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Identification of key water quality data for Ranger uranium mine

M Iles, C Camilleri & R Pilley

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Michelle Iles, Caroline Camilleri & Richard Pilley

Supervising Scientist Division
GPO Box 461, Darwin NT 0801

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Contents

Tables

Figures

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1 Introduction

This report has been prepared in response to a recommendation from the Alligator Rivers Region Technical Committee's (ARRTC) 11th meeting (17–19 February 2003), to provide information on assessing and quantifying contaminant movement through surface water (and possibly groundwater) pathways in the waters of Magela Creek upstream and downstream of Ranger uranium mine.

The aims of this report are as follows:

1 Identify all major water chemistry data collections from stakeholders.

2 Assess the quality of the data sets for use in further environmental protection and risk assessment modelling.

3 Clean up any data sets that are not in suitable format.

4 Enter all data into SSD Explorer and identify how to access it.

5 Prepare detailed site map of Energy Resources Australia (ERA) Ranger Mine identifying key sites for water release into Magela Creek, both upstream and downstream of the mine.

Results and interpretation of the Risk Assessment evaluation performed using the data identified here will be reported elsewhere.

2 Site descriptions

Point source sites with the greatest potential to impact on Magela and Gulungul Creek surface waters are shown in Figure 1. Information on these sites is given in Table 1. For full updated details on these sites refer to the most recent annual review of the ERA -Ranger Mine, Water Management Systems Operation Manual. The current version (Energy Resources Australia 2002) is available at SSD explorer\\Supervisory Work\Assessment and Review\Reports and Reviews of Reports\Ranger\Water Management\ERA Ranger Water Systems Management Operations Manual 2003.

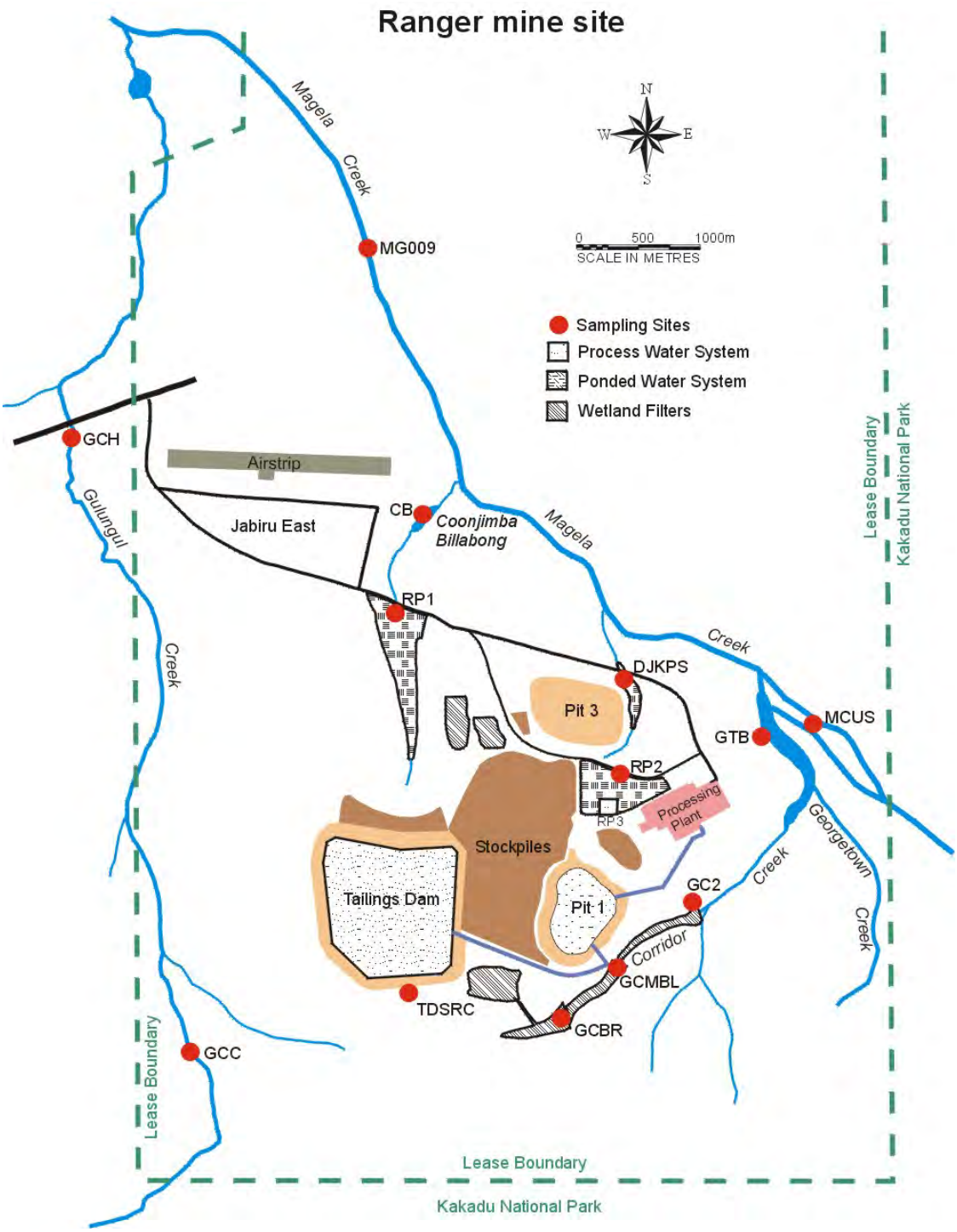

Figure 1 Map of the Ranger project area showing the sites used in this study. Note the site codes are those used by ERA. Refer to table 2 for alternative site codes and full site names.

Table 1 Site details

Area	Site	Description	Major inputs from	Major outputs to	Other names used / Notes
Magela Creek	GS8210028	Magela Creek historic upstream site	Undisturbed areas of catchment upstream of Ranger mine.	Magela Creek	Arnhem Border/MG028
	MCUS	Magela Creek Upstream (control site) of the -Georgetown Creek confluence.			Magela Creek Georgetown (***eriss***)
	MG009	Magela Creek downstream (the Central Channel gauging station is the statutory compliance point).	MCUS, Corridor/Georgetown Creek System, Djalkmarra Billabong, RP1-Coonjimba Billabong.	Magela Creek downstream of Ranger Project Area.	MG009C/009C (central channel - the compliance point) MG009W/009W (west channel)
Corridor and Georgetown Creeks System	GCBR	Georgetown Creek Brockman bund (actually on Corridor Creek). Part of the Corridor Creek Wetland System.	Corridor Creek Constructed Wetland Filter.	GCMBL	
	GCMBL	Georgetown Creek MBL bund (actually on Corridor Creek). Represents the outflow of the Corridor Creek Wetland System.	GCBR; Mine Bore L discharge.	GC2	
	GC2	Georgetown Creek site 2 (actually on Corridor Creek).	GCMBL; possibly seepage from High Grade Ore Stockpile (under investigation)	GTB via Sleepy Cod Billabong	Georgetown Creek site 2
	GTB	Georgetown Billabong	Georgetown Creek and Corridor Creek (GCBR).	Magela Creek upstream of RP2 system inputs.	Georgetown
RP2 System	RP2	Retention Pond 2, storage and evaporation,	Pit3; Stockpile runoff and seepage; Mill/site catchment runoff.	Constructed Wetland Filters (RP1 & Corridor Creek); Irrigation areas; Milling and mining operations.	*Note*: RP2 water is often transferred temporarily to Djalkmarra Billabong before being moved elsewhere.
	DJKPS	Djalkmarra Billabong, a natural billabong used for excess storage capacity for non-process mine waters and sediment control.	RP2; Pit3 dewatering bores; Runoff from buffer zone SW of Pit 3.	Magela Creek (under strict release conditions) upstream of RP1 system; RP2; Flood irrigation.	Djalkmarra Billabong Pumping Station

Table 1 continued Site details

Area	Site	Description	Major inputs from	Major outputs to	Other names used
RP1 System	RP1	Retention Pond 1. Permanent pond. A major part of sediment control zone north of Tailings Dam.	RP1 Constructed Wetland Filter; RP1 catchment which includes a flood irrigation area and the Tailings Dam north wall stockpile area.	Excess water flows over weir in Wet Season to Coonjimba Billabong; RP2 supplement.	RP1W
	CB	Coonjimba Billabong, a natural billabong downstream of RP1 weir.	RP1.	Magela Creek downstream of Djalkmarra inlet.	
Gulungul Creek System	GCC	Gulungul Creek headwaters (control site) upstream of the mine.	Undisturbed catchment upstream of the mine.	Gulungul Creek	Gulungul Creek Upstream (GCUS)
	TDSRC or TDSRV (1-3)	Culvert on the south side of the Tailings Dam or V notch weirs at the culvert inflows.	Runoff from the external south wall of the dam and the south wall toe loading.	Feeder creek to Gulungul Creek	Tailing Dam South Road Culvert
	GCH	Gulungul Creek at the Arnhem Highway. The downstream monitoring point.	GCC; Several feeder creeks from the east coming from the southwestern side of the Ranger Project area; Undisturbed catchment to the west of the creek.	Magela Creek downstream of MG009 (the compliance point).	Gulungul Creek Downstream

3 Data sources

Data have been identified from four main sources: the two Energy Resources Australia (ERA) databases (i) the Laboratory Information Management System (LIMS)—the current database, and (ii) the old ERA Mine Water Database[1]; the Northern Territory Department of Business Industry and Resource Development[2] (DBIRD) check monitoring water quality database (includes the Water Resources data); the Northern Territory Water Resources Division of DIPE, and the ***eriss*** monitoring water quality database. Table 2 details the sites and time spans covered by each data set.

