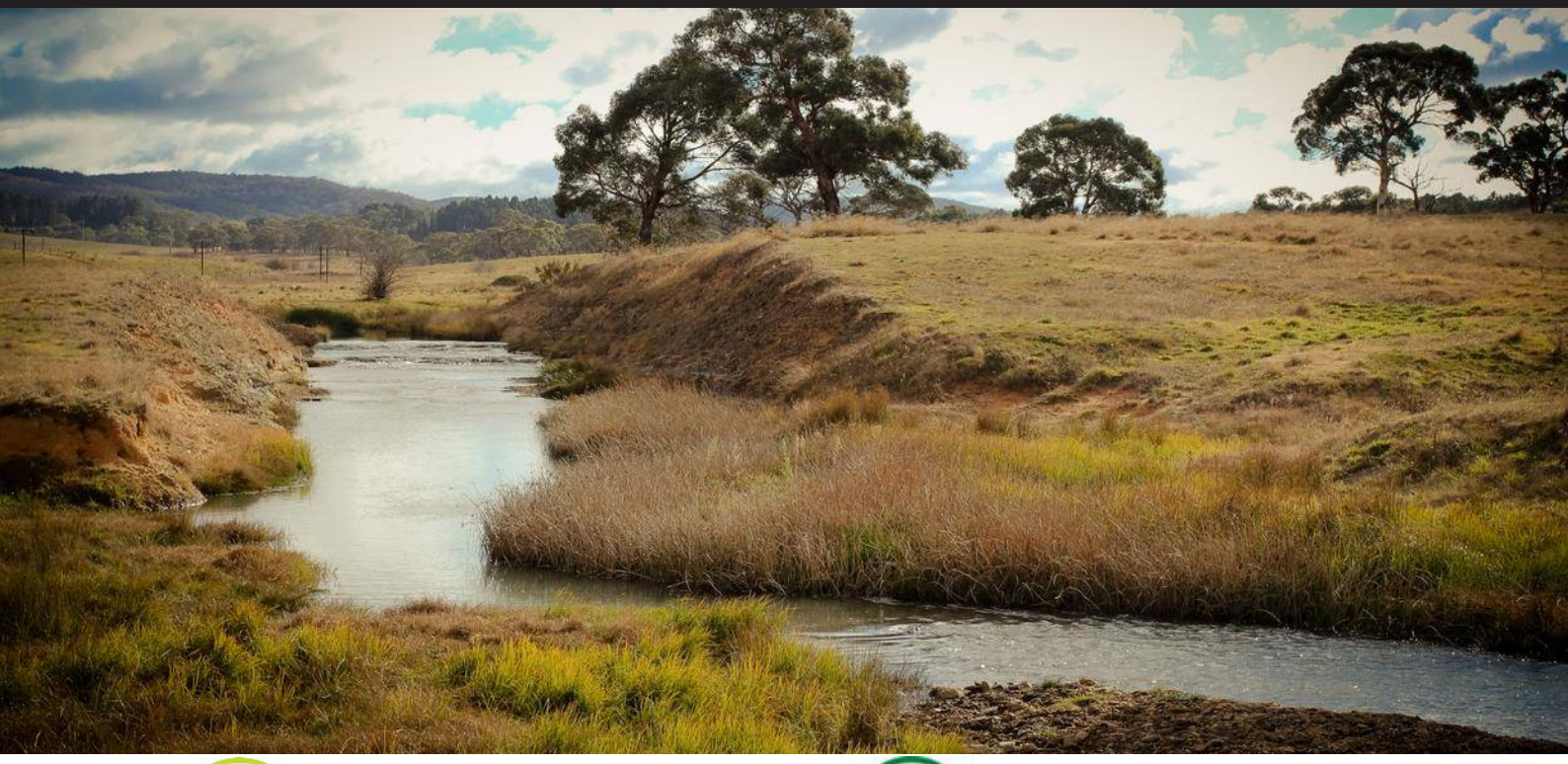
# Springvale Water Treatment Project

## State Significant Development 7592
## Environmental Impact Statement
## Volume 2 - Appendix B7

September 2016



EnergyAustralia

Centennial Coal

# Appendix C – Supporting catchment hydrology and hydraulics modelling information

## C.1 Hydrology model input data

Data utilised in the establishment of the hydrology model for Wangcol Creek is provided in Table C-1 and Table C-2 below.

### Table C-1 Intensity-frequency-duration input data

| Parameter | *Event* | | |
|---|---|---|---|
| | *1 HR* | *12 HR* | *72 HR* |
| 2 YEAR ARI | *23.6 mm/hr* | *5.06 mm/hr* | *1.76 mm/hr* |
| 50 YEAR ARI | *45.2 mm/hr* | *9.22 mm/hr* | *2.77 mm/hr* |
| F2 | 4.31 | | |
| F50 | 15.72 | | |
| Skew | 0.17 | | |

### Table C-2 Hydrology model input data

| Model Node | Catchment Area (ha) | Percentage Impervious Area (%) | Catchment Slope (%) | Catchment Roughness |
|---|---|---|---|---|
| Base1 | 111.22 | 30 | 2.3 | 0.05 |
| Base11 | 11.54 | 10 | 2.7 | 0.05 |
| Base12 | 60.26 | 5 | 12.2 | 0.05 |
| Base13 | 44.40 | 10 | 2.6 | 0.05 |
| Base14 | 45.25 | 0 | 7.2 | 0.05 |
| Base15 | 158.79 | 10 | 2.3 | 0.05 |
| Base16 | 54.46 | 0 | 7.7 | 0.05 |
| Base17 | 385.24 | 60 | 1.4 | 0.05 |
| Base18 | 64.27 | 0 | 8.9 | 0.05 |
| Base19 | 98.00 | 0 | 6.5 | 0.05 |
| Base20 | 178.70 | 0 | 6.1 | 0.05 |
| Base21 | 2.20 | 10 | 4.1 | 0.05 |
| Base22 | 25.34 | 10 | 4.6 | 0.05 |
| Base23 | 17.72 | 10 | 5.6 | 0.05 |
| Base24 | 12.77 | 10 | 7.3 | 0.05 |
| Base25 | 47.48 | 10 | 1.1 | 0.05 |
| Base26 | 87.23 | 5 | 7.6 | 0.05 |

| Model Node | Catchment Area (ha) | Percentage Impervious Area (%) | Catchment Slope (%) | Catchment Roughness |
|---|---|---|---|---|
| Base27 | 60.71 | 5 | 4.6 | 0.05 |
| Base28 | 10.20 | 30 | 1.0 | 0.05 |
| Base30 | 25.38 | 10 | 1.0 | 0.05 |
| Base31 | 8.63 | 10 | 4.0 | 0.05 |
| Base33 | 21.61 | 0 | 14.6 | 0.05 |
| Base34 | 6.79 | 0 | 22.4 | 0.05 |
| Base35 | 13.66 | 0 | 30.0 | 0.05 |
| Base36 | 29.06 | 30 | 2.7 | 0.05 |
| Base37 | 283.91 | 0 | 6.2 | 0.05 |
| Base4 | 84.32 | 0 | 8.8 | 0.05 |
| Base43 | 142.68 | 0 | 5.4 | 0.05 |
| Base45 | 71.39 | 30 | 15 | 0.05 |
| Base46 | 82.87 | 0 | 6.1 | 0.05 |
| Base47 | 312.76 | 10 | 0.4 | 0.05 |
| Base5 | 34.98 | 5 | 9.8 | 0.05 |
| Base51 | 18.05 | 30 | 2.2 | 0.05 |
| Base52 | 44.46 | 30 | 6.4 | 0.05 |
| Base53 | 137.98 | 30 | 2.8 | 0.05 |
| Base55 | 7.13 | 30 | 2.6 | 0.05 |
| Base8 | 54.96 | 0 | 7.3 | 0.05 |

## C.2 Hydraulic model input data

The following Table C-3 and Table C-4, presents the input data for the hydraulic modelling undertaken for Wangcol Creek.

### Table C-3 Input flows to hydraulic model

| Model Sections | Hydrology Model Reference | 1 Year – Existing (Proposed) | 10 Year Existing (Proposed) | 100 Yea Existing (Proposed) |
|---|---|---|---|---|
| 3218.5 to 2872.4 | Base30 | 25.0 $m^3/s$ (25.0 $m^3/s$) | 66.4 $m^3/s$ (66.4 $m^3/s$) | 119.2 $m^3/s$ (119.2 $m^3/s$) |
| 2872.4 to 2269.62 | Base30 | 25.0 $m^3/s$ (25.0 $m^3/s$) | 66.4 $m^3/s$ (66.4 $m^3/s$) | 119.2 $m^3/s$ (119.2 $m^3/s$) |
| 2269.62 to 2178.52 | Base28 | 33.2 $m^3/s$ (33.6 $m^3/s$) | 82.7 $m^3/s$ (83 $m^3/s$) | 143.6 $m^3/s$ (144 $m^3/s$) |
| 2178.52 to 877.84 | Base28 | 33.2 $m^3/s$ (33.6 $m^3/s$) | 82.7 $m^3/s$ (83 $m^3/s$) | 143.6 $m^3/s$ (144 $m^3/s$) |
| 877.84 to 33.84 | Base25 | 37.4 $m^3/s$ (37.7 $m^3/s$) | 91.5 $m^3/s$ (91.8 $m^3/s$) | 154.4 $m^3/s$ (154.7 $m^3/s$) |

### Table C-4 Roughness assumptions for hydraulic model cross-sections

| Model Sections | Left bank roughness | Centre roughness | Right bank roughness |
|---|---|---|---|
| 3218.5 | 0.065 | 0.04 | 0.065 |
| 3168.5 to 1849.91 | 0.065 | 0.035 | 0.065 |
| 1822.24 to 200.38 | 0.04 | 0.03 | 0.04 |
| 196.53 to 33.84 | 0.04 | 0.015 | 0.04 |

