AUSTRALIAN GOVERNMENT COMMUNITY STREAM SAMPLING AND SALINITY MAPPING PROJECT

River Murray Corridor Victorian AEM Mapping Project

BOUNDARY BEND - NYAH
GIS

User Guide

Australian Government
Department of Agriculture, Fisheries and Forestry
Bureau of Rural Sciences
Department of the Environment, Water, Heritage and the Arts

Australian Government
Geoscience Australia

River Murray Corridor Victorian AEM Mapping Project

Boundary Bend - Nyah GIS

GEOCAT # 68789

Users Guide

Heike Apps

RIVER MURRAY CORRIDOR
BOUNDARY BEND – NYAH GIS

Apps, H.E., Cullen, K., Halas, L., Tan, K.P., Pain, C., Clarke, J.D., Lawrie, K.L., Gibson, D., Brodie, R.C., Wong, V.

This CD contains all data acquired by GA in fulfilling the research aims of the project.
Interpretations of that data are also included in GIS format.

The River Murray Corridor Boundary Bend - Nyah GIS was compiled using ESRI ArcGIS software. All projects are available in both version 9.2 and 9.3.

The data is structured in directories for easy viewing and interrogation in ArcGIS. At the top of the structure is **BoundaryBend_Nyah_overview.mxd**. This project launches a GIS showing a range of themes held in the 'data' directory. All AEM images are also displayed in the overview. Userguide_BoundaryBend_ Nyah_GIS.pdf (this user guide) plus the copyright/disclaimer sit at the top of the data structure.

The data is also structured into themes displaying set products. There is an ArcMap project for each product to best display the related themes. Products include:

Blanchetown Clay	Conductive Soils	Flush zones
Groundwater conductivity	Near surface conductive zones	Near surface resistive zones
Parilla Sands	Quaternary Alluvium	Recharge
Salt store	Stratigraphic extents and reliability	Shepparton Formation
Surface salt	Vegetation health	Woorinen Formation

Front cover photo taken by Jon Clarke: Major Mitchells Lagoon

Many themes have images linked to a feature. These images are accessed by using the lightning bolt icon, selecting the feature, then opening the image/s in the list. The images can also be viewed outside the GIS in any image viewing software.

NOTE: If there is an issue with the linked images, use the 'i' button to identify the feature. When the feature identity is displayed, right click and select Manage Hyperlinks. Select the appropriate file listed in the hotlink field (always in the same directory as the theme). This will reset all links for the theme.

INDEX

Directory Listing

All data in the GIS fits into the directory structure below. This structure is expanded further in the following pages with information on the folder contents

- aem
  - b45_slice_ne_sunangle_0_1s
  - b45_slice_no_sunangle_0_1s
  - b45_watertable
  - b45slice_no_sun_0_1_log
  - b45slice_no_sun_0_2_log
  - depth_no_sun_b45_log0_1
  - depth_no_sun_b45_log0_2
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  - bil
  - borehole
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  - grids
  - hydro
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  - shape
- ga_merged_dem
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  - ESRI_Grids
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  - blanchetown_clay
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  - flush_zones
  - gwater_cond
  - near_surf_cond_zone
  - near_surf_resist_zone
  - parilla_sands
  - quaternary_alluvium
  - recharge
  - salt_store
  - shepparton_fm
  - strat_units_extents
  - surface_salt
  - veg_health
  - woorinen_fm
- reports
  - atlas
  - geomorphology
  - methodology

\AEM

AEM data are organised into directories and displayed as .bil (band interleaved by line) format images using various stretches to enhance the image. AEM data units are siemens per meter (S/m).

Each image directory includes a legend image (.bmp format bitmap) showing the relationship between image colours and conductivity values (S/m). Each image directory contains a set AEM of depth images presented using various colour stretches to highlight various features. The three types of depth images are: depth slices, floodplain slices and watertable slices. These are explained below.

Depth slice grids represent the average conductivity in S/m of various regular depth intervals below the natural surface of the terrain. The depth slice intervals are shown in Table 1. All depths are relative to the natural surface.

Table 1. Depth slice intervals

Depth to top (m)	Depth to bottom (m)	Conductivity grid base filename
0	2	depthslice_00_02
0	5	depthslice_00_05
0	10	depthslice_00_10
2	5	depthslice_02_05
5	10	depthslice_05_10
10	15	depthslice_10_15
15	20	depthslice_15_20
20	25	depthslice_20_25
25	30	depthslice_25_30
30	35	depthslice_30_35
35	40	depthslice_35_40
40	45	depthslice_40_45
45	50	depthslice_45_50
50	55	depthslice_50_55
55	60	depthslice_55_60

Floodplain slice grids represent the average conductivity in S/m of various depth intervals relative to the elevation above or below a smooth surface that approximates the River Murray floodplain. They are not slices that follow a certain depth extent, but are relative to the gentle upstream/downstream incline/decline of the river and floodplain. This smooth floodplain surface was generated by gridding (then extrapolating and smoothing) elevation data that lay inside the recent floodplain sediments of the River Murray. The file naming convention is as follows:

floodplainslice_bbb_ttt

where bbb and ttt represent the distance from the smooth floodplain surface to the bottom and top of the interval respectively. Positive values of bbb or ttt mean that the interval is above the floodplain surface and negative values mean that the interval is below the floodplain surface The floodplain slice intervals are shown in Table 2.

