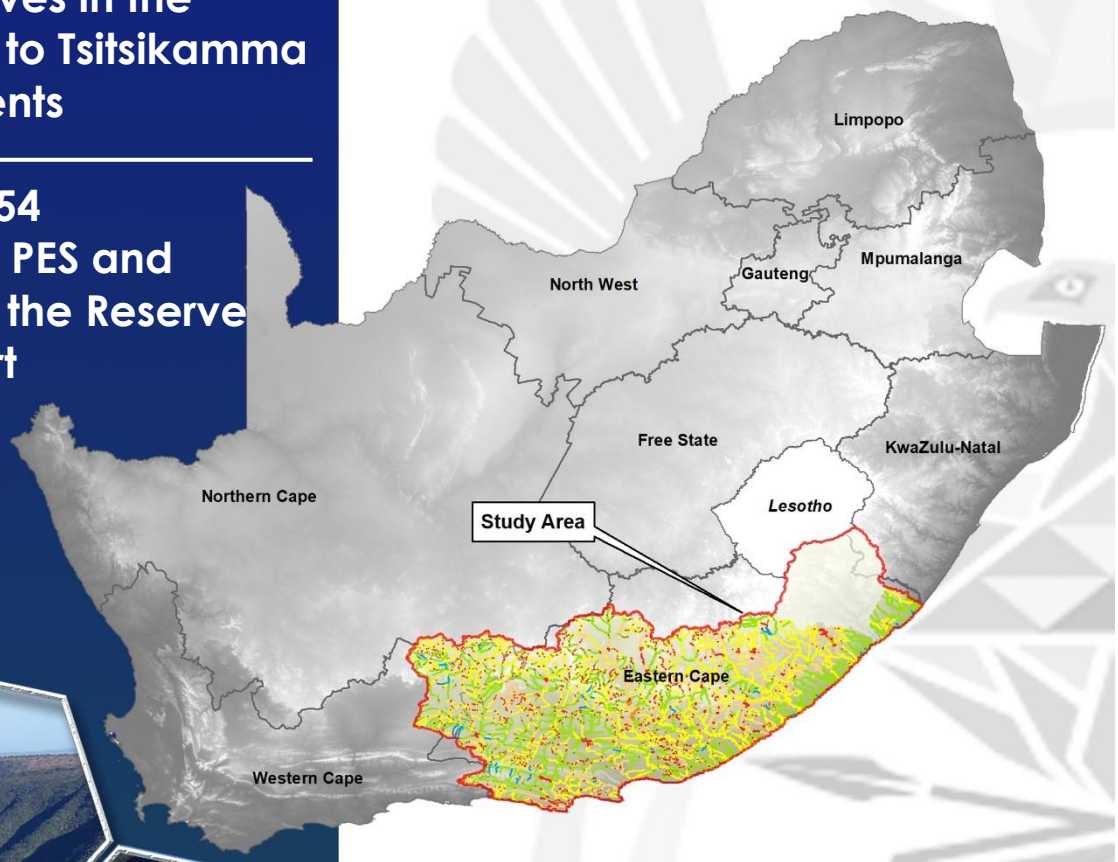
DEPARTMENT OF WATER AND SANITATION

Determination of Water Resource Classes, Reserve and the Resource Quality Objectives in the Keiskamma and Fish to Tsitsikamma Catchments

WP11354
Groundwater PES and Quantification of the Reserve Report



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BHN	Basic Human Needs
CMB	Chloride Mass Balance
CRD	Cumulative Rainfall Departure
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EWR	Ecological Water Requirements
GDE	Groundwater Dependent Ecosystem
GRDM	Groundwater Resource Directed Measures
IUA	Integrated Unit of Analysis
NWA	National Water Act
RDM	Resource Directed Measures
RQO	Resource Quality Objectives
SVF	Saturated Volume Fluctuation
TDS	Total Dissolved Solids
TMG	Table Mountain Group
WARMS	Water use Authorization and Registration Management System
WMA	Water Management Area
WR2012	Water Resources 2012
WRC	Water Research Commission
WRCS	Water Resource Classification System

1. INTRODUCTION

The National Water Act, 1998 (No. 36 of 1998) (NWA) is founded on the principle that National Government has overall responsibility for and authority over water resource management for the benefit of the public without affecting the functioning of water resource systems. To achieve this objective, Chapter 3 of the NWA provides for the protection of water resources through the implementation of Resource Directed Measures (RDM). These measures are protection-based and include Water Resource Classification, determination of the Reserve and setting the associated Resource Quality Objectives (RQOs). These measures collectively aim to ensure that a balance is reached between the need to protect and sustain water resources, while allowing economic development.

The provision of water required for the maintenance of the natural functionality of the ecosystem and provision of Basic Human Needs (BHN) is the only right to water in the National Water Act (No. 36 of 1998) (NWA). The other water users from a strategic use who are second in line to other water users are subject to formal gazetted General Authorization and water use authorization as per Section 21 of the NWA.

The Chief Directorate: Water Ecosystems Management (CD: WEM) has initiated a study for the determination of Water Resource Classes, Reserve and associated Resource Quality Objectives for the identified significant water resources in the Keiskamma, Fish to Tsitsikamma catchments. The water resource components included for this study are rivers, wetlands, groundwater and estuaries. The Reserve determination include both the water quantity and quality of Ecological Water Requirements (EWR) and Basic Human Needs (BHN). This will ensure the availability of water required to protect aquatic systems and that the human basics are directly dependent on these water resources.

1.1 Study motivation

The Keiskamma and Fish to Tsitsikamma catchments within the Mzimvubu to Tsitsikamma Water Management Area (WMA7) are amongst many water stressed catchments in South Africa. This study area is important for conservation and have recognisable protected areas, natural heritage, cultural and historical sites that require protection. As a number of rivers and estuaries are within these catchments with no major impacts, it is vital that their ecological integrity is retained.

However, water use from surface as well as groundwater for agricultural and other land use activities are high, especially in the more arid catchments, impacting on the availability of water resources for the protection of the aquatic ecosystems. Industrial practices and domestic water use are on the rise in some of these catchments, especially around the major towns and cities. Water transfers into the study area from adjacent Water Management Areas (WMA) and within the study area and numerous storage dams changes the flow patterns, impacting on the aquatic biota. Furthermore, various water use license applications and increasing land use impacts in the catchments (forestry, farming, eradication of alien vegetation, wastewater treatment works) are increasing.

Therefore, measures including the Classification of water resources, quantification of the Reserve and setting of Resource Quality Objectives (RQOs) for all identified significant water resources is required to ensure ecological sustainability within these catchments. This will ultimately assist the DWS in managing and protecting of the water resources in the study area in an integrated manner, as well as making informed decisions regarding the authorisation of future water use and the magnitude of the impacts of proposed developments.

Overall, the ultimate goal of this study is to provide information that is legally defensible and that the Management Class identified, set RQOs and the determined Reserve, will be gazetted and thus the outputs will be legally binding.

1.2 Study objective

The main objectives of the study are to determine (i) Water Resource Classes, (ii) the Reserve and (iii) associated Resource Quality Objectives (RQOs) and gazetting of all of these for the significant identified water resources in the Keiskamma and Fish to Tsitsikamma catchment area that would facilitate sustainable use of the water resources while maintaining the required ecological integrity. All the water resource components, including rivers, wetlands, estuaries and groundwater will be considered during this study and where applicable, integration between these components will be undertaken.

Furthermore, the determination of the Water Resource Classes, the Reserve and setting RQOs will depend on the integration of a number of disciplines in respect of water resources protection (i.e. instream and riparian health and Source Directed Control) that includes the needs of the water users present in the catchment area. This will be done through a consultative process with continual communication and liaison by involving the various stakeholders in the study area. Skills development and transfer through a number of workshops, training days, in-field surveys and day-to-day management of the study will be undertaken as part of the capacity building requirements of the DWS.

The key aims of this study are thus to (i) co-ordinate the implementation of the Water Resource Classification System (WRCS) through the published Regulation 810 (DWA, September 2010) and (ii) following the various methodologies for the determination of the Reserve and setting the RQOs as prescribed by the DWS. The integrated procedure as developed to Operationalise Resource Directed Measures (DWS, 2017) will be used to guide the overall process for this study. The study team understands that this study is linked to previous Reserve determination studies and other water resource management initiatives within the study area. Linking and integration with current parallel studies, including the development of a reconciliation strategy for the management of the water resources in the study area will be undertaken as part of this study.

The Water Resource Classes and associated RQOs will assist as input information when assessing potential authorisation of future water uses, provide guidance on the operation and management of the system and the evaluation of the impacts of the present and proposed developments, in the form of operational scenario evaluation. Furthermore, taking the economic, social and ecological goals to be attained, and considering and specifying the risks of non-compliance, with meeting of the Recommended Ecological Category (REC) and the potential loss of social and economic water use.

1.3 Purpose of this report

The purpose of this Quantification of the Reserve Report is to produce the preliminary results of the Groundwater Contributions of the Reserve.

2. STUDY AREA

The study area forms part of the Mzimvubu to Tsitsikamma WMA (WMA7) as indicated in Table 1. The water resources of the Mzimvubu catchment (T31 – T36) are not included as part of the study area for the purposes of this study. Secondary catchments T40 (Mtamvuna) and T50 (Mzimkhulu) form part of WMA4.

Table 1: Main catchments and rivers in the study area

Catchment	Major Rivers
K80	Tsitsikamma and small coastal rivers
K90	Krom and small coastal rivers
L10 - L90	Gamtoos with main tributaries Groot, Baviaanskloof and Kouga
M10 - M30	Koega, Swartkops and small coastal rivers
N10 - N40	Sundays
P10 - P40	Kowie, Kariega, Boesmans and small coastal rivers
Q10 - Q90	Fish River with main tributaries of Little Fish, Koonap and Kat
R10 - R50	Keiskamma and small coastal rivers
S10 - S70	Great Kei River with main tributaries of Klipplaats, Indwe, White Kei, Black Kei
T10	Mbashe
T20	Mthatha
T60	Small coastal rivers (Mtentu, Msikaba, Mzintlava)
T70	Small coastal rivers (Mtakatye, Mngazi)
T80 & T90	Small coastal rivers

2.1 Regional Geology

Basement rocks in the catchment is represented by the Precambrian aged Gamtoos Group consisting mainly of quartzite, limestone and phyllite. The Gamtoos Group is unconformably overlain by the Cape Supergroup, comprising of the Table Mountain, Bokkeveld and Witteberg Groups of alternating quartzitic sandstone and shale. The Cape Supergroup is overlain by the Karoo Supergroup, comprising of the Ecca, Beaufort, Stormberg and Drakensberg Groups.

The Karoo Supergroup consists of a sequence of units, mostly of non-marine origin, deposited between the Late Carboniferous and Early Jurassic age. Late Jurassic aged dolerite sills and dykes intruded into the main Karoo basin.

The Uitenhage Group unconformably overlies older deposits of the Cape Supergroup in small rift basins, i.e. Algoa and Gamtoos Basins and comprise of poorly sorted conglomerate and subordinate sandstone, siltstone and mudstone. These rift basins formed mainly due to normal faulting during the break-up of Gondwana. Unconsolidated to semi-consolidated, palaeo-coastal calcareous sand and conglomerate deposits of the Algoa Group occur within the eastern portion of the Algoa Basin and the Bushman's River coastal plain. Significant alluvium deposits are associated with the major river systems like the Sundays River valley south of Kirkwood. Recent and reworked coastal sands occur within a narrow dune zone between Cannonvale and Port Alfred.

The regional geology is presented in Table 2 and shown in Figure 1**.**

Table 2: Regional Geological Succession of Keiskamma and Fish to Tsitsikamma Catchment

Symbol on Map	Geological Time Scale (Period)	Lithological Unit		Description
		Sedimentary & Volcanic Rocks	Intrusive Rocks	
Qz	Quaternary	Aeolian sand	-	Aeolian sand
Q		Alluvium		Unconsolidated sediments
T-Qa	Nanaga	Nanaga Formation		Calcareous sandstone, sandy limestone
Kmb	Cretaceous	Mbotyi Formation		Dark greyish conglomerate sandstone
J-Ku	Jurassic	Uitenhage Group: Kirkwood Formation		Reddish greenish mudstone and sandstone
Jdr / Jd		Drakensberg Formation	Dolerite	Dolerite dyke and Sills-
				Basaltic lava, tuff, and agglomerate
Trc	Triassic	Clarens Formation	-	Yellowish-grey, pale-orange, or pink, very fine-grained sandstone
Tre		Elliot Formation		Brownish-red and grey mudstone, sandstone
Trm		Molteno Formation		Gritty sandstone, grey mudstone, shale, and occasional coal seams

Symbol on Map	Geological Time Scale (Period)	Lithological Unit		Description
		Sedimentary & Volcanic Rocks	Intrusive Rocks	
P-Trb		Beaufort Group: Katberg Formation		fine-grained sandstone and red and green-grey mudstone
	Permian	Beaufort Group: Adelaide Formation		Red, purple, grey, and blue green mudstone subordinate sandstone
Pe		Ecca Group		Alternating succession of Sandstone, siltstone and mudstone
C-Pd	Carboniferous	Dwyka Formation		Tillite
Dw	Carboniferous/ Devonian	Witteberg Group: Weltevrede Formation		Shale, quartzite
Dms	Devonian	Witteberg Group:		Sandstone, feldspathic sandstone, arkose
Db	Devonian	Bokkeveld Group		Claystone, mudstone, Shale)
O-St	Silurian/Ordovician	Table Mountain Group		Quartzite
Ng	Namibian	Mpambanyoni Formation	Mapumulo Metamorphic Suite	Quartz feldspar gneiss
Nmp				Biotite garnet cordierites sillimanite gneiss and migmatite subordinate hornblende gneiss
Nk		Gamtoos Group: Klein River Formation	-	Quartzite, limestone and phyllite

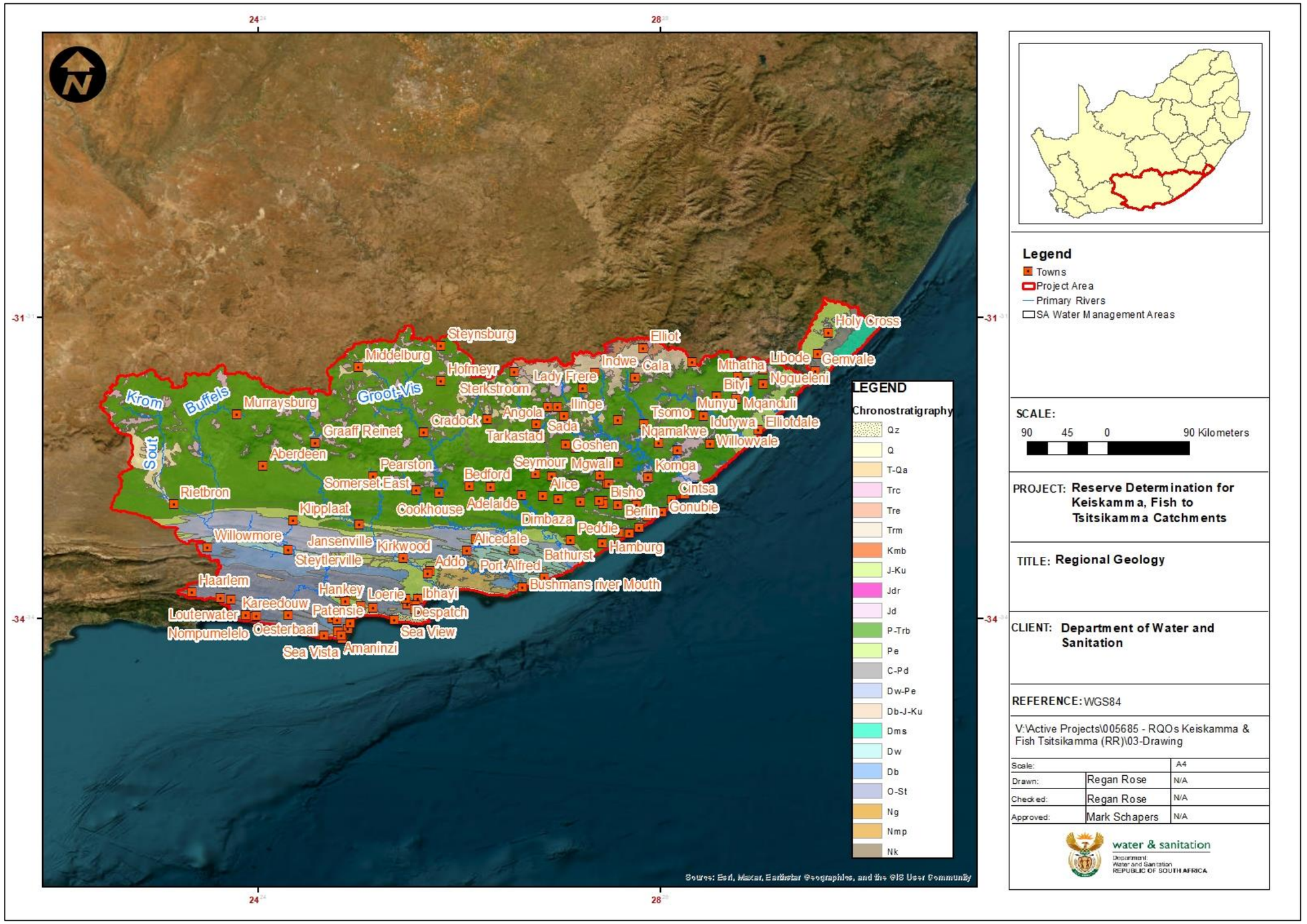


Figure 1: Regional Geology

2.2 Regional Geohydrology

The regional geohydrology of the catchment is characterised by three types of aquifers, fractured, intergranular and intergranular and fractured.

The north eastern portion and to a lesser extent the north western extremity of the catchment is characterised by intergranular and fractured aquifer types. Isolated portions of the catchment, to the north, are underlain by a two layered intergranular and fractured aquifer type. Characteristically associated with the arenaceous rocks of the Beaufort Group the principal groundwater occurrence in the area is inferred to be “d2” and “d3”. According to the DWS geohydrological map series of Port Elizabeth (3324) median borehole yields are expected to be in the range of 0.1 to 0.5l/s and 0.5 to 2.0l/s. The portions of the catchment underlain by the two layered inter granular and fractured aquifer type are anticipated to have borehole yields exceeding 5.0l/s.

The south eastern extremity of the catchment, specifically along the coast is underlain by an intergranular aquifer type. This type of aquifer is typically associated with Quaternary aged porous sands of the coastal belt, alluvium and the semi consolidated calcareous sands and conglomerates of the Algoa Group. In accordance with the DWS geohydrological map series of Port Elizabeth the principal groundwater occurrence in the area is inferred to be “a2” and “a3”. Median borehole yields are anticipated to be in the range of 0.1 to 0.5l/s and 0.5 to 2.0l/s.

Fractured aquifer types predominantly underlie the central and western areas of the catchment and are generally associated with the quartz arenites of the Table Mountain and Witteberg Groups, as well as the Karoo dolerites. Typically, “b2”, “b3” and “b4” types occur. The occurrence of “b5” type aquifers is not uncommon in isolated patches, specifically towards the western margin of the catchment. Median borehole yields are anticipated to be in the range of 0.5 to 2.0l/s, 2.0 to 5.0l/s and 2.0 to 5.0l/s with higher borehole yields exceeding 5.0l/s, expected in “b5” aquifers.

Elevated borehole yields can occur especially adjacent to defined valleys and near to river channels within the area due to favourable recharge conditions. The regional geohydrology of the catchment is presented in Figure 2.

Groundwater quality, as contoured in the DWS geohydrological map series, indicates Electrical Conductivity (EC) to be in the range of 0-70mS/m towards the north eastern region of the catchment and isolated portions along the northern, north western and south western parts. The south eastern and central parts of the catchment are predominated by electrical conductivities in the rage of 70-300mS/m and 300-1000mS/m. These is an isolated occurrence in the western extremity of the catchment which is inferred to have ECs that exceed 1000mS/m. The regional groundwater quality of the catchment is presented in Figure 3. The improved groundwater quality along the north eastern and south western coast parts reflect higher rainfall and elevated groundwater recharge conditions.

Groundwater resources within the study area are mainly linked with the Cape Supergroup and Karoo Supergroup aquifers. The Mzimvubu to Keiskamma sub-catchment area is mainly covered with Karoo Supergroup sediments whilst the Fish to Tsitsikamma sub-catchment area is covered with Cape Supergroup, Karoo Supergroup, as well as Uitenhage Group. Quaternary sand deposits also occur in the Coega region close to Gqeberha, whilst significant alluvial deposits also occur in parts of the Great Karoo.

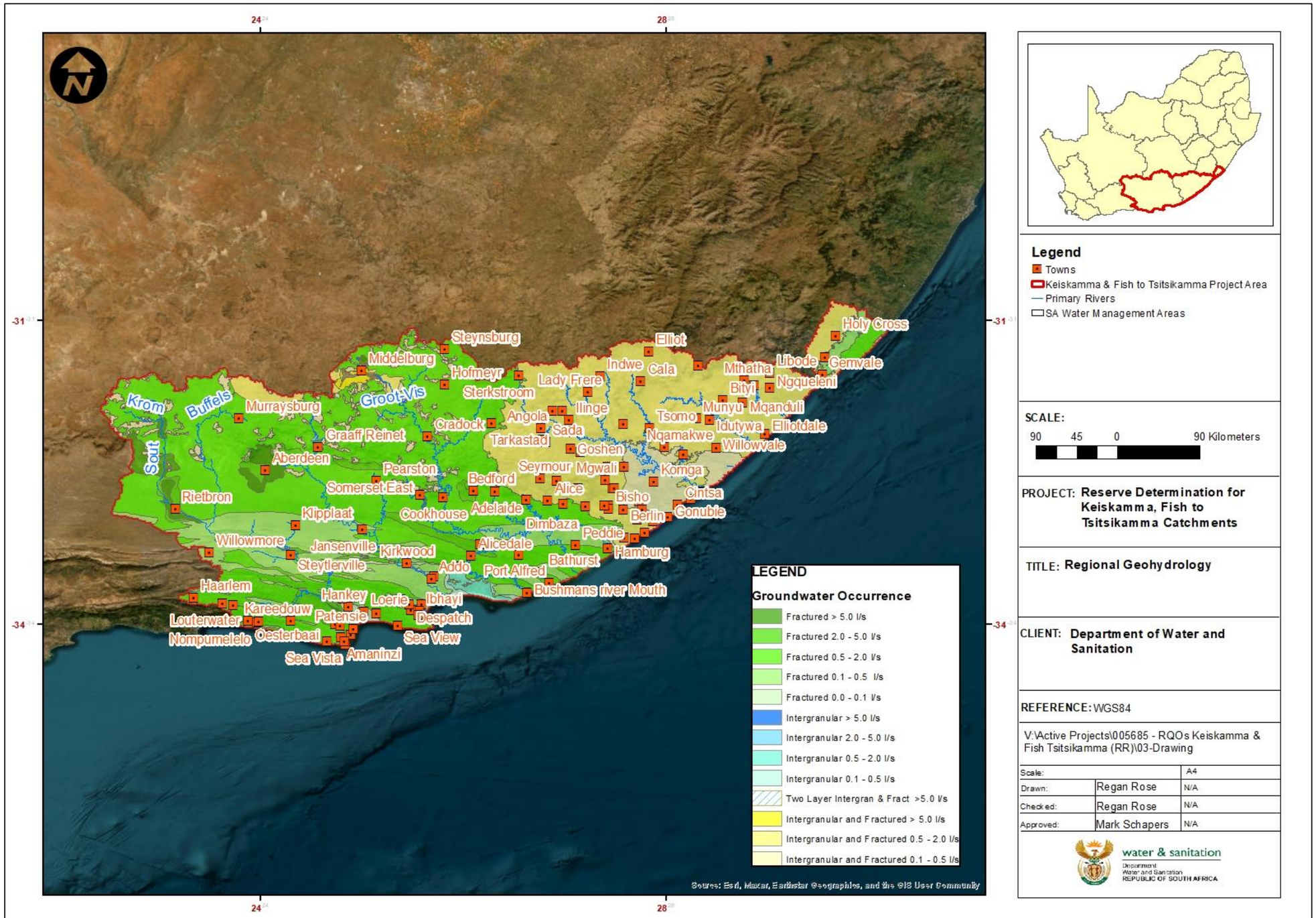


Figure 2: Regional Geohydrology

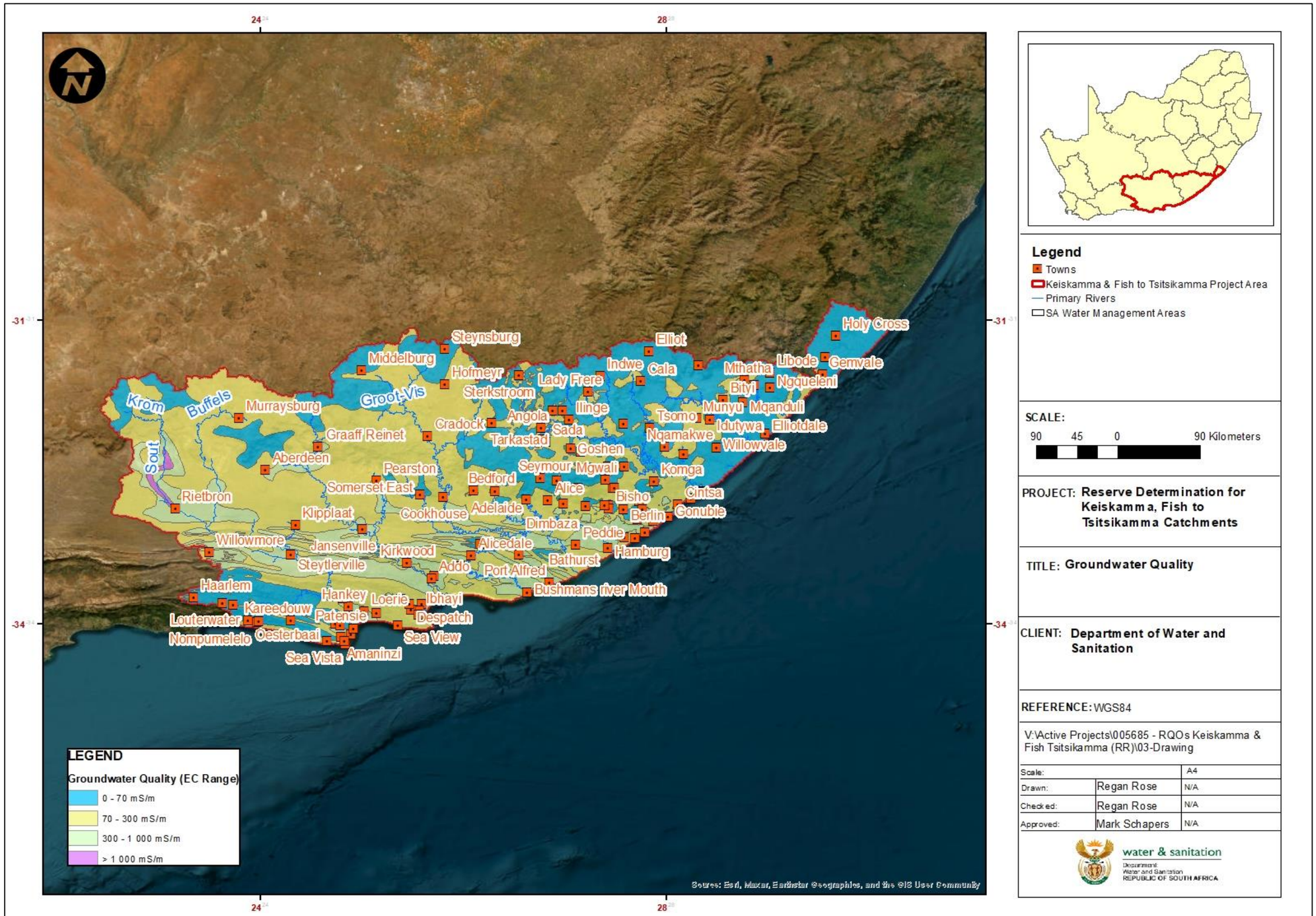


Figure 3: Regional Groundwater Quality

(i) Mzimvubu to Keiskamma

Groundwater is mainly used for rural domestic purposes and stock watering as well as for supplies to towns and rural settlements. Substantial irrigation from groundwater is practised in the vicinity of Queenstown, where some over-exploitation of groundwater is also experienced. The quality of groundwater is generally of a high standard. However, water of high salinity is found along parts of the coast and at some inland locations where the rainfall is low and the geology is not favourable.

(ii) Fish to Tsitsikamma

Groundwater is used for municipal, rural settlements, rural domestic and stock watering purposes. Towns in the Karoo region generally have a greater dependence on groundwater with some town's almost entirely dependent on groundwater for their existence. Recent exploration of groundwater in the Nelson Mandela Bay Municipality in particular, is to supplement the diminishing surface water supplies in the region caused by a decline in rainfall. In this region, the Table Mountain Group (TMG) of the Cape Supergroup generally provides the best option for groundwater development in terms of borehole yield and quality. Groundwater quality is generally good with minor treatment required at municipal level.

3. GROUNDWATER PES AND QUANTIFICATION OF THE RESERVE OBJECTIVE

The Groundwater component of the Reserve determination study has the following objectives:

- Execution of the Groundwater Resource Directed Measures (GRDM) determinations for the set of groundwater resource units, including groundwater dependent ecosystems (GDEs), identified in the study.
- Address both the quantity and quality of the EWR and the BHN components of groundwater resources.
- Integration of the GRDM determination results with those of the surface water Reserve determination studies regarding rivers, wetlands and estuaries following prioritization of groundwater resource units (GRUs)/GDEs in terms of current use, future potential use and degree impacted (stress on the groundwater resources).
- Seek the protection of groundwater resources with consideration to equitable and sustainable use thereof; and
- Presentation of the results in a manner that is supportive of the managerial and administrative procedures that inform implementation of the groundwater Reserve.

4. DETAILED SCOPE OF WORK / METHODOLOGY

The study envisaged to meet the requirements of a high level GRDM determination. This is informed by factors such as the significant degree of groundwater use, the measure of negative impact on and threat to groundwater quality, and the uncertainty regarding the importance and sensitivity of GDEs in the study area.

Step 1: Review of water resources information and data

The study interrogated various literature sources and databases for groundwater information, including the National Groundwater Archive (NGA), the Water Authorisation and Registration Management System (WARMS), the Water Resources of South Africa 2012 Study, Reconciliation strategies for towns, Water Resources Assessment documents, DWS and Water Research Commission (WRC) technical reports, Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) reports, Consultant reports and published scientific papers.

Step 2: Hydrocensus Survey

A hydrocensus survey was undertaken from 1 to 23 August 2022 of all identified monitoring sites. Several DWS WMS monitoring stations and Hydstra monitoring stations were visited through the catchment, totalling 116 monitoring sites visited (Figure 4, overleaf). At all sites, the following was undertaken:

- Borehole depths and water levels by use of a dip meter was done, where possible;
- Water samples by use of a bailer, tap or grab sample were retrieved where possible; and
- Field measurements of Electrical Conductivity (EC), pH, Total Dissolved Solids (TDS), Oxygen Reduction Potential (ORP) and Temperature by use of handheld EC/pH and ORP/Temp multi-meters were measured. Multi-parameter probes were calibrated prior to taking all measurements.

Step 3: Defining the present status

The present status category was assessed for each IUA on the basis of factors such as the environmental impacts, level of stress, groundwater usage, groundwater contamination and land use. The present status category, in turn, inform the derivation of a water resource category for each IUA, the setting of the Reserve itself.

***Step 4:* Quantification of the Reserve**

This activity will seek to establish the volume of groundwater that contributes to sustaining the surface water EWR and BHN. This is a necessary prerequisite to determining the quantity of groundwater potentially available for allocation to users and potential users.

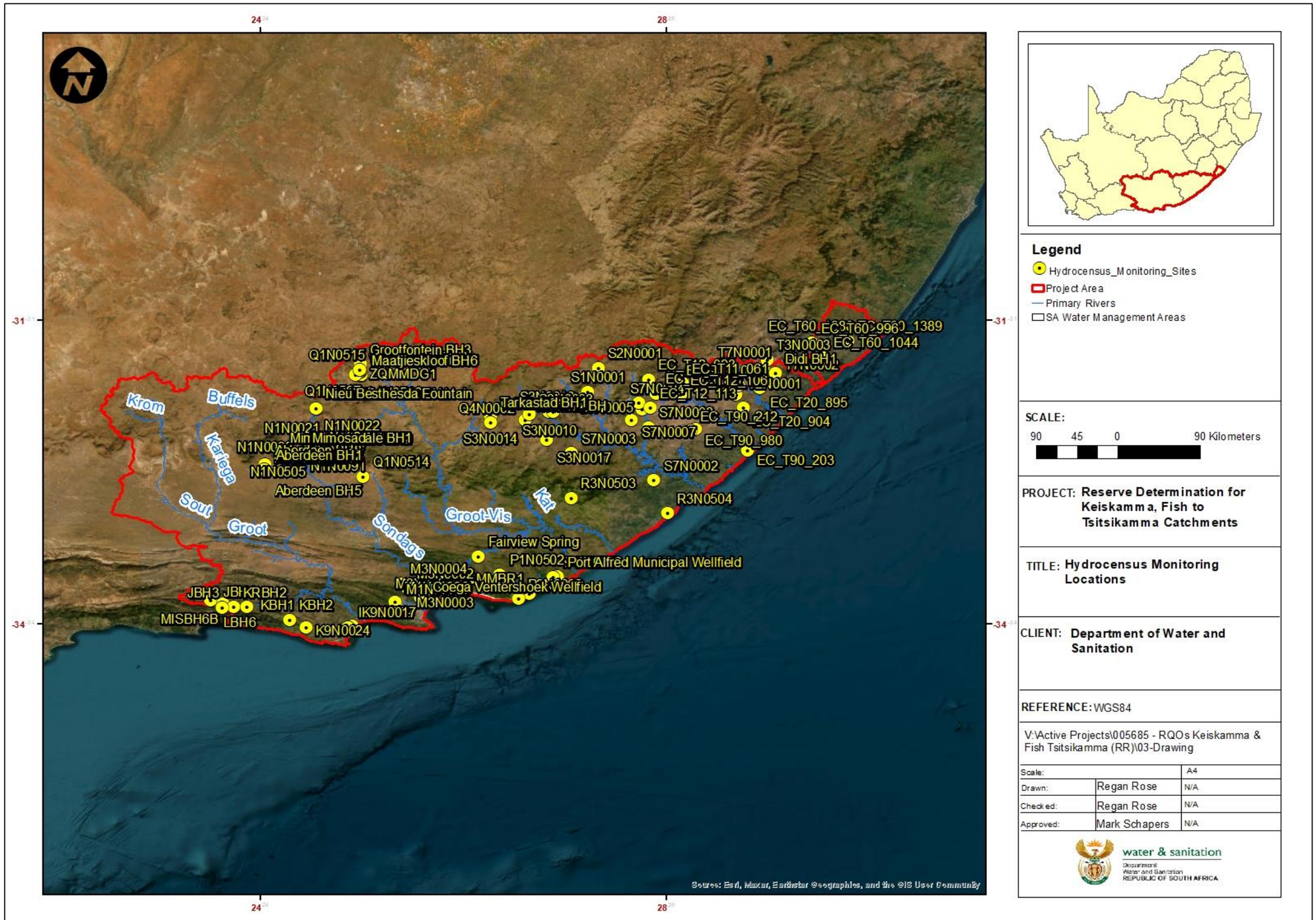


Figure 4: Hydrocensus monitoring sites

5. PRESENT STATUS OF GROUNDWATER

The available data for the Hydstra and WMS monitoring sites was used to assess the present status of groundwater in the catchment. The Hydstra monitoring sites are mainly time series water levels, whilst the WMS sites are time series water quality. Time series data of water levels and water quality (using EC as overall indicator) is presented in Appendix A. It is important to note that not all monitoring sites have long-term data as some sites have become closed sites but have historical data.

5.1 IUA_K01: Tsitsikamma and headwaters of Kromme to Kromme Dam

IUA Description	Tsitsikamma and headwaters of Kromme to Kromme Dam
	The aquifer is of a fractured type, mainly associated with the fractured Table Mountain Group Aquifer. The IUA is moderately to highly stressed.
GW RU	G_RU01

The monitoring sites in IUA 1 (K1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 3 and provided in Figure 5**.** A total of five (5) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 24 and Figure 25, respectively in Appendix A.

Table 3: Monitoring sites in IUA 1 (K1)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
K9N0024	-34.03161	24.45145	Borehole, water level	K90F
K9N0029	-33.95778	24.30192	Borehole, water level	K90B
K9N0030	-33.95808	24.30175	Borehole, water level	K90B
K9N0032	-33.95808	24.30275	Borehole, water level	K90B
ZQMKWN1	-33.95583	24.29556	Borehole, water quality	K90B

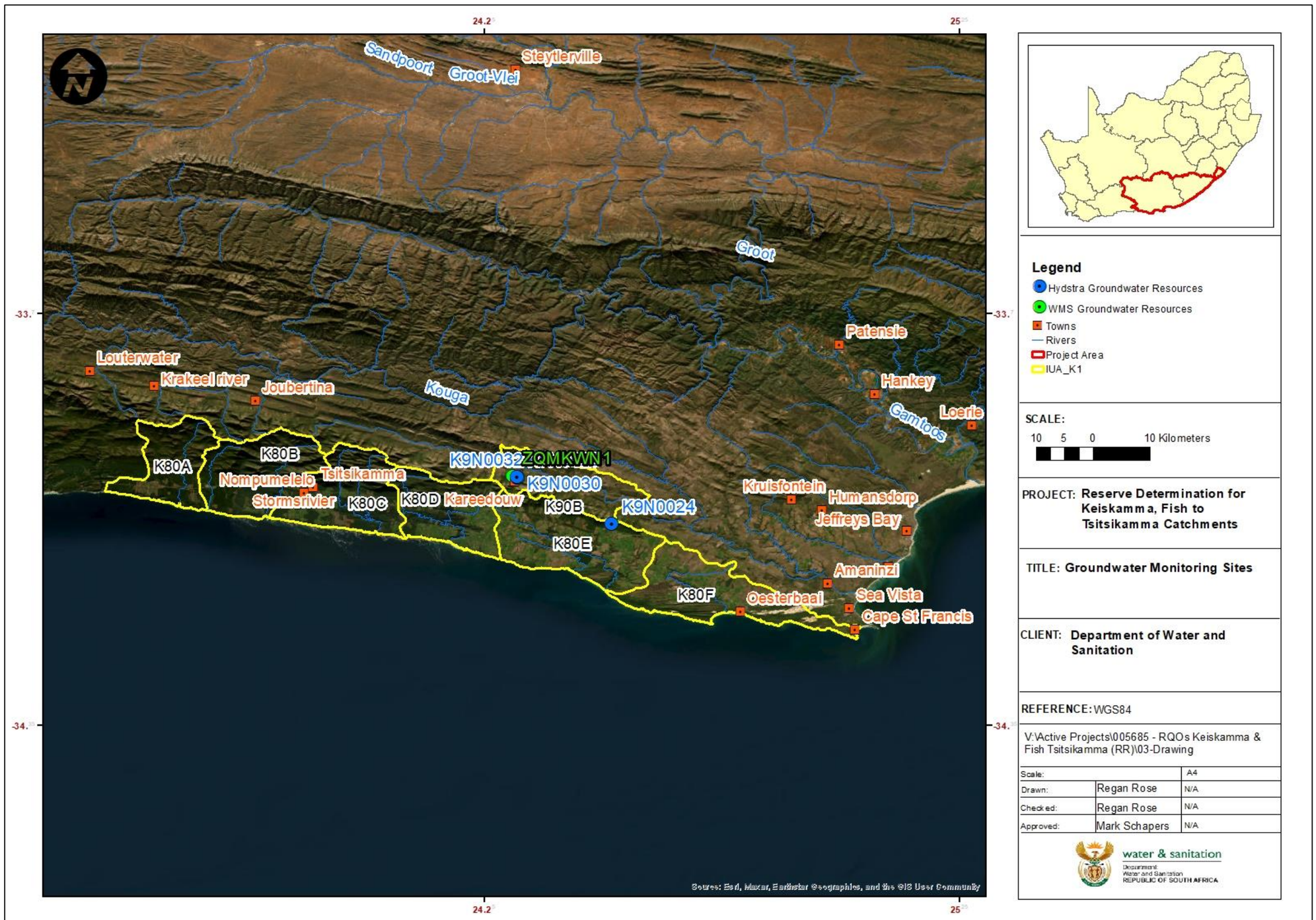


Figure 5: Monitoring sites in IUA 1 (K1)

5.2 IUA_KL01: Kromme from Kromriver Dam to Estuary and Gamtoos

IUA Description	Kromme from Kromriver Dam to Estuary and Gamtoos
	The aquifer is of a fractured type, mainly associated with the fractured Table Mountain Group Aquifer. The IUA is moderately stressed in certain areas.
GW RU	GW_RU02

The monitoring sites in IUA 2 (KL1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 4 and provided in Figure 6**.** A total of twenty-seven (27) monitoring sites exists for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 26 and Figure 27, respectively in Appendix A.

Table 4: Monitoring sites in IUA 2 (KL1)

Site Name	NGA ID	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
3424BB00071	3424BB00071	-34.06667	24.85639	Borehole, water quality	K90F
BBF2	-	-33.77115	24.81543	Borehole, water level	L90A
K9N0002	3424BB00002	-34.03278	24.92500	Borehole, water level	K90G
K9N0004	3424BB00004	-34.03472	24.92500	Borehole, water level	K90G
K9N0005	3424BB00068	-34.01944	24.90778	Borehole, water level	K90G
K9N0006	3424BB00005	-34.01650	24.90911	Borehole, water level	K90G
K9N0009	3424BB00008	-34.02306	24.92389	Borehole, water level	K90G
K9N0010	3324DD00001	-33.97500	24.92083	Borehole, water level	K90G
K9N0011	3424BB00069	-34.01914	24.54186	Borehole, water level	K90D
K9N0016	3324DD00009	-33.97500	24.92083	Borehole, water level	K90G
K9N0017	33997	-34.02569	24.90122	Borehole, water level	K90G
K9N0018	33996	-34.03094	24.89567	Borehole, water level	K90G
K9N0019	39913	-34.02675	24.86858	Borehole, water level	K90F
K9N0020	39914	-34.01556	24.85925	Borehole, water level	K90F
K9N0021	39915	-34.02519	24.84208	Borehole, water level	K90F
K9N0025	3424BB00009	-34.17731	24.81547	Borehole, water level	K80F
K9N0026	3324DC00001	-33.99167	24.73167	Borehole, water level	K90F
K9N0027	3324DC00002	-33.99000	24.73083	Borehole, water level	K90F
K9N0028	3324DC00003	-33.99156	24.73450	Borehole, water level	K90F
K9N0034	EC/K90/0276	-34.01741	24.90918	Borehole, water level	K90G
K9N0035	EC/K90/0279	-34.01783	24.90808	Borehole, water level	K90G
KRA2	-	-33.80381	24.83702	Borehole, water level	L90B
PWDP2	-	-33.74706	24.76489	Borehole, water level	L90A
WKR1	-	-33.81663	24.89681	Borehole, water level	L90B
WKR2	-	-33.72229	24.82513	Borehole, water level	L90A
ZQMHDP1	3424BB00086	-34.00111	24.75917	Spring, water quality	K90F
ZQMSFB1	3424BB00085	-34.17278	24.80833	Borehole, water quality	K90E

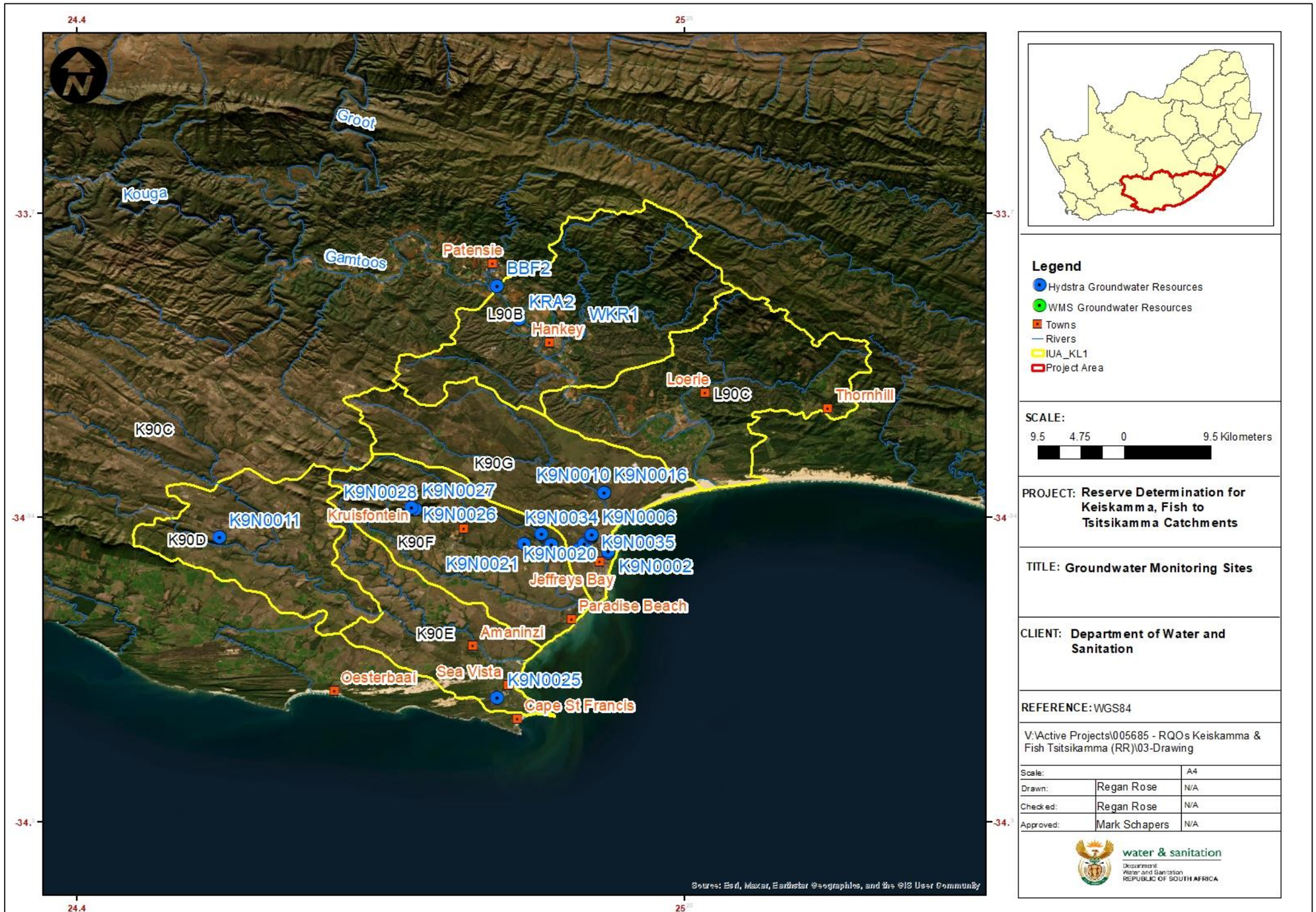


Figure 6: Monitoring sites in IUA 2 (KL1)

5.3 IUA_L01: Kouga to Kouga Dam, Baviaanskloof

IUA Description	Kouga to Kouga Dam, Baviaanskloof
	The aquifer is of a fractured type, mainly associated with the fractured Table Mountain Group Aquifer. The IUA is mildly stressed in certain areas.
GW RU	GW_RU03

The monitoring sites in IUA 3 (L1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 5 and provided in Figure 7**.** A total of twenty-three (23) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 28 and Figure 29, respectively in Appendix A.

Table 5: Monitoring sites in IUA 3 (L1)

Site Name	NGA ID	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
3323DC00006	3323DC00006	-33.80250	23.73194	Borehole, water quality	L82D
3323DC00007	3323DC00007	-33.82194	23.73611	Borehole, water quality	L82D
3323DC00009	3323DC00009	-33.83111	23.73417	Borehole, water quality	L82D
3323DD000005	3323DD000005	-33.85250	23.89028	Borehole, water quality	L82D
3323DD00004	3323DD00004	-33.86583	23.88611	Borehole, water quality	L82D
3323DD00007	3323DD00007	-33.86556	23.89167	Borehole, water quality	L82D
3323DD00009	3323DD00009	-33.84222	23.98167	Borehole, water quality	L82D
3323DD00010	3323DD00010	-33.82917	23.94528	Borehole, water quality	L82D
3323DD00011	3323DD00011	-33.83333	23.98667	Borehole, water quality	L82D
3323DD00012	3323DD00012	-33.84889	23.90361	Borehole, water quality	L82D
3323DD00013	3323DD00013	-33.83778	23.89722	Borehole, water quality	L82D
3323DD00014	3323DD00014	-33.84111	23.89639	Borehole, water quality	L82D
JBH01	-	-33.83009	23.86567	Borehole, water level	L82D
JBH02	-	-33.83020	23.86621	Borehole, water level	L82D
JBH03	-	-33.83121	23.86574	Borehole, water level	L82D
JBH04	-	-33.83087	23.86515	Borehole, water level	L82D
JBH06	-	-33.82645	23.87166	Borehole, water level	L82D
KRBH1	-	-33.83059	23.73577	Borehole, water level	L82D
KRBH2	-	-33.81208	23.72060	Borehole, water level	L82D
LBH5	-	-33.79167	23.63667	Borehole, water level	L82C
LBH6	-	-33.79306	23.62917	Borehole, water level	L82C
MISBH6B	-	-33.76056	23.50583	Borehole, water level	L82B
ZQMJOU1	3323DD00015	-33.84194	23.98083	Borehole, water quality	L82D

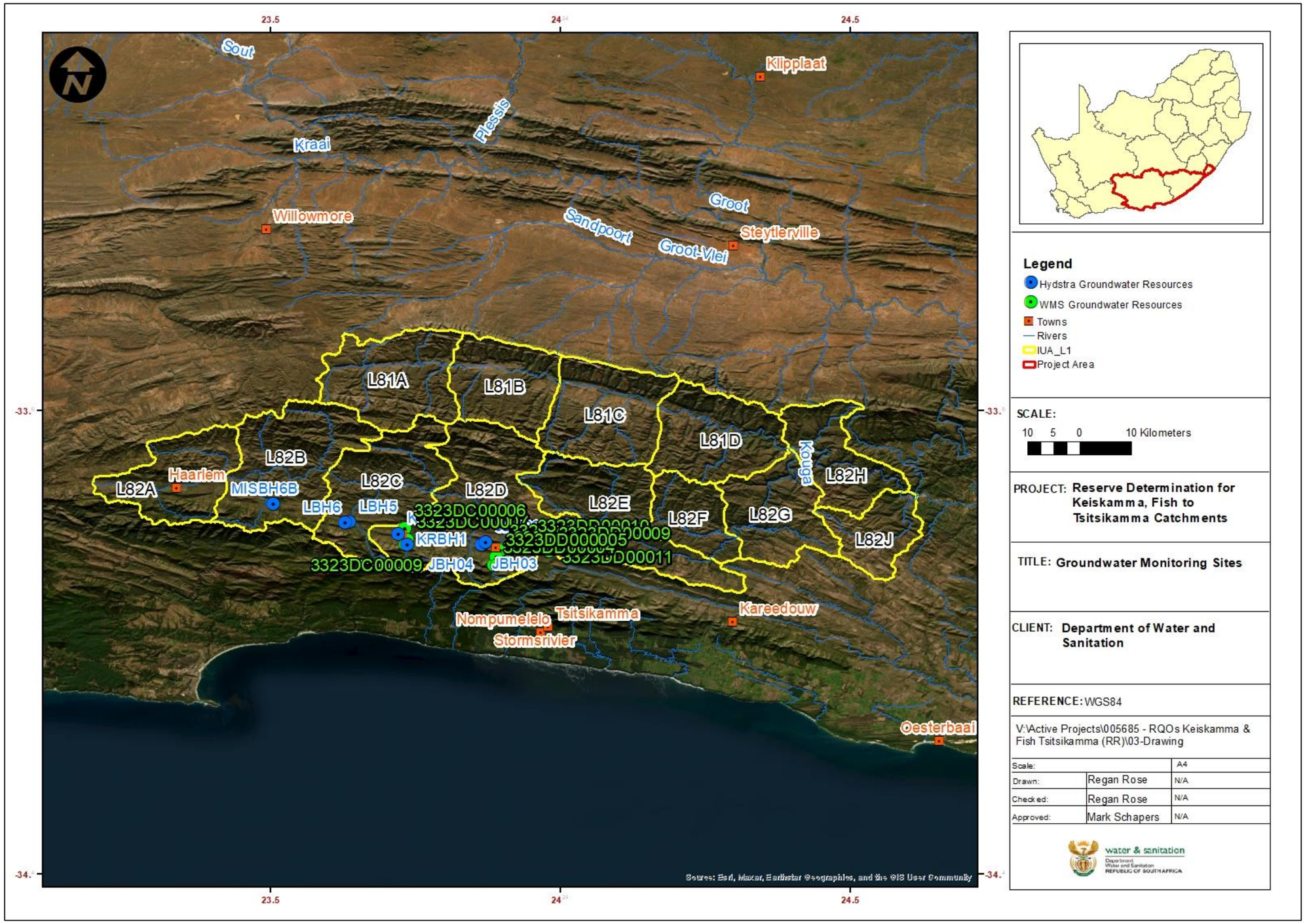


Figure 7: Monitoring sites in IUA 3 (L1)

5.4 IUA_LN01: Groot to Kouga confluence, Upper Sundays to Darlington Dam

IUA Description	Groot to Kouga confluence, Upper Sundays to Darlington Dam
	The aquifer is of a fractured type, mainly associated with the fractured Upper Cape Supergroup (Bokkeveld and Witteberg Groups) and Lower Karoo Supergroup. The IUA is mildly to moderately stressed in certain areas.
GW RU	GW_RU07
	GW_RU08
	GW_RU09
	GW_RU10

The monitoring sites in IUA 4 (LN1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 6 and provided in Figure 8**.** A total of four hundred and sixty-one (461) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 30 and Figure 31, respectively in Appendix A.