Ongoing time series data collection will be carried out by three of the above four agencies.

- ERA carry out statutory and operational monitoring as prescribed in the annual Ranger Mining Management Plan — the table of statutory monitoring from the 2003 Mining Management Plan is reproduced here as Appendix 1..
- ***eriss*** will carry out monitoring on a weekly basis during the Wet seasons at least at the following sites; MCUS, MG009, GCC and GCH. Sampling of an investigative nature is often carried out at other sites.
- DBIRD perform check monitoring of the statutory and several operational sites throughout the year.
- NT Water Resources no longer collect chemistry data for these sites.

For the purpose of this report the LIMS database was queried for data up to a sample collection date of 27th May 2003; see table 2 for actual dates of data for each site.

4 Data storage

These data sets will be imported into the SSD explorer databases (see Section 6) which are currently still under construction. Pending full operational status of the SSD explorer databases, the data (to date) is stored in four spreadsheets

1. Ranger_Lims_Risk_Ass.xls
2. Ranger_eriss_00_03.xls
3. Ranger_WaterRes.xls (data for Magela creek upstream and downstream are repeated in Magela_DBIRD.xls, data for Gulungul Creek downstream not repeated)
4. Magela_DBIRD.xls (contains Water Resources and DBIRD data)

at SSD explorer at \\Ecological Risk Assessment Administration\Peter Bayliss\Ecological Risk Modelling\Data Mines\

Future studies of this nature will require an updated dataset, possibly including new sites and redundancy of existing sites according to contemporary water management practices at Ranger uranium mine. Updated data will need to be retrieved from the SSD explorer databases (Section 6 of this report details how to do this). The OSS chemist (or delegate) will regularly update the SSD database with ERA and DBIRD data, future users of these data sets should see the OSS chemist to verify the currency of data available in the SSD database for each site.

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[1] Data for MG028 (GS 8210028 - the historic Magela Creek upstream site) only was extracted from the old ERA Mine Water database. No pre 1991 data is available on LIMS for MCUS.

[2] Only data for the Magela Creek upstream and downstream sites have been sourced from DBIRD for this work.

Table 2 Summary of data used

Site	Data source	Site Code	Time span
Magela Creek upstream (MCUS)	LIMS	MCUS	19 Feb 1991 – 27 May 2003
			No data available pre 1991
	eriss	MCUS	8 Dec 2000 – 27 May 2003
	DBIRD	MCUS	7 Dec 2002 – 2 July 2003
Magela Creek upstream (GS 8210028) (no longer sampled)	ERA old Mine Water Database	MG028	30 July 1980 – 10 Feb 1999
	NT Water Resources	G8210028	11 Jan 1979 – 25 Jun 1987
			included in DBIRD dataset
	DBIRD	G8210028	11 Jan 1979 – 7 Dec 1999
			includes Water Resources data
Magela Creek downstream (central channel) (GS 8210009)	LIMS	MG009	23 June 1980 – 27 May 2003
	eriss	009C	27 Nov 2000 – 22 May 2003
	NT Water Resources	G8210009	6 July 1971 – 7 May 1987
			included in DBIRD dataset
	DBIRD	GS 8210009	6 July 1971 – 3 Jun 2003
			includes Water Resources data
Corridor Creek Wetland System–Brockman Bund	LIMS	GCBR	24 Feb 1992 – 14 April 2003
Corridor Creek Wetland System–Mine Bore L Bund	LIMS	GCMBL	1 Sept 2000 – 6 May 2003
Georgetown–Corridor Creek	LIMS	GC2	30 Jan 1985 – 14 April 2003
Georgetown Billabong	LIMS	GTB	30 June 1980 – 6 May 2003
	eriss	Georgetown Billabong	8 Jan 2002 – 12 June 2003
Retention Pond 2	LIMS	RP2	21 Feb 1980 – 27 May 2003
Djalkmarra Billabong (pump station)	LIMS	DJKPS	1 Jan 1995 – 27 May 2003
Retention Pond 1(Weir)	LIMS	RP1W	6 June 1980 – 22 April 2003
	eriss	RP1	15 Jan 2002 – 14 April 2003
Coonjimba Billabong	LIMS	CB	30 June 1980 – 6 May 2003
	eriss	Coonjimba overflow	16 Jan 2002 – 15 April 2002
Gulungul Creek upstream	LIMS	GCC (Gulungul Creek control)	27 Nov 1998 – 2 May 2001
	eriss	Gulungul upstream	5 Dec 2001 – 27 May 2003
Gulungul Creek downstream	LIMS	GCH (Gulungul Creek Highway)	23 Jun 1980 – 28 April 2003
	eriss	Gulungul downstream	5 Dec 2001 – 27 May 2003
	NT Water Resources	G8210210	25 Jan 1972 – 23 Jan 1987
Tailings Dam South Rd Culvert	LIMS	TDSRC	No results available yet
Tailings Dam South Rd V Weirs (1-3) (analogue for TDSRC)	LIMS	TDSRV	22 Dec 1999 – 5 Feb 2002

As different users of the data will have different reasons to reject or accept data the datasets that will be imported into the SSD database will be in almost "raw" or uncleaned form (any edits of the data are discussed in Section 5).

The ERA data will be imported into the SSD database as they were/are downloaded from LIMS (or from the old Mine Water database in the case of G8210028). The full three years of monitoring data collected by ***eriss***[3] (2000–2001, 2001–2002, 2002–2003) will be imported in the SSD database. As mentioned above future ERA, DBIRD and ***eriss*** data will be imported to the SSD database as they become available.

Of the Water Resources data only the key parameters required for this study will be imported to the SSD database (see Table 4).

5 Data quality

The quality of data varies between the datasets and over time. Data users need to be aware of the data quality issues associated with each data set. These are summarised below. For more information on data quality, distribution of MCUS data and comparison of historical upstream and downstream data see Klessa 2000.

5.1 Site specific notes

5.1.1 Magela Creek upstream sites

Several sites have been sampled upstream of the mine on the Magela Creek and the name MCUS has been applied to more than one site.

The historic Magela Creek upstream site was the GS8210028 gauging station (MG028) known also as "Arnhem border". Data are available for this site upto 1999 (ERA & DBIRD) but the majority of records are for >1990.

Gauging station GS8210067 is incorrectly listed as MCUS in some reports and in early versions of Appendix A of the *Ranger Authorisation (0108-01)*. The '067' gauging station, just downstream of the Georgetown confluence, is still used to gauge flow conditions. Physico-chemical data has been collected from this site but should not be included with upstream data from MCUS or MG028.

Different sites have been known as MCUS historically; the current site is shown in figure 1. The following points summarise the MCUS site history.

- Prior to the 1999 report the ERA Annual Reports refer to an upstream site "Magela Creek upstream of pipe outlet" with respect to releases from RP2 and RP4 only. "MCUS" is not discussed in the Annual Reports until the 1999 report (Energy Resources Australia 1999) when it is discussed in the context of comparing upstream and downstream values.
- There is no data on LIMS for "MCUS" prior to 1991. According to Energy Resources Australia 1991 Annual Report the Magela Creek upstream sampling site was shifted closer to the mine because of access difficulties that year.

[3] ***eriss*** ^{226}Ra results for 2001–2002 and 2002–2003 have not been entered into the database. They will be entered when they have been fully validated and accepted by the ***eriss*** chemist.

