place and relevant to the region*	SC6 – Used in other monitoring programs (consistent with other regions, states, nations)	SC7 – Scientific interpretation is straightforward and meaningful	SC8 – Simple to communicate and good public understanding	SC9 – Important to ecosystem function (will exposure cause serious environmental effects?)	SC10 – Sensitive to changes in ecosystem function	SC11 – Contributes to assessment of ecosystem resilience	SC12 – Related to regional, state, national, international policies and management goals	SC13 – Feasibility and logistics to measure (monitor and analyse) are consistent with outcome benefits	SC14 – Time requirements to measure (monitor and analyse) are consistent with outcome benefits	SC15 – Costs to measure (monitor and analyse) are consistent with outcome benefits	SC16 – Provides an early warning of ecosystem health decline	

Descriptions and (scores)	Yes (10) Probably (7.5) **Possibly (5) Probably not (2.5) No (0)**	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	Yes (10) Probably (7.5) **Possibly (5) Probably not (2.5) No (0)**	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	Yes (10) Probably (7.5) **Possibly (5) Probably not (2.5) No (0)**	Yes, all (10) Most (7.5) Some (5) Few (2.5) No, none (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No/unknown (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No/unknown (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No/unknown (0)	Yes, all (10) Most (7.5) Some (5) Few (2.5) No, none (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No (0)	Yes (10) Probably (7.5) Possibly (5) Probably not (2.5) No/unknown (0)	
pH	10	10	10	5	10	7.5	10	7.5	5	7.5	7.5	7.5	10	10	10	7.5	**84**
Conductivity base flow	10	10	10	5	10	5	7.5	5	5	5	7.5	7.5	10	10	10	7.5	**78**
Conductivity high flow	10	10	7.5	5	10	5	7.5	5	2.5	5	5	5	10	10	10	5	**70**
Total suspended solids	10	10	7.5	5	10	5	7.5	2.5	5	5	5	5	7.5	5	10	5	**66**
Turbidity	10	10	10	5	5	7.5	7.5	5	5	5	7.5	7.5	10	10	10	7.5	**77**
Ions	7.5	N/A	7.5	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**50**
SAR	0	N/A	7.5	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**25**
RA	0	N/A	7.5	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**25**
Sulfate	10	10	10	7.5	10	5	7.5	5	5	7.5	5	5	10	7.5	7.5	7.5	**75**
Fluoride	7.5	N/A	7.5	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**50**
Ammonia as N	7.5	10	7.5	7.5	10	5	7.5	5	7.5	7.5	5	5	7.5	5	5	5	**67**
Nitrite as N	7.5	N/A	7.5	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**50**
Nitrate as N	7.5	10	7.5	7.5	2.5	5	7.5	5	5	5	5	5	7.5	7.5	7.5	5	**63**
Oxidised N	10	10	7.5	7.5	10	5	7.5	5	7.5	7.5	5	5	7.5	7.5	7.5	7.5	**73**
Total Nitrogen as N	10	10	10	7.5	10	7.5	10	7.5	5	7.5	5	7.5	7.5	7.5	7.5	7.5	**80**

Dissolved Inorganic Nitrogen	2.5	N/A	7.5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**
Total Phosphorus	10	10	10	7.5	10	7.5	10	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	**83**
Filterable Reactive Phosphorus	10	10	7.5	5	7.5	5	7.5	5	7.5	7.5	7.5	5	7.5	7.5	7.5	7.5	**72**
Chlorophyll- a concentration	0	N/A	7.5	N/A	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**58**
Tebuthiuron	0	N/A	7.5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**
Atrazine	0	N/A	7.5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**
Diuron	0	N/A	7.5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**
MEMC	0	N/A	7.5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**
Ametryn	0	N/A	7.5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**
Hexazinone	0	N/A	7.5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**
Dissolved metals/metalloids /total Se	10	10	7.5	5	10	5	7.5	5	7.5	7.5	7.5	5	7.5	7.5	5	5	**70**
Total coliform concentration	0	N/A	7.5	N/A	7.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**50**
***E. coli* concentrations**	0	N/A	7.5	N/A	7.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**50**
Enterococci	0	N/A	7.5	N/A	7.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**50**
Hydrogen sulfide	0	N/A	7.5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**33**
Sediment metals/metalloids	0	N/A	7.5	N/A	7.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**50**
Algal composition	0	N/A	7.5	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**25**

Algal concentration	0	N/A	7.5	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**25**
Groundwater Levels	10	10	10	10	5	5	10	10	7.5	7.5	7.5	5	10	10	10	5	**83**
Macroinvertebrate Taxa Richness	5	10	7.5	7.5	10	5	7.5	5	10	10	10	5	7.5	7.5	5	10	**77**
Macroinvertebrate PET Taxa Richness	5	10	7.5	7.5	10	5	7.5	5	10	10	10	5	7.5	7.5	5	10	**77**
Macroinvertebrate SIGNAL index	5	10	7.5	7.5	10	5	7.5	5	10	10	10	5	7.5	7.5	5	10	**77**
Macro invertebrate % Tolerant Taxa	5	10	7.5	7.5	10	5	7.5	5	10	10	10	5	7.5	7.5	5	10	**77**
Freshwater Pest Plants (% cover)	0	N/A	5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**25**
Freshwater Pest Plants (Native:Exotic)	0	N/A	5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**25**
Wetland cover	0	N/A	5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**25**
Riparian Vegetation Condition	0	N/A	7.5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**33**
Riparian Vegetation Extent	0	N/A	7.5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**33**
Riparian Vegetation Composition	0	N/A	7.5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**33**

Riparian Vegetation Connectivity	0	N/A	7.5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**33**
In stream connectivity	0	N/A	5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**33**
Presence of Instream barriers	0	N/A	5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**33**
Bank condition	0	N/A	7.5	N/A	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**33**
Flow	10	10	7.5	10	5	2.5	5	5	10	7.5	10	7.5	10	10	10	5	**78**
Native Fish Species (observed:expected ratio ≥1)	0	N/A	5	N/A	7.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**
Exotic Fish Species (present/absent)	0	N/A	5	N/A	7.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**42**

APPENDIX II FURTHER DETAIL ON SCORING METHODS

General Score aggregation

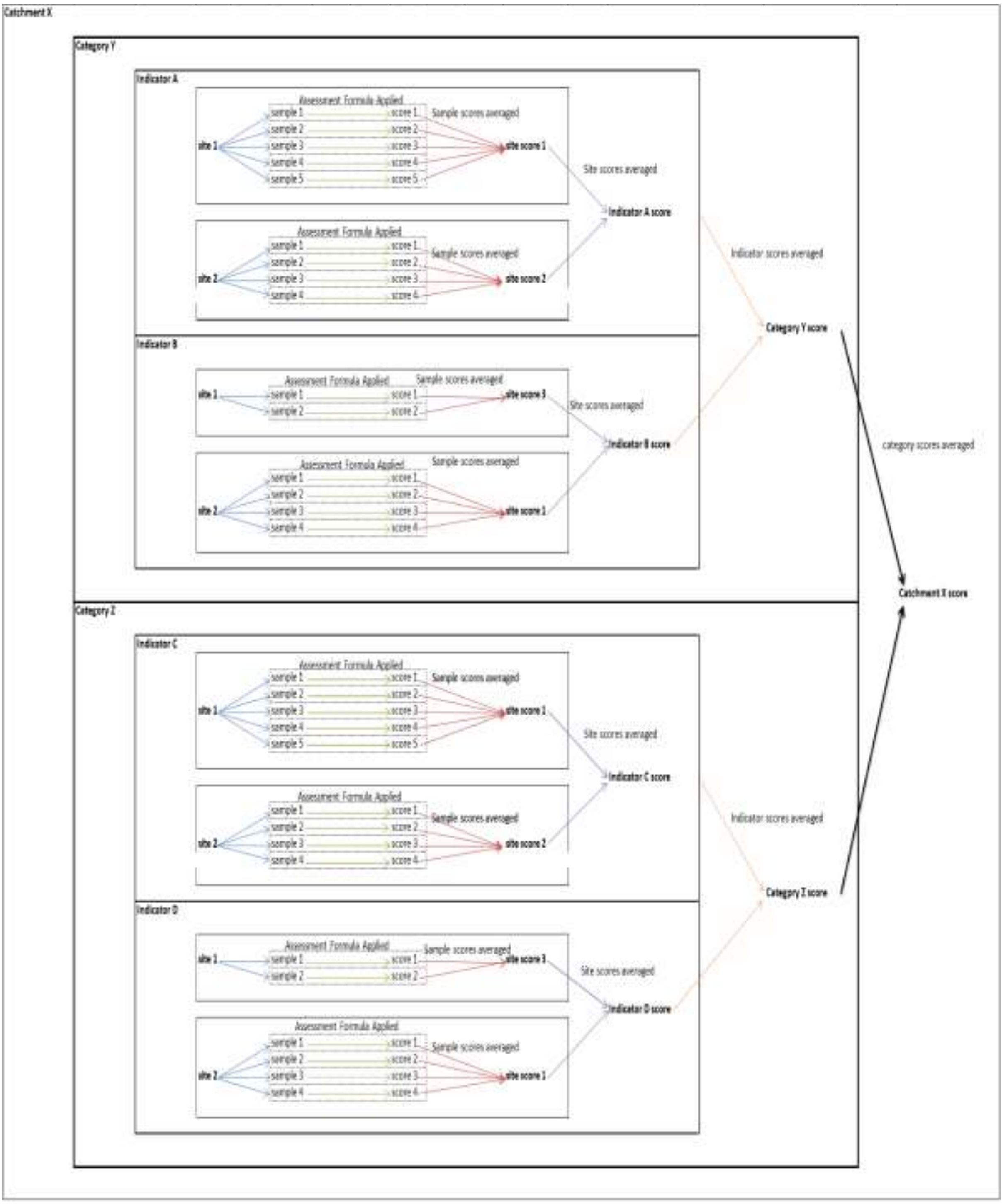


Figure A1: Flow diagram of score aggregation (courtesy of Luke Ukkola)

pH scores

The pH scale is logarithmic. This means that a score of 2 is several times worst than a score of 3, and so on. As well, the ideal range for observations falls in the mid-range of the Ph scale. To reflect this scores have been scaled by an exponential function which is an inverse to a logarithmic scale.
Function:
=IF(E3<4.5,0,(IF(E3<6.5,EXP(E3)*EXP(E3)/EXP(6.5)/EXP(6.5),(IF(E3<8.5111111,1,IF(E3<11,(EXP((15-E3))/EXP(6.5)),0))))))

The formula scores observations against a 'mesa' distribution of values. The flat top of the mesa gives values of '1' between scores of 6.5 and 8.5 (ideal range). Once observations fall on either side of the ideal range (flat top), then the scores fall towards zero - slightly faster on the downward side (to reflect the natural alkalinity of the Fitzroy catchment). The IF command sorts values into 5 groups: below 4.5, below 6.5, below 8.5111111, above 8.51111 and above 11, and applies a value transformation to each group.

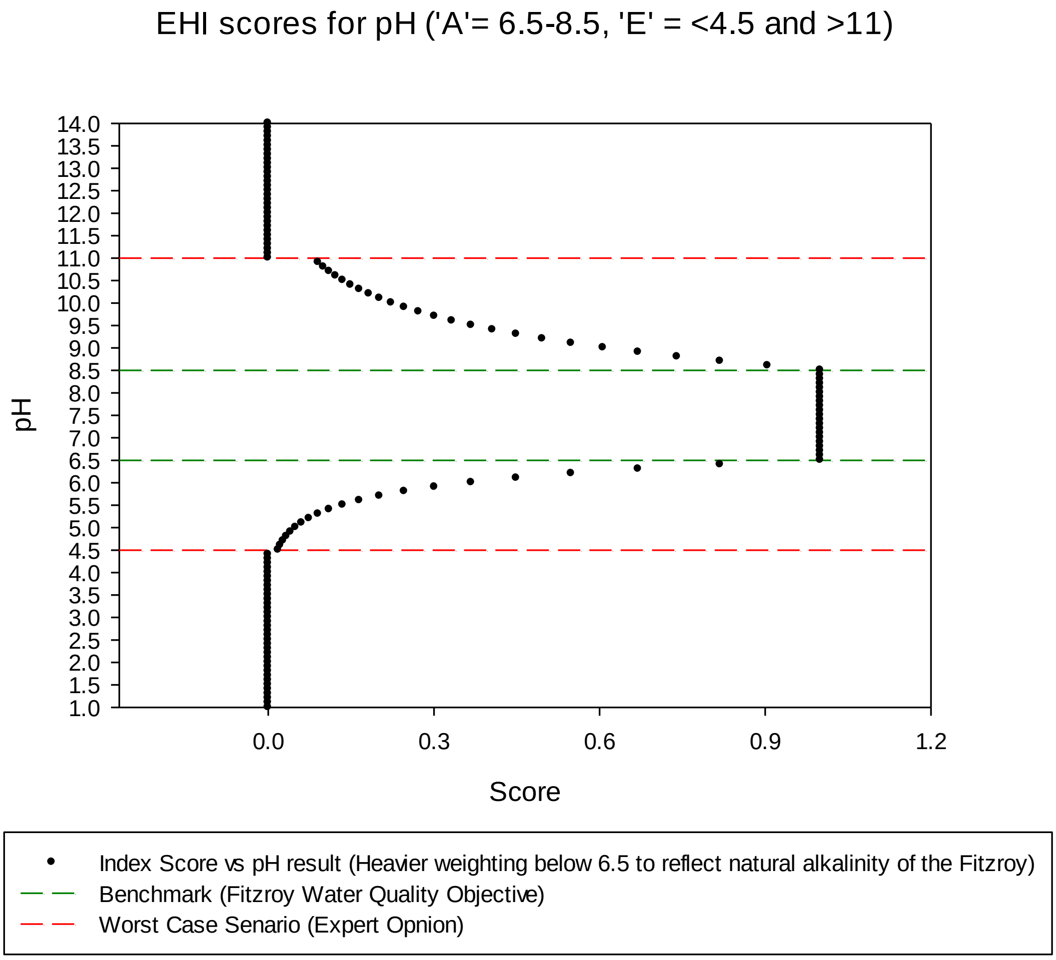


Figure A2 Graphical representation of the pH scoring method showing reference benchmark and WCS

Toxicant aggregating options

The maximum number of metals endorsed by the Science Panel for inclusion in the index is 17. Concerns that elevated results of one metal sub-indicator would be averaged out using the current scoring method were raised by CQUniversity, the Science Team and the Science Panel. The table below suggests two alternative ways of grading the Toxicant category. Note: scores, sites and samples shown do not refer to actual data, they are theoretical examples only.

Table A1 Toxicant aggregating options

	Aluminium	Arsenic	Nickel	Zinc	Molybdenum	Selenium	Silver	Uranium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury
Indicator Score	0.111	0.978	0.999	0.270	1	0.987	0.997	0.999	1	0.978	0.878	1	0.341	0.933	0.987	1	0.999
Indicator Grade	D	B	B	D	A	B	B	B	A	B	B	A	C	B	B	A	B
Number of Sites	5	5	5	5	5	5	5	5	3	5	5	3	5	5	5	5	5
Number of Samples	10	10	10	10	10	10	10	10	6	10	10	6	10	10	10	10	10

Toxicant Category Score and Grade:	Aggregating Option 1 (As per other categories- gives the average of all 17 sub-indicator scores):	0.850	B	Note: Option 1 was rejected at the February 2013 Science Panel Meeting.
	Aggregating Option 2 (As suggested at Feb 2013 Science Panel Meeting -report lowest score):	0.111	D	
	Aggregating Option 3 (Suggested by CQUniversity after Feb 2013 Science Panel Meeting - take the average of the 3 worst scores):	0.241	D	

APPENDIX III DATA SUMMARIES OF ALL AVAILABLE CATCHMENT DATA

Separated into high and low flows based on the following cut off rates:

Catchment	Stream Site	Flow Rate
Callide	Don River at Rannes	5.4 cumecs
Upper Dawson	Dawson River at Taroom	2 cumecs
Lower Dawson	Dawson River at Beckers	33 cumecs
Comet	Comet River at the Lake	4 cumecs
Upper Nogoa	Nogoa River at Craigmore	4 cumecs
Theresa Creek	Theresa Creek at Gregory Highway	4 cumecs
Lower Nogoa	Nogoa River at Duckponds	4 cumecs
Isaac	Manual data collected as required	
Lower Isaac	Isaac River at Yatton	33 cumecs
Connors	Connors River at Pink Lagoon	33 cumecs
Mackenzie	Mackenzie River at Coolmaringa	33 cumecs
Fitzroy	Fitzroy River The Gap	50 cumecs

Summary statistics of all 2010-11 FPRH Callide data (including groundwater) as at 14.08.12

	High Flow					Low Flow				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	62	249.11	230.00	104.06	10828.40	41	436.66	230.00	431.34	186056.58
Electrical Conductivity @ 25C (ÂµS/cm) field	2	713.50	713.50	456.08	208012.50	11	1045.82	1023.00	469.22	220169.56
Turbidity (NTU)	62	70.71	57.50	69.85	4879.02	41	66.05	57.00	61.23	3749.30
Turbidity (NTU) field	2	40.00	40.00	21.21	450.00	10	22.90	11.00	33.66	1132.77
Transparency (secchi depth) (m) field	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Colour True (Hazen units)	2	39.00	39.00	16.97	288.00	11	26.64	14.00	25.75	662.85
Water Temperature (deg C) field	2	27.95	27.95	2.76	7.60	10	22.68	23.05	4.74	22.48
pH (pH units)	62	7.09	7.00	0.47	0.22	41	7.74	7.80	0.50	0.25
pH (pH units) field	2	7.70	7.70	0.14	0.02	11	7.55	7.70	0.60	0.35
Total Alkalinity as CaCO3 (mg/L)	2	151.00	151.00	77.78	6050.00	11	188.09	189.00	78.63	6182.49

Total Alkalinity as CaCO3 (mg/L) field	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Phenolphthalein Alk. as CaCO3 field	2	0.55	0.55	0.49	0.25	11	1.51	1.10	1.62	2.63
Hydroxide as OH (mg/L)	2	0.00	0.00	0.00	0.00	11	0.00	0.00	0.00	0.00
Bicarbonate as HCO3 (mg/L)	2	183.00	183.00	94.75	8978.00	11	226.45	228.00	93.31	8705.87
Hardness as CaCO3 (mg/L)	2	188.50	188.50	142.13	20200.50	11	361.91	295.00	222.72	49603.69
Hydrogen as H (mg/L)	2	0.00	0.00	0.00	0.00	11	0.00	0.00	0.00	0.00
Total Dissolved Solids (mg/L)	2	404.50	404.50	256.68	65884.50	11	625.09	559.00	332.85	110787.89
Total Dissolved Ions (mg/L)	2	477.50	477.50	300.52	90312.50	11	709.73	678.00	331.06	109598.02
Total Suspended Solids (mg/L)	62	81.26	34.00	129.70	16822.42	41	66.74	37.00	92.67	8587.91
Calcium as Ca soluble (mg/L)	2	36.50	36.50	26.16	684.50	11	75.55	64.00	47.34	2241.47
Chloride as Cl (mg/L)	2	111.50	111.50	82.73	6844.50	11	140.64	130.00	76.84	5903.65

Magnesium as Mg soluble (mg/L)	2	23.50	23.50	19.09	364.50	11	42.04	34.00	25.76	663.53
Nitrite as N (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Nitrate as N (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Nitrate as NO3 (mg/L)	2	0.25	0.25	0.00	0.00	11	0.76	0.25	0.90	0.81
Total Nitrogen (mg/L)	2	0.72	0.72	0.28	0.08	11	0.45	0.41	0.24	0.06
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	2	0.02	0.02	0.03	0.00	11	0.01	0.00	0.02	0.00
Ammonia as N - soluble (mg/L) (Field Filtered)	2	0.02	0.02	0.01	0.00	11	0.01	0.00	0.02	0.00
Oxygen (Dissolved) (mg/L) field	2	6.90	6.90	0.42	0.18	10	7.52	7.85	1.91	3.66
Total Phosphorus as P (mg/L)	2	0.38	0.38	0.01	0.00	11	0.19	0.11	0.19	0.04
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	2	0.28	0.28	0.01	0.00	11	0.12	0.05	0.15	0.02
Potassium as K (mg/L)	2	5.80	5.80	2.26	5.12	11	4.14	3.90	1.16	1.35