Table 6: Monitoring sites in IUA 4 (LN1)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
971	-32.38667	22.84500	Borehole, water quality	L11F
972	-32.21028	22.75750	Borehole, water quality	L11F
2446	-32.17750	24.54056	Borehole, water quality	N12C
2626	-32.19500	24.46722	Borehole, water quality	N12C
2635	-32.18917	24.54250	Borehole, water quality	N11B
2636	-32.18000	24.57833	Borehole, water quality	N11B
2637	-32.17167	24.56472	Borehole, water quality	N11B
2717	-32.43333	24.31389	Borehole, water quality	N14D
2718	-32.42750	24.21944	Borehole, water quality	N14D
2720	-33.25000	24.25000	Borehole, water quality	L50B
2727	-32.18500	24.56472	Borehole, water quality	N11B
3112	-32.47167	24.45889	Borehole, water quality	N14D
3113	-32.43611	24.20167	Borehole, water quality	N14B
3114	-32.44306	24.36472	Borehole, water quality	N14D
3115	-32.40667	24.39694	Borehole, water quality	N14D
3116	-32.45333	24.42556	Borehole, water quality	N14D
3117	-32.39917	24.28472	Borehole, water quality	N14D
3125	-32.43222	24.62306	Borehole, water quality	N21D
3175	-32.41667	24.22083	Borehole, water quality	N14D
3238	-32.32306	24.45167	Borehole, water quality	N13A
3239	-32.34500	24.29333	Borehole, water quality	N13B

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
3240	-32.31278	24.44000	Borehole, water quality	N13A
3241	-32.37667	24.41361	Borehole, water quality	N13B
3242	-32.39167	24.43056	Borehole, water quality	N13C
3243	-32.36333	24.28417	Borehole, water quality	N14D
3244	-32.41250	24.27611	Borehole, water quality	N14D
3245	-32.33222	24.30472	Borehole, water quality	N13B
3312	-32.41667	24.30694	Borehole, water quality	N14D
3313	-32.36556	24.37528	Borehole, water quality	N13B
3314	-32.30194	24.41639	Borehole, water quality	N13A
3638	-32.30944	24.27917	Borehole, water quality	N13B
3639	-32.34167	24.37722	Borehole, water quality	N13B
3640	-32.41389	24.30611	Borehole, water quality	N14D
3641	-32.42861	24.21528	Borehole, water quality	N14D
4158	-33.30000	24.25833	Borehole, water quality	L70B
4159	-33.30500	24.26500	Borehole, water quality	L70B
5495	-32.21444	22.81889	Borehole, water quality	L11F
8558	-31.76389	23.28917	Borehole, water quality	L21A
8559	-31.81194	23.29278	Borehole, water quality	L22A
8560	-31.72528	23.26389	Borehole, water quality	L21A
8562	-31.71222	23.23500	Borehole, water quality	L21A
8802	-31.85333	23.26639	Borehole, water quality	L22A
8803	-31.84778	23.26028	Borehole, water quality	L22A
8804	-31.80194	23.21361	Borehole, water quality	L11C
8905	-31.78222	23.15194	Borehole, water quality	L11C
8906	-31.75000	23.19083	Borehole, water quality	L11C
8907	-31.80778	23.16583	Borehole, water quality	L11C
9050	-32.50000	22.93333	Borehole, water quality	L11G
9052	-32.23333	22.80000	Borehole, water quality	L11F
9064	-32.48667	23.12833	Borehole, water quality	L11G
9065	-32.40500	22.88000	Borehole, water quality	L11F
9473	-32.36667	22.80000	Borehole, water quality	L11F
9474	-32.45000	22.83333	Borehole, water quality	L11F
9475	-32.63333	22.90000	Borehole, water quality	L11G
9476	-32.50000	23.20000	Borehole, water quality	L11G
9477	-32.45000	22.94167	Borehole, water quality	L11G
9478	-33.30000	24.80000	Borehole, water quality	L70E
9575	-32.34583	22.99583	Borehole, water quality	L11G
9577	-32.58333	22.80000	Borehole, water quality	L11G
9578	-32.62500	22.81667	Borehole, water quality	L11G
9579	-32.45833	22.82500	Borehole, water quality	L11G
9580	-32.62917	22.83333	Borehole, water quality	L11G

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
9581	-32.61667	22.81667	Borehole, water quality	L11G
9593	-32.55417	22.78750	Borehole, water quality	L11G
9594	-32.53333	22.83333	Borehole, water quality	L11G
9596	-32.50000	22.91667	Borehole, water quality	L11G
9597	-32.42917	22.85000	Borehole, water quality	L11F
9599	-32.48667	23.11667	Borehole, water quality	L11G
9606	-32.45944	22.82500	Borehole, water quality	L11G
9607	-32.33611	23.05000	Borehole, water quality	L11G
9608	-32.53000	22.85667	Borehole, water quality	L11G
9632	-32.45000	23.06667	Borehole, water quality	L11G
9633	-32.53333	22.94167	Borehole, water quality	L11G
9634	-32.48806	23.12833	Borehole, water quality	L11G
9635	-32.46667	22.85000	Borehole, water quality	L11G
9636	-32.44167	23.06667	Borehole, water quality	L11G
9639	-32.45000	22.81667	Borehole, water quality	L11F
9643	-32.47806	22.85000	Borehole, water quality	L11G
9645	-32.53000	22.86222	Borehole, water quality	L11G
9646	-32.43333	23.10000	Borehole, water quality	L11G
9647	-32.42500	23.55833	Borehole, water quality	L22C
9661	-33.21250	25.15000	Borehole, water quality	N40A
9663	-32.27083	23.60000	Borehole, water quality	L22C
9664	-32.57000	22.85417	Borehole, water quality	L11G
9680	-33.14111	25.15000	Borehole, water quality	N23B
9941	-33.13333	25.15417	Borehole, water quality	N23B
9942	-33.07500	25.05417	Borehole, water quality	N22E
9944	-33.15417	25.19583	Borehole, water quality	N23B
9945	-33.13611	25.12083	Borehole, water quality	N23B
10008	-32.41333	22.83167	Borehole, water quality	L11F
10009	-32.41167	22.86500	Borehole, water quality	L11F
10010	-32.40500	22.87833	Borehole, water quality	L11F
10011	-32.39833	22.89500	Borehole, water quality	L11F
10012	-32.38833	22.92167	Borehole, water quality	L11G
10013	-32.35333	22.86333	Borehole, water quality	L11F
10014	-32.38167	22.93333	Borehole, water quality	L11G
10015	-32.32667	22.78000	Borehole, water quality	L11F
10018	-32.33333	22.78500	Borehole, water quality	L11F
10019	-32.34500	22.78167	Borehole, water quality	L11F
10020	-32.35500	22.78167	Borehole, water quality	L11F
10021	-32.34833	22.79667	Borehole, water quality	L11F
10027	-32.21333	22.83000	Borehole, water quality	L11F
10028	-32.21111	22.81667	Borehole, water quality	L11F

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
10029	-32.20000	22.80000	Borehole, water quality	L11F
10103	-32.21167	22.80333	Borehole, water quality	L11F
10104	-32.24000	22.83667	Borehole, water quality	L11F
10105	-32.23833	22.84333	Borehole, water quality	L11F
10106	-32.24000	22.84333	Borehole, water quality	L11F
10107	-32.24167	22.84500	Borehole, water quality	L11F
10108	-32.24333	22.84167	Borehole, water quality	L11F
10109	-32.22167	22.86000	Borehole, water quality	L11F
10110	-32.23000	22.85333	Borehole, water quality	L11F
10184	-32.22000	22.85667	Borehole, water quality	L11F
10185	-32.21111	22.80278	Borehole, water quality	L11F
10186	-32.20000	22.73472	Borehole, water quality	L11F
10187	-32.18472	22.74861	Borehole, water quality	L11F
10188	-32.22222	22.78472	Borehole, water quality	L11F
10189	-32.21583	22.82500	Borehole, water quality	L11F
10356	-32.22833	22.82778	Borehole, water quality	L11F
10357	-32.22778	22.80833	Borehole, water quality	L11F
10358	-32.26972	22.74111	Borehole, water quality	L11F
10359	-32.25278	22.78750	Borehole, water quality	L11F
11435	-31.58167	23.75167	Borehole, water quality	L21C
11436	-31.75167	23.75167	Borehole, water quality	L21C
11437	-31.58667	23.58333	Borehole, water quality	L21B
11438	-31.59833	23.75333	Borehole, water quality	L21C
11439	-31.61167	23.77833	Borehole, water quality	L21C
11440	-31.60500	23.79333	Borehole, water quality	L21C
11441	-31.62333	23.80333	Borehole, water quality	L21C
11442	-31.63833	23.80500	Borehole, water quality	L21C
11443	-31.61667	23.76667	Borehole, water quality	L21C
11444	-31.62167	23.77333	Borehole, water quality	L21C
11445	-31.62333	23.77000	Borehole, water quality	L21C
11446	-31.64000	23.78667	Borehole, water quality	L21C
11447	-31.71167	23.82833	Borehole, water quality	L21C
11448	-31.71167	23.81833	Borehole, water quality	L21C
11449	-31.67333	23.77500	Borehole, water quality	L21C
11450	-31.68667	23.79667	Borehole, water quality	L21C
11451	-31.69000	23.80000	Borehole, water quality	L21C
11452	-31.73667	23.77500	Borehole, water quality	L21C
11453	-31.70833	23.76333	Borehole, water quality	L21C
11454	-31.74167	23.80833	Borehole, water quality	L21C
11455	-31.72833	23.15500	Borehole, water quality	L11B
11456	-31.73167	23.20667	Borehole, water quality	L11C

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
11457	-31.71333	23.20167	Borehole, water quality	L11C
11477	-31.69833	23.20667	Borehole, water quality	L21A
11480	-31.70333	23.07167	Borehole, water quality	L11B
11481	-31.69833	23.08500	Borehole, water quality	L11B
11482	-31.73167	23.09500	Borehole, water quality	L11B
11483	-31.72333	23.14833	Borehole, water quality	L11B
11484	-31.73333	23.12333	Borehole, water quality	L11B
11485	-31.71333	23.12000	Borehole, water quality	L11B
11486	-31.70833	23.10000	Borehole, water quality	L11B
11487	-31.70333	23.12167	Borehole, water quality	L11B
11488	-31.70500	23.13167	Borehole, water quality	L11B
11489	-31.70167	23.14833	Borehole, water quality	L11B
11490	-31.70833	23.16333	Borehole, water quality	L11B
11491	-31.62833	23.04667	Borehole, water quality	L11B
11492	-31.64833	23.04000	Borehole, water quality	L11B
11493	-31.63667	23.01167	Borehole, water quality	L11B
11494	-31.62833	23.01333	Borehole, water quality	L11B
11501	-31.68833	23.04333	Borehole, water quality	L11B
11502	-31.69167	23.03000	Borehole, water quality	L11B
11503	-31.68000	23.03333	Borehole, water quality	L11B
11504	-31.69167	23.05833	Borehole, water quality	L11B
11505	-31.72167	23.11167	Borehole, water quality	L11B
11506	-31.71667	23.06500	Borehole, water quality	L11B
11520	-31.97333	23.78500	Borehole, water quality	L21E
11521	-31.95833	23.76333	Borehole, water quality	L21E
11522	-31.96000	23.76333	Borehole, water quality	L21E
11523	-31.95833	23.76167	Borehole, water quality	L21E
11524	-31.95833	23.75833	Borehole, water quality	L21E
11525	-31.95833	23.75667	Borehole, water quality	L21E
11526	-31.95667	23.75667	Borehole, water quality	L21E
11527	-31.95833	23.76500	Borehole, water quality	L21E
11528	-31.96333	23.76500	Borehole, water quality	L21E
11529	-31.96167	23.77000	Borehole, water quality	L21E
11530	-31.96278	23.70333	Borehole, water quality	L21E
11531	-31.97167	23.78667	Borehole, water quality	L21E
11532	-31.96500	23.84833	Borehole, water quality	L21E
11533	-31.95833	23.83667	Borehole, water quality	L21E
11534	-31.93667	23.83667	Borehole, water quality	L21E
11535	-31.97667	23.85000	Borehole, water quality	L21E
11536	-31.99333	23.86000	Borehole, water quality	L21D
11537	-31.98833	23.89167	Borehole, water quality	L21D

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
11538	-31.97500	23.93333	Borehole, water quality	L21D
11539	-31.98167	23.78667	Borehole, water quality	L21E
11540	-31.88833	23.95667	Borehole, water quality	L21E
11541	-31.89667	23.93167	Borehole, water quality	L21E
11542	-31.93833	23.91333	Borehole, water quality	L21E
11543	-31.93667	23.91500	Borehole, water quality	L21E
11544	-31.90500	23.88833	Borehole, water quality	L21E
11545	-31.89167	23.86667	Borehole, water quality	L21E
11546	-31.87833	23.88000	Borehole, water quality	L21E
11547	-31.88167	23.91833	Borehole, water quality	L21E
11548	-31.87500	23.94000	Borehole, water quality	L21E
11549	-31.86500	23.96333	Borehole, water quality	L21E
11550	-31.86500	23.96333	Borehole, water quality	L21E
11552	-31.85500	23.95333	Borehole, water quality	L21E
11553	-31.86333	23.91000	Borehole, water quality	L21E
11554	-31.86000	23.94000	Borehole, water quality	L21E
11555	-31.85000	23.93667	Borehole, water quality	L21E
11556	-31.84000	23.91333	Borehole, water quality	L21E
11557	-31.80667	23.93167	Borehole, water quality	L21E
11558	-31.79667	23.93667	Borehole, water quality	L21C
11559	-31.83000	23.93500	Borehole, water quality	L21E
3222BA00001	-32.23194	22.73056	Borehole, water quality	L11F
3222BA00002	-32.24972	22.73306	Borehole, water quality	L11F
3222BA00093	-32.18889	22.73750	Borehole, water quality	L11F
3222BA00098	-32.17500	22.76667	Borehole, water quality	L11F
3222BA00226	-32.16750	22.73528	Borehole, water quality	L11F
3222BB00001	-32.22333	22.80611	Borehole, water quality	L11F
3222BB00022	-32.19667	22.76500	Borehole, water quality	L11F
3222BB00032	-32.19083	22.77917	Borehole, water quality	L11F
3222BB00033	-32.18889	22.81333	Borehole, water quality	L11F
3222BB00094	-32.19667	22.82194	Borehole, water quality	L11F
3222BB00099	-32.23056	22.78944	Borehole, water quality	L11F
3222BB00100	-32.23278	22.79722	Borehole, water quality	L11F
3222BD00008	-32.35833	22.88750	Borehole, water quality	L11F
3222BD00030	-32.49444	22.96444	Borehole, water quality	L11G
3222BD00037	-32.40889	22.85833	Borehole, water quality	L11F
3222BD00038	-32.40500	22.87167	Borehole, water quality	L11F
3222BD00053	-32.35222	22.84417	Borehole, water quality	L11F
3222BD00054	-32.36667	22.85889	Borehole, water quality	L11F
3222BD00055	-32.36639	22.83250	Borehole, water quality	L11F
3222BD00063	-32.41083	22.85167	Borehole, water quality	L11F

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
3224AD00010	-32.31278	24.45361	Borehole, water quality	N13A
3224AD00300	-32.35806	24.47222	Borehole, water quality	L11F
3324AB00048	-33.23556	24.30361	Borehole, water quality	L60B
3324AD00091	-33.26194	24.32806	Borehole, water quality	L70B
ABERDEENWEG	-32.71667	24.31667	Borehole, water quality	N24A
ALLEMANS KRAAL	-33.23333	24.28333	Borehole, water quality	L60B
ALLEMANS KRAAL	-33.24611	24.29500	Borehole, water quality	L60B
BAROE	-33.23333	24.58333	Borehole, water quality	L70E
BEYERSVLEI	-32.46667	23.20000	Borehole, water quality	L11G
BIETJESFONTEIN	-33.00833	25.06250	Borehole, water quality	N22D
BLOEDSKRAAL	-32.16750	24.55556	Borehole, water quality	N12C
BLOEMKRAAL	-32.16806	24.55250	Borehole, water quality	N12C
BLOUBOSKRAAL	-32.43333	22.70833	Borehole, water quality	L11F
BOSKRAAL	-32.15861	24.55000	Borehole, water quality	N12C
BRAKFONTEIN	-32.13528	24.44944	Borehole, water quality	N12C
BRANDWAGTWEELING	-32.24333	22.75167	Borehole, water quality	L11F
BRITSHOEK	-32.80000	22.81667	Borehole, water quality	L12A
DAGLUIMER	-32.43000	24.34889	Borehole, water quality	N14D
GRAAFF REINET ALL	-32.18444	24.54556	Borehole, water quality	N11B
GRAAFF REINET ALL	-32.18417	24.54528	Borehole, water quality	N11B
GRAAFF-REINET ALLOT	-32.17222	24.49028	Borehole, water quality	N12C
GRAAFF-REINET-ALLOT	-32.18944	24.51139	Borehole, water quality	N12C
GRASRAMD	-32.31361	24.44917	Borehole, water quality	N13A
GROOTKRAANVOESKUIL	-32.53333	22.91667	Borehole, water quality	L11G
IRENE	-32.29278	24.39694	Borehole, water quality	N13A
J2N0050	-32.10028	22.74194	Borehole, water level	L11F
J2N0051	-32.16250	22.74389	Borehole, water level	L11F
J2N0052	-32.16413	22.78470	Borehole, water level	L11F
J2N0054	-32.21389	22.79583	Borehole, water level	L11F
J2N0060	-32.24139	22.80056	Borehole, water level	L11F
J2N0061	-32.22833	22.75917	Borehole, water level	L11F
J2N0065	-32.25556	22.78583	Borehole, water level	L11F
J2N0073	-32.20389	22.78306	Borehole, water level	L11F
J2N0075	-32.39639	22.74306	Borehole, water level	L11F
J2N0076	-32.41556	22.75583	Borehole, water level	L11F
J2N0077	-32.41417	22.83278	Borehole, water level	L11F
J2N0081	-32.37778	22.78389	Borehole, water level	L11F
J2N0082	-32.25278	22.78306	Borehole, water level	L11F
J2N0109	-32.25615	22.78489	Borehole, water level	L11F
J2N0111	-32.21571	22.81690	Borehole, water level	L11F
J2N0529	-32.21389	22.79389	Borehole, water level	L11F

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
KAMFERKRAAL	-32.20000	22.98333	Borehole, water quality	L11E
KAMFERSKRAAL	-32.26833	23.01333	Borehole, water quality	L11E
KLEIN AAR	-32.31667	23.16667	Borehole, water quality	L11G
KRA1	-33.47160	24.50150	Borehole, water level	L70D
L1N0005	-32.41667	22.83306	Borehole, water level	L11F
L1N0027	-32.13306	23.03306	Borehole, water level	L11E
L1N0028	-32.15556	23.03583	Borehole, water level	L11E
L1N0029	-32.16667	23.04139	Borehole, water level	L11E
L1N0030	-32.14278	22.99500	Borehole, water level	L11E
L1N0031	-32.11583	23.00167	Borehole, water level	L11E
L1N0032	-32.11556	23.00194	Borehole, water level	L11E
L1N0033	-32.09500	23.02333	Borehole, water level	L11E
L1N0034	-32.07833	23.01167	Borehole, water level	L11E
L1N0035	-32.09000	23.01083	Borehole, water level	L11E
L1N0036	-32.05000	23.02222	Borehole, water level	L11C
L1N0037	-32.04694	22.99917	Borehole, water level	L11C
L1N0038	-32.01083	23.01944	Borehole, water level	L11C
L1N0039	-31.97500	23.00806	Borehole, water level	L11C
L1N0040	-31.96944	23.01667	Borehole, water level	L11C
L1N0041	-32.00278	23.00000	Borehole, water level	L11C
L1N0042	-32.36250	22.98917	Borehole, water level	L11F
L1N0043	-32.39833	22.97472	Borehole, water level	L11F
L1N0044	-32.39889	22.97417	Borehole, water level	L11F
L1N0045	-32.43389	22.79500	Borehole, water level	L11F
L1N0047	-32.38500	23.10194	Borehole, water level	L11G
L1N0048	-32.34667	23.04528	Borehole, water level	L11G
L1N0049	-32.33639	23.06250	Borehole, water level	L11G
L1N0050	-32.32139	23.07444	Borehole, water level	L11G
L1N0051	-32.33667	23.12556	Borehole, water level	L11G
L1N0052	-32.25139	23.06694	Borehole, water level	L11G
L1N0054	-32.28056	22.99611	Borehole, water level	L11E
L1N0055	-32.22917	23.06278	Borehole, water level	L11E
L1N0056	-32.20750	23.05944	Borehole, water level	L11E
L1N0062	-32.26083	22.99889	Borehole, water level	L11E
L1N0063	-32.28056	23.04889	Borehole, water level	L11G
L1N0064	-32.36389	22.99139	Borehole, water level	L11F
L1N0065	-32.43583	23.03194	Borehole, water level	L11G
L1N0066	-32.44417	23.15306	Borehole, water level	L11G
L1N0067	-32.17500	23.04833	Borehole, water level	L11E
L1N0068	-32.22500	23.06528	Borehole, water level	L11E
L1N0069	-32.24083	23.07556	Borehole, water level	L11G

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
L1N0070	-32.50778	22.93556	Borehole, water level	L11G
L1N0071	-32.17417	23.04889	Borehole, water level	L11E
L1N0072	-32.70694	22.79417	Borehole, water level	L11G
L1N0073	-32.77583	22.81278	Borehole, water level	L12A
L1N0076	-32.77611	22.81278	Borehole, water level	L12A
L1N0080	-32.24167	23.07528	Borehole, water level	L11G
L1N0111	-32.24917	22.75056	Borehole, water level	L11F
L1N0113	-32.19827	22.76485	Borehole, water level	L11F
L1N0114	-32.19056	22.77889	Borehole, water level	L11F
L1N0115	-32.18583	22.78750	Borehole, water level	L11F
L1N0116	-32.18861	22.81306	Borehole, water level	L11F
L1N0117	-32.19639	22.82167	Borehole, water level	L11F
L1N0118	-32.21167	22.84000	Borehole, water level	L11F
L1N0119	-32.21417	22.81389	Borehole, water level	L11F
L1N0120	-32.20417	22.80417	Borehole, water level	L11F
L1N0121	-32.19833	22.80167	Borehole, water level	L11F
L1N0122	-32.22306	22.80583	Borehole, water level	L11F
L1N0123	-32.21389	22.79139	Borehole, water level	L11F
L1N0124	-32.22222	22.76694	Borehole, water level	L11F
L1N0125	-32.23056	22.78917	Borehole, water level	L11F
L1N0126	-32.23278	22.79694	Borehole, water level	L11F
L1N0127	-32.23528	22.83944	Borehole, water level	L11F
L1N0128	-32.24583	22.81306	Borehole, water level	L11F
L1N0129	-32.24500	22.81056	Borehole, water level	L11F
L1N0130	-32.26250	22.80056	Borehole, water level	L11F
L1N0131	-32.25455	22.77488	Borehole, water level	L11F
L1N0132	-32.26306	22.74667	Borehole, water level	L11F
L1N0133	-32.27840	22.78029	Borehole, water level	L11F
L1N0134	-32.28306	22.78139	Borehole, water level	L11F
L1N0136	-32.21028	22.75750	Borehole, water level	L11F
L1N0137	-32.21056	22.82222	Borehole, water level	L11F
L1N0138	-32.21917	22.85667	Borehole, water level	L11F
L1N0139	-32.22778	22.82694	Borehole, water level	L11F
L1N0140	-32.23167	22.81556	Borehole, water level	L11F
L1N0141	-32.22583	22.79139	Borehole, water level	L11F
L1N0143	-32.35889	22.85889	Borehole, water level	L11F
L1N0144	-32.23056	22.80639	Borehole, water level	L11F
L1N0145	-32.42556	22.78889	Borehole, water level	L11F
L1N0146	-32.10957	22.75417	Borehole, water level	L11F
L1N0147	-32.10500	22.74806	Borehole, water level	L11F
L1N0148	-32.16295	22.78386	Borehole, water level	L11F

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
L1N0149	-32.16414	22.78246	Borehole, water level	L11F
L1N0151	-32.21895	22.86250	Borehole, water level	L11F
L1N0152	-32.09707	22.63811	Borehole, water level	L11F
L1N0153	-32.67464	22.87174	Borehole, water level	L11G
L1N0154	-32.21583	22.81806	Borehole, water level	L11F
L1N0164	-32.10889	22.74667	Borehole, water level	L11F
L1N0168	-32.90517	23.14768	Borehole, water level	L12C
L1N0169	-32.18889	23.08639	Borehole, water level	L11E
L3N0001	-33.07726	23.49294	Borehole, water level	L30C
L4N0001	-33.08492	23.92842	Borehole, water level	L40B
L4N0002	-33.17712	23.83105	Borehole, water level	L30D
L6N0002	-33.23278	24.25806	Borehole, water level	L60B
L6N0003	-33.23278	24.26056	Borehole, water level	L60B
L6N0004	-33.23278	24.25889	Borehole, water level	L60B
L6N0005	-33.01324	24.34521	Borehole, water level	L60A
L6N0006	-32.96140	24.33153	Borehole, water level	N24C
L6N0007	-33.02139	24.34249	Borehole, water level	L60A
L7N0001	-33.25194	24.33889	Borehole, water level	L70B
L7N0002	-33.25278	24.33833	Borehole, water level	L70B
L7N0003	-33.25278	24.33861	Borehole, water level	L70B
L7N0004	-33.25250	24.33750	Borehole, water level	L70B
L7N0005	-33.24861	24.38333	Borehole, water level	L70B
L7N0006	-33.25444	24.26556	Borehole, water level	L50B
L7N0010	-33.26556	24.32444	Borehole, water level	L70B
L7N0011	-33.26146	24.32780	Borehole, water level	L70B
L7N0012	-33.53292	24.48438	Borehole, water level	L70D
L7N0013	-33.53255	24.47427	Borehole, water level	L70D
L7N0014	-33.26105	24.35296	Borehole, water level	L70B
MOUNT STEWART	-33.15000	24.43333	Borehole, water quality	L60B
MUNICIPALITY	-32.20111	24.54917	Borehole, water quality	N11B
N1H011Q01	-32.16889	24.07639	Borehole, water quality	N13B
N1H012Q01	-32.16083	24.12639	Borehole, water quality	N13B
N1H013Q01	-32.24139	24.53222	Borehole, water quality	N13C
N1H014Q01	-32.03556	24.67306	Borehole, water quality	N11B
N1N0001	-32.18333	24.55000	Borehole, water level	N12C
N1N0005	-32.19833	24.54694	Borehole, water level	N12C
N1N0021	-32.20239	24.54083	Borehole, water level	N12C
N1N0022	-32.18528	24.54478	Borehole, water level	N12C
N1N0023	-32.31278	24.45333	Borehole, water level	N13A
N1N0024	-32.31028	24.40417	Borehole, water level	N13A
N1N0025	-32.29164	24.42561	Borehole, water level	N13A

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
N1N0026	-32.28861	24.35028	Borehole, water level	N13A
N1N0028	-32.23194	24.34583	Borehole, water level	N13A
N1N0029	-32.20389	24.33889	Borehole, water level	N13A
N1N0030	-32.35556	24.47306	Borehole, water level	N13A
N1N0031	-32.39167	24.41778	Borehole, water level	N13C
N1N0032	-32.37111	24.41306	Borehole, water level	N13C
N1N0033	-32.35000	24.38222	Borehole, water level	N13B
N1N0034	-32.33806	24.37556	Borehole, water level	N13B
N1N0036	-32.30972	24.27917	Borehole, water level	N13B
N1N0037	-32.30583	24.28028	Borehole, water level	N13B
N1N0041	-32.42750	24.20000	Borehole, water level	N14C
N1N0042	-32.43167	24.21694	Borehole, water level	N14D
N1N0046	-32.41667	24.29944	Borehole, water level	N14D
N1N0047	-32.42806	24.35556	Borehole, water level	N14D
N1N0058	-32.31056	24.27833	Borehole, water level	N13B
N1N0071	-32.35806	24.35222	Borehole, water level	N13B
N1N0091	-32.30450	24.40094	Borehole, water level	N13A
N1N0092	-32.30825	24.41214	Borehole, water level	N13A
N1N0503	-32.30875	24.41244	Borehole, water level	N13A
N1N0504	-32.18307	24.24433	Borehole, water level	N13B
N1N0505	-32.30619	24.40474	Borehole, water level	N13A
N1N0506	-32.31083	24.41944	Borehole, water level	N13A
N1N0507	-32.31344	24.41286	Borehole, water level	N13A
N1N0510	-32.47461	24.06006	Borehole, water level	N14B
N1N0511	-32.48908	24.07112	Borehole, water level	N14B
N1N0512	-32.49445	24.04990	Borehole, water level	N14A
N1N0513	-32.48322	24.06225	Borehole, water level	N14B
N1N0514	-31.86565	24.55983	Borehole, water level	N12A
N1N0515	-32.47160	24.05846	Borehole, water level	N14B
N2N0500	-32.94167	24.66111	Borehole, water level	N24C
N2N0501	-33.19500	24.90056	Borehole, water level	N22E
N2N0502	-32.93407	24.70008	Borehole, water level	N24D
N2N0503	-32.91490	24.65493	Borehole, water level	N24C
N2N0504	-33.07542	25.00177	Borehole, water level	N22C
N2N0505	-32.90220	24.65670	Borehole, water level	N24C
N3N0001	-32.57324	25.13486	Borehole, water level	N30A
N3N0002	-32.56670	25.13931	Borehole, water level	N30A
ONDER PLAATDOORNS	-32.38333	22.78500	Borehole, water quality	L11F
OORLOGS POORT	-33.26167	24.32806	Borehole, water quality	L70B
POLISIE AKADEMIE GRAAF REINET	-32.26417	24.53778	Borehole, water quality	N13C
RUST VREDE	-32.61667	22.90000	Borehole, water quality	L11G

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
SPOELMANS KUIL	-32.26667	22.74917	Borehole, water quality	L11F
SUNNYSIDESPRUIT	-32.35833	22.87500	Borehole, water quality	L11F
THORNLANDS	-32.19361	24.46139	Borehole, water quality	N12C
THORNLANDS	-32.19722	24.46944	Borehole, water quality	N12C
THORNLANDS	-32.19861	24.46139	Borehole, water quality	N12C
TOORNITZ	-32.58333	22.86667	Borehole, water quality	L11G
TRULERSKUIL	-32.33333	23.19167	Borehole, water quality	L11G
TRUTERSKUIL	-32.36667	23.05000	Borehole, water quality	L11G
VAALE DRAAI	-33.12083	25.06667	Borehole, water quality	N22E
VAALNEK	-33.16667	25.10417	Borehole, water quality	N23B
VAN DER WALTSKLOOF	-32.38500	24.18861	Borehole, water quality	N14D
VK348	-32.43389	22.79500	Borehole, water quality	L11F
VK353	-32.47944	22.86111	Borehole, water quality	L11G
ZEVENFONTYNEN	-32.46528	24.53667	Borehole, water quality	N13C
ZQMABD1	-32.47722	24.04667	Borehole, water quality	N14A
ZQMABD2	-32.47389	23.80944	Borehole, water quality	N14A
ZQMABD3	-32.45750	23.81111	Borehole, water quality	N14A
ZQMABR1	-32.73972	24.31694	Borehole, water quality	N24A
ZQMARBI	-32.73833	24.31750	Borehole, water quality	N24A
ZQMGRT1	-32.20111	24.54917	Borehole, water quality	N11B
ZQMGRT2	-32.30889	24.41306	Borehole, water quality	N13A
ZQMKPT1	-33.13806	24.28083	Borehole, water quality	L60B
ZQMNLS1	-32.03917	23.00750	Borehole, water quality	L11D
ZQMRSK1	-32.21444	22.81889	Borehole, water quality	L11F
ZQMRTB1	-32.95361	23.00806	Borehole, water quality	L12C
ZQMRTB2	-32.97472	23.11583	Borehole, water quality	L12C
ZQMSTY1	-33.26167	24.35083	Borehole, water quality	L70B
ZQMTSS1	-31.89333	23.06722	Borehole, water quality	L11C
ZQMURG1	-31.96444	23.76500	Borehole, water quality	L21E
ZQMWHW1	-33.25556	23.48972	Borehole, water quality	L30A

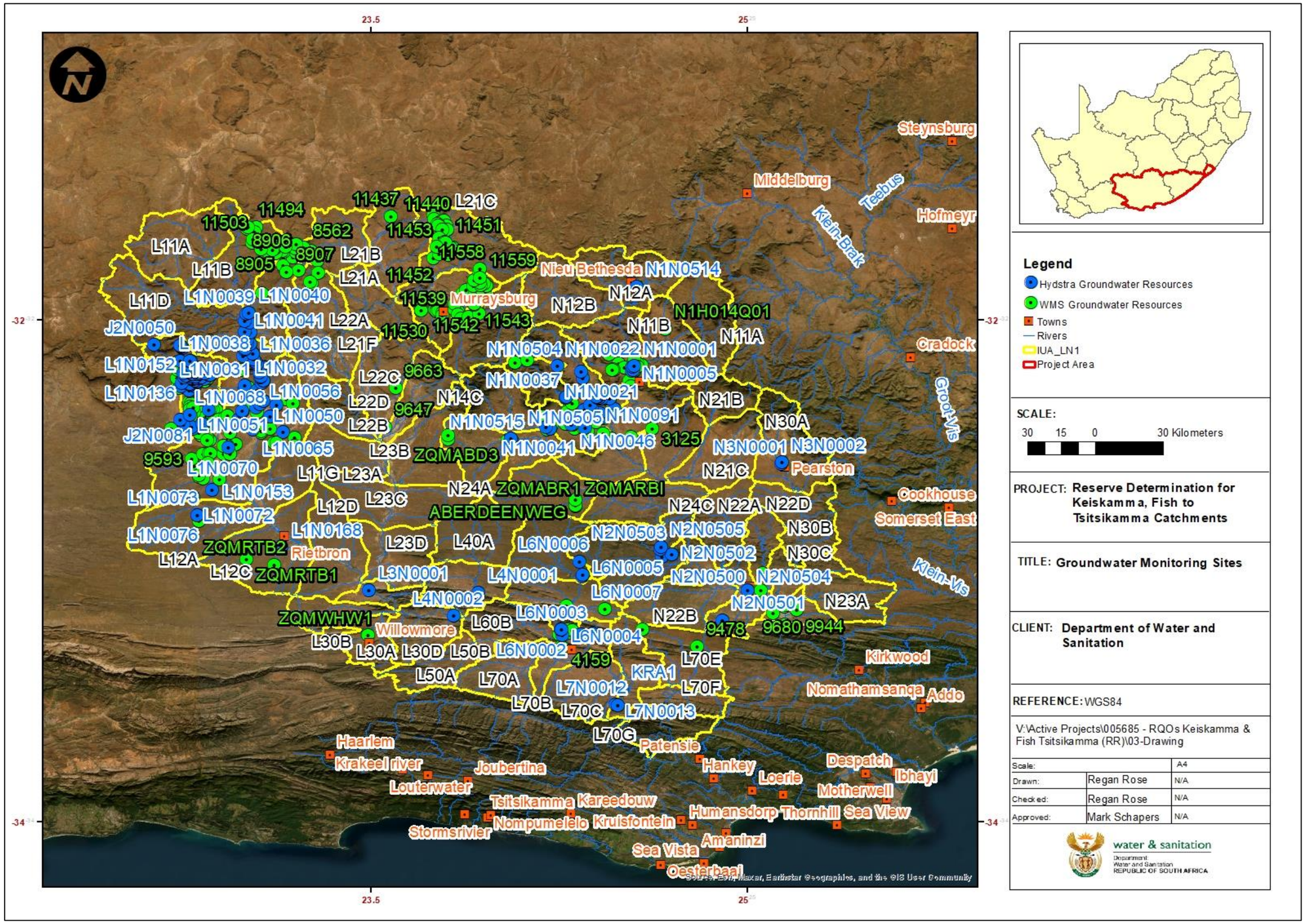


Figure 8: Monitoring sites in IUA 4 (LN1)

5.5 IUA_M01: M primary catchment

IUA Description	M primary catchment
	The aquifer is of a fractured type, mainly associated with the fractured Table Mountain Group and Uitenhage Group. A small part of the IUA is also of an intergranular type, associated with Quaternary sands. The IUA is mildly stressed in certain areas.
GW RU	GW_RU04
	GW_RU05
	GW_RU06

The monitoring sites in IUA 5 (M1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 7 and provided in Figure 9**.** A total of sixty-four (64) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 32 and Figure 33, respectively in Appendix A.

Table 7: Monitoring sites in IUA 5 (M1)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
5289	-33.84861	25.29889	Borehole, water quality	M10C
5290	-33.84472	25.29833	Borehole, water quality	M10C
5291	-33.85222	25.30222	Borehole, water quality	M10C
5292	-33.85889	25.29139	Borehole, water quality	M10C
5293	-33.85944	25.28917	Borehole, water quality	M10C
5294	-33.85806	25.29528	Borehole, water quality	M10C
5295	-33.86028	25.29472	Borehole, water quality	M10C
5296	-33.86306	25.29528	Borehole, water quality	M10C
5297	-33.87472	25.29417	Borehole, water quality	M10C
5298	-33.86306	25.30222	Borehole, water quality	M10C
5299	-33.86389	25.30639	Borehole, water quality	M10C
5300	-33.86222	25.30389	Borehole, water quality	M10C
5301	-33.87194	25.31639	Borehole, water quality	M10C
5302	-33.86306	25.32083	Borehole, water quality	M10C
5303	-33.85583	25.31694	Borehole, water quality	M10C
5304	-33.87694	25.30000	Borehole, water quality	M10C
5305	-33.86500	25.31500	Borehole, water quality	M10C
5306	-33.87444	25.32583	Borehole, water quality	M10C
5307	-33.87389	25.32556	Borehole, water quality	M10C
9054	-33.61667	25.43333	Borehole, water quality	M30A

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
3325CB00089	-33.77083	25.33722	Borehole, water quality	M10C
3325CB00125	-33.73389	25.32278	Borehole, water quality	M10C
3325CB00127	-33.74028	25.32389	Borehole, water quality	M10C
3325CD00072	-33.80083	25.48861	Borehole, water quality	M10D
3325CD00073	-33.79306	25.43056	Borehole, water quality	M10D
3325CD00074	-33.78611	25.42500	Borehole, water quality	M10D
3325CD00075	-33.78389	25.42389	Borehole, water quality	M10D
3325CD00078	-33.79250	25.48111	Borehole, water quality	M10D
3325CD00082	-33.78722	25.42667	Borehole, water quality	M10D
3325CD00085	-33.77278	25.35417	Borehole, water quality	M10C
3325CD00090	-33.76972	25.33417	Borehole, water quality	M10C
3325CD00091	-33.77139	25.33000	Borehole, water quality	M10C
3325CD00092	-33.77833	25.32306	Borehole, water quality	M10C
3325CD00093	-33.77972	25.33056	Borehole, water quality	M10C
3325CD00095	-33.77972	25.33417	Borehole, water quality	M10C
3325DC00041	-33.81528	25.53889	Borehole, water quality	M10D
ECHODALE (UITENHAGE DISTRIK)	-33.79750	25.31611	Borehole, water quality	M10C
M1H003Q01	-33.70000	25.43806	Borehole, water quality	M10C
M1N0001	-33.72083	25.51194	Borehole, water level	M30A
M1N0002	-33.73750	25.48000	Borehole, water level	M30B
M1N0003	-33.78961	25.33086	Borehole, water level	M10B
M1N0004	-33.80114	25.32944	Borehole, water level	M10B
M1N0007	-33.76583	25.32500	Borehole, water level	M10C
M1N0010	-33.84667	25.40778	Borehole, water level	M10C
M1N0012	-33.77083	25.62083	Borehole, water level	M30B
M1N0016	-33.72833	25.52778	Borehole, water level	M30B
M1N0021	-33.58806	25.31944	Borehole, water level	M30A
M1N0024	-33.69528	25.39667	Borehole, water level	M10C
M1N0029	-33.78889	25.30139	Borehole, water level	M10B
M1N0030	-33.79833	25.32556	Borehole, water level	M10B
M1N0032	-33.76139	25.33889	Borehole, water level	M10C
M1N0034	-33.74361	25.30125	Borehole, water level	M10C
M1N0036	-33.77761	25.33136	Borehole, water level	M10C
M1N0037	-33.78056	25.33000	Borehole, water level	M10C
M1N0038	-33.80228	25.34147	Borehole, water level	M10B
M3N0001	-33.64422	25.27303	Borehole, water level	M10C
M3N0002	-33.64717	25.45364	Borehole, water level	M30A
M3N0003	-33.64306	25.45094	Borehole, water level	M30A
M3N0004	-33.59675	25.38683	Borehole, water level	M30A

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
M3N0005	-33.72381	25.50897	Borehole, water level	M30A
M3N0006	-33.73556	25.55814	Borehole, water level	M30B
M3N0007	-33.73786	25.58000	Borehole, water level	M30B
ZQMMRA1	-33.72389	25.59722	Borehole, water quality	M30B
ZQMUTH1	-33.70000	25.43806	Borehole, water quality	M10C

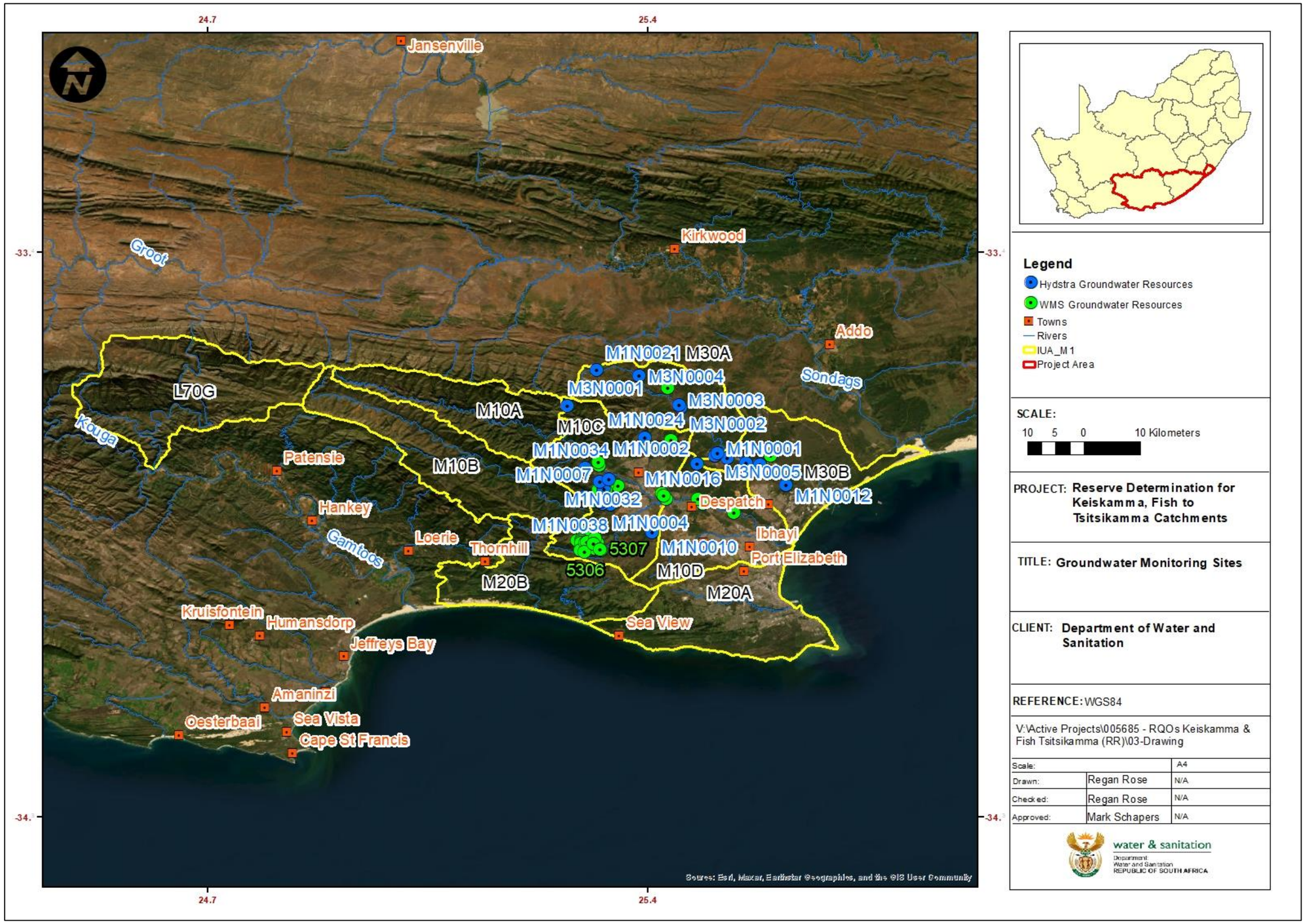


Figure 9: Monitoring sites in IUA 5 (M1)

5.6 IUA_NQ1: Sundays downstream Darlington Dam

IUA Description	Sundays downstream Darlington Dam
	The aquifer is mainly of a fractured type associated with the fractured Lower Karoo Supergroup and Uitenhage Group. A smaller part of the area is also of an intergranular type associated with Quaternary sand and alluvium. There are no stressed areas in the IUA.
GW RU	GW_RU11
	GW_RU12
	GW_RU13
	GW_RU14
	GW_RU15
	GW_RU16
	GW_RU17

The monitoring sites in IUA 6 (NQ1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 8 and provided in Figure 10**.** A total of seventeen (17) monitoring sites exist for this IUA. Time series data of water quality (using EC as overall indicator) is presented in Figure 34 in Appendix A.

Table 8: Monitoring sites in IUA 6 (NQ1)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
7445	-33.37167	25.24278	Borehole, water quality	N40B
7446	-33.37750	25.18750	Borehole, water quality	N40B
7447	-33.37361	25.25389	Borehole, water quality	N40B
9089	-33.45000	25.73333	Borehole, water quality	N40D
9661	-33.21250	25.15000	Borehole, water quality	N40A
ADDO DRIFT EAST	-33.58278	25.67056	Borehole, water quality	N40F
FARM 49 UIT Q 4C 79/WINTERHOEKSBERGE	-33.34667	25.25250	Borehole, water quality	N40B
GLENCONNER	-33.40000	25.16667	Borehole, water quality	N40B
M1N0008	-33.43306	25.07111	Borehole, water level	N40B
N4N0505	-33.39639	25.44306	Borehole, water level	N40C
N4N0507	-33.39639	25.44306	Borehole, water level	N40C
N4N0508	-33.39667	25.44278	Borehole, water level	N40C

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
N4N0511	-33.39639	25.44306	Borehole, water level	N40C
ROCKWOOD/ADDO	-33.39111	25.71944	Borehole, water quality	N40D
STRATHSOMERS ESTATE KIRKWOOD	-33.43000	25.44583	Borehole, water quality	N40C
ZQMADO1	-33.38944	25.72056	Borehole, water quality	N40D
ZQMKWD1	-33.43000	25.44583	Borehole, water quality	N40C

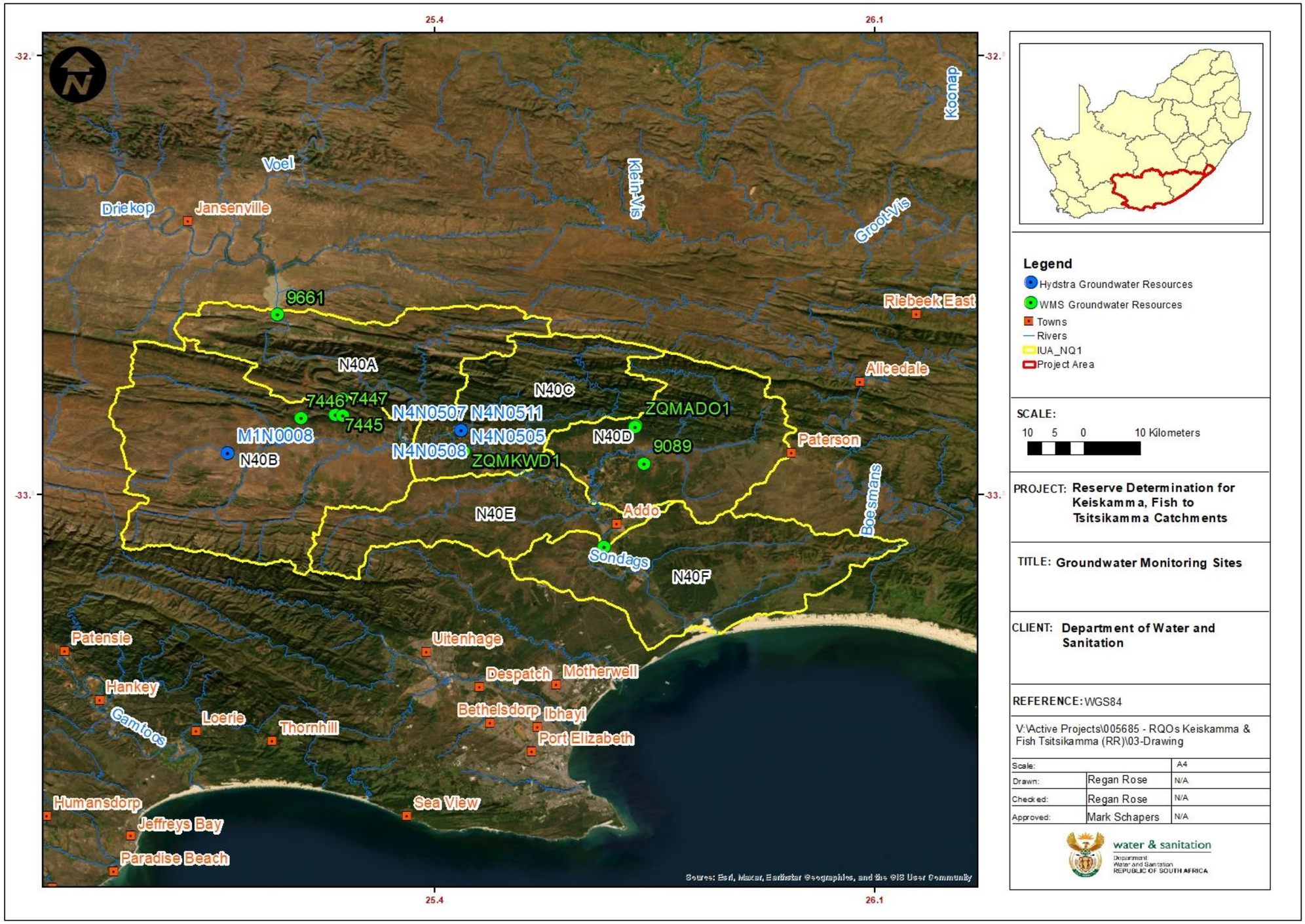


Figure 10: Monitoring sites in IUA 6 (NQ1)

5.7 IUA_P01: P1 primary catchment

IUA Description	P1 primary catchment
	The aquifer is mainly of a fractured type associated with the upper Cape Supergroup (Bokkeveld and Witteberg Groups) and Lower Karoo Supergroup. A smaller part of the area is also of an intergranular type associated with Quaternary sand and alluvium. There are no stressed areas in the IUA.
GW RU	No priority 1 or 2 groundwater areas

The monitoring sites in IUA 7 (P1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 9 and provided in Figure 11**.** A total of sixteen (16) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 35 and Figure 36, respectively in Appendix A.

Table 9: Monitoring sites in IUA 7 (P1)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
8060	-33.50694	26.40167	Borehole, water quality	P10F
8061	-33.52028	26.40639	Borehole, water quality	P10F
9090	-33.51667	26.83333	Borehole, water quality	P40C
NOOITGEDAGHT	-33.23472	25.68333	Borehole, water quality	P10C
P1N0502	-33.50981	26.36575	Borehole, water level	P10F
P1N0504	-33.20691	25.79665	Borehole, water level	P10C
P1N0505	-33.53033	27.04664	Borehole, water level	P40D
P4N0003	-33.53097	26.89333	Borehole, water level	P40C
P4N0004	-33.56389	26.84750	Borehole, water level	P40C
P4N0008	-33.52800	26.93288	Borehole, water level	P40D
P4N0009	-33.53229	26.94093	Borehole, water level	P40D
P4N0010	-33.53042	26.94026	Borehole, water level	P40D
P4N0011	-33.53106	26.94248	Borehole, water level	P40D
P4N0012	-33.53213	26.94601	Borehole, water level	P40D
ZQMCPD1	-33.77083	26.46250	Spring, water quality	P20A
ZQMMND1	-33.37028	26.81667	Borehole, water quality	P40B

Figure 11: Monitoring sites in IUA 7 (P1)

5.8 IUA_Q1: Fish

IUA Description	Fish
	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist, as well as localised intergranular aquifers associated with alluvial deposits. The IUA is mildly to highly stressed in certain areas.
GW RU	GW_RU18
	GW_RU19
	GW_RU20
	GW_RU21
	GW_RU22

The monitoring sites in IUA 8 (Q1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 10 and provided in Figure 12**.** A total of forty (40) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 37 and Figure 38, respectively in Appendix A.

