Lake Eyre Basin Springs Assessment

SA Data Management

DEWNR Technical report 2015/49

Government of South Australia
Department of Environment,
Water and Natural Resources

Funding for these projects has been provided by the Australian Government through the Bioregional Assessment Programme.

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SA Data Management

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DEWNR Technical report 2015/49

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Foreword

The Department of Environment, Water and Natural Resources (DEWNR) is responsible for the management of the State's natural resources, ranging from policy leadership to on-ground delivery in consultation with government, industry and communities.

High-quality science and effective monitoring provides the foundation for the successful management of our environment and natural resources. This is achieved through undertaking appropriate research, investigations, assessments, monitoring and evaluation.

DEWNR's strong partnerships with educational and research institutions, industries, government agencies, Natural Resources Management Boards and the community ensures that there is continual capacity building across the sector, and that the best skills and expertise are used to inform decision making.

Sandy Pitcher
CHIEF EXECUTIVE
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Acknowledgements

The Lake Eyre Basin Springs Assessment (LEBSA) project received valuable guidance from the project Technical Reference Committee members made up of members from various offices, departments and groups and of diverse backgrounds, including the Department of the Environment (DE), Bureau of Meteorology (BoM), Geoscience Australia (GA), Queensland Department of Science, Information Technology, Innovation, and the Arts (DSITIA), the South Australian Arid Lands (SAAL) NRM Board and the South Australian Department of Environment, Water and Natural Resources (DEWNR).

The LEBSA project has been delivered concurrently and in-conjunction with an equivalent project run by DSITIA, of which Keryn Oude-egberink (DSITIA LEBSA PM) has been instrumental in providing feedback to the TRC and SA LEBSA project, and guidance to the many DSITIA staff working on the project.

Overarching program guidance and coordination of SA and Qld LEBSA projects was provided by the Executive Steering Committee members: Peter Baker (DE), Edwina Johnson (DE), Anisa Coric (DE), Kriton Glenn (GA), Tim Evans (GA), Phil Deamer (BoM), Sarah van Rooyen (BoM), Brendan Moran (BoM), Tom Carrangis (DEWNR), Tim Ryan (DSITIA) and Keryn Oude-egberink (DSITIA).

The DEWNR LEBSA project team comprised: Andy Harrison (Project Manager), Danny Brock (sub-Project Manager), Travis Gotch, Ronald Bonifacio, Mel White, Dan Wohling, Mark Keppel, Dave Armstrong, Glen Scholz, Lloyd Sampson, Helen Owens, David Thompson, Matt Miles (DEWNR), with Catherine Miles (Miles Environmental Consulting), Ellen Krahnert (Ecological Directions) and Katie Fels (Jacobs).

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Contents

List of figures

List of tables

Summary

In 2012, the Australian Government established an Independent Expert Scientific Committee (IESC) on Coal Seam Gas (CSG) and Large Coal Mining Developments to provide independent expert scientific advice concerning the impacts such developments may have on water resources. As part of this initiative, the South Australian Department of Environment, Water and Natural Resources (DEWNR) has been commissioned to collate and ground-truth baseline groundwater, surface water and ecology information in regions with the potential for CSG and large coal mining development. The Lake Eyre Basin (LEB) is a priority bioregional area of assessment. As such, a key project within the broader program involving data acquisition is the LEB Springs Assessment (LEBSA).

The LEBSA focuses on groundwater dependent ecosystems (GDEs) of the regions encompassing the Galilee, Cooper, Arckaringa and Pedirka basins. The aim is to provide the Office of Water Science with aligned data management tools that can be used across sub-regions and across both South Australia and Queensland. To achieve this outcome the following was undertaken:

- Audit of existing water and ecological data
- Gap analysis
- Development of an aligned data model for GAB springs across South Australia and Queensland.

More accurate mapping of GAB springs and detailed investigations in priority regions (Gotch et al. 2016; Keppel et al. 2015, 2016) has been undertaken and data results have been integrated so that standardised data can be accessed in the future. Within South Australia this database platform will access biological data stored in the Biological Databases of SA (BDBSA), and hydrogeology and geomorphology data from within the SA groundwater database – SA Geodata.

Ultimately the amassed data sets will be used to undertake impact and risk assessments for the cumulative and individual impacts of CSG and coal mining activities on the GAB springs. However, in establishing baseline conditions, we also need to ensure that monitoring is continued to assess the health of the GAB springs and to capture the natural variations in the system.

1 Introduction

1.1 Independent Expert Scientific Committee and Bioregional Assessment

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) is a statutory body under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) which provides scientific advice to the Australian Government's on the water-related impacts of coal seam gas and large coal mining development proposals.

Under the EPBC Act, the IESC has several legislative functions to:

- Provide scientific advice to the Commonwealth Environment Minister and relevant state ministers on the water-related impacts of proposed coal seam gas or large coal mining developments
- Provide scientific advice to the Commonwealth Environment Minister on:
    - Bioregional assessments being undertaken by the Australian Government
    - Research priorities and projects commissioned by the Commonwealth Environment Minister.
- Publish and disseminate scientific information about the impacts of coal seam gas and large coal mining activities on water resources.

Funding for these projects has been provided by the Australian Government through the Department of the Environment.

The Bioregional Assessment Programme is a transparent and accessible programme of baseline assessments that increase the available science for decision making associated on potential water-related impacts of CSG and large coal mining developments. A bioregional assessment is a scientific analysis of the ecology, hydrology, geology and hydrogeology of a bioregion with explicit assessment of the potential direct, indirect and cumulative impacts of CSG and coal mining development on water resources. This programme draws on the best available scientific information and knowledge from many sources, including government, industry and regional communities, to produce bioregional assessments that are independent, scientifically robust, and relevant and meaningful at a regional scale.

The Lake Eyre Basin (LEB) is a priority bioregional assessment area.

1.2 Lake Eyre Basin Springs Assessment project

The Lake Eyre Basin Springs Assessment is a project between the Australian Government Department of the Environment, the South Australian Department of Environment, Water and Natural Resources (DEWNR) and the Queensland Government's Department of Science, Information, Technology, Innovation and the Arts (DSITIA).

The primary aim of the LEBSA project is to ensure that future decisions by the IESC about potential water-related impacts of CSG and large coal mining activities are informed by substantially improved science and knowledge. The groundwater dependent ecosystem products developed under the LEBSA project will be made available through state databases and the Bureau of Meteorology's National GDE Atlas. This information will ultimately support the IESC in its assessment of future CSG and large coal mining projects.

The LEB presents unique challenges to assessing and managing the risks that may arise from CSG and large coal mining developments. It is characterised by a high degree of hydro-climatic variability and unpredictability, with patterns of water availability occurring over annual and decadal scales. The LEBSA project will inform knowledge gaps providing valuable information to the IESC about water-related resources and potential impacts and risks from CSG and large coal mining activities. It is further hoped that baseline datasets will continue to be expanded over time through continued investigation and monitoring, to better capture baseline conditions and characterise natural system variations.

The LEBSA focuses upon groundwater dependent ecosystems (GDEs) of the regions surrounding the Galilee, Cooper, Arckaringa and Pedirka basins. (see Figure 1). The LEBSA project captures essential water asset information on GDEs including GAB springs in aligned SA and Qld datasets. The SA and Qld datasets, maps, and conceptual models will be used to support the National GDE Atlas.

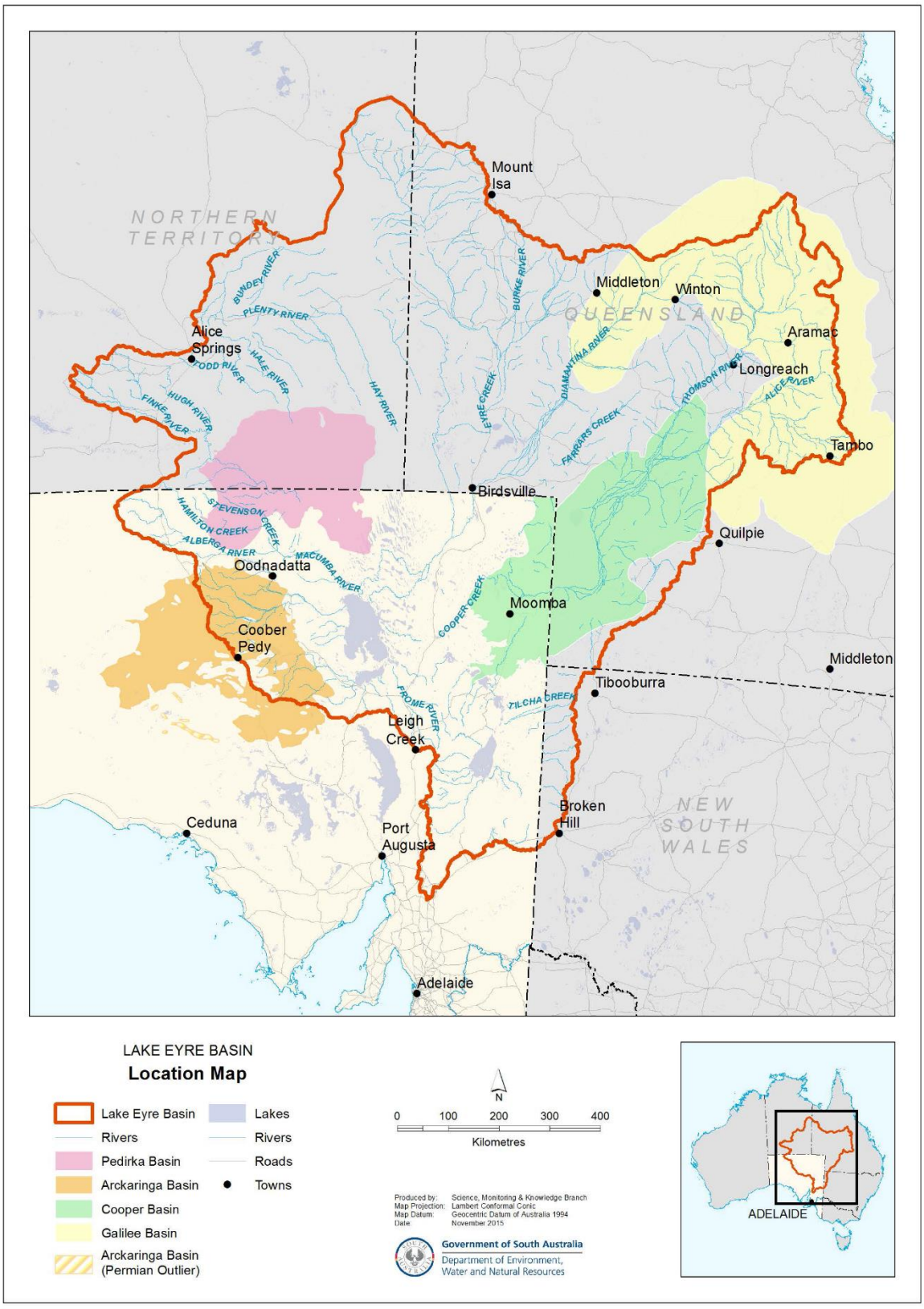

Figure 1: Map of the LEB, showing the geological basins

1.3 South Australian LEBSA project

This report is part of a series of studies that form the LEBSA project. The LEBSA project is one of three water knowledge projects undertaken by DEWNR to inform the Bioregional Assessment Programme in the LEB. The three projects are:

- Lake Eyre Basin Rivers Monitoring
- Arckaringa Basin and Pedirka Basin Groundwater Assessment
- Lake Eyre Basin Springs Assessment.

The South Australian LEBSA project focuses on groundwater dependent ecosystems (GDEs) within the regions surrounding the Cooper, Pedirka, and the Arckaringa basins and provide to the Australian Government consistent information products on GDE assets (including springs) for these sub-regions. These products will consist of GDE aligned and attributed datasets, maps, and conceptual models.

Prior to the LEBSA, consolidated knowledge of the location, ecology and hydrogeology of the GAB springs was limited. There was particularly poor understanding of the responses and potential impacts on springs from the water extraction activities associated with coal mining and coal seam gas activities. These information gaps place significant constraints on the capacity of governments to manage environmental risks associated with both the cumulative and individual impacts of CSG and large coal mining developments. An initial step to addressing information gaps is the establishment of baseline data survey data and the interpretation of such data for spring groups, ultimately to inform decision making of cumulative development pressures. (Keppel et al. 2015a).

This report outlines the processes undertaken from a data management perspective for LEBSA, with the following associated LEBSA Reports being closely linked:

- A hydrogeological baseline characterisation of springs in the Neales River catchment and Lake Cadibarrawirracanna regions, Lake Eyre Basin, South Australia (Keppel et al. 2015a)
- A hydrogeological characterisation of springs in the vicinity of Lake Blanche, Lake Eyre Basin, South Australia, draft (Keppel et al. 2016)
- LEBSA Remote Sensing Reports – 'GAB wetland area mapping, flow estimation' (White et al. 2015) and 'GAB wetland diffuse discharge' (Turner et al. 2015)
- LEBSA GDE Mapping report (Miles & Costelloe 2015)
- Ecohydrological conceptual models of springs in the western Lake Eyre Basin, South Australia, draft (Gotch et al. 2016).

1.4 Springs definition

The following definition of a spring was developed for the purposes of the LEBSA project

LEBSA project springs definition

A spring is a hydrogeological feature by which groundwater discharges naturally to the land or cave surface. This includes springs with:

- Permanent and non-permanent (i.e. intermittent or ephemeral) saturation regimes
- Dynamic or static geographic locations; and
- Diffuse or point source geographic locations.

The SA LEBSA dataset does include extinct springs however, information on these types of springs is limited.

Some standardisation of spatial hierarchy and nomenclature of GAB Springs had occurred prior to LEBSA, as part of an earlier project *Allocating Water and Maintaining Springs in the Great Artesian Basin Project* (AWMSGAB NWC 2013)). During this

process, definitions and classifications were applied to spring attributes and groups of springs. Table 1 displays the definitions used in South Australia, primarily based on hydrological parameters.

Table 1: SA spring classification hierarchy and definitions (source: Lewis, White and Gotch 2013)

Classification	Definition and description
Supergroup	Clusters of spring complexes; there are 13 supergroups across the GAB with three found in South Australia
Complexe	Clusters of spring groups that share similar geomorphological settings and broad similarities in water chemistry
Group	Clusters of springs that share similar water chemistry and source their water from the same fault or structure
Spring	Individual wetlands comprising one or more vents and tail joined together by permanent wetland vegetation
Vents	Individual point discharges of water from the GAB, varying in size and structure; some are discrete discharges of water as if coming from a pipe, while others may be several metres across with no clear point of discharge within the region – the spring vent is the minimum unit used when describing the number of springs from a legislative perspective and in accordance with water allocation planning
Tails	Wetlands associated with flow away from the vent

Queensland had defined springs primarily based on spatial organization and distance (e.g. definitions as developed by Fensham and Fairfax, 2003) whereby:

- A spring group is a cluster of springs no further than 1 km apart and sharing a similar geomorphic setting.
- A spring complex is a cluster of spring groups no further than 6 km apart and sharing a similar geomorphic setting.
- A supergroup is a major regional cluster of spring complexes.

In order to promote consistency within the LEBSA project and facilitate integration of the LEBSA project work further the LEBSA Technical Reference Committee have endorsed a 'springs' definition which is aligned between the states.

1.5 Aligned datasets and core attributes

In line with the broader aims of the Australian Government's Bioregional Assessment Program to develop a national repository to store bioregional assessment data, the LEBSA project was required to collate, align and ground-truth existing GDE data in the LEB region. In addition to aligning and validating existing data, new data generated for the LEBSA project required a group of attributes to be identified that could be used across the states.

Discussions were held between the SA and Qld LEBSA teams to determine how spring data in both states could be standardised. The Qld team held springs data within a Microsoft Access database and SA held existing springs data within DEWNR corporate databases (SA Geodata and BDBSA

Through a process of iteration it was decided that the solution to data alignment was to develop a mutually agreed list of attribute definitions that could be used both nationally and internally by both states. Relevant data held within both the SA and Qld databases could then be supplied to any future assessment methodologies knowing that attributes from each state were like for like. For this process to work some changes would be required to both SA and Qld databases to align terminology and definitions.

Initially a range of eco-physiological data attributes were identified. Following this, the LEBSA Technical Reference Committee agreed upon a core list of attributes. It was noted that retrospective calculations or conversions could not be undertaken for existing datasets. Once an attribute list was developed, a comparison between states was undertaken. Table 2 is a summary of attributes that are being measured/collected by SA and Qld to date. In developing the aligned data model, Priority 1 are essential attributes to collect, and Priority 2 are desirable attributes to collect.

Table 2: Priority data attributes

Area	Field name	Priority
Spring definition	Discharge; Elevation; Horizontal location; Source Aquifers; Spring Wetland; Vent ID*	1
Spring morphology	Active; Area derivation; Estimated spring flow; Flow derivation; General Morphology; Mound length; Mound width; Relative mound height; Spring wetland length; Spring wetland width; Spring wetland area; Surface Composition; Surface expression (Saturation)	1
Condition/risk	% connectivity; Excavation damage (proportion); Excavation damage (type); naturalness; pH sediments; Pig damage; Stock damage; sulfate status	1
Water	Conductivity; Hydrogeological Report Exists; pH; Temperature	1
Flora/fauna	Opportunistic fish survey; opportunistic flora list; opportunistic flora list;	1
Photos	Photo ID; Photo locations;	1
Spatial	Complex polygon; group polygon; wetland polygon	1
Condition/risk	Sulfate in water sulfide in sediment calcium carbonate in sediment	2
Water	Isotope analysis; nutrient analysis	2
Flora/fauna	Detailed fauna survey; detailed fish survey; detailed flora survey	2

**Some remote sensing data attributes were not collected for all springs, refer Clarke et al (215) and White et al (2015) for more detail.*

The agreed list of aligned spring attributes (Appendix B) was developed and signed off by both states. This now forms the basis of all future GAB spring data collection and reporting in SA and Qld. Appendix B is a version of the metadata.doc and describes:

- which of the SA corporate databases the field is stored in (SA Geodata or BDBSA)
- whether it is an existing field or one that required creation
- description of the attribute (definitions/ methods)
- allowed values.

