A SURVEY OF THE DISTRIBUTION OF BITOU BUSH

(CHRYSANTHEMOIDES MONILIFERA SSP. ROTUNDATA)

ON THE NORTH COAST OF N.S.W. BETWEEN DIAMOND HEAD AND SEAL ROCKS, WITH RECOMMENDATIONS FOR MANAGEMENT

SUMMARY REPORT

INTRODUCTION

Bitou bush is an invasive, exotic weed that is seriously degrading the coastal environment of New South Wales. Previous aerial surveys (1981, 1984) identified the area between Diamond Head and Seal Rocks as one of the few long stretches of coastline north from Sydney that was relatively free of the weed.

Recognising significant convervation values along this coastline, the New South Government Interdepartmental Working Group on Bitou Bush (hereafter called the Working Group) commissioned a more detailed ground survey of the area. **The objectives of the survey were to accurately pinpoint bitou bush infestations within the area, identify conservation values and the impacts of bitou bush upon them, and propose a strategy for management of the bitou bush problem.**

The survey was financed by, and conducted on behalf of, the following land mangement authorities and state government departments: Great Lakes Shire Council; Greater Taree City Council; Booti Booti State Recreation Area; National Parks and Wildlife Service; Department of Lands; Soil Conservation Service; Department of Agriculture and Fisheries; and the Public Works Department.

The survey was undertaken by Consulting Botanist Stephen J. Griffith. Considerable editorial and typing assistance was provided by M. Dodkin, with support from R.J. Stanley (both Working Group members). Field assistance was provided by the Soil Conservation Service of N.S.W.

This report summarises the survey, and suggests a strategy for bitou bush control within the area.

THE SURVEY

To achieve objectives, a detailed ground survey was undertaken of the beach dunes and headlands within the area. Information was recorded on the vegetation, including degree of bitou bush infestation, and an assessment made of the conservation values of vegetation communities, plant species, and landscapes. Detailed descriptions were recorded from 232 sites along the 100 km of survey area coastline. The site data is summarised in Appendix I of the report. Appendix III provides air photos which can be used to identify the ground location of each site.

Bitou bush was found to be threatening, or potentially threatening, to the survival or conservation values of a number of vegetation communities, plant species and landscapes:-

Vegetation communities of inherent conservation value

1. Littoral Rainforest
2. Bracelet Honey-myrtle *(Melaleuca armillaris)* Shrubland
3. Coast Tea-tree *(Leptospermum laevigatum)* Shrubland
4. Saw Banksia *(Banksia serrata)* Forest/Woodland
5. Kangaroo Grass *(Themeda australis)* Tussock Grassland

Plant species of high conservation value

1. Climbing Orchid (*Galeola cassythoides)*
2. Staghorn Fern (*Platycerium superbum)*
3. Caustic Vine (*Sarcostemma australe)*
4. Coast Sophora (*Sophora tomentosa)*
5. Austral Toad Flax (*Thesium australe)*
6. Coast Westringia *(Westringia fruticosa)*
7. Screw Palm (*Pandanus pedunculatus)*

Landscapes of high scenic value

1. Diamond Head cliffs and the view from Diamond Head along Crowdy Bay Beach.
2. Wallabi Point and the view along Saltwater Beach.
3. Redhead and Hallidays Point headland complexes.
4. Hallidays Point south and the view along Nine Mile Beach.
5. The cliffs south of Cape Hawke trig and the view from Cape Hawke along Seven Mile Beach to Booti Hill and Charlotte Head.
6. Charlotte Head cliffs and the view acrosss Elizabeth Bay to Booti Hill.
7. Bald Head and the view along the cliffs to Blueys Head and Boomerang Point.
8. Bald Head to Seal Rocks including the cliffs about Seal Rocks trig and lighthouse.

By combining information on the bitou bush infestation and conservation values of each site, the report identifies 3 bitou bush management categories, and allocates all sections of the survey area coastline to one of these categories. (See report Figure 1 and Table II). The categories are based primarily on the principles of protecting relatively weed free areas and of working from areas of low bitou bush infestation towards areas of high infestation. A summary of the categories follows:-

Control Priority 1: bitou bush absent - management by regular surveillance and control of infestations.

Control Priority 2: bitou bush rare to occasional - new management requires relatively small inputs of resources.

Control Priority 3: bitou bush common to very common - new management requires relatively large inputs of resources.

A SUGGESTED STRATEGY FOR BITOU BUSH CONTROL

Biological control

The potential for biological control of bitou bush is currently being investigated by the CSIRO, through the work of an entomologist in South Africa. In order to avoid massive sand drift problems which would follow the complete demise of bitou bush plants by biological control agents, the investigation is targetting only organisms which destroy bitou bush seed or inhibit seeding. A *Comostolopsis* moth was introduced into Victoria in late 1987 for strictly controlled laboratory testing of host specificity. Plans are in hand for the introduction and similar testing of 2 *Chrysolina* leaf beetles, *Mesoclanis* seed flies and *Cecidomyiid* apex gall flies.

However conventional bitou bush control techniques will need to be integrated with biological controls (if they eventuate) to control the weed and to protect conservation values in the survey area.

Conventional Controls

Conventional controls include a range of chemical and physical techniques which, depending on site characteristics, may often be integrated and additionally require active revegetation work to achieve effective long term control.

The Working Group has prepared a "Bitou Bush Control and Rehabilitation Handbook" that will provide all the information necessary for both organisations and community groups to plan and implement bitou bush control programs. The handbook will be available soon.

A suggested control strategy

1. Target Areas

The priority categories for bitou bush management in the survey area are directly related to the levels of input of resources - labour, materials, equipment, finance - necessary to achieve control. Recognising the continually diminishing levels of resources available to organisations to undertake conservation works, **the Working Group generally supports the initial concentration of control efforts within priority control areas 1 & 2, whilst recognising that to preserve the significant conservation values of the survey area coastline in the long term, it will be necessary to control bitou bush in all 3 priority categories.**

However there are sections of coastline within control priority category 3 which have high conservation values, and the Working Group encourages control activities in these areas by committed groups with the necessary resources available.

2. A Control Strategy

The Working Group suggests a bitou bush control strategy within the survey area involving the combined resources of relevant land management authorities and the community. This strategy would allow the limited financial resources of authorities to be bolstered by the voluntary labour resources of interested community groups.

Bitou bush control within priority categories 1 & 2 lends itself to the integration of chemical, and labour-intensive physical techniques. **Extensive inputs of voluntary labour have already been directed to integrated control programs in the survey area:** for example the National Parks Association Mid North Coast Branch has been working with the National Parks & Wildlife Service at Diamond Head in Crowdy Bay National Park for 8 years; school groups and Apexians are working with the Soil Conservation Service & Crown Lands Office at Harrington; while a Dune Care group at Diamond Beach is working with the Soil Conservation Service, Crown Lands Office and Greater Taree City Council.

The survey area coastline is increasingly the focus for recreation and tourism. Local community groups often readily identify with particular sections of coastline. We suggest that groups "adopt" these locations, and implement integrated bitou bush control programs similar to those outlined above.

3. Conclusion

The sucessful implementation of integrated community-based bitou bush control programs will depend on the interest not only of the people but also of the responsible land management authorities. Good organisation and support of activities is essential, and in this regard Working Group members, through their experience with the types of integrated control programs outlined above, may be in a position to advise on the establishment of similar projects in the survey area.

In order to discuss the survey report, and as a first step in its implementation, we suggest that a meeting of Working Group members and all organisations which contributed to the preparation of the survey should be held.

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Undertaken for: N.S.W. Interdepartmental Working Group on Bitou Bush

Undertaken by: Stephen J. Griffith,
Consulting Botanist,
Old Bar, N.S.W.

Date: 1st August, 1987

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Plate 1. Bracelet Honey-myrtle Shrubland on Charlotte Head. Note Bitou Bush in flower - see arrows.