# Appendix D – Surface water quality assessment

## D.1 Upstream locations

### D.1.1 Physicochemical parameters

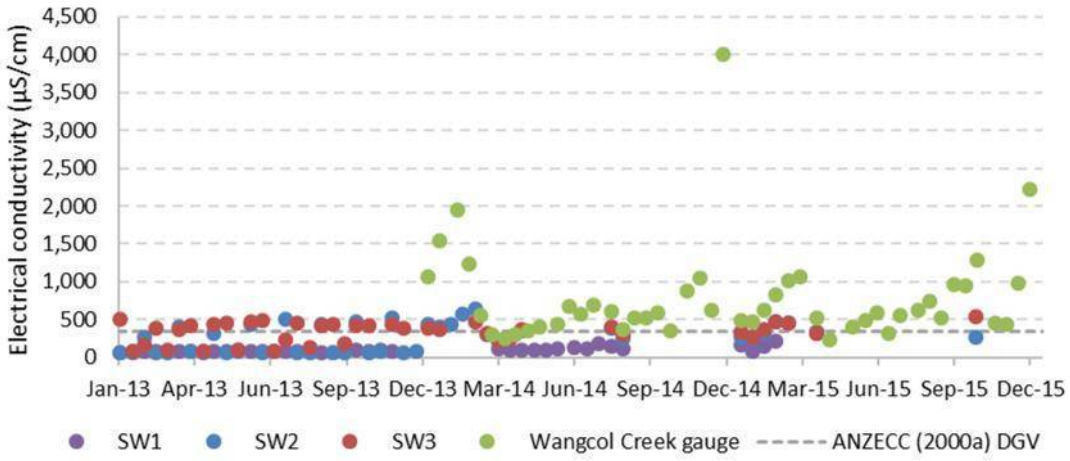



Figure D-1 Electrical conductivity recorded at upstream monitoring locations

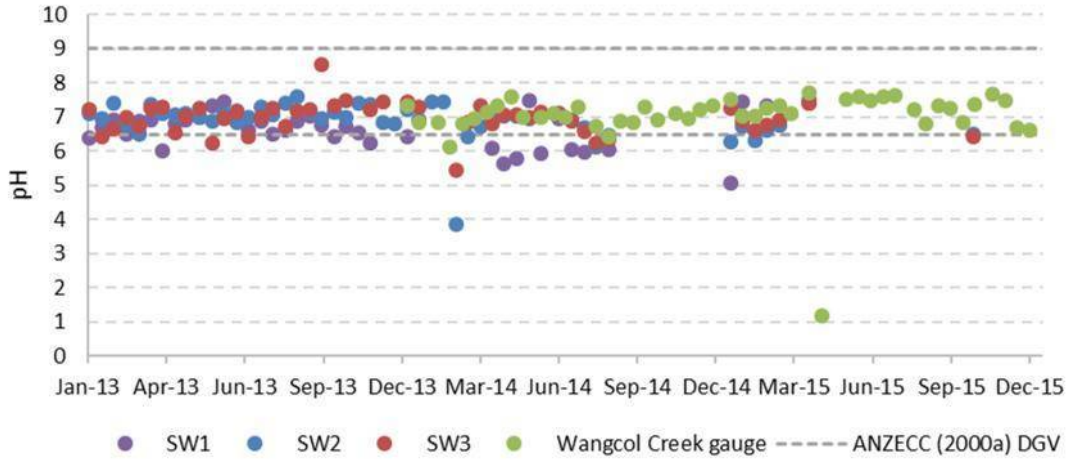



Figure D-2 pH recorded at upstream monitoring locations

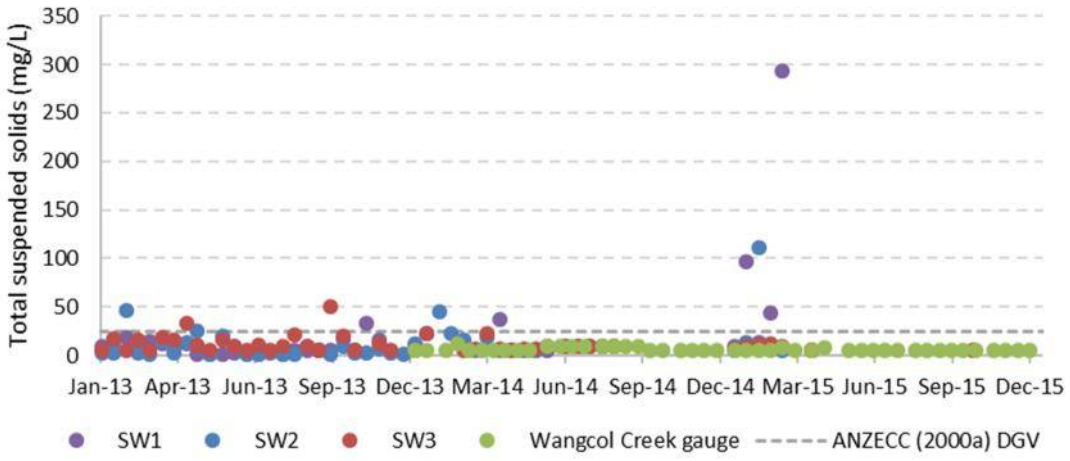



Figure D-3 Total suspended solids recorded at upstream monitoring locations

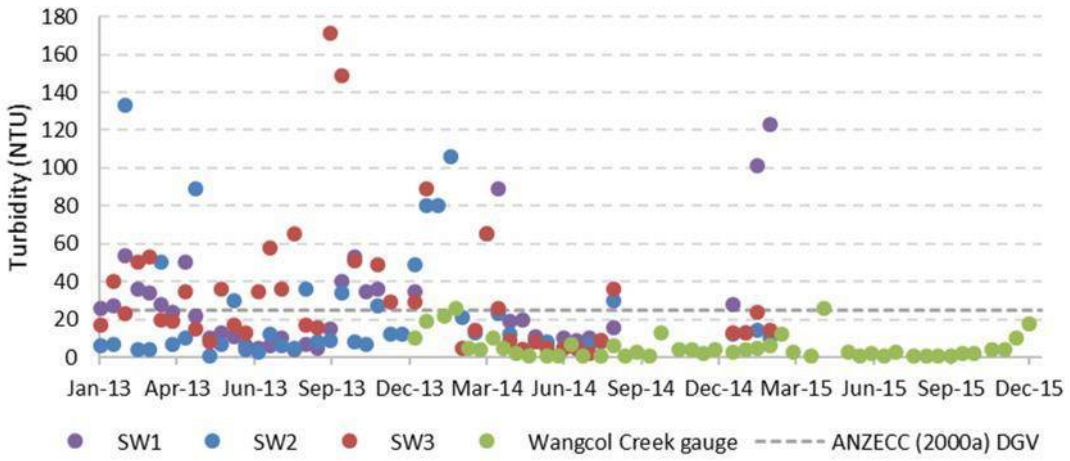



Figure D-4 Turbidity recorded at upstream monitoring locations

### D.1.2 Nutrients

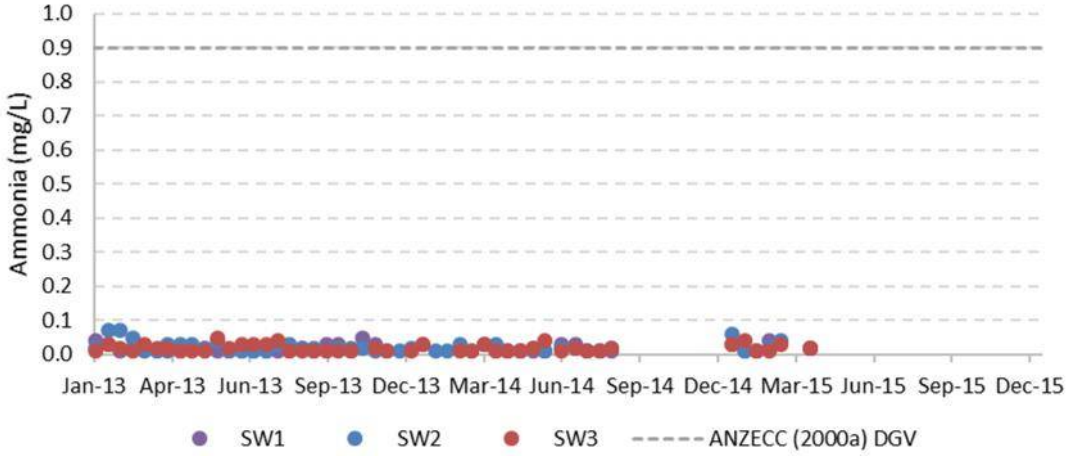



Figure D-5 Ammonia recorded at upstream monitoring locations

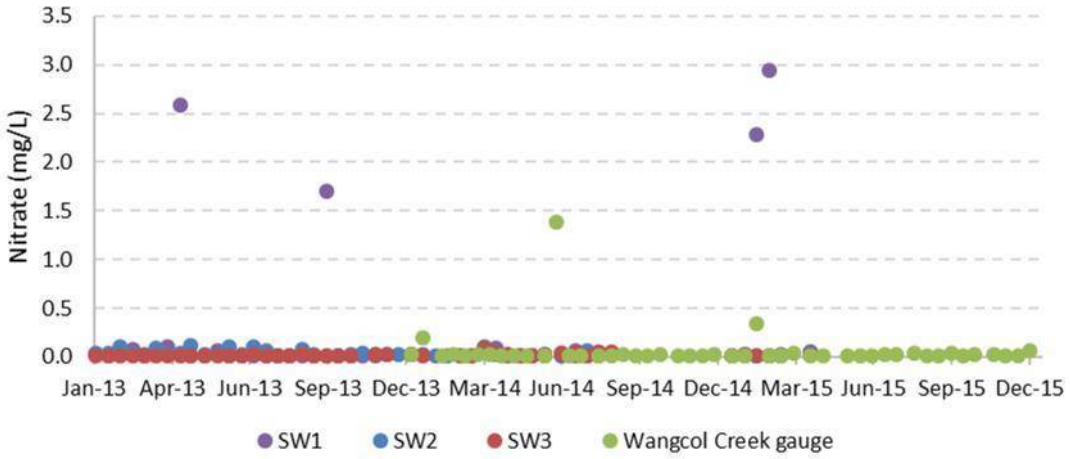



Figure D-6 Nitrate recorded at upstream monitoring locations

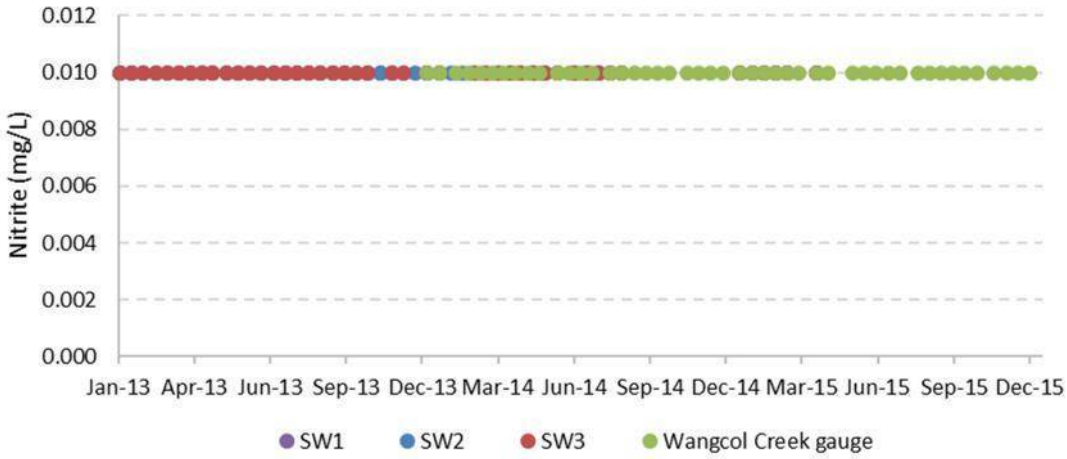



Figure D-7 Nitrite recorded at upstream monitoring locations

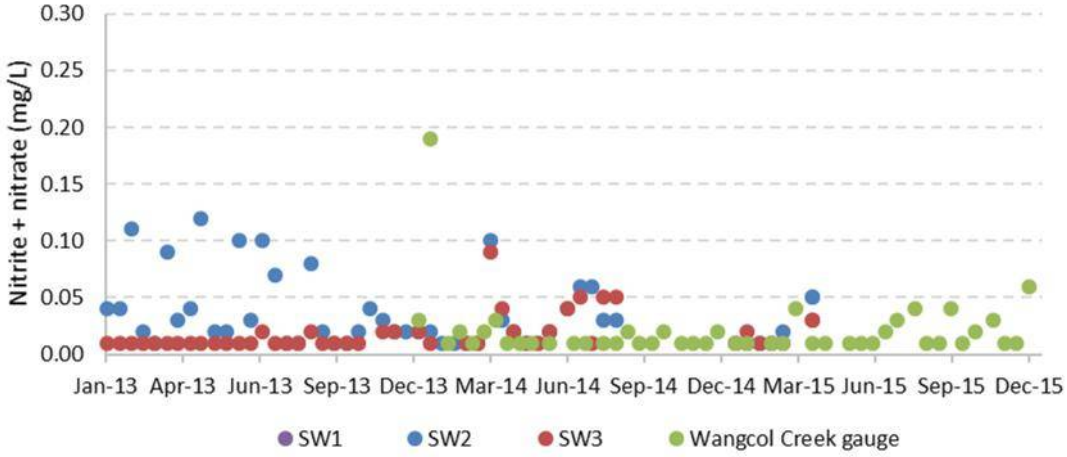



Figure D-8 Nitrite + nitrate recorded at upstream monitoring locations

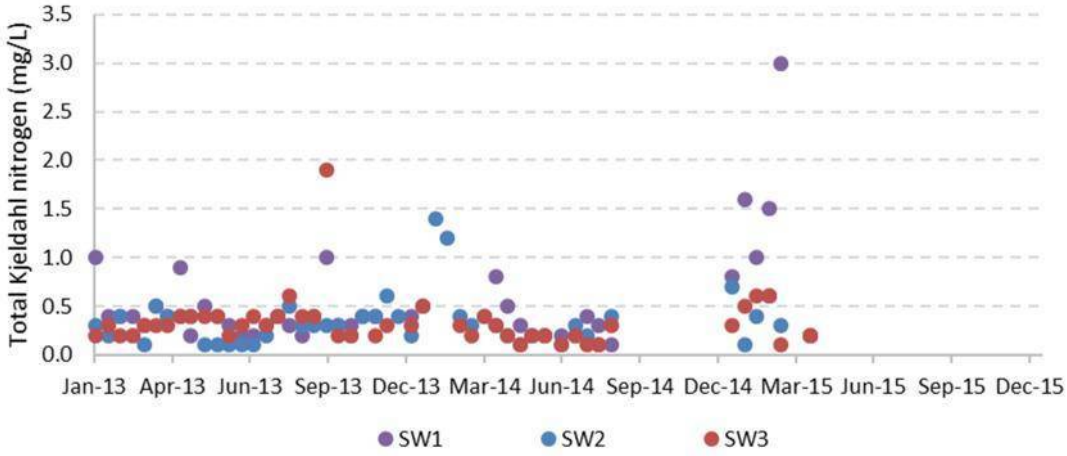



Figure D-9 Total Kjeldahl nitrogen recorded at upstream monitoring locations

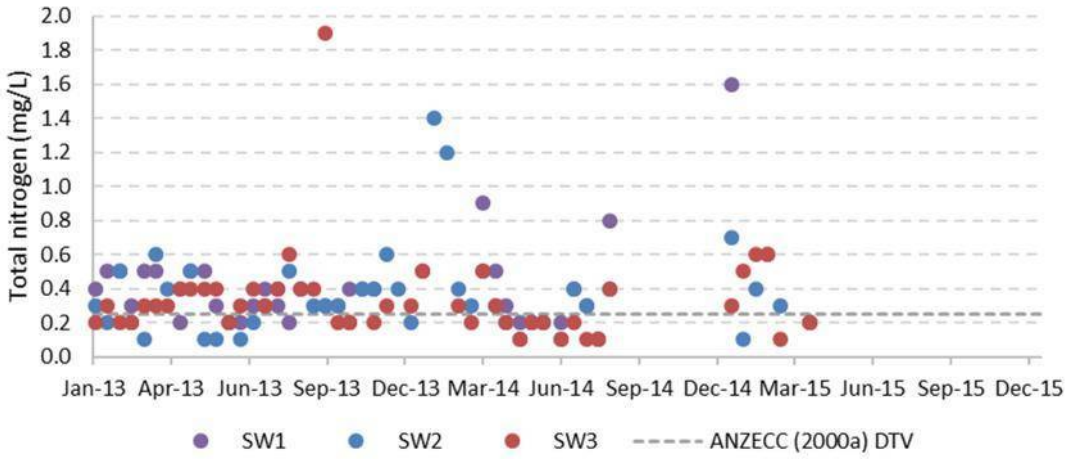



Figure D-10 Total nitrogen recorded at upstream monitoring locations

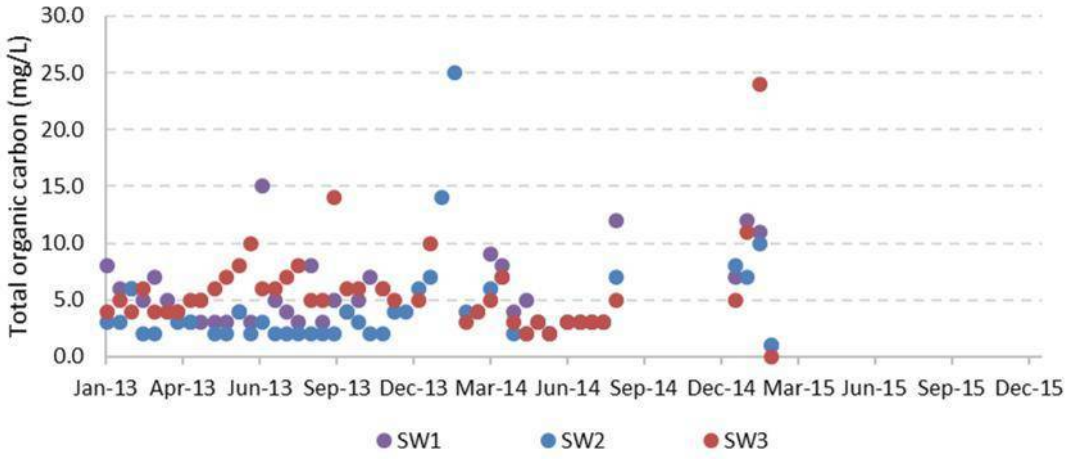



Figure D-11 Total organic carbon recorded at upstream monitoring locations

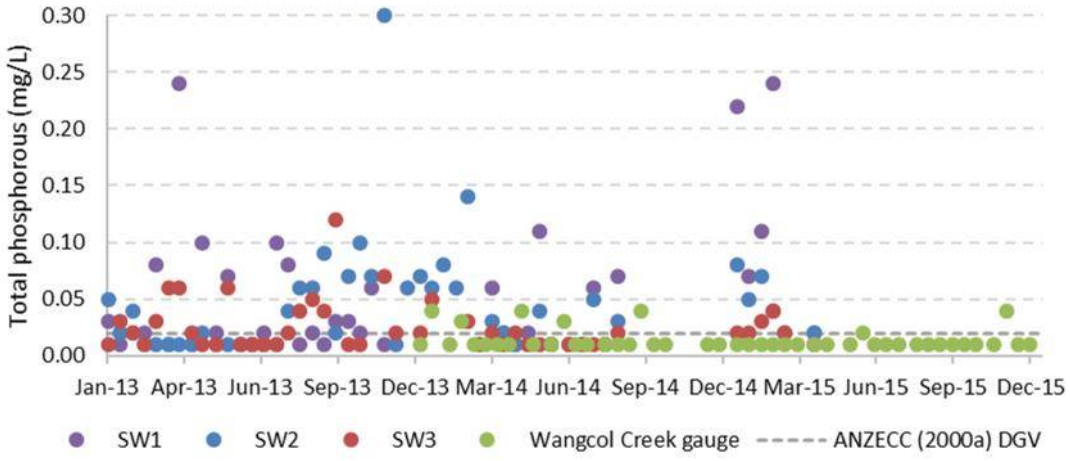



Figure D-12 Total phosphorus recorded at upstream monitoring locations

### D.1.3 Anions

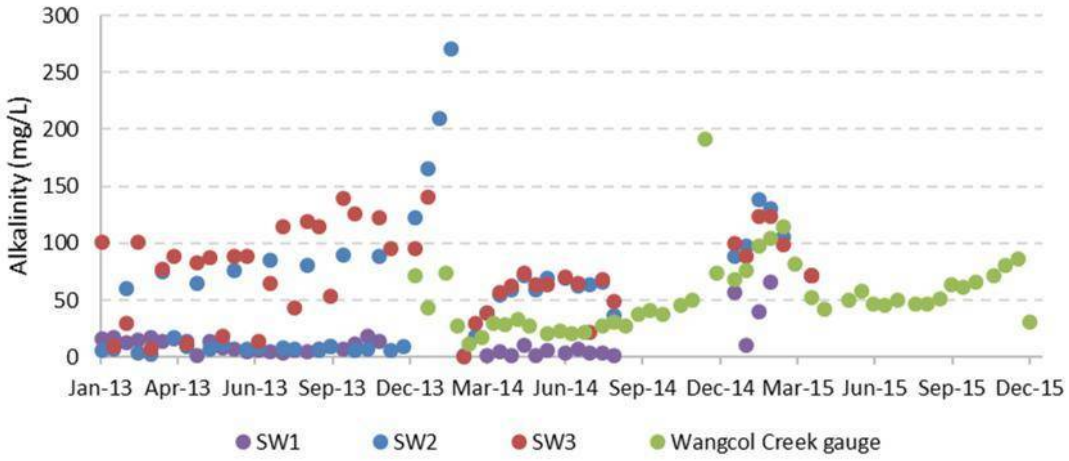



Figure D-13 Alkalinity recorded at upstream monitoring locations

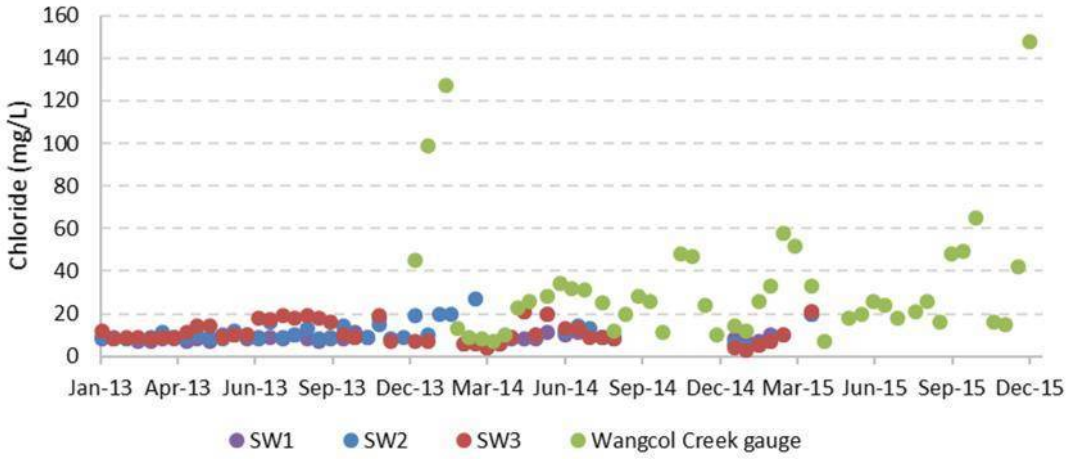



Figure D-14 Chloride recorded at upstream monitoring locations

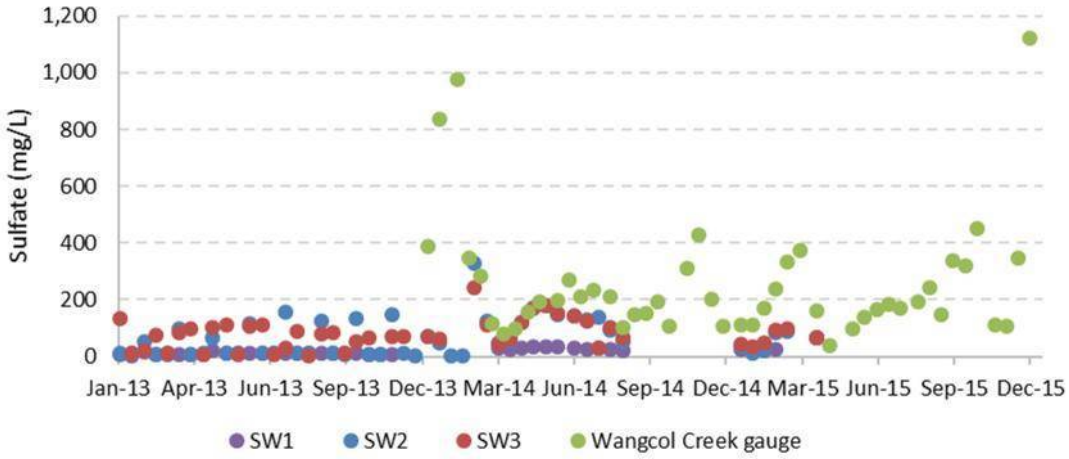



Figure D-15 Sulfate recorded at upstream monitoring locations

### D.1.4 Cations

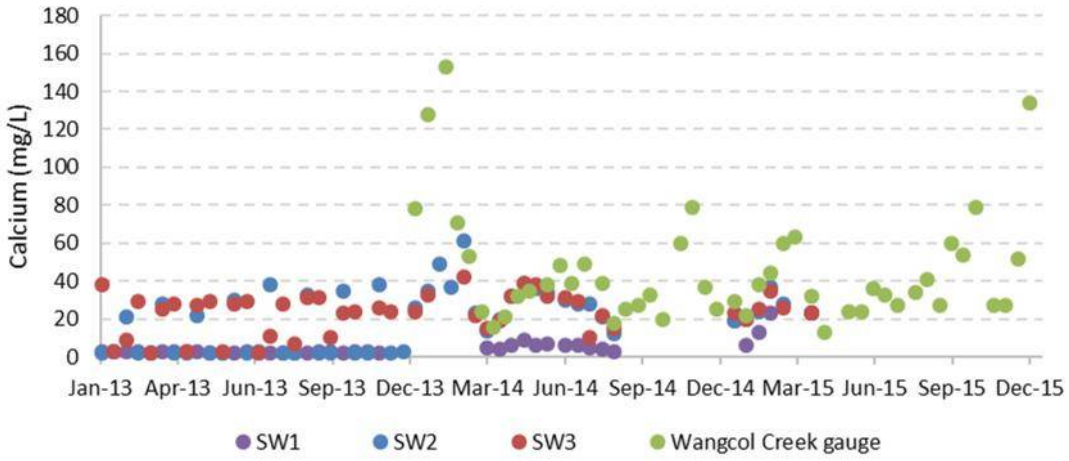



Figure D-16 Calcium recorded at upstream monitoring locations

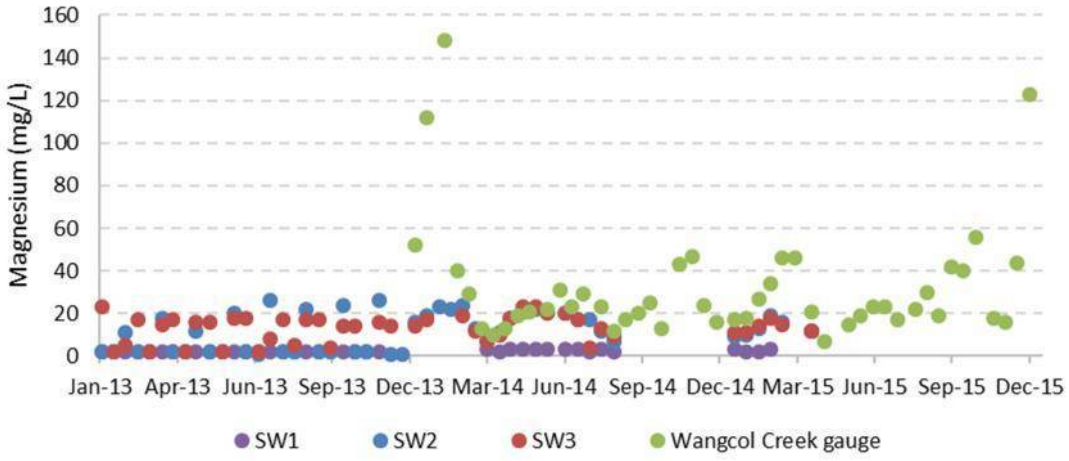



Figure D-17 Magnesium recorded at upstream monitoring locations

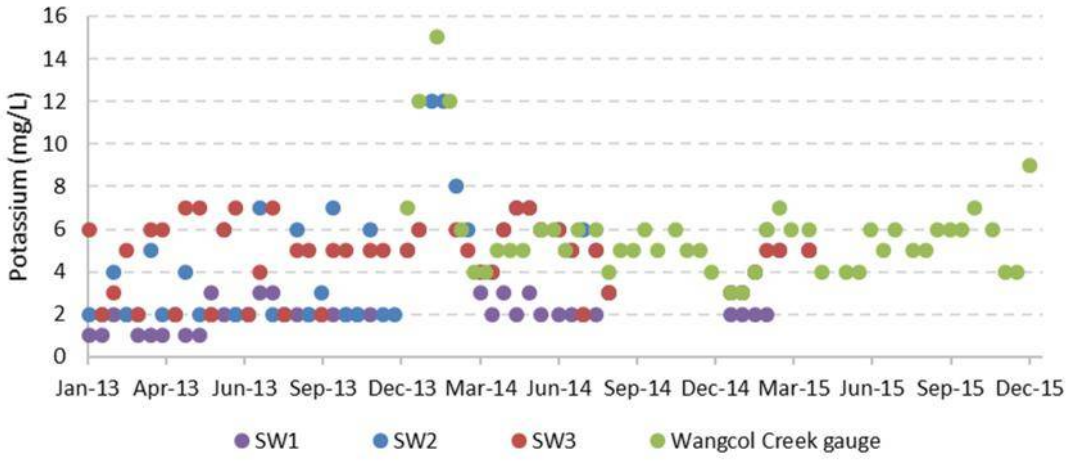



Figure D-18 Potassium recorded at upstream monitoring locations

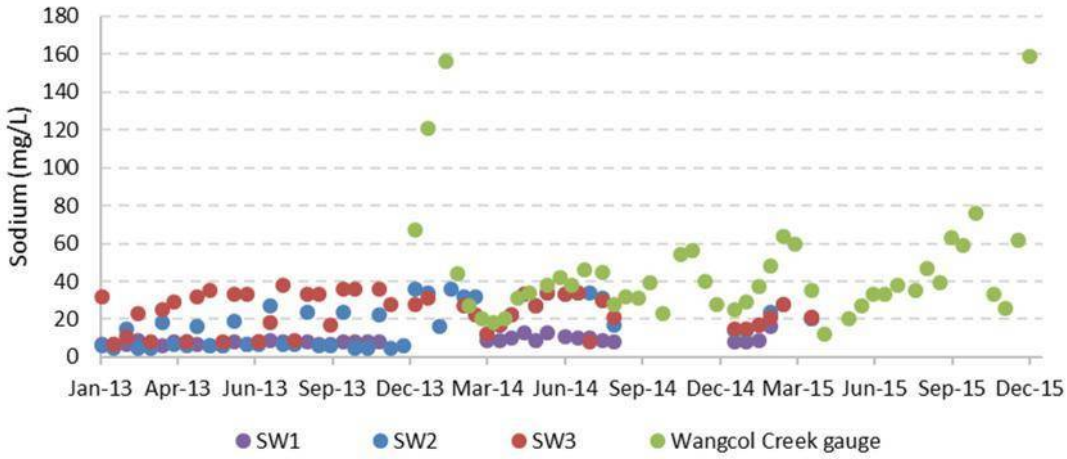



Figure D-19 Sodium recorded at upstream monitoring locations

### D.1.5 Metals

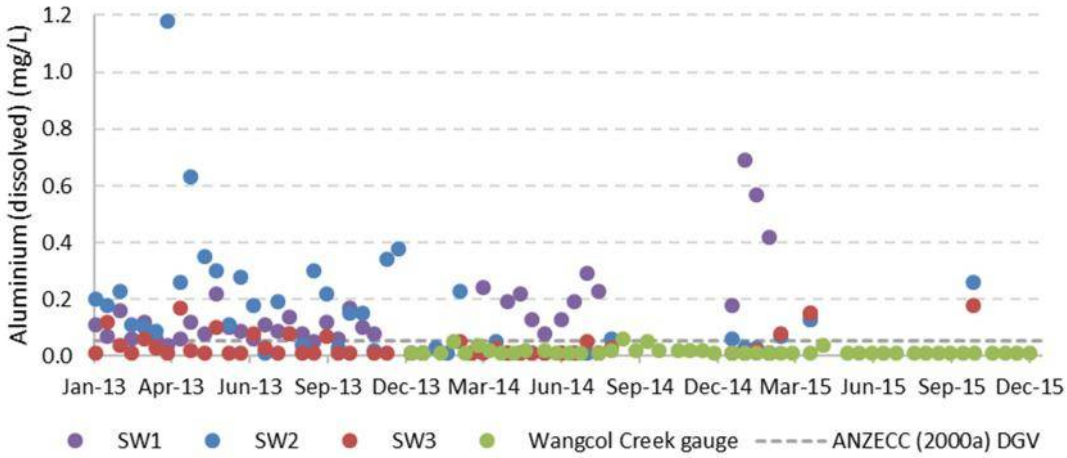



Figure D-20 Aluminium (dissolved) recorded at upstream monitoring locations


Figure D-21 Antimony (dissolved) recorded at upstream monitoring locations

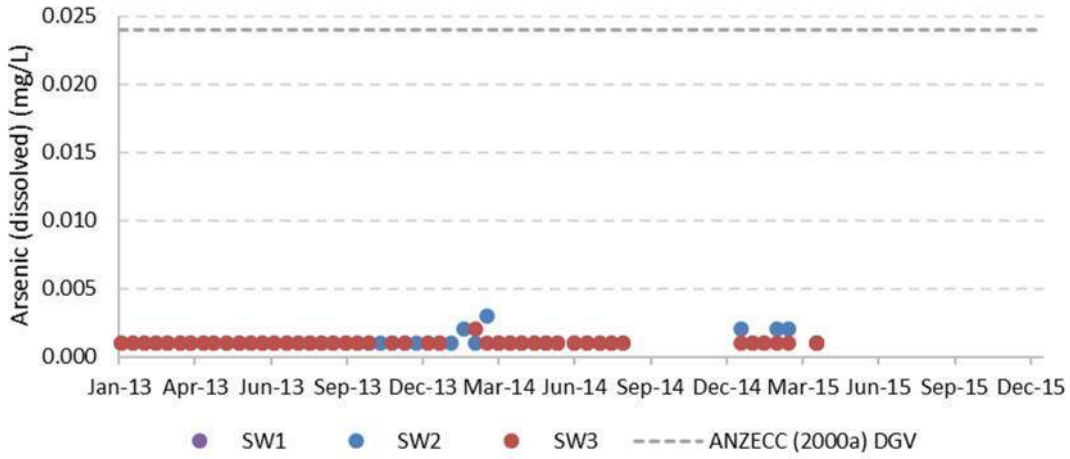



Figure D-22 Arsenic (dissolved) recorded at upstream monitoring locations

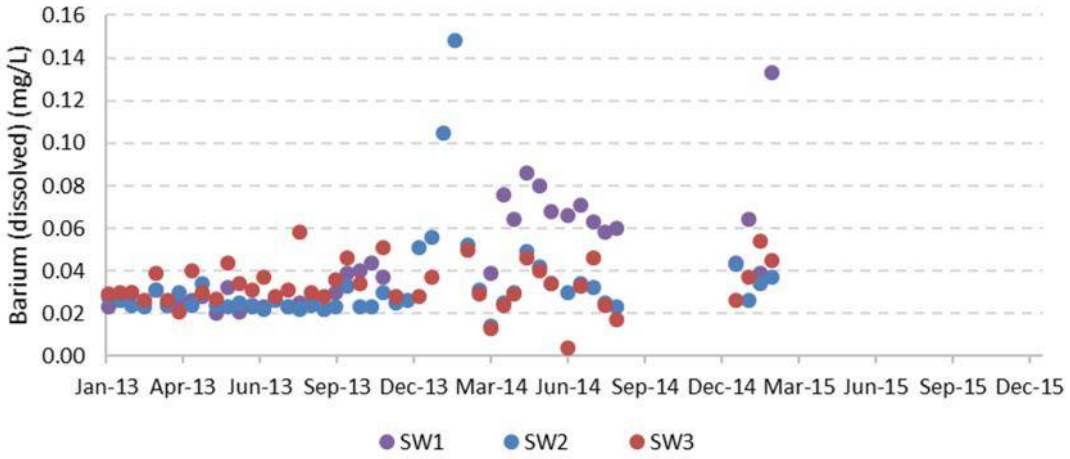



Figure D-23 Barium (dissolved) recorded at upstream monitoring locations

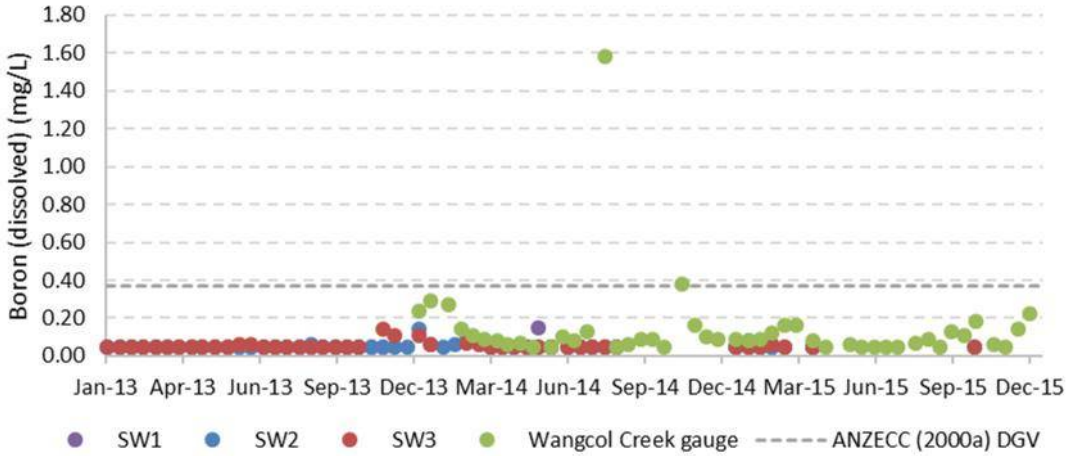



Figure D-24 Boron (dissolved) recorded at upstream monitoring locations

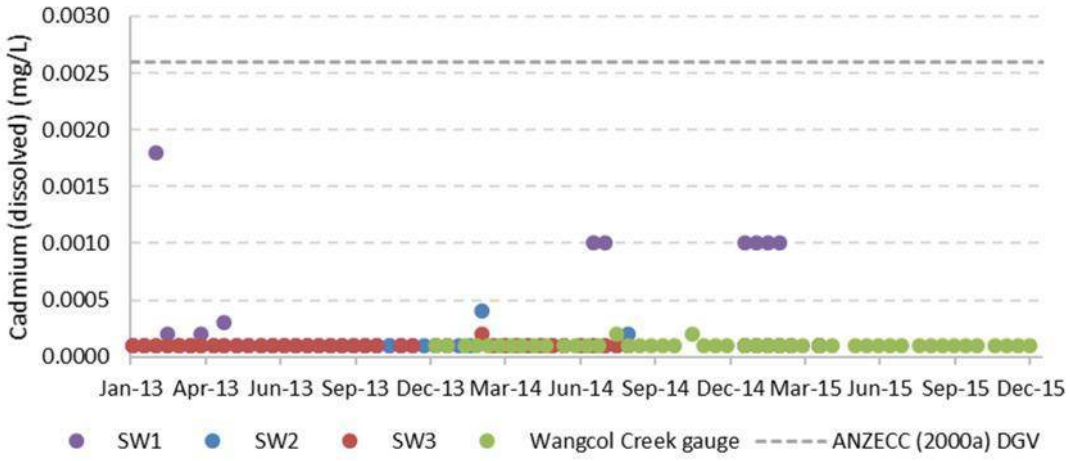



Figure D-25 Cadmium (dissolved) recorded at upstream monitoring locations

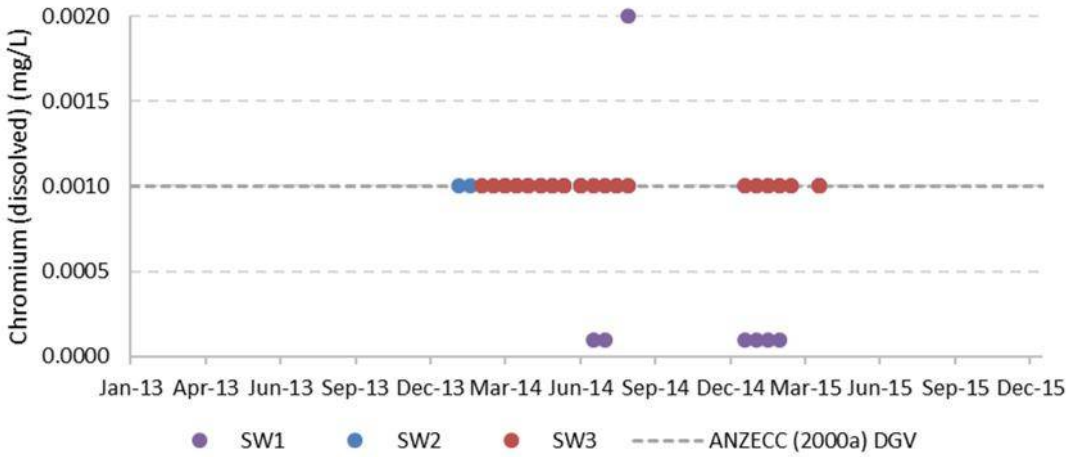



Figure D-26 Chromium (dissolved) recorded at upstream monitoring locations

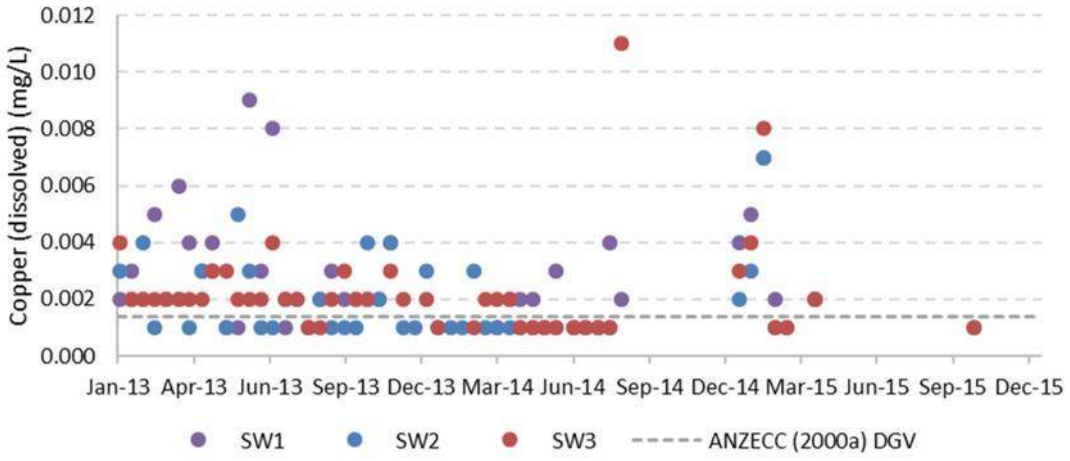



Figure D-27 Copper (dissolved) recorded at upstream monitoring locations

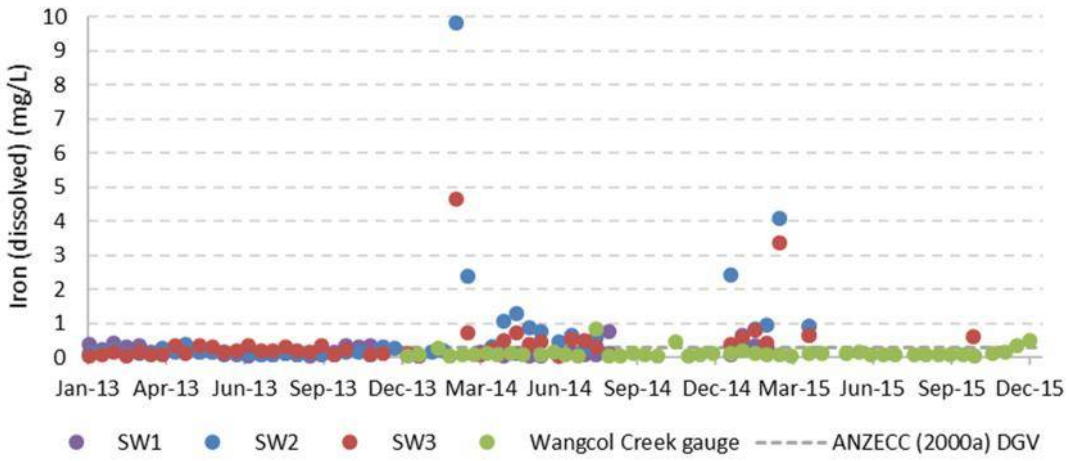



