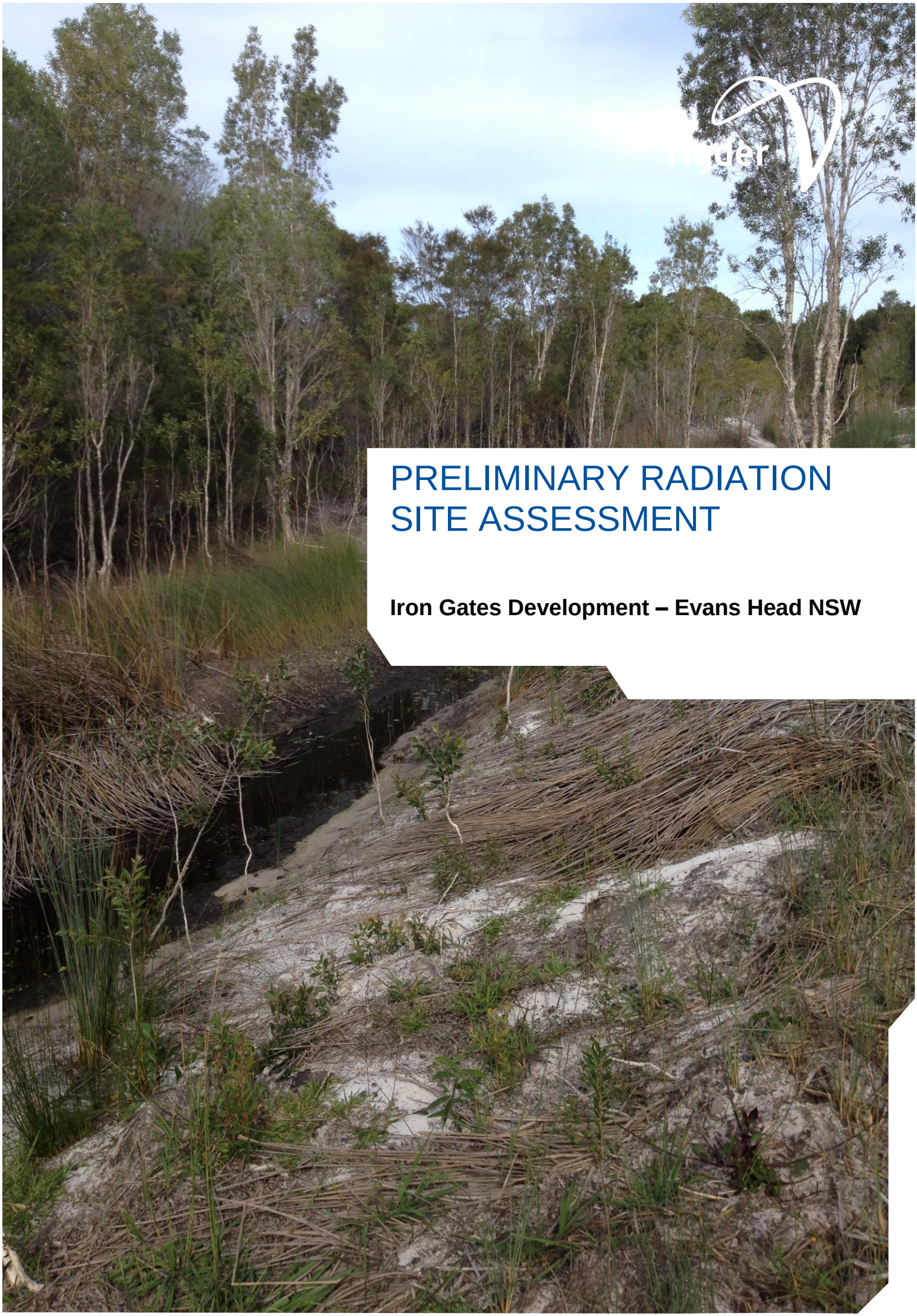

PRELIMINARY RADIATION SITE ASSESSMENT

Iron Gates Development – Evans Head NSW

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GOLDCORAL PTY LTD

PRELIMINARY RADIATION SITE ASSESSMENT

Iron Gates Development – Evans Head NSW

Author	Simon Groth	
Checker	Lauren Dykes	
Approver	Simon Groth	

Report No

Date 22 May 2014

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

Hyder Consulting Pty Ltd (Hyder) has been commissioned by Goldcoral Pty Ltd to undertake a Preliminary Radiation Site Assessment of the proposed Iron Gates residential development, Evans Head. This assessment comprises of:

- A preliminary site investigation, to establish whether radioactive sand residues from former mineral sand mining activities exists on the site; and
- If required, establishing the extent of soil contamination, and possible environmental, health and safety impairment risks, with a view to establishing a suitable remediation/management strategy.