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1. Introduction

Two aerial surveys of Bitou Bush distribution along the NSW coastline have been undertaken by the NSW National Parks and Wildlife Service, the first in July, 1981, and the second in May, 1984. Both surveys have shown Bitou Bush to be rare or absent over much of the coastline between Diamond Head in Crowdy Bay National Park and Seal Rocks (Love, 1985).

In light of the findings of the aerial surveys, a ground survey of the Diamond Head-Seal Rocks region (hereinafter referred to as "the Study Area") was undertaken over the period August to October, 1986, the principal objectives being to:

(a) confirm or otherwise the findings of the aerial surveys by mapping the distribution and degree of infestation of Bitou Bush,

(b) assess the impact of Bitou Bush upon conservation and scenic values, and

(c) formulate a draft management strategy.

2. Methodology

Prior to formulation of a sampling programme, aerial photograph coverage of the Study Area was examined, namely the 1:25,000 NSW Coastal Wetlands series (colour, June 1981) and the 1:10,000 Coastal Surveillance series (colour, March 1983).

Unfortunately, initial field reconnaissance revealed that photograph age and scale limited the usefulness of Air Photo Interpretation (API) for the purpose of locating Bitou Bush. In addition to this, Bitou Bush often closely intermixes with taller native species such as White Banksia (**Banksia integrifolia var. integrifolia**) and Coast Tea-tree (**Leptospermum laevigatum**), and so in many instances is largely obscured from view from above. Consequently, in selecting sample sites attention was paid to areas of probable infestation such as:

(a) those showing signs of present or past disturbance due to sandmining, quarrying, heavy vehicle and/or pedestrian usage, sand 'blows', grazing, and

(b) those with a low percentage ground cover.

In those areas supporting a continuous, or near continuous, cover of native species, vehicle and foot traverses along beaches and tracks, and foot traverses over headlands, enabled the location and assessment of Bitou Bush infestations. Intersite distances varied relative to landform and vegetation complexity, and so for headland systems sites were spaced as close as 100 metres whereas along extensive, uniform beaches intersite distances ranged up to 1.75 kilometres.

Data collected at each sample site included:

(a) a brief vegetation description

(b) an assessment of Bitou Bush infestation. In order to facilitate later comparisons, the abundance classes used by the NSW National Parks and Wildlife Service during their aerial surveys were employed after minor modification (Table I)

(c) an assessment of the conservation value of both individual plant species and communities

(d) notes on access limitations

(e) a record of exotic species other than Bitou Bush

(f) an assessment of the scenic value of the site/vicinity.

A summary of all sample site data is given in Appendix I. Sample site locations are given in Appendix III.

TABLE I Abundance classes used to assess Bitou Bush infestations (after the "density categories" of Love, 1985).

Abundance Class	Love (1985)	This Survey (1987)
A - Absent	Bitou Bush not present	Not present at site or between sites.
R - Rare	One or two plants per beach or headland system.	Few plants at site or between sites.
O - Occasional	Scattered plants but not continuous distribution.	Scattered plants at site or between sites but distribution not continuous.
C - Common	Continuous,or almost continuous, distribution but native species still predominant.	Continuous,or near continuous, distribution about or between sites, but native species still dominate.
(C) -(Common)	-	Common in patches at or between sites. Used in areas where distribution of Bitou Bush variable at or between sites.
VC - Very Common	Continuous and dominating or starting to dominate native vegetation.	Continuous distribution about or between sites and dominating or approaching domination of native vegetation.
(VC) - (Very Common)	-	Very common in patches at or between sites.

Notes:

1. Where possible, plant counts were undertaken at or between sites (see Appendix I).

2. An assumption made in using the "A-Absent" category is that, although undetected during sampling, Bitou Bush may be present as widely scattered, isolated individuals.

3. Vegetation of the Study Area

The coastline of the Study Area supports a wide variety of plant communities, each community occurring in one of three broad geomorphic units:

(a) Frontal Dune
(b) Headland
(c) Estuarine

The growth form and structural formation categories used to describe the vegetation of the Study Area generally follow those of Walker and Hopkins (1984).

(a) Frontal Dune Complex (FDC)

The FDC occurs on soils derived from marine-aeolian sands, in particular those of Holocene age (less than 12,000 years old). These show little or no profile development other than a possible surface accumulation of organic matter and so are identified as Siliceous Sands.

In some parts of the study area (e.g. Crowdy Bay National Park and Seven Mile Beach) Holocene sands overlie or adjoin sands of Pleistocene age (greater than 12,000 years but less than 1.7 million). In contrast to Siliceous Sands, the soils formed on these older deposits display distinct horizons as a result of podzolisation over an extended period of time. Sand Podzols (of freely draining areas) and Humus Podzols (of seasonally waterlogged areas) are the soil types commonly derived from Pleistocene sands.

A brief description of each of the FDC communities follows:

(i) Hairy Spinifex (Spinifex sericeus) Tussock Grassland: up to 0.5m high; crown cover very sparse to dense. Occurs on berm deposits where disturbance by high seas is a common occurrence.

(ii) Beach Sally Wattle (Acacia longifolia var. sophorae) Shrubland: up to 1m high; crown cover often dense; no distinct ground stratum although forbs and grasses may be present. Occurs immediately inland of the Hairy Spinifex community where above the general level of high sea influence.

(iii) Coast Tea-tree (Leptospermum laevigatum) Shrubland: to 5m in height (older stands form a low forest approaching 10m); crown cover dense; ground surface usually heavily shaded and so only sparsely vegetated by forbs, grasses and sedges. Occurs immediately inland of the Beach Sally Wattle community on the crest and lee slope of the frontal dune.

(iv) White Banksia (Banksia integrifolia var. integrifolia) Shrubland/ Forest: 2-10m high; crown cover usually dense where stands intact; ground surface only sparsely vegetated where heavily shaded - grasses, forbs, sedges and the rush Flat-leaved Lomandra (Lomandra longifolia) are common. Occurs to the lee of, or intermixes with, the Coast Tea-Tree community.

(v) Littoral Tuckeroo (Cupaniopsis anacardioides) Rainforest: a closed forest of variable height; floristic composition is diverse. Littoral Rainforest occurs in moist, sheltered situations to the lee of the Coast Tea-Tree and White Banksia communities. At locations where shelter from prevailing winds is minimal the community is reduced to a shrubland formation.

(vi) Broad-leaved Paperbark (Melaleuca quinquenervia) - Swamp Oak (Casuarina glauca) Swamp Forest: 10-20m in height; crown cover mid-dense to dense; ground cover usually dense, consisting of sedges and ferns to a height of 1m or so. Either Broad-leaved Paperbark or Swamp Oak may occur as the single dominant but often both share dominance. Cabbage Palm (Livistona australis) and Swamp Mahogany (Eucalyptus robusta) are additional co- or subdominants in the Booti Booti area. The community typically occurs in low-lying open depressions where the water table lies near or above ground level for extended periods.

(vii) Saw Banksia (Banksia serrata) Forest/Woodland: to 10m in height; crown cover mid-dense to very sparse; ground cover commonly composed of Blady Grass (Imperata cylindrica var. major), Flat-leaved Lomandra (Lomandra longifolia), Bracken Fern (Pteridium esculentum) and various heath shrub species. The community occurs on beach barriers immediately inland of the present frontal dune system along Nine Mile Beach. Fire appears to be a frequent event in the community.

(b) Headland Complex (HC)

The headland systems of the study area all consist of sedimentary material of Permian to Devonian age with the exception of Diamond Head which is Tertiary rhyolite. Headland soils were not investigated in detail during the survey but, from casual observations, it appears that they range from Lithosols to Yellow Podzolics and Yellow Earths, to Grey Earths.

On some headlands Holocene marine-aeolian sands partly mantle the bedrock substrate. In such areas species more typical of Siliceous Sands are usually conspicuous.