Sodium as Na (mg/L)	2	71.00	71.00	42.43	1800.00	11	78.45	80.00	33.84	1145.27
Sulphate as SO4 (mg/L)	62	4.16	2.50	9.86	97.24	41	39.58	2.50	128.29	16458.55
Aluminium - Total (ug/L)	31	601.61	0.00	1370.66	1878720.65	7	1331.43	620.00	1879.07	3530914.29
Aluminium - Dissolved (ug/L)	33	36.53	0.00	111.29	12385.19	18	142.33	25.00	255.42	65240.94
Arsenic - Total (ug/L)	31	0.48	0.00	0.96	0.92	7	1.29	2.00	1.25	1.57
Arsenic - Dissolved (ug/L)	31	2.68	0.00	7.46	55.63	7	4.29	1.00	9.18	84.24
Cadmium - Total (ug/L)	31	0.03	0.00	0.08	0.01	7	0.06	0.10	0.05	0.00
Cadmium - Dissolved (ug/L)	31	0.16	0.00	0.56	0.32	7	51.46	0.01	136.05	18510.69
Chromium - Total (ug/L)	31	0.66	0.00	1.47	2.16	7	1.00	1.00	1.00	1.00
Chromium - Dissolved(ug/L)	31	0.18	0.00	0.42	0.18	7	0.43	0.50	0.45	0.20
Copper - Total (ug/L)	31	2.00	0.00	5.00	25.00	7	3.29	3.00	3.99	15.90
Copper - Dissolved (ug/L)	33	57.29	0.00	199.33	39734.05	18	9.83	15.00	6.78	46.03
Iron - Total (ug/L)	31	661.61	0.00	1487.64	2213080.65	7	1471.43	1000.00	1883.89	3549047.62
Iron - Dissolved(ug/L)	33	41.11	0.00	109.14	11911.42	18	160.00	7.50	277.92	77238.24

Lead - Total (ug/L)	31	0.24	0.00	0.55	0.30	7	0.36	0.50	0.38	0.14
Lead - Dissolved (ug/L)	31	0.73	0.00	2.26	5.10	7	0.29	0.50	0.27	0.07
Mercury - Total (ug/L)	31	0.01	0.00	0.02	0.00	7	0.03	0.05	0.03	0.00
Mercury - Dissolved (ug/L)	31	0.25	0.00	0.75	0.56	7	0.03	0.05	0.03	0.00
Nickel - Total (ug/L)	31	0.97	0.00	2.18	4.77	7	1.86	2.00	1.95	3.81
Nickel - Dissolved (ug/L)	31	0.48	0.00	1.66	2.76	7	0.64	0.50	0.75	0.56
Zinc - Total (ug/L)	31	5.71	0.00	11.53	132.95	7	9.71	9.00	12.82	164.24
Zinc - Dissolved (ug/L)	61	0.54	0.00	2.67	7.15	18	5.94	5.00	6.09	37.11
Boron - Total (ug/L)	33	12.42	0.00	23.52	553.31	18	56.94	65.00	38.66	1494.53
Boron - Dissolved (ug/L)	31	4.05	0.00	11.35	128.90	7	10.73	0.10	13.35	178.22
Barium - Total (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Barium - Dissolved (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Beryllium - Total (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Beryllium - Dissolved (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00

Cobalt - Total (ug/L)	31	0.61	0.00	1.49	2.23	7	0.93	0.50	1.43	2.04
Cobalt - Dissolved(ug/L)	31	0.27	0.00	0.79	0.63	7	0.64	0.50	1.07	1.14
Manganese - Total (ug/L)	31	41.87	0.00	92.44	8545.05	7	60.86	51.00	73.06	5338.14
Manganese - Dissolved (ug/L)	33	0.61	0.00	1.40	1.96	18	13.47	5.00	41.61	1730.98
Molybdenum - Total (ug/L)	31	0.56	0.00	1.06	1.13	7	1.43	2.50	1.34	1.79
Molybdenum - Dissolved(ug/L)	31	0.53	0.00	1.10	1.22	7	1.43	2.50	1.34	1.79
Selenium - Total (ug/L)	31	0.48	0.00	2.15	4.61	7	0.36	0.50	0.38	0.14
Selenium - Dissolved(ug/L)	31	0.31	0.00	0.75	0.56	7	0.29	0.50	0.27	0.07
Silver -Total (ug/L)	31	0.56	0.00	1.06	1.13	7	1.79	2.50	1.89	3.57
Silver - Dissolved (ug/L)	31	5.16	0.00	14.94	223.31	7	1.43	2.50	1.34	1.79
Uranium - Total (ug/L)	31	11.29	0.00	21.25	451.61	7	28.57	50.00	26.73	714.29
Uranium - Dissolved (ug/L)	31	6.92	0.00	16.93	286.47	7	28.57	50.00	26.73	714.29
Vanadium - Total (ug/L)	31	2.47	0.00	5.31	28.18	7	5.71	7.00	6.07	36.90

Vanadium - Dissolved (ug/L)	31	0.81	0.00	1.79	3.21	7	3.36	2.50	3.66	13.39
Ammonia(ug/L)	31	0.01	0.00	0.02	0.00	7	0.05	0.02	0.10	0.01
Nitrate(ug/L)	31	0.01	0.00	0.02	0.00	7	0.01	0.01	0.01	0.00
Total Fluoride(ug/L)	33	12.13	0.00	49.48	2448.37	18	105.56	90.00	105.00	11025.65
Flow Rate (L/s)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Flow Rate (ML/day)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Flow Rate (m3/s)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Pet. Hydrocarbons C6-C9(ug/L)	31	2.26	0.00	4.25	18.06	6	5.00	5.00	5.48	30.00
Pet. Hydrocarbons C10-C36(ug/L)	31	8.06	0.00	16.31	266.13	7	17.86	25.00	18.90	357.14
Pet. Hydrocarbons C10-C14(ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Pet. Hydrocarbons C15-C28(ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Pet. Hydrocarbons C29-C36(ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00

1.2-Dichloroethane-D4 (%)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Toluene-D8 (%)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
4-Bromofluorobenzene (%)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
E.coli (CFU/mL)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Faecal Coliforms (cnt/100 mls)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Legionella pneumophila Sg 1-14 (CFU/mL)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Legionella species (not pneumophila) (CFU/mL)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Cyanobacteria (cells/mL)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Tannins (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Volatile Acids as Acetic Acid (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Benzene (ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Ethylbenzene (ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00

meta- & para-Xylene (ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
ortho-Xylene (ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
comments	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Total Potassium (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Silica Si02 - dissolved(mg/L)	2	20.50	20.50	3.54	12.50	11	30.55	28.00	11.24	126.27
Sulphide as S2- (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Chemical Oxygen Demand (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Biochemical Oxygen Demand (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Indicator type	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Bank	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Bank level	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Bank Condition Category	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Category code	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00

Bank condition value	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Aquatic habitat category	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Aquatic habitat value	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Value	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Habitat Type	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Category	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Taxa code	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Reach environs category	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Transect number	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
distance along transect	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
reference	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
riparian vegetation category	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
vegetation value	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Depth (m)	474	-12.58	-12.80	4.43	19.60	1319	-13.12	-13.13	5.49	30.16
Carbon - Organic -	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00

Dissolved (mg/L)										
Chlorophyll-a (ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Oxygen per cent saturation (%)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Pheopigments (ug/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Salinity (g/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Nitrogen (organic) as N (mg/L)	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Carbonate as CO3 (mg/L)	68	0.00	0.00	0.00	0.00	74	0.00	0.00	0.00	0.00
Sodium absorption ratio	0	0	0	0	0	0	0	0	0	0

Summary statistics of all 2010-11 FPRH Comet data (including groundwater) as at 14.08.12

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	57.0	226.1	218.0	86.4	7461.8	4.0	337.0	313.0	113.2	12821.3
Electrical Conductivity @	6.0	365.7	389.0	78.1	6094.3	2.0	422.5	422.5	67.2	4512.5

25C (ÂµS/cm) field										
Turbidity (NTU)	61.0	559.4	351.0	527.5	278241.3	4.0	883.6	892.0	1000.5	1000994.6
Turbidity (NTU) field	6.0	71.8	81.5	85.2	7265.8	2.0	17.0	17.0	21.2	450.0
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	8.0	17.4	20.5	13.8	189.7	2.0	5.0	5.0	4.2	18.0
Water Temperature (deg C) field	8.0	21.7	25.5	6.4	41.4	2.0	18.1	18.1	2.5	6.1
pH (pH units)	61.0	7.4	7.3	0.4	0.2	4.0	7.5	7.3	0.9	0.8
pH (pH units) field	8.0	8.1	8.0	0.3	0.1	2.0	8.3	8.3	0.5	0.2
Total Alkalinity as CaCO3 (mg/L)	8.0	173.8	176.0	39.2	1539.6	2.0	197.5	197.5	46.0	2112.5
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as CaCO3 field	8.0	2.5	2.5	1.8	3.2	2.0	3.0	3.0	2.8	7.6
Hydroxide as OH (mg/L)	8.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3	8.0	206.8	209.5	44.3	1963.6	2.0	234.5	234.5	50.2	2520.5

(mg/L)										
Hardness as CaCO3 (mg/L)	8.0	156.8	158.0	38.1	1448.5	2.0	181.5	181.5	37.5	1404.5
Hydrogen as H (mg/L)	8.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	8.0	225.6	235.5	45.4	2062.6	2.0	244.0	244.0	43.8	1922.0
Total Dissolved Ions (mg/L)	8.0	306.3	313.5	64.1	4103.6	2.0	340.0	340.0	66.5	4418.0
Total Suspended Solids (mg/L)	61.0	330.5	216.0	317.1	100532.9	4.0	527.4	534.5	592.0	350514.6
Calcium as Ca soluble (mg/L)	8.0	29.6	29.5	6.2	38.3	2.0	33.5	33.5	6.4	40.5
Chloride as Cl (mg/L)	8.0	15.0	13.0	5.8	33.4	2.0	13.0	13.0	1.4	2.0
Magnesium as Mg soluble (mg/L)	8.0	20.1	20.5	5.7	33.0	2.0	24.0	24.0	5.7	32.0
Nitrite as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as NO3 (mg/L)	8.0	0.3	0.3	0.2	0.0	2.0	0.3	0.3	0.0	0.0

Total Nitrogen (mg/L)	8.0	0.4	0.5	0.3	0.1	2.0	0.2	0.2	0.1	0.0
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	8.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Ammonia as N - soluble (mg/L) (Field Filtered)	8.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Oxygen (Dissolved) (mg/L) field	5.0	7.3	6.7	1.5	2.1	2.0	8.6	8.6	0.6	0.3
Total Phosphorus as P (mg/L)	8.0	0.2	0.2	0.1	0.0	2.0	0.1	0.1	0.0	0.0
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	8.0	0.1	0.1	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	8.0	3.7	4.1	1.5	2.3	2.0	2.8	2.8	0.3	0.1
Sodium as Na (mg/L)	8.0	20.1	20.0	4.4	19.3	2.0	20.5	20.5	4.9	24.5
Sulphate as SO4 (mg/L)	61.0	10.6	4.0	17.0	288.0	4.0	20.1	21.3	13.9	194.6
Aluminium - Total (ug/L)	53.0	5917.9	4050.0	5194.2	26979286.0	2.0	9050.0	9050.0	0.0	0.0
Aluminium - Dissolved (ug/L)	61.0	356.6	230.0	378.7	143428.1	4.0	47.5	47.5	26.0	675.0

Arsenic - Total (ug/L)	53.0	1.6	1.0	0.9	0.8	2.0	3.0	3.0	0.0	0.0
Arsenic - Dissolved (ug/L)	53.0	0.8	0.5	0.6	0.3	2.0	0.5	0.5	0.0	0.0
Cadmium - Total (ug/L)	53.0	0.2	0.1	0.3	0.1	2.0	0.1	0.1	0.0	0.0
Cadmium - Dissolved (ug/L)	53.0	0.1	0.1	0.0	0.0	2.0	0.1	0.1	0.0	0.0
Chromium - Total (ug/L)	53.0	9.8	8.0	9.7	94.9	2.0	14.0	14.0	0.0	0.0
Chromium - Dissolved(ug/L)	53.0	0.7	0.5	0.5	0.2	2.0	0.5	0.5	0.0	0.0
Copper - Total (ug/L)	53.0	10.1	9.0	6.3	39.1	2.0	23.0	23.0	0.0	0.0
Copper - Dissolved (ug/L)	61.0	4.8	3.0	4.2	17.3	4.0	9.5	9.5	6.4	40.3
Iron - Total (ug/L)	53.0	7182.8	5000.0	6754.2	45619613.0	2.0	15300.0	15300.0	0.0	0.0
Iron - Dissolved(ug/L)	61.0	307.3	280.0	282.1	79604.6	4.0	57.5	57.5	60.6	3675.0
Lead - Total (ug/L)	53.0	2.9	2.0	2.5	6.5	2.0	10.0	10.0	0.0	0.0
Lead - Dissolved (ug/L)	53.0	0.6	0.5	0.4	0.2	2.0	0.5	0.5	0.0	0.0
Mercury - Total (ug/L)	53.0	0.1	0.1	0.0	0.0	2.0	0.1	0.1	0.0	0.0
Mercury - Dissolved (ug/L)	53.0	0.1	0.1	0.0	0.0	2.0	0.1	0.1	0.0	0.0

Nickel - Total (ug/L)	53.0	13.0	10.0	8.9	79.6	2.0	22.0	22.0	0.0	0.0
Nickel - Dissolved (ug/L)	53.0	4.2	3.0	2.4	5.7	2.0	6.0	6.0	0.0	0.0
Zinc - Total (ug/L)	53.0	17.9	16.0	12.5	156.6	2.0	39.0	39.0	0.0	0.0
Zinc - Dissolved (ug/L)	61.0	3.4	2.5	2.7	7.4	4.0	3.8	3.8	1.4	2.1
Boron - Total (ug/L)	61.0	39.7	25.0	21.4	457.4	4.0	17.5	17.5	8.7	75.0
Boron - Dissolved (ug/L)	53.0	36.3	25.0	20.6	426.1	2.0	25.0	25.0	0.0	0.0
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	53.0	4.6	4.0	4.0	15.9	2.0	10.0	10.0	0.0	0.0
Cobalt - Dissolved(ug/L)	53.0	0.8	0.5	1.2	1.4	2.0	2.0	2.0	0.0	0.0
Manganese - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Dissolved (ug/L)	8.0	5.0	5.0	0.0	0.0	2.0	5.0	5.0	0.0	0.0

Molybdenum - Total (ug/L)	53.0	0.5	0.5	0.0	0.0	2.0	0.5	0.5	0.0	0.0
Molybdenum - Dissolved(ug/L)	53.0	0.5	0.5	0.0	0.0	2.0	0.5	0.5	0.0	0.0
Selenium - Total (ug/L)	53.0	5.0	5.0	0.0	0.0	2.0	5.0	5.0	0.0	0.0
Selenium - Dissolved(ug/L)	53.0	5.0	5.0	0.0	0.0	2.0	5.0	5.0	0.0	0.0
Silver -Total (ug/L)	53.0	0.5	0.5	0.0	0.0	2.0	0.5	0.5	0.0	0.0
Silver - Dissolved (ug/L)	53.0	0.5	0.5	0.0	0.0	2.0	0.5	0.5	0.0	0.0
Uranium - Total (ug/L)	53.0	0.5	0.5	0.0	0.0	2.0	0.5	0.5	0.0	0.0
Uranium - Dissolved (ug/L)	53.0	0.5	0.5	0.0	0.0	2.0	0.5	0.5	0.0	0.0
Vanadium - Total (ug/L)	53.0	17.1	10.0	13.4	179.3	2.0	30.0	30.0	0.0	0.0
Vanadium - Dissolved (ug/L)	53.0	5.3	5.0	2.1	4.2	2.0	5.0	5.0	0.0	0.0
Ammonia(ug/L)	53.0	38.0	30.0	29.1	848.4	2.0	50.0	50.0	0.0	0.0
Nitrate(ug/L)	46.0	152.9	50.0	248.5	61764.0	2.0	340.0	340.0	0.0	0.0
Total Fluoride(ug/L)	61.0	84.8	50.0	96.6	9330.1	4.0	95.0	120.0	66.0	4360.3

Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	40193.0	1586.2	504.7	5978.8	35746077.9	7801.0	24.9	13.5	48.9	2395.9
Flow Rate (m3/s)	40193.0	18.4	5.8	69.2	4788.5	7801.0	0.3	0.2	0.6	0.3
Pet. Hydrocarbons C6-C9(ug/L)	53.0	10.0	10.0	0.0	0.0	2.0	10.0	10.0	0.0	0.0
Pet. Hydrocarbons C10-C36(ug/L)	53.0	25.0	25.0	0.0	0.0	2.0	25.0	25.0	0.0	0.0
Pet. Hydrocarbons C10-C14(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C15-C28(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(%)										
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	8.0	24.4	24.0	6.4	40.6	2.0	23.5	23.5	3.5	12.5
Sulphide as S2- (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	40340.0	10.8	10.5	1.7	3.0	7819.0	10.0	10.1	2.3	5.2
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate as CO3 (mg/L)	85.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

<u>Summary statistics of all 2010-11 FPRH Connors data (including groundwater) as at 14.08.12</u>

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	238.0	967.5	846.0	617.0	380717.7	11.0	875.4	652.0	595.8	354977.9
Electrical Conductivity @ 25C (ÂµS/cm) field	410.0	965.0	840.0	555.6	308732.2	16.0	1018.4	773.5	671.8	451374.0
Turbidity (NTU)	182.0	112.9	16.5	259.4	67287.1	10.0	3.9	2.5	4.0	15.8
Turbidity (NTU) field	275.0	169.9	66.7	298.4	89056.9	13.0	95.2	17.9	141.1	19896.2
Transparency (secchi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

depth) (m) field										
Colour True (Hazen units)	1.0	48.0	48.0	0.0	0.0	6.0	10.3	6.5	8.2	67.1
Water Temperature (deg C) field	1.0	27.3	27.3	0.0	0.0	6.0	21.7	24.2	5.3	27.8
pH (pH units)	238.0	8.0	8.2	1.2	1.4	11.0	8.0	8.1	0.3	0.1
pH (pH units) field	410.0	8.2	8.3	0.3	0.1	16.0	8.0	8.1	0.4	0.2
Total Alkalinity as CaCO3 (mg/L)	1.0	99.0	99.0	0.0	0.0	6.0	134.5	124.5	35.1	1229.9
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as CaCO3 field	1.0	0.5	0.5	0.0	0.0	6.0	1.0	0.7	0.7	0.6
Hydroxide as OH (mg/L)	1.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3 (mg/L)	1.0	120.0	120.0	0.0	0.0	6.0	162.2	150.0	41.3	1706.6
Hardness as CaCO3 (mg/L)	1.0	95.0	95.0	0.0	0.0	6.0	152.7	143.0	39.2	1535.5
Hydrogen as H (mg/L)	1.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0

Total Dissolved Solids (mg/L)	1.0	190.0	190.0	0.0	0.0	6.0	291.3	264.0	76.2	5807.9
Total Dissolved Ions (mg/L)	1.0	223.0	223.0	0.0	0.0	6.0	347.7	314.5	97.0	9413.1
Total Suspended Solids (mg/L)	238.0	100.3	21.0	228.2	52065.6	11.0	10.6	8.0	7.9	61.6
Calcium as Ca soluble (mg/L)	1.0	20.0	20.0	0.0	0.0	6.0	31.8	30.5	6.7	45.0
Chloride as Cl (mg/L)	1.0	36.0	36.0	0.0	0.0	6.0	81.7	73.0	24.4	594.3
Magnesium as Mg soluble (mg/L)	1.0	11.0	11.0	0.0	0.0	6.0	18.0	16.5	5.4	29.2
Nitrite as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	237.0	0.3	0.0	1.1	1.3	5.0	0.6	0.0	1.3	1.8
Nitrate as NO3 (mg/L)	1.0	0.3	0.3	0.0	0.0	6.0	0.4	0.3	0.4	0.2
Total Nitrogen (mg/L)	1.0	0.3	0.3	0.0	0.0	6.0	0.2	0.2	0.1	0.0
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	1.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.1	0.0
Ammonia as N - soluble	197.0	0.0	0.0	0.0	0.0	11.0	0.0	0.0	0.0	0.0