It should also be noted that it was determined that within the LEBSA focus study area all data would be collected, with the exception of the isotope, soil and water chemistry data. Data for these three data fields was collected for specific sites based on the suitability for sampling, which is discussed in Keppel et al (2015a). There are also limitations in the ability to identify invertebrates, but for each spring, reference samples were collected for future identification and DNA sequencing.

The aligned LEBSA dataset includes comprehensive information from available surveys including spring location, status (active/inactive), and grouping (complex). Where available, information is also provided on physical properties, general morphology, water chemistry, floristic composition, disturbance, faunal composition, survey effort, photographic documentation, and historical descriptions. The dataset accommodates sufficient information to create a conservation ranking at both the individual spring and complex levels.

1.6 Overview of the key tasks

A number of key data management tasks were required to meet the aims of LEBSA, including developing and gathering baseline springs data and characterising, aligning and attributing the GDE water. These key tasks are summarized below and discussed in more detail in the sections below:

- Data audit, prioritization, gaps analysis and attribution (Section 2)
- Data collection (Section 3)
- Data management and access (Section 4)

2 Existing data audit and prioritisation

2.1 SA springs data audit and project metadata

As part of the broader Bioregional Assessment Programme to align LEB GDE data, an initial assessment was undertaken to identify relevant datasets and document knowledge of their properties. SA GAB spring's data primarily constitutes spatial data, hydrogeological data and biological data, which are stored separately in thematically based corporately managed databases. The point of truth for location and hydrogeological data is SA's authoritative groundwater and geology database known as SA Geodata. The point of truth for SA biological data is the Biological Databases of South Australia known as BDBSA. Datasets identified in the initial audit included both historic (pre 1980s to 2010s) and new data collected as part of the LEBSA in 2014/15. Some of the historic data had already been entered into the corporate databases, while some was field data sheets and spreadsheets. Collectively the assessment identified data of varying types including:

- General survey datasets (e.g. location, size, number of vents, spring group complexes, elevations, flow rates, chemistry)
- Photo points
- Aerial imagery and remote sensing data
- Relevant stand-alone databases
- Corporate datasets or sections of datasets
- Technical survey datasets (e.g. hydrological, flow data, avian, fish, social, flora, geological, cultural, invertebrates, amphipods, general spring vegetation and threatened flora species).

A total of 21 datasets (see Table 3) were identified in this audit including data from long term projects stored in SA Geodata and BDBSA. Each project was matched to an appropriate BDBSA project number in order to capture project details within the BDBSA project metadata system, including the following:

- Dataset name, project name
- Data storage type (e.g. hard copy, spreadsheet or database)
- Brief description of data, location, years of collection, number of vents assessed
- Data type (e.g. general, bird, fish, hydrogeology etc.)
- Data Authority (e.g. custodian or key contact)
- Status (e.g. copy of data held within DEWNR, priority to track down).

New site data collected as part of the LEBSA gap filling program completes the final data audit which is listed in the table in Appendix A. It is important to note this project metadata system documents data residing in BDBSA as well as non-biological data that resides in SA Geodata. Detailed project metadata is available by looking up BDBSA project reference numbers (from Table 3 or Appendix A) here on DEWNR website.

Table 3: Summary of the initial GAB springs data audit results

Data ID	Initial dataset name	BDBSA project reference No. (SURVEYNR) Red=new	Project name	Region	Priority	Data authority	Data type / description
1	Mound Springs of SA (DEH)	130	Mound Springs Of SA (DEH)	GAB SA	2	DEWNR	General Survey
2	Badmans Bird Survey	not registered yet	Frank Badman's Birds	Lake Eyre Supergroup	3	Frank Badman	Bird Survey
3	NCSSA 1978	680	MOUND SPRING SURVEY - 1978 NCSSA	Statewide	1	DEWNR	Photo points
4	Denise Noak P	942	PhD; Veg Ecology Dalhousie Springs – Noack	Dalhousie	2	Denise Noak	Vegetation
5	BHP Olympic Dam Wellfield A Monitoring Program	828	GAB Spring Flow Monitoring – WMC / BHPB	Southern Lake Eyre Supergroup / Northern Lake Frome	2	BHP Billiton	Mixed (macroinvertebrates, flora, flow, chemistry, remote sensing)
6	Fatchen & Fatchen	938	GAB Spring Vegetation Monitoring - WMC/BHPB	Lake Eyre Supergroup / GAB	2	BHP Billiton / Fatchen	Vegetation
7	Allocating Water and Maintaining Springs in the Great Artesian Basin	not BDBSA data	AWMSGAB	Statewide	2	Flinders Uni (Andy Love), SAAL / T Gotch	Hydrological
8	Kodrik Brown	945 & 946	Dalhousie Fish Surveys	Dalhousie	2	Kodrik Brown	Fish
9	The University of Adelaide Springs Projects	936	White & Lewis Mound Springs	Dalhousie and Lake Eyre Supergroup	2	Adelaide Uni (Megan Lewis)	Mixed (imagery flow, flora), multiple projects
10	Ponder and Zeidler	942	NCSSA Dalhousie/National Recovery Plan; Misc historic moundspring data	Dalhousie / Lake Eyre Supergroups	1	Ponder	Invertebrates (hydobiid)
11	Travis Gotch Honours / PhD	990	GAB SPRINGS FLORA & FAUNA (PHD)	Statewide	1	T. Gotch	Flora and fauna
12	Guzik, King and Murphy Data	947	Genetics of mound spring macoinvertebrates	SA Mound Springs	2	Guzik King and Murphy data	Macroinvertebrates
13	Chris Wilcox / Jess WW (Queensland Museum)	945	Olympic Dam Wellfield A Monitoring	Hermit Hill	3	QLD Museum	Genetic?
14	EPA Macro-invertebrates	not BDBSA data	EPA Macro-invertebrates	Statewide	3	EPA (contact TBA)	Macroinverterbrate
15	1996 Niejalke WMC Springs Survey	935	GAB Springs Baseline Survey-WMC 1995/6	Statewide (excl. Dalhousie)	1	BHP Billiton	Detail Survey (spatial, flora, invertebrates,

Data ID	Initial dataset name	BDBSA project reference No. (SURVEYNR) Red=new	Project name	Region	Priority	Data authority	Data type / description
							wetland extent)
16	SA Geodata	not BDBSA data	SA Geodata State Database	Statewide	1	DEWNR	Hydrogeological data
17	Niejalke expansion study	933	GAB Springs Expansion Study -BHPB 2005	GAB - Borefield C	2	BHP Billiton	inverts, plants, spring attributes
18	Social and ecological Survey of Mounds Springs 1984	442	Mound Springs SVY (SEA 1985)	Lake Eyre Supergroup	1	DEWNR	General survey
19	SARDI Fish Data	851	SAAL wetland fish survey?		1	SARDI	Fish
20	New Dalhousie Survey	937 & 851	CFOC DESERT JEWELS DALHOUSIE FISH SURVEY?		2	DEWNR	Fish
21	Whalen, Mackay, Clarke and Davies data	943	MOUND SPRING ERIOCAULON - DAVIES PHD		3	Flinders Uni (Whalen)	Threatened flora

2.2 Prioritisation and integration of SA springs data into DEWNR corporate databases

From the initial data audit the 21 relevant springs data sets were documented through consultation with technical experts in this field within DEWNR (e.g. Science, Monitoring and Knowledge Branch, South Australian Arid Lands NRM region), DSITIA, SA and Qld Universities, SARDI, the South Australian Museum, private environmental consultants and industry (e.g. mining companies), Office of Water Science (OWS), Bureau of Meteorology (BOM) and the Qld LEBSA team.

The preliminary list of spring datasets identified during the audit phase was then reviewed and data sets were given a priority rating for entry into the relevant state databases for integration into the LEBSA project outputs. The priority ratings (listed in Table 3) were based on availability of data sets yet to be integrated, timing of datasets and effort required to upload data:

1. High = significant datasets that are recent and available in electronic form
2. Medium = significant datasets with access/licensing and formatting issues. Where possible these were entered, some remain outstanding.
3. Low = historically less significant (not filling a major gap) datasets requiring large effort to input. Where possible these were entered, some remain outstanding.

The most recent data entered into BDBSA for the LEBSA is related to an ongoing PhD study (Gotch, in prep) and ongoing SAAL GAB project observations (as part of the AWMSGAB). Most of the (location and hydrologic) springs related data for these projects had been captured in SA Geodata whereas most biological data had not been entered into BDBSA until LEBSA.

Based on the priorities assigned, spring vent locations were validated and entered into SA Geodata as this is the point of truth containing most up to date and accurate listing of all spring vents in SA. Some of the 'aligned' LEBSA attributes needed to be created within the DEWNR corporate databases (SA Geodata and BDBSA), these are noted in Appendix B. Appendix C illustrates the data form views that enable the aligned data to be entered in SA Geodata.

Once attribute modifications were made, and vents up to date, hydrogeological and geomorphological data was entered into SA Geodata. Depending on the ability to resolve access or licensing issues, biological data was validated, checked for quality and entered in BDBSA.

3 Data management and access

Figure 2 illustrates how SA LEBSA data is aligned to Queensland LEBSA data, stored in DEWNR's corporate systems and then output for delivery in the flat tables format.

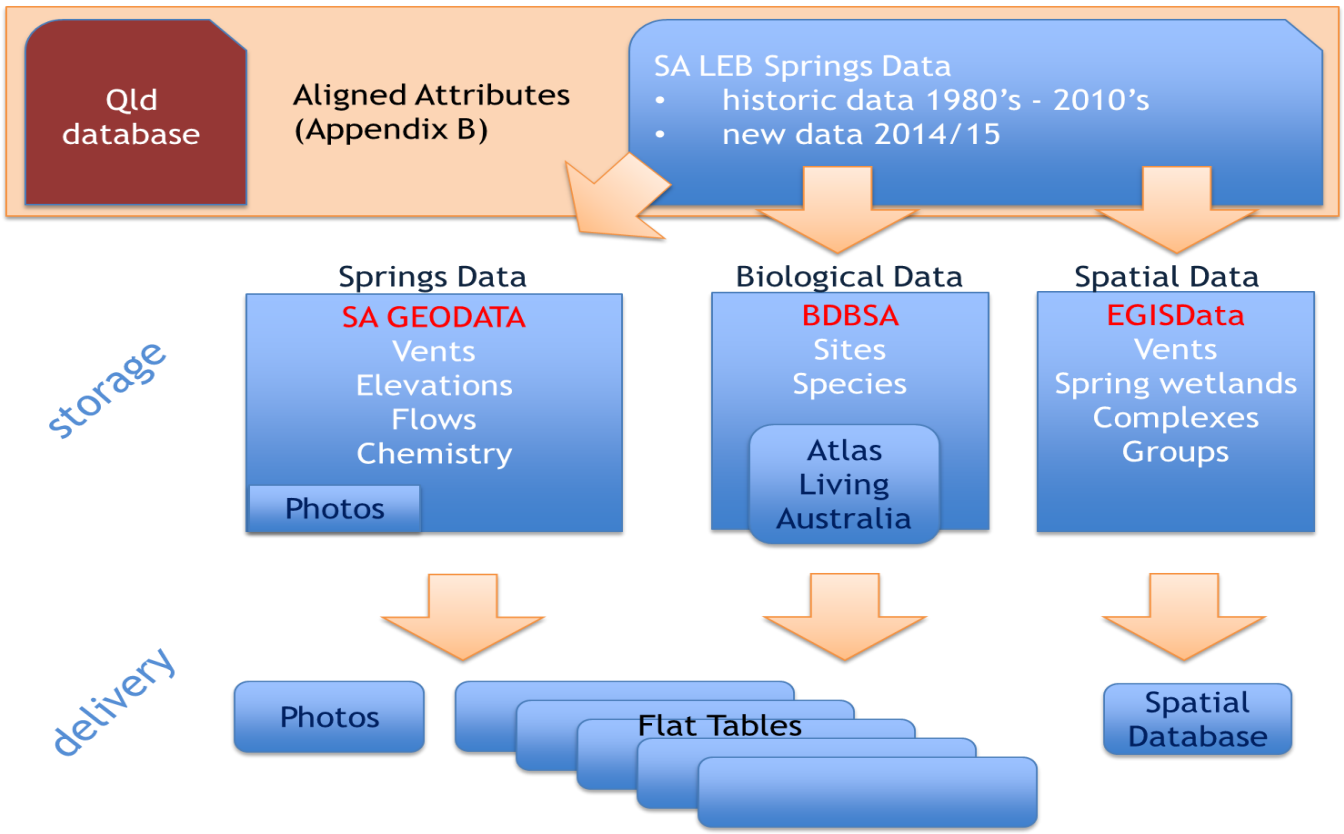

Figure 2: Summary of SA LEBSA Data storage and output

Management and access to SA LEBSA data is discussed in detail under the following topics:

1. Data entry and validation, including modification of state databases to accept aligned data model
2. Data output, into flat tables format, method to prepare for upload to Queensland Access database, spatial data and access via the web
3. Photos management
4. Future data capture.

3.1 Entry and validation

Data from the 21 existing datasets along with data from new LEBSA field investigations (Gotch et al. 2016) were prepared and entered as described below.

3.1.1 SA Geodata

SA Geodata is the Government of South Australia's corporate geoscientific data repository and captures groundwater and mineral exploration data derived by industry reporting requirements and government exploration programs since the 1850s. As the authoritative system for recording drillhole data, it stores mining, petroleum, groundwater, exploration and monitoring data. The groundwater information stored in SA Geodata is used for reporting the state and condition of groundwater resources across South Australia. It has been used to store GAB springs data for a number of years.

SA Geodata is the point of truth for spring location coordinates. Locations and vent-ids must be created here first before hydrological and other related data can be entered. This is also the basis for generating spatial data layers in the DEWNR corporate spatial data stores - various web enabled mapping applications can display these.

Spring locations and accurately surveyed elevation information for most of the vents in the 21 historic datasets identified in the audit had already been entered into SA Geodata. However some of the associated hydrologic data including a number of the LEBSA aligned attributes had not been entered. Modifications to SA Geodata were needed to ensure all of the aligned attributes could be stored. This required a process of reconciling existing fields against the aligned ones and creating tables for those not represented. In addition, lookup tables, code descriptions, forms to enter LEBSA data and views for exporting LEBSA data were developed and implemented.

Once modifications to SA Geodata were complete, any vents not entered or newly surveyed were added, followed by entering of any elevation, hydrological or photographic data available. Appendix E illustrates the data entry and maintenance forms for the GAB springs component of SA Geodata.

3.1.2 BDBSA

The Biological Databases of South Australia are a suite of database applications that manage terrestrial South Australian biota specimen and observation records. Critically, it includes systems that maintain the authoritative point of truth for taxonomy of South Australian flora and fauna.

Biological records from the hardcopy and electronic datasets were extracted into corporate templates to load into BDBSA, with basic validation and checking of hand written entries.

Due to the variation and age of data some key attributes were missing from historical datasets. For example, where the original intent of the data collected was not focused on mound springs, often only the name of the broader spring complex or spring group was recorded. In order to provide site locations for this biological data in BDBSA, coordinates were generated at the centroid of the polygon for that complex or group, so as to create a dummy biological observation site. These are given a spatial reliability related to the width of the group, to indicate uncertainty as to which vent the record is associated with. Other more recent data where survey focus was mound springs had more precise GPS coordinates and/or vent-ids recorded.

Invertebrate data was formatted into the load template for BDBSA and had taxonomy validated as far as possible (some samples to be identified by the SA Museum in coming months). This data was appended to the flat tables (see Sect. 3.2.1) as BDBSA is currently unable to store these taxa. Developments to add invertebrate taxonomy to BDBSA are underway and these records will be sourced from the corporate data stores following that.

3.2 Output

The full LEBSA datasets are held within SA Geodata and BDBSA and will be managed by DEWNR including maintenance of taxonomy and entry of new data. DEWNR will always hold the point of truth for LEBSA data in SA and it should be extracted when a full IESC assessment process requires it. For this reason, it is not advised to go about storing the current (snapshot in time) flat tables in the Bioregional Assessment Information Platform. That system is designed to store data actually used in an assessment as distinct from data likely to need updating before use in an assessment.

For some assessments (e.g. initial investigations) the aligned SA LEBSA data is supplied via four flat tables (Appendix B). This can be ingested in to the Qld MS Access database by working through the process described in Section 3.2.2.

In addition, by storing data in DEWNR's corporate systems, it is available via existing web applications. This includes most fields in the Site table, Water Condition table and Species table. Opportunities may exist in the future to investigate best ways to augment these applications, either with data fields from the Site Condition table or perhaps with a more integrated LEBSA focused application and web services.

3.2.1 Flat tables

A series of repeatable processes have been established to extract aligned LEB Spring data from DEWNR's corporate information systems. These processes produce the aligned dataset described in Appendix B in the form of four flat tables. The four output tables that will be produced by querying the relevant state databases are called:

- Site table
- Site condition table
- Species table
- Water table.

A fifth table listing photographs associated with vents will be supplied when the process of moving them from network folders into SA Geodata has been finalized.