Each of the plant communities comprising the HC are described in turn below:

(i) Kangaroo Grass (Themeda australis) Tussock Grassland: commonly less that 25cm high; crown cover dense. Shrub and forb species such as Golden Everlasting (Helichrysum bracteatum), Jam Tarts (Melichrus procumbens), Blunt Bush-pea (Pultenaea retusa), Slender Rice Flower (Pimelea linifolia), Small Poranthera (Poranthera microphylla) and Ivy-leaf Violet (Viola hederacea) are usually present also. Occurs on the seaward margin of headlands where exposed to the full impact of onshore winds.

(ii) Graminoid Clay Heathland: up to 1m high; crown cover commonly dense; no distinct ground stratum - sedges and grasses conspicuous and continuous in height with shrubs (hence the term "graminoid"). Common species include Dagger Hakea (Hakea teretifolia), Finger Hakea (Hakea dactyloides), Tall Drumsticks (Isopogon anemonifolius), Swamp Banksia (Banksia oblongifolia), Black She Oak (Allocasuarina littoralis), Horned Sedge (Ptilanthelium deustem) and Twisted Wire Grass (Aristida warburgii). Occurs on very shallow, heavy soils, often immediately inland of the Kangaroo Grass community.

(iii) Bracelet Honey-myrtle (Melaleuca armillaris) Shrubland: generally less than 5m high; crown cover dense; ground surface usually very heavily shaded and so plant cover sparse to absent. Commonly found growing on rocky sites where very little soil present, or on bedrock mantled by Holocene sand (Plate 1).

(iv) Littoral Rainforest: a closed forest (sometimes shrubland) community ranging in height from 3-15m; lianes abundant and epiphytes present; groundcover often sparse. Floristic composition is variable however,from the work of de Castro Lopo (1980) it appears that the common tree species in the extensive rainforests of Cape Hawke and Booti Headland are Rosewood (Dysoxylum fraseranum), Flintwood (Scolopia braunii), Yellow Tulip (Drypetes australasica), Red Olive Plum (Cassine australis), Black Plum (Diospyros australis), Black Apple (Planchonella australis), Large Mock-olive (Notelaea longifolia) and Whalebone Tree (Streblus brunonianus). The community frequently occupies steep, rocky sites where the aspect is easterly or southerly (Plate 2).



Plate 2. View north to Bald Head from site 226. Littoral Rainforest and associated Headland Complex communities.

(v) Sclerophyll Forest and Woodland: ranges in height from 5-25m, the lower formations occurring at sites exposed to prevailing winds; a shrub stratum is present or absent; the ground cover is variable in composition but often contains tussock grasses such as Kangaroo Grass (**Themeda australis**) and Blady Grass (**Imperata cylindrica var. major**). Any of several species may locally dominate or co-dominate the upper stratum, common ones being Blackbutt (**Eucalyptus pilularis**), Forest Red Gum (**Eucalyptus tereticornis**), Tallowwood (**Eucalyptus microcorys**), Small-fruited Grey Gum (**Eucalyptus propinqua**), Turpentine (**Syncarpia glomulifera**), Spotted Gum (**Eucalyptus maculata**) and Brush Box (**Lophostemon confertus**). The community occurs on all aspects over a range of gradients and soil types.

The HC also includes a number of species which occur as scattered plants or small clumps on cliff edges and faces. Examples of such species are Coast Westringia (**Westringia fruticosa**), White Banksia (**Banksia integrifolia var. integrifolia**), Swamp Oak (**Casuarina glauca**) and Broad-leaved Paperbark (**Melaleuca quinquenervia**).

(c) Estuarine Complex (EST)

A small group of communities found on intertidal and supratidal (seldom inundated) flats near river mouths (e.g. the Farquhar Inlet entrance of the Manning River). The soils supporting estuarine vegetation show little or no profile development, although sedimentary layering is usually apparent. Such soils are called **saline muds** or **Solonchaks**.

(i) Samphire (**Sarcocornia quinqueflora**) - Sand Couch (**Sporobolus virginicus**) Chenopod Shrubland/Tussock Grassland approximately 10-20cm high; crown cover dense. Occurs immediately inland of mangrove forest where inundated by spring high tides (Plate 3).

(ii) Maritime Rush (**Juncus kraussii**) Sedgeland: 1-1.5m in height; crown cover commonly dense; a ground stratum of Sand Couch is often present. Occurs inland on the Samphire-Sand Couch community where only rarely flooded by high tides.

(iii) Grey Mangrove (**Avicennia marina var. australasica**) Shrubland/Woodland/Forest: to 6-8m in height; crown cover sparse to dense; ground surface covered by pneumatophores and associated algae. River Mangrove (**Aegiceras corniculatum**) is often present as a subdominant species. Occurs on the seaward margin of the Samphire-Sand Couch community where daily inundated by high tides.



Plate 3. Samphire - Sand Couch community (of the estuarine complex) at Mudbishops Point, Old Bar.

4. Conservation Value of the Vegetation

In attempting to rate the vegetation of the Study Area in terms of its conservation value, the following points need to be considered:

(a) much of the coastline north of the Study Area to the Queensland border and south to Newcastle is already heavily infested with Bitou Bush (Love, 1985),

(b) the bioclimatic potential distribution of Bitou Bush along the coast of NSW (and Queensland) far exceeds its present distribution (Howden, 1985; Love, 1985), and

(c) financial restraints will no doubt operate to preclude control programmes in many areas of NSW, and so native vegetation will be further displaced.

In line with the above it could easily be argued that coastal vegetation is a natural resource under threat of large-scale displacement and therefore, all of those areas which are at present relatively free of Bitou Bush are, by default, of high conservation value. Obviously, within the Study Area such an argument does little to facilitate the identification of priority areas for Bitou Bush control. Notwithstanding this point, several of the Study Area's communities and individual species are of inherent conservation value for reasons additional to that of the general threat of displacement by Bitou Bush. Each is discussed below.

(i) Estuarine Complex

The report "Estuarine Habitat Management Guidelines" (NSW Department of Agriculture, 1985) highlights the conservation value of estuarine vegetation as fauna habitat. The report's strategy for protecting estuarine habitat extends to maintaining foreshore buffer zones and, where possible, preserving islands supporting estuarine vegetation in their entirety. From personal observations, it appears that edaphic constraints operate to exclude Bitou Bush from the estuarine complex.

(ii) Broadleaved Paperbark - Swamp Oak Swamp Forest

This community is one of a number that comprise "coastal wetlands", a diverse range of habitats that have been drastically reduced in area as a direct result of clearing, draining and reclamation for agricultural and urban development. So extensive has been the degradation of coastal wetlands that a State Environmental Planning Policy (SEPP No. 14, 1985) is now in force over those remaining. Although Bitou Bush was recorded on the margins of Swamp Oak Swamp Forest during the survey, soil waterlogging generally limits its distribution (Howden, 1985). Bitou Bush is therefore not seen as a real threat to the community.

(iii) Coastal Tea-tree Shrubland

Apart from an isolated outlier in the Nambucca River (M. Dodkin, pers. comm.), this community has the Port Macquarie area as its natural northern limit of distribution. It is therefore of regional conservation value. Bitou Bush readily displaces this community (Dodkin and Gilmore, 1985) as is the case north of the Study Area.

(iv) Bracelet Honey-myrtle Shrubland

This community occurs at its northern limit of distribution within the Study Area at Charlotte Head. It is therefore of regional significance. Bitou Bush invades the community, and so has the potential to displace it.

(v) Graminoid Clay Heathland

This community is of disjunct occurrence along the length of the NSW coastline, and as such displays a latitudinal shift in floristic composition from region to region. Any strategy aimed at conserving its floristic diversity would therefore require the preservation of a representative sample at each of its major sites of occurrence (eg.Diamond Head). The edaphic conditions under which the community grows (heavy, hard-setting clays subject to seasonal waterlogging) appear to severely limit the degree to which Bitou Bush will invade.