(mg/L) (Field Filtered)										
Oxygen (Dissolved) (mg/L) field	1.0	7.5	7.5	0.0	0.0	6.0	6.9	7.3	3.7	13.5
Total Phosphorus as P (mg/L)	1.0	0.1	0.1	0.0	0.0	6.0	0.0	0.0	0.0	0.0
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	1.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	1.0	1.2	1.2	0.0	0.0	6.0	1.5	1.5	0.4	0.2
Sodium as Na (mg/L)	1.0	28.0	28.0	0.0	0.0	6.0	45.7	40.0	14.7	215.1
Sulphate as SO4 (mg/L)	238.0	28.4	19.0	28.2	795.5	11.0	26.2	10.0	45.5	2073.6
Aluminium - Total (ug/L)	237.0	2008.1	460.0	3527.0	12439436.4	5.0	160.0	70.0	216.0	46650.0
Aluminium - Dissolved (ug/L)	238.0	74.0	5.0	253.6	64337.2	11.0	15.9	25.0	10.4	109.1
Arsenic - Total (ug/L)	237.0	1.1	1.0	0.7	0.5	5.0	1.1	0.5	0.8	0.7
Arsenic - Dissolved (ug/L)	237.0	1.0	1.0	0.7	0.4	5.0	1.4	1.0	1.1	1.2
Cadmium - Total (ug/L)	237.0	0.1	0.1	0.0	0.0	5.0	0.1	0.1	0.0	0.0
Cadmium - Dissolved	237.0	0.1	0.1	0.0	0.0	5.0	0.1	0.1	0.0	0.0

(ug/L)										
Chromium - Total (ug/L)	237.0	2.0	0.5	3.4	11.5	5.0	0.5	0.5	0.0	0.0
Chromium - Dissolved(ug/L)	237.0	0.7	0.5	0.8	0.6	5.0	0.5	0.5	0.0	0.0
Copper - Total (ug/L)	237.0	5.3	2.0	15.7	247.7	5.0	1.7	2.0	1.0	1.0
Copper - Dissolved (ug/L)	238.0	1.5	1.0	1.6	2.4	11.0	10.3	15.0	9.4	88.2
Iron - Total (ug/L)	237.0	2275.1	540.0	4161.4	17317144.3	5.0	230.0	130.0	237.4	56350.0
Iron - Dissolved(ug/L)	238.0	91.1	25.0	164.2	26956.7	11.0	17.3	25.0	12.5	156.8
Lead - Total (ug/L)	237.0	1.5	0.5	2.4	5.8	5.0	0.5	0.5	0.0	0.0
Lead - Dissolved (ug/L)	237.0	0.7	0.5	1.0	0.9	5.0	0.5	0.5	0.0	0.0
Mercury - Total (ug/L)	237.0	0.1	0.1	0.0	0.0	5.0	0.1	0.1	0.0	0.0
Mercury - Dissolved (ug/L)	237.0	0.1	0.1	0.0	0.0	5.0	0.1	0.1	0.0	0.0
Nickel - Total (ug/L)	237.0	2.9	1.0	4.6	21.5	5.0	0.7	0.5	0.3	0.1
Nickel - Dissolved (ug/L)	237.0	0.8	0.5	0.9	0.9	5.0	0.5	0.5	0.0	0.0
Zinc - Total (ug/L)	184.0	3.4	2.5	3.0	9.1	4.0	2.5	2.5	0.0	0.0

Zinc - Dissolved (ug/L)	185.0	10.6	6.0	14.6	213.8	10.0	4.4	5.0	1.3	1.7
Boron - Total (ug/L)	238.0	43.4	25.0	24.9	618.7	11.0	29.5	25.0	15.4	237.3
Boron - Dissolved (ug/L)	237.0	41.4	25.0	22.4	501.3	5.0	39.0	25.0	19.2	367.5
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	237.0	1.5	0.5	2.5	6.5	5.0	0.5	0.5	0.0	0.0
Cobalt - Dissolved(ug/L)	237.0	0.6	0.5	0.8	0.6	5.0	0.5	0.5	0.0	0.0
Manganese - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Dissolved (ug/L)	1.0	5.0	5.0	0.0	0.0	6.0	5.0	5.0	0.0	0.0
Molybdenum - Total (ug/L)	237.0	2.8	2.0	4.1	17.1	5.0	8.0	3.0	11.7	138.0
Molybdenum - Dissolved(ug/L)	237.0	2.9	2.0	4.3	18.6	5.0	7.4	2.0	12.6	159.8

Selenium - Total (ug/L)	237.0	5.0	5.0	0.0	0.0	5.0	5.0	5.0	0.0	0.0
Selenium - Dissolved(ug/L)	237.0	5.0	5.0	0.0	0.0	5.0	5.0	5.0	0.0	0.0
Silver -Total (ug/L)	237.0	1.0	0.5	1.4	1.8	5.0	0.5	0.5	0.0	0.0
Silver - Dissolved (ug/L)	237.0	0.9	0.5	1.3	1.6	5.0	0.5	0.5	0.0	0.0
Uranium - Total (ug/L)	184.0	0.8	0.5	0.5	0.2	4.0	2.1	1.5	2.0	4.1
Uranium - Dissolved (ug/L)	184.0	0.7	0.5	0.4	0.1	4.0	1.3	0.8	1.2	1.4
Vanadium - Total (ug/L)	184.0	8.5	5.0	8.2	67.6	4.0	5.0	5.0	0.0	0.0
Vanadium - Dissolved (ug/L)	184.0	5.3	5.0	1.1	1.3	4.0	7.5	7.5	2.9	8.3
Ammonia(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Fluoride(ug/L)	237.0	244.5	200.0	120.5	14516.4	11.0	198.2	150.0	172.6	29796.4
Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (m3/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pet. Hydrocarbons C6-C9(ug/L)	249.0	10.0	10.0	0.0	0.0	5.0	10.0	10.0	0.0	0.0
Pet. Hydrocarbons C10-C36(ug/L)	248.0	35.7	25.0	73.0	5332.7	5.0	25.0	25.0	0.0	0.0
Pet. Hydrocarbons C10-C14(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C15-C28(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella pneumophila	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sg 1-14 (CFU/mL)										
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	1.0	28.0	28.0	0.0	0.0	6.0	26.0	26.0	1.4	2.0
Sulphide as S2- (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	4371.0	-22.8	0.2	1512.5	2287772.6	541.0	-11.4	-12.3	5.9	35.4
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Carbonate as CO3 (mg/L)	4620.0	0.0	0.0	0.0	0.0	119.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

<u>Summary statistics of all 2010-11 FPRH Fitzroy data (including groundwater) as at 14.08.12</u>

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	10.0	556.1	466.0	392.6	154132.5	10.0	808.4	742.0	539.4	290904.0
Electrical Conductivity @ 25C (ÂµS/cm) field	54.0	200.1	161.0	309.4	95740.4	9.0	720.9	545.0	508.0	258016.9
Turbidity (NTU)	10.0	104.9	68.0	129.6	16791.2	10.0	55.3	4.5	120.4	14484.2
Turbidity (NTU) field	11.0	104.3	10.0	134.9	18191.8	9.0	51.3	5.0	95.9	9193.5
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	10.0	38.6	29.0	31.6	996.7	10.0	15.5	12.5	12.2	149.2
Water Temperature (deg C) field	52.0	15.9	23.7	11.8	138.5	9.0	20.4	19.2	4.2	17.5

pH (pH units)	10.0	7.7	7.7	0.3	0.1	10.0	8.0	8.1	0.3	0.1
pH (pH units) field	52.0	5.3	7.5	3.2	10.0	9.0	8.1	8.1	0.3	0.1
Total Alkalinity as CaCO3 (mg/L)	10.0	133.8	117.0	82.3	6766.0	10.0	175.8	165.0	92.3	8518.4
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as CaCO3 field	10.0	0.8	0.5	0.7	0.5	10.0	1.7	1.7	1.2	1.5
Hydroxide as OH (mg/L)	10.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3 (mg/L)	10.0	161.6	141.5	98.9	9786.5	10.0	210.9	198.0	110.0	12106.3
Hardness as CaCO3 (mg/L)	10.0	172.4	141.0	131.2	17204.7	10.0	252.9	223.5	178.9	32017.4
Hydrogen as H (mg/L)	10.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	10.0	309.8	260.5	207.5	43073.7	10.0	443.7	401.5	289.2	83633.8
Total Dissolved Ions (mg/L)	10.0	367.6	311.5	253.1	64074.9	10.0	527.9	480.0	341.4	116577.7

Total Suspended Solids (mg/L)	10.0	79.8	51.5	89.4	7989.7	10.0	45.1	8.5	105.4	11112.3
Calcium as Ca soluble (mg/L)	10.0	36.2	29.5	27.0	731.3	10.0	50.1	44.5	34.2	1168.1
Chloride as Cl (mg/L)	10.0	85.5	65.0	73.1	5341.4	10.0	143.6	124.5	116.8	13651.8
Magnesium as Mg soluble (mg/L)	10.0	19.9	16.0	15.5	239.5	10.0	31.1	27.5	23.0	528.5
Nitrite as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as NO3 (mg/L)	10.0	0.4	0.3	0.3	0.1	10.0	0.5	0.3	0.3	0.1
Total Nitrogen (mg/L)	16.0	0.5	0.5	0.2	0.0	10.0	0.4	0.3	0.3	0.1
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	10.0	0.1	0.1	0.1	0.0	10.0	0.0	0.0	0.1	0.0
Ammonia as N - soluble (mg/L) (Field Filtered)	10.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Oxygen (Dissolved) (mg/L) field	51.0	5.0	6.7	4.3	18.7	9.0	10.1	9.2	2.9	8.7
Total Phosphorus as P	16.0	0.2	0.2	0.1	0.0	10.0	0.1	0.1	0.1	0.0

(mg/L)										
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	10.0	0.1	0.1	0.1	0.0	10.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	10.0	2.9	2.4	1.6	2.5	10.0	2.6	2.4	1.4	1.9
Sodium as Na (mg/L)	10.0	44.1	38.5	30.0	898.1	10.0	67.7	63.5	44.9	2016.2
Sulphate as SO4 (mg/L)	10.0	16.1	15.3	11.7	137.0	10.0	21.2	20.2	15.5	240.5
Aluminium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aluminium - Dissolved (ug/L)	10.0	505.0	25.0	894.5	800144.4	10.0	173.0	25.0	373.4	139401.1
Arsenic - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Copper - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper - Dissolved (ug/L)	10.0	15.0	15.0	0.0	0.0	10.0	15.0	15.0	0.0	0.0
Iron - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iron - Dissolved(ug/L)	10.0	287.0	60.0	438.9	192590.0	10.0	90.0	5.0	211.9	44911.1
Lead - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc - Dissolved (ug/L)	10.0	9.0	5.0	8.8	76.7	10.0	7.0	5.0	4.8	23.3
Boron - Total (ug/L)	10.0	34.0	35.0	7.0	48.9	10.0	34.0	30.0	8.4	71.1
Boron - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Dissolved (ug/L)	10.0	5.0	5.0	0.0	0.0	10.0	5.0	5.0	0.0	0.0
Molybdenum - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Molybdenum - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver -Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Uranium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uranium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ammonia(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Fluoride(ug/L)	10.0	118.0	130.0	38.8	1506.7	10.0	142.0	150.0	34.3	1173.3
Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (m3/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C6-C9(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C14(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pet. Hydrocarbons C15-C28(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	10.0	24.5	24.0	4.6	20.7	10.0	23.0	22.5	4.3	18.4
Sulphide as S2- (mg/L)	2.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	72.0	-7.1	-6.9	5.5	30.0	28.0	-8.2	-9.0	5.4	29.6
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate as CO3 (mg/L)	41.0	0.0	0.0	0.0	0.0	39.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

<u>Summary statistics of all 2010-11 FPRH Lower Dawson data (including groundwater) as at 14.08.12</u>

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**

Electrical Conductivity @ 25C (ÂµS/cm)	25.0	268.1	200.0	246.9	60951.4	21.0	1890.0	570.0	2167.3	4697026.6
Electrical Conductivity @ 25C (ÂµS/cm) field	21.0	111.1	118.0	112.6	12677.6	23.0	258.2	291.0	147.7	21810.2
Turbidity (NTU)	25.0	244.6	210.0	204.6	41867.6	21.0	31.1	26.0	23.4	547.3
Turbidity (NTU) field	6.0	602.2	604.0	285.3	81410.2	4.0	50.0	59.5	30.0	898.0
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	6.0	70.3	73.0	11.3	127.5	4.0	29.5	24.0	15.5	239.0
Water Temperature (deg C) field	12.0	23.4	21.5	3.7	13.4	20.0	23.1	23.3	3.0	8.9
pH (pH units)	25.0	7.3	7.3	0.3	0.1	21.0	8.1	8.1	0.3	0.1
pH (pH units) field	12.0	7.5	7.4	0.4	0.1	20.0	7.6	7.6	0.3	0.1
Total Alkalinity as CaCO3 (mg/L)	6.0	52.2	52.0	14.2	202.2	4.0	113.8	123.0	34.1	1164.9
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as	6.0	0.1	0.1	0.1	0.0	4.0	0.5	0.6	0.2	0.0

CaCO3 field										
Hydroxide as OH (mg/L)	6.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3 (mg/L)	6.0	63.2	63.0	17.2	297.0	4.0	137.3	148.5	41.5	1724.9
Hardness as CaCO3 (mg/L)	6.0	36.7	30.0	17.6	308.3	4.0	111.3	124.5	37.6	1410.3
Hydrogen as H (mg/L)	6.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	6.0	100.5	92.5	24.5	602.7	4.0	256.3	278.5	73.7	5437.6
Total Dissolved Ions (mg/L)	6.0	117.2	108.5	32.5	1056.6	4.0	308.3	336.0	93.0	8642.3
Total Suspended Solids (mg/L)	25.0	178.0	122.0	165.1	27262.7	21.0	35.0	36.0	19.7	387.6
Calcium as Ca soluble (mg/L)	6.0	9.4	8.2	3.8	14.8	4.0	27.0	31.0	10.1	102.0
Chloride as Cl (mg/L)	6.0	12.6	9.2	7.7	59.1	4.0	69.0	75.5	25.9	671.3
Magnesium as Mg soluble (mg/L)	6.0	3.2	2.5	1.9	3.6	4.0	10.5	11.5	3.1	9.4

Nitrite as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as NO3 (mg/L)	6.0	1.2	1.3	0.2	0.0	4.0	0.8	0.9	0.3	0.1
Total Nitrogen (mg/L)	12.0	1.0	1.0	0.4	0.2	13.0	0.7	0.7	0.1	0.0
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	6.0	0.2	0.2	0.0	0.0	4.0	0.1	0.2	0.1	0.0
Ammonia as N - soluble (mg/L) (Field Filtered)	6.0	0.2	0.1	0.3	0.1	4.0	0.0	0.0	0.0	0.0
Oxygen (Dissolved) (mg/L) field	11.0	7.2	7.2	1.5	2.3	20.0	5.8	5.7	1.4	2.0
Total Phosphorus as P (mg/L)	12.0	0.3	0.4	0.1	0.0	13.0	0.2	0.2	0.1	0.0
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	6.0	0.2	0.2	0.1	0.0	4.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	6.0	5.3	5.7	1.5	2.2	4.0	6.4	7.0	1.3	1.7
Sodium as Na (mg/L)	6.0	16.5	15.5	2.9	8.3	4.0	47.0	50.0	13.9	193.3
Sulphate as SO4 (mg/L)	25.0	17.3	4.2	55.6	3086.0	21.0	218.3	10.8	300.0	89990.9

Aluminium - Total (ug/L)	19.0	2334.2	1800.0	2168.7	4703348.0	17.0	512.6	430.0	295.4	87281.6
Aluminium - Dissolved (ug/L)	24.0	678.5	435.0	829.5	688095.0	21.0	245.1	110.0	322.5	103990.0
Arsenic - Total (ug/L)	19.0	4.2	2.5	4.8	22.7	17.0	2.5	2.5	0.0	0.0
Arsenic - Dissolved (ug/L)	18.0	4.4	2.5	4.9	23.8	17.0	2.5	2.5	0.0	0.0
Cadmium - Total (ug/L)	19.0	0.1	0.1	0.0	0.0	17.0	0.1	0.1	0.0	0.0
Cadmium - Dissolved (ug/L)	18.0	0.1	0.1	0.0	0.0	17.0	0.1	0.1	0.0	0.0
Chromium - Total (ug/L)	19.0	1.9	2.5	1.1	1.1	17.0	2.5	2.5	0.0	0.0
Chromium - Dissolved(ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	3.0	2.5	1.5	2.4
Copper - Total (ug/L)	19.0	9.7	5.0	22.1	489.6	17.0	2.5	2.5	0.0	0.0
Copper - Dissolved (ug/L)	24.0	5.2	2.5	5.8	34.2	21.0	4.9	2.5	5.0	25.3
Iron - Total (ug/L)	19.0	1831.6	1400.0	1596.2	2547836.3	17.0	467.6	400.0	313.7	98419.1
Iron - Dissolved(ug/L)	24.0	372.9	250.0	459.9	211525.9	21.0	109.3	50.0	173.5	30105.7
Lead - Total (ug/L)	19.0	1.9	2.5	1.1	1.1	17.0	2.5	2.5	0.0	0.0
Lead - Dissolved (ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	2.5	2.5	0.0	0.0

Mercury - Total (ug/L)	18.0	0.0	0.1	0.0	0.0	17.0	0.1	0.1	0.0	0.0
Mercury - Dissolved (ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	2.9	2.5	1.0	1.0
Nickel - Total (ug/L)	19.0	2.0	2.5	1.0	1.1	17.0	2.6	2.5	0.6	0.4
Nickel - Dissolved (ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	4.8	2.5	3.3	10.8
Zinc - Total (ug/L)	19.0	14.9	16.0	10.3	106.3	17.0	4.6	5.0	2.1	4.5
Zinc - Dissolved (ug/L)	24.0	16.8	9.0	21.6	467.7	21.0	10.3	7.0	8.6	73.7
Boron - Total (ug/L)	24.0	48.7	52.0	30.9	953.9	21.0	117.0	60.0	105.2	11064.3
Boron - Dissolved (ug/L)	18.0	47.1	53.0	29.8	890.5	17.0	144.2	77.0	109.4	11978.2
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	2.5	2.5	0.0	0.0
Cobalt - Dissolved(ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	2.5	2.5	0.0	0.0

Manganese - Total (ug/L)	19.0	88.1	66.0	73.4	5394.5	17.0	122.1	140.0	65.3	4269.7
Manganese - Dissolved (ug/L)	24.0	1.3	0.1	2.2	4.8	21.0	1.0	0.1	2.0	4.0
Molybdenum - Total (ug/L)	18.0	7.8	10.0	4.3	18.3	17.0	10.0	10.0	0.0	0.0
Molybdenum - Dissolved(ug/L)	18.0	2408.3	1850.0	2206.7	4869485.3	17.0	512.6	430.0	295.4	87281.6
Selenium - Total (ug/L)	18.0	38.9	50.0	21.4	457.5	17.0	50.0	50.0	0.0	0.0
Selenium - Dissolved(ug/L)	18.0	45.4	52.0	30.6	935.8	17.0	133.3	61.0	111.0	12323.6
Silver -Total (ug/L)	19.0	0.0	0.0	0.0	0.0	17.0	0.0	0.0	0.0	0.0
Silver - Dissolved (ug/L)	18.0	0.1	0.1	0.0	0.0	17.0	0.1	0.1	0.0	0.0
Uranium - Total (ug/L)	18.0	0.2	0.3	0.2	0.0	17.0	0.3	0.3	0.0	0.0
Uranium - Dissolved (ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	2.5	2.5	0.0	0.0
Vanadium - Total (ug/L)	18.0	0.3	0.5	0.2	0.0	17.0	0.5	0.5	0.0	0.0
Vanadium - Dissolved (ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	2.5	2.5	0.0	0.0

Ammonia(ug/L)	18.0	780.8	555.0	936.4	876831.2	17.0	260.1	160.0	332.3	110419.0
Nitrate(ug/L)	18.0	4.4	2.5	4.9	23.8	17.0	2.5	2.5	0.0	0.0
Total Fluoride(ug/L)	24.0	56.5	59.5	31.0	963.8	21.0	139.6	100.0	99.0	9807.2
Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (m3/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C6-C9(ug/L)	18.0	0.1	0.1	0.0	0.0	17.0	0.1	0.1	0.0	0.0
Pet. Hydrocarbons C10-C36(ug/L)	18.0	1.9	2.5	1.1	1.1	17.0	3.0	2.5	1.5	2.4
Pet. Hydrocarbons C10-C14(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C15-C28(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	6.0	15.7	15.5	1.2	1.5	4.0	18.3	18.5	2.1	4.3
Sulphide as S2- (mg/L)	2.0	0.1	0.1	0.1	0.0	3.0	0.0	0.0	0.0	0.0
Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	31.0	-10.2	-9.5	3.5	12.2	97.0	-10.5	-9.0	7.2	52.3
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate as CO3 (mg/L)	44.0	0.0	0.0	0.0	0.0	33.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

