

APPENDIX 9. BORTOLO RADIATION SURVEY

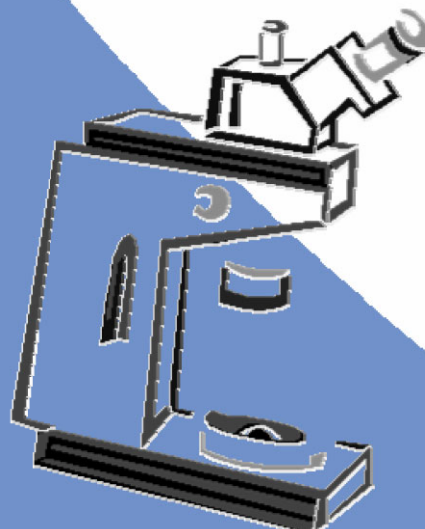


**Surface Gamma Radiation
Survey of Site 2
(sand stock)
of the Sand Quarry Site,
Cabbage Tree Road,
Williamtown, NSW**

27 July 2020

**Bartolo Safety
Management Service**

Laboratory, Radiation and
Dangerous Goods Consultant



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Survey of Site 2
(sand stock)
of the Sand Quarry Site,
Cabbage Tree Road, Williamtown,
NSW**

July 2020


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Signed: 

Date: ...27th July, 2020.

Reviewer:

Signed:

Date:

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1.0 Introduction

Glossary

ARPANSA – Australian Radiation Protection Nuclear Science Agency

Becquerel – the SI unit for radioactive activity is defined as the number of disintegrations per second

EPA – Environmental Protection Agency

Gray – is the SI unit of absorbed dose). It is defined as an energy deposition of one joule per kilogram.

NORM – Naturally Occurring Radioactive Material

Sievert – is the SI unit of equivalent dose. Dose equivalent remains, by definition, the absorbed dose multiplied by the quality factor, Q.

TENORM – Technically Enhanced Naturally Occurring Radioactive Material

1.1 Site Description

The site (see Appendix 1), Cabbage Tree Road site Williamstown, has been partly sand mined and is generally an undulating site with some low lying areas that have creeks and ponds.

The area Under consideration is deemed as Stage 2 and is an area of sand dune that will be used as commercial sand. The majority of the vegetation (undergrowth) has been removed prior to the survey.

The site has a total area of approx. 2ha and the survey measurements were taken on 22nd July 2020.

Additionally, there has been some import in the past of crushed ironstone, crushed feldspar and ironstone river pebble to form the access roads, etc.

1.2 Purpose

The purpose of this project is to determine if there is any remaining deposits of heavy mineral sands and their associated radioactivity, either left as not being mined or due to man's activities such as stock-piling and vehicle wash-downs.

1.3 Scope

The scope of the work being undertaken by Bartolo Safety Management Service is the Geotechnic Surface Gamma Radiation Survey (where the terrain and vegetation permits). Any situations elucidated during the survey will not be part of this work.

Radiological exposure of non-human species was not included within the scope of this assessment, nor was assessment of non-radiological contaminants.

1.4 Information and Reference Material

General

Natural radionuclide content in soil can vary significantly as evidenced by the following ranges of global median values: 16-110 Bq/kg for uranium-238, 11-64 Bq/kg for thorium-232 and 140-850 Bq/kg for potassium-40[3]. Mineral sands can have enhanced concentrations of the naturally occurring radionuclides uranium-238 and thorium-232, as well as their associated decay progeny, which can result in elevated terrestrial air kerma rates. In-situ processing of mineral sands typically separates sands of varying mineralogy by mass, magnetic and electrostatic properties; the main constituents include rutile, ilmenite, zircon, garnet and monazite. A dataset of uranium-238 and thorium-232 concentrations in heavy mineral sands is listed in Table 1.

TABLE 1: Typical specific activity concentrations of uranium and thorium in commercially available South East Queensland mineral sands (adapted from Johnston, 1988)^[4].

MINERAL PRODUCT	Uranium-238 (Bq/kg)	Thorium-232 (Bq/kg)
Rutile	560 ± 50	70 ± 15
Ilmenite	50 ± 20	64 ± 20
Zircon	3900 ± 300	620 ± 30
Monazite	21000 ± 2000	147000 ± 1900

(Note: while the radiation dose units in the different State regulations are variously quoted in μSv (microsievert) or μGy (microgray) these units are identical for gamma radiation in this situation)

The results of the radiation survey are compared to the limits as set in the following:

A surface radiation survey, as described in EPA Guideline 12 (see below), was conducted to better define radiation levels over the site. There is no justification under **Guideline 12** and **International Commission on Radiation Protection** guidelines for further investigation methods such as sub-surface bore and soil measurements. The process of accurate boring and bore radiation measurements is relatively expensive, with only a very few companies/authorities in Australia doing such work.

The International Commission on Radiological Protection (ICRP) recommendations

The ICRP, an independent international body, recommends upper limits on acceptable radiation dose to occupationally exposed workers (20mSv/yr averaged over 5 years) and members of the public (1mSv/yr). These limits are accepted throughout the world and used as the basis of national laws and regulations. The most recent recommendations were published in 1991 (ICRP 1991) and have been reconfirmed in 2007 (ICRP 103).

This publication introduced a new concept that is relevant to this site; the concept of “intervention”. Intervention applies to situations, such as abandoned contaminated sites, where “the sources of exposure and the exposure pathways are already present and the only type of action available is intervention”.

These ICRP recommendations have been adopted by the National Health and Medical Research Council (NHMRC 1995) [now controlled by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)] for use in Australia. ARPANSA has also updated and/or released a number of documents such as RPS 9 *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste management in Mining and Mineral Processing (2005)*, and RPS 15 *Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM) (2008)*. The relevant Commonwealth and State laws and Codes of Practice in turn adopt the NHMRC/ARPANSA recommendations but not all ARPANSA codes have yet been gazetted/mandated or included in the legislation at this time.

New South Wales

NSW Radiation Control Branch Radiation Safety Information Series No 12: ***Clean-up and Disposal of Radioactive Residues from Commercial Operations Involving Mineral Sands.***

This document is based on the 1984 recommendations of the NHMRC and so does not necessarily reflect current international recommendations or limits/constraints. It is also only aimed at active sand mining sites, not “out of control” situations (out of control meaning that the plant and/or company are no longer operational). The limits set in this document do not correlate with current ICRP and National radiation limits. The Radiation Branch of the NSW EPA, however, has not yet produced a revised version, nor does it include reference to the latest relevant ARPANSA Codes.

Action levels are set:

- For high occupancy areas such as dwellings, schools (including playground), businesses factories etc. where occupancies by the same individuals occur regularly on a day by day basis, the remedial action level should be 0.7 $\mu\text{Gy/hr}$ (700 nGy/hr) at 1 m above the ground.
- For intermediate occupancy areas where occupancies are for a few hours per week by the same individuals or by differing individuals and for garden areas, the remedial action level should be 1.0 $\mu\text{Gy/hr}$ (1000 nGy/hr) at 1 m above the ground.
- For roads paths, and other areas with intermittent occupancy the remedial action level should be 2.5 $\mu\text{Gy/hr}$ (2500 nGy/hr) at 1 m above the ground.

Other States

Queensland

Queensland Health Policy Document: Radiation Dose Levels for Properties where Mineral Sand Residues are Deposited on the Ground

This document is of relevance because it was written in 1995 and incorporates the more recent ICRP concept of “intervention”. For some of its recommendations, however, it still refers back to a 1984 NHMRC document.

For practices under control, where technically enhanced radiation sources (TENORM) of mineral sands are deposited on the ground the limits are:

- 0.1 $\mu\text{Sv/hr}$ above the natural background level for dwellings, schools, etc. and
- 0.2 $\mu\text{Sv/hr}$ above the natural background level for parks etc.

Assuming a background level of 0.1 $\mu\text{Sv/hr}$, the action levels for dwellings, schools, etc. would be 0.2 $\mu\text{Sv/hr}$ and for parks etc. would be 0.3 $\mu\text{Sv/hr}$. Practices under control refer to situations where the mining company is still operating and has responsibility for the land in question.

For an “out of control” practice (i.e. an intervention situation), where the mining company is not still operating and has no responsibility for the land in question, the action levels including background are:

- for dwellings, schools etc., 0.6 $\mu\text{Sv/hr}$ (600 nGy/hr),
- for parks etc., 1.0 $\mu\text{Sv/hr}$ (1000 nGy/hr) and
- for roads and footpaths, 2.5 $\mu\text{Sv/hr}$ (2500 nGy/hr).

Western Australia

Radiation Health Branch of WA Mines Department Guidelines

The Radiation Health Branch of the West Australian Mines Department set (in 1988) Guidelines for remedial action in areas of enhanced background gamma radiation levels. The action level criteria are:

- for dwellings, 0.46 $\mu\text{Gy/hr}$,
- for schools, 0.57 $\mu\text{Gy/hr}$,

- for other areas, 0.7 $\mu\text{Gy/hr}$, and
- for roads, paths etc, 2.5 $\mu\text{Gy/hr}$.

2.0 Historic Aspects

This land has been sand mined in an unusual pattern, probably following a natural depressions where the heavy mineral sands would accumulate due to transport mechanisms such as water run-off and wind erosion.

The land does not appear to have been developed since the mining, other than a little sand quarrying.

3.0 Instruments and Measurement Technique

3.1 Instruments

- SAIC Exploranium Model No.: GR130 Serial No.: 9940+GM Gamma ray survey (calibration conducted in May/June 2020 [see attached sheets Appendix 4] and confirmed on the day by use of an educational Thorium Standard and stabilized using a Cs-137 source);
- As a confirmation of any “high” counts a Radiation Alert “Inspector” (Calibrated May/June 2020 - see Appendix 5), also used with the wipe test plate for any required soil analysis ;
- a Magellan eXplorist 110 GPS unit.

The SAIC equipment measures in Counts per Second, and hence measurements need to be converted to dose rate for comparison with the NSW Guidelines and other documents. To do this the following formula, which is based and derived from the data supplied with the calibration certificates, is used:

$$y = 0.9628x - 2E-13$$

$$R^2 = 1$$

Where:

y – is dose rate in nGy/hr

x – is counts per second

3.2 Measurement Techniques

Surface Measurements

The proposal was to measure at approximately 15 metre grid transect using the GPS for tracking of the measurement transects and any other deviations and paths. This whole approach was dependent on the conditions (vegetation, radiation activity, topography, obstructions, and structures), Work health and Safety (WHS) Risk Assessment and as such the measurement transect pattern varied slightly taking the Risk Assessment into consideration as the procedure progressed. This modification “on-the-run” would continually consider the necessity of accurate and

reliable data, and the need for sufficient measurements to capture substantial contamination zones.

The transect patterns that were finalized “on-the-run” are displayed in the Appendix (Appendix 2).

The measurement process is to trek the transect line with the instrument above the ground at about the 1 metre level. Measurements were noted when the auditory level of the instrument changed. Any “high” measurements were defined by moving about the area to determine the limit of the contamination and the highest level. The measurements would then be confirmed by using the RadAlert instrument.

The SAIC Exploranium is set up to record the measurements every two seconds in unique data sets as determined by when the measurement activity is terminated. Two second measurement intervals would equate to approximately 3 metres of normal walking ***over an easy walking surface***. Once the work or area under consideration is completed the Exploranium is then attached to a computer and the data downloaded as a CSV file for assessment and manipulation.

NOTE: the measurements as displayed in the relevant appendices **do not** indicate a length of transect but rather in this situation the time and thus difficulty of progress across the terrain.

The information contained in the header of the first column of the results is the following for example:

Using the Perimeter Transect the header is:

1 20:07:22 09:46:44 cps Live time (s) 2.00

- The first number is the data set number (hence this is data set 1 for this site)
- The second set 20:07:22 is the date – 22 July 2020
- The third set 09:46:44 is the time – is 9.46.44 AM
- The fourth set of information is cps indicating that the results are in Counts Per Second
- The last piece of information is Live Time (s) 2.00 which means that the measurement and data record is set at 2 second intervals.

Cosmic Radiation Component

The cosmic radiation component of natural background is latitude, longitude and altitude dependent; and has been calculated using United States Federal Aviation Administration Civil Aerospace Medical Institute software 'CARI-6'. The mean cosmic surface air kerma rate for May 2019 (there is a 6 week delay in world heliocentric potential calculation) was 41 nGy/h (0.041 μ Sv/h) at 32 48 S, 151 48 E, elevation of 25 m, using a dose conversion factor of 1Sv/Gy.

This does not however take into account such things as heavy cloud, rain and dense vegetation canopy which acts as shielding.

The results in the relevant Appendices have not been adjusted by the reduction of the measurements by the 0.041 μ Sv/h factor and this has been incorporated in the data contained in column 3 of the data sets of the relevant appendices.

Work, Health and Safety Risk Assessment

As this work is being conducted in a "remote" location and that there are various risks associated with this type of work (such as slips, trips and falls, snake/spider/tick/insect bites, cuts and abrasions due to vegetation, allergy reactions to plants and other things, and falling limbs and branches) then a risk assessment is required and that this risk assessment is "living" whilst the work is being conducted. The risk assessment is detailed in Appendix 3.

As the risk for some of the hazards are medium and high then the approach BSMS will conduct during the transect measurements will be to change the transects as needed to avoid or minimise such risks.

4.0 Survey Results

4.1 General

All measurements were completed on the 22nd July 2020, and the results for the transects showed results that in general were not of concern in terms of radiation.

As can be seen from the results the dose range was from 0.0 to 0.10 $\mu\text{Sv/h}$, which is well below the 0.7 $\mu\text{Sv/h}$ limit for residential use. Hence there would be no radiological concerns for this area or from the sand for commercial use..

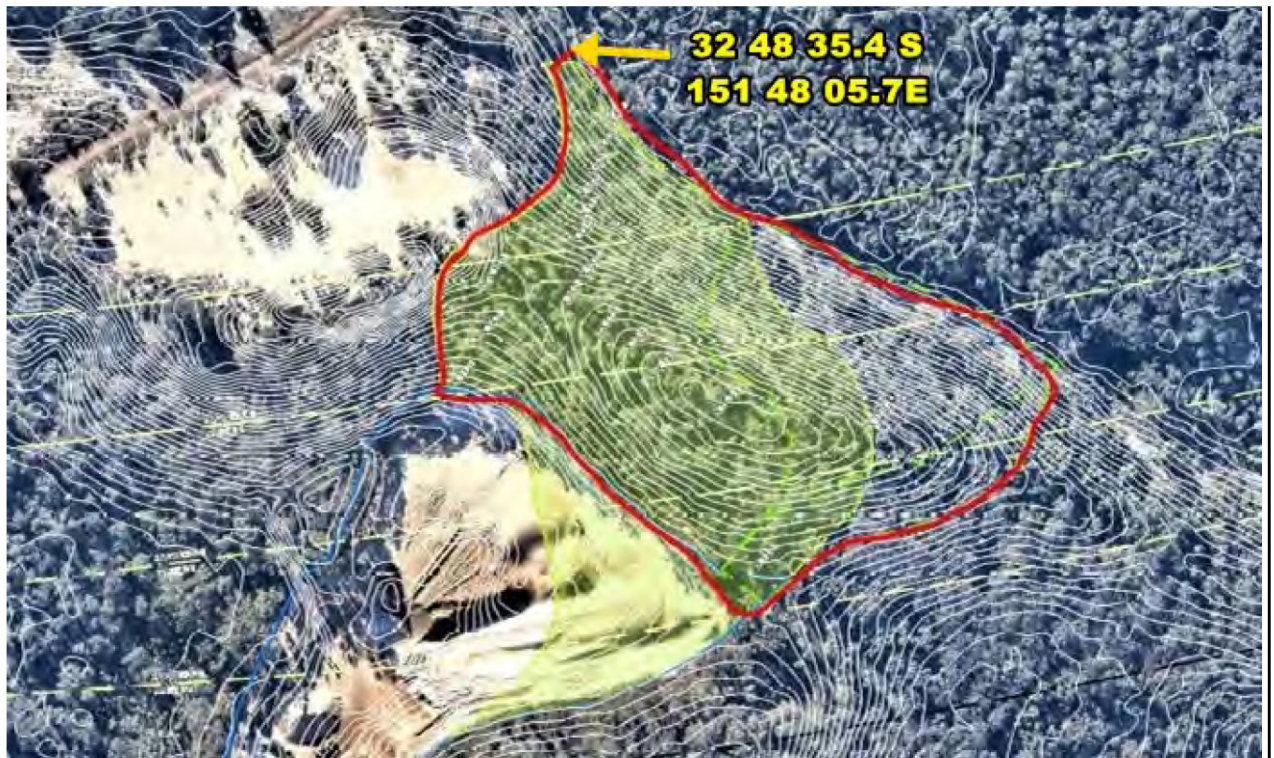
5.0 Discussion

On examining the results of the surface gamma radiation survey there are no radioactive concentrations or activities that are of any concern for the proposed use of the land/sand. All locations are below the level of 0.7 $\mu\text{Sv/hr}$ set by the NSW Guideline for residential use. BSMS observation of an exploratory dig site during the survey had characteristics that would indicate no accumulations of heavy mineral sands (based on Mr Bartolo's experience).

The results, even when compared to the most restrictive of the guidelines/legislation (WA in this instance), indicate that none of the results would reach the level of 0.46 $\mu\text{Gy/hr}$ for dwellings (note 0.46 $\mu\text{Gy/hr}$ is equivalent to 0.46 $\mu\text{Sv/hr}$ in this situation; conversion factor of 1:1). As such there is no need for any remedial action, intervention or concern for the use of the sand for commercial activities.

References

- ICRP 2007. Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Elsevier 2007.
- NSW Dept of Health. Guidelines for the Clean-up and Disposal of Radioactive Residues from Commercial operations Involving Mineral Sands 1984. Available from NSW DECC (EPA).
- Qld Health Department. Radiation Dose Levels For Properties Where Mineral Sand Residues Are Deposited On The Ground. 1995
- ARPANSA RPS 9 *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste management in Mining and Mineral Processing (2005)*
- ARPANSA RPS 15 *Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM) (2008)*.
- FAA's Civil Aerospace Medical Institute Radiobiology Research Team, *CARI-6*, 2004, United States of America Federal Aviation Administration. p. Computer Freeware.

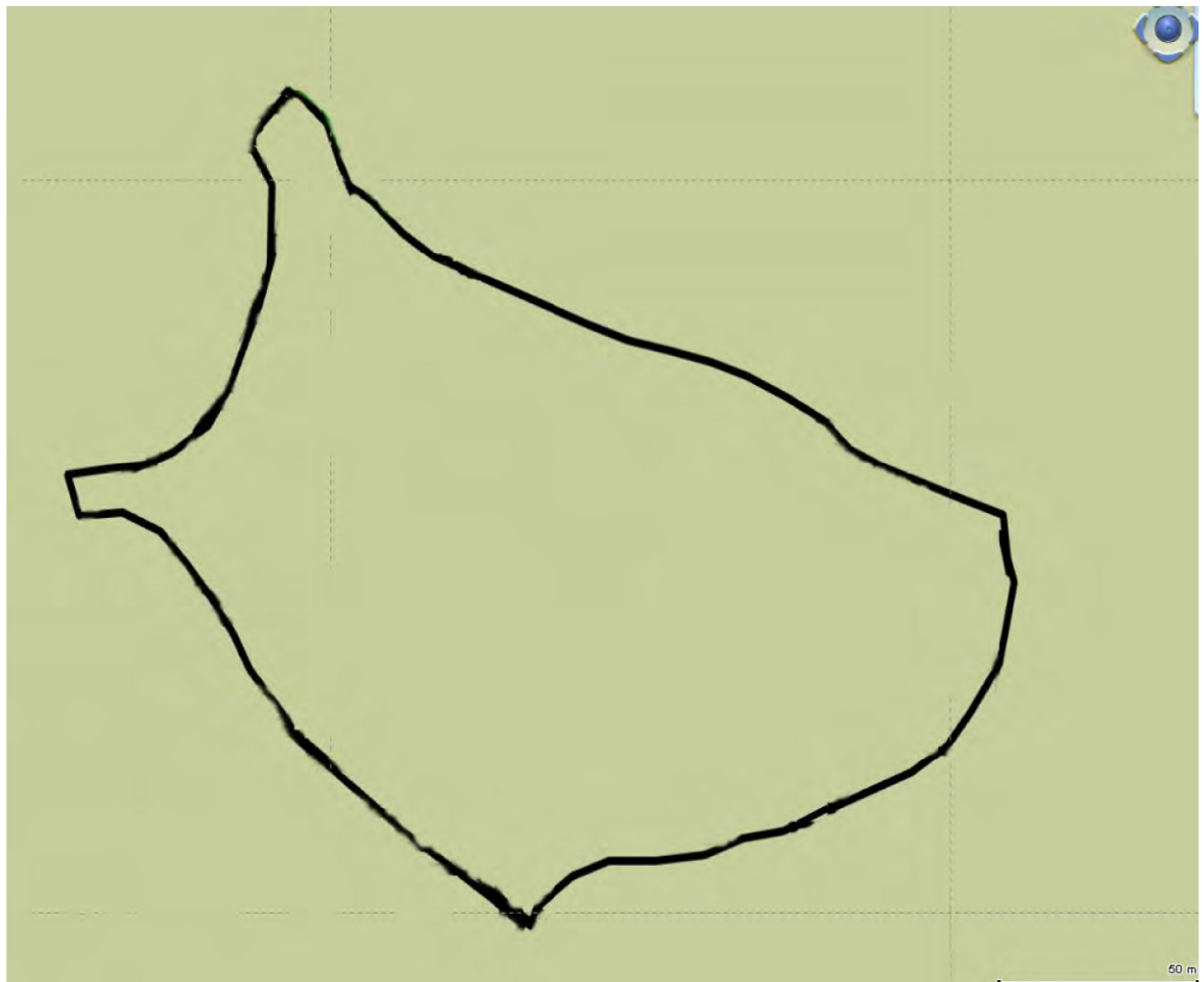


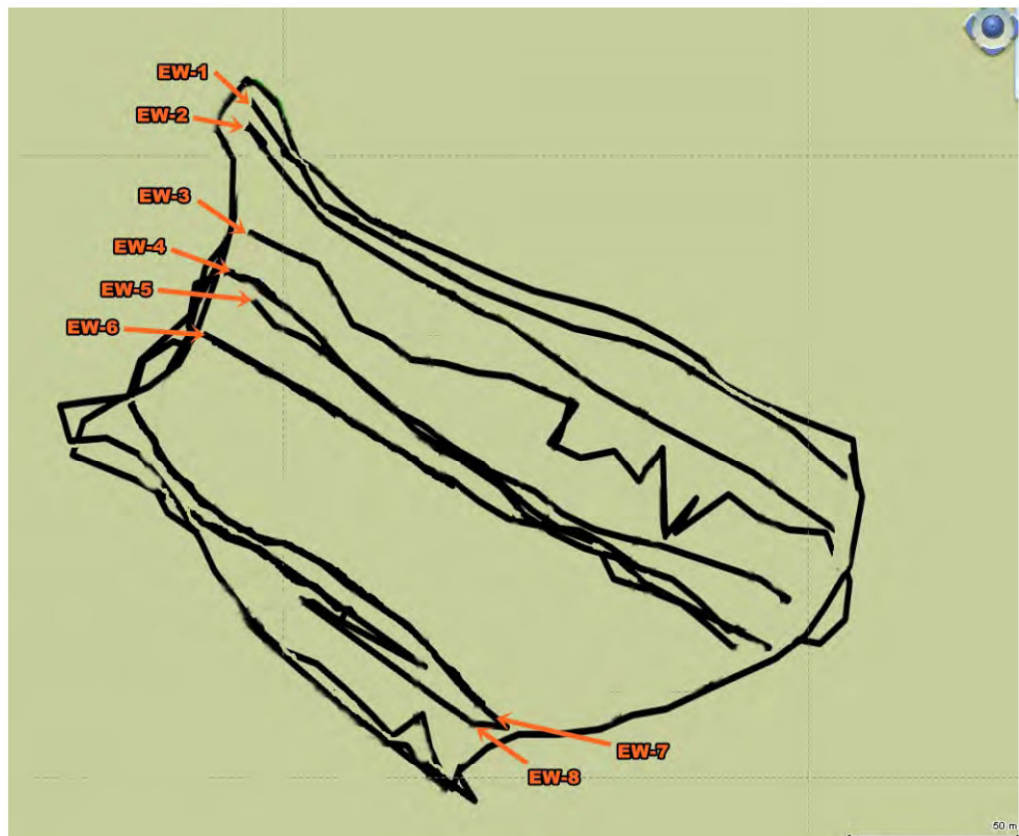
APPENDIX 2 Transect Tracks & Surface Gamma radiation Results

Measurement Transects

Note: *BSMS GPS instrument is a pocket instrument with an accuracy of $\pm 2-4$ metres, and as such the displayed transects recorded by the instrument may only be a general representation of the transects. Also the terrain (line of site) gave some limitations in the accuracy of following a planned transect.*

Note: *The scale at the bottom right of the images represents 50m.*





Transect Measurement Results

(Boundary - Perimeter)

1 20:07:22
09:46:44 cps

Live time (s)	cps to micro Sv/h	solar corrected
2.00		
68	0.07	0.02
68	0.07	0.02
62	0.06	0.02
57	0.05	0.01
65	0.06	0.02
69	0.07	0.03
63	0.06	0.02
61	0.06	0.02
56	0.05	0.01
57	0.05	0.01
58	0.06	0.01
60	0.06	0.02
59	0.06	0.02
43	0.04	0.00
33	0.03	0.00
31	0.03	0.00
41	0.04	0.00
33	0.03	0.00
34	0.03	0.00
37	0.04	0.00
37	0.04	0.00
35	0.03	0.00
32	0.03	0.00
45	0.04	0.00
29	0.03	0.00
37	0.04	0.00
45	0.04	0.00
34	0.03	0.00
37	0.04	0.00
35	0.03	0.00
45	0.04	0.00
38	0.04	0.00
39	0.04	0.00
36	0.03	0.00
36	0.03	0.00
30	0.03	0.00
35	0.03	0.00
39	0.04	0.00
31	0.03	0.00
44	0.04	0.00
33	0.03	0.00
45	0.04	0.00
40	0.04	0.00

35	0.03	0.00
38	0.04	0.00
30	0.03	0.00
40	0.04	0.00
38	0.04	0.00
34	0.03	0.00
37	0.04	0.00
33	0.03	0.00
35	0.03	0.00
34	0.03	0.00
35	0.03	0.00
33	0.03	0.00
34	0.03	0.00
30	0.03	0.00
46	0.04	0.00
35	0.03	0.00
28	0.03	0.00
38	0.04	0.00
31	0.03	0.00
38	0.04	0.00
35	0.03	0.00
43	0.04	0.00
27	0.03	0.00
36	0.03	0.00
36	0.03	0.00
38	0.04	0.00
36	0.03	0.00
44	0.04	0.00
44	0.04	0.00
36	0.03	0.00
37	0.04	0.00
40	0.04	0.00
33	0.03	0.00
42	0.04	0.00
41	0.04	0.00
40	0.04	0.00
48	0.05	0.01
40	0.04	0.00
38	0.04	0.00
38	0.04	0.00
36	0.03	0.00
44	0.04	0.00
36	0.03	0.00
35	0.03	0.00
37	0.04	0.00
39	0.04	0.00
34	0.03	0.00
42	0.04	0.00
41	0.04	0.00
39	0.04	0.00

35	0.03	0.00	50	0.05	0.01
43	0.04	0.00	45	0.04	0.00
37	0.04	0.00	42	0.04	0.00
40	0.04	0.00	41	0.04	0.00
33	0.03	0.00	49	0.05	0.01
36	0.03	0.00	34	0.03	0.00
40	0.04	0.00	42	0.04	0.00
34	0.03	0.00	41	0.04	0.00
37	0.04	0.00	46	0.04	0.00
39	0.04	0.00	42	0.04	0.00
37	0.04	0.00	44	0.04	0.00
40	0.04	0.00	56	0.05	0.01
29	0.03	0.00	46	0.04	0.00
43	0.04	0.00	53	0.05	0.01
39	0.04	0.00	53	0.05	0.01
46	0.04	0.00	44	0.04	0.00
40	0.04	0.00	42	0.04	0.00
46	0.04	0.00	51	0.05	0.01
38	0.04	0.00	48	0.05	0.01
36	0.03	0.00	59	0.06	0.02
41	0.04	0.00	33	0.03	0.00
41	0.04	0.00	52	0.05	0.01
42	0.04	0.00	47	0.05	0.00
51	0.05	0.01	54	0.05	0.01
44	0.04	0.00	50	0.05	0.01
42	0.04	0.00	40	0.04	0.00
42	0.04	0.00	51	0.05	0.01
46	0.04	0.00	48	0.05	0.01
43	0.04	0.00	48	0.05	0.01
44	0.04	0.00	44	0.04	0.00
45	0.04	0.00	37	0.04	0.00
43	0.04	0.00	45	0.04	0.00
48	0.05	0.01	48	0.05	0.01
46	0.04	0.00	52	0.05	0.01
47	0.05	0.00	50	0.05	0.01
44	0.04	0.00	52	0.05	0.01
51	0.05	0.01	55	0.05	0.01
42	0.04	0.00	49	0.05	0.01
42	0.04	0.00	46	0.04	0.00
44	0.04	0.00	42	0.04	0.00
41	0.04	0.00	48	0.05	0.01
40	0.04	0.00	43	0.04	0.00
45	0.04	0.00	46	0.04	0.00
41	0.04	0.00	53	0.05	0.01
43	0.04	0.00	52	0.05	0.01
48	0.05	0.01	53	0.05	0.01
43	0.04	0.00	43	0.04	0.00
39	0.04	0.00	44	0.04	0.00
47	0.05	0.00	51	0.05	0.01
39	0.04	0.00	46	0.04	0.00
42	0.04	0.00	54	0.05	0.01
52	0.05	0.01	50	0.05	0.01
42	0.04	0.00	51	0.05	0.01
39	0.04	0.00	46	0.04	0.00
50	0.05	0.01	36	0.03	0.00
48	0.05	0.01	40	0.04	0.00

46	0.04	0.00	34	0.03	0.00
40	0.04	0.00	34	0.03	0.00
36	0.03	0.00	33	0.03	0.00
35	0.03	0.00	27	0.03	0.00
38	0.04	0.00	32	0.03	0.00
35	0.03	0.00	31	0.03	0.00
30	0.03	0.00	26	0.03	0.00
26	0.03	0.00	28	0.03	0.00
27	0.03	0.00	39	0.04	0.00
37	0.04	0.00	34	0.03	0.00
26	0.03	0.00	31	0.03	0.00
39	0.04	0.00	26	0.03	0.00
30	0.03	0.00	26	0.03	0.00
24	0.02	0.00	34	0.03	0.00
28	0.03	0.00	33	0.03	0.00
30	0.03	0.00	30	0.03	0.00
35	0.03	0.00	36	0.03	0.00
32	0.03	0.00	44	0.04	0.00
28	0.03	0.00	35	0.03	0.00
30	0.03	0.00	38	0.04	0.00
38	0.04	0.00	46	0.04	0.00
24	0.02	0.00	45	0.04	0.00
28	0.03	0.00	58	0.06	0.01
26	0.03	0.00	64	0.06	0.02
33	0.03	0.00	76	0.07	0.03
35	0.03	0.00	104	0.10	0.06
26	0.03	0.00	86	0.08	0.04
23	0.02	0.00	86	0.08	0.04
31	0.03	0.00	63	0.06	0.02
28	0.03	0.00	65	0.06	0.02
26	0.03	0.00	84	0.08	0.04
31	0.03	0.00	80	0.08	0.04
21	0.02	0.00	64	0.06	0.02
21	0.02	0.00	65	0.06	0.02
25	0.02	0.00	58	0.06	0.01
27	0.03	0.00	58	0.06	0.01
32	0.03	0.00	62	0.06	0.02
20	0.02	0.00	56	0.05	0.01
26	0.03	0.00	55	0.05	0.01
25	0.02	0.00	66	0.06	0.02
26	0.03	0.00	68	0.07	0.02
26	0.03	0.00	61	0.06	0.02
21	0.02	0.00	65	0.06	0.02
30	0.03	0.00	61	0.06	0.02
25	0.02	0.00	69	0.07	0.03
32	0.03	0.00	66	0.06	0.02
25	0.02	0.00	49	0.05	0.01
27	0.03	0.00	46	0.04	0.00
24	0.02	0.00	63	0.06	0.02
36	0.03	0.00	44	0.04	0.00
32	0.03	0.00	42	0.04	0.00
34	0.03	0.00	26	0.03	0.00
33	0.03	0.00	35	0.03	0.00
32	0.03	0.00	31	0.03	0.00
22	0.02	0.00	22	0.02	0.00
35	0.03	0.00	25	0.02	0.00

28	0.03	0.00	48	0.05	0.01
27	0.03	0.00	58	0.06	0.01
26	0.03	0.00	52	0.05	0.01
32	0.03	0.00	47	0.05	0.00
35	0.03	0.00	65	0.06	0.02
30	0.03	0.00	42	0.04	0.00
25	0.02	0.00	46	0.04	0.00
36	0.03	0.00	57	0.05	0.01
30	0.03	0.00	45	0.04	0.00
35	0.03	0.00	49	0.05	0.01
32	0.03	0.00	46	0.04	0.00
21	0.02	0.00	55	0.05	0.01
33	0.03	0.00	52	0.05	0.01
32	0.03	0.00	64	0.06	0.02
36	0.03	0.00	61	0.06	0.02
39	0.04	0.00	58	0.06	0.01
33	0.03	0.00	55	0.05	0.01
26	0.03	0.00	57	0.05	0.01
24	0.02	0.00	46	0.04	0.00
42	0.04	0.00	51	0.05	0.01
33	0.03	0.00	53	0.05	0.01
26	0.03	0.00	59	0.06	0.02
30	0.03	0.00	53	0.05	0.01
36	0.03	0.00	68	0.07	0.02
40	0.04	0.00	55	0.05	0.01
27	0.03	0.00	50	0.05	0.01
26	0.03	0.00	52	0.05	0.01
27	0.03	0.00	51	0.05	0.01
23	0.02	0.00	49	0.05	0.01
29	0.03	0.00	48	0.05	0.01
36	0.03	0.00	54	0.05	0.01
27	0.03	0.00	60	0.06	0.02
32	0.03	0.00	48	0.05	0.01
31	0.03	0.00	50	0.05	0.01
28	0.03	0.00	49	0.05	0.01
33	0.03	0.00	52	0.05	0.01
30	0.03	0.00	55	0.05	0.01
28	0.03	0.00	52	0.05	0.01
30	0.03	0.00	61	0.06	0.02
30	0.03	0.00	51	0.05	0.01
28	0.03	0.00	50	0.05	0.01
34	0.03	0.00	44	0.04	0.00
27	0.03	0.00	55	0.05	0.01
28	0.03	0.00	65	0.06	0.02
30	0.03	0.00	60	0.06	0.02
37	0.04	0.00	67	0.06	0.02
26	0.03	0.00	51	0.05	0.01
54	0.05	0.01	60	0.06	0.02
52	0.05	0.01	62	0.06	0.02
56	0.05	0.01	56	0.05	0.01
58	0.06	0.01	76	0.07	0.03
52	0.05	0.01	66	0.06	0.02
58	0.06	0.01	65	0.06	0.02
50	0.05	0.01	71	0.07	0.03
60	0.06	0.02	63	0.06	0.02
57	0.05	0.01	54	0.05	0.01