Note that in the upper (+ve) floodplain slices many of the cells in the grid will be set to the null (missing) value because at that cell the slice will be entirely above ground surface. For some sub-blocks, the upper slices are above the ground surface everywhere on the grid (all values are set to null) and accordingly have not been included in the dataset.

Table 2. Floodplain slice intervals

Distance from smooth floodplain surface to bottom of interval (m)	Distance from smooth floodplain surface to top of interval (m)	Conductivity grid base filename
+40	+35	floodplainslice_+40_+35
+35	+25	floodplainslice_+35_+25
+30	+20	floodplainslice_+30_+20
+25	+20	floodplainslice_+25_+20
+20	+15	floodplainslice_+20_+15
+15	+10	floodplainslice_+15_+10
+10	+05	floodplainslice_+10_+05
+06	+04	floodplainslice_+06_+04
+05	+00	floodplainslice_+05_+00
+04	+02	floodplainslice_+04_+02
+02	+00	floodplainslice_+02_+00
+00	-05	floodplainslice_+00_-05
+00	-02	floodplainslice_+00_-02
-02	-04	floodplainslice_-02_-04
-04	-06	floodplainslice_-04_-06
-05	-10	floodplainslice_-05_-10
-06	-08	floodplainslice_-06_-08
-08	-10	floodplainslice_-08_-10
-10	-12	floodplainslice_-10_-12
-10	-15	floodplainslice_-10_-15
-12	-14	floodplainslice_-12_-14
-14	-16	floodplainslice_-14_-16
-15	-20	floodplainslice_-15_-20
-16	-18	floodplainslice_-16_-18
-18	-20	floodplainslice_-18_-20
-20	-25	floodplainslice_-20_-25
-25	-30	floodplainslice_-25_-30
-30	-35	floodplainslice_-30_-35
-35	-40	floodplainslice_-35_-40
-40	-45	floodplainslice_-40_-45
-45	-50	floodplainslice_-45_-50
-50	-55	floodplainslice_-50_-55
-55	-60	floodplainslice_-55_-60

Watertable slice grids represent the average conductivity in S/m of various intervals relative to the elevation above or below a smooth surface that approximates the regional watertable. They are not slices that follow a certain depth extent, but are relative to the gentle upstream/downstream incline/decline of the watertable. This watertable surface was generated by gridding (then extrapolating and smoothing) watertable data from bores and river height data. Table 3 lists and describes the watertable slice grids.

Table 3. Watertable slice grids

Conductivity grid filename	Description
floodplain_watertable_averageconductivity.bil	Image of the average conductivity (S/m) of the variable thickness interval between the generalised floodplain surface and the watertable surface.
floodp_wt_avgcond.jpg	Legend image for floodplain_watertable_averageconductivity.bil showing the relationship between image colours and conductivity values (S/m).
floodplain_watertable_conductance.bil	Total conductance (S) of the variable thickness interval between the generalised floodplain surface and the watertable surface.
floodp_wt_cond.jpg	Legend image for floodplain_watertable_conductance.bil showing the relationship between image colours and conductance values (S).
surface_watertable_averageconductivity.bil	Image of the average conductivity (S/m) of the variable thickness interval between natural surface and the watertable.
surf_wt_avgcond.jpg	Legend image for surface_watertable_averageconductivity.bil showing the relationship between image colours and conductivity values (S/m).
surface_watertable_conductance.bil	Total conductance (S) of the variable thickness interval between natural surface and the watertable.
surf_wt_cond.jpg	Legend image for surface_watertable_conductance.bil showing the relationship between image colours and conductance values (S).

AEM data is displayed using various stretches to enhance the data. AEM data units are S/m. Depth slices represent the depth from the surface of the terrain; whereas floodplain slices represent the holistic inversion tilted to the floodplain.

\aem\b45_slice_ne_sunangle_0_1s
20 AEM floodplain slices from +15m to -60m with a NE sunangle and a linear stretch 0 to 1 S/m

\aem\b45_slice_no_sunangle_0_1s
20 AEM floodplain slices from +15m to -60m with no sunangle and a linear stretch 0 to 1 S/m

\aem\b45_watertable
Average conductivity (S/m) from the surface to the watertable. This data were used to produce various products including salt store, near surface conductive zones and near surface resistive zones.

\aem\b45slice_no_sun_0_1_log
21 AEM floodplain slices from +15m to -60m with no sunangle and a log stretch 0 to 1 S/m

\aem\b45slice_no_sun_0_2_log
21 AEM floodplain slices from +15m to -60m with no sunangle and a log stretch 0 to 2 S/m

\aem\depth_no_sun_b45_log0_1
15 AEM depth slices from 0 to -60m with no sunangle and a log stretch 0 to 1 S/m

\aem\depth_no_sun_ b45_log0_2
15 AEM depth slices from 0 to -60m with no sunangle and a log stretch 0 to 2 S/m

\aem\metadata
AEM metadata

\aem\sections_line
220 AEM sections linked to flight lines via the theme bbn_flightlines.shp

\AEM_GRIDS

Directory contains ERMapper grids in .ers format. All AEM products were derived from these grids. See Appendix 1 for a full description.

By default, ArcGIS will not recognize these data files. ERMapper has a plug-in module for ArcGIS that permits direct reading of these files. The extension can be downloaded from www.erdas.com but requires users to register for access to software product downloads. Click on this link then click on the “downloads” tab to see details of the ArcGIS 8.x and 9.x ECW JPEG 2000 plugin 4.2 (link current as at December 2009).