<u>Summary statistics of all 2010-11 FPRH Lower Isaac data (including groundwater) as at 14.08.12</u>

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	1.0	276.0	276.0	0.0	0.0	2.0	516.0	516.0	73.5	5408.0
Electrical Conductivity @ 25C (ÂµS/cm) field	1.0	274.0	274.0	0.0	0.0	2.0	512.0	512.0	75.0	5618.0
Turbidity (NTU)	1.0	224.0	224.0	0.0	0.0	2.0	10.5	10.5	4.9	24.5

Turbidity (NTU) field	1.0	190.0	190.0	0.0	0.0	2.0	13.0	13.0	4.2	18.0
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	1.0	37.0	37.0	0.0	0.0	2.0	6.5	6.5	2.1	4.5
Water Temperature (deg C) field	1.0	28.2	28.2	0.0	0.0	2.0	22.5	22.5	0.2	0.0
pH (pH units)	1.0	7.9	7.9	0.0	0.0	2.0	8.0	8.0	0.1	0.0
pH (pH units) field	1.0	7.3	7.3	0.0	0.0	2.0	7.9	7.9	0.1	0.0
Total Alkalinity as CaCO3 (mg/L)	1.0	87.0	87.0	0.0	0.0	2.0	137.0	137.0	32.5	1058.0
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as CaCO3 field	1.0	0.6	0.6	0.0	0.0	2.0	0.8	0.8	0.4	0.1
Hydroxide as OH (mg/L)	1.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3 (mg/L)	1.0	105.0	105.0	0.0	0.0	2.0	165.5	165.5	38.9	1512.5
Hardness as CaCO3	1.0	77.0	77.0	0.0	0.0	2.0	151.0	151.0	26.9	722.0

(mg/L)										
Hydrogen as H (mg/L)	1.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	1.0	168.0	168.0	0.0	0.0	2.0	283.5	283.5	48.8	2380.5
Total Dissolved Ions (mg/L)	1.0	200.0	200.0	0.0	0.0	2.0	341.5	341.5	64.3	4140.5
Total Suspended Solids (mg/L)	1.0	199.0	199.0	0.0	0.0	2.0	11.5	11.5	6.4	40.5
Calcium as Ca soluble (mg/L)	1.0	16.0	16.0	0.0	0.0	2.0	31.0	31.0	5.7	32.0
Chloride as Cl (mg/L)	1.0	29.0	29.0	0.0	0.0	2.0	71.0	71.0	0.0	0.0
Magnesium as Mg soluble (mg/L)	1.0	8.9	8.9	0.0	0.0	2.0	18.0	18.0	2.8	8.0
Nitrite as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as NO3 (mg/L)	1.0	0.3	0.3	0.0	0.0	2.0	0.3	0.3	0.0	0.0
Total Nitrogen (mg/L)	1.0	0.5	0.5	0.0	0.0	2.0	0.3	0.3	0.1	0.0
Nitrate+nitrite as N	1.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.1	0.0

soluble (mg/L) (FieldFilt)										
Ammonia as N - soluble (mg/L) (Field Filtered)	1.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Oxygen (Dissolved) (mg/L) field	1.0	6.2	6.2	0.0	0.0	2.0	5.8	5.8	0.1	0.0
Total Phosphorus as P (mg/L)	1.0	0.1	0.1	0.0	0.0	2.0	0.1	0.1	0.0	0.0
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	1.0	0.1	0.1	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	1.0	2.2	2.2	0.0	0.0	2.0	1.6	1.6	0.4	0.2
Sodium as Na (mg/L)	1.0	27.0	27.0	0.0	0.0	2.0	44.5	44.5	7.8	60.5
Sulphate as SO4 (mg/L)	1.0	9.8	9.8	0.0	0.0	2.0	9.1	9.1	7.4	55.1
Aluminium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aluminium - Dissolved (ug/L)	1.0	80.0	80.0	0.0	0.0	2.0	25.0	25.0	0.0	0.0
Arsenic - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Cadmium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper - Dissolved (ug/L)	1.0	15.0	15.0	0.0	0.0	2.0	15.0	15.0	0.0	0.0
Iron - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iron - Dissolved(ug/L)	1.0	150.0	150.0	0.0	0.0	2.0	5.0	5.0	0.0	0.0
Lead - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Zinc - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc - Dissolved (ug/L)	1.0	20.0	20.0	0.0	0.0	2.0	5.0	5.0	0.0	0.0
Boron - Total (ug/L)	1.0	50.0	50.0	0.0	0.0	2.0	25.0	25.0	7.1	50.0
Boron - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Dissolved (ug/L)	1.0	5.0	5.0	0.0	0.0	2.0	5.0	5.0	0.0	0.0
Molybdenum - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Molybdenum -	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Dissolved(ug/L)										
Selenium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver -Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uranium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uranium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ammonia(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Fluoride(ug/L)	1.0	110.0	110.0	0.0	0.0	2.0	125.0	125.0	35.4	1250.0
Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Flow Rate (m3/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C6-C9(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C14(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C15-C28(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	1.0	22.0	22.0	0.0	0.0	2.0	26.0	26.0	4.2	18.0
Sulphide as S2- (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	0.0	0.0	0.0	0.0	0.0	11.0	-13.8	-10.8	7.1	51.0
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Carbonate as CO3 (mg/L)	4.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Summary statistics of all 2010-11 FPRH Lower Nogoa and Theresa Creek data (including groundwater) as at 14.08.12

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	3.0	469.7	400.0	145.6	21196.3	1.0	455.0	455.0	0.0	0.0
Electrical Conductivity @ 25C (ÂµS/cm) field	3.0	493.7	434.0	131.1	17190.3	1.0	457.0	457.0	0.0	0.0
Turbidity (NTU)	3.0	103.0	120.0	82.8	6859.0	1.0	36.0	36.0	0.0	0.0
Turbidity (NTU) field	3.0	129.0	160.0	102.1	10423.0	1.0	42.0	42.0	0.0	0.0
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	3.0	19.3	22.0	10.3	105.3	1.0	26.0	26.0	0.0	0.0
Water Temperature (deg C) field	3.0	28.7	28.9	0.5	0.2	1.0	25.9	25.9	0.0	0.0

pH (pH units)	3.0	7.8	7.9	0.2	0.0	1.0	7.8	7.8	0.0	0.0
pH (pH units) field	3.0	7.7	7.9	0.4	0.2	1.0	8.3	8.3	0.0	0.0
Total Alkalinity as CaCO3 (mg/L)	3.0	127.3	115.0	38.0	1446.3	1.0	142.0	142.0	0.0	0.0
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as CaCO3 field	3.0	0.7	0.7	0.4	0.2	1.0	0.5	0.5	0.0	0.0
Hydroxide as OH (mg/L)	3.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3 (mg/L)	3.0	153.7	139.0	45.8	2097.3	1.0	172.0	172.0	0.0	0.0
Hardness as CaCO3 (mg/L)	3.0	132.3	112.0	41.4	1716.3	1.0	140.0	140.0	0.0	0.0
Hydrogen as H (mg/L)	3.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	3.0	261.0	221.0	77.2	5961.0	1.0	260.0	260.0	0.0	0.0
Total Dissolved Ions (mg/L)	3.0	322.7	266.0	99.9	9977.3	1.0	329.0	329.0	0.0	0.0

Total Suspended Solids (mg/L)	3.0	136.3	192.0	102.5	10514.3	1.0	43.0	43.0	0.0	0.0
Calcium as Ca soluble (mg/L)	3.0	27.0	26.0	10.5	111.0	1.0	32.0	32.0	0.0	0.0
Chloride as Cl (mg/L)	3.0	60.7	53.0	26.4	694.3	1.0	44.0	44.0	0.0	0.0
Magnesium as Mg soluble (mg/L)	3.0	15.6	17.0	5.2	26.9	1.0	15.0	15.0	0.0	0.0
Nitrite as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as NO3 (mg/L)	3.0	0.4	0.3	0.3	0.1	1.0	1.3	1.3	0.0	0.0
Total Nitrogen (mg/L)	3.0	0.5	0.6	0.3	0.1	1.0	0.8	0.8	0.0	0.0
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	3.0	0.0	0.0	0.0	0.0	1.0	0.2	0.2	0.0	0.0
Ammonia as N - soluble (mg/L) (Field Filtered)	3.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Oxygen (Dissolved) (mg/L) field	3.0	7.0	7.0	0.3	0.1	1.0	7.8	7.8	0.0	0.0
Total Phosphorus as P	3.0	0.1	0.2	0.1	0.0	1.0	0.1	0.1	0.0	0.0

(mg/L)										
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	3.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	3.0	4.5	4.7	0.7	0.4	1.0	4.1	4.1	0.0	0.0
Sodium as Na (mg/L)	3.0	43.0	34.0	15.6	243.0	1.0	38.0	38.0	0.0	0.0
Sulphate as SO4 (mg/L)	3.0	16.7	16.2	4.1	16.6	1.0	22.0	22.0	0.0	0.0
Aluminium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aluminium - Dissolved (ug/L)	3.0	25.0	25.0	0.0	0.0	1.0	25.0	25.0	0.0	0.0
Arsenic - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Copper - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper - Dissolved (ug/L)	3.0	15.0	15.0	0.0	0.0	1.0	15.0	15.0	0.0	0.0
Iron - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iron - Dissolved(ug/L)	3.0	15.0	10.0	13.2	175.0	1.0	20.0	20.0	0.0	0.0
Lead - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc - Dissolved (ug/L)	3.0	5.0	5.0	0.0	0.0	1.0	5.0	5.0	0.0	0.0
Boron - Total (ug/L)	3.0	60.0	60.0	20.0	400.0	1.0	40.0	40.0	0.0	0.0
Boron - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Dissolved (ug/L)	3.0	5.0	5.0	0.0	0.0	1.0	5.0	5.0	0.0	0.0
Molybdenum - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Molybdenum - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver -Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Uranium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uranium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ammonia(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Fluoride(ug/L)	3.0	156.7	160.0	15.3	233.3	1.0	200.0	200.0	0.0	0.0
Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (m3/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C6-C9(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C14(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pet. Hydrocarbons C15-C28(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	3.0	16.7	16.0	1.2	1.3	1.0	18.0	18.0	0.0	0.0
Sulphide as S2- (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	45.0	-13.8	-10.0	11.9	142.7	88.0	-14.6	-11.4	13.2	175.2
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate as CO3 (mg/L)	12.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Summary statistics of all 2010-11 FPRH Mackenzie data (including groundwater) as at 14.08.12

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**

Electrical Conductivity @ 25C (ÂµS/cm)	359.0	428.8	267.0	506.5	256579.4	17.0	237.1	155.0	175.5	30800.1
Electrical Conductivity @ 25C (ÂµS/cm) field	29.0	61.0	0.0	102.9	10580.2	5.0	182.4	0.0	261.0	68105.3
Turbidity (NTU)	351.0	393.0	230.0	467.1	218140.3	17.0	876.7	550.0	925.3	856173.8
Turbidity (NTU) field	2.0	130.0	130.0	120.2	14450.0	2.0	15.0	15.0	5.7	32.0
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	2.0	30.0	30.0	2.8	8.0	3.0	9.0	11.0	4.4	19.0
Water Temperature (deg C) field	25.0	8.0	0.0	12.0	143.3	5.0	8.2	0.0	11.2	126.1
pH (pH units)	307.0	7.6	7.7	0.3	0.1	17.0	7.6	7.6	0.4	0.1
pH (pH units) field	25.0	3.1	1.0	3.2	10.2	5.0	3.8	1.0	3.8	14.7
Total Alkalinity as CaCO3 (mg/L)	2.0	87.5	87.5	2.1	4.5	3.0	140.3	158.0	35.9	1290.3
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as	2.0	0.4	0.4	0.3	0.1	3.0	1.7	1.3	1.2	1.4

CaCO3 field										
Hydroxide as OH (mg/L)	2.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3 (mg/L)	2.0	106.0	106.0	2.8	8.0	3.0	167.7	187.0	42.4	1801.3
Hardness as CaCO3 (mg/L)	2.0	83.5	83.5	3.5	12.5	3.0	151.3	169.0	43.3	1874.3
Hydrogen as H (mg/L)	2.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	2.0	164.5	164.5	13.4	180.5	3.0	285.3	317.0	78.4	6154.3
Total Dissolved Ions (mg/L)	2.0	197.5	197.5	12.0	144.5	3.0	348.3	394.0	98.8	9754.3
Total Suspended Solids (mg/L)	262.0	351.1	135.5	787.7	620421.7	17.0	767.4	366.0	849.1	721028.7
Calcium as Ca soluble (mg/L)	64.0	17.0	15.0	9.4	88.0	3.0	30.7	34.0	7.6	57.3
Chloride as Cl (mg/L)	2.0	29.0	29.0	7.1	50.0	3.0	70.3	72.0	24.5	602.3
Magnesium as Mg soluble (mg/L)	64.0	9.3	8.0	5.7	32.1	3.0	17.7	20.0	5.9	34.3

Nitrite as N (mg/L)	97.0	0.0	0.0	0.1	0.0	2.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	97.0	0.1	0.1	0.2	0.0	2.0	0.0	0.0	0.0	0.0
Nitrate as NO3 (mg/L)	2.0	0.6	0.6	0.5	0.2	3.0	0.4	0.3	0.3	0.1
Total Nitrogen (mg/L)	7.0	0.4	0.4	0.2	0.0	3.0	0.3	0.2	0.1	0.0
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	102.0	0.4	0.1	1.7	2.9	5.0	0.0	0.0	0.1	0.0
Ammonia as N - soluble (mg/L) (Field Filtered)	98.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0
Oxygen (Dissolved) (mg/L) field	25.0	3.0	0.0	4.8	22.8	4.0	2.0	0.0	4.1	16.4
Total Phosphorus as P (mg/L)	6.0	0.3	0.2	0.1	0.0	3.0	0.1	0.1	0.0	0.0
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	2.0	0.1	0.1	0.0	0.0	3.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	64.0	4.7	5.0	1.8	3.2	3.0	2.8	2.8	0.5	0.2
Sodium as Na (mg/L)	64.0	20.3	16.5	12.3	150.7	3.0	45.7	51.0	13.8	190.3
Sulphate as SO4 (mg/L)	262.0	23.9	14.5	28.2	794.8	17.0	9.1	4.0	12.2	148.4

Aluminium - Total (ug/L)	192.0	5771.2	3525.0	8882.0	78890191.5	14.0	11944.3	7135.0	16592.1	275298903.3
Aluminium - Dissolved (ug/L)	215.0	278.7	140.0	419.5	175943.6	17.0	394.4	300.0	356.5	127065.3
Arsenic - Total (ug/L)	198.0	1.8	2.0	1.0	1.1	14.0	2.4	2.0	0.9	0.9
Arsenic - Dissolved (ug/L)	198.0	0.8	0.5	0.5	0.2	14.0	1.3	1.0	0.8	0.7
Cadmium - Total (ug/L)	198.0	0.1	0.1	0.1	0.0	14.0	0.1	0.1	0.0	0.0
Cadmium - Dissolved (ug/L)	209.0	0.1	0.1	0.1	0.0	14.0	0.1	0.1	0.0	0.0
Chromium - Total (ug/L)	198.0	5.1	3.0	5.6	31.8	14.0	10.6	8.0	10.6	113.3
Chromium - Dissolved(ug/L)	208.0	0.6	0.5	0.3	0.1	14.0	0.5	0.5	0.0	0.0
Copper - Total (ug/L)	198.0	6.8	4.0	7.3	52.9	14.0	14.9	11.5	12.3	152.2
Copper - Dissolved (ug/L)	215.0	2.4	2.0	2.3	5.3	17.0	4.9	3.0	4.9	23.7
Iron - Total (ug/L)	192.0	5262.2	3630.0	5746.2	33019245.6	14.0	12386.4	7585.0	15571.7	242478101.6
Iron - Dissolved(ug/L)	215.0	304.0	220.0	365.8	133790.8	17.0	317.9	280.0	234.2	54856.4
Lead - Total (ug/L)	198.0	4.0	3.0	3.8	14.6	14.0	8.6	5.5	8.9	79.2
Lead - Dissolved (ug/L)	201.0	0.8	0.5	1.7	2.8	14.0	0.5	0.5	0.0	0.0

Mercury - Total (ug/L)	198.0	0.1	0.1	0.1	0.0	14.0	0.1	0.1	0.0	0.0
Mercury - Dissolved (ug/L)	195.0	0.1	0.1	0.1	0.0	14.0	0.1	0.1	0.0	0.0
Nickel - Total (ug/L)	198.0	7.3	5.0	9.1	83.2	14.0	17.0	12.0	18.7	348.0
Nickel - Dissolved (ug/L)	211.0	2.1	2.0	1.4	1.8	14.0	3.7	2.0	6.0	35.6
Zinc - Total (ug/L)	198.0	16.7	11.0	25.8	664.1	14.0	35.1	24.5	34.0	1157.9
Zinc - Dissolved (ug/L)	215.0	4.9	2.5	12.6	159.8	17.0	5.6	2.5	8.0	64.4
Boron - Total (ug/L)	194.0	42.6	25.0	25.5	649.3	17.0	30.6	25.0	13.7	187.1
Boron - Dissolved (ug/L)	198.0	41.5	25.0	53.5	2864.7	14.0	31.4	25.0	16.8	282.4
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	188.0	3.5	2.0	4.7	21.8	14.0	8.9	5.5	8.9	79.4
Cobalt - Dissolved(ug/L)	201.0	0.8	0.5	1.7	2.9	14.0	2.3	0.5	4.9	24.5

Manganese - Total (ug/L)	97.0	79.5	55.0	94.1	8846.8	2.0	512.5	512.5	580.5	337020.5
Manganese - Dissolved (ug/L)	118.0	22.5	3.0	53.9	2910.6	5.0	190.4	5.0	416.2	173260.8
Molybdenum - Total (ug/L)	192.0	1.0	0.5	1.7	2.8	14.0	0.5	0.5	0.0	0.0
Molybdenum - Dissolved(ug/L)	201.0	0.9	0.5	1.2	1.5	14.0	0.8	0.5	0.9	0.9
Selenium - Total (ug/L)	192.0	4.9	5.0	1.1	1.3	14.0	5.0	5.0	0.0	0.0
Selenium - Dissolved(ug/L)	198.0	4.9	5.0	0.6	0.3	14.0	5.0	5.0	0.0	0.0
Silver -Total (ug/L)	192.0	0.8	0.5	0.9	0.7	14.0	0.5	0.5	0.0	0.0
Silver - Dissolved (ug/L)	198.0	0.6	0.5	0.7	0.5	14.0	0.5	0.5	0.0	0.0
Uranium - Total (ug/L)	191.0	3.9	0.5	12.5	155.9	14.0	0.7	0.5	0.5	0.3
Uranium - Dissolved (ug/L)	209.0	0.6	0.5	0.6	0.4	14.0	0.5	0.5	0.0	0.0
Vanadium - Total (ug/L)	192.0	12.5	5.0	11.2	125.5	14.0	26.8	25.0	19.0	360.0
Vanadium - Dissolved (ug/L)	200.0	5.6	5.0	4.6	21.1	14.0	5.0	5.0	0.0	0.0

Ammonia(ug/L)	108.0	32.5	30.0	23.1	533.9	12.0	105.8	60.0	137.1	18790.2
Nitrate(ug/L)	117.0	105.4	70.0	120.9	14620.9	12.0	193.8	80.0	267.5	71536.9
Total Fluoride(ug/L)	219.0	110.5	100.0	101.0	10207.9	17.0	138.3	110.0	110.4	12184.4
Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	11382.0	1765.0	245.4	7196.0	51782595.5	809.0	112.8	60.5	148.0	21901.8
Flow Rate (m3/s)	11382.0	20.4	2.8	83.3	6936.8	809.0	1.3	0.7	1.7	2.9
Pet. Hydrocarbons C6-C9(ug/L)	208.0	32.6	10.0	318.2	101282.1	14.0	12.9	10.0	10.7	114.3
Pet. Hydrocarbons C10-C36(ug/L)	210.0	36.5	25.0	94.4	8909.1	14.0	93.9	25.0	257.9	66516.1
Pet. Hydrocarbons C10-C14(ug/L)	105.0	26.9	25.0	12.8	164.6	2.0	367.5	367.5	484.4	234612.5
Pet. Hydrocarbons C15-C28(ug/L)	105.0	58.8	50.0	67.2	4522.4	2.0	125.0	125.0	106.1	11250.0
Pet. Hydrocarbons C29-C36(ug/L)	105.0	32.2	25.0	71.7	5147.6	2.0	52.5	52.5	38.9	1512.5