52	0.05	0.01	43	0.04	0.00
69	0.07	0.03	47	0.05	0.00
57	0.05	0.01	41	0.04	0.00
55	0.05	0.01	47	0.05	0.00
59	0.06	0.02	36	0.03	0.00
53	0.05	0.01	43	0.04	0.00
57	0.05	0.01	39	0.04	0.00
58	0.06	0.01	40	0.04	0.00
55	0.05	0.01	31	0.03	0.00
52	0.05	0.01	41	0.04	0.00
63	0.06	0.02	33	0.03	0.00
50	0.05	0.01	41	0.04	0.00
57	0.05	0.01	35	0.03	0.00
48	0.05	0.01	38	0.04	0.00
51	0.05	0.01	31	0.03	0.00
45	0.04	0.00	41	0.04	0.00
51	0.05	0.01	46	0.04	0.00
42	0.04	0.00	36	0.03	0.00
50	0.05	0.01	46	0.04	0.00
41	0.04	0.00	40	0.04	0.00
46	0.04	0.00	43	0.04	0.00
39	0.04	0.00	47	0.05	0.00
52	0.05	0.01	39	0.04	0.00
50	0.05	0.01	39	0.04	0.00
59	0.06	0.02	43	0.04	0.00
56	0.05	0.01	41	0.04	0.00
53	0.05	0.01	48	0.05	0.01
47	0.05	0.00	36	0.03	0.00
54	0.05	0.01	39	0.04	0.00
41	0.04	0.00	45	0.04	0.00
48	0.05	0.01	40	0.04	0.00
38	0.04	0.00	46	0.04	0.00
55	0.05	0.01	44	0.04	0.00
56	0.05	0.01	40	0.04	0.00
59	0.06	0.02	45	0.04	0.00
57	0.05	0.01	43	0.04	0.00
49	0.05	0.01	52	0.05	0.01
50	0.05	0.01	45	0.04	0.00
46	0.04	0.00	68	0.07	0.02
42	0.04	0.00	68	0.07	0.02
52	0.05	0.01	62	0.06	0.02
49	0.05	0.01	57	0.05	0.01
57	0.05	0.01	65	0.06	0.02
47	0.05	0.00	69	0.07	0.03
41	0.04	0.00	63	0.06	0.02
44	0.04	0.00	61	0.06	0.02
40	0.04	0.00	56	0.05	0.01
57	0.05	0.01	57	0.05	0.01
47	0.05	0.00	58	0.06	0.01
48	0.05	0.01	60	0.06	0.02
44	0.04	0.00	59	0.06	0.02
47	0.05	0.00	43	0.04	0.00
49	0.05	0.01	33	0.03	0.00
44	0.04	0.00	31	0.03	0.00
44	0.04	0.00	41	0.04	0.00
39	0.04	0.00	33	0.03	0.00

34	0.03	0.00	40	0.04	0.00
37	0.04	0.00	33	0.03	0.00
37	0.04	0.00	42	0.04	0.00
35	0.03	0.00	41	0.04	0.00
32	0.03	0.00	40	0.04	0.00
45	0.04	0.00	48	0.05	0.01
29	0.03	0.00	40	0.04	0.00
37	0.04	0.00	38	0.04	0.00
45	0.04	0.00	38	0.04	0.00
34	0.03	0.00	36	0.03	0.00
37	0.04	0.00	44	0.04	0.00
35	0.03	0.00	36	0.03	0.00
45	0.04	0.00	35	0.03	0.00
38	0.04	0.00	37	0.04	0.00
39	0.04	0.00	39	0.04	0.00
36	0.03	0.00	34	0.03	0.00
36	0.03	0.00	42	0.04	0.00
30	0.03	0.00	41	0.04	0.00
35	0.03	0.00	39	0.04	0.00
39	0.04	0.00	35	0.03	0.00
31	0.03	0.00	43	0.04	0.00
44	0.04	0.00	37	0.04	0.00
33	0.03	0.00	40	0.04	0.00
45	0.04	0.00	33	0.03	0.00
40	0.04	0.00	36	0.03	0.00
35	0.03	0.00	40	0.04	0.00
38	0.04	0.00	34	0.03	0.00
30	0.03	0.00	37	0.04	0.00
40	0.04	0.00	39	0.04	0.00
38	0.04	0.00	37	0.04	0.00
34	0.03	0.00	40	0.04	0.00
37	0.04	0.00	29	0.03	0.00
33	0.03	0.00	43	0.04	0.00
35	0.03	0.00	39	0.04	0.00
34	0.03	0.00	46	0.04	0.00
35	0.03	0.00	40	0.04	0.00
33	0.03	0.00	46	0.04	0.00
34	0.03	0.00	38	0.04	0.00
30	0.03	0.00	36	0.03	0.00
46	0.04	0.00	41	0.04	0.00
35	0.03	0.00	41	0.04	0.00
28	0.03	0.00	42	0.04	0.00
38	0.04	0.00	51	0.05	0.01
31	0.03	0.00	44	0.04	0.00
38	0.04	0.00	42	0.04	0.00
35	0.03	0.00	42	0.04	0.00
43	0.04	0.00	46	0.04	0.00
27	0.03	0.00	43	0.04	0.00
36	0.03	0.00	44	0.04	0.00
36	0.03	0.00	45	0.04	0.00
38	0.04	0.00	43	0.04	0.00
36	0.03	0.00	48	0.05	0.01
44	0.04	0.00	46	0.04	0.00
44	0.04	0.00	47	0.05	0.00
36	0.03	0.00	44	0.04	0.00
37	0.04	0.00	51	0.05	0.01

42	0.04	0.00	49	0.05	0.01
42	0.04	0.00	46	0.04	0.00
44	0.04	0.00	42	0.04	0.00
41	0.04	0.00	48	0.05	0.01
40	0.04	0.00	43	0.04	0.00
45	0.04	0.00	46	0.04	0.00
41	0.04	0.00	53	0.05	0.01
43	0.04	0.00	52	0.05	0.01
48	0.05	0.01	53	0.05	0.01
43	0.04	0.00	43	0.04	0.00
39	0.04	0.00	44	0.04	0.00
47	0.05	0.00	51	0.05	0.01
39	0.04	0.00	46	0.04	0.00
42	0.04	0.00	54	0.05	0.01
52	0.05	0.01	50	0.05	0.01
42	0.04	0.00	51	0.05	0.01
39	0.04	0.00	46	0.04	0.00
50	0.05	0.01	36	0.03	0.00
48	0.05	0.01	40	0.04	0.00
50	0.05	0.01	46	0.04	0.00
45	0.04	0.00	40	0.04	0.00
42	0.04	0.00	36	0.03	0.00
41	0.04	0.00	35	0.03	0.00
49	0.05	0.01	38	0.04	0.00
34	0.03	0.00	35	0.03	0.00
42	0.04	0.00	30	0.03	0.00
41	0.04	0.00	26	0.03	0.00
46	0.04	0.00	27	0.03	0.00
42	0.04	0.00	37	0.04	0.00
44	0.04	0.00	26	0.03	0.00
56	0.05	0.01	39	0.04	0.00
46	0.04	0.00	30	0.03	0.00
53	0.05	0.01	24	0.02	0.00
53	0.05	0.01	28	0.03	0.00
44	0.04	0.00	30	0.03	0.00
42	0.04	0.00	35	0.03	0.00
51	0.05	0.01	32	0.03	0.00
48	0.05	0.01	28	0.03	0.00
59	0.06	0.02	30	0.03	0.00
33	0.03	0.00	38	0.04	0.00
52	0.05	0.01	24	0.02	0.00
47	0.05	0.00	28	0.03	0.00
54	0.05	0.01	26	0.03	0.00
50	0.05	0.01	33	0.03	0.00
40	0.04	0.00	35	0.03	0.00
51	0.05	0.01	26	0.03	0.00
48	0.05	0.01	23	0.02	0.00
48	0.05	0.01	31	0.03	0.00
44	0.04	0.00	28	0.03	0.00
37	0.04	0.00	26	0.03	0.00
45	0.04	0.00	31	0.03	0.00
48	0.05	0.01	21	0.02	0.00
52	0.05	0.01	21	0.02	0.00
50	0.05	0.01	25	0.02	0.00
52	0.05	0.01	27	0.03	0.00
55	0.05	0.01	32	0.03	0.00

20	0.02	0.00	56	0.05	0.01
26	0.03	0.00	55	0.05	0.01
25	0.02	0.00	66	0.06	0.02
26	0.03	0.00	68	0.07	0.02
26	0.03	0.00	61	0.06	0.02
21	0.02	0.00	65	0.06	0.02
30	0.03	0.00	61	0.06	0.02
25	0.02	0.00	69	0.07	0.03
32	0.03	0.00	66	0.06	0.02
25	0.02	0.00	49	0.05	0.01
27	0.03	0.00	46	0.04	0.00
24	0.02	0.00	63	0.06	0.02
36	0.03	0.00	44	0.04	0.00
32	0.03	0.00	42	0.04	0.00
34	0.03	0.00	26	0.03	0.00
33	0.03	0.00	35	0.03	0.00
32	0.03	0.00	31	0.03	0.00
22	0.02	0.00	22	0.02	0.00
35	0.03	0.00	25	0.02	0.00
34	0.03	0.00	28	0.03	0.00
34	0.03	0.00	27	0.03	0.00
33	0.03	0.00	26	0.03	0.00
27	0.03	0.00	32	0.03	0.00
32	0.03	0.00	35	0.03	0.00
31	0.03	0.00	30	0.03	0.00
26	0.03	0.00	25	0.02	0.00
28	0.03	0.00	36	0.03	0.00
39	0.04	0.00	30	0.03	0.00
34	0.03	0.00	35	0.03	0.00
31	0.03	0.00	32	0.03	0.00
26	0.03	0.00	21	0.02	0.00
26	0.03	0.00	33	0.03	0.00
34	0.03	0.00	32	0.03	0.00
33	0.03	0.00	36	0.03	0.00
30	0.03	0.00	39	0.04	0.00
36	0.03	0.00	33	0.03	0.00
44	0.04	0.00	26	0.03	0.00
35	0.03	0.00	24	0.02	0.00
38	0.04	0.00	42	0.04	0.00
46	0.04	0.00	33	0.03	0.00
45	0.04	0.00	26	0.03	0.00
58	0.06	0.01	30	0.03	0.00
64	0.06	0.02	36	0.03	0.00
76	0.07	0.03	40	0.04	0.00
104	0.10	0.06	27	0.03	0.00
86	0.08	0.04	26	0.03	0.00
86	0.08	0.04	27	0.03	0.00
63	0.06	0.02	23	0.02	0.00
65	0.06	0.02	29	0.03	0.00
84	0.08	0.04	36	0.03	0.00
80	0.08	0.04	27	0.03	0.00
64	0.06	0.02	32	0.03	0.00
65	0.06	0.02	31	0.03	0.00
58	0.06	0.01	28	0.03	0.00
58	0.06	0.01	33	0.03	0.00
62	0.06	0.02	30	0.03	0.00

28	0.03	0.00	52	0.05	0.01
30	0.03	0.00	61	0.06	0.02
30	0.03	0.00	51	0.05	0.01
28	0.03	0.00	50	0.05	0.01
34	0.03	0.00	44	0.04	0.00
27	0.03	0.00	55	0.05	0.01
28	0.03	0.00	65	0.06	0.02
30	0.03	0.00	60	0.06	0.02
37	0.04	0.00	67	0.06	0.02
26	0.03	0.00	51	0.05	0.01
54	0.05	0.01	60	0.06	0.02
52	0.05	0.01	62	0.06	0.02
56	0.05	0.01	56	0.05	0.01
58	0.06	0.01	76	0.07	0.03
52	0.05	0.01	66	0.06	0.02
58	0.06	0.01	65	0.06	0.02
50	0.05	0.01	71	0.07	0.03
60	0.06	0.02	63	0.06	0.02
57	0.05	0.01	54	0.05	0.01
48	0.05	0.01	52	0.05	0.01
58	0.06	0.01	69	0.07	0.03
52	0.05	0.01	57	0.05	0.01
47	0.05	0.00	55	0.05	0.01
65	0.06	0.02	59	0.06	0.02
42	0.04	0.00	53	0.05	0.01
46	0.04	0.00	57	0.05	0.01
57	0.05	0.01	58	0.06	0.01
45	0.04	0.00	55	0.05	0.01
49	0.05	0.01	52	0.05	0.01
46	0.04	0.00	63	0.06	0.02
55	0.05	0.01	50	0.05	0.01
52	0.05	0.01	57	0.05	0.01
64	0.06	0.02	48	0.05	0.01
61	0.06	0.02	51	0.05	0.01
58	0.06	0.01	45	0.04	0.00
55	0.05	0.01	51	0.05	0.01
57	0.05	0.01	42	0.04	0.00
46	0.04	0.00	50	0.05	0.01
51	0.05	0.01	41	0.04	0.00
53	0.05	0.01	46	0.04	0.00
59	0.06	0.02	39	0.04	0.00
53	0.05	0.01	52	0.05	0.01
68	0.07	0.02	50	0.05	0.01
55	0.05	0.01	59	0.06	0.02
50	0.05	0.01	56	0.05	0.01
52	0.05	0.01	53	0.05	0.01
51	0.05	0.01	47	0.05	0.00
49	0.05	0.01	54	0.05	0.01
48	0.05	0.01	41	0.04	0.00
54	0.05	0.01	48	0.05	0.01
60	0.06	0.02	38	0.04	0.00
48	0.05	0.01	55	0.05	0.01
50	0.05	0.01	56	0.05	0.01
49	0.05	0.01	59	0.06	0.02
52	0.05	0.01	57	0.05	0.01
55	0.05	0.01	49	0.05	0.01

50	0.05	0.01	45	0.04	0.00
46	0.04	0.00			
42	0.04	0.00			
52	0.05	0.01	NS Transects		
49	0.05	0.01			
57	0.05	0.01	1 20:07:22		
47	0.05	0.00	11:54:50 cps		
41	0.04	0.00	Live time (s)	cps to	solar
44	0.04	0.00	2.00	micro Sv/h	corrected
40	0.04	0.00	NS1		
57	0.05	0.01	45	0.04	0.00
47	0.05	0.00	38	0.04	0.00
48	0.05	0.01	39	0.04	0.00
44	0.04	0.00	37	0.04	0.00
47	0.05	0.00	29	0.03	0.00
49	0.05	0.01	31	0.03	0.00
44	0.04	0.00	43	0.04	0.00
44	0.04	0.00	39	0.04	0.00
39	0.04	0.00	37	0.04	0.00
43	0.04	0.00	46	0.04	0.00
47	0.05	0.00	32	0.03	0.00
41	0.04	0.00	36	0.03	0.00
47	0.05	0.00	38	0.04	0.00
36	0.03	0.00	38	0.04	0.00
43	0.04	0.00	39	0.04	0.00
39	0.04	0.00	35	0.03	0.00
40	0.04	0.00	41	0.04	0.00
31	0.03	0.00	36	0.03	0.00
41	0.04	0.00	45	0.04	0.00
33	0.03	0.00	35	0.03	0.00
41	0.04	0.00	31	0.03	0.00
35	0.03	0.00	42	0.04	0.00
38	0.04	0.00	42	0.04	0.00
31	0.03	0.00	43	0.04	0.00
41	0.04	0.00	35	0.03	0.00
46	0.04	0.00	41	0.04	0.00
36	0.03	0.00	31	0.03	0.00
46	0.04	0.00	36	0.03	0.00
40	0.04	0.00	38	0.04	0.00
43	0.04	0.00	40	0.04	0.00
47	0.05	0.00	49	0.05	0.01
39	0.04	0.00	38	0.04	0.00
39	0.04	0.00	34	0.03	0.00
43	0.04	0.00	42	0.04	0.00
41	0.04	0.00	46	0.04	0.00
48	0.05	0.01	39	0.04	0.00
36	0.03	0.00	37	0.04	0.00
39	0.04	0.00	26	0.03	0.00
45	0.04	0.00	42	0.04	0.00
40	0.04	0.00	48	0.05	0.01
46	0.04	0.00	45	0.04	0.00
44	0.04	0.00	40	0.04	0.00
40	0.04	0.00	43	0.04	0.00
45	0.04	0.00	37	0.04	0.00
43	0.04	0.00	36	0.03	0.00
52	0.05	0.01	52	0.05	0.01

49	0.05	0.01	26	0.03	0.00
54	0.05	0.01	27	0.03	0.00
54	0.05	0.01	36	0.03	0.00
50	0.05	0.01	34	0.03	0.00
49	0.05	0.01	34	0.03	0.00
51	0.05	0.01	33	0.03	0.00
55	0.05	0.01	44	0.04	0.00
43	0.04	0.00	29	0.03	0.00
44	0.04	0.00	37	0.04	0.00
56	0.05	0.01	41	0.04	0.00
49	0.05	0.01	39	0.04	0.00
50	0.05	0.01	38	0.04	0.00
36	0.03	0.00	35	0.03	0.00
35	0.03	0.00	40	0.04	0.00
31	0.03	0.00	45	0.04	0.00
37	0.04	0.00	49	0.05	0.01
35	0.03	0.00	63	0.06	0.02
29	0.03	0.00	53	0.05	0.01
31	0.03	0.00	62	0.06	0.02
32	0.03	0.00	61	0.06	0.02
36	0.03	0.00	60	0.06	0.02
40	0.04	0.00	68	0.07	0.02
36	0.03	0.00	51	0.05	0.01
40	0.04	0.00	57	0.05	0.01
38	0.04	0.00	55	0.05	0.01
38	0.04	0.00	52	0.05	0.01
32	0.03	0.00	49	0.05	0.01
36	0.03	0.00	52	0.05	0.01
35	0.03	0.00	45	0.04	0.00
27	0.03	0.00	45	0.04	0.00
22	0.02	0.00	54	0.05	0.01
25	0.02	0.00	45	0.04	0.00
31	0.03	0.00	47	0.05	0.00
32	0.03	0.00	50	0.05	0.01
25	0.02	0.00	27	0.03	0.00
26	0.03	0.00	40	0.04	0.00
30	0.03	0.00	46	0.04	0.00
32	0.03	0.00	46	0.04	0.00
			45	0.04	0.00
			40	0.04	0.00
			31	0.03	0.00
			43	0.04	0.00
			44	0.04	0.00
			45	0.04	0.00
			41	0.04	0.00
			35	0.03	0.00
			45	0.04	0.00
			36	0.03	0.00
			39	0.04	0.00
			40	0.04	0.00
			44	0.04	0.00
			36	0.03	0.00
2 20:07:22					
11:58:29 cps					
Live time (s)					
2.00	cps to	solar			
NS2	micro Sv/h	corrected			
27	0.03	0.00			
29	0.03	0.00			
27	0.03	0.00			
29	0.03	0.00			
32	0.03	0.00			
30	0.03	0.00			
30	0.03	0.00			
31	0.03	0.00			

3 20:07:22			72		
12:01:37 cps Live			75		
time (s) 2.00			62		
NS3			67		
39	0.04	0.00	54	0.05	0.01
40	0.04	0.00	57	0.05	0.01
32	0.03	0.00	56	0.05	0.01
25	0.02	0.00	46	0.04	0.00
36	0.03	0.00	53	0.05	0.01
32	0.03	0.00	40	0.04	0.00
37	0.04	0.00	43	0.04	0.00
40	0.04	0.00	29	0.03	0.00
42	0.04	0.00	41	0.04	0.00
36	0.03	0.00	39	0.04	0.00
45	0.04	0.00	42	0.04	0.00
34	0.03	0.00	35	0.03	0.00
37	0.04	0.00	44	0.04	0.00
44	0.04	0.00	44	0.04	0.00
65	0.06	0.02	43	0.04	0.00
42	0.04	0.00	40	0.04	0.00
45	0.04	0.00	44	0.04	0.00
49	0.05	0.01	45	0.04	0.00
49	0.05	0.01	42	0.04	0.00
43	0.04	0.00	40	0.04	0.00
36	0.03	0.00	48	0.05	0.01
44	0.04	0.00	43	0.04	0.00
44	0.04	0.00	44	0.04	0.00
56	0.05	0.01	26	0.03	0.00
42	0.04	0.00	27	0.03	0.00
45	0.04	0.00	31	0.03	0.00
45	0.04	0.00	46	0.04	0.00
50	0.05	0.01	4 20:07:22		
62	0.06	0.02	12:06:32 cps Live		
51	0.05	0.01	time (s) 2.00		
53	0.05	0.01	NS4		
70	0.07	0.03	31	0.03	0.00
55	0.05	0.01	29	0.03	0.00
62	0.06	0.02	34	0.03	0.00
55	0.05	0.01	32	0.03	0.00
69	0.07	0.03	38	0.04	0.00
60	0.06	0.02	37	0.04	0.00
64	0.06	0.02	41	0.04	0.00
65	0.06	0.02	34	0.03	0.00
64	0.06	0.02	34	0.03	0.00
66	0.06	0.02	43	0.04	0.00
65	0.06	0.02	34	0.03	0.00
62	0.06	0.02	31	0.03	0.00
67	0.06	0.02	37	0.04	0.00
77	0.07	0.03	32	0.03	0.00
73	0.07	0.03	39	0.04	0.00
80	0.08	0.04	35	0.03	0.00
72	0.07	0.03	37	0.04	0.00
74	0.07	0.03			

50	0.05	0.01	5 20:07:22 12:09:43 cps Live time (s) 2.00	cps to micro Sv/h	solar corrected
37	0.04	0.00			
45	0.04	0.00	NS5		
52	0.05	0.01	39	0.04	0.00
41	0.04	0.00	40	0.04	0.00
44	0.04	0.00	41	0.04	0.00
40	0.04	0.00	37	0.04	0.00
47	0.05	0.00	34	0.03	0.00
50	0.05	0.01	44	0.04	0.00
48	0.05	0.01	46	0.04	0.00
48	0.05	0.01	39	0.04	0.00
46	0.04	0.00	37	0.04	0.00
47	0.05	0.00	43	0.04	0.00
43	0.04	0.00	40	0.04	0.00
50	0.05	0.01	42	0.04	0.00
62	0.06	0.02	37	0.04	0.00
49	0.05	0.01	49	0.05	0.01
52	0.05	0.01	43	0.04	0.00
45	0.04	0.00	48	0.05	0.01
63	0.06	0.02	51	0.05	0.01
63	0.06	0.02	50	0.05	0.01
55	0.05	0.01	41	0.04	0.00
71	0.07	0.03	59	0.06	0.02
59	0.06	0.02	54	0.05	0.01
64	0.06	0.02	55	0.05	0.01
58	0.06	0.01	48	0.05	0.01
65	0.06	0.02	52	0.05	0.01
68	0.07	0.02	61	0.06	0.02
70	0.07	0.03	45	0.04	0.00
54	0.05	0.01	69	0.07	0.03
58	0.06	0.01	65	0.06	0.02
53	0.05	0.01	53	0.05	0.01
58	0.06	0.01	51	0.05	0.01
57	0.05	0.01	52	0.05	0.01
48	0.05	0.01	55	0.05	0.01
50	0.05	0.01	65	0.06	0.02
49	0.05	0.01	47	0.05	0.00
41	0.04	0.00	58	0.06	0.01
36	0.03	0.00	52	0.05	0.01
49	0.05	0.01	62	0.06	0.02
48	0.05	0.01	58	0.06	0.01
48	0.05	0.01	56	0.05	0.01
57	0.05	0.01	59	0.06	0.02
44	0.04	0.00	52	0.05	0.01
45	0.04	0.00	55	0.05	0.01
48	0.05	0.01	54	0.05	0.01
48	0.05	0.01	55	0.05	0.01
47	0.05	0.00	54	0.05	0.01
47	0.05	0.00	47	0.05	0.00
48	0.05	0.01	45	0.04	0.00
46	0.04	0.00	44	0.04	0.00
40	0.04	0.00	45	0.04	0.00
46	0.04	0.00	50	0.05	0.01

43	0.04	0.00	73	0.07	0.03
50	0.05	0.01	98	0.09	0.05
53	0.05	0.01	82	0.08	0.04
50	0.05	0.01	83	0.08	0.04
49	0.05	0.01	84	0.08	0.04
58	0.06	0.01	85	0.08	0.04
60	0.06	0.02	85	0.08	0.04
53	0.05	0.01	78	0.08	0.03
41	0.04	0.00	81	0.08	0.04
57	0.05	0.01	83	0.08	0.04
63	0.06	0.02	81	0.08	0.04
66	0.06	0.02	87	0.08	0.04
61	0.06	0.02	58	0.06	0.01
54	0.05	0.01	73	0.07	0.03
57	0.05	0.01			
61	0.06	0.02			
55	0.05	0.01			
67	0.06	0.02			
55	0.05	0.01			
51	0.05	0.01			
50	0.05	0.01	6 20:07:22		
55	0.05	0.01	12:14:35 cps Live		
49	0.05	0.01	time (s) 2.00	cps to	solar
56	0.05	0.01	NS6	micro Sv/h	corrected
40	0.04	0.00	38	0.04	0.00
54	0.05	0.01	29	0.03	0.00
51	0.05	0.01	56	0.05	0.01
51	0.05	0.01	78	0.08	0.03
47	0.05	0.00	66	0.06	0.02
37	0.04	0.00	37	0.04	0.00
50	0.05	0.01	33	0.03	0.00
42	0.04	0.00	33	0.03	0.00
44	0.04	0.00	28	0.03	0.00
45	0.04	0.00	33	0.03	0.00
42	0.04	0.00	36	0.03	0.00
38	0.04	0.00	36	0.03	0.00
44	0.04	0.00	39	0.04	0.00
42	0.04	0.00	44	0.04	0.00
34	0.03	0.00	31	0.03	0.00
35	0.03	0.00	34	0.03	0.00
35	0.03	0.00	42	0.04	0.00
44	0.04	0.00	40	0.04	0.00
37	0.04	0.00	34	0.03	0.00
32	0.03	0.00	46	0.04	0.00
47	0.05	0.00	36	0.03	0.00
37	0.04	0.00	33	0.03	0.00
39	0.04	0.00	50	0.05	0.01
43	0.04	0.00	38	0.04	0.00
33	0.03	0.00	39	0.04	0.00
38	0.04	0.00	37	0.04	0.00
30	0.03	0.00	41	0.04	0.00
32	0.03	0.00	41	0.04	0.00
31	0.03	0.00	47	0.05	0.00
47	0.05	0.00	54	0.05	0.01
48	0.05	0.01	49	0.05	0.01
61	0.06	0.02	50	0.05	0.01

50	0.05	0.01			
48	0.05	0.01			
62	0.06	0.02			
68	0.07	0.02			
53	0.05	0.01			
60	0.06	0.02			
62	0.06	0.02	7 20:07:22		
63	0.06	0.02	12:18:56 cps Live	cps to micro	solar
60	0.06	0.02	time (s) 2.00	Sv/h	corrected
72	0.07	0.03	NS7		
65	0.06	0.02	45	0.04	0.00
75	0.07	0.03	42	0.04	0.00
63	0.06	0.02	58	0.06	0.01
61	0.06	0.02	39	0.04	0.00
60	0.06	0.02	51	0.05	0.01
63	0.06	0.02	46	0.04	0.00
56	0.05	0.01	45	0.04	0.00
62	0.06	0.02	53	0.05	0.01
66	0.06	0.02	47	0.05	0.00
64	0.06	0.02	40	0.04	0.00
70	0.07	0.03	48	0.05	0.01
63	0.06	0.02	53	0.05	0.01
57	0.05	0.01	49	0.05	0.01
75	0.07	0.03	55	0.05	0.01
56	0.05	0.01	56	0.05	0.01
69	0.07	0.03	64	0.06	0.02
56	0.05	0.01	59	0.06	0.02
59	0.06	0.02	63	0.06	0.02
67	0.06	0.02	81	0.08	0.04
59	0.06	0.02	77	0.07	0.03
66	0.06	0.02	71	0.07	0.03
64	0.06	0.02	78	0.08	0.03
71	0.07	0.03	78	0.08	0.03
67	0.06	0.02	66	0.06	0.02
73	0.07	0.03	75	0.07	0.03
60	0.06	0.02	69	0.07	0.03
68	0.07	0.02	75	0.07	0.03
56	0.05	0.01	76	0.07	0.03
52	0.05	0.01	84	0.08	0.04
49	0.05	0.01	74	0.07	0.03
57	0.05	0.01	69	0.07	0.03
50	0.05	0.01	68	0.07	0.02
49	0.05	0.01	61	0.06	0.02
56	0.05	0.01	80	0.08	0.04
			70	0.07	0.03
			72	0.07	0.03
			87	0.08	0.04
			64	0.06	0.02
			71	0.07	0.03
			65	0.06	0.02
			82	0.08	0.04
			75	0.07	0.03
			67	0.06	0.02
			62	0.06	0.02
			77	0.07	0.03
			74	0.07	0.03
			64	0.06	0.02
			71	0.07	0.03

68	0.07	0.02	30	0.03	0.00
71	0.07	0.03	32	0.03	0.00
67	0.06	0.02	33	0.03	0.00
77	0.07	0.03	37	0.04	0.00
78	0.08	0.03	42	0.04	0.00
72	0.07	0.03	38	0.04	0.00
70	0.07	0.03	42	0.04	0.00
79	0.08	0.04	37	0.04	0.00
65	0.06	0.02	43	0.04	0.00
66	0.06	0.02	40	0.04	0.00
70	0.07	0.03	44	0.04	0.00
61	0.06	0.02	46	0.04	0.00
60	0.06	0.02	55	0.05	0.01
61	0.06	0.02	43	0.04	0.00
54	0.05	0.01	53	0.05	0.01
67	0.06	0.02	65	0.06	0.02
57	0.05	0.01	56	0.05	0.01
51	0.05	0.01	64	0.06	0.02
63	0.06	0.02	70	0.07	0.03
38	0.04	0.00	60	0.06	0.02
51	0.05	0.01	60	0.06	0.02
47	0.05	0.00	68	0.07	0.02
43	0.04	0.00	60	0.06	0.02
37	0.04	0.00	62	0.06	0.02
40	0.04	0.00	66	0.06	0.02
48	0.05	0.01	55	0.05	0.01
40	0.04	0.00	63	0.06	0.02
35	0.03	0.00	53	0.05	0.01
39	0.04	0.00	63	0.06	0.02
43	0.04	0.00	61	0.06	0.02
42	0.04	0.00	53	0.05	0.01
32	0.03	0.00	53	0.05	0.01
34	0.03	0.00	60	0.06	0.02
34	0.03	0.00	52	0.05	0.01
37	0.04	0.00	60	0.06	0.02
27	0.03	0.00	58	0.06	0.01
28	0.03	0.00	57	0.05	0.01
25	0.02	0.00	52	0.05	0.01
23	0.02	0.00	61	0.06	0.02
29	0.03	0.00	61	0.06	0.02
8 20:07:22			70	0.07	0.03
12:23:39 cps Live			69	0.07	0.03
time (s) 2.00			55	0.05	0.01
NS8			62	0.06	0.02
cps to micro			59	0.06	0.02
Sv/h			57	0.05	0.01
solar			64	0.06	0.02
corrected			70	0.07	0.03
27	0.03	0.00	66	0.06	0.02
31	0.03	0.00	55	0.05	0.01
30	0.03	0.00	47	0.05	0.00
33	0.03	0.00	46	0.04	0.00
38	0.04	0.00	51	0.05	0.01
27	0.03	0.00	55	0.05	0.01
35	0.03	0.00	50	0.05	0.01
			52	0.05	0.01
			47	0.05	0.00

49	0.05	0.01	50	0.05	0.01
44	0.04	0.00	54	0.05	0.01
38	0.04	0.00	52	0.05	0.01
			55	0.05	0.01
			55	0.05	0.01
			55	0.05	0.01
			59	0.06	0.02
			58	0.06	0.01
			60	0.06	0.02
			58	0.06	0.01
			59	0.06	0.02
			48	0.05	0.01
			47	0.05	0.00
			48	0.05	0.01
			34	0.03	0.00
			41	0.04	0.00
			34	0.03	0.00
			33	0.03	0.00
			31	0.03	0.00
			39	0.04	0.00
9 20:07:22			10 20:07:22		
12:27:02 cps Live	cps to micro	solar	12:30:03 cps Live	cps to micro	solar
time (s) 2.00	Sv/h	corrected	time (s) 2.00	Sv/h	corrected
NS9			NS10		
41	0.04	0.00	36	0.03	0.00
43	0.04	0.00	40	0.04	0.00
47	0.05	0.00	43	0.04	0.00
44	0.04	0.00	39	0.04	0.00
40	0.04	0.00	50	0.05	0.01
43	0.04	0.00	45	0.04	0.00
52	0.05	0.01	60	0.06	0.02
45	0.04	0.00	63	0.06	0.02
39	0.04	0.00	53	0.05	0.01
43	0.04	0.00	58	0.06	0.01
46	0.04	0.00	67	0.06	0.02
52	0.05	0.01	69	0.07	0.03
53	0.05	0.01	44	0.04	0.00
50	0.05	0.01	60	0.06	0.02
54	0.05	0.01	59	0.06	0.02
60	0.06	0.02	66	0.06	0.02
63	0.06	0.02	82	0.08	0.04
64	0.06	0.02	76	0.07	0.03
54	0.05	0.01	73	0.07	0.03
60	0.06	0.02	80	0.08	0.04
53	0.05	0.01	75	0.07	0.03
54	0.05	0.01	79	0.08	0.04
62	0.06	0.02	73	0.07	0.03
48	0.05	0.01	69	0.07	0.03
53	0.05	0.01	68	0.07	0.02
42	0.04	0.00	65	0.06	0.02
52	0.05	0.01	65	0.06	0.02
53	0.05	0.01			
41	0.04	0.00			
54	0.05	0.01			
42	0.04	0.00			
47	0.05	0.00			
51	0.05	0.01			
51	0.05	0.01			
51	0.05	0.01			
47	0.05	0.00			
56	0.05	0.01			
46	0.04	0.00			
49	0.05	0.01			
43	0.04	0.00			
46	0.04	0.00			
44	0.04	0.00			
50	0.05	0.01			
42	0.04	0.00			

70	0.07	0.03
68	0.07	0.02
64	0.06	0.02
82	0.08	0.04
77	0.07	0.03
79	0.08	0.04
79	0.08	0.04
71	0.07	0.03
68	0.07	0.02
54	0.05	0.01
49	0.05	0.01
61	0.06	0.02
65	0.06	0.02

86	0.08	0.04
65	0.06	0.02
70	0.07	0.03
63	0.06	0.02
69	0.07	0.03
67	0.06	0.02
52	0.05	0.01

EW Transects

11 20:07:22		
12:34:22 cps Live	cps to micro	solar
time (s) 2.00	Sv/h	corrected
NS11		
83	0.08	0.04
71	0.07	0.03
69	0.07	0.03
68	0.07	0.02
93	0.09	0.05
87	0.08	0.04
79	0.08	0.04
91	0.09	0.05
85	0.08	0.04
102	0.10	0.06
98	0.09	0.05
90	0.09	0.05
100	0.10	0.06
100	0.10	0.06
81	0.08	0.04
78	0.08	0.03
69	0.07	0.03
79	0.08	0.04
78	0.08	0.03
71	0.07	0.03
73	0.07	0.03
76	0.07	0.03
72	0.07	0.03
69	0.07	0.03
76	0.07	0.03
74	0.07	0.03
69	0.07	0.03
71	0.07	0.03
60	0.06	0.02
64	0.06	0.02
64	0.06	0.02
79	0.08	0.04
71	0.07	0.03
82	0.08	0.04

1 20:07:22		
10:38:34 cps Live	cps to micro	solar
time (s) 2.00	Sv/h	corrected
ew1		
38	0.04	0.00
40	0.04	0.00
40	0.04	0.00
29	0.03	0.00
33	0.03	0.00
35	0.03	0.00
37	0.04	0.00
38	0.04	0.00
37	0.04	0.00
44	0.04	0.00
39	0.04	0.00
41	0.04	0.00
39	0.04	0.00
37	0.04	0.00
35	0.03	0.00
45	0.04	0.00
40	0.04	0.00
37	0.04	0.00
41	0.04	0.00
42	0.04	0.00
36	0.03	0.00
34	0.03	0.00
37	0.04	0.00
42	0.04	0.00
35	0.03	0.00
39	0.04	0.00
39	0.04	0.00
28	0.03	0.00
32	0.03	0.00
36	0.03	0.00
33	0.03	0.00
42	0.04	0.00
43	0.04	0.00
44	0.04	0.00
38	0.04	0.00
32	0.03	0.00
41	0.04	0.00
37	0.04	0.00