\aem_grids\floodplain_elevation\rmc_b_floodplain_elevation.ers

Grid surface that approximates the elevation (meters AHD) of the River Murray floodplain.

\aem_grids\holistic_inversion\b45

Holistic inversion data for block B45

layers

The layer conductivity grids represent the conductivity in siemens per metre (S/m) of each layer of the 18 layer conductivity model

slices_depth

Depth slice grids represent the average conductivity in S/m of various regular intervals from 00m to -60m

slices_floodplain

The floodplain slice grids represent the average conductivity in S/m of various intervals relative to the elevation above or below a smooth surface that approximates the River Murray floodplain.

slices_watertable

The watertable slice grids represent the average conductivity in S/m of various intervals relative to the elevation above or below the regional watertable

\DATA

\data\bil

Directory containing ERMapper .bil files with the following themes and associated legends (.jpgs).

Image filename	Description
aster321.bil	ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) data (15 m resolution) displayed as a composite red-green-blue (RGB) image using the visible and near infrared radiation (VNIR) bands 3, 2 and 1. See "\data\metadata\satellite\aster processing.pdf" for additional information.
dems_all_10m.bil	Image of composite DEM (digital elevation model) at 10 m resolution (cell size) of the most detailed DEM data available from various sources. See "\data\metadata\other\DEM.pdf" for details of methodology. Saved as an ERMapper dataset at 10m resolution and displayed using the rainbow1 lookup table. Stretch is from 30 to 80m.
elevation_b45_10m.bil	Same data and methodology as "dems_stitch_10m.bil" but using a different image colour stretch.
elevation_legend.jpg	Legend image for elevation_b123_10m.bil showing the relationship between image colours and elevation (m).
kthu.bil	Low resolution (80 m) gamma ray radiometric data as a ternary image of potassium, thorium, uranium (red, green, blue). Data obtained from the Geological Survey of New South Wales.
kthu_legend.jpg	Legend image for kthu_rgb.bil showing the relationship between image colours and potassium/thorium/uranium.
potassium.bil	Low resolution (80 m) potassium gamma ray radiometric data. Data obtained from the Geological Survey of New South Wales.
spot321_5m.bil	SPOT 5 (Satellite Pour l'Observation de la Terre) pan-sharpened pseudo natural colour imagery (5 m resolution).
srtm_pseudo.bil	SRTM (Shuttle Radar Terrain Mission) version 1.0 DEM (93 m resolution). Elevation image with North-East sun-angle highlight.
thorium.bil	Low resolution (80 m) thorium gamma ray radiometric data. Data obtained from the Geological Survey of New South Wales.
tmi.bil	High resolution (40 m) Total Magnetic Intensity (TMI) data obtained at the same time as the AEM survey.
tmi_regional.bil	Low resolution (80 m) regional Total Magnetic Intensity (TMI) data from the Geological Survey of New South Wales, clipped to the project area to give a regional view of the area.
vd1_regional.bil	1^{st} vertical derivative of the TMI. Low resolution (80 m) regional data from the Geological Survey of New South Wales.

\data\borehole\BRS

Directory contains shapefiles of the borehole data obtained from BRS (bbn_bh_brs.shp)
Well logs are displayed in pdf format and are linked to the bores in the GIS.

The BRS directory has one sub-directory:

strat_lith – data for the drilling program

\data\borehole\other
See \data\metadata\borehole for information on these datasets

Directory contains borehole shapefiles
bendigo_bores100.shp
bores_min_gsv.shp
bores_N2B.shp
bores_water_gsv.shp
skm_bh.shp

\data\field_lab_data
Directory contains EC/ph information for soil pit sites in Area B. There is a shapefile showing the distribution and other information for these soil pits (bbn_EC_ph.shp).

PIMA for AreaB.xls
EC_pH AreaB.xls
Laser Data AreaB.xls
XRD AreaB.xls
XRF AreaB.xls

\data\geologic
bbn_stratigraphy.shp
rmc_structure - structural elements scanned and located from the Thorne report
geology_250k.tif - image scanned and located from the 1:250 000 geology map

\data\geomorph
landform_arc.shp
bbn_landform.shp
bbn_surface_materials.shp
bbn_vegetation.shp

\data\hydro
flood_extents.jpg - located image of flood extents for both 1956 and 1974
rwlb_5_clip – regional watertable data provided by BRS
baranald_hydro_250k - scanned and geo-referenced 1:250 000 hydrogeology map

\data\images
Directory contains a geo-referenced tiff image of the 1:250 000 topographic map cropped to the study area –bound_bend_nyah.tif

\data\metadata
Contains various subdirectories with metadata files for the above themes

aem
AEM data and images.pdf
AEM sections.pdf
Flightlines metadata.pdf
Generation of floodplain surface.pdf

borehole
Boreholes.pdf
gsv_boreholes_metadata.pdf

SKM_sobn_bore_consultant_organisation access 2006.pdf
20081125 Drilling Program Report Final Draft.pdf – (Report for BRS bores)

geologic
Stratigraphy metadata.pdf

geomorph
Surface materials metadata.pdf
Landforms metadata.pdf
Vegetation Structure metadata.pdf

satellite
aster processing.pdf
RMC_spot_imagery_flightareas_dm_a4_22jan07.pdf
ssp5_374420_240405.pdf
sp5_374421_240405.pdf

other
DEM.pdf
Generation of floodplain surface.pdf
NSW_LMD Land Use Mapping - metadata.pdf
surface_properties_ASTER.pdf
Vic_Landuse.pdf