1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	2.0	21.5	21.5	3.5	12.5	3.0	22.0	22.0	1.0	1.0
Sulphide as S2- (mg/L)	2.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	9.0	-29.3	-26.2	18.4	339.9	8.0	-29.3	-26.9	16.3	266.5
Carbon - Organic -	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Dissolved (mg/L)										
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate as CO3 (mg/L)	299.0	0.0	0.0	0.0	0.0	23.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Summary statistics of all 2010-11 FPRH Upper Dawson data (including groundwater) as at 14.08.12

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	5.0	462.4	467.0	88.2	7782.3	4.0	421.3	427.0	39.5	1558.9
Electrical Conductivity @	30.0	227.6	254.5	182.3	33231.6	16.0	251.1	236.5	152.2	23157.5

25C (ÂµS/cm) field										
Turbidity (NTU)	5.0	102.4	90.0	84.0	7058.3	4.0	42.8	38.0	27.9	780.9
Turbidity (NTU) field	5.0	133.2	112.0	123.3	15202.7	4.0	50.5	46.5	25.7	661.7
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	5.0	35.6	32.0	21.9	479.3	4.0	20.0	19.5	6.5	42.0
Water Temperature (deg C) field	21.0	22.5	24.4	4.7	22.3	13.0	21.6	23.0	3.2	10.4
pH (pH units)	5.0	8.0	7.9	0.2	0.0	4.0	7.8	7.8	0.1	0.0
pH (pH units) field	21.0	7.7	7.6	0.2	0.1	13.0	7.8	7.7	0.2	0.0
Total Alkalinity as CaCO3 (mg/L)	5.0	166.8	164.0	34.8	1207.7	4.0	156.0	158.0	13.3	176.7
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as CaCO3 field	5.0	1.5	0.9	1.3	1.7	4.0	0.7	0.7	0.2	0.0
Hydroxide as OH (mg/L)	5.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3	5.0	200.8	197.0	39.9	1590.7	4.0	188.8	191.0	16.2	260.9

(mg/L)										
Hardness as CaCO3 (mg/L)	5.0	129.4	120.0	19.6	383.3	4.0	107.8	109.0	19.4	376.9
Hydrogen as H (mg/L)	5.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	5.0	267.0	265.0	48.9	2392.5	4.0	236.8	238.5	25.5	652.3
Total Dissolved Ions (mg/L)	5.0	349.6	348.0	71.4	5103.3	4.0	318.3	322.5	29.0	842.3
Total Suspended Solids (mg/L)	5.0	108.0	109.0	82.9	6872.0	4.0	46.3	43.5	24.0	575.6
Calcium as Ca soluble (mg/L)	5.0	34.2	31.0	5.5	30.7	4.0	28.0	29.0	5.6	31.3
Chloride as Cl (mg/L)	5.0	42.8	44.0	9.9	97.7	4.0	38.0	38.5	2.9	8.7
Magnesium as Mg soluble (mg/L)	5.0	10.7	11.0	1.4	2.1	4.0	9.3	9.2	1.4	1.9
Nitrite as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as NO3 (mg/L)	5.0	0.3	0.3	0.1	0.0	4.0	0.8	0.9	0.3	0.1

Total Nitrogen (mg/L)	17.0	0.8	0.7	0.4	0.2	7.0	0.6	0.7	0.2	0.0
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	5.0	0.1	0.1	0.0	0.0	4.0	0.1	0.1	0.1	0.0
Ammonia as N - soluble (mg/L) (Field Filtered)	5.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Oxygen (Dissolved) (mg/L) field	21.0	6.5	7.3	2.6	7.0	14.0	5.5	5.0	2.2	5.0
Total Phosphorus as P (mg/L)	17.0	0.2	0.1	0.1	0.0	7.0	0.1	0.1	0.0	0.0
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	5.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	5.0	6.1	6.1	0.7	0.5	4.0	5.3	5.2	1.4	2.0
Sodium as Na (mg/L)	5.0	47.8	48.0	14.4	207.7	4.0	45.0	44.5	3.2	10.0
Sulphate as SO4 (mg/L)	5.0	5.3	5.3	0.6	0.4	4.0	2.9	2.8	1.7	2.8
Aluminium - Total (ug/L)	2.0	1300.0	1300.0	282.8	80000.0	0.0	0.0	0.0	0.0	0.0
Aluminium - Dissolved (ug/L)	5.0	30.0	25.0	11.2	125.0	4.0	36.3	25.0	22.5	506.3

Arsenic - Total (ug/L)	2.0	1.9	1.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Total (ug/L)	2.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Total (ug/L)	2.0	0.9	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper - Total (ug/L)	2.0	4.5	4.5	0.7	0.5	0.0	0.0	0.0	0.0	0.0
Copper - Dissolved (ug/L)	5.0	15.0	15.0	0.0	0.0	4.0	15.0	15.0	0.0	0.0
Iron - Total (ug/L)	2.0	2500.0	2500.0	282.8	80000.0	0.0	0.0	0.0	0.0	0.0
Iron - Dissolved(ug/L)	5.0	113.0	80.0	117.9	13895.0	4.0	53.8	50.0	46.1	2122.9
Lead - Total (ug/L)	2.0	2.8	2.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Lead - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Nickel - Total (ug/L)	2.0	3.8	3.8	0.4	0.2	0.0	0.0	0.0	0.0	0.0
Nickel - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc - Total (ug/L)	2.0	11.0	11.0	2.8	8.0	0.0	0.0	0.0	0.0	0.0
Zinc - Dissolved (ug/L)	5.0	25.0	10.0	26.9	725.0	4.0	8.8	5.0	7.5	56.3
Boron - Total (ug/L)	5.0	64.0	60.0	15.2	230.0	4.0	32.5	30.0	15.0	225.0
Boron - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Total (ug/L)	2.0	220.0	220.0	56.6	3200.0	0.0	0.0	0.0	0.0	0.0
Manganese - Dissolved (ug/L)	5.0	5.0	5.0	0.0	0.0	4.0	5.0	5.0	0.0	0.0

Molybdenum - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Molybdenum - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver -Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uranium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uranium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ammonia(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Fluoride(ug/L)	5.0	140.0	140.0	42.4	1800.0	4.0	127.5	130.0	5.0	25.0

Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (m3/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C6-C9(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C14(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C15-C28(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Silica Si02 - dissolved(mg/L)	5.0	19.4	20.0	2.8	7.8	4.0	14.5	15.5	7.2	52.3
Sulphide as S2- (mg/L)	4.0	0.0	0.0	0.1	0.0	1.0	0.0	0.0	0.0	0.0
Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	216.0	-32.9	-32.9	0.1	0.0	35.0	-32.1	-32.9	5.2	27.5
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate as CO3 (mg/L)	22.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Summary statistics of all 2010-11 FPRH Upper Isaac data (including groundwater; all flows) as at 14.08.12

	All data				
	Count	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	375.0	359.1	204.0	394.5	155624.3
Electrical Conductivity @ 25C (ÂµS/cm) field	124698.0	389.0	103.8	548.2	300510.3
Turbidity (NTU)	375.0	475.6	250.0	679.3	461493.5
Turbidity (NTU) field	27.0	334.3	207.3	411.2	169055.6
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	1.0	52.0	52.0	0.0	0.0

Water Temperature (deg C) field	24.0	26.7	26.7	2.8	7.6
pH (pH units)	375.0	7.7	7.7	0.5	0.2
pH (pH units) field	90.0	7.7	7.8	0.4	0.2
Total Alkalinity as CaCO3 (mg/L)	1.0	82.0	82.0	0.0	0.0
Total Alkalinity as CaCO3 (mg/L) field	5.0	97.8	112.0	42.6	1817.2
Phenolphthalein Alk. as CaCO3 field	1.0	0.3	0.3	0.0	0.0
Hydroxide as OH (mg/L)	1.0	0.0	0.0	0.0	0.0
Bicarbonate as HCO3 (mg/L)	1.0	99.0	99.0	0.0	0.0
Hardness as CaCO3 (mg/L)	1.0	60.0	60.0	0.0	0.0
Hydrogen as H (mg/L)	1.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	1.0	127.0	127.0	0.0	0.0

Total Dissolved Ions (mg/L)	1.0	161.0	161.0	0.0	0.0
Total Suspended Solids (mg/L)	368.0	352.7	169.5	985.2	970595.3
Calcium as Ca soluble (mg/L)	6.0	15.7	16.0	8.4	70.7
Chloride as Cl (mg/L)	6.0	11.0	10.5	5.1	26.0
Magnesium as Mg soluble (mg/L)	6.0	7.6	7.7	3.5	12.5
Nitrite as N (mg/L)	29.0	2.2	0.0	2.9	8.2
Nitrate as N (mg/L)	29.0	44.8	0.0	84.8	7189.0
Nitrate as NO3 (mg/L)	1.0	0.3	0.3	0.0	0.0
Total Nitrogen (mg/L)	18.0	0.7	0.7	0.2	0.1
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	30.0	43.7	0.0	83.8	7029.7
Ammonia as N - soluble (mg/L) (Field Filtered)	30.0	11.0	0.0	19.1	364.2
Oxygen (Dissolved)	8.0	7.9	7.9	0.3	0.1

(mg/L) field					
Total Phosphorus as P (mg/L)	18.0	0.2	0.2	0.1	0.0
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	1.0	0.0	0.0	0.0	0.0
Potassium as K (mg/L)	6.0	3.6	3.8	1.0	1.0
Sodium as Na (mg/L)	6.0	18.5	19.0	5.9	34.7
Sulphate as SO4 (mg/L)	368.0	13.8	4.0	24.3	589.5
Aluminium - Total (ug/L)	226.0	1424023.0	7280.0	9243174.6	85436276866481.6
Aluminium - Dissolved (ug/L)	227.0	1242.1	390.0	1930.8	3728061.6
Arsenic - Total (ug/L)	226.0	2.3	2.5	2.4	5.8
Arsenic - Dissolved (ug/L)	226.0	0.6	0.5	0.3	0.1
Cadmium - Total (ug/L)	226.0	0.3	0.3	0.7	0.5
Cadmium - Dissolved (ug/L)	226.0	0.1	0.1	0.0	0.0

Chromium - Total (ug/L)	226.0	18.9	14.0	21.9	479.4
Chromium - Dissolved(ug/L)	226.0	1.4	0.5	1.6	2.6
Copper - Total (ug/L)	226.0	15.0	8.0	41.4	1710.6
Copper - Dissolved (ug/L)	227.0	3.4	2.0	4.0	16.3
Iron - Total (ug/L)	226.0	11599.3	7465.0	14170.3	200796632.4
Iron - Dissolved(ug/L)	181.0	548.4	300.0	824.4	679716.8
Lead - Total (ug/L)	226.0	7.6	2.5	26.3	692.8
Lead - Dissolved (ug/L)	226.0	0.5	0.5	0.2	0.0
Mercury - Total (ug/L)	226.0	0.1	0.1	0.0	0.0
Mercury - Dissolved (ug/L)	220.0	0.1	0.1	0.0	0.0
Nickel - Total (ug/L)	226.0	19.8	12.5	32.3	1043.7
Nickel - Dissolved (ug/L)	226.0	3.4	3.0	2.9	8.7
Zinc - Total (ug/L)	226.0	60.8	18.0	338.3	114427.3
Zinc - Dissolved (ug/L)	227.0	5.7	2.5	14.9	222.6

Boron - Total (ug/L)	227.0	60.6	50.0	40.3	1624.5
Boron - Dissolved (ug/L)	226.0	52.4	50.0	41.2	1695.9
Barium - Total (mg/L)	50.0	171.6	69.5	400.2	160162.0
Barium - Dissolved (mg/L)	50.0	42.0	34.0	23.8	568.5
Beryllium - Total (mg/L)	50.0	0.9	0.5	1.4	1.9
Beryllium - Dissolved (mg/L)	50.0	0.5	0.5	0.0	0.0
Cobalt - Total (ug/L)	226.0	8.1	4.0	18.8	353.2
Cobalt - Dissolved(ug/L)	226.0	0.6	0.5	0.7	0.5
Manganese - Total (ug/L)	226.0	265.2	150.0	570.4	325343.0
Manganese - Dissolved (ug/L)	227.0	5.0	2.5	15.7	246.0
Molybdenum - Total (ug/L)	226.0	2.8	2.5	2.6	6.6
Molybdenum - Dissolved(ug/L)	226.0	1.8	0.5	3.7	13.6
Selenium - Total (ug/L)	226.0	3.3	2.5	3.1	9.6

Selenium - Dissolved(ug/L)	226.0	2.8	2.5	1.8	3.2
Silver -Total (ug/L)	226.0	1.1	0.3	1.4	1.9
Silver - Dissolved (ug/L)	226.0	0.6	0.1	0.9	0.8
Uranium - Total (ug/L)	226.0	3.3	0.5	10.8	117.0
Uranium - Dissolved (ug/L)	223.0	1.0	0.1	5.8	33.7
Vanadium - Total (ug/L)	226.0	28.6	20.0	28.5	809.5
Vanadium - Dissolved (ug/L)	226.0	3.5	2.5	1.8	3.3
Ammonia(ug/L)	175.0	30.5	20.0	110.7	12252.6
Nitrate(ug/L)	176.0	149.3	30.0	666.6	444381.5
Total Fluoride(ug/L)	238.0	220.7	50.0	1940.4	3765211.4
Flow Rate (L/s)	73102.0	747.6	0.1	2726.2	7432103.5
Flow Rate (ML/day)	73102.0	64.6	0.0	235.5	55480.4
Flow Rate (m3/s)	110022	6.5	0.0	48.2	2318.8

	.0				
Pet. Hydrocarbons C6-C9(ug/L)	186.0	23.3	25.0	9.5	90.8
Pet. Hydrocarbons C10-C36(ug/L)	186.0	187.9	100.0	1111.0	1234376.7
Pet. Hydrocarbons C10-C14(ug/L)	12.0	25.0	25.0	0.0	0.0
Pet. Hydrocarbons C15-C28(ug/L)	12.0	50.0	50.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	12.0	25.0	25.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0

Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0
Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	1.0	16.0	16.0	0.0	0.0
Sulphide as S2- (mg/L)	0.0	0.0	0.0	0.0	0.0

Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0
Bank level	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0

Reach environs category	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0
vegetation value	0.0	0.0	0.0	0.0	0.0
Depth (m)	35.0	1.0	0.8	0.8	0.6
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0

Carbonate as CO3 (mg/L)	235057.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0

<u>Summary statistics of all 2010-11 FPRH Upper Nogoa data (including groundwater) as at 14.08.12</u>

	High Flow					**Low Flow**				
	Count	**Mean**	**Median**	**SD**	**Var**	**Count**	**Mean**	**Median**	**SD**	**Var**
Electrical Conductivity @ 25C (ÂµS/cm)	0.0	0.0	0.0	0.0	0.0	3.0	604.3	520.0	279.2	77964.3
Electrical Conductivity @ 25C (ÂµS/cm) field	0.0	0.0	0.0	0.0	0.0	3.0	599.3	524.0	265.2	70305.3
Turbidity (NTU)	0.0	0.0	0.0	0.0	0.0	3.0	213.0	200.0	196.8	38739.0
Turbidity (NTU) field	0.0	0.0	0.0	0.0	0.0	3.0	189.7	186.0	170.5	29080.3
Transparency (secchi depth) (m) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colour True (Hazen units)	0.0	0.0	0.0	0.0	0.0	3.0	25.0	28.0	15.7	247.0
Water Temperature (deg C) field	0.0	0.0	0.0	0.0	0.0	3.0	23.2	24.7	3.9	15.5

pH (pH units)	0.0	0.0	0.0	0.0	0.0	3.0	8.2	8.0	0.4	0.1
pH (pH units) field	0.0	0.0	0.0	0.0	0.0	3.0	8.2	8.1	0.2	0.0
Total Alkalinity as CaCO3 (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	244.0	189.0	116.7	13611.0
Total Alkalinity as CaCO3 (mg/L) field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenolphthalein Alk. as CaCO3 field	0.0	0.0	0.0	0.0	0.0	3.0	4.6	1.4	5.5	30.7
Hydroxide as OH (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.1	0.0
Bicarbonate as HCO3 (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	288.0	228.0	130.8	17100.0
Hardness as CaCO3 (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	222.3	176.0	112.9	12740.3
Hydrogen as H (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	355.7	302.0	163.3	26652.3
Total Dissolved Ions (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	475.7	396.0	223.4	49916.3

Total Suspended Solids (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	252.7	173.0	267.5	71582.3
Calcium as Ca soluble (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	40.3	36.0	14.0	196.3
Chloride as Cl (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	46.0	46.0	28.0	784.0
Magnesium as Mg soluble (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	30.0	21.0	19.2	367.0
Nitrite as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate as NO3 (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	0.5	0.5	0.3	0.1
Total Nitrogen (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	0.6	0.6	0.4	0.1
Nitrate+nitrite as N soluble (mg/L) (FieldFilt)	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0
Ammonia as N - soluble (mg/L) (Field Filtered)	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0
Oxygen (Dissolved) (mg/L) field	0.0	0.0	0.0	0.0	0.0	2.0	6.1	6.1	1.0	1.0
Total Phosphorus as P	0.0	0.0	0.0	0.0	0.0	3.0	0.3	0.4	0.2	0.0

(mg/L)										
Total Reactive Phosphorus (Ortho P) - soluble (FieldFiltered)	0.0	0.0	0.0	0.0	0.0	3.0	0.1	0.2	0.1	0.0
Potassium as K (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	4.5	4.8	1.0	1.0
Sodium as Na (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	45.7	41.0	23.4	545.3
Sulphate as SO4 (mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	15.5	15.8	6.7	45.0
Aluminium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aluminium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	3.0	25.0	25.0	0.0	0.0
Arsenic - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Copper - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	3.0	20.0	15.0	8.7	75.0
Iron - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iron - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	3.0	15.0	10.0	13.2	175.0
Lead - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zinc - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	3.0	5.0	5.0	0.0	0.0
Boron - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	3.0	36.7	40.0	15.3	233.3
Boron - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Barium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Total (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	3.0	10.0	5.0	8.7	75.0
Molybdenum - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Molybdenum - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium - Dissolved(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver -Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silver - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Uranium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uranium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Total (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium - Dissolved (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ammonia(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Fluoride(ug/L)	0.0	0.0	0.0	0.0	0.0	3.0	236.7	260.0	40.4	1633.3
Flow Rate (L/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (ML/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate (m3/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C6-C9(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C10-C14(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pet. Hydrocarbons C15-C28(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pet. Hydrocarbons C29-C36(ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-Dichloroethane-D4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene-D8 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-Bromofluorobenzene (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E.coli (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliforms (cnt/100 mls)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella pneumophila Sg 1-14 (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legionella species (not pneumophila) (CFU/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanobacteria (cells/mL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tannins (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Volatile Acids as Acetic Acid (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
meta- & para-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ortho-Xylene (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
comments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Potassium (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica Si02 - dissolved(mg/L)	0.0	0.0	0.0	0.0	0.0	3.0	26.3	24.0	5.9	34.3
Sulphide as S2- (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biochemical Oxygen Demand (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indicator type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bank level	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank Condition Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank condition value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic habitat value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Habitat Type	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa code	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach environs category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transect number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
distance along transect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
riparian vegetation category	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

vegetation value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depth (m)	1.0	-15.5	-15.5	0.0	0.0	24.0	-22.0	-18.4	8.4	69.7
Carbon - Organic - Dissolved (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyll-a (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxygen per cent saturation (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pheopigments (ug/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salinity (g/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrogen (organic) as N (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate as CO3 (mg/L)	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0
Sodium absorption ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

APPENDIX IV METALS GRAPHS

Graphs of the FPRH metal indicators data that was available on 14 August 2012, with very preliminary analysis for potential data errors.