Figure D-28 Iron (dissolved) recorded at upstream monitoring locations

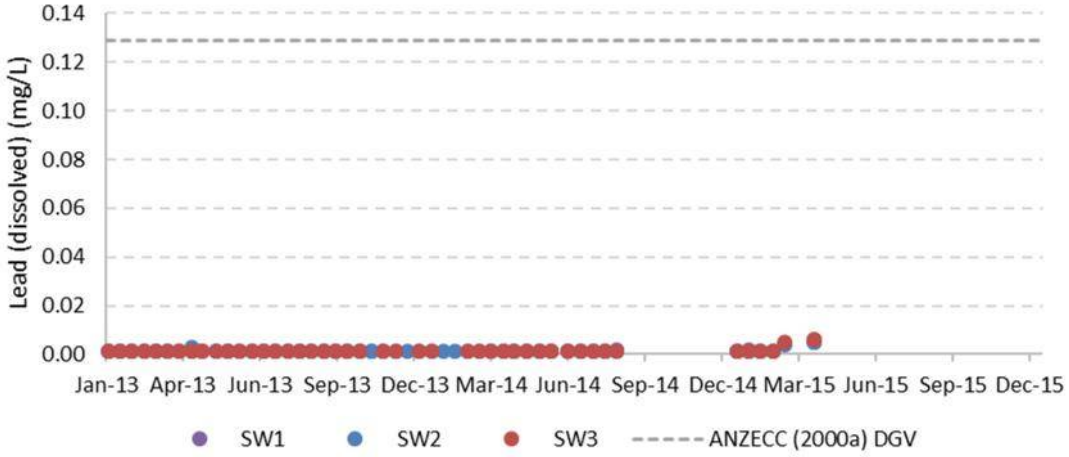



Figure D-29 Lead (dissolved) recorded at upstream monitoring locations

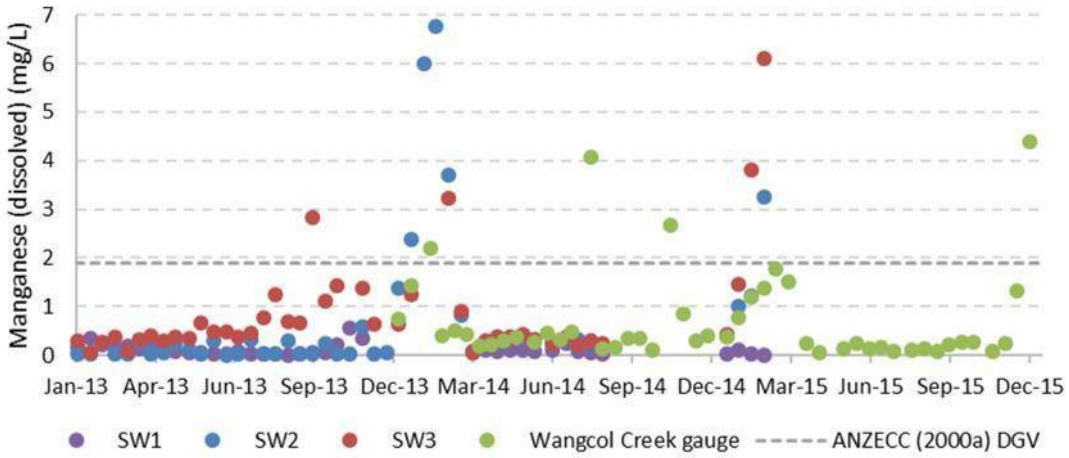



Figure D-30 Manganese (dissolved) recorded at upstream monitoring locations

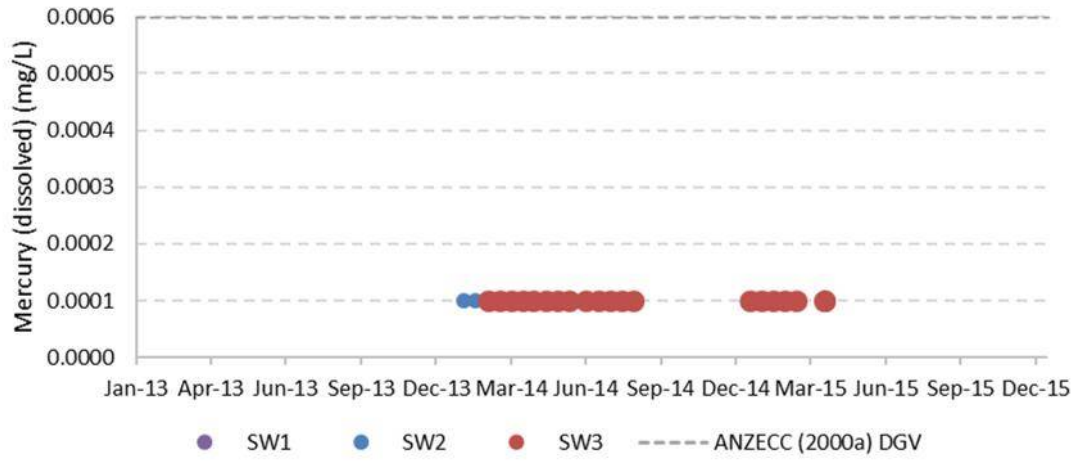



Figure D-31 Mercury (dissolved) recorded at upstream monitoring locations


Figure D-32 Molybdenum (dissolved) recorded at upstream monitoring locations

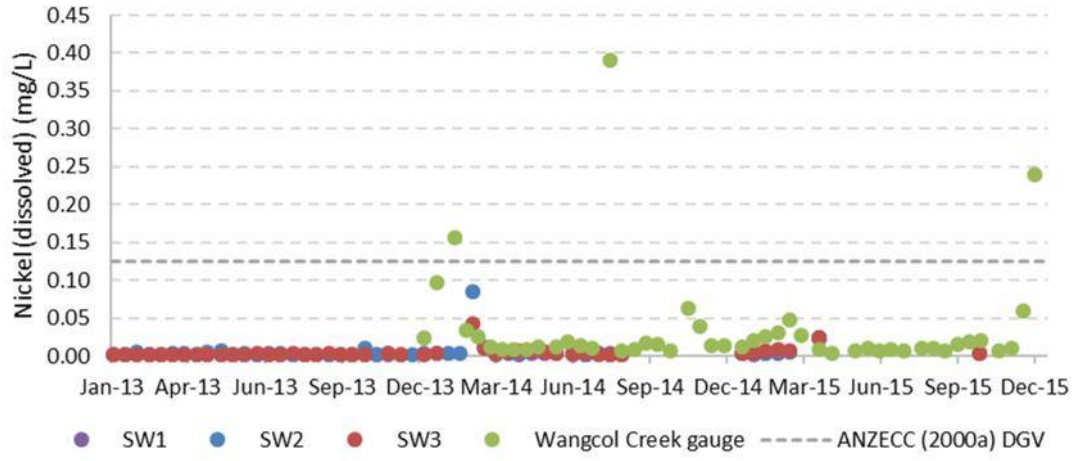



Figure D-33 Nickel (dissolved) recorded at upstream monitoring locations

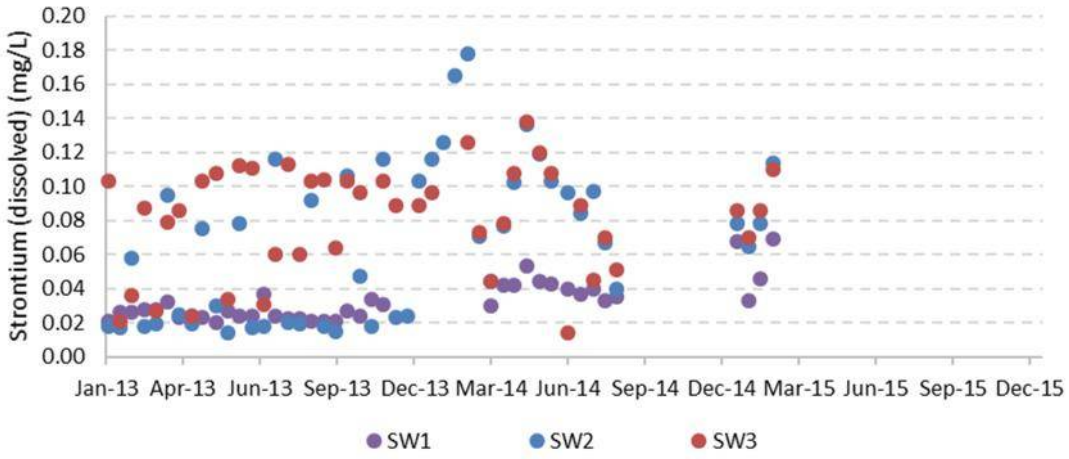



Figure D-34 Strontium (dissolved) recorded at upstream monitoring locations

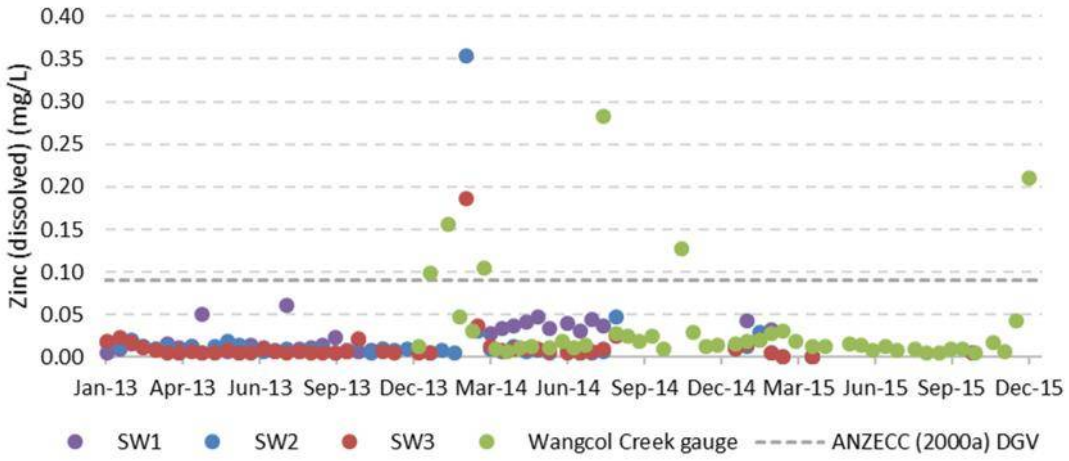



Figure D-35 Zinc (dissolved) recorded at upstream monitoring locations

### D.1.6 Other parameters


Figure D-36 Fluoride recorded at upstream monitoring locations

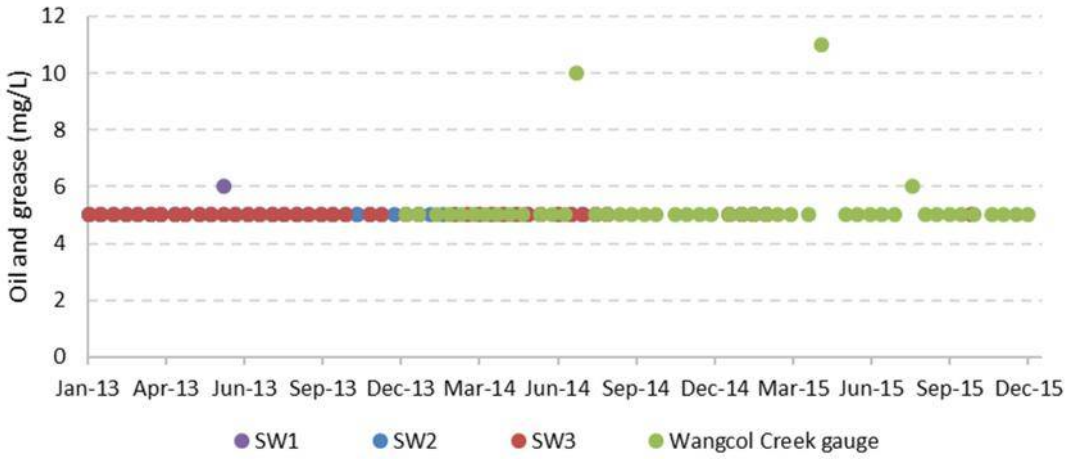



Figure D-37 Oil and grease recorded at upstream monitoring locations

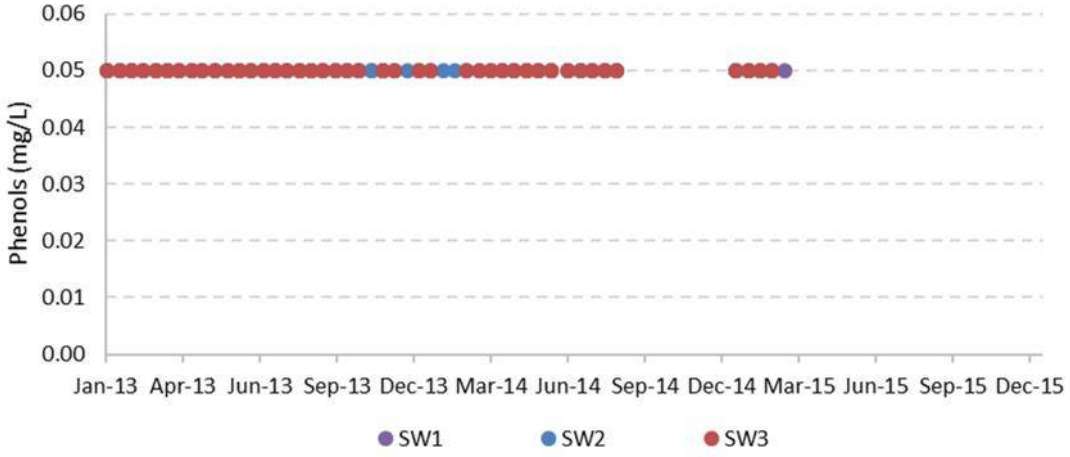



Figure D-38 Phenols recorded at upstream monitoring locations

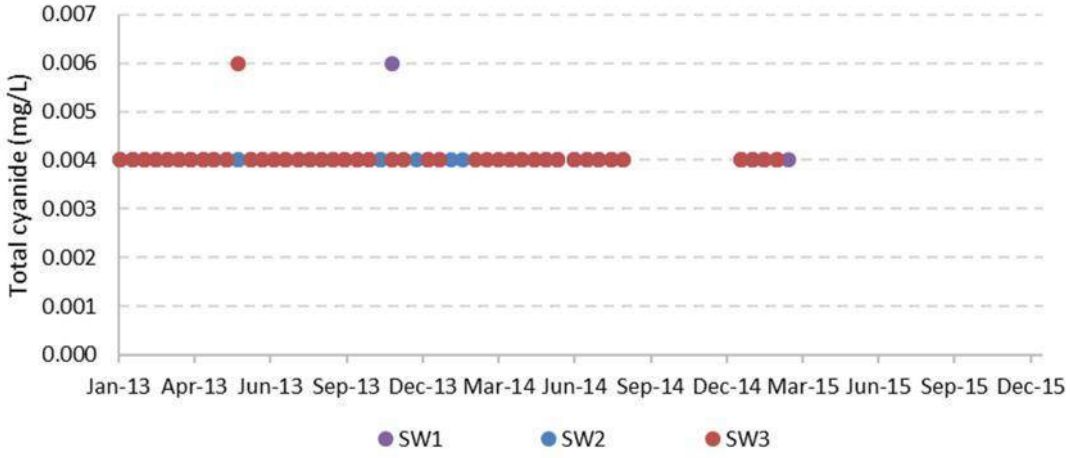



Figure D-39 Total cyanide recorded at upstream monitoring locations

## D.2 Discharge locations

### D.2.1 Physicochemical parameters

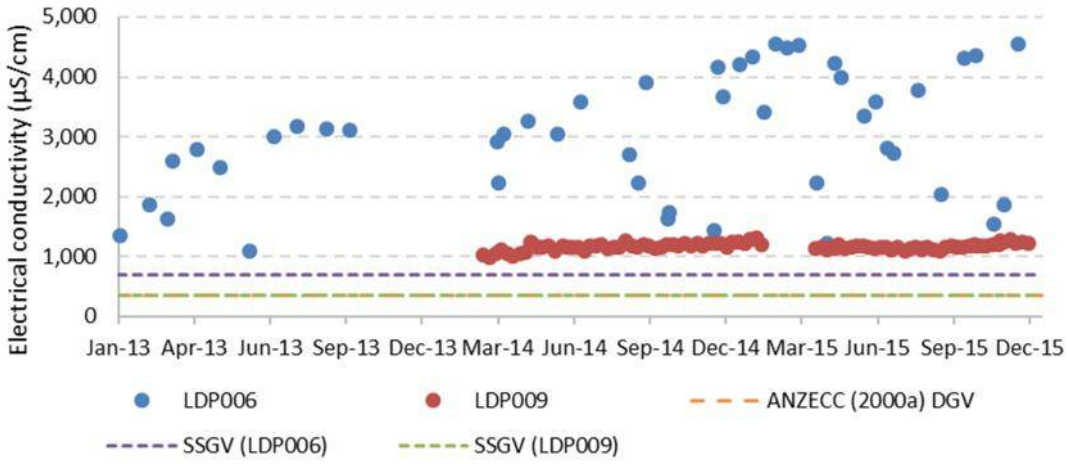



Figure D-40 Electrical conductivity recorded at LDP006 and LDP009

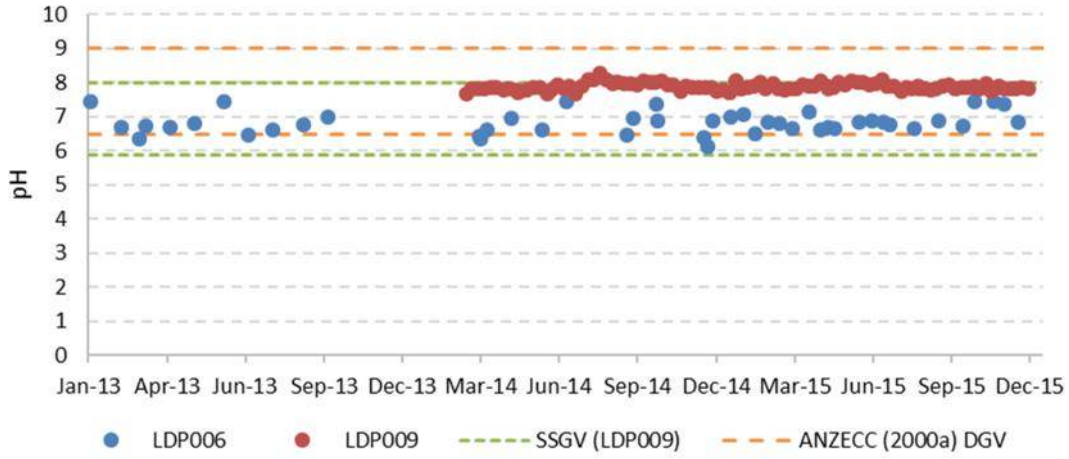



Figure D-41 pH recorded at LDP006 and LDP009

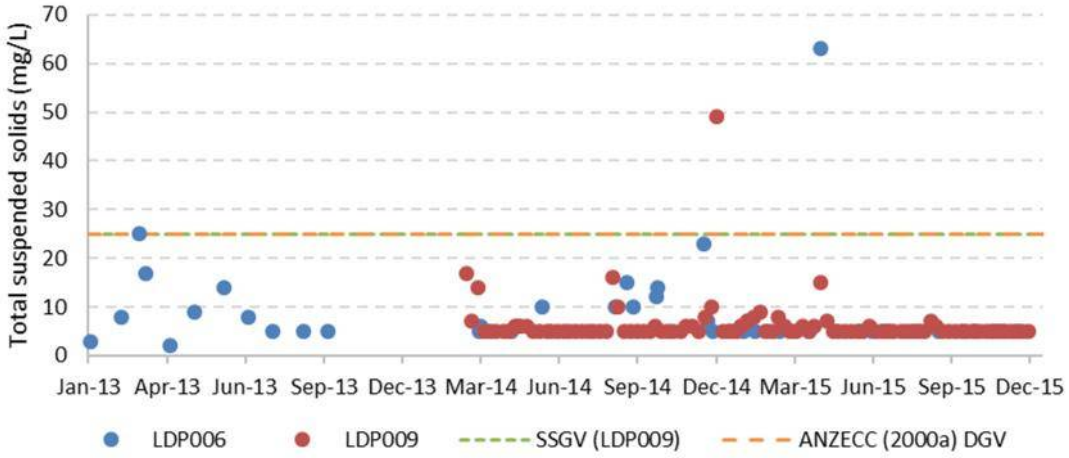



Figure D-42 Total suspended solids recorded at LDP006 and LDP009

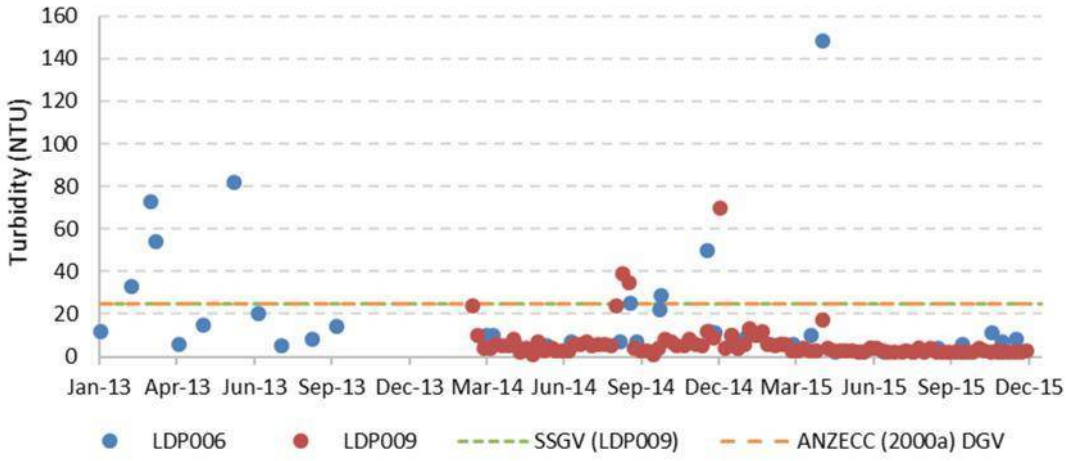



Figure D-43 Turbidity recorded at LDP006 and LDP009

### D.2.2 Nutrients

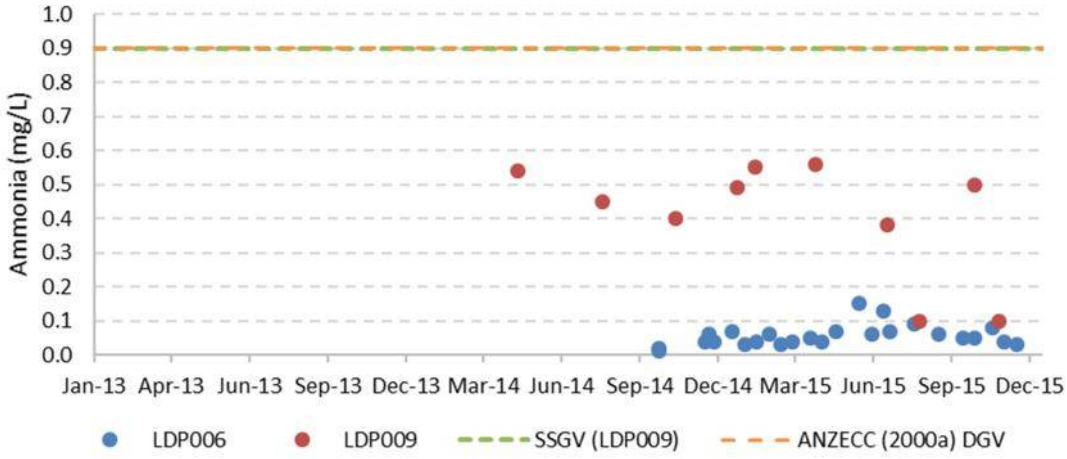



Figure D-44 Ammonia recorded at LDP006 and LDP009

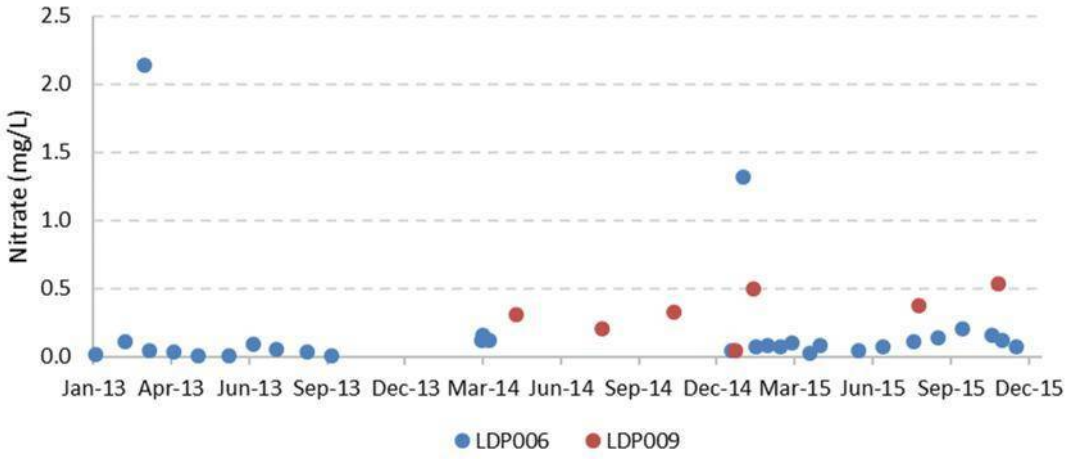



Figure D-45 Nitrate recorded at LDP006 and LDP009

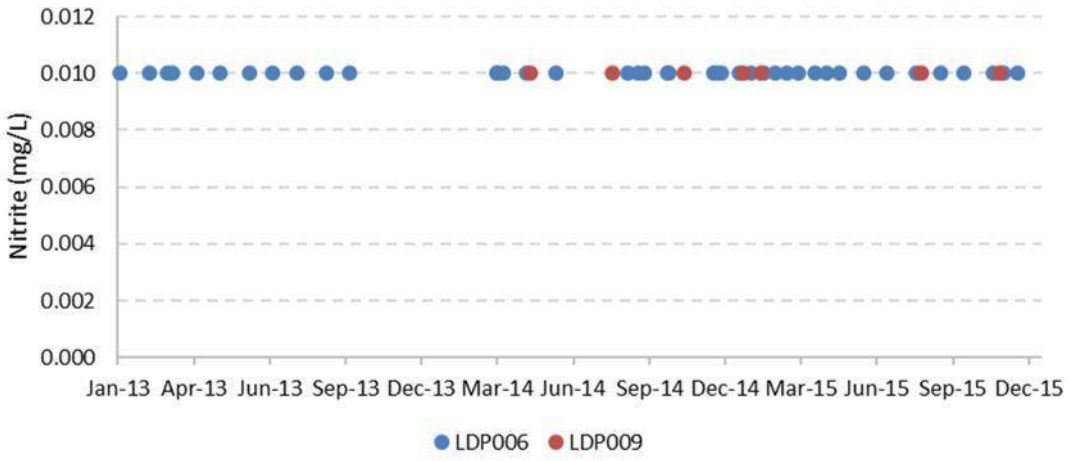



Figure D-46 Nitrite recorded at LDP006 and LDP009

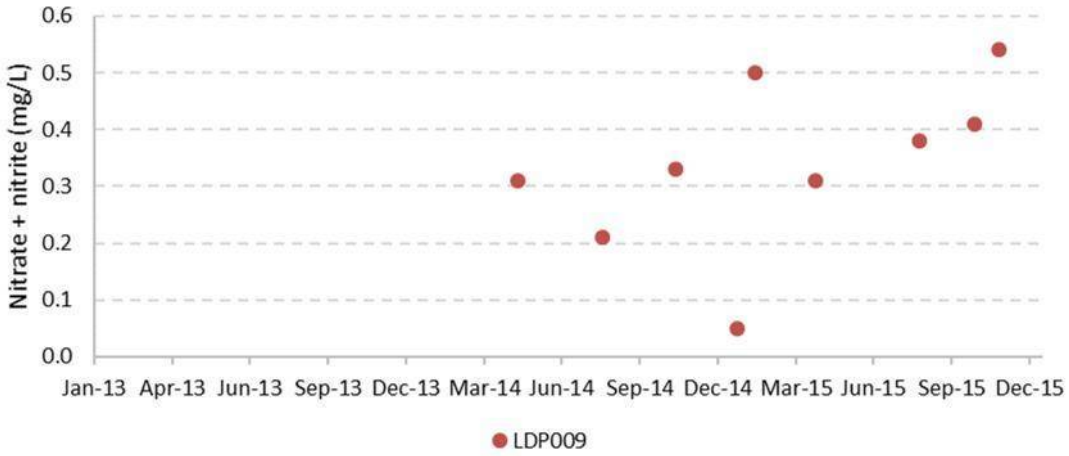



Figure D-47 Nitrite + nitrate recorded at LDP009

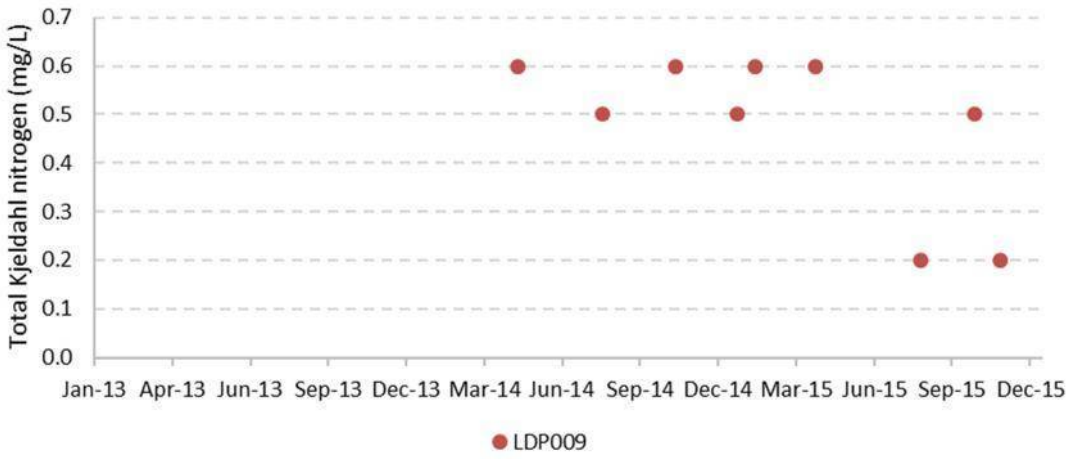



Figure D-48 Total Kjeldahl nitrogen recorded at LDP009

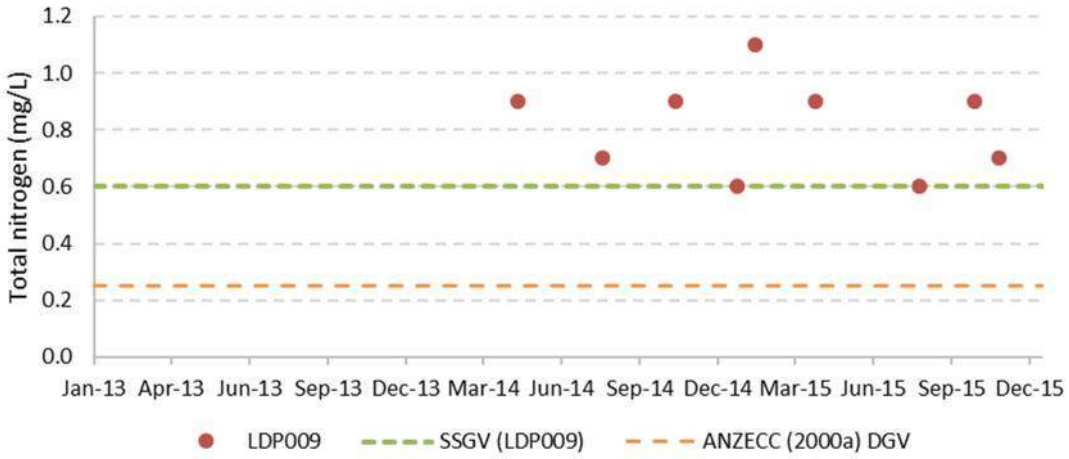



Figure D-49 Total nitrogen recorded at LDP009

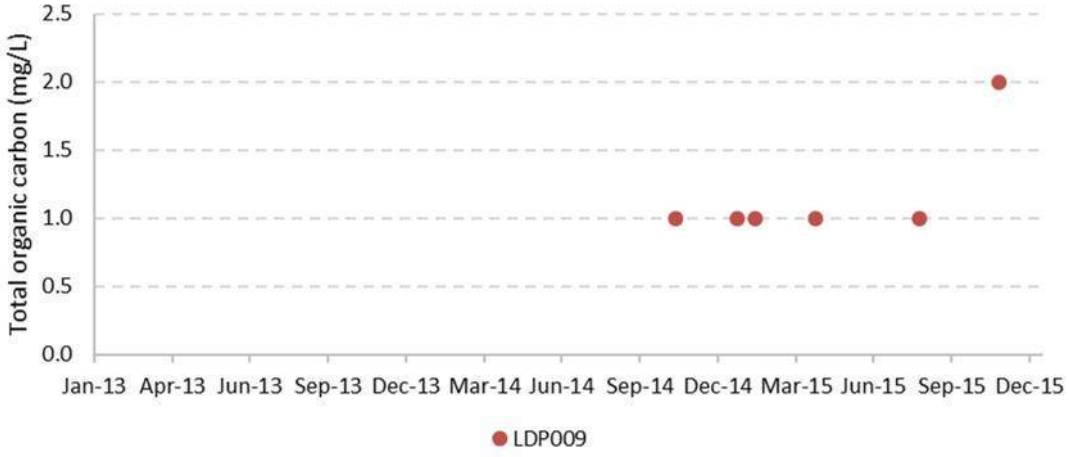



Figure D-50 Total organic carbon recorded at LDP009

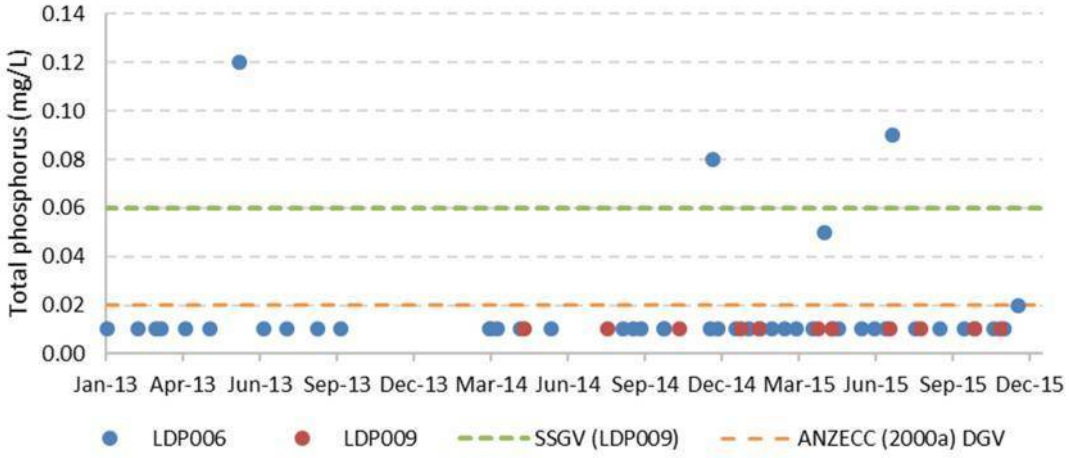



Figure D-51 Total phosphorus recorded at LDP006 and LDP009

### D.2.3 Anions

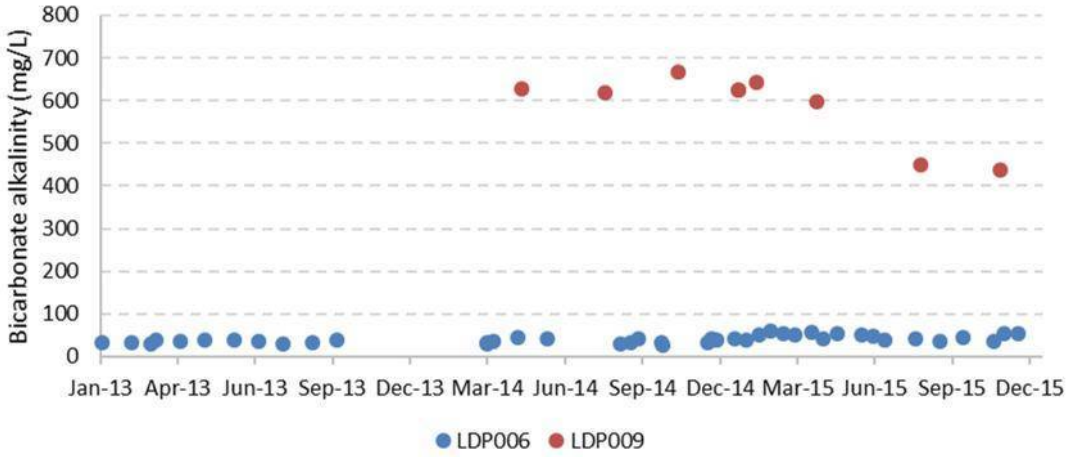



Figure D-52 Bicarbonate alkalinity recorded at LDP006 and LDP009

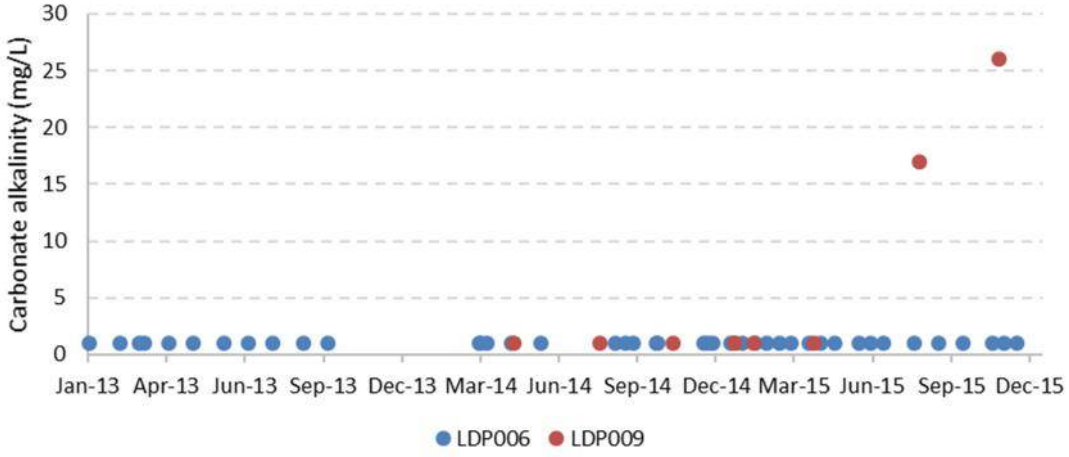



Figure D-53 Carbonate alkalinity recorded at LDP006 and LDP009

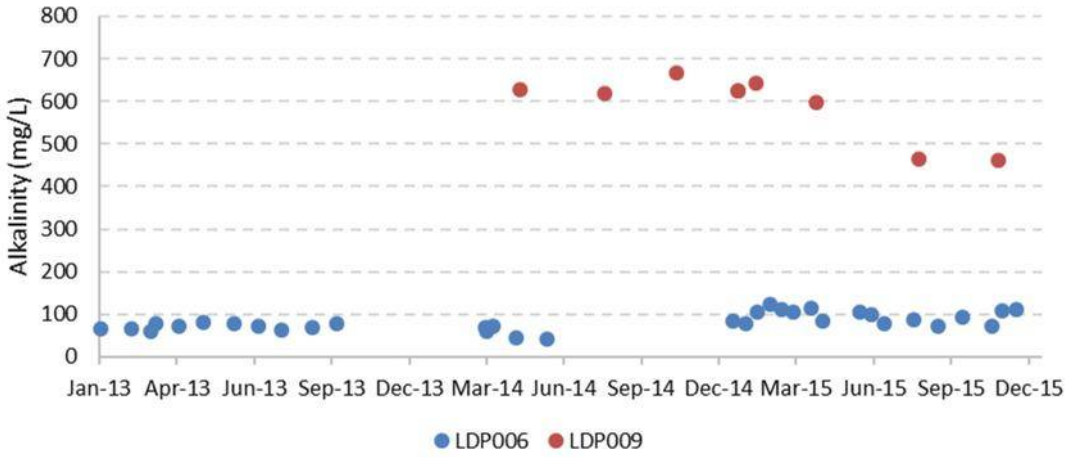



Figure D-54 Total alkalinity recorded at LDP006 and LDP009

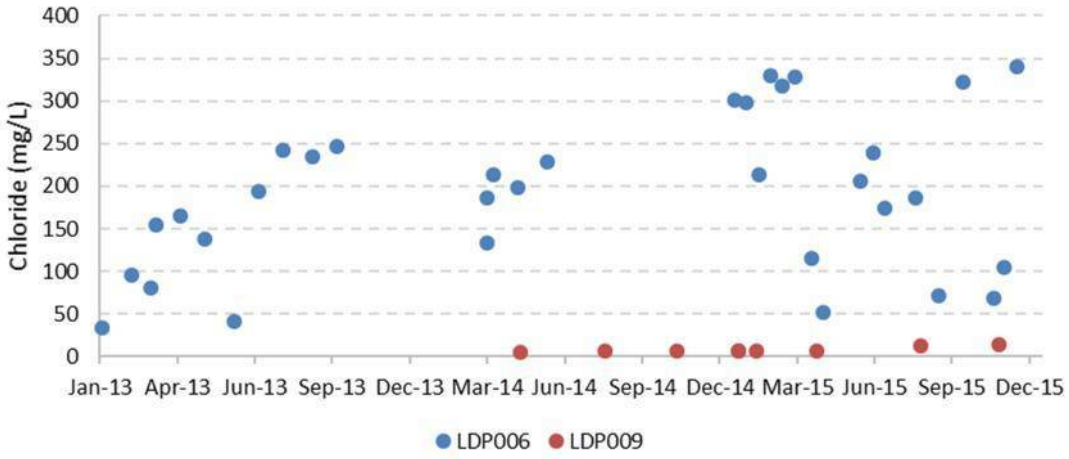



Figure D-55 Chloride recorded at LDP006 and LDP009

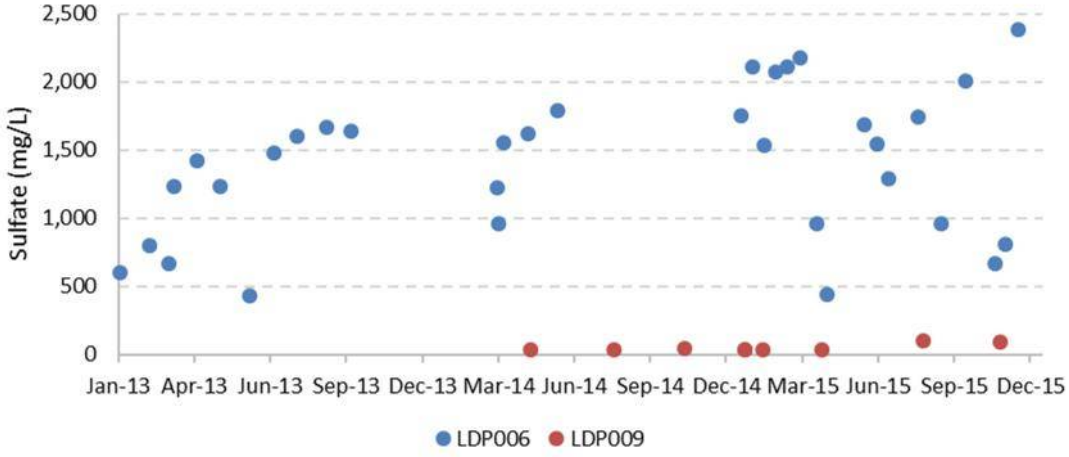



Figure D-56 Sulfate recorded at LDP006 and LDP009

### D.2.4 Cations

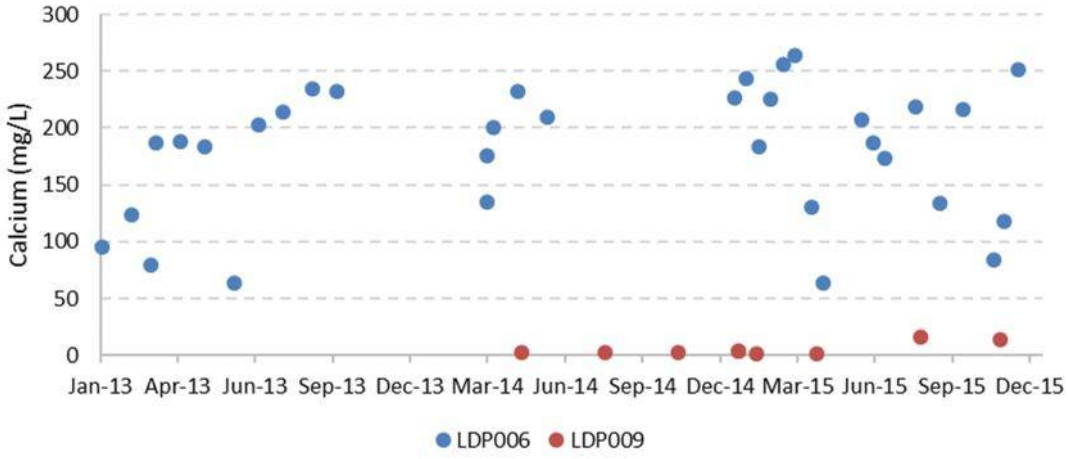



Figure D-57 Calcium recorded at LDP006 and LDP009

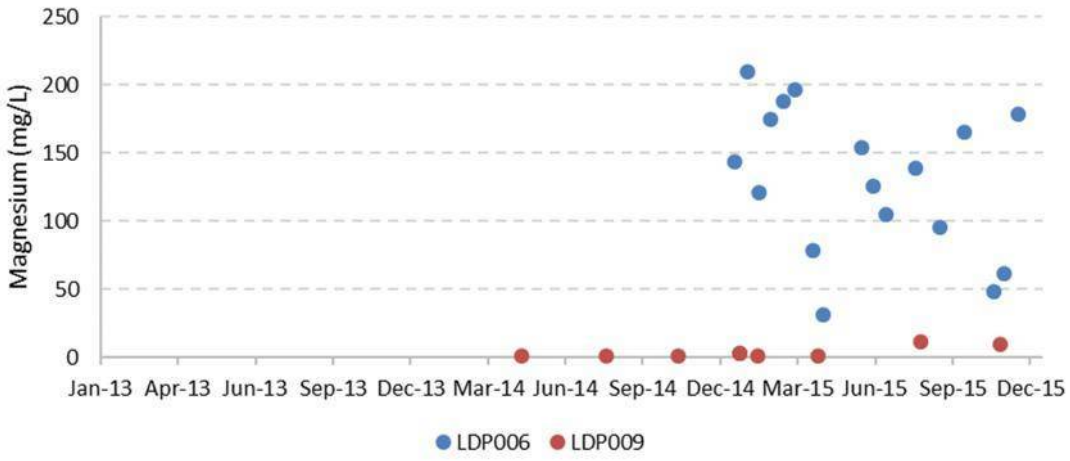



Figure D-58 Magnesium recorded at LDP006 and LDP009