77	0.07	0.03	63	0.06	0.02
73	0.07	0.03	57	0.05	0.01
72	0.07	0.03	58	0.06	0.01
69	0.07	0.03	62	0.06	0.02
58	0.06	0.01	62	0.06	0.02
63	0.06	0.02	59	0.06	0.02
69	0.07	0.03	58	0.06	0.01
52	0.05	0.01	59	0.06	0.02
55	0.05	0.01	52	0.05	0.01
48	0.05	0.01	44	0.04	0.00
53	0.05	0.01	49	0.05	0.01
55	0.05	0.01	47	0.05	0.00
52	0.05	0.01	48	0.05	0.01
59	0.06	0.02	49	0.05	0.01
54	0.05	0.01	53	0.05	0.01
47	0.05	0.00	57	0.05	0.01
57	0.05	0.01	58	0.06	0.01
69	0.07	0.03	54	0.05	0.01
75	0.07	0.03	48	0.05	0.01
55	0.05	0.01	51	0.05	0.01
75	0.07	0.03	62	0.06	0.02
77	0.07	0.03	59	0.06	0.02
68	0.07	0.02	53	0.05	0.01
64	0.06	0.02	58	0.06	0.01
74	0.07	0.03	42	0.04	0.00
67	0.06	0.02	47	0.05	0.00
67	0.06	0.02	61	0.06	0.02
59	0.06	0.02	45	0.04	0.00
64	0.06	0.02	36	0.03	0.00
84	0.08	0.04	41	0.04	0.00
65	0.06	0.02	43	0.04	0.00
74	0.07	0.03	45	0.04	0.00
81	0.08	0.04	43	0.04	0.00
81	0.08	0.04	56	0.05	0.01
65	0.06	0.02	35	0.03	0.00
71	0.07	0.03	43	0.04	0.00
65	0.06	0.02	42	0.04	0.00
74	0.07	0.03	45	0.04	0.00
85	0.08	0.04	39	0.04	0.00
65	0.06	0.02	49	0.05	0.01
70	0.07	0.03	29	0.03	0.00
62	0.06	0.02	43	0.04	0.00
54	0.05	0.01	45	0.04	0.00
59	0.06	0.02	46	0.04	0.00
64	0.06	0.02	42	0.04	0.00
64	0.06	0.02	38	0.04	0.00
58	0.06	0.01	44	0.04	0.00
62	0.06	0.02	36	0.03	0.00
66	0.06	0.02	36	0.03	0.00
69	0.07	0.03	41	0.04	0.00
63	0.06	0.02	41	0.04	0.00
78	0.08	0.03	45	0.04	0.00
65	0.06	0.02	39	0.04	0.00
74	0.07	0.03	43	0.04	0.00
76	0.07	0.03	41	0.04	0.00
75	0.07	0.03	42	0.04	0.00
82	0.08	0.04	40	0.04	0.00

3 20:07:22			55	0.05	0.01
10:50:29 cps Live			55	0.05	0.01
time (s) 2.00			53	0.05	0.01
ew3			64	0.06	0.02
45	0.04	0.00	49	0.05	0.01
35	0.03	0.00	58	0.06	0.01
42	0.04	0.00	51	0.05	0.01
50	0.05	0.01	61	0.06	0.02
49	0.05	0.01	51	0.05	0.01
41	0.04	0.00	47	0.05	0.00
47	0.05	0.00	47	0.05	0.00
30	0.03	0.00	58	0.06	0.01
40	0.04	0.00	59	0.06	0.02
37	0.04	0.00	61	0.06	0.02
33	0.03	0.00	57	0.05	0.01
42	0.04	0.00	59	0.06	0.02
41	0.04	0.00	64	0.06	0.02
32	0.03	0.00	48	0.05	0.01
34	0.03	0.00	71	0.07	0.03
37	0.04	0.00	57	0.05	0.01
33	0.03	0.00	55	0.05	0.01
41	0.04	0.00	59	0.06	0.02
36	0.03	0.00	62	0.06	0.02
33	0.03	0.00	62	0.06	0.02
38	0.04	0.00	55	0.05	0.01
49	0.05	0.01	67	0.06	0.02
45	0.04	0.00	68	0.07	0.02
44	0.04	0.00	69	0.07	0.03
54	0.05	0.01	62	0.06	0.02
59	0.06	0.02	69	0.07	0.03
41	0.04	0.00	81	0.08	0.04
45	0.04	0.00	74	0.07	0.03
53	0.05	0.01	85	0.08	0.04
56	0.05	0.01	76	0.07	0.03
55	0.05	0.01	67	0.06	0.02
54	0.05	0.01	84	0.08	0.04
47	0.05	0.00	83	0.08	0.04
58	0.06	0.01	80	0.08	0.04
65	0.06	0.02	65	0.06	0.02
57	0.05	0.01	77	0.07	0.03
73	0.07	0.03	73	0.07	0.03
62	0.06	0.02	68	0.07	0.02
63	0.06	0.02	64	0.06	0.02
53	0.05	0.01	69	0.07	0.03
65	0.06	0.02	74	0.07	0.03
52	0.05	0.01	66	0.06	0.02
57	0.05	0.01	65	0.06	0.02
62	0.06	0.02	64	0.06	0.02
54	0.05	0.01	57	0.05	0.01
61	0.06	0.02	52	0.05	0.01
64	0.06	0.02	64	0.06	0.02
57	0.05	0.01	59	0.06	0.02
52	0.05	0.01	49	0.05	0.01
			47	0.05	0.00
			48	0.05	0.01
			51	0.05	0.01
			56	0.05	0.01

51	0.05	0.01	69	0.07	0.03
53	0.05	0.01	63	0.06	0.02
56	0.05	0.01	59	0.06	0.02
50	0.05	0.01	55	0.05	0.01
60	0.06	0.02	68	0.07	0.02
56	0.05	0.01	68	0.07	0.02
49	0.05	0.01	59	0.06	0.02
59	0.06	0.02	74	0.07	0.03
56	0.05	0.01	70	0.07	0.03
67	0.06	0.02	58	0.06	0.01
70	0.07	0.03	59	0.06	0.02
59	0.06	0.02	64	0.06	0.02
70	0.07	0.03	66	0.06	0.02
75	0.07	0.03	68	0.07	0.02
68	0.07	0.02	65	0.06	0.02
72	0.07	0.03	71	0.07	0.03
70	0.07	0.03	78	0.08	0.03
73	0.07	0.03	75	0.07	0.03
59	0.06	0.02	68	0.07	0.02
58	0.06	0.01	61	0.06	0.02
			74	0.07	0.03
			74	0.07	0.03
			68	0.07	0.02
			72	0.07	0.03
			62	0.06	0.02
			71	0.07	0.03
			75	0.07	0.03
			61	0.06	0.02
			56	0.05	0.01
			57	0.05	0.01
			62	0.06	0.02
			50	0.05	0.01
			47	0.05	0.00
			57	0.05	0.01
			56	0.05	0.01
			51	0.05	0.01
			48	0.05	0.01
			48	0.05	0.01
			58	0.06	0.01
			49	0.05	0.01
			56	0.05	0.01
			65	0.06	0.02
			58	0.06	0.01
			57	0.05	0.01
			58	0.06	0.01
			61	0.06	0.02
			66	0.06	0.02
			54	0.05	0.01
			60	0.06	0.02
			60	0.06	0.02
			61	0.06	0.02
			52	0.05	0.01
			65	0.06	0.02
			61	0.06	0.02
			67	0.06	0.02
			58	0.06	0.01
			60	0.06	0.02

4 20:07:22		
10:55:20 cps Live	cps to micro	solar
time (s) 2.00	Sv/h	corrected
ew4		
38	0.04	0.00
54	0.05	0.01
44	0.04	0.00
46	0.04	0.00
54	0.05	0.01
47	0.05	0.00
56	0.05	0.01
57	0.05	0.01
58	0.06	0.01
52	0.05	0.01
54	0.05	0.01
52	0.05	0.01
61	0.06	0.02
57	0.05	0.01
58	0.06	0.01
71	0.07	0.03
55	0.05	0.01
60	0.06	0.02
59	0.06	0.02
58	0.06	0.01
58	0.06	0.01
53	0.05	0.01
64	0.06	0.02
68	0.07	0.02
60	0.06	0.02
62	0.06	0.02
54	0.05	0.01
60	0.06	0.02

45	0.04	0.00	64	0.06	0.02
71	0.07	0.03	53	0.05	0.01
63	0.06	0.02	49	0.05	0.01
64	0.06	0.02	51	0.05	0.01
53	0.05	0.01	57	0.05	0.01
58	0.06	0.01	56	0.05	0.01
53	0.05	0.01	60	0.06	0.02
49	0.05	0.01	60	0.06	0.02
53	0.05	0.01	53	0.05	0.01
52	0.05	0.01	64	0.06	0.02
55	0.05	0.01	61	0.06	0.02
46	0.04	0.00	63	0.06	0.02
52	0.05	0.01	63	0.06	0.02
42	0.04	0.00	56	0.05	0.01
47	0.05	0.00	55	0.05	0.01
39	0.04	0.00	54	0.05	0.01
37	0.04	0.00	62	0.06	0.02
37	0.04	0.00	65	0.06	0.02
39	0.04	0.00	67	0.06	0.02
43	0.04	0.00	67	0.06	0.02
41	0.04	0.00	66	0.06	0.02
35	0.03	0.00	66	0.06	0.02
35	0.03	0.00	69	0.07	0.03
33	0.03	0.00	64	0.06	0.02
43	0.04	0.00	55	0.05	0.01
40	0.04	0.00	60	0.06	0.02
5 20:07:22			72	0.07	0.03
10:59:44 cps Live			61	0.06	0.02
time (s) 2.00			61	0.06	0.02
ew5			54	0.05	0.01
cps to micro			61	0.06	0.02
Sv/h			64	0.06	0.02
solar			60	0.06	0.02
corrected			52	0.05	0.01
47	0.05	0.00	55	0.05	0.01
35	0.03	0.00	48	0.05	0.01
56	0.05	0.01	48	0.05	0.01
41	0.04	0.00	51	0.05	0.01
44	0.04	0.00	60	0.06	0.02
40	0.04	0.00	59	0.06	0.02
43	0.04	0.00	57	0.05	0.01
40	0.04	0.00	62	0.06	0.02
39	0.04	0.00	65	0.06	0.02
44	0.04	0.00	63	0.06	0.02
41	0.04	0.00	63	0.06	0.02
54	0.05	0.01	67	0.06	0.02
43	0.04	0.00	68	0.07	0.02
46	0.04	0.00	56	0.05	0.01
56	0.05	0.01	74	0.07	0.03
48	0.05	0.01	72	0.07	0.03
55	0.05	0.01	62	0.06	0.02
51	0.05	0.01	64	0.06	0.02
49	0.05	0.01	74	0.07	0.03
51	0.05	0.01	67	0.06	0.02
53	0.05	0.01	67	0.06	0.02
			57	0.05	0.01
			67	0.06	0.02

70	0.07	0.03	67	0.06	0.02
67	0.06	0.02	60	0.06	0.02
72	0.07	0.03	58	0.06	0.01
56	0.05	0.01	61	0.06	0.02
59	0.06	0.02	63	0.06	0.02
56	0.05	0.01	55	0.05	0.01
51	0.05	0.01	64	0.06	0.02
59	0.06	0.02	58	0.06	0.01
48	0.05	0.01	62	0.06	0.02
50	0.05	0.01	47	0.05	0.00
49	0.05	0.01	53	0.05	0.01
48	0.05	0.01	59	0.06	0.02
47	0.05	0.00	50	0.05	0.01
49	0.05	0.01	57	0.05	0.01
43	0.04	0.00	53	0.05	0.01
50	0.05	0.01	58	0.06	0.01
57	0.05	0.01	54	0.05	0.01
49	0.05	0.01	54	0.05	0.01
58	0.06	0.01	45	0.04	0.00
48	0.05	0.01	51	0.05	0.01
49	0.05	0.01	59	0.06	0.02
51	0.05	0.01	46	0.04	0.00
53	0.05	0.01	60	0.06	0.02
60	0.06	0.02	50	0.05	0.01
53	0.05	0.01	58	0.06	0.01
59	0.06	0.02	52	0.05	0.01
61	0.06	0.02	47	0.05	0.00
60	0.06	0.02	58	0.06	0.01
67	0.06	0.02	63	0.06	0.02
69	0.07	0.03	68	0.07	0.02
75	0.07	0.03	60	0.06	0.02
76	0.07	0.03	71	0.07	0.03
69	0.07	0.03	72	0.07	0.03
70	0.07	0.03	70	0.07	0.03
70	0.07	0.03	81	0.08	0.04
61	0.06	0.02	86	0.08	0.04
63	0.06	0.02	84	0.08	0.04
75	0.07	0.03	85	0.08	0.04
75	0.07	0.03	83	0.08	0.04
75	0.07	0.03	77	0.07	0.03
71	0.07	0.03	75	0.07	0.03
63	0.06	0.02	76	0.07	0.03
70	0.07	0.03	82	0.08	0.04
75	0.07	0.03	84	0.08	0.04
89	0.09	0.04	74	0.07	0.03
			72	0.07	0.03
			73	0.07	0.03
			52	0.05	0.01
			68	0.07	0.02
			64	0.06	0.02
			71	0.07	0.03
			73	0.07	0.03
			71	0.07	0.03
			80	0.08	0.04
			68	0.07	0.02
			70	0.07	0.03
			72	0.07	0.03
6 20:07:22					
11:04:44 cps Live					
time (s) 2.00					
ew6					
64	0.06	0.02			
77	0.07	0.03			
69	0.07	0.03			

24	0.02	0.00
35	0.03	0.00
41	0.04	0.00
44	0.04	0.00
39	0.04	0.00
47	0.05	0.00
43	0.04	0.00
37	0.04	0.00
44	0.04	0.00
39	0.04	0.00
47	0.05	0.00
30	0.03	0.00
31	0.03	0.00
38	0.04	0.00
28	0.03	0.00
46	0.04	0.00
44	0.04	0.00
46	0.04	0.00
52	0.05	0.01
47	0.05	0.00
47	0.05	0.00
45	0.04	0.00
36	0.03	0.00
44	0.04	0.00
38	0.04	0.00
28	0.03	0.00
30	0.03	0.00
33	0.03	0.00
42	0.04	0.00
42	0.04	0.00
47	0.05	0.00
43	0.04	0.00
31	0.03	0.00
41	0.04	0.00
46	0.04	0.00
37	0.04	0.00
37	0.04	0.00
36	0.03	0.00
41	0.04	0.00
34	0.03	0.00
34	0.03	0.00
38	0.04	0.00
40	0.04	0.00
32	0.03	0.00
33	0.03	0.00
32	0.03	0.00
25	0.02	0.00
31	0.03	0.00
27	0.03	0.00
28	0.03	0.00
32	0.03	0.00
28	0.03	0.00
37	0.04	0.00
27	0.03	0.00
26	0.03	0.00
35	0.03	0.00
28	0.03	0.00

24	0.02	0.00
27	0.03	0.00
25	0.02	0.00
25	0.02	0.00
28	0.03	0.00
34	0.03	0.00
32	0.03	0.00
23	0.02	0.00
23	0.02	0.00
39	0.04	0.00
24	0.02	0.00
27	0.03	0.00

8 20:07:22		
11:14:55 cps Live	cps to micro	solar
time (s) 2.00	Sv/h	corrected
ew8		
34	0.03	0.00
35	0.03	0.00
32	0.03	0.00
39	0.04	0.00
29	0.03	0.00
38	0.04	0.00
35	0.03	0.00
34	0.03	0.00
31	0.03	0.00
34	0.03	0.00
30	0.03	0.00
36	0.03	0.00
29	0.03	0.00
32	0.03	0.00
40	0.04	0.00
32	0.03	0.00
42	0.04	0.00
32	0.03	0.00
43	0.04	0.00
36	0.03	0.00
39	0.04	0.00
36	0.03	0.00
30	0.03	0.00
38	0.04	0.00
34	0.03	0.00
26	0.03	0.00
42	0.04	0.00
30	0.03	0.00
42	0.04	0.00
36	0.03	0.00
38	0.04	0.00
39	0.04	0.00
29	0.03	0.00
29	0.03	0.00
29	0.03	0.00
32	0.03	0.00

35	0.03	0.00	32	0.03	0.00
32	0.03	0.00	36	0.03	0.00
41	0.04	0.00	23	0.02	0.00
33	0.03	0.00	31	0.03	0.00
48	0.05	0.01	31	0.03	0.00
38	0.04	0.00	25	0.02	0.00
35	0.03	0.00	28	0.03	0.00
42	0.04	0.00	35	0.03	0.00
46	0.04	0.00	40	0.04	0.00
37	0.04	0.00	36	0.03	0.00
38	0.04	0.00	34	0.03	0.00
34	0.03	0.00	47	0.05	0.00
38	0.04	0.00	40	0.04	0.00
39	0.04	0.00	45	0.04	0.00
32	0.03	0.00	37	0.04	0.00
33	0.03	0.00	38	0.04	0.00
37	0.04	0.00	39	0.04	0.00
28	0.03	0.00	35	0.03	0.00
36	0.03	0.00	43	0.04	0.00
30	0.03	0.00	43	0.04	0.00
23	0.02	0.00	49	0.05	0.01
34	0.03	0.00	42	0.04	0.00
30	0.03	0.00	34	0.03	0.00
29	0.03	0.00	38	0.04	0.00
21	0.02	0.00			
26	0.03	0.00			
36	0.03	0.00			
29	0.03	0.00			
30	0.03	0.00			
31	0.03	0.00			
31	0.03	0.00			
27	0.03	0.00			
29	0.03	0.00			
27	0.03	0.00			
32	0.03	0.00			
26	0.03	0.00			

APPENDIX 3 WHS Risk Assessment

Consequence	Likelihood				
	Unlikely	Possible	Likely	Almost Certain	
	Catastrophic <i>Eg. Kill or Permanently Maim</i>	MEDIUM	HIGH	EXTREME	EXTREME
	Major <i>Eg. Long term Injury or Illness</i>	MEDIUM	MEDIUM	HIGH	EXTREME
	Moderate <i>Eg. Medical Attention with several days off work</i>	LOW	MEDIUM	MEDIUM	HIGH
	Minor <i>Eg. First Aid Needed</i>	LOW	LOW	MEDIUM	MEDIUM

Summary of Requirements

Personal Protective Equipment	Broad rimmed hat, long sleeve cotton shirt with good sun protection and comfort, comfortable long pants, solid work/walking shoes, sun glasses, insect repellent, sun screen,
Training	Bush craft and field work
Equipment	Clothing, water containers, snacks, pocket knife, communication device(s) [mobile phone with good signal], measurement equipment, camera, first aid kit
Relevant Legislation etc.	NSW Work Health and Safety
Review	During the measurement survey

Hazard Identification		Control		Risk Assessment
What are the steps of the activity / items of equipment	What are the potential hazards	What methods will be used to reduce the likelihood and/or the consequence of an illness or injury from those hazards	What hazard remains	What is the level of risk remaining based on the Risk Assessment matrix
Vehicular travel to and from site	Vehicular accident	Trucking Road Safety Protocols	Accident due to other person's misadventure	Medium
Sun exposure	Sun burn, melanoma, heat stroke	Long sleeve shirts, long pants, hat and sun screen	Heat exhaustion and possible sun exposure due to reflection	Low
Slip, trip and fall	broken limbs, vegetative impalement, unconsciousness, lack of rescue	Care in walking, avoiding areas of greatest concern, use of remote communication device(s)	Small possibility of trip	Medium

Snake bite	Severe medical reaction, hospitalisation, death	Not working at a time of greatest snake activity, avoiding areas of greatest vegetative density and risk, appropriate clothing	Small possibility of interacting with a snake	Medium
Insect bite	Itches, medical reaction, allergy, pathogens	Long sleeve shirts, long pants, hat and insect repellent	Small possibility of insect bite	Medium
Tick problems	Pathogens and diseases, discomfort, hospitalisation	Long sleeve shirts, long pants, hat and insect repellent, avoiding dense vegetation areas; continual vigilance and end of day body check	There still remains the possibility of tick infestation	Medium
Vegetation (cuts, scratches and reactions)	Scratches, bleeding, infections, reaction to vegetation materials	Long sleeve shirts, long pants, hat and avoiding dense vegetation areas	Slight possibility of all the problems listed	Medium
Dehydration	Unconsciousness, loss of normal body function(s)	Carrying and drinking sufficient drinking water as is needed	Slight chance of dehydration	Low
Disorientation (geographical misplacement)	All of the above hazards (except vehicle travel)	Use of GPS and ensuring a good supply of batteries.	none	Low
Falling Branches	Injury, unconsciousness, death	Vegetation and tree awareness; avoiding as much as is possible locations of greatest hazard	unlikely	Low
Plant Interaction	Injury, unconsciousness, death	Following Newcastle Sand's Protocols and safety Procedures	Small possibility	Low

APPENDIX 4 Exploranium Calibration Certificate

 Queensland Government		Forensic and Scientific Services HSSA Health Services Support Agency	
--	--	---	--

CERTIFICATE OF CALIBRATION

CLIENT: INMED Healthcare Pty. Ltd. 45 Prime Drive Seven Hills NSW 2147 leeann.sands@inmed.com.au ATTN: Leeann Sands	Laboratory Reference: 20060055 Client Order Number: n/a Quote Number: n/a Date Received: 16/06/2020 Date Commenced: 29/06/2020 Laboratory Number/s: 19PX422_Environmental
--	--

INSTRUMENT DESCRIPTION

	Instrument	Detector
Manufacturer:	SAIC Exploranium	
Model:	GR130	
Serial Number:	9940+GM	
Type :	Nal+GM	

PRE CALIBRATION CHECKS

Visual Inspection:	Check performed adequately on receipt, during and after the calibration process.
Battery Check:	Check performed adequately on receipt, during and after the calibration process.
High/Low Voltage:	N/A
Self-diagnosis system:	N/A
Desiccant condition:	N/A
Mechanical zero:	No adjustment was necessary.
Check Source Reading:	No check source was supplied.
Background/Leakage:	All calibration measurements were adjusted to take into account the background radiation levels.

CALIBRATION CONDITIONS

Detector Reference Point:	The effective measurement point was taken to be the centre of the detector volume.
Instrument Orientation:	The instrument was orientated so that its detector axis was parallel to the surface plane of the calibration pads.
Cosmic Response:	The cosmic response of the instrument was 1.4 ± 0.7 nGy/h (Count time - 30 sec). Local cosmic background radiation was 40 nGy/h ¹ . (1 - "FAA's Civil Aerospace Medical Institute Radiobiology Research Team, CARI-6: 2004, United States of America Federal Aviation Administration. p. Computer Firmware.")

ATMOSPHERIC CONDITIONS

Dry Bulb Temperature:	25 °C
Relative Humidity:	60 %
Atmospheric Pressure:	1014 hPa (765.4 mm Hg)
Height Above Sea Level:	32.4 m

This report overrides all previous reports. The results relate solely to the sample/s as received and are limited to the specific tests undertaken as listed on the report. The results of this report are confidential and are not to be used or disclosed to any other person or used for any other purpose, whether directly or indirectly, unless that use is disclosed or the purpose is expressly authorised in writing by Queensland Health and the named recipient on this report. To the fullest extent permitted by law, Queensland Health will not be liable for any loss or claim (including legal costs calculated on an indemnity basis) which arise because of (a) problems related to the merchantability, fitness or quality of the sample/s, or (b) any negligent or unlawful act or omissions by Queensland Health that is connected with any activities or services provided by Queensland Health under this agreement (including the timing and/or method under which the sample/s were taken, stored or transported).

Enquiries: Principal Health Physicist Phone (+61) 7 3096 2901	39 Kessels Road Coopers Plains QLD 4108 AUSTRALIA	PO Box 594 Archerfield QLD 4108 AUSTRALIA	Phone (+61 7) 3096 2900 Fax (+61 7) 3096 2913 Email FSS-RadiationScience@health.qld.gov.au
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CALIBRATION TRACEABILITY

The expected air kerma rates 150mm above the Calibration pads are traceable to measurements using a reference High Pressure Ion Chamber (RSS-131ER -SN- 12B0038D) calibrated across a range of energies utilising radioactive sources traceable to NIST standards.

Nuclide /photon source	Emission	Serial Number	Nominal Activity (GBq)	Reference Date
Caesium-137	0.662 MeV gamma	1192GN	0.037	01-July-1984

CALIBRATION RESULTS - DOSE RATE MODE (Without Stabilization)

PAD	Expected air Kerma rate (nGy/h)	Cosmic & Bgnd corrected measured Kerma (nGy/h)	Uncertainty (2u) (%) of corrected level	Variation from expected (%)	Calibration Factor
1	9.00	-	-	-	-
2	29.00	56.57	7.1%	95.1%	0.51
3	68.00	121.14	8.6%	78.2%	0.56
4	190.00	365.71	5.3%	92.5%	0.52
5	312.00	645.71	3.3%	107.0%	0.48

CALIBRATION RESULTS - DOSE RATE MODE (With Stabilization)

PAD	Expected air Kerma rate (nGy/h)	Cosmic & Bgnd corrected measured Kerma (nGy/h)	Uncertainty (2u) (%) of corrected level	Variation from expected (%)	Calibration Factor
1	9.00	-	-	-	-
2	29.00	44.60	7.6%	53.8%	0.65
3	68.00	120.31	5.5%	76.9%	0.57
4	190.00	392.31	2.8%	106.5%	0.48
5	312.00	623.74	2.2%	99.9%	0.50

CALIBRATION RESULTS - SPECTRUM MODE (eU, eTh, and K%)

No results available

This report overrides all previous reports. The results relate solely to the sample/s as received and are limited to the specific tests undertaken as listed on the report. The results of this report are confidential and are not to be used or disclosed to any other person or used for any other purpose, whether directly or indirectly, unless that use is disclosed or the purpose is expressly authorised in writing by Queensland Health and the named recipient on this report. To the fullest extent permitted by law, Queensland Health will not be liable for any loss or claim (including legal costs calculated on an indemnity basis) which arise because of (a) problems related to the merchantability, fitness or quality of the sample/s, or (b) any negligent or unlawful act or omissions by Queensland Health that is connected with any activities or services provided by Queensland Health under this agreement (including the timing and/or method under which the sample/s were taken, stored or transported).

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COMMENTS

The centre of detector was sitting 150 mm from the surface of calibration pad for all measurements.

Over-Range Response: Not applicable to this environmental level calibration.

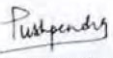
Energy Dependence Factors: The response of the instrument was tested for a range of NORM energies (46keV to 2.612 MeV) using U238; Th232 and progeny and K40 spiked aerated concrete (density=1550kg/m³) planar sources shown to be homogenous and produce uniform radiation fields.

Accuracy: For calibration of this instrument, accuracy is dependent on laboratory measurements, transfer standards and stability of the instrument being calibrated. The uncertainty of the corrected measurement tends to be larger at the very low air kerma levels associated with pads #1 & #2. The result for this calibration can be considered reliable to within 20%.


General: Method as described in Radiation & Nuclear Science unit Technical Document RSS14-004 - NORM based Environmental Radiation Calibration Facility - Calibration Procedure (based on published paper: Wallace, J 2016 JER, Establishing a NORM Based Radiation Calibration Facility)

NEXT CALIBRATION DUE 29 June 2021

PERFORMED BY


Pushpendra Chauhan
Snr Health Physicist
Radiation & Nuclear Science
1-Jul-20

REVIEWED BY


Drew Watson
Principal Health Physicist
Radiation & Nuclear Science

This report overrides all previous reports. The results relate solely to the sample/s as received and are limited to the specific tests undertaken as listed on the report. The results of this report are confidential and are not to be used or disclosed to any other person or used for any other purpose, whether directly or indirectly, unless that use is disclosed or the purpose is expressly authorised in writing by Queensland Health and the named recipient on this report. To the fullest extent permitted by law, Queensland Health will not be liable for any loss or claim (including legal costs calculated on an indemnity basis) which arise because of (a) problems related to the merchantability, fitness or quality of the sample/s, or (b) any negligent or unlawful act or omissions by Queensland Health that is connected with any activities or services provided by Queensland Health under this agreement (including the timing and/or method under which the sample/s were taken, stored or transported).

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APPENDIX 5 SEI RadAlert Calibration Certificate



Date: 29/06/2020
 Customer: Bartolo Safety Management Services
 Site Address: PO Box 264
 Jannali
 NSW, 2226
 Dosimeter: Inspector
 S/N: 42104
 Cal Number: IR045297

Results	
Authority standards	+/- 25
InMed standards	+/- 15

Temp 25.6°C Humidity 30%

Activity MBq	Date	1/2 Life Days	Half Lives	Current Activity	Energy (MeV)	Fractional Yield	(u/p) air	
Cs137	9.117	1/07/2017	10964.6	0.0997756	8.507784755	3.18170E-02	1.99500E-02	1.38188E-01
1907-41-3						3.21940E-02	3.64100E-02	1.34970E-01
						6.61650E-01	8.51020E-01	2.93111E-02

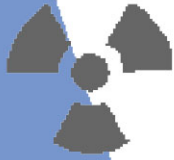
Distance (cm)	100	60	40	20
Calculated Dose Rate (uSv/hr)	0.649533483	1.804259674	4.0595843	16.238337

NOTE: Source must be flipped before taking measurement

BEFORE					
Background	0.27	Cal Factor	3340	Date	29/06/2020
Measurement	Dose Rate (uSv/hr)	Dosimeter (uSv/hr)	Ref	% Dif	Fail/Pass
100cm	0.95	1	0.6495335	12.39%	PASS
	1.05				
	1				
60cm	2.28	2.25	1.8042597	10%	PASS
	2.37				
	2.1				
40cm	4.55	4.61666667	4.0595843	7%	PASS
	4.6				
	4.7				
20cm	18.3	18.06666667	16.238337	10%	PASS
	17.8				
	18.1				

ADJUSTED					
Background	Cal Factor	Date	#####		
Measurement	Dose Rate (uSv/hr)	Dosimeter (uSv/hr)	Ref	% Dif	Fail/Pass
1		#DIV/0!	0.649533483	#DIV/0!	#DIV/0!
2		#DIV/0!	1.804259674	#DIV/0!	#DIV/0!
3		#DIV/0!	4.059584266	#DIV/0!	#DIV/0!
4		#DIV/0!	16.23833707	#DIV/0!	#DIV/0!

Completed by: J Enderstein

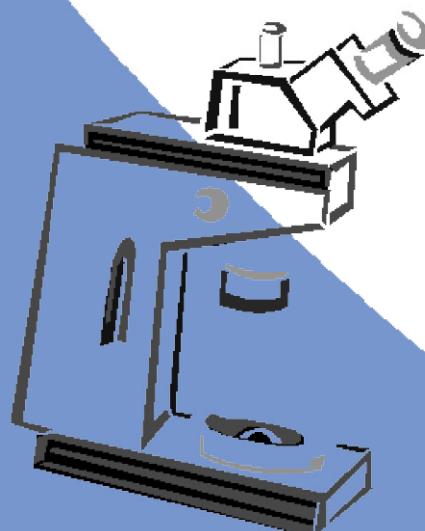


Surface Gamma Radiation Survey of Sections 3 & 4 of the Sand Quarry Site, Cabbage Tree Road, Williamtown, NSW

7 December 2020

**BARTOLO SAFETY
MANAGEMENT SERVICE**

Laboratory, Radiation and
Dangerous Goods Consultant



Surface Gamma Radiation Survey of Sections 3 & 4 of the Sand Quarry Site, Cabbage Tree Road, Williamtown, NSW

December 2020

by
Bartolo Safety Management Service
PO Box 264
Jannali NSW 2226
Phone/fax: 02 9528 7676
Mobile: 0427 287 630
Email: bartolo-safety@hotmail.net.au

Disclaimer
The material contained in this report is the professional opinion of the author based on the relevant Legislation, Australian Standards, Codes of Practice and experience. The author has taken all care with respect to the information contained in the report but takes no responsibility for any errors contained in it or arising from it.

This report has been prepared in accordance within the scope of services described, in consultation between the Douglas Partners Pty Ltd and Bartolo Safety Management Service. The report may rely on information, data, surveys and results provided by the client and the client shall assume responsibility for the accuracy of the supplied information.

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Author:

William C F Bartolo, B.Sc., M.Sc., M.A.R.P.S

Signed:

.....

Date: ...7th December, 2020.

Reviewer:

.....

Signed:

.....

Date:

.....

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1.0 Introduction

Glossary

ARPANSA – Australian Radiation Protection Nuclear Science Agency

Becquerel – the SI unit for radioactive activity is defined as the number of disintegrations per second

EPA – Environmental Protection Agency

Gray – is the SI unit of absorbed dose). It is defined as an energy deposition of one joule per kilogram.

NORM – Naturally Occurring Radioactive Material

Sievert – is the SI unit of equivalent dose. Dose equivalent remains, by definition, the absorbed dose multiplied by the quality factor, Q.

TENORM – Technically Enhanced Naturally Occurring Radioactive Material

1.1 Site Description

The site (see Appendix 1), Cabbage Tree Road site Williamtown, has been partly sand mined and is generally an undulating site with some low lying areas that have creeks and ponds.

The area Under consideration is deemed as sections 3 & 4 and is being quarried for the sand for use in construction etc.

The site has a total area of approx. 4ha and the survey measurements were taken on 1st December 2020.

Additionally, there has been some import in the past of ironstone river pebble to form the access roads, etc.

1.2 Purpose

The purpose of this project is to determine if there is any remaining deposits of heavy mineral sands and their associated radioactivity, either left as not being mined or due to man's activities such as stock-piling and vehicle wash-downs.

1.3 Scope

The scope of the work being undertaken by Bartolo Safety Management Service is the Geotechnic Surface Gamma Radiation Survey (where the terrain and vegetation permits). Any situations elucidated during the survey will not be part of this work.

Radiological exposure of non-human species was not included within the scope of this assessment, nor was assessment of non-radiological contaminants.

1.4 Information and Reference Material

General

Natural radionuclide content in soil can vary significantly as evidenced by the following ranges of global median values: 16-110 Bq/kg for uranium-238, 11-64 Bq/kg for thorium-232 and 140-850 Bq/kg for potassium-40[3]. Mineral sands can have enhanced concentrations of the naturally occurring radionuclides uranium-238 and thorium-232, as well as their associated decay progeny, which can result in elevated terrestrial air kerma rates. In-situ processing of mineral sands typically separates sands of varying mineralogy by mass, magnetic and electrostatic properties; the main constituents include rutile, ilmenite, zircon, garnet and monazite. A dataset of uranium-238 and thorium-232 concentrations in heavy mineral sands is listed in Table 1.

TABLE 1: Typical specific activity concentrations of uranium and thorium in commercially available South East Queensland mineral sands (adapted from Johnston, 1988)^[4].

MINERAL PRODUCT	Uranium-238 (Bq/kg)	Thorium-232 (Bq/kg)
Rutile	560 ± 50	70 ± 15
Ilmenite	50 ± 20	64 ± 20
Zircon	3900 ± 300	620 ± 30
Monazite	21000 ± 2000	147000 ± 1900

(Note: while the radiation dose units in the different State regulations are variously quoted in μSv (microsievert) or μGy (microgray) these units are identical for gamma radiation in this situation)

The results of the radiation survey are compared to the limits as set in the following:

A surface radiation survey, as described in EPA Guideline 12 (see below), was conducted to better define radiation levels over the site. There is no justification under **Guideline 12** and **International Commission on Radiation Protection** guidelines for further investigation methods such as sub-surface bore and soil measurements. The process of accurate boring and bore radiation measurements is relatively expensive, with only a very few companies/authorities in Australia doing such work.