Biological data is extracted, processed and formatted via a series of tools in an ESRI® ArcGIS Toolbox to generate the species flat table. This process is summarised below with technical details presented in Appendix C.

BDBSA records (from the suite of databases) are consolidated and updated weekly into two separate statewide spatial layers in the DEWNR Corporate spatial data warehouse. These are known as the Flora and Fauna Supertables. The creation of the species flat table starts with the supertable records and sub-sets or clips them to a five (5) kilometre buffer of the known spring locations held within SA Geodata. This buffer is the stated distance from springs in the Far North Prescribed Wells Area Water Allocation Plan (SAALNRMB, 2009), within which no new water wells are allowed for the purpose of extracting water and at the boundary of which a cumulative drawdown threshold of 0.5 metres exists.

Many of the historic biological data records do not have a Vent ID stored with them, so a major function in the Toolbox is to generate and assign a Vent ID to as many of the BDBSA records as possible in an automated way. The Toolbox then appends the invertebrate records to the resulting species flat table, along with species related fields such as endemism.

Spring and hydrogeological data are more straight forward to deal with as SA Geodata fields match the aligned data schema and all have vent-ids. The other three flat tables then are exported from a custom built view of SA Geodata that matches the requirements of the aligned dataset.

3.2.2 Preparation to load flat tables into Qld Access database

It was decided that SA would investigate what issues there may be in transferring the flat tables into the schema of the Qld Access database. While it is known that the data attributes align in definition between the states, it is differences in format and structure of storage that make designing this transfer process non-trivial. This section (supported by Appendix E) describes how to deal with issues encountered in transferring the species flat table into the Access database. It is known that similar issues exist in transferring the remaining three tables, however these have not been documented as resolution would require a collaborative approach and depend on specific decisions around apparent options.

It is acknowledged that the aligned nature of the data fields means that most of the data content will be compatible between the state systems. The main issues for this transfer process relate to fields that are assumed to be internally unique to the access database. This means that any values residing in corresponding BDBSA fields would need to be recalculated to ensure internal referential integrity. For unique key fields that provide the relationships between tables, recalculation will be achievable via unique values supplied. Specifically:

- Visit_nr can be generated from sighting date and
- observer_no can be generated from observer_name. Where multiple observers are recorded in the flat table, they will need separating.

In addition to these internal references, and the need to append records to various look up tables, a process to harmonise taxonomy between the states systems will be needed. Accordingly a taxon-id system just for this database will be needed unless the National Species List approach used by Atlas of Living Australia can be adopted.

3.2.3 Spatial data

An ESRI® ArcGIS 'file geodatabase' containing the following GAB Springs (SA) datasets has been supplied. Vent related layers extracted from the point of truth (SA Geodata) contain an 'extract date' field and are not maintained. Table 4 provides a summary description of these data layers and links to metadata records:

- Vent locations (points)
- Vents buffered by 5 km (polygons)
- Group Boundaries (polygons)
- Complex Boundaries (polygons)
- Supergroup Areas (polygons)
- Vegetation Extents from Remote Sensing projects (polygons)(White et al, 2015)
- Aquatic Ecosystem Mapping including GDEs (polygons)
- Diffuse Discharge Areas from Remote Sensing projects (polygons)(Turner et al, 2015)

Figure 3 below illustrates the extent of SA GAB springs represented by vents, complexes and supergroups with aquatic ecosystems mapping. Figure 4 breaks down the aquatic ecosystem mapping to show GDEs as in the National GDE Atlas classes. Due to lack of data, the majority of these are of low or medium confidence at best.

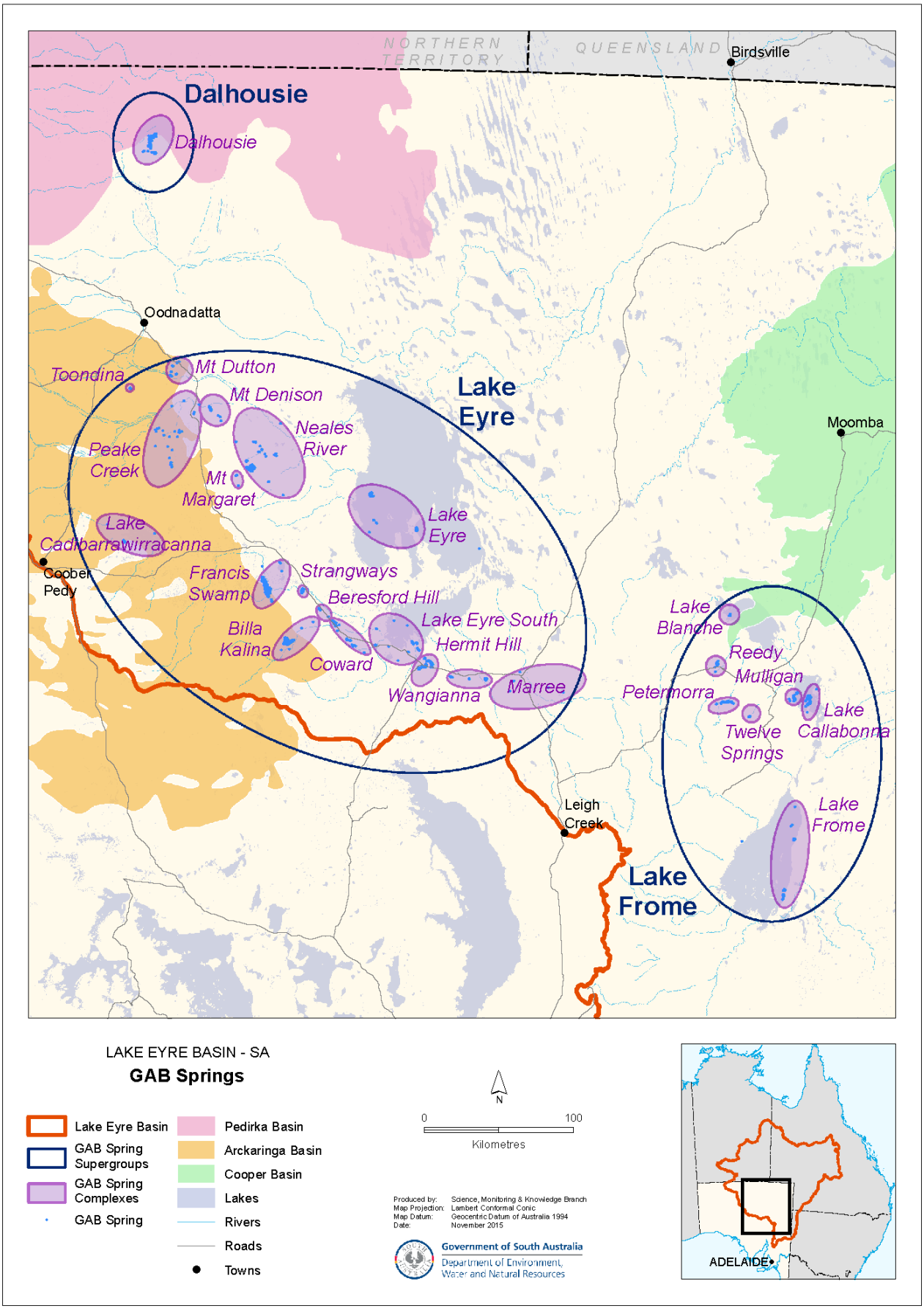

Figure 3: Summary map of SA GAB Spring spatial data with Supergroups and Complexes named

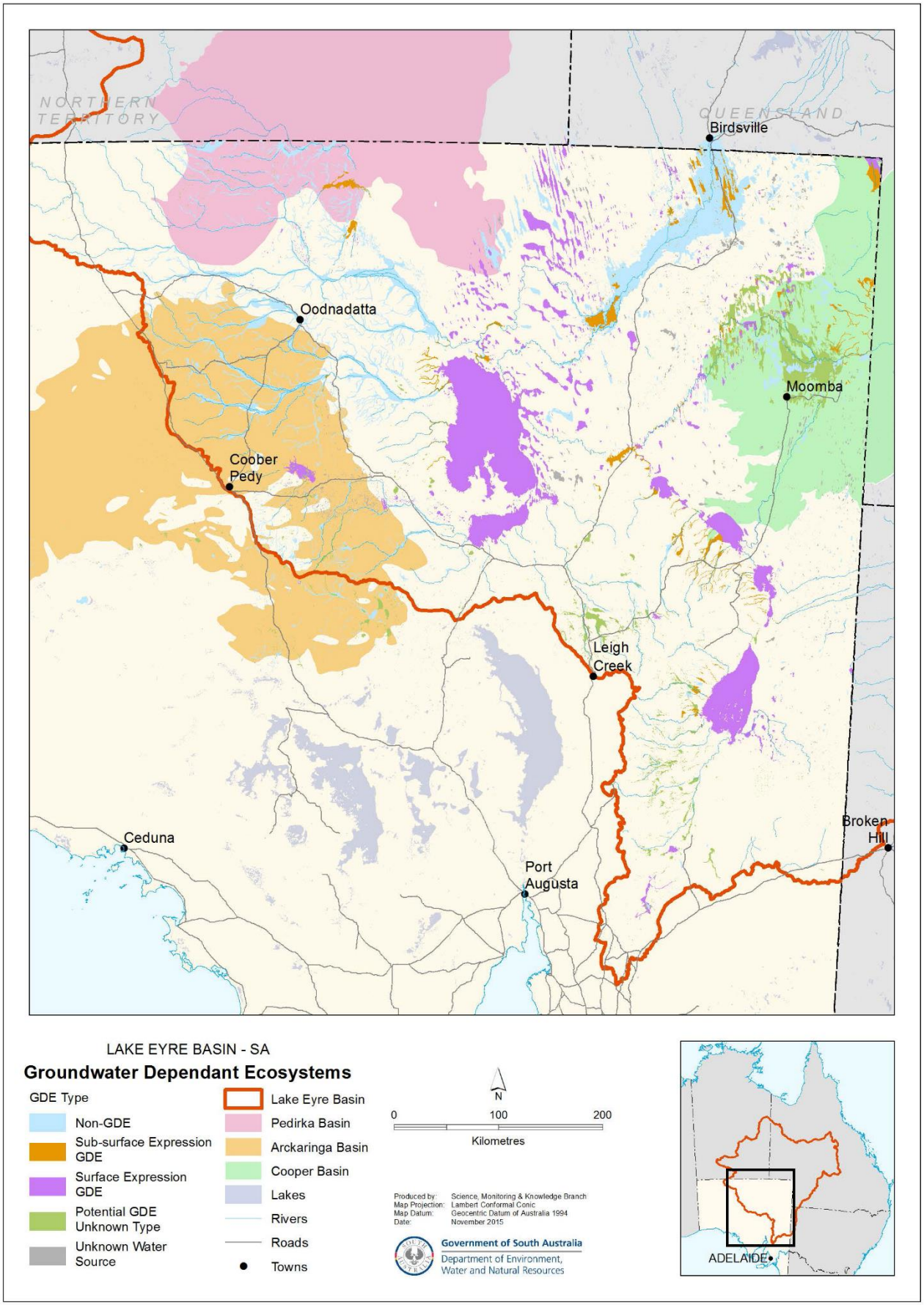

Figure 4: Summary map of SA groundwater dependent ecosystem spatial data

Table 4: Spatial data layers and metadata links

Data Layer Name	Dataset Description	Dataset Metadata Link
WATER_GABSpringVents	Known location of GAB spring vents from SA Geodata	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1566
WATER_GABSpringVents_Buffer_5km	5 km buffer of known location of GAB spring vents from SA Geodata	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1567
LANDSCAPE_GABSpringGroups	GAB spring group boundaries	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1563
LANDSCAPE_GABSpringComplexes	GAB spring complex boundaries	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1569
LANDSCAPE_GABSpringSuperGroups	GAB spring supergroup areas	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1570
LANDSCAPE_GABSprings_WetlandVegetationExtent_RS_2009	GAB spring wetland vegetation extents 2009	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1564
LANDSCAPE_AquaticEcosystems_GAB	Aquatic ecosystems (including Groundwater Dependant)	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1565
LANDSCAPE_DiffuseDischarge_Albedo85_LowTemperature	Diffuse discharge (albedo 85 and low temperature)	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1568
LANDSCAPE_DiffuseDischarge_Albedo90_LowTemperature	Diffuse discharge (albedo 90 and low temperature)	http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1568

3.2.4 Web Access

The data contained in the Site table and Water Condition table is currently available via Groundwater Data in DEWNR's WaterConnect website, see example screen shots below in Figure 5 and Figure 6. Browse mode can be used, or Unit numbers of springs (given in the spatial data set) can be entered to access location and water condition data. Note the two zeros in the spatial attribute must be replace by a dash (-) when searching Groundwater Data: e.g. 59450036 becomes 5945-36.

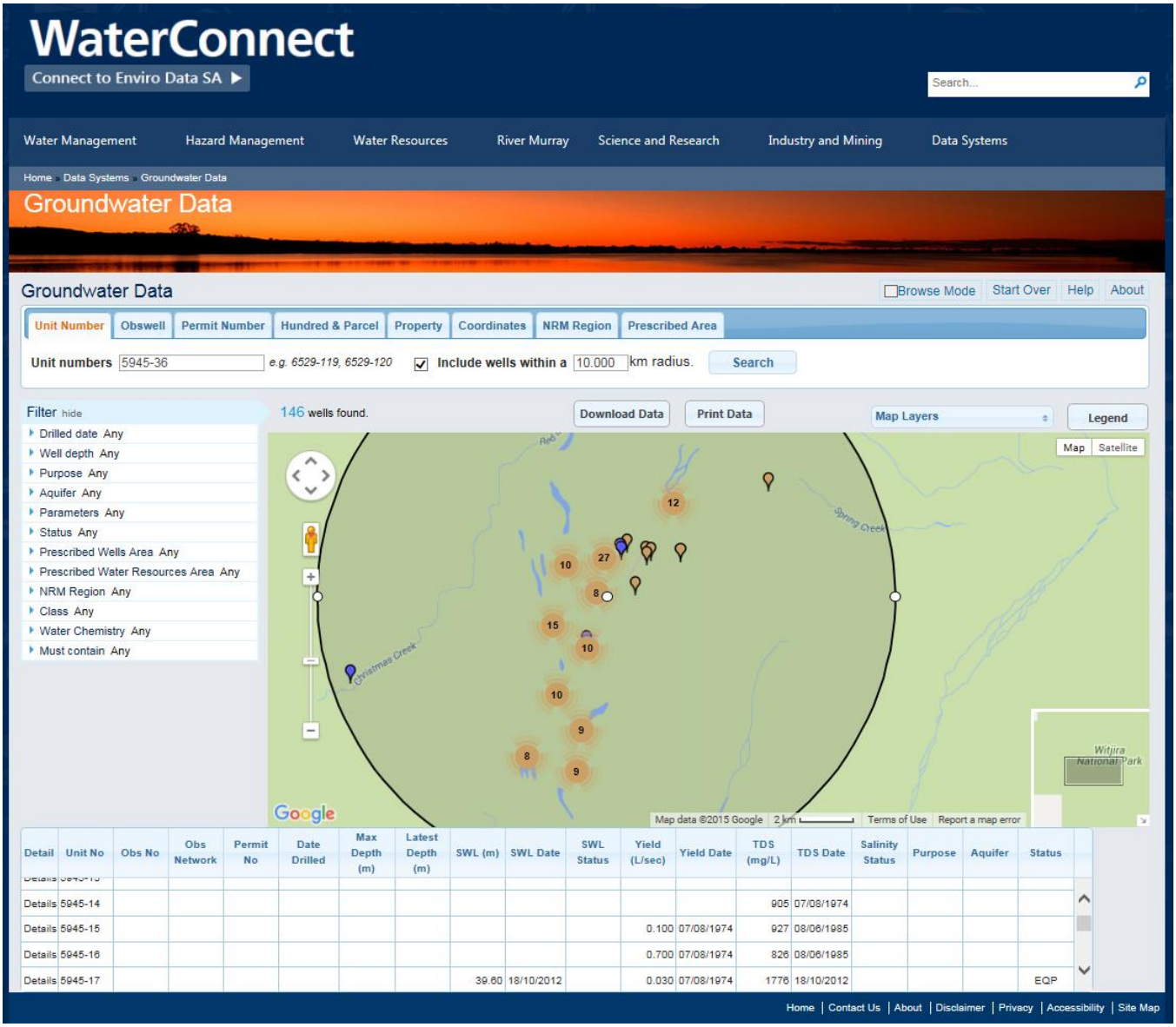

Figure 5: Screen shot 1 of information for GAB Spring vents at Dalhousie Springs, Witjira National Park, SA