Table 10: Monitoring sites in IUA 8 (Q1)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
2706	-31.46667	25.03361	Borehole, water quality	Q14B
CYPRESSGROVE	-31.81250	25.33333	Borehole, water quality	Q14E
Q1N0042	-31.53372	25.00017	Borehole, water level	Q14B
Q1N0043	-31.60611	24.79139	Borehole, water level	Q14A
Q1N0050	-31.46236	25.02317	Borehole, water level	Q14B
Q1N0054	-31.56889	25.08306	Borehole, water level	Q14C
Q1N0061	-31.55000	25.00000	Borehole, water level	Q14B
Q1N0062	-31.57750	24.92083	Borehole, water level	Q14B
Q1N0063	-31.55167	25.11306	Borehole, water level	Q14C
Q1N0064	-31.57500	25.05806	Borehole, water level	Q14C
Q1N0065	-31.49056	24.97639	Borehole, water level	Q14B
Q1N0066	-31.45000	25.03250	Borehole, water level	Q14B
Q1N0067	-31.45000	25.03250	Borehole, water level	Q14B
Q1N0068	-31.53750	24.94417	Borehole, water level	Q14B
Q1N0069	-31.54917	24.82250	Borehole, water level	Q14A
Q1N0070	-31.50833	24.80806	Borehole, water level	Q14A
Q1N0071	-31.51778	24.79639	Borehole, water level	Q14A

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
Q1N0072	-31.52028	25.07444	Borehole, water level	Q14C
Q1N0073	-31.60000	24.79139	Borehole, water level	Q14A
Q1N0074	-31.29361	25.01639	Borehole, water level	Q14B
Q1N0075	-31.52472	24.91944	Borehole, water level	Q14B
Q1N0502	-31.47722	25.02583	Borehole, water level	Q14B
Q1N0503	-31.47722	25.02611	Borehole, water level	Q14B
Q1N0504	-31.47722	25.02583	Borehole, water level	Q14B
Q1N0505	-31.45000	25.00000	Borehole, water level	Q14B
Q1N0506	-31.47722	25.02611	Borehole, water level	Q14B
Q1N0507	-31.50611	24.98947	Borehole, water level	Q14B
Q1N0508	-31.51403	24.97233	Borehole, water level	Q14B
Q1N0509	-31.54333	24.90778	Borehole, water level	Q14B
Q1N0510	-31.66667	24.96778	Borehole, water level	Q14C
Q1N0511	-31.43121	24.98600	Borehole, water level	Q14B
Q1N0512	-31.48742	25.10950	Borehole, water level	Q14C
Q1N0513	-31.44015	25.29320	Borehole, water level	Q11D
Q1N0514	-31.54246	25.01686	Borehole, water level	Q14B
Q1N0515	-31.48293	24.98436	Borehole, water level	Q14B
Q1N0516	-31.53711	24.94391	Borehole, water level	Q14B
Q1N0517	-31.50411	25.04747	Borehole, water level	Q14B
SHERBORNE	-31.36667	25.01667	Borehole, water quality	Q14B
ZQMMDG2	-31.31833	24.98278	Spring, water quality	Q14B
ZQMMID1	-31.48472	24.99250	Borehole, water quality	Q14B

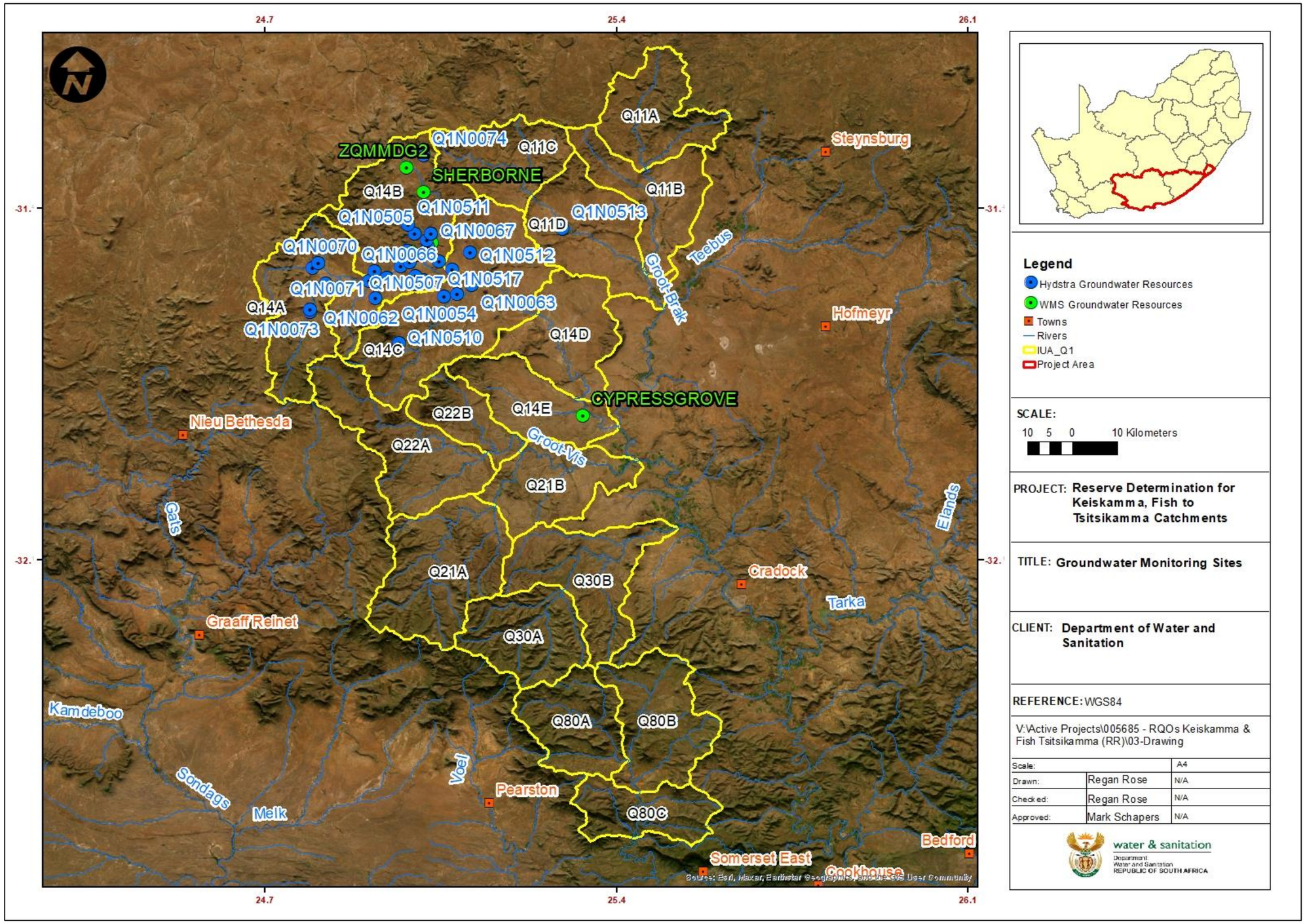


Figure 12: Monitoring sites in IUA 8 (Q1)

5.9 IUA_Q02: Great Fish

IUA Description	Great Fish
	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist. The IUA is mildly to highly stressed in certain areas.
GW RU	GW_RU23
	GW_RU24
	GW_RU25
	GW_RU26
	GW_RU27

The monitoring sites in IUA 9 (Q2) include Hydstra and WMS sites. These monitoring sites are summarised in Table 11 and provided in Figure 13**.** A total of thirty two (32) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 39 and Figure 40, respectively in Appendix A.

Table 11: Monitoring sites in IUA 9 (Q2)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
5460	-31.65278	25.81528	Borehole, water quality	Q13A
7385	-32.15806	25.82917	Borehole, water quality	Q44B
7386	-32.15972	25.87500	Borehole, water quality	Q44B
9091	-32.75000	25.82500	Borehole, water quality	Q70A
3225BA00107	-32.13500	25.62583	Spring, water quality	Q30D
EASTPOORT	-32.66667	25.80000	Borehole, water quality	Q50C
NELLAND	-32.48333	25.75000	Borehole, water quality	Q50A
Q1N0046	-31.65000	25.80000	Borehole, water level	Q13A
Q1N0055	-32.01306	26.25417	Borehole, water level	Q41C
Q1N0059	-31.65528	25.81528	Borehole, water level	Q13A
Q1N0060	-31.65511	25.81758	Borehole, water level	Q13A
Q1N0518	-31.29054	25.82594	Borehole, water level	Q12B
Q1N0519	-31.29329	25.81578	Borehole, water level	Q12B
Q4N0002	-32.00867	26.27428	Borehole, water level	Q41C
Q4N0003	-31.95756	26.27733	Borehole, water level	Q41C
Q4N0004	-31.95883	26.27550	Borehole, water level	Q41C
Q7N0004	-32.97333	25.83056	Borehole, water level	Q70C

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
Q7N0005	-32.97556	25.82917	Borehole, water level	Q70C
Q7N0008	-32.95000	25.81667	Borehole, water level	Q70B
Q7N0009	-32.75019	25.80260	Borehole, water level	Q70A
Q8N0001	-32.72274	25.57475	Borehole, water level	Q80D
Q8N0002	-32.70695	25.55711	Borehole, water level	Q80D
ZQMCBG1	-33.12556	26.20944	Borehole, water quality	Q91B
ZQMCRA1	-32.03472	25.68750	Spring, water quality	Q30C
ZQMCRA2	-32.13500	25.62583	Spring, water quality	Q30D
ZQMFRR1	-33.05278	26.07111	Borehole, water quality	Q91A
ZQMHFR1	-31.65278	25.81528	Borehole, water quality	Q13A
ZQMMND1	-33.37028	26.81667	Borehole, water quality	P40B
ZQMSME1	-32.73861	25.60500	Borehole, water quality	Q80D
ZQMSTB1	-31.29611	25.83028	Borehole, water quality	Q12B
ZQMTAR1	-31.95611	26.27583	Borehole, water quality	Q41C
ZQMTAR2	-31.95611	26.27583	Borehole, water quality	Q41C

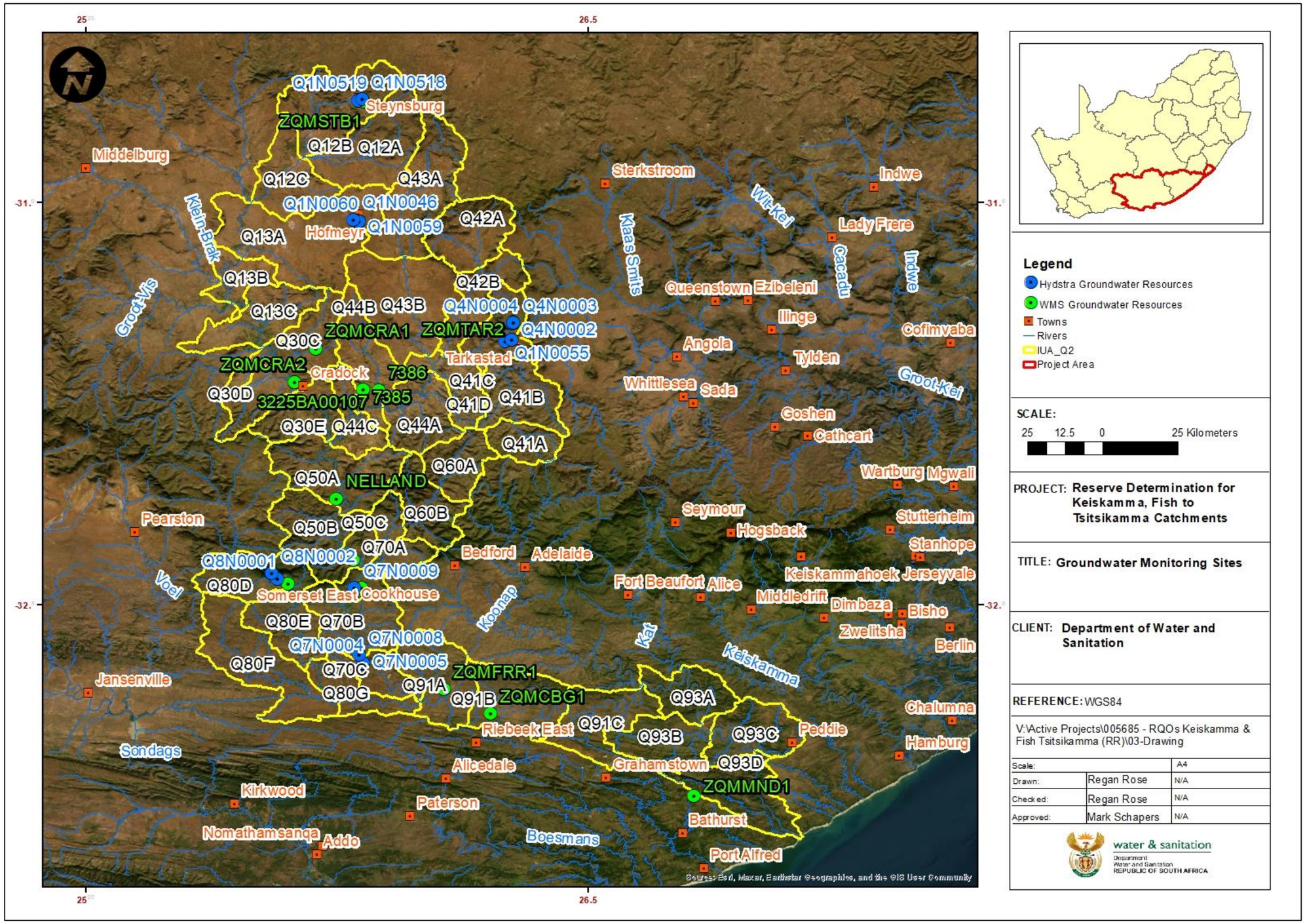


Figure 13: Monitoring sites in IUA 9 (Q2)

5.10 IUA_Q03: Koonap and Kat

IUA Description	Koonap and Kat
	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist. There are no stressed areas in the IUA.
GW RU	GW_RU28
	GW_RU29

The monitoring sites in IUA 10 (Q3) include only WMS sites. These monitoring sites are summarised in Table 12 and provided in Figure 14**.** A total of seven (7) monitoring sites exist for this IUA. Time series data of water quality (using EC as overall indicator) is presented in Figure 41 in Appendix A.

Table 12: Monitoring sites in IUA 10 (Q3)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
9055	-32.85000	26.31667	Borehole, water quality	Q92G
HAVELOCK HOLME BEDFORD DIST	-32.70972	26.13944	Borehole, water quality	Q92F
KINGSVALE BEDFORD DIST	-32.73000	26.13556	Borehole, water quality	Q92F
KROOMIE	-32.77500	26.43333	Borehole, water quality	Q92G
ZQMADK1	-32.70750	26.29444	Borehole, water quality	Q92C
ZQMADL1	-32.71194	26.29028	Borehole, water quality	Q92C
ZQMBTH1	-32.82556	26.67056	Borehole, water quality	Q94F

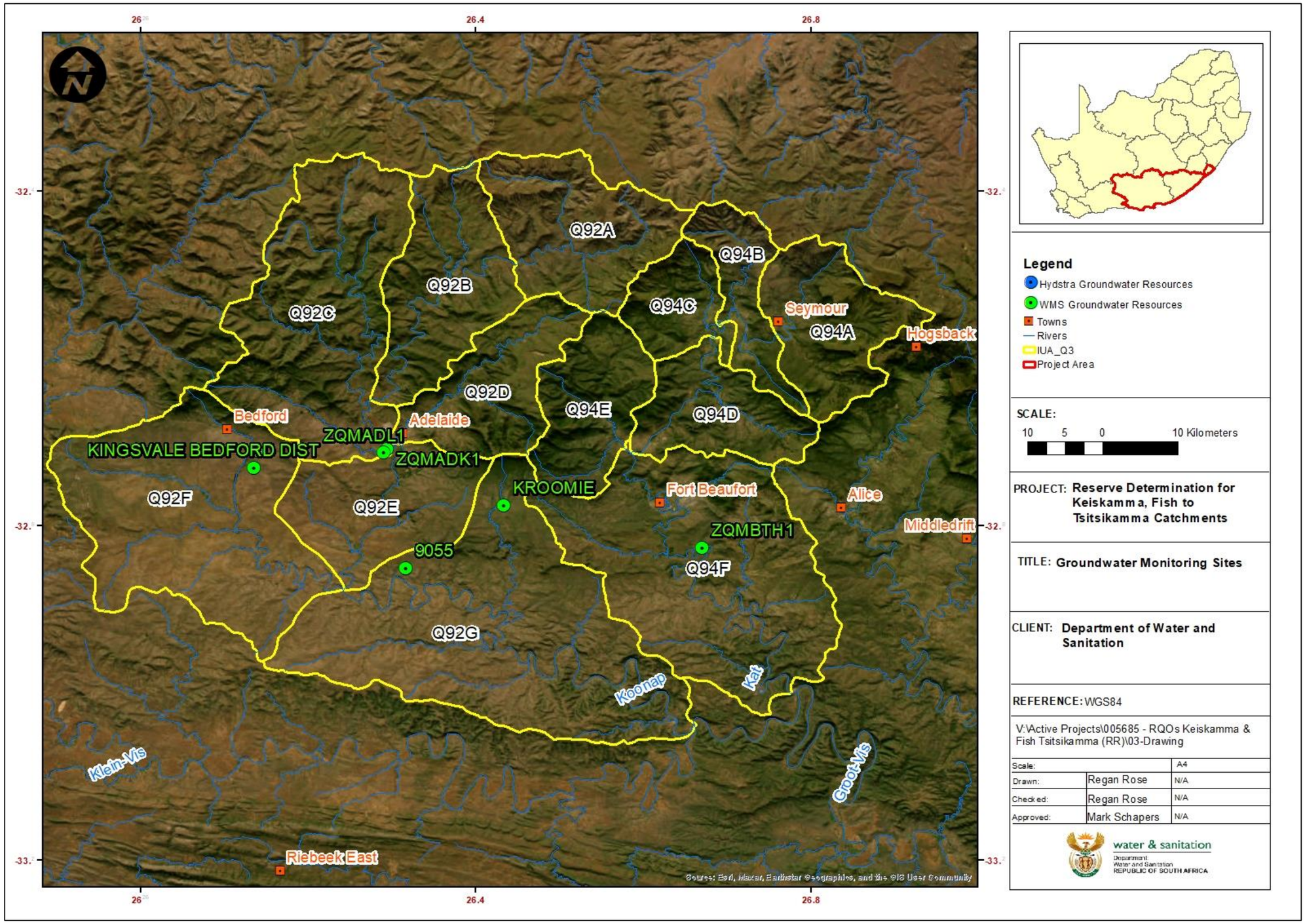


Figure 14: Monitoring sites in IUA 10 (Q3)

5.11 IUA_R1: Keiskamma

IUA Description	Keiskamma
	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist. There are no stressed areas in the IUA.
GW RU	GW_RU30
	GW_RU31

There are currently no monitoring sites in IUA 11 (R1). The IUA layout is provided in Figure 15.

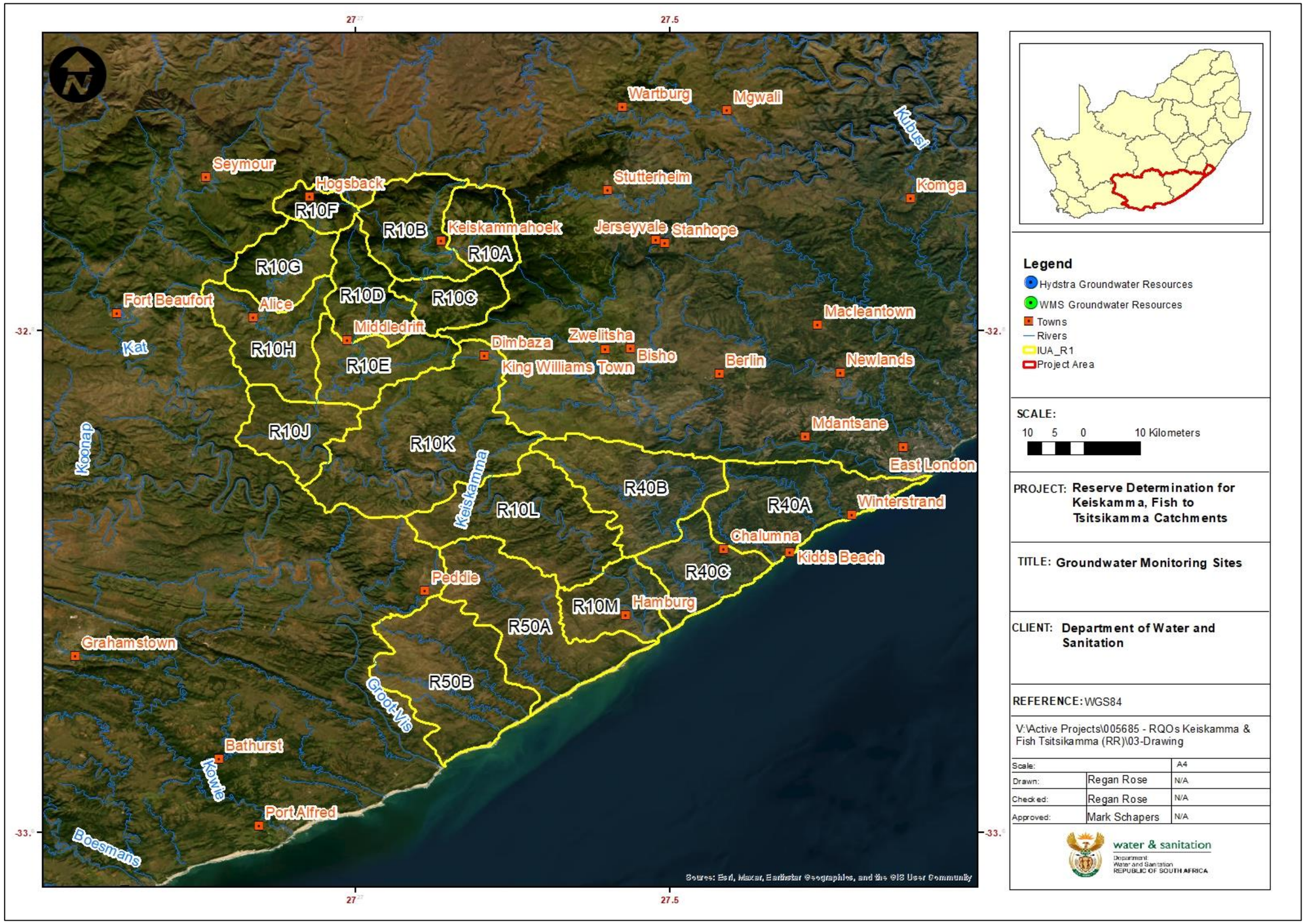


Figure 15: Map of IUA 11 (R1)

5.12 IUA_R02: Buffalo/ Nahoon

IUA Description	Buffalo/ Nahoon
	The aquifer is mainly of a fractured type associated with the Karoo Supergroup. Intergranular and fractured aquifers, owing to the presence of dolerite sills and dykes also exist. The IUA is mildly stressed in certain areas.
GW RU	GW_RU32
	GW_RU33

The monitoring sites in IUA 12 (R2) include Hydstra and WMS sites. These monitoring sites are summarised in Table 13 and provided in Figure 16**.** A total of seventy one (71) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 42 and Figure 43, respectively in Appendix A.

Table 13: Monitoring sites in IUA 12 (R2)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
R3N0500	-32.93306	27.95833	Borehole, water level	R30D
R3N0501	-32.93306	27.95806	Borehole, water level	R30D
R3N0502	-32.93333	27.95806	Borehole, water level	R30D
R3N0503	-32.75040	28.06816	Borehole, water level	R30A
R3N0504	-32.90440	28.02220	Borehole, water level	R30B
EAST-LONDON	-33.03111	27.90194	Borehole, water quality	R20G
MNTLABATHI	-32.96861	27.61222	Borehole, water quality	R20F
FORT-JACKSON	-32.95000	27.68333	Borehole, water quality	R20F
DONGWE	-32.93472	27.55833	Borehole, water quality	R20F
MNCOTSHO	-32.93361	27.59639	Borehole, water quality	R20F
RICHMOND-HILL	-32.92556	27.88444	Borehole, water quality	R30F
GRAYLANDS	-32.90583	27.69667	Borehole, water quality	R30E
WOLSELEY	-32.89750	27.69917	Borehole, water quality	R30E
GLENGARIFF	-32.89389	28.09111	Borehole, water quality	R30B
STREET-LEA	-32.89167	27.57278	Borehole, water quality	R20E
27675	-32.87611	27.78472	Borehole, water quality	R30E
PLUMBAGO	-32.87389	27.43861	Borehole, water quality	R20E
28306	-32.87083	27.68333	Borehole, water quality	R30E
28308	-32.87083	27.72944	Borehole, water quality	R30E
BLANEY	-32.86667	27.51667	Borehole, water quality	R20E
TYUTYU	-32.86306	27.45083	Borehole, water quality	R20E
NAVEL-VALLEY	-32.86278	27.75083	Borehole, water quality	R30E
3227CD00331	-32.85278	27.38778	Borehole, water quality	R20B

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
3227CD00331	-32.85278	27.38778	Borehole, water quality	R20B
3227CD00330	-32.85250	27.38861	Borehole, water quality	R20B
3227CD00330	-32.85250	27.38861	Borehole, water quality	R20B
28312	-32.85139	27.74222	Borehole, water quality	R30E
27676	-32.84194	27.80194	Borehole, water quality	R30E
27677	-32.83694	27.80861	Borehole, water quality	R30E
28309	-32.83667	27.73917	Borehole, water quality	R30E
28304	-32.82528	27.47694	Borehole, water quality	R20E
LONE-TREE	-32.81833	28.08667	Borehole, water quality	R30B
ERHAMNYIBA	-32.79944	27.35306	Borehole, water quality	R20B
BLACK-LANDS	-32.79111	27.39500	Borehole, water quality	R20B
MACLEANTOWN	-32.78528	27.74528	Borehole, water quality	R30E
28305	-32.75250	27.87083	Borehole, water quality	R30C
3227CB00110	-32.74992	27.47728	Borehole, water quality	R20E
3227CB00110	-32.74992	27.47728	Borehole, water quality	R20E
LORAINE	-32.74583	27.98056	Borehole, water quality	R30B
CKO429	-32.73944	27.87528	Borehole, water quality	R30C
3227DA00121	-32.73750	27.52333	Borehole, water quality	R20E
3227DA00121	-32.73750	27.52333	Borehole, water quality	R20E
MAJALI-ZWELITSHA	-32.73722	27.52306	Borehole, water quality	R20E
PEELTON-MAJALI	-32.73722	27.52306	Borehole, water quality	R20E
28307	-32.73694	27.84361	Borehole, water quality	R30C
PEELTON-KWARENI	-32.73389	27.54167	Borehole, water quality	R30E
PEELTON-KWARENI	-32.73389	27.54167	Borehole, water quality	R30E
5740	-32.73056	27.50778	Borehole, water quality	R20E
29557	-32.72944	27.49139	Borehole, water quality	R20E
KWENXURA	-32.72694	28.10500	Borehole, water quality	R30A
28311	-32.72278	27.85361	Borehole, water quality	R30C
27006	-32.71472	27.70472	Borehole, water quality	R30C
DALEVIEW	-32.69639	27.85167	Borehole, water quality	R30B
22027	-32.69306	27.80000	Borehole, water quality	R30C
FAIRVIEW	-32.68861	27.36611	Borehole, water quality	R20A
THORNKLOOF	-32.67556	27.60111	Borehole, water quality	R30C
28310	-32.67028	27.86222	Borehole, water quality	R30B
ROCKBY	-32.67000	27.63778	Borehole, water quality	R30C
23083	-32.66667	27.53333	Borehole, water quality	R30C
28313	-32.66444	27.85806	Borehole, water quality	R30B
YANTOLAS	-32.66417	27.94250	Borehole, water quality	R30B
23064	-32.65000	27.55000	Borehole, water quality	R30C
MPETU	-32.64472	28.08861	Borehole, water quality	R30A
SRAINLANDS	-32.64222	27.82778	Borehole, water quality	R30B

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
24769	-32.63333	27.58500	Borehole, water quality	R30C
24769	-32.63333	27.58500	Borehole, water quality	R30C
24769	-32.63333	27.58500	Borehole, water quality	R30C
24769	-32.63333	27.58500	Borehole, water quality	R30C
22389	-32.61722	27.80000	Borehole, water quality	R30C
22390	-32.60056	27.78417	Borehole, water quality	R30C
LONEOAK	-32.60000	27.82500	Borehole, water quality	R30B

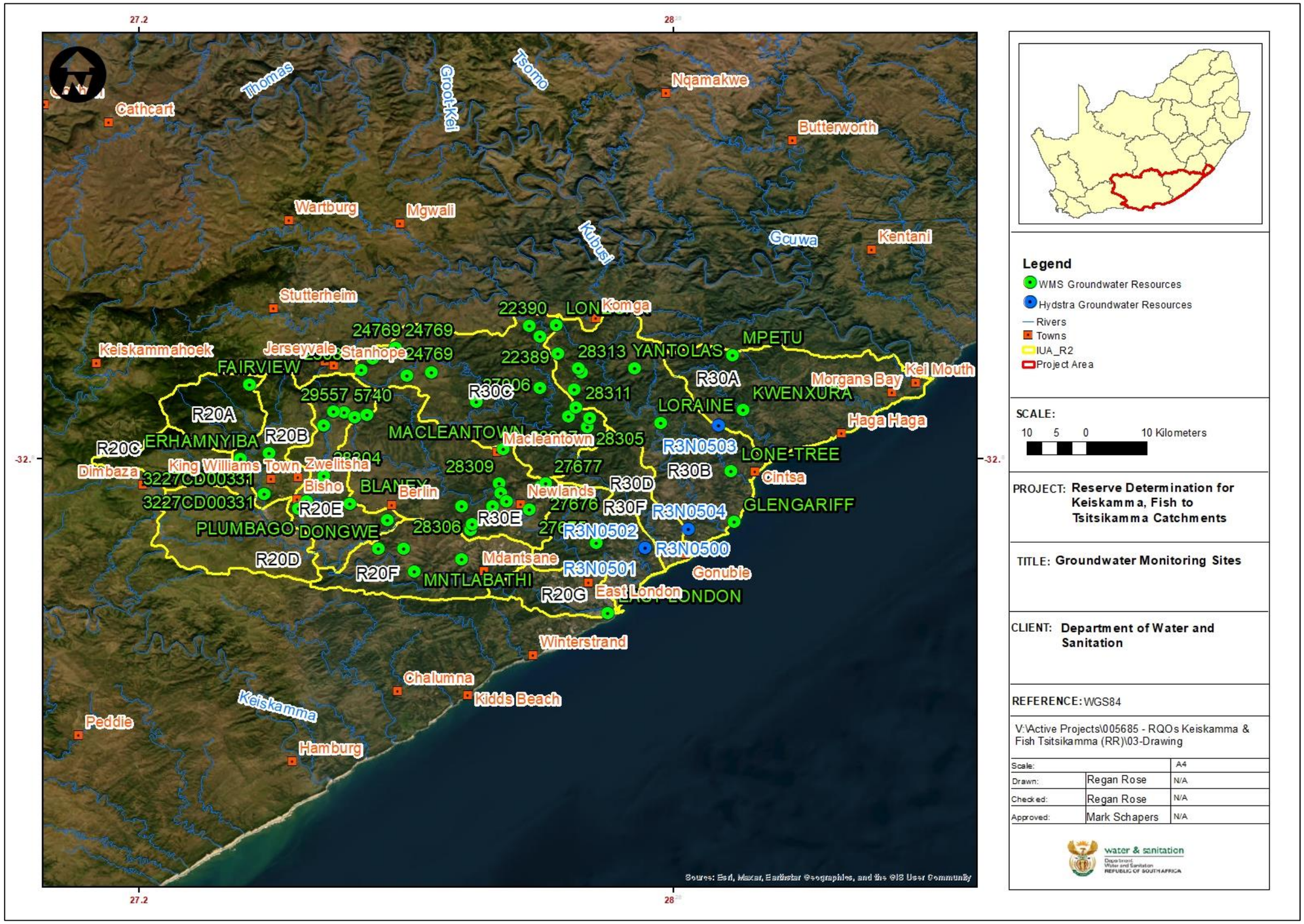


Figure 16: Monitoring sites in IUA 12 (R2)

5.13 IUA_S01: Upper Great Kei

IUA Description	Upper Great Kei
	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. There are no stressed areas in the IUA.
GW RU	GW_RU34
	GW_RU35
	GW_RU36

The monitoring sites in IUA 13 (S1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 14 and provided in Figure 17**.** A total of sixty four (64) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 44 and Figure 45, respectively in Appendix A.

Table 14: Monitoring sites in IUA 13 (S1)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
S1N0001	-31.70448	27.23228	Borehole, water level	S10G
S2N0001	-31.47037	27.33360	Borehole, water level	S20A
S5N0002	-31.74230	27.59937	Borehole, water level	S50E
S7N0004	-31.81290	27.73293	Borehole, water level	T12C
S7N0005	-31.88040	27.77054	Borehole, water level	S50G
S7N0006	-31.92640	27.75019	Borehole, water level	S50G
S7N0007	-31.98530	27.66327	Borehole, water level	S50H
S7N0008	-32.05500	27.83516	Borehole, water level	S50J
HAPPYVALLEY	-32.49167	27.07083	Borehole, water quality	S40A
GIDDYS-FARM	-32.45083	27.16667	Borehole, water quality	S40B
ITALY	-32.41667	27.22500	Borehole, water quality	S40B
THOMAS-RIVER	-32.41667	27.30000	Borehole, water quality	S40B
SURBITON	-32.36667	27.25417	Borehole, water quality	S40B
22380	-32.36528	27.07083	Borehole, water quality	S40A
22426	-32.31667	27.35083	Borehole, water quality	S40C
2242	-32.31667	27.35139	Borehole, water quality	S40C
27244	-32.31278	27.33111	Borehole, water quality	S40C
HILLPATH	-32.30500	27.51389	Borehole, water quality	S40E
HENDERSON-MISSION	-32.28389	27.31667	Borehole, water quality	S40C
BROKEN-SLAPES	-32.26667	27.35083	Borehole, water quality	S40C
BROKEN-SLOPEST	-32.26667	27.35417	Borehole, water quality	S40C
LANGFIELD	-32.26667	27.43333	Borehole, water quality	S40C
THE-GEORGE	-32.25000	27.38750	Borehole, water quality	S40C

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
MKWINTI-3	-31.99556	27.77944	Borehole, water quality	S50G
30476	-31.95444	27.36306	Borehole, water quality	S20D
30477	-31.94778	27.38417	Borehole, water quality	S20D
KWABOMBELA	-31.94667	27.84944	Borehole, water quality	S50G
KUMNGQANGA	-31.93972	27.43444	Borehole, water quality	S20D
SINGENI	-31.91333	27.32806	Borehole, water quality	S10H
KUWOHLO	-31.90972	27.59917	Borehole, water quality	S50F
SINGENI	-31.89500	27.30861	Borehole, water quality	S10H
3126DB00093	-31.74125	26.90356	Borehole, water quality	S10D
3126DB00093	-31.74125	26.90356	Borehole, water quality	S10D
3126DB00094	-31.73706	26.90485	Borehole, water quality	S10D
3126DB00094	-31.73706	26.90485	Borehole, water quality	S10D
3126DB00095	-31.73458	26.90797	Borehole, water quality	S10D
3126DB00095	-31.73458	26.90797	Borehole, water quality	S10D
LADY-FRERE	-31.70222	27.23667	Borehole, water quality	S10G
3126DB00072	-31.68467	26.89656	Borehole, water quality	S10C
3126DB00063	-31.64578	26.95133	Borehole, water quality	S10C
3126DB00064	-31.63853	26.94208	Borehole, water quality	S10C
3126DB00062	-31.63778	26.98297	Borehole, water quality	S10C
3127CA00053	-31.61617	27.01525	Borehole, water quality	S10C
27366	-31.59833	26.71500	Borehole, water quality	S10A
3126DB00073	-31.59131	26.88722	Borehole, water quality	S10B
ZQMSSM1	-31.58750	26.72944	Borehole, water quality	S10A
3126DB00065	-31.58472	26.89528	Borehole, water quality	S10B
3126DB00069	-31.57986	26.94956	Borehole, water quality	S10B
3127CA00054	-31.57750	27.02322	Borehole, water quality	S10C
3126DB00068	-31.57717	26.95994	Borehole, water quality	S10C
3127CA00056	-31.56670	27.03081	Borehole, water quality	S10C
3126DB00067	-31.55622	26.97361	Borehole, water quality	S10C
3126DB00070	-31.55572	26.88311	Borehole, water quality	S10B
3126DB00071	-31.55569	26.88364	Borehole, water quality	S10B
3126DB00066	-31.54878	26.96919	Borehole, water quality	S10C
3127CA00055	-31.54553	27.00364	Borehole, water quality	S10C
3126DB00074	-31.54067	26.94964	Borehole, water quality	S10B
3126DB00075	-31.53736	26.95786	Borehole, water quality	S10C
27360	-31.46972	27.48611	Borehole, water quality	S50C
DOORN-KOP	-31.45889	27.26611	Borehole, water quality	S20A
JOUBERTS-KOP	-31.44472	26.94972	Borehole, water quality	S10B
3126BD00075	-31.43222	26.88100	Borehole, water quality	S10B
IDA-POLST	-31.41667	27.55000	Borehole, water quality	S50C
ROSTON	-31.38389	27.72083	Borehole, water quality	S50C

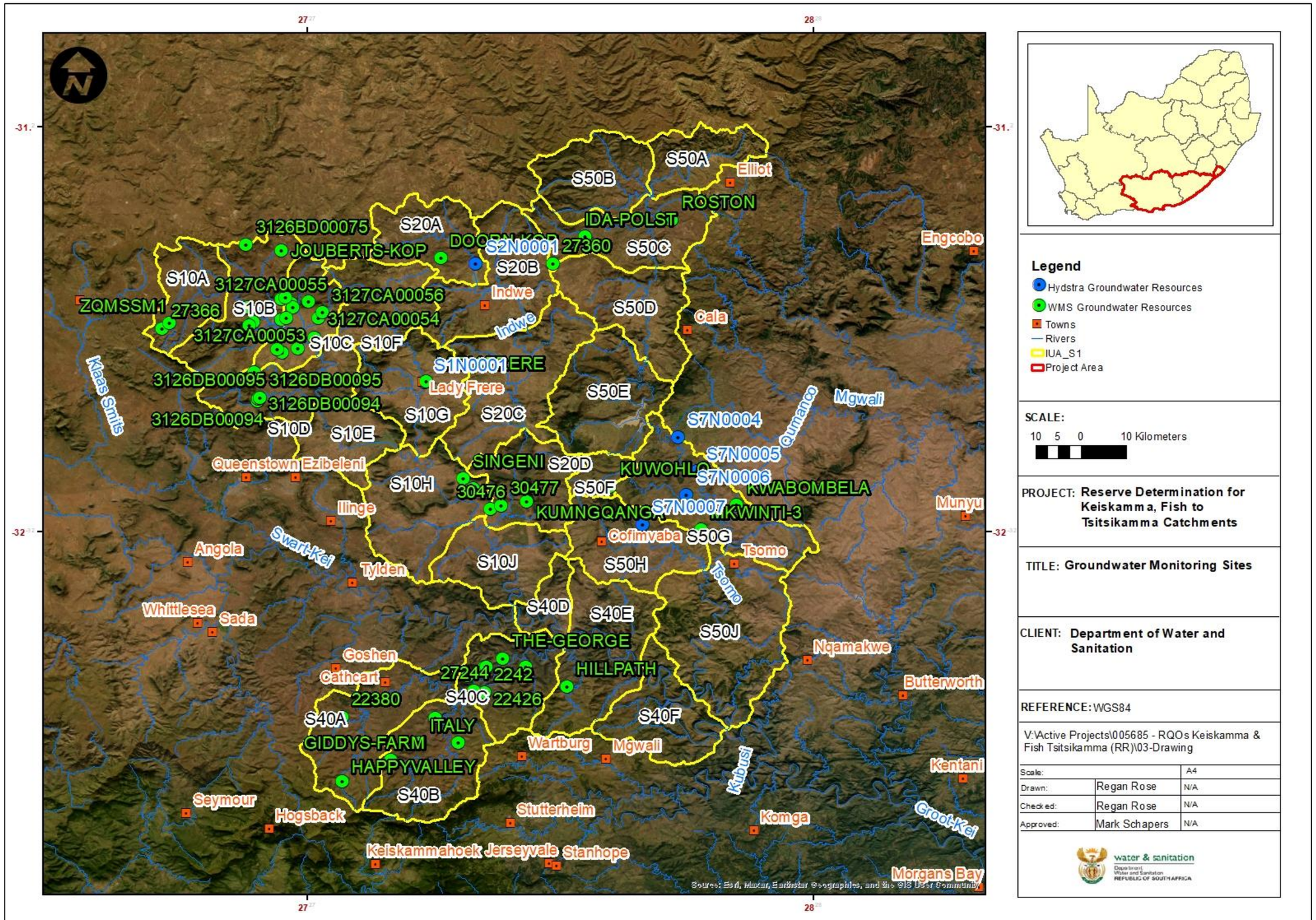


Figure 17: Monitoring sites in IUA 13 (S1)

5.14 IUA_S02: Black Kei

IUA Description	Black Kei
	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is mildly to moderately stressed in certain areas.
GW RU	GW_RU37

The monitoring sites in IUA 14 (S2) include Hydstra and WMS sites. These monitoring sites are summarised in Table 15 and provided in Figure 18**.** A total of two hundred and twelve (212) monitoring sites exists for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 46 and Figure 47, respectively in Appendix A.

Table 15: Monitoring sites in IUA 14 (S2)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
S3N0001	-31.89117	26.59400	Borehole, water level	S31E
S3N0002	-31.90311	26.64231	Borehole, water level	S31E
S3N0003	-31.92367	26.65039	Borehole, water level	S31E
S3N0004	-31.54568	26.46486	Borehole, water level	S31B
S3N0005	-32.10167	26.84472	Borehole, water level	S32H
S3N0006	-31.95667	26.83056	Borehole, water level	S31G
S3N0007	-31.83056	26.90667	Borehole, water level	S31F
S3N0008	-31.92839	26.82814	Borehole, water level	S31G
S3N0010	-31.90228	26.84647	Borehole, water level	S31G
S3N0013	-31.59038	26.36415	Borehole, water level	S31B
S3N0014	-31.98422	26.61258	Borehole, water level	S32C
S3N0016	-31.90076	26.89054	Borehole, water level	S31G
S3N0017	-32.17493	26.82692	Borehole, water level	S32G
MUSWA	-32.34750	26.62667	Borehole, water quality	S32F
BUSHBYPARK-ZWELEDINGA	-32.32444	26.69167	Borehole, water quality	S32F
GOSHEN-MISSION	-32.28028	27.05694	Borehole, water quality	S32L
22378	-32.27083	27.26250	Borehole, water quality	S32M
22393	-32.25833	27.25111	Borehole, water quality	S32M
29644	-32.25194	27.30333	Borehole, water quality	S32M
HALLOWDALE	-32.25000	27.25000	Borehole, water quality	S32M
22259	-32.25000	27.28333	Borehole, water quality	S32M
22258	-32.22500	27.27500	Borehole, water quality	S32M
UPPER-THORN-PARK	-32.15472	27.05417	Borehole, water quality	S32K
3226BB00243	-32.14917	26.82333	Borehole, water quality	S32H
3226BB00251	-32.14583	26.82250	Borehole, water quality	S32H

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
19106	-32.13583	27.02028	Borehole, water quality	S32K
19192	-32.13111	27.06750	Borehole, water quality	S32K
3226BB00239	-32.12083	26.79806	Borehole, water quality	S32H
TRADERS-DRIFT	-32.11833	27.08583	Borehole, water quality	S32K
19191	-32.11667	27.07028	Borehole, water quality	S32K
19105	-32.11194	27.02972	Borehole, water quality	S32K
19116	-32.10750	26.87278	Borehole, water quality	S32H
ZQMLAN1	-32.10556	26.80722	Borehole, water quality	S32H
19115	-32.10472	26.88528	Borehole, water quality	S32H
19104	-32.10306	27.05722	Borehole, water quality	S32K
WELDON	-32.10000	26.83333	Borehole, water quality	S32H
19093	-32.09028	26.98167	Borehole, water quality	S32K
19092	-32.08694	26.98194	Borehole, water quality	S32K
19119	-32.08389	26.81833	Borehole, water quality	S32H
19117	-32.08056	26.86806	Borehole, water quality	S32H
1XWORTH	-32.07917	27.06139	Borehole, water quality	S32K
19108	-32.07806	26.94361	Borehole, water quality	S32K
19120	-32.07583	26.81972	Borehole, water quality	S32H
GLEN-THORN	-32.07472	27.10778	Borehole, water quality	S32J
19123	-32.06750	26.80528	Borehole, water quality	S32H
1701	-32.06667	26.83333	Borehole, water quality	S32H
19112	-32.06583	26.97139	Borehole, water quality	S32K
19110	-32.06111	26.99083	Borehole, water quality	S32K
3226BB00242	-32.06000	26.78611	Borehole, water quality	S32H
19109	-32.05917	26.99167	Borehole, water quality	S32K
19107	-32.05889	26.97083	Borehole, water quality	S32K
19124	-32.05750	26.81417	Borehole, water quality	S32H
22984	-32.05417	26.90000	Borehole, water quality	S32H
3226BB00241	-32.05278	26.79139	Borehole, water quality	S32H
19121	-32.05194	26.84389	Borehole, water quality	S32H
19118	-32.05194	26.84611	Borehole, water quality	S32H
19193	-32.05167	27.11417	Borehole, water quality	S32J
19122	-32.05111	26.84000	Borehole, water quality	S32H
MAPASSA-KRAAL	-32.05083	26.94944	Borehole, water quality	S32K
CATHCARDS-GIFT	-32.05056	26.81306	Borehole, water quality	S32H
BLOEMHOF(P1)	-32.05000	27.08333	Borehole, water quality	S32J
19412	-32.04583	26.81972	Borehole, water quality	S32H
19412	-32.04583	26.81972	Borehole, water quality	S32H
19113	-32.04528	26.95361	Borehole, water quality	S32K
19111	-32.04528	26.97972	Borehole, water quality	S32K
3226BB00240	-32.04167	26.75389	Borehole, water quality	S32C

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
19114	-32.03861	26.96000	Borehole, water quality	S32K
SHERWOOD-FOREST	-32.03806	26.76694	Borehole, water quality	S32C
19200	-32.03778	26.82611	Borehole, water quality	S32H
LAUSANNE	-32.03750	27.06917	Borehole, water quality	S32J
19194	-32.03500	27.07111	Borehole, water quality	S32J
19195	-32.03139	27.10861	Borehole, water quality	S32J
19211	-32.02500	26.73833	Borehole, water quality	S32C
CATHCARD	-32.02472	26.92083	Borehole, water quality	S31G
MOUNTAIN-GLEN	-32.02306	26.95000	Borehole, water quality	S31G
19097	-32.02056	26.90639	Borehole, water quality	S31G
POPLAR-GRAVE	-32.02028	26.82278	Borehole, water quality	S32H
19125	-32.01778	26.87556	Borehole, water quality	S31G
19198	-32.01028	27.02417	Borehole, water quality	S32J
19098	-32.00722	26.90333	Borehole, water quality	S31G
19201	-32.00667	26.85861	Borehole, water quality	S31G
POTGIETERS-KRAAL	-32.00306	26.68611	Borehole, water quality	S32C
18945	-32.00250	26.82222	Borehole, water quality	S32H
19099	-32.00194	26.89278	Borehole, water quality	S31G
19210	-32.00167	26.71083	Borehole, water quality	S32C
19096	-32.00139	26.88278	Borehole, water quality	S31G
18948	-32.00056	26.80833	Borehole, water quality	S32H
19100	-31.99917	26.89361	Borehole, water quality	S31G
19196	-31.99917	27.07528	Borehole, water quality	S32J
19408	-31.99806	26.64056	Borehole, water quality	S32C
19101	-31.99639	26.95139	Borehole, water quality	S31G
19209	-31.99417	26.69528	Borehole, water quality	S32C
19197	-31.99222	27.05389	Borehole, water quality	S32J
ESSEX	-31.99083	26.99056	Borehole, water quality	S31G
18947	-31.98639	26.84139	Borehole, water quality	S31G
19102	-31.98556	26.94194	Borehole, water quality	S31G
19199	-31.98500	26.99889	Borehole, water quality	S32J
18946	-31.98250	26.82778	Borehole, water quality	S31G
DICKENSTONE	-31.97528	26.79722	Borehole, water quality	S31G
19103	-31.97444	26.93333	Borehole, water quality	S31G
ILINGE	-31.97167	27.05278	Borehole, water quality	S32J
30458	-31.96833	26.58972	Borehole, water quality	S32C
19207	-31.96833	26.70389	Borehole, water quality	S32C
30459	-31.96806	26.58889	Borehole, water quality	S32C
19091	-31.96778	26.84444	Borehole, water quality	S31G
18951	-31.96750	26.81500	Borehole, water quality	S31G
18950	-31.96722	26.79139	Borehole, water quality	S31G

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
FORDYCEFONTEIN	-31.96611	26.71694	Borehole, water quality	S32C
THORNHILL	-31.96500	26.61250	Borehole, water quality	S32C
18942	-31.96361	26.81917	Borehole, water quality	S31G
19095	-31.96194	26.92444	Borehole, water quality	S31G
19094	-31.95917	26.90917	Borehole, water quality	S31G
19202	-31.95889	26.97806	Borehole, water quality	S31G
18940	-31.95694	26.78139	Borehole, water quality	S31G
19205	-31.95694	26.83111	Borehole, water quality	S31G
19205	-31.95694	26.83111	Borehole, water quality	S31G
19203	-31.95583	26.97056	Borehole, water quality	S31G
19208	-31.95333	26.69222	Borehole, water quality	S32C
19085	-31.95333	26.80444	Borehole, water quality	S31G
19087	-31.95139	26.82361	Borehole, water quality	S31G
19084	-31.95083	26.78083	Borehole, water quality	S31G
19204	-31.95056	26.79083	Borehole, water quality	S31G
ROODE-KRANTZ	-31.95000	26.78333	Borehole, water quality	S31G
19082	-31.94639	26.79611	Borehole, water quality	S31G
18949	-31.94528	26.79972	Borehole, water quality	S31G
18937	-31.94444	26.87056	Borehole, water quality	S31G
18939	-31.94389	26.84306	Borehole, water quality	S31G
19086	-31.94361	26.81250	Borehole, water quality	S31G
18952	-31.94194	26.75250	Borehole, water quality	S31G
18935	-31.94167	26.89944	Borehole, water quality	S31G
19083	-31.94056	26.79778	Borehole, water quality	S31G
18941	-31.94000	26.76611	Borehole, water quality	S31G
18957	-31.93917	26.74111	Borehole, water quality	S31G
19404	-31.93861	26.80111	Borehole, water quality	S31G
18936	-31.93389	26.86583	Borehole, water quality	S31G
19586	-31.93333	26.80000	Borehole, water quality	S31G
18928	-31.93278	26.80556	Borehole, water quality	S31G
3126CD00103	-31.92989	26.38517	Borehole, water quality	S32B
19206	-31.92944	26.82778	Borehole, water quality	S31G
18938	-31.92861	26.84889	Borehole, water quality	S31G
18930	-31.92500	26.81639	Borehole, water quality	S31G
19406	-31.92250	26.65194	Borehole, water quality	S31E
18943	-31.92000	26.77889	Borehole, water quality	S31E
18931	-31.92000	26.82278	Borehole, water quality	S31G
19409	-31.91750	26.64000	Borehole, water quality	S31E
1699	-31.91667	26.65000	Borehole, water quality	S31E
19405	-31.91667	26.66167	Borehole, water quality	S31E
18944	-31.91639	26.79139	Borehole, water quality	S31G

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
19088	-31.91556	26.76389	Borehole, water quality	S31E
19090	-31.91556	26.77500	Borehole, water quality	S31E
18932	-31.91528	26.82750	Borehole, water quality	S31G
19403	-31.91500	26.78389	Borehole, water quality	S31E
3126DC00423	-31.91472	26.61861	Borehole, water quality	S31E
ZOLA	-31.91472	26.62083	Borehole, water quality	S31E
ZOLA	-31.91472	26.62083	Borehole, water quality	S31E
18933	-31.91333	26.81583	Borehole, water quality	S31G
WAAYPOORT	-31.91222	26.73611	Borehole, water quality	S31E
18927	-31.91167	26.83889	Borehole, water quality	S31G
19089	-31.91111	26.78750	Borehole, water quality	S31E
18953	-31.91056	26.77083	Borehole, water quality	S31E
WELTEVREEDEN	-31.90861	26.80417	Borehole, water quality	S31G
DOORN-HOEK	-31.90639	26.78139	Borehole, water quality	S31E
18934	-31.90583	26.83278	Borehole, water quality	S31F
18929	-31.90361	26.83694	Borehole, water quality	S31F
19407	-31.90222	26.64000	Borehole, water quality	S31E
1700	-31.90000	26.63333	Borehole, water quality	S31E
BOWKERSPARK	-31.89750	26.74556	Borehole, water quality	S31E
18955	-31.89583	26.74750	Borehole, water quality	S31E
TURVEU`S-POST	-31.89306	26.59167	Borehole, water quality	S31E
ZQMQSN1	-31.89306	26.59167	Borehole, water quality	S31E
19410	-31.89278	26.59472	Borehole, water quality	S31E
PLAATTAFELBERG	-31.89278	26.59694	Borehole, water quality	S31E
18954	-31.89167	26.70417	Borehole, water quality	S31E
19411	-31.88500	26.59806	Borehole, water quality	S31E
1698	-31.88333	26.58333	Borehole, water quality	S31E
18956	-31.87222	26.71722	Borehole, water quality	S31E
BECKERSFONTEIN	-31.85889	26.70444	Borehole, water quality	S31E
3126DD00623	-31.85306	26.76833	Borehole, water quality	S31D
3126DD00551	-31.85167	26.77583	Borehole, water quality	S31D
OCHTER-MITHIL	-31.84944	26.38444	Borehole, water quality	S31C
3126DD00624	-31.84639	26.76250	Borehole, water quality	S31D
3126DC00415	-31.83111	26.73639	Borehole, water quality	S31D
3126DC00410	-31.83028	26.73306	Borehole, water quality	S31D
3126DC00325	-31.81000	26.73528	Borehole, water quality	S31D
BAILEY	-31.80000	26.73333	Borehole, water quality	S31D
HUNTERS-HILL	-31.79556	26.44250	Borehole, water quality	S31C
27379	-31.73417	26.47639	Borehole, water quality	S31C
BOMBANI	-31.73333	26.66667	Borehole, water quality	S31E
27367	-31.72111	26.55278	Borehole, water quality	S31B

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
HARTFONTEIN	-31.71944	26.30528	Borehole, water quality	S31C
27368	-31.64583	26.40917	Borehole, water quality	S31C
LE-GRANGE-EST	-31.61917	26.56083	Borehole, water quality	S31A
24415	-31.60250	26.54944	Borehole, water quality	S31B
24414	-31.59694	26.52056	Borehole, water quality	S31B
24408	-31.58611	26.51500	Borehole, water quality	S31B
24412	-31.57556	26.47250	Borehole, water quality	S31B
24411	-31.57333	26.49556	Borehole, water quality	S31B
STRATHFIELD	-31.56833	26.68000	Borehole, water quality	S31A
PRIMGRADIA	-31.55806	26.66667	Borehole, water quality	S31A
24406	-31.54861	26.49639	Borehole, water quality	S31B
3126DA00282	-31.54861	26.55056	Borehole, water quality	S31A
3126DA00246	-31.54528	26.55222	Borehole, water quality	S31A
27374	-31.54250	26.55333	Borehole, water quality	S31A
ZQMSSM2	-31.54250	26.55333	Borehole, water quality	S31A
24407	-31.54111	26.49139	Borehole, water quality	S31B
ZQMSSM3	-31.54028	26.55289	Borehole, water quality	S31A
PIET-KUIL	-31.53694	26.62250	Borehole, water quality	S31A
24413	-31.52972	26.59333	Borehole, water quality	S31A
24409	-31.52861	26.63639	Borehole, water quality	S31A
27371	-31.52472	26.44611	Borehole, water quality	S31B
24410	-31.51472	26.64528	Borehole, water quality	S31A
27369	-31.44056	26.61389	Borehole, water quality	S31A

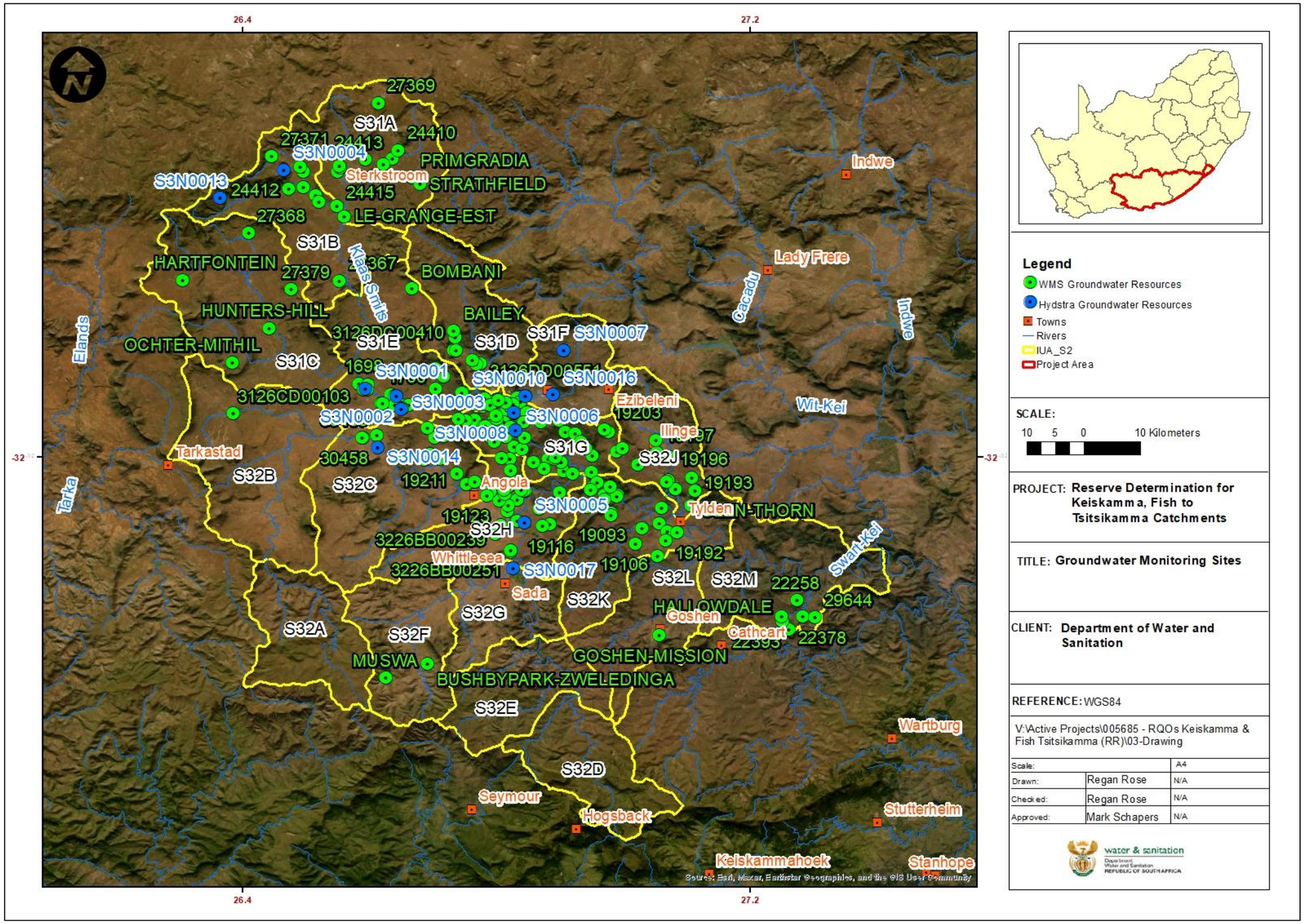


Figure 18: Monitoring sites in IUA 14 (S2)

5.15 IUA_S03: Lower Great Kei

IUA Description	Lower Great Kei
	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is moderately stressed in certain areas.
GW RU	GW_RU38
	GW_RU39

The monitoring sites in IUA 15 (S3) include Hydstra and WMS sites. These monitoring sites are summarised in Table 16 and provided in Figure 19**.** A total of twenty three (23) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 48 and Figure 49, respectively in Appendix A.