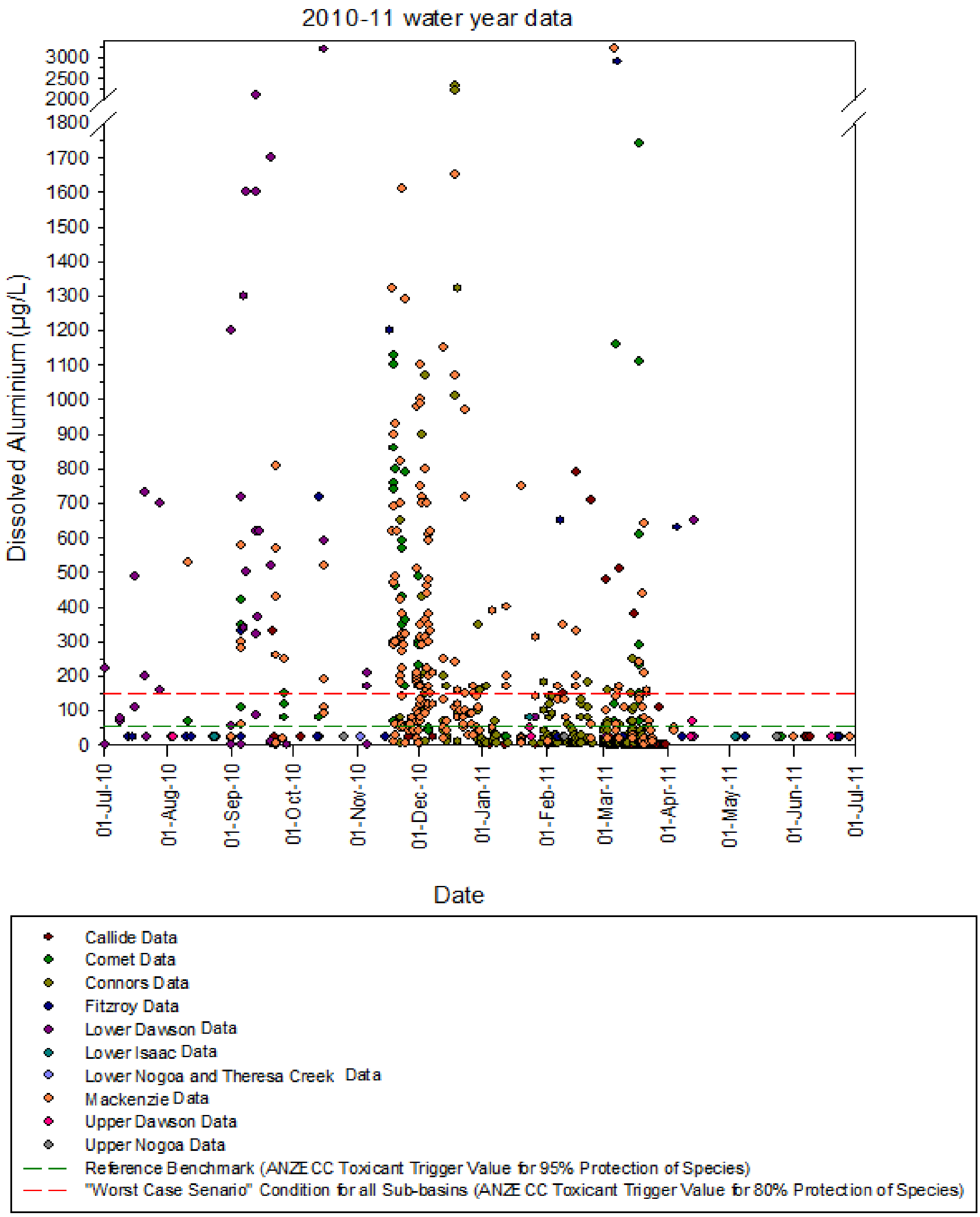


Figure A3 Dissolved aluminium with reference benchmark and WCS

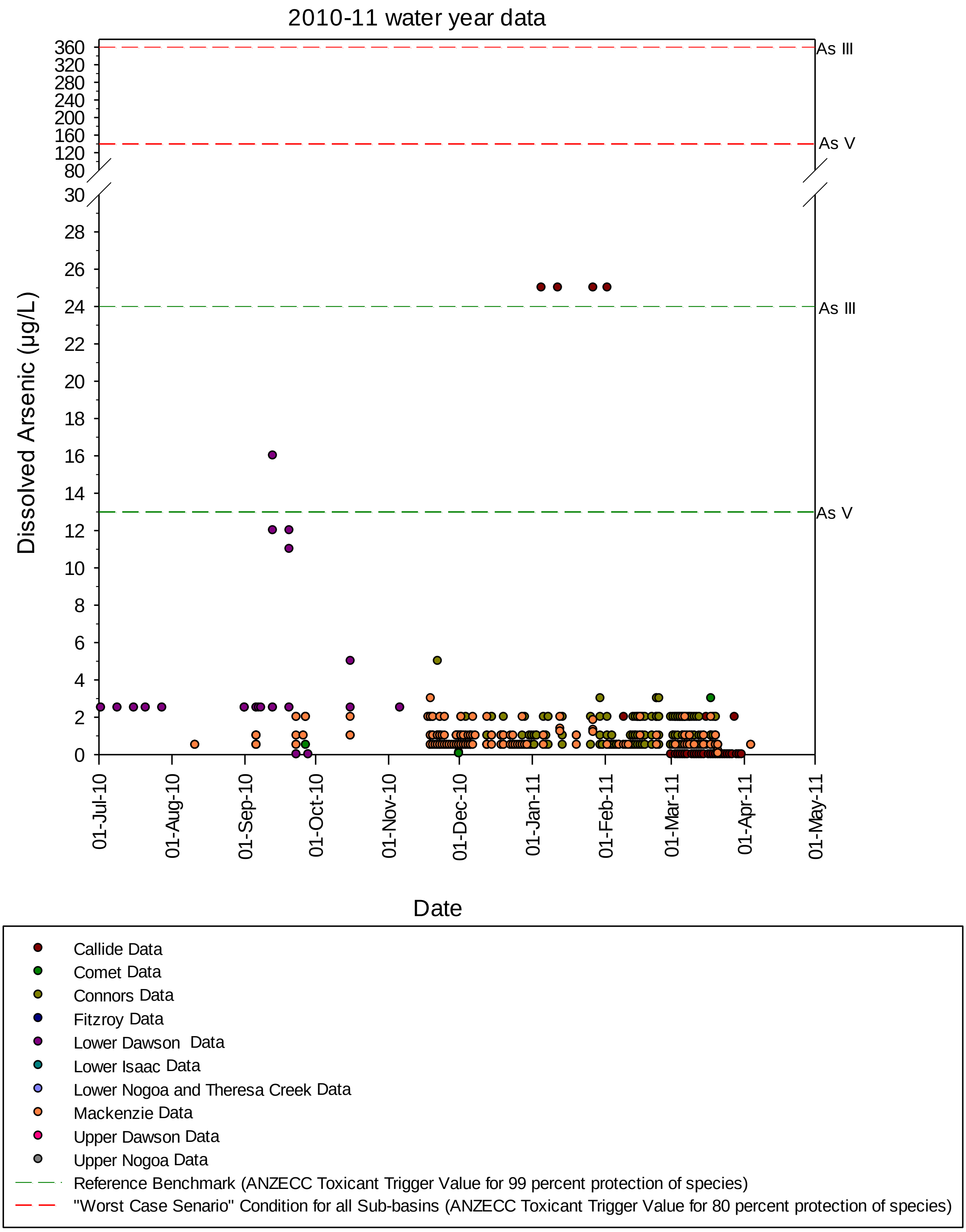


Figure A4 Dissolved arsenic with reference benchmark and WCS

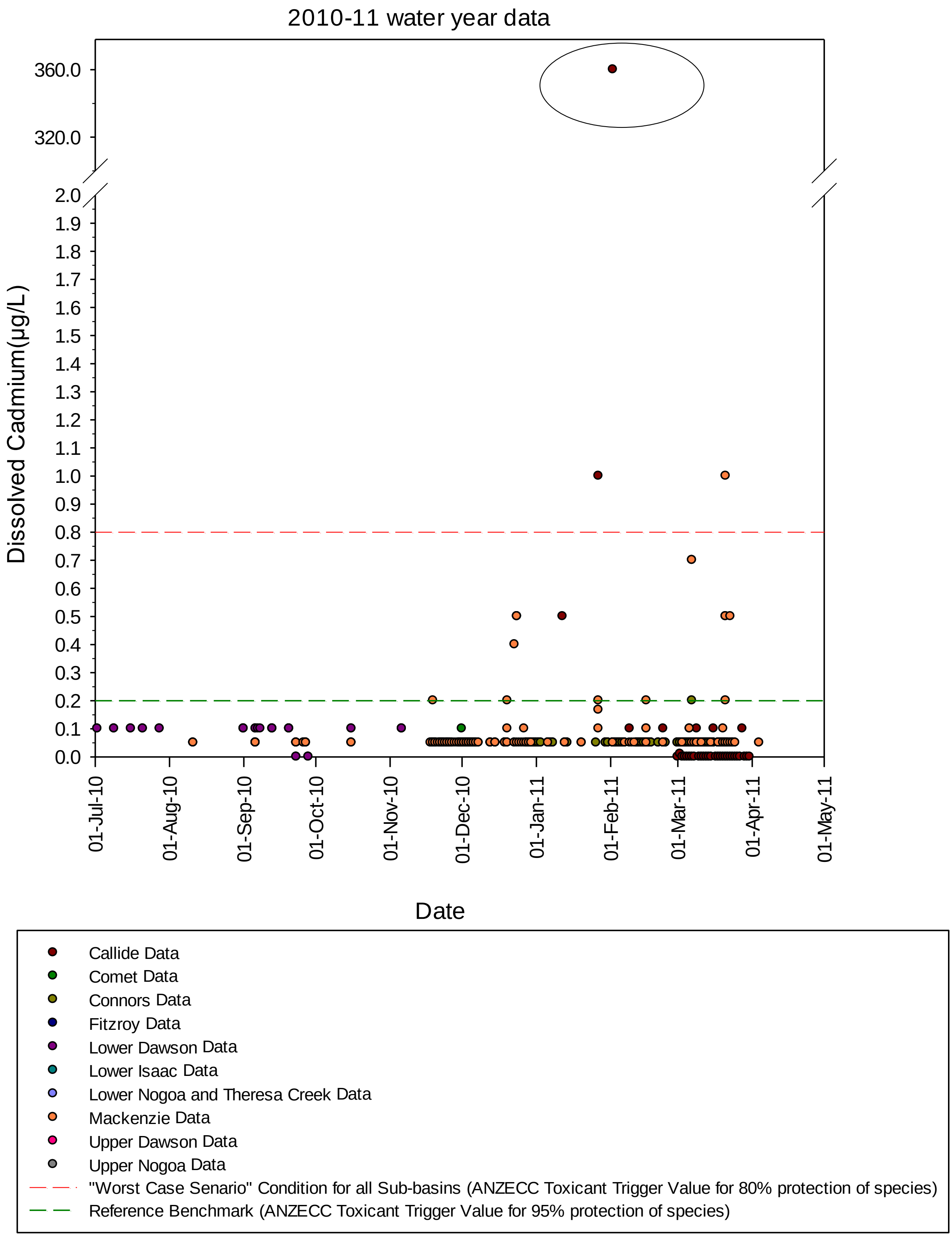


Figure A5 Dissolved cadmium with reference benchmark and WCS

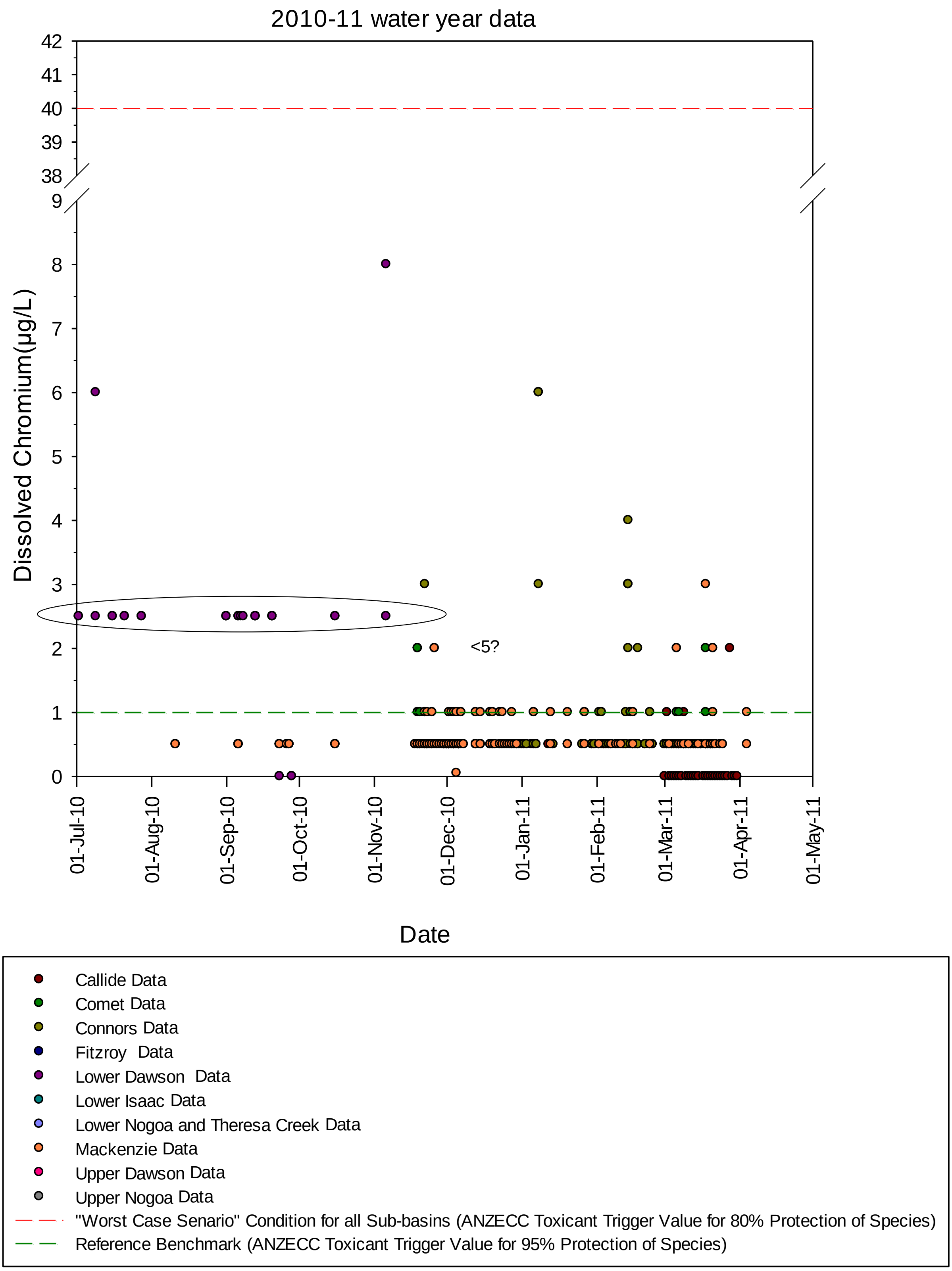


Figure A6 Dissolved chromium with reference benchmark and WCS

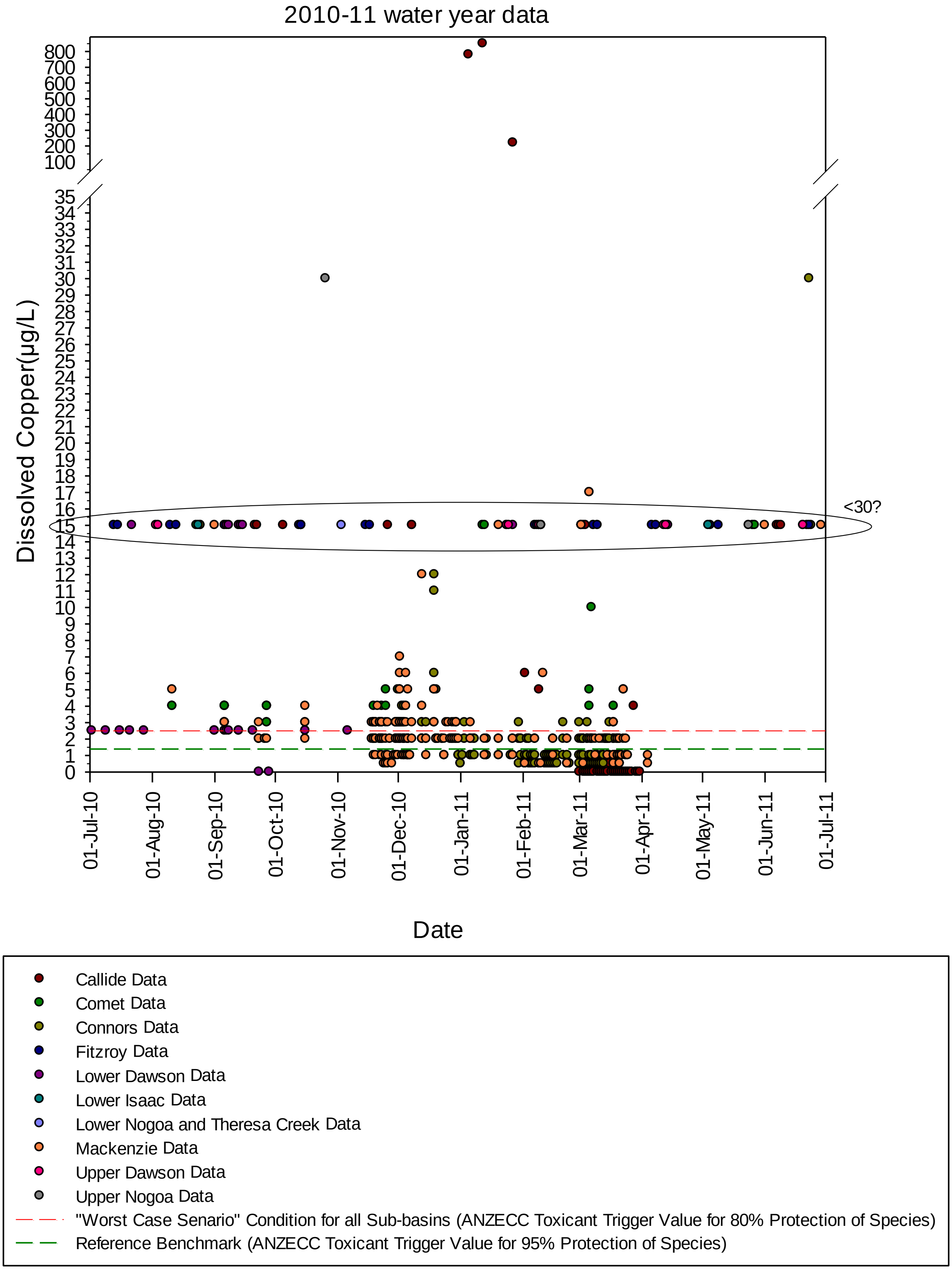


Figure A7 Dissolved copper with reference benchmark and WCS

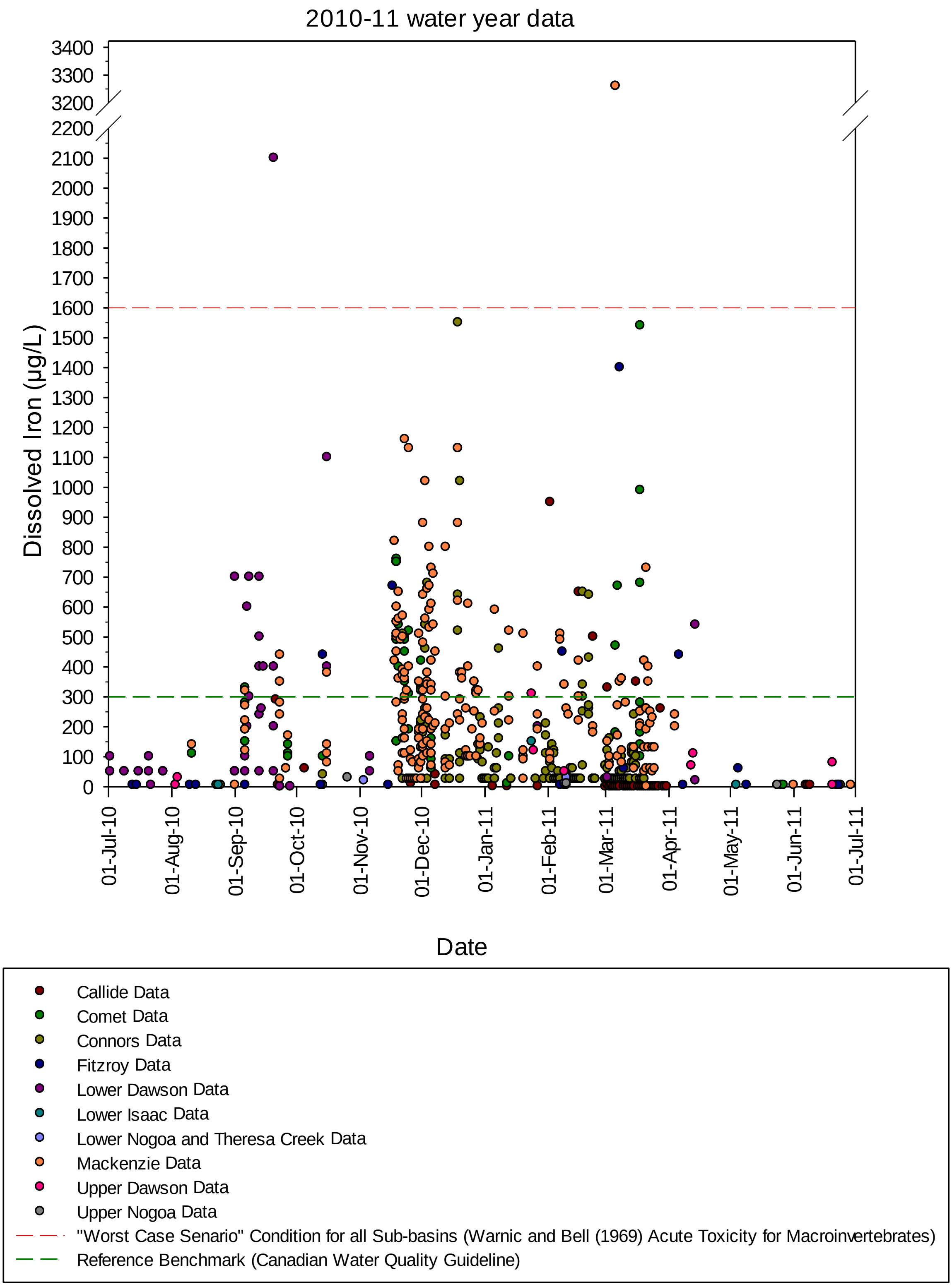