- In the early 1990's Chris Humphrey (***eriss***) noticed that ERA staff sampling very close to the Magela-Georgetown confluence and in his opinion the samples collected would be impacted by backflow from Georgetown Billabong. Recent communications with ERA staff employed since the mid 1990s indicate that all sampling was undertaken at the current MCUS site according to their recollections. Figure 2 shows that uranium concentrations at "MCUS" are unusaully high in early 1991 (possibly the period when incorrect site sampling was witnessed by C Humphrey) but are within expected concentration range after March 1991. (Note elevated uranium concentrations seen in Georgetown Billabong in 1992 were not seen at MCUS).
- The description given for the MCUS sample collected on 13 December 1993 in the ERA LIMS database is "NEW SITE". Figure 2 shows a sample of data collected before and after the site change. Apart from the elevated results mentioned in the dot point above, the old and new sites have similar uranium values.
- Prior to the 2003–04 wet season the ***eriss*** MCUS site was close to the Georgetown-Magela confluence. ***eriss*** now sample at the same location as ERA and DBIRD (figure 1).

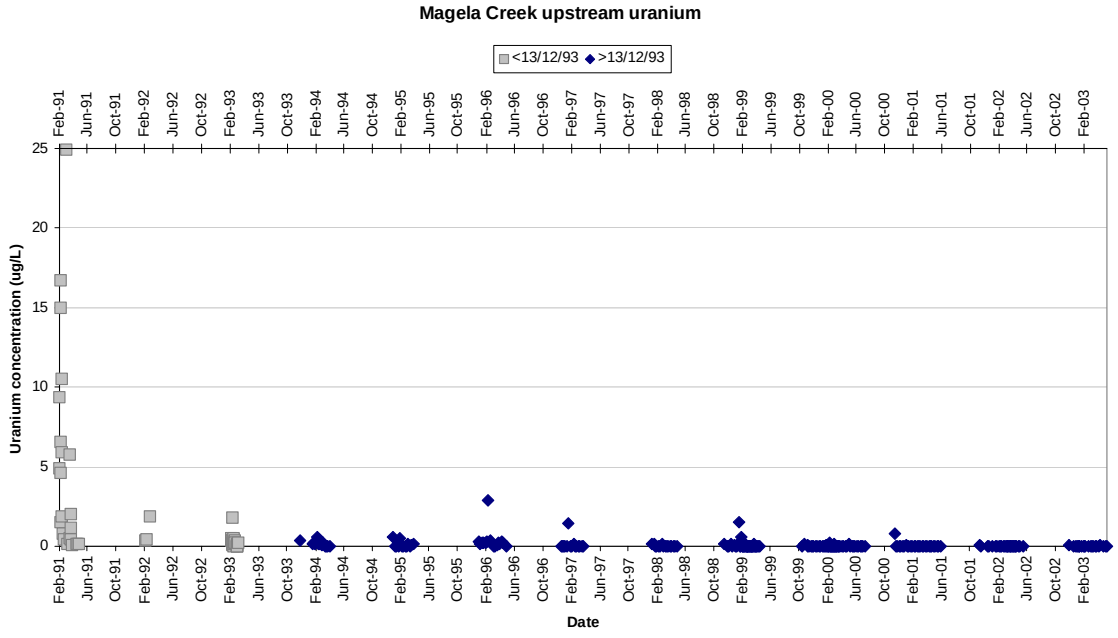


Figure 2 Uranium concentrations at Magela Creek upstream (MCUS) before and after the change to the new sampling site indicated in the LIMS database showing the high values measured in early 1991

5.1.2 MG009

Two high uranium values are recorded in the LIMS database – 15 µg/L on 25/3/1991 and 2.2 µg/L on 17/4/1996. There is no record of these samples being reanalysed so the values have been retained. These high values are believed to be caused by sample contamination (Supervising Scientist & Department of Business, Industry and Resource Development 2002).

ERA collected several samples in February 1993 from the "side channel" at the Magela Creek downstream site, these data points have been removed from the Ranger_Lims_Risk_Ass.xls

spreadsheet but will be imported into the SSD explorer database. Also, the point of sample collection at the MG009 varies:

eriss sampled the central and west channels during the 2001–2002 and 2002–2003 Wet seasons so the cross channel variation can be assessed. All data will go into the SSD explorer database but only the central channel (the compliance point) data is in the Lims_Risk_Ass.xls spreadsheet.

ERA have historically sampled from the west bank of the western channel during low flows and from the central channel during moderate to high flows (Klessa 2001). Following a request from the Minesite Technical Committee ERA have sampled from the central channel for the last two Wet seasons, only sampling from the western channel when the central ceased to flow.

DBIRD sample at a point as close to, or just downstream of the 009 gauging station, where the mixing looks to be greatest on the day (personal communication Megan Bailey, DBIRD).

5.1.3 GCBR

Data users need to be aware that this site is not always sampled at the same location and does not always have the same feed source. Some examples of the sample description are, “ex MBL”, “split feed pipe” etc. these samples usually have very high U (~200 µg/L) compared with values a magnitude smaller when the water body itself is sampled.

5.1.4 GCMBL

One data point has been removed from the Ranger_Lims_Risk_Ass.xls spreadsheet. That is ERA sample # 78295, 1/9/2000; the sample description is “pig wallow”.

5.1.5 GTB

Data for ERA sample # 50009 “DIW flush” has been removed from the Ranger_Lims_Risk_Ass.xls spreadsheet.

5.1.6 RP2

See the sample description field in LIMS data for the point of sample collection as this varies (eg bilge pump, drains etc.). The effect of the different collection points on the data has not been analysed and no records have been removed.

5.1.7 DJKPS

As for 5.1.6 above.

5.1.8 GCC

Sample 62686 (ERA 27/11/1998) has probable manganese and uranium contamination (2.12 and 147 µg/L respectively). The data have been retained in the Ranger_Lims_Risk_Ass.xls.

5.2 Contamination

Klessa (2000) discusses uranium results and sample contamination. Some of the historic uranium values are very high, especially at the Magela Creek upstream site (possibly for reasons explained in dot point 1 above). It is likely that many of these high values reflect sample contamination rather than true uranium concentrations. A list of all U results >1.4 µg/L (the current Action level) are given in Appendix 2.

5.3 Less than detection limit values

On importation to the SSD explorer data base all <x records will be multiplied by 0.5 and flagged as being originally <x. Thus the stored value will be y, where y = x/2 (the default number of decimal places for y should be no more than the original value – a program needs to be written to automate this). The original value is stored as x in a separate field, with a "<" identifier and can also be exported. Data are stored as <x in the working spreadsheets (Ranger _####.xls).

5.4 Change in detection limits over time

5.4.1 ERA – LIMS data

The greatest change in detection limit over time is for uranium. In the ERA LIMS data the uranium detection limit is 0.1 μg/L until ~ 2000–2001. When ICPMS became the preferred method of analyses, the detection limit dropped to 0.005 μg/L. There is not a clear date for the change from 0.1 to 0.005 as the detection limit; for MCUS data the change appears to have been in late May 2001 and the data at the other sites in this study do not disagree with this[4].

The ERA detection limits for Mn (1 μg/L), Mg (0.1 mg/L) and SO_4 (0.1 mg/L) have remained the same throughout the data collection period. Note the difference between ERA and ***eriss*** Mn detection limits.

5.4.2 *eriss* data

The data collected during the SSD monitoring program cover only a short period of time and have not undergone changes in the detection limits during that period. The detection limits for ***eriss*** data are U 0.005 μg/L, Mn 0.01 μg/L, Mg 0.1 mg/L and SO_4 0.1 mg/L. Note the difference between ERA and ***eriss*** Mn detection limits.

5.4.3 Water Resources data

The detection limits for the key variables in the Water Resources data changed several times throughout the period of data collection. Details are listed in Table 3.

Table 3 Detection limits of key variables in the Water Resources data

Uranium-soluble detection limit (μg/L) and dates		Magnesium-soluble detection limit (mg/L) and dates		Sulphate-soluble detection limit (mg/L) and dates	
0.5	1981–1982	<1	1972–1978	2	1971–1978
0.3	1986	<0.005	1 point only 10 Jan 1981	1	1978–1986
0.1	1978–1987	Note: n=288 where x < 1; Across entire date range		0.1	1982–1987

5.4.4 DBIRD data

There are no "<" values recorded for Mn at the three DBIRD sites (GS8210009, GS8210028 and MCUS). The detection limit for Mg and SO_4 is 0.1 mg/L. The detection limit for uranium varies; several <0.1 μg/L results are reported for 1996 yet values lower than that detection limit are reported as early as 1993, no <0.005 μg/L values are recorded.

[4] < 0.005 values are recorded at Jabiluka (JSC) as early as January 2000.