(vi) Kangaroo Grass Tussock Grassland

A fact which can be used to substantiate a high conservation value for this community is that of its loss or degradation in many areas of the north and central coasts of NSW as a result of urban, recreational and other land uses. More importantly however, is the community's regional significance as the habitat of Austral Toadflax (Thesium australe) - see specific comments below. Bitou Bush is capable of displacing the community.

(vii) Littoral Rainforests

It is now recognised that Littoral Rainforests are of high conservation value (National Parks and Wildlife Service, 1979), and specific areas will soon be designated under a new State Environmental Planning Policy. Furthermore, a number of species within the Littoral Rainforests of the Study Area occur at their known southern limit of distribution - see below. Bitou Bush penetrates the low, windward margins of Littoral Rainforest. It also invades the ground surface below canopy breaks, and once established can adopt a semi-climbing habit. Indications are that Bitou Bush is capable of long-term displacement of Littoral Rainforest.

(viii) Saw Banksia Forest and Woodland

Saw Banksia (Banksia serrata) is widespread on Holocene sands as an associate of Blackbutt (Eucalyptus pilularis), Smooth-barked Apple (Angophora costata), Black She-oak (Allocasuarina littoralis), White Banksia (Banksia integrifolia var. integrifolia) and other species. However, it is not known by the writer to occur in extensive monospecific stands north of the Study Area (Griffith, 1983; Griffith, 1984; Griffith, 1985; Pressey & Griffith, 1987). The large stands of Saw Banksia on the beach barriers of Nine Mile Beach are therefore considered to be of regional significance. Bitou Bush is capable of displacing the community.

Within the Study Area are a number of species of distributional significance, and others which are considered rare or endangered (Leigh et al, 1981). Several were not previously recorded, or known to occur, in the Study Area. Each is described below.

(i) Climbing Orchid (**Galeola cassythoides**): recorded in Kangaroo Grass Tussock Grassland on Booti Hill; considered rare.

(ii) Coast Sophora (**Sophora tomentosa**): recorded in FDC vegetation at Old Bar (Site 111); prior to this survey Port Macquarie was considered to be the southern limit of this species.

(iii) Screw Palm (**Pandanus pedunculatus**): recorded in FDC vegetation on Harrington Beach (Site 45); as for Coast Sophora, Port Macquarie was considered to be the southern limit of distribution of this species.

(iv) Staghorn Fern (**Platycerium superbum**): recorded in Littoral Rainforest at Harrington Beach (Site 56) and on sea cliffs at Diamond Head (Site 9); although common in the rainforests of NSW and Qld, the species is considered to be vulnerable.

(v) Caustic Vine (**Sarcostemma australe**): recorded on sea cliffs in the Red Head - Hallidays Point area (Sites 142, 150); Williams (1984) lists Crescent Head as the southern limit of distribution of the species within Littoral Rainforest - this survey therefore extends the known range of Caustic Vine.

(vi) Coast Westringia (**Westringia fruticosa**): recorded within the HC, especially on cliff edges and faces, south of the Old Bar - Wallabi Point area; appears to be at its northern limit of distribution within the Study Area.

(vii) Austral Toadflax (**Thesium australe**): recorded in Kangaroo Grass Tussock Grassland on Diamond Head (M.Dodkin, pers. comm.); an endangered species.

The following rainforest species occur at their known southern limit of distribution within the Study Area (Williams, 1984):

(viii) Veiny Morinda (**Morinda acutifolia**)

(ix) Blunt-leaved Coondoo (**Planchonella myrsinoides**)

(x) Brush Ironbark (**Bridelia exaltata**)

(xi) Grey Walnut (**Beilschmiedia elliptica**)

(xii) Giant Water Gum (**Syzygium francisii**)

(xiii) Python Tree (**Austromyrtus bidwillii**)

(xiv) Native Ixora (**Ixora beckleri**)

(xv) Native Gardenia (**Randia benthamiana**)

(xvi) Beach Acronychia (**Acronychia imperforata**)

(xvii) Coogera (**Arytera divaricata**)

(xviii) Yellow Pear Fruit (**Mischocarpus pyriformis**)

Bitou Bush is capable of displacing all of the above species.

5. Areas of High Scenic Value

For the purposes of the field survey an area of high scenic value was defined as a panorama of inherent natural beauty, with only minor incursions (such as a lighthouse, lookout, small cluster of houses, camping area, adequately regenerated sandmining path), or with larger incursions (such as townships) distant on the horizon. Within the framework of the present study, the basic assumption underlying any assessment of the scenic value of the Study Area is that Bitou Bush infestations are unnatural and therefore aesthetically unacceptable. Having adopted this assumption, the following areas are identified as being of high scenic value and so at risk of degradation.

(i) Diamond Head cliffs and the view from Diamond Head looking south along Crowdy Bay Beach.

(ii) Wallabi Point looking south along Saltwater Beach.

(iii) The headland complexes at Redhead and Hallidays Point.

(iv) The southern end of Hallidays Point looking south along Nine Mile Beach.

(v) The cliffs south of Cape Hawke trig and the view looking south from Cape Hawke along Seven Mile Beach to Booti Hill and Charlotte Head.

(vi) Charlotte Head looking northwest across Elizabeth Bay to Booti Hill. Also Charlotte Head cliffs.

(vii) Bald Head looking north along the cliffs to Blueys Head, and on to Boomerang Point.

(viii) Bald Head looking south to Seal Rocks (Plate 4) and Seal Rocks looking north to Bald Head (Plate 2). Also the cliffs about Seal Rocks trig and lighthouse.



Plate 4. Looking south to Seal Rocks from site 204.