Table 16: Monitoring sites in IUA 15 (S3)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
S7N0001	-32.57722	27.88444	Borehole, water level	S70A
S7N0002	-32.57758	27.88506	Borehole, water level	S70A
S7N0003	-32.31150	28.07159	Borehole, water level	S70E
MIRITE-FARM	-32.61667	27.43333	Borehole, water quality	S60A
QUOIN	-32.59694	27.65889	Borehole, water quality	S60B
27372	-32.58528	27.87389	Borehole, water quality	S70A
22292	-32.58333	27.86250	Borehole, water quality	S70A
5459	-32.58056	27.88278	Borehole, water quality	S70A
ZQMKMG1	-32.58056	27.88278	Borehole, water quality	S70A
22291	-32.57500	27.88306	Borehole, water quality	S70A
22391	-32.56667	27.96667	Borehole, water quality	S70F
29584	-32.55667	27.32639	Borehole, water quality	S60A
22388	-32.55000	27.96667	Borehole, water quality	S70A
27007	-32.52694	27.45750	Borehole, water quality	S60C
27373	-32.51000	27.46722	Borehole, water quality	S60C
ZQMSTH1	-32.51000	27.46722	Borehole, water quality	S60C
HOVE	-32.46139	27.35417	Borehole, water quality	S60C
HECKEL	-32.45806	27.54444	Borehole, water quality	S60D
ESIGINGQINI	-32.40472	28.19972	Borehole, water quality	S70E
15684	-32.30528	27.97000	Borehole, water quality	S70A
THEMBENI-EBIKA	-32.29806	28.19750	Borehole, water quality	S70D
EMANTUNZELENI	-32.24871	28.04810	Borehole, water quality	S70E
NQAMAKWE	-32.20729	27.94589	Borehole, water quality	S70D

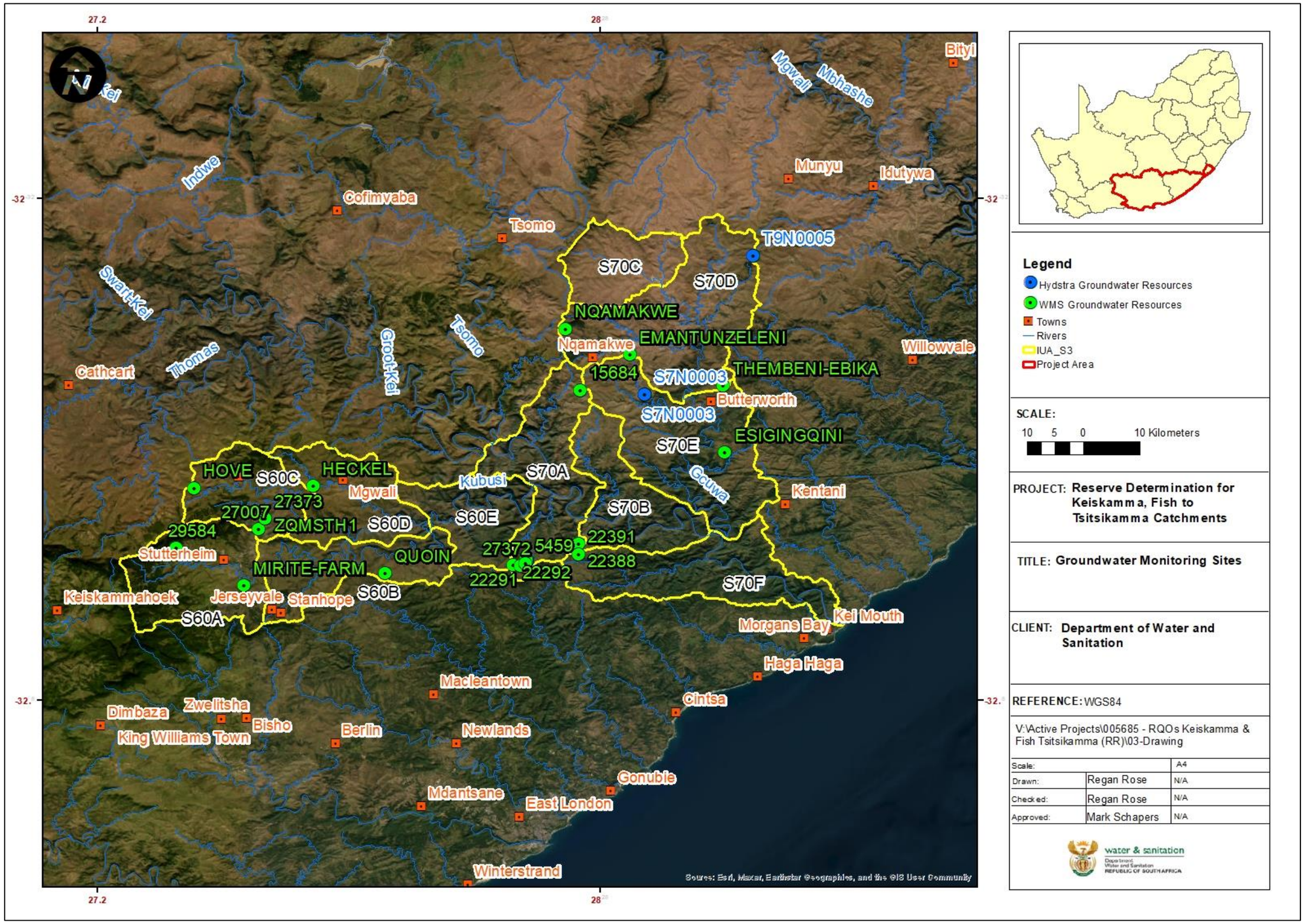


Figure 19: Monitoring sites in IUA 15 (S3)

5.16 IUA_T01: Upper Mbashe, Upper Mthatha

IUA Description	Upper Mbashe, Upper Mthatha
	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is mildly to highly stressed in certain areas.
GW RU	GW_RU40
	GW_RU41
	GW_RU42

The monitoring sites in IUA 16 (T1) include Hydstra and WMS sites. These monitoring sites are summarised in Table 17 and provided in Figure 20**.** A total of forty three (43) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 50 and Figure 51, respectively in Appendix A.

Table 17: Monitoring sites in IUA 16 (T1)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
T1N0001	-31.33261	27.85320	Borehole, water level	T11A
T1N0002	-31.86120	27.84752	Borehole, water level	T12D
T1N0003	-31.74740	27.77098	Borehole, water level	T12C
T1N0004	-31.77890	27.90253	Borehole, water level	T12C
T1N0005	-31.71747	27.95005	Borehole, water level	T12B
T1N0006	-31.73430	28.14605	Borehole, water level	T12F
T1N0007	-31.63560	28.11393	Borehole, water level	T11C
T1N0008	-31.61890	28.16621	Borehole, water level	T11F
T1N0009	-31.58170	27.83217	Borehole, water level	T12A
ZQMNOB1	-31.88861	27.83917	Borehole, water quality	T12D
LOWER-MAKWABABA	-31.85556	27.92056	Borehole, water quality	T12D
EHUKWINI	-31.84667	28.04722	Borehole, water quality	T12D
BASHEE-HILL-A	-31.80139	28.37556	Borehole, water quality	T11H
3128CD00069	-31.80111	28.36333	Borehole, water quality	T11H
3128CD00064	-31.79583	28.35194	Borehole, water quality	T11H
LUHEWINI	-31.70139	28.12222	Borehole, water quality	T12F
SIKOBENI	-31.69722	27.94222	Borehole, water quality	T12B
NKONDLO	-31.66083	28.23667	Borehole, water quality	T11C
ENGXOGI	-31.64333	28.19389	Borehole, water quality	T11F
3128CB00040	-31.64167	28.48972	Borehole, water quality	T11G
3128CB00021	-31.63861	28.35694	Borehole, water quality	T11G
3128CB00031	-31.63250	28.45583	Borehole, water quality	T11G

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
3128CB00024	-31.63167	28.39277	Borehole, water quality	T11G
3128CB00023	-31.62723	28.39139	Borehole, water quality	T11G
3128CB00025	-31.62389	28.43139	Borehole, water quality	T11G
3128CB00039	-31.61778	28.48417	Borehole, water quality	T11G
3128CB00034	-31.61388	28.47055	Borehole, water quality	T11G
3128CB00020	-31.61306	28.38056	Borehole, water quality	T11G
3128CB00033	-31.59750	28.40194	Borehole, water quality	T11G
3128CB00035	-31.59611	28.41888	Borehole, water quality	T11G
3128CB00030	-31.59444	28.39666	Borehole, water quality	T11G
3128CB00028	-31.59277	28.40750	Borehole, water quality	T11G
3128CB00029	-31.59027	28.39138	Borehole, water quality	T11G
3128CB00027	-31.59027	28.42194	Borehole, water quality	T11G
3128CB00037	-31.58199	28.45805	Borehole, water quality	T11G
3127DB00028	-31.55439	27.98817	Borehole, water quality	T11C
27359	-31.41389	28.04139	Borehole, water quality	T11E
DUIRA	-31.41306	27.97361	Borehole, water quality	T11B
RONDAVEL-HOEK	-31.37333	28.24778	Borehole, water quality	T11D
HOME-ELLIOT-SMALL-GRAN	-31.34778	28.18472	Borehole, water quality	T11D
CLOETA	-31.34278	27.79139	Borehole, water quality	T11A
ZQMELT1	-31.32944	27.85583	Borehole, water quality	T11A
10969	-31.30000	28.12667	Borehole, water quality	T11D

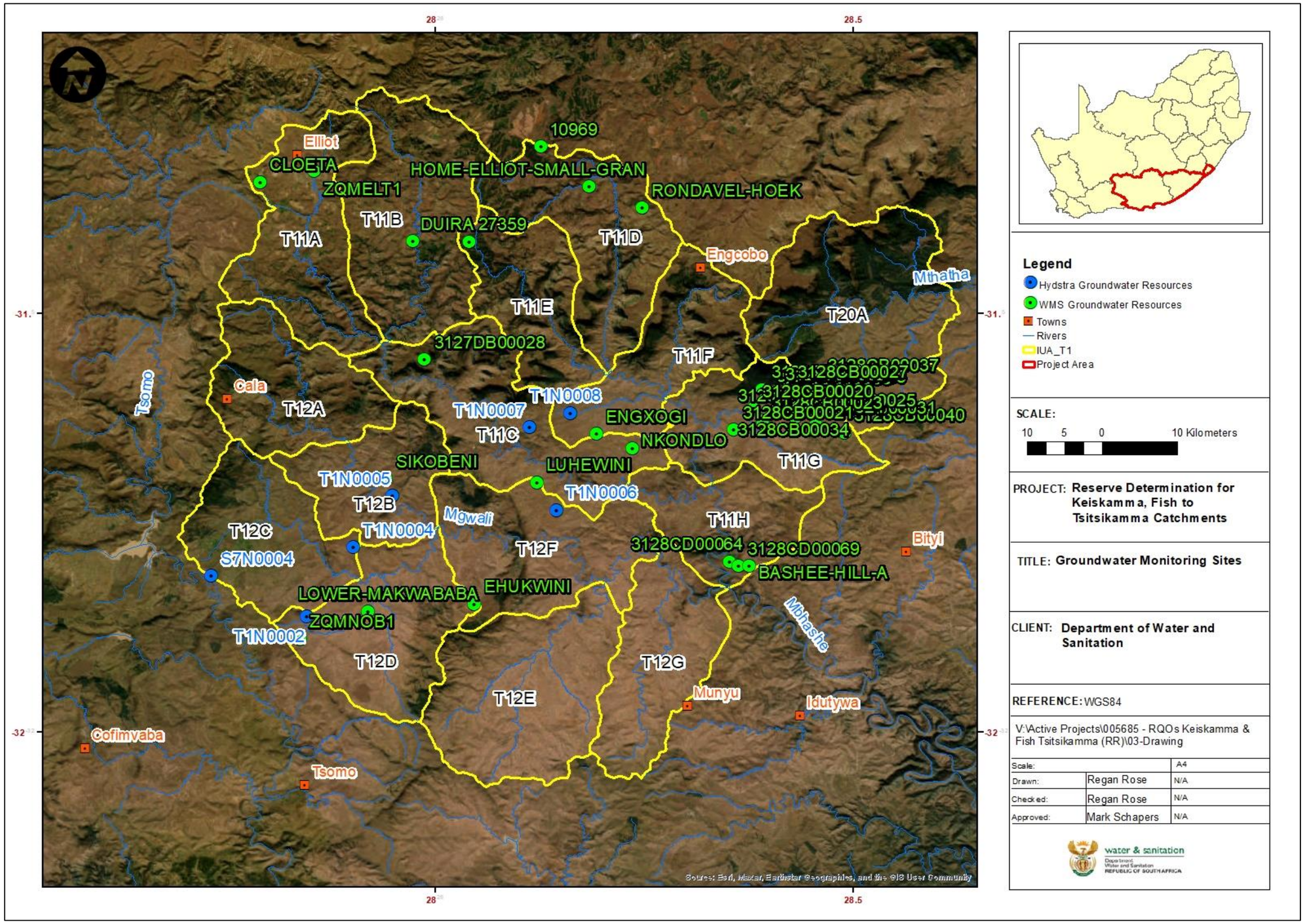


Figure 20: Monitoring sites in IUA 16 (T1)

5.17 IUA_T02: Lower Mbashe

IUA Description	Lower Mbashe
	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is mildly stressed in certain areas.
GW RU	GW_RU43

The monitoring sites in IUA 17 (T2) include only WMS sites. These monitoring sites are summarised in Table 18 and provided in Figure 21. A total of ten (10) monitoring sites exist for this IUA. Time series data of water quality (using EC as overall indicator) is presented in Figure 52 in Appendix A.

Table 18: Monitoring sites in IUA 17 (T2)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
EC/T13/278	-31.99686	28.70633	Borehole, water quality	T13D
KUMJELO	-31.96000	28.32111	Borehole, water quality	T13C
3128CD00061	-31.84666	28.44972	Borehole, water quality	T13A
3128CD00066	-31.84416	28.45055	Borehole, water quality	T13A
3128CD00068	-31.83833	28.45694	Borehole, water quality	T13A
3128CD00070	-31.83222	28.41111	Borehole, water quality	T13A
3128CD00065	-31.82388	28.37388	Borehole, water quality	T13A
3128CD00062	-31.81860	28.44638	Borehole, water quality	T13A
3128CD00067	-31.81555	28.43666	Borehole, water quality	T13A
3128CD00063	-31.80500	28.43611	Borehole, water quality	T13A

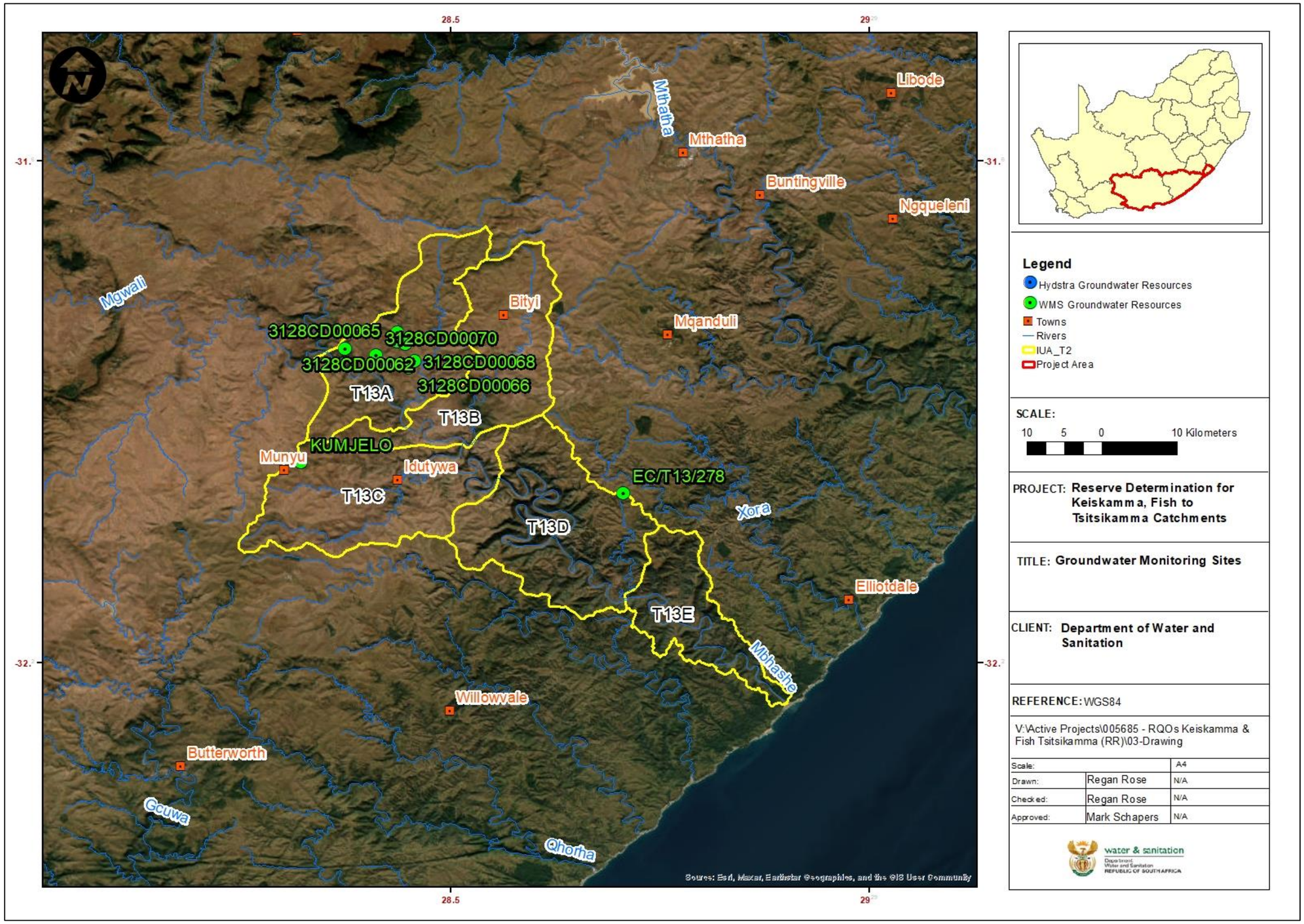


Figure 21: Monitoring sites in IUA 17 (T2)

5.18 T3 IUA_T03: Lower Mthatha

IUA Description	Lower Mthatha
	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. The IUA is moderately stressed in certain areas.
GW RU	GW_RU44

The monitoring sites in IUA 18 (T3) include Hydstra and WMS sites. These monitoring sites are summarised in Table 19 and provided in Figure 22**.** A total of sixteen (16) monitoring sites exist for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 53 and Figure 54, respectively in Appendix A.

Table 19: Monitoring sites in IUA 18 (T3)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
T2N0001	-31.64392	28.71503	Borehole, water level	T20C
T2N0002	-31.73361	28.69083	Borehole, water level	T20F
T2N0003	-31.66702	28.93310	Borehole, water level	T20E
T2N0004	-31.86190	28.76823	Borehole, water level	T20F
VIEDGESVILLE	-31.73300	28.68300	Borehole, water quality	T20C
ZQMYFM1	-31.64400	28.71500	Borehole, water quality	T20C
27382	-31.56200	28.67100	Borehole, water quality	T20C
31240	-31.50800	28.61500	Borehole, water quality	T20B
3128BC00017	-31.50000	28.64600	Borehole, water quality	T20B
3128BC00015	-31.50000	28.64900	Borehole, water quality	T20B
3128BC00016	-31.49000	28.65900	Borehole, water quality	T20B
3128BC00014	-31.48900	28.64900	Borehole, water quality	T20B
3128BC00018	-31.48900	28.66100	Borehole, water quality	T20B
3128BC00012	-31.48100	28.64100	Borehole, water quality	T20B
3128BC00013	-31.48000	28.66600	Borehole, water quality	T20B
3128BC00019	-31.47500	28.62800	Borehole, water quality	T20B

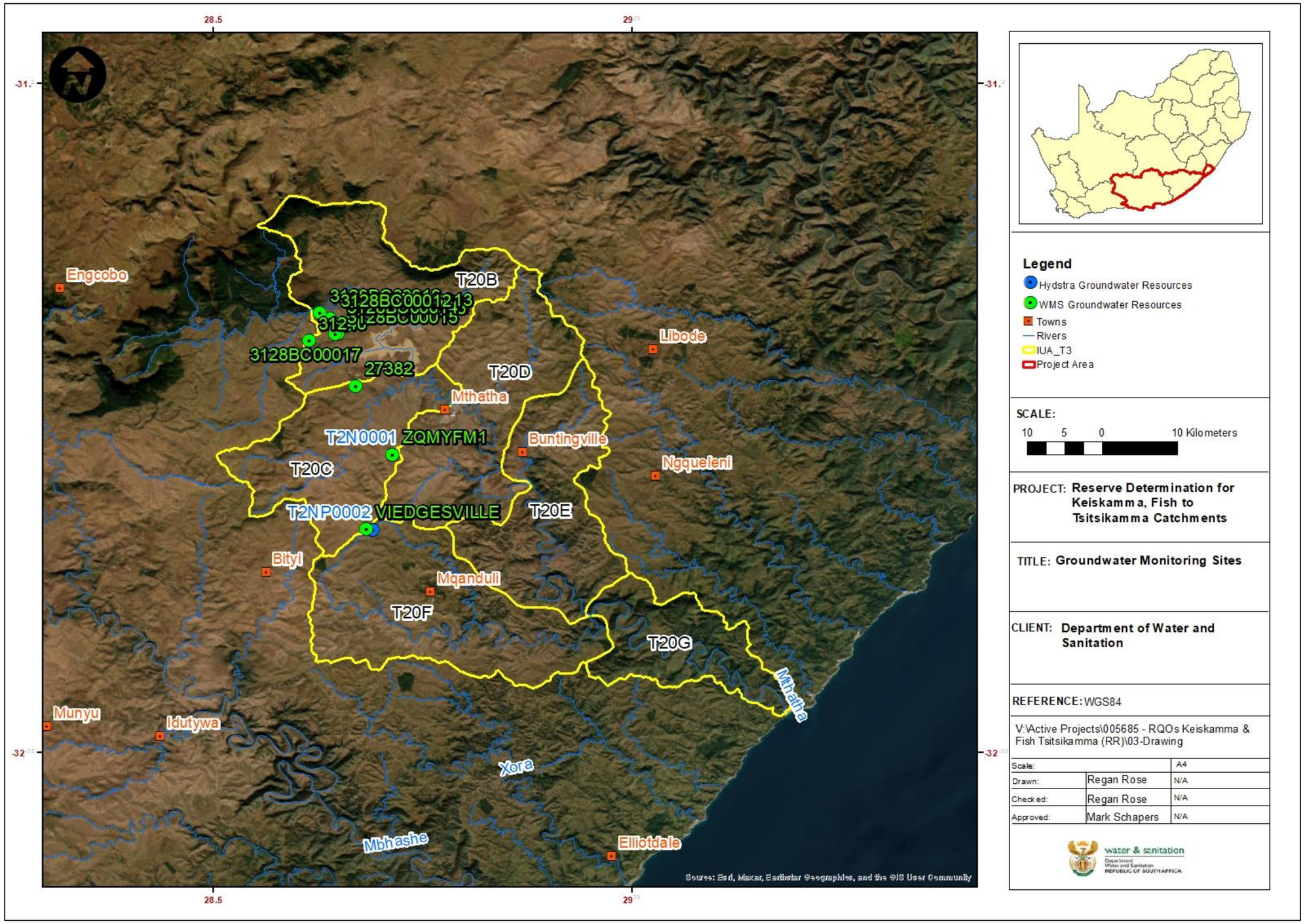


Figure 22: Monitoring sites in IUA 18 (T3)

5.19 IUA_T04: Pondaland Coastal

IUA Description	Pondaland Coastal
	The aquifer is of an intergranular and fractured type associated with the Karoo Supergroup, as well as the presence of dolerite sills and dykes. There are no stressed areas in the IUA
GW RU	GW_RU45
	GW_RU46
	GW_RU47
	GW_RU48

The monitoring sites in IUA 19 (T4) include Hydstra and WMS sites. These monitoring sites are summarised in Table 20 and provided in Figure 23**.** A total of thirty two (32) monitoring sites exists for this IUA. Time series data of water levels and water quality (using EC as overall indicator) is presented in Figure 55 and Figure 56, respectively in Appendix A.

Table 20: Monitoring sites in IUA 19 (T4)

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
T6N0001	-31.36484	29.56955	Borehole, water level	T60F
T6N0003	-31.19725	29.74789	Borehole, water level	T60C
T6N0004	-31.19928	29.80521	Borehole, water level	T60G
T7N0001	-31.45881	28.96275	Borehole, water level	T70A
T7N0002	-31.52139	29.08308	Borehole, water level	T70B
T9N0001	-32.47020	28.31941	Borehole, water level	T90G
T9N0002	-32.43630	28.45978	Borehole, water level	T90F
T9N0003	-32.28650	28.80700	Borehole, water level	T90B
T9N0004	-32.06880	28.29755	Borehole, water level	T90A
T9N0005	-32.09040	28.24459	Borehole, water level	T90A
EC/T90/876	-32.43626	28.45978	Borehole, water quality	T90F
EC/T90/881	-32.37882	28.68222	Borehole, water quality	T90C
ZQMTKA2	-32.34444	28.26972	Borehole, water quality	T90G
BOJENI	-32.33250	28.58583	Borehole, water quality	T90E
MPUME	-32.28645	28.80700	Borehole, water quality	T90B
NQADU	-32.22306	28.39528	Borehole, water quality	T90E
GQUPU	-32.18833	28.33528	Borehole, water quality	T90A
QAKAZANA-FORTMALAN	-32.16665	28.51736	Borehole, water quality	T90C
EC/T80/158	-32.14133	28.86996	Borehole, water quality	T80D
IDUTYWA-COMMONAGE	-32.10693	28.33414	Borehole, water quality	T90A

Site Name	Latitude	Longitude	Monitoring Site Type	Quaternary Catchment
21799	-32.09000	28.41444	Borehole, water quality	T90A
COLOSA	-32.07056	28.33000	Borehole, water quality	T90A
EC/T90/980	-32.06879	28.29755	Borehole, water quality	T90A
EC/T90/209	-32.06870	28.33956	Borehole, water quality	T90A
TOMBO	-31.63111	29.37500	Borehole, water quality	T70D
LOWER-NTAFUFU	-31.54278	29.53972	Borehole, water quality	T60K
MZINTLAVA	-31.43444	29.52889	Borehole, water quality	T60J
TRACOR-LUSIKISIKI	-31.35889	29.71444	Borehole, water quality	T60H
27672	-31.08389	30.15222	Borehole, water quality	T60A
ZQMLAN1	-31.05944	29.51389	Borehole, water quality	T60B
IMIZIZI	-30.97250	29.99528	Borehole, water quality	T60A
EKSIKUMBENI	-30.84306	29.77417	Borehole, water quality	T60A

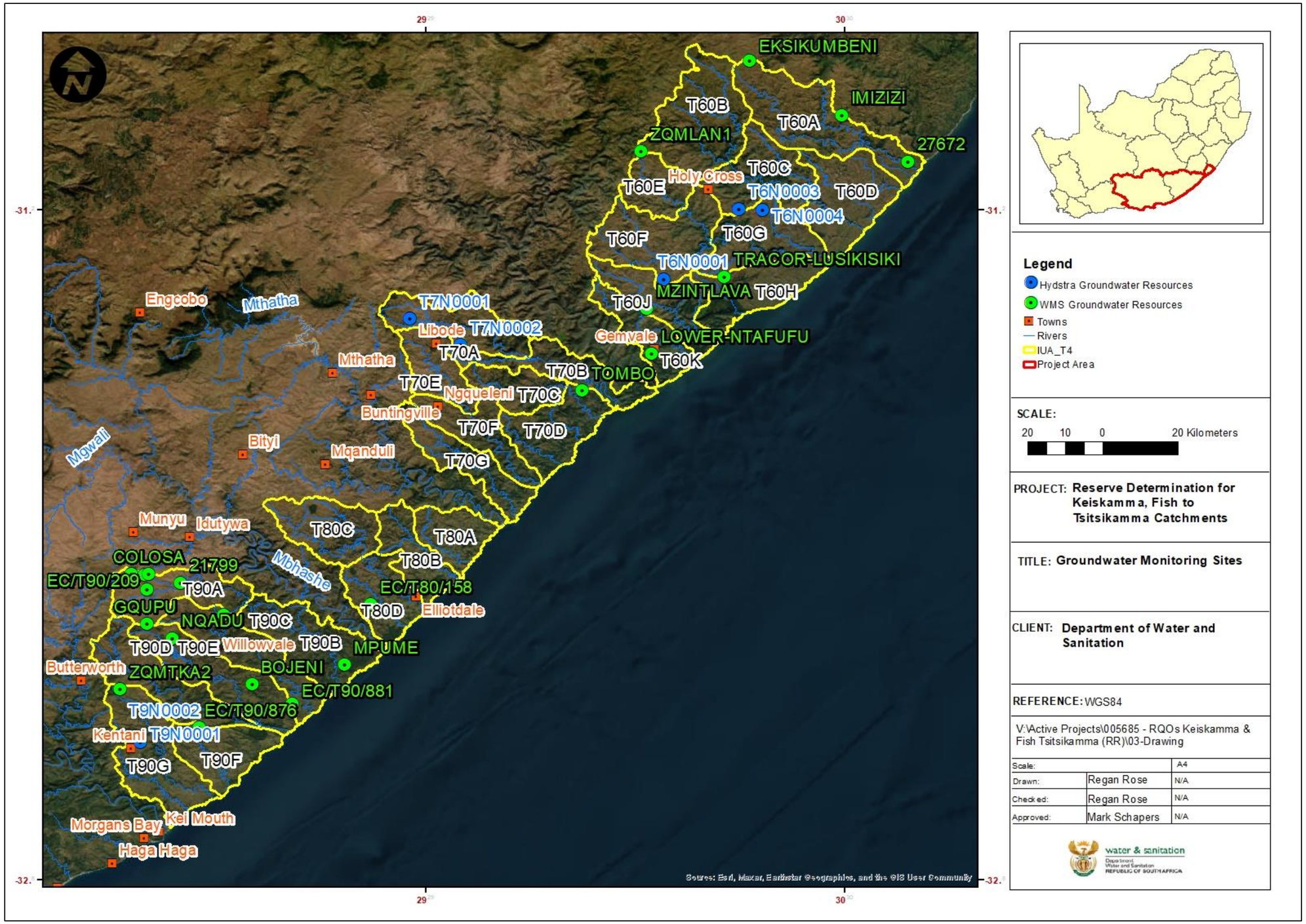


Figure 23: Monitoring sites in IUA 19 (T4)

6. RESOURCE DIRECTED MEASURES

6.1 Preliminary Groundwater Reserve Determination

6.1.1 Approach

The methodology for the groundwater component of the Reserve is well documented in WRC (2007) and later updated in WRC (2012). The Reserve is defined as the water that is set aside to 1) provide for basic human needs (BHN), and 2) protect water ecosystems (sustain healthy ecosystems). The procedure for determining the Reserve involves an eight step process. Step 1 is to "Initiate the basic human needs and ecological water requirements (EWR) assessment". This involves quantification of the volume of groundwater needed for BHN and contributing to EWR.

The current GRDM is currently under review by a consortium of specialists from the University of the Western Cape and University of the North West, respectively, under the auspices of the Water Research Commission. An update of the GRDM methodology and software is expected in 2024.

According to WRC (2012), the groundwater component of the Reserve is defined by the following equation:

Reserve (%) = EWR_{gw} + BHN_{gw}/Re x 100

Where:

Re = Recharge

BHN_{gw} = Basic human needs derived from groundwater

EWR_{gw} = Groundwater contribution to EWR

Whilst the BHN derived from groundwater are set at 25l/p/day, recharge and groundwater contribution to EWR require additional care. Chapter 8 of the WRC (2012) provides estimation tools for both recharge and groundwater contribution to EWR. The appropriate selection of tools depends on availability of data.

6.1.2 Groundwater Recharge

WRC (2012) provides several tools for the determination of groundwater recharge. These tools include the following:

- National scale Maps
- Chloride mass balance method
- Earth Model
- Cumulative rainfall departure method
- Saturated volume fluctuation method
- Isotopes

The above tools have been packaged into a comprehensive Excel-based Recharge toolkit produced by DWS in 2000. Depending on data availability, several methods can be employed simultaneously to produce recharge estimations of specific areas as defined by the user. The Chloride Mass Balance (CMB), Saturated Volume Fluctuation (SVF) and Cumulative Rainfall Departure (CRD) methods generally produce the highest confidence levels (weighting of 4) with recharge estimations. However, they require very detailed data relating to monthly water levels, rainfall and abstraction, which is not always available on larger catchment scale assessments.

The next level of recharge estimation is through qualified guesses using national scale maps of soil, geology, Vegter Groundwater Recharge, ACRU, Harvest Potential and expert guesses (where available through specialist studies and research). These methods generally produce a slightly lower confidence (weighting of 3) compared to the methods described in the previous paragraph.

The final level of recharge estimation in accordance with the Recharge Toolkit is through additional methods such as Baseflow, Isotopes, Earth Model and Groundwater Flow Model. These methods, however, have the lowest confidence (weighting of 1).

Based on the available data, the Recharge toolkit was used to determine recharge per quaternary catchment. Recharge was estimated for of the three hundred and forty five (345 No.) quaternary catchments in the study area. Mean annual precipitation from WR 2012 datasets was used to calculate the mean recharge for each quaternary catchment. A summary of recharge for the quaternary catchments present within the Catchment is presented in Appendix B (Table 22)**.** Recharge estimation was mainly based on CMB and CRD methods, where possible, as well as qualified guesses in cases of insufficient data.

6.1.3 Basic Human Needs

As defined by the Water Services Act (Act No. 108 of 1997) “basic water supply” means the prescribed minimum standard of water supply services necessary for the reliable supply of a sufficient quantity and quality of water to households, including informal households, to support life and personal hygiene. The Reconstruction and Development Programme’s (RDP) target of 25 litres per person per day has generally been accepted as the standard quantum for the purposes of the Basic Human Need (BHN).

The Stats SA 2011 census data was used to determine population reliant on water resource, as the data is represented on a ward level. This was in accordance with DWS, 2017, which describes standardised input of BHN determination.

The Census data was adjusted to 2021 population using Eastern Cape growth rate of 0.8. The BHNR is therefore for the year 2021. It is acknowledged that population growth rates will vary, specifically between the rural and urban areas; however, this generic growth rate is considered acceptable for projection purposes.

The following methodology steps were used to quantify persons reliant on water resources:

- Persons with access to piped water (formal supply) were not considered to qualify for under the BHNR.
- Persons using surface water and groundwater were separated.
- Wards as provided in Stats SA Census 2011, do not align completely with quaternary catchments, several approaches were used to identify population reliance on water resource:
    - Wards that fell completely into a quat were identified

- For wards that fell partially into bigger quats, and for bigger wards that had multiple quats, google earth was used as a supporting tool to make judgment on what percentage of the ward population fall into the quat.

- Using the population figures a BHNR for the qualifying population was estimated per quaternary catchment. The results were calculated at 25 l per person per day.

It was estimated that out of 6.1 million people in the study area, 1.3 million people are reliant on surface water (i.e., 21 percent) 162,135 on ground water for the same year. BHN was for 25l/person/day and it was estimated at 12.57Mm^3/annum for surface water and 1.47Mm^3/annum for groundwater. The data for the groundwater BHN for the catchment is provided in Appendix C (Table 23).

6.1.4 Groundwater Contribution to Baseflow

WRC (2012) provides several tools for the determination of groundwater contribution to baseflow. These include the following:

- Herold method of baseflow separation, which is one of the most common methods used in South Africa to determine the groundwater contribution to flow in a river.
- Recession curve by Moore is the specific part of the hydrograph after the crest (and the rainfall event) where streamflow diminishes. The slope of the recession curve flattens over time from its initial steepness as the quickflow component passes and baseflow becomes dominant.
- Stang and Hunt's analytical solution for a homogeneous, isotropic aquifer of infinite lateral extent, with dominant lateral flow and constant T (Dupuit flow), overlain by an infinitely thin stream with a semi-pervious layer.
- The (Laplace-space) solution of Butler et al. (2001) considers, in addition to a partially penetrating stream underlain by a semi-pervious layer, an aquifer of finite lateral extent. Bounded or strip aquifers are frequently observed in valleys and for alluvial aquifers consisting of river sediments (river trains).
- The (semi-analytical) solution of Chen & Yin (2004) is a solution for a partially penetrating stream, adding a gradient between the aquifer and the gaining river.
- The Système Hydrologique Européen (SHE) is a physically based distributed hydrological numerical modelling system that integrates surface and subsurface flow (including unsaturated vertical flow) on a catchment scale.
- MODFLOW – SFR1 (numerical model): The STREAMFLOW ROUTING, package SFR1, allows for water in-/outflows from run-off, precipitation and evapotranspiration within each reach. In comparison to the RIVER or BRANCH packages, the hydraulic conductance of the riverbed is calculated from input data (hydraulic conductivity, thickness, stream length and stream width) or computed based on streamflow (conductance as a function of river width).
- MODFLOW – SFR2 (numerical model): An extension of the SFR2 package by Niswonger and Prudic (2005) allows modelling the unsaturated vertical flow between streams and aquifers, hence enabling the description of, for example, limited leakage due to the relative permeability of the unsaturated zone.
- The groundwater contribution to the wetland can be estimated using Darcy's Law, which states that the rate of flow through a porous medium is proportional to the loss of head, and inversely proportional to the length of the flow path.

Baseflow is the portion of streamflow that is not directly generated from the excess rainfall during a storm event. It is the flow that would exist in the stream without the contribution of direct runoff from

the rainfall. Separation of baseflow and direct runoff is useful to understand the hydrology of a catchment, including the interaction of surface and sub-surface water.[1]Observed baseflows are rarely available and are limited to focused pilot studies. Fortunately, a plethora of simple to complex tools exist to facilitate the separation of baseflow, the selection of which tool to use is often based on assumptions that may not be fully met depending on the catchment and availability of hydrological data. Ideally measured streamflow records of long duration, at shorter time intervals are required to properly characterize flow hydrographs as baseflow separation techniques are better suited to analyzing hydrographs for individual rainfall-runoff events. For this study, only monthly surface flow data was available for 345 quaternary catchments, and consequently traditional separation techniques could not be used.

In consultation with the civil engineering department at the University of Pretoria, a simplistic technique of baseflow separation was devised that could provide reasonable results based on the limited available data. The technique considers the monthly flow during dry months, specifically extracting the lowest average monthly flows during dry months. A desktop analysis was conducted using these lowest monthly flows as a proxy for baseflow. Various options exist including using the single lowest, two lowest or three lowest monthly flows. In this assessment, all three options were considered, and sensitivity analysis conducted to determine the significance of the differences between the three options. The results indicated an insignificant difference, and therefore an average of the results from the three options were used to determine the baseflow. A summary of the data is presented in Table 21. The data for the catchment is provided in Appendix D (Table 24).

Table 21: Summary of baseflow results

	Quaternary	Average Annual total flow (Mm^3/m)	Baseflow (Mm^3/m)
Maximum Baseflow (Mm^3/m)	K80B	88.5	5.52
Minimum Baseflow (M^3/m)	L30C	0.96	0.02

[1] Baseflow Separation Using Straight Line Method (carleton.edu)

7. CONCLUSION

This report details the findings of the groundwater status quo in the catchment and provides estimates of the Groundwater Reserve. The available monitoring data, which comprises of groundwater levels, groundwater quality and surface flow were assessed to determine as far possible the groundwater components of the Reserve. In accordance with WRC (2012), components of the Groundwater Reserve include groundwater recharge, BHN for groundwater, as well as groundwater contribution to baseflow. Using the available data, the latter components were estimated to determine the Groundwater Reserve for each quaternary catchment as a percentage, as well as the volume of groundwater that contributes to sustaining the surface water EWR and BHN indicated in million cubic metres. Please refer to Appendix E (Table 25). Overall, the Groundwater Reserve varies significantly across the catchment from a low of 1.45% in L60B to a high of 327.30% in K80A.

Several limitations were identified during this assessment relating to the following:

1) Lack of monthly rainfall and abstraction data to determine more detailed groundwater recharge calculations. Although WR 2012 rainfall data was used, the data is only until end-2009.
2) Lack of rainfall chemistry data for detailed groundwater recharge calculations. In the absence of rainfall chemistry data, a default value of 0.97mg/l for inland rainfall was used as prescribed by the Recharge Toolkit.
3) Incomplete surface flow monitoring data. Although WR 2012 flow data was used, the data is only until end-2009.
4) The GRDM methodology is currently being updated and will only be available in 2024. The current assessment is therefore based on WRC (2012) methodology.

Due to the above-mentioned limitations, this report must be treated as an initial assessment for estimations of the groundwater component of the Reserve in the catchment. This needs to be updated once more detailed data and information become available.