5.5 Fraction analysed

Results for all fractions (total, residual (>0.45 μm) and filtrate/dissolved (<0.45 μm) will eventually be imported into the SSD explorer databases but users of the data sets need to be aware of the following;

All results in the Ranger_eriss_00_03.xls spreadsheet are for the filtrate fraction.

The fraction is not always identified in the ERA datasets; results that are clearly for the residual fraction have been removed from the Ranger_Lims_Risk_Ass.xls spreadsheet (see section 4). It is assumed that all other result are for the filtrate fraction except for heavy metals, uranium and radium prior to the start of the 1985–86 wet season. These analytes were determined as 'pseudo-total' concentrations in acidified (<pH2) samples prior to this (Klessa 2000). These 'pseudo-total' results remain in the Ranger_Lims_Risk_Ass.xls spreadsheet.

Only filtrate fraction results have been retained in the Ranger_WaterRes.xls and Ranger_DBIRD.sxls spreadsheets (see section 4).

5.6 ^{226}Ra data

In the ERA LIMS data the values pre May 1991 for ^{226}Ra are mostly well below what the current detection limit is (0.5 mBq/L ***eriss*** method and ~2 mBq/L for many samples analysed by previously used analytical methods/facilities). The values all appear to increase by ~ 1000 between April 91 and May 91. Presumably the pre 1991 data should be Bq/L but is listed as mBq/L. Also, many of the recent ^{226}Ra results are reported to a large number of decimal places. These results were supplied by the ***eriss*** radiochemistry laboratory and should only be reported to 3 significant figures.

The ^{226}Ra results have been removed from the DBIRD data. Like the ERA data the DBIRD data contain many ^{226}Ra results that probably should be Bq/L not mBq/L. However, unlike the ERA data there is no clear date where a change to the correct units occur.

6 Parameters

The parameters selected for investigation were: uranium, manganese, magnesium, calcium, sulphate, ammonia, radium-226, pH, electrical conductivity, and turbidity. Klessa (2001) describes the relevance of these key variables in table 4.

Table 4 Relevance of key variables (from Klessa 2001)

Key Variable	Relevance
PH	Stipulated under ER3.3; master variable influencing speciation and toxicity of potential contaminants
EC	As above for pH
U	Stipulated under ER3.3; principal contaminant of public concern; potential ecological impact
Turbidity	No evidence of mine effect but becomes increasingly important as physico-chemical indicator of potential ecological impact from surface disturbance during rehabilitation
Mg	Evidence of mine effect; potential water potability impacts; potential ecological impact unclear
SO4	As above for Mg
Mn	Evidence of mine effect; contaminant arising primarily from use of pyrolusite in U3O8 production; potential ecological impact
226Ra	No evidence of mine effect; potential human health impact
Ca	No direct effect envisaged but required for the interpretation of potential ecological impact from Mg imbalance (i.e. Ca:Mg ratio)

7 SSD Explorer Corporate Site Database and SSD Explorer Corporate Imported Datasets: Users Guide

7.1 Introduction

In conjunction with the staff of the Supervising Scientist, the previous generic site database has been modified to incorporate specifically defined areas for site data storage and retrieval. The result is the SSD Corporate Database, an Object Oriented Data Warehouse whose objects are Data and Site/Sample. The main functions of the data warehouse are data storage, object matching and data retrieval. Figure 3 illustrates the data warehouse model.

There are two categories of data in the warehouse, (i) SSD or "internal" data in the "Corporate Site Database" and (ii) data from other agencies, "external" data, in the "Imported Datasets" repository. The following describes the data types and how to access and use the SSD explorer database where the data will be stored.

Note: this Users Guide has been developed concurrently with the Databases. Some of the relationships between data types, field names and the appearance of the data entry forms may change slightly as the Databases undergo refinement and finalisation. A more comprehensive and updated User Guide is currently under development

7.1.1 Internal data

An analysis of the existing datasets within the organization showed that there were seven definite themes of data being collected and queried. These are summarised in Table 5. For further information on the fields within the database use the SSD Explorer help (press F1) which describes the size, type and uses of the fields.

Table 5 Themes within the Corporate Site Database

Site Data	This is the data about a specific location (defined by a geographic point). Biological survey duplicates and replicates are recorded as sub sites.
Observation/Sample Data	Information about a visit to the site, this includes the date of data/sample collection/site visit, whom collected the data, destination of collected data, method of collection, collection purpose and project
Chemical Results	When a site is visited a sample may be taken and analysed. The results of the analyses are stored against the sample record– these data are specified as being the type of analysis test (ie U) method of analysis (mass spectrometry), the unit of measurement in (ie µg/L), the result of the test (ie reported measurement), any error factors of the test, count number of the test (ie the same test may be performed over and over), the date of the test (this field differs from the collection date field and enables the users to determine time variances)
Taxa Counts (Biological survey data)	Genus/species counts of samples taken or done onsite
Radionuclide Activities	Count of radionuclides in samples taken
General Parameters	This area is to capture general information about the site at the time of the visit. This could include data such as water level, rainfall data, sample volume, air humidity etc.)
Sub Samples	Samples may be divided for separate analyses. For some sub-samples adjustment of the reported result to the original volume is necessary. These adjusted figures are available via the Adjusted Results area of the data discovery area of the database.

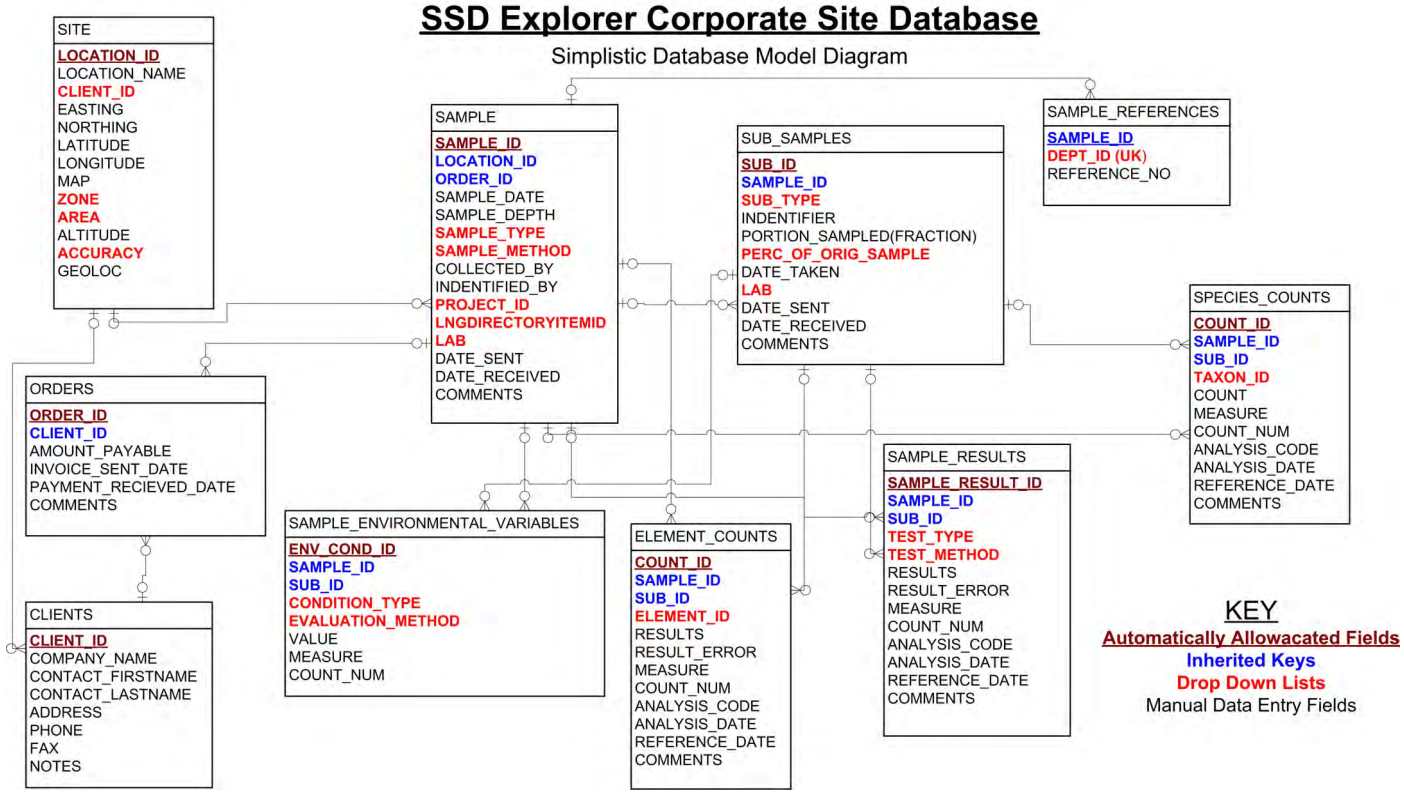


Figure 3 Schematic diagram of the Object Warehouse database model

7.1.2 External data

The Data Warehouse is designed to store non-SSD data – the SSD Corporate Imported Datasets. These datasets are Excel spreadsheets or Comma Separated Files (CSV) provided to SSD from a variety of other agencies including, ERA, DBIRD and the Bureau of Meteorology (BoM). These datasets are imported into the generic structure summarised in Table 6.