The above will be carried out in accordance with NSW Government Department of Health – Radiation Branch publication, "No. 12 Clean-Up and Disposal of Radioactive Residues from Commercial Operations Involving Mineral Sands".

This report covers:

- The results of the on-site inspection and preliminary in-situ analysis, (to identify, likely areas of contamination, and prepare a sampling and analysis protocol);
- Recommendations for ongoing site management.

1.2 SITE IDENTIFICATION

The scope of this study was the "development area" as detailed in the locality plan provided below. The development site is located approximately 1.7 kilometres south-west of Evans Head township. This is the area that will be directly disturbed as a result of the construction required for the development. This includes bulk earthworks, road construction and ancillary activities such as stockpile and compound sites, utility installation and access requirements, and any alterations to intersections. The location of the proposal is illustrated in Figure 1 (a detailed locality plan with development layout is provided in Appendix 1).

Figure 1: Site locality plan showing the development area

1.3 OBJECTIVE

The objective of this contamination investigation was to identify potential risks associated with radioactive sand residues from past sand mining activities in the study area and to identify areas that may require remediation or management through construction phases.

Carrying out the Preliminary Radiation Site Assessment will provide the Goldcoral Pty Ltd with information on potential risks associated with contamination based on past sand mining operations adjacent to and on portions of the site. The process will identify where there is a contamination risk which warrants additional intrusive investigations aimed at characterising the presence and extent of any impact within the vicinity of the proposal. The outcomes of the assessment will inform management actions for ongoing protection of the environment and will provide baseline information to monitor future change.

1.4 SCOPE OF WORKS

To achieve the above outlined objectives the following scope of works was undertaken:

- Desktop review of site history information of the proposal site and adjoining sites in May 2014 was undertaken to identify potential areas of environmental concern. Where available, this included review of the following information sources:
  - Historical titles.
  - Historical aerial photographs (from 1953 to present, where available).
  - Previous environmental reports for the site.
- A site assessment/walkover by a Hyder representative; this included:

- Evidence of past sand mining activities.
- Identification of sand mining residues or former tailings.
- General review of previous operations within the area of impact.
- Checking for signs of ground illminite or monozite that are visible on the ground surface.
- A radiation survey recording surface radiation levels.

- Preparation of a Preliminary Radiation Site Assessment Report for the proposal.

1.5 LIMITATIONS

The findings in this report are based on a preliminary environmental desktop study described in the scope of works. Hyder has performed the services in a manner consistent with the level of care and expertise exercised by members of the environmental consulting profession. No warranties, expressed or implied are made. Hyder's assessment is limited strictly to identifying typical environmental conditions associated with the study area. All environmental and contaminated land/radiation survey work is subject to general limitations related to the heterogeneity of the natural environment, variability of contaminant distribution and constraints imposed by the investigation methods utilised.

The results of this assessment are based on the site inspection undertaken by Hyder personnel from accessible areas, information provided by Goldcoral Pty Ltd and publically available background information. All conclusions and recommendations are the professional opinions of the Hyder personnel involved in the project, subject to the qualifications made above. While normal assessments of data reliability have been made, Hyder assumes no responsibility or liability for errors in any data obtained from external sources, or developments resulting from situations outside the scope of this project.

Specifically, with regard to this report, it should be noted that the scope of works carried out herein is not intended to include sufficient information to enable completion of a statutory audit of the site, and as such does not include the following:

- Any intrusive soil/groundwater sampling and analysis.
- Sampling and analysis of any emissions to air, wastewater discharges or solid and liquid wastes.

Please ensure that these limitations are understood before utilising, or basing decisions on the information presented in this report.

2 GEOLOGY AND HYDROLOGY

2.1 GEOLOGY

The Australian Stratigraphic Units Database describes the Evan Head area (Evans Head Coal Measure) as Thin- to thick-bedded, crossbedded, coarse-grained quartz to sublithic arenite, thinly-bedded grey siltstone, claystone, minor coal, as partings and very thin bands. The Evans Head area belongs to the Ipswich Basin Geological Province.

Basic geological mapping of the area indicates that the Evans Head headlands are comprised of different types of sediments. These are all very recent which geologically places them at Quaternary (or more specifically Pleistocene to Holocene aged) comprising mainly sands in the beach and dune systems and silts and clays around the river estuary. Many of the Holocene aged sediments contain potential acid sulfate soils, which are common in the region. Acid sulphate soils are covered in more detail in section 2.3 of this report.