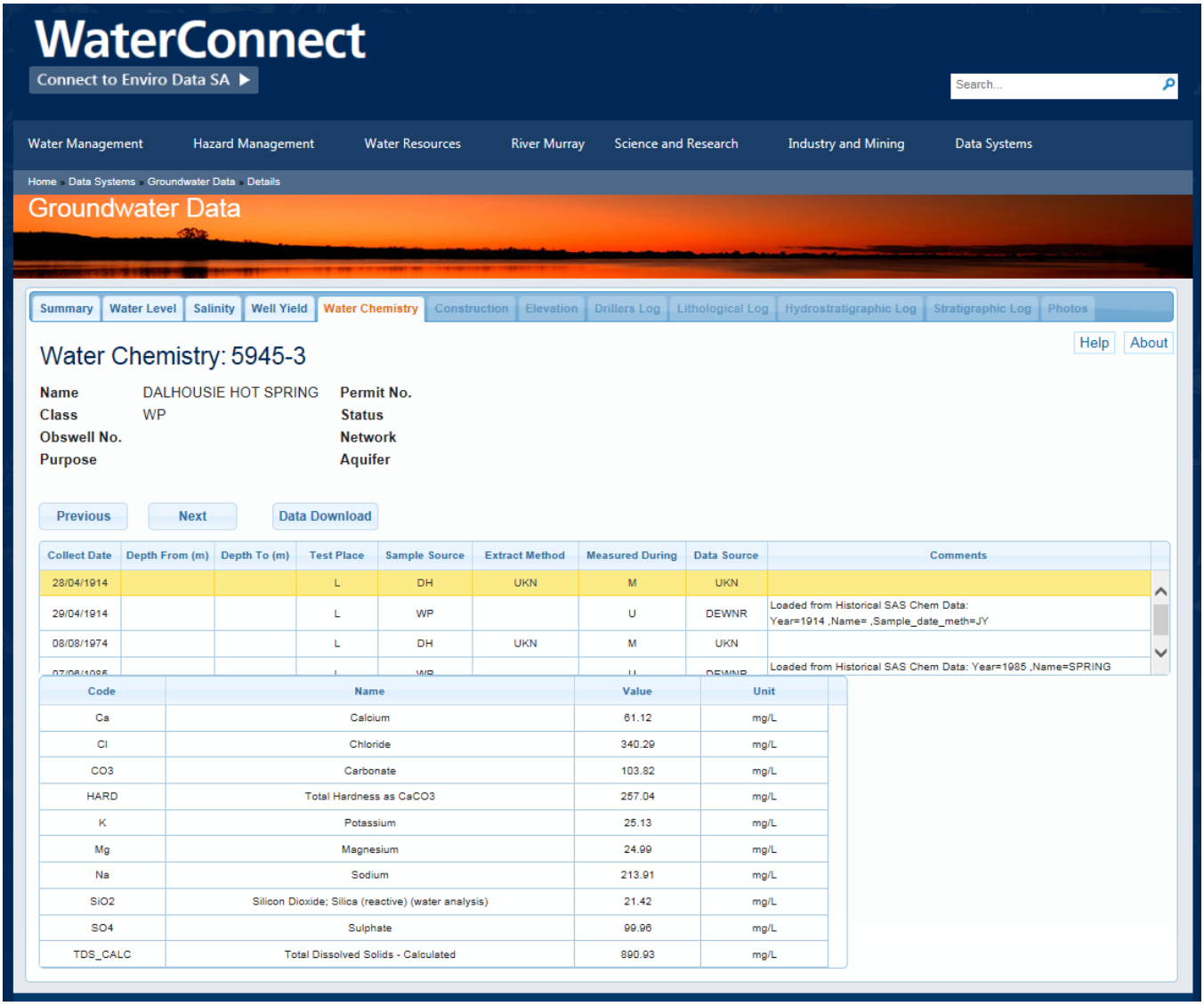

Figure 6: Screen shot 2 of Water Chemistry information for a vent at Dalhousie Springs, Witjira National Park, SA

For web access to biological records, DEWNR have a process whereby BDBSA observations are uploaded to Atlas of Living Australia (ALA) regularly. Appendix F describes how to access this data step by step if the following links malfunction, however in summary the following links will take users straight to ALA and display records as stated:

1. All DEWNR biological records within 5 km of SA GAB springs as a list of Records View: http://biocache.ala.org.au/occurrences/search?q=qid:1446174292910%20-%20tab_recordsView%23tab_recordsView%20-%20tab_recordsView#tab_recordsView **Note** Species identified on the SA Environmentally Sensitive Data Register have their coordinates rounded to one decimal place and as a result may be up to 10 km from their sighting point. The spatial selection accommodates for spatial accuracy so these records will still be selected in the facet however the downloaded data will have generalised coordinates. Accurate coordinates for these records can be supplied upon request by DEWNR.

2. All DEWNR biological records within 5 km of SA GAB springs as a Spatial View: http://spatial.ala.org.au/webportal/?ss=5A407D14EA032475EF4428D704264009 **Note** see above

3. All ALA biological records within 5 km of SA GAB springs as a Spatial View: http://spatial.ala.org.au/webportal/?ss=73F9E796FAE91596CAE97AE42AAFBD56 **Note** Table 5 shows all ALA data providers relevant to this link (created October, 2015), which represent records potentially of significant value to

any IESC assessment. Some of the records from SA Museum, Birdlife Australia and Australia's Virtual Herbarium are stored in BDBSA and therefore supplied in the species flat table. Metadata is available on each data provider and individual datasets through the ALA metadata. This metadata can help decide what records will be fit for purpose.

Table 5: List of Data Providers from ALA data linked above

Data Provider	No of Records within 5 km of GAB Springs
Australian National Insect Collection, CSIRO	215
OZCAM (Online Zoological Collections of Australian Museums) Provider	5988
CSIRO National Fish Collection	1
BirdLife Australia	11745
Northern Territory Department of Land Resource Management	2
Citizen Science - ALA Website	4
South Australia, Department of Environment, Water and Natural Resources	11691
The University of Adelaide	34
Office of Environment and Heritage, Department of Premier and Cabinet representing the State of New South Wales	14
Barcode of Life	18
Australia's Virtual Herbarium	9824
European Molecular Biology Laboratory Australia	18
Global Biodiversity Information Facility	91
Australian Seedbank Partnership	10
DigiVol	4
Total	**39659**

3.3 Photos

This project is facilitating the transfer of spring photographs from storage in network folders to more robust and ultimately accessible storage within SA Geodata. This process was prioritized lower than documented data procedures and is continuing. The photos and associated flat table will be supplied upon request.

3.4 Future data capture / monitoring

For future data capture and monitoring to be successful data management needs to be coordinated and in appropriate formats. Processes that will assist this are as follows:

- Development of clear streamlined processes for data capture and storage (both field and electronic data)
- Use existing data to further identify gaps in current data and historic data

- Ensure data attributes are consolidated and consistent for efficiency, for example a subset of 10 key fields / attributes could be established as a minimum and an additional agreed upon list could be available where projects have time, funding and capacity to capture more data.
- Clear data linkage pathways need to be defined, for example so that future data can be linked to old and new BDBSA projects as appropriate
- Timely entry of data load into corporate systems
- Standardised template forms could be developed for tablets, along with an automatic upload system that efficiently uploads data from a tablet into the database (with consideration that for SA, some data will be stored in the BDBSA and some will stored in SA Geodata).

Development and implementation of the above processes and protocols should result in consistent classification and attribution of GDEs across the LEB which will enable efficiencies in subsequent entry into national data frameworks. It is further hoped that LEBSA datasets will continue to be expanded over time through continued investigation, data set integration and enhanced integrated web access.

Future data capture that has already been identified includes:

- Data gathered in the last 6 months (e.g. Mound Spring Vegetation Data collected by Jacobs for BHP; Mound Spring Invertebrate Date collected by GHD for BHP, more recent Stygofauna data if now applicable to mound springs (South Australian Museum / Flinders University).

4 References

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Appendix A

GAB springs data projects as recorded in DEWNR project metadata system, including summary of BDBSA records

BDBSA SURVEYNR*	SURVEY NAME	BDBSA Fauna records	BDBSA Flora Records	BDBSA Sites	START DATE	END DATE	Data Authority/Custodian	Access or Open Licensing Issue
130	MOUND SPRINGS OF SA (DEH)				1/08/1997	1/08/2001	DEWNR	Yes
161	DALHOUSIE (SEG)	225	170	47	12/07/2003	26/07/2003	Scientific Expedition Group & DEWNR	No
175	WABMA KARDARBU MOUND SPRINGS	1	257	520	5/05/2004	19/05/2004	DEWNR	No
442	BIO ASSESS - SA MOUND SPRINGS (SEA 1985)	4	239	81	1/01/1900	1/01/2020	DEWNR	No
680	MOUND SPRING SURVEY - 1978 NCSSA	460	247	39	1/01/1977	31/12/1978	Nature Conservation Society of SA Inc	No
828	GAB SPRING FLOW MONITORING - WMC/BHPB				1/01/1989	31/12/1990	BHP Billiton & WMC Resources Ltd	Yes
851	SAAL WETLAND FISH SURVEYS	44830		99	1/01/2006	1/01/2020	South Australian Arid Lands NRM	No
894	GAB SPRINGS FLORA & FAUNA	13	1827	4492	1/01/1999	1/01/2020	South Australian Arid Lands NRM	No
933	GAB SPRINGS EXPANSION STUDY -BHPB 2005				1/09/2005	30/09/2005	BHP Billiton	Yes
935	GAB SPRINGS BASELINE SURVEY -WMC 1995/6				1/01/1995	30/12/1996	WMC Resources Ltd & Royal Geographic Society of SA	Yes
936	WHITE & LEWIS MOUND SPRINGS				1/01/2007	31/12/2013	University of Adelaide & SA Arid Lands NRM & National Water Commission (NWC)	Yes
937	CFOC DESERT JEWELS DALHOUSIE FISH SURVEY				1/01/1900	1/01/2020	Unknown	Yes

BDBSA SURVEYNR*	SURVEY NAME	BDBSA Fauna records	BDBSA Flora Records	BDBSA Sites	START DATE	END DATE	Data Authority/Custodian	Access or Open Licensing Issue
938	GAB SPRING VEG MONITORING - WMC/BHPB				1/01/1980	1/01/2020	BHP Billiton & WMC Resources Ltd	Yes
941	VEG ECOLOGY DALHOUSIE SPRINGS - NOACK				1/01/1992	31/12/1995	Researcher	Yes
942	MISC AND HISTORIC MOUND SPRING DATA	136	172	138	1/01/1900	31/12/1999	Unknown	No
943	MOUND SPRING ERIOCAULON - DAVIES PHD				1/10/1999	1/03/2002	Flinders University of SA & BHP Billiton	Yes
945	DALHOUSIE FISH SURVEY -KODRIC-BROWN 1991				1/07/1991	1/01/1992	CSIRO Sustainable Ecosystems	Yes
946	DALHOUSIE FISH SURVEY -KODRIC-BROWN 2003				1/08/2003	1/10/2003	University of New Mexico & CSIRO	Yes
947	MOUND SPRING INVERTS - MURPHY/GUZIK/KING				1/09/2007	30/06/2013	University of Ad & SA Museum & DEWNR & Latrobe & NWC	Yes
944	GOBIES IN LAKE EYRE BASIN - MOSSOP PHD				1/10/2010	31/01/2014	Monash University	Yes
990	LAKE EYRE BASIN SPRINGS ASSESSMENT	47	194	53	1/07/2014	31/12/2015	Commonwealth Government & DEWNR	No

***** Further details for each SURVEYNR including types of data collected available at:
http://apps.environment.sa.gov.au/emap/envmaps-query.do?cmd=su.SurveySummaryMain

Appendix B List of data fields that form the 'aligned' national GAB spring database

Table Name	Field Name	SA Geodata Field	BDBSA Field	Description	Allowed Values
Site Table	Vent ID	existing		Unique identifier for an individual spring vent. Multiple vents rom the same wetland are differentiated using underscore and a number.	Primary Key, Text
Site Table	**Site Number**		new	Numerical identifier for spring wetland. Numbers with the prefix "-"refer to potential spring locations that have been searched but no spring found.	Primary key, >= 0
Site Table	Name	existing		European name	Text, Blank
Site Table	Aboriginal name	new		Aboriginal name	Text, Blank
Site Table	Synonym	new		Other names that the spring have been known by	Text, Blank
Site Table	Property Name	new		Name of property/pastoral station/national park on which spring wetland is located	LUT, Text, Blank
Site Table	Group Number	existing		Spring group code in SA this is the same as the three letter code at the beginning of the vent id i.e. HWF in HWF003. (SA Data). Springs are naturally grouped and derive water from a similar fault or fracture and largely have similar water chemistry	Text, Blank
Site Table	Group Name	new		(SA Data) Spring group name as summarised in Gotch (2013) Volume IV. AWMSGAB	Text, Blank
Site Table	Complex Name	new		Name of spring complex to which spring wetland belongs. Slight variations on how this is derived exist between states. In Queensland a complex represents a group of springs or spring-groups such that no adjacent pair of springs or spring-groups is more than about 6km distant and all springs within the spring-complex are in a similar geomorphic setting. South Australia has no distance criteria, Complexes are naturally clustered Spring Groups located in a similar geomorphological setting. Geomorphic setting includes geological unit, landform, landscape position or soil type. Complexes can contain both active and inactive springs.	LUT, Text, Blank

Table Name	Field Name	SA Geodata Field	BDBSA Field	Description	Allowed Values
Site Table	Supergroup Name	new		Name of spring supergroup to which spring wetland belongs. A supergroup represents a major regional cluster of spring-complexes with some consistent hydrogeological characteristics as defined by Habermehl (1982) Ponder (1986) GABCC (1998) and Fensham et al. (2003)	LUT, Text, Blank
Site Table	Source Aquifer	existing		Source aquifer where the water is coming from. More details are available in the hydrogeology reports.	LUT, Text, Blank
Site Table	Discharge	new		Discharge springs emanate from a confined aquifer, as opposed to outcrop springs that emanate from where the water-bearing sediments are outcropping. An outcrop spring in the GAB can be referred to as a 'recharge' spring or 'recharge-rejection' spring.	LUT, TRUE/FALSE
Site Table	Active	existing		The spring vent is active. Location data collected for inactive springs are from an educated guess in the field.	LUT, TRUE/FALSE
Site Table	Latitude	existing		Latitude, recorded as decimal degrees to 7 decimal places (0.01m accuracy). Negative values indicate location in southern hemisphere	(mandatory), Number
Site Table	Longitude	existing		Longitude, recorded as decimal degrees to 7 decimal places (0.01m accuracy). Positive values indicate location in eastern hemisphere	(mandatory), Number
Site Table	Horizontal Coordinate System	existing		Coordinate system used for horizontal location. 1. Australian Geodetic Datum of 1984 (AGD84), 2. Map Grid of Australia 1994 (MGA1994)	LUT, AGD84, MGA1994
Site Table	Zone	existing		Zone within Map Grid of Australia 1994 (MGA1994) coordinate system	LUT, 52, 53, 54, 55, 56
Site Table	Easting	existing		Metres east within zone, recorded to 3 decimal places (0.001m accuracy), MGA 1994 coordinate system	Number
Site Table	Northing	existing		Metres north within zone, recorded to 3 decimal places (0.001m accuracy), MGA 1994 coordinate system	Number
Site Table	Horizontal precision	existing		Meters to 3 decimal places. Given by the device.	Number, Blank
Site Table	Vertical precision	existing		Meters to 3 decimal places. Given by the device.	Number, Blank
Site Table	Vert. coordinate system	existing		Australian Height Datum (AHD)	Australian Height Datum (AHD), Blank

Table Name	Field Name	SA Geodata Field	BDBSA Field	Description	Allowed Values
Site Table	Elevation	existing		Mean elevation referenced to Australian Height Datum (AHD). Calculated from *Ellipsoidal Height* using AUSGeoid09 V1.01 (11 April 2011) http://www.ga.gov.au/earth-monitoring/geodesy/geodetic-datums/geoid.html (accessed 27/09/2011). Recorded in metres to 2 decimal places (0.1m accuracy).	Number, Blank
Site Table	Survey device	existing		Indication of the precision (accuracy) of location data (horizontal coordinates, latitude and longitude). 1. RTK (Real Time Kinematic) has a mean elevation error of 5cm. 2. Omnistar Differential GPS has a mean horizontal positional error of ± 0.1m. 3. Handheld GPS units have a mean horizontal positional error of ± 10m. 4. Other measures of location have been given a horizontal positional error range from 0.1-10km. 5. Some spring wetland locations have had their location masked to protect populations of endangered species, these have been given a horizontal positional error of >10km. In some cases springs have been assigned the same location as nearby springs. This is usually inactive springs where the precise location of old vents was difficult to determine, or awaits further field survey. The actual location of inactive springs is uncertain despite the accuracy of measurement.	LUT, RTK ~ 0.5cm; Omni-star Differential ~ 0.1m accuracy, Garmin handheld ~10m accuracy, Other 0.1-10km accuracy, Masked >10km accuracy LUT
Site Table	Morphological Type (landscape situation)	new		Field description of the landscape situation of the spring wetland using Morphological types as defined by J.G. Speight in Australian Soil and Land Survey Field Handbook 3rd Edition (CSIRO 2009).	LUT, Crest, Hillock, Ridge, Simple slope, Upper slope, Mid-slope, Lower slope, Flat, Open depression, Closed depression, blank
Site Table	Landform (landscape) element	new		Field description of Landform element (landform with 20m radius) of the spring wetland using landform element types described & defined by J.G. Speight in Australian Soil and Land Survey Field Handbook 3rd Edition (CSIRO 2009). Page 34-35.	LUT, refer to (CSIRO 2009)

Table Name	Field Name	SA Geodata Field	BDBSA Field	Description	Allowed Values
Site Table	Erosional Landform Pattern	new		Field description of Erosional pattern (landform with 300m radius) of the spring wetland using erosional landform pattern classes described by J.G. Speight in Australian Soil and Land Survey Field Handbook 3rd Edition (CSIRO 2009). Page 47-48.	LUT, refer to (CSIRO 2009)
Site Table	Location notes	existing		Additional information including information on spring location	Text, Blank
Site Table	References	existing		Directory path to the folder containing all additional information regarding this spring (e.g. Hydrogeological report, additional information, survey plans)	Text, Blank
Site Condition Table	Vent ID	existing	_	Unique identifier for an individual spring vent. Multiple vents rom the same wetland are differentiated using underscore and a number.	Primary key, Text
Site Condition Table	Visit NR	existing	_	Unique date for each visit.	Primary key, Date
Site Condition Table	Date	existing	_	Dates of visit	Text, Blank
Site Condition Table	Observer Number	new		Unique identifier for each observer	Number, Blank
Site Condition Table	Observer Name	new		Name of observer associated with unique number	Text, Blank
Site Condition Table	Excavation (prop)	new		Visual estimate of excavation damage recorded as one of five classes based on proportion of wetland area affected.	0 = none; 1 = adjacent to spring wetland; 2 = spring wetland less than 50% affected; 3 = spring wetland more than 50% affected, but not totally eradicated; 4 = spring wetland totally eradicated, blank LUT
Site Condition Table	Excavation (type)	new		Description of excavation damage to site. 1. Bored, 2. Milled, 3. Dammed, 4. Drained, 5. Boxed well, 6. Pumped, 7. Other	text, blank LUT
Site Condition Table	Pig damage	new		Visual estimate of pig damage recorded as one of four classes based on proportion of wetland area affected.	0 = absent; 1 = <10% affected; 2 = 10-50% affected; 3