Table 6 Imported Data Table

RECORD ID (primary key)	Unique Record Identifier–System Allocated
DATA_SOURCE	Source of the Dataset eg LIMS
SITE_NAME	Name of the location where sample was taken
SAMPLE_ID	An Unique Sample Identifier
SITE_AREA	Site Grouping eg RUM (Ranger Uranium Mine), Jabiluka
SAMPLE_DESCRIPTION	Any further description of the sample provided and/or comments
TEST	Analysis performed eg U (uranium)
TEST_METHOD	Method of analysis eg U_F (filtered uranium)
LEVEL_RESULT	Result of the analysis
MEASURE	Unit of measurement
IS_LESS_THAN	Captures “<” (less than detection limit values)
SAMPLE_DATE	Date of sample collection
SAMPLE_TIME	Time of sample collection
ORIGINAL_VALUE	When a “<” is detected the user can apply a multiplication factor. The original value is stored for reference

7.1.3 Data custodianship

The custodians of data, ie the position responsible for updating data, quality control/assurance and assigning editing privileges will be the ***eriss*** chemist (or delegate) for the internal chemistry data (ie SSD water chemistry data) and the ***oss*** chemist (or delegate) for the external chemistry data (ie LIMS and DBIRD etc.).

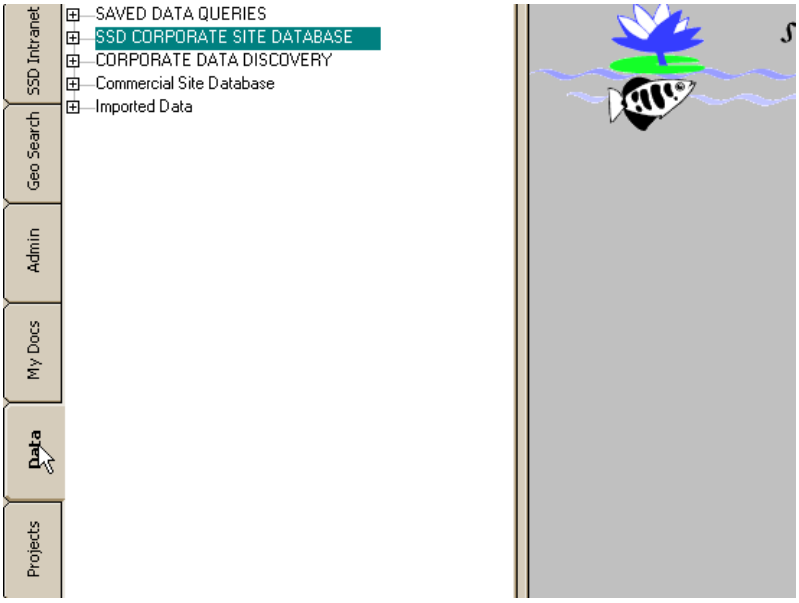
Copies of the master data set can be made by using the data export tool described below. These copies can be used as required for specific projects and stored by the user in relevant project areas on SSD explorer. These exported data sets MUST NOT BE IMPORTED BACK TO THE CORPORATE SITE DATABASES.

7.2 SSD (internal) data

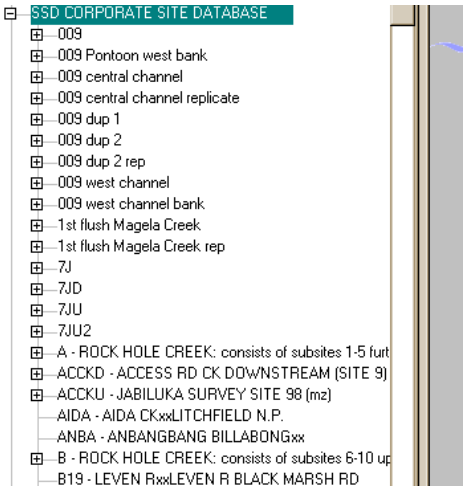
7.2.1 Data Entry

To enter data into the SSD Corporate Site Database (for all data attached to a site) follow these prompts:

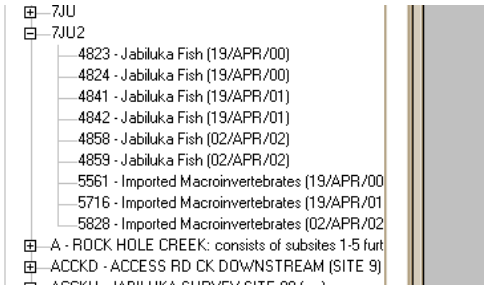
1 Go to the Data tab on SSD Explorer



2 Expand the SSD CORPORATE SITE DATABASE Node on the Data Tab Tree. This will display all the sites within the system (the sites with samples can be expanded to view those samples)

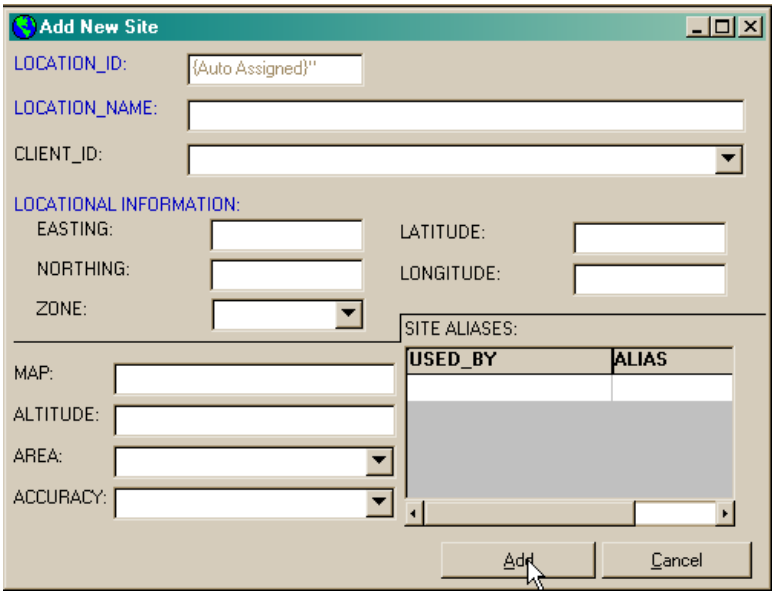


3 Expand the Site you wish to view the samples for and the samples will be displayed. The node is detailing the sample number, the sample type and the date of the sample.



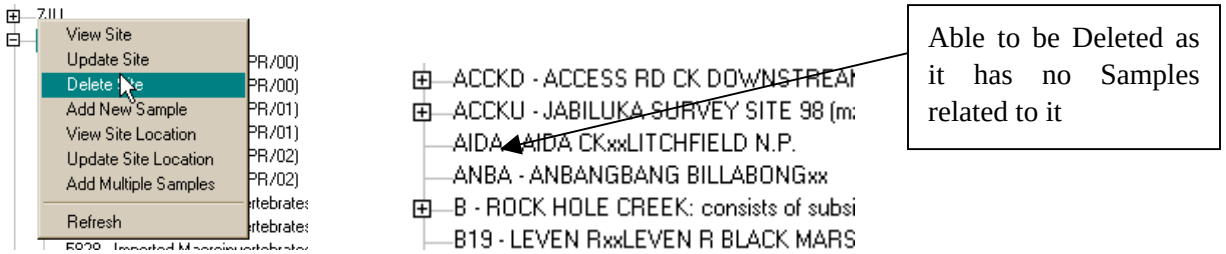
4 Adding a new site to the site register. Right click on the node “SSD EXPLORER SITE DATABASE” and select the Add New Site option on the menu.

A blank site form will be displayed allowing you to enter the information about the site. Note as with all the forms within SSD Explorer the fields with Blue Labels are required and a value must be entered.