8. RECOMMENDATIONS

Based on the results of the current assessment, the following are recommended:

- Conduct rainfall sampling and laboratory analysis at strategic locations within the catchment
    - Laboratory analysis must include chloride as a minimum
- Establish and implement an improved regional groundwater monitoring plan. Utilise the outcomes of the current and future assessments to implement and improve the existing regional groundwater monitoring plan.
- Conduct a follow up on compliance of groundwater use licenses

APPENDIX A – GRAPHS

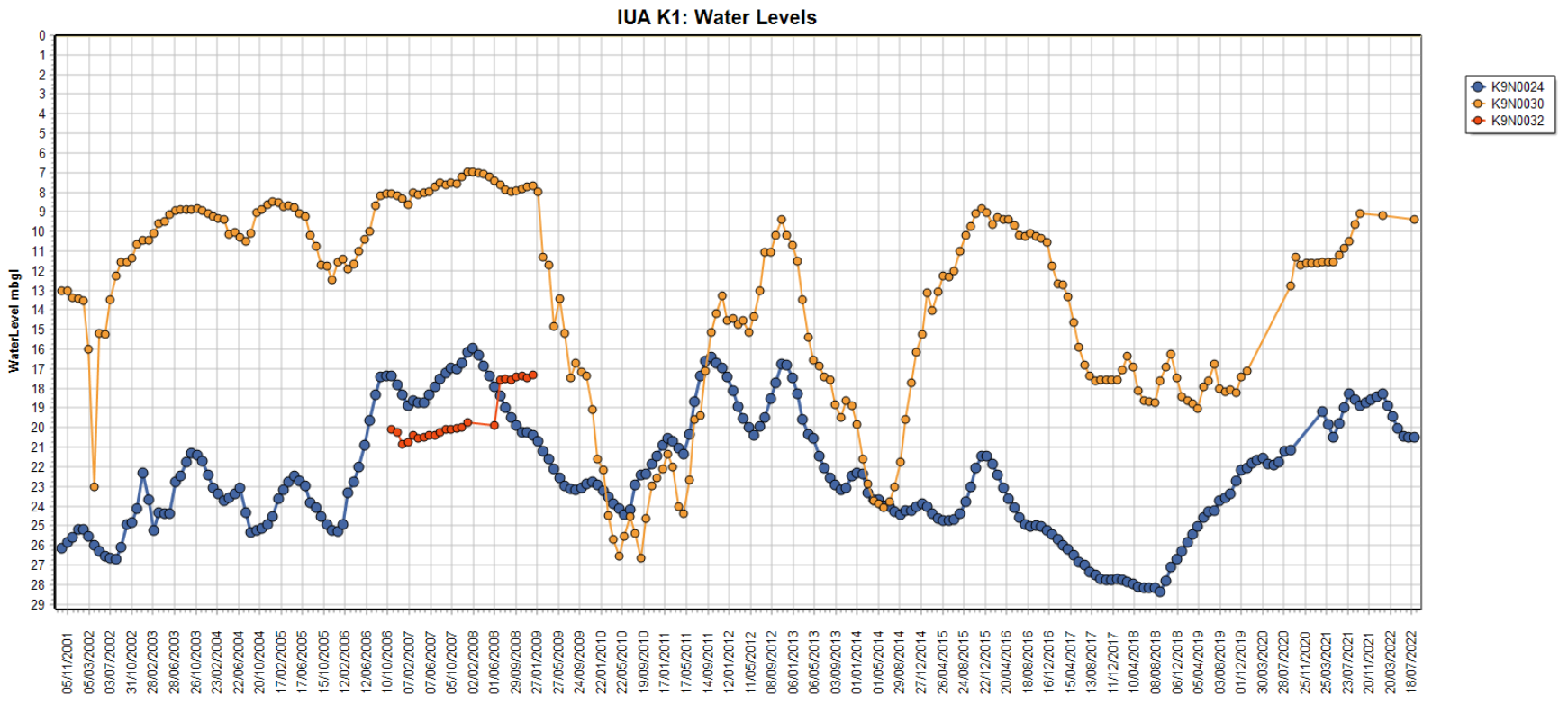


Figure 24: IUA K1 Water Levels

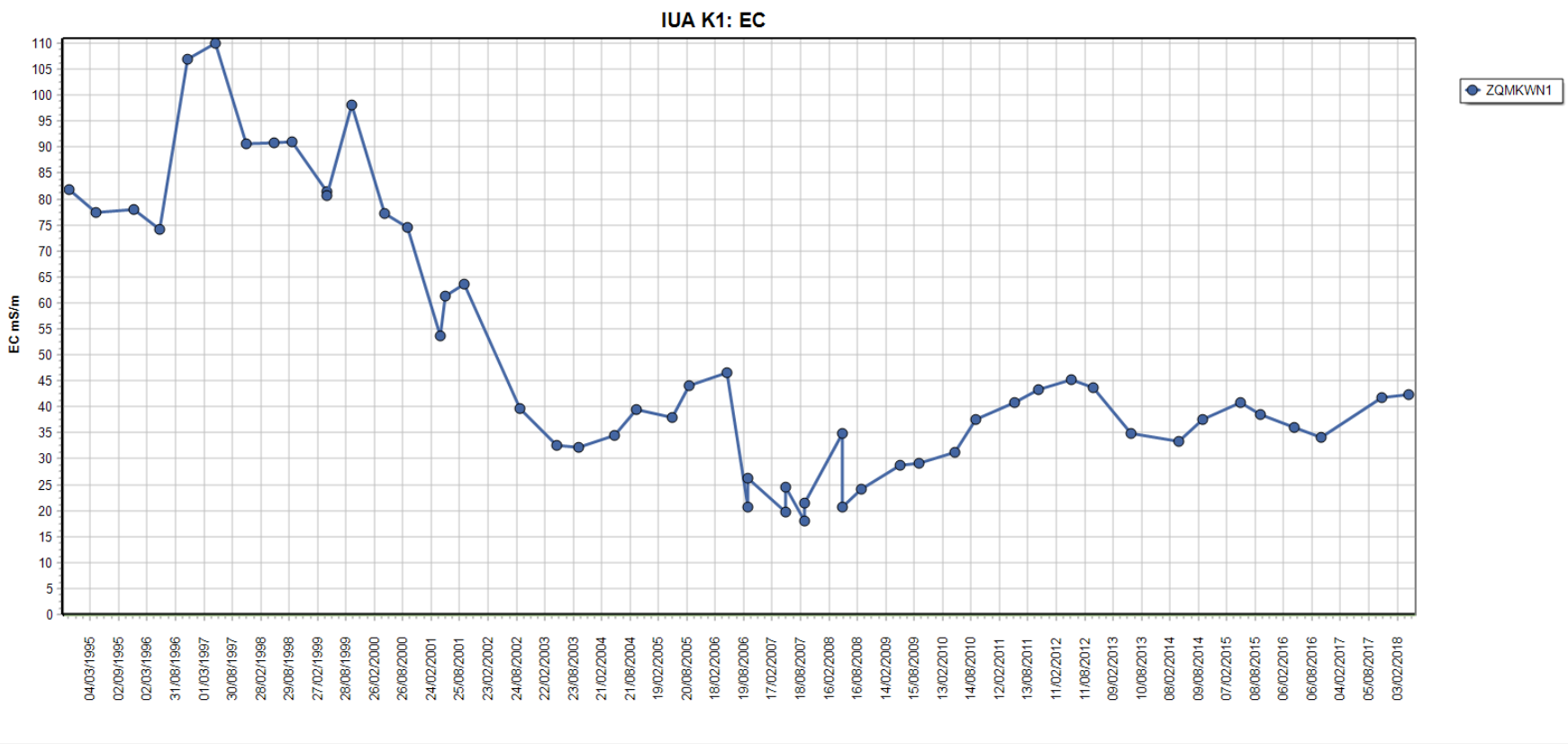


Figure 25: IUA K1 EC

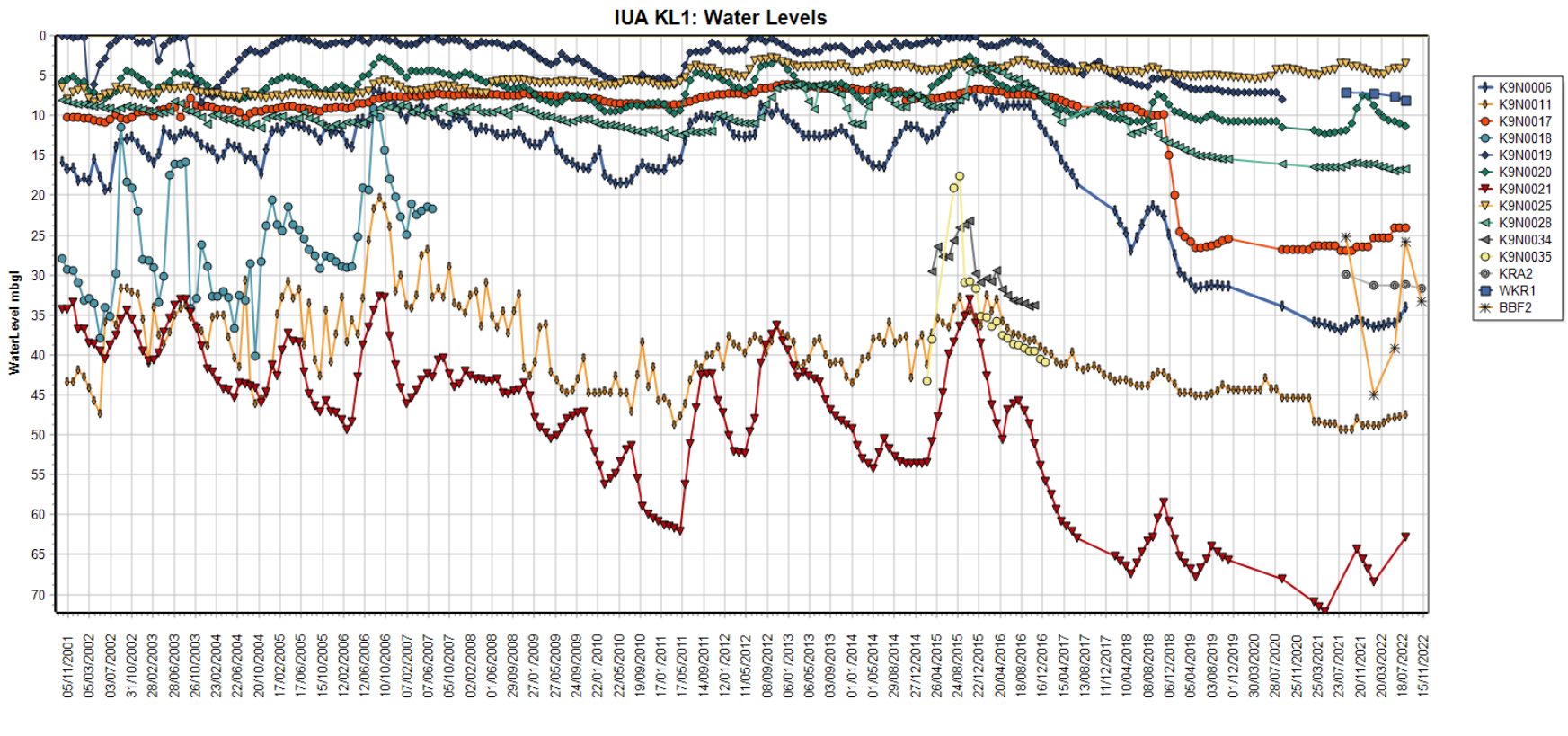


Figure 26: IUA KL1 Water Levels

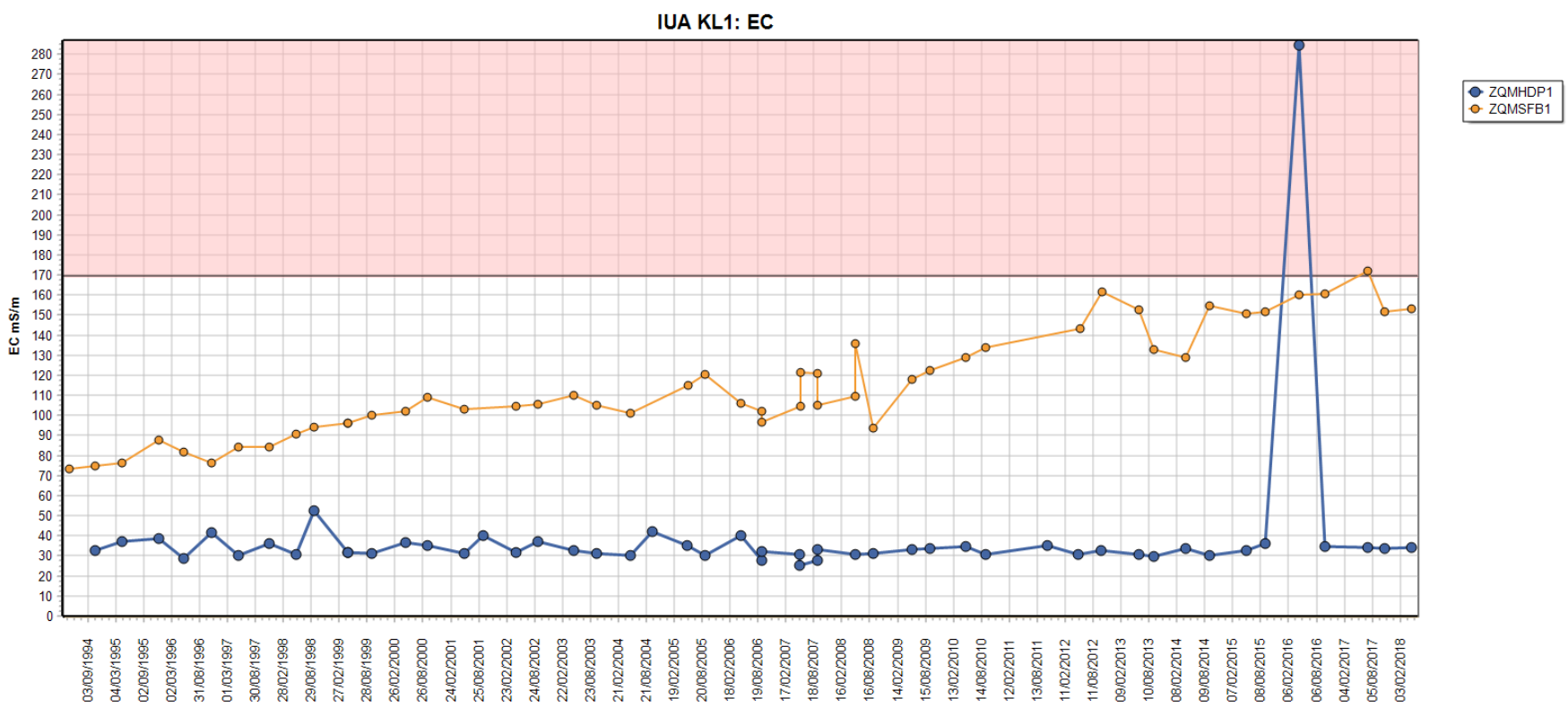


Figure 27: IUA KL1 EC

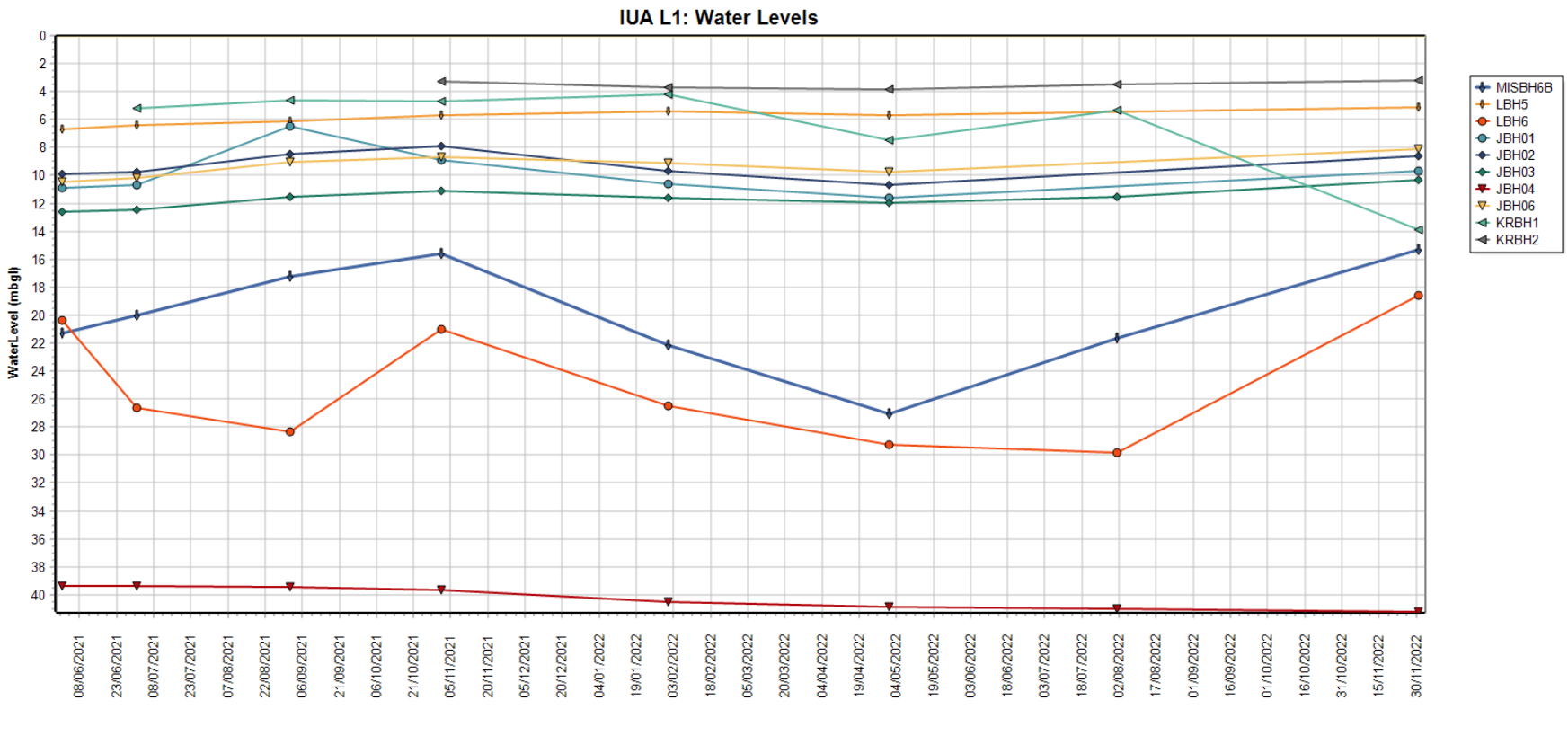


Figure 28: IUA L1 Water Levels

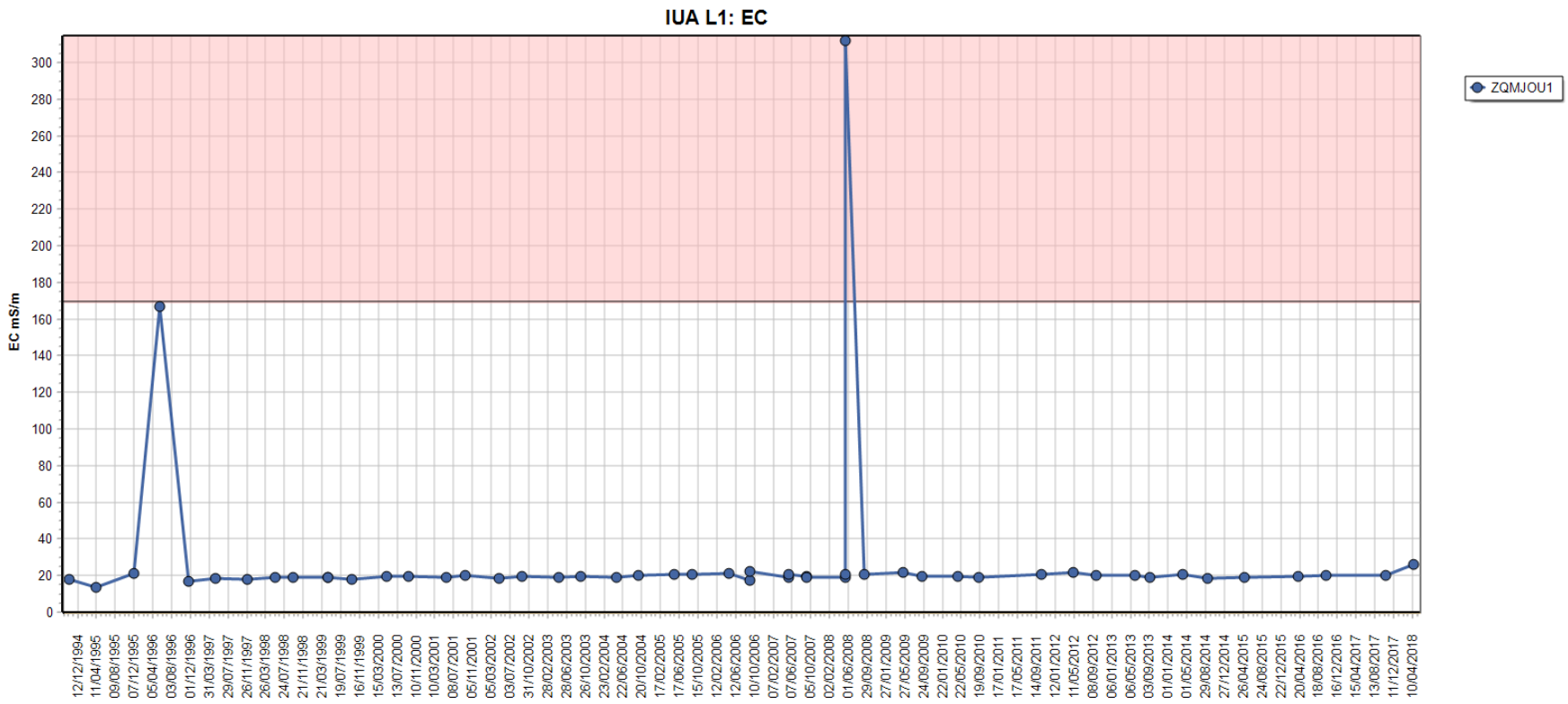


Figure 29: IUA L1 EC

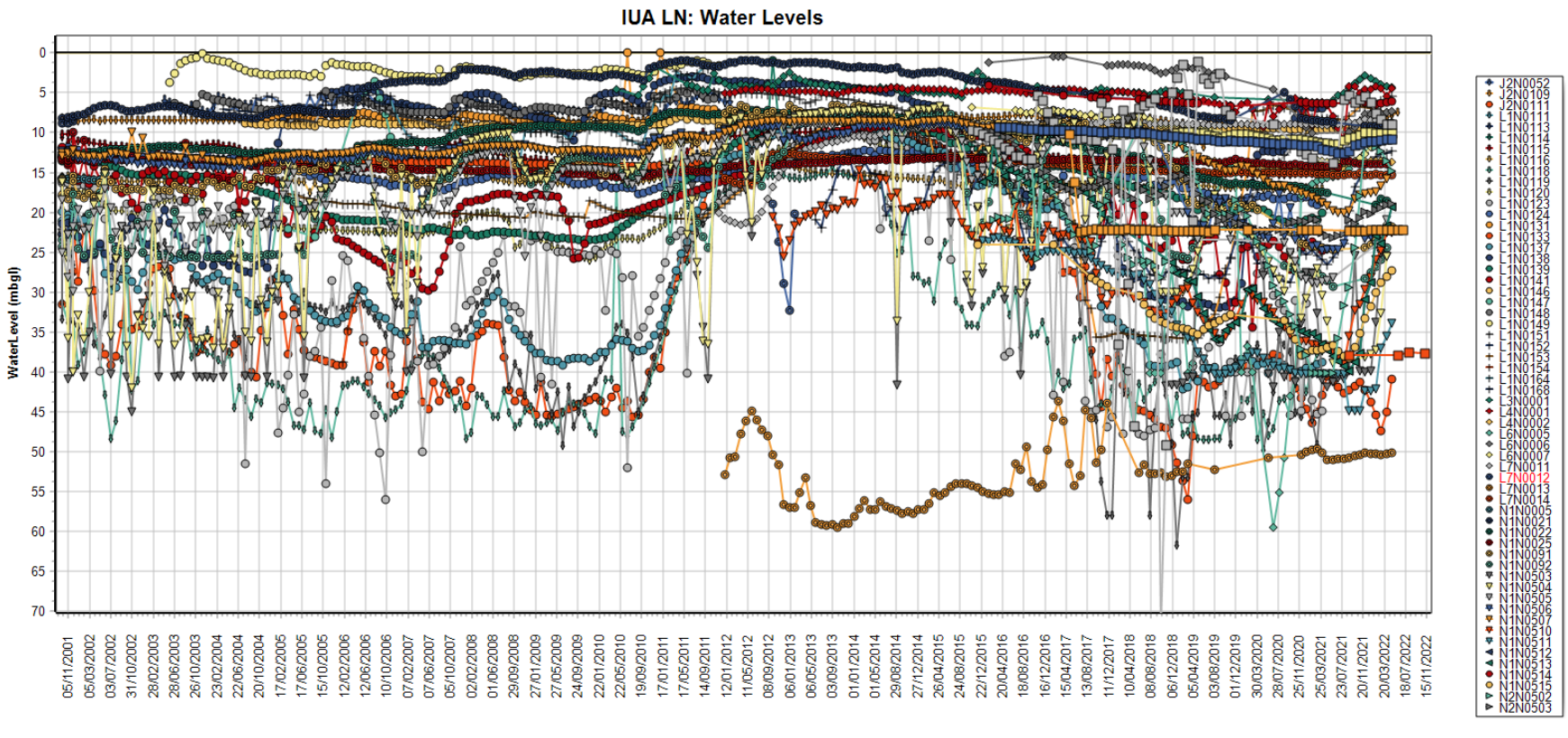


Figure 30: IUA LN1 Water Levels

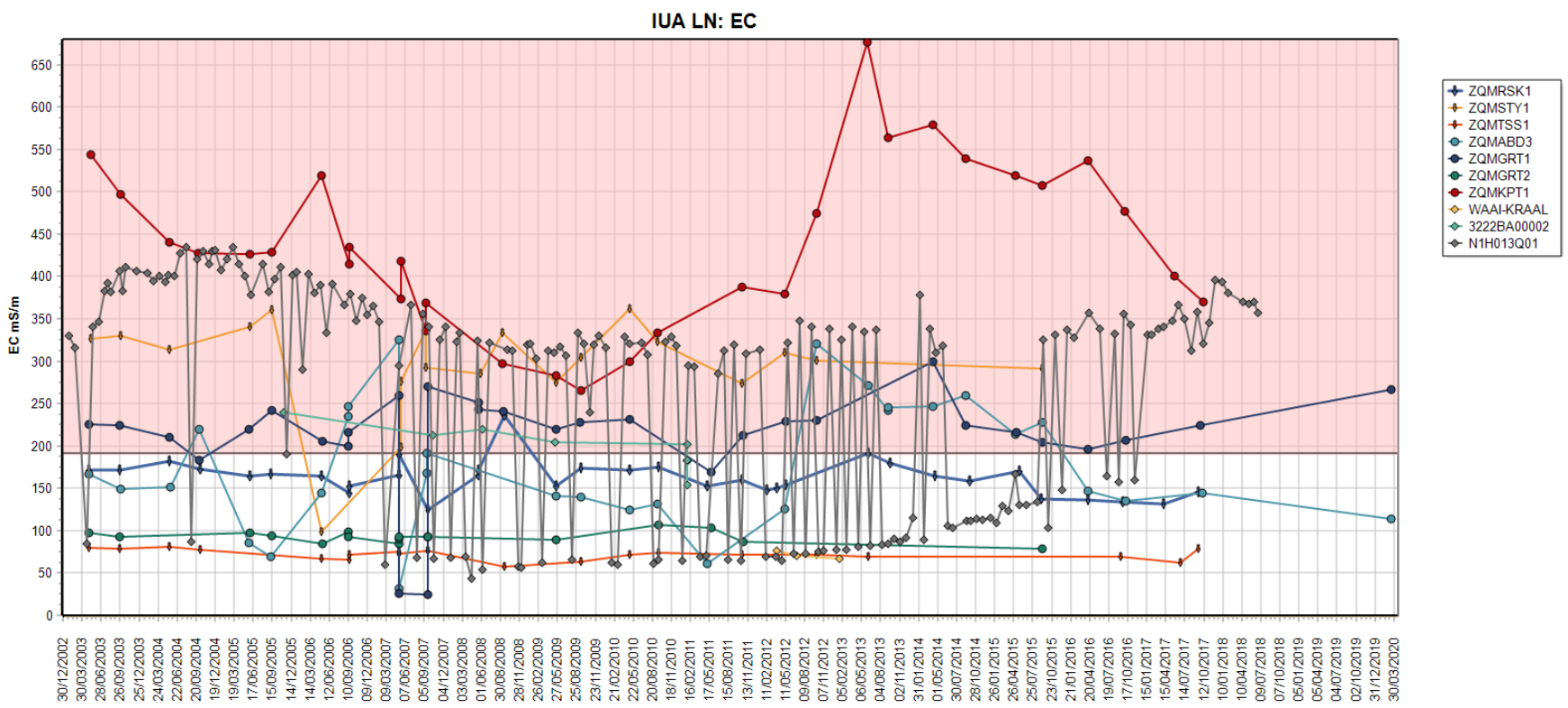


Figure 31: IUA LN1 EC

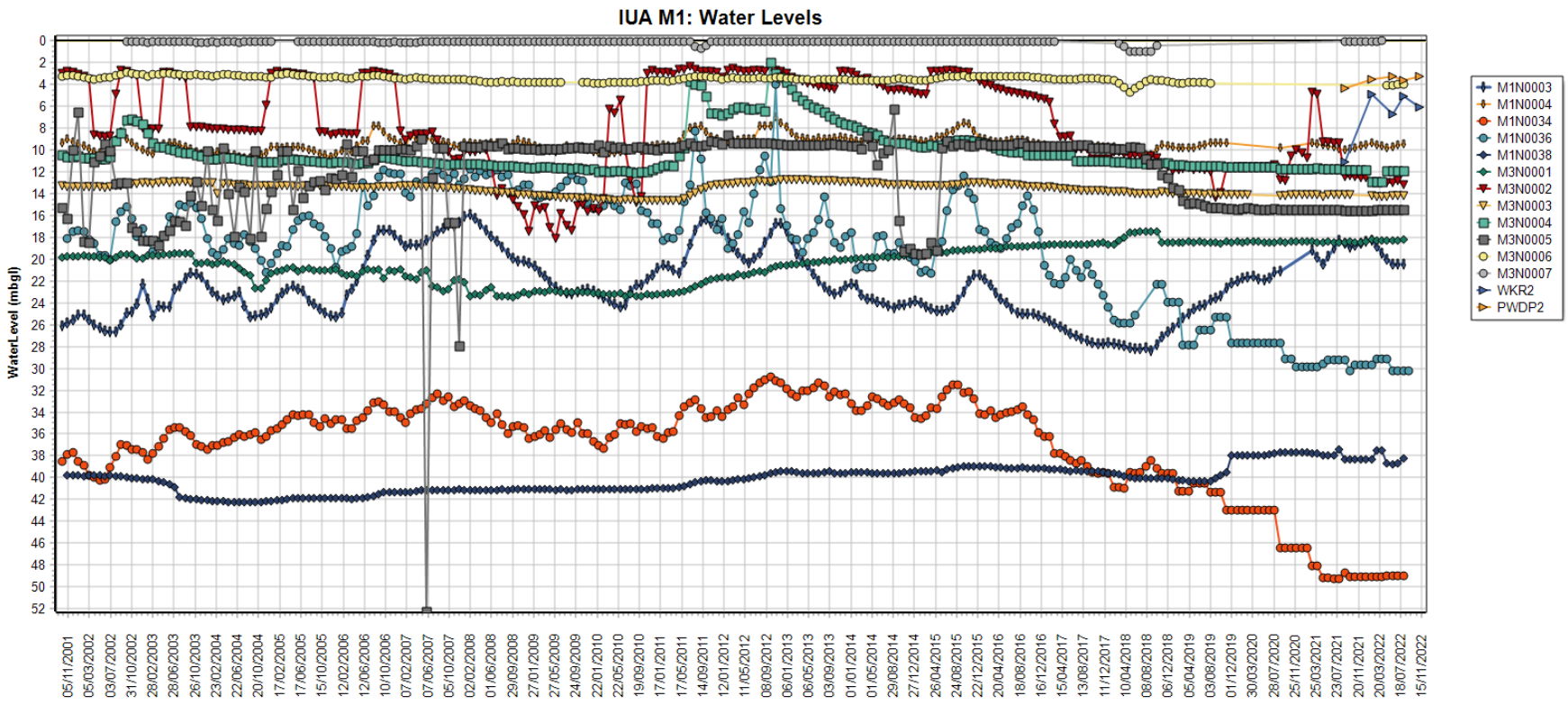


Figure 32: IUA M1 Water Levels

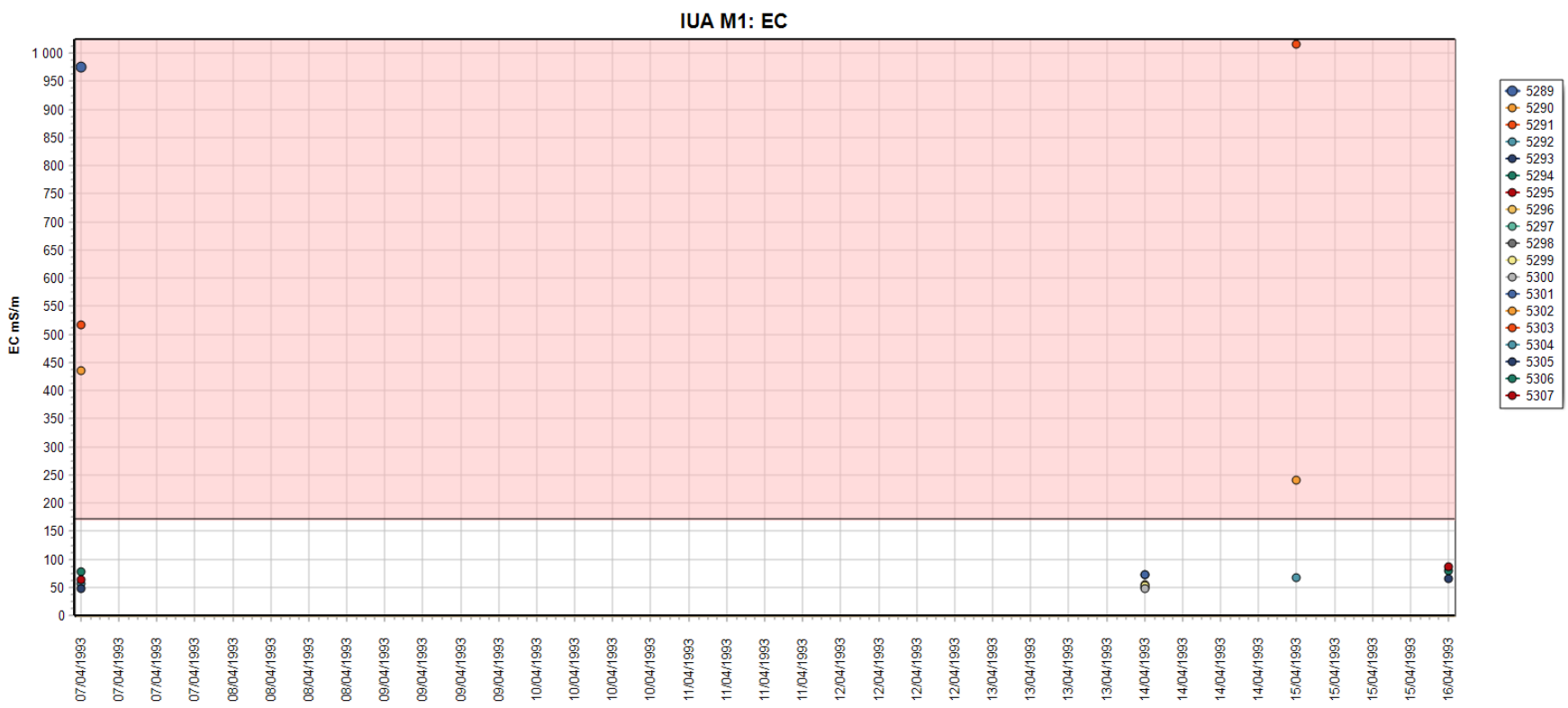


Figure 33: IUA M1 EC

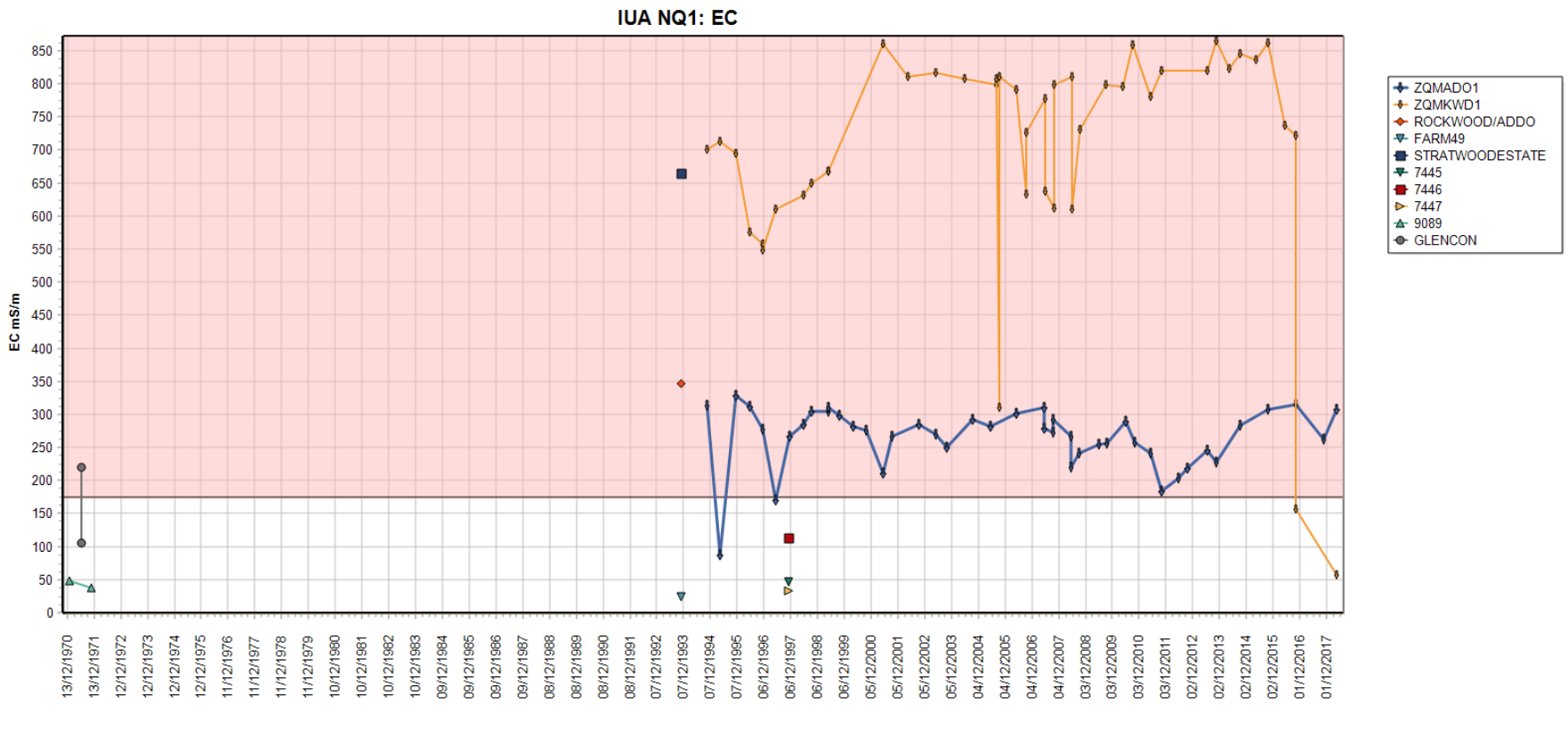


Figure 34: IUA NQ1 EC

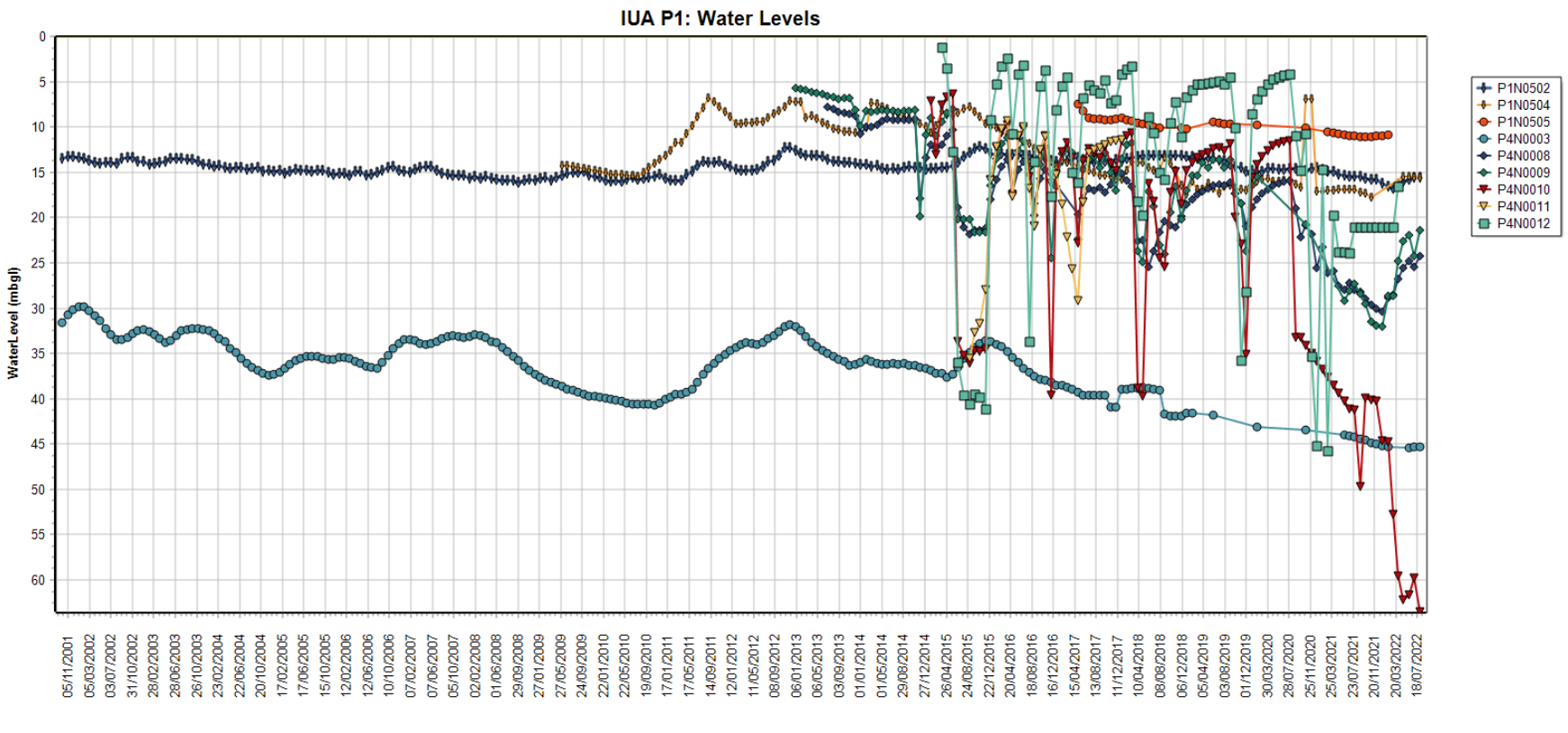


Figure 35: IUA P1 Water Levels

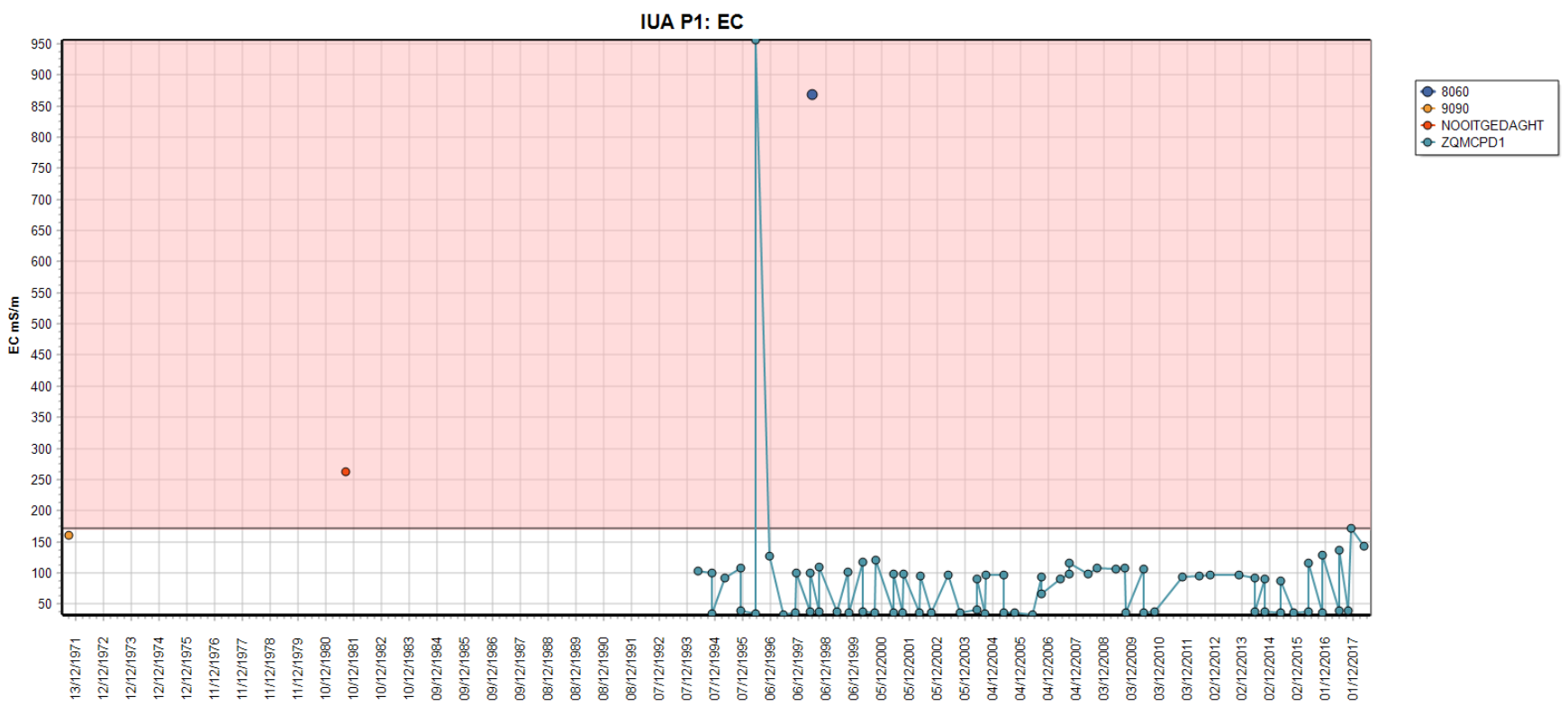


Figure 36: IUA P1 EC

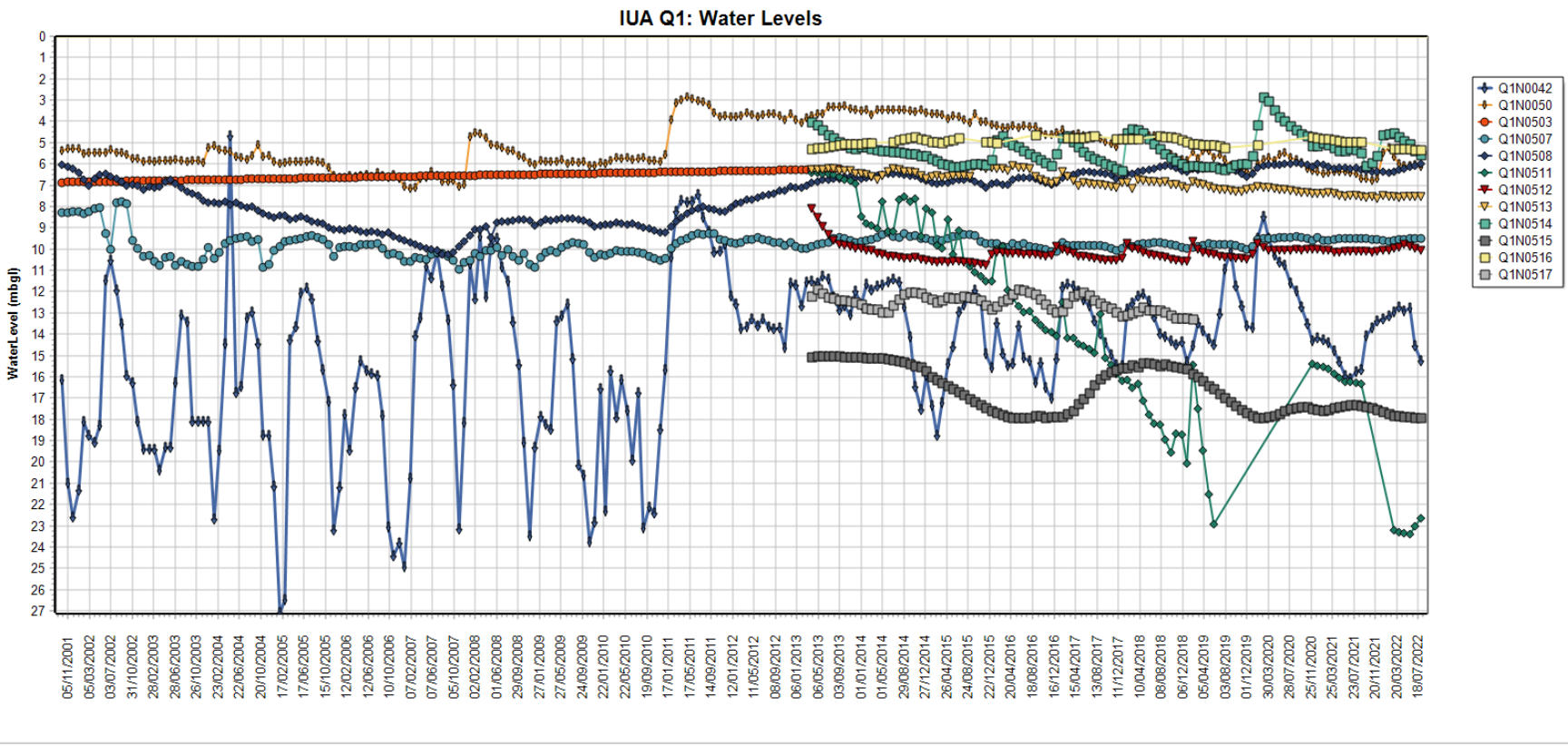
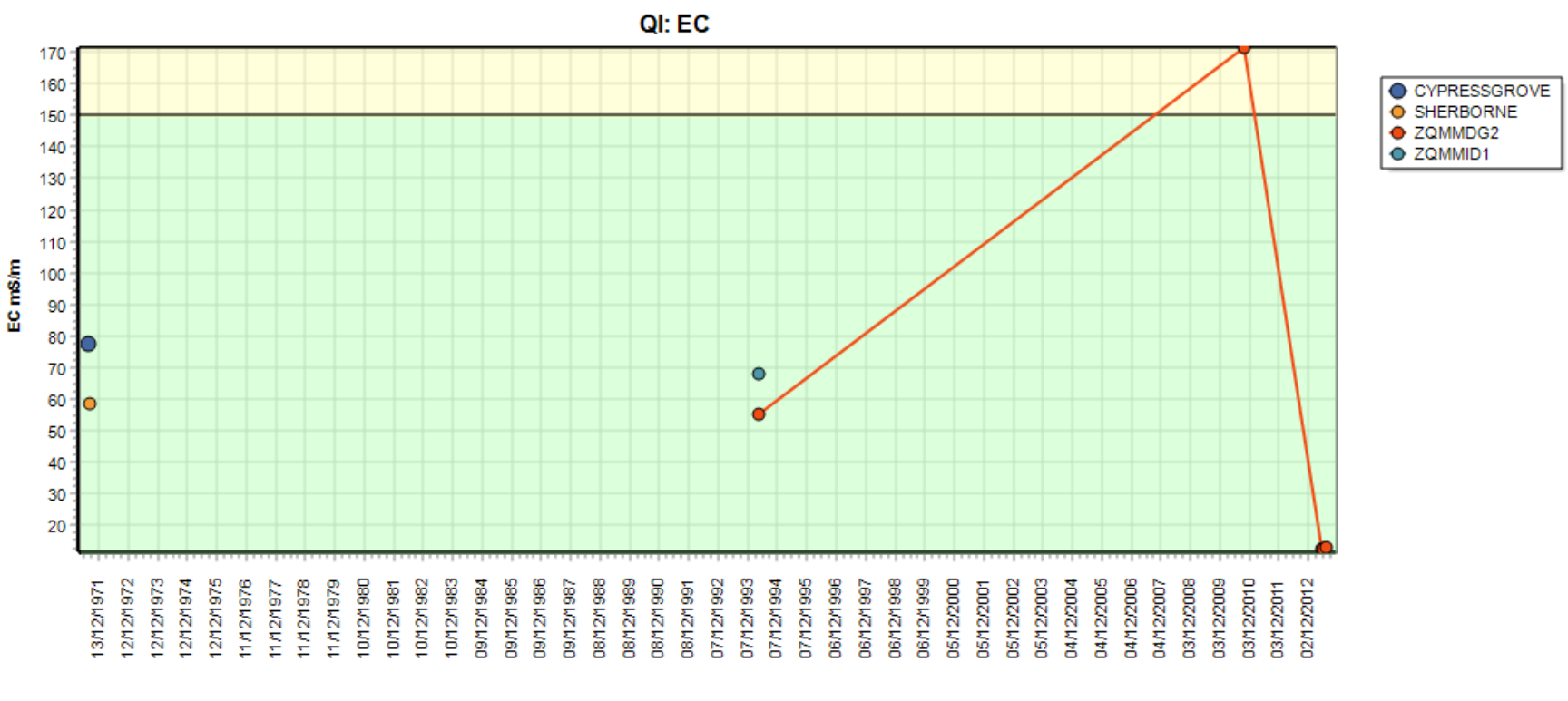


Figure 37: IUA Q1 Water Levels



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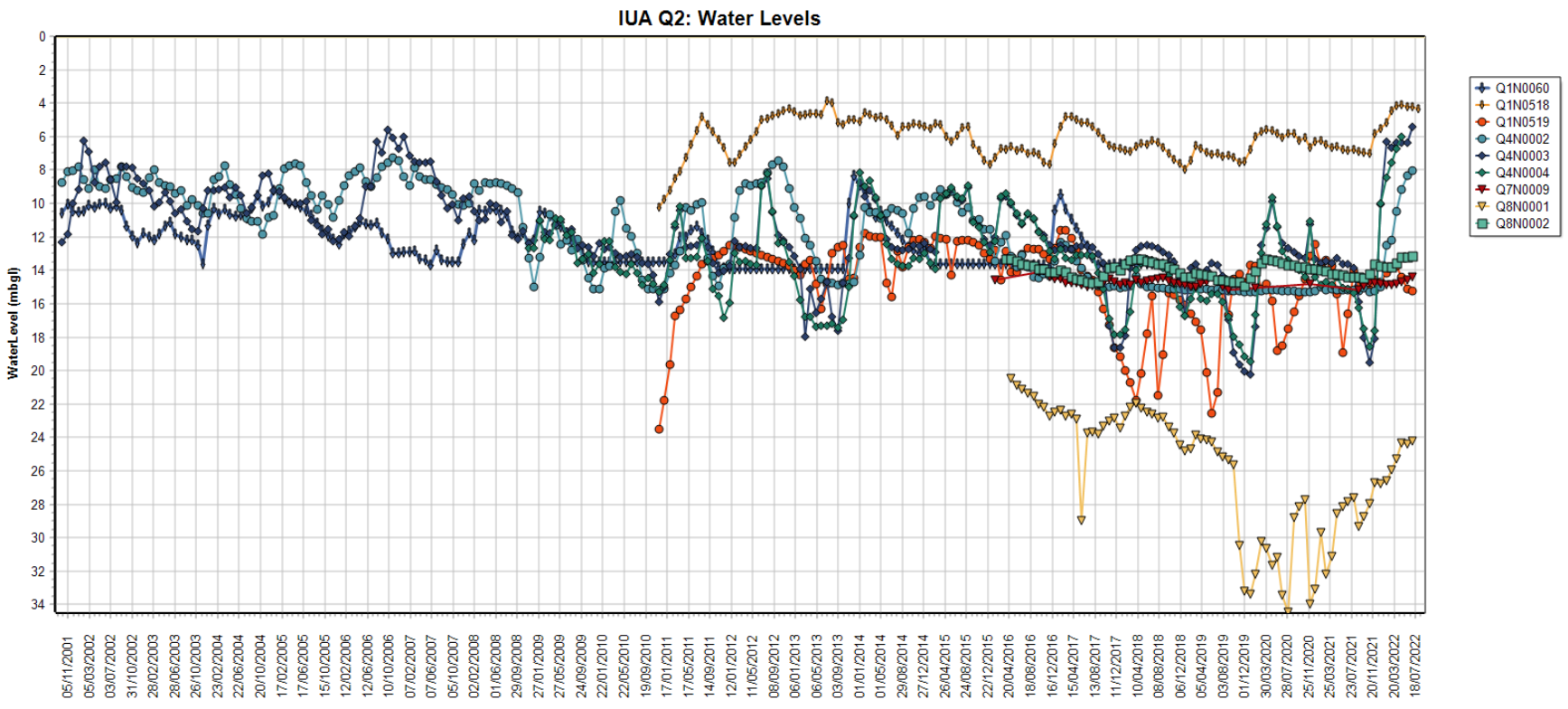