Table Name	Field Name	SA Geodata Field	BDBSA Field	Description	Allowed Values
					= >50% affected, blank LUT
Site Condition Table	Stock damage	new		Visual estimate of stock damage recorded as one of four classes based on proportion of wetland area affected.	0 = absent; 1 = <10% affected; 2 = 10-50% affected; 3 = >50% affected, blank LUT
Site Condition Table	Sulfate status	new		Sulfate or sulfides present at spring	LUT, True/False
Site Condition Table	Bore casing	new		Presence or absence of bore casing in spring vent to improve flow (default value no)	LUT, True/False
Site Condition Table	Dominant Surface Composition (vent level)	new		Field description of the dominant surface composition of the vent. 1. Peat, 2. Mud (exuded), 3. Rocky seep (fractured), 4. Sand/Silt, 5. Carbonate (travertine), 6. Water/soak, 7. Other	Peat, Mud (exuded), Rocky Seep (fractured), Sand/Silt, Carbonate (travertine), Water/soak, Other, Blank
Site Condition Table	General Morphology	new		Field description of the general morphology of the vent. Mound, Flat, Closed depression (concave), Open depression (watercourse) bed, Open depression (watercourse) bank, Terraced, Other	Mound, Flat, Closed Depression (concave), Oped Depression (watercourse) bed, Open Depression (watercourse) bank, Terraced, Other, Blank
Site Condition Table	Mound Width	new		Visual estimate of the width (metres) of mound.	>0, Blank
Site Condition Table	Relative mound height	new		Visual estimate of the relative height (metres) of mound to the adjoining non-mounded area	>0, Blank
Site Condition Table	Surface expression	new		Known or inferred moisture status, based on information from landholders and floristic composition of spring wetland (perennial obligate wetland species). The surface expression of some excavated springs with sub-surface water levels is uncertain.	Assumed permanent; Ephemeral; Inactive; Not Applicable; Not permanent;

Table Name	Field Name	SA Geodata Field	BDBSA Field	Description	Allowed Values
					Permanent; Unknown
Site Condition Table	Surface Morphology (SA only)	new		one of 7 types 1 = Carbonate Mound, 2 = Carbonate Terrace, 3 = Rocky Seep, 4 = Peat/fen bog, 5 = Clay Swelling, 6 = Mud Mound, 7 = Sand/Silt	Number, Blank
Site Condition Table	Stromatolites	new		Presence or absence of stromatolites.	LUT, TRUE/FALSE
Site Condition Table	Notes	new		Additional information about the visit.	Text, Blank
Species Table	Vent ID	_	use Site_ID	Unique date for each visit.	Primary key, Date
n/a (see appendix C)	Visit NR	_	existing	unique visit number for each site	Primary key, No.
Species Table	Date	_	existing	Unique date for each visit.	Primary key, Date
n/a (see appendix C)	Observer Number		existing	Unique identifier for each observer	Number, Blank
Species Table	Observer Name		existing	Name of observer associated with unique number	Text, Blank
n/a (see appendix C)	NSX Code		existing	Unique code for each taxonomic entity (species name) in the database used to allow record taxonomy to be updated as changes occur.	Text, Blank
Species Table	Taxon name		existing	Accepted Taxon Name, without Author details	Text, Blank
Species Table	Genus		existing	Taxonomic genus of species observed e.g. "Manorina".	Text, Blank
Species Table	Common Name		existing	Common name of species observed e.g. "Black-eared Miner".	Text, Blank
Species Table	Species Type		existing	Identifies the taxa group (eg A=Amphibia, B=Birds, F = Fish, M = Mammalia, P = Plants and R = Reptilia) of the observation, that is used in the FLORACODE and FAUNACODE.	
Species Table	Abundance		existing	Approximate number of a species encountered in the spring.	Number, Blank
Species Table	Method		existing	method used to assess abundance	Text, Blank
Species Table	Genetically Distinct populations		new	Occurrence of populations of plant and/or animal taxa that are genetically different from any other known population.	LUT, TRUE/FALSE

Table Name	Field Name	SA Geodata Field	BDBSA Field	Description	Allowed Values
Species Table	Disjunct/isolated population		new	Occurrence of populations of plant and/or animal taxa not known from habitat other than spring wetlands within 250km, listed in Appendix R. Based on confirmed species records held in the Queensland Herbarium HERBRECS database.	LUT, TRUE/FALSE
Species Table	DNA		existing	A DNA sample of the Flora specimen has been taken.	LUT, TRUE/FALSE
Species Table	Spring Endemic		new	Taxon endemic to GAB springs	LUT, TRUE/ FALSE
Species Table	Scald Endemic		new	Taxon Endemic to scalds associated with springs	LUT, TRUE/ FALSE
Species Table	Widespread colonisers		new	Taxon recognised as common and widespread in a broad range of wetland habitats (cosmopolitan wetland taxa)	LUT, TRUE/ FALSE
Species Table	Non-wetland Incidental Taxa		new	Taxon not normally associated with wetland habitats	LUT, TRUE/ FALSE
Species Table	EPBC status		existing	National conservation rating of the species based on the EPBC Act 1999. VU = Vulnerable, EN = Endangered, CR = Critically Endangered, EX = Extinct.	Text, Blank
Species Table	NPWA Status		existing	South Australian conservation rating of the species based on the National Parks and Wildlife Act 1972. R= Rare, V= Vulnerable, E= Endangered.	Text, Blank
Species Table	Invasive		existing	Naturalised taxon recognised as potentially invasive in wetland habitats e.g. 'Ponded Pasture' taxa	LUT, TRUE/ FALSE
Species Table	Notes		existing		Text, Blank
Water Condition Table	Vent ID	existing		Unique date for each visit.	Primary key, Date
Water Condition Table	Visit NR	new		unique visit number for each site	Primary key, No.
Water Condition Table	Date	new		Unique date for each visit.	Primary key, Date
Water Condition Table	Observer Number	new		Unique identifier for each observer	Number, Blank
Water Condition Table	Observer Name	new		Name of observer associated with unique number	Text, Blank
Water Condition Table	Distance from vent	new		The distance (metres) from main spring vent to the point at which water chemistry data was collected	Primary Key, >=0
Water Condition Table	Latitude	new		Latitude, recorded as decimal degrees to 7 decimal places (0.01m accuracy). Negative values indicate location in southern hemisphere	(mandatory)
Water Condition Table	Longitude	new		Longitude, recorded as decimal degrees to 7 decimal places (0.01m accuracy). Positive values indicate location in eastern hemisphere	(mandatory)

Table Name	Field Name	SA Geodata Field	BDBSA Field	Description	Allowed Values
Water Condition Table	Northing	new		Latitude recorded as metres north within zone, recorded to 3 decimal places (0.001m accuracy), MGA 1994 coordinate system	Number within Zone
Water Condition Table	Easting	new		Longitude recorded as metres east within zone, recorded to 3 decimal places (0.001m accuracy), MGA 1994 coordinate system	Number within Zone
Water Condition Table	Measured Spring Flow	existing		Estimated discharge rate (Litres per minute) of water from spring wetland.	>0, Blank
Water Condition Table	Flow Measurement Method	existing		Method used to measure spring flow: (a) Salt dilution. (b) Weir gauge. (c) Timed volume measurement. (d) Colorimetric method.	Salt Dilution, Weir Gauge, Timed volume measurement, Colorimetric method, Blank
Water Condition Table	Qualitative flow	existing		Description of flow: FW+T= Free water and tail. F= Free water. S= Soak. D= Damp. Dry= Dry. Extinct= Extinct	
Water Condition Table	ph	existing		Hydrogen ion potential of field water sample	0-14, blank
Water Condition Table	Temperature	existing		Water temperature in degrees Celsius (recorded to 1 decimal place)	>0, blank
Water Condition Table	Conductivity	existing		Measure of electrical conductivity in micro Siemens by centimetre	>0, blank
Water Condition Table	Alkalinity	existing		Field Measure of Alkalinity as total dissolved CaCO3 using a Hach© digital titrator.	>0, Blank
Water Condition Table	Methods	existing		Method used for physical property measurement	Text, Blank
Water Condition Table	Param 1	existing		generic name for any no. of other water parameters that might be assessed e.g. Phosphorous, Nitrogen, various isotopes etc.	>0, Blank
Water Condition Table	Param 1 Method	existing		method param 1 collected	Text, Blank
Water Condition Table	Param 2	existing		etc.	>0, Blank
Water Condition Table	Param 2 Method	existing		etc.	Text, Blank
Water Condition Table	notes	existing		Additional information	Text, blank

Appendix C Populating the Species flat table from BDBSA

The initial data extract and preparation process has been captured as a series of GIS Tools in an ESRI ArcGIS Toolbox (Version 10.2), see:

R:\IST\SRC\GIS_Analysis\GIS\InlandWater\LEB\Springs\tools\toolboxes Toolbox Name:
01_SMK_LEBSA_DataExtract_00_Toolbox.tbx

Steps to assign a generated Vent ID:

- Extract from DEWNR's SA Geodata database system: mound springs 'site' view and generate spatial layer from stored coordinates. Hereafter referred to as known spring locations.
- Start with extract from DEWNR's spatial data warehouse of the BDBSA Supertable Unfiltered records (as spatial layers) for flora and fauna (vertebrate and draft invertebrate) record locations, here after referred to as BDBSA records (processed as three separate datasets). Extract included a selection (filter) based on the following expressions that filters out sub-fossil records:
    - Fauna (Vertebrates): SPRELIABCODE NOT IN ('R') AND METHODNR NOT IN (23 , 73, 76)
    - Fauna (Invertebrates) and Flora: SPRELIABCODE NOT IN ('R')
- Add new fields to BDBSA records for the BDBSA Vent ID and generated BDBSA Vent ID. Populate these fields with a default value (- -) using the ESRI ArcGIS Calculate Field tool.
    - BDBSA Vent ID: is a copy of the 'SITEID' field for BDBSA records where 'SITEID' IS NOT NULL (actual field used is 'VENT_ID_BDBSA')
    - generated Vent ID: is the derived Vent ID that will be used to populate the LEBSA species flat table and Queensland Springs Database, (actual field used is 'VENT_ID_GENERATE')
- Buffer BDBSA records by the greatest distance in the assigned spatial reliability range (eg, 10m buffer for the 1 – 10m spatial reliability). A distance of 2.5 km was assigned for all records with a spatial reliability recorded as 1 – 10km. A default value of -9999 was assigned for all records with a spatial reliability recorded as >= 11km stated within the reliability distance range; these records were excluded from the buffered BDBSA records output.
- Add a new field (called 'RELIAB_TEMP') and assign a spatial reliability summary for BDBSA records, into two classes:
    - Spatial reliability less than / equal to 100m: Calculate field = "HIGH"
    - Spatial reliability greater than 100m: Calculate field = "LOW"
- Calculate the distance to the closest known spring location to the buffered BDBSA records features, using the ESRI ArcGIS 'Generate Near Table' tool – referred to as a near analysis. Output table used to assign the closest SA Geodata Vent ID and distance in meters to each of the BDBSA records.
- Populate the BDBSA Vent ID (using the ESRI ArcGIS Calculate Field tool) to be the identifier in the BDBSA 'SITEID' field, where 'SITEID' is not null (the value calculated in this step could be either an actual Vent ID's, as entered into BDBSA, or site identifiers from other biological survey site not related to a mound spring environment). This step is undertaken regardless of the spatial reliability of the record (spatial reliability summary either "HIGH" or "LOW").
- Populate the generated Vent ID (using the ESRI ArcGIS Calculate Field tool) to be the same as the BDBSA Vent ID field, where 'SITEID' is not null.

- Switch the selection of BDBSA records to where 'SITEID' is null and then subset these selected records to a select of only those records that have been calculated to be within 30m of a known spring location (as determined from the near analysis) and have a high spatial reliability as entered into BDBSA (<=100m). Calculate the generated Vent ID for the selected subset BDBSA records to the spring group ID (three letter alpha code) concatenated with "_G" to indicate 'generated'.
    - Spring Group ID is the first three letters in the SA Geodata Vent ID, and Spring Complex ID is the first letter in the SA Geodata Vent ID).

Steps to assign additional attributes in preparation for fields in the target database:

- Add a new field ('NOTES_CONCAT', Text data type, 900 characters) for concatenating text fields that may contain important contextual descriptions about the BDBSA records, and calculate this field using the expressions below:
    - [FLORACODE] & " - Comments " & [LOCATIONCOMM] & " / " & [SIGHTINGCOMM] & " / " & [HABITATCOMM]
    - [FAUNAACODE] & " - Comments " & [LOCATIONCOMM] & " / " & [SIGHTINGCOMM] & " / " & [HABITATCOMM]
- Where the BDBSA Record is part of a defined BDBSA survey (i.e. not opportune), the 'NOTES_CONCAT' field is calculated as above with additional text capturing survey numbers and names. These use the following expressions:
    - [FLORACODE] & " - " & "SURVEYNR = " & [SURVEYNR] & " - " & [SURVEYNAME] " - Comments " & [LOCATIONCOMM] & " / " & [SIGHTINGCOMM] & " / " & [HABITATCOMM]
    - [FAUNACODE] & " - " & "SURVEYNR = " & [SURVEYNR] & " - " & [SURVEYNAME] " - Comments " & [LOCATIONCOMM] & " / " & [SIGHTINGCOMM] & " / " & [HABITATCOMM]
- Add a new field ('DNA_DERVIVED', Long Integer data type) to capture the 'IS_VOUCHERED' attributes from BDBSA records (stored for BDBSA records as 'Y', 'N' or '') and populate new field as numeric values:
    - Where 'IS_VOUCHERED' = "Y", calculate 'DNA_DERIVED' = 1
    - Where 'IS_VOUCHERED' <> "Y", calculate 'DNA_DERIVED' = 0
- Output separate tables for flora, fauna (vertebrates and invertebrates) to Access database tables, based on attribute table of spatial layers.

Final steps are undertaken within Microsoft Access 2013 (using a series of Append and Update queries), see:

R:\IST\SRC\GIS_Analysis\GIS\InlandWater\LEB\Springs\access Database name:
00_SMK_LEBSA_DataExtract_BDBSA_Access2000_V93.mdb

A summary of the BDBSA fields that have been identified from the DEWNR Supertable layers as the most appropriate fields to populate the Species flat table, including an indication of any issues involved in transferring the data to this format, are summarized in table below. Green: no issues. Orange: requires additional information. Red: issues expected.

SPECIES Table Fields	SPECIES Data Type	SPECIES Text Length	BDBSA (Supertable) Field Map	BDBSA Data Type	BDBSA Text Length	Comments
OBJECTID	Object ID	N/A		Object ID		System defined
Vent_ID_BDBSA	Text	255	VENT_ID_BDBSA	Text	255	From SITEID field
Vent_ID_Generated	Text	255	VENT_ID_GENERATE	Text	255	From SITEID or spatially derived
Date_	Date	N/A	SIGHTINGDATE	Date	N/A	
Observer_Name	Text	255	OBSERVER	Text	100	One - many observers
Taxon_name	Text	200	SPECIES	Text	150	
Genus	Text	255	GENUSNAME	Text	80	
Common_Name	Text	70	COMNAME	Text	70	
Author name	Text	200				Stored in BDBSA tables
Species_Type	Text	255	SPECIESTYPE	Text	1	
Abundance	Long Integer	N/A	NUMOBSERVED	Long Integer	N/A	Fauna only if recorded.
Method	Text	50	METHODDESC	Text	25	recorded for Fauna only
Genetically_Distinct_populations	Yes/No	N/A				Stored in BDBSA Species Attribute tables
Disjunct_isolated_population	Yes/No	N/A				Stored in BDBSA Species Attribute tables
DNA	Yes/No	N/A	ISVOUCHERED	Text	3	FALSE unless ISVOUCHERED = 'Y'
Spring_Endemic	Yes/No	N/A				Stored in BDBSA Species Attribute tables

SPECIES Table Fields	SPECIES Data Type	SPECIES Text Length	BDBSA (Supertable) Field Map	BDBSA Data Type	BDBSA Text Length	Comments
Scald_Endemic	Yes/No	N/A				Stored in BDBSA Species Attribute tables
EPBC_status	Text	255	ESACTSTATCODE	Text	10	EPBC Act Status
NCA	Text	255	NPWACTSTATCODE	Text	10	National Parks and Wildlife Act Status
Naturalised	Yes/No	N/A				Stored in BDBSA Species Attribute tables
Widespread colonisers	Yes/No	N/A				Stored in BDBSA Species Attribute tables
Non-wetland Incidental Taxa	Yes/No	N/A				Stored in BDBSA Species Attribute tables
Invasive Taxa	Yes/No	N/A				Stored in BDBSA Species Attribute tables
Invasive	Yes/No	N/A				Stored in BDBSA Species Attribute tables
Notes	Text	2147483647	SURVEYNR	Short Integer	N/A	Concatenate fields as noted
			SURVEYNAME	Text	40	Concatenate fields as noted
			LOCATIONCOMM	Text	300	Concatenate fields as noted
			SIGHTINGCOMM	Text	300	Concatenate fields as noted
			HABITATCOMM	Text	300	Concatenate fields as noted
			FLORACODE	Text	18	Concatenate fields as noted
			FAUNACODE	Text	18	Concatenate fields as noted

Appendix D Information for populating the Access Database 'Species' tables

These tables simply present the biology related tables and an indication of what is needed to resolve issues involved in transferring the data to this format from the species flat table.