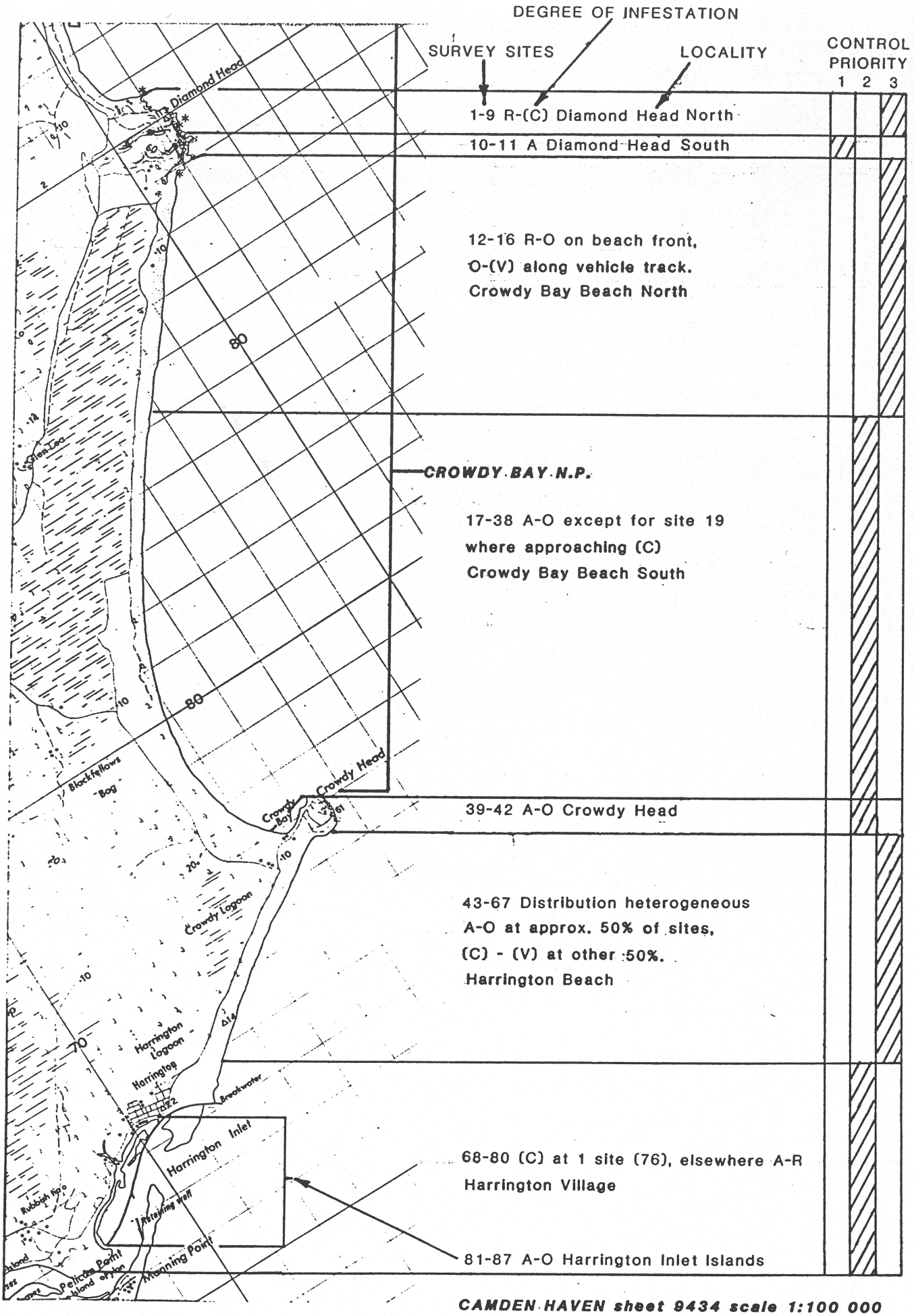
6. Bitou Bush Distribution

Figure I summarises the distribution pattern of Bitou Bush within the Study Area as determined by the field survey. In the figure the Study Area is divided into "localities", each locality coinciding with a change in Bitou Bush abundance.

Below are listed those localities most heavily infested:

1. Diamond Head North
2. Crowdy Bay Beach North
3. Harrington Beach
4. Diamond Beach
5. Nine Mile Beach Middle
6. Seven Mile Beach South
7. Elizabeth Beach - Boomerang Beach
8. Sandbar

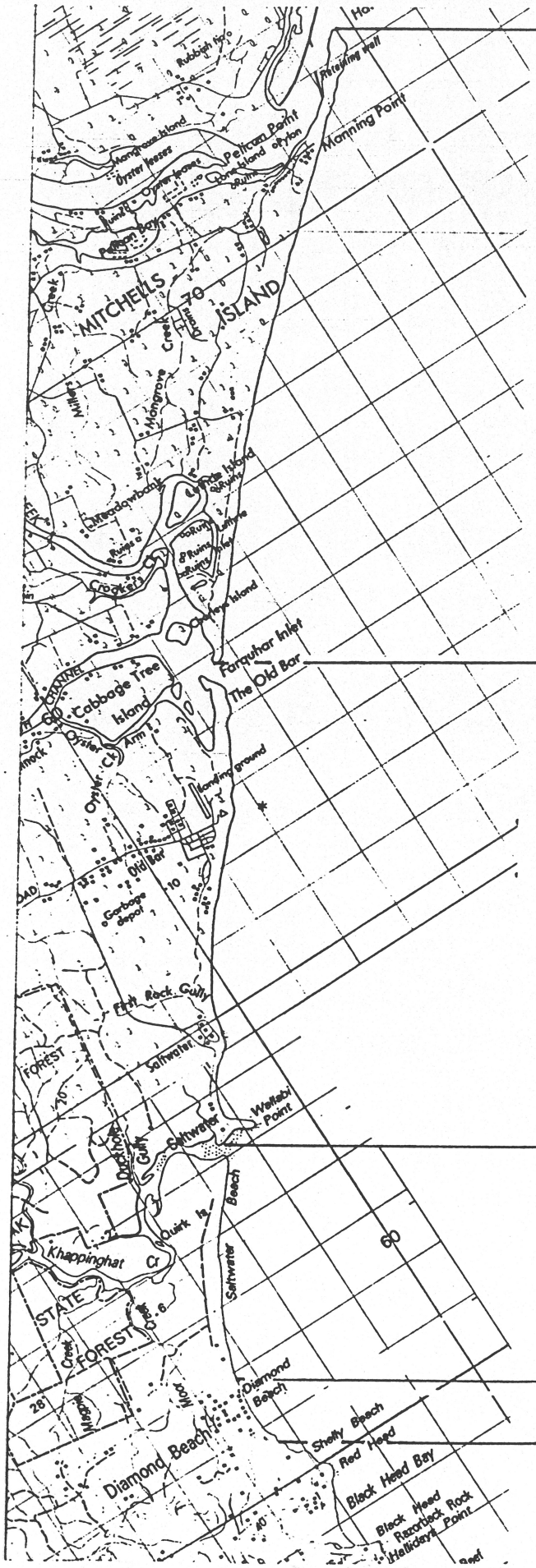
FIGURE 1. DISTRIBUTION OF BITOU BUSH



CAMDEN HAVEN sheet 9434 scale 1:100 000

Sheet 2 of 4

FIGURE 1. DISTRIBUTION OF BITOU BUSH



CONTROL PRIORITY 1 2 3

88-108 A Mitchells Is., Charleys Is.

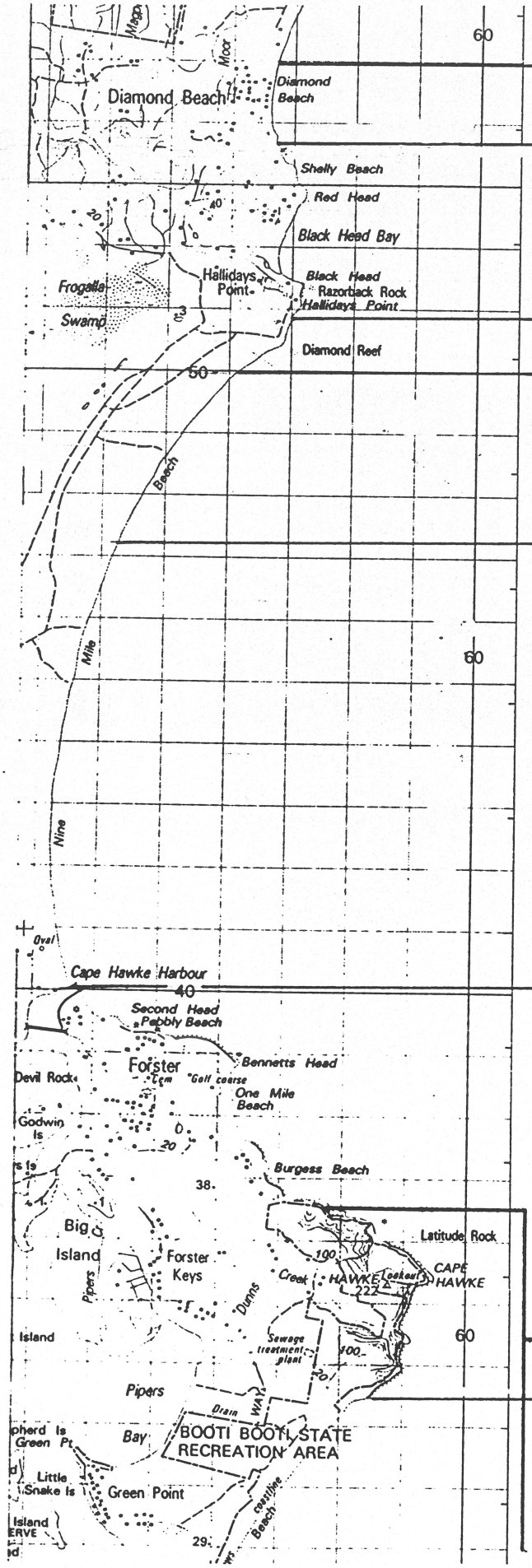
109-132 A except for Site 123 where R.
Old Bar-Wallabi Point