3 SITE BACKGROUND AND HISTORICAL REVIEW

3.1 GENERAL INFORMATION

Goldcoal Pty Ltd propose to develop the Iron Gates site into a 180 lot residential development. The proposal is located approximately 1.7 kilometres south-west of Evans Head township. Figures 1 shows the proposal in relation to its local and regional context.

Table 1: Site identification details

Site Address:	Iron Gates Road, Iron Gates			
Approximate Total Area of Impact	18 Hectares			
Postcode	2473			
Adjacent Lot and DP Numbers	544/48550	547/48550	276/55624	277/755624
Local Government Area	Richmond Valley Council			
Current Site Zoning	Low Medium Residential			
Current Site Use	Vacant Land			

3.2 ADJOINING LAND USES

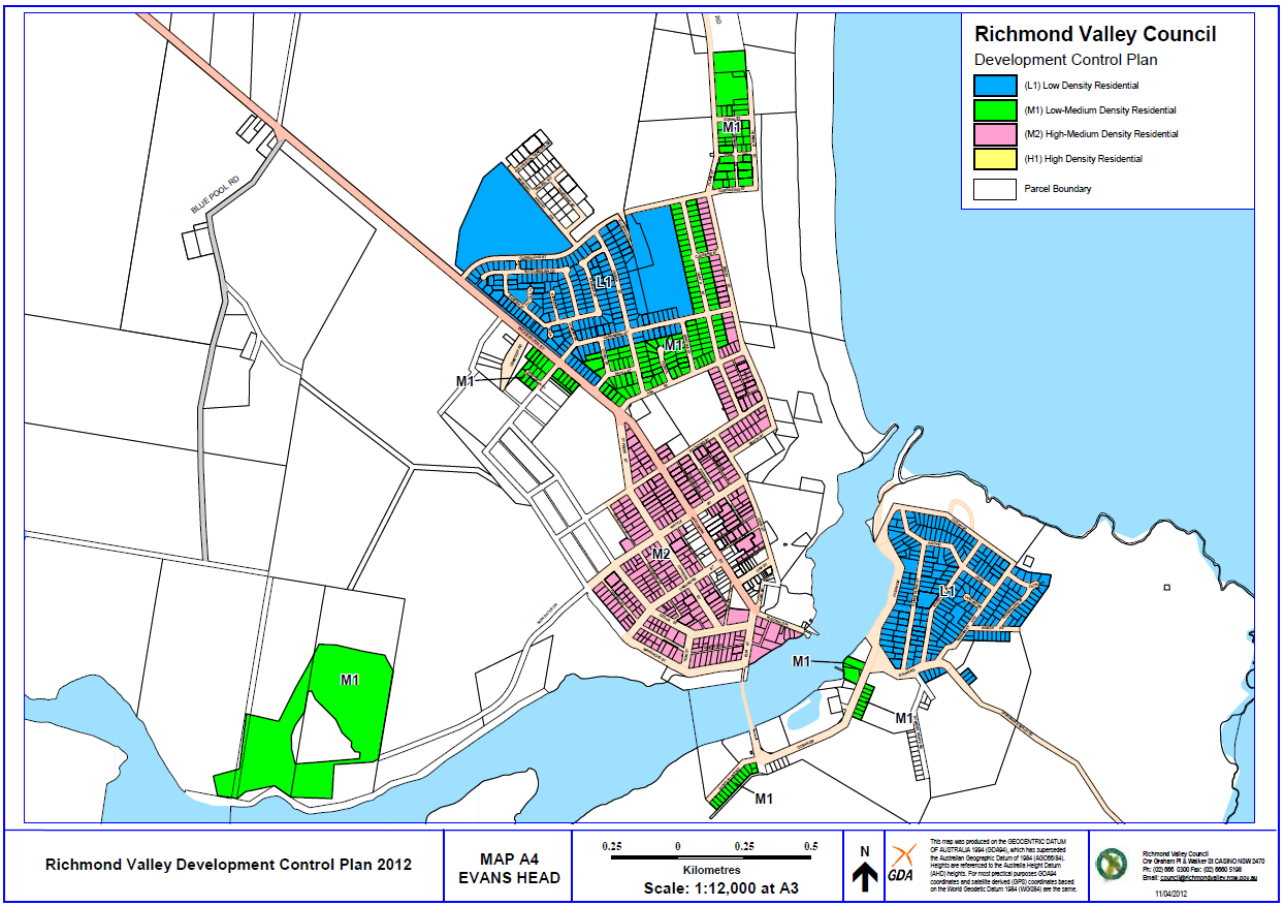
Land use in the study area is characterised by surrounding undeveloped land zones Parcel Boundary.

3.3 PLANNING CONTEXT

3.3.1 ZONING

The Proposal area is zoned under the Richmond Valley Council Development Control Plan (DCP). This planning context is shown in Figure 3 below.