\data\shape
aem_no_data – areas within boundaries where there are no AEM flight lines
frame_clip – frame in which some raster datasets were clipped
frame – boundary of the priority area b3
bbn_flightlines – AEM flightlines. These are linked to sections
bbn_irrigation – derived from the NSW and VIC landuse data
bbn_terrace – terrace areas
bbn_uplands – uplands areas
bbn_landuse – landuse data from available sources
surf_prop_aster – surface properties derived from ASTER interpretation

\data\shape\topo_rmc
includes the following themes

canal_lines	flats	lakes
locations	locks	pipelines
populated places	powerlines	railways
reservoirs	roads	sandridges
sands	spot_elevations	watercourse_areas
watercourse_line	waterholes	waterpoint

\GA_MERGED_DEM

This directory contains composite digital elevation model grids for the River Murray Corridor AEM Survey area. The mosaic datasets have a 10 meter horizontal resolution (pixel size) and are stored as raster grids of elevation in meters relative to the Australian Height Datum (AHD).

See “\ga_merged_dem\readme.pdf” for a full description.

\ga_merged_dem\ERMapper_Rasters

ER MAPPER 7.1 format rasters of elevation, stored as 32 bit real numbers. Elevation in meters AHD.

rmc_b_elevation_merge_10m.ers
Elevation for sub area B, which encompasses the AEM survey areas for Nangiloc-Colignan, Liparoo-Robinvale, Robinvale-Boundary Bend, Boundary Bend-Nyah and Speewa.

\ga_merged_dem\ESRI_Grids

ESRI format rasters of elevation, stored as 32 bit real numbers. Elevation in meters AHD.

rmc_b_z_10m
Elevation for sub area B, which encompasses the AEM survey areas for Nangiloc-Colignan, Liparoo-Robinvale, Robinvale-Boundary Bend, Boundary Bend-Nyah and Speewa.

\PRODUCTS

\products\blanchetown_clay

bbn_blanchetown_clay.mxd

bil

b45surf_wt_av_cond_qa_qpc – average conductivity between the surface and the watertable

grid

dp_2top_qpc – depth to the top of Blanchetown Clay derived from floodplain elevation slices and borehole information. Slices deeper than 30m have not been utilised as the boundary between units becomes too tentative

qpc_thick – thickness of Blanchetown Clay also derived from floodplain elevation slices

lith_p02_00 to lith_p20_15 – extent of Blanchetown Clay interpreted from six positive AEM slices

lith_00_04 to lith_12_16 – extent of Blanchetown Clay interpreted from three negative AEM slices

metadata

Blanchetown Clay metadata.pdf
Lithology summary.pdf

\products\conductive_soils

uplands_cond_soils.mxd

bil

cond_soils – derived from floodplain elevation slice 0 to -2m, displays conductive material classified into two groups; <0.15 S/m and > 0.15 S/m

metadata

Conductive soils metadata.pdf

\products\flush_zones
bbn_flushzones_with_sections.mxd

aem_sections
Directory contains four images of AEM sections along selected flight lines (section_lines.shp)

bil

B45_Holistic_floodplain
ERMapper .bil files of the holistic floodplain elevation slices at 5m intervals from +15 to -60m, classified into two groups; Slightly brackish (1000 – 3000 μS/cm) and Fresh (< 1000 μS/cm)

B45_holistic_floodplain_025_050_075_0105
ERMapper .bil files of the holistic floodplain elevation slices at 2 & 5m intervals from +4 to -60m, classified into 4 groups; 0 to 25 mS/m, 25 to 50 mS/m, 50 to 75 mS/m and 75 to 100 mS/m

metadata
Flush_zones metadata.pdf

thickness
flush_thick – thickness (m) of flush zones associated with rivers, standing water bodies and irrigated areas.

\products\gwater_cond
bbn_gwater_conductance.mxd

bil
Directory contains fifteen AEM elevation slices from the surface down to -60m, classified into two groups; Brackish (5000 – 17000 μS/cm) and Saline (>17000 μS/cm)

metadata
Conductive Groundwater Metadata.pdf

shape
Directory contains lithological data from the floodplain elevation slice 0 to -20m. This provides information on the degree of mobility of the salt

\products\near_surf_cond_zone
bbn_near_surf_cond_zone.mxd

bil
b45_surf_wt_avcond02_03_07_gt07 – average conductivity from the surface to the watertable, classified into four groups; <200 mS/m, 200 - 300 mS/m, 300 to 700 mS/m, and >700 mS/m

metadata
Near surface conductive zone metadata.pdf

shape
lith_00_04 – lithology interpreted from the AEM 00 to -04m slice

\products\near_surf_resist_zone
bbn_near_surface_resistive_zone.mxd

bil
b45surf_wt_avcond_035_0105 - classified into two classes; 0 to 35 mS/m and 35 to 105 mS/m

b45surf_wt_avcond_035_0105_0130 - classified into three classes; 0 to 35 mS/m and 35 to 105 mS/m and 105 to 130 mS/m

metadata
Near surface resistive zone metadata.pdf

shape
bbn_irrigation

bbn_recharge – estimated recharge derived from vegetative and geomorphic in mm/year