Figure 39: IUA Q2 Water Levels

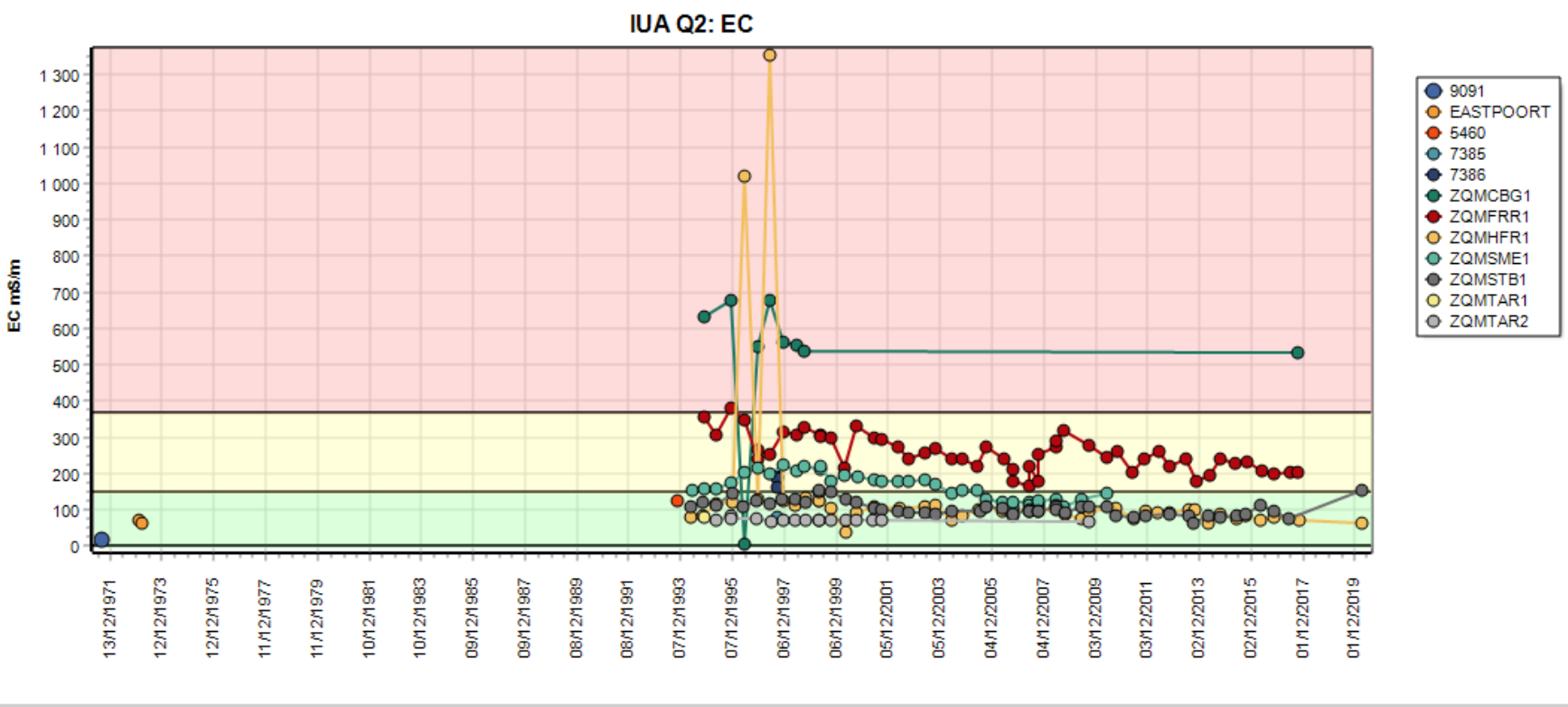

Figure 40: IUA Q2 EC

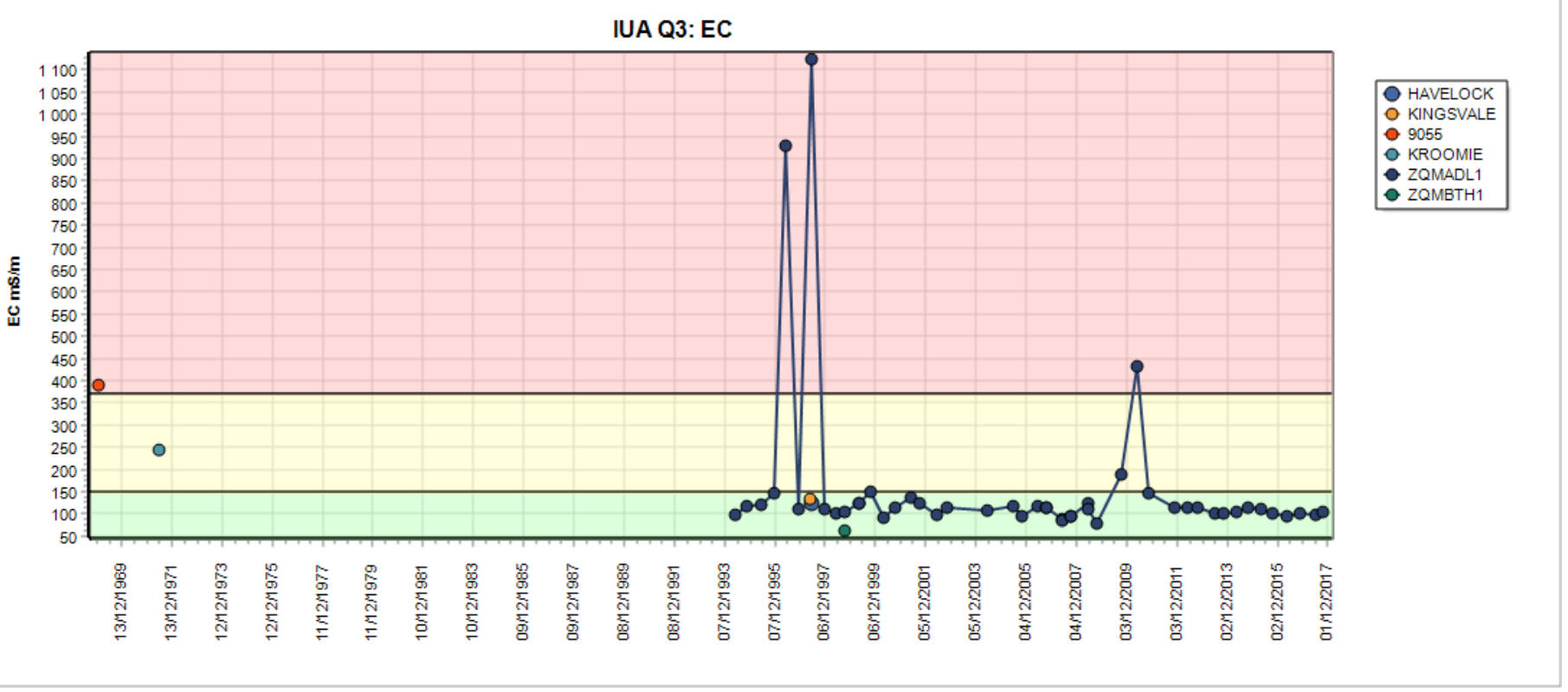

Figure 41: IUA Q3 EC

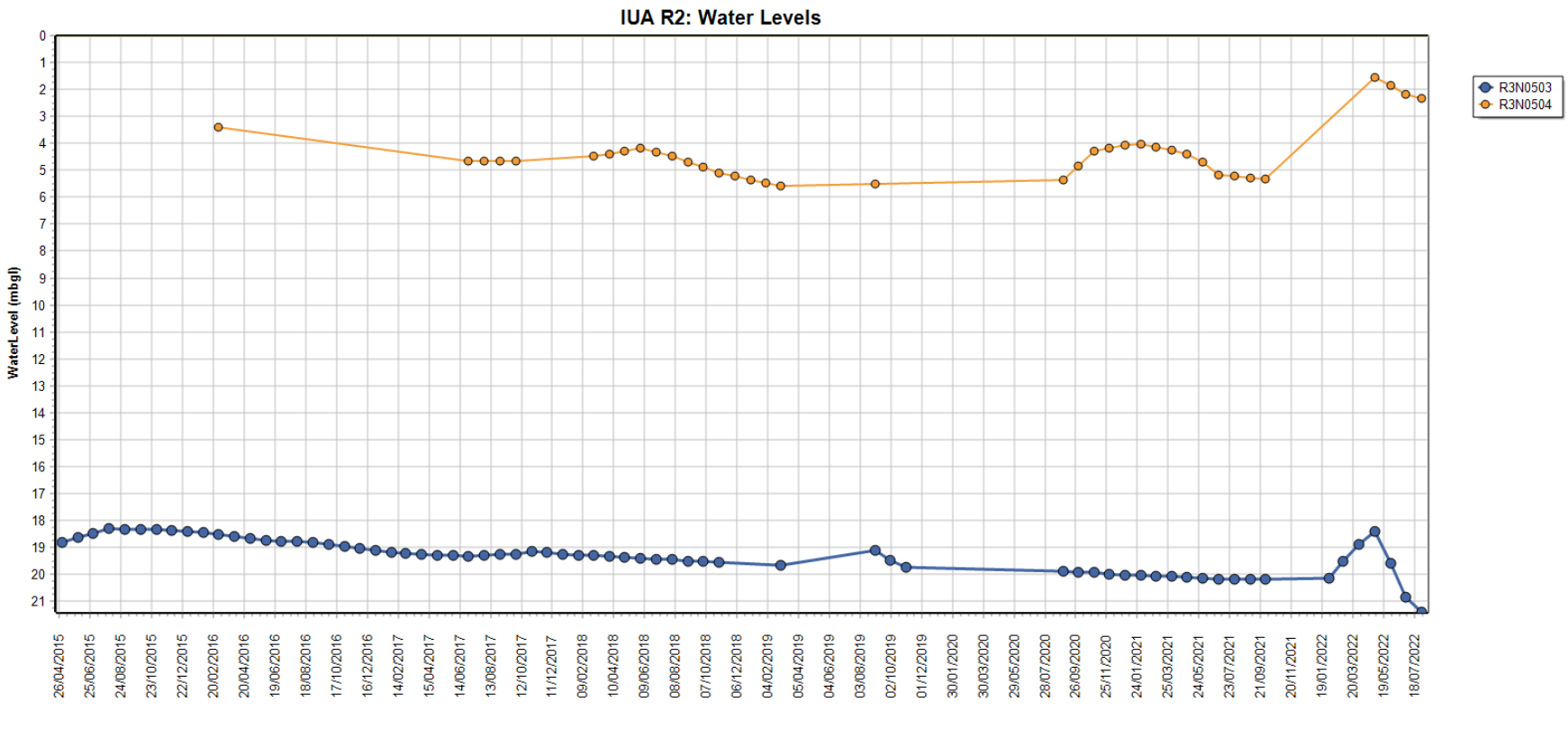

Figure 42: IUA R2 Water Levels

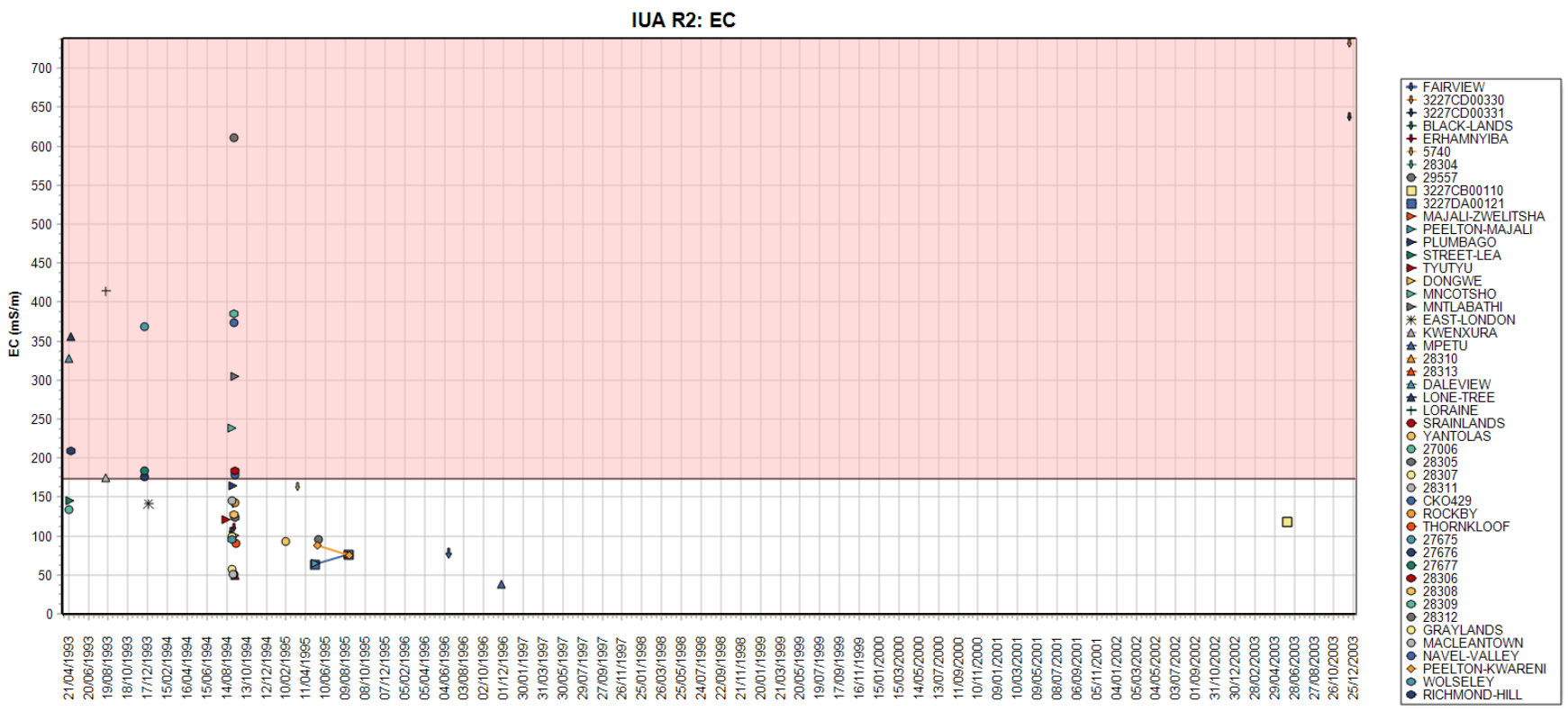

Figure 43: IUA R2 EC

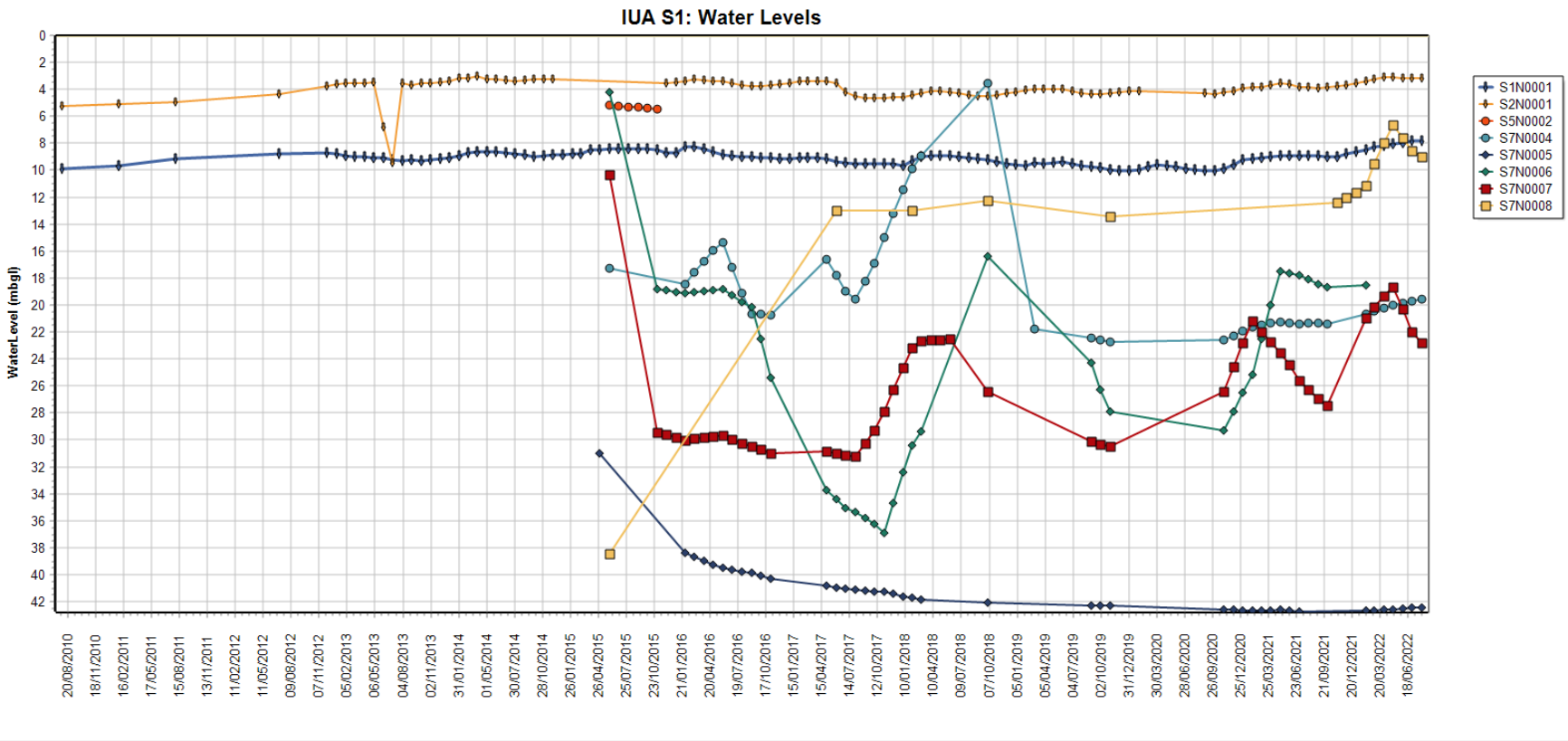

Figure 44: IUA S1 Water Levels

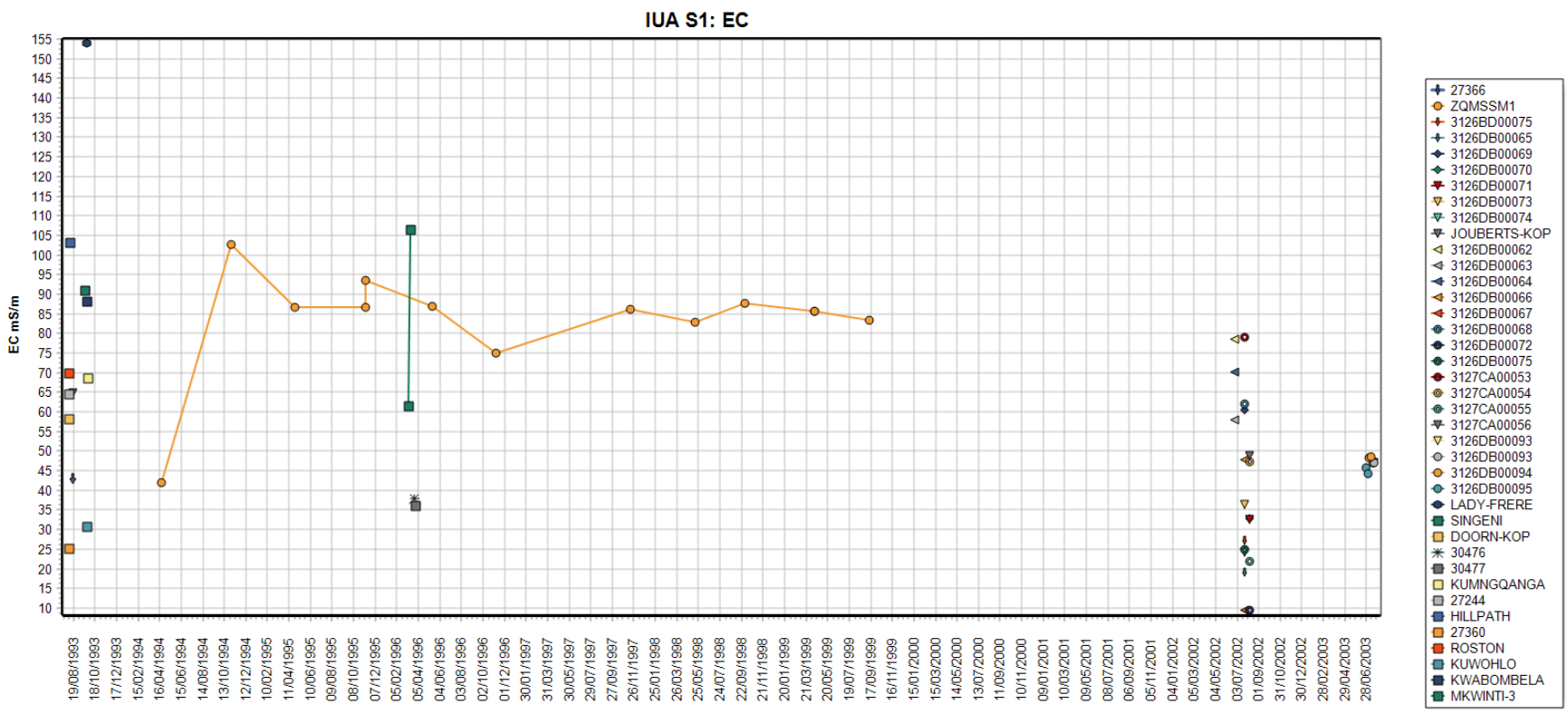

Figure 45: IUA S1 EC

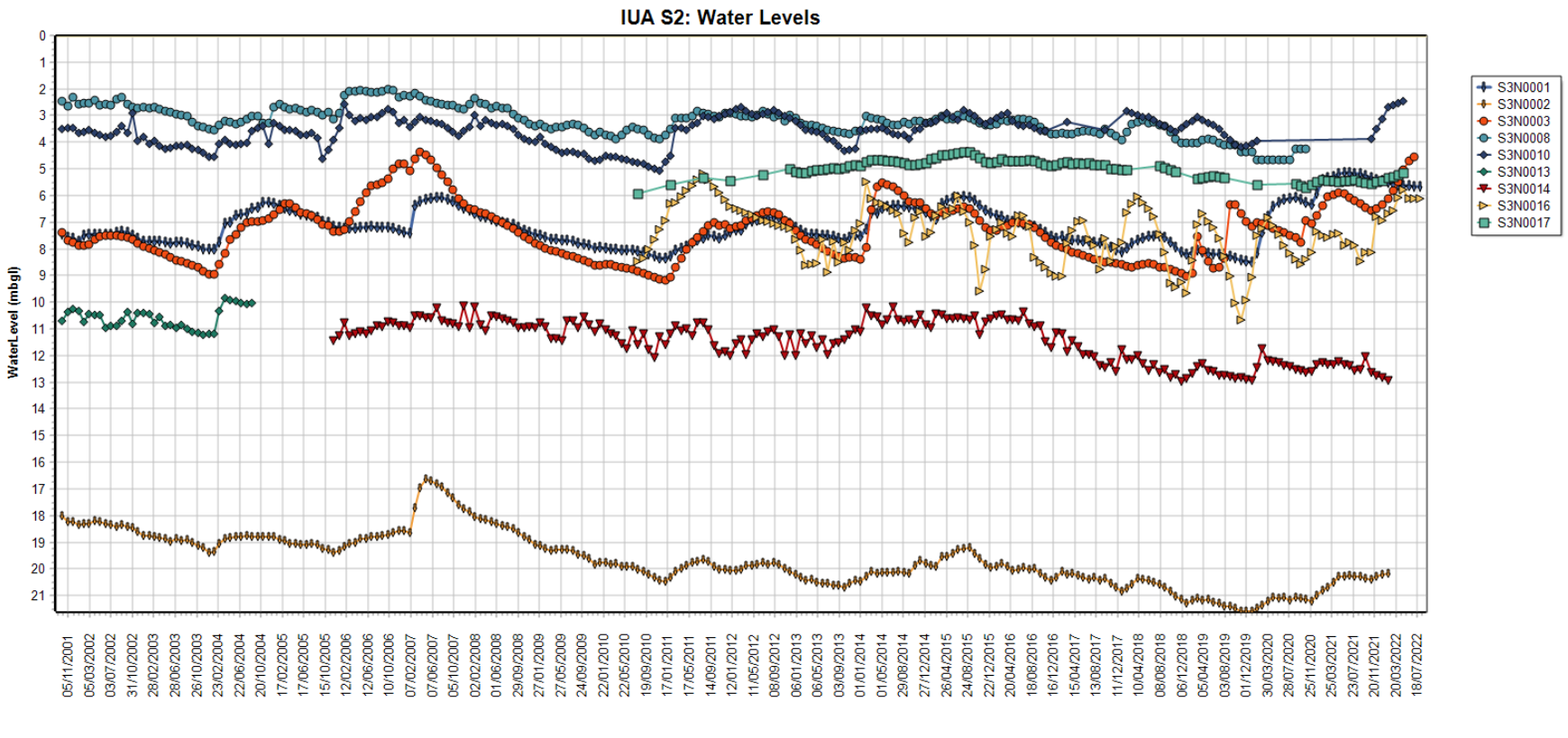

Figure 46: IUA S2 Water Levels

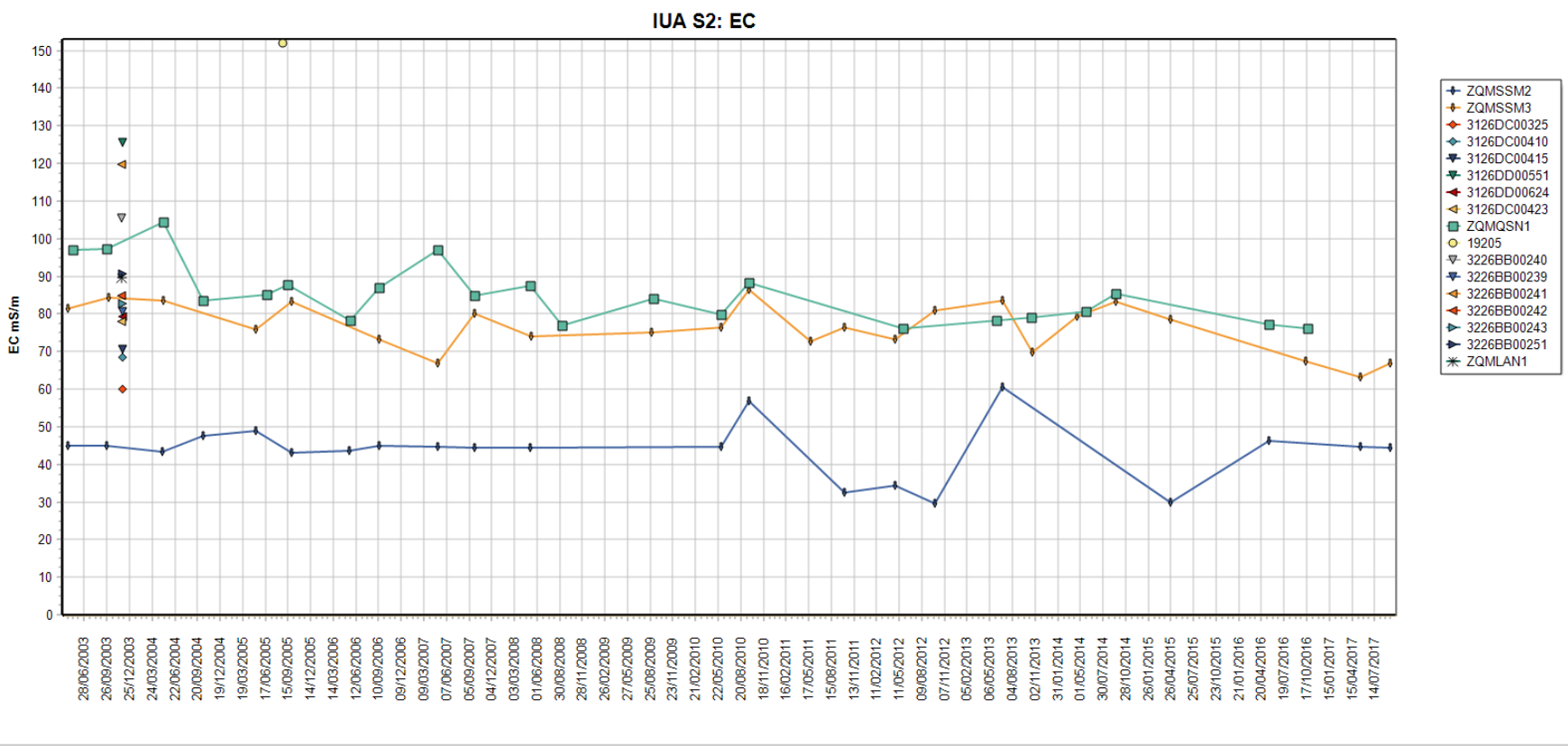

Figure 47: IUA S2 EC

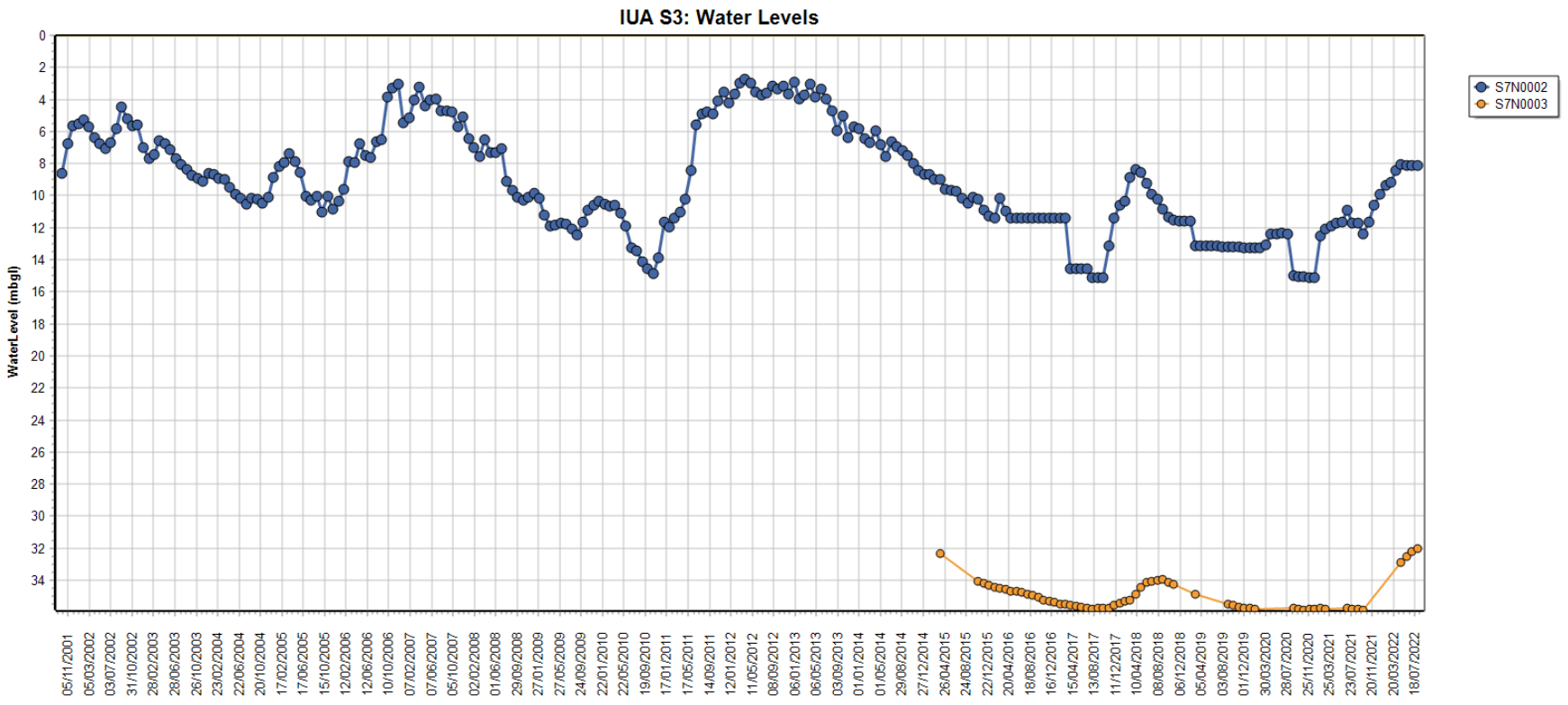

Figure 48: IUA S3 Water Levels

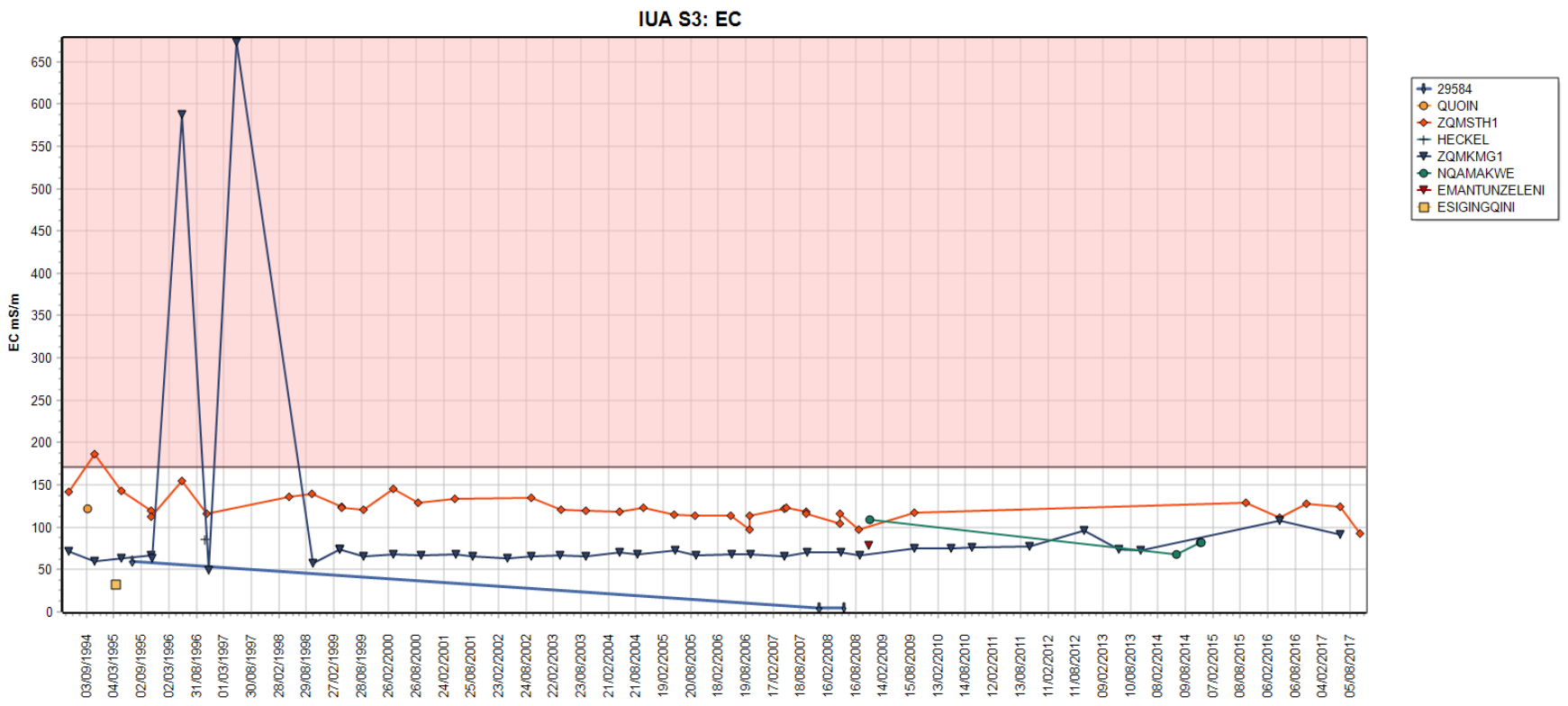

Figure 49: IUA S3 EC

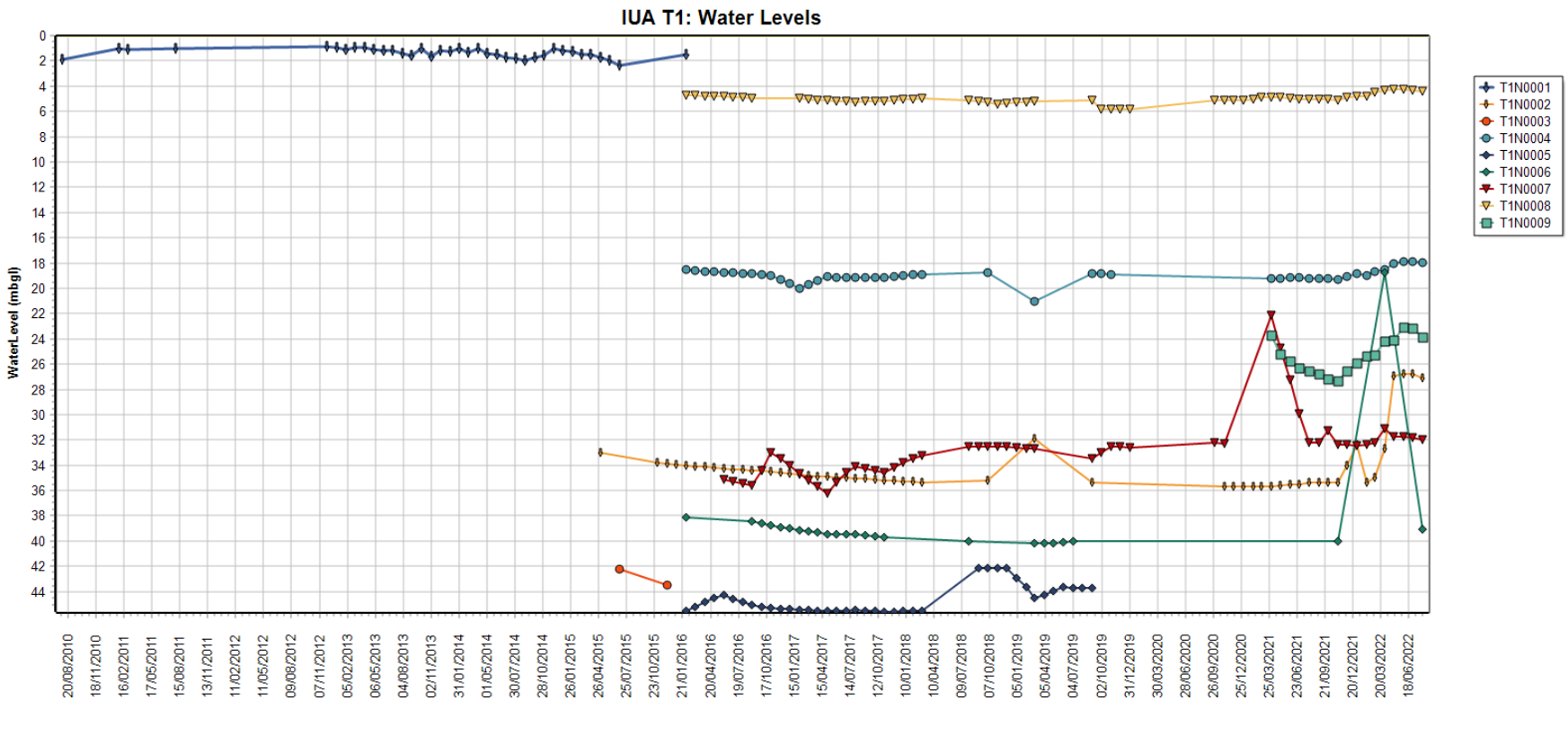

Figure 50: IUA T1 Water Levels

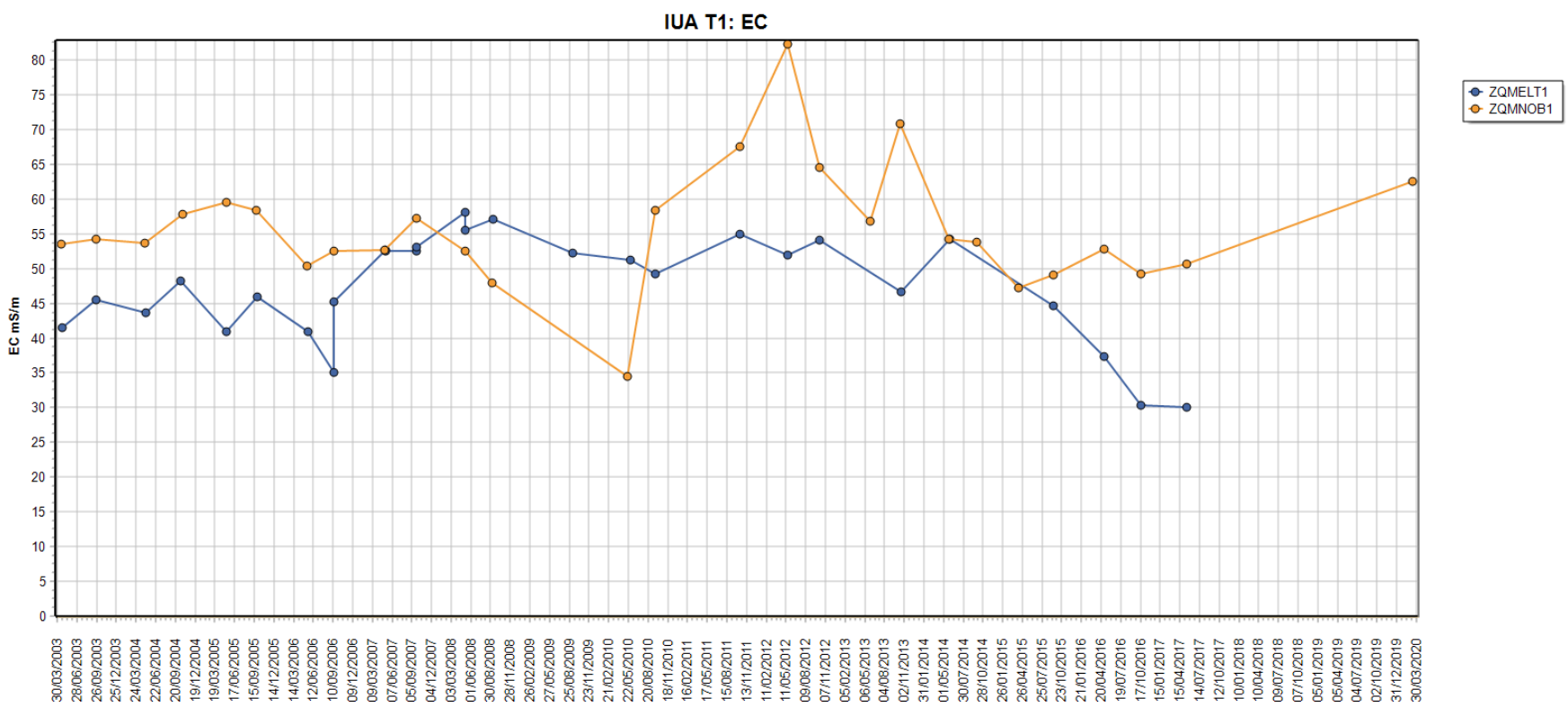

Figure 51: IUA T1 EC

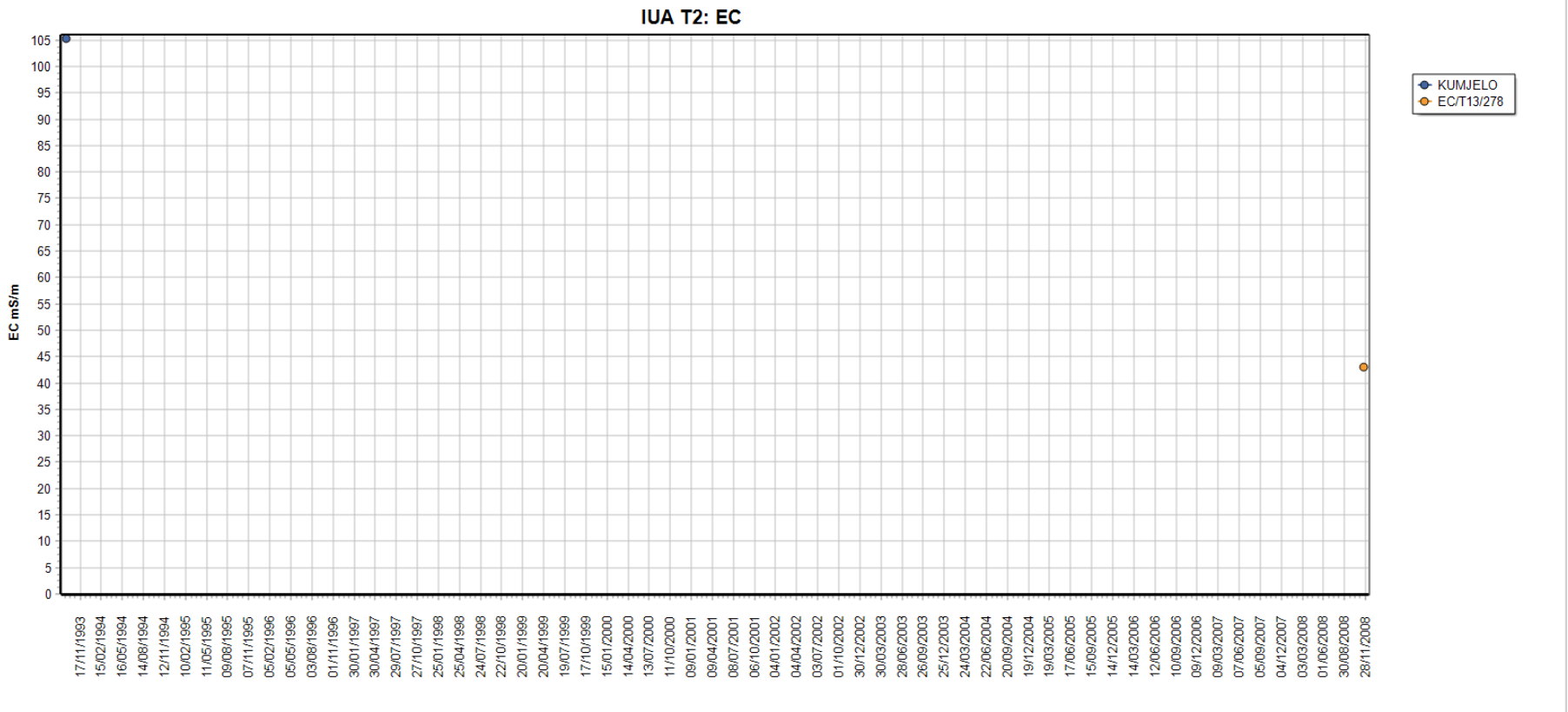

Figure 52: IUA T2 EC

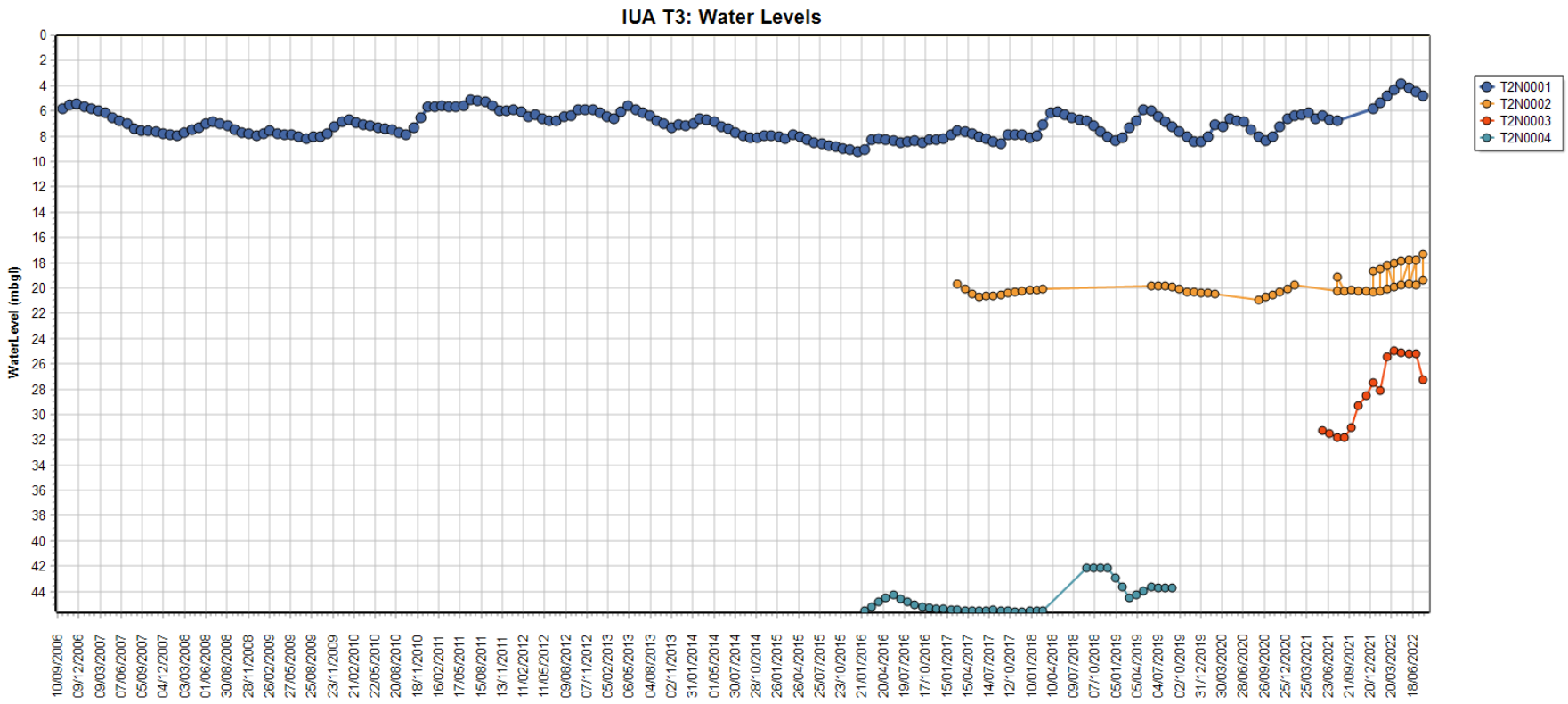

Figure 53: IUA T3 Water Levels

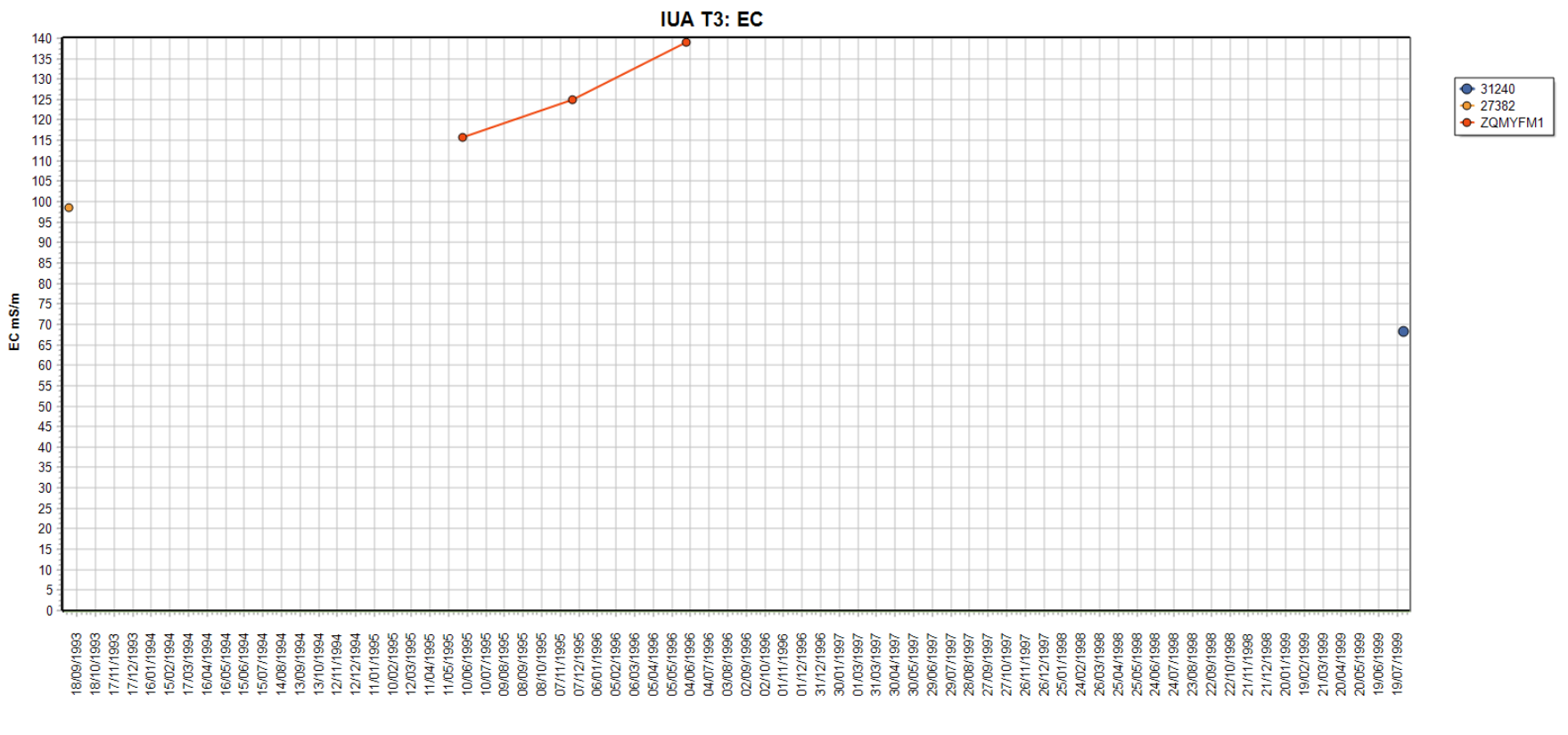

Figure 54: IUA T3 EC

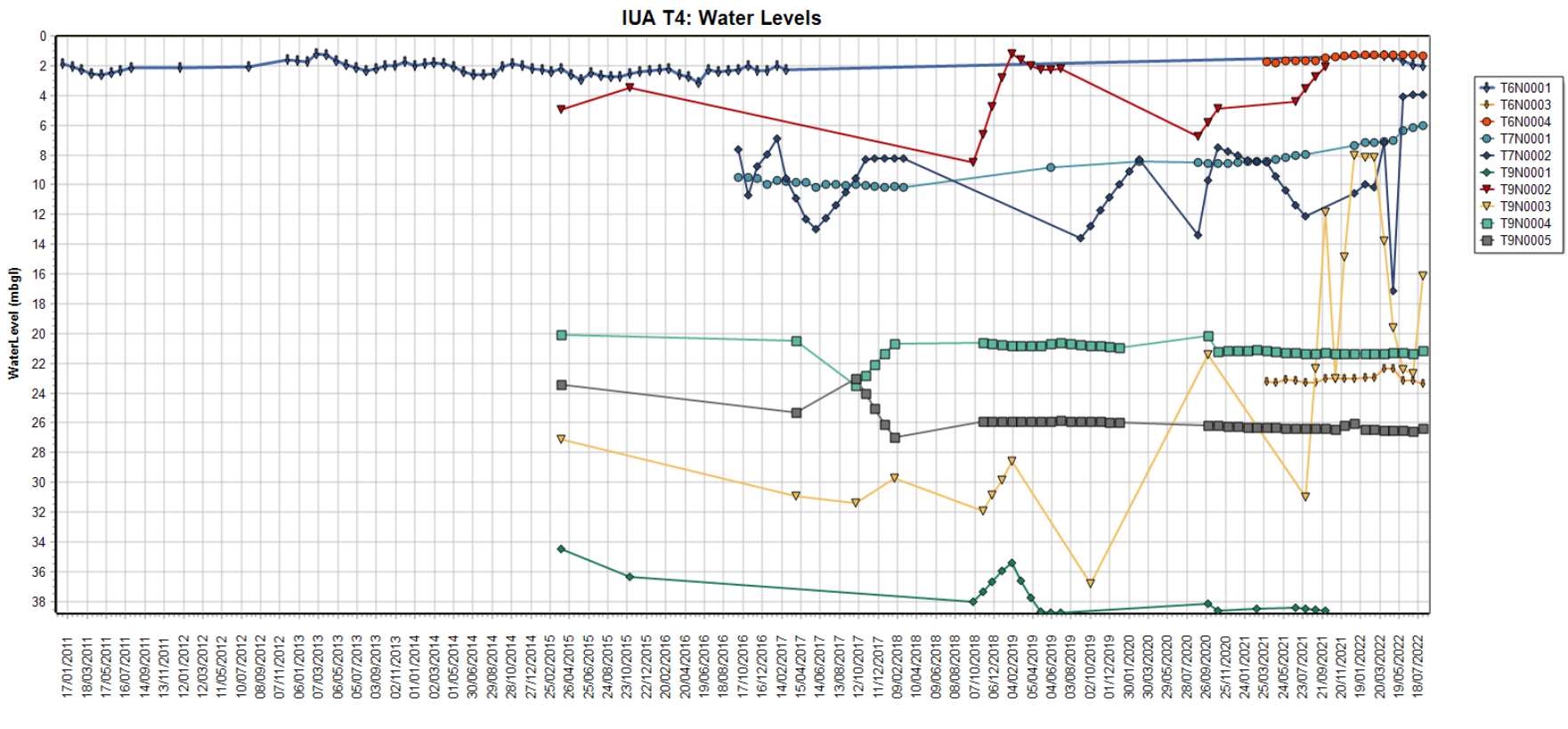

Figure 55: IUA T4 Water Levels

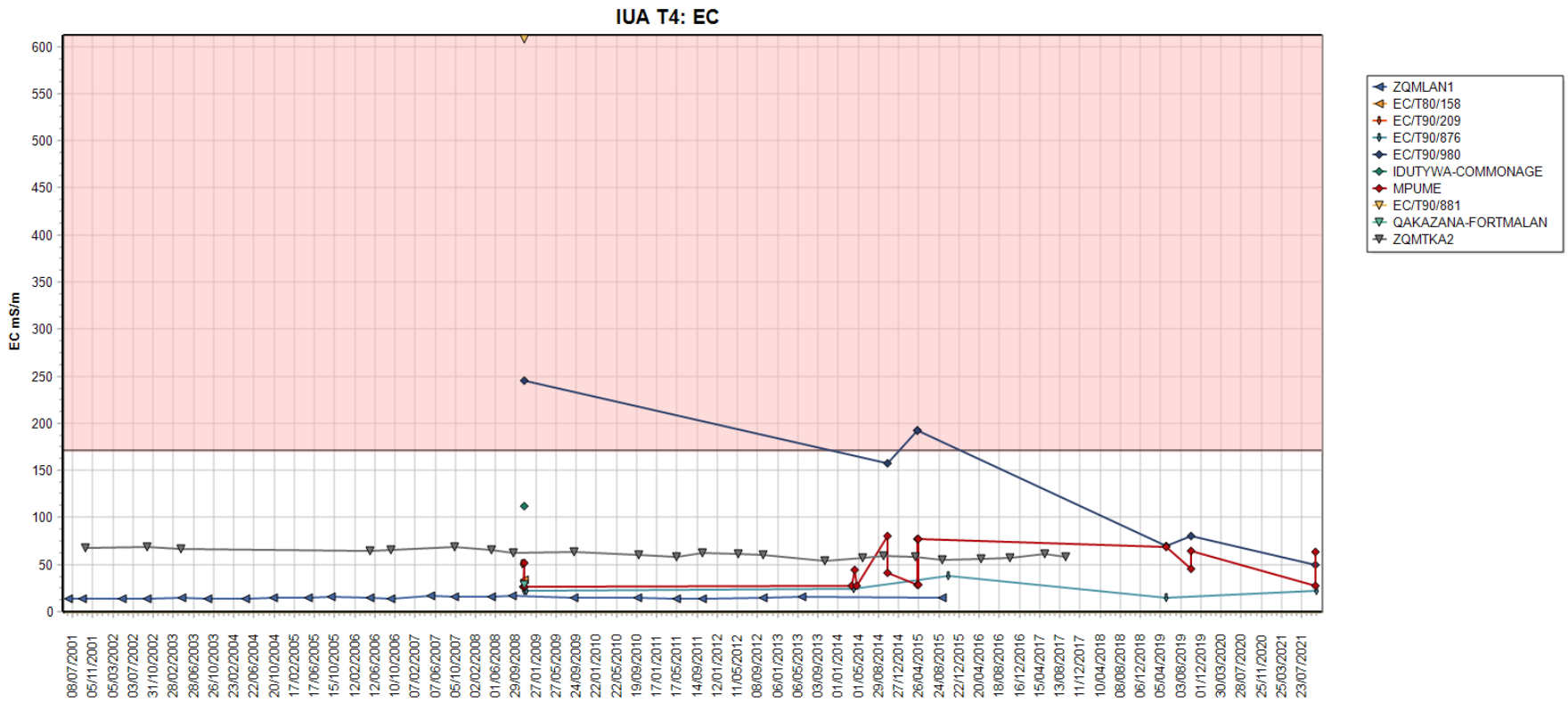

Figure 56: IUA T4 EC

APPENDIX B – GROUNDWATER RECHARGE RESULTS

Table 22: Groundwater recharge results

IUA	Quaternary	Area (km2)	Recharge Method	Recharge (mm)	% Recharge	Recharge (Mm3/a)
IUA1	K80A	145.90	Qualified Guess	97.5	9.5	14.225
	K80B	208.20	Qualified Guess	88.8	11.5	18.488
	K80C	188.80	Qualified Guess	110.0	10.8	20.768
	K80D	173.00	Qualified Guess	104.6	11.2	18.096
	K80E	265.80	CRD+Qualified Guess	94.3	10.5	25.065
	K80F	220.90	CRD+Qualified Guess	71.9	13.2	15.883
	K90A	213.50	Qualified Guess	84.8	10.5	18.105
	K90B	149.60	CMB+CRD+Qualified Guess	81.3	10.5	12.163
IUA2	K90C	267.00	Qualified Guess	74.8	11.5	19.972
	K90D	215.20	CRD+Qualified Guess	59.0	8.5	12.697
	K90E	176.40	CMB+Qualified Guess	62.2	9.6	10.972
	K90F	250.30	CMB+CRD+Qualified Guess	61.1	9.4	15.293
	K90G	286.50	CRD+Qualified Guess	64.1	9.9	18.365
	L90A	515.90	Qualified Guess	71.4	11.0	36.835
	L90B	365.80	Qualified Guess	74.4	11.5	27.325
	L90C	318.90	Qualified Guess	74.7	11.5	23.822
IUA3	L81A	332.10	Qualified Guess	63.2	12.0	20.989
	L81B	261.10	Qualified Guess	57.0	13.3	14.883
	L81C	332.10	Qualified Guess	57.5	13.2	19.096
	L81D	307.70	Qualified Guess	54.8	13.9	16.862
	L82A	269.20	Qualified Guess	67.5	11.3	18.171
	L82B	404.70	Qualified Guess	72.7	10.7	29.422
	L82C	362.10	Qualified Guess	73.2	10.7	26.506
	L82D	590.80	CMB+Qualified Guess	61.5	10.6	36.334
	L82E	365.00	Qualified Guess	66.9	11.4	24.419
	L82F	168.60	Qualified Guess	62.3	12.2	10.466
	L82G	265.30	Qualified Guess	59.7	12.7	15.838
	L82H	229.90	Qualified Guess	58.4	13.0	13.426
	L82J	164.00	Qualified Guess	60.9	12.4	9.988
IUA4	M10A	264.30	Qualified Guess	63.6	11.9	16.810
	M10B	392.90	CRD+Qualified Guess	52.4	9.4	20.588
	M10C	429.90	CMB+CRD+Qualified Guess	48.3	8.5	20.764
	M10D	306.50	CMB+Qualified Guess	45.6	9.7	13.976
	M20A	361.50	Qualified Guess	67.4	10.2	24.365
	M20B	307.50	Qualified Guess	71.5	11.3	21.986
	M30A	257.80	CRD+Qualified Guess	51.1	10.0	13.174

IUA	Quaternary	Area (km2)	Recharge Method	Recharge (mm)	% Recharge	Recharge (Mm3/a)
	M30B	306.60	Qualified Guess	44.2	10.2	13.552
IUA5	L11A	930.10	Qualified Guess	34.1	15.6	31.716
	L11B	875.00	CMB+Qualified Guess	31.2	13.3	27.300
	L11C	568.20	CMB+Qualified Guess	29.1	12.1	16.535
	L11D	1286.40	CMB+Qualified Guess	25.7	11.5	33.061
	L11E	455.70	CMB+Qualified Guess	26.6	11.7	12.122
	L11F	745.00	CMB+CRD+Qualified Guess	28.4	12.9	21.158
	L11G	2024.40	CMB+CRD+Qualified Guess	26.8	13.7	54.254
	L12A	905.60	CMB+Qualified Guess	20.7	13.0	18.746
	L12B	518.70	Qualified Guess	26.3	13.7	13.642
	L12C	1067.60	CMB+Qualified Guess	20.9	13.7	22.313
	L12D	869.90	Qualified Guess	44.4	12.0	38.264
	L21A	609.30	CMB+Qualified Guess	31.6	12.9	19.254
	L21B	756.30	CMB+Qualified Guess	33.5	13.0	25.336
	L21C	1033.50	CMB+Qualified Guess	36.5	12.2	37.723
	L21D	864.60	CMB+Qualified Guess	39.1	10.7	33.802
	L21E	712.30	CMB+Qualified Guess	38.0	13.1	27.067
	L21F	576.10	Qualified Guess	30.7	12.2	21.868
	L22A	1072.40	CMB+Qualified Guess	32.8	14.0	35.175
	L22B	474.60	Qualified Guess	28.1	13.4	13.336
	L22C	759.60	CMB+Qualified Guess	32.5	13.9	24.687
	L22D	530.40	Qualified Guess	39.6	14.0	21.004
	L23A	516.00	Qualified Guess	25.5	14.3	13.158
	L23B	818.10	Qualified Guess	37.4	15.0	30.597
	L23C	890.60	Qualified Guess	23	12.6	20.484
	L23D	664.60	Qualified Guess	24.5	13.1	16.283
	L30A	360.80	CMB+Qualified Guess	36.5	12.9	13.169
	L30B	378.00	Qualified Guess	29.5	13.4	11.151
	L30C	237.20	Qualified Guess	30.8	12.6	7.306
	L30D	551.70	Qualified Guess	26.1	14.0	17.346
	L40A	762.60	Qualified Guess	27.7	12.8	21.124
	L40B	593.80	Qualified Guess	30.6	12.7	18.170
	L50A	466.40	Qualified Guess	44.5	15.0	20.755
	L50B	556.90	Qualified Guess	43.1	16.0	24.002
	L60A	677.20	Qualified Guess	36.5	15.2	24.718
	L60B	671.00	CMB+Qualified Guess	33.5	15.4	22.479
	L70A	581.50	Qualified Guess	42.1	16.0	24.481
	L70B	440.60	CMB+Qualified Guess	34.4	14.0	15.157
	L70C	661.80	Qualified Guess	33.8	15.1	22.369
	L70D	535.80	Qualified Guess	35.2	13.9	18.860
	L70E	701.70	CMB+Qualified Guess	34.1	12.0	23.928

IUA	Quaternary	Area (km2)	Recharge Method	Recharge (mm)	% Recharge	Recharge (Mm3/a)
	L70F	306.40	Qualified Guess	37.5	13.8	11.490
	L70G	469.70	Qualified Guess	55.8	11.1	26.209
	N11A	699.90	Qualified Guess	46.8	12.9	32.755
	N11B	774.10	CMB+CRD+Qualified Guess	34.4	10.3	26.629
	N12A	737.60	Qualified Guess	46.9	12.9	34.593
	N12B	799.70	Qualified Guess	46.1	13.2	36.866
	N12C	656.40	CMB+CRD+Qualified Guess	40.3	11.3	26.847
	N13A	553.80	CMB+CRD+Qualified Guess	39	10.2	21.598
	N13B	482.10	CMB+CRD+Qualified Guess	49.6	13.1	23.912
	N13C	491.30	CMB+Qualified Guess	36.5	11.9	17.933
IUA6	N40A	667.70	CMB+Qualified Guess	39.5	11.2	26.374
	N40B	1209.60	CMB+Qualified Guess	38.7	12.1	46.812
	N40C	579.90	CMB+Qualified Guess	46.3	9.2	26.849
	N40D	668.70	CMB+Qualified Guess	45.3	9.6	30.292
	N40E	510.10	Qualified Guess	48.2	13.3	24.587
	N40F	762.10	Qualified Guess	53.3	11.1	40.620
IUA7	P10A	125.50	CRD+Qualified Guess	47.4	7.9	5.949
	P10B	508.30	Qualified Guess	49.6	9.3	25.212
	P10C	280.70	CMB+Qualified Guess	35.6	9.2	9.993
	P10D	563.90	Qualified Guess	43.5	10.1	25.530
	P10E	466.30	Qualified Guess	46.5	9.4	21.683
	P10F	469.10	CMB+CRD+Qualified Guess	37.7	6.8	17.685
	P10G	343.20	CMB+Qualified Guess	41.1	7.5	14.106
	P20A	421.80	CMB+Qualified Guess	50.3	7.0	21.217
	P20B	331.70	Qualified Guess	53.3	8.4	17.680
	P30A	175.80	Qualified Guess	52.7	8.5	9.265
	P30B	402.70	Qualified Guess	49.6	8.9	19.974
	P30C	67.60	Qualified Guess	48.5	9.0	3.279
	P40A	311.60	Qualified Guess	53.3	8.4	16.608
	P40B	264.30	CMB+Qualified Guess	46.6	8.2	12.316
	P40C	342.10	CMB+CRD+Qualified Guess	44.8	7.3	15.326
	P40D	245.70	Qualified Guess	54.8	8.2	13.432
IUA8	Q11A	382.20	Qualified Guess	38.6	9.4	14.753
	Q11B	375.50	Qualified Guess	36.6	10.4	13.732
	Q11C	361.60	Qualified Guess	36.4	10.5	13.162
	Q11D	481.20	Qualified Guess	34.9	11.5	16.794
	Q14A	486.00	Qualified Guess	36.4	10.5	17.690
	Q14B	725.30	CMB+CRD+Qualified Guess	34.7	10.1	25.168
	Q14C	834.80	Qualified Guess	35.1	11.0	29.302
	Q14D	408.30	Qualified Guess	33.7	11.6	13.760
	Q14E	342.80	CMB+Qualified Guess	35.1	11.4	12.032

IUA	Quaternary	Area (km2)	Recharge Method	Recharge (mm)	% Recharge	Recharge (Mm3/a)
	Q21A	600.20	Qualified Guess	36.7	10.4	22.027
	Q21B	380.40	Qualified Guess	34.3	11.3	13.048
	Q22A	518.00	Qualified Guess	36.4	10.5	18.855
	Q22B	219.70	Qualified Guess	35.5	10.8	7.799
	Q30A	394.40	Qualified Guess	38.4	9.8	15.160
	Q30B	481.90	Qualified Guess	36.0	10.6	17.348
	Q80A	356.50	Qualified Guess	39.8	9.5	14.189
	Q80B	449.60	Qualified Guess	39.2	9.6	17.624
	Q80C	281.20	Qualified Guess	39.5	9.5	11.107
IUA9	Q12A	626.90	Qualified Guess	38.1	9.9	23.885
	Q12B	637.10	CMB+Qualified Guess	35.4	8.7	22.553
	Q12C	428.10	Qualified Guess	33.3	9.7	14.256
	Q13A	1031.00	CMB+CRD+Qualified Guess	26.7	8.2	27.528
	Q13B	240.00	Qualified Guess	30.8	10.7	7.392
	Q13C	454.30	Qualified Guess	31.6	10.4	14.356
	Q30C	420.40	CMB+Qualified Guess	29.8	9.1	12.528
	Q30D	310.90	CMB+Qualified Guess	33.8	9.7	10.508
	Q30E	325.80	Qualified Guess	33.5	9.8	10.914
	Q41A	229.60	Qualified Guess	42.4	7.9	9.735
	Q41B	433.90	Qualified Guess	38.3	8.5	16.618
	Q41C	333.10	CMB+CRD+Qualified Guess	34.8	8.0	11.592
	Q41D	295.20	Qualified Guess	34.1	9.5	10.066
	Q42A	445.50	Qualified Guess	38.5	8.5	17.152
	Q42B	375.60	Qualified Guess	37.1	8.8	13.935
	Q43A	705.50	Qualified Guess	35.6	9.1	25.116
	Q43B	802.60	Qualified Guess	33.3	9.7	26.727
	Q44A	425.40	Qualified Guess	33.9	9.6	14.421
	Q44B	448.90	CMB+Qualified Guess	27.8	8.7	12.479
	Q44C	254.20	Qualified Guess	33.3	9.7	8.465
	Q50A	639.60	CMB+Qualified Guess	30.0	8.0	19.188
	Q50B	402.90	Qualified Guess	36.5	8.9	14.706
	Q50C	197.90	CMB+Qualified Guess	32.0	7.8	6.333
	Q60A	315.60	Qualified Guess	36.5	8.9	7.223
	Q60B	369.40	Qualified Guess	40.9	8.1	15.109
	Q60C	131.50	Qualified Guess	38.3	8.5	5.036
	Q70A	251.20	CMB+Qualified Guess	43.5	10.2	10.927
	Q70B	457.70	Qualified Guess	34.8	9.3	15.928
	Q70C	249.50	Qualified Guess	34.3	9.4	8.558
	Q80A	356.50	Qualified Guess	37.0	8.8	13.191
	Q80B	449.60	Qualified Guess	36.3	8.9	16.321
	Q80C	281.20	Qualified Guess	36.7	8.8	10.320

IUA	Quaternary	Area (km2)	Recharge Method	Recharge (mm)	% Recharge	Recharge (Mm3/a)
	Q80D	417.80	CMB+Qualified Guess	34.6	7.0	14.456
	Q80E	364.40	Qualified Guess	34.9	9.3	12.718
	Q80F	700.90	Qualified Guess	33.9	9.6	23.761
	Q80G	266.30	Qualified Guess	34.0	9.5	9.054
	Q91A	477.50	CMB+Qualified Guess	30.1	7.6	14.373
	Q91B	514.60	CMB+Qualified Guess	38.4	8.2	19.761
	Q91C	485.00	Qualified Guess	40.2	8.5	19.497
IUA10	Q92A	324.00	Qualified Guess	48.2	7.3	15.617
	Q92B	324.40	Qualified Guess	44.6	7.6	14.468
	Q92C	600.60	CMB+Qualified Guess	40.1	6.8	24.084
	Q92D	248.70	Qualified Guess	45.0	7.6	11.192
	Q92E	287.00	Qualified Guess	39.0	8.4	11.193
	Q92F	665.30	CMB+Qualified Guess	31.6	7.6	21.024
	Q92G	884.40	CMB+Qualified Guess	32.7	7.0	28.920
	Q94A	258.90	Qualified Guess	54.7	6.8	14.162
	Q94B	147.40	Qualified Guess	50.2	7.1	7.399
	Q94C	135.20	Qualified Guess	53.1	6.9	7.179
	Q94D	212.00	Qualified Guess	45.6	7.5	9.667
	Q94E	227.70	Qualified Guess	47.2	7.4	10.747
	Q94F	734.10	CMB+Qualified Guess	35.5	7.4	26.061
IUA11	R10A	137.80	Qualified Guess	61.9	7.4	8.530
	R10B	222.20	Qualified Guess	63.1	7.3	14.021
	R10C	125.50	Qualified Guess	5.9.7	7.6	7.492
	R10D	178.40	Qualified Guess	56.1	7.9	10.008
	R10E	198.20	Qualified Guess	48.5	8.9	9.613
	R10F	70.70	Qualified Guess	71.3	6.9	5.041
	R10G	168.90	Qualified Guess	51.9	8.4	8.766
	R10H	243.30	CMB+Qualified Guess	40.5	7.8	9.854
	R10J	178.80	Qualified Guess	44.1	9.8	7.885
	R10K	602.70	Qualified Guess	47.3	9.1	28.508
	R10L	394.70	Qualified Guess	47.3	9.1	18.669
	R10M	176.50	Qualified Guess	51.9	8.4	9.160
	R40A	332.50	Qualified Guess	62.0	8.9	20.615
	R40B	326.10	Qualified Guess	54.1	8.1	17.642
	R40C	194.60	CMB+Qualified Guess	52.0	8.8	10.119
	R50A	393.80	Qualified Guess	52.6	9.1	20.714
	R50B	412.70	Qualified Guess	52.7	9.1	21.749
IUA12	R20A	139.40	Qualified Guess	74.5	7.4	10.385
	R20B	154.70	Qualified Guess	58.5	8.4	9.050
	R20C	121.00	Qualified Guess	63.8	8.0	7.720
	R20D	258.30	Qualified Guess	52.3	9.1	13.509

IUA	Quaternary	Area (km2)	Recharge Method	Recharge (mm)	% Recharge	Recharge (Mm3/a)
	R20E	249.40	Qualified Guess	56.5	8.6	14.091
	R20F	260.90	Qualified Guess	57.4	8.5	14.976
	R20G	103.20	Qualified Guess	64.4	7.9	6.646
	R30A	425.50	Qualified Guess	67.1	7.8	28.551
	R30B	527.00	Qualified Guess	63.4	8.0	33.412
	R30C	507.10	Qualified Guess	58.1	8.4	29.463
	R30D	150.60	Qualified Guess	63.0	8.0	9.488
	R30E	471.60	Qualified Guess	57.2	8.5	26.976
	R30F	208.60	Qualified Guess	63.4	8.0	13.225
IUA13	S10A	257.70	Qualified Guess	45.2	8.6	11.648
	S10B	398.70	Qualified Guess	47.5	8.2	18.938
	S10C	236.40	Qualified Guess	46.0	8.4	10.874
	S10D	316.80	Qualified Guess	48.2	8.1	15.270
	S10E	240.40	Qualified Guess	47.9	8.1	11.515
	S10F	301.00	Qualified Guess	47.7	8.2	14.358
	S10G	377.30	Qualified Guess	49.4	7.9	18.639
	S10H	473.00	Qualified Guess	47.2	8.2	22.326
	S10J	324.10	Qualified Guess	46.9	8.3	15.200
	S20A	298.10	Qualified Guess	49.6	7.9	14.786
	S20B	446.80	Qualified Guess	49.5	7.9	22.117
	S20C	552.10	Qualified Guess	49.9	7.9	27.550
	S20D	309.60	Qualified Guess	52.1	7.6	16.130
	S40A	446.30	Qualified Guess	46.4	8.4	20.708
	S40B	438.50	Qualified Guess	46.3	8.4	20.303
	S40C	326.90	Qualified Guess	47.6	8.2	15.560
	S40D	120.80	Qualified Guess	50.6	7.8	6.112
	S40E	502.30	Qualified Guess	48.6	8.1	24.412
	S40F	335.50	Qualified Guess	48.9	8.0	16.406
	S50A	224.00	Qualified Guess	54.2	7.4	12.141
	S50B	333.60	Qualified Guess	58.2	7.1	19.416
	S50C	383.40	Qualified Guess	51.5	7.7	19.745
	S50D	395.50	Qualified Guess	53.2	7.5	21.041
	S50E	447.90	Qualified Guess	56.6	7.2	25.351
	S50F	86.80	Qualified Guess	52.9	7.6	4.517
	S50G	501.20	Qualified Guess	51.9	7.7	26.012
	S50H	374.80	Qualified Guess	50.0	7.9	18.740
	S50J	685.10	Qualified Guess	51.5	7.7	35.283
IUA14	S31A	408.90	CMB+Qualified Guess	45.9	8.9	18.769
	S31B	400.10	Qualified Guess	44.5	8.7	17.800
	S31C	605.90	Qualified Guess	43.3	8.4	26.236
	S31D	331.00	Qualified Guess	46.5	8.8	15.392

IUA	Quaternary	Area (km2)	Recharge Method	Recharge (mm)	% Recharge	Recharge (Mm3/a)
	S31E	440.50	CMB+CRD+Qualified Guess	40.3	8.4	17.752
	S31F	225.70	Qualified Guess	46.7	8.7	10.540
	S31G	239.90	CRD+Qualified Guess	43.0	8.5	10.316
	S32A	324.30	Qualified Guess	46.1	8.4	14.950
	S32B	559.40	Qualified Guess	41.9	92.0	23.439
	S32C	525.60	CRD+Qualified Guess	38.7	7.8	20.341
	S32D	307.20	Qualified Guess	53.1	7.5	16.312
	S32E	295.10	Qualified Guess	50.3	7.8	14.844
	S32F	327.10	Qualified Guess	46.2	8.4	15.112
	S32G	237.90	Qualified Guess	44.7	8.7	10.634
	S32H	344.70	Qualified Guess	43.2	8.9	14.891
	S32J	238.60	Qualified Guess	46.4	8.4	11.071
	S32K	399.00	Qualified Guess	45.2	8.6	18.035
	S32L	286.80	Qualified Guess	45.5	8.5	13.049
	S32M	406.80	Qualified Guess	47.4	8.2	19.282
IUA15	S60A	327.50	Qualified Guess	59.3	7.2	19.421
	S60B	264.00	Qualified Guess	50.2	8.1	13.253
	S60C	215.80	CMB+Qualified Guess	46.1	6.9	9.948
	S60D	265.30	Qualified Guess	49.6	8.2	13.159
	S60E	214.70	Qualified Guess	51.4	7.9	11.057
	S70A	339.10	CMB+CRD+Qualified Guess	47.9	7.0	16.243
	S70B	267.30	Qualified Guess	55.7	7.5	14.889
	S70C	197.50	Qualified Guess	52.2	7.9	10.310
	S70D	513.60	Qualified Guess	53.0	7.8	27.221
	S70E	480.70	Qualified Guess	55.8	7.5	26.823
	S70F	358.60	Qualified Guess	58.6	7.3	21.026
IUA16	T11A	329.70	CMB+Qualified Guess	61.0	8.2	20.112