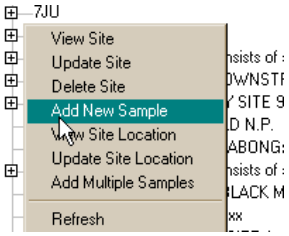


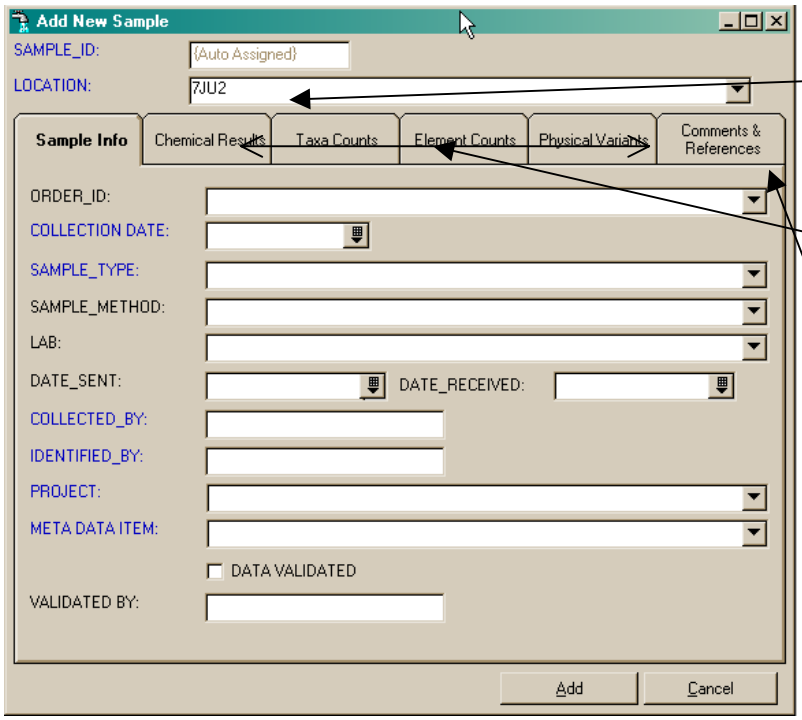
Press F1 with the form open for any further descriptions of the fields and their usage.

5 To view or edit information about a site click on the site and select the required option (View, Update or Delete). Note it will not be possible to delete a site that has samples related to it). When updating information follow each entry by pressing the update button.



6 Add samples and sample results, right click on the Site you wish to add the sample for and select the add new sample option





Location is automatically select for you

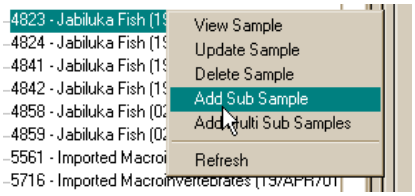
To enter results select the type of results you wish to enter and complete the grid (note fields with bold headings are required

To Enter Comments or other reference numbers about the sample click the comments and references tab

A blank sample form will be displayed allowing entry of the sample information and various results

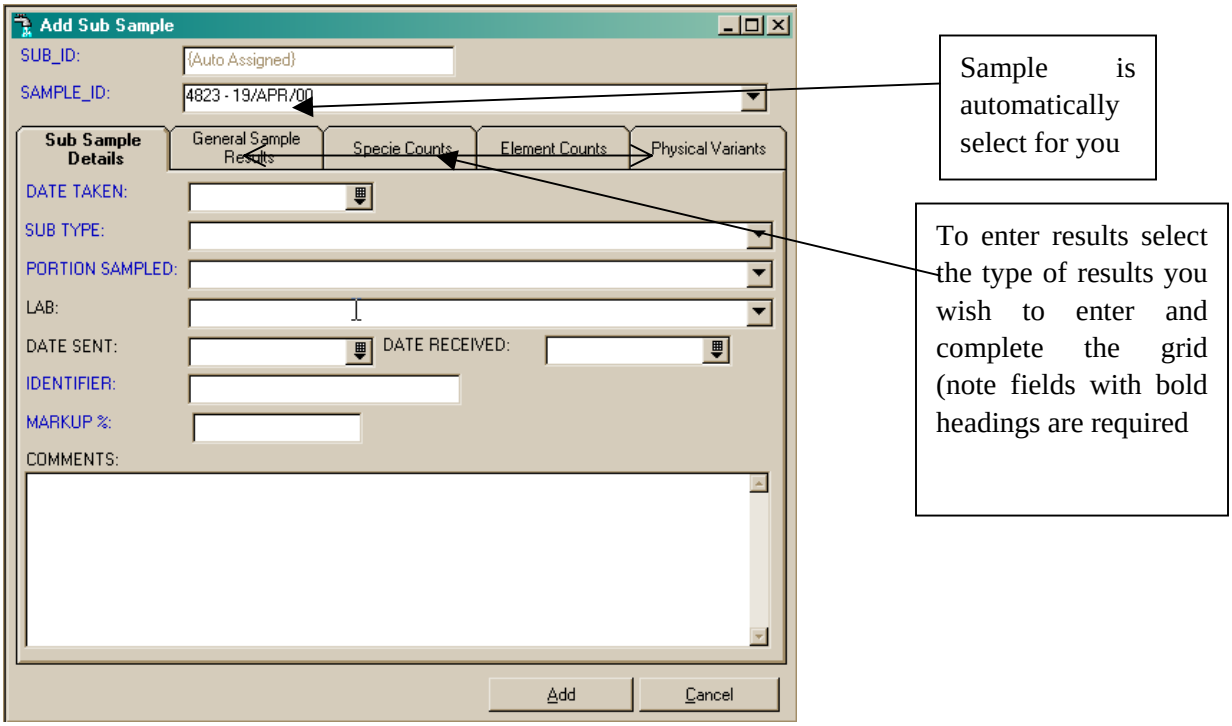
7 To view information about a sample, results or update the sample or results, click on the sample and select the required option (View, Update or Delete). Note samples will be unable to be deleted if they have related sub-samples.

8 To add a sub-sample against a sample, select the sub-sample to be added, right click and select the 'add sub-sample' option



A blank sub-sample form will be displayed allowing you to enter the sub sample information and various results. Select the option of the type of data you wish to add and complete the results grid for the results type selected.

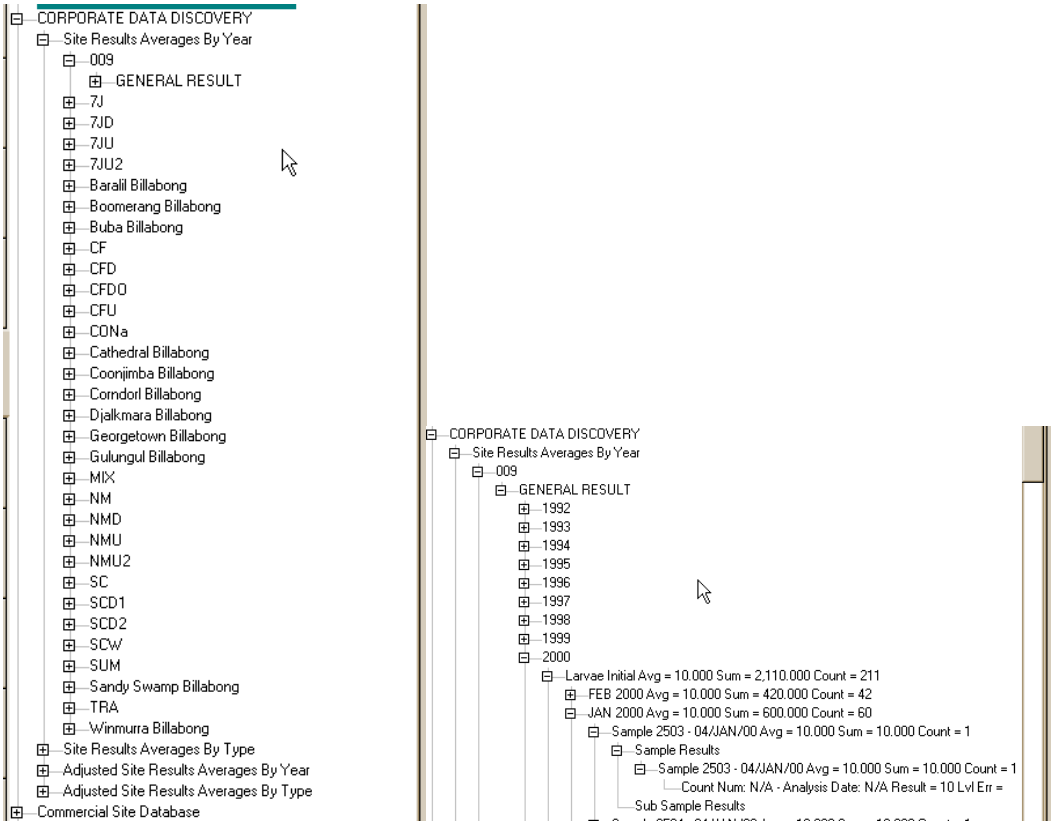
Note: the mark-up% field is for adjusted results (for help press F1 with the form open).