The International Commission on Radiological Protection (ICRP) recommendations

The ICRP, an independent international body, recommends upper limits on acceptable radiation dose to occupationally exposed workers (20mSv/yr averaged over 5 years) and members of the public (1mSv/yr). These limits are accepted throughout the world and used as the basis of national laws and regulations. The most recent recommendations were published in 1991 (ICRP 1991) and have been reconfirmed in 2007 (ICRP 103).

This publication introduced a new concept that is relevant to this site; the concept of “intervention”. Intervention applies to situations, such as abandoned contaminated sites, where “the sources of exposure and the exposure pathways are already present and the only type of action available is intervention”.

These ICRP recommendations have been adopted by the National Health and Medical Research Council (NHMRC 1995) [now controlled by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)] for use in Australia. ARPANSA has also updated and/or released a number of documents such as RPS 9 *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste management in Mining and Mineral Processing* (2005), and RPS 15 *Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM)* (2008). The relevant Commonwealth and State laws and Codes of Practice in turn adopt the NHMRC/ARPANSA recommendations but not all ARPANSA codes have yet been gazetted/mandated or included in the legislation at this time.

New South Wales

NSW Radiation Control Branch Radiation Safety Information Series No 12: ***Clean-up and Disposal of Radioactive Residues from Commercial Operations Involving***

Mineral Sands.

This document is based on the 1984 recommendations of the NHMRC and so does not necessarily reflect current international recommendations or limits/constraints. It is also only aimed at active sand mining sites, not “out of control” situations (out of control meaning that the plant and/or company are no longer operational). The limits set in this document do not correlate with current ICRP and National radiation limits. The Radiation Branch of the NSW EPA, however, has not yet produced a revised version, nor does it include reference to the latest relevant ARPANSA Codes.

Action levels are set:

- For high occupancy areas such as dwellings, schools (including playground), businesses factories etc. where occupancies by the same individuals occur regularly on a day by day basis, the remedial action level should be 0.7 $\mu\text{Gy/hr}$ (700 nGy/hr) at 1 m above the ground.
- For intermediate occupancy areas where occupancies are for a few hours per week by the same individuals or by differing individuals and for garden areas, the remedial action level should be 1.0 $\mu\text{Gy/hr}$ (1000 nGy/hr) at 1 m above the ground.
- For roads paths, and other areas with intermittent occupancy the remedial action level should be 2.5 $\mu\text{Gy/hr}$ (2500 nGy/hr) at 1 m above the ground.

Other States

See Appendice 2

2.0 Historic Aspects

This land has been sand mined in an unusual pattern, probably following a natural depressions where the heavy mineral sands would accumulate due to transport mechanisms such as water run-off and wind erosion.

The land does not appear to have been developed since the mining, other than a little sand quarrying.

3.0 Instruments and Measurement Technique

3.1 Instruments

- SAIC Exploranium Model No.: GR130 Serial No.: 9940+GM Gamma ray survey (calibration conducted in June 2020 [see attached sheets Appendix 5] and confirmed on the day by use of an educational Thorium Standard and stabilized using a Cs-137 source);
- As a confirmation of any “high” counts a Radiation Alert “Inspector” (Calibrated June 2020 - see Appendix 6), also used with the wipe test plate for the soil analysis ;
- a Magellan eXplorist 110 GPS unit.

The SAIC equipment measures in Counts per Second, and hence measurements need to be converted to dose rate for comparison with the NSW Guidelines and other documents. To do this the following formula, which is based and derived from the data supplied with the calibration certificates, is used:

$$y = 1.0127x - 1E-11$$

$$R^2 = 1$$

Where:

y – is dose rate in nGy/hr

x – is counts per second

3.2 Measurement Techniques

Surface Measurements

The proposal was to measure each of the lots as discreet areas with each area measured at approximately 10 metre grid transect using the GPS for tracking of the measurement transects and any other deviations and paths. This whole approach was dependent on the conditions (vegetation, radiation activity, topography, obstructions, and structures), Work health and Safety (WHS) Risk Assessment and as such the measurement transect pattern varied slightly taking the Risk Assessment into consideration as the procedure progressed. This modification “on-the-run” would continually consider the necessity of accurate and reliable data, and the need for sufficient measurements to capture substantial contamination zones.

The transect patterns that were finalized “on-the-run” are displayed in the Appendix (Appendix 2).

The measurement process is to trek the transect line with the instrument above the ground at about the 1 metre level. Measurements were noted when the auditory level of the instrument changed. Any “high” measurements were defined by moving about the area to determine the limit of the contamination and the highest level. The measurements would then be confirmed by using the RadAlert instrument.

The SAIC Exploranium is set up to record the measurements every two seconds in unique data sets as determined by when the measurement activity is terminated. Two second measurement intervals would equate to approximately 3 metres of normal walking over an easy walking surface. Once the work or area under consideration is completed the Exploranium is then attached to a computer and the data downloaded as a CSV file for assessment and manipulation.

NOTE: the measurements as displayed in the relevant appendices **do not** indicate a length of transect but rather in this situation the time and thus difficulty of progress across the terrain.

The information contained in the header of the first column of the results is the following for example:

Using Transect P6-B3 the header is:

3 16:05:25 10:20:28 cps Live time (s) 2.00

- The first number is the data set number (hence this is data set 3 for this site)
- The second set 16:05:25 is the date – 25 May 2016
- The third set 10:20:28 is the time – is 10.20.28 AM
- The fourth set of information is cps indicating that the results are in Counts Per Second
- The last piece of information is Live Time (s) 2.00 which means that the measurement and data record is set at 2 second intervals.

Cosmic Radiation Component

The cosmic radiation component of natural background is latitude, longitude and altitude dependent; and has been calculated using United States Federal Aviation Administration Civil Aerospace Medical Institute software ‘CARI-6’. The mean cosmic surface air kerma rate for September was 40.7 nGy/h (0.041 µSv/h) at 32

48 S, 151 48 E, elevation of 10 m, using a dose conversion factor of 1Sv/Gy.

This does not however take into account such things as heavy cloud, rain and dense vegetation canopy which acts as shielding.

The results in the relevant Appendices have not been adjusted by the reduction of the measurements by the 0.0407 $\mu\text{Sv/h}$ factor and this has been incorporated in the data contained in column 3 of the data sets of the relevant appendices.

Work, Health and Safety Risk Assessment

As this work is being conducted in a “remote” location and that there are various risks associated with this type of work (such as slips, trips and falls, snake/spider/tick/insect bites, cuts and abrasions due to vegetation, allergy reactions to plants and other things, and falling limbs and branches) then a risk assessment is required and that this risk assessment is “living” whilst the work is being conducted.

As the risk for some of the hazards are medium and high then the approach BSMS will conduct during the transect measurements will be to change the transects as needed to avoid or minimise such risks.

4.0 Survey Results

4.1 General

All measurements were completed on the 1st December 2020, and the results for the transects that were measured, showed results that in general were not of concern in terms of radiation.

The areas that had the higher though still insignificant in terms of exposure were all associated with the road base rock used for the making of the access tracks. The areas that actually were above the general level for these section (but are at or about normal background level) are highlighted in pale yellow for interest only. The transect that had the highest dose rate was EW7 and that coincided with the track./road which had river pebble used as road base.

As can be seen from the results the dose range was from 0.0 to 0.32 $\mu\text{Sv/h}$, which is still well below the 0.7 $\mu\text{Sv/h}$ limit for residential use. Hence there would be no radiological concerns for this area.

5.0 Discussion

NOTE: The transects were not conducted as planned due to the large population of spiders (mostly orb weavers – Golden Orb Weavers, and other species) and spider webs – this caused loss of direction and the rambling of the transects. It was extremely difficult to walk the planned transects and avoid the spiders at the same time.

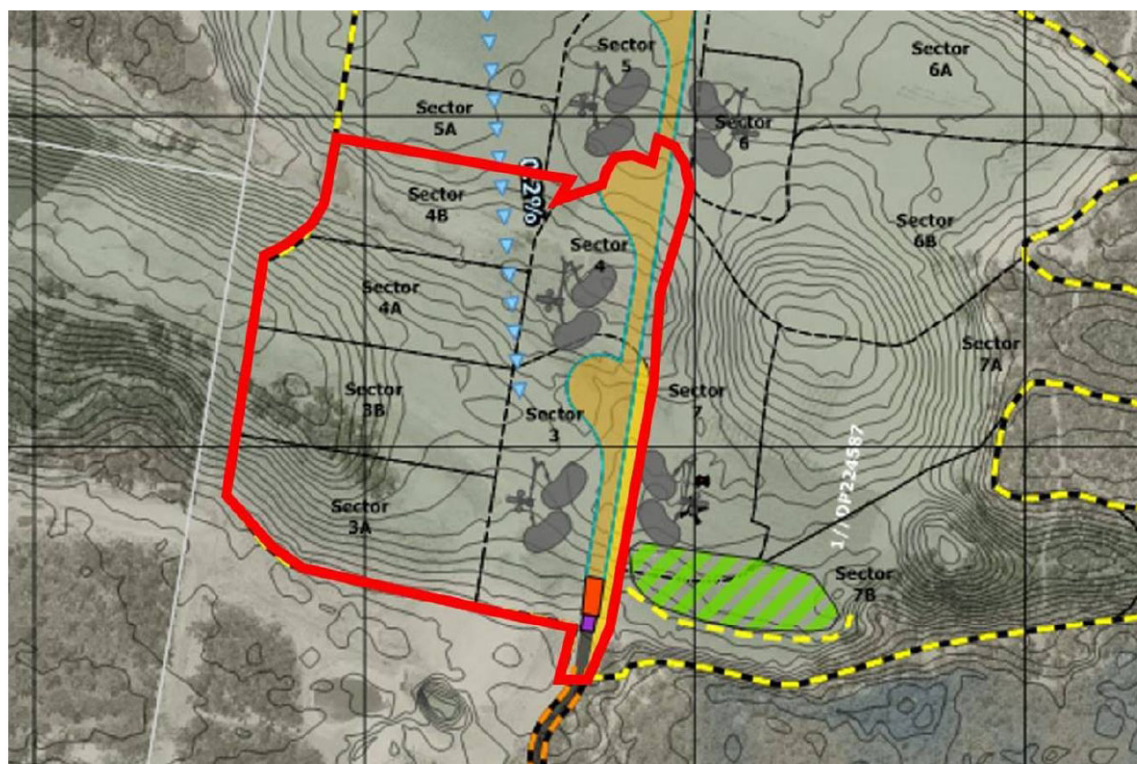
On examining the results of the surface gamma radiation survey there are no radioactive concentrations or activities that are of any concern for the proposed use of the land/sand. All locations are below the level of 0.7 $\mu\text{Sv/hr}$ set by the NSW Guideline for residential use.

The results, even when compared to the most restrictive of the guidelines/legislation (WA in this instance), indicate that none of the results would

reach the level of 0.46 $\mu\text{Gy/hr}$ for dwellings (note 0.46 $\mu\text{Gy/hr}$ is equivalent to 0.46 $\mu\text{Sv/hr}$ in this situation; conversion factor of 1:1). As such there is no need for any remedial action or intervention.

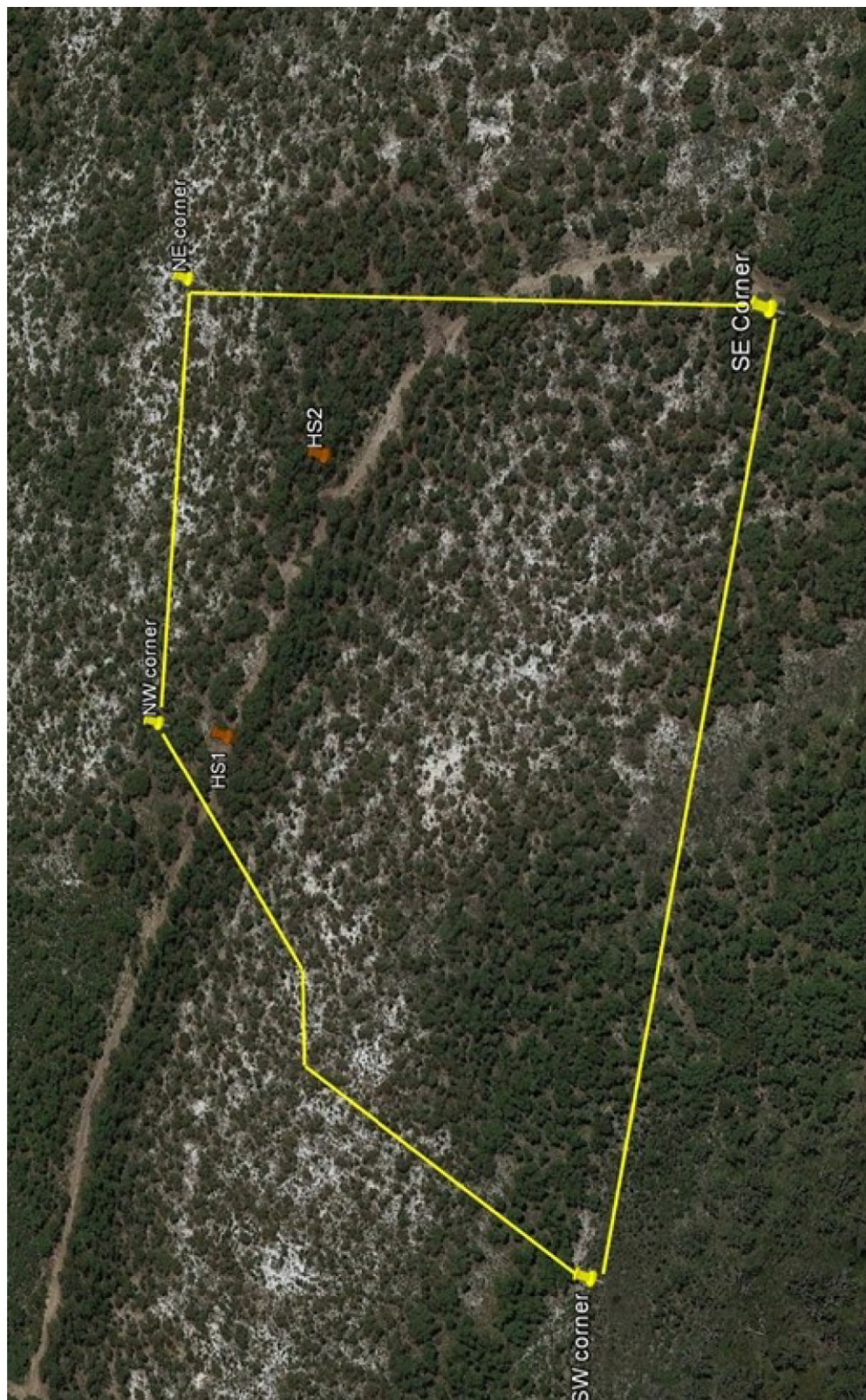
References

- ICRP 2007. Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Elsevier 2007.
- NSW Dept of Health. Guidelines for the Clean-up and Disposal of Radioactive Residues from Commercial operations Involving Mineral Sands 1984. Available from NSW DECC (EPA).
- Qld Health Department. Radiation Dose Levels For Properties Where Mineral Sand Residues Are Deposited On The Ground. 1995
- ARPANSA RPS 9 *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste management in Mining and Mineral Processing (2005)*
- ARPANSA RPS 15 *Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM) (2008)*.
- FAA's Civil Aerospace Medical Institute Radiobiology Research Team, *CARI-6*, 2004, United States of America Federal Aviation Administration. p. Computer Freeware.



Reference	Latitude	Longitude
SE corner	32° 48' 30.9"S	151° 48' 05.5"E
SW corner	32° 48' 28.5"S	151° 47' 50.8"E
NW corner	32° 48' 21.5"S	151° 47' 59.3"E
NE corner	32° 48' 22.1"S	151° 48' 07.3"E
HS1	32° 48' 22.6"S	151° 47' 59"E
HS2	32° 48' 22.8"S	151° 47' 59.9"E

The following graphic shows a current Google satellite image of the site with coordinates shown..



APPENDIX 2 Other States' Relevant Legislation

Queensland

Queensland Health Policy Document: Radiation Dose Levels for Properties where Mineral Sand Residues are Deposited on the Ground

This document is of relevance because it was written in 1995 and incorporates the more recent ICRP concept of "intervention". For some of its recommendations, however, it still refers back to a 1984 NHMRC document.

For practices under control, where technically enhanced radiation sources (TENORM) of mineral sands are deposited on the ground the limits are:

- 0.1 $\mu\text{Sv/hr}$ above the natural background level for dwellings, schools, etc. and
- 0.2 $\mu\text{Sv/hr}$ above the natural background level for parks etc.

Assuming a background level of 0.1 $\mu\text{Sv/hr}$, the action levels for dwellings, schools, etc. would be 0.2 $\mu\text{Sv/hr}$ and for parks etc. would be 0.3 $\mu\text{Sv/hr}$. Practices under control refer to situations where the mining company is still operating and has responsibility for the land in question.

For an "out of control" practice (i.e. an intervention situation), where the mining company is not still operating and has no responsibility for the land in question, the action levels including background are:

- for dwellings, schools etc., 0.6 $\mu\text{Sv/hr}$ (600 nGy/hr),
- for parks etc., 1.0 $\mu\text{Sv/hr}$ (1000 nGy/hr) and
- for roads and footpaths, 2.5 $\mu\text{Sv/hr}$ (2500 nGy/hr).

PTO

Western Australia

Radiation Health Branch of WA Mines Department Guidelines

The Radiation Health Branch of the West Australian Mines Department set (in 1988) Guidelines for remedial action in areas of enhanced background gamma radiation levels. The action level criteria are:

- for dwellings, 0.46 $\mu\text{Gy/hr}$,
- for schools, 0.57 $\mu\text{Gy/hr}$,
- for other areas, 0.7 $\mu\text{Gy/hr}$, and
- for roads, paths etc, 2.5 $\mu\text{Gy/hr}$.

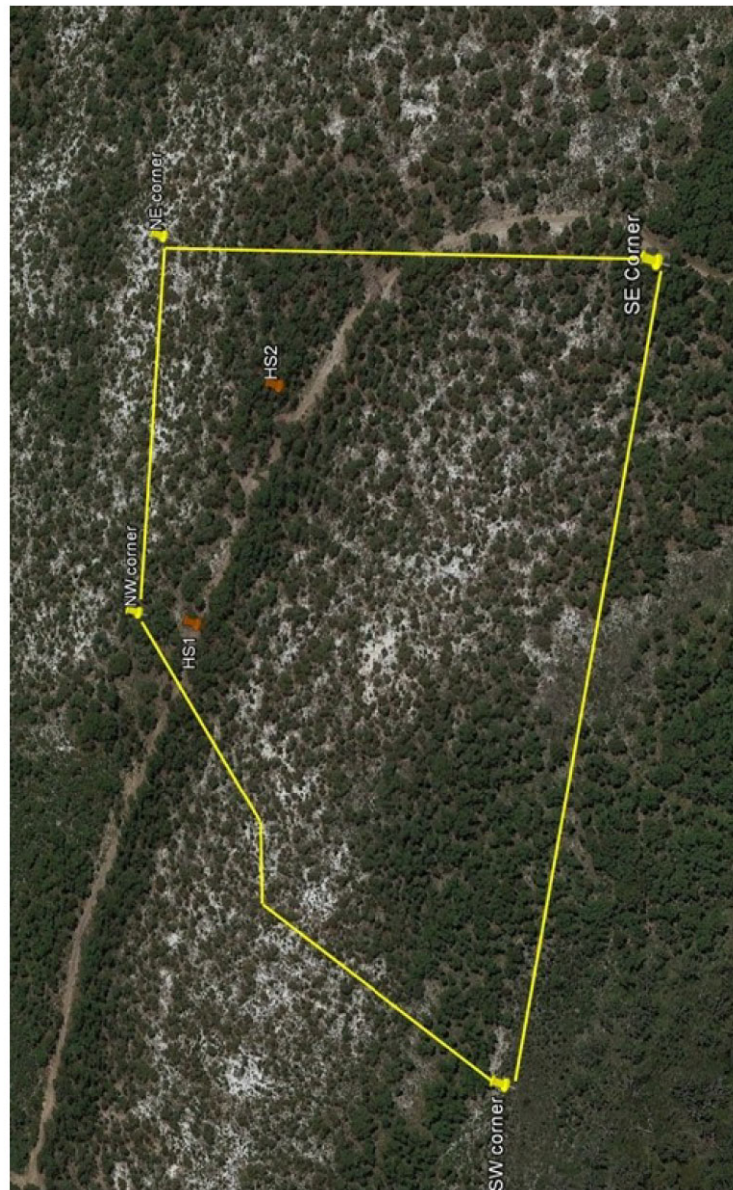
APPENDIX 4 GPS Coordinates, and transects

*Map datum WSG84; North Reference – Magnetic;
Coordinate type – Degree minutes & seconds*

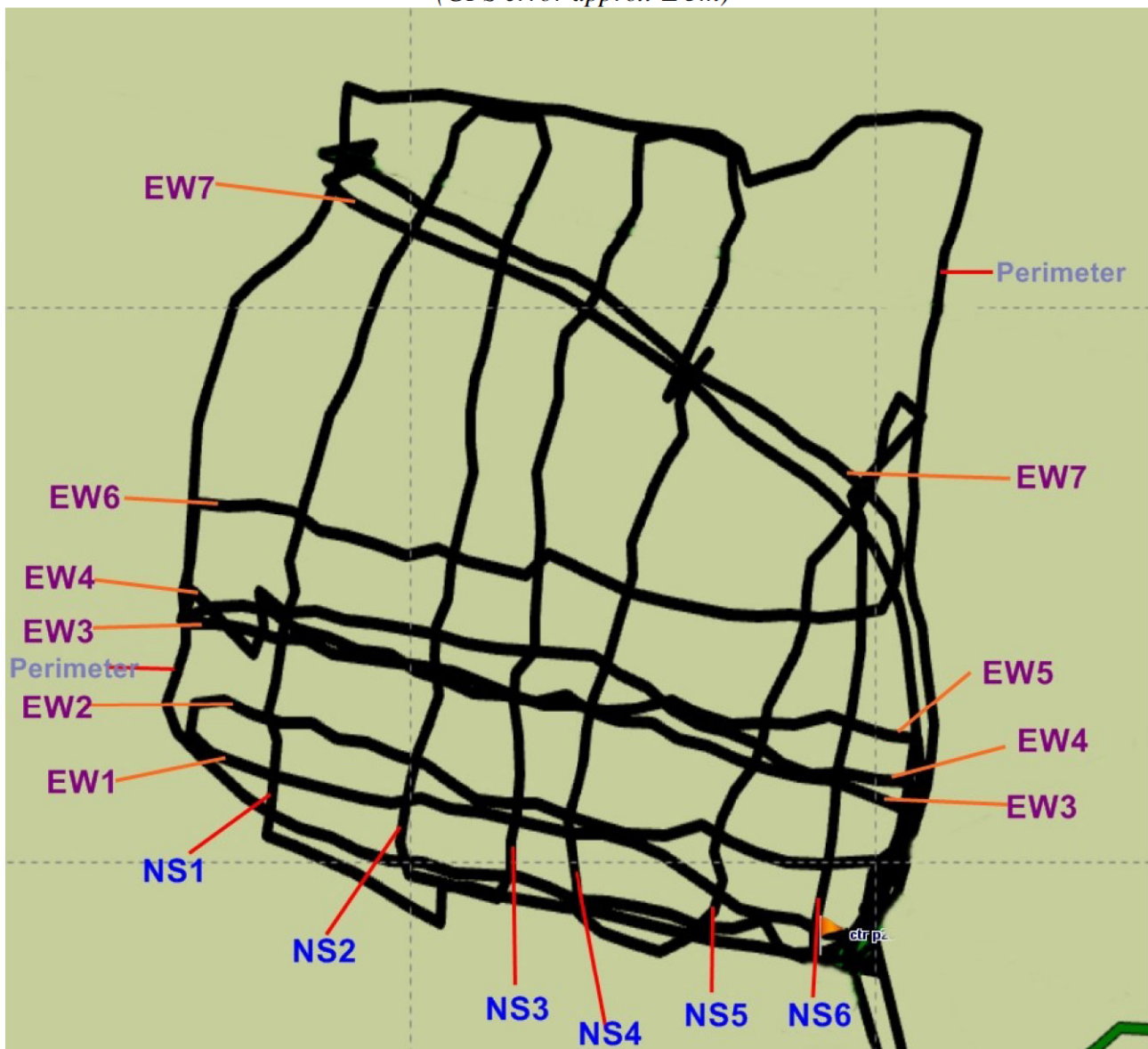
Reference	Latitude	Longitude
SE corner	32° 48' 30.9"S	151° 48' 05.5"E
SW corner	32° 48' 28.5"S	151° 47' 50.8"E
NW corner	32° 48' 21.5"S	151° 47' 59.3"E
NE corner	32° 48' 22.1"S	151° 48' 07.3"E
HS1	32° 48' 22.6"S	151° 47' 59"E
HS2	32° 48' 22.8"S	151° 47' 59.9"E

Information Detail	Value
Distance traversed	Approx. 8 km
No. transects	14 (1 perimeter, 7 EW; 6 NS)
No. data Points	Approx 3000

The Perimeter and the Corner Markers/GPS Points



*The transects (P1, EW, & NS) conducted on the site for the Gamma Radiation Surface Survey
(GPS error approx $\pm 3m$)*



APPENDIX 4 Surface Gamma Radiation Results

NS3 - 1 (South Boundary)					
1			55	0.05	0.01
20:12:01			40	0.04	0.00
08:31:31 cps Live	cps to		42	0.04	0.00
time (s) 2.00	microGy/h	solar corrected	43	0.04	0.00
90	0.09	0.05	47	0.05	0.01
87	0.09	0.05	42	0.04	0.00
94	0.09	0.05	40	0.04	0.00
68	0.07	0.03	43	0.04	0.00
61	0.06	0.02	42	0.04	0.00
75	0.07	0.03	44	0.04	0.00
77	0.08	0.04	41	0.04	0.00
71	0.07	0.03	36	0.04	0.00
60	0.06	0.02	47	0.05	0.01
59	0.06	0.02	42	0.04	0.00
56	0.06	0.01	37	0.04	0.00
58	0.06	0.02	48	0.05	0.01
66	0.07	0.02	45	0.04	0.00
74	0.07	0.03	37	0.04	0.00
67	0.07	0.03	47	0.05	0.01
64	0.06	0.02	45	0.04	0.00
53	0.05	0.01	43	0.04	0.00
42	0.04	0.00	37	0.04	0.00
32	0.03	0.00	39	0.04	0.00
51	0.05	0.01	39	0.04	0.00
42	0.04	0.00	35	0.03	0.00
48	0.05	0.01	33	0.03	0.00
39	0.04	0.00	29	0.03	0.00
46	0.05	0.00	26	0.03	0.00
44	0.04	0.00	31	0.03	0.00
55	0.05	0.01	26	0.03	0.00
54	0.05	0.01	32	0.03	0.00
48	0.05	0.01	28	0.03	0.00
43	0.04	0.00	32	0.03	0.00
43	0.04	0.00	32	0.03	0.00
54	0.05	0.01	25	0.02	0.00
50	0.05	0.01	24	0.02	0.00
49	0.05	0.01	30	0.03	0.00
60	0.06	0.02	35	0.03	0.00
57	0.06	0.02	32	0.03	0.00
54	0.05	0.01	26	0.03	0.00
49	0.05	0.01	25	0.02	0.00

37	0.04	0.00
36	0.04	0.00
30	0.03	0.00
29	0.03	0.00
29	0.03	0.00
36	0.04	0.00
33	0.03	0.00
28	0.03	0.00
38	0.04	0.00
34	0.03	0.00
34	0.03	0.00
29	0.03	0.00
28	0.03	0.00
35	0.03	0.00
30	0.03	0.00
31	0.03	0.00
23	0.02	0.00
26	0.03	0.00
27	0.03	0.00
34	0.03	0.00
36	0.04	0.00
36	0.04	0.00
24	0.02	0.00
33	0.03	0.00
27	0.03	0.00
28	0.03	0.00
30	0.03	0.00
32	0.03	0.00
25	0.02	0.00
38	0.04	0.00
31	0.03	0.00
26	0.03	0.00
29	0.03	0.00
32	0.03	0.00
30	0.03	0.00
32	0.03	0.00
29	0.03	0.00

NS3 - 2 (West Boundary)

2
20:12:01
08:36:57 cps
Live time (s)
2.00
28
31

cps to microGy/h	solar corrected
0.03	0.00
0.03	0.00

30	0.03	0.00
37	0.04	0.00
36	0.04	0.00
35	0.03	0.00
35	0.03	0.00
47	0.05	0.01
36	0.04	0.00
46	0.05	0.00
39	0.04	0.00
39	0.04	0.00
36	0.04	0.00
38	0.04	0.00
48	0.05	0.01
37	0.04	0.00
50	0.05	0.01
38	0.04	0.00
41	0.04	0.00
42	0.04	0.00
41	0.04	0.00
37	0.04	0.00
36	0.04	0.00
35	0.03	0.00
28	0.03	0.00
48	0.05	0.01
39	0.04	0.00
35	0.03	0.00
48	0.05	0.01
37	0.04	0.00
40	0.04	0.00
37	0.04	0.00
42	0.04	0.00
33	0.03	0.00
38	0.04	0.00
41	0.04	0.00
44	0.04	0.00
56	0.06	0.01
58	0.06	0.02
49	0.05	0.01
52	0.05	0.01
57	0.06	0.02
45	0.04	0.00
47	0.05	0.01
44	0.04	0.00
53	0.05	0.01
50	0.05	0.01
48	0.05	0.01
43	0.04	0.00

48	0.05	0.01	189	0.19	0.15
50	0.05	0.01	191	0.19	0.15
44	0.04	0.00	239	0.24	0.19
53	0.05	0.01	180	0.18	0.14
51	0.05	0.01	197	0.19	0.15
46	0.05	0.00	225	0.22	0.18
48	0.05	0.01	234	0.23	0.19
45	0.04	0.00	226	0.22	0.18
46	0.05	0.00	220	0.22	0.18
44	0.04	0.00	227	0.22	0.18
52	0.05	0.01	209	0.21	0.17
52	0.05	0.01	241	0.24	0.20
44	0.04	0.00	209	0.21	0.17
53	0.05	0.01	231	0.23	0.19
38	0.04	0.00	221	0.22	0.18
45	0.04	0.00	229	0.23	0.18
35	0.03	0.00	172	0.17	0.13
38	0.04	0.00	207	0.20	0.16
52	0.05	0.01	197	0.19	0.15
51	0.05	0.01	216	0.21	0.17
46	0.05	0.00	195	0.19	0.15
49	0.05	0.01	191	0.19	0.15
46	0.05	0.00	201	0.20	0.16
35	0.03	0.00	211	0.21	0.17
53	0.05	0.01	216	0.21	0.17
41	0.04	0.00	204	0.20	0.16
48	0.05	0.01	206	0.20	0.16
52	0.05	0.01	205	0.20	0.16
51	0.05	0.01	212	0.21	0.17
50	0.05	0.01	234	0.23	0.19
47	0.05	0.01	217	0.21	0.17
52	0.05	0.01	203	0.20	0.16
49	0.05	0.01	220	0.22	0.18
59	0.06	0.02	191	0.19	0.15
52	0.05	0.01	190	0.19	0.15
51	0.05	0.01	219	0.22	0.18
45	0.04	0.00	196	0.19	0.15
60	0.06	0.02	202	0.20	0.16
63	0.06	0.02	219	0.22	0.18
92	0.09	0.05	204	0.20	0.16
119	0.12	0.08	224	0.22	0.18
173	0.17	0.13	210	0.21	0.17
146	0.14	0.10	234	0.23	0.19
130	0.13	0.09	167	0.16	0.12
95	0.09	0.05	117	0.12	0.07
110	0.11	0.07	124	0.12	0.08
133	0.13	0.09	152	0.15	0.11

140	0.14	0.10
125	0.12	0.08
127	0.13	0.08
123	0.12	0.08
155	0.15	0.11
152	0.15	0.11
135	0.13	0.09
147	0.14	0.10
107	0.11	0.06
100	0.10	0.06
83	0.08	0.04
80	0.08	0.04
75	0.07	0.03

61	0.06	0.02
61	0.06	0.02
60	0.06	0.02
49	0.05	0.01
52	0.05	0.01
53	0.05	0.01
47	0.05	0.01
55	0.05	0.01
47	0.05	0.01
49	0.05	0.01
58	0.06	0.02
52	0.05	0.01
55	0.05	0.01
61	0.06	0.02
51	0.05	0.01

NS3 - 3 (North Boundary)

3		
20:12:01		
08:43:25 cps Live	cps to	
time (s) 2.00	microGy/h	solar corrected
82	0.08	0.04
69	0.07	0.03
64	0.06	0.02
72	0.07	0.03
75	0.07	0.03
72	0.07	0.03
67	0.07	0.03
64	0.06	0.02
71	0.07	0.03
80	0.08	0.04
65	0.06	0.02
53	0.05	0.01
60	0.06	0.02
61	0.06	0.02
65	0.06	0.02
69	0.07	0.03
75	0.07	0.03
75	0.07	0.03
64	0.06	0.02
69	0.07	0.03
70	0.07	0.03
56	0.06	0.01
67	0.07	0.03
52	0.05	0.01
48	0.05	0.01
57	0.06	0.02
56	0.06	0.01

58	0.06	0.02
69	0.07	0.03
59	0.06	0.02
61	0.06	0.02
64	0.06	0.02
48	0.05	0.01
52	0.05	0.01
56	0.06	0.01
63	0.06	0.02
61	0.06	0.02
62	0.06	0.02
57	0.06	0.02
56	0.06	0.01
65	0.06	0.02
66	0.07	0.02
64	0.06	0.02
56	0.06	0.01
54	0.05	0.01
57	0.06	0.02
59	0.06	0.02
55	0.05	0.01
52	0.05	0.01
52	0.05	0.01
63	0.06	0.02
60	0.06	0.02
64	0.06	0.02
58	0.06	0.02
55	0.05	0.01
59	0.06	0.02
56	0.06	0.01
59	0.06	0.02
64	0.06	0.02

70	0.07	0.03
55	0.05	0.01
71	0.07	0.03
66	0.07	0.02
78	0.08	0.04
67	0.07	0.03
60	0.06	0.02
64	0.06	0.02
60	0.06	0.02
67	0.07	0.03
57	0.06	0.02
59	0.06	0.02
56	0.06	0.01
77	0.08	0.04
55	0.05	0.01
62	0.06	0.02
63	0.06	0.02
70	0.07	0.03
70	0.07	0.03
67	0.07	0.03
61	0.06	0.02
71	0.07	0.03
67	0.07	0.03
68	0.07	0.03
57	0.06	0.02
58	0.06	0.02
53	0.05	0.01
54	0.05	0.01
59	0.06	0.02
59	0.06	0.02
60	0.06	0.02
54	0.05	0.01

NS3 - 4 (East Boundary)

4		
20:12:01		
08:48:02 cps		
Live time (s)		
2.00		
cps to microGy/h solar corrected		
53	0.05	0.01
70	0.07	0.03
61	0.06	0.02
65	0.06	0.02
69	0.07	0.03
63	0.06	0.02
52	0.05	0.01