Fauna Record Table

FAUNA RECORD Fields	FAUNA RECORD Data Type	FAUNA RECORD Text Length	Comments
Vent ID	Text	255	
Visit Number	Date	N/A	Create from field 'Date_' in flat table
Taxon ID	Long Integer	N/A	To create links in this database between taxa table and record table, taxon-id can be generated based on field 'Taxon_name'
Taxon Name	Text	200	
Method	Text	50	
Abundance	Long Integer	N/A	
Genetically Distinct Population	Yes/No	N/A	
Disjunct/Isolated Population	Yes/No	N/A	
DNA	Yes/No	N/A	
Notes	Text	50	Text length needs increasing

Fauna Taxa Table

FAUNA TAXA Fields	FAUNA TAXA Data Type	FAUNA TAXA Text Length	Comments
Taxon ID	Long Integer	N/A	To create links in this database between taxa table and record table, taxon-id can be generated based on field 'Taxon_name'
Taxon Name Including Author	Text	255	See body text section 3.2.2
Taxon Name	Text	255	
Common Name	Text	50	Increase text length of field to 70 so that no truncation of SA common naes occurs
Species Type	Text	255	
Spring Endemic	Yes/No	N/A	
Scald Endemic	Yes/No	N/A	
NCA	Text	255	
EPBC	Text	255	
Naturalised	Yes/No	N/A	
Widespread colonisers	Yes/No	N/A	
Non-wetland Incidental Taxa	Yes/No	N/A	
Invasive Taxa	Yes/No	N/A	
Notes	Text	255	

Flora Record Table

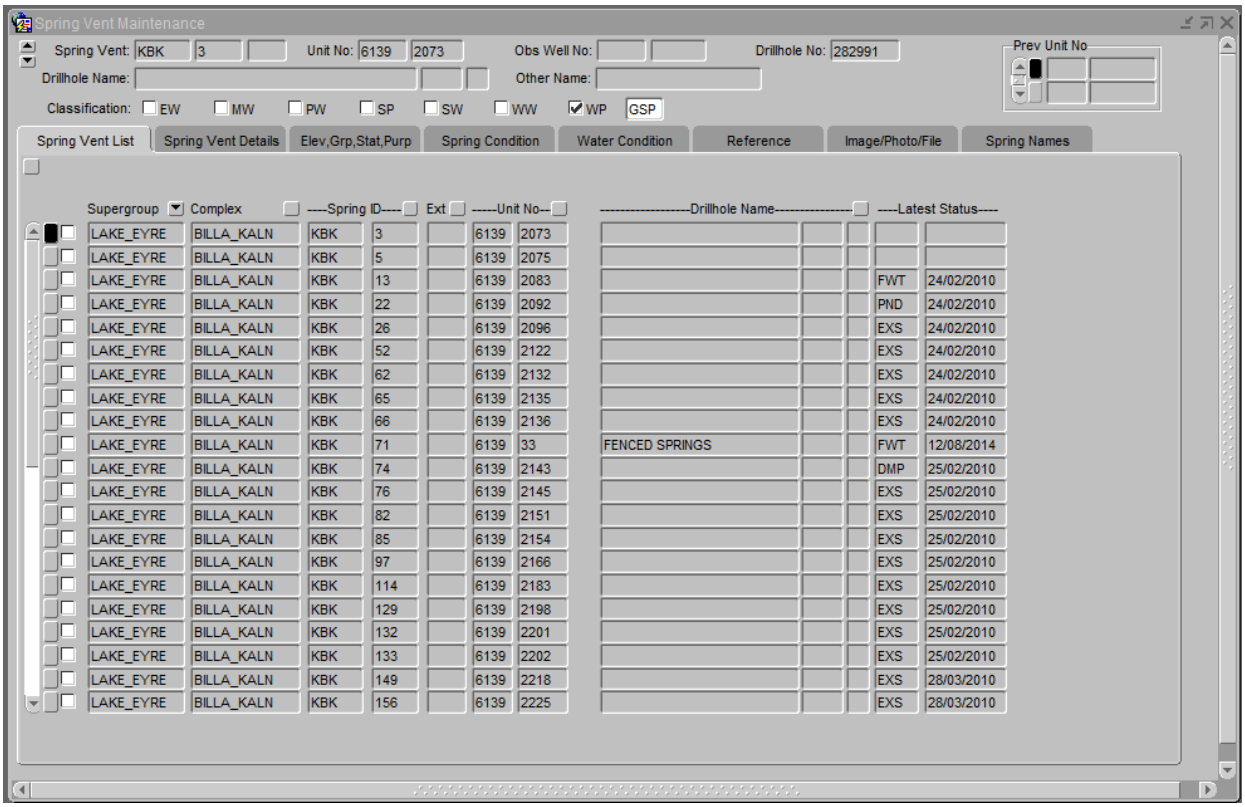
FLORA RECORD Fields	FLORA RECORD Data Type	FLORA RECORD Text Length	Comments
Vent ID	Text	255	
Visit Number	Date	N/A	Create from field 'Date_' in flat table
Taxon ID	Long Integer	N/A	To create links in this database between taxa table and record table, taxon-id can be generated based on field 'Taxon_name'
Taxon Name	Text	200	
Method	Text	50	Recorded as 'Observed' for all flora
Abundance	Long Integer	N/A	Not available for SA due to limited / inconsistent collection
Genetically Distinct Population	Yes/No	N/A	
Disjunct/Isolated Population	Yes/No	N/A	
DNA	Yes/No	N/A	
Notes	Text	50	Text length needs increasing

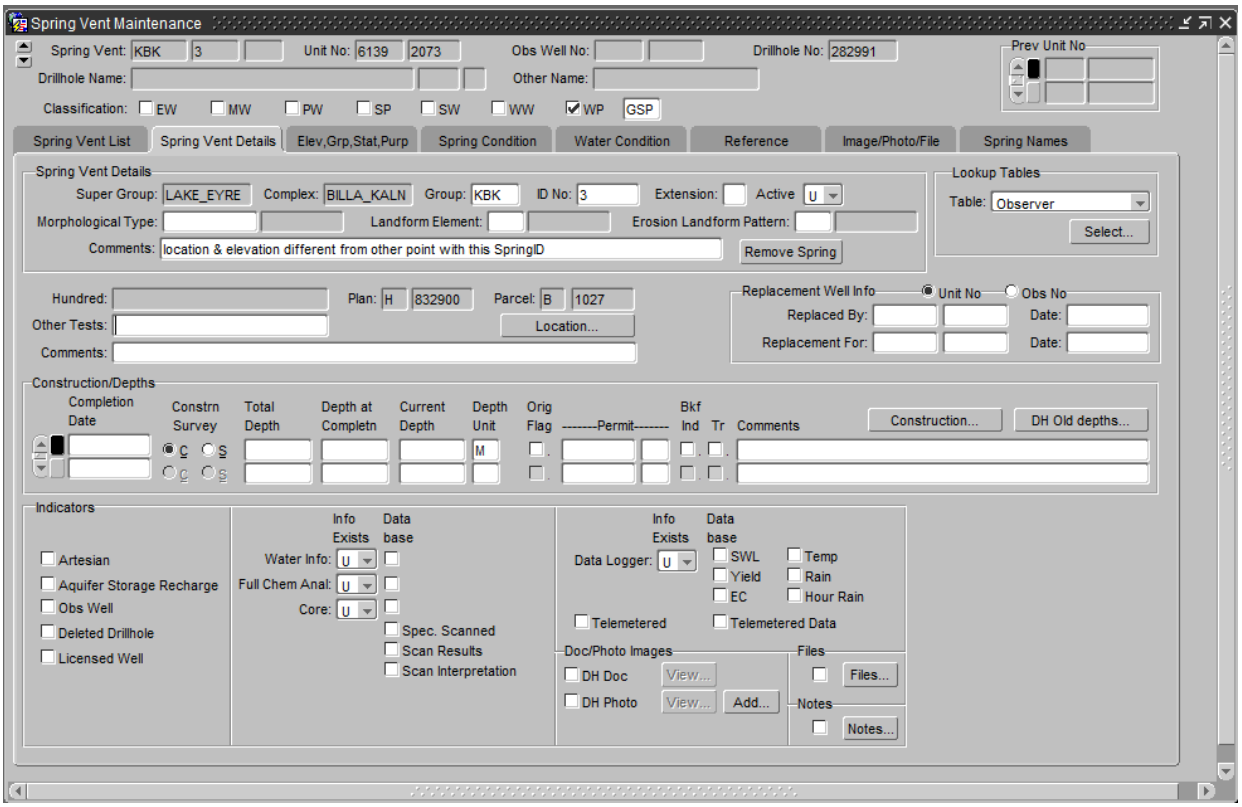
Flora Taxa Table

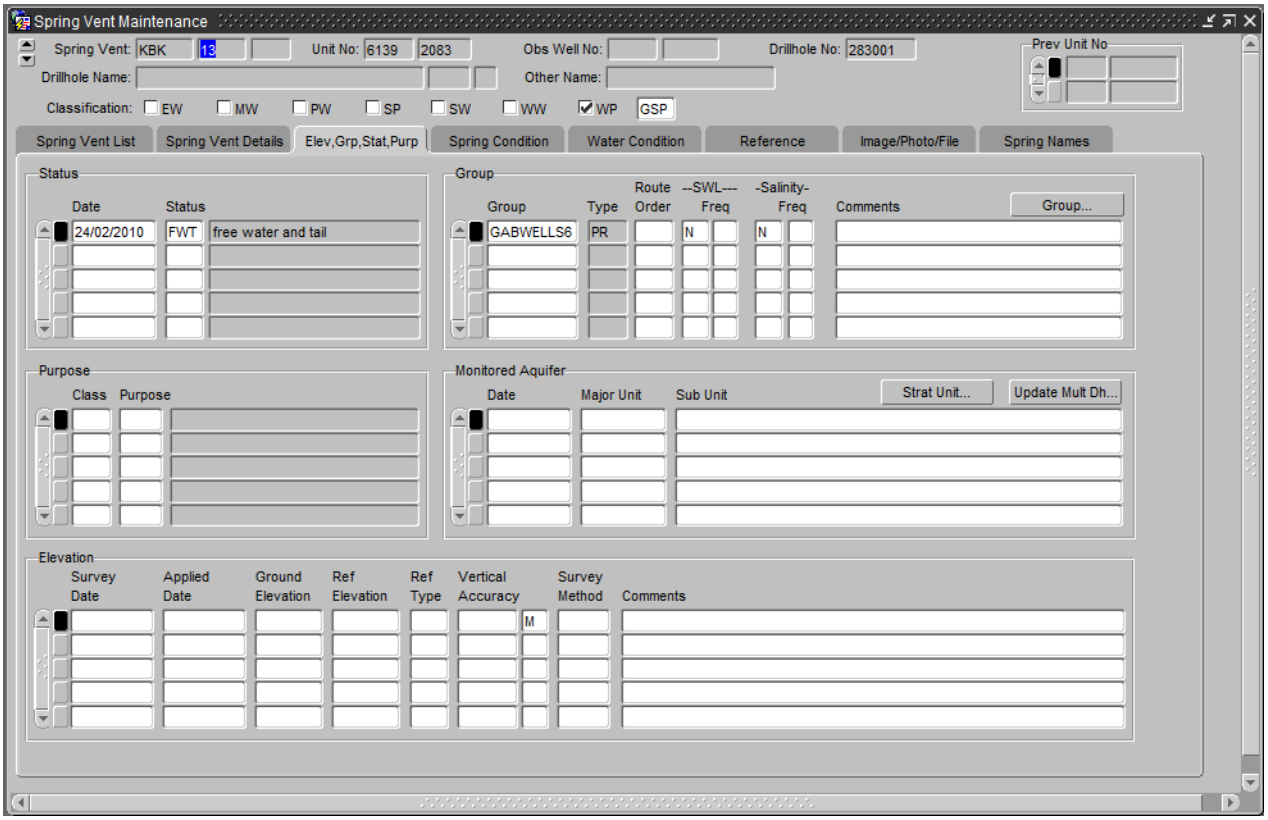
FLORA TAXA Fields	FLORA TAXA Data Type	FLORA TAXA Text Length	Comments
Taxon ID	Long Integer	N/A	
Taxon Name Including Author	Text	255	See body text section 3.2.2
Taxon Name	Text	255	
Common Name	Text	50	
Species Type	Text	255	
Spring Endemic	Yes/No	N/A	
Scald Endemic	Yes/No	N/A	
NCA	Text	255	
EPBC	Text	255	
Naturalised	Yes/No	N/A	
Widespread colonisers	Yes/No	N/A	
Non-wetland Incidental Taxa	Yes/No	N/A	
Invasive Taxa	Yes/No	N/A	
Notes	Text	50	