133-137 A-O Saltwater Beach

138-141 O-(C) Diamond Beach

CAMDEN HAVEN sheet 9434 scale 1:100 000
and BULAHDELAH sheet 9333 scale 1:100 000

FIGURE 1. DISTRIBUTION OF BITOU BUSH

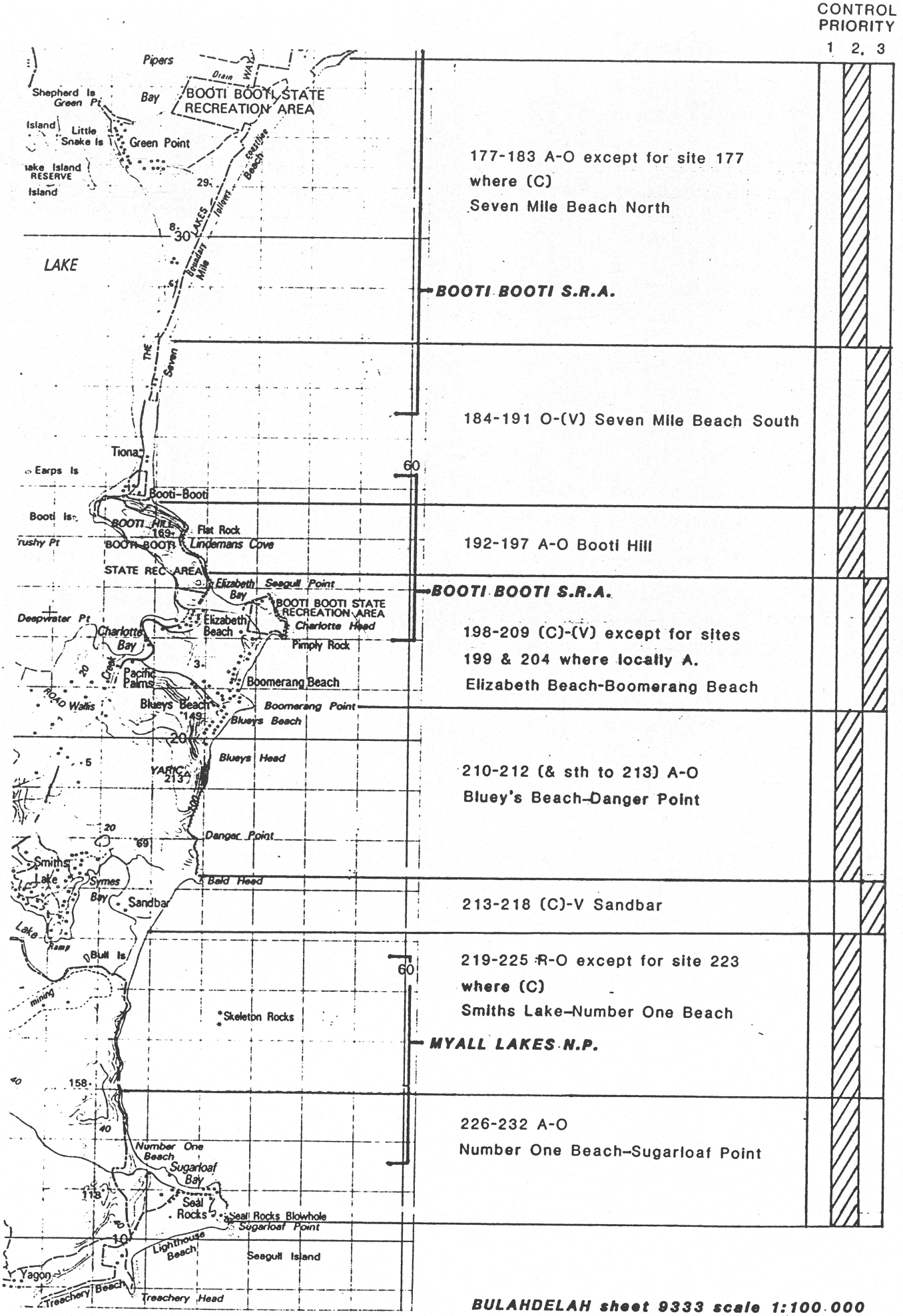


CONTROL PRIORITY 1	2	3	
			138-141 O-(C) Diamond Beach
			142-150 A-R Red Head-Hallidays Point
			151-152 R-O Nine Mile Beach North
			153-155 O-(V) Nine Mile Beach Middle
			156-162 A-R Nine Mile Beach South
			163-176 A except for site 168 where R. Forster-Cape Hawke

BOOTI BOOTI S.R.A.

BULAHDELAH sheet 9333 scale 1:100 000

FIGURE 1. DISTRIBUTION OF BITOU BUSH



7. A Proposed Bitou Bush Management Strategy

For the purpose of designing an efficient management strategy, the Study Area localities, as delineated in Figure I, have been ranked on a "priority for Bitou Bush management" basis using the following criteria:

(a) degree of infestation - the aim being to protect those localities which are presently in a relatively weed-free state by working from areas of low Bitou Bush infestation towards areas of high infestation.

(b) conservation value - Coastal Tea-tree Shrubland, Bracelet Honey-myrtle Shrubland, Kangaroo Grass Tussock Grassland, Saw Banksia Forest/Woodland and Littoral Rainforest are communities of high conservation value that are under threat of displacement by Bitou Bush. Similarly, Climbing Orchid, Coast Sophora, Screw Palm, Staghorn Fern, Caustic Vine, Coast Westringia and Austral Toadflax are significant threatened species (refer Chapter 4). Those localities supporting one or more of the abovementioned communities and/or species are given higher priority.

(c) scenic value - localities of high scenic value are rated accordingly (refer chapter 5).

Application of the priority ranking criteria to the Study Area localities enabled the recognition of three management groups (refer Table II):

Priority 1 Group: those localities within which Bitou Bush was recorded as absent - regular surveillance and control of new infestations is all that would be required.

Priority 2 Group: those localities within which Bitou Bush is rare to occasional - management would be relatively simple and require a manual labour input only.

Priority 3 Group: those localities within which Bitou Bush is locally common or very common - effective management of such areas would require a significant labour input.

TABLE II Bitou Bush Priority Management Localities.

Priority management localities were selected by applying the "ranking criteria" of Chapter 7 in the following order:

(a) initially localities were ranked according to "degree of infestation" into one of the three previously determined "priority groups".

(b) within each of the "priority groups", localities were then ranked on the basis of "conservation value" and/or "scenic value".

Column 1
Management Priority Groups (1-3) and Localities.

Column 2
Degree of Bitou Bush Infestation - refer Table I.

Column 3
Conservation value - localities supporting communities or individual species of high conservation value which are at risk of displacement by Bitou Bush are given higher priority for management and so ranked accordingly. The communities and species in question (as detailed in Chapters 4 and 7) are numerated in column 3 as follows:

Communities:
1. Littoral Rainforest
2. Bracelet Honey-myrtle Shrubland
3. Coast Tea-tree Shrubland
4. Saw Banksia Forest/Woodland
5. Kangaroo Grass Tussock Grassland
\# denotes of limited extent and/or disturbed remnant.

Species:
6. Climbing Orchid (Galeola cassythoides)
7. Staghorn Fern (Platycerium superbum)
8. Caustic Vine (Sarcostemma australe)
9. Coast Sophora (Sophora tomentosa)
10. Austral Toad Flax (Thesium australe)
11. Coast Westringia (Westringia fruticosa)
12. Screw Palm (Pandanus pedunculatus)

Column 4
Localities forming all or part of an area of high scenic value (refer Chapter 5) are ranked accordingly. An asterisk(*) denotes the presence of such an area.

Column 5
Where access to Bitou Bush infestations is limited, i.e. on cliff faces where the use of ropes would be necessary, column 5 is marked with an "X". Diamond Head North is one such locality where much of the Bitou Bush occurs on cliff faces.