Figure 2: Richmond Valley Council Development Control Plan for the study area



3.4 TITLE SEARCHES

Hyder conducted a title search of "properties of interest" with the aim of tracing ownership details through a search of title records. The proposed Iron Gates development comprises of three separate properties. Those properties that have been identified by aerial photography historic searches as having past activities that may have had the potential to contaminate the receiving environment. No historical potentially contaminating activities were identified by the historical title search.

3.5 AERIAL PHOTOGRAPH REVIEW

Historical aerial photographs were obtained from the Land and Property Management Authority (LPMA). A review of the historical aerial photographs of the site is presented in the Table 2. Aerial photographs are presented in Appendix 2.

Table 2: Review of historical aerial photographs

Year	Site History Details	Potential contamination Implications
1953	Sole Dwelling with surrounding cleared land for rural use	
1964	Sole Dwelling with surrounding cleared land for rural use	
1971	Sole Dwelling with surrounding cleared land for rural use	
	Eastern portion and adjacent property to the Iron Gates property has evidence of substantial sand mining activities (Refer Figure 2)	Potential sand mining residues with elevated radiation levels
1980	Sole Dwelling with surrounding cleared land for rural use	
	Sand mining activities seem to have down sized and revegetation of areas is evident	Potential sand mining residues with elevated radiation levels
1988	Sole Dwelling with surrounding cleared land for rural use	
	Sand mining activities have ceased	
1998	Sole dwelling and cleared land and constructed roads associated with the Iron Gates development (Refer Figure 3)	
2001	Sole dwelling and cleared land and constructed roads associated with the Iron Gates development	
2014	Sole dwelling and cleared land and constructed roads associated with the Iron Gates development	

3.6 SUMMARY OF SITE HISTORY

The information obtained from the site history review can be summarised as follows:

- Previous to 1971 the area was generally rural with a sole dwelling.
- There is evidence that sand mining activities were undertaken between 1965 and 1981
- Sand mining activities ceased before 1988.
- In 1996 the Iron Gates urban development was constructed.
- The site has remained unchanged since 1996.

3.7 POTENTIAL AREAS OF ENVIRONMENTAL CONCERN

Based on information obtained from this site history review, potential environmental issues at the site can be summarised as follows:

- During the 1970's and early 1980's sand mining activities took place. As a result tailings dams may have concentrated monazite separated out as part of the mining process.

Monazite tailing can be responsible for elevated radiation levels and potentially causes health risks.

Figure 2: Aerial photograph of Iron Gates Site in 1971 with sand mining activities evident on the eastern portion of the site and adjacent property

Figure 3: Aerial photograph of Iron Gates Site in 1998 with developed roads.

4 RELEVENT REGULATIONS AND GUIDELEINES

The NSW Department of Health - Radiation Branch has developed action level thresholds for the clean-up and disposal of radioactive residues from commercial operations involving mineral sands, and are presented below.

1. Action Level Criteria

1.1 For 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 µGy h^{-1} (or 70 µR h^{-1}) for all points at 1 metre above the area of concern on the property.

1.2 For other 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 µGy h^{-1} (100 µR h^{-1}) for all points at 1 metre above the lowest surface of the area.

1.3 For roads, paths, and other areas with intermittent occupancy, the remedial action level should be 2.5 µGy h^{-1} (250 µR h^{-1}) for all points at 1 metre above the surface of the areas.

1.4 All values quoted above should include a value for normal natural background of 0.1 µGy h^{-1} (10 µR h^{-1}).

5 SITE INSPECTION

A site inspection was undertaken by Hyder Consulting on 17 June 2014 by Simon Groth of Hyder Consulting. The site visit involved identifying activities or site features that may be associated with past sand mining activities being present in areas identified in historic aerial photographs. These locations were closely inspected and reference made to the concept plan of the development works proposed. Site inspection photographs are provided in Appendix 3. No contaminating activities or evidence of mineral sand staining was identified during the site inspection.

A surface radiation survey of the development site was also undertaken using a calibrated HPI Cypher 5000 Digital Radiation Alert Monitor to measure surface gamma radiation levels and detect and locate any areas of elevated radiation levels. The assessment was undertaken by walking transects of the site approximately 20-25 metres apart with the aid of a GPS device. Radiation levels were continuously monitored at all times whilst walking transects. Transects were recorded and plotted in Figure 4 below.

Radiation levels were also recorded at three off site locations to determine endemic background radiation levels for the Evans Head area. These locations are detailed in table 7.