Figure A8 Dissolved iron with reference benchmark and WCS

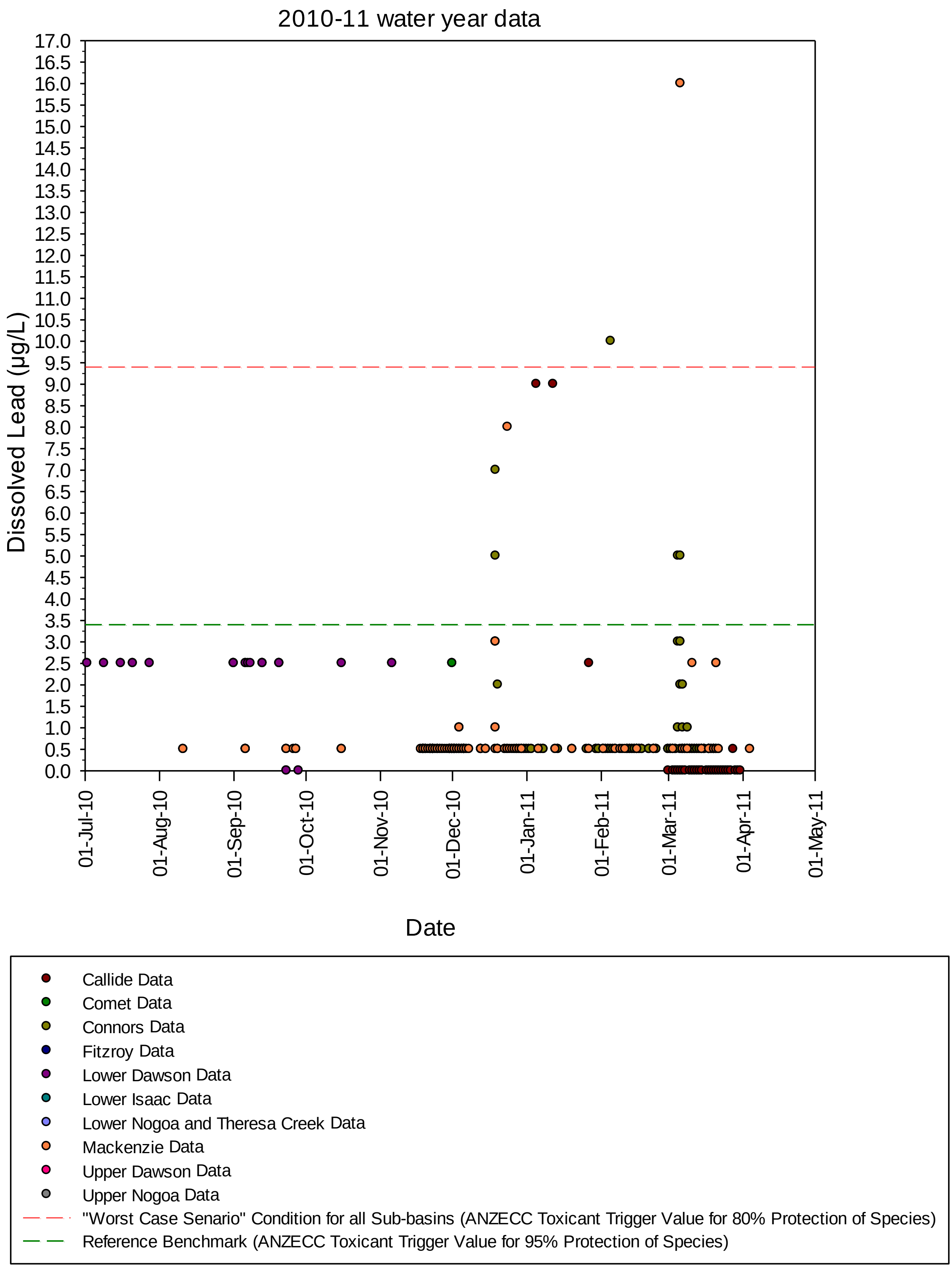


Figure A9 Dissolved lead with reference benchmark and WCS

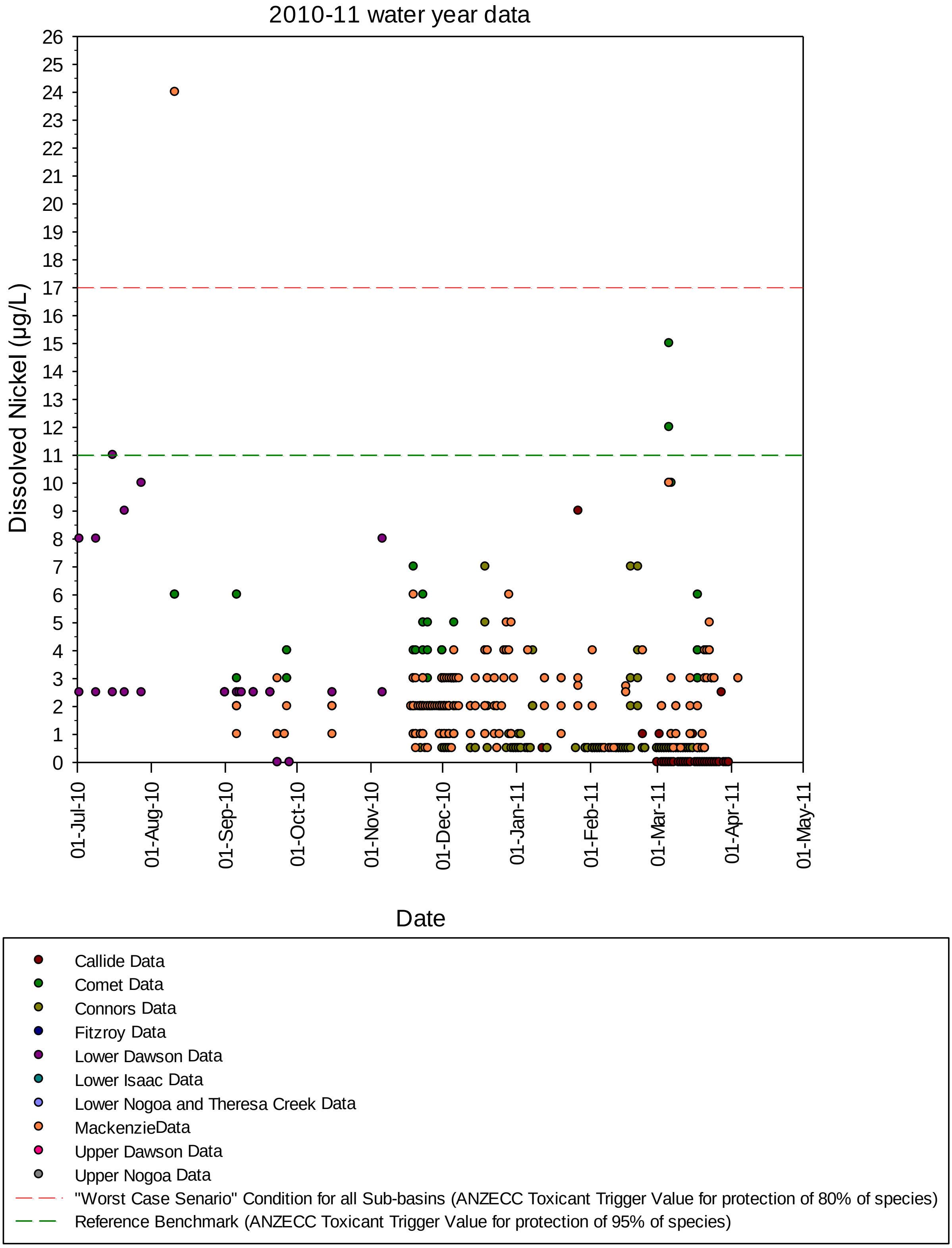


Figure A10 Dissolved nickel with reference benchmark and WCS

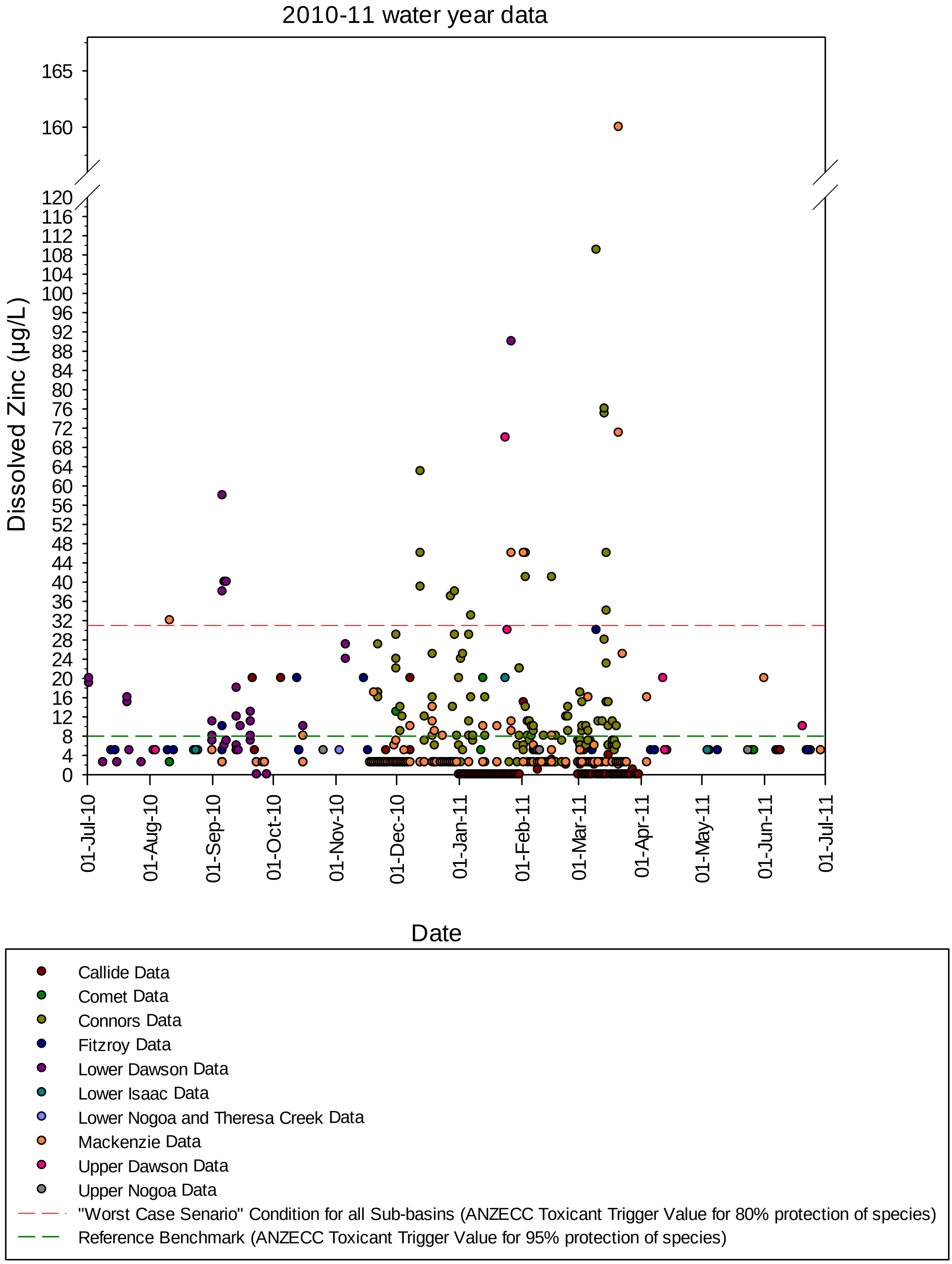


Figure A11 Dissolved zinc with reference benchmark and WCS

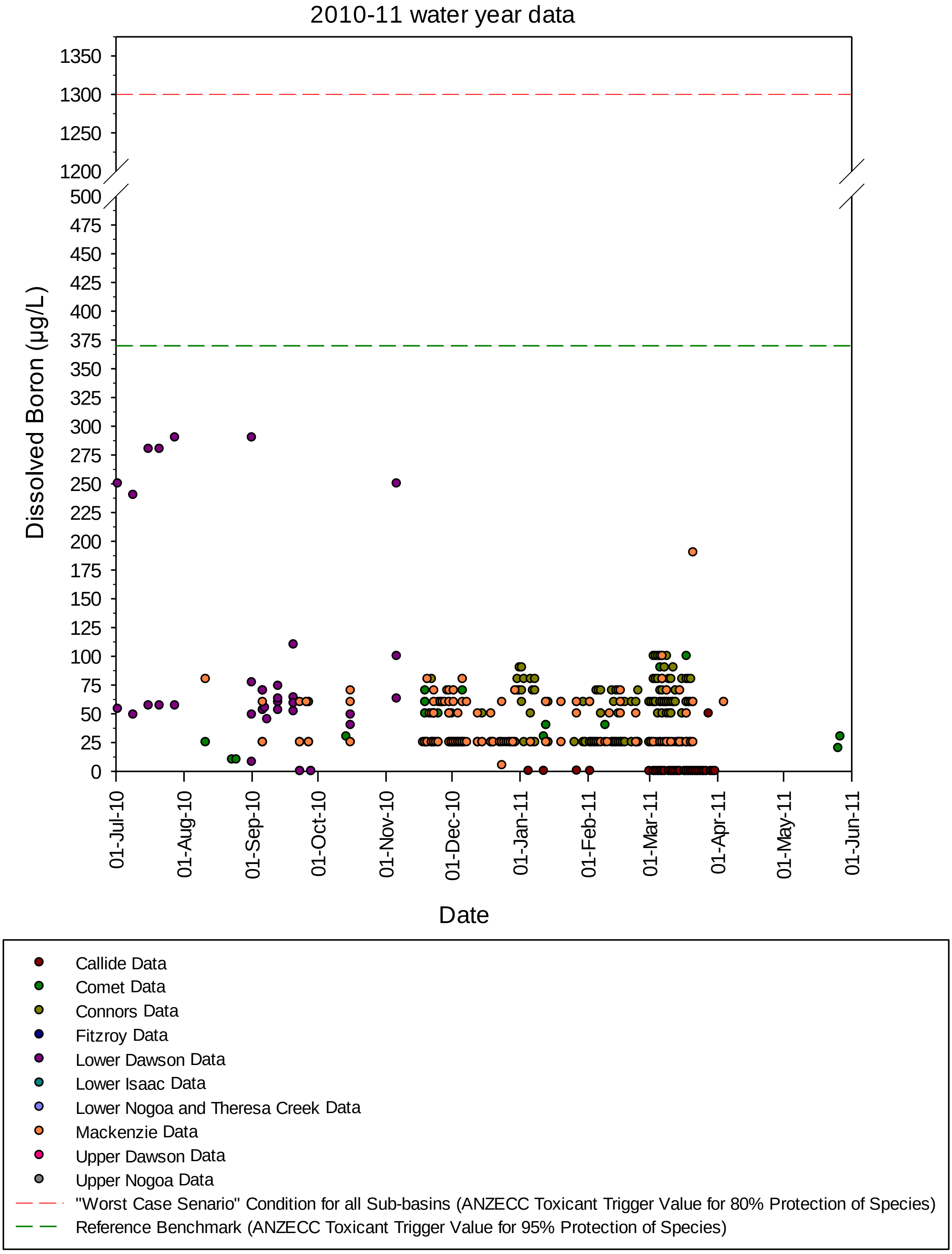


Figure A12 Dissolved boron with reference benchmark and WCS

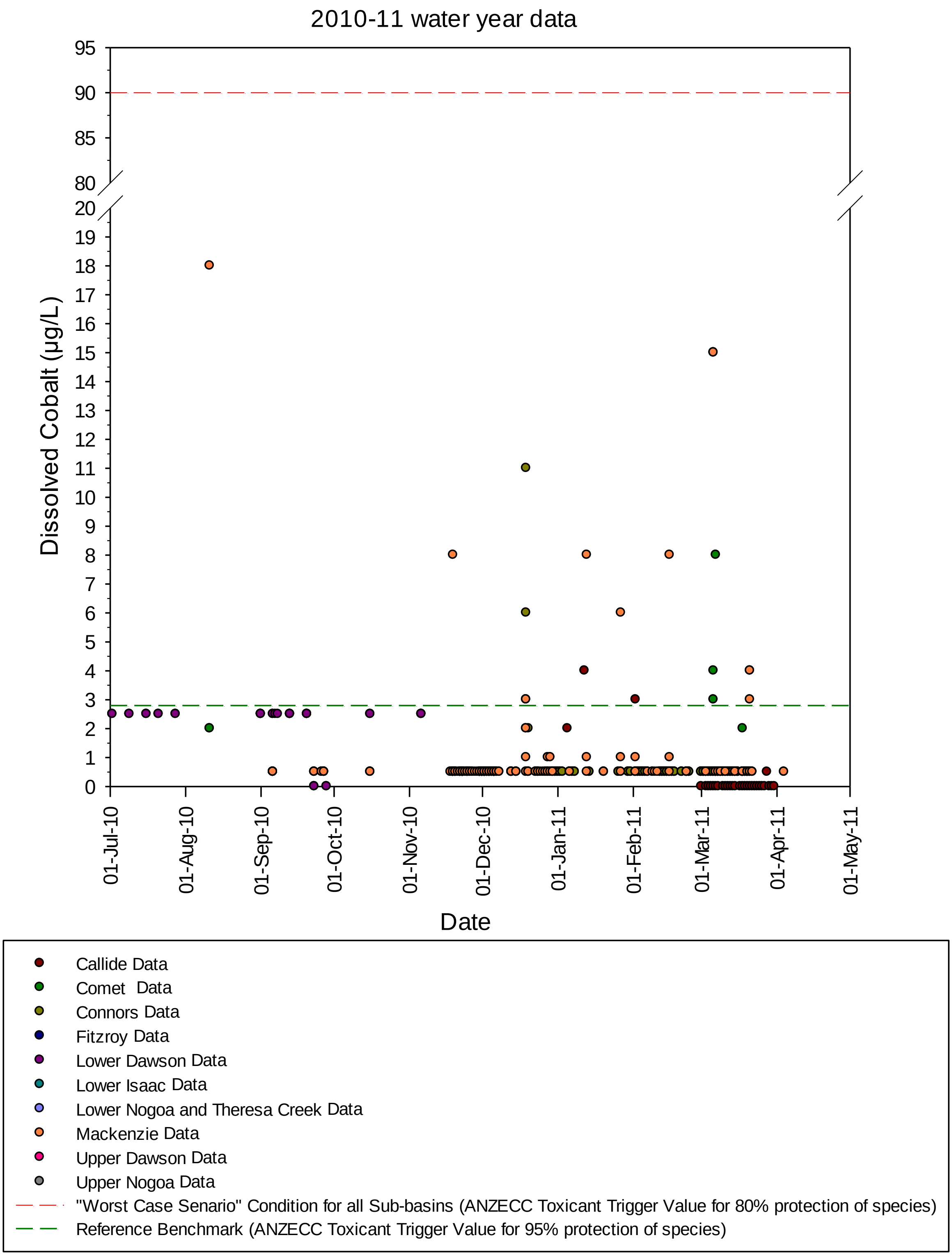


Figure A13 Dissolved cobalt with reference benchmark and WCS