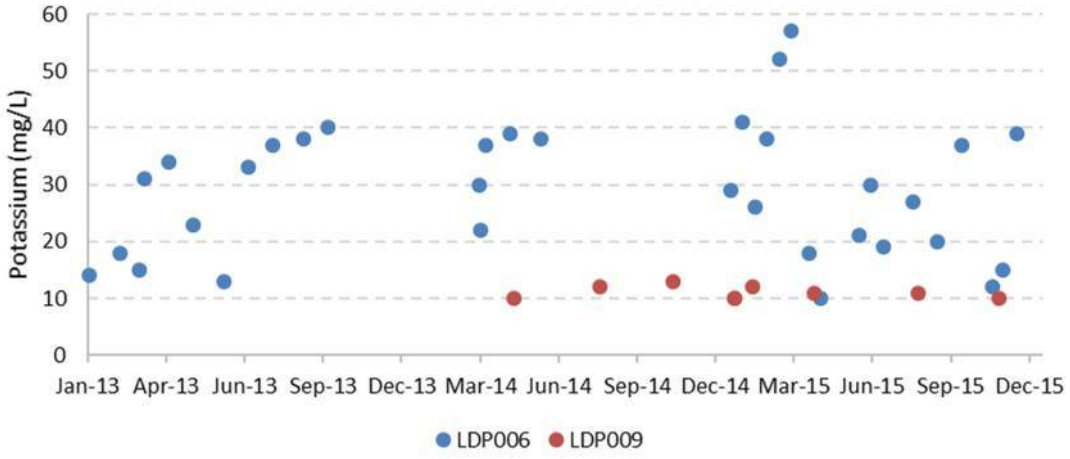



Figure D-59 Potassium recorded at LDP006 and LDP009

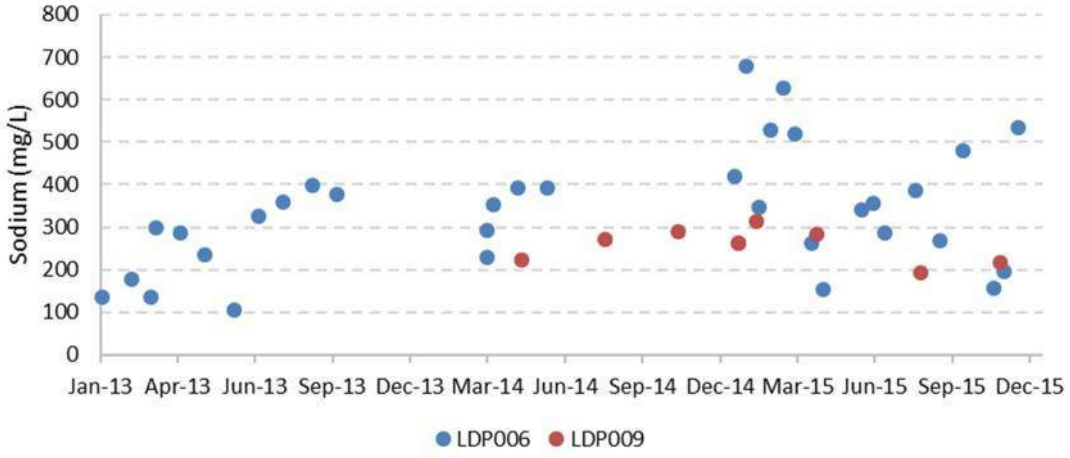



Figure D-60 Sodium recorded at LDP006 and LDP009

### D.2.5 Metals

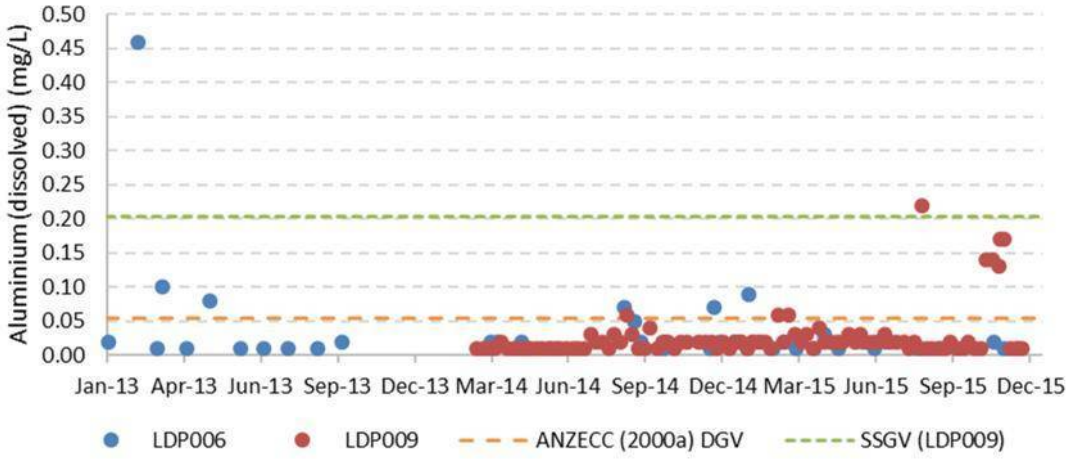



Figure D-61 Aluminium (dissolved) recorded at LDP006 and LDP009

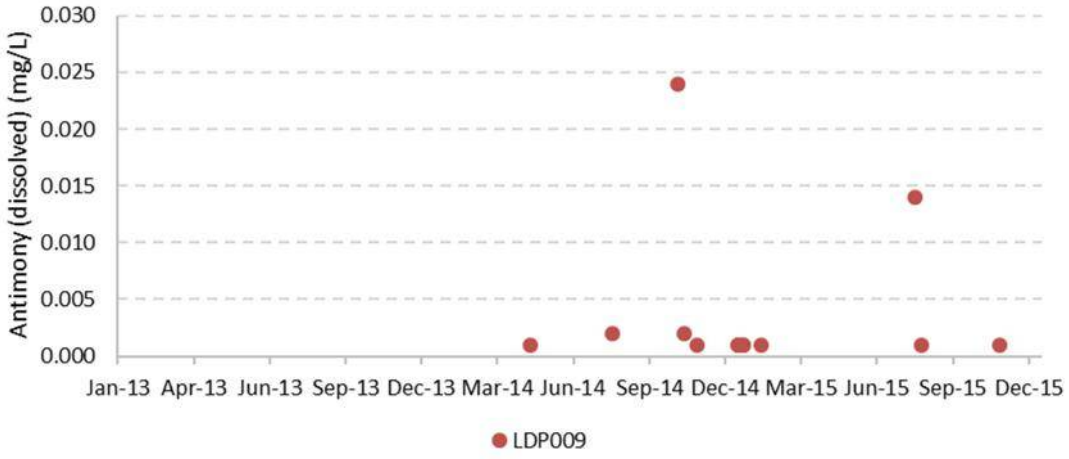



Figure D-62 Antimony (dissolved) recorded at LDP009

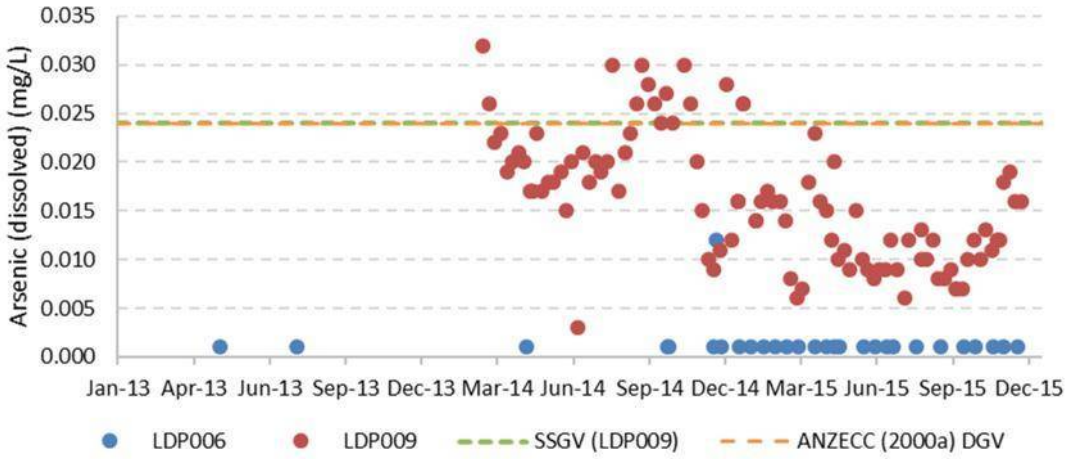



Figure D-63 Arsenic (dissolved) recorded at LDP006 and LDP009

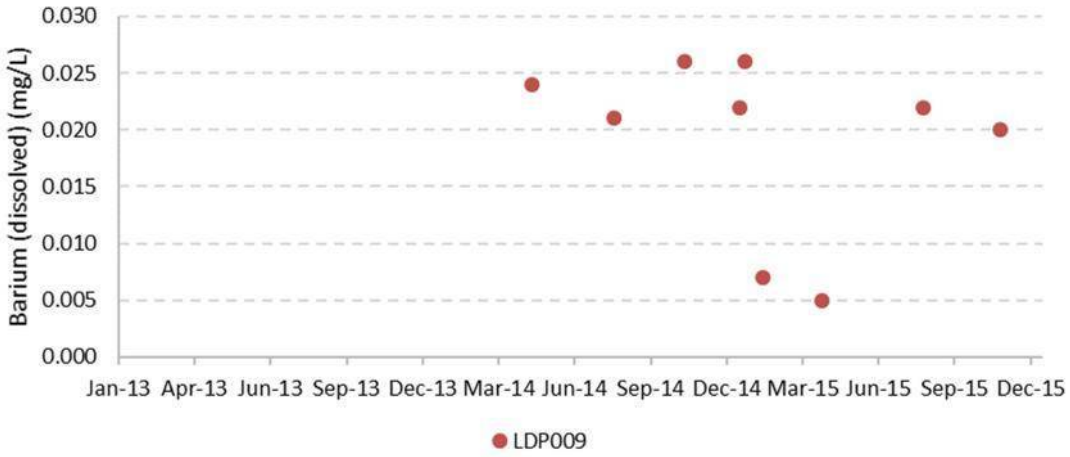



Figure D-64 Barium (dissolved) recorded at LDP009

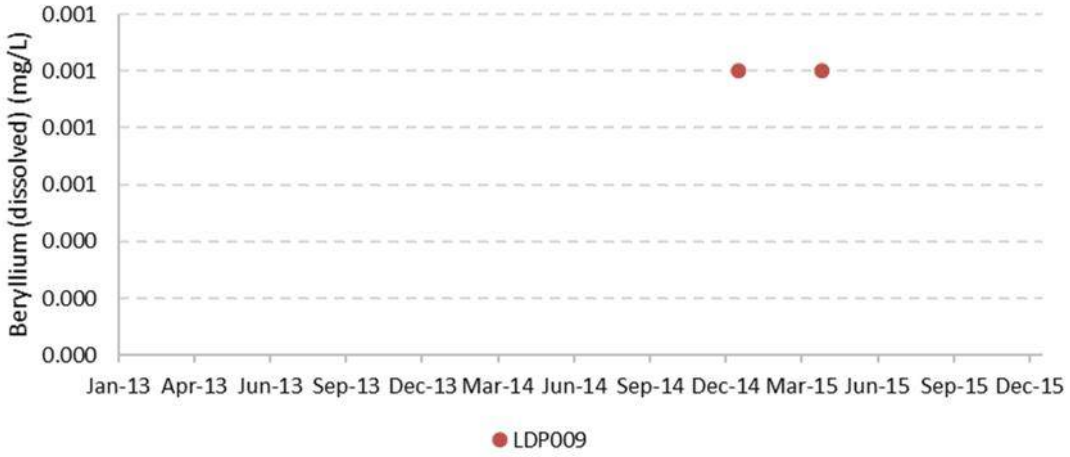



Figure D-65 Beryllium (dissolved) recorded at LDP009

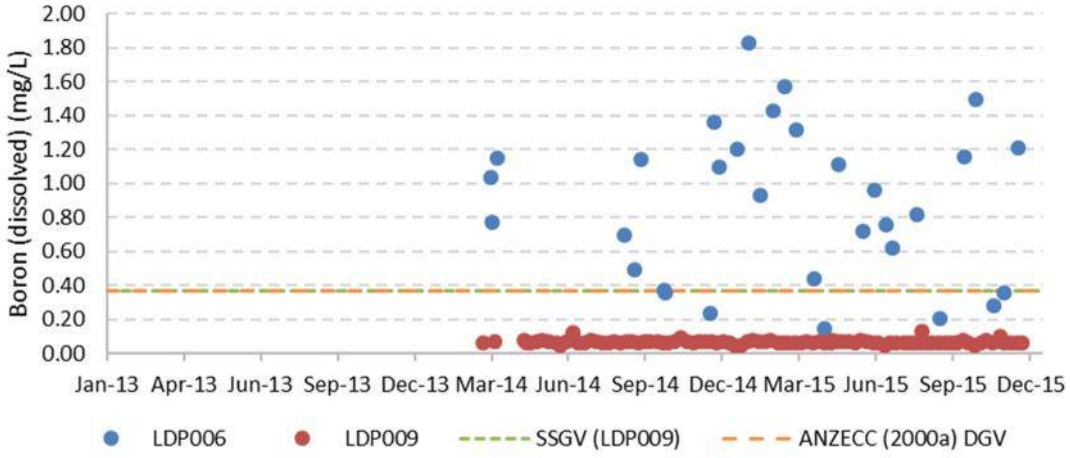



Figure D-66 Boron (dissolved) recorded at LDP006 and LDP009

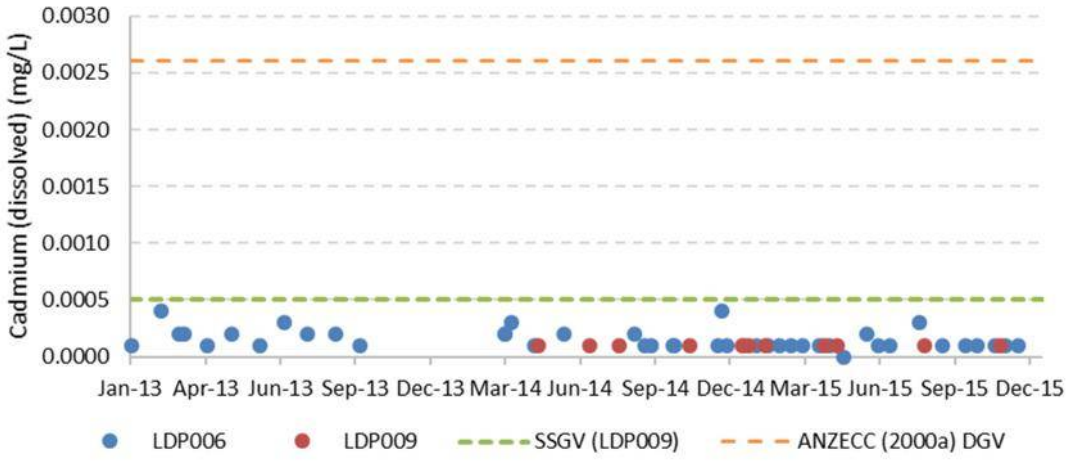



Figure D-67 Cadmium (dissolved) recorded at LDP006 and LDP009

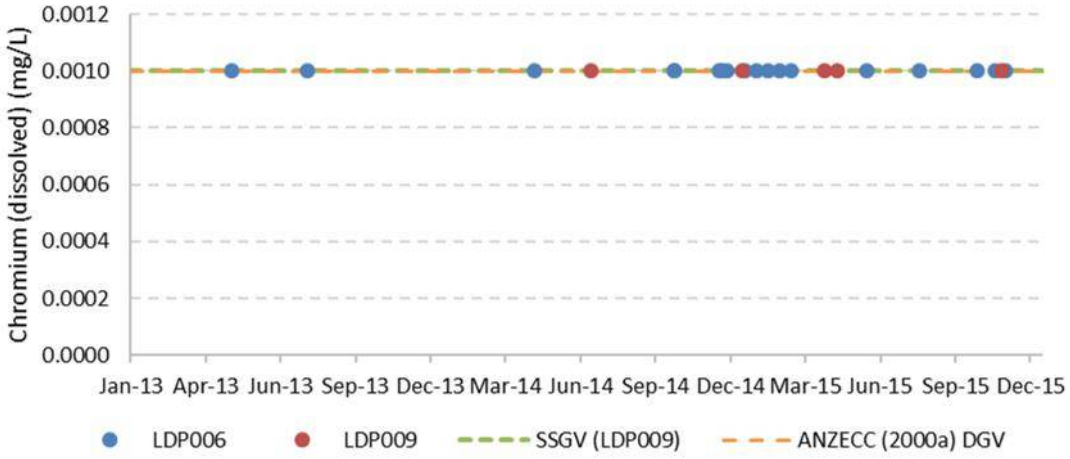



Figure D-68 Chromium (dissolved) recorded at LDP006 and LDP009

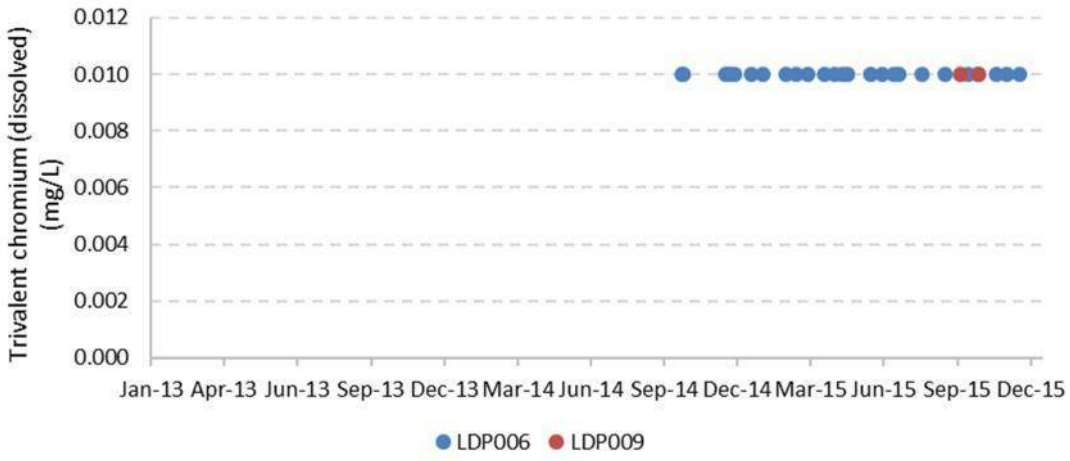



Figure D-69 Trivalent chromium (dissolved) recorded at LDP006 and LDP009

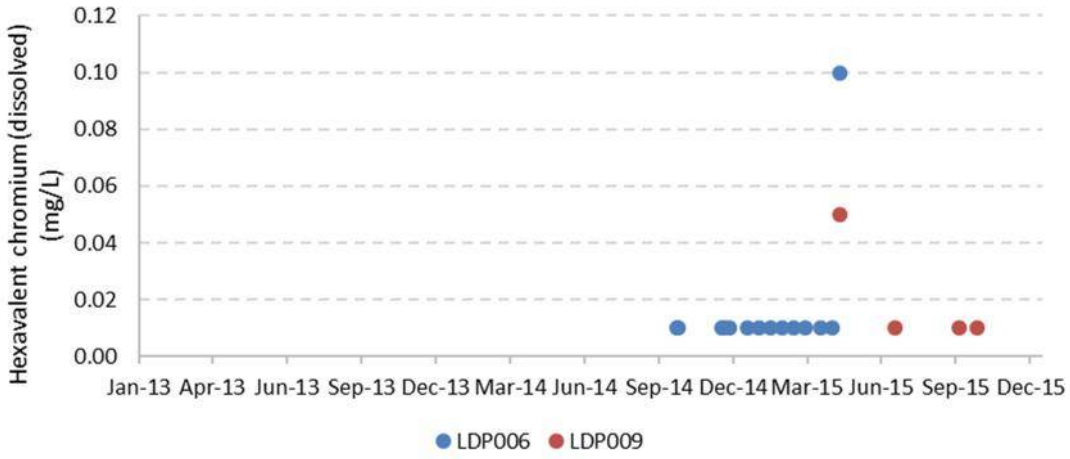



Figure D-70 Hexavalent chromium (dissolved) recorded at LDP006 and LDP009

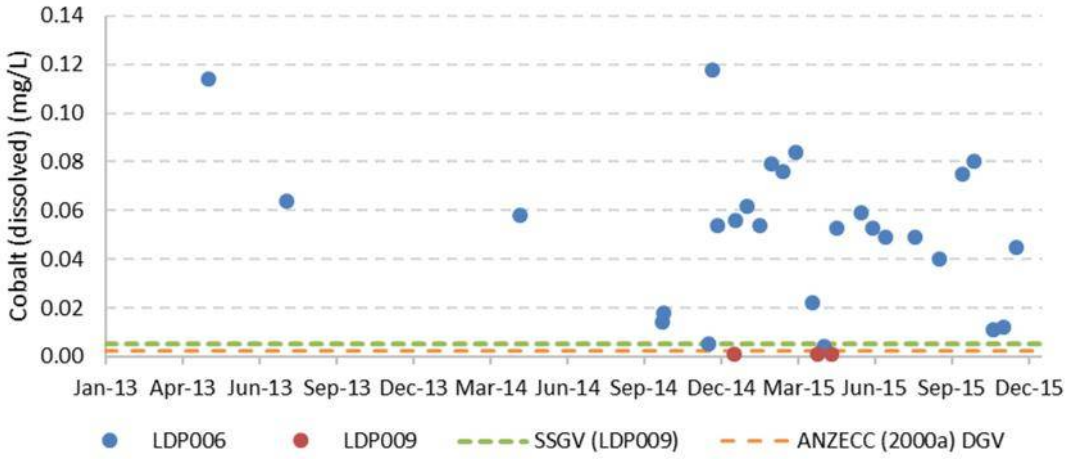



Figure D-71 Cobalt (dissolved) recorded at LDP006 and LDP009

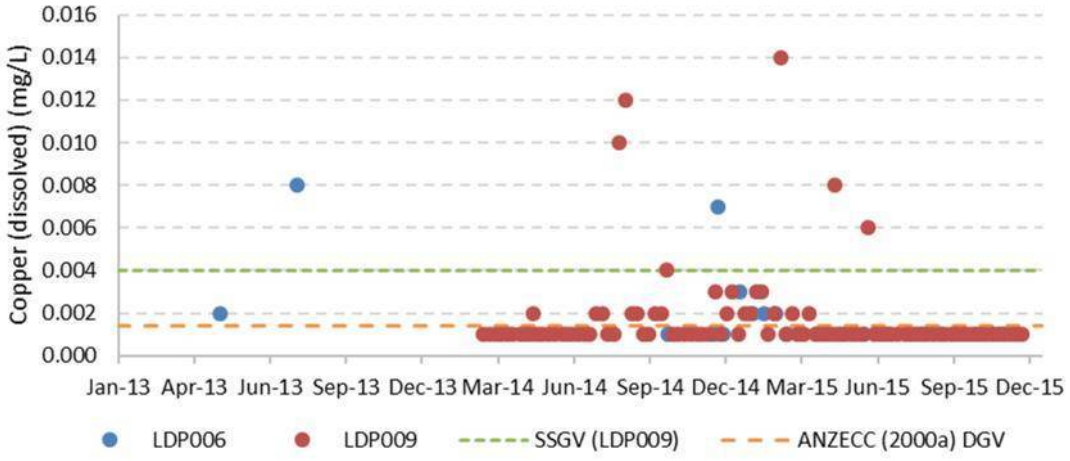



Figure D-72 Copper (dissolved) recorded at LDP006 and LDP009

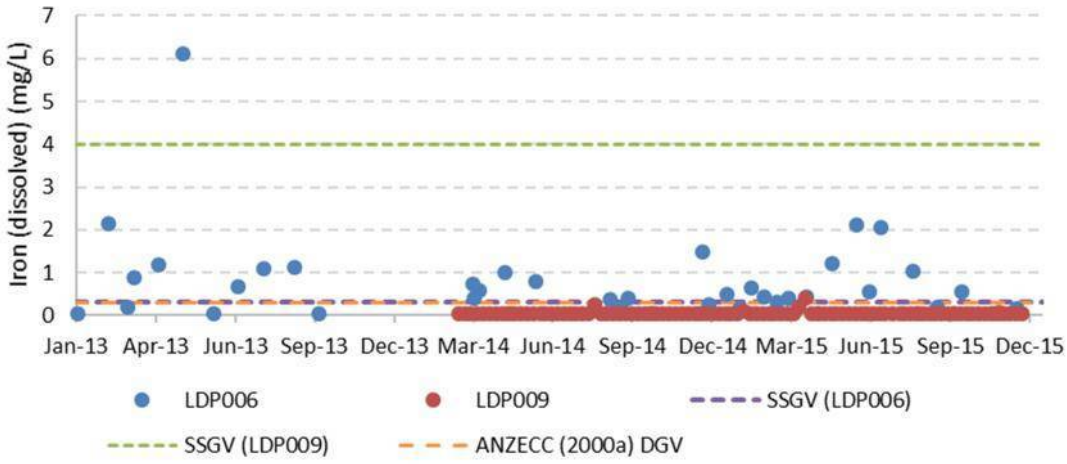



Figure D-73 Iron (dissolved) recorded at LDP006 and LDP009

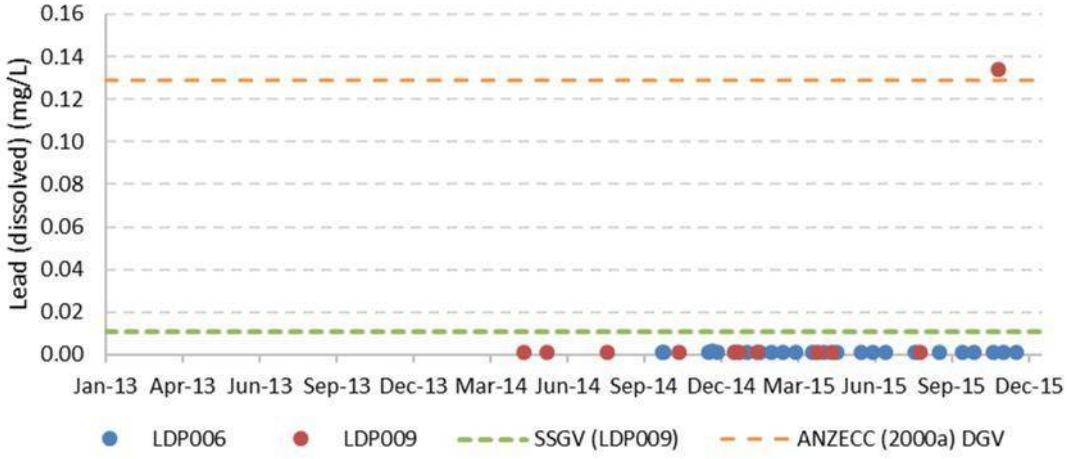



Figure D-74 Lead (dissolved) recorded at LDP006 and LDP009

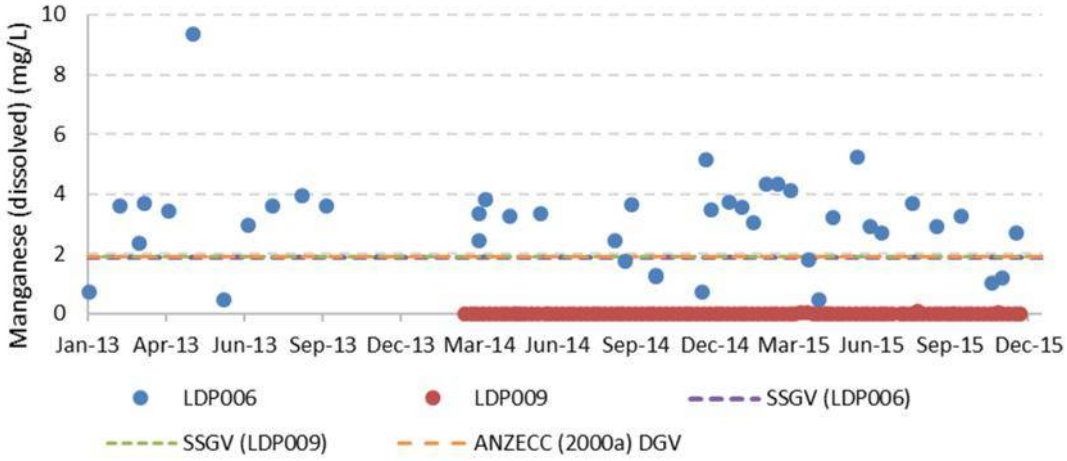



Figure D-75 Manganese (dissolved) recorded at LDP006 and LDP009

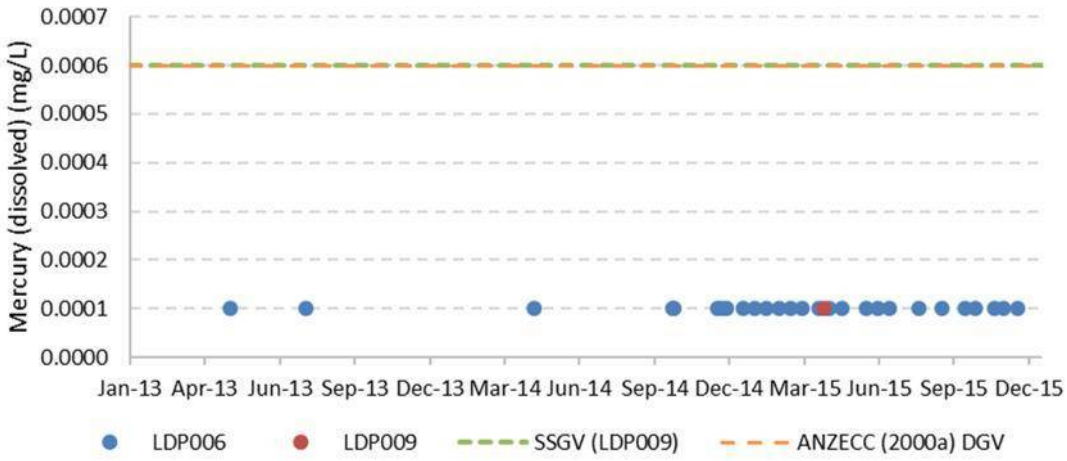



Figure D-76 Mercury (dissolved) recorded at LDP006 and LDP009

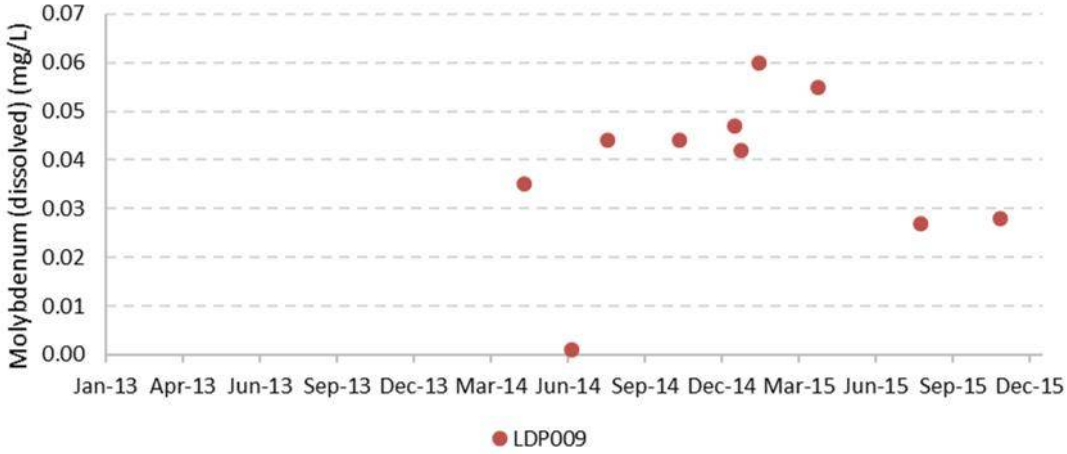



Figure D-77 Molybdenum (dissolved) recorded at LDP009

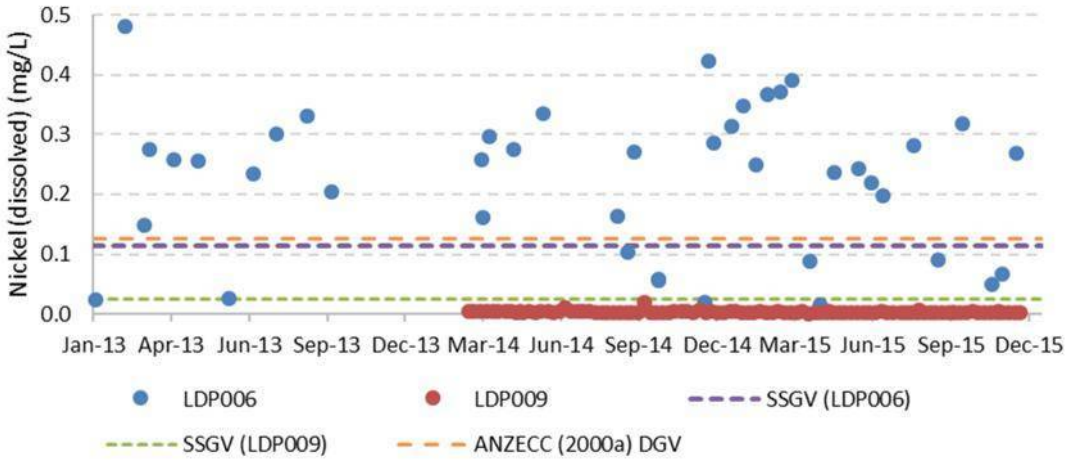



Figure D-78 Nickel (dissolved) recorded at LDP006 and LDP009

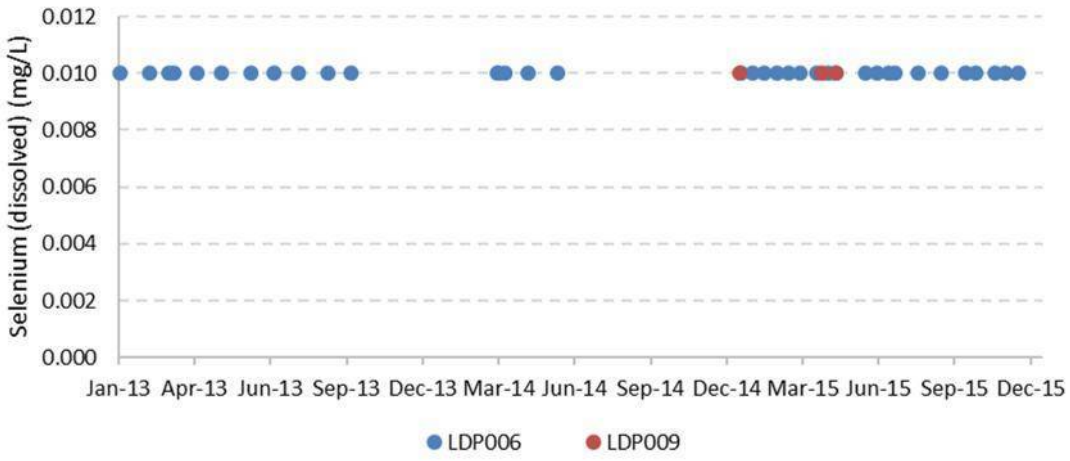



Figure D-79 Selenium (dissolved) recorded at LDP006 and LDP009

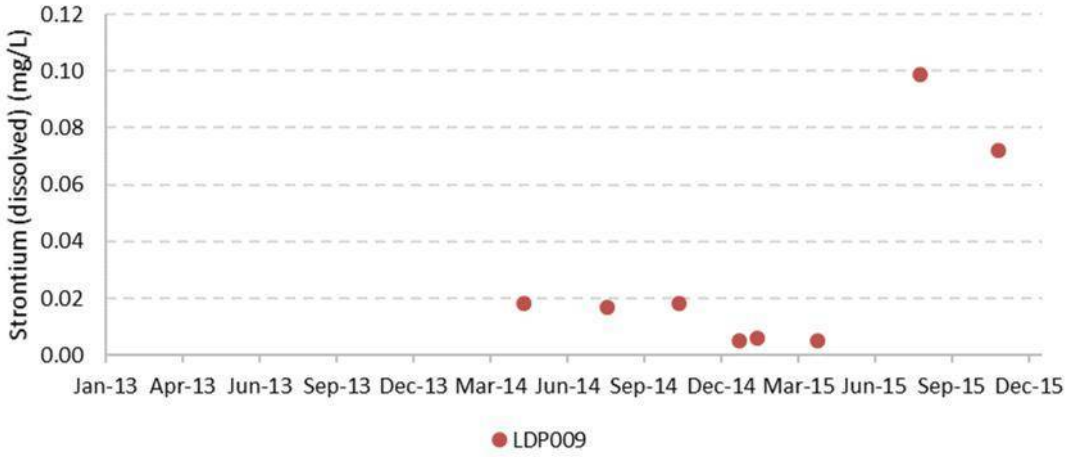



Figure D-80 Strontium (dissolved) recorded at LDP009

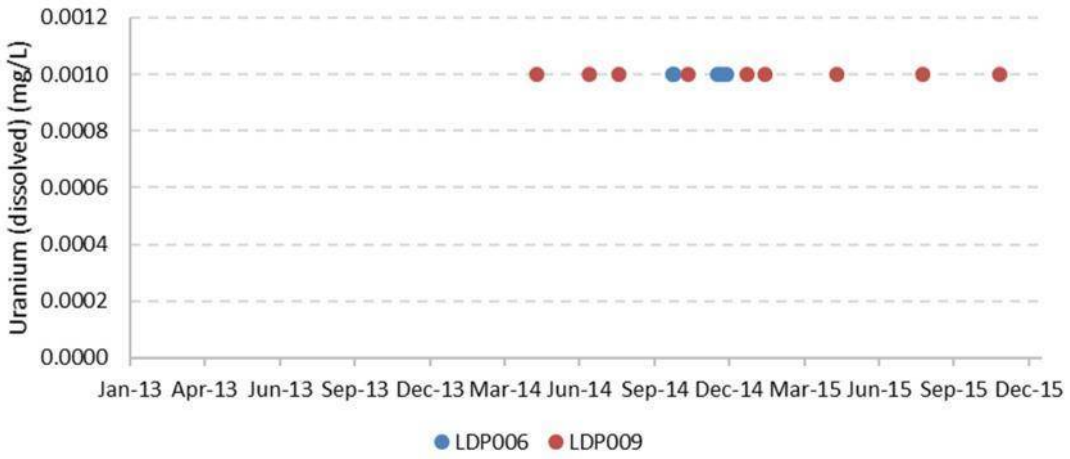



Figure D-81 Uranium (dissolved) recorded at LDP006 and LDP009

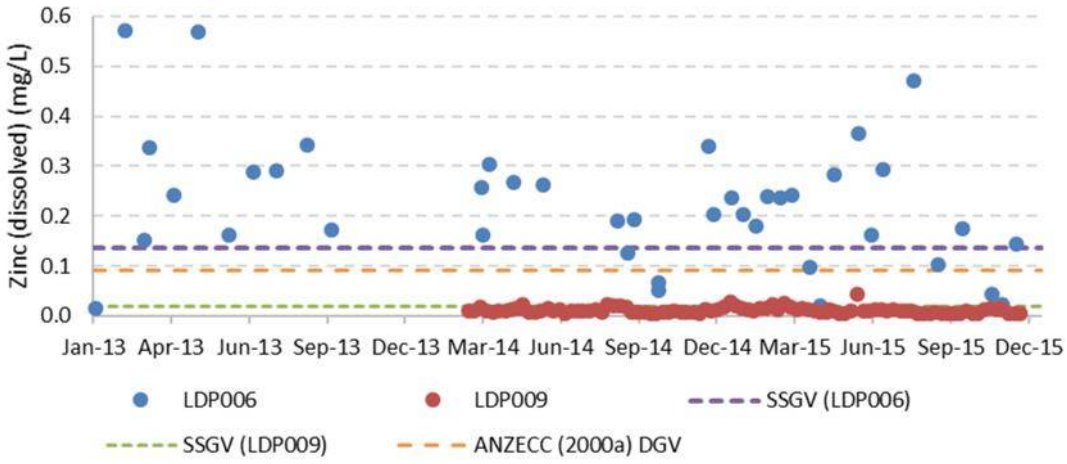



Figure D-82 Zinc (dissolved) recorded at LDP006 and LDP009

### D.2.6 Other parameters

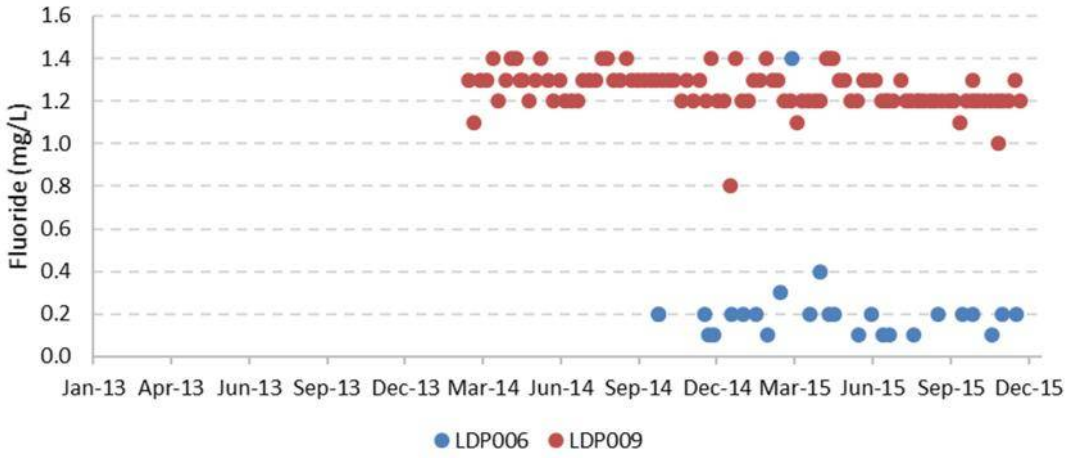



Figure D-83 Fluoride recorded at LDP006 and LDP009

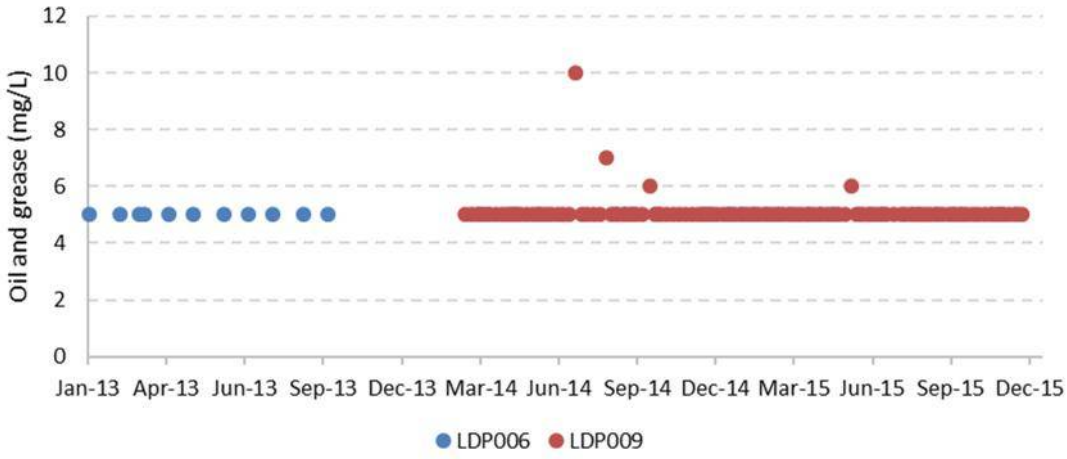



Figure D-84 Oil and grease recorded at LDP006 and LDP009

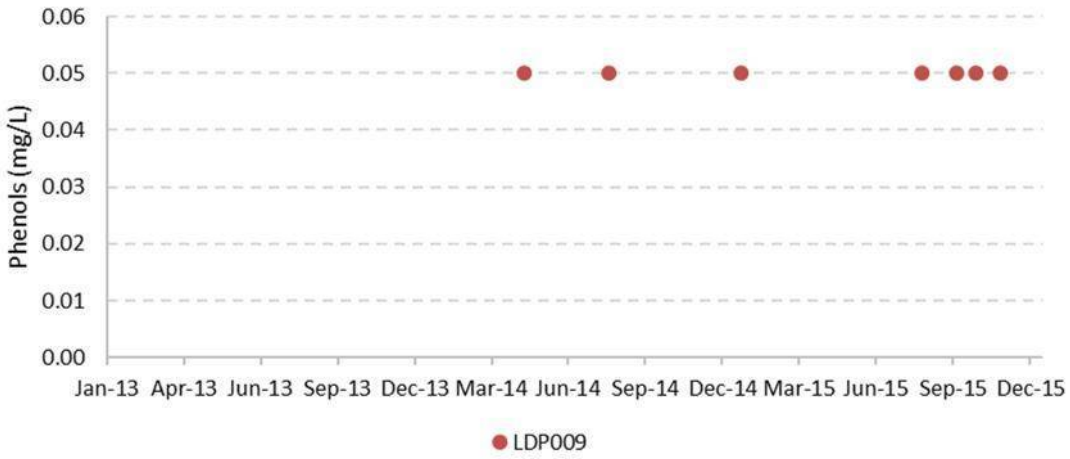



Figure D-85 Phenols recorded at LDP009

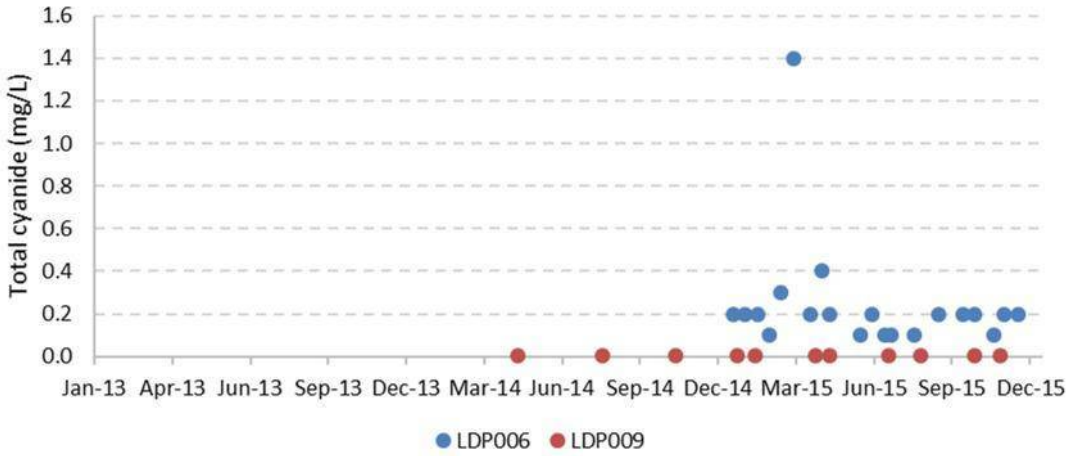



Figure D-86 Total cyanide recorded at LDP006 and LDP009

## D.3 Downstream locations

### D.3.1 Statistical summary

| Parameter | Units | ANZECC (2000a) DGV | Wangcol Creek D/S | | Wangcol Creek far D/S | | Coxs River D/S | |
|---|---|---|---|---|---|---|---|---|
| | | | Count | Median | Count | Median | Count | Median |
| **Physicochemical parameters** | | | | | | | | |