Table 3: Off-site locations to determine endemic background levels for the Evans Head area

Location Description	Distance from Iron Gates Site (Km)	Radiation Measurement (microsievert/ hour)
Cherry Street, Evans Head	1.0	0.2 - 0.4
Evans Head Rugby League Club	1.8	0.2 – 0.35
Evans Heads River K12 School	1.6	0.2 – 0.385

Figure 4: Surface radiation survey transects continuously monitored (in red) on the Iron Gates site.

Conditions at Site Boundary

There were no visible signs of mineral sand staining identified during the site inspection

6 RESULTS

The surface radiation levels monitored on the Iron Gates site in areas where previous sand mining activities were located are all equivalent to background levels displayed at the three off site background control locations. Surface radiation levels generally varied between 0.00 uSv/Hr to 0.3 uSv/Hr. Some discrete areas displayed levels of 0.4 and 0.5 uSv/Hr however these areas are still below Action Level Criteria for dwellings.

It should be noted that while radiation dose rate unit results are quoted in uSv/Hr (microsieverts) and Action Level Criteria units are quoted in uGy/Hr (microgray) these units are identical for gamma radiation in this situation.

7 FURTHER INVESTIGATIONS

Based on the site assessment undertaken, it is consider that no further investigations or actions are required.

8 CONCLUSIONS AND RECOMMENDATIONS

Desktop studies revealed that eastern parts of the site and the property adjacent of the Iron Gates development was subject to sandmining activities during the 1970's and early 1980's. As a result there may have been potential for the existence of sand mining residues with elevated radiation levels on site that may have been associated with tailings dams from rutile separation processes.

Site investigations were undertaken and surface radiation levels monitored on the Iron Gates site in areas where previous sand mining activities were located are all equivalent to background levels displayed at the three off site background control locations. Surface radiation levels generally varied between 0.00 uSv/Hr to 0.3 uSv/Hr. Some discrete areas displayed levels of 0.4 and 0.5 uSv/Hr however these areas are still below Action Level Criteria for dwellings.

Based on the site assessment undertaken, it is consider that no further investigations or actions are required.

APPENDIX 1

PROPOSED DEVELOPEMENT

PLAN OF SUBDIVISION

IRON GATES, EVANS HEAD

LOT	AREA
01	775.87m²
02	716.33m²
03	716.75m²
04	717.37m²
05	717.79m²
06	718.21m²
07	718.62m²
08	719.04m²
09	719.46m²
10	719.88m²
11	718.36m²
12	655.26m²
13	717.40m²
14	721.68m²
15	722.11m²
16	722.52m²
17	722.93m²
18	723.35m²
19	721.28m²
20	712.63m²
21	704.46m²
22	705.28m²
23	731.26m²
24	760.45m²
25	605.22m²
26	604.95m²
27	604.34m²
28	603.50m²
29	608.17m²
30	631.42m²
31	610.14m²
32	621.92m²
33	624.75m²
34	623.00m²
35	702.93m²
36	731.13m²
37	637.48m²
38	637.94m²
39	645.10m²
40	662.18m²
41	702.14m²
42	900.50m²
43	740.08m²
44	842.92m²
45	1010.23m²
46	734.75m²
47	762.20m²
48	735.82m²
49	727.34m²
50	761.10m²
51	613.18m²
52	613.18m²
53	612.89m²
54	608.33m²
55	603.19m²
56	601.05m²
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58	602.05m²
59	600.02m²
60	600.02m²
61	701.13m²
62	1036.44m²
63	600.02m²
64	600.02m²
65	602.59m²
66	605.71m²
67	603.17m²
68	606.88m²
69	613.09m²
70	614.95m²
71	614.14m²
72	613.62m²
73	612.85m²

LOT	AREA
74	613.89m²
75	614.87m²
76	615.20m²
77	610.77m²
78	602.59m²
79	606.69m²
80	614.72m²
81	604.57m²
82	603.68m²
83	604.43m²
84	965.81m²
85	700.60m²
86	600.44m²
87	601.25m²
88	601.25m²
89	601.98m²
90	602.56m²
91	600.10m²
92	604.53m²
93	632.61m²
94	1203.58m²
95	988.60m²
96	1240.48m²
97	636.56m²
98	604.37m²
99	603.90m²
100	603.90m²
101	603.90m²
102	603.90m²
103	602.35m²
104	701.24m²
105	600.48m²
106	634.18m²
107	682.60m²
108	732.12m²
109	808.89m²
110	658.76m²
111	696.84m²
112	685.82m²
113	683.69m²
114	598.33m²
115	787.29m²
116	650.11m²
117	729.98m²
118	600.37m²
119	600.00m²
120	600.00m²
121	600.00m²
122	600.00m²
123	600.00m²
124	600.00m²
125	657.17m²
126	626.78m²
127	600.06m²
128	608.66m²
129	604.19m²
130	602.30m²
131	602.10m²
132	602.52m²
133	601.86m²
134	601.96m²
135	620.43m²
136	650.47m²
137	827.42m²
138	830.40m²
139	808.84m²
140	743.40m²
141	701.49m²
142	685.26m²
143	694.41m²
144	701.04m²
145	911.13m²
146	1066.93m²