TABLE II (cont'd): Priority Management Areas

Column 1	Column 2	Column 3	Column 4	Column 5
Management Priority Group/Locality	Bitou Bush Infestation	Conservation Value	Scenic Value	Access Limitations
PRIORITY 1 GROUP				
1. Mitchells Island - Charleys Island	A	1,3		
2. Diamond Head South	A	5,10	*	
PRIORITY 2 GROUP				
3. Number One Beach - Sugarloaf Point	A-O	1,2,3,5,11	*	X
4. Smiths Lake - Number One Beach	R-O,(C) at 1 site	1,2,3#,5,11	*	X
5. Blueys Beach - Danger Point	A-O	1,2,5,11	*	
6. Forster - Cape Hawke	A-R	1,3,#5,11	*	
7. Nine Mile Beach South	A-R	1,3,4,11	*	
8. Nine Mile Beach North	R-O	1,3,4	*	
9. Booti Hill	A-O	1,5,6,11	*	
10. Crowdy Bay Beach South	A-O	1,3	*	
11. Red Head - Hallidays Point	A-R	1#,3,8,11	*	
12. Old Bar - Wallabi Point	A-R	1,3,9,11		
13. Saltwater Beach	A-O	3	*	
14. Seven Mile Beach North	A-O,(C) at 1 site	3	*	
15. Harrington Village	A-R,(C) at 1 site	1,3		
16. Harrington Inlet Islands	A-O	3		
17. Crowdy Head	A-O	1#,5#		

PRIORITY 3 GROUP

18. Elizabeth Beach - Boomerang Beach	(C)-(V)C	1,2,3,5,11	*	X
19. Sandbar (+)	(C)-VC	1,2,3,5#,11	*	X
20. Diamond Head North	R-(C)	1#,3,5,7,8,10	*	X
21. Crowdy Bay Beach North	R-(V)C	1,3	*	
22. Seven Mile Beach South	O-(V)C	1,3	*	
23. Nine Mile Beach Middle	O-(V)C	3,4	*	
24. Diamond Beach	O-(C)	1#,3,11		
25. Harrington Beach	A-VC	1,3,12		

(+) Within the Sandbar locality, Bald Head stands alone as an area of higher scenic and conservation value. Given its limited size, it was considered inappropriate to separate this headland out as a distinct locality. Nevertheless, it is recommended that an exception be made and the headland treated as a priority 2 grouping.

A comprehensive review of Bitou Bush management techniques has been prepared by Wright and Lyons (1985) on behalf of Wyong Shire Council. In their report Wright and Lyons concluded that the Bradley Method (hand removal or minimal disturbance) of regeneration is the most cost-effective technique in areas where Bitou Bush infestations are rare to occasional.

In light of the review of Wright and Lyons, and on the assumption that adequately trained workers are engaged, those localities of the Study Area in Priority 2 Group should respond well to the Bradley Method. On the other hand, implementation of the Bradley Method for the removal of those heavy infestations (of common to very common abundance) within the localities of Priority 3 Group would prove to be slow and tedious. In such areas the initial use of registered weedicides and mechanical methods (with or without follow-up revegetation) would be more appropriate. These control methods could in turn be replaced by hand removal techniques as infestations are reduced to individual plants.

Bitou Bush is capable of strong regeneration from soil-stored seed following fire (Weiss, 1985). Surveillance of post-fire regeneration is therefore recommended, especially at those localities where mature Bitou Bush is known to be present.

8. Management for the Control of Other Weed Species

A large number of exotic species other than Bitou Bush were recorded during the field survey (Appendix II). Of these, most are either of infrequent occurrence or confined to highly disturbed sites. A few however, are, or may become, a management problem. Specific information on those species in question is presented in Table III.

TABLE III Other weed species that are,or may become, a management problem (for specific locations refer to Appendix I).

Botanical Name	Common Name	Comments
Anredera cordifolia	Madeira Vine	Occurs within Frontal Dune Complex communities; an aggressive invader of Littoral Rainforest.
Asparagus densiflorus A. setaceus	Asparagus Vine Ferny Asparagus	Both occur within Frontal Dune Complex communities, in particular White Banksia Forest and Littoral Rainforest; they displace native groundcover species.
Cortaderia selloana	Pampas Grass	Primarily a weed of highly disturbed areas; becoming a problem on other parts of the NSW coast, in particular the Sydney region.
Lantana camara	Lantana	Widespread and abundant within Frontal Dune and Headland Complex communities; capable of displacing shrubland communities, including the lower structural forms of Littoral "Rainforest".

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APPENDIX I - SITE DATA

Column 1: LOCALITY - see Figure 1
Column 2: SITE - see Appendix III (S.1 - S.232)

Column 3: COMMENTS (a) Vegetation at site
(b) Degree of Bitou Bush infestation
(c) Other weed species observed
(d) Additional comments

Abbreviations:

BB = Bitou Bush
FDC = Frontal Dune Complex
HC = Headland Complex
EST = Estuarine Complex

COLUMN 1 LOCALITY	COLUMN 2 SITE	COLUMN 3 COMMENTS
Diamond Head North	S.1	(a) White Banksia Forest (b) BB common in patches but of limited extent (c) Lantana Kikuyu White Clover Pennywort Buffalo Grass Winter Senna
	S.2	(a) HC (b) 6 BB plants observed between sites (c) Lantana - very common in patches
	S.3	(a) HC; rainforest species present in sheltered locations (b) BB common in patches but of limited extent (c) None
	S.4	(a) HC; rainforest species present (b) BB occasional (c) Lantana - common in patches
	S.5	(a) HC; graminoid clay heath to west (b) BB common on cliffs of cove (c) Lantana - very common in patches (d) Some BB inaccessible

	S.6	(a) HC (b) BB common in patches on south facing cliff (c) None (d) BB largely inaccessible; noted small clump of BB south-west of site on track uphill through graminoid clay heath
	S.7	(a) HC (b) BB common in patches on cliff-face (c) None (d) BB largely inaccessible
	S.8	(a) HC (b) BB occasional on cliff-face (c) None (d) BB largely inaccessible
	S.9	(a) HC (b) BB rare - 2 plants seen through binoculars (c) Lantana - very common in patches
Diamond Head South	S.10	(a) HC; Kangaroo Grass tussock grassland on promontary (b) BB absent (c) None
	S.11	(a) Kangaroo Grass tussock grassland (b) BB absent (c) None
Crowdy Bay Beach North	S.12	(a) FDC (b) BB rare - 3 plants observed (c) None
	S.13	(a) FDC (b) BB rare along beach front (3 plants observed) but occasional along vehicle track to west (approx. 15 plants counted between sites 12 and 13) (c) Lantana
	S.14	(a) FDC (b) BB occasional on beach front (5 plants observed) but common in patches along vehicle track to west between sites 13 and 14. (c) None

	S.15	(a) FDC (b) BB occasional on east face of frontal dune but common in patches along vehicle track and lee of dune between sites 14 and 15. (c) None
	S.16	(a) FDC (b) BB common to very common in patches about vehicle track north to site 15 and south to near site 17 (200+ plants and clumps counted). (c) Lantana
Crowdy Bay Beach South	S.17	(a) FDC; rainforest species present (b) BB absent (c) Lantana
	S.18	(a) FDC (b) BB occasional - 6 plants observed looking north and south of site (c) None
	S.19	(a) FDC (b) BB occasional, to common in patches - approx. 30 plants observed looking north and south of site (c) None
	S.20	(a) FDC; Smooth-barked Apple present (b) BB occasional on roadside (c) None
	S.21	(a) Wet heath, dry heath and sedgeland in area (b) BB absent (c) None (d) Area has been sandmined
	S.22	(a) FDC (b) BB occasional - 7 plants observed looking north and south of site (c) None
	S.23	(a) FDC (b) BB occasional - 15 plants observed looking north and south of site (c) None
	S.24	(a) FDC (b) BB occasional - 5 plants observed looking north and south of site (c) None