	T11B	414.70	Qualified Guess	55.7	7.5	23.099
	T11C	385.50	Qualified Guess	60.7	7.1	23.400
	T11D	342.60	Qualified Guess	60.3	7.1	20.659
	T11E	232.80	Qualified Guess	64.5	6.9	15.016
	T11F	275.20	Qualified Guess	62.5	7.0	17.200
	T11G	290.80	Qualified Guess	55.7	7.5	16.198
	T11H	216.20	Qualified Guess	54.5	7.6	11.783
	T12A	278.80	Qualified Guess	60.2	7.1	16.784
	T12B	229.80	Qualified Guess	55.4	7.5	12.731
	T12C	283.60	Qualified Guess	55.5	7.5	15.740
	T12D	320.30	CMB+Qualified Guess	64.1	9.0	20.852
	T12E	412.10	Qualified Guess	54.7	7.5	22.542
	T12F	346.10	Qualified Guess	55.6	7.5	19.243
	T12G	276.30	Qualified Guess	52.8	7.7	14.589

IUA	Quaternary	Area (km2)	Recharge Method	Recharge (mm)	% Recharge	Recharge (Mm3/a)
	T20A	480.80	Qualified Guess	64.5	6.9	31.012
IUA17	T13A	287.50	Qualified Guess	55.7	7.5	16.014
	T13B	285.30	Qualified Guess	53.7	7.6	15.321
	T13C	318.30	Qualified Guess	54.7	7.5	17.411
	T13D	357.30	Qualified Guess	62.2	7.0	22.224
	T13E	167.50	Qualified Guess	72.9	7.7	12.211
IUA18	T20B	405.20	Qualified Guess	60.1	7.1	24.353
	T20C	319.70	Qualified Guess	52.9	7.6	16.912
	T20D	387.60	Qualified Guess	56.5	7.4	21.899
	T20E	349.40	Qualified Guess	59.4	7.2	20.754
	T20F	443.00	Qualified Guess	56.5	7.4	25.030
IUA19	T60A	545.50	Qualified Guess	71.6	8.2	39.058
	T60B	527.00	CMB+Qualified Guess	93.8	10.5	49.433
	T60C	362.60	Qualified Guess	73.4	7.7	26.615
	T60D	413.90	Qualified Guess	95.4	8.9	39.486
	T60E	197.90	Qualified Guess	86.1	9.7	17.039
	T60F	463.20	Qualified Guess	86.2	9.2	39.928
	T60G	359.40	Qualified Guess	97.6	8.7	35.077
	T60H	321.60	Qualified Guess	110.3	8.6	35.473
	T60J	293.40	Qualified Guess	101.6	9.2	29.809
	T60K	242.00	Qualified Guess	100.3	9.3	24.273
	T70A	314.00	Qualified Guess	87.1	10.1	27.349
	T70B	276.40	Qualified Guess	92.7	9.5	25.622
	T70C	197.60	Qualified Guess	90.5	9.7	17.883
	T70D	332.30	Qualified Guess	94.0	9.4	31.236
	T70E	228.10	Qualified Guess	85.4	10.3	19.480
	T70F	264.60	Qualified Guess	90.4	9.7	23.920
	T70G	268.30	Qualified Guess	91.1	9.4	24.442
	T80A	212.80	Qualified Guess	94.0	9.4	20.003
	T80B	233.50	Qualified Guess	90.3	9.7	21.085
	T80C	314.40	Qualified Guess	83.8	10.5	26.347
	T80D	280.20	Qualified Guess	92.2	9.6	25.834
	T90A	328.50	Qualified Guess	79.2	11.3	26.017
	T90B	402.10	Qualified Guess	92.3	9.6	37.114
	T90C	366.50	Qualified Guess	88.8	9.9	32.545
	T90D	374.30	Qualified Guess	84.4	10.5	31.591
	T90E	411.80	Qualified Guess	88.9	9.9	36.609
	T90F	281.80	Qualified Guess	92.8	9.5	26.151
	T90G	460.20	CMB+Qualified Guess	83.4	9.6	38.381

APPENDIX C – BASIC HUMAN NEEDS RESULTS

Table 23: Basic Human Needs results

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
IUA1	K80A	0	0	0.0000
	K80B	3 423	587	0.0054
	K80C	3 423	587	0.0054
	K80D	4 348	1 266	0.0115
	K80E	4 348	1 266	0.0115
	K80F	2 679	1 164	0.0106
	K90A	2 657	119	0.0011
	K90B	2 657	119	0.0011
IUA2	K90C	2 657	119	0.0011
	K90D	0	0	0.0000
	K90E	7 726	269	0.0025
	K90F	32 595	66	0.0006
	K90G	19 437	560	0.0051
	L90A	8 734	97	0.0009
	L90B	8 171	269	0.0025
	L90C	11 864	326	0.0030
IUA3	L81A	1 462	66	0.0006
	L81B	1 462	66	0.0006
	L81C	0	0	0.0000
	L81D	0	0	0.0000
	L82A	5 029	675	0.0062
	L82B	6 715	1 349	0.0123
	L82C	6 715	1 349	0.0123
	L82D	7 372	282	0.0026
	L82E	0	0	0.0000
	L82F	0	0	0.0000
	L82G	0	0	0.0000
	L82H	0	0	0.0000
	L82J	0	0	0.0000
IUA4	M10A	0	0	0.0000
	M10B	2 598	207	0.0019
	M10C	332 193	2 540	0.0232
	M10D	542 873	2 176	0.0199
	M20A	403 409	2 059	0.0188
	M20B	56 410	2 668	0.0243

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
	M30A	40 008	811	0.0074
	M30B	95 628	146	0.0013
IUA5	L11A	0	0	0.0000
	L11B	0	0	0.0000
	L11C	14 154	2893	0.0264
	L11D	0	0	0.0000
	L11E	8 214	1 446	0.0132
	L11F	0	0	0.0000
	L11G	0	0	0.0000
	L12A	0	0	0.0000
	L12B	0	0	0.0000
	L12C	0	13	0.0001
	L12D	0	0	0.0000
	L21A	0	0	0.0000
	L21B	8 214	1 449	0.0132
	L21C	5 940	4384	0.0400
	L21D	0	0	0.0000
	L21E	9 392	1 449	0.0132
	L21F	0	0	0.0000
	L22A	0	0	0.0000
	L22B	0	0	0.0000
	L22C	0	0	0.0000
	L22D	0	0	0.0000
	L23A	0	0	0.0000
	L23B	0	0	0.0000
	L23C	0	0	0.0000
	L23D	0	0	0.0000
	L30A	9 689	886	0.0081
	L30B	0	0	0.0000
	L30C	0	0	0.0000
	L30D	0	0	0.0000
	L40A	0	0	0.0000
	L40B	0	0	0.0000
	L50A	0	0	0.0000
	L50B	0	0	0.0000
	L60A	0	0	0.0000
	L60B	0	0	0.0000
	L70A	0	0	0.0000
	L70B	0	0	0.0000
	L70C	0	0	0.0000

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
	L70D	0	0	0.0000
	L70E	0	0	0.0000
	L70F	0	0	0.0000
	L70G	0	0	0.0000
	N11A	9 145	278	0.0025
	N11B	0	0	0.0000
	N12A	3 977	974	0.0089
	N12B	3 977	974	0.0089
	N12C	9 145	0	0.0000
	N13A	0	0	0.0000
	N13B	3 977	974	0.0089
	N13C	3 977	974	0.0089
IUA6	N40A	5 196	415	0.0038
	N40B	5 196	415	0.0038
	N40C	5 877	54	0.0005
	N40D	5 877	54	0.0005
	N40E	5 877	54	0.0005
	N40F	9 756	763	0.0070
IUA7	P10A	5 335	49	0.0004
	P10B	5 335	49	0.0004
	P10C	7 746	849	0.0077
	P10D	7 746	849	0.0077
	P10E	7 298	1 222	0.0111
	P10F	7 298	917	0.0084
	P10G	12 553	902	0.0082
	P20A	13 633	902	0.0082
	P20B	4 878	381	0.0035
	P30A	4 254	609	0.0056
	P30B	4 254	0	0.0000
	P30C	2 044	11	0.0001
	P40A	3 689	0	0.0000
	P40B	5 664	16 41	0.0150
	P40C	38 451	2 152	0.0196
	P40D	5 664	820	0.0075
IUA8	Q11A	1 853	1 164	0.0106
	Q11B	1 853	1 164	0.0106
	Q11C	1 853	1 164	0.0106
	Q11D	1 853	1 164	0.0106
	Q14A	15 416	2 811	0.0257
	Q14B	10 587	0	0.0000

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
	Q14C	3 705	1164	0.0106
	Q14D	1 853	1164	0.0106
	Q14E	0	0	0.0000
	Q21A	3 854	937	0.0086
	Q21B	3 854	937	0.0086
	Q22A	3 854	937	0.0086
	Q22B	3 854	937	0.0086
	Q30A	3 854	937	0.0086
	Q30B	1 853	1 442	0.0132
	Q80A	1 869	332	0.0030
	Q80B	1 869	332	0.0030
	Q80C	1 869	332	0.0030
IUA9	Q12A	0	0	0.0000
	Q12B	5 956	79	0.0007
	Q12C	3 197	759	0.0069
	Q13A	2 157	701	0.0064
	Q13B	3 854	106	0.0010
	Q13C	10 587	0	0.0000
	Q30C	3 854	106	0.0010
	Q30D	3 854	106	0.0010
	Q30E	32893	0	0.0000
	Q41A	2157	701	0.0064
	Q41B	6 170	424	0.0039
	Q41C	1 909	424	0.0039
	Q41D	2 756	30	0.0003
	Q42A	2 157	467	0.0043
	Q42B	7 634	119	0.0011
	Q43A	0	0	0.0000
	Q43B	0	0	0.0000
	Q44A	0	0	0.0000
	Q44B	2 157	701	0.0064
	Q44C	3 854	424	0.0039
	Q50A	3 854	424	0.0039
	Q50B	0	0	0.0000
	Q50C	0	0	0.0000
	Q60A	0	0	0.0000
	Q60B	0	0	0.0000
	Q60C	0	0	0.0000
	Q70A	0	0	0.0000
	Q70B	0	0	0.0000

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
	Q70C	0	0	0.0000
	Q80A	0	0	0.0000
	Q80B	0	0	0.0000
	Q80C	0	0	0.0000
	Q80D	17 562	213	0.0019
	Q80E	0	0	0.0000
	Q80F	0	0	0.0000
	Q80G	0	0	0.0000
	Q91A	0	0	0.0000
	Q91B	0	0	0.0000
	Q91C	0	0	0.0000
IUA10	Q92A	2 584	136	0.0012
	Q92B	2 584	272	0.0025
	Q92C	2 584	272	0.0025
	Q92D	2 584	272	0.0025
	Q92E	6 761	154	0.0014
	Q92F	7 767	0	0.0000
	Q92G	6 761	154	0.0014
	Q94A	7 613	0	0.0000
	Q94B	5 167	0	0.0000
	Q94C	3 704	0	0.0000
	Q94D	3 704	0	0.0000
	Q94E	2 236	0	0.0000
	Q94F	4 133	0	0.0000
IUA11	R10A	3 788	11	0.0001
	R10B	8 321	0	0.0000
	R10C	6 468	60	0.0005
	R10D	10 966	108	0.0010
	R10E	7 535	40	0.0004
	R10F	1 852	31	0.0003
	R10G	10 566	110	0.0010
	R10H	11 967	2	0.0000
	R10J	14 576	534	0.0049
	R10K	21 516	68	0.0006
	R10L	6 868	39	0.0004
	R10M	6 385	193	0.0018
	R40A	26 538	1 528	0.0139
	R40B	17 539	234	0.0021
	R40C	16 039	1 134	0.0104
	R50A	10 936	318	0.0029

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
	R50B	14 794	240	0.0022
IUA12	R20A	19 592	88	0.0008
	R20B	45 820	18	0.0002
	R20C	56 730	26	0.0002
	R20D	57 292	31	0.0003
	R20E	114 577	71	0.0006
	R20F	168 877	0	0.0000
	R20G	202 953	26	0.0002
	R30A	28 554	1 883	0.0172
	R30B	20 607	1 305	0.0119
	R30C	13 195	132	0.0012
	R30D	14 205	701	0.0064
	R30E	43 949	357	0.0033
	R30F	111 276	736	0.0067
IUA13	S10A	8 694	0	0.0000
	S10B	8 510	644	0.0059
	S10C	12 378	1 226	0.0112
	S10D	15 453	979	0.0089
	S10E	11 579	860	0.0078
	S10F	11 579	860	0.0078
	S10G	32 765	2 567	0.0234
	S10H	17 629	3 065	0.0280
	S10J	7 197	0	0.0000
	S20A	9 766	719	0.0066
	S20B	10 113	1 106	0.0101
	S20C	33 777	0	0.0000
	S20D	14 983	1 312	0.0120
	S40A	8 521	1 352	0.0123
	S40B	9 113	680	0.0062
	S40C	2 215	0	0.0000
	S40D	7 748	0	0.0000
	S40E	3 779	229	0.0021
	S40F	6 393	109	0.0010
	S50A	10 299	372	0.0034
	S50B	4 749	696	0.0063
	S50C	5 150	743	0.0068
	S50D	25 128	1 976	0.0180
	S50E	32 978	0	0.0000
	S50F	7 604	336	0.0031
	S50G	25 512	2 073	0.0189

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
	S50H	28 533	979	0.0089
	S50J	38 184	1 658	0.0151
IUA14	S31A	7 457	440	0.0040
	S31B	1 887	483	0.0044
	S31C	3 664	607	0.0055
	S31D	4 050	1 079	0.0098
	S31E	6 332	750	0.0068
	S31F	65 327	1 182	0.0108
	S31G	3 949	444	0.0041
	S32A	2 157	49	0.0004
	S32B	8 361	289	0.0026
	S32C	16 068	3 354	0.0306
	S32D	3 418	444	0.0041
	S32E	3 490	0	0.0000
	S32F	14 065	418	0.0038
	S32G	44 112	476	0.0043
	S32H	7 896	972	0.0089
	S32J	19 965	809	0.0074
	S32K	2 805	192	0.0018
	S32L	1 709	0	0.0000
	S32M	2 805	192	0.0018
IUA15	S60A	13 481	170	0.0015
	S60B	19 305	271	0.0025
	S60C	15 307	130	0.0012
	S60D	2 232	116	0.0011
	S60E	12 072	0	0.0000
	S70A	18 768	104	0.0009
	S70B	19 371	184	0.0017
	S70C	9 764	428	0.0039
	S70D	59 514	1 334	0.0122
	S70E	76 453	234	0.0021
	S70F	27 416	0	0.0000
IUA16	T11A	2 600	74	0.0007
	T11B	2600	74	0.0007
	T11C	4 987	269	0.0025
	T11D	2 600	148	0.0013
	T11E	12 286	474	0.0043
	T11F	25 277	3 627	0.0331
	T11G	10 065	87	0.0008
	T11H	6 172	2 130	0.0194

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
	T12A	15 713	1 303	0.0119
	T12B	24 277	789	0.0072
	T12C	24 277	2 386	0.0218
	T12D	24 654	1 865	0.0170
	T12E	32 465	472	0.0043
	T12F	37 456	1 996	0.0182
	T12G	20 387	1 556	0.0142
	T20A	23 199	675	0.0062
IUA17	T13A	25 243	396	0.0036
	T13B	35 919	1 341	0.0122
	T13C	18 688	157	0.0014
	T13D	25 768	456	0.0042
	T13E	13 793	593	0.0054
IUA18	T20B	49 645	1 087	0.0099
	T20C	109 351	966	0.0088
	T20D	152 158	2 033	0.0186
	T20E	61 989	2 035	0.0186
	T20F	57 247	1 173	0.0107
IUA19	T60A	74 894	838	0.0076
	T60B	48 790	576	0.0053
	T60C	55 576	717	0.0065
	T60D	13 066	286	0.0026
	T60E	34 613	1 665	0.0152
	T60F	82 680	1 775	0.0162
	T60G	55 900	247	0.0023
	T60H	8 720	141	0.0013
	T60J	82 398	957	0.0087
	T60K	30 475	0	0.0000
	T70A	25 190	410	0.0037
	T70B	37 110	46	0.0004
	T70C	47 413	443	0.0040
	T70D	68 749	0	0.0000
	T70E	47 966	278	0.0025
	T70F	33 254	135	0.0012
	T70G	28 156	31	0.0003
	T80A	28 775	31	0.0003
	T80B	35 155	212	0.0019
	T80C	38 845	0	0.0000
	T80D	28 632	123	0.0011
	T90A	48 557	269	0.0025

IUA	Quaternary	Total population	Persons with informal supply (ground water)	BHN (Mm3/a)
	T90B	32 492	106	0.0010
	T90C	18 525	79	0.0007
	T90D	21 976	776	0.0071
	T90E	39 075	1 764	0.0161
	T90F	36 199	362	0.0033
	T90G	27 350	869	0.0079

APPENDIX D – GROUNDWATER CONTRIBUTION TO BASEFLOW

Table 24: Groundwater contribution to baseflow results

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
K80A	62.86	3.69	4.11	4.35	3.9	4.05	5.87	6.20	6.44	6.17	3.88	46.56
K80B	88.50	5.28	5.88	5.96	5.58	5.71	5.97	6.31	6.45	6.24	5.52	66.27
K80C	84.35	5.07	5.57	5.82	5.32	5.49	6.01	6.31	6.50	6.27	5.29	63.51
K80D	63.43	2.71	3.22	3.58	2.97	3.17	4.27	4.67	5.00	4.65	2.95	35.38
K80E	54.91	2.38	2.86	3.2	2.62	2.81	4.33	4.77	5.12	4.74	2.60	31.25
K80F	41.18	1.81	2.2	2.51	2.01	2.17	4.40	4.87	5.28	4.85	2.00	23.95
K90A	27.85	0.77	0.83	1.14	0.80	0.91	2.76	2.87	3.28	2.97	0.83	9.93
K90B	23.89	0.67	0.73	1	0.70	0.80	2.80	2.93	3.35	3.03	0.72	8.68
K90C	12.64	0.46	0.61	0.8	0.54	0.62	3.64	4.23	4.93	4.27	0.54	6.47
K90D	16.43	0.57	0.76	0.99	0.67	0.77	3.47	4.05	4.71	4.07	0.67	8.03
K90E	11.83	0.37	0.42	0.62	0.40	0.47	3.13	3.34	3.97	3.48	0.41	4.94
K90F	18.7	0.58	0.65	0.97	0.62	0.73	3.10	3.29	3.92	3.44	0.64	7.71
K90G	16.47	0.53	0.61	0.9	0.57	0.68	3.22	3.46	4.13	3.60	0.59	7.12
L11A	5.82	0.06	0.07	0.11	0.07	0.08	1.03	1.12	1.37	1.17	0.07	0.82
L11B	6.97	0.07	0.09	0.13	0.08	0.10	1.00	1.15	1.39	1.18	0.08	0.99
L11C	4.91	0.05	0.06	0.09	0.06	0.07	1.02	1.12	1.36	1.17	0.06	0.69
L11D	8.78	0.08	0.11	0.17	0.10	0.12	0.91	1.08	1.37	1.12	0.10	1.18
L11E	3.6	0.04	0.05	0.12	0.05	0.07	1.11	1.25	1.94	1.44	0.05	0.62
L11F	4.94	0.14	0.15	0.22	0.15	0.17	2.83	2.94	3.44	3.07	0.15	1.82

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
L11G	9.58	0.32	0.33	0.45	0.33	0.37	3.34	3.39	3.83	3.52	0.34	4.05
L12A	2.4	0.1	0.11	0.12	0.11	0.11	4.17	4.38	4.58	4.38	0.11	1.26
L12B	2.23	0.08	0.1	0.11	0.09	0.10	3.59	4.04	4.33	3.99	0.09	1.07
L12C	2.52	0.12	0.13	0.14	0.13	0.13	4.76	4.96	5.16	4.96	0.13	1.50
L12D	2.95	0.12	0.15	0.16	0.14	0.14	4.07	4.58	4.86	4.50	0.13	1.59
L21A	5.72	0.15	0.16	0.17	0.16	0.16	2.62	2.71	2.80	2.71	0.16	1.86
L21B	9.68	0.4	0.42	0.43	0.41	0.42	4.13	4.24	4.30	4.22	0.41	4.91
L21C	10.04	0.15	0.21	0.26	0.18	0.21	1.49	1.79	2.06	1.78	0.18	2.15
L21D	15.68	0.21	0.32	0.4	0.27	0.31	1.34	1.69	1.98	1.67	0.26	3.14
L21E	6.41	0.12	0.15	0.19	0.14	0.15	1.87	2.11	2.39	2.12	0.14	1.63
L21F	5.82	0.14	0.16	0.17	0.15	0.16	2.41	2.58	2.69	2.56	0.15	1.79
L22A	8.17	0.24	0.32	0.33	0.28	0.30	2.94	3.43	3.63	3.33	0.27	3.27
L22B	2.71	0.09	0.11	0.12	0.10	0.11	3.32	3.69	3.94	3.65	0.10	1.19
L22C	6.01	0.18	0.24	0.25	0.21	0.22	3.00	3.49	3.72	3.40	0.20	2.45
L22D	6.57	0.16	0.23	0.25	0.20	0.21	2.44	2.97	3.25	2.88	0.19	2.27
L23A	1.95	0.07	0.09	0.1	0.08	0.09	3.59	4.10	4.44	4.05	0.08	0.95
L23B	6.54	0.18	0.26	0.28	0.22	0.24	2.75	3.36	3.67	3.26	0.21	2.56
L23C	3.58	0.13	0.16	0.17	0.15	0.15	3.63	4.05	4.28	3.99	0.14	1.71
L23D	2.79	0.09	0.1	0.12	0.10	0.10	3.23	3.41	3.70	3.44	0.10	1.15
L30A	1.62	0.03	0.04	0.05	0.04	0.04	1.85	2.16	2.47	2.16	0.04	0.42

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
L30B	1.09	0.02	0.03	0.05	0.03	0.03	1.83	2.29	3.06	2.40	0.03	0.31
L30C	0.96	0.01	0.02	0.04	0.02	0.02	1.04	1.56	2.43	1.68	0.02	0.19
L30D	1.58	0.03	0.05	0.06	0.04	0.05	1.90	2.53	2.95	2.46	0.04	0.47
L40A	1.58	0.03	0.07	0.1	0.05	0.07	1.90	3.16	4.22	3.09	0.05	0.59
L40B	1.83	0.03	0.04	0.08	0.04	0.05	1.64	1.91	2.73	2.09	0.04	0.46
L50A	2.4	0.04	0.05	0.08	0.05	0.06	1.67	1.88	2.36	1.97	0.05	0.57
L50B	2.02	0.04	0.06	0.08	0.05	0.06	1.98	2.48	2.97	2.48	0.05	0.60
L60A	1.88	0.03	0.04	0.08	0.04	0.05	1.60	1.86	2.66	2.04	0.04	0.46
L60B	1.46	0.02	0.03	0.06	0.03	0.04	1.37	1.71	2.51	1.86	0.03	0.33
L70A	1.69	0.03	0.04	0.06	0.04	0.04	1.78	2.07	2.56	2.14	0.04	0.43
L70B	0.82	0.02	0.03	0.04	0.03	0.03	2.44	3.05	3.66	3.05	0.03	0.30
L70C	1.66	0.03	0.05	0.07	0.04	0.05	1.81	2.41	3.01	2.41	0.04	0.48
L70D	1.73	0.04	0.05	0.07	0.05	0.05	2.31	2.60	3.08	2.67	0.05	0.55
L70E	3.33	0.07	0.1	0.15	0.09	0.11	2.10	2.55	3.20	2.62	0.09	1.05
L70F	2.11	0.04	0.06	0.09	0.05	0.06	1.90	2.37	3.00	2.42	0.05	0.61
L70G	11.62	0.51	0.53	0.56	0.52	0.53	4.39	4.48	4.59	4.48	0.52	6.25
L81A	17.8	0.87	0.9	1.02	0.89	0.93	4.89	4.97	5.22	5.03	0.90	10.74
L81B	8.91	0.41	0.44	0.5	0.43	0.45	4.60	4.77	5.05	4.81	0.43	5.14
L81C	12.25	0.56	0.61	0.69	0.59	0.62	4.57	4.78	5.06	4.80	0.59	7.06
L81D	9.13	0.41	0.46	0.51	0.44	0.46	4.49	4.76	5.04	4.76	0.44	5.22