LOT	AREA
147	1183.68m²
148	1926.16m²
149	815.70m²
150	680.12m²
151	668.89m²
152	748.72m²
153	683.46m²
154	684.66m²
155	669.78m²
156	604.03m²
157	600.73m²
158	600.73m²
159	600.73m²
160	600.73m²
161	703.24m²
162	703.42m²
163	611.15m²
164	611.15m²
165	611.15m²
166	611.15m²
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168	611.18m²
169	814.48m²
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172	623.04m²
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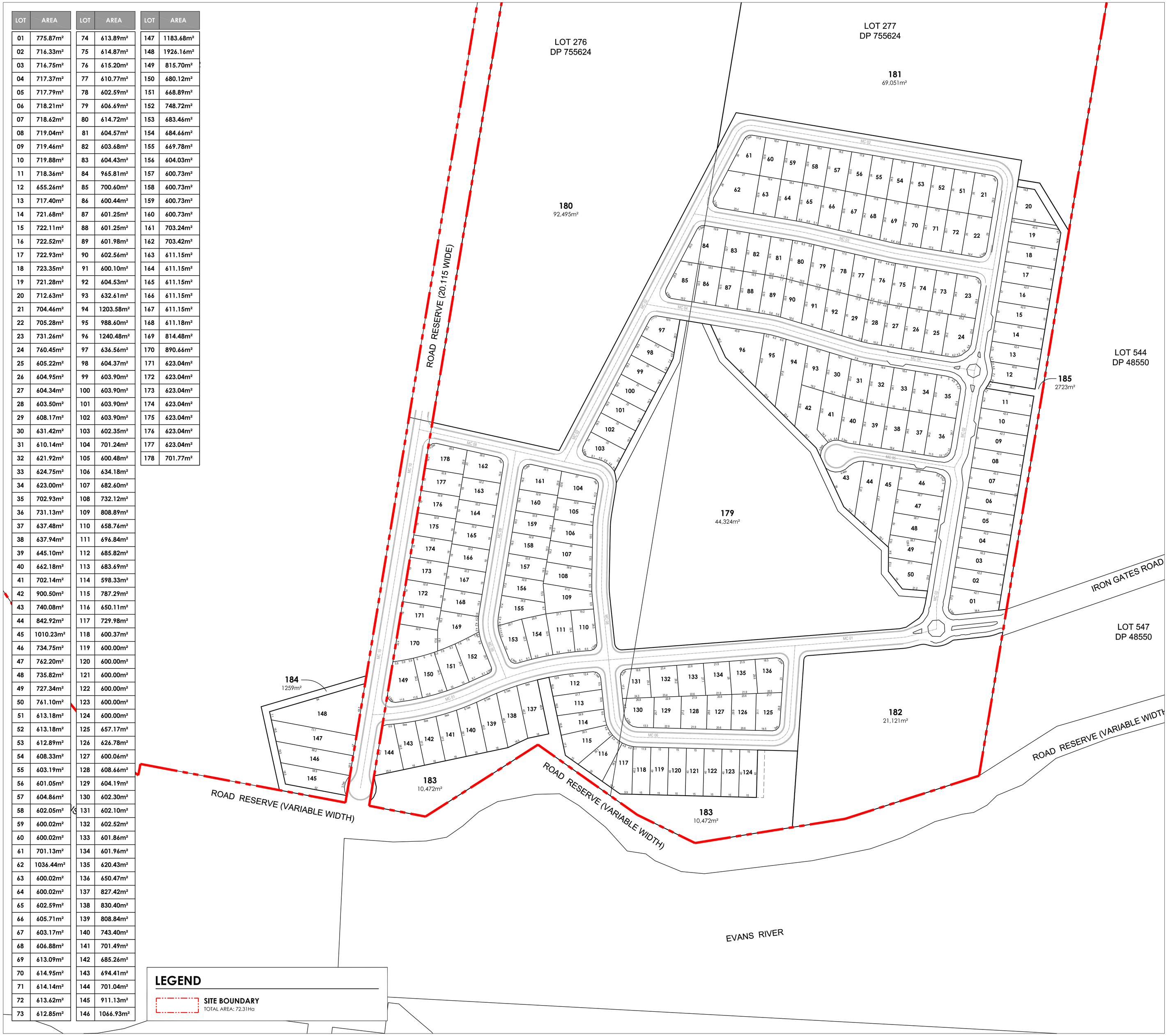