| EC | µS/cm | 350 | 34 | 1,640 | 33 | 1,930 | 161 | 1,030 |
| pH | pH units | 6.5–9.0 | 34 | 7.06 | 33 | 7.24 | 161 | 8.53 |
| TSS | mg/L | 25 | 34 | 5 | 33 | 5 | 37 | 5 |
| Turbidity | NTU | 25 | 34 | 2 | 33 | 3 | 14 | 4 |
| **Nutrients** | | | | | | | | |
| Ammonia | mg/L | 0.9 | – | – | – | – | 12 | 0.04 |
| Nitrate | mg/L | – | 34 | 0.03 | 33 | 0.04 | 12 | 0.03 |
| Nitrite | mg/L | – | 31 | 0.01 | 30 | 0.01 | 12 | 0.01 |
| Nitrite + nitrate | mg/L | – | 28 | 0.04 | 27 | 0.04 | 12 | 0.05 |
| TKN | mg/L | – | – | – | – | – | 12 | 0.45 |
| Total nitrogen | mg/L | 0.25 | – | – | – | – | 12 | 0.5 |
| Total organic carbon | mg/L | – | – | – | – | – | 16 | 5 |
| Total phosphorus | mg/L | 0.02 | 34 | 0.01 | 33 | 0.01 | 12 | 0.03 |
| **Anions** | | | | | | | | |
| Alkalinity | mg/L | – | 31 | 41 | 30 | 34 | 12 | 208 |
| Chloride | mg/L | – | 34 | 99 | 33 | 113 | 12 | 23 |

| Parameter | Units | ANZECC (2000a) DGV | Wangcol Creek D/S | | Wangcol Creek far D/S | | Coxs River D/S | |
|---|---|---|---|---|---|---|---|---|
| | | | Count | Median | Count | Median | Count | Median |
| Sulfate | mg/L | – | 34 | 800 | 33 | 878 | 12 | 165 |
| **Cations** | | | | | | | | |
| Calcium | mg/L | – | 34 | 103 | 33 | 114 | 12 | 22 |
| Magnesium | mg/L | – | 23 | 84 | 23 | 74 | 12 | 14 |
| Potassium | mg/L | – | 34 | 16 | 33 | 14 | 12 | 13 |
| Sodium | mg/L | – | 34 | 161 | 33 | 194 | 12 | 138 |
| **Dissolved metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 34 | 0.01 | 33 | 0.04 | 130 | 0.04 |
| Antimony | mg/L | – | – | – | – | – | 15 | 0.001 |
| Arsenic | mg/L | 0.024 | – | – | – | – | 105 | 0.01 |
| Barium | mg/L | – | – | – | – | – | 12 | 0.027 |
| Boron | mg/L | 0.37 | 34 | 0.49 | 32 | 0.50 | 99 | 0.09 |
| Cadmium | mg/L | 0.0026* | 34 | 0.0001 | 33 | 0.0001 | 12 | 0.0001 |
| Copper | mg/L | 0.0014 | – | – | – | – | 126 | 0.001 |
| Iron | mg/L | 0.3 | 34 | 0.115 | 33 | 0.07 | 127 | 0.05 |
| Lead | mg/L | 0.129* | – | – | – | – | 12 | 0.001 |
| Manganese | mg/L | 1.9 | 34 | 0.745 | 33 | 1.13 | 105 | 0.049 |
| Molybdenum | mg/L | – | – | – | – | – | 12 | 0.007 |
| Nickel | mg/L | 0.125* | 34 | 0.054 | 33 | 0.054 | 105 | 0.005 |
| Selenium | mg/L | – | 34 | 0.01 | 33 | 0.01 | – | – |

| Parameter | Units | ANZECC (2000a) DGV | Wangcol Creek D/S | | Wangcol Creek far D/S | | Coxs River D/S | |
|---|---|---|---|---|---|---|---|---|
| | | | Count | Median | Count | Median | Count | Median |
| Strontium | mg/L | – | – | – | – | – | 13 | 0.127 |
| Zinc | mg/L | 0.091* | 34 | 0.035 | 33 | 0.063 | 125 | 0.01 |
| **Total metals** | | | | | | | | |
| Aluminium | mg/L | – | – | – | – | – | 11 | 0.03 |
| Arsenic | mg/L | – | – | – | – | – | 11 | 0.002 |
| Barium | mg/L | – | – | – | – | – | 10 | 0.03 |
| Iron | mg/L | – | – | – | – | – | 10 | 0.05 |
| Lead | mg/L | – | – | – | – | – | 10 | 0.001 |
| Manganese | mg/L | – | – | – | – | – | 11 | 0.088 |
| Nickel | mg/L | – | 34 | 0.057 | 33 | 0.058 | 11 | 0.006 |
| Zinc | mg/L | – | 34 | 0.037 | 33 | 0.071 | 15 | 0.015 |
| **Other** | | | | | | | | |
| Fluoride | mg/L | – | – | – | – | – | 18 | 1.0 |
| Oil and grease | mg/L | – | 34 | 5 | 33 | 5 | 12 | 5 |
| Phenols | mg/L | – | – | – | – | – | 11 | 0.05 |
| Total cyanide | mg/L | – | – | – | – | – | 11 | 0.004 |

* ANZECC (2000a) DGV modified for hardness.