9 To view information about a sub sample or its results or update the sub sample or results click on the sub sample and select the required option (View, Update or Delete).

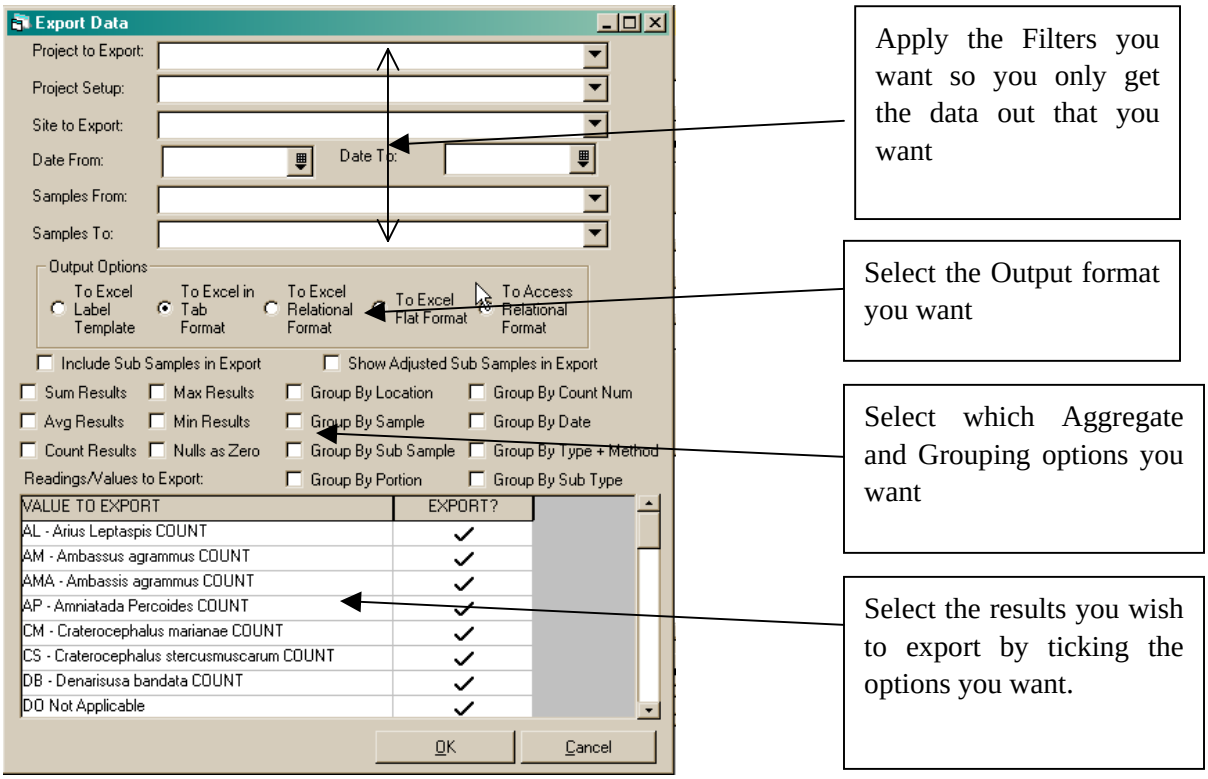
7.2.2 Data viewing (Corporate Site Data Discovery)

Underneath the CORPORATION SITE DATABASE node in SSD Explorer is the CORPORATE SITE DATA DISCOVERY tool. Providing the user with generic queries and groupings of the data, this tool allows the user to "surf" their way through the results. Additional groupings will be added to here, so users should make a point of frequently visiting this node in SSD Explorer.



7.2.3 Corporate Site Database Data Extraction/Export

1 Right click on the CORPORATE Site Database node and click on the Export Data Item.

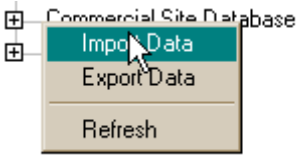


With the data export tool you can export the results into a variety of formats with a variety of groupings and filters. For more information see the help on this item by pressing F1 while the form is open.

7.3 External Data

7.3.1 Importing Corporate Imported Datasets

1 To Import data into the Corporate Imported Datasets select the Import Data option on the "IMPORTED DATA" node.

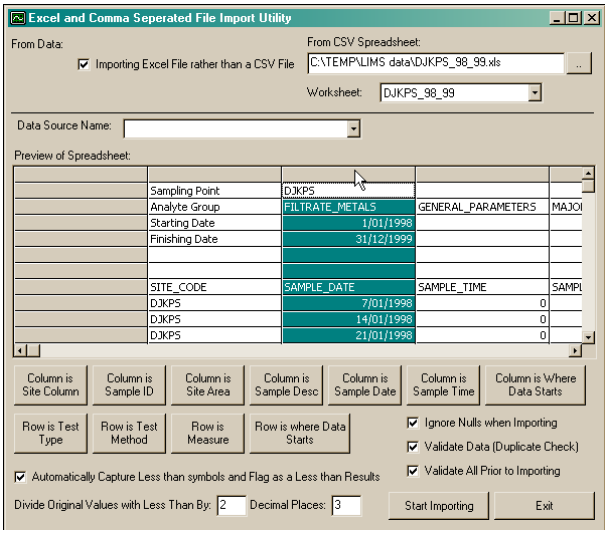


The import form will then be displayed. Select the format of the file you are importing (Excel or CSV) and the location of the file you are importing from. Note:

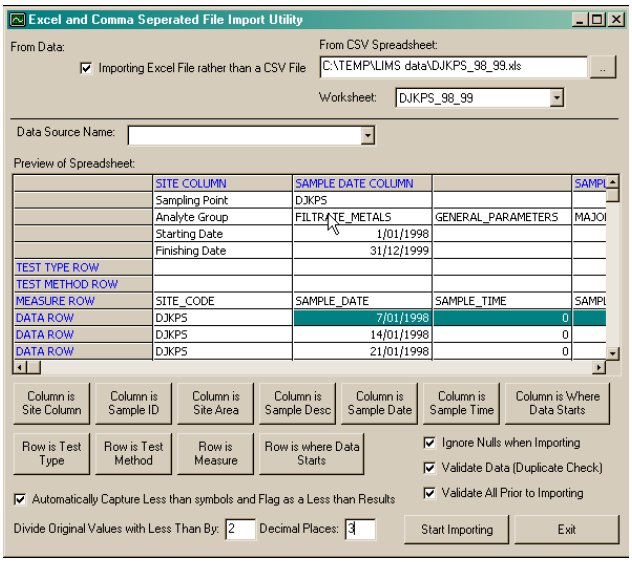
The file must be checked out of SSD explorer to import it and it must not be 'read only'.

All descriptive fields (eg site names, site ID, dates, comments etc.) must be to the left of the results fields

2 Highlight each column and select the appropriate button to describe the contents of the column. Only the first column of data needs to be selected. By selecting the [Column is Where Data Starts] button all other data columns to the right will be automatically selected.



3 Highlight the appropriate rows and buttons for Test Type (eg U), Test Method (eg U-F), Measure (ie the units of measurement) and the Row where the data starts. As for the columns only the first row of data needs to be selected



4 Tick the check boxes to enable data validation (checks that each result does not already exist) and capture of “less than” symbols.

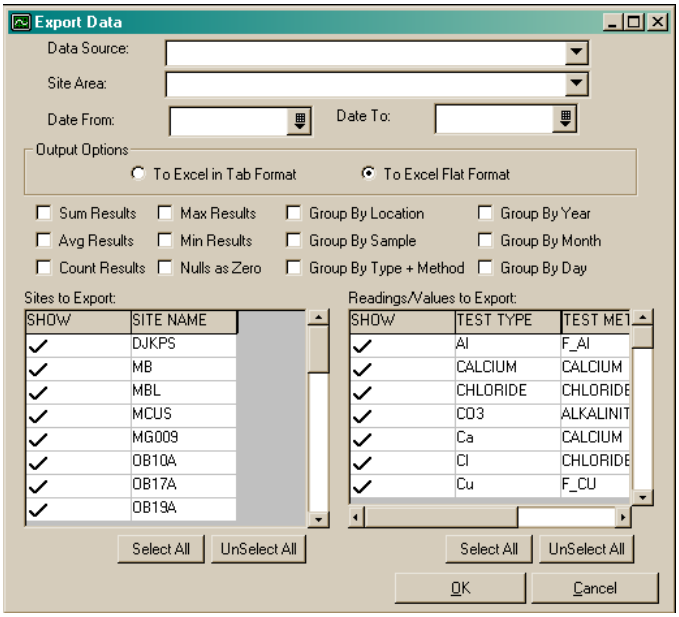
5 Enter a value as the amount to divide “less than” values by. Two is routinely used

6 Enter [Start Importing].

7.3.2 Exporting Corporate Imported Datasets

To export data from the Corporate Imported datasets

1. Go to the DATA view
2. Right click on Imported Data and select the Export Data option
3. Select the data source, site, date range and output file format (csv or excel).
4. There are a number of check boxes that determine the format of the output. It may be necessary to run a trial on a small number of data points (restrict the number of sites and date range) to get the most suitable format.
5. Click OK.