61	0.06	0.02
60	0.06	0.02
55	0.05	0.01
62	0.06	0.02
66	0.07	0.02
55	0.05	0.01
58	0.06	0.02
59	0.06	0.02
50	0.05	0.01
61	0.06	0.02
45	0.04	0.00
54	0.05	0.01
52	0.05	0.01
35	0.03	0.00
44	0.04	0.00
49	0.05	0.01
50	0.05	0.01
44	0.04	0.00
53	0.05	0.01
54	0.05	0.01
57	0.06	0.02
52	0.05	0.01
50	0.05	0.01
53	0.05	0.01
59	0.06	0.02
49	0.05	0.01
40	0.04	0.00
43	0.04	0.00
36	0.04	0.00
41	0.04	0.00
67	0.07	0.03
62	0.06	0.02
57	0.06	0.02
57	0.06	0.02
57	0.06	0.02
57	0.06	0.02
53	0.05	0.01
54	0.05	0.01
55	0.05	0.01
48	0.05	0.01
51	0.05	0.01
55	0.05	0.01
85	0.08	0.04
56	0.06	0.01
66	0.07	0.02
54	0.05	0.01
61	0.06	0.02

56	0.06	0.01	65	0.06	0.02
66	0.07	0.02	77	0.08	0.04
53	0.05	0.01	77	0.08	0.04
63	0.06	0.02	72	0.07	0.03
79	0.08	0.04	71	0.07	0.03
80	0.08	0.04	76	0.07	0.03
68	0.07	0.03	73	0.07	0.03
83	0.08	0.04	93	0.09	0.05
58	0.06	0.02	88	0.09	0.05
66	0.07	0.02	95	0.09	0.05
73	0.07	0.03	97	0.10	0.05
56	0.06	0.01	92	0.09	0.05
56	0.06	0.01	111	0.11	0.07
81	0.08	0.04	105	0.10	0.06
78	0.08	0.04	111	0.11	0.07
85	0.08	0.04	112	0.11	0.07
81	0.08	0.04	110	0.11	0.07
68	0.07	0.03	102	0.10	0.06
77	0.08	0.04	100	0.10	0.06
68	0.07	0.03	114	0.11	0.07
68	0.07	0.03	96	0.09	0.05
64	0.06	0.02	90	0.09	0.05
65	0.06	0.02	80	0.08	0.04
57	0.06	0.02	73	0.07	0.03
58	0.06	0.02	64	0.06	0.02
64	0.06	0.02	91	0.09	0.05
59	0.06	0.02	93	0.09	0.05
52	0.05	0.01	99	0.10	0.06
46	0.05	0.00			
51	0.05	0.01			
52	0.05	0.01			
55	0.05	0.01			
49	0.05	0.01			
46	0.05	0.00			
48	0.05	0.01			
52	0.05	0.01			
44	0.04	0.00			
55	0.05	0.01			
46	0.05	0.00			
47	0.05	0.01			
52	0.05	0.01			
65	0.06	0.02			
49	0.05	0.01			
57	0.06	0.02			
60	0.06	0.02			
63	0.06	0.02			
63	0.06	0.02			

NS3 - EW1

6

20:12:01

08:58:46 cps Live

time (s) 2.00 cps to microGy/h solar corrected

60	0.06	0.02
56	0.06	0.01
49	0.05	0.01
60	0.06	0.02
59	0.06	0.02
58	0.06	0.02
56	0.06	0.01
60	0.06	0.02
48	0.05	0.01
53	0.05	0.01
52	0.05	0.01

55	0.05	0.01	55	0.05	0.01
58	0.06	0.02	43	0.04	0.00
51	0.05	0.01	34	0.03	0.00
40	0.04	0.00	35	0.03	0.00
51	0.05	0.01	34	0.03	0.00
56	0.06	0.01	41	0.04	0.00
56	0.06	0.01	33	0.03	0.00
64	0.06	0.02	52	0.05	0.01
51	0.05	0.01	45	0.04	0.00
58	0.06	0.02	48	0.05	0.01
65	0.06	0.02	44	0.04	0.00
46	0.05	0.00	44	0.04	0.00
56	0.06	0.01	47	0.05	0.01
46	0.05	0.00	43	0.04	0.00
47	0.05	0.01	41	0.04	0.00
37	0.04	0.00	33	0.03	0.00
40	0.04	0.00	46	0.05	0.00
34	0.03	0.00	39	0.04	0.00
40	0.04	0.00	47	0.05	0.01
52	0.05	0.01	47	0.05	0.01
57	0.06	0.02	41	0.04	0.00
61	0.06	0.02	52	0.05	0.01
41	0.04	0.00	45	0.04	0.00
55	0.05	0.01	45	0.04	0.00
47	0.05	0.01	56	0.06	0.01
56	0.06	0.01	43	0.04	0.00
48	0.05	0.01	46	0.05	0.00
52	0.05	0.01	37	0.04	0.00
46	0.05	0.00	41	0.04	0.00
63	0.06	0.02	48	0.05	0.01
50	0.05	0.01	52	0.05	0.01
46	0.05	0.00	53	0.05	0.01
49	0.05	0.01	53	0.05	0.01
50	0.05	0.01	50	0.05	0.01
59	0.06	0.02	37	0.04	0.00
46	0.05	0.00	56	0.06	0.01
51	0.05	0.01	51	0.05	0.01
44	0.04	0.00	44	0.04	0.00
50	0.05	0.01	44	0.04	0.00
49	0.05	0.01	38	0.04	0.00
49	0.05	0.01	43	0.04	0.00
40	0.04	0.00	43	0.04	0.00
44	0.04	0.00	44	0.04	0.00
45	0.04	0.00	39	0.04	0.00
42	0.04	0.00	41	0.04	0.00
44	0.04	0.00	33	0.03	0.00
54	0.05	0.01	40	0.04	0.00

30	0.03	0.00
30	0.03	0.00
35	0.03	0.00
24	0.02	0.00
30	0.03	0.00
29	0.03	0.00
31	0.03	0.00
31	0.03	0.00
37	0.04	0.00
28	0.03	0.00
26	0.03	0.00
25	0.02	0.00
25	0.02	0.00
32	0.03	0.00
30	0.03	0.00
30	0.03	0.00
28	0.03	0.00
25	0.02	0.00
36	0.04	0.00
32	0.03	0.00
32	0.03	0.00
26	0.03	0.00
35	0.03	0.00
37	0.04	0.00
29	0.03	0.00
29	0.03	0.00
33	0.03	0.00
35	0.03	0.00
37	0.04	0.00
41	0.04	0.00
33	0.03	0.00
29	0.03	0.00
38	0.04	0.00
30	0.03	0.00
34	0.03	0.00
38	0.04	0.00
26	0.03	0.00
34	0.03	0.00
31	0.03	0.00
30	0.03	0.00
41	0.04	0.00
32	0.03	0.00
29	0.03	0.00
35	0.03	0.00
31	0.03	0.00
34	0.03	0.00
29	0.03	0.00

36	0.04	0.00
32	0.03	0.00
36	0.04	0.00
29	0.03	0.00
29	0.03	0.00
31	0.03	0.00
31	0.03	0.00
32	0.03	0.00
34	0.03	0.00
39	0.04	0.00
32	0.03	0.00
26	0.03	0.00
29	0.03	0.00
36	0.04	0.00
34	0.03	0.00
35	0.03	0.00
35	0.03	0.00
36	0.04	0.00
31	0.03	0.00
21	0.02	0.00
25	0.02	0.00
27	0.03	0.00
27	0.03	0.00
32	0.03	0.00
31	0.03	0.00
33	0.03	0.00
28	0.03	0.00
29	0.03	0.00
31	0.03	0.00
30	0.03	0.00
27	0.03	0.00
38	0.04	0.00
32	0.03	0.00

NS3 - EW2

7

20:12:01

09:07:17 cps Live

time (s)	2.00	cps to microGy/h	solar corrected
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34	0.03	0.00
42	0.04	0.00
38	0.04	0.00
36	0.04	0.00
49	0.05	0.01
44	0.04	0.00
34	0.03	0.00

41	0.04	0.00	27	0.03	0.00
36	0.04	0.00	32	0.03	0.00
38	0.04	0.00	25	0.02	0.00
29	0.03	0.00	25	0.02	0.00
35	0.03	0.00	36	0.04	0.00
34	0.03	0.00	38	0.04	0.00
36	0.04	0.00	34	0.03	0.00
30	0.03	0.00	33	0.03	0.00
34	0.03	0.00	34	0.03	0.00
28	0.03	0.00	34	0.03	0.00
39	0.04	0.00	41	0.04	0.00
32	0.03	0.00	39	0.04	0.00
32	0.03	0.00	26	0.03	0.00
32	0.03	0.00	32	0.03	0.00
27	0.03	0.00	29	0.03	0.00
37	0.04	0.00	32	0.03	0.00
26	0.03	0.00	35	0.03	0.00
28	0.03	0.00	34	0.03	0.00
32	0.03	0.00	35	0.03	0.00
31	0.03	0.00	32	0.03	0.00
30	0.03	0.00	29	0.03	0.00
29	0.03	0.00	33	0.03	0.00
26	0.03	0.00	28	0.03	0.00
28	0.03	0.00	23	0.02	0.00
29	0.03	0.00	28	0.03	0.00
30	0.03	0.00	32	0.03	0.00
26	0.03	0.00	31	0.03	0.00
26	0.03	0.00	36	0.04	0.00
26	0.03	0.00	27	0.03	0.00
29	0.03	0.00	25	0.02	0.00
35	0.03	0.00	26	0.03	0.00
28	0.03	0.00	30	0.03	0.00
30	0.03	0.00	34	0.03	0.00
28	0.03	0.00	31	0.03	0.00
41	0.04	0.00	33	0.03	0.00
36	0.04	0.00	39	0.04	0.00
33	0.03	0.00	26	0.03	0.00
27	0.03	0.00	32	0.03	0.00
43	0.04	0.00	31	0.03	0.00
30	0.03	0.00	40	0.04	0.00
21	0.02	0.00	36	0.04	0.00
37	0.04	0.00	33	0.03	0.00
30	0.03	0.00	30	0.03	0.00
36	0.04	0.00	42	0.04	0.00
28	0.03	0.00	41	0.04	0.00
40	0.04	0.00	38	0.04	0.00
32	0.03	0.00	45	0.04	0.00

39	0.04	0.00	45	0.04	0.00
47	0.05	0.01	42	0.04	0.00
39	0.04	0.00	38	0.04	0.00
44	0.04	0.00	42	0.04	0.00
37	0.04	0.00	52	0.05	0.01
43	0.04	0.00	37	0.04	0.00
41	0.04	0.00	42	0.04	0.00
36	0.04	0.00	36	0.04	0.00
47	0.05	0.01	37	0.04	0.00
39	0.04	0.00	55	0.05	0.01
37	0.04	0.00	39	0.04	0.00
44	0.04	0.00	35	0.03	0.00
50	0.05	0.01	51	0.05	0.01
42	0.04	0.00	43	0.04	0.00
37	0.04	0.00	46	0.05	0.00
43	0.04	0.00	49	0.05	0.01
43	0.04	0.00	44	0.04	0.00
37	0.04	0.00	48	0.05	0.01
39	0.04	0.00	46	0.05	0.00
47	0.05	0.01	46	0.05	0.00
44	0.04	0.00	43	0.04	0.00
39	0.04	0.00	49	0.05	0.01
37	0.04	0.00	54	0.05	0.01
42	0.04	0.00	44	0.04	0.00
38	0.04	0.00	49	0.05	0.01
54	0.05	0.01	50	0.05	0.01
42	0.04	0.00	50	0.05	0.01
47	0.05	0.01	41	0.04	0.00
46	0.05	0.00	56	0.06	0.01
39	0.04	0.00	48	0.05	0.01
55	0.05	0.01	50	0.05	0.01
47	0.05	0.01	45	0.04	0.00
45	0.04	0.00	55	0.05	0.01
45	0.04	0.00	42	0.04	0.00
46	0.05	0.00	52	0.05	0.01
37	0.04	0.00	51	0.05	0.01
34	0.03	0.00	50	0.05	0.01
43	0.04	0.00	55	0.05	0.01
39	0.04	0.00	44	0.04	0.00
43	0.04	0.00	51	0.05	0.01
48	0.05	0.01	54	0.05	0.01
49	0.05	0.01	52	0.05	0.01
54	0.05	0.01	45	0.04	0.00
40	0.04	0.00	48	0.05	0.01
38	0.04	0.00	44	0.04	0.00
38	0.04	0.00	47	0.05	0.01
41	0.04	0.00	44	0.04	0.00

43	0.04	0.00
54	0.05	0.01
42	0.04	0.00
42	0.04	0.00
46	0.05	0.00
43	0.04	0.00
50	0.05	0.01
44	0.04	0.00
50	0.05	0.01
44	0.04	0.00
42	0.04	0.00
46	0.05	0.00
50	0.05	0.01
48	0.05	0.01
48	0.05	0.01
49	0.05	0.01
47	0.05	0.01
50	0.05	0.01
51	0.05	0.01
46	0.05	0.00

50	0.05	0.01
59	0.06	0.02
47	0.05	0.01
49	0.05	0.01
48	0.05	0.01
57	0.06	0.02
54	0.05	0.01
52	0.05	0.01
51	0.05	0.01
52	0.05	0.01
47	0.05	0.01
51	0.05	0.01
50	0.05	0.01
53	0.05	0.01
33	0.03	0.00
30	0.03	0.00
44	0.04	0.00
41	0.04	0.00
48	0.05	0.01
46	0.05	0.00
47	0.05	0.01
61	0.06	0.02
49	0.05	0.01
33	0.03	0.00
44	0.04	0.00
51	0.05	0.01
49	0.05	0.01
42	0.04	0.00
45	0.04	0.00
45	0.04	0.00
39	0.04	0.00
38	0.04	0.00
50	0.05	0.01
51	0.05	0.01
55	0.05	0.01
44	0.04	0.00
44	0.04	0.00
37	0.04	0.00
42	0.04	0.00
43	0.04	0.00
44	0.04	0.00
41	0.04	0.00
43	0.04	0.00
46	0.05	0.00
37	0.04	0.00
47	0.05	0.01
43	0.04	0.00

NS3 - EW3

8		
20:12:01		
09:16:43 cps		
Live time (s)		
2.00	cps to microGy/h	solar corrected
68	0.07	0.03
58	0.06	0.02
49	0.05	0.01
50	0.05	0.01
52	0.05	0.01
47	0.05	0.01
54	0.05	0.01
43	0.04	0.00
55	0.05	0.01
41	0.04	0.00
53	0.05	0.01
52	0.05	0.01
57	0.06	0.02
60	0.06	0.02
60	0.06	0.02
47	0.05	0.01
49	0.05	0.01
54	0.05	0.01
48	0.05	0.01

52	0.05	0.01	64	0.06	0.02
46	0.05	0.00	51	0.05	0.01
33	0.03	0.00	53	0.05	0.01
36	0.04	0.00	48	0.05	0.01
41	0.04	0.00	42	0.04	0.00
38	0.04	0.00	47	0.05	0.01
59	0.06	0.02	50	0.05	0.01
48	0.05	0.01	55	0.05	0.01
54	0.05	0.01	51	0.05	0.01
46	0.05	0.00	51	0.05	0.01
38	0.04	0.00	42	0.04	0.00
45	0.04	0.00	41	0.04	0.00
54	0.05	0.01	41	0.04	0.00
54	0.05	0.01	47	0.05	0.01
46	0.05	0.00	55	0.05	0.01
50	0.05	0.01	55	0.05	0.01
54	0.05	0.01	54	0.05	0.01
38	0.04	0.00	41	0.04	0.00
39	0.04	0.00	40	0.04	0.00
46	0.05	0.00	46	0.05	0.00
51	0.05	0.01	46	0.05	0.00
42	0.04	0.00	43	0.04	0.00
47	0.05	0.01	46	0.05	0.00
49	0.05	0.01	46	0.05	0.00
47	0.05	0.01	50	0.05	0.01
44	0.04	0.00	52	0.05	0.01
46	0.05	0.00	47	0.05	0.01
58	0.06	0.02	47	0.05	0.01
47	0.05	0.01	41	0.04	0.00
45	0.04	0.00	46	0.05	0.00
44	0.04	0.00	52	0.05	0.01
48	0.05	0.01	45	0.04	0.00
45	0.04	0.00	39	0.04	0.00
39	0.04	0.00	48	0.05	0.01
46	0.05	0.00	49	0.05	0.01
56	0.06	0.01	47	0.05	0.01
66	0.07	0.02	55	0.05	0.01
48	0.05	0.01	51	0.05	0.01
56	0.06	0.01	48	0.05	0.01
40	0.04	0.00	32	0.03	0.00
43	0.04	0.00	35	0.03	0.00
45	0.04	0.00	32	0.03	0.00
42	0.04	0.00	27	0.03	0.00
38	0.04	0.00	30	0.03	0.00
51	0.05	0.01	35	0.03	0.00
40	0.04	0.00	36	0.04	0.00
47	0.05	0.01	30	0.03	0.00

41	0.04	0.00	34	0.03	0.00
40	0.04	0.00	30	0.03	0.00
45	0.04	0.00	35	0.03	0.00
39	0.04	0.00	26	0.03	0.00
49	0.05	0.01	33	0.03	0.00
45	0.04	0.00	33	0.03	0.00
40	0.04	0.00	38	0.04	0.00
37	0.04	0.00	33	0.03	0.00
44	0.04	0.00	41	0.04	0.00
36	0.04	0.00	32	0.03	0.00
35	0.03	0.00	37	0.04	0.00
40	0.04	0.00	38	0.04	0.00
42	0.04	0.00	31	0.03	0.00
30	0.03	0.00	30	0.03	0.00
34	0.03	0.00	33	0.03	0.00
40	0.04	0.00	31	0.03	0.00
39	0.04	0.00	35	0.03	0.00
34	0.03	0.00	30	0.03	0.00
40	0.04	0.00	38	0.04	0.00
42	0.04	0.00	35	0.03	0.00
37	0.04	0.00	31	0.03	0.00
45	0.04	0.00	33	0.03	0.00
44	0.04	0.00	42	0.04	0.00
42	0.04	0.00	41	0.04	0.00
47	0.05	0.01	37	0.04	0.00
38	0.04	0.00	31	0.03	0.00
45	0.04	0.00	31	0.03	0.00
28	0.03	0.00	32	0.03	0.00
41	0.04	0.00	35	0.03	0.00
42	0.04	0.00	36	0.04	0.00
49	0.05	0.01	33	0.03	0.00
51	0.05	0.01	31	0.03	0.00
47	0.05	0.01	37	0.04	0.00
53	0.05	0.01	44	0.04	0.00
38	0.04	0.00	31	0.03	0.00
39	0.04	0.00	40	0.04	0.00
30	0.03	0.00	42	0.04	0.00
42	0.04	0.00	43	0.04	0.00
40	0.04	0.00	32	0.03	0.00
37	0.04	0.00	34	0.03	0.00
32	0.03	0.00	35	0.03	0.00
30	0.03	0.00	39	0.04	0.00
36	0.04	0.00	42	0.04	0.00
30	0.03	0.00	37	0.04	0.00
33	0.03	0.00	37	0.04	0.00
32	0.03	0.00	35	0.03	0.00
29	0.03	0.00	35	0.03	0.00

39	0.04	0.00
44	0.04	0.00
41	0.04	0.00
40	0.04	0.00
36	0.04	0.00
39	0.04	0.00
32	0.03	0.00
34	0.03	0.00
42	0.04	0.00
39	0.04	0.00
39	0.04	0.00
49	0.05	0.01
38	0.04	0.00
43	0.04	0.00

NS3 - EW4

9		
20:12:01		
09:27:22 cps		
Live time (s)		
2.00	cps to microGy/h	solar corrected
40	0.04	0.00
33	0.03	0.00
42	0.04	0.00
38	0.04	0.00
40	0.04	0.00
42	0.04	0.00
35	0.03	0.00
46	0.05	0.00
35	0.03	0.00
41	0.04	0.00
39	0.04	0.00
33	0.03	0.00
38	0.04	0.00
30	0.03	0.00
40	0.04	0.00
37	0.04	0.00
28	0.03	0.00
40	0.04	0.00
42	0.04	0.00
36	0.04	0.00
38	0.04	0.00
35	0.03	0.00
42	0.04	0.00
32	0.03	0.00
50	0.05	0.01

35	0.03	0.00
43	0.04	0.00
39	0.04	0.00
36	0.04	0.00
43	0.04	0.00
39	0.04	0.00
38	0.04	0.00
35	0.03	0.00
40	0.04	0.00
39	0.04	0.00
40	0.04	0.00
36	0.04	0.00
45	0.04	0.00
40	0.04	0.00
44	0.04	0.00
39	0.04	0.00
48	0.05	0.01
49	0.05	0.01
47	0.05	0.01
34	0.03	0.00
42	0.04	0.00
24	0.02	0.00
30	0.03	0.00
27	0.03	0.00
39	0.04	0.00
39	0.04	0.00
40	0.04	0.00
31	0.03	0.00
39	0.04	0.00
33	0.03	0.00
40	0.04	0.00
36	0.04	0.00
32	0.03	0.00
39	0.04	0.00
32	0.03	0.00
29	0.03	0.00
30	0.03	0.00
40	0.04	0.00
37	0.04	0.00
44	0.04	0.00
26	0.03	0.00
44	0.04	0.00
40	0.04	0.00
33	0.03	0.00
42	0.04	0.00
43	0.04	0.00
44	0.04	0.00

46	0.05	0.00	46	0.05	0.00
49	0.05	0.01	43	0.04	0.00
60	0.06	0.02	55	0.05	0.01
49	0.05	0.01	46	0.05	0.00
51	0.05	0.01	43	0.04	0.00
41	0.04	0.00	50	0.05	0.01
45	0.04	0.00	52	0.05	0.01
50	0.05	0.01	35	0.03	0.00
46	0.05	0.00	43	0.04	0.00
47	0.05	0.01	50	0.05	0.01
45	0.04	0.00	39	0.04	0.00
53	0.05	0.01	37	0.04	0.00
58	0.06	0.02	39	0.04	0.00
62	0.06	0.02	43	0.04	0.00
65	0.06	0.02	48	0.05	0.01
51	0.05	0.01	41	0.04	0.00
61	0.06	0.02	44	0.04	0.00
68	0.07	0.03	46	0.05	0.00
73	0.07	0.03	47	0.05	0.01
74	0.07	0.03	43	0.04	0.00
55	0.05	0.01	54	0.05	0.01
54	0.05	0.01	54	0.05	0.01
49	0.05	0.01	41	0.04	0.00
57	0.06	0.02	44	0.04	0.00
60	0.06	0.02	43	0.04	0.00
62	0.06	0.02	44	0.04	0.00
56	0.06	0.01	45	0.04	0.00
54	0.05	0.01	47	0.05	0.01
49	0.05	0.01	47	0.05	0.01
67	0.07	0.03	50	0.05	0.01
62	0.06	0.02	48	0.05	0.01
50	0.05	0.01	50	0.05	0.01
60	0.06	0.02	50	0.05	0.01
58	0.06	0.02	53	0.05	0.01
48	0.05	0.01	49	0.05	0.01
46	0.05	0.00	54	0.05	0.01
51	0.05	0.01	49	0.05	0.01
45	0.04	0.00	42	0.04	0.00
48	0.05	0.01	48	0.05	0.01
53	0.05	0.01	52	0.05	0.01
48	0.05	0.01	53	0.05	0.01
46	0.05	0.00	48	0.05	0.01
52	0.05	0.01	51	0.05	0.01
51	0.05	0.01	44	0.04	0.00
41	0.04	0.00	50	0.05	0.01
48	0.05	0.01	46	0.05	0.00
48	0.05	0.01	50	0.05	0.01

52	0.05	0.01	51	0.05	0.01
41	0.04	0.00	52	0.05	0.01
39	0.04	0.00	49	0.05	0.01
43	0.04	0.00	46	0.05	0.00
40	0.04	0.00	49	0.05	0.01
35	0.03	0.00	48	0.05	0.01
46	0.05	0.00	49	0.05	0.01
42	0.04	0.00	49	0.05	0.01
52	0.05	0.01	44	0.04	0.00
43	0.04	0.00	44	0.04	0.00
51	0.05	0.01	51	0.05	0.01
53	0.05	0.01	50	0.05	0.01
44	0.04	0.00	54	0.05	0.01
45	0.04	0.00	51	0.05	0.01
44	0.04	0.00	42	0.04	0.00
46	0.05	0.00	50	0.05	0.01
49	0.05	0.01	43	0.04	0.00
49	0.05	0.01	46	0.05	0.00
59	0.06	0.02	47	0.05	0.01
53	0.05	0.01	60	0.06	0.02
58	0.06	0.02	41	0.04	0.00
50	0.05	0.01	45	0.04	0.00
48	0.05	0.01	48	0.05	0.01
46	0.05	0.00	45	0.04	0.00
45	0.04	0.00	56	0.06	0.01
53	0.05	0.01	38	0.04	0.00
43	0.04	0.00	40	0.04	0.00
59	0.06	0.02	51	0.05	0.01
45	0.04	0.00	48	0.05	0.01
39	0.04	0.00	50	0.05	0.01
51	0.05	0.01	53	0.05	0.01
48	0.05	0.01	43	0.04	0.00
47	0.05	0.01	40	0.04	0.00
44	0.04	0.00	48	0.05	0.01
45	0.04	0.00	49	0.05	0.01
43	0.04	0.00	58	0.06	0.02
45	0.04	0.00	43	0.04	0.00
52	0.05	0.01	52	0.05	0.01
49	0.05	0.01	51	0.05	0.01
41	0.04	0.00	52	0.05	0.01
43	0.04	0.00			
50	0.05	0.01			
49	0.05	0.01			
43	0.04	0.00			
49	0.05	0.01			
43	0.04	0.00			
55	0.05	0.01			

NS3 - EW5

10		
20:12:01		
09:44:38 cps Live		
time (s) 2.00	cps to microGy/h	solar corrected
43	0.04	0.00
52	0.05	0.01
47	0.05	0.01
61	0.06	0.02
55	0.05	0.01
54	0.05	0.01
45	0.04	0.00
43	0.04	0.00
46	0.05	0.00
50	0.05	0.01
48	0.05	0.01
57	0.06	0.02
47	0.05	0.01
52	0.05	0.01
52	0.05	0.01
58	0.06	0.02
55	0.05	0.01
55	0.05	0.01
62	0.06	0.02
53	0.05	0.01
54	0.05	0.01
52	0.05	0.01
54	0.05	0.01
55	0.05	0.01
51	0.05	0.01
41	0.04	0.00
44	0.04	0.00
52	0.05	0.01
42	0.04	0.00
38	0.04	0.00
44	0.04	0.00
43	0.04	0.00
41	0.04	0.00
48	0.05	0.01
45	0.04	0.00
36	0.04	0.00
40	0.04	0.00
40	0.04	0.00
41	0.04	0.00
38	0.04	0.00
49	0.05	0.01

45	0.04	0.00
46	0.05	0.00
40	0.04	0.00
44	0.04	0.00
41	0.04	0.00
51	0.05	0.01
51	0.05	0.01
41	0.04	0.00
48	0.05	0.01
49	0.05	0.01
45	0.04	0.00
47	0.05	0.01
52	0.05	0.01
47	0.05	0.01
49	0.05	0.01
47	0.05	0.01
52	0.05	0.01
47	0.05	0.01
50	0.05	0.01
39	0.04	0.00
41	0.04	0.00
46	0.05	0.00
40	0.04	0.00
47	0.05	0.01
48	0.05	0.01
46	0.05	0.00
45	0.04	0.00
37	0.04	0.00
50	0.05	0.01
46	0.05	0.00
52	0.05	0.01
53	0.05	0.01
48	0.05	0.01
44	0.04	0.00
53	0.05	0.01
51	0.05	0.01
50	0.05	0.01
55	0.05	0.01
52	0.05	0.01
46	0.05	0.00
48	0.05	0.01
46	0.05	0.00
42	0.04	0.00
52	0.05	0.01
41	0.04	0.00
49	0.05	0.01
45	0.04	0.00

39	0.04	0.00	53	0.05	0.01
35	0.03	0.00	34	0.03	0.00
42	0.04	0.00	46	0.05	0.00
46	0.05	0.00	27	0.03	0.00
48	0.05	0.01	32	0.03	0.00
50	0.05	0.01	30	0.03	0.00
47	0.05	0.01	39	0.04	0.00
52	0.05	0.01	37	0.04	0.00
38	0.04	0.00	36	0.04	0.00
53	0.05	0.01	36	0.04	0.00
53	0.05	0.01	36	0.04	0.00
63	0.06	0.02	43	0.04	0.00
54	0.05	0.01	40	0.04	0.00
52	0.05	0.01	41	0.04	0.00
53	0.05	0.01	32	0.03	0.00
48	0.05	0.01	33	0.03	0.00
46	0.05	0.00	38	0.04	0.00
38	0.04	0.00	43	0.04	0.00
41	0.04	0.00	32	0.03	0.00
39	0.04	0.00	36	0.04	0.00
45	0.04	0.00	34	0.03	0.00
42	0.04	0.00	38	0.04	0.00
38	0.04	0.00	41	0.04	0.00
40	0.04	0.00	39	0.04	0.00
57	0.06	0.02	41	0.04	0.00
46	0.05	0.00	38	0.04	0.00
44	0.04	0.00	40	0.04	0.00
49	0.05	0.01	37	0.04	0.00
53	0.05	0.01	28	0.03	0.00
50	0.05	0.01	36	0.04	0.00
50	0.05	0.01	31	0.03	0.00
45	0.04	0.00	36	0.04	0.00
34	0.03	0.00	35	0.03	0.00
33	0.03	0.00	45	0.04	0.00
45	0.04	0.00	33	0.03	0.00
41	0.04	0.00	37	0.04	0.00
38	0.04	0.00	33	0.03	0.00
40	0.04	0.00	31	0.03	0.00
38	0.04	0.00	39	0.04	0.00
43	0.04	0.00	39	0.04	0.00
41	0.04	0.00	38	0.04	0.00
42	0.04	0.00	38	0.04	0.00
40	0.04	0.00	30	0.03	0.00
50	0.05	0.01	35	0.03	0.00
42	0.04	0.00	39	0.04	0.00
39	0.04	0.00	25	0.02	0.00
42	0.04	0.00	35	0.03	0.00

31	0.03	0.00
31	0.03	0.00
25	0.02	0.00
33	0.03	0.00
36	0.04	0.00
33	0.03	0.00
26	0.03	0.00
30	0.03	0.00
24	0.02	0.00
26	0.03	0.00
31	0.03	0.00
27	0.03	0.00
28	0.03	0.00
29	0.03	0.00
30	0.03	0.00
27	0.03	0.00
27	0.03	0.00
35	0.03	0.00
35	0.03	0.00
34	0.03	0.00
35	0.03	0.00
29	0.03	0.00
37	0.04	0.00
28	0.03	0.00
42	0.04	0.00
28	0.03	0.00
28	0.03	0.00
35	0.03	0.00
31	0.03	0.00
42	0.04	0.00
33	0.03	0.00
33	0.03	0.00
30	0.03	0.00
37	0.04	0.00
37	0.04	0.00
38	0.04	0.00
34	0.03	0.00
30	0.03	0.00
34	0.03	0.00
37	0.04	0.00
37	0.04	0.00
44	0.04	0.00
38	0.04	0.00
26	0.03	0.00
39	0.04	0.00
41	0.04	0.00
38	0.04	0.00

38	0.04	0.00
40	0.04	0.00
47	0.05	0.01
37	0.04	0.00
39	0.04	0.00
40	0.04	0.00
41	0.04	0.00
39	0.04	0.00
37	0.04	0.00
35	0.03	0.00
50	0.05	0.01
34	0.03	0.00
43	0.04	0.00
33	0.03	0.00
37	0.04	0.00

NS3 - EW6

11

20:12:01

09:54:27 cps Live

time (s)	2.00	cps to microGy/h	solar corrected
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46	0.05	0.00
44	0.04	0.00
46	0.05	0.00
46	0.05	0.00
38	0.04	0.00
38	0.04	0.00
36	0.04	0.00
38	0.04	0.00
38	0.04	0.00
43	0.04	0.00
38	0.04	0.00
39	0.04	0.00
38	0.04	0.00
37	0.04	0.00
52	0.05	0.01
54	0.05	0.01
44	0.04	0.00
44	0.04	0.00
40	0.04	0.00
31	0.03	0.00
35	0.03	0.00
40	0.04	0.00
35	0.03	0.00
40	0.04	0.00
39	0.04	0.00

34	0.03	0.00	48	0.05	0.01
28	0.03	0.00	57	0.06	0.02
36	0.04	0.00	63	0.06	0.02
43	0.04	0.00	72	0.07	0.03
32	0.03	0.00	60	0.06	0.02
35	0.03	0.00	57	0.06	0.02
32	0.03	0.00	50	0.05	0.01
37	0.04	0.00	54	0.05	0.01
38	0.04	0.00	55	0.05	0.01
35	0.03	0.00	58	0.06	0.02
45	0.04	0.00	52	0.05	0.01
53	0.05	0.01	56	0.06	0.01
45	0.04	0.00	48	0.05	0.01
46	0.05	0.00	61	0.06	0.02
35	0.03	0.00	56	0.06	0.01
39	0.04	0.00	56	0.06	0.01
41	0.04	0.00	55	0.05	0.01
60	0.06	0.02	46	0.05	0.00
55	0.05	0.01	50	0.05	0.01
52	0.05	0.01	49	0.05	0.01
58	0.06	0.02	40	0.04	0.00
63	0.06	0.02	52	0.05	0.01
53	0.05	0.01	36	0.04	0.00
57	0.06	0.02	47	0.05	0.01
59	0.06	0.02	49	0.05	0.01
52	0.05	0.01	51	0.05	0.01
50	0.05	0.01	43	0.04	0.00
54	0.05	0.01	52	0.05	0.01
61	0.06	0.02	44	0.04	0.00
54	0.05	0.01	56	0.06	0.01
63	0.06	0.02	49	0.05	0.01
69	0.07	0.03	48	0.05	0.01
50	0.05	0.01	50	0.05	0.01
57	0.06	0.02	43	0.04	0.00
63	0.06	0.02	41	0.04	0.00
62	0.06	0.02	40	0.04	0.00
59	0.06	0.02	44	0.04	0.00
67	0.07	0.03	47	0.05	0.01
66	0.07	0.02	47	0.05	0.01
59	0.06	0.02	36	0.04	0.00
64	0.06	0.02	36	0.04	0.00
65	0.06	0.02	47	0.05	0.01
51	0.05	0.01	39	0.04	0.00
52	0.05	0.01	47	0.05	0.01
64	0.06	0.02	38	0.04	0.00
66	0.07	0.02	40	0.04	0.00
61	0.06	0.02	46	0.05	0.00

41	0.04	0.00	48	0.05	0.01
42	0.04	0.00	53	0.05	0.01
38	0.04	0.00	53	0.05	0.01
40	0.04	0.00	54	0.05	0.01
30	0.03	0.00	52	0.05	0.01
40	0.04	0.00	42	0.04	0.00
43	0.04	0.00	43	0.04	0.00
40	0.04	0.00	33	0.03	0.00
39	0.04	0.00	39	0.04	0.00
39	0.04	0.00	40	0.04	0.00
50	0.05	0.01	42	0.04	0.00
40	0.04	0.00	48	0.05	0.01
40	0.04	0.00	46	0.05	0.00
37	0.04	0.00	45	0.04	0.00
39	0.04	0.00	47	0.05	0.01
40	0.04	0.00	50	0.05	0.01
46	0.05	0.00	49	0.05	0.01
34	0.03	0.00	56	0.06	0.01
40	0.04	0.00	61	0.06	0.02
49	0.05	0.01	55	0.05	0.01
43	0.04	0.00	60	0.06	0.02
44	0.04	0.00	55	0.05	0.01
37	0.04	0.00	56	0.06	0.01
39	0.04	0.00	48	0.05	0.01
42	0.04	0.00	49	0.05	0.01
42	0.04	0.00	48	0.05	0.01
38	0.04	0.00	54	0.05	0.01
39	0.04	0.00	54	0.05	0.01
46	0.05	0.00	50	0.05	0.01
43	0.04	0.00	51	0.05	0.01
43	0.04	0.00	46	0.05	0.00
48	0.05	0.01	61	0.06	0.02
42	0.04	0.00	52	0.05	0.01
42	0.04	0.00	54	0.05	0.01
48	0.05	0.01	54	0.05	0.01
48	0.05	0.01	44	0.04	0.00
48	0.05	0.01	47	0.05	0.01
48	0.05	0.01	56	0.06	0.01
57	0.06	0.02	54	0.05	0.01
54	0.05	0.01	50	0.05	0.01
48	0.05	0.01	53	0.05	0.01
46	0.05	0.00	60	0.06	0.02
49	0.05	0.01	65	0.06	0.02
49	0.05	0.01	53	0.05	0.01
55	0.05	0.01	55	0.05	0.01
53	0.05	0.01	48	0.05	0.01
52	0.05	0.01	50	0.05	0.01