### D.3.2 Time series graphs

***Physicochemical parameters***

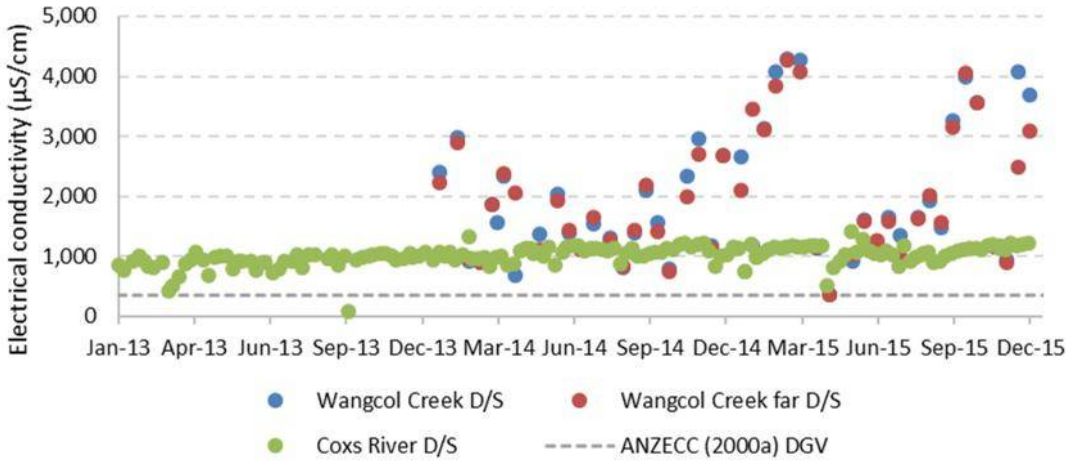



Figure D-87 Electrical conductivity recorded at downstream monitoring locations

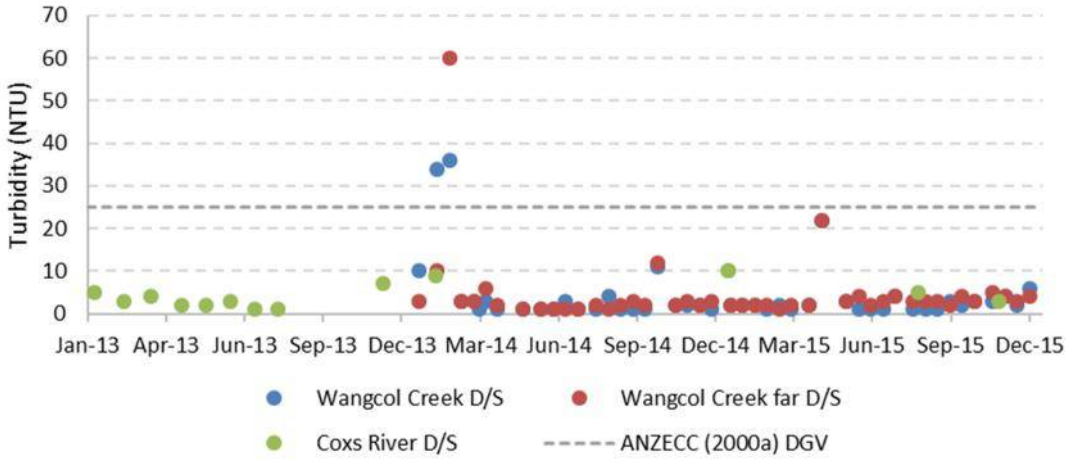



Figure D-88 pH recorded at downstream monitoring locations

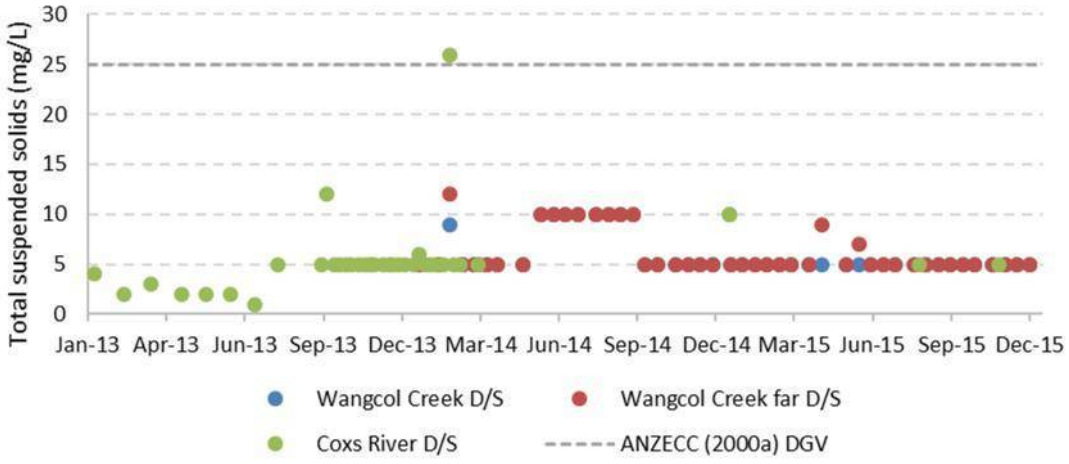



Figure D-89 Total suspended solids recorded at downstream monitoring locations

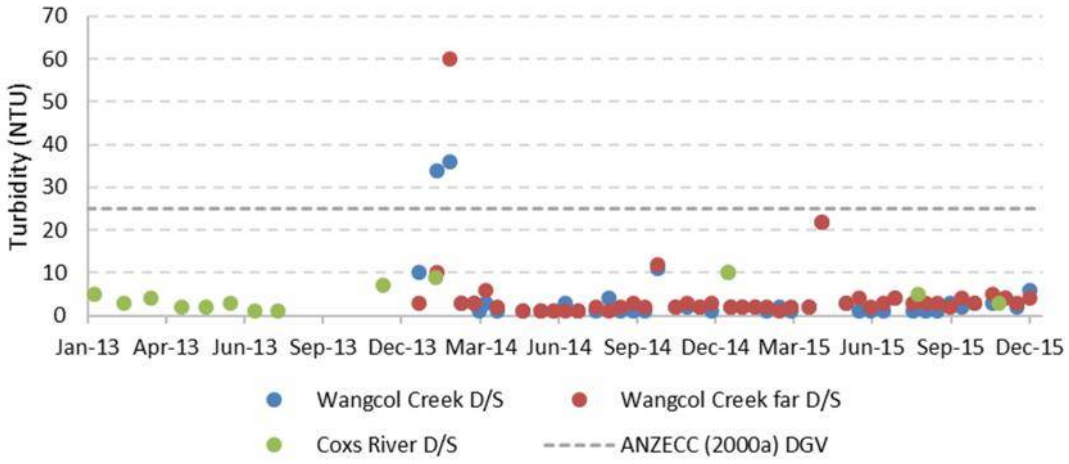



Figure D-90 Turbidity recorded at downstream monitoring locations

***Nutrients***

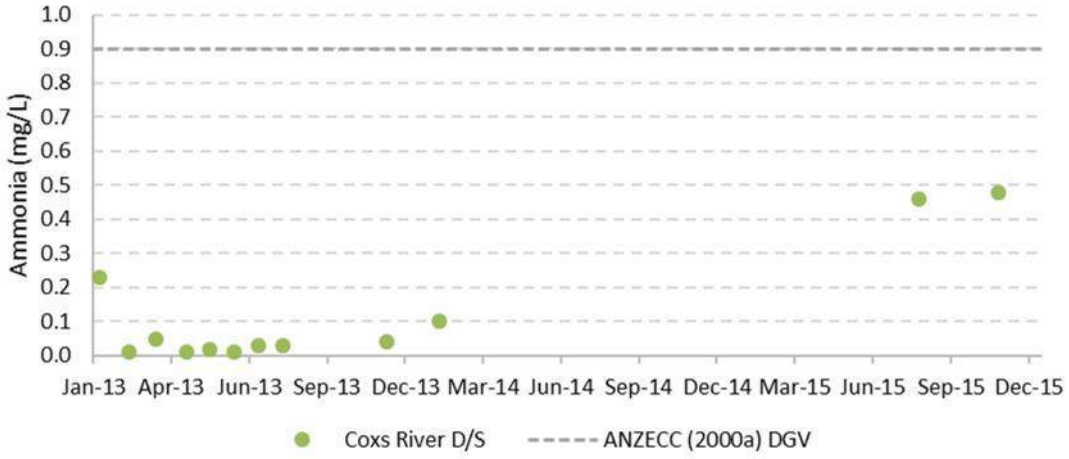



Figure D-91 Ammonia recorded at downstream monitoring locations

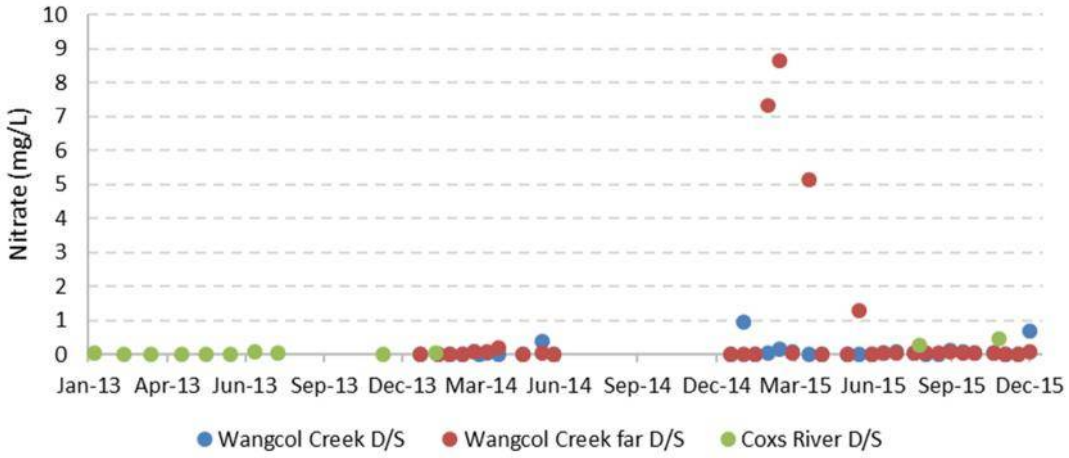



Figure D-92 Nitrate recorded at downstream monitoring locations

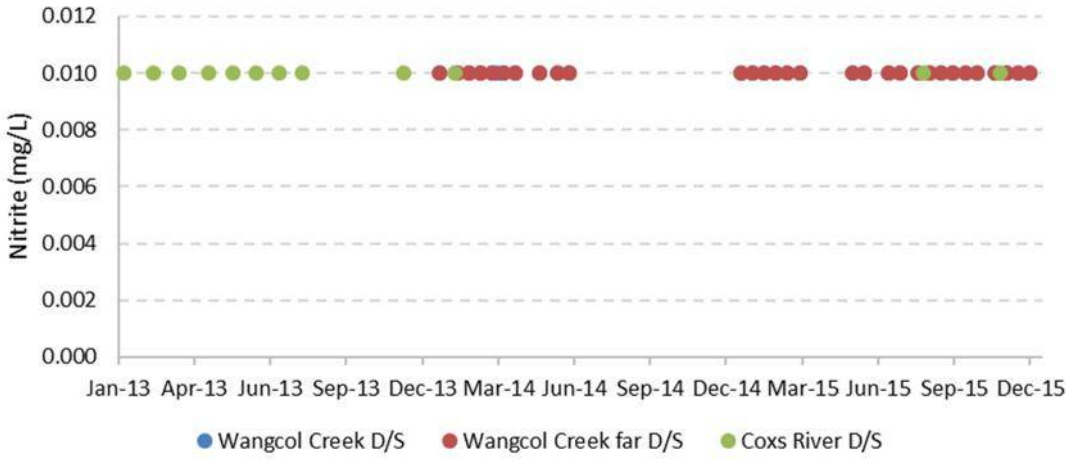



Figure D-93 Nitrite recorded at downstream monitoring locations

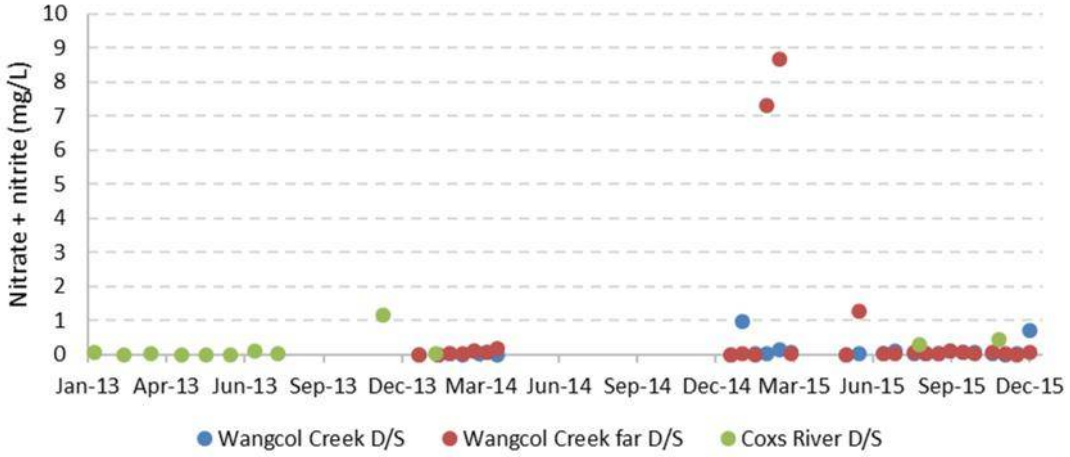



Figure D-94 Nitrite + nitrate recorded at downstream monitoring locations

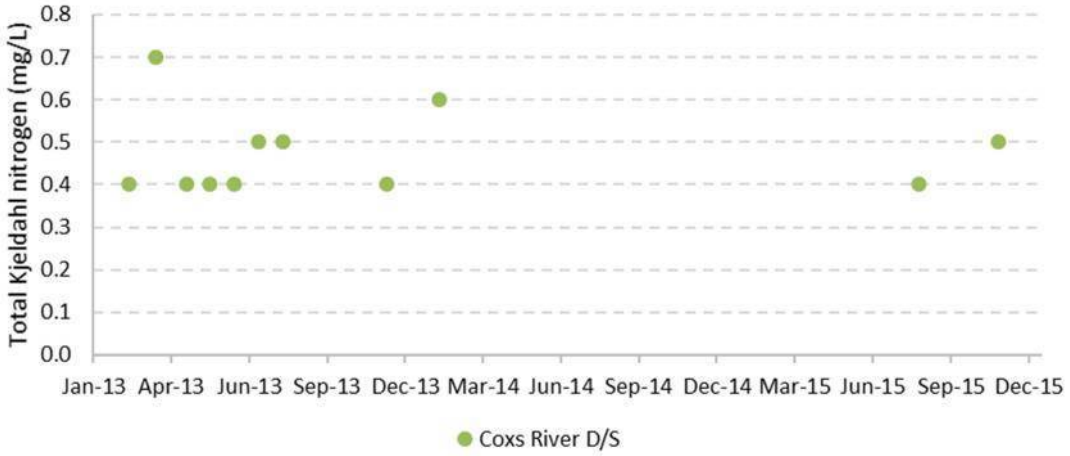



Figure D-95 Total Kjeldahl nitrogen recorded at downstream monitoring locations

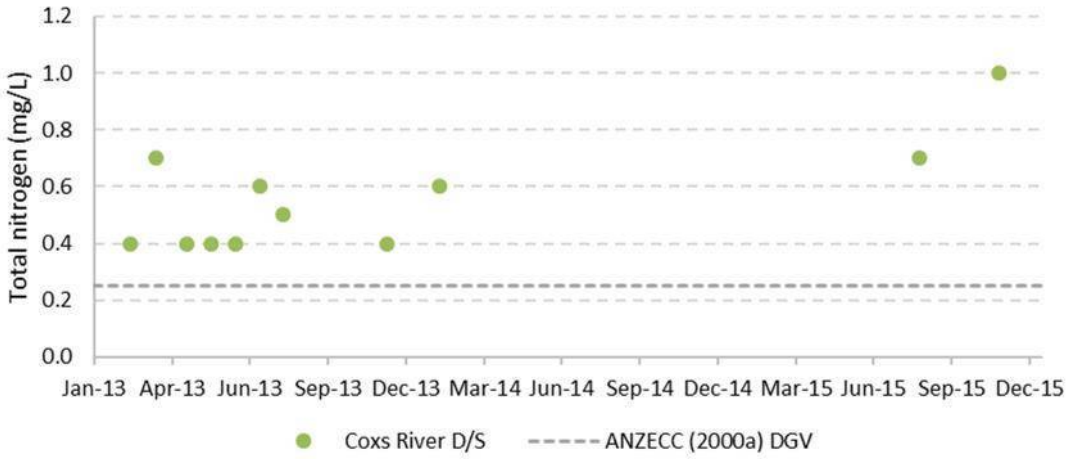



Figure D-96 Total nitrogen recorded at downstream monitoring locations

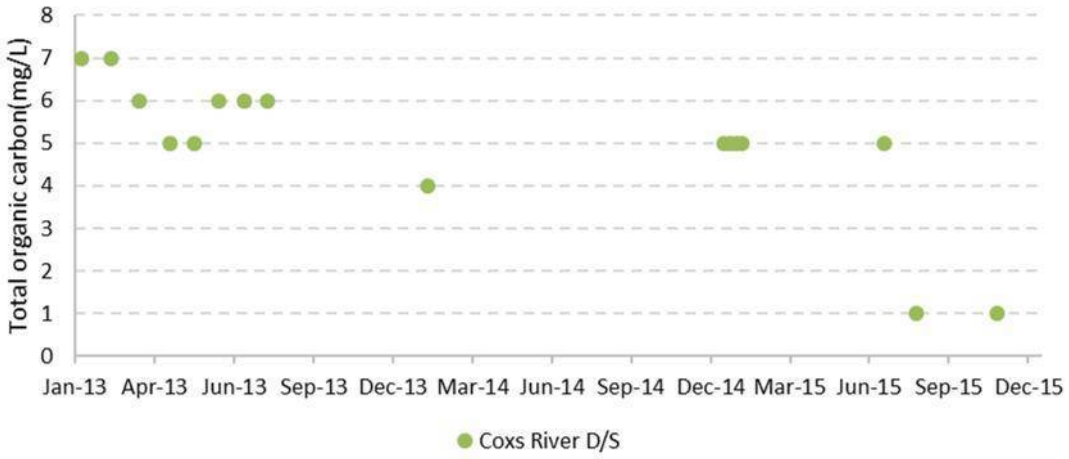



Figure D-97 Total organic carbon recorded at downstream monitoring locations

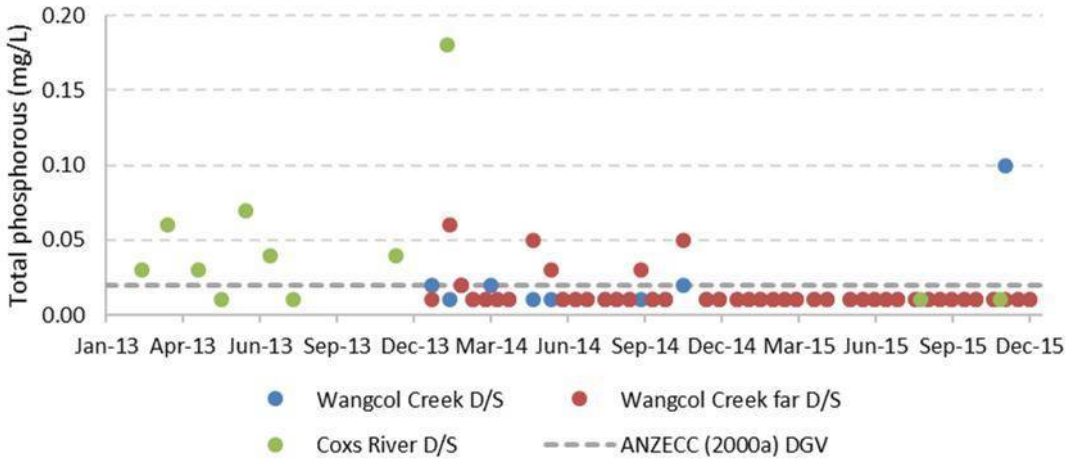



Figure D-98 Total phosphorus recorded at downstream monitoring locations

### *Anions*

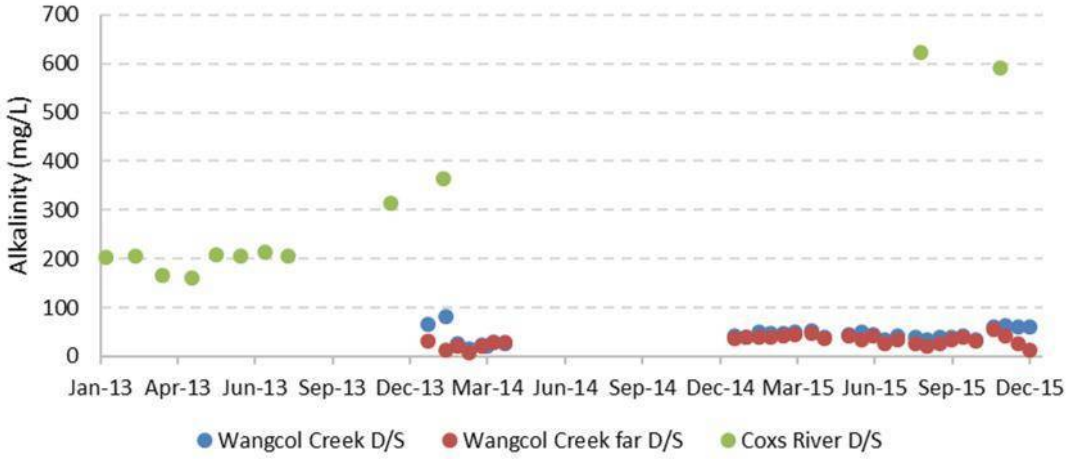



Figure D-99 Alkalinity recorded at downstream monitoring locations

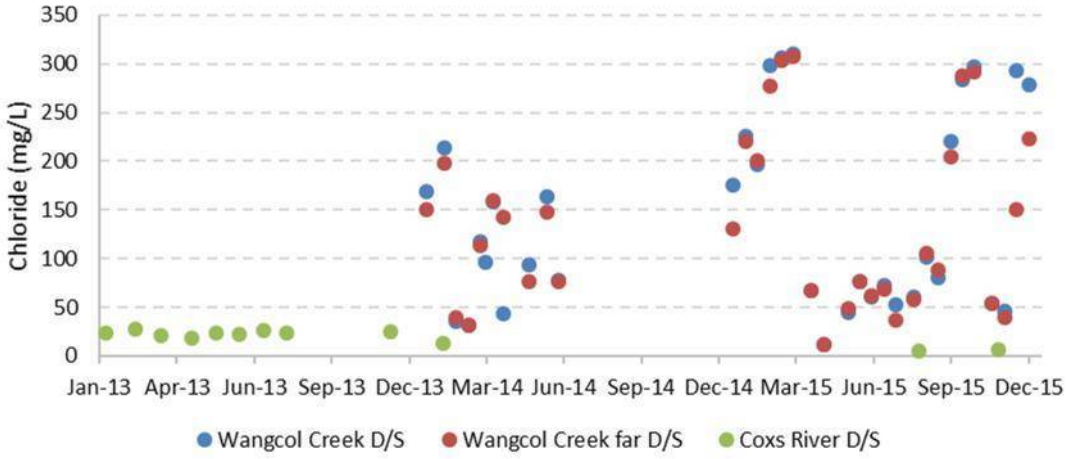



Figure D-100 Chloride recorded at downstream monitoring locations

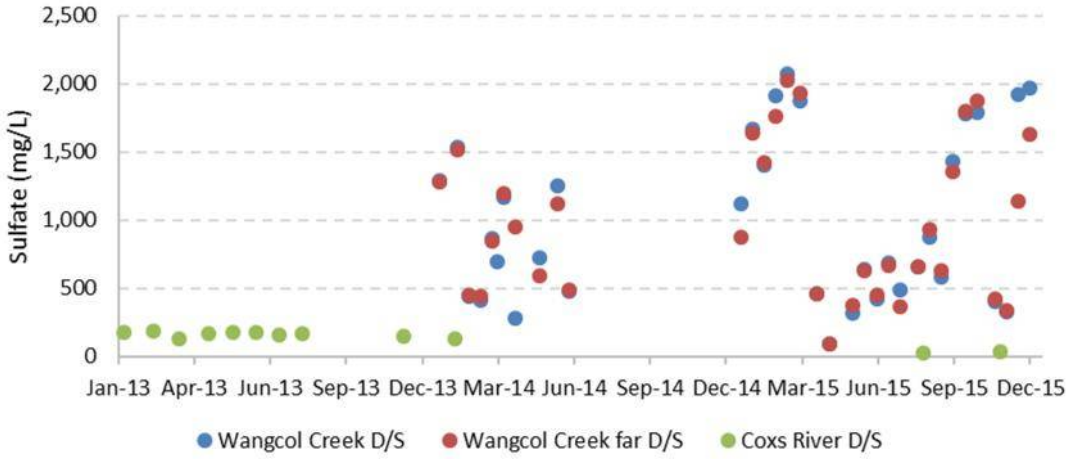



Figure D-101 Sulfate recorded at downstream monitoring locations

### *Cations*

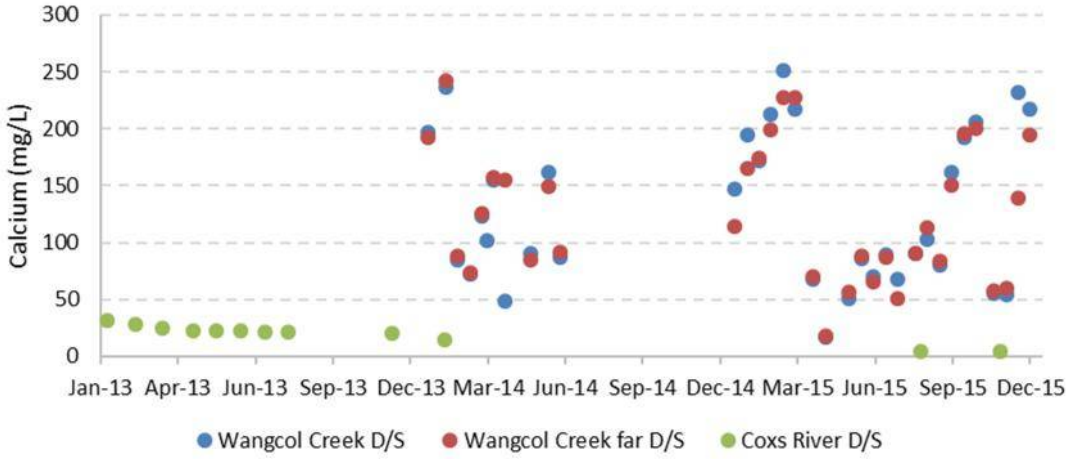



Figure D-102 Calcium recorded at downstream monitoring locations

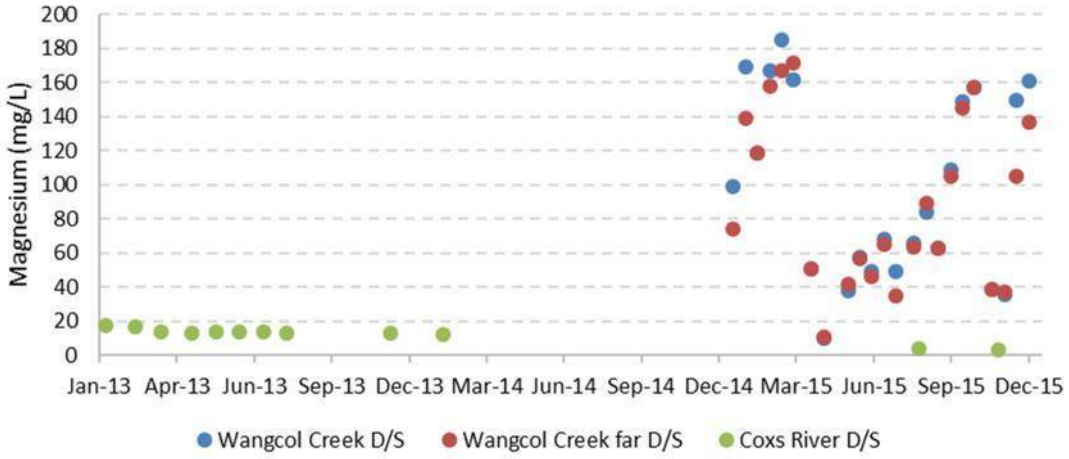



Figure D-103 Magnesium recorded at downstream monitoring locations

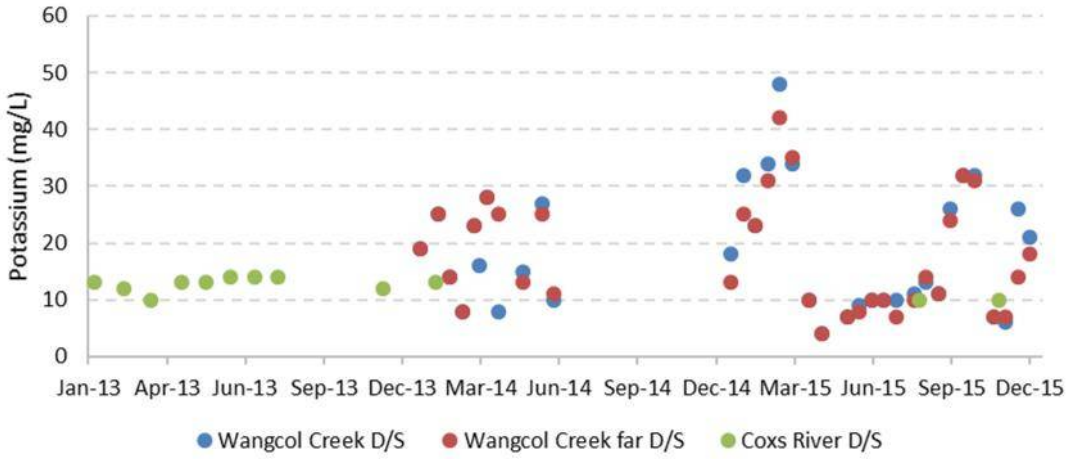



Figure D-104 Potassium recorded at downstream monitoring locations

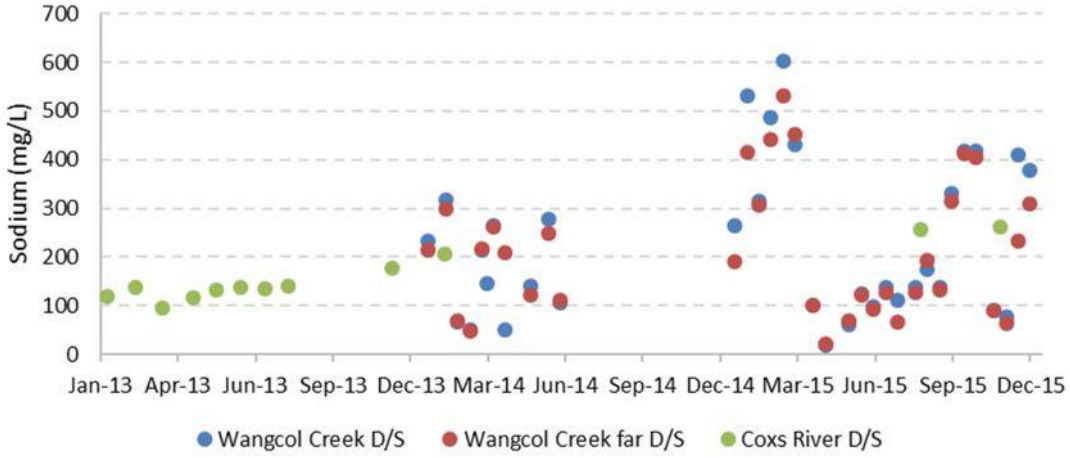



Figure D-105 Sodium recorded at downstream monitoring locations

***Metals***

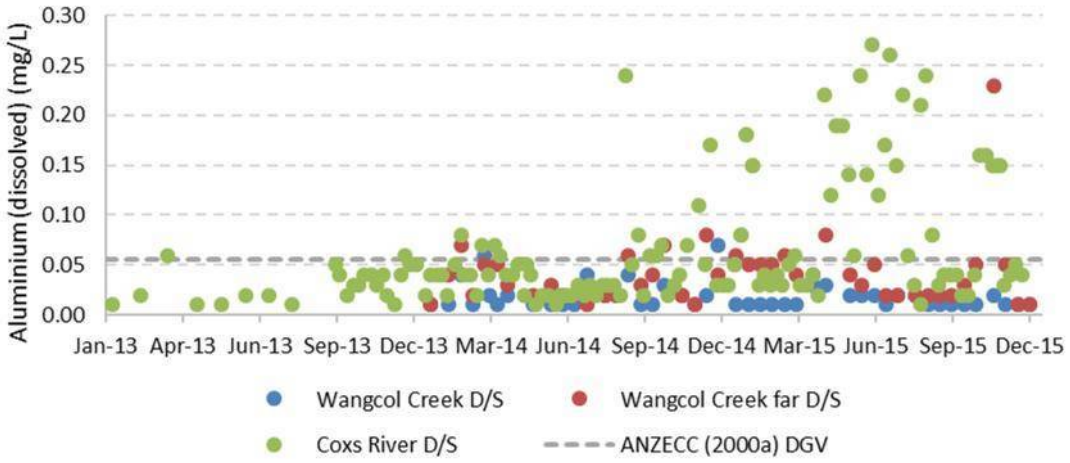