\products\parilla_sands
bbn_parilla_sands.mxd

bil
Directory contains greyscale floodplain elevation slices, from depths -5 to -40

grid
dp2top_tps – depth to the top of the Loxton Parilla Sands derived from floodplain elevation slices and borehole information. Slices deeper than 30m have not been utilised as the boundary between units becomes too tentative

tps_thick – partial thickness of Loxton Parilla Sands interpreted down to 30m from floodplain elevation slices

lith_p02_00 to lith_p04_02 interpreted from two positive AEM slices

lith_00_04 to lith_20_30 interpreted from six negative AEM slices

metadata
Parilla Sands metadata.pdf

Lithology summary.pdf

Strandlines metadata.pdf

shape
Directory contains Loxton Parilla Sands strandlines from -10 to -40m interpreted from AEM floodplain elevation slices

\products\quaternary_alluvium
bbn_quaternary_alluvium.mxd

bil
Directory contains five floodplain slices from 0 to -15m with log stretch 0.01 to 2

grid
lith_p04_02 to lith_p02_00 – extent of Loxton Parilla Sands interpreted from two positive AEM slices

lith_00_04 to lith_14_16 – extent of Loxton Parilla Sands interpreted from four negative AEM slices qa_thick – thickness of Quaternary alluvium derived from floodplain elevation slices and borehole information.

qac_thick – thickness of Quaternary alluvium clay facies

qas_thick – thickness of Quaternary alluvium sand facies

qdp_thick – thickness of Quaternary alluvium dune deposits

metadata
Quaternary alluvium metadata.pdf
Lithology summary.pdf

\products\recharge
bbn_recharge_elevation_slice.mxd
bbn_vertical_recharge_depth_slice.mxd

bil
Directory contains five AEM depth slices from 0 to -10m and twenty-one AEM floodplain elevation slices from +15 to -60m

metadata
Recharge metadata.pdf

shape
bbn_recharge – recharge interpreted from vegetation and geomorphic data

\products\salt_store
bbn_salt_store.mxd

grid
ave_ tot_ss - average salt store derived from combining b45_ss_sat and b45_ss_unsat

b45_ss_sat - average salt store in the saturated zone 0 -30m below the regional watertable

b45_ss_unsat – average salt store in the unsaturated zone between the present landscape and the regional watertable

sstsat_hazard – sub-surface salinity hazard

metadata
Salt store metadata.pdf

shape
Directory contains two stratigraphic layers interpreted from two AEM floodplain elevation slices 0 to -4m and -4 to -8m

clay_thick_awt – thickness of clay facies above the watertable

sands_thick_awt – thickness of sand facies above the watertable

\products\shepparton_fm
bbn_shepparton_fm.mxd

grid
lith_00_04 to lith_08_12 interpreted from three positive AEM slices

tqs_thick - thickness of Shepparton Formation – derived from floodplain elevation slices and borehole information.

metadata
Shepparton Formation metadata.pdf

\products\strat_unit_extent
bbn_strat_units_and_reliability.mxd

Directory contains eighteen stratigraphic layers interpreted from AEM slices

lith_p20_15 to lith_p2_0 – interpreted from six positive AEM slices above the floodplain

lith_0_4 to lith_20_30 – interpreted from six negative AEM slices below the floodplain

reliability
Directory contains sixteen stratigraphic layers reliability maps, one for each stratigraphic layer

Reliability of strat unit extent interpretation including methods used to map the units. See metadata and methodology notes for more information.

metadata
Combined Stratigraphic Unit, Clays and Sands thickness above the water table metadata.pdf

Reliability and methods for mapping stratigraphic units.pdf

\products\surface_salt
bbn_surface_salt.mxd

arc_grid
Surface salinity is derived from AEM, vegetation and geomorphic layers

surf_salt – surface salinity

ssalt_hazard – surface salinity hazard

metadata
Surface salt metadata.pdf

photos
Photos relating to surface salt map are linked via surf_salt_sites_b4

\products\veg_ health
bbn_veg_health.mxd

grid
bbs_ndvi_06 – ndvi grid for 2006
bbs_ndvi_96 – ndvi grid for 1996
bbs_ndvi_diff – difference of the ndvi grids for the years 2006 and 1996

image
Mosaic_06_green_96_red_ndvi_diff_BB_N_S.tif - image of change detection between two NDVIs (1996 and 2006) to show a ten year difference in vegetation health (vigour) on the floodplain.

metadata
Vegetation health metadata.pdf
NDVI difference metadata.pdf

\products\woorien_fm
bbn_woorinen_fm.mxd

grid
llith_p20_15 to lith_p0_2 interpreted from six positive AEM slices

qdw_thick - thickness of Woorinen Formation – derived from floodplain elevation slices and borehole information.

metadata
Woorinen Formation metadata.pdf

\REPORT

\report\atlas
This directory contains the A2 size atlas divided into two parts - east and west

\report\geomorphology
This directory contains the geomorphology report and appendices where applicable.

\report\methodology
This directory contains the methodology report.