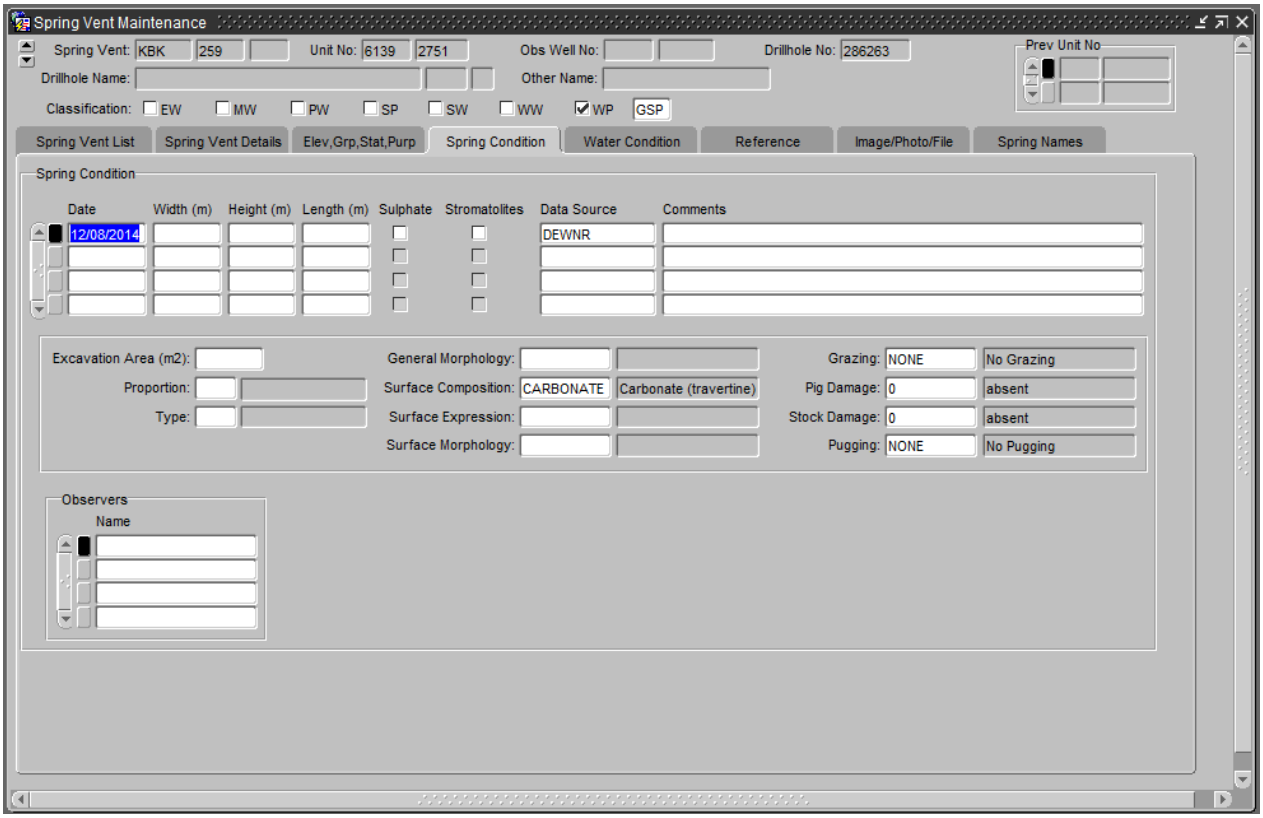
Appendix E

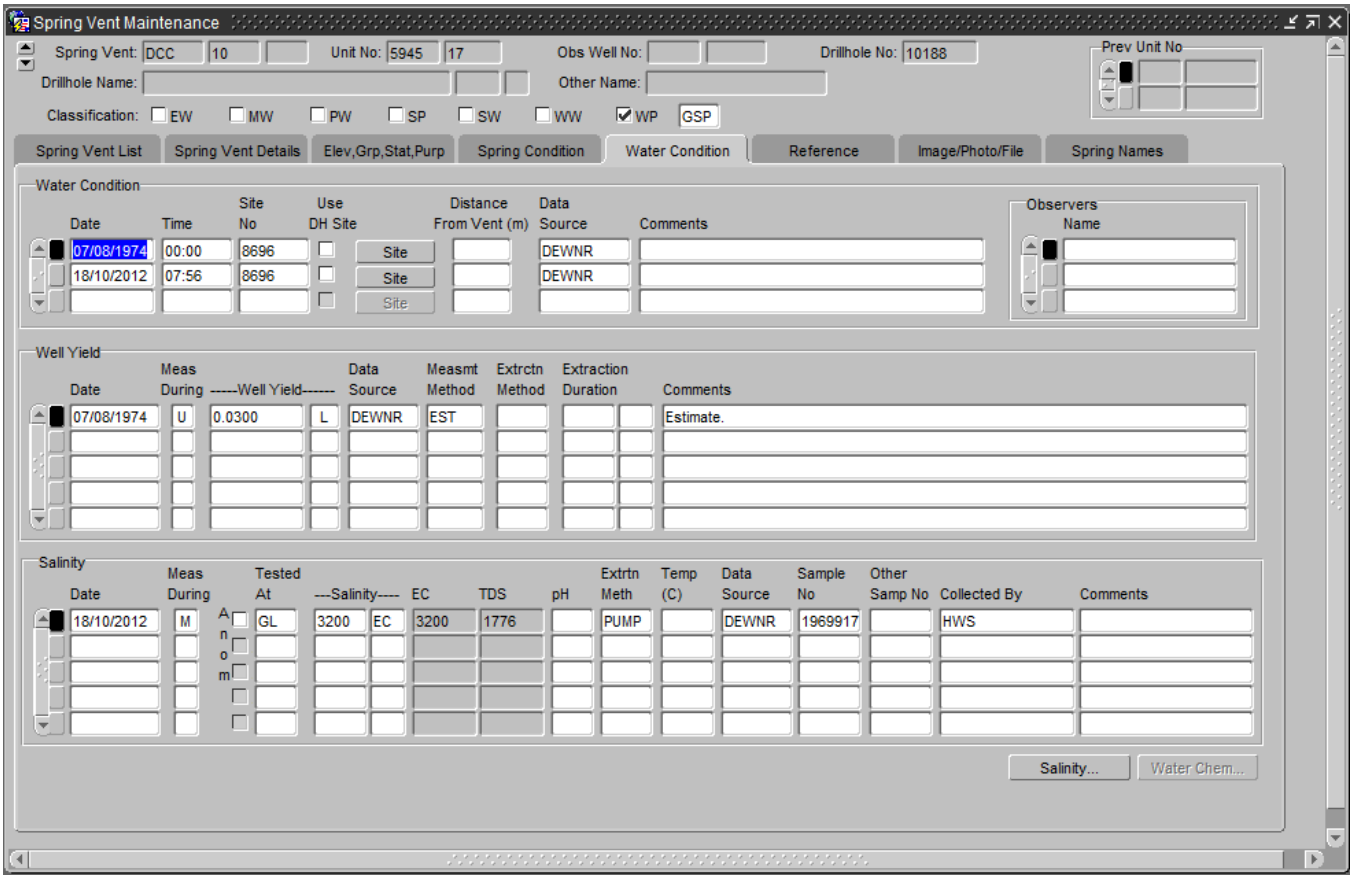
Spring vent data entry and maintenance forms in SA Geodata

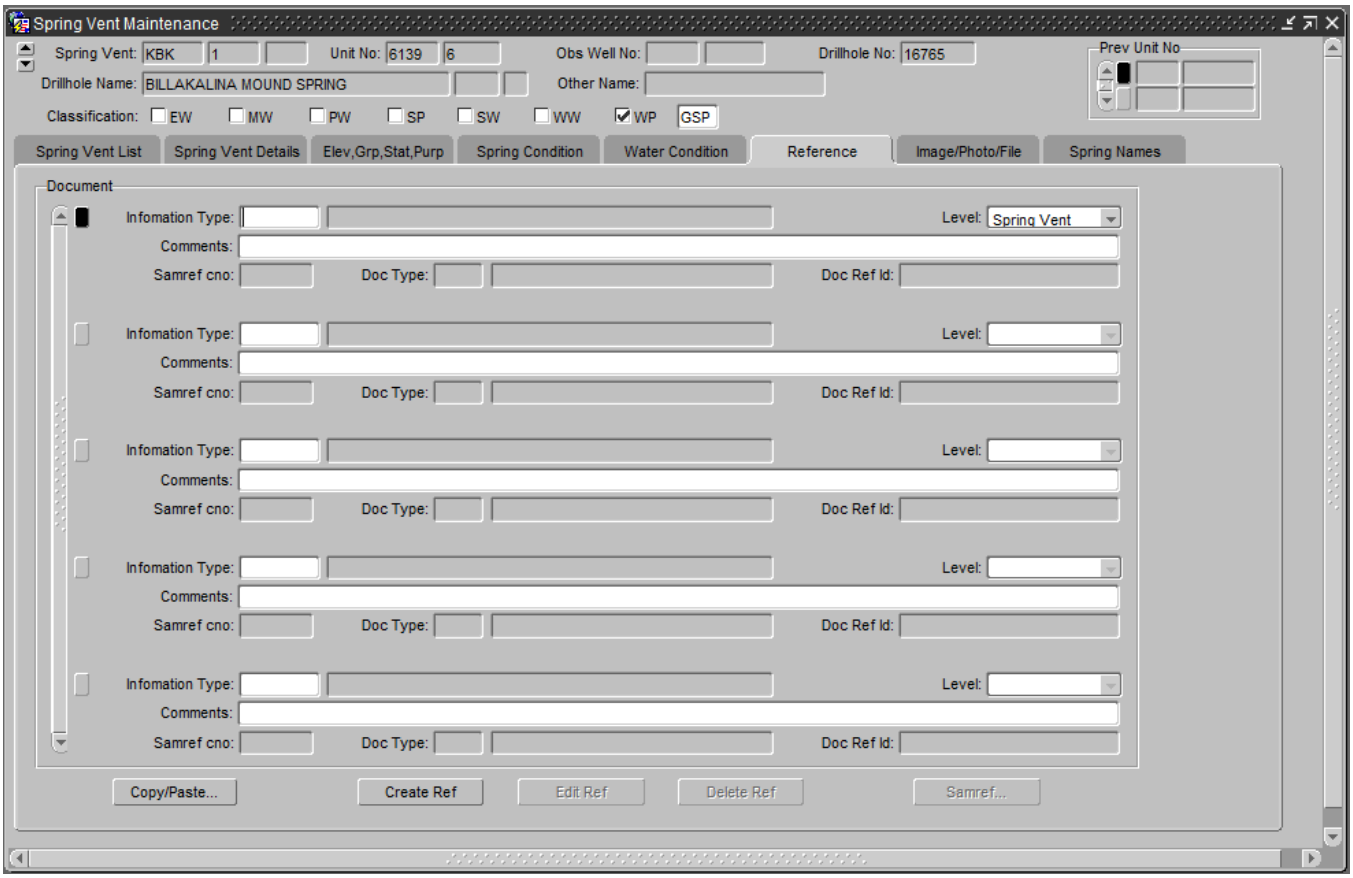


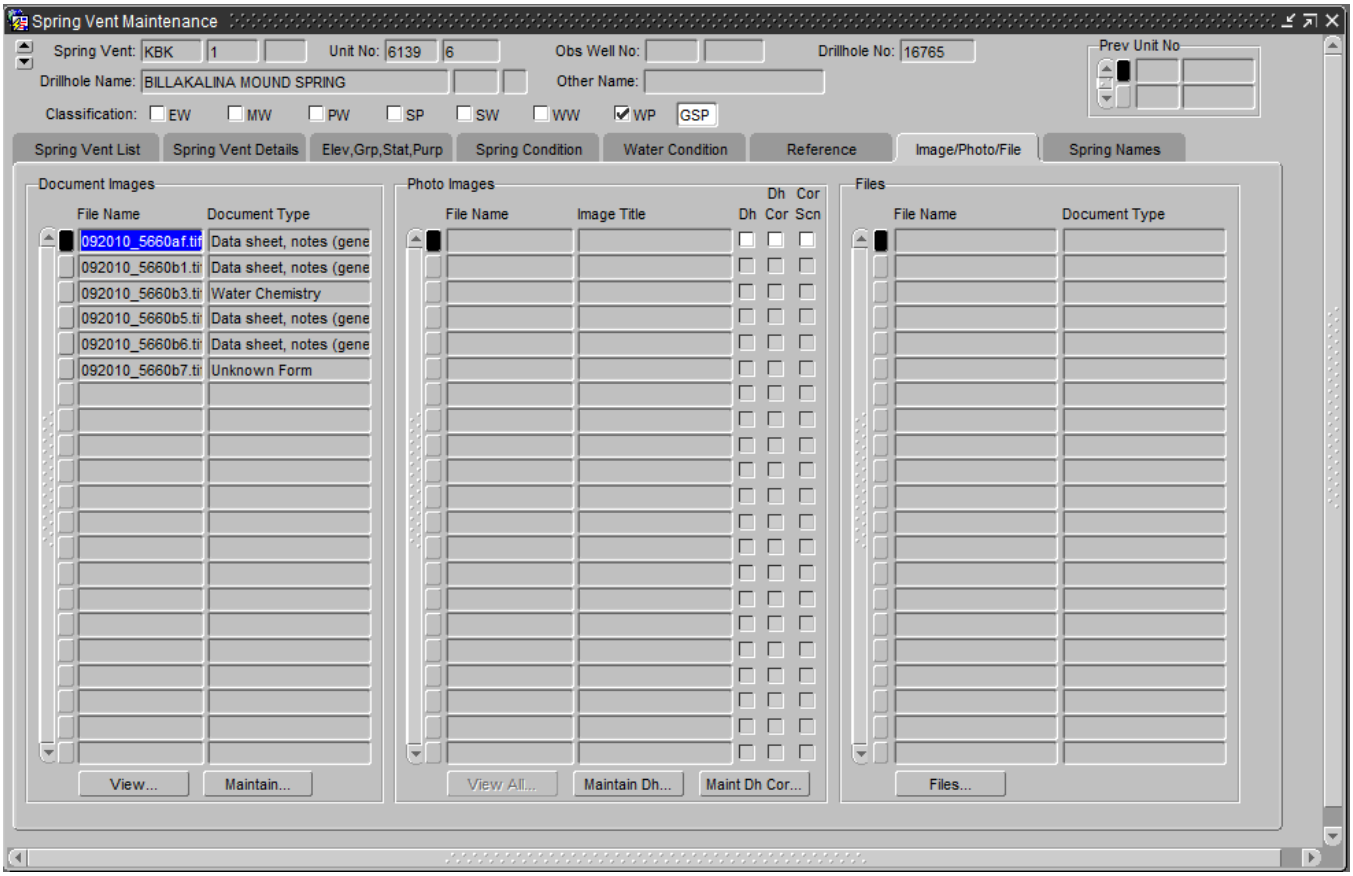


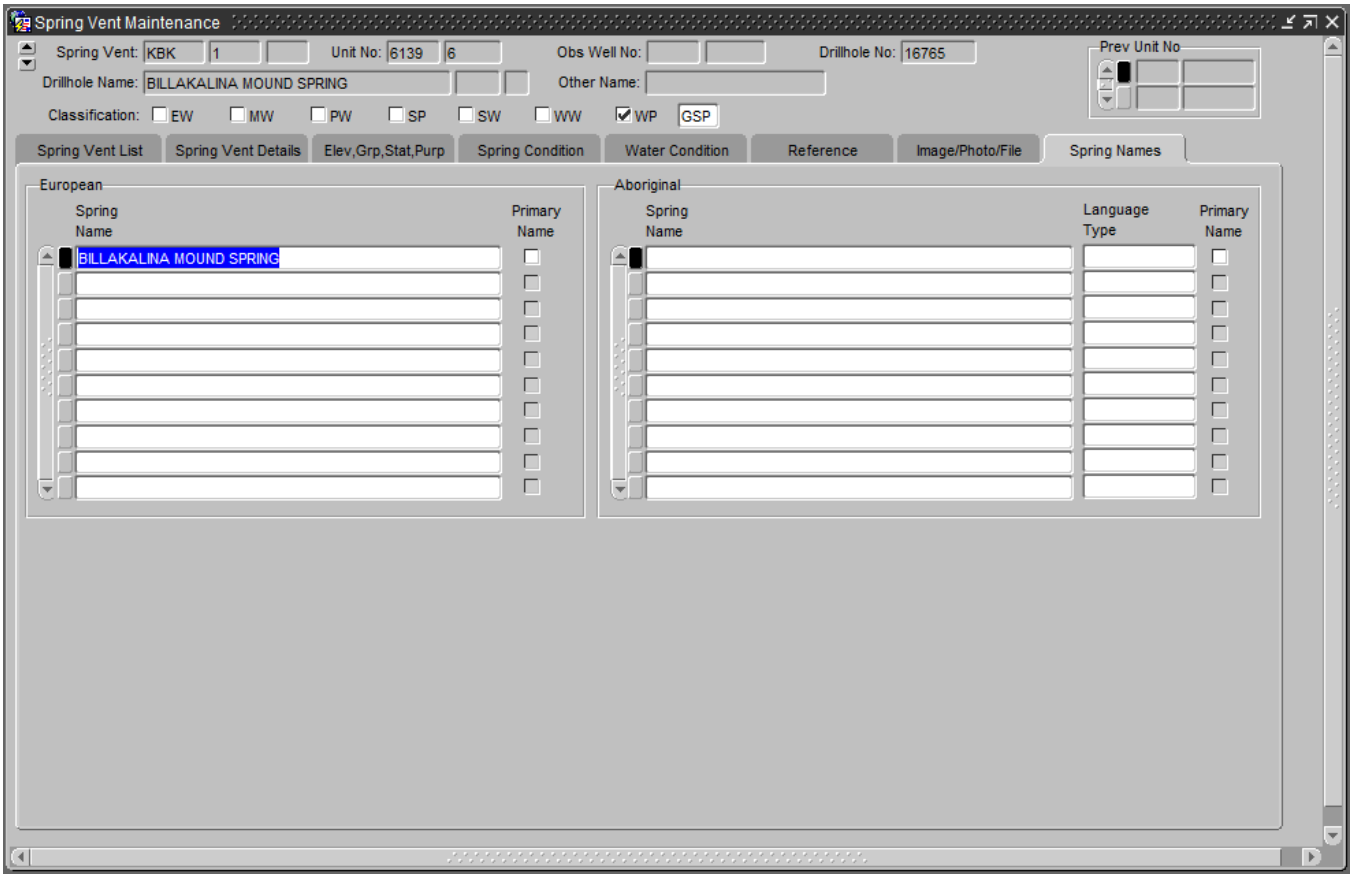

Spring Vent Maintenance
Spring Vent: KBK 13
Unit No: 6139 2083
Obs Well No:
Drillhole No: 283001
Drillhole Name:
Other Name:
Prev Unit No
Classification: EW MW PW SP SW WW WP GSP
Spring Vent List
Spring Vent Details
Elev,Grp,Stat,Purp
Spring Condition
Water Condition
Reference
Image/Photo/File
Spring Names
Status
Date
Status
24/02/2010
FWT
free water and tail
Group
Group
Type
Route Order
--SWL--- Freq
-Salinity- Freq
Comments
Group...
GABWELLS6
PR
N
N
Purpose
Class
Purpose
Monitored Aquifer
Date
Major Unit
Sub Unit
Strat Unit...
Update Mult Dh...
Elevation
Survey Date
Applied Date
Ground Elevation
Ref Elevation
Ref Type
Vertical Accuracy
Survey Method
Comments
M