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
L82A	17.81	0.49	0.57	0.59	0.53	0.55	2.75	2.98	3.09	2.94	0.52	6.28
L82B	35.83	0.91	1.1	1.12	1.01	1.04	2.54	2.80	2.91	2.75	0.99	11.83
L82C	33.3	0.93	1.1	1.11	1.02	1.05	2.79	3.05	3.14	2.99	1.00	11.97
L82D	42.76	1.37	1.58	1.81	1.48	1.59	3.20	3.45	3.71	3.45	1.48	17.73
L82E	25.38	0.82	0.95	1.09	0.89	0.95	3.23	3.49	3.76	3.49	0.89	10.63
L82F	8	0.32	0.37	0.41	0.35	0.37	4.00	4.31	4.58	4.30	0.34	4.13
L82G	10.44	0.42	0.48	0.54	0.45	0.48	4.02	4.31	4.60	4.31	0.45	5.40
L82H	7.65	0.3	0.35	0.39	0.33	0.35	3.92	4.25	4.53	4.23	0.32	3.89
L82J	6.14	0.19	0.23	0.27	0.21	0.23	3.09	3.42	3.75	3.42	0.21	2.52
L90A	19.48	0.78	0.88	1.21	0.83	0.96	4.00	4.26	4.91	4.39	0.86	10.27
L90B	38.03	1.87	2.08	2.18	1.98	2.04	4.92	5.19	5.37	5.16	1.96	23.55
L90C	33.96	1.67	1.86	1.95	1.77	1.83	4.92	5.20	5.38	5.16	1.75	21.05
M10A	20.02	0.67	1.27	1.31	0.97	1.08	3.35	4.85	5.41	4.53	0.91	10.89
M10B	33.06	1.14	2.13	2.15	1.64	1.81	3.45	4.95	5.46	4.62	1.53	18.33
M10C	38.41	1.31	2.45	2.51	1.88	2.09	3.41	4.89	5.44	4.58	1.76	21.12
M10D	18.48	0.75	1.25	1.32	1.00	1.11	4.06	5.41	5.99	5.15	0.95	11.43
M20A	22.69	0.43	0.58	1.34	0.51	0.78	1.90	2.23	3.45	2.52	0.57	6.87
M20B	49.74	1.05	1.25	2.51	1.15	1.60	2.11	2.31	3.22	2.55	1.27	15.21
M30A	6.05	0.1	0.14	0.15	0.12	0.13	1.65	1.98	2.15	1.93	0.12	1.40
M30B	4.98	0.11	0.12	0.14	0.12	0.12	2.21	2.31	2.48	2.33	0.12	1.39

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
N11A	7.32	0.07	0.13	0.15	0.10	0.12	0.96	1.37	1.59	1.31	0.10	1.15
N11B	5.99	0.05	0.1	0.17	0.08	0.11	0.83	1.25	1.78	1.29	0.08	0.93
N12A	7.64	0.05	0.09	0.14	0.07	0.09	0.65	0.92	1.22	0.93	0.07	0.85
N12B	7.11	0.04	0.08	0.13	0.06	0.08	0.56	0.84	1.17	0.86	0.06	0.73
N12C	6.21	0.04	0.07	0.12	0.06	0.08	0.64	0.89	1.23	0.92	0.06	0.69
N13A	7.44	0.16	0.19	0.31	0.18	0.22	2.15	2.35	2.96	2.49	0.19	2.22
N13B	6.09	0.13	0.15	0.23	0.14	0.17	2.13	2.30	2.79	2.41	0.15	1.76
N13C	3.3	0.08	0.13	0.16	0.11	0.12	2.42	3.18	3.74	3.11	0.10	1.23
N40A	6.98	0.32	0.37	0.41	0.35	0.37	4.58	4.94	5.25	4.93	0.34	4.13
N40B	8.86	0.33	0.42	0.5	0.38	0.42	3.72	4.23	4.70	4.22	0.37	4.49
N40C	14.59	0.54	0.57	0.75	0.56	0.62	3.70	3.80	4.25	3.92	0.57	6.86
N40D	14.07	0.52	0.57	0.59	0.55	0.56	3.70	3.87	3.98	3.85	0.54	6.50
N40E	4.02	0.13	0.15	0.16	0.14	0.15	3.23	3.48	3.65	3.45	0.14	1.67
N40F	17.28	0.67	0.69	0.71	0.68	0.69	3.88	3.94	3.99	3.94	0.68	8.16
P10A	1.87	0.06	0.08	0.09	0.07	0.08	3.21	3.74	4.10	3.68	0.07	0.83
P10B	4.65	0.13	0.22	0.24	0.18	0.20	2.80	3.76	4.23	3.60	0.17	2.01
P10C	0.73	0.02	0.03	0.04	0.03	0.03	2.74	3.42	4.11	3.42	0.03	0.30
P10D	2.23	0.06	0.11	0.12	0.09	0.10	2.69	3.81	4.33	3.61	0.08	0.97
P10E	8.91	0.21	0.29	0.47	0.25	0.32	2.36	2.81	3.63	2.93	0.26	3.13
P10F	14.32	0.34	0.45	0.77	0.40	0.52	2.37	2.76	3.63	2.92	0.42	5.02

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
P10G	10.38	0.24	0.32	0.55	0.28	0.37	2.31	2.70	3.56	2.86	0.30	3.56
P20A	32.37	0.77	0.97	1.77	0.87	1.17	2.38	2.69	3.61	2.89	0.94	11.24
P20B	16.14	0.37	0.48	0.88	0.43	0.58	2.29	2.63	3.57	2.83	0.46	5.49
P30A	8.07	0.26	0.29	0.57	0.28	0.37	3.22	3.41	4.63	3.75	0.30	3.63
P30B	12.09	0.39	0.44	0.8	0.42	0.54	3.23	3.43	4.49	3.72	0.45	5.39
P30C	1.73	0.06	0.11	0.12	0.09	0.10	3.47	4.91	5.59	4.66	0.08	0.97
P40A	15.19	0.43	0.44	0.87	0.44	0.58	2.83	2.86	3.82	3.17	0.48	5.78
P40B	8.54	0.28	0.31	0.57	0.30	0.39	3.28	3.45	4.53	3.75	0.32	3.85
P40C	15.27	0.49	0.53	1.05	0.51	0.69	3.21	3.34	4.52	3.69	0.56	6.76
P40D	14.47	0.46	0.5	0.97	0.48	0.64	3.18	3.32	4.45	3.65	0.53	6.33
Q11A	5.92	0.07	0.09	0.13	0.08	0.10	1.18	1.35	1.63	1.39	0.08	0.99
Q11B	4.09	0.05	0.07	0.09	0.06	0.07	1.22	1.47	1.71	1.47	0.06	0.72
Q11C	3.81	0.05	0.06	0.08	0.06	0.06	1.31	1.44	1.66	1.47	0.06	0.67
Q11D	3.78	0.05	0.06	0.08	0.06	0.06	1.32	1.46	1.68	1.48	0.06	0.67
Q12A	7.87	0.09	0.12	0.14	0.11	0.12	1.14	1.33	1.48	1.32	0.10	1.25
Q12B	9.58	0.12	0.15	0.18	0.14	0.15	1.25	1.41	1.57	1.41	0.14	1.62
Q12C	3.5	0.04	0.05	0.06	0.05	0.05	1.14	1.29	1.43	1.29	0.05	0.54
Q13A	8.4	0.11	0.12	0.15	0.12	0.13	1.31	1.37	1.51	1.40	0.12	1.41
Q13B	1.64	0.02	0.03	0.05	0.03	0.03	1.22	1.52	2.03	1.59	0.03	0.31
Q13C	3.68	0.05	0.07	0.11	0.06	0.08	1.36	1.63	2.08	1.69	0.06	0.75

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
Q14A	6.27	0.08	0.13	0.14	0.11	0.12	1.28	1.67	1.86	1.60	0.10	1.21
Q14B	9.1	0.11	0.12	0.19	0.12	0.14	1.21	1.26	1.54	1.34	0.12	1.46
Q14C	8.36	0.1	0.11	0.17	0.11	0.13	1.20	1.26	1.52	1.32	0.11	1.33
Q14D	3.04	0.04	0.06	0.07	0.05	0.06	1.32	1.64	1.86	1.61	0.05	0.59
Q14E	3.01	0.04	0.06	0.07	0.05	0.06	1.33	1.66	1.88	1.62	0.05	0.59
Q21A	7.3	0.09	0.1	0.15	0.10	0.11	1.23	1.30	1.55	1.36	0.10	1.19
Q21B	2.9	0.04	0.06	0.07	0.05	0.06	1.38	1.72	1.95	1.69	0.05	0.59
Q22A	6.01	0.08	0.13	0.15	0.11	0.12	1.33	1.75	2.00	1.69	0.10	1.22
Q22B	2.13	0.03	0.04	0.05	0.04	0.04	1.41	1.64	1.88	1.64	0.04	0.42
Q30A	5.94	0.11	0.13	0.14	0.12	0.13	1.85	2.02	2.13	2.00	0.12	1.43
Q30B	4.77	0.09	0.1	0.11	0.10	0.10	1.89	1.99	2.10	1.99	0.10	1.14
Q30C	4.49	0.16	0.17	0.2	0.17	0.18	3.56	3.67	3.93	3.72	0.17	2.01
Q30D	3.76	0.13	0.14	0.16	0.14	0.14	3.46	3.59	3.81	3.62	0.14	1.63
Q30E	4.03	0.14	0.16	0.18	0.15	0.16	3.47	3.72	3.97	3.72	0.15	1.80
Q41A	7.44	0.16	0.18	0.2	0.17	0.18	2.15	2.28	2.42	2.28	0.17	2.04
Q41B	7.89	0.13	0.17	0.22	0.15	0.17	1.65	1.90	2.20	1.92	0.15	1.81
Q41C	5.38	0.09	0.11	0.15	0.10	0.12	1.67	1.86	2.17	1.90	0.10	1.23
Q41D	2.59	0.05	0.07	0.09	0.06	0.07	1.93	2.32	2.70	2.32	0.06	0.72
Q42A	9.28	0.16	0.2	0.23	0.18	0.20	1.72	1.94	2.12	1.93	0.18	2.15
Q42B	6.2	0.1	0.12	0.15	0.11	0.12	1.61	1.77	1.99	1.79	0.11	1.33

Quaternary	Flows						Baseflow (%)					
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Q43A	8.97	0.14	0.16	0.21	0.15	0.17	1.56	1.67	1.90	1.71	0.15	1.84
Q43B	6.58	0.11	0.12	0.16	0.12	0.13	1.67	1.75	1.98	1.80	0.12	1.42
Q44A	4.13	0.09	0.1	0.12	0.10	0.10	2.18	2.30	2.50	2.33	0.10	1.15
Q44B	3.1	0.06	0.07	0.08	0.07	0.07	1.94	2.10	2.26	2.10	0.07	0.78
Q44C	2.22	0.04	0.05	0.06	0.05	0.05	1.80	2.03	2.25	2.03	0.05	0.54
Q50A	8.34	0.24	0.26	0.29	0.25	0.26	2.88	3.00	3.16	3.01	0.25	3.01
Q50B	6.37	0.14	0.18	0.2	0.16	0.17	2.20	2.51	2.72	2.48	0.16	1.89
Q50C	3.14	0.06	0.09	0.1	0.08	0.08	1.91	2.39	2.65	2.32	0.07	0.87
Q60A	5.06	0.12	0.15	0.21	0.14	0.16	2.37	2.67	3.16	2.73	0.14	1.66
Q60B	6.95	0.19	0.21	0.23	0.20	0.21	2.73	2.88	3.02	2.88	0.20	2.40
Q60C	1.4	0.03	0.04	0.05	0.04	0.04	2.14	2.50	2.86	2.50	0.04	0.42
Q70A	4.63	0.06	0.09	0.14	0.08	0.10	1.30	1.62	2.09	1.67	0.08	0.93
Q70B	5.99	0.09	0.12	0.16	0.11	0.12	1.50	1.75	2.06	1.77	0.11	1.27
Q70C	2.81	0.04	0.06	0.07	0.05	0.06	1.42	1.78	2.02	1.74	0.05	0.59
Q80A	14.34	0.42	0.51	0.55	0.47	0.49	2.93	3.24	3.44	3.20	0.46	5.51
Q80B	16.55	0.5	0.6	0.64	0.55	0.58	3.02	3.32	3.50	3.28	0.54	6.52
Q80C	10.87	0.32	0.39	0.42	0.36	0.38	2.94	3.27	3.47	3.22	0.35	4.21
Q80D	25.36	0.69	0.84	0.97	0.77	0.83	2.72	3.02	3.29	3.01	0.76	9.15
Q80E	12.79	0.43	0.46	0.56	0.45	0.48	3.36	3.48	3.78	3.54	0.45	5.43
Q80F	7.54	0.2	0.22	0.28	0.21	0.23	2.65	2.79	3.09	2.84	0.21	2.57

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Q80G	2.94	0.08	0.09	0.11	0.09	0.09	2.72	2.89	3.17	2.93	0.09	1.03
Q91A	6.49	0.11	0.13	0.19	0.12	0.14	1.69	1.85	2.21	1.92	0.12	1.49
Q91B	10.25	0.18	0.21	0.31	0.20	0.23	1.76	1.90	2.28	1.98	0.20	2.43
Q91C	8.63	0.14	0.18	0.27	0.16	0.20	1.62	1.85	2.28	1.92	0.17	1.99
Q92A	21.25	0.98	1.09	1.21	1.04	1.09	4.61	4.87	5.15	4.88	1.04	12.43
Q92B	11.19	0.35	0.42	0.56	0.39	0.44	3.13	3.44	3.96	3.51	0.39	4.71
Q92C	16.64	0.46	0.59	0.74	0.53	0.60	2.76	3.16	3.59	3.17	0.53	6.33
Q92D	10.76	0.4	0.47	0.55	0.44	0.47	3.72	4.04	4.40	4.05	0.44	5.23
Q92E	3.42	0.08	0.15	0.2	0.12	0.14	2.34	3.36	4.19	3.30	0.11	1.35
Q92F	4.24	0.07	0.14	0.15	0.11	0.12	1.65	2.48	2.83	2.32	0.10	1.18
Q92G	9.47	0.17	0.18	0.33	0.18	0.23	1.80	1.85	2.39	2.01	0.19	2.29
Q94A	18.31	0.47	0.51	0.63	0.49	0.54	2.57	2.68	2.93	2.72	0.50	5.99
Q94B	11.22	0.43	0.47	0.52	0.45	0.47	3.83	4.01	4.22	4.02	0.45	5.41
Q94C	14.14	0.38	0.42	0.56	0.40	0.45	2.69	2.83	3.21	2.91	0.41	4.93
Q94D	8.21	0.25	0.29	0.35	0.27	0.30	3.05	3.29	3.61	3.32	0.27	3.27
Q94E	5.21	0.1	0.12	0.17	0.11	0.13	1.92	2.11	2.50	2.18	0.11	1.36
Q94F	9.12	0.16	0.17	0.32	0.17	0.22	1.75	1.81	2.38	1.98	0.18	2.17
R10A	10.52	0.36	0.4	0.46	0.38	0.41	3.42	3.61	3.87	3.63	0.38	4.59
R10B	33.39	1.32	1.77	1.95	1.55	1.68	3.95	4.63	5.03	4.54	1.52	18.18
R10C	9.12	0.29	0.32	0.39	0.31	0.33	3.18	3.34	3.65	3.39	0.31	3.71

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R10D	9.8	0.37	0.4	0.58	0.39	0.45	3.78	3.93	4.59	4.10	0.40	4.82
R10E	6.03	0.24	0.31	0.33	0.28	0.29	3.98	4.56	4.86	4.47	0.27	3.23
R10F	20.17	0.92	0.93	1.22	0.93	1.02	4.56	4.59	5.07	4.74	0.96	11.47
R10G	6.45	0.29	0.31	0.39	0.30	0.33	4.50	4.65	5.12	4.75	0.31	3.68
R10H	6	0.24	0.3	0.33	0.27	0.29	4.00	4.50	4.83	4.44	0.27	3.20
R10J	3.9	0.25	0.26	0.3	0.26	0.27	6.41	6.54	6.92	6.62	0.26	3.10
R10K	13.85	0.55	0.6	0.79	0.58	0.65	3.97	4.15	4.67	4.26	0.59	7.09
R10L	12.71	0.34	0.41	0.67	0.38	0.47	2.68	2.95	3.72	3.12	0.40	4.75
R10M	9.84	0.29	0.36	0.49	0.33	0.38	2.95	3.30	3.86	3.37	0.33	3.98
R20A	40.65	1.61	1.94	2.4	1.78	1.98	3.96	4.37	4.88	4.40	1.79	21.47
R20B	13.41	0.41	0.58	0.72	0.50	0.57	3.06	3.69	4.25	3.67	0.49	5.90
R20C	9.24	0.38	0.47	0.57	0.43	0.47	4.11	4.60	5.12	4.61	0.43	5.11
R20D	6.98	0.29	0.34	0.39	0.32	0.34	4.15	4.51	4.87	4.51	0.32	3.78
R20E	12.56	0.37	0.49	0.6	0.43	0.49	2.95	3.42	3.87	3.41	0.43	5.15
R20F	27.44	0.75	1.1	1.44	0.93	1.10	2.73	3.37	4.00	3.37	0.92	11.09
R20G	13.6	0.48	0.66	0.86	0.57	0.67	3.53	4.19	4.90	4.21	0.57	6.87
R30A	48.18	1.6	2.35	2.67	1.98	2.21	3.32	4.10	4.58	4.00	1.93	23.13
R30B	45.75	1.56	2.31	2.58	1.94	2.15	3.41	4.23	4.70	4.11	1.88	22.58
R30C	24.63	0.93	1.33	1.43	1.13	1.23	3.78	4.59	4.99	4.45	1.10	13.16
R30D	13.56	0.51	0.72	0.8	0.62	0.68	3.76	4.54	4.99	4.43	0.60	7.21

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
R30E	29.94	1.21	1.87	1.91	1.54	1.66	4.04	5.14	5.56	4.91	1.47	17.65
R30F	23.71	0.8	1.21	1.3	1.01	1.10	3.37	4.24	4.65	4.09	0.97	11.63
R40A	41.72	1.06	1.32	2.31	1.19	1.56	2.54	2.85	3.75	3.05	1.27	15.25
R40B	22.58	0.52	0.55	1.27	0.54	0.78	2.30	2.37	3.45	2.71	0.61	7.34
R40C	17.37	0.42	0.46	1.01	0.44	0.63	2.42	2.53	3.63	2.86	0.50	5.96
R50A	19.36	0.64	0.78	0.95	0.71	0.79	3.31	3.67	4.08	3.68	0.71	8.56
R50B	20.51	0.67	0.83	1.01	0.75	0.84	3.27	3.66	4.08	3.67	0.75	9.03
S10A	6.02	0.14	0.16	0.17	0.15	0.16	2.33	2.49	2.60	2.47	0.15	1.79
S10B	12.52	0.27	0.3	0.34	0.29	0.30	2.16	2.28	2.42	2.29	0.29	3.43
S10C	6.18	0.14	0.16	0.18	0.15	0.16	2.27	2.43	2.59	2.43	0.15	1.80
S10D	9.3	0.21	0.22	0.26	0.22	0.23	2.26	2.31	2.47	2.35	0.22	2.62
S10E	7.81	0.18	0.19	0.23	0.19	0.20	2.30	2.37	2.56	2.41	0.19	2.26
S10F	11.17	0.28	0.36	0.44	0.32	0.36	2.51	2.86	3.22	2.86	0.32	3.84
S10G	12.77	0.3	0.31	0.38	0.31	0.33	2.35	2.39	2.58	2.44	0.31	3.74
S10H	18.79	0.47	0.67	0.73	0.57	0.62	2.50	3.03	3.32	2.95	0.55	6.65
S10J	13.07	0.34	0.47	0.52	0.41	0.44	2.60	3.10	3.39	3.03	0.40	4.75
S20A	11.15	0.46	0.51	0.54	0.49	0.50	4.13	4.35	4.51	4.33	0.48	5.79
S20B	19.05	0.65	0.85	0.86	0.75	0.79	3.41	3.94	4.13	3.83	0.73	8.75
S20C	24.82	0.82	1.09	1.1	0.96	1.00	3.30	3.85	4.04	3.73	0.93	11.11
S20D	15.16	0.57	0.6	0.64	0.59	0.60	3.76	3.86	3.98	3.87	0.59	7.03

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
S31A	11.07	0.49	0.5	0.58	0.50	0.52	4.43	4.47	4.73	4.54	0.50	6.03
S31B	10.56	0.47	0.48	0.56	0.48	0.50	4.45	4.50	4.77	4.57	0.48	5.79
S31C	8.91	0.52	0.54	0.58	0.53	0.55	5.84	5.95	6.14	5.97	0.53	6.39
S31D	7.37	0.31	0.32	0.35	0.32	0.33	4.21	4.27	4.43	4.30	0.32	3.81
S31E	6.27	0.33	0.36	0.39	0.35	0.36	5.26	5.50	5.74	5.50	0.35	4.14
S31F	7.44	0.23	0.32	0.38	0.28	0.31	3.09	3.70	4.17	3.65	0.27	3.26
S31G	5.71	0.2	0.24	0.25	0.22	0.23	3.50	3.85	4.03	3.79	0.22	2.60
S32A	8.31	0.3	0.32	0.41	0.31	0.34	3.61	3.73	4.13	3.82	0.32	3.81
S32B	9.06	0.32	0.33	0.34	0.33	0.33	3.53	3.59	3.64	3.59	0.33	3.90
S32C	11.21	0.36	0.38	0.4	0.37	0.38	3.21	3.30	3.39	3.30	0.37	4.44
S32D	33.51	1.44	1.51	1.86	1.48	1.60	4.30	4.40	4.78	4.49	1.51	18.07
S32E	24.56	1.13	1.18	1.46	1.16	1.26	4.60	4.70	5.12	4.81	1.18	14.17
S32F	13.57	0.6	0.62	0.81	0.61	0.68	4.42	4.50	4.99	4.63	0.63	7.55
S32G	5.88	0.29	0.32	0.36	0.31	0.32	4.93	5.19	5.50	5.21	0.31	3.67
S32H	5.28	0.11	0.13	0.14	0.12	0.13	2.08	2.27	2.40	2.25	0.12	1.43
S32J	9.06	0.14	0.19	0.25	0.17	0.19	1.55	1.82	2.13	1.83	0.17	1.99
S32K	12.71	0.21	0.27	0.37	0.24	0.28	1.65	1.89	2.23	1.92	0.24	2.93
S32L	9.55	0.16	0.2	0.28	0.18	0.21	1.68	1.88	2.23	1.93	0.18	2.21
S32M	18.78	0.3	0.38	0.5	0.34	0.39	1.60	1.81	2.09	1.83	0.34	4.13
S40A	18.03	0.48	0.6	0.8	0.54	0.63	2.66	3.00	3.48	3.04	0.55	6.59

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
S40B	18.46	0.49	0.62	0.82	0.56	0.64	2.65	3.01	3.49	3.05	0.56	6.75
S40C	14.22	0.24	0.49	0.51	0.37	0.41	1.69	2.57	2.91	2.39	0.34	4.07
S40D	7.72	0.11	0.22	0.26	0.17	0.20	1.42	2.14	2.55	2.04	0.16	1.89
S40E	28.05	0.52	0.91	1.07	0.72	0.83	1.85	2.55	2.97	2.46	0.69	8.27
S40F	20.64	0.38	0.65	0.8	0.52	0.61	1.84	2.50	2.96	2.43	0.50	6.02
S50A	19.39	0.3	0.45	0.58	0.38	0.44	1.55	1.93	2.29	1.92	0.37	4.47
S50B	39.97	0.62	0.87	1.15	0.75	0.88	1.55	1.86	2.20	1.87	0.75	8.98
S50C	23.57	0.4	0.6	0.72	0.50	0.57	1.70	2.12	2.43	2.08	0.49	5.89
S50D	29.62	0.51	0.74	0.9	0.63	0.72	1.72	2.11	2.42	2.08	0.62	7.41
S50E	55.53	0.48	0.6	0.87	0.54	0.65	0.86	0.97	1.17	1.00	0.56	6.68
S50F	4.42	0.08	0.12	0.13	0.10	0.11	1.81	2.26	2.49	2.19	0.10	1.16
S50G	24.24	0.44	0.65	0.73	0.55	0.61	1.82	2.25	2.50	2.19	0.53	6.37
S50H	19.03	0.38	0.61	0.69	0.50	0.56	2.00	2.60	2.94	2.51	0.48	5.74
S50J	44.51	0.83	1.31	1.52	1.07	1.22	1.86	2.40	2.74	2.34	1.04	12.48
S60A	70.1	1.61	2.04	2.74	1.83	2.13	2.30	2.60	3.04	2.65	1.86	22.26
S60B	7.43	0.31	0.32	0.36	0.32	0.33	4.17	4.24	4.44	4.28	0.32	3.82
S60C	19.36	0.43	0.68	0.82	0.56	0.64	2.22	2.87	3.32	2.80	0.54	6.51
S60D	16.38	0.44	0.61	0.78	0.53	0.61	2.69	3.21	3.72	3.21	0.53	6.30
S60E	15.37	0.36	0.53	0.68	0.45	0.52	2.34	2.90	3.40	2.88	0.44	5.31
S70A	29.83	1.34	1.37	1.97	1.36	1.56	4.49	4.54	5.23	4.75	1.42	17.02

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
S70B	17.17	0.64	0.92	1.1	0.78	0.89	3.73	4.54	5.16	4.48	0.77	9.23
S70C	15.75	0.68	0.97	1.02	0.83	0.89	4.32	5.24	5.65	5.07	0.80	9.58
S70D	46.86	2.1	2.24	3.05	2.17	2.46	4.48	4.63	5.26	4.79	2.24	26.93
S70E	31.32	1.19	1.69	2.01	1.44	1.63	3.80	4.60	5.20	4.53	1.42	17.04
S70F	32.44	1.46	1.84	2.08	1.65	1.79	4.50	5.09	5.53	5.04	1.63	19.61
T11A	33.78	1.07	1.12	1.19	1.10	1.13	3.17	3.24	3.34	3.25	1.10	13.17
T11B	45.58	1.43	1.48	1.58	1.46	1.50	3.14	3.19	3.28	3.20	1.46	17.53
T11C	66.54	1.86	1.89	2.07	1.88	1.94	2.80	2.82	2.92	2.84	1.89	22.70
T11D	58.33	1.8	1.83	1.88	1.82	1.84	3.09	3.11	3.15	3.12	1.82	21.81
T11E	51.33	1.44	1.47	1.52	1.46	1.48	2.81	2.83	2.88	2.84	1.46	17.49
T11F	56.85	1.66	1.7	1.75	1.68	1.70	2.92	2.96	3.00	2.96	1.68	20.17
T11G	36.9	1.3	1.33	1.34	1.32	1.32	3.52	3.56	3.59	3.56	1.31	15.75
T11H	24.8	0.91	0.93	0.94	0.92	0.93	3.67	3.71	3.74	3.71	0.92	11.03
T12A	36.98	0.86	1.01	1.13	0.94	1.00	2.33	2.53	2.70	2.52	0.93	11.18
T12B	23.93	0.66	0.77	0.83	0.72	0.75	2.76	2.99	3.15	2.96	0.71	8.51
T12C	27.4	0.75	0.88	0.95	0.82	0.86	2.74	2.97	3.14	2.95	0.81	9.70
T12D	31.18	0.88	1.02	1.11	0.95	1.00	2.82	3.05	3.22	3.03	0.94	11.33
T12E	42.43	1.37	1.5	1.56	1.44	1.48	3.23	3.38	3.48	3.36	1.43	17.13
T12F	37.65	1.13	1.22	1.3	1.18	1.22	3.00	3.12	3.23	3.12	1.17	14.09
T12G	26.06	0.93	1.01	1.05	0.97	1.00	3.57	3.72	3.82	3.71	0.97	11.59

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
T13A	40.91	1.91	2.04	2.44	1.98	2.13	4.67	4.83	5.21	4.90	2.01	24.06
T13B	32.74	1.55	1.65	2.02	1.60	1.74	4.73	4.89	5.31	4.98	1.63	19.56
T13C	39.44	1.82	1.95	2.37	1.89	2.05	4.61	4.78	5.19	4.86	1.92	23.01
T13D	45.95	2.4	2.5	2.81	2.45	2.57	5.22	5.33	5.59	5.38	2.47	29.68
T13E	28.09	1.37	1.39	1.55	1.38	1.44	4.88	4.91	5.11	4.97	1.40	16.75
T20A	122.49	3.75	3.97	4.03	3.86	3.92	3.06	3.15	3.20	3.14	3.84	46.11
T20B	84.44	2.78	2.96	3.95	2.87	3.23	3.29	3.40	3.83	3.51	2.96	35.52
T20C	41.09	1.65	1.73	1.76	1.69	1.71	4.02	4.11	4.17	4.10	1.68	20.21
T20D	31.73	1.75	1.96	1.98	1.86	1.90	5.52	5.85	5.98	5.78	1.83	22.01
T20E	37.24	1.92	2.1	2.11	2.01	2.04	5.16	5.40	5.49	5.35	1.99	23.89
T20F	36.27	2	2.24	2.27	2.12	2.17	5.51	5.85	5.98	5.78	2.10	25.16
T60A	74.35	2.65	3.63	3.71	3.14	3.33	3.56	4.22	4.48	4.09	3.04	36.48
T60B	77.98	2.69	3.7	3.8	3.20	3.40	3.45	4.10	4.36	3.97	3.09	37.13
T60C	64.37	2.04	2.85	2.99	2.45	2.63	3.17	3.80	4.08	3.68	2.37	28.45
T60D	104.16	2.97	4.1	4.49	3.54	3.85	2.85	3.39	3.70	3.31	3.45	41.43
T60E	28.81	1.13	1.47	1.5	1.30	1.37	3.92	4.51	4.74	4.39	1.27	15.19
T60F	93.56	3.44	4.33	4.54	3.89	4.10	3.68	4.15	4.39	4.07	3.81	45.71
T60G	101.16	3.18	4.26	4.34	3.72	3.93	3.14	3.68	3.88	3.57	3.61	43.31
T60H	128.27	3.85	5.04	5.07	4.45	4.65	3.00	3.47	3.63	3.36	4.32	51.79
T60J	80.27	2.6	3.46	3.51	3.03	3.19	3.24	3.77	3.97	3.66	2.94	35.28

Quaternary	Flows						Baseflow (%)					
	Average Annual total flow (1920-2009) (Mm3/m)	Lowest average monthly flow (Mm3/m)	2nd Lowest average monthly flow (Mm3/m)	3rd Lowest average monthly flow (Mm3/m)	Average of two lowest monthly flows (Mm3/m)	Average of three lowest monthly flows (Mm3/m)	Lowest average monthly flow/average annual total flow (Mm3/m)	Average of two lowest monthly flows/average annual total flow (Mm3/m)	Average of three lowest monthly flows/average annual total flow (Mm3/m)	Average Baseflow (%)	Baseflow (Mm3/m)	Baseflow Annualise (Mm3/a)
T60K	61.93	2.04	2.72	2.75	2.38	2.50	3.29	3.84	4.04	3.73	2.31	27.69
T70A	38.61	1.89	2.11	2.42	2.00	2.14	4.90	5.18	5.54	5.21	2.01	24.12
T70B	53.51	2.35	3.02	3.18	2.69	2.85	4.39	5.02	5.33	4.91	2.63	31.54
T70C	30.91	1.43	1.77	1.87	1.60	1.69	4.63	5.18	5.47	5.09	1.57	18.88
T70D	69.86	3	3.83	4.05	3.42	3.63	4.29	4.89	5.19	4.79	3.35	40.17
T70E	24.8	1.25	1.32	1.6	1.29	1.39	5.04	5.18	5.60	5.28	1.31	15.70
T70F	41.05	1.9	2.34	2.49	2.12	2.24	4.63	5.16	5.46	5.09	2.09	25.05
T70G	43.55	2	2.51	2.61	2.26	2.37	4.59	5.18	5.45	5.07	2.21	26.51
T80A	43.16	2.18	2.25	2.73	2.22	2.39	5.05	5.13	5.53	5.24	2.26	27.13
T80B	38.02	2.07	2.09	2.39	2.08	2.18	5.44	5.47	5.74	5.55	2.11	25.33
T80C	32.02	1.82	1.96	2	1.89	1.93	5.68	5.90	6.02	5.87	1.88	22.55
T80D	50.96	2.67	2.73	3.27	2.70	2.89	5.24	5.30	5.67	5.40	2.75	33.04
T90A	18.88	0.77	0.87	1.27	0.82	0.97	4.08	4.34	5.14	4.52	0.85	10.24
T90B	72.98	3.73	3.96	4.02	3.85	3.90	5.11	5.27	5.35	5.24	3.83	45.91
T90C	49.19	2.54	2.8	2.92	2.67	2.75	5.16	5.43	5.60	5.40	2.65	31.85
T90D	33.75	1.49	1.83	2.18	1.66	1.83	4.41	4.92	5.43	4.92	1.66	19.93
T90E	55.82	2.9	3.17	3.3	3.04	3.12	5.20	5.44	5.60	5.41	3.02	36.23
T90F	48.95	2.54	2.7	2.74	2.62	2.66	5.19	5.35	5.43	5.33	2.61	31.28
T90G	51.72	2.43	2.98	3.12	2.71	2.84	4.70	5.23	5.50	5.14	2.66	31.91

APPENDIX E – RESERVE ESTIMATIONS

Table 25: Reserve estimate results

Quaternary	Recharge (Mm^3/a)	BHN (Mm^3/a)	Baseflow (Mm^3/a)	Reserve (Mm^3/a)	Reserve (%)
K80A	14.2253	0	46.56	46.560	327.3
K80B	23.0894	0.0054	66.27	66.275	287.02
K80C	20.768	0.0054	63.51	63.515	305.82
K80D	18.0958	0.0115	35.38	35.392	195.58
K80E	25.0649	0.0115	31.25	31.262	124.74
K80F	15.8827	0.0106	23.95	23.961	150.88
K90A	18.1048	0.0011	9.93	9.931	54.87
K90B	12.1625	0.0011	8.68	8.681	71.38
K90C	19.9716	0.0011	6.47	6.471	32.42
K90D	12.6968	0	8.03	8.030	63.27
K90E	10.9721	0.0025	4.94	4.943	45.05
K90F	15.2933	0.0006	7.71	7.711	50.44
K90G	18.3647	0.0051	7.12	7.125	38.8
L11A	43.1566	0	0.82	0.820	1.9
L11B	36.575	0	0.99	0.990	2.7
L11C	24.0917	0.0264	0.69	0.716	2.96
L11D	45.5386	0	1.18	1.180	2.59
L11E	15.8549	0.0132	0.62	0.633	3.99
L11F	21.158	0	1.82	1.820	8.6
L11G	54.2539	0	4.05	4.050	7.46
L12A	25.0851	0	1.26	1.260	5.02
L12B	18.2064	0	1.07	1.070	5.86
L12C	30.4266	0.0001	1.5	1.500	4.93
L12D	28.4896	0	1.59	1.590	5.59
L21A	19.2539	0	1.86	1.860	9.66
L21B	25.3361	0.0132	4.91	4.923	19.42
L21C	37.7228	0.04	2.15	2.190	5.8
L21D	33.802	0	3.14	3.140	9.29
L21E	27.0674	0.0132	1.63	1.643	6.08
L21F	22.007	0	1.79	1.790	8.12
L22A	35.1747	0	3.27	3.270	9.29
L22B	17.0856	0	1.19	1.190	6.95
L22C	24.687	0	2.45	2.450	9.94
L22D	21.0038	0	2.27	2.270	10.82
L23A	17.7504	0	0.95	0.950	5.33
L23B	30.5969	0	2.56	2.560	8.37
L23C	30.8148	0	1.71	1.710	5.56
L23D	23.1281	0	1.15	1.150	4.99

Quaternary	Recharge (Mm^3/a)	BHN (Mm^3/a)	Baseflow (Mm^3/a)	Reserve (Mm^3/a)	Reserve (%)
L30A	13.1692	0.0081	0.42	0.428	3.25
L30B	15.3568	0	0.31	0.310	2.04
L30C	9.915	0	0.19	0.190	1.95
L30D	25.72	0	0.47	0.470	1.81
L40A	30.7328	0	0.59	0.590	1.91
L40B	24.7021	0	0.46	0.460	1.86
L50A	20.7548	0	0.57	0.570	2.73
L50B	24.0024	0	0.6	0.600	2.5
L60A	27.9684	0	0.46	0.460	1.64
L60B	22.4785	0	0.33	0.330	1.45
L70A	24.4812	0	0.43	0.430	1.77
L70B	15.1566	0	0.3	0.300	1.98
L70C	22.3688	0	0.48	0.480	2.15
L70D	18.8602	0	0.55	0.550	2.93
L70E	23.928	0	1.05	1.050	4.37
L70F	11.49	0	0.61	0.610	5.34
L70G	26.2093	0	6.25	6.250	23.86
L81A	20.9887	0.0006	10.74	10.741	51.17
L81B	14.8827	0.0006	5.14	5.141	34.54
L81C	19.0958	0	7.06	7.060	36.97
L81D	16.862	0	5.22	5.220	30.96
L82A	18.171	0.0062	6.28	6.286	34.59
L82B	29.4217	0.0123	11.83	11.842	40.26
L82C	26.5057	0.0123	11.97	11.982	45.19
L82D	36.3342	0.0026	17.73	17.733	48.79
L82E	24.4185	0	10.63	10.630	43.55
L82F	10.4664	0	4.13	4.130	39.43
L82G	15.3078	0	5.4	5.400	35.28
L82H	13.4262	0	3.89	3.890	28.95
L82J	9.9876	0	2.52	2.520	25.23
L90A	36.8353	0.0009	10.27	10.271	27.87
L90B	27.3253	0.0025	23.55	23.553	86.21
L90C	23.8218	0.003	21.05	21.053	88.36
M10A	16.8095	0	10.89	10.890	64.8
M10B	20.588	0.0019	18.33	18.332	89.03
M10C	20.7642	0.0232	21.12	21.143	101.83
M10D	13.9764	0.0199	11.43	11.450	81.9
M20A	24.3651	0.0188	6.87	6.889	28.29
M20B	21.9863	0.0243	15.21	15.234	69.31
M30A	13.1736	0.0074	1.4	1.407	10.68
M30B	13.5517	0.0013	1.39	1.391	10.29
N11A	32.7553	0.0025	1.15	1.153	3.51
N11B	26.629	0	0.93	0.930	3.48

Quaternary	Recharge (Mm^3/a)	BHN (Mm^3/a)	Baseflow (Mm^3/a)	Reserve (Mm^3/a)	Reserve (%)
N12A	34.5934	0.0089	0.85	0.859	2.49
N12B	36.8662	0.0089	0.73	0.739	2.01
N12C	26.8468	0	0.69	0.690	2.56
N13A	21.5982	0	2.22	2.220	10.28
N13B	23.9122	0.0089	1.76	1.769	7.4
N13C	17.9325	0.0089	1.23	1.239	6.93
N40A	26.3742	0.0038	4.13	4.134	15.66
N40B	46.8115	0.0038	4.49	4.494	9.59
N40C	26.8494	0.0005	6.86	6.861	25.55
N40D	30.2921	0.0005	6.5	6.501	21.46
N40E	24.5868	0.0005	1.67	1.671	6.78
N40F	40.6199	0.007	8.16	8.167	20.11
P10A	5.9487	0.0004	0.83	0.830	13.9
P10B	25.2117	0.0004	2.01	2.010	7.96
P10C	9.9929	0.0077	0.3	0.308	3.08
P10D	25.5297	0.0077	0.97	0.978	3.82
P10E	21.683	0.0111	3.13	3.141	14.5
P10F	17.6851	0.0084	5.02	5.028	28.43
P10G	14.1055	0.0082	3.56	3.568	25.3
P20A	21.2165	0.0082	11.24	11.248	53.02
P20B	17.6796	0.0035	5.49	5.494	31.05
P30A	9.2647	0.0056	3.63	3.636	39.28
P30B	19.9739	0	5.39	5.390	27
P30C	3.2786	0.0001	0.97	0.970	29.49
P40A	16.6083	0	5.78	5.780	34.8
P40B	12.3165	0.015	3.85	3.865	31.35
P40C	15.3261	0.0196	6.76	6.780	44.24
P40D	13.4315	0.0075	6.33	6.338	47.21
Q11A	14.7529	0.0106	0.99	1.001	6.76
Q11B	13.7323	0.0106	0.72	0.731	5.32
Q11C	13.1622	0.0106	0.67	0.681	5.2
Q11D	16.7939	0.0106	0.67	0.681	4.07
Q12A	23.8849	0	1.25	1.250	5.22
Q12B	22.5533	0.0007	1.62	1.621	7.19
Q12C	14.2557	0.0069	0.54	0.547	3.84
Q13A	27.5277	0.0064	1.41	1.416	5.13
Q13B	7.392	0.001	0.31	0.311	4.25
Q13C	14.3559	0	0.75	0.750	5.2
Q14A	17.6904	0.0257	1.21	1.236	6.97
Q14B	25.1679	0	1.46	1.460	5.8
Q14C	29.3015	0.0106	1.33	1.341	4.56
Q14D	13.7597	0.0106	0.59	0.601	4.34
Q14E	12.0323	0	0.59	0.590	4.88

Quaternary	Recharge (Mm^3/a)	BHN (Mm^3/a)	Baseflow (Mm^3/a)	Reserve (Mm^3/a)	Reserve (%)
Q21A	22.0273	0.0086	1.19	1.199	5.46
Q21B	13.0477	0.0086	0.59	0.599	4.56
Q22A	18.8552	0.0086	1.22	1.229	6.52
Q22B	7.7994	0.0086	0.42	0.429	5.5
Q30A	15.1603	0.0086	1.43	1.439	9.47
Q30B	17.3484	0.0132	1.14	1.153	6.65
Q30C	12.5279	0.001	2.01	2.011	16.03
Q30D	10.5084	0.001	1.63	1.631	15.55
Q30E	10.9143	0	1.8	1.800	16.49
Q41A	9.735	0.0064	2.04	2.046	21.02
Q41B	16.6184	0.0039	1.81	1.814	10.94
Q41C	11.5919	0.0039	1.23	1.234	10.62
Q41D	10.0663	0.0003	0.72	0.720	7.16
Q42A	17.1518	0.0043	2.15	2.154	12.54
Q42B	13.9348	0.0011	1.33	1.331	9.58
Q43A	25.1158	0	1.84	1.840	7.33
Q43B	26.7266	0	1.42	1.420	5.31
Q44A	14.4211	0	1.15	1.150	8
Q44B	12.4794	0.0064	0.78	0.786	6.3
Q44C	8.4649	0.0039	0.54	0.544	6.43
Q50A	19.188	0.0039	3.01	3.014	15.72
Q50B	14.7059	0	1.89	1.890	12.87
Q50C	6.3328	0	0.87	0.870	13.79
Q60A	7.2233	0	1.66	1.660	22.98
Q60B	15.1085	0	2.4	2.400	15.89
Q60C	5.0365	0	0.42	0.420	8.34
Q70A	10.9272	0	0.93	0.930	8.48
Q70B	15.928	0	1.27	1.270	7.99
Q70C	8.5579	0	0.59	0.590	6.86
Q80A	14.1887	0.003	5.51	5.513	38.88
Q80B	17.6243	0.003	6.52	6.523	37.01
Q80C	11.1074	0.003	4.21	4.213	37.9
Q80D	14.4559	0.0019	9.15	9.152	63.33
Q80E	12.7176	0	5.43	5.430	42.72
Q80F	23.7605	0	2.57	2.570	10.83
Q80G	9.0542	0	1.03	1.030	11.41
Q91A	14.3728	0	1.49	1.490	10.39
Q91B	19.7606	0	2.43	2.430	12.31
Q91C	19.497	0	1.99	1.990	10.19
Q92A	15.6168	0.0012	12.43	12.431	79.62
Q92B	14.4682	0.0025	4.71	4.713	32.59
Q92C	24.0841	0.0025	6.33	6.333	26.28
Q92D	11.1915	0.0025	5.23	5.233	46.78

Quaternary	Recharge (Mm^3/a)	BHN (Mm^3/a)	Baseflow (Mm^3/a)	Reserve (Mm^3/a)	Reserve (%)
Q92E	11.193	0.0014	1.35	1.351	12.1
Q92F	21.0235	0	1.18	1.180	5.61
Q92G	28.92	0.0014	2.29	2.291	7.91
Q94A	14.1618	0	5.99	5.990	42.27
Q94B	7.3995	0	5.41	5.410	73.16
Q94C	7.1791	0	4.93	4.930	68.72
Q94D	9.6672	0	3.27	3.270	33.79
Q94E	10.7474	0	1.36	1.360	12.65
Q94F	26.0606	0	2.17	2.170	8.31
R10A	8.5298	0.0001	4.59	4.590	53.77
R10B	14.0208	0	18.18	18.180	129.66
R10C	7.4924	0.0005	3.71	3.711	49.57
R10D	10.0082	0.001	4.82	4.821	48.17
R10E	9.6127	0.0004	3.23	3.230	33.64
R10F	5.0409	0.0003	11.47	11.470	227.61
R10G	8.7659	0.001	3.68	3.681	41.99
R10H	9.8537	0	3.2	3.200	32.48
R10J	7.8851	0.0049	3.1	3.105	39.38
R10K	28.5077	0.0006	7.09	7.091	24.86
R10L	18.6693	0.0004	4.75	4.750	25.46
R10M	9.1604	0.0018	3.98	3.982	43.47
R20A	10.3853	0.0008	21.47	21.471	206.77
R20B	9.05	0.0002	5.9	5.900	65.2
R20C	7.7198	0.0002	5.11	5.110	66.24
R20D	13.5091	0.0003	3.78	3.780	27.98
R20E	14.0911	0.0006	5.15	5.151	36.53
R20F	14.9757	0	11.09	11.090	74.03
R20G	6.6461	0.0002	6.87	6.870	103.32
R30A	28.5511	0.0172	23.13	23.147	81.06
R30B	33.4118	0.0119	22.58	22.592	67.62
R30C	29.4625	0.0012	13.16	13.161	44.67
R30D	9.4878	0.0064	7.21	7.216	76.02
R30E	26.9755	0.0033	17.65	17.653	65.45
R30F	13.2252	0.0067	11.63	11.637	88.01
R40A	20.615	0.0139	15.25	15.264	74.06
R40B	17.642	0.0021	7.34	7.342	41.62
R40C	10.1192	0.0104	5.96	5.970	59
R50A	20.7139	0.0029	8.56	8.563	41.34
R50B	21.7493	0.0022	9.03	9.032	41.51
S10A	11.648	0	1.79	1.790	15.34
S10B	18.9383	0.0059	3.43	3.436	18.16
S10C	10.8744	0.0112	1.8	1.811	16.66
S10D	15.2695	0.0089	2.62	2.629	17.22

Quaternary	Recharge (Mm^3/a)	BHN (Mm^3/a)	Baseflow (Mm^3/a)	Reserve (Mm^3/a)	Reserve (%)
S10E	11.5152	0.0078	2.26	2.268	19.69
S10F	14.3577	0.0078	3.84	3.848	26.8
S10G	18.6386	0.0234	3.74	3.763	20.19
S10H	22.3256	0.028	6.65	6.678	29.93
S10J	15.2003	0	4.75	4.750	31.27
S20A	14.7858	0.0066	5.79	5.797	39.23
S20B	22.1166	0.0101	8.75	8.760	39.59
S20C	27.5498	0	11.11	11.110	40.34
S20D	16.1302	0.012	7.03	7.042	43.68
S31A	18.7685	0.004	6.03	6.034	32.17
S31B	17.8	0.0044	5.79	5.794	32.57
S31C	26.2355	0.0055	6.39	6.396	24.36
S31D	15.3915	0.0098	3.81	3.820	24.8
S31E	17.7522	0.0068	4.14	4.147	23.36
S31F	10.5402	0.0108	3.26	3.271	31.03
S31G	10.3157	0.0041	2.6	2.604	25.24
S32A	14.9502	0.0004	3.81	3.810	25.51
S32B	23.4389	0.0026	3.9	3.903	16.65
S32C	20.3407	0.0306	4.44	4.471	21.98
S32D	16.3123	0.0041	18.07	18.074	110.82
S32E	14.8435	0	14.17	14.170	95.44
S32F	15.112	0.0038	7.55	7.554	49.96
S32G	10.6341	0.0043	3.67	3.674	34.58
S32H	14.891	0.0089	1.43	1.439	9.64
S32J	11.071	0.0074	1.99	1.997	18.07
S32K	18.0348	0.0018	2.93	2.932	16.27
S32L	13.0494	0	2.21	2.210	16.96
S32M	19.2823	0.0018	4.13	4.132	21.45
S40A	20.7083	0.0123	6.59	6.602	31.87
S40B	20.3026	0.0062	6.75	6.756	33.29
S40C	15.5604	0	4.07	4.070	26.18
S40D	6.1125	0	1.89	1.890	30.87
S40E	24.4118	0.0021	8.27	8.272	33.9
S40F	16.406	0.001	6.02	6.021	36.7
S50A	12.1408	0.0034	4.47	4.473	36.87
S50B	19.4155	0.0063	8.98	8.986	46.28
S50C	19.7451	0.0068	5.89	5.897	29.88
S50D	21.0406	0.018	7.41	7.428	35.29
S50E	25.3511	0	6.68	6.680	26.35
S50F	4.5172	0.0031	1.16	1.163	25.75
S50G	26.0123	0.0189	6.37	6.389	24.55
S50H	18.74	0.0089	5.74	5.749	30.68
S50J	35.2827	0.0151	12.48	12.495	35.41

Quaternary	Recharge (Mm^3/a)	BHN (Mm^3/a)	Baseflow (Mm^3/a)	Reserve (Mm^3/a)	Reserve (%)
S60A	19.4208	0.0015	22.26	22.262	114.63
S60B	13.2528	0.0025	3.82	3.823	28.84
S60C	9.9484	0.0012	6.51	6.511	65.48
S60D	13.1589	0.0011	6.3	6.301	47.88
S60E	11.0571	0	5.31	5.310	48.05
S70A	16.2429	0.0009	17.02	17.021	104.79
S70B	14.8886	0.0017	9.23	9.232	61.98
S70C	10.3095	0.0039	9.58	9.584	92.96
S70D	27.2208	0.0122	26.93	26.942	98.99
S70E	26.8231	0.0021	17.04	17.042	63.54
S70F	21.0257	0	19.61	19.610	93.28
T11A	20.1117	0.0007	13.17	13.171	65.47
T11B	23.0988	0.0007	17.53	17.531	75.88
T11C	23.3999	0.0025	22.7	22.703	97.02
T11D	20.6588	0.0013	21.81	21.811	105.56
T11E	15.0156	0.0043	17.49	17.494	116.49
T11F	17.2	0.0331	20.17	20.203	117.48
T11G	16.1976	0.0008	15.75	15.751	97.26
T11H	11.7829	0.0194	11.03	11.049	93.75
T12A	16.7838	0.0119	11.18	11.192	66.68
T12B	12.7309	0.0072	8.51	8.517	66.93
T12C	15.7398	0.0218	9.7	9.722	61.77
T12D	20.8515	0.017	11.33	11.347	54.43
T12E	22.5419	0.0043	17.13	17.134	76
T12F	19.2432	0.0182	14.09	14.108	73.3
T12G	14.5886	0.0142	11.59	11.604	79.52
T13A	16.0138	0.0036	24.06	24.064	150.27
T13B	15.3206	0.0122	19.56	19.572	127.75
T13C	17.411	0.0014	23.01	23.011	132.15
T13D	22.2241	0.0042	29.68	29.684	133.57
T13E	12.2108	0.0054	16.75	16.755	137.19
T20A	31.0116	0.0062	46.11	46.116	148.7
T20B	24.3525	0.0099	35.52	35.530	145.9
T20C	16.9121	0.0088	20.21	20.219	119.57
T20D	21.8994	0.0186	22.01	22.029	100.57
T20E	20.7544	0.0186	23.89	23.909	115.21
T20F	25.0295	0.0107	25.16	25.171	100.56
T60A	39.0578	0.0076	36.48	36.488	93.42
T60B	49.4326	0.0053	37.13	37.135	75.12
T60C	26.6148	0.0065	28.45	28.457	106.91
T60D	39.4861	0.0026	41.43	41.433	104.94
T60E	17.0392	0.0152	15.19	15.205	89.22
T60F	39.9278	0.0162	45.71	45.726	114.53

Quaternary	Recharge (Mm^3/a)	BHN (Mm^3/a)	Baseflow (Mm^3/a)	Reserve (Mm^3/a)	Reserve (%)
T60G	35.077	0.0023	43.31	43.312	123.47
T60H	35.4725	0.0013	51.79	51.791	146.01
T60J	29.8094	0.0087	35.28	35.289	118.38
T60K	24.2726	0	27.69	27.690	114.09
T70A	27.3494	0.0037	24.12	24.124	88.21
T70B	25.6223	0.0004	31.54	31.540	123.1
T70C	17.8828	0.004	18.88	18.884	105.6
T70D	31.2362	0	40.17	40.170	128.59
T70E	19.4797	0.0025	15.7	15.703	80.61
T70F	23.9198	0.0012	25.05	25.051	104.74
T70G	24.4421	0.0003	26.51	26.510	108.48
T80A	20.0032	0.0003	27.13	27.130	135.61
T80B	21.0851	0.0019	25.33	25.332	120.16
T80C	26.3467	0	22.55	22.550	85.58
T80D	25.8344	0.0011	33.04	33.041	127.9
T90A	26.0172	0.0025	10.24	10.243	39.37
T90B	37.1138	0.001	45.91	45.911	123.71
T90C	32.5452	0.0007	31.85	31.851	97.88
T90D	31.5909	0.0071	19.93	19.937	63.12
T90E	36.609	0.0161	36.23	36.246	99.02
T90F	26.151	0.0033	31.28	31.283	119.63
T90G	38.3807	0.0079	31.91	31.918	83.17