57	0.06	0.02	42	0.04	0.00
42	0.04	0.00	44	0.04	0.00
59	0.06	0.02	40	0.04	0.00
50	0.05	0.01	42	0.04	0.00
48	0.05	0.01	47	0.05	0.01
54	0.05	0.01	47	0.05	0.01
50	0.05	0.01	51	0.05	0.01
43	0.04	0.00	47	0.05	0.01
57	0.06	0.02	53	0.05	0.01
41	0.04	0.00	42	0.04	0.00
48	0.05	0.01	61	0.06	0.02
48	0.05	0.01	37	0.04	0.00
58	0.06	0.02	50	0.05	0.01
49	0.05	0.01	57	0.06	0.02
50	0.05	0.01	63	0.06	0.02
57	0.06	0.02	61	0.06	0.02
45	0.04	0.00	59	0.06	0.02
49	0.05	0.01	68	0.07	0.03
44	0.04	0.00			
50	0.05	0.01			
48	0.05	0.01			
52	0.05	0.01			
60	0.06	0.02			
45	0.04	0.00			
57	0.06	0.02			
52	0.05	0.01			
56	0.06	0.01			
55	0.05	0.01			
57	0.06	0.02			
54	0.05	0.01			
47	0.05	0.01			
49	0.05	0.01			
51	0.05	0.01			
50	0.05	0.01			
46	0.05	0.00			
40	0.04	0.00			
41	0.04	0.00			
51	0.05	0.01			
44	0.04	0.00			
49	0.05	0.01			
47	0.05	0.01			
45	0.04	0.00			
37	0.04	0.00			
47	0.05	0.01			
53	0.05	0.01			
44	0.04	0.00			
47	0.05	0.01			

NS3 - EW7		
12		
20:12:01		
10:06:18 cps		
Live time (s)		
2.00	cps to microGy/h	solar corrected
75	0.07	0.03
88	0.09	0.05
90	0.09	0.05
92	0.09	0.05
82	0.08	0.04
86	0.08	0.04
73	0.07	0.03
93	0.09	0.05
96	0.09	0.05
96	0.09	0.05
98	0.10	0.06
99	0.10	0.06
102	0.10	0.06
98	0.10	0.06
86	0.08	0.04
93	0.09	0.05
90	0.09	0.05
70	0.07	0.03
71	0.07	0.03
71	0.07	0.03
78	0.08	0.04

86	0.08	0.04	126	0.12	0.08
70	0.07	0.03	120	0.12	0.08
65	0.06	0.02	117	0.12	0.07
77	0.08	0.04	124	0.12	0.08
77	0.08	0.04	122	0.12	0.08
82	0.08	0.04	112	0.11	0.07
78	0.08	0.04	102	0.10	0.06
104	0.10	0.06	117	0.12	0.07
84	0.08	0.04	114	0.11	0.07
98	0.10	0.06	131	0.13	0.09
92	0.09	0.05	136	0.13	0.09
96	0.09	0.05	130	0.13	0.09
94	0.09	0.05	115	0.11	0.07
100	0.10	0.06	94	0.09	0.05
118	0.12	0.08	111	0.11	0.07
118	0.12	0.08	97	0.10	0.05
110	0.11	0.07	104	0.10	0.06
119	0.12	0.08	93	0.09	0.05
120	0.12	0.08	97	0.10	0.05
106	0.10	0.06	132	0.13	0.09
112	0.11	0.07	146	0.14	0.10
112	0.11	0.07	173	0.17	0.13
114	0.11	0.07	141	0.14	0.10
108	0.11	0.07	112	0.11	0.07
105	0.10	0.06	96	0.09	0.05
108	0.11	0.07	108	0.11	0.07
116	0.11	0.07	127	0.13	0.08
90	0.09	0.05	156	0.15	0.11
102	0.10	0.06	216	0.21	0.17
106	0.10	0.06	150	0.15	0.11
113	0.11	0.07	163	0.16	0.12
103	0.10	0.06	148	0.15	0.11
114	0.11	0.07	200	0.20	0.16
109	0.11	0.07	209	0.21	0.17
121	0.12	0.08	198	0.20	0.15
112	0.11	0.07	210	0.21	0.17
90	0.09	0.05	218	0.21	0.17
105	0.10	0.06	202	0.20	0.16
93	0.09	0.05	231	0.23	0.19
110	0.11	0.07	229	0.23	0.18
98	0.10	0.06	208	0.20	0.16
97	0.10	0.05	177	0.17	0.13
100	0.10	0.06	183	0.18	0.14
112	0.11	0.07	188	0.19	0.14
109	0.11	0.07	231	0.23	0.19
116	0.11	0.07	270	0.27	0.23
128	0.13	0.09	270	0.27	0.23

244	0.24	0.20	194	0.19	0.15
253	0.25	0.21	192	0.19	0.15
272	0.27	0.23	185	0.18	0.14
268	0.26	0.22	195	0.19	0.15
264	0.26	0.22	195	0.19	0.15
293	0.29	0.25	174	0.17	0.13
288	0.28	0.24	201	0.20	0.16
274	0.27	0.23	180	0.18	0.14
279	0.27	0.23	192	0.19	0.15
303	0.30	0.26	203	0.20	0.16
302	0.30	0.26	180	0.18	0.14
284	0.28	0.24	192	0.19	0.15
274	0.27	0.23	182	0.18	0.14
297	0.29	0.25	178	0.18	0.13
272	0.27	0.23	208	0.20	0.16
297	0.29	0.25	178	0.18	0.13
272	0.27	0.23	192	0.19	0.15
297	0.29	0.25	191	0.19	0.15
284	0.28	0.24	211	0.21	0.17
299	0.29	0.25	212	0.21	0.17
275	0.27	0.23	231	0.23	0.19
275	0.27	0.23	214	0.21	0.17
265	0.26	0.22	217	0.21	0.17
290	0.29	0.25	212	0.21	0.17
306	0.30	0.26	207	0.20	0.16
294	0.29	0.25	201	0.20	0.16
289	0.28	0.24	213	0.21	0.17
288	0.28	0.24	207	0.20	0.16
318	0.31	0.27	212	0.21	0.17
303	0.30	0.26	203	0.20	0.16
296	0.29	0.25	201	0.20	0.16
287	0.28	0.24	187	0.18	0.14
317	0.31	0.27	194	0.19	0.15
320	0.32	0.27	192	0.19	0.15
308	0.30	0.26	198	0.20	0.15
299	0.29	0.25	182	0.18	0.14
243	0.24	0.20	158	0.16	0.11
202	0.20	0.16	149	0.15	0.11
204	0.20	0.16	124	0.12	0.08
263	0.26	0.22	102	0.10	0.06
241	0.24	0.20	126	0.12	0.08
174	0.17	0.13	141	0.14	0.10
179	0.18	0.14	187	0.18	0.14
202	0.20	0.16	176	0.17	0.13
159	0.16	0.12	134	0.13	0.09
188	0.19	0.14	115	0.11	0.07
173	0.17	0.13	117	0.12	0.07

121	0.12	0.08
117	0.12	0.07
141	0.14	0.10
132	0.13	0.09
125	0.12	0.08
105	0.10	0.06
148	0.15	0.11
170	0.17	0.13
127	0.13	0.08
112	0.11	0.07

37	0.04	0.00
34	0.03	0.00
34	0.03	0.00
36	0.04	0.00
37	0.04	0.00
29	0.03	0.00
34	0.03	0.00
33	0.03	0.00
36	0.04	0.00
27	0.03	0.00
29	0.03	0.00
26	0.03	0.00
29	0.03	0.00
26	0.03	0.00
36	0.04	0.00
33	0.03	0.00
33	0.03	0.00
38	0.04	0.00
33	0.03	0.00
39	0.04	0.00
32	0.03	0.00
35	0.03	0.00
44	0.04	0.00
41	0.04	0.00
39	0.04	0.00
35	0.03	0.00
38	0.04	0.00
39	0.04	0.00
44	0.04	0.00
39	0.04	0.00
45	0.04	0.00
35	0.03	0.00
40	0.04	0.00
36	0.04	0.00
38	0.04	0.00
40	0.04	0.00
42	0.04	0.00
51	0.05	0.01
41	0.04	0.00
41	0.04	0.00
46	0.05	0.00
38	0.04	0.00
41	0.04	0.00
35	0.03	0.00
36	0.04	0.00
32	0.03	0.00
36	0.04	0.00

NS3 - NS1

14
20:12:01
10:40:05 cps
Live time (s)
2.00
cps to microGy/h
solar corrected
28
36
31
34
34
27
31
30
29
38
31
33
35
33
35
30
31
26
28
34
27
36
32
27
36
27
39
29
31

27	0.03	0.00	51	0.05	0.01
36	0.04	0.00	59	0.06	0.02
40	0.04	0.00	51	0.05	0.01
42	0.04	0.00	52	0.05	0.01
40	0.04	0.00	43	0.04	0.00
40	0.04	0.00	40	0.04	0.00
39	0.04	0.00	44	0.04	0.00
45	0.04	0.00	41	0.04	0.00
52	0.05	0.01	45	0.04	0.00
53	0.05	0.01	42	0.04	0.00
40	0.04	0.00	41	0.04	0.00
37	0.04	0.00	39	0.04	0.00
40	0.04	0.00	46	0.05	0.00
29	0.03	0.00	41	0.04	0.00
40	0.04	0.00	36	0.04	0.00
42	0.04	0.00	33	0.03	0.00
42	0.04	0.00	34	0.03	0.00
43	0.04	0.00	45	0.04	0.00
61	0.06	0.02	42	0.04	0.00
51	0.05	0.01	39	0.04	0.00
48	0.05	0.01	43	0.04	0.00
51	0.05	0.01	44	0.04	0.00
37	0.04	0.00	41	0.04	0.00
54	0.05	0.01	45	0.04	0.00
50	0.05	0.01	44	0.04	0.00
46	0.05	0.00	43	0.04	0.00
40	0.04	0.00	46	0.05	0.00
52	0.05	0.01	43	0.04	0.00
56	0.06	0.01	46	0.05	0.00
49	0.05	0.01	44	0.04	0.00
40	0.04	0.00	44	0.04	0.00
51	0.05	0.01	54	0.05	0.01
56	0.06	0.01	42	0.04	0.00
47	0.05	0.01	41	0.04	0.00
42	0.04	0.00	39	0.04	0.00
47	0.05	0.01	47	0.05	0.01
47	0.05	0.01	41	0.04	0.00
43	0.04	0.00	49	0.05	0.01
36	0.04	0.00	49	0.05	0.01
42	0.04	0.00	50	0.05	0.01
46	0.05	0.00	47	0.05	0.01
43	0.04	0.00	59	0.06	0.02
49	0.05	0.01	57	0.06	0.02
45	0.04	0.00	52	0.05	0.01
49	0.05	0.01	61	0.06	0.02
46	0.05	0.00	52	0.05	0.01
51	0.05	0.01	54	0.05	0.01

66	0.07	0.02
93	0.09	0.05
102	0.10	0.06
93	0.09	0.05
101	0.10	0.06
80	0.08	0.04
86	0.08	0.04
87	0.09	0.05
103	0.10	0.06
117	0.12	0.07
117	0.12	0.07
152	0.15	0.11
157	0.15	0.11
176	0.17	0.13
136	0.13	0.09
145	0.14	0.10
190	0.19	0.15
210	0.21	0.17
168	0.17	0.12
145	0.14	0.10
213	0.21	0.17
173	0.17	0.13
113	0.11	0.07
79	0.08	0.04
67	0.07	0.03
45	0.04	0.00
56	0.06	0.01
76	0.07	0.03
73	0.07	0.03
69	0.07	0.03
93	0.09	0.05
97	0.10	0.05
81	0.08	0.04
72	0.07	0.03
68	0.07	0.03
75	0.07	0.03

55	0.05	0.01
49	0.05	0.01
56	0.06	0.01
64	0.06	0.02
59	0.06	0.02
59	0.06	0.02
57	0.06	0.02
56	0.06	0.01
58	0.06	0.02
46	0.05	0.00
49	0.05	0.01
51	0.05	0.01
48	0.05	0.01
56	0.06	0.01
50	0.05	0.01
51	0.05	0.01
64	0.06	0.02
58	0.06	0.02
61	0.06	0.02
83	0.08	0.04
75	0.07	0.03
100	0.10	0.06
106	0.10	0.06
112	0.11	0.07
123	0.12	0.08
122	0.12	0.08
129	0.13	0.09
132	0.13	0.09
128	0.13	0.09
125	0.12	0.08
90	0.09	0.05
84	0.08	0.04
81	0.08	0.04
83	0.08	0.04
87	0.09	0.05
65	0.06	0.02
51	0.05	0.01
51	0.05	0.01
45	0.04	0.00
43	0.04	0.00
47	0.05	0.01
47	0.05	0.01
44	0.04	0.00
41	0.04	0.00
36	0.04	0.00
38	0.04	0.00
51	0.05	0.01

NS3 - NS2

15		
20:12:01		
10:48:11 cps		
Live time (s)		
2.00	cps to microGy/h	solar corrected
51	0.05	0.01
63	0.06	0.02
58	0.06	0.02

44	0.04	0.00	54	0.05	0.01
43	0.04	0.00	45	0.04	0.00
40	0.04	0.00	41	0.04	0.00
50	0.05	0.01	45	0.04	0.00
38	0.04	0.00	34	0.03	0.00
47	0.05	0.01	42	0.04	0.00
40	0.04	0.00	40	0.04	0.00
38	0.04	0.00	48	0.05	0.01
35	0.03	0.00	46	0.05	0.00
36	0.04	0.00	45	0.04	0.00
40	0.04	0.00	55	0.05	0.01
30	0.03	0.00	52	0.05	0.01
44	0.04	0.00	55	0.05	0.01
37	0.04	0.00	53	0.05	0.01
36	0.04	0.00	47	0.05	0.01
45	0.04	0.00	52	0.05	0.01
41	0.04	0.00	52	0.05	0.01
34	0.03	0.00	47	0.05	0.01
34	0.03	0.00	43	0.04	0.00
40	0.04	0.00	48	0.05	0.01
41	0.04	0.00	44	0.04	0.00
45	0.04	0.00	48	0.05	0.01
39	0.04	0.00	54	0.05	0.01
40	0.04	0.00	56	0.06	0.01
42	0.04	0.00	50	0.05	0.01
50	0.05	0.01	57	0.06	0.02
40	0.04	0.00	59	0.06	0.02
44	0.04	0.00	55	0.05	0.01
43	0.04	0.00	60	0.06	0.02
42	0.04	0.00	51	0.05	0.01
46	0.05	0.00	47	0.05	0.01
39	0.04	0.00	45	0.04	0.00
46	0.05	0.00	46	0.05	0.00
43	0.04	0.00	48	0.05	0.01
48	0.05	0.01	50	0.05	0.01
42	0.04	0.00	58	0.06	0.02
38	0.04	0.00	56	0.06	0.01
51	0.05	0.01	58	0.06	0.02
51	0.05	0.01	50	0.05	0.01
43	0.04	0.00	55	0.05	0.01
48	0.05	0.01	56	0.06	0.01
50	0.05	0.01	46	0.05	0.00
46	0.05	0.00	52	0.05	0.01
42	0.04	0.00	52	0.05	0.01
52	0.05	0.01	43	0.04	0.00
47	0.05	0.01	49	0.05	0.01
47	0.05	0.01	55	0.05	0.01

47	0.05	0.01	37	0.04	0.00
55	0.05	0.01	32	0.03	0.00
55	0.05	0.01	35	0.03	0.00
42	0.04	0.00	31	0.03	0.00
49	0.05	0.01	21	0.02	0.00
46	0.05	0.00	35	0.03	0.00
46	0.05	0.00	33	0.03	0.00
43	0.04	0.00	30	0.03	0.00
43	0.04	0.00	43	0.04	0.00
51	0.05	0.01	32	0.03	0.00
43	0.04	0.00	31	0.03	0.00
42	0.04	0.00	32	0.03	0.00
33	0.03	0.00	28	0.03	0.00
32	0.03	0.00	30	0.03	0.00
31	0.03	0.00	34	0.03	0.00
21	0.02	0.00	39	0.04	0.00
28	0.03	0.00	33	0.03	0.00
36	0.04	0.00	28	0.03	0.00
35	0.03	0.00	33	0.03	0.00
35	0.03	0.00	28	0.03	0.00
29	0.03	0.00	40	0.04	0.00
31	0.03	0.00			
35	0.03	0.00			
35	0.03	0.00			
36	0.04	0.00			
38	0.04	0.00			
32	0.03	0.00			
29	0.03	0.00			
30	0.03	0.00			
34	0.03	0.00			
31	0.03	0.00			
36	0.04	0.00			
32	0.03	0.00			
35	0.03	0.00			
32	0.03	0.00			
39	0.04	0.00			
29	0.03	0.00			
25	0.02	0.00			
33	0.03	0.00			
34	0.03	0.00			
26	0.03	0.00			
28	0.03	0.00			
33	0.03	0.00			
29	0.03	0.00			
27	0.03	0.00			
28	0.03	0.00			
31	0.03	0.00			

NS3 - NS3

16

20:12:01

10:56:55 cps Live

time (s) 2.00 cps to microGy/h solar corrected

37	0.04	0.00
41	0.04	0.00
50	0.05	0.01
44	0.04	0.00
48	0.05	0.01
37	0.04	0.00
38	0.04	0.00
43	0.04	0.00
39	0.04	0.00
51	0.05	0.01
45	0.04	0.00
41	0.04	0.00
39	0.04	0.00
29	0.03	0.00
42	0.04	0.00
41	0.04	0.00
39	0.04	0.00
45	0.04	0.00
33	0.03	0.00

40	0.04	0.00	44	0.04	0.00
47	0.05	0.01	56	0.06	0.01
38	0.04	0.00	54	0.05	0.01
35	0.03	0.00	49	0.05	0.01
43	0.04	0.00	58	0.06	0.02
38	0.04	0.00	50	0.05	0.01
39	0.04	0.00	46	0.05	0.00
39	0.04	0.00	54	0.05	0.01
41	0.04	0.00	61	0.06	0.02
42	0.04	0.00	55	0.05	0.01
42	0.04	0.00	48	0.05	0.01
39	0.04	0.00	43	0.04	0.00
42	0.04	0.00	51	0.05	0.01
35	0.03	0.00	56	0.06	0.01
35	0.03	0.00	54	0.05	0.01
38	0.04	0.00	45	0.04	0.00
42	0.04	0.00	46	0.05	0.00
37	0.04	0.00	49	0.05	0.01
34	0.03	0.00	40	0.04	0.00
37	0.04	0.00	43	0.04	0.00
35	0.03	0.00	43	0.04	0.00
32	0.03	0.00	43	0.04	0.00
36	0.04	0.00	40	0.04	0.00
45	0.04	0.00	40	0.04	0.00
35	0.03	0.00	51	0.05	0.01
43	0.04	0.00	54	0.05	0.01
38	0.04	0.00	43	0.04	0.00
47	0.05	0.01	49	0.05	0.01
50	0.05	0.01	33	0.03	0.00
55	0.05	0.01	42	0.04	0.00
41	0.04	0.00	43	0.04	0.00
48	0.05	0.01	44	0.04	0.00
46	0.05	0.00	46	0.05	0.00
44	0.04	0.00	37	0.04	0.00
36	0.04	0.00	51	0.05	0.01
42	0.04	0.00	42	0.04	0.00
52	0.05	0.01	47	0.05	0.01
49	0.05	0.01	53	0.05	0.01
50	0.05	0.01	50	0.05	0.01
50	0.05	0.01	60	0.06	0.02
55	0.05	0.01	51	0.05	0.01
56	0.06	0.01	52	0.05	0.01
48	0.05	0.01	47	0.05	0.01
45	0.04	0.00	58	0.06	0.02
39	0.04	0.00	45	0.04	0.00
43	0.04	0.00	46	0.05	0.00
48	0.05	0.01	45	0.04	0.00

49	0.05	0.01	45	0.04	0.00
48	0.05	0.01	42	0.04	0.00
37	0.04	0.00	37	0.04	0.00
36	0.04	0.00	45	0.04	0.00
50	0.05	0.01	39	0.04	0.00
49	0.05	0.01	33	0.03	0.00
36	0.04	0.00	42	0.04	0.00
43	0.04	0.00	48	0.05	0.01
49	0.05	0.01	41	0.04	0.00
42	0.04	0.00	48	0.05	0.01
44	0.04	0.00	48	0.05	0.01
38	0.04	0.00	45	0.04	0.00
41	0.04	0.00	48	0.05	0.01
33	0.03	0.00	42	0.04	0.00
30	0.03	0.00	57	0.06	0.02
42	0.04	0.00	61	0.06	0.02
33	0.03	0.00	46	0.05	0.00
39	0.04	0.00	52	0.05	0.01
34	0.03	0.00	41	0.04	0.00
36	0.04	0.00	54	0.05	0.01
40	0.04	0.00	54	0.05	0.01
46	0.05	0.00	45	0.04	0.00
45	0.04	0.00	51	0.05	0.01
36	0.04	0.00	38	0.04	0.00
52	0.05	0.01	51	0.05	0.01
41	0.04	0.00	39	0.04	0.00
44	0.04	0.00	36	0.04	0.00
47	0.05	0.01	54	0.05	0.01
44	0.04	0.00	51	0.05	0.01
45	0.04	0.00	51	0.05	0.01
38	0.04	0.00	52	0.05	0.01
45	0.04	0.00	46	0.05	0.00
44	0.04	0.00	48	0.05	0.01
38	0.04	0.00	59	0.06	0.02
38	0.04	0.00	55	0.05	0.01
44	0.04	0.00	53	0.05	0.01
40	0.04	0.00	57	0.06	0.02
48	0.05	0.01	56	0.06	0.01
42	0.04	0.00	57	0.06	0.02
44	0.04	0.00	54	0.05	0.01
42	0.04	0.00	54	0.05	0.01
43	0.04	0.00	58	0.06	0.02
42	0.04	0.00	59	0.06	0.02
46	0.05	0.00	59	0.06	0.02
40	0.04	0.00	67	0.07	0.03
49	0.05	0.01	64	0.06	0.02
49	0.05	0.01	73	0.07	0.03

102	0.10	0.06	58	0.06	0.02
89	0.09	0.05	61	0.06	0.02
114	0.11	0.07	77	0.08	0.04
111	0.11	0.07	75	0.07	0.03
127	0.13	0.08	64	0.06	0.02
143	0.14	0.10	65	0.06	0.02
127	0.13	0.08	77	0.08	0.04
138	0.14	0.10	81	0.08	0.04
117	0.12	0.07	71	0.07	0.03
120	0.12	0.08	57	0.06	0.02
129	0.13	0.09	63	0.06	0.02
110	0.11	0.07	57	0.06	0.02
134	0.13	0.09	57	0.06	0.02
118	0.12	0.08	70	0.07	0.03
109	0.11	0.07	61	0.06	0.02
114	0.11	0.07	54	0.05	0.01
87	0.09	0.05	66	0.07	0.02
106	0.10	0.06	54	0.05	0.01
105	0.10	0.06	63	0.06	0.02
94	0.09	0.05	63	0.06	0.02
98	0.10	0.06	69	0.07	0.03
87	0.09	0.05	72	0.07	0.03
86	0.08	0.04	67	0.07	0.03
92	0.09	0.05	72	0.07	0.03
105	0.10	0.06			
107	0.11	0.06			
94	0.09	0.05	NS3 - NS4		
90	0.09	0.05	17		
85	0.08	0.04	20:12:01		
72	0.07	0.03	11:07:19 cps Live		
87	0.09	0.05	time (s) 2.00	cps to microGy/h	solar corrected
89	0.09	0.05	59	0.06	0.02
72	0.07	0.03	61	0.06	0.02
62	0.06	0.02	53	0.05	0.01
66	0.07	0.02	60	0.06	0.02
70	0.07	0.03	58	0.06	0.02
73	0.07	0.03	66	0.07	0.02
75	0.07	0.03	69	0.07	0.03
63	0.06	0.02	65	0.06	0.02
68	0.07	0.03	60	0.06	0.02
78	0.08	0.04	69	0.07	0.03
62	0.06	0.02	66	0.07	0.02
68	0.07	0.03	79	0.08	0.04
62	0.06	0.02	67	0.07	0.03
68	0.07	0.03	75	0.07	0.03
66	0.07	0.02	68	0.07	0.03
71	0.07	0.03	71	0.07	0.03

74	0.07	0.03	227	0.22	0.18
65	0.06	0.02	227	0.22	0.18
76	0.07	0.03	254	0.25	0.21
77	0.08	0.04	225	0.22	0.18
67	0.07	0.03	268	0.26	0.22
72	0.07	0.03	225	0.22	0.18
65	0.06	0.02	238	0.23	0.19
71	0.07	0.03	242	0.24	0.20
66	0.07	0.02	239	0.24	0.19
64	0.06	0.02	246	0.24	0.20
66	0.07	0.02	240	0.24	0.20
65	0.06	0.02	231	0.23	0.19
68	0.07	0.03	242	0.24	0.20
57	0.06	0.02	233	0.23	0.19
53	0.05	0.01	229	0.23	0.18
63	0.06	0.02	233	0.23	0.19
68	0.07	0.03	240	0.24	0.20
63	0.06	0.02	255	0.25	0.21
70	0.07	0.03	256	0.25	0.21
61	0.06	0.02	215	0.21	0.17
63	0.06	0.02	173	0.17	0.13
56	0.06	0.01	166	0.16	0.12
66	0.07	0.02	179	0.18	0.14
81	0.08	0.04	188	0.19	0.14
123	0.12	0.08	182	0.18	0.14
151	0.15	0.11	140	0.14	0.10
170	0.17	0.13	149	0.15	0.11
137	0.13	0.09	150	0.15	0.11
190	0.19	0.15	133	0.13	0.09
246	0.24	0.20	133	0.13	0.09
262	0.26	0.22	96	0.09	0.05
251	0.25	0.21	106	0.10	0.06
227	0.22	0.18	112	0.11	0.07
232	0.23	0.19	97	0.10	0.05
245	0.24	0.20	94	0.09	0.05
229	0.23	0.18	89	0.09	0.05
228	0.22	0.18	99	0.10	0.06
225	0.22	0.18	95	0.09	0.05
249	0.25	0.20	89	0.09	0.05
247	0.24	0.20	93	0.09	0.05
230	0.23	0.19	94	0.09	0.05
227	0.22	0.18	100	0.10	0.06
228	0.22	0.18	82	0.08	0.04
241	0.24	0.20	118	0.12	0.08
230	0.23	0.19	125	0.12	0.08
229	0.23	0.18	103	0.10	0.06
239	0.24	0.19	103	0.10	0.06

77	0.08	0.04	44	0.04	0.00
68	0.07	0.03	37	0.04	0.00
84	0.08	0.04	39	0.04	0.00
68	0.07	0.03	47	0.05	0.01
61	0.06	0.02	45	0.04	0.00
57	0.06	0.02	42	0.04	0.00
58	0.06	0.02	49	0.05	0.01
59	0.06	0.02	52	0.05	0.01
54	0.05	0.01	43	0.04	0.00
53	0.05	0.01	40	0.04	0.00
40	0.04	0.00	40	0.04	0.00
50	0.05	0.01	39	0.04	0.00
51	0.05	0.01	51	0.05	0.01
48	0.05	0.01	50	0.05	0.01
42	0.04	0.00	37	0.04	0.00
42	0.04	0.00	46	0.05	0.00
41	0.04	0.00	47	0.05	0.01
39	0.04	0.00	57	0.06	0.02
39	0.04	0.00	61	0.06	0.02
39	0.04	0.00	59	0.06	0.02
35	0.03	0.00	57	0.06	0.02
52	0.05	0.01	48	0.05	0.01
45	0.04	0.00	53	0.05	0.01
53	0.05	0.01	48	0.05	0.01
48	0.05	0.01	48	0.05	0.01
51	0.05	0.01	54	0.05	0.01
40	0.04	0.00	60	0.06	0.02
45	0.04	0.00	46	0.05	0.00
50	0.05	0.01	52	0.05	0.01
49	0.05	0.01	50	0.05	0.01
43	0.04	0.00	40	0.04	0.00
50	0.05	0.01	40	0.04	0.00
46	0.05	0.00	35	0.03	0.00
48	0.05	0.01	42	0.04	0.00
48	0.05	0.01	48	0.05	0.01
46	0.05	0.00	48	0.05	0.01
46	0.05	0.00	44	0.04	0.00
47	0.05	0.01	41	0.04	0.00
47	0.05	0.01	46	0.05	0.00
47	0.05	0.01	51	0.05	0.01
51	0.05	0.01	49	0.05	0.01
66	0.07	0.02	48	0.05	0.01
44	0.04	0.00	48	0.05	0.01
45	0.04	0.00	47	0.05	0.01
49	0.05	0.01	58	0.06	0.02
47	0.05	0.01	47	0.05	0.01
39	0.04	0.00	54	0.05	0.01

57	0.06	0.02	49	0.05	0.01
39	0.04	0.00	47	0.05	0.01
43	0.04	0.00	43	0.04	0.00
46	0.05	0.00	54	0.05	0.01
44	0.04	0.00	47	0.05	0.01
46	0.05	0.00	58	0.06	0.02
47	0.05	0.01	50	0.05	0.01
47	0.05	0.01	55	0.05	0.01
39	0.04	0.00	49	0.05	0.01
41	0.04	0.00	48	0.05	0.01
40	0.04	0.00	52	0.05	0.01
48	0.05	0.01	51	0.05	0.01
43	0.04	0.00	47	0.05	0.01
38	0.04	0.00	48	0.05	0.01
46	0.05	0.00	53	0.05	0.01
39	0.04	0.00	54	0.05	0.01
37	0.04	0.00	44	0.04	0.00
39	0.04	0.00	58	0.06	0.02
45	0.04	0.00	59	0.06	0.02
41	0.04	0.00	53	0.05	0.01
35	0.03	0.00	36	0.04	0.00
42	0.04	0.00	57	0.06	0.02
45	0.04	0.00	51	0.05	0.01
39	0.04	0.00	52	0.05	0.01
47	0.05	0.01	63	0.06	0.02
34	0.03	0.00	49	0.05	0.01
34	0.03	0.00	49	0.05	0.01
42	0.04	0.00	45	0.04	0.00
52	0.05	0.01	43	0.04	0.00
55	0.05	0.01	40	0.04	0.00
43	0.04	0.00	57	0.06	0.02
48	0.05	0.01	52	0.05	0.01
47	0.05	0.01	53	0.05	0.01
43	0.04	0.00	56	0.06	0.01
47	0.05	0.01	42	0.04	0.00
46	0.05	0.00	42	0.04	0.00
32	0.03	0.00	49	0.05	0.01
42	0.04	0.00	53	0.05	0.01
39	0.04	0.00	46	0.05	0.00
48	0.05	0.01	44	0.04	0.00
39	0.04	0.00	58	0.06	0.02
40	0.04	0.00	46	0.05	0.00
37	0.04	0.00	42	0.04	0.00
43	0.04	0.00	49	0.05	0.01
42	0.04	0.00	42	0.04	0.00
40	0.04	0.00	52	0.05	0.01
45	0.04	0.00	46	0.05	0.00

57	0.06	0.02
42	0.04	0.00
46	0.05	0.00
50	0.05	0.01
45	0.04	0.00
45	0.04	0.00
53	0.05	0.01
43	0.04	0.00
39	0.04	0.00
54	0.05	0.01
43	0.04	0.00
46	0.05	0.00
51	0.05	0.01
51	0.05	0.01
42	0.04	0.00
47	0.05	0.01
56	0.06	0.01
52	0.05	0.01
52	0.05	0.01
48	0.05	0.01
56	0.06	0.01
47	0.05	0.01
57	0.06	0.02
47	0.05	0.01
42	0.04	0.00
42	0.04	0.00
43	0.04	0.00
47	0.05	0.01

48	0.05	0.01
45	0.04	0.00
51	0.05	0.01
60	0.06	0.02
61	0.06	0.02
43	0.04	0.00
60	0.06	0.02
51	0.05	0.01
46	0.05	0.00
48	0.05	0.01
47	0.05	0.01
57	0.06	0.02
57	0.06	0.02
51	0.05	0.01
52	0.05	0.01
47	0.05	0.01
50	0.05	0.01
51	0.05	0.01
44	0.04	0.00
45	0.04	0.00
53	0.05	0.01
62	0.06	0.02
53	0.05	0.01
63	0.06	0.02
49	0.05	0.01
54	0.05	0.01
46	0.05	0.00
48	0.05	0.01
49	0.05	0.01
49	0.05	0.01
54	0.05	0.01
47	0.05	0.01
41	0.04	0.00
41	0.04	0.00
42	0.04	0.00
36	0.04	0.00
43	0.04	0.00
44	0.04	0.00
49	0.05	0.01
51	0.05	0.01
53	0.05	0.01
37	0.04	0.00
55	0.05	0.01
41	0.04	0.00
55	0.05	0.01
44	0.04	0.00
49	0.05	0.01

NS3 - NS5

18		
20:12:01		
11:18:48 cps		
Live time (s)		
2.00	cps to microGy/h	solar corrected
46	0.05	0.00
41	0.04	0.00
54	0.05	0.01
45	0.04	0.00
49	0.05	0.01
48	0.05	0.01
55	0.05	0.01
45	0.04	0.00
40	0.04	0.00
54	0.05	0.01
54	0.05	0.01

61	0.06	0.02	43	0.04	0.00
47	0.05	0.01	34	0.03	0.00
56	0.06	0.01	37	0.04	0.00
50	0.05	0.01	46	0.05	0.00
44	0.04	0.00	45	0.04	0.00
46	0.05	0.00	39	0.04	0.00
51	0.05	0.01	48	0.05	0.01
44	0.04	0.00	48	0.05	0.01
55	0.05	0.01	46	0.05	0.00
45	0.04	0.00	45	0.04	0.00
43	0.04	0.00	52	0.05	0.01
43	0.04	0.00	52	0.05	0.01
43	0.04	0.00	56	0.06	0.01
54	0.05	0.01	51	0.05	0.01
43	0.04	0.00	67	0.07	0.03
45	0.04	0.00	71	0.07	0.03
41	0.04	0.00	70	0.07	0.03
50	0.05	0.01	80	0.08	0.04
49	0.05	0.01	64	0.06	0.02
44	0.04	0.00	62	0.06	0.02
57	0.06	0.02	58	0.06	0.02
54	0.05	0.01	68	0.07	0.03
50	0.05	0.01	74	0.07	0.03
45	0.04	0.00	80	0.08	0.04
65	0.06	0.02	73	0.07	0.03
51	0.05	0.01	82	0.08	0.04
59	0.06	0.02	79	0.08	0.04
54	0.05	0.01	84	0.08	0.04
65	0.06	0.02	72	0.07	0.03
41	0.04	0.00	64	0.06	0.02
48	0.05	0.01	67	0.07	0.03
50	0.05	0.01	60	0.06	0.02
52	0.05	0.01	59	0.06	0.02
39	0.04	0.00	56	0.06	0.01
45	0.04	0.00	65	0.06	0.02
48	0.05	0.01	57	0.06	0.02
50	0.05	0.01	58	0.06	0.02
46	0.05	0.00	52	0.05	0.01
50	0.05	0.01	53	0.05	0.01
35	0.03	0.00	53	0.05	0.01
50	0.05	0.01	62	0.06	0.02
42	0.04	0.00	61	0.06	0.02
37	0.04	0.00			
47	0.05	0.01			
49	0.05	0.01			
39	0.04	0.00			
42	0.04	0.00			

NS3 - NS6

19
20:12:01
11:25:22 cps
Live time (s)
2.00
cps to microGy/h solar corrected
83 0.08 0.04
84 0.08 0.04
77 0.08 0.04
86 0.08 0.04
82 0.08 0.04
90 0.09 0.05
69 0.07 0.03
71 0.07 0.03
66 0.07 0.02
65 0.06 0.02
52 0.05 0.01
49 0.05 0.01
49 0.05 0.01
38 0.04 0.00
47 0.05 0.01
41 0.04 0.00
44 0.04 0.00
36 0.04 0.00
40 0.04 0.00
50 0.05 0.01
54 0.05 0.01
47 0.05 0.01
48 0.05 0.01
55 0.05 0.01
58 0.06 0.02
56 0.06 0.01
47 0.05 0.01
53 0.05 0.01
51 0.05 0.01
60 0.06 0.02

55 0.05 0.01
49 0.05 0.01
44 0.04 0.00
54 0.05 0.01
47 0.05 0.01
54 0.05 0.01
57 0.06 0.02
44 0.04 0.00
55 0.05 0.01
43 0.04 0.00
47 0.05 0.01
52 0.05 0.01
56 0.06 0.01
44 0.04 0.00
44 0.04 0.00
57 0.06 0.02
49 0.05 0.01
46 0.05 0.00
48 0.05 0.01
41 0.04 0.00
54 0.05 0.01
48 0.05 0.01
43 0.04 0.00
39 0.04 0.00
54 0.05 0.01
50 0.05 0.01
49 0.05 0.01
49 0.05 0.01
60 0.06 0.02
54 0.05 0.01
54 0.05 0.01
57 0.06 0.02
50 0.05 0.01
65 0.06 0.02
59 0.06 0.02
54 0.05 0.01



**Queensland
Government**

Forensic and Scientific Services
HSSA | Health Services Support Agency

CERTIFICATE OF CALIBRATION

CLIENT:	INMED Healthcare Pty. Ltd. 45 Prime Drive Seven Hills NSW 2147 leeann.sands@inmed.com.au	Laboratory Reference: 20060055 Client Order Number: n/a Quote Number: n/a Date Received: 16/06/2020 Date Commenced: 29/06/2020 Laboratory Number/s: 19PX422_Environmental
ATTN:	Leeann Sands	

INSTRUMENT DESCRIPTION

	Instrument	Detector
Manufacturer:	SAIC Exploranium	
Model:	GR130	
Serial Number:	9940+GM	
Type :	NaI+GM	

PRE CALIBRATION CHECKS

Visual Inspection:	Check performed adequately on receipt, during and after the calibration process.
Battery Check:	Check performed adequately on receipt, during and after the calibration process.
High/Low Voltage:	N/A
Self-diagnosis system:	N/A
Desiccant condition:	N/A
Mechanical zero:	No adjustment was necessary.
Check Source Reading:	No check source was supplied.
Background/Leakage:	All calibration measurements were adjusted to take into account the background radiation levels.