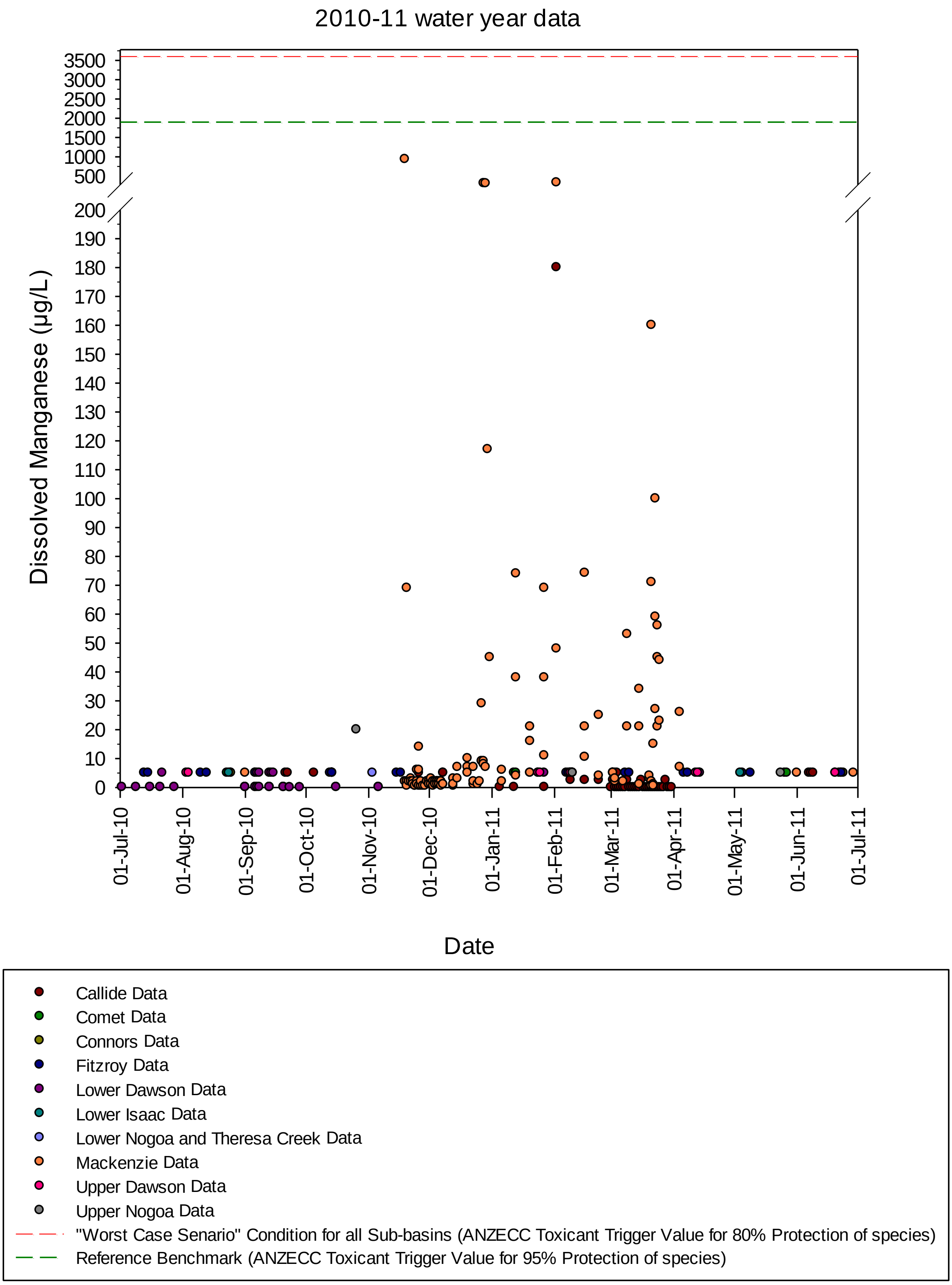


Figure A14 Dissolved manganese with reference benchmark and WCS

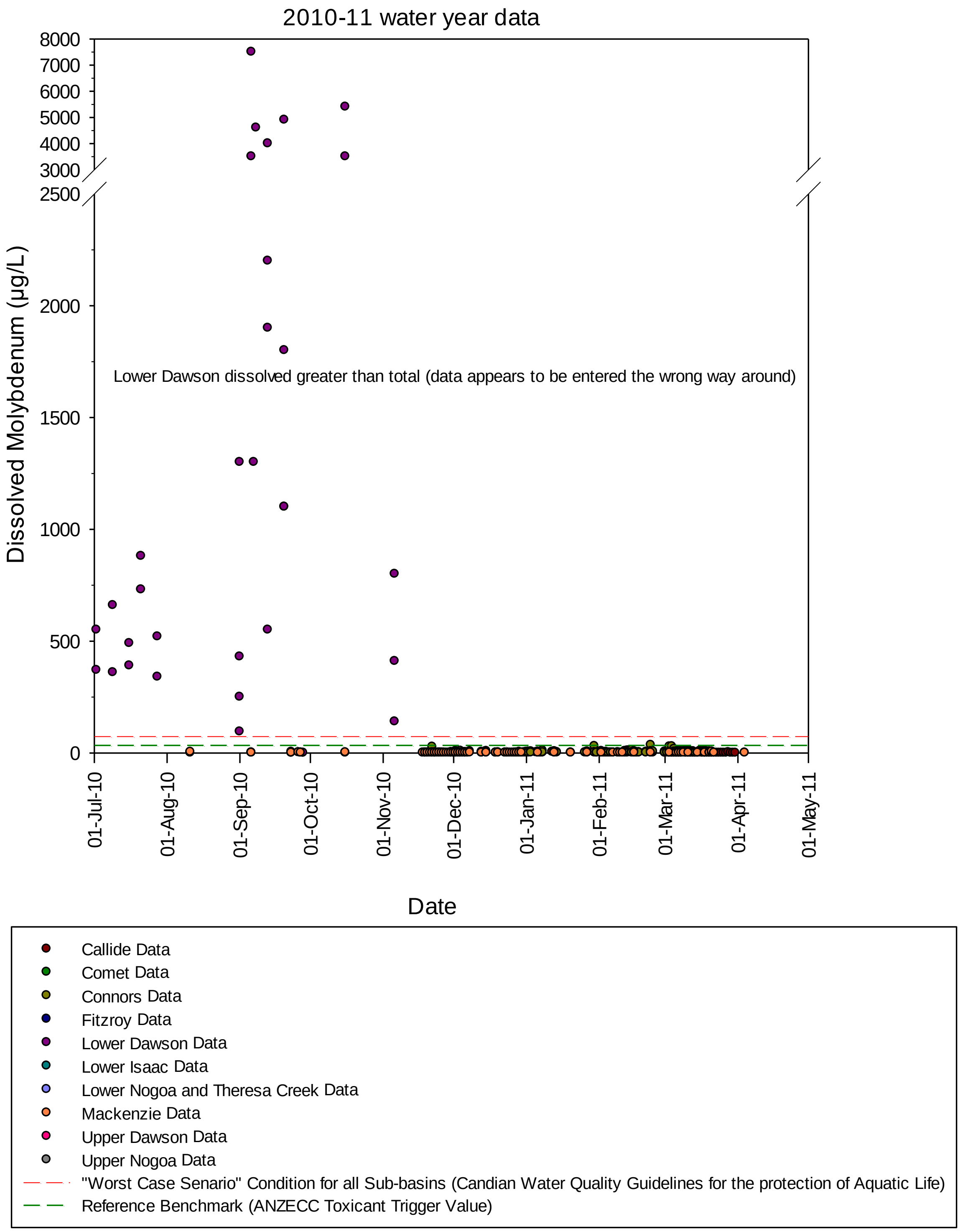


Figure A15 Dissolved molybdenum with reference benchmark and WCS

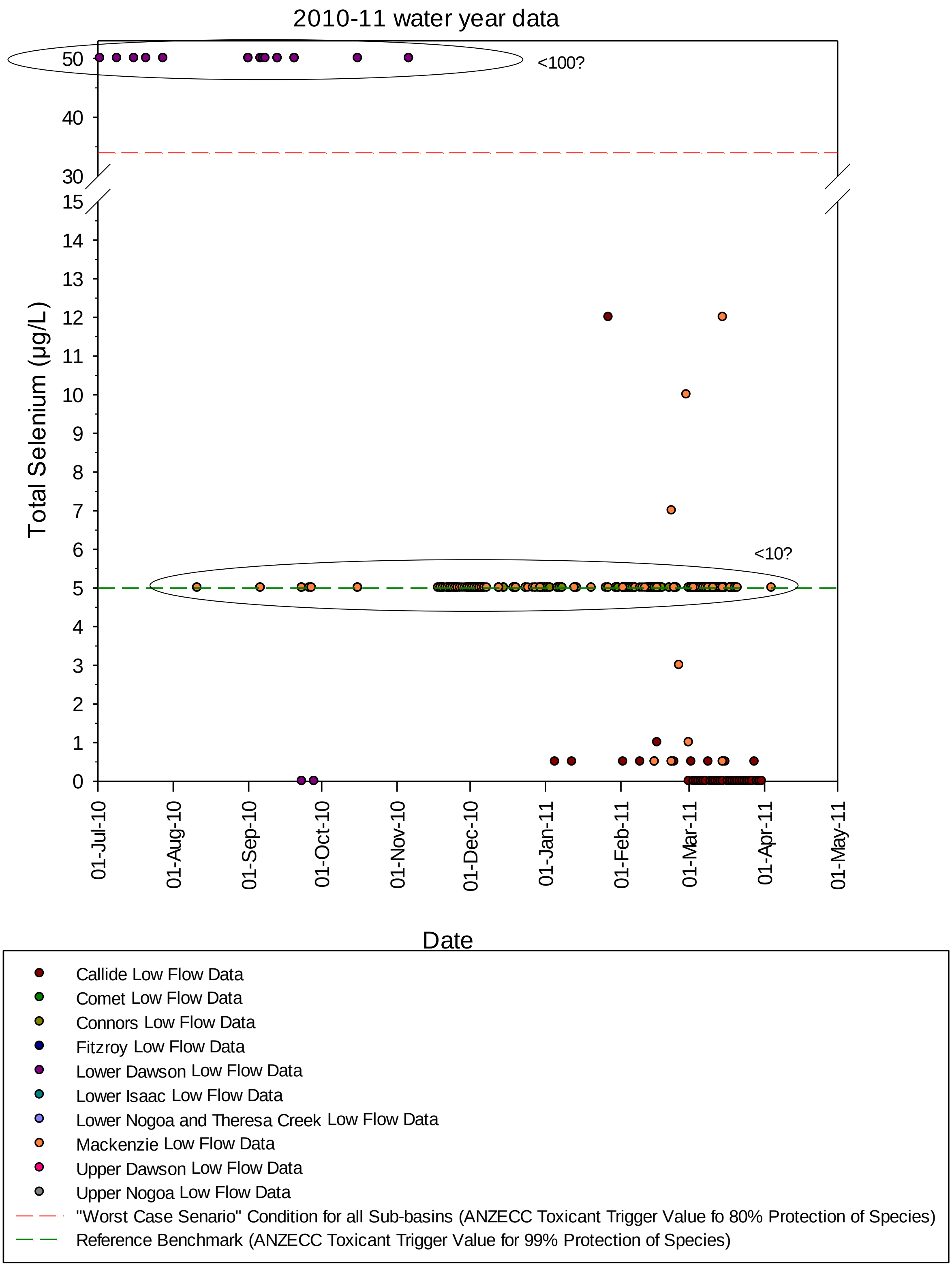


Figure A16 Total selenium with reference benchmark and WCS

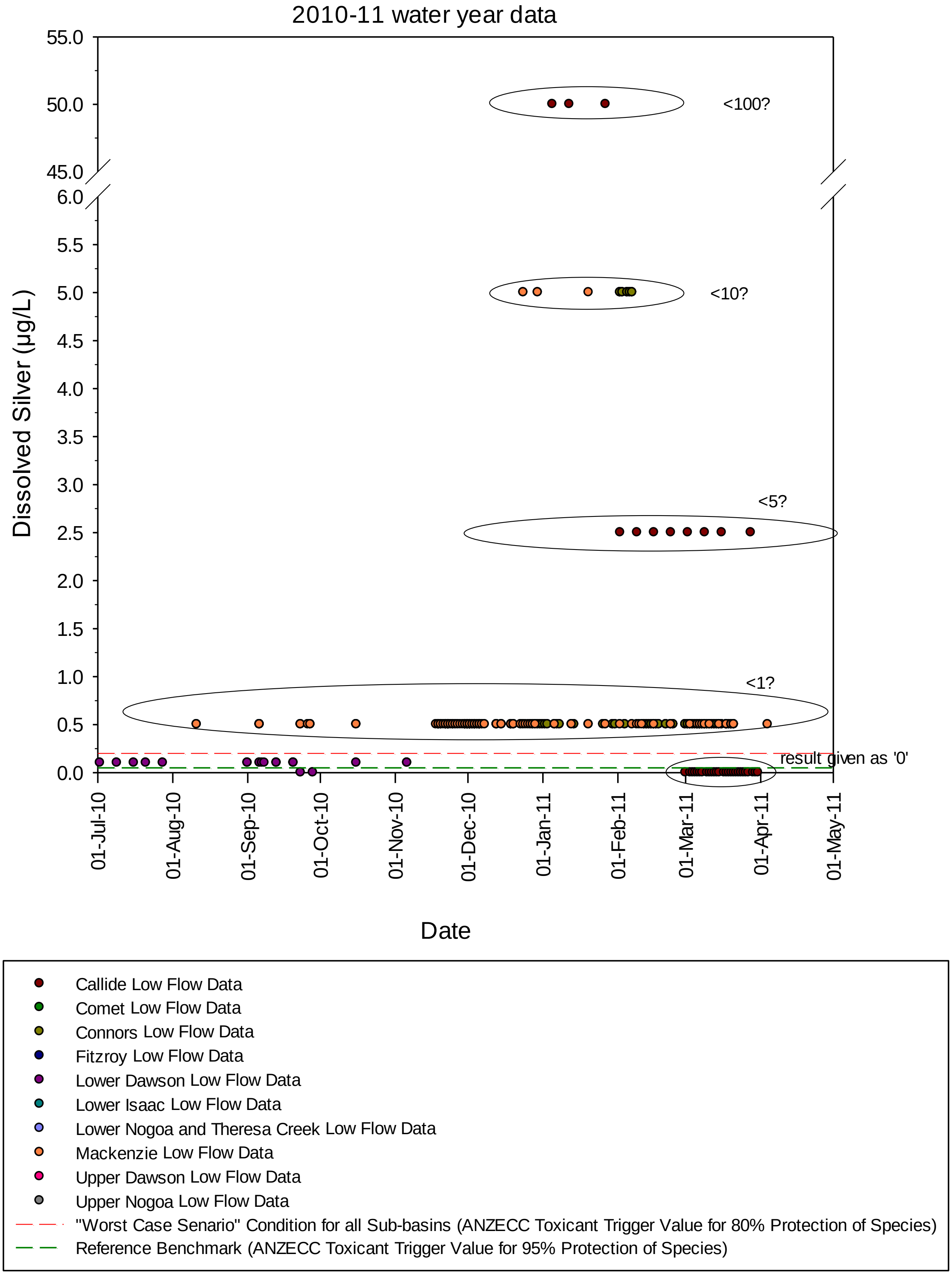


Figure A17 Dissolved silver with reference benchmark and WCS

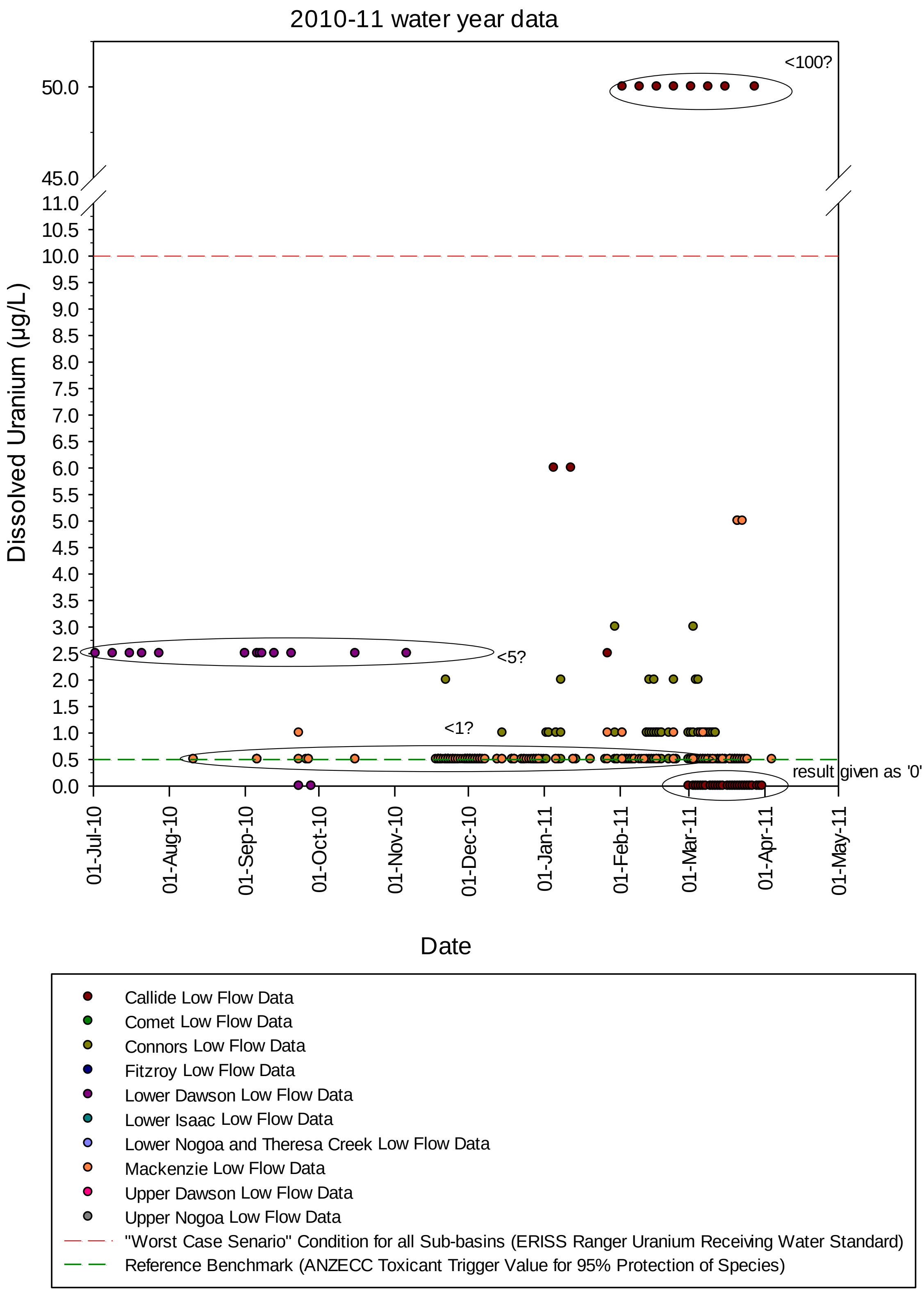


Figure A18 Dissolved uranium with reference benchmark and WCS

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