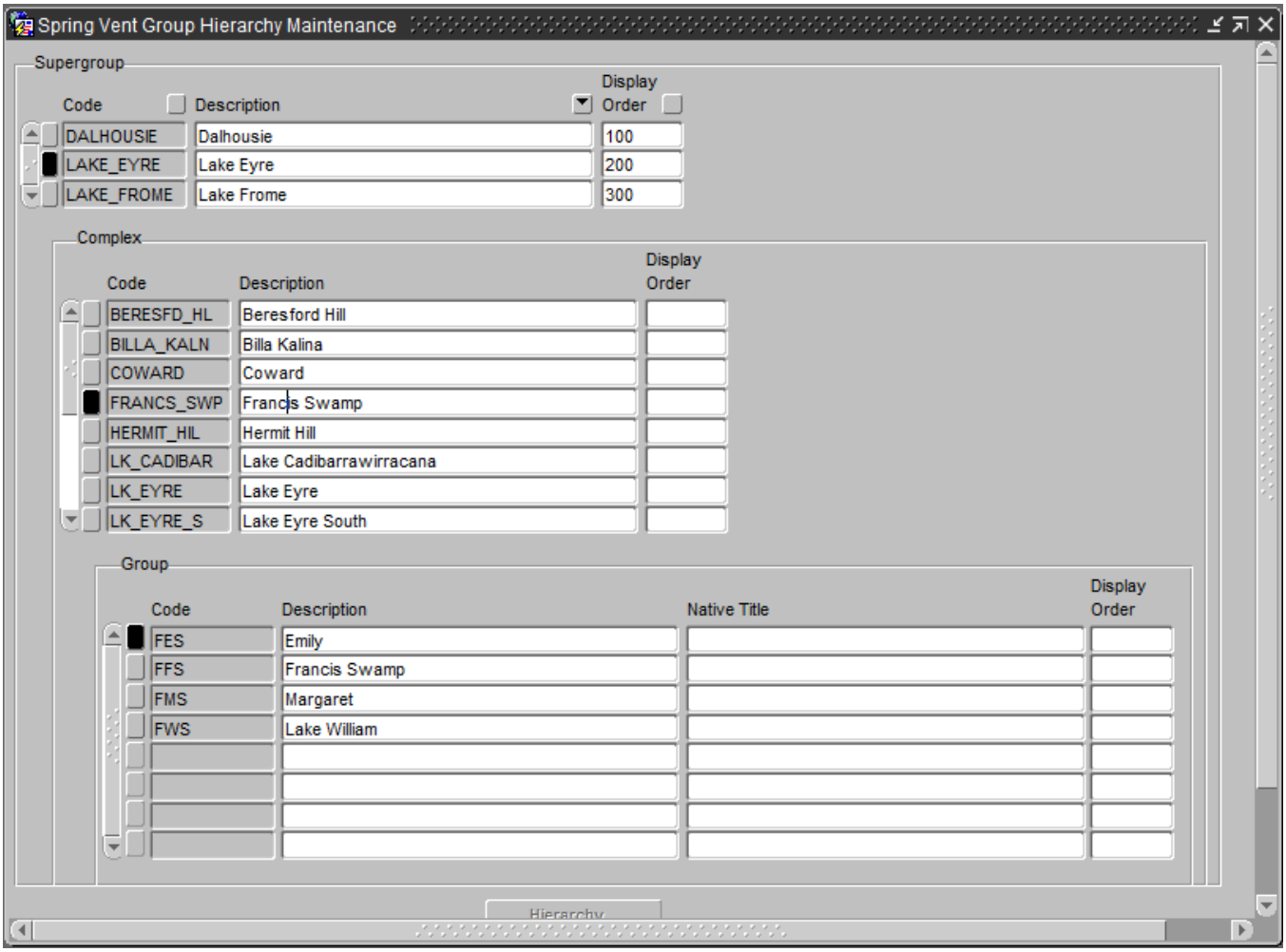

Spring Vent Maintenance
Spring Vent: KBK 259
Unit No: 6139 2751
Obs Well No:
Drillhole No: 286263
Drillhole Name:
Other Name:
Prev Unit No
Classification: EW MW PW SP SW WW WP GSP
Spring Vent List
Spring Vent Details
Elev,Grp,Stat,Purp
Spring Condition
Water Condition
Reference
Image/Photo/File
Spring Names
Spring Condition
Date
Width (m)
Height (m)
Length (m)
Sulphate
Stromatolites
Data Source
Comments
12/08/2014
DEWNR
Excavation Area (m2):
Proportion:
Type:
General Morphology:
Surface Composition:
CARBONATE
Carbonate (travertine)
Surface Expression:
Surface Morphology:
Grazing:
NONE
No Grazing
Pig Damage:
0
absent
Stock Damage:
0
absent
Pugging:
NONE
No Pugging
Observers
Name


Spring Vent Maintenance
Spring Vent: DCC 10 Unit No: 5945 17 Obs Well No: Drillhole No: 10188
Drillhole Name: Other Name:
Prev Unit No
Classification: EW MW PW SP SW WW WP GSP
Spring Vent List | Spring Vent Details | Elev,Grp,Stat,Purp | Spring Condition | Water Condition | Reference | Image/Photo/File | Spring Names
Water Condition
Date | Time | Site No | Use DH Site | Distance From Vent (m) | Data Source | Comments
07/08/1974 | 00:00 | 8696 | Site | DEWNR
18/10/2012 | 07:56 | 8696 | Site | DEWNR
Observers Name
Well Yield
Date | Meas During | Well Yield | Data Source | Measmt Method | Extrctn Method | Extraction Duration | Comments
07/08/1974 | U | 0.0300 | L | DEWNR | EST | Estimate.
Salinity
Date | Meas During | Tested At | Salinity | EC | TDS | pH | Extrtn Meth | Temp (C) | Data Source | Sample No | Other Samp No | Collected By | Comments
18/10/2012 | M | GL | 3200 | EC | 3200 | 1776 | PUMP | DEWNR | 1969917 | HWS
Anom
Salinity... Water Chem...


Spring Vent Maintenance
Spring Vent: KBK 1 Unit No: 6139 6 Obs Well No: Drillhole No: 16765
Drillhole Name: BILLAKALINA MOUND SPRING Other Name:
Prev Unit No
Classification: EW MW PW SP SW WW WP GSP
Spring Vent List | Spring Vent Details | Elev,Grp,Stat,Purp | Spring Condition | Water Condition | Reference | Image/Photo/File | Spring Names
Document
Infomation Type: Level: Spring Vent
Comments:
Samref cno: Doc Type: Doc Ref Id:
Copy/Paste... Create Ref Edit Ref Delete Ref Samref...


Spring Vent Maintenance
Spring Vent: KBK 1 Unit No: 6139 6 Obs Well No: Drillhole No: 16765
Drillhole Name: BILLAKALINA MOUND SPRING Other Name:
Prev Unit No
Classification: EW MW PW SP SW WW WP GSP
Spring Vent List
Spring Vent Details
Elev,Grp,Stat,Purp
Spring Condition
Water Condition
Reference
Image/Photo/File
Spring Names
Document Images
File Name
Document Type
092010_5660af.tif
Data sheet, notes (gene
092010_5660b1.tif
Data sheet, notes (gene
092010_5660b3.tif
Water Chemistry
092010_5660b5.tif
Data sheet, notes (gene
092010_5660b6.tif
Data sheet, notes (gene
092010_5660b7.tif
Unknown Form
View...
Maintain...
Photo Images
File Name
Image Title
Dh
Cor
Scn
View All...
Maintain Dh...
Maint Dh Cor...
Files
File Name
Document Type
Files...


Spring Vent Maintenance
Spring Vent: KBK 1 Unit No: 6139 6 Obs Well No: Drillhole No: 16765
Drillhole Name: BILLAKALINA MOUND SPRING Other Name:
Prev Unit No
Classification: EW MW PW SP SW WW WP GSP
Spring Vent List
Spring Vent Details
Elev,Grp,Stat,Purp
Spring Condition
Water Condition
Reference
Image/Photo/File
Spring Names
European
Spring Name
Primary Name
BILLAKALINA MOUND SPRING
Aboriginal
Spring Name
Language Type
Primary Name


Spring Vent Group Hierarchy Maintenance
Supergroup
Code
Description
Display Order
DALHOUSIE
Dalhousie
100
LAKE_EYRE
Lake Eyre
200
LAKE_FROME
Lake Frome
300
Complex
Code
Description
Display Order
BERESFD_HL
Beresford Hill
BILLA_KALN
Billa Kalina
COWARD
Coward
FRANCS_SWP
Francis Swamp
HERMIT_HIL
Hermit Hill
LK_CADIBAR
Lake Cadibarrawirracana
LK_EYRE
Lake Eyre
LK_EYRE_S
Lake Eyre South
Group
Code
Description
Native Title
Display Order
FES
Emily
FFS
Francis Swamp
FMS
Margaret
FWS
Lake William
Hierarchy

Appendix F Extracting species data from ALA for SA GAB Springs

The following web link will allow viewing and download of DEWNR species data associated with Mound Springs, through the Atlas of Living Australia (ALA) portal. DEWNR species data is stored in two corporate systems. ADHERB is refreshed on ALA through AVH on a regular basis (~weekly) and BDBSA data is refreshed on ALA every 3 months.

Record View:

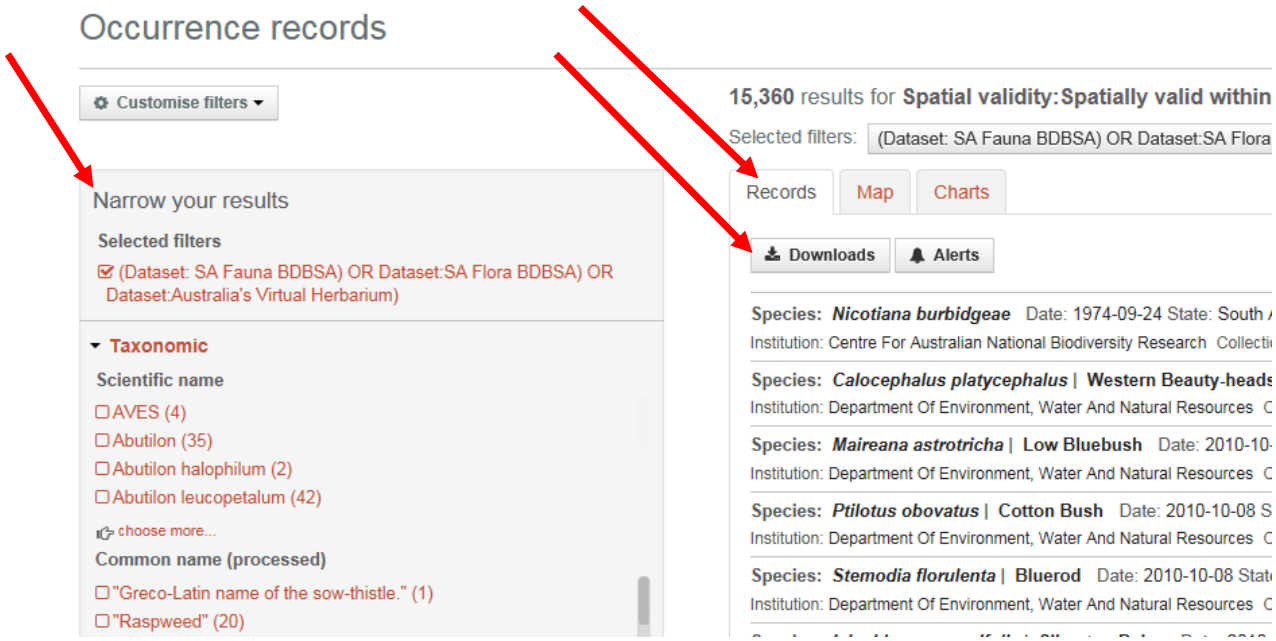
http://biocache.ala.org.au/occurrences/search?q=qid:1446174292910%20-%20tab_recordsView%23tab_recordsView#tab_recordsView

Spatial View:

http://spatial.ala.org.au/webportal/?ss=5A407D14EA032475EF4428D704264009

If the links need to be re-created refer to section below "Re-creating ALA selection"

The data selected through Record View link above can be viewed as a **Record** list, spatially on **Maps (view in spatial portal)** or summarised in **Charts**.



Further filtering can be applied by selecting desired tick boxes in the **Narrow your results** column on the left of the screen.

When in the records view the **Downloads** button will output the Darwin Core fields (plus ALA validation checks) for the selected records.

Re-creating ALA selection

- Select ALA spatial portal

http://spatial.ala.org.au/

- Add to map - Areas

  Import shapefile

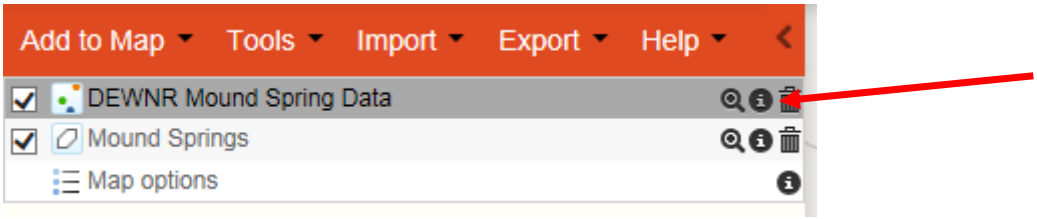
  Browse to locate zipped shapefile for 'Mound Springs'

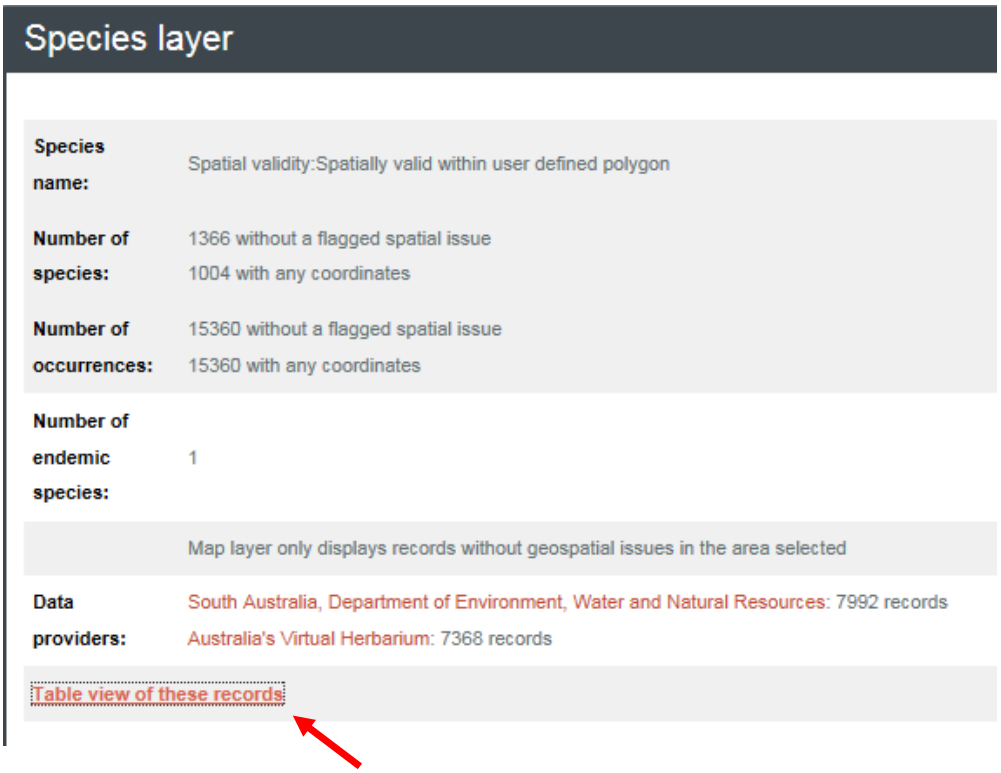
- Add to map - Add facet

  Apply to spatially valid records for the 'Mound Springs' layer.

  Facet on **data providers** SADEWNR and AVH (SADEWNR does not include ADHERB and ADHERB can't be selected from AVH so all herbaria have been included). See section on other relevant datasets below. Select **NEXT**

Click on "i" symbol



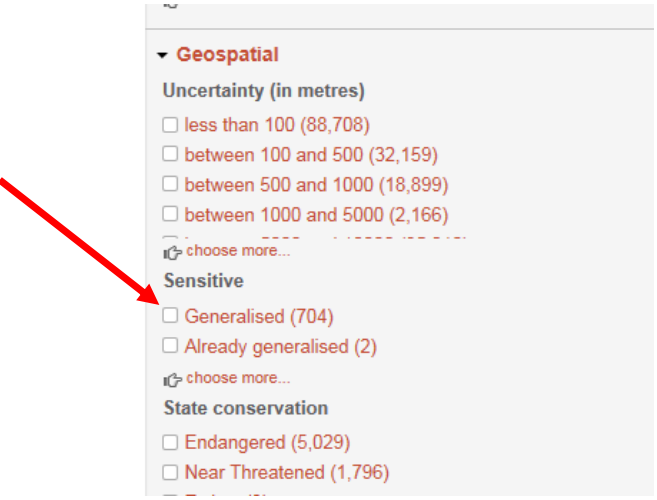


Select **Table view of these records**

Requesting precise coordinates for sensitive species

Species idenitified on the SA Environmentally Sensitive Data Register have their coordinates rounded to one decimal place and as a result may be up to 10 km from their sighting point. The spatial selection accommodates for spatial accuracy so these records will still be selected in the facet however the downloaded data will have generalised coordinates.

Records affected by this in the search area can be identified by selecting the **Generalised** check box under **Narrow your results** in the **Table view of record**s screen. This subset can be **downloaded** and will include a unique supplier's code (Catalogue Number) for each record. By supplying the unique code to the source institution precise data can be requested for required records.



Other relevant datasets

Outstanding BDBSA projects.

> For a complete list of projects documented on the BDBSA metadata system but not yet available see the accompanying report. As each dataset is accessed and loaded onto BDBSA it will become available through the next scheduled ALA refresh (unless license agreements prevent release).
>
> This list includes the National Springs Database Project, SA Gap filling.

DEWNR Invertebrate data

> All invertebrate data generated from BDBSA projects are currently stored independent to the BDBSA system. They will be appended to data request until such time as they are able to be loaded into BDBSA and forwarded to ALA as part of regular refreshes.

Major Institutions

> There are several other significant data_providers supplying data to ALA in the Mound Springs region. These can be selected in addition to DEWNR during the **Add to Map – Facet** step. A recent ALA session extracting all Data_providers can be viewed via:
>
> http://spatial.ala.org.au/webportal/?ss=73F9E796FAE91596CAE97AE42AAFBD56

The list of **data_provider** from this session (October 2015) is shown below. Metadata is available on each data provider and individual datasets through the ALA metadata . This metadata can help decide what records will be fit for purpose.

Species name:	Spatial validity: Spatially valid within user defined polygon
Number of species:	1630 without a flagged spatial issue 0 with any coordinates
Number of occurrences:	40764 without a flagged spatial issue 0 with any coordinates
Number of endemic species:	40
	Map layer only displays records without geospatial issues in the area selected
Data providers:	Australian National Insect Collection, CSIRO: 215 records OZCAM (Online Zoological Collections of Australian Museums) Provider: 5988 records CSIRO National Fish Collection: 1 records BirdLife Australia: 11745 records Northern Territory Department of Land Resource Management: 2 records Citizen Science - ALA Website: 4 records South Australia, Department of Environment, Water and Natural Resources: 11691 records The University of Adelaide: 34 records Office of Environment and Heritage, Department of Premier and Cabinet representing the State of New South Wales: 14 records Barcode of Life: 18 records Australia's Virtual Herbarium: 9824 records European Molecular Biology Laboratory Australia: 18 records Global Biodiversity Information Facility: 91 records Australian Seedbank Partnership: 10 records DigiVol: 4 records
Table view of these records	

Government of South Australia
Department of Environment,
Water and Natural Resources