Appendix 1. River Murray Corridor RESOLVE AEM Survey Holistic Inversion Data

Introduction

This document describes the contents of the data directories containing conductivity model data derived from a holistic inversion of the River Murray Corridor RESOLVE AEM survey data. The conductivity model datasets are:

- grids of conductivity model layers output from the inversion; the layers are relative to ground surface (sub-folder: layers)
- grids of depth slices of regular thicknesses generated from the layers; the depth slices are relative to natural surface (sub-folder: slices_depth)
- grids of depth slices relative to a smooth surface that approximates the River Murray floodplain (sub-folder: slices_floodplain)
- grids of depth slices relative to a smooth surface that approximates the regional water table (sub-folder: slices_watertable)

The disk also contains:

- Explanatory document (this document)
- Grids of the floodplain used as the reference for the grids in the sub-folder: grids_depth_slice (subfolder: floodplain_ elevation).

Note that the basic (response) data are in a separate product which is distributed by Geoscience Australia.

Brief details of inversion

The holistic inversion methodology used to generate the conductivity model data is described in:

> Brodie, R. & Sambridge, M., 2006, *A holistic approach to inversion of frequency-domain airborne EM data*, Geophysics, 71, 6, G301 – G312.

Fundamentally, the holistic inversion algorithm solves for the coefficients of the nodes on 18 separate 2-D bi-cubic B-spline meshes. Each spline mesh corresponds to a layer in the 18-layer conductivity model. The nodes of the meshes were located on 100m x 100m centres. Since the coefficients of the spline nodes (which are analogous to the coefficients a, b and c in the polynomial function $f(x) = ax^2 + bx + c$) are abstract mathematical quantities and generally not that useful to most end users, the holistic inversion algorithm outputted the data on a series of 40m x 40m layer conductivity grids. This was achieved by evaluating the splines at the centre of the output grids' cells (which is analogous to computing the value of f(x) for a given value of x). Once the layer grids were constructed several additional products were also derived. These are described in Sections 6 to 9.

Sub-areas

The survey (summary of acquisition is in Appendix 2) was flown in eight different sub-blocks: A1, A2, B1, B2, B3, B4, B5, and C. (See Figure 1 for their geographic locations, and Appendix 3 for some informal names for them that may appear in documents about the survey and its interpretation.) However the holistic inversion on the survey data was carried out on five separate sub-blocks (AWEST, AEAST, B123, B45 and C) as shown in Figure 1.

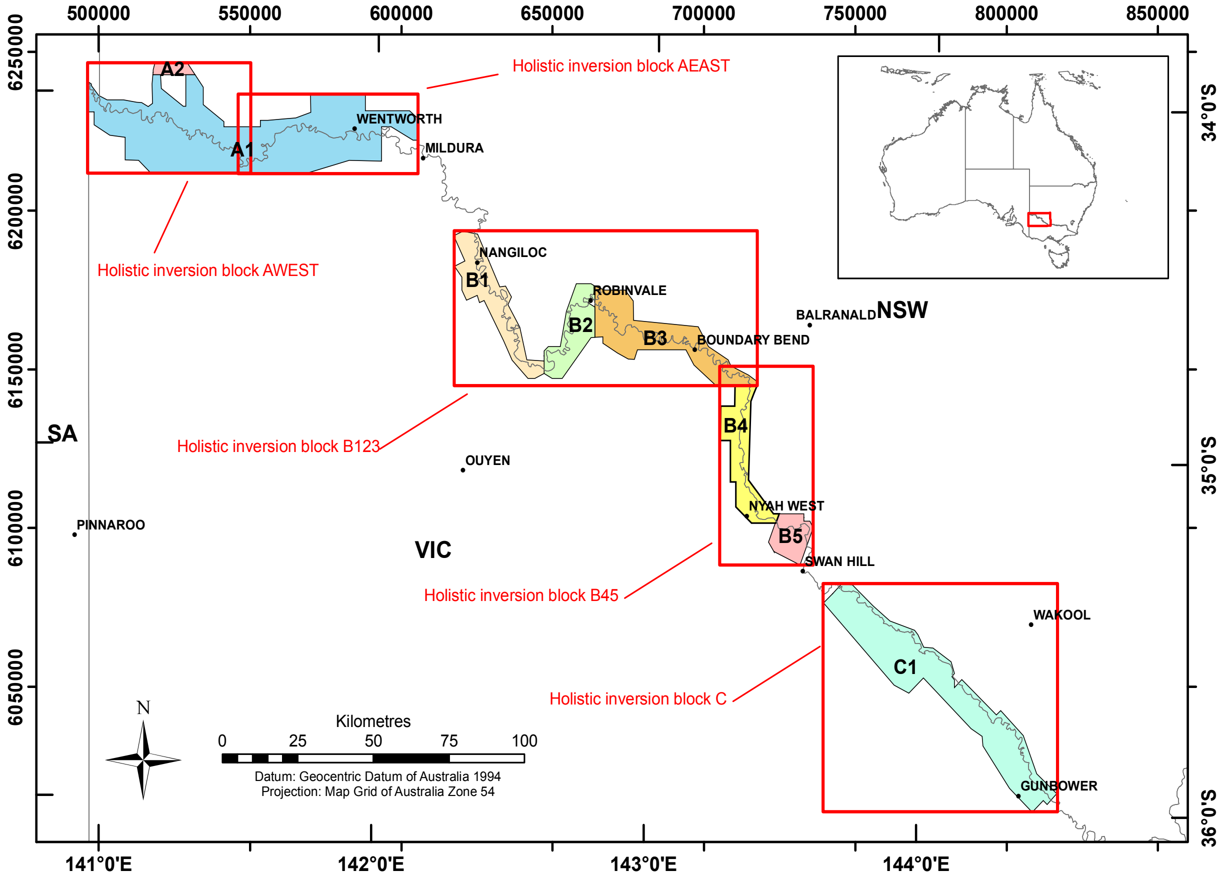

Figure 1. Locality map showing the extent of different data acquisition sub-blocks and the holistic inversion sub-blocks.