CALIBRATION CONDITIONS

Detector Reference Point:	The effective measurement point was taken to be the centre of the detector volume.
Instrument Orientation:	The instrument was orientated so that its detector axis was parallel to the surface plane of the calibration pads.
Cosmic Response:	The cosmic response of the instrument was 1.4 ± 0.7 nGy/h (Count time - 30 sec). Local cosmic background radiation was 40 nGy/h ¹ . (1 - "FAA's Civil Aerospace Medical Institute Radiobiology Research Team, CARI-6. 2004, United States of America Federal Aviation Administration. p. Computer Freeware.")

ATMOSPHERIC CONDITIONS

Dry Bulb Temperature:	25 °C
Relative Humidity:	60 %
Atmospheric Pressure:	1014 hPa (765.4 mm Hg)
Height Above Sea Level:	32.4 m

This report overrides all previous reports. The results relate solely to the sample/s as received and are limited to the specific tests undertaken as listed on the report. The results of this report are confidential and are not to be used or disclosed to any other person or used for any other purpose, whether directly or indirectly, unless that use is disclosed or the purpose is expressly authorised in writing by Queensland Health and the named recipient on this report. To the fullest extent permitted by law, Queensland Health will not be liable for any loss or claim (including legal costs calculated on an indemnity basis) which arise because of (a) problems related to the merchantability, fitness or quality of the sample/s, or (b) any negligent or unlawful act or omissions by Queensland Health that is connected with any activities or services provided by Queensland Health under this agreement (including the timing and/or method under which the sample/s were taken, stored or transported).

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CALIBRATION TRACEABILITY

The expected air kerma rates 150mm above the Calibration pads are traceable to measurements using a reference High Pressure Ion Chamber (RSS-131ER -SN- 12B0038D) calibrated across a range of energies utilising radioactive sources traceable to NIST standards.

Nuclide /photon source	Emission	Serial Number	Nominal Activity (GBq)	Reference Date
Caesium-137	0.662 MeV gamma	1192GN	0.037	01-July-1984

CALIBRATION RESULTS - DOSE RATE MODE (Without Stabilization)

PAD	Expected air Kerma rate (nGy/h)	Cosmic & Bgnd corrected measured Kerma (nGy/h)	Uncertainty (2u) (%) of corrected level	Variation from expected (%)	Calibration Factor
1	9.00	-	-	-	-
2	29.00	56.57	7.1%	95.1%	0.51
3	68.00	121.14	8.6%	78.2%	0.56
4	190.00	365.71	5.3%	92.5%	0.52
5	312.00	645.71	3.3%	107.0%	0.48

CALIBRATION RESULTS - DOSE RATE MODE (With Stabilization)

PAD	Expected air Kerma rate (nGy/h)	Cosmic & Bgnd corrected measured Kerma (nGy/h)	Uncertainty (2u) (%) of corrected level	Variation from expected (%)	Calibration Factor
1	9.00	-	-	-	-
2	29.00	44.60	7.6%	53.8%	0.65
3	68.00	120.31	5.5%	76.9%	0.57
4	190.00	392.31	2.8%	106.5%	0.48
5	312.00	623.74	2.2%	99.9%	0.50

CALIBRATION RESULTS - SPECTRUM MODE (eU, eTh, and K%)

No results available

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COMMENTS

The centre of detector was sitting 150 mm from the surface of calibration pad for all measurements.

Over-Range Response: Not applicable to this environmental level calibration.

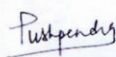
Energy Dependence Factors: The response of the instrument was tested for a range of NORM energies (46keV to 2.612 MeV) using U238; Th232 and progeny and K40 spiked aerated concrete (density=1550kg/m³) planar sources shown to be homogenous and produce uniform radiation fields.

Accuracy: For calibration of this instrument, accuracy is dependent on laboratory measurements, transfer standards and stability of the instrument being calibrated. The uncertainty of the corrected measurement tends to be larger at the very low air kerma levels associated with pads #1 & #2. The result for this calibration can be considered reliable to within 20%.

General: Method as described in Radiation & Nuclear Science unit Technical Document RSS14-004 - NORM based Environmental Radiation Calibration Facility - Calibration Procedure (based on published paper: Wallace, J 2016 JER, Establishing a NORM Based Radiation Calibration Facility)

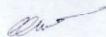
NEXT CALIBRATION DUE 29 June 2021

PERFORMED BY



Pushpendra Chauhan
Snr Health Physicist
Radiation & Nuclear Science
1-Jul-20

REVIEWED BY



Drew Watson
Principal Health Physicist
Radiation & Nuclear Science

This report overrides all previous reports. The results relate solely to the sample/s as received and are limited to the specific tests undertaken as listed on the report. The results of this report are confidential and are not to be used or disclosed to any other person or used for any other purpose, whether directly or indirectly, unless that use is disclosed or the purpose is expressly authorised in writing by Queensland Health and the named recipient on this report. To the fullest extent permitted by law, Queensland Health will not be liable for any loss or claim (including legal costs calculated on an indemnity basis) which arise because of (a) problems related to the merchantability, fitness or quality of the sample/s, or (b) any negligent or unlawful act or omissions by Queensland Health that is connected with any activities or services provided by Queensland Health under this agreement (including the timing and/or method under which the sample/s were taken, stored or transported).

Enquiries: Principal Health Physicist
Phone (+61) 7 3096 2901

39 Kessels Road
Coopers Plains QLD 4108
AUSTRALIA

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Phone (+61 7) 3096 2900
Fax (+61 7) 3096 2913
Email FSS-RadiationScience@health.qld.gov.au

Print 1/07/2020 4:59 PM

Page 3 of 3

APPENDIX 6 RadAlert Inspector USB Calibration Certificate



Date: 29/06/2020
 Customer: Bartolo Safety Management Services
 Site Address: PO Box 264
 Jannali
 NSW, 2226
 Dosimeter: Inspector
 S/N: 42104
 Cal Number: IR045297

Results	
Authority standards	+/- 25
InMed standards	+/- 15

Temp 25.6°C Humidity 30%

Activity MBq	Date	1/2 Life Days	Half Lives	Current Activity
Cs137 1907-41-3	9.117 1/07/2017	10964.6	0.0997756	8.507784755

Energy (MeV)	Fractional Yield	(u/p) air
3.18170E-02	1.99500E-02	1.38188E-01
3.21940E-02	3.64100E-02	1.34970E-01
6.61650E-01	8.51020E-01	2.93111E-02

Distance (cm)	100	60	40	20
Calculated Dose Rate (uSv/hr)	0.649533483	1.804259674	4.0595843	16.238337

NOTE: Source must be flipped before taking measurement

BEFORE					
Background	0.27	Cal Factor	3340	Date	29/06/2020
Measurement	Dose Rate (uSv/hr)	Dosimeter (uSv/hr)	Ref	% Dif	Fail/Pass
100cm	0.95	1	0.6495335	12.30%	PASS
	1.05				
	1				
60cm	2.28	2.25	1.8042597	10%	PASS
	2.37				
	2.1				
40cm	4.55	4.61666667	4.0595843	7%	PASS
	4.6				
	4.7				
20cm	18.3	18.0666667	16.238337	10%	PASS
	17.8				
	18.1				

ADJUSTED					
Background	Cal Factor	Date	#####		
Measurement	Dose Rate (uSv/hr)	Dosimeter (uSv/hr)	Ref	% Dif	Fail/Pass
1		#DIV/0!	0.649533483	#DIV/0!	#DIV/0!
2		#DIV/0!	1.804259674	#DIV/0!	#DIV/0!
3		#DIV/0!	4.059584266	#DIV/0!	#DIV/0!
4		#DIV/0!	16.23833707	#DIV/0!	#DIV/0!

Completed by: J Enderstein

InMed Pty Ltd
Service Record



Please complete all sections, sign and email to sales@inmed.com.au

SERVICE DETAILS

Service Engineer J Enderstein		Service Record Number	
Start Date 29/6/20	Start Time 09:00	Finish Date 29/6/20	Finish Time 09:45

SERVICE TYPE

☐ Warranty
 ☐ Charge
 ☐ Contract
 ☐ No Charge

EQUIPMENT DETAILS

Brand SE International	Model Inspector
Serial Number 42104	Date of Manufacture

CUSTOMER DETAILS

Contact Name	Customer P.O
Institution Bartolo Safety Management Services	
Address PO Box 264	
Suburb/City Jannali	State NSW Postcode
Email	

REPORTED FAULT

Routine Maintenance	On-site Hours
	Travel Hours

ACTION TAKEN

Completed Routine Maintenance according to Manufacturer's Specification.	Count Rate
Completed Radiation Detector Report.	Peak Graph <input type="checkbox"/> Yes <input type="checkbox"/> No
Unit is OK to use.	Laser Aligned <input type="checkbox"/> Yes <input type="checkbox"/> No

In-House Hours **0.75**
 On-Site Hours
 Other

PARTS REPLACED

Part Number	Description	New S/N	Old S/N	W/H

CUSTOMER SIGNATURE

SERVICE REPRESENTATIVE SIGNATURE

J Enderstein

Last updated 29/3/17

INMED PTY LTD Tel 1300 364 336 | Fax 1300 364 391 | Email sales@inmed.com.au | www.inmed.com.au

APPENDIX 10. KLEINFELDER ECOLOGICAL INSPECTION LETTERS

22 June 2020

File Ref: NCA20L112874

Document Ref: NCA20L112874

Quarry Manager
Newcastle Sand
398 Cabbage Tree Road
Williamstown, NSW 2318

Attention: Paul Bourne

Delivered by email: paul@newcastlesand.com.au

Subject: Sector 1a and Sector 2 Pre-clearance Survey

Assessment

On June 12, 2020 a Kleinfelder ecologist, Ben Stewart, conducted a pre-clearance assessment within sector 1a and sector 2 (referred to as the resource area) of the Newcastle Sand Resource Quarry at Williamstown, NSW (**Figure 1**). The resource area consists of approximately 4.5 ha of a dry sclerophyll sand community with the upper stratum dominated by *Corymbia gummifera* (Red Bloodwood), *Angophora costata* (Smooth-bark Apple) and *Banksia serrata* (Old Man Banksia) with a moderately dense ground cover. At the time of assessment, the area was recovering from the effects of fire.

The resource area was assessed for habitat trees (hollow-bearing trees, dead stags containing hollows and trees containing nests), hollowed logs and the presence and abundance of exotic weed species. The location of these features and the survey effort were recorded during the assessment (**Figure 2**). Pink chalk paint was used to conspicuously mark a "H" on the trunk of habitat trees (**Plate 1**). Pink flagging tape was used in conjunction with the chalk paint to aid in visual identification of habitat trees where the painted "H" was obscured by epicormic growth or shrubs. Any habitat trees located within three (3) metres of the resource boundary were marked appropriately to avoid impact during the construction phase.

A total of 25 hollow-bearing trees, 21 dead stag trees containing hollows and one (1) hollowed log were recorded during the assessment (**Table 1**). No stick nests were observed within the resource area or observed within three (3) metres of the resource boundary. The majority of the habitat trees were observed to have no obvious signs of fauna use. Only three (3) habitat trees were observed to have signs of fauna use, which included fresh scratches on the trunk or 'chew marks' (typical of arboreal mammals such as Sugar Gliders and Squirrel Gliders (**Plate 2**)). Additionally, numerous non-habitat trees (trees without hollows) within the resource area contained 'chew marks' on their trunks.

A total of four (4) exotic weed species were identified during the assessment. These included:

- *Megathyrsus maximus* (Guinea Grass)
- *Cyperus aggregatus*
- *Sida rhombifolia* (Paddy's Lucerne)
- *Axonopus fissifolius* (Narrow-leafed Carpet Grass).

Exotic weed species were confined to previously disturbed areas i.e. cleared tracks where they were observed in low concentrations. Weeds consisted of scattered individuals or small patches up to approximately 6m² in area.

Limitations

Every effort was made to record habitat features as accurately as possible during the assessment. Habitat features such as the number of hollows, height of hollows above the ground, width at the hollow entrance and a hollow's suitability for threatened species e.g. Squirrel Glider are determined from ground-based surveys. The effects of fire (charred limbs and bark) affected depth perception (when viewing hollows through binoculars) which made it difficult to determining a hollow from a shallow cut-out of a knot or snapped branch.

Recommendations

As per Section 6.14 of the Biodiversity and Rehabilitation Management Plan (Kleinfelder, 2020), hollows are to be replaced at a rate of 1:1 and installed in adjacent vegetation prior to the clearing of the vegetation in the surveyed areas. Due to the low abundance of exotic weeds within the resource area, it is not necessary to separate topsoil containing weeds from uncontaminated topsoil.

For any further questions, please do not hesitate to contact me.

Sincerely,

Kleinfelder Australia Pty Ltd

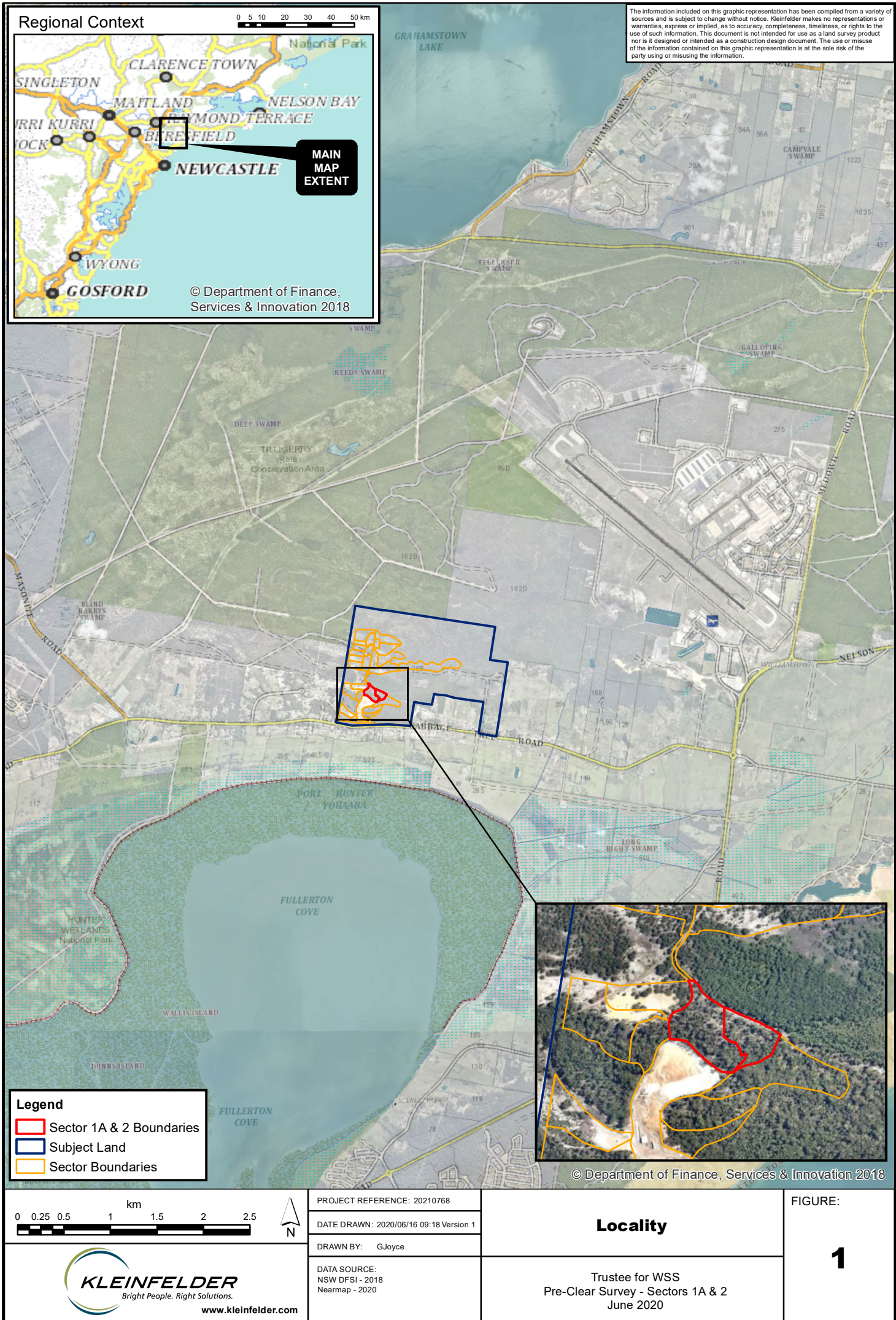


Ben Stewart MMsc & Mgmt

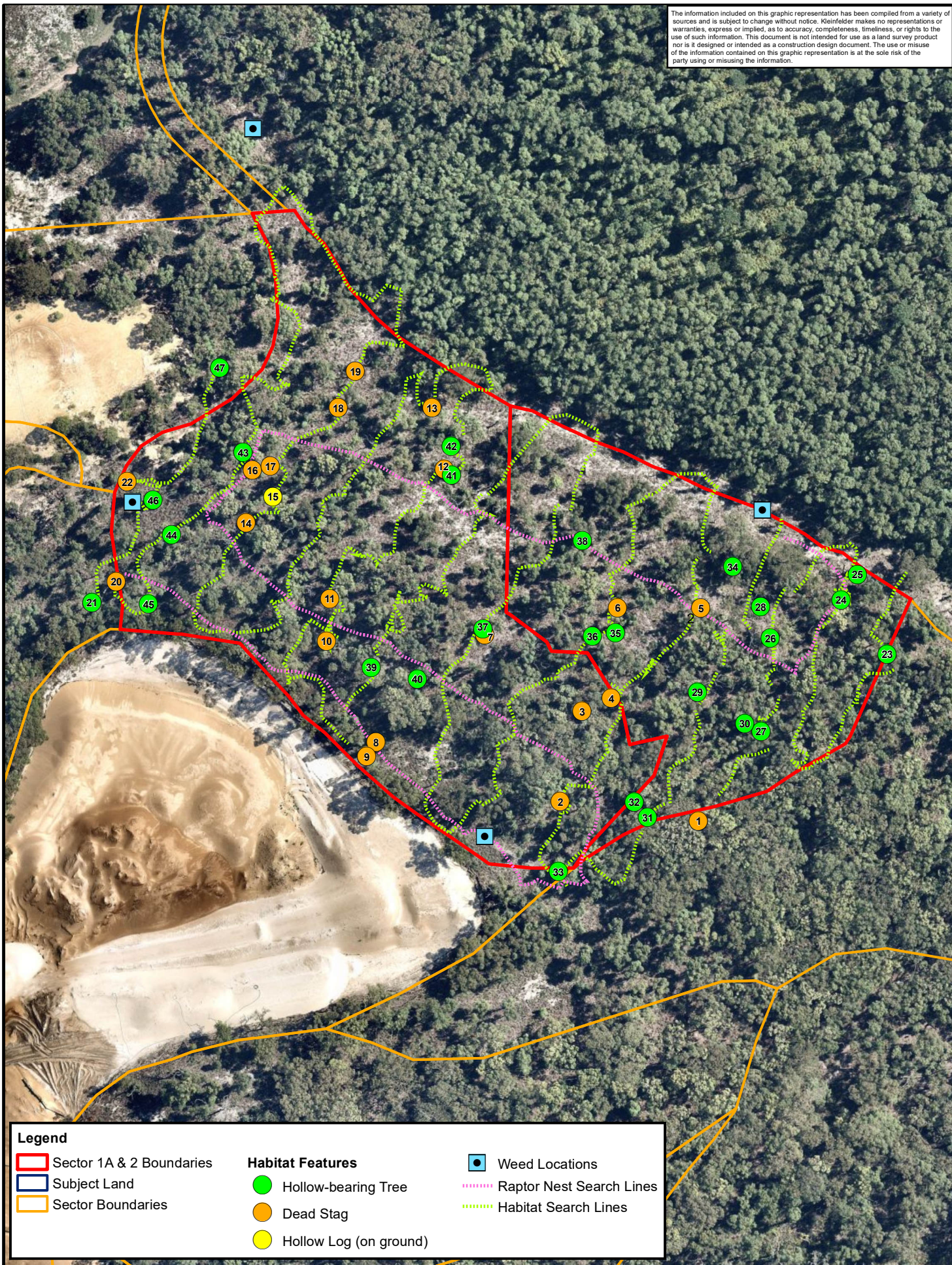
Ecologist

Email: BStewart@kleinfelder.com

Mobile: 0427 487 991



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Legend

- Sector 1A & 2 Boundaries
- Subject Land
- Sector Boundaries

Habitat Features

- Hollow-bearing Tree
- Dead Stag
- Hollow Log (on ground)



Weed Locations



Raptor Nest Search Lines



Habitat Search Lines

Metres
0 5 10 20 30 40 50



PROJECT REFERENCE: 20210768

DATE DRAWN: 2020/06/16 09:38 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2020

Survey Effort, Habitat Features and Weed Locations

FIGURE:

2



Trustee for WSS
Pre-Clear Survey - Sectors 1A & 2
June 2020

Table 1: Habitat tree census before clearing within sector 1a and sector 2.

Location			Tree Description	Habitat Features		Size of Hollow Entrance (cm)			Squirrel Glider Suitability	Signs of Use
Map Ref.	Easting	Northing	Species	Hollow type	Number of hollows	0-5	5-20	>20	Yes / No	Yes / No
1	387921	6368975	Dead Stag	Upright	1	-	-	-	No	No
2	387879	6368981	Dead Stag	Branch	1		1		No	No
3	387886	6369009	Dead Stag	Upright	1	1			No	No
4	387895	6369013	Dead Stag	Branch	2	-	-	-	No	No
5	387922	6369040	Dead Stag	Branch	2	-	-	-	No	No
6	387897	6369040	Dead Stag	Branch	2		2		No	No
7	387857	6369032	Dead Stag	Upright	3		2	1	No	No
8	387823	6368999	Dead Stag	Upright	1		1		No	No
9	387821	6368995	Dead Stag	Upright	2		1		No	No
10	387809	6369030	Dead Stag	Branch	1	-	-	-	No	No
11	387810	6369043	Dead Stag	Upright	1		1		No	Yes
12	387844	6369082	Dead Stag	Branch	2		2		No	No
13	387841	6369101	Dead Stag	Branch	3		3		No	No
14	387784	6369066	Dead Stag	Branch	1		1		No	No
15	387792	6369074	Log	-	1	-	-	-	No	No
16	387786	6369082	Dead Stag	-	2	1	1		No	No

Location			Tree Description	Habitat Features		Size of Hollow Entrance (cm)			Squirrel Glider Suitability	Signs of Use
Map Ref.	Easting	Northing	Species	Hollow type	Number of hollows	0-5	5-20	>20	Yes / No	Yes / No
17	387792	6369083	Dead Stag	-	2	2			No	No
18	387812	6369101	Dead Stag	-	1		1		No	No
19	387817	6369112	Dead Stag	-	3	3			No	No
20	387745	6369048	Dead Stag	Fissure	1	1			No	No
21	387737	6369042	<i>A. costata</i>	Trunk	3	-	-	-	No	No
22	387748	6369078	Dead Stag	Upright	1			1	No	No
23	387979	6369026	<i>A. costata</i>	Branch	3	1	2		No	No
24	387965	6369042	<i>C. gummifera</i>	Branch	1		1		No	No
25	387970	6369050	<i>C. gummifera</i>	Branch	1		1		No	No
26	387943	6369031	<i>C. gummifera</i>	Branch	1		1		No	No
27	387940	6369003	<i>A. costata</i>	Trunk	1		1		No	No
28	387940	6369040	<i>C. gummifera</i>	Branch	1		1		No	No
29	387921	6369014	<i>C. gummifera</i>	Trunk	4		4		No	No
30	387935	6369005	<i>A. costata</i>	Branch	1		1		No	No
31	387906	6368976	<i>A. costata</i>	Branch	1	1			No	No
32	387902	6368981	<i>C. gummifera</i>	Branch	1	1			No	No
33	387879	6368960	<i>A. costata</i>	Branch	2		2		No	No

Location			Tree Description	Habitat Features		Size of Hollow Entrance (cm)			Squirrel Glider Suitability	Signs of Use
Map Ref.	Easting	Northing	Species	Hollow type	Number of hollows	0-5	5-20	>20	Yes / No	Yes / No
34	387932	6369052	-	Branch	2		2		Possible	No
35	387896	6369032	<i>C. gummifera</i>	Branch	2		2		No	No
36	387889	6369031	<i>C. gummifera</i>	Branch	1		1		No	No
37	387856	6369034	<i>A. costata</i>	Trunk	2		2		No	Yes
38	387886	6369060	<i>A. costata</i>	Branch	2		2		Possible	Yes
39	387822	6369022	<i>A. costata</i>	Branch	1	1			Possible	No
40	387836	6369019	<i>C. gummifera</i>	Branch	1		1		No	No
41	387847	6369080	<i>A. costata</i>	Crack/Fissure	1			1	No	No
42	387846	6369089	<i>C. gummifera</i>	Branch	1		1		Yes	No
43	387783	6369087	<i>C. gummifera</i>	Branch	2	1	1		No	No
44	387762	6369062	<i>C. gummifera</i>	Branch	2		2		Possible	No
45	387755	6369041	<i>A. costata</i>	Branch	2		2		No	No
46	387756	6369073	<i>C. gummifera</i>	Branch	1	1			No	No
47	387776	6369113	<i>C. gummifera</i>	Branch	1	1			Yes	No
Total Hollows					25	7	16	2		

Note: Eastings and Northings pertain to map reference GDA 94 MGA 56.



Plate 1 **Pink “H” marked on habitat trees for visual identification.**



Plate 2 **Horizontal ‘chew marks’ typical of arboreal mammals such as gliders.**

10 July 2020

File Ref: NCA20L113893

Document Ref: NCA20L113893

Quarry Manager
Newcastle Sand
398 Cabbage Tree Road
Williamstown, NSW 2318

Attention: Paul Bourne

Delivered by email: paul@newcastlesand.com.au

Subject: Newcastle Sand Nest box Pre-installation Survey

Background

Kleinfelder previously conducted a hollow-bearing tree survey within resource areas 1a and 2 which require the removal of vegetation. Twenty-five (25) hollows were identified for replacement during the survey. Their location, height above the ground, width at opening and suitability for threatened species i.e. Squirrel Glider were recorded. Nest boxes are to be installed at a 1:1 ratio of hollows removed pursuant to Section 6.14 of the Biodiversity and Rehabilitation Management Plan (BRMP). The BRMP also states that nest boxes should be installed to face away from the resource areas and to have a southerly aspect if possible.

Assessment

On July 10, 2020, a Kleinfelder ecologist, Ben Stewart, conducted a nest box pre-installation survey within two retained vegetation areas adjacent to the resource areas 1a and 2. Eleven (11) nest box locations were chosen within the retained vegetation to the south-west of resource areas, and fourteen (14) nest box locations were chosen within the retained vegetation to the north of resource areas (**Figure 1**). For each nest box location, the tree species, diameter at breast height (DBH), nest box number, aspect, install height and nest box size was recorded (**Table 1**).

Limitations and Recommendations

Nest box locations were spread through the retained vegetation areas as best as possible. Recommended installation heights and corresponding aspect was determined from the ground and may change slightly during installation. Recommended nest box aspects were chosen to typically face away from the resource area where appropriate and to face south where appropriate.

For any further questions, please do not hesitate to contact me.

Sincerely,

Kleinfelder Australia Pty Ltd

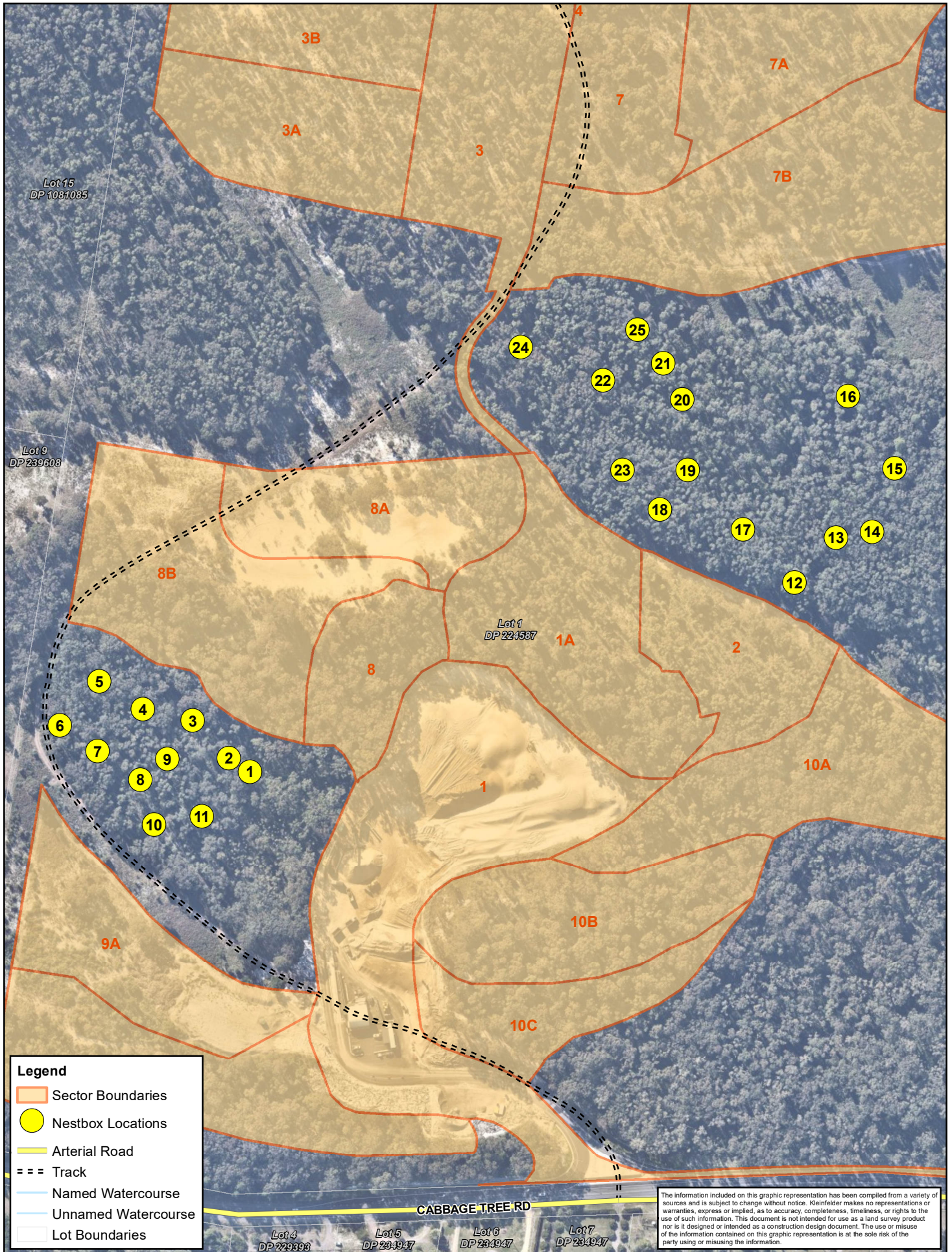


Ben Stewart MMsc & Mgmt

Ecologist

Email: BStewart@kleinfelder.com

Mobile: 0427 487 991



	PROJECT REFERENCE: 20211095 DATE DRAWN: 2020/07/10 15:16 Version 1 DRAWN BY: G.Joyce	Nestbox Locations	FIGURE: 1
	DATA SOURCE: NSW DFSI - 2019 Nearmap - 2020	Trustee for WSS Nestbox Installation July 2020	

Table 1: Nest box pre-install survey – July 2020.