8 Conclusions

Data sources, quality, storage and retrieval have been described in this document.

The ERA LIMS data set is the most extensive dataset. Users of the ERA data need to be aware of the data quality issues outlined in section 5. The ***eriss*** dataset only covers the recent Wet seasons but the data quality is high. The Water Resources dataset is very extensive but the data is not recent and apart from the physical values and pH most of the results are not very useful due to the high detection limits of the time. Only the upstream and downstream Magela Creek sites from the DBIRD dataset (which also contains Water Resources data) are included in this study.

All these datasets will eventually be imported into the SSD explorer databases and users will need to query the databases to gain subsets of data relevant to their needs. For the Ecotoxicological Risk Assessment project spreadsheets containing the relevant data are stored at \\Ecological Risk Assessment Administration\Peter Bayliss\Ecological Risk Modelling\Data Mines\<data source name>.xls. These spreadsheets will not be updated regularly and future users requiring updated datasets to work with will need to download data from SSD explorer databases. Details of how this can be done and the data custodians are given in this report.

9 References

Energy Resources Australia, Energy Resources Australia – Ranger Mine, Environmental Monitoring Program, Environmental Annual Report 1999.

Energy Resources of Australia, Ranger Mine Water Management System Operation Manual, November 2002.

Klessa DA 2000. *The chemistry of Magela Creek: A baseline for assessing change downstream of Ranger*. Supervising Scientist Report 151, Supervising Scientist, Darwin.

Klessa D 2001. Water quality in Magela Creek upstream and downstream of Ranger: A summary of performance for 2000–2001 and derived triggers and limits for 2001–2002. Internal Report 380, Supervising Scientist, Darwin. Unpublished paper.

Supervising Scientist & Department of Business, Industry and Resource Development 2002. *Evaluation of alleged deficiencies in management of the Ranger Uranium Mine between 1996 and 1998*. Supervising Scientist Report 171, Supervising Scientist, Darwin NT.

Appendix 1

Table A.1 ERA statutory surface water monitoring program (from *Ranger Mining Management Plan, November 2003*)

Surface water	Measurement	Frequency[1]
Magela Creek (GS8210009) (MG009)	pH, EC, turbidity; dissolved magnesium, calcium, sulphate, manganese & uranium	Weekly
	total radium-226	Monthly
	pH, EC, turbidity; dissolved magnesium, calcium, sulphate, manganese & uranium	Daily during RP2 release and once just prior to release
Magela Creek (GS8210067)[2] (MCUS)	pH, EC, turbidity; dissolved magnesium, calcium, sulphate, manganese & uranium	Weekly
	total radium-226	Monthly
	pH, EC, turbidity; dissolved magnesium, calcium, sulphate, manganese & uranium	Daily during RP2 release and once just prior to release
RP1 Weir (RP1W)	L, pH, EC, turbidity; dissolved magnesium, sulphate, manganese & uranium; residue uranium	Weekly during RP1 weir overflow; monthly at all other times
RP1 Weir (RP1W) prior to release	pH, EC, turbidity; dissolved magnesium, sulphate, manganese nitrate & phosphate; total uranium, radium-226 & polonium 210	At least once within one week of first release
Djalkmara Billabong (DJKPS) prior to release	pH, EC, turbidity; dissolved sulphate, magnesium, nitrate,phosphate & manganese; total uranium, radium-226 & polonium-210	At least once within one week of first release
Djalkmara Billabong (DJKPS) during release	pH, EC, turbidity; dissolved sulphate, magnesium manganese, uranium; residue uranium	Weekly
RP2 prior to release	pH, EC, turbidity, alkalinity; dissolved magnesium sodium, potassium, calcium, ammonium, chloride, nitrate sulphate, phosphate, manganese & uranium; total radium-226 & polonium-210	At least once within one week of first release
RP2 during release	pH, EC, turbidity; dissolved sulphate, magnesium manganese & uranium; residue uranium	Daily if period of release is ≤7 days
	pH, EC, turbidity, alkalinity; dissolved sulphate, magnesium & manganese; total uranium, radium-226 & polonium-210	Weekly if period of release is >7 days
Coonjimba Billabong (CB)	pH, EC, turbidity; dissolved magnesium, calcium, sulphate, manganese & uranium	The week prior to, and weekly from, RP1 weir overflow; monthly at all other times
Georgetown Creek (GC2)	pH, EC, turbidity; dissolved magnesium, calcium sulphate, manganese & uranium	Weekly during flow
Georgetown Billabong (GTB)	pH, EC, turbidity; dissolved magnesium, calcium sulphate, manganese & uranium	Weekly during flow at GC2; monthly at other times
Gulungul Creek	pH, EC, turbidity; dissolved magnesium, calcium, sulphate, manganese & uranium	Weekly
	total radium-226	Monthly

1 Unless otherwise stated, monitoring shall begin as soon as is practical when the central channel of Magela Creek at MG009 starts to flow. Monitoring shall end when the central channel of Magela Creek at of MG009 ceases to flow.

2 The gauging station identified is used for gauging flow and is not the MCUS sampling site, the Authorisation will be changed to reflect this (Ranger Minesite Technical Committee 17/10/2003).

Appendix 2

Table A.2 Uranium values < 1.4 μg/L (the current action level) at the upstream and downstream Magela and Gulungul Creek sites.

SITE_CODE	SAMPLE_DATE	SAMPLE_NUMBER	U (ug/L)	Data source
GCC	27/11/1998	62686	2.115	ERA _LIMS
GCH	23/06/1980	10185	11	ERA _LIMS
GCH	2/12/1991	34780	1.7411	ERA _LIMS
MG009	23/06/1980	10181	1.7	ERA _LIMS
MG009	20/02/1991	31541	1.7485	ERA _LIMS
MG009	21/02/1991	31558	1.4373	ERA _LIMS
MG009	25/02/1991	31684	1.7296	ERA _LIMS
MG009	25/03/1991	32678	15.013	ERA _LIMS
MG009	17/04/1979		3.1	Water Resources (and DBIRD)
MG009	08/05/1985		1.5	Water Resources (and DBIRD)
MG009	25/02/1991		1.7	DBIRD
MG009	17/03/1992		1.8	DBIRD
MG009	23/04/1992		1.5	DBIRD
MG009	03/02/1993		1.6	DBIRD
MCUS	19/02/1991	31513	9.3691	ERA _LIMS
MCUS	20/02/1991	31525	4.898	ERA _LIMS
MCUS	21/02/1991	31555	6.5661	ERA _LIMS
MCUS	22/02/1991	31613	14.96	ERA _LIMS
MCUS	23/02/1991	31657	4.5858	ERA _LIMS
MCUS	24/02/1991	31669	1.5	ERA _LIMS
MCUS	25/02/1991	31687	16.698	ERA _LIMS
MCUS	26/02/1991	31712	5.9425	ERA _LIMS
MCUS	27/02/1991	31750	1.8941	ERA _LIMS
MCUS	28/02/1991	31798	10.519	ERA _LIMS
MCUS	18/03/1991	32476	24.954	ERA _LIMS
MCUS	2/04/1991	32795	5.7795	ERA _LIMS
MCUS	8/04/1991	33015	1.982	ERA _LIMS
MCUS	12/03/1992	35568	1.9	ERA _LIMS
MCUS	2/03/1993	38282	1.807	ERA _LIMS
MCUS	28/02/1996	50312	2.8958	ERA _LIMS

SITE_CODE	SAMPLE_DATE	SAMPLE_NUMBER	U (ug/L)	Data source
MCUS	5/02/1997	53290	1.419485	ERA _LIMS
MCUS	3/02/1999	65074	1.478396	ERA _LIMS
MG028	18/04/1979		2.8	Water Resources (and DBIRD)
MG028	02/03/1981		2.6	ERA – Old Mine Water Database