Figure D-106 Aluminium (dissolved) recorded at downstream monitoring locations

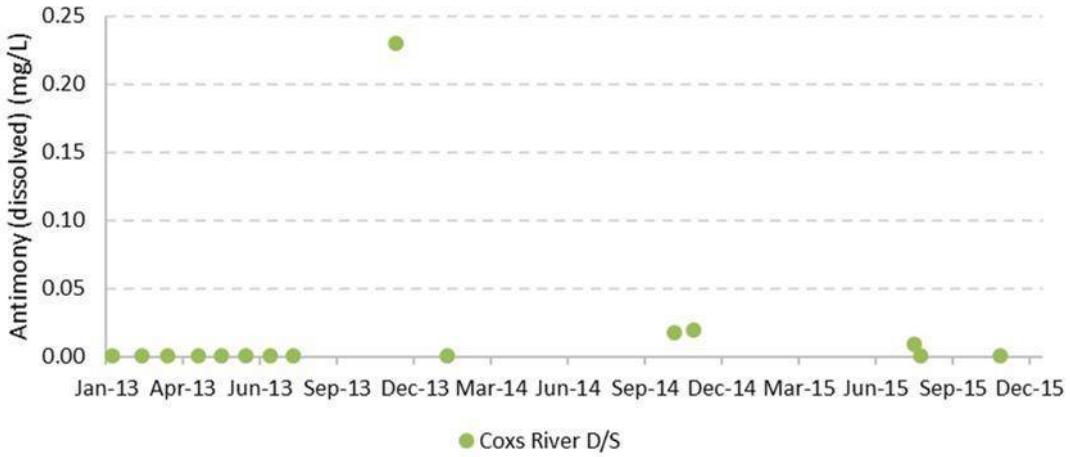



Figure D-107 Antimony (dissolved) recorded at downstream monitoring locations

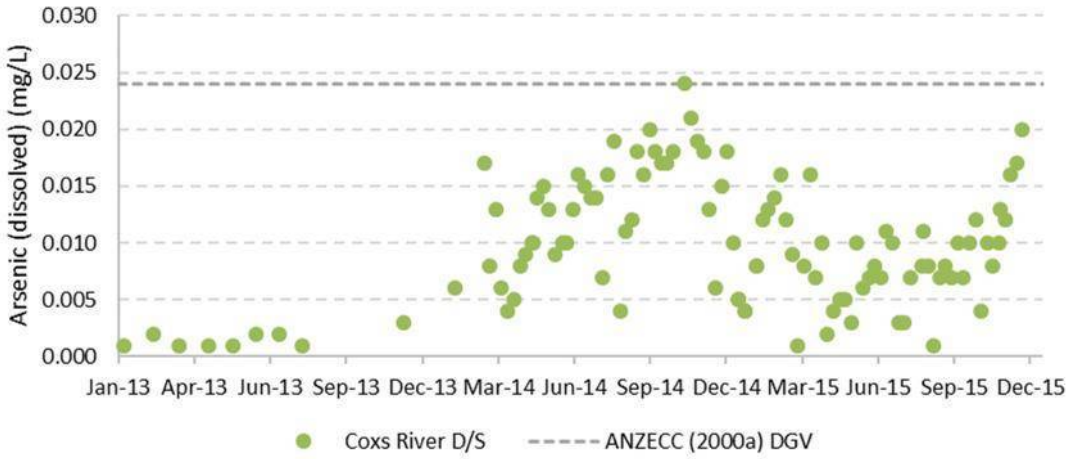



Figure D-108 Arsenic (dissolved) recorded at downstream monitoring locations

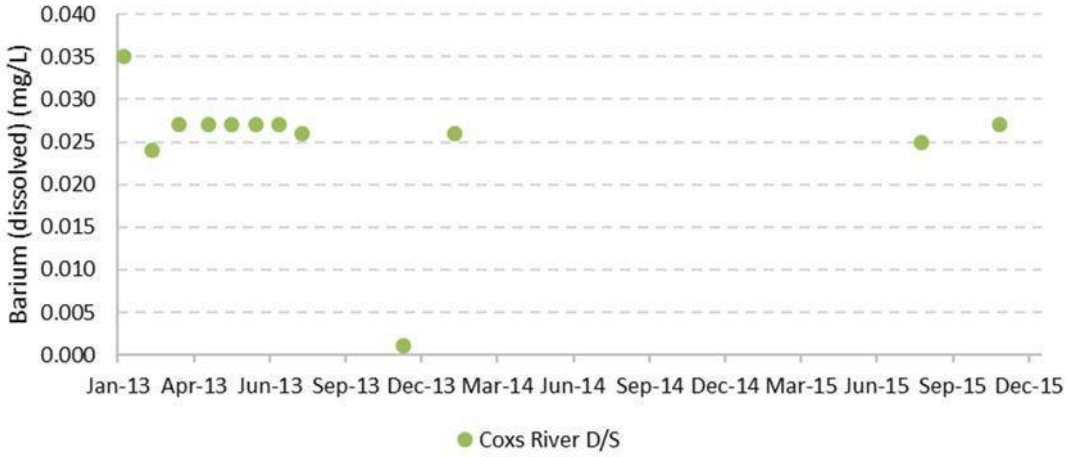



Figure D-109 Barium (dissolved) recorded at downstream monitoring locations

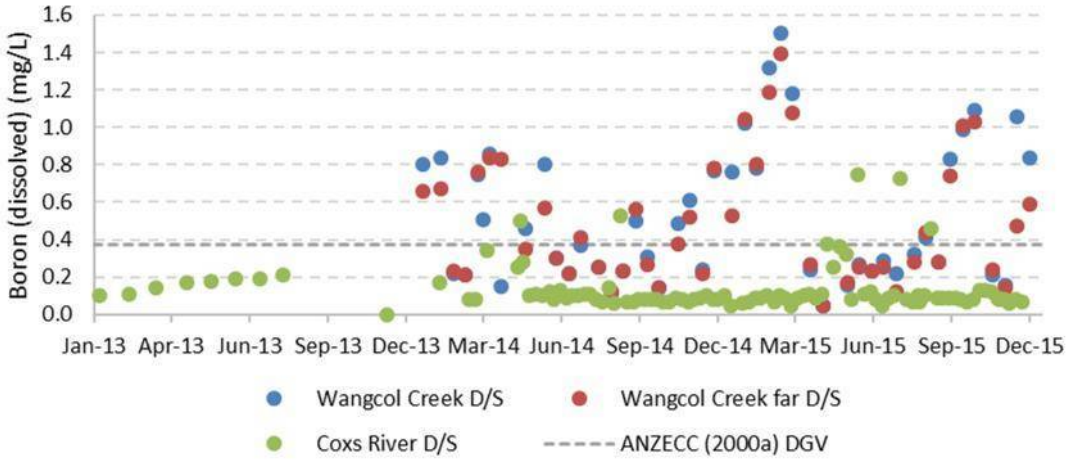



Figure D-110 Boron (dissolved) recorded at downstream monitoring locations

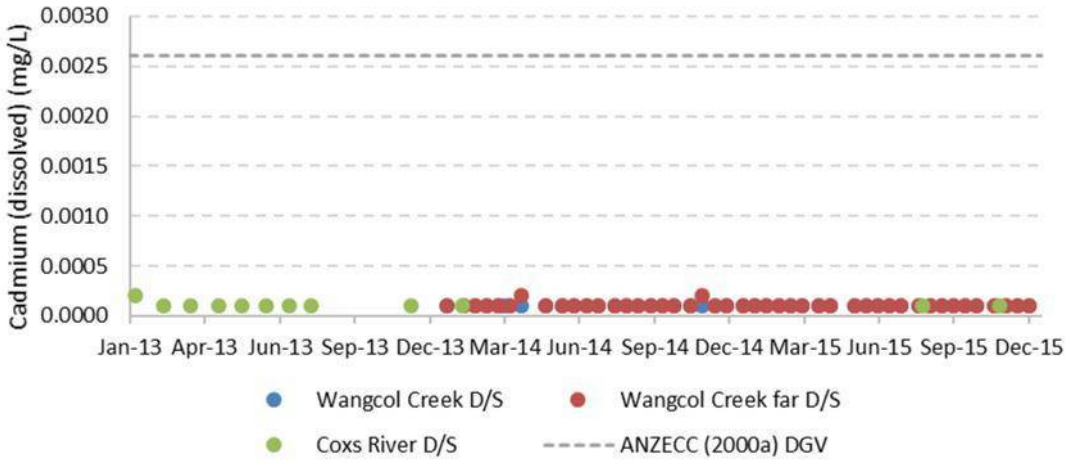



Figure D-111 Cadmium (dissolved) recorded at downstream monitoring locations

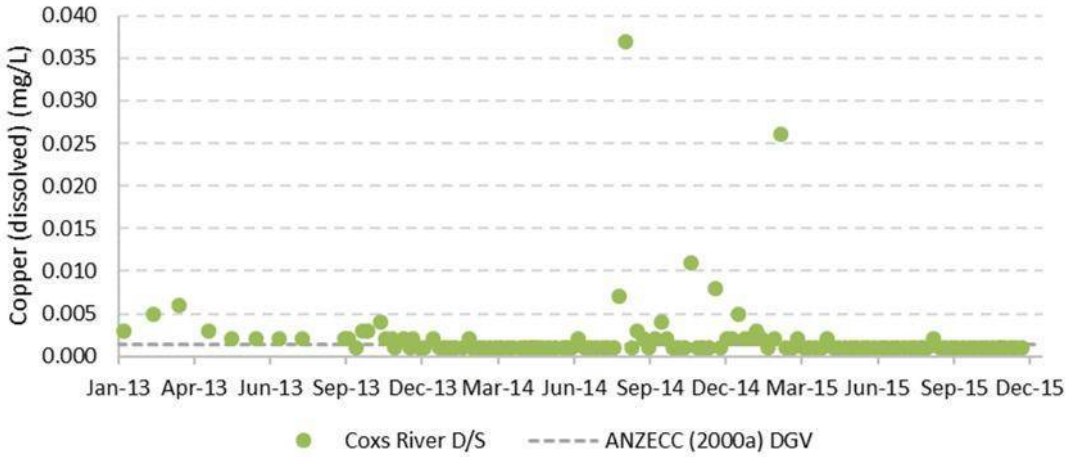



Figure D-112 Copper (dissolved) recorded at downstream monitoring locations

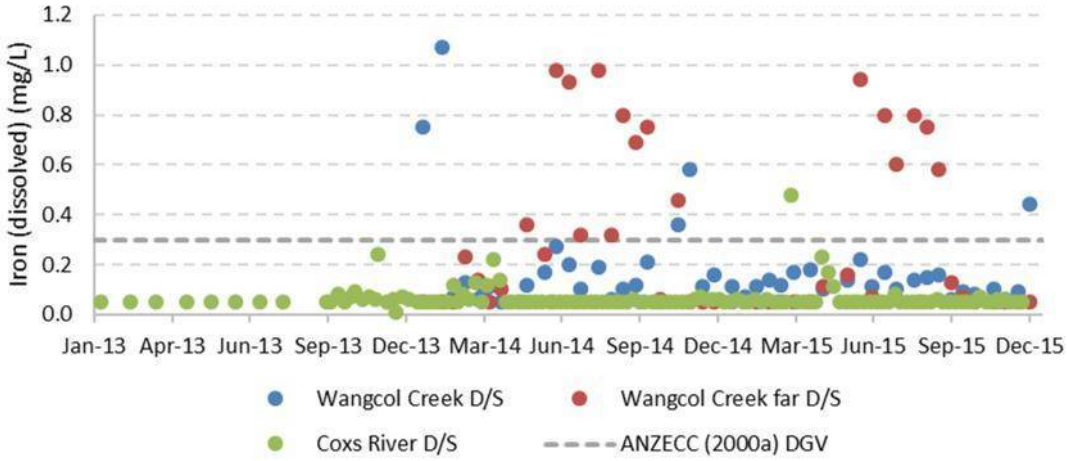



Figure D-113 Iron (dissolved) recorded at downstream monitoring locations

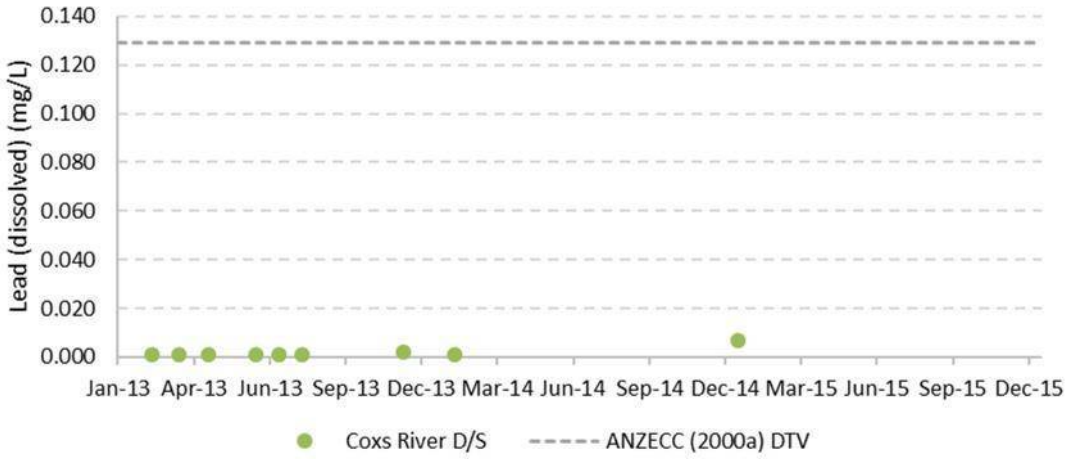



Figure D-114 Lead (dissolved) recorded at downstream monitoring locations

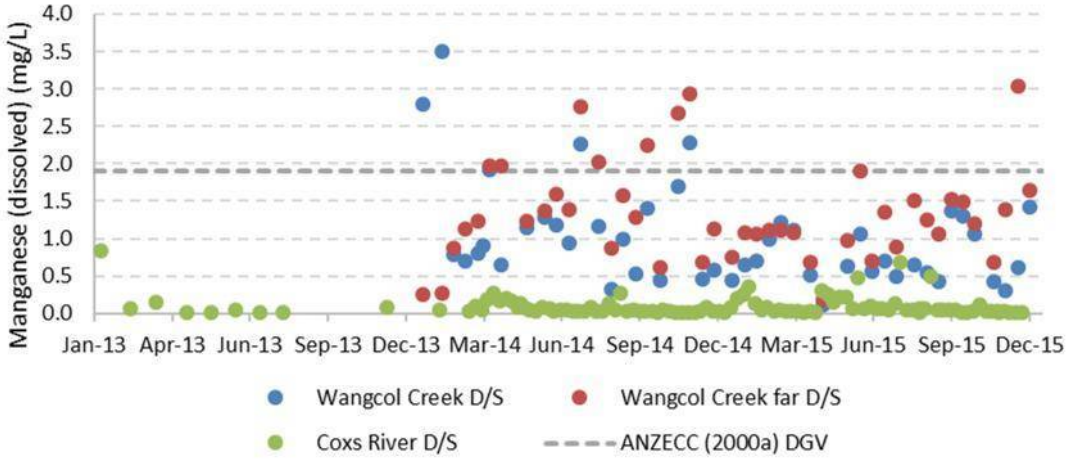



Figure D-115 Manganese (dissolved) recorded at downstream monitoring locations

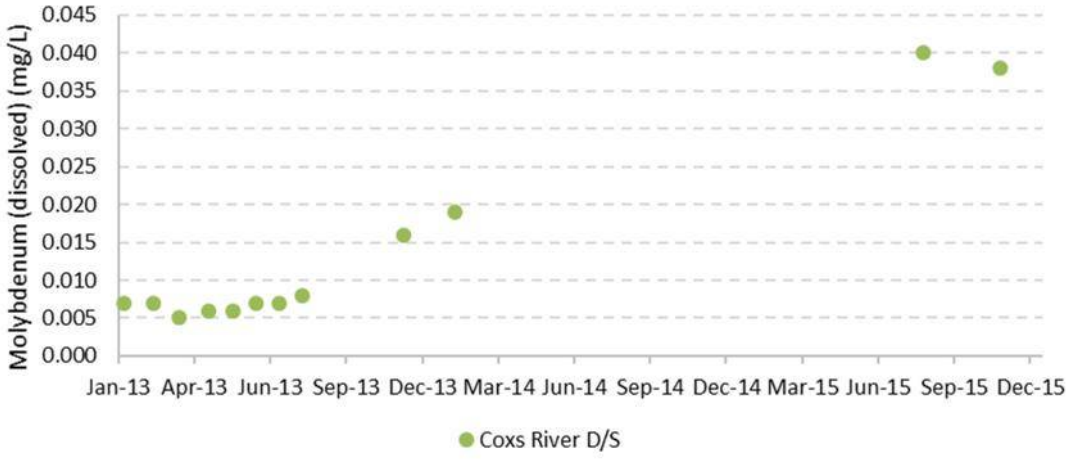



Figure D-116 Molybdenum (dissolved) recorded at downstream monitoring locations

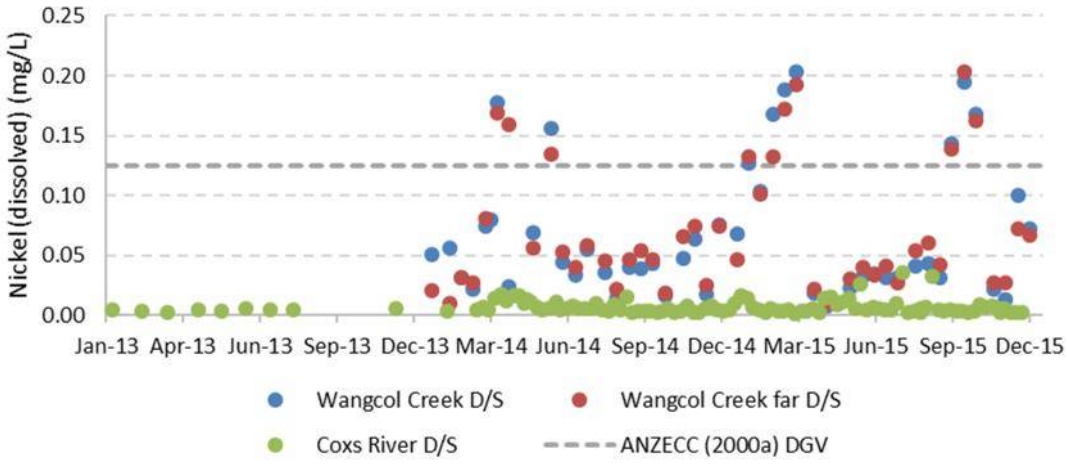



Figure D-117 Nickel (dissolved) recorded at downstream monitoring locations


Figure D-118 Selenium (dissolved) recorded at downstream monitoring locations

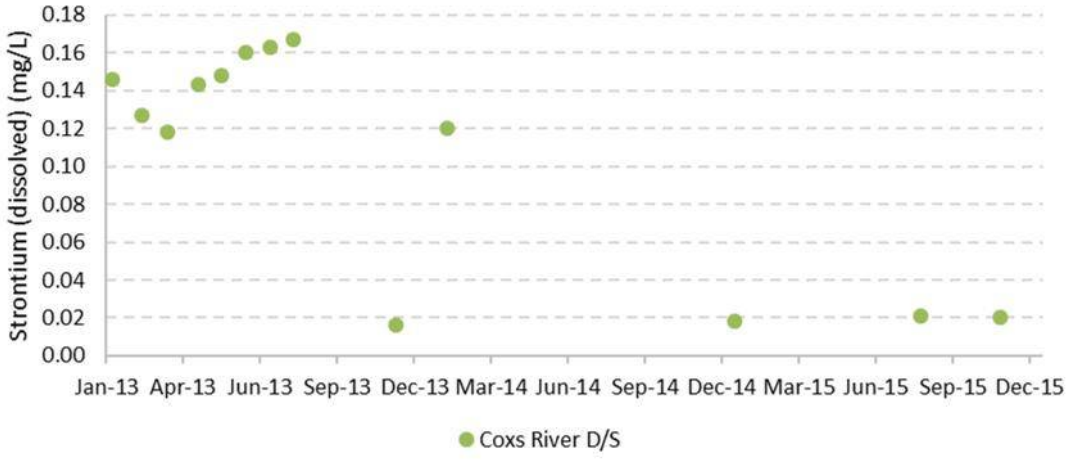



Figure D-119 Strontium (dissolved) recorded at downstream monitoring locations

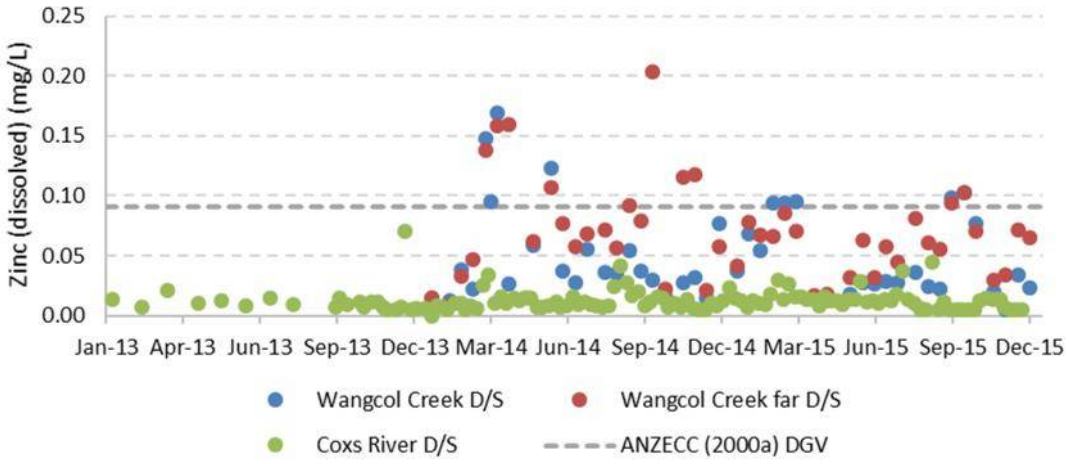



Figure D-120 Zinc (dissolved) recorded at downstream monitoring locations

***Other parameters***

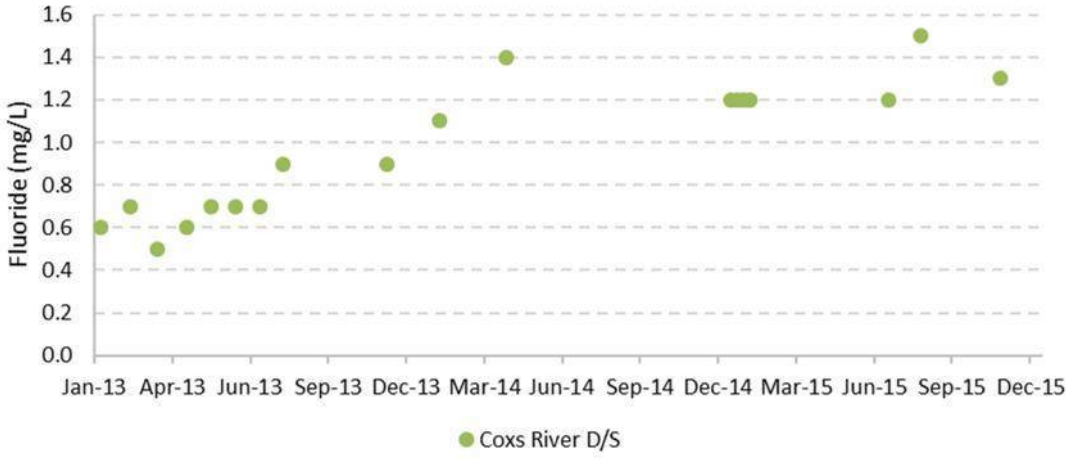



Figure D-121 Fluoride recorded at downstream monitoring locations

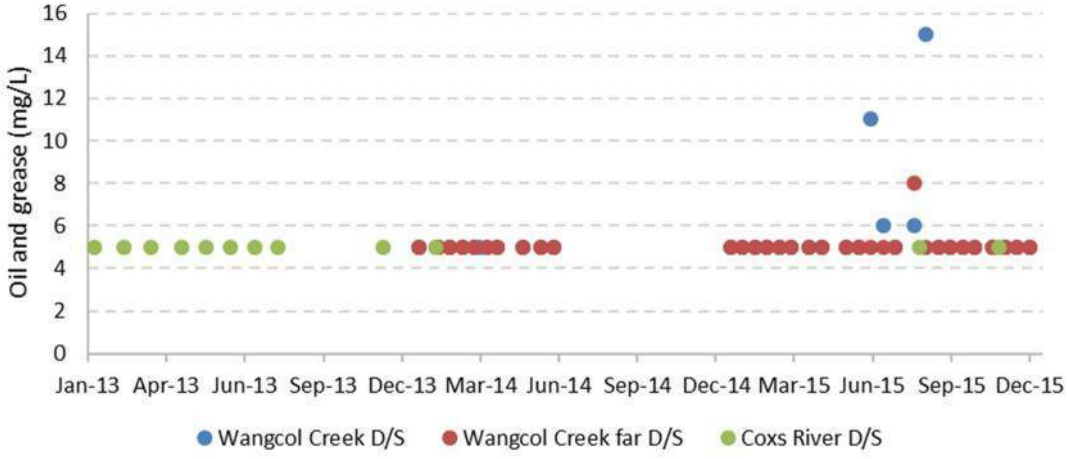



Figure D-122 Oil and grease recorded at downstream monitoring locations

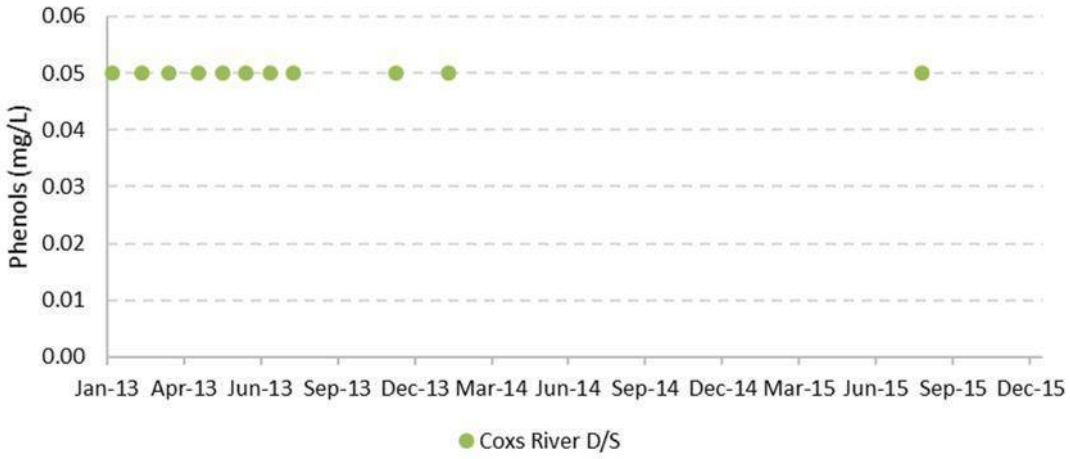



Figure D-123 Phenols recorded at downstream monitoring locations

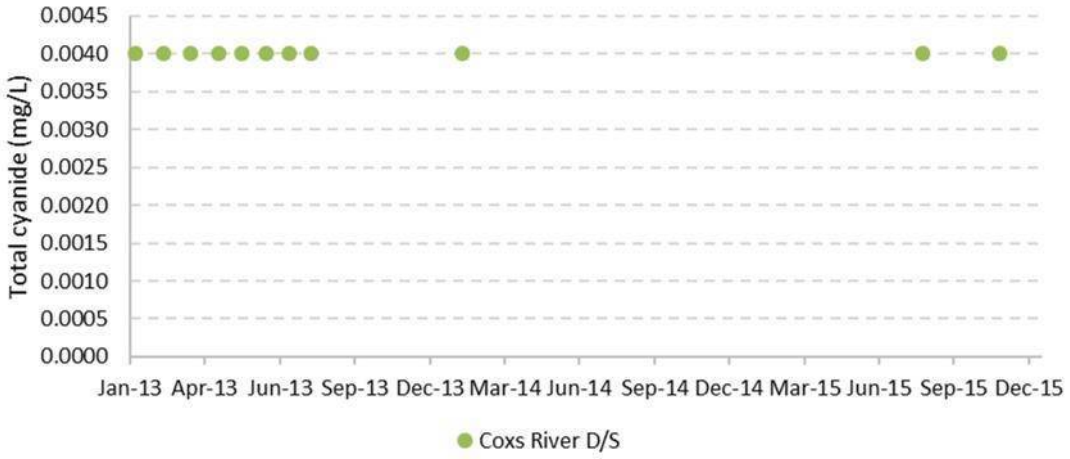



Figure D-124 Total cyanide recorded at downstream monitoring locations

# Appendix E – Groundwater information

Table D-1 SCSS Groundwater Bore Information (RPS 2013a)