Nest box ID	Tree Species	Latitude	Longitude	DBH (cm)	Recommended Height (m)	Recommended Aspect	Recommended Box size
1	<i>A. costata</i>	-32.81155986	151.7996272	32.5	5	S	Small
2	<i>A. costata</i>	-32.81148285	151.7994905	23	3.5	SW	Small
3	<i>C. gummifera</i>	-32.81127348	151.7992577	38.5	4	NW	Small
4	<i>A. costata</i>	-32.81120705	151.7989335	23	4.5	SW	Medium
5	<i>E. robusta</i>	-32.81105188	151.798651	44.5	4	SW	Large
6	<i>E. robusta</i>	-32.81129278	151.7983895	50.5	4	SE	Medium
7	<i>A. costata</i>	-32.81143688	151.7986337	22	4	S	Medium
8	<i>E. robusta</i>	-32.81159619	151.7989119	41.5	4	NW	Small
9	<i>E. robusta</i>	-32.81148448	151.7990893	34.5	5	S	Medium
10	<i>A. costata</i>	-32.81184598	151.7989979	39	5	S	Small
11	<i>E. robusta</i>	-32.81180194	151.7993105	20.5	4	SE	Medium
12	<i>A. costata</i>	-32.81055038	151.8031995	38.5	5	NW	Small
13	<i>E. robusta</i>	-32.81030437	151.803473	34	5	N	Medium
14	<i>E. robusta</i>	-32.81027423	151.8037098	30	4	S	Medium
15	<i>E. robusta</i>	-32.80992682	151.8038602	50.5	5	W	Large
16	<i>E. robusta</i>	-32.80952514	151.8035618	25	4.5	SE	Medium
17	<i>E. robusta</i>	-32.81025289	151.8028671	30.5	4.5	NE	Medium
18	<i>E. robusta</i>	-32.81013732	151.8023262	64.5	4.5	NW	Medium

Nest box ID	Tree Species	Latitude	Longitude	DBH (cm)	Recommended Height (m)	Recommended Aspect	Recommended Box size
19	<i>E. robusta</i>	-32.80992263	151.8025085	33.5	4	S	Small
20	<i>E. robusta</i>	-32.80953321	151.80248	36	4	S	Medium
21	<i>A. costata</i>	-32.80933308	151.8023561	48	3.5	SW	Medium
22	<i>A. costata</i>	-32.80942164	151.8019619	29.5	4.5	W	Medium
23	<i>E. robusta</i>	-32.80991821	151.802083	37	4	S	Medium
24	<i>E. robusta</i>	-32.8092348	151.8014276	37	4.5	NE	Medium
25	<i>E. robusta</i>	-32.80914408	151.8021916	30	5	W	Medium

28 July 2020

File Ref: NCA20L114507
Document Ref: NCA20L114507

Quarry Manager
Newcastle Sand
398 Cabbage Tree Road
Williamstown, NSW 2318

Attention: Paul Bourne

Delivered by email: paul@newcastlesand.com.au

Subject: Sector 1a and Sector 2 Nocturnal and Diurnal Fauna Surveys and Tree Removal

Fauna surveys

On 22 of July 2020, a Kleinfelder Ecologist, Ben Stewart, conducted a nocturnal fauna survey within Sectors 1a and 2 prior to tree removal pursuant to Section 6.6 of the Biodiversity and Rehabilitation Management Plan (BRMP). The survey consisted of a meandering spotlight transect and call-playback. Species targeted during call-playback were Koala (*Phascolarctos cinereus*) and the Squirrel Glider (*Petaurus norfolkensis*).

No fauna were detected during spotlighting or call-playback efforts.

On 23, 24 and 27 of July 2020, diurnal fauna surveys were conducted prior to tree removal pursuant to Section 6.6 of the BRMP. Diurnal surveys consisted of a walkthrough to identify any fauna residing within Sector 1a and 2. This also included inspecting stockpiles of felled trees.

No fauna were detected during the diurnal surveys.

Tree removal

On 23, 24 and 27 of July 2020, a Kleinfelder Ecologist and experienced fauna spotter-catcher, Ben Stewart supervised the clearing of non-habitat and habitat trees pursuant to Section 6.6 of the BRMP. Non-habitat trees were soft felled on the 23 and 24 of July under direction of the ecologist.

One pair of Feathertail Gliders (*Acrobates pygmaeus*) were revealed to be nesting within a small hollow (not previously identified during the hollow-bearing tree census) during the felling of non-habitat trees. The hollow containing the gliders was relocated to retained vegetation where nest boxes had been installed prior to the clearing, outside of the resource area as per Section 6.10 of the BRMP. The location of the relocated hollow was GPS marked for reference.

Habitat trees were left standing for a minimum of two nights, pursuant to Section 6.8 of the BRMP, and felled following the procedure outlined in Section 6.11 of the BRMP on 27 of July 2020 under the direction of the ecologist. Once felled, each hollow was thoroughly inspected for fauna.

No fauna were identified during the felling of the habitat trees. Two old glider nests (a collection of eucalyptus leaves arranged in a 'bowl' shape) were identified during this process.

Seed collection

During the pre-clearance survey, previously conducted by Kleinfelder, limited flora species were observed to contain fruit viable for seed collection, apart from the overstorey species *Angophora costata* (Smooth-bark Apple) and *Corymbia gummifera* (Red Bloodwood). During the tree removal process, fruit from each of these species was able to be collected from multiple felled individuals within the resource area.

Recommendations

No hollows were deemed suitable for relocation as per Section 6.11 of the BRMP (apart from the hollow containing the Feathertail Gliders) due to wood rot, termites, and damage upon tree felling.

Felled trees/limbs which may provide suitable ground habitat should be relocated into retained vegetation areas after the re-distribution of topsoil.

For any further questions, please do not hesitate to contact me.

Sincerely,

Kleinfelder Australia Pty Ltd



Ben Stewart MMsc & Mgmt

Ecologist

Email: BStewart@kleinfelder.com

Mobile: 0427 487 991

30 October 2020

File Ref: NCA20L118152

Document Ref: NCA20L118152

Quarry Manager
Newcastle Sand
398 Cabbage Tree Road
Williamstown, NSW 2318

Attention: Paul Bourne

Delivered by email: paul@newcastlesand.com.au

Subject: Sector 3, 3A, 3B, 4, 4A, 4B Pre-clearance Survey

Assessment

On 29 October, 2020 a Kleinfelder ecologist, Mark Dean, conducted a pre-clearance assessment within sectors 3, 3A, 3B, 4, 4A and 4B (referred to as the resource area) of the Newcastle Sand Resource Quarry at Williamstown, NSW in accordance with Section 6.14A of the Biodiversity and Rehabilitation Management Plan (BRMP) (Kleinfelder, 2020) (**Figure 1**). The resource area consists of approximately 6.5 ha of a Coastal Sand Apple – Blackbutt Forest community with the upper stratum dominated by *Eucalyptus pilularis* (Blackbutt), *Corymbia gummifera* (Red Bloodwood), *Angophora costata* (Smooth-bark Apple), *Eucalyptus signata* (Scribbly Gum) *Eucalyptus camfieldii* (Camfield's Stringybark), *Eucalyptus parramattensis* (Parramatta Red Gum), and *Banksia serrata* (Old Man Banksia) with a sparse ground cover. At the time of assessment, the area was recovering from the effects of fire.

The resource area was assessed for habitat trees (hollow-bearing trees, dead stags containing hollows and trees containing nests), hollowed logs and the presence and abundance of exotic weed species. The location of these features and the survey effort were recorded during the assessment (**Figure 2**). Pink chalk paint was used to conspicuously mark a “H” on the trunk of habitat trees. Pink flagging tape was used in conjunction with the chalk paint to aid in visual identification of habitat trees where the painted “H” was obscured by epicormic growth or shrubs.

A total of 12 hollow-bearing trees and 2 dead stags containing hollows were recorded during the assessment for a total of 14 small (0-5 cm opening) hollows (**Table 1**). No stick nests were observed within the resource area or observed within three (3) metres of the resource boundary. The majority of the habitat trees were observed to have no obvious signs of fauna use. Only one (1) habitat tree was observed to have signs of fauna use, which included 'chew marks' (typical of arboreal mammals such as Sugar Gliders and Squirrel Gliders (**Plate 1**)). Other non-habitat trees (trees without hollows) within the resource area also contained 'chew marks' on their trunks.

Additionally, there was three (3) fauna species noted during the pre-clearance these included *Varanus varius* (Lace Monitor), *Pogona barbata* (Eastern Bearded Dragon) and a *Eurostopodus mystacalis* (White-throated Nightjar) nesting 10m outside the resource area (**Plate 2**). The nesting area has been flagged off with wooden stakes and pink flagging tape to delineate the area to prevent any harm (**Plate 3**).

Limitations

Every effort was made to record habitat features as accurately as possible during the assessment. Habitat features such as the number of hollows, width at the hollow entrance and a hollow's suitability for threatened species e.g. Squirrel Glider are determined from ground-based surveys. The effects of fire (charred limbs and bark) affected depth perception (when viewing hollows through binoculars) which made it difficult to determining a hollow from a shallow cut-out of a knot or snapped branch.

Recommendations

As per Section 6.14A of the BRMP, hollows are to be replaced at a rate of 1:1 and installed in adjacent vegetation prior to the clearing of the vegetation in the surveyed areas. Due to the low abundance of exotic weeds within the resource area, it is not necessary to separate topsoil containing weeds from uncontaminated topsoil.

For any further questions, please do not hesitate to contact me.

Sincerely,

Kleinfelder Australia Pty Ltd



Mark Dean EnvSc & Mgmt

Ecologist

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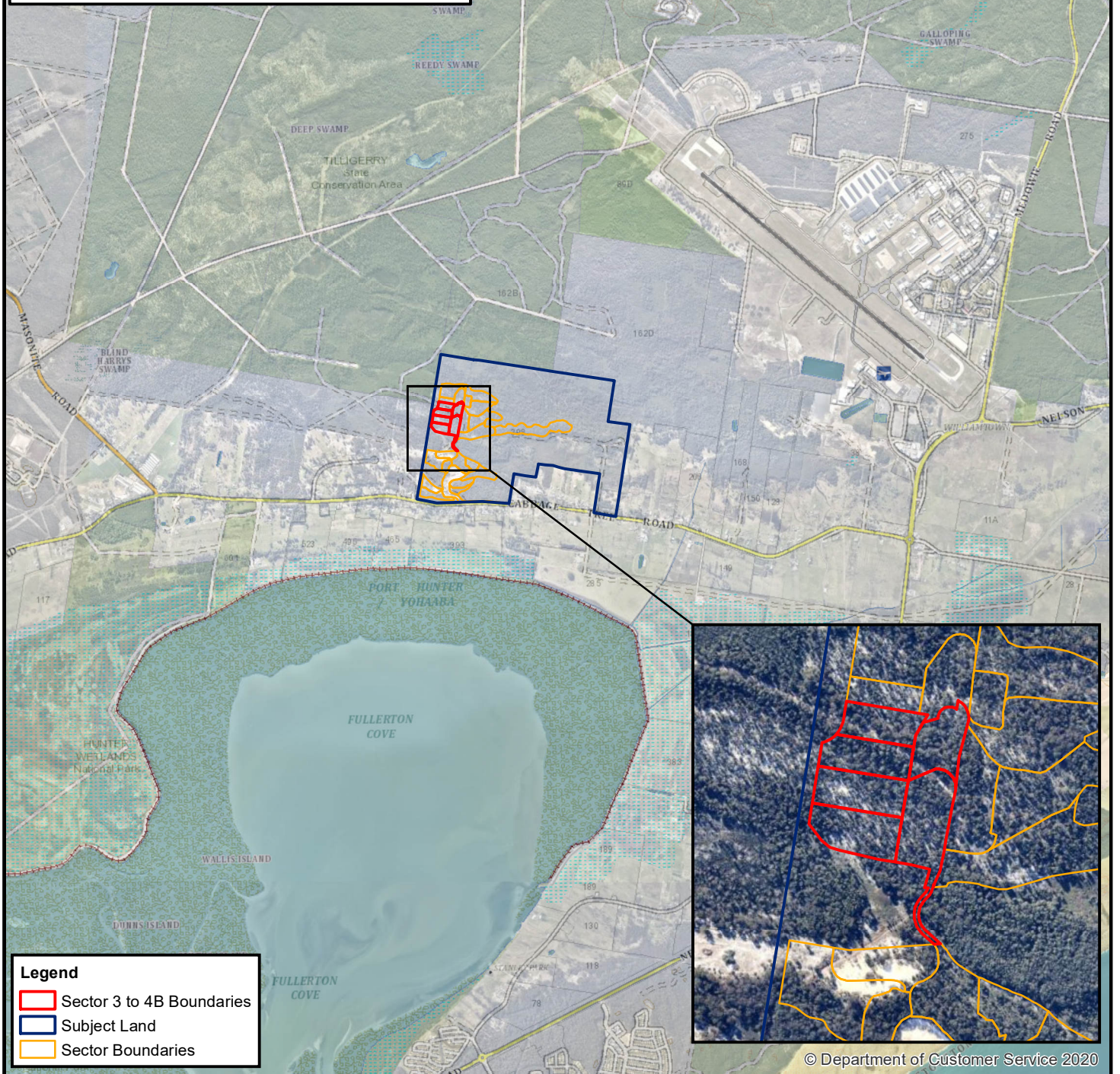
Regional Context

0 5 10 20 30 40 50 km



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Legend

- ▬ Sector 3 to 4B Boundaries
- ▬ Subject Land
- ▬ Sector Boundaries

0 0.25 0.5 1 1.5 2 2.5 km



PROJECT REFERENCE: 20212528

DATE DRAWN: 2020/10/30 13:05 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2020

Locality

Trustee for WSS
Pre-Clear Survey - Sectors 3 to 4B
October 2020

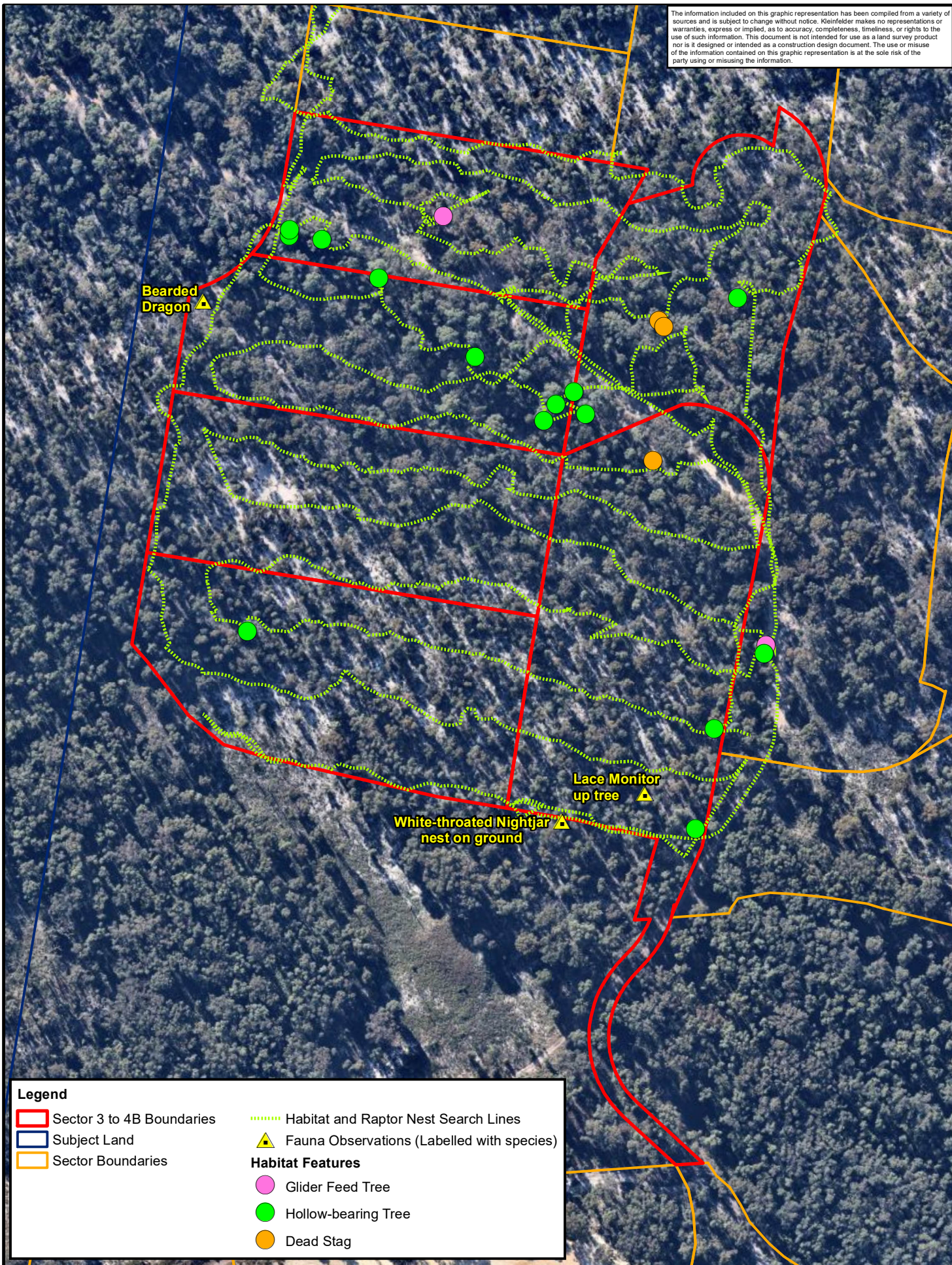
FIGURE:

1



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Legend

- Sector 3 to 4B Boundaries
- Subject Land
- Sector Boundaries
- Habitat and Raptor Nest Search Lines
- ▲ Fauna Observations (Labelled with species)
- Habitat Features**
- Glider Feed Tree
- Hollow-bearing Tree
- Dead Stag

0 10 20 40 60 80 100
Metres



PROJECT REFERENCE: 20212528

DATE DRAWN: 2020/10/30 13:15 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2020

Survey Effort, Habitat Features and Weed Locations

FIGURE:

2



Trustee for WSS
Pre-Clear Survey - Sectors 3 to 4B
October 2020

Table 1: Habitat tree census before clearing within sector 3, 3A, 3B, 4, 4A and 4B.

Location			Tree Description	Habitat Features		Size of Hollow Entrance (cm)			Squirrel Glider Suitability	Signs of Use
Map Ref.	Easting	Northing	Species	Hollow type	Number of hollows	0-5	5-20	>20	Yes / No	Yes / No
1	387794	6369296	<i>Eucalyptus pilularis</i>	-	-	-	-	-	No	No
2	387629	6369536	<i>Corymbia gummifera</i>	-	-	-	-	-	No	No
3	387811	6369511	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	Yes	No
4	387801	6369336	<i>Eucalyptus signata</i>	Branch	1	1	-	-	Yes	No
5	387613	6369376	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	No	No
6	387777	6369445	Dead Stag	Branch	1	1	-	-	No	No
7	387733	6369461	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	No	No
8	387750	6369463	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	No	No
9	387745	6369473	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	No	No
10	387737	6369468	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	No	No
11	387705	6369487	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	No	No
12	387666	6369518	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	No	No
13	387630	6369538	<i>Corymbia gummifera</i>	Branch	1	1	-	-	No	No
14	387643	6369534	<i>Eucalyptus pilularis</i>	Branch	1	1	-	-	No	No
15	387779	6369501	Dead Stag	Upright	1	1	-	-	No	No
16	387781	6369499	Dead Stag	Upright	1	1	-	-	No	No

Location			Tree Description	Habitat Features		Size of Hollow Entrance (cm)			Squirrel Glider Suitability	Signs of Use
Map Ref.	Easting	Northing	Species	Hollow type	Number of hollows	0-5	5-20	>20	Yes / No	Yes / No
17	387692	6369544	<i>Corymbia gummifera</i>	-	-	-	-	-	Yes	Yes
18	387822	6369370	<i>Corymbia gummifera</i>	-	-	-	-	-	Yes	Yes
19	387822	6369367	<i>Eucalyptus pilularis</i>	-	-	-	-	-	No	No
Total Hollows					14	14	0	0		

Note: Eastings and Northings pertain to map reference GDA 94 MGA 56.



Plate 1 **Horizontal 'chew marks' typical of arboreal mammals such as gliders.**



Plate 2 ***Eurostopodus mystacalis* (White-throated Nightjar) Nest/Egg.**



Plate 3 ***Eurostopodus mystacalis* (White-throated Nightjar) Nest/Egg.**

17 November 2020

File Ref: NCA20L118815

Document Ref: NCA20L118815

Quarry Manager
Newcastle Sand
398 Cabbage Tree Road
Williamstown, NSW 2318

Attention: Paul Bourne

Delivered by email: paul@newcastlesand.com.au

Subject: Newcastle Sand Nest box Pre-installation Survey

Background

Kleinfelder previously conducted a hollow-bearing tree survey within resource areas 3, 3A, 3B, 4, 4A and 4B which require the removal of vegetation. Fourteen (14) hollows were identified for replacement during the survey. Their location, height above the ground, width at opening and suitability for threatened species i.e. Squirrel Glider, were recorded. Nest boxes are to be installed at a ratio of 1:1 for hollows removed pursuant to Section 6.14 of the Biodiversity and Rehabilitation Management Plan (BRMP). The BRMP also states that nest boxes should be installed to face away from the resource areas and to have a southerly aspect if possible.

An additional thirty-nine (39) nest boxes will be erected within the offset areas due to an error in the total hollows within the previous report from resource areas 1A and 2. There will also be an additional six (6) boxes to be included from the clearing of the access road within resource area 1.

Assessment

On November 11, 2020, a Kleinfelder ecologist, Mark Dean, conducted a nest box pre-installation survey within three retained vegetation areas adjacent to future and current resource areas. Five (5) nest box locations were chosen within the retained vegetation to the west of resource area 1, twenty-eight (28) south of area 3 and 3A and twenty-six (26) to the north and north-west of 5A and 5B (**Figure 1**). For each nest box location, the tree species, diameter at breast height (DBH), nest box number, aspect, install height and nest box size was recorded (**Table 1**).

Limitations and Recommendations

Nest box locations were spread throughout the retained vegetation areas to maximise potential fauna utilisation. Recommended installation heights and corresponding aspect were determined from the ground and may change slightly during installation. Recommended nest box aspects were chosen to typically face away from the resource area where appropriate and to face south where appropriate.

For any further questions, please do not hesitate to contact me.

Sincerely,

Kleinfelder Australia Pty Ltd



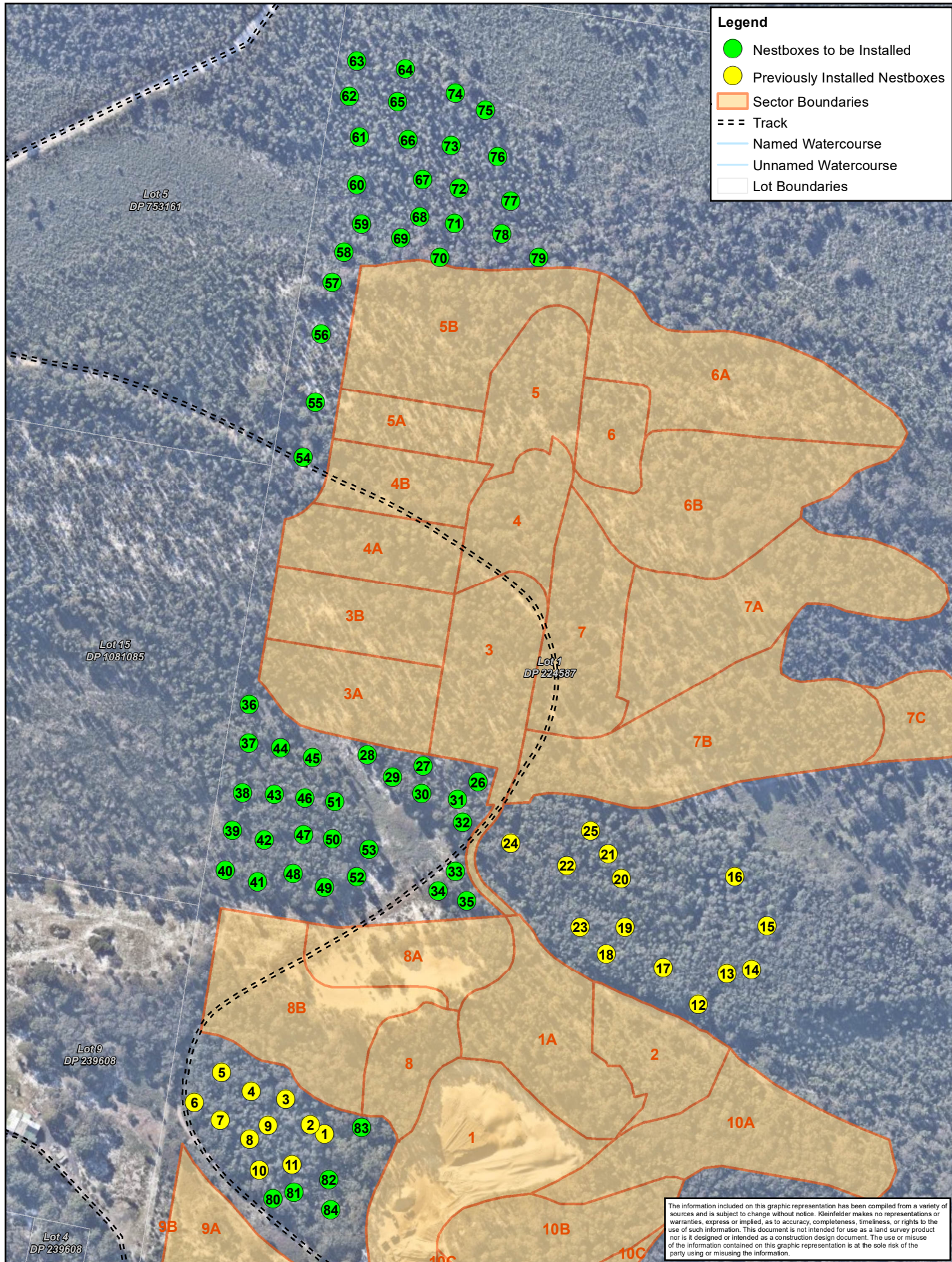
Mark Dean EnvSc & Mgmt

Ecologist

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	PROJECT REFERENCE: 20212528 DATE DRAWN: 2020/11/17 10:27 Version 1 DRAWN BY: G.Joyce	Nestbox Locations Trustee for WSS Nestbox Installation November 2020	FIGURE: 1
	DATA SOURCE: NSW DFSI - 2019 Nearmap - 2020		

Table 1: Nest box pre-install survey – November 2020.

Nest box ID	Tree Species	Latitude	Longitude	DBH (cm)	Recommended Height (m)	Recommended Aspect	Recommended Box size
26	<i>A. costata</i>	-32.8087404	151.8011233	29	4	S-SW	Medium
27	<i>E. signata</i>	-32.8086085	151.8006046	32	4	SW	Small
28	<i>E. pilularis</i>	-32.8085101	151.8000735	46	5	S-SW	Large
29	<i>A. costata</i>	-32.808694	151.8003105	30	5	S	Medium
30	<i>E. pilularis</i>	-32.8088307	151.8005885	48	4	SW	Medium
31	<i>C. gummifera</i>	-32.8088804	151.8009264	21	3.5	SE	Small
32	<i>E. pilularis</i>	-32.8090632	151.8009701	48	3.5	W	Medium
33	<i>A. costata</i>	-32.8094564	151.8008977	30	4	SW	Medium
34	<i>A. costata</i>	-32.8096122	151.800732	30	4	S	Small
35	<i>A. costata</i>	-32.8096981	151.8010051	60	3	SW	Medium
36	<i>A. costata</i>	-32.8080982	151.7989544	43	5	W	Medium
37	<i>A. costata</i>	-32.8084075	151.7989438	45	4	NW	Medium
38	<i>A. costata</i>	-32.8088067	151.7988785	35	3	SW	Small
39	<i>A. costata</i>	-32.8091083	151.7987784	32	4	S	Small
40	<i>A. costata</i>	-32.8094286	151.7987072	32	4	NW	Small
41	<i>C. gummifera</i>	-32.8095236	151.7990123	40	4	W	Small
42	<i>A. costata</i>	-32.8091856	151.7990833	51	3.5	S	Small
43	<i>C. gummifera</i>	-32.8088234	151.7991823	32	5	W	Medium
44	<i>A. costata</i>	-32.8084495	151.7992498	29	5	SW	Medium
45	<i>A. costata</i>	-32.8085314	151.7995487	46	3.5	SW	Medium
46	<i>A. costata</i>	-32.8088527	151.7994735	29	3	SW	Small
47	<i>C. gummifera</i>	-32.8091509	151.7994572	51	3.5	SE	Medium
48	<i>C. gummifera</i>	-32.8094626	151.7993545	41	4	SW	Medium
49	<i>C. gummifera</i>	-32.8095777	151.7996525	64	5	W-SW	Medium

Nest box ID	Tree Species	Latitude	Longitude	DBH (cm)	Recommended Height (m)	Recommended Aspect	Recommended Box size
50	<i>C. gummifera</i>	-32.8091863	151.7997333	35	4.5	W	Small
51	<i>A. costata</i>	-32.8088872	151.799756	38	4	SW	Small
52	<i>C. gummifera</i>	-32.8094959	151.7999606	53	5	S	Medium
53	<i>A. costata</i>	-32.8092724	151.8000786	32	4	W	Small
54	<i>C. gummifera</i>	-32.8061141	151.799497	64	4	NE	Medium
55	<i>C. gummifera</i>	-32.8056726	151.7996169	32	3.5	S	Medium
56	<i>E. pilularis</i>	-32.8051233	151.7996796	22	3	S	Small
57	<i>E. pilularis</i>	-32.8047119	151.7997903	25	4	N	Small
58	<i>A. costata</i>	-32.8044653	151.7999038	35	4.5	S	Medium
59	<i>A. costata</i>	-32.8042425	151.8000731	38	4.5	SW	Small
60	<i>E. pilularis</i>	-32.8039248	151.8000334	35	3.5	S	Small
61	<i>C. gummifera</i>	-32.8035392	151.8000639	51	4	W	Small
62	<i>C. gummifera</i>	-32.8032108	151.799972	35	4	SW	Small
63	<i>C. gummifera</i>	-32.8029303	151.8000474	51	4	SE	Medium
64	<i>C. gummifera</i>	-32.8029996	151.8005111	48	4	SE	Medium
65	<i>C. gummifera</i>	-32.8032624	151.8004307	38	3.5	S-SW	Medium
66	<i>C. gummifera</i>	-32.8035688	151.8005284	19	3.5	S	Small
67	<i>C. gummifera</i>	-32.8038882	151.8006633	19	3.5	SW	Small
68	<i>C. gummifera</i>	-32.8041897	151.8006286	35	4.5	S	Medium
69	<i>E. signata</i>	-32.8043595	151.8004472	57	3.5	S=SE	Small
70	<i>C. gummifera</i>	-32.8045188	151.8008195	29	4	N	Medium
71	<i>C. gummifera</i>	-32.8042452	151.8009603	35	4	S	Medium
72	<i>C. gummifera</i>	-32.8039641	151.8010073	29	3	S-SW	Medium
73	<i>C. gummifera</i>	-32.8036206	151.8009376	29	3	SE	Small
74	<i>C. gummifera</i>	-32.8031974	151.8009849	41	5	SE	Small

Nest box ID	Tree Species	Latitude	Longitude	DBH (cm)	Recommended Height (m)	Recommended Aspect	Recommended Box size
75	<i>C. gummifera</i>	-32.8033348	151.8012672	48	4.5	SE	Medium
76	<i>C. gummifera</i>	-32.8037113	151.8013782	41	3	S	Medium
77	<i>C. gummifera</i>	-32.8040681	151.8014964	32	4.5	SE	Small
78	<i>C. gummifera</i>	-32.804335	151.8014098	29	3	SW	Small
79	<i>A. costata</i>	-32.8045273	151.8017597	32	4	SW	Small
80	<i>A. costata</i>	-32.8120767	151.799127	64	4	SE	Small
81	<i>E. robusta</i>	-32.8120271	151.7993296	64	3.5	SW	Small
82	<i>E. robusta</i>	-32.8119267	151.7996599	51	3.5	SW	Medium
83	<i>E. robusta</i>	-32.8115109	151.7999769	57	4	S	Medium
84	<i>E. robusta</i>	-32.8121678	151.7996768	51	5	S	Medium

12 December 2020

File Ref: NCA20L119364

Document Ref: NCA20L119364

Quarry Manager
Newcastle Sand
398 Cabbage Tree Road
Williamstown, NSW 2318

Attention: Paul Bourne

Delivered by email: paul@newcastlesand.com.au

**Subject: Sector 3, 3A, 3B, 4, 4A, 4B Pre-clearance, Nocturnal, Diurnal Fauna
Surveys and Tree Removal.**

Pre-clearance

On 20 November 2020 Kleinfelder ecologist, David Martin, conducted a pre-clearance assessment within Sector 3 (Access Road). The access road was assessed for habitat trees (hollow-bearing trees, dead stags containing hollows and trees containing nests), hollowed logs and the presence and abundance of exotic weed species. The location of these features and the survey effort were recorded during the assessment. Pink flagging tape was used in conjunction with the chalk paint to aid in visual identification of habitat trees where the painted "H" was obscured by epicormic growth or shrubs.

A total of one hollow-bearing tree containing one hollow was recorded during the assessment. No stick nests were observed within the area or observed within three (3) metres of the resource boundary. The majority of the habitat trees were observed to have no obvious signs of fauna use. One nest box location has been marked up (NB60) to offset the hollow bearing tree within the adjacent area.

Fauna surveys

On 2 of December 2020, a Kleinfelder Ecologist, Mark Dean, conducted a nocturnal fauna survey within Sector 3, 3A, 3B, 4, 4A, 4B prior to tree removal pursuant to Section 6.6 of the Biodiversity and Rehabilitation Management Plan (BRMP) (**Figure 1**). The survey consisted of a meandering spotlight transect and call-playback. Species targeted during call-playback were Koala (*Phascolarctos cinereus*) and the Squirrel Glider (*Petaurus norfolkensis*).

One fauna species the Brown Quail (*Coturnix ypsilophora*) was detected during spotlighting efforts. Three juvenile quails were captured and relocated offsite adjacent to the extraction area in the direction the adult was seen flying away. No fauna was heard during call-playback efforts.

On 4 of December 2020, diurnal fauna surveys were conducted prior to tree removal pursuant to Section 6.6 of the BRMP. Diurnal surveys consisted of a walkthrough to identify any fauna residing within Sector 3, 3A and 3B.

One White-throated Nightjar (*Eurostopodus mystacalis*) was detected during the diurnal surveys and was dispersed into adjacent vegetation away from the clearing activities.

Tree removal

On 4 of December 2020, a Kleinfelder Ecologist and experienced fauna spotter-catcher, Mark Dean supervised the clearing of non-habitat and habitat trees pursuant to Section 6.6 of the BRMP within sectors 3, 3A and 3B. Non-habitat trees were soft felled under direction of the ecologist. The three habitat trees within the south-east portion of sector 3 have been left standing for a minimum of two nights, pursuant to Section 6.8 of the BRMP, and will be felled following the procedure outlined in Section 6.11 of the BRMP at a later date under the direction of the ecologist (**Figure 2**).

One Koala (*Phascolarctos cinereus*) was found during the clearing operations within sector 3 in a Blackbutt (*Eucalyptus pilularis*) tree. Clearing operations were stopped immediately to assess the koala. The relocation of the koala was deemed to be hazardous to the welfare of the koala and was left to relocate overnight. The location of the Koala was GPS marked for reference. Clearing operations resumed within sector 3 away from the koala. The koala was assessed the next morning at 6:30am by Newcastle Sand staff and was not located in the Blackbutt has relocated into an adjacent vegetation.

Seed collection

During the pre-clearance survey, previously conducted by Kleinfelder, limited flora species were observed to contain fruit viable for seed collection, apart from the overstorey species *Angophora costata* (Smooth-bark Apple), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus pilularis* (Blackbutt). During the tree removal process, fruit from each of these species was available to be collected from multiple felled individuals within the resource area.

Recommendations

No hollows were found during the clearing operations for relocation as per Section 6.11 of the BRMP.

Felled trees/limbs which may provide suitable ground habitat should be relocated into retained vegetation areas after the re-distribution of topsoil.

Sincerely,

Kleinfelder Australia Pty Ltd



Mark Dean EnvSc & Mgmt

Ecologist

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Mobile: 0455 381 346

Figure 1 Locality

Figure 2 Clearing Extent



Plate 1 **Koala (*Phascolarctos cinereus*)**



Plate 2 **Brown Quail (*Coturnix ypsilophora*) chick**