Layer conductivity grids (sub-folder: layers)

The layer conductivity grids represent the conductivity in siemens per metre (S/m) of each layer of the 18 layer conductivity model. They have been derived by direct evaluation of the fundamental holistic inversion spline mesh functions at the grid cell centres as described in Section 2. There are always 18 layers in the model and the thickness of each layer is constant over the whole survey area. The layer thicknesses and depth extents are shown in Table 1. All depths are relative to the natural surface.

Table 1. Layer thicknesses and depth extents

Layer number	Thickness (m)	Depth to top (m)	Depth to bottom (m)	Conductivity grid filename
01	2.00	0.00	2.00	layer_01.ers
02	2.20	2.00	4.20	layer_02.ers
03	2.42	4.20	6.62	layer_03.ers
04	2.66	6.62	9.28	layer_04.ers
05	2.93	9.28	12.21	layer_05.ers
06	3.22	12.21	15.43	layer_06.ers
07	3.54	15.43	18.97	layer_07.ers
08	3.90	18.97	22.87	layer_08.ers
09	4.29	22.87	27.16	layer_09.ers
10	4.72	27.16	31.87	layer_10.ers
11	5.19	31.87	37.06	layer_11.ers
12	5.71	37.06	42.77	layer_12.ers
13	6.28	42.77	49.05	layer_13.ers
14	6.90	49.05	55.95	layer_14.ers
15	7.59	55.95	63.54	layer_15.ers
16	8.35	63.54	71.90	layer_16.ers
17	9.19	71.90	81.09	layer_17.ers
18	∞	81.09	∞	layer_18.ers

The grids are stored in ER Mapper binary floating point raster grid format (IEEE 4 byte reals) with an associated header (.ers) file. The folder and file naming convention for the binary grid and header is as follows:

aa\layers\layer_nn.ers (header file),

aa\layers\layer_nn (binary grid file),

where aa represents the holistic inversion sub-block name (e.g., b123) and nn represents the layer number.

Depth slice grids (sub-folder: slices_depth)

The depth slice grids represent the average conductivity in S/m of various regular intervals (Table 2). They have been derived from the layer conductivity grids by a weighted average of the layers that intersect the depth interval. For example a slice between 5m and 10m depth would be constructed as follows;

(1.62×layer 3 conductivity + 2.66×layer 4 conductivity + 0.72×layer 5 conductivity)/5.0

The grids are stored in ER Mapper binary floating point raster grid format (IEEE 4 byte reals) with an associated header (.ers) file. The folder and file naming convention for the binary grid and header is as follows:

aa\slices_depth\depth_slice_dt_db.ers (header file),

aa\slices_depth\depth_slice_dt_db (binary grid file),

where aa represents the holistic inversion sub-block name (e.g., b123) and dt and db represent the depth to the top and bottom of the interval respectively. The depth slice intervals are shown in Table 2.

Table 2. Depth slice intervals

Depth to top (m)	Depth to bottom (m)	Conductivity grid filename
0	2	depth_slice_00_02.ers
0	5	depth_slice_00_05.ers
0	10	depth_slice_00_10.ers
2	5	depth_slice_02_05.ers
5	10	depth_slice_05_10.ers
10	15	depth_slice_10_15.ers
15	20	depth_slice_15_20.ers
20	25	depth_slice_20_25.ers
25	30	depth_slice_25_30.ers
30	35	depth_slice_30_35.ers
35	40	depth_slice_35_40.ers
40	45	depth_slice_40_45.ers
45	50	depth_slice_45_50.ers
50	55	depth_slice_50_55.ers
55	60	depth_slice_55_60.ers

Floodplain slice grids (sub-folder: slices_floodplain)

The floodplain slice grids represent the average conductivity in S/m of various intervals relative to the elevation above or below a smooth surface that approximates the River Murray floodplain. They are not slices that follow a certain depth extent, but are relative to the gentle upstream/downstream incline/decline of the river and floodplain. This smooth floodplain surface was generated by gridding (then extrapolating and smoothing) elevation data that lay inside polygons, that from an independent geomorphic interpretation had been interpreted to represent the recent floodplain sediments of the River Murray.

The slices have been derived from the layer conductivity grids by a weighted average of the layers that intersect the interval. To do this it was necessary to use a different weighting for each grid cell depending on the actual surface elevation and the smooth floodplain surface elevation at that cell.

The grids are stored in ER Mapper binary floating point raster grid format (IEEE 4 byte reals) with and associated header (.ers) file. The folder and file naming convention for the binary grid and header is as follows:

aa\slices_floodplain\floodplainslice_bbb_ttt.ers (header file),

aa\slices_floodplain\floodplainslice_bbb_ttt (binary grid file),

where aa represents the holistic inversion sub-block name (e.g., b123) and bbb and ttt represent the distance from the smooth floodplain surface to the bottom and top of the interval respectively. Positive values of bbb or ttt mean that the the interval is above the floodplain surface and negative values mean that the the interval is below the floodplain surface The floodplain slice intervals are shown in Table 3.