LEGEND

SITE BOUNDARY
TOTAL AREA: 72.31Ha

PLANIT CONSULTING

PROJECT TITLE:
IRON GATES DEVELOPMENT, EVANS HEAD

DRAWING TITLE:
PLAN OF SUBDIVISION

BASE PROVIDED BY:
N/A

CLIENT:
GOLD CORAL

NO	DATE	REVISION	BY
01	18/09/14	LAYOUT AMENDMENTS TO MATCH ENGINEERS ENTRY ROAD DESIGN	ZP

SCALE:
1/1500 @ A1

DESIGN:
PLANIT CONSULTING

DRAWN:
ZP

DATE:
08/2014

CHECKED:
BL

DRAWING NO:
IRONGATES_PLNOFSUB_01

NORTH POINT:

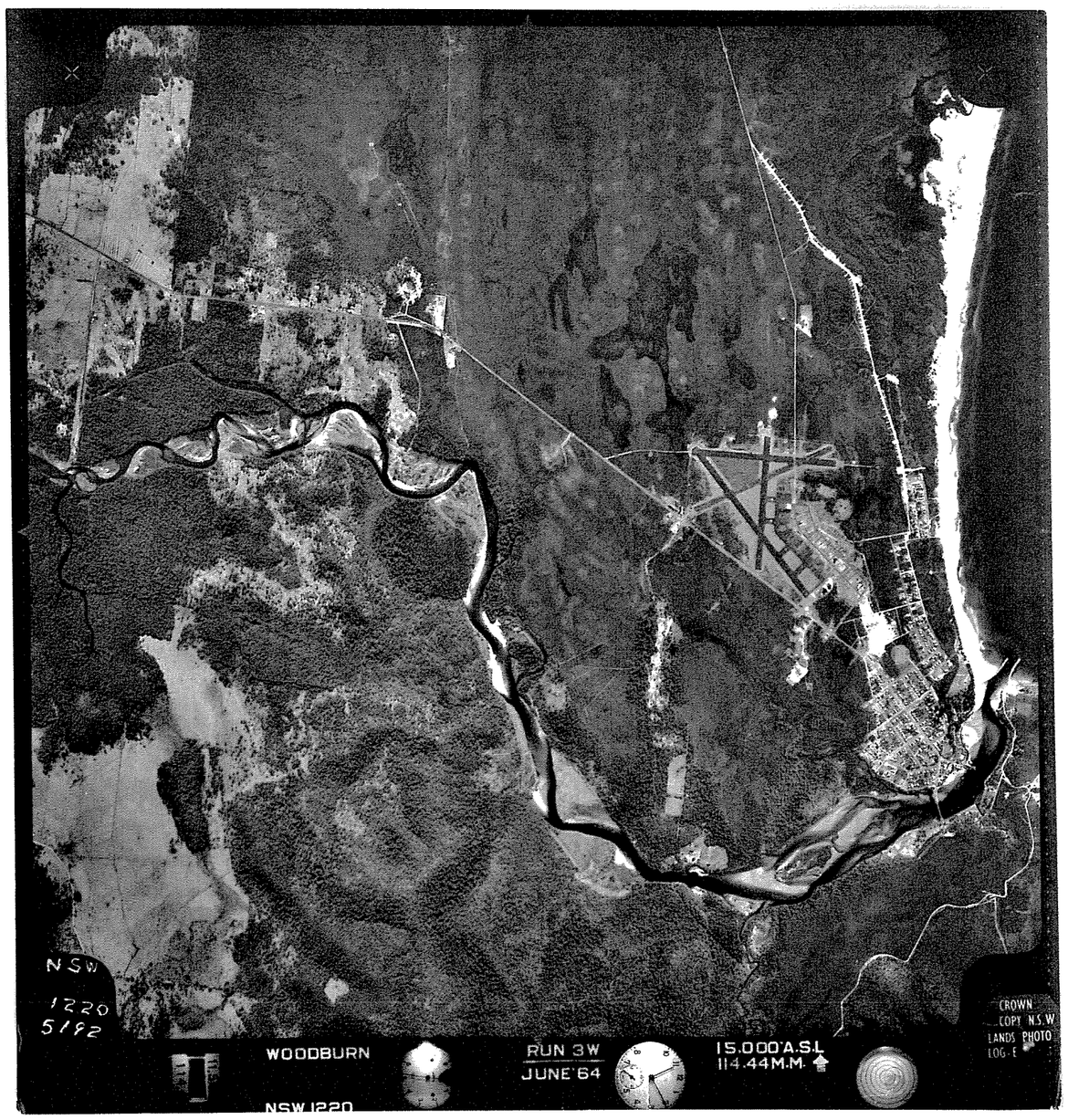
SHEET NO:
01 OF 01

Level 1 2247 Gold Coast Hwy
Nobby Beach
PO Box 206 QLD 4218

Telephone: 07 5526 1500
Fax: 07 5526 1502
Email: admin@planitconsulting.com.au

APPENDIX 2