| Bore Id | Approximate Easting (m) | Approximate Northing (m) | Bore Depth Drilled (m) | Approximate Ground Elevation (m AHD) | Screen Interval (m) | Target Aquifer |
|---|---|---|---|---|---|---|
| BH01 | 225978 | 6305018 | 18.3 | 912.4 | N/A | Lithgow Seam (unmined) |
| BH02 | 225948 | 6303880 | 30 | 916.0 | N/A | Marrangaroo Formation |
| BH03 | 226175 | 6304416 | 18.57 | 905.2 | N/A | Saturated overburden |
| BH04 | 225611 | 6304579 | 27.51 | 923.0 | N/A | Lithgow Seam workings (void) |
| BH05 | 225757 | 6304656 | 30.19 | 928.8 | N/A | Lithgow Seam (unmined pillar) |
| BH06 | 226183 | 6304758 | 9.3 | 905.4 | N/A | Lithgow Seam |
| BH07 | 225485.7 | 6303099 | 33 | 924.2 | 18.0–33.0 | Up-gradient saturated overburden |
| BH08 | 225978.6 | 6304608 | 24.4 | 927.4 | 21.4–24.4 | Lithgow Seam workings (void) |
| BH09 | 225875.7 | 6304526 | 25.5 | 929.8 | 22.5–25.0 | Lithgow Seam workings (void) |
| BH10 | 225652.9 | 6304342 | 25.2 | 936.5 | 22.0–25.0 | Lithgow Seam workings (void) |
| BH11 | 225088 | 6304251 | N/A | 921.0 | N/A | General |
| BH12 | 225667 | 6304819 | N/A | 916.5 | N/A | General (paired site) |
| BH13 | 225667 | 6304819 | N/A | 916.5 | N/A | General (paired site) |
| BH14 | 224866 | 6304259 | 33.2 | 940.0 | Open hole | Lithgow Seam |
| BH15 | 225042 | 6304667 | 25.5 | 940.0 | 18.6–24.6 | Up-gradient Overburden (dry) |

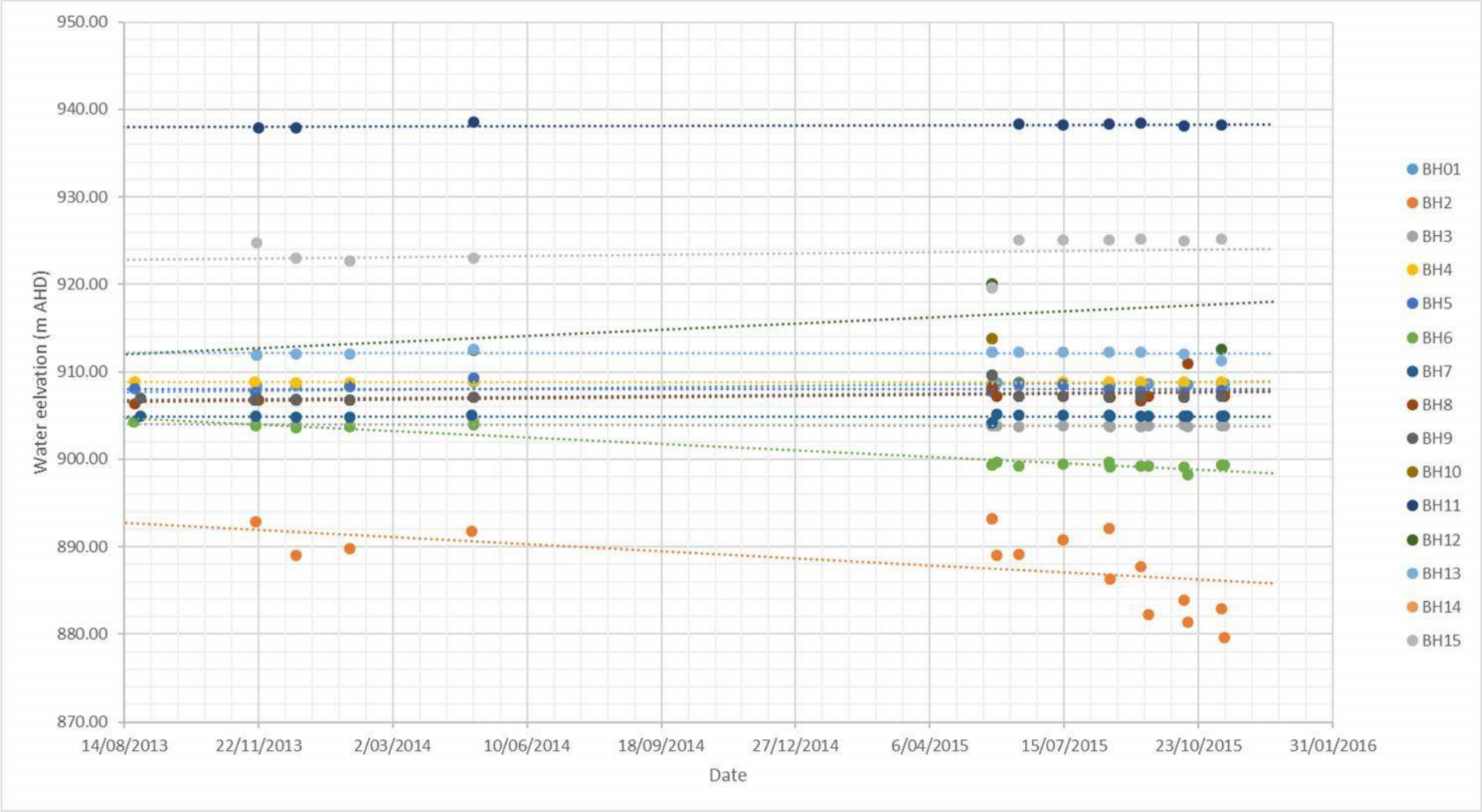



Figure D-1 Groundwater Level Monitoring Data at SCSS (2013-2015)

Table D-2 MPPS Groundwater Bore Information (CDM Smith 2012)

| Bore Id | Approximate Easting (m) | Approximate Northing (m) | Bore Depth Drilled (m) | Approximate Ground Elevation (m AHD) | Target Aquifer |
|---|---|---|---|---|---|
| MPGM4_D1 | 225604 | 6305355 | 11.2 | 911.97 | Coal / Sandstone (unknown screen) |
| MPGM4_D8 | 226000.5 | 6305242 | 7.6 | 919.38 | Alluvium |
| MPGM4_D9 | 225686.7 | 6305314 | UNK | 905.9 | Not known |
| MPGM4_D10 | 225241.5 | 6304898 | UNK | *909.611* | Fill / sandstone @ 16.2 m bgl |
| MPGM4_D11 | 225312.6 | 6305090 | 22.2 | 925.93 | Fill / sandstone @ 21 m bgl |
| MPGM4_D15 | 225029.6 | 6304670 | 27 | 937.34 | Blackmans Flat Conglomerate and Marrangaroo Conglomerate |
| MPGM4_D16 | 225092.4 | 6304253 | 27.13 | 940.9 | |
| MPGM4_D17 | 225456.9 | 6304438 | 28.71 | 921.88 | |
| MPGM4_D18 | 225280 | 6304711 | 31.25 | 936.55 | |
| MPGM4_D19 | 225029.6 | 6304670 | 38.1 | 932.86 | |
| MPGM4_D4 (BG) | 224626 | 6305937 | 8.67 | 917.62 | Fill (unknown screen) |

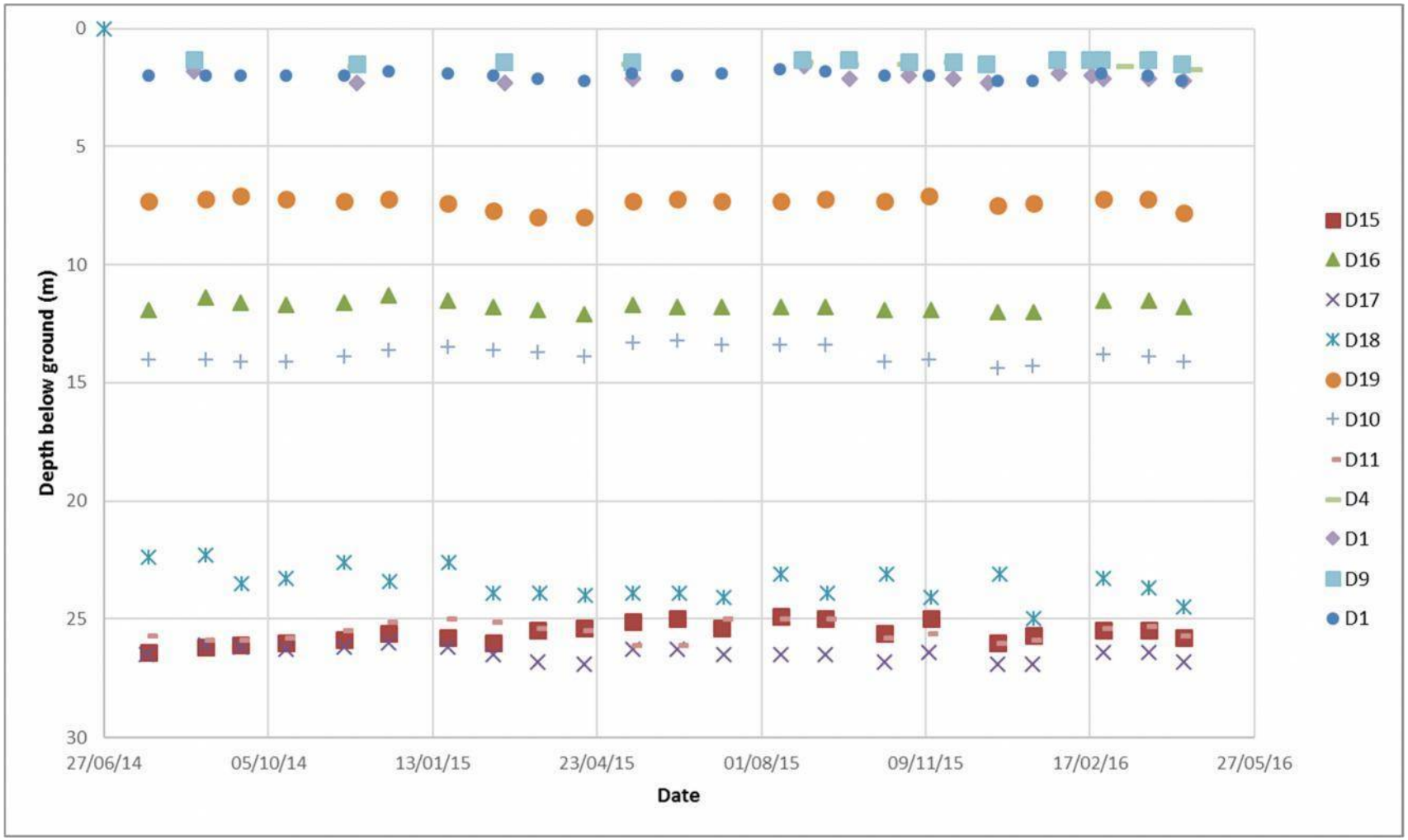



Figure D-2 Groundwater Level Monitoring Data at MPPS (2014-2016)

Table D-3 Licensed groundwater bores within 7.5 km radius of SCSS and MPPS

| Work no. | License no. | Type | Final depth | Drilled Date | Function | Salinity | Yield | SWL | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|
| 212008 | | | 0 | | UNK | | | | 228634 | 6297591 |
| 212023 | | | 0 | | UNK | | | | 228556 | 6297619 |
| 212054 | | | 0 | | UNK | | | | 228806 | 6300679 |
| 212055 | | | 0 | | UNK | | | | 226170 | 6305169 |
| 21210036 | | | 0 | | UNK | | | | 227465 | 6298729 |
| GW030862 | | | 146 | 1/07/1981 | INDS | | | | 232011 | 6305425 |
| GW030898 | | | 232 | 1/09/1981 | INDS | | | | 227255 | 6310750 |
| GW039443 | | | 70 | 1/02/1990 | IRAG | | | | 231952 | 6297313 |
| GW045638 | | | 61 | | HUSE | | | | 221353 | 6311600 |
| GW047572 | 10BL141431 | Bore open thru rock | 29 | 1/03/1980 | IRAG | (Unknown) | 0 | 0 | 778887 | 6301601 |
| GW047706 | | | 23 | 1/11/1980 | IRAG | | | | 777764 | 6301233 |
| GW050247 | | | 31 | 1/02/1980 | HUSE | | | | 777853 | 6301631 |
| GW050996 | | | 46 | 1/02/1980 | HUSE | | | | 230232 | 6299640 |
| GW053046 | | Bore | 59 | | INDS | 0-500 ppm | 0 | 0 | 229846 | 6306999 |
| GW053071 | 10BL134354 | Bore open thru rock | 15 | 1/12/1980 | IRAG | (Unknown) | 0 | 0 | 227433 | 6300764 |
| GW053401 | | Bore open thru rock | 26 | 1/11/1980 | IRAG | 1001-3000 ppm | 0 | 0 | 778055 | 6302365 |
| GW053598 | | | 60 | 1/06/1981 | INDS, MINE | | | | 777016 | 6305818 |
| GW053719 | | Other | 60 | | INDS | V.Salty | 0 | 0 | 228233 | 6306368 |
| GW053868 | | | 28 | 1/05/1982 | IRAG | | | | 777781 | 6300924 |
| GW054873 | | Bore | 0 | 1/05/1981 | HUSE | (Unknown) | 0 | 0 | 220800 | 6306526 |
| GW054874 | 80BL118273 | Bore open thru rock | 30 | 1/05/1981 | HUSE | (Unknown) | 0 | 0 | 220863 | 6307053 |
| GW056349 | | | 37 | 1/09/1981 | HUSE | | | | 777146 | 6304951 |
| GW057380 | 10BL125180 | Bore open thru rock | 43 | 1/03/1983 | HUSE | (Unknown) | 0 | 0 | 225236 | 6298882 |
| GW057649 | 10BL126321 | Bore | 24 | 1/02/1983 | HUSE | Fair | 0 | 0 | 225902 | 6299117 |

| Work no. | License no. | Type | Final depth | Drilled Date | Function | Salinity | Yield | SWL | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|
| GW057658 | | | 31 | 1/02/1983 | HUSE | | | | 778116 | 6299958 |
| GW058320 | 80BL124389 | Bore | 33 | 1/01/1980 | UNK | (Unknown) | 0 | 0 | 779149 | 6307114 |
| GW058576 | 10BL128116 | Bore | 0 | 1/02/1983 | HUSE | (Unknown) | 0 | 0 | 225778 | 6298928 |
| GW059086 | | | 75 | 1/08/1980 | WSUP | | | | 221041 | 6299965 |
| GW059358 | | | 24 | 1/02/1983 | MINE, MNAS | | | | 227236 | 6313278 |
| GW060428 | | | 15 | 1/01/1983 | IRAG | | | | 231162 | 6296890 |
| GW062815 | 10BL134742 | Bore | 57 | 1/11/1983 | HUSE | Fair | 0 | 0 | 228910 | 6302103 |
| GW067586 | | | 49 | 24/01/1989 | HUSE | | | | 778248 | 6299386 |
| GW067999 | | Bore open thru rock | 53 | 26/03/1990 | HUSE | | 0 | 0 | 221253 | 6300518 |
| GW068458 | | Bore | 53 | 26/03/1990 | UNK | | 0.75 | 3.05 | 221242 | 6300530 |
| GW072713 | 10BL154771 | Bore | 16 | 26/05/1994 | HUSE | Good | 0 | 0 | 228517 | 6302706 |
| GW100514 | 10BL138828 | Bore | 33 | 1/01/1982 | HUSE | | 0.75 | 0 | 221229 | 6300410 |
| GW101340 | 10BL158032 | Bore | 26 | 5/09/1996 | MON | | 0 | 2.55 | 225045 | 6305599 |
| GW101341 | 10BL158032 | Bore | 31 | 5/09/1996 | MON | | 0 | 18.49 | 224965 | 6305690 |
| GW101342 | 10BL158032 | Bore | 29 | 5/09/1996 | MON | | 0 | 27.2 | 224586 | 6305370 |
| GW101413 | 10BL158376 | Bore | 36 | 9/01/1998 | HUSE | | 0.63 | 22 | 779031 | 6303157 |
| GW101461 | 10BL158341 | Bore | 45 | 8/01/1998 | HUSE | | 0.63 | 15 | 228708 | 6301416 |
| GW101752 | | | 53 | 11/08/1995 | HUSE | | | | 776893 | 6304283 |
| GW101844 | 10BL157524 | Bore | 50 | 17/06/1983 | HUSE | | 0 | 20 | 221039 | 6300127 |
| GW102079 | 10BL158928 | Bore | 43 | 27/01/1999 | HUSE | Good | 1.51 | 3 | 223093 | 6299654 |
| GW102175 | | | 40 | 10/12/1998 | HUSE | | | | 223183 | 6298330 |
| GW102225 | 10BL142467 | Bore | 53 | 1/02/1991 | HUSE | | 0 | 0 | 221174 | 6300328 |
| GW102254 | 10BL156819 | Bore | 38 | 1/09/1994 | HUSE | | 0.06 | 6.4 | 221344 | 6300719 |
| GW102426 | | | 70 | 14/08/1995 | HUSE | | | | 231546 | 6299830 |
| GW102427 | | | 68 | 14/08/1995 | HUSE | | | | 231521 | 6299799 |

| Work no. | License no. | Type | Final depth | Drilled Date | Function | Salinity | Yield | SWL | Latitude | Longitude |
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| GW103032 | 10BL156822 | Bore | 58 | 1/01/1994 | IRAG | | 3 | 0 | 778347 | 6301555 |
| GW103238 | | | 68 | 14/08/1995 | HUSE | | | | 231463 | 6299287 |
| GW105064 | 10BL164659 | Bore | 104 | 11/07/2002 | INDS | | 0.6 | 6 | 230354 | 6307751 |
| GW105235 | 10BL161212 | Bore | 72 | 9/02/2003 | HUSE | | 1.136 | 23.5 | 224097 | 6299210 |
| GW105294 | 10BL162989 | Bore | 16 | 1/02/2003 | HUSE | | 0.126 | 3 | 230337 | 6307812 |
| GW105295 | 10BL162991 | Bore | 16 | 2/08/2004 | HUSE | | 0.126 | 3 | 230239 | 6307855 |
| GW105801 | | | 37 | 1/01/2003 | HUSE | | | | 227528 | 6297908 |
| GW105973 | 10BL163783 | Bore | 0 | 24/05/2005 | UNK | | 0 | 0 | 230354 | 6307815 |
| GW106243 | 10BL163822 | Bore | 0 | 18/07/2005 | UNK | | 0 | 0 | 229939 | 6307312 |
| GW106259 | | | 72 | 18/09/2002 | HUSE | | | | 777440 | 6301052 |
| GW106737 | 10BL164509 | Bore | 90 | 25/11/2004 | HUSE | | 0.65 | 33 | 228017 | 6303098 |
| GW107329 | 10BL165224 | Bore | 48 | 5/09/2005 | HUSE | | 0.4 | 26 | 230020 | 6307335 |
| GW108613 | | Bore | 53 | 28/07/2004 | HUSE | Good | 5.675 | 27 | 788327 | 6307462 |
| GW108881 | | | 21 | 29/05/2008 | MON | | | | 229567 | 6311037 |
| GW108932 | | | 18 | 18/06/2008 | MON | | | | 229743 | 6312099 |
| GW108939 | | | 16 | 19/06/2008 | MON | | | | 229924 | 6312340 |
| GW109018 | | | 12 | 10/07/2008 | MON | | | | 229888 | 6311416 |
| GW109260 | | | 9 | 29/10/1985 | MON | | | | 231949 | 6301453 |
| GW109261 | 10WM000002 | Piezometer | 18 | 2/11/1985 | MON | | 0 | 9.8 | 229804 | 6301350 |
| GW109262 | 10WM000002 | Piezometer | 17 | 30/10/1985 | MON | | 0 | 3.6 | 230234 | 6301699 |
| GW109263 | 10WM000002 | Piezometer | 6 | 25/08/2008 | MON | | 0 | 3.5 | 230188 | 6302356 |
| GW109264 | 10WM000002 | Piezometer | 14 | 6/11/1985 | MON | | 0 | 4.5 | 229631 | 6302172 |
| GW109265 | 10WM000002 | Piezometer | 15 | 7/11/1985 | MON | | 0 | 1 | 229380 | 6301985 |
| GW110157 | 10BL165933 | Bore | 9 | 14/10/2005 | MON | | 0 | 0 | 227341 | 6304272 |
| GW110158 | 10BL165933 | Bore | 9 | 14/10/2005 | MON | | 0 | 0 | 227594 | 6304231 |

| Work no. | License no. | Type | Final depth | Drilled Date | Function | Salinity | Yield | SWL | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|
| GW110159 | 10BL165933 | Bore | 10 | 13/10/2005 | MON | | 0 | 0 | 227830 | 6304284 |
| GW110160 | 10BL165933 | Bore | 43 | 15/10/2005 | MON | | 0 | 0 | 228222 | 6304736 |
| GW110161 | 10BL165933 | Bore | 28 | 13/10/2005 | MON | | 0 | 0 | 228450 | 6304256 |
| GW110162 | 10BL165933 | Bore | 12 | 13/10/2005 | MON | | 0 | 0 | 228445 | 6304252 |
| GW110329 | 10BL600114 | Bore | 8 | 1/01/2006 | HUSE | | 2.5 | 2 | 779076 | 6302271 |
| GW110437 | | Bore | 90 | 9/03/2009 | MON | | 0.0631 | 0 | 227895 | 6300507 |
| GW110480 | 10BL603120 | Bore | 10 | 28/07/2009 | MON | | 0 | 0 | 229530 | 6301970 |
| GW110481 | 10BL603121 | Bore | 16 | 28/07/2009 | MON | | 0 | 0 | 229166 | 6301607 |
| GW110482 | 10BL603122 | Bore | 33 | 29/07/2009 | MON | | 0 | 0 | 229153 | 6303047 |
| GW110483 | 10BL603122 | Bore | 21 | 29/07/2009 | MON | | 0 | 0 | 229149 | 6303043 |
| GW110484 | 10BL603123 | Bore | 59 | 29/07/2009 | MON | | 0 | 0 | 229722 | 6302886 |
| GW110485 | 10BL603123 | Bore | 65 | 17/09/2009 | MON | | 0 | 0 | 229732 | 6301996 |
| GW110520 | 10BL603501 | Bore | 38 | 6/03/2009 | INDS | | 0.505 | 1.2 | 227995 | 6300665 |
| GW110847 | | | 8 | 1/01/2007 | HUSE | | | | 777262 | 6303431 |
| GW110861 | 10BL603591 | Bore | 24 | 19/02/2010 | MON | | 0 | 0 | 227055 | 6303562 |
| GW110998 | | | 55 | 6/08/2010 | HUSE | | | | 225718 | 6296702 |
| GW110999 | | | 55 | 1/05/2007 | HUSE | | | | 225943 | 6297777 |
| GW111021 | | | 360 | 19/08/2010 | DRNG | | | | 230615 | 6306064 |
| GW111025 | | | 380 | 23/08/2010 | DRNG | | | | 233981 | 6300737 |
| GW111026 | | | 400 | 23/08/2010 | DRNG | | | | 231254 | 6300484 |
| GW111027 | | | 24 | 23/02/2004 | MON | | | | 226988 | 6303549 |
| GW111028 | | | 24 | 23/02/2004 | MON | | | | 226945 | 6303551 |
| GW111029 | | | 24 | 21/02/2010 | MON | | | | 227030 | 6303584 |
| GW111030 | | | 24 | 20/02/2010 | MON | | | | 227070 | 6303571 |
| GW111203 | | | 84 | 3/02/2010 | MON | | | | 226800 | 6306346 |

| Work no. | License no. | Type | Final depth | Drilled Date | Function | Salinity | Yield | SWL | Latitude | Longitude |
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| GW111204 | | | 16 | 15/03/2010 | MON | | | | 228994 | 6308259 |
| GW111205 | | | 87 | 1/02/2010 | MON | | | | 226797 | 6306348 |
| GW111206 | | | 39 | 6/02/2010 | MON | | | | 227132 | 6306531 |
| GW111207 | | | 50 | 18/02/2010 | MON | | | | 224813 | 6306516 |
| GW111208 | | | 105 | 8/03/2010 | MON | | | | 228994 | 6308259 |
| GW111334 | | | 12 | 14/02/2010 | MON | | | | 227687 | 6304308 |
| GW111358 | | | 6 | 10/02/2011 | MON | | | | 227122 | 6299450 |
| GW111359 | | | 6 | 10/02/2011 | MON | | | | 227111 | 6299452 |
| GW111360 | | | 6 | 10/02/2011 | MON | | | | 227109 | 6299443 |
| GW111471 | | | 24 | 23/02/2010 | MON | | | | 227094 | 6303739 |
| GW111472 | | | 24 | 23/02/2010 | MON | | | | 227053 | 6303741 |
| GW111473 | | | 81 | 23/03/2010 | MON | | | | 227298 | 6303561 |
| GW111535 | | | 15 | 28/07/2011 | MON | | | | 777602 | 6305622 |
| GW111536 | | | 15 | 28/07/2011 | MON | | | | 777679 | 6305661 |
| GW111537 | | | 15 | 27/07/2011 | MON | | | | 777725 | 6305604 |
| GW111587 | | | 80 | 6/12/2011 | HUSE | | | | 227926 | 6297585 |
| GW801271 | | | 55 | 8/06/2000 | HUSE | | | | 227176 | 6297536 |
| GW802266 | 80BL242355 | Bore | 114 | 21/06/2004 | HUSE | (Unknown) | 0.189 | 5 | 779038 | 6305343 |
| GW802816 | | | 37 | 22/03/2004 | HUSE | | | | 776817 | 6304350 |
| GW804393 | | | 27 | 16/05/2000 | MINE, MNAS | | | | 782725 | 6313040 |
| GW804550 | | | 33 | 15/05/1989 | HUSE | | | | 776920 | 6304210 |
| GW804624 | | | 0 | 29/06/1994 | HUSE | | | | 778710 | 6305445 |

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| Revision | Author | Reviewer | | Approved for Issue | | |
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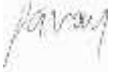
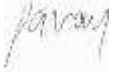
| | | Name | Signature | Name | Signature | Date |
| 0 | L Hammersley, T Davies | S Gray |  | S Gray |  | 23/08/2016 |
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