Note that in the upper (+ve) floodplain slices many of the cells in the grid will be set to the null (missing) value because at that cell the slice will be entirely above ground surface. For some sub-blocks, the upper slices are above the ground surface everywhere on the grid (all values are set to null) and accordingly have not been included in the dataset.

The floodplain surface, which is the elevation datum for the slices, is in the folder floodplain_elevation.

The floodplain slice grids are stored in ER Mapper binary floating point raster grid format (IEEE 4 byte reals) with and associated header (.ers) file. The file naming convention for the binary grids are shown in Table 3.

Table 3. Floodplain slice intervals

Distance from smooth floodplain surface to bottom of interval (m)	Distance from smooth floodplain surface to top of interval (m)	Conductivity grid filename
+40	+35	floodplainslice_+40_+35.ers
+35	+25	floodplainslice_+35_+25.ers
+30	+20	floodplainslice_+30_+20.ers
+25	+20	floodplainslice_+25_+20.ers
+20	+15	floodplainslice_+20_+15.ers
+15	+10	floodplainslice_+15_+10.ers
+10	+05	floodplainslice_+10_+05.ers
+06	+04	floodplainslice_+06_+04.ers
+05	+00	floodplainslice_+05_+00.ers
+04	+02	floodplainslice_+04_+02.ers
+02	+00	floodplainslice_+02_+00.ers
+00	-05	floodplainslice_+00_-05.ers
+00	-02	floodplainslice_+00_-02.ers
-02	-04	floodplainslice_-02_-04.ers
-04	-06	floodplainslice_-04_-06.ers
-05	-10	floodplainslice_-05_-10.ers
-06	-08	floodplainslice_-06_-08.ers
-08	-10	floodplainslice_-08_-10.ers
-10	-12	floodplainslice_-10_-12.ers
-10	-15	floodplainslice_-10_-15.ers
-12	-14	floodplainslice_-12_-14.ers
-14	-16	floodplainslice_-14_-16.ers
-15	-20	floodplainslice_-15_-20.ers
-16	-18	floodplainslice_-16_-18.ers
-18	-20	floodplainslice_-18_-20.ers
-20	-25	floodplainslice_-20_-25.ers
-25	-30	floodplainslice_-25_-30.ers
-30	-35	floodplainslice_-30_-35.ers
-35	-40	floodplainslice_-35_-40.ers
-40	-45	floodplainslice_-40_-45.ers
-45	-50	floodplainslice_-45_-50.ers
-50	-55	floodplainslice_-50_-55.ers
-55	-60	floodplainslice_-55_-60.ers

Watertable slice grids (sub-folder: slices_watertable)

The watertable slice grids represent the average conductivity in S/m of various intervals relative to the elevation above or below a smooth surface that approximates the regional watertable. They are not slices that follow a certain depth extent, but are relative to the gentle upstream/downstream incline/decline of the watertable. This watertable surface was generated by gridding (then extrapolating and smoothing) watertable data from bores and river height data.

Table 4 lists and describes the watertable slice grids.

Table 4. Floodplain slice intervals

Conductivity grid filename	Description
floodplain_watertable_averageconductivity.ers	Average conductivity (S/m) of the variable thickness interval between the generalised floodplain surface and the watertable surface. Calculated by a weighted average of the layer conductivity grids.
floodplain_watertable_conductance.ers	Total conductance (S) of the variable thickness interval between the generalised floodplain surface and the watertable surface.
floodplain_watertable_thickness.ers	Thickness (m) of the variable thickness interval between the generalised floodplain surface and the watertable surface.
surface_watertable_averageconductivity.ers	Average conductivity (S/m) of the variable thickness interval between natural surface and the watertable. Calculated by a weighted average of the layer conductivity grids.
surface_watertable_conductance.ers	Total conductance (S) of the variable thickness interval between natural surface and the watertable.
surface_watertable_thickness.ers	Thickness in metres (m) of the variable thickness interval between natural surface and the watertable.
watertableslice_+00_-05.ers	Average conductivity (S/m) from 0 to 5 meters below the watertable surface. Calculated by a weighted average of the layer conductivity grids.
watertableslice_+00_-30.ers	Average conductivity (S/m) from 0 to 30 meters below the watertable surface. Calculated by a weighted average of the layer conductivity grids.

Appendix 2. AEM survey details

System:	RESOLVE
Contractor:	Fugro Airborne Surveys
Data sampled:	Frequency domain electromagnetics Magnetics Elevation model
Total distance flown:	24 069 km
Nominal flying height:	Helicopter – 60 m Bird – 30 m
Survey period:	February – May 2008

Line, tie spacings and directions:

Block	*Line spacing (m)*	*Line direction (º grid)*	*Tie spacing (m)*	*Tie direction (º grid)*
A1	200	0	2 000	90
A2	200	90	2 000	0
B1	200	65	2 000	155
B2	200	120	2 000	30
B3	200	0	2 000	90
B4	200	90	2 000	0
B5	200	20	2 000	110
C1	250	45	2 500	135

Appendix 3. Informal geographic names of survey areas

Block	*Typical informal name*
A1	Lindsay – Walpolla – Darling Anabranch
A2	North Lake Victoria
B1	Nangiloc – Colignan
B2	Liparoo – Robinvale
B3	Robinvale – Boundary Bend
B4	Boundary Bend – Nyah
B5	Speewa
C1	Barr Creek – Gunbower