HISTORIC AERIAL PHOTOGRAPHS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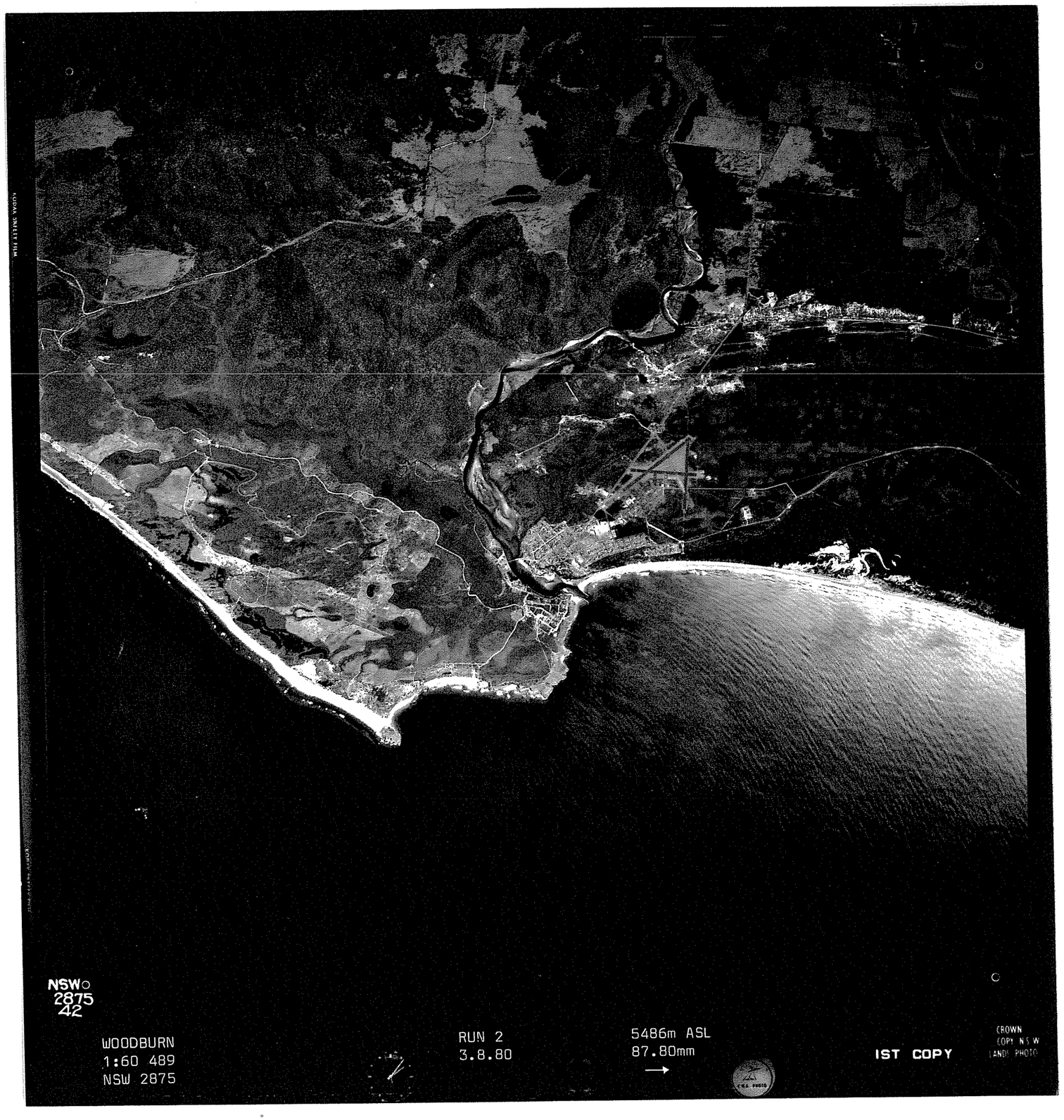
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LANDS PHOTO

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APPENDIX 3

SITE INSPECTION PHOTOGRAPHS

Photographic Illustration 1: Cleared area adjacent to Evans Creek with sole dwelling in the back ground.

Photographic Illustration 2: Open drain located on the eastern boundary of the site were previous sand mining activities are likely to have taken place.

Photographic Illustration 3: Previously constructed road on the Iron Gates estate.

Photographic Illustration 4: Photograph of the North West portion of the Iron Gates property.