S.25
(a) FDC
(b) BB occasional - 12 plants observed looking north and south of site
(c) None

S.26
(a) Heath Banksia - Broad-leaved Paperbark regeneration following sandmining
(b) BB absent
(c) None

S.27
(a) FDC; Horsetail Oak present - probably planted following sandmining
(b) BB absent
(c) None

S.28
(a) FDC
(b) BB present
(c) None

S.29
(a) FDC
(b) BB occasional - 4 plants observed at site, and 6 plants between sites 29 and 31
(c) Cypress Wattle

S.30
(a) FDC
(b) BB absent
(c) Lupin

S.31
(a) FDC
(b) BB absent
(c) None

S.32
(a) FDC
(b) BB rare - 3 plants observed between sites 32 and 35
(c) None

S.33
(a) Graminoid clay heathland on bedrock knoll that has been quarried
(b) BB absent
(c) None

S.34
(a) Clearing on Holocene sand
(b) BB absent
(c) Narrow-leaved Carpet Grass
Pelargonium
(d) Area recently burnt

S.35
(a) FDC: rainforest species present
(b) BB rare - 1 plant observed on track
(c) Lantana
Kikuyu

	S.36	(a) FDC species and eucalypt seedlings regenerating former clearing (b) BB absent (c) Lantana Cypress Wattle Whiskey Grass
	S.37	(a) FDC in blowout (b) BB rare - 3 plants observed (c) None
	S.38	(a) FDC in blowout (b) BB occasional - 5 plants observed (c) None
Crowdy Head	S.39	(a) White Banksia - Broad-leaved Paperbark forest with rainforest species beneath (b) BB absent (c) Lantana Winter Senna Wild Tobacco
	S.40	(a) Kangaroo Grass tussock grassland with shrubs of Swamp Oak and White Banksia (b) BB absent (c) Lantana Prickly Pear Paramatta Grass Kikuyu Narrow-leaved Carpet Grass Buffalo Grass Aloe Gazania Pennyweed White Clover Night Blooming Cactus
	S.41	(a) Littoral Rainforest (very small, depauperate fragment) (b) BB occasional - 5 plants observed (c) Blackberry
	S.42	(a) Disturbed (b) BB rare - 1 plant observed (c) as for site 40
Harrington Beach	S.43	(a) FDC (b) BB absent (c) None

S.44
(a) FDC; Littoral Rainforest present
(b) BB rare - 1 clump observed
(c) None

S.45
(a) FDC; Horsetail Oak present - probably planted following sandmining
(b) BB common beneath Horsetail Oak
(c) None

S.46
(a) FDC; Horsetail Oak present
(b) BB common to very common in patches
(c) None

S.47
(a) FDC
(b) BB very common in patches
(c) None

S.48
(a) Disturbed but some FDC species regeneration
(b) BB absent
(c) None

S.49
(a) Clearing
(b) BB absent
(c) Whiskey Grass

S.50
(a) FDC
(b) BB occasional, to common in patches
(c) None

S.51
(a) FDC; Horsetail Oak present
(b) BB occasional, to common in patches beneath Horsetail Oak
(c) None

S.52
(a) FDC
(b) BB occasional in blowout (8 plants observed) but common in patches on crest and lee slope
(c) Lantana

S.53
(a) FDC
(b) BB absent
(c) Lantana

S.54
(a) FDC
(b) BB occasional - 6 plants observed between sites 54 and 57
(c) None

S.55
(a) FDC species regeneration, Broad-leaved Paperbark swamp forest and a Littoral Rainforest remnant
(b) BB absent
(c) Rhodes Grass

S.56
(a) FDC; Littoral Rainforest present
(b) BB rare - 2 plants observed
(c) Rhodes Grass

S.57
(a) FDC; rainforest species present
(b) BB occasional - 2 plants observed
(c) Rhodes Grass

S.58
(a) FDC; rainforest species regenerating
(b) BB occasional, to common in patches
(c) Cypress Wattle

S.59
(a) FDC
(b) BB rare - 1 plant observed
(c) None

S.60
(a) FDC
(b) BB occasional - 2 plants observed about site but more to south
(c) None

S.61
(a) FDC; Littoral Rainforest present
(b) BB occasional on lee of blowout but being buried by moving sand
(c) None
(d) Dune stabilization work in area

S.62
(a) FDC; rainforest species regeneration; Littoral Rainforest remnant to west of site on margin of Broad-leaved Paperbark swamp forest
(b) BB occasional, to common in patches
(c) Lantana

S.63
(a) FDC species regeneration; Littoral Rainforest remnants present
(b) BB absent
(c) None

S.64
(a) FDC; rainforest species present
(b) BB absent
(c) None

S.65
(a) FDC
(b) BB occasional, to common in patches
(c) None
(d) Dune stabilisation work in area

S.66
(a) FDC
(b) BB common in patches
(c) None
(d) Dune stabilisation work in area

	S.67	(a) FDC; rainforest species present. Grades into Broad-leaved Paperbark swamp forest (b) BB occasional, to common in patches along roadside margin (c) Lantana
Harrington Village	S.68	(a) Clearing surrounded by Broad-leaved Paperbark swamp forest (b) BB absent (c) None
	S.69	(a) Littoral Rainforest, Broad-leaved Paperbark swamp forest and FDC species (b) BB absent (c) Lantana
	S.70	(a) FDC (b) BB absent (c) None (d) Dune restoration work in area
	S.71	(a) Disturbed margin of swamp forest (b) BB absent (c) Papyrus
	S.72	(a) Littoral Rainforest (b) BB absent (c) Lantana Climbing Nightshade Ferny Asparagus Madeira Vine Winter Senna Cobbler's Peg Aloe
	S.73	(a) Littoral Rainforest and other FDC species (b) BB absent (c) Lantana Asparagus Vine
	S.74	(a) White Banksia forest on bedrock (b) BB rare - 1 plant observed (c) Lantana
	S.75	(a) Clearing adjacent Broad-leaved Paperbark-Swamp Oak swamp forest (b) BB absent (c) Pampas Grass
	S.76	(a) White Banksia forest on bedrock (b) BB common in patches (c) Mother-of-millions Pelargonium

	S.77	(a) Cleared house block (b) BB rare - 1 plant observed (c) None
	S.78	(a) Cleared house block (b) BB rare - 1 plant observed (c) None
	S.79	(a) Clearing on margin of swamp forest (b) BB absent (c) Pampas Grass
	S.80	(a) FDC, including rainforest species and Swamp Oak swamp forest (b) BB absent (c) Lantana
Harrington Inlet Islands	S.81	(a) Swamp Oak and other FDC species (b) BB rare - 1 plant observed (c) Prickly Pear
	S.82	(a) FDC; EST adjoining (b) BB occasional - approximately 10 plants observed (c) Lantana Canadian Fleabane Fleabane Evening Primrose Noogoora Burr
	S.83	(a) FDC; EST adjoining (b) BB absent (c) Prickly Pear Rhodes Grass
	S.84	(a) FDC (b) BB rare - 1 plant observed on edge of walking track (c) Rhodes Grass
	S.85	(a) FDC (b) BB absent (c) Lantana Prickly Pear
	S.86	(a) FDC (b) BB occasional - 2 plants and 3 very large clumps(which could be rated as locally common) observed (c) Lantana
	S.87	(a) FDC; Tuckeroo present. EST adjoining (b) BB absent (c) Lantana Prickly Pear Buffalo Grass

Mitchells Island, Charleys Island	S.88	(a) FDC (b) BB absent (c) None
	S.89	(a) FDC; Littoral Rainforest present (b) BB absent. A clump some 250m NE of site has been poisoned by M. Booker(pers.comm.). (c) None
	S.90	(a) FDC (b) BB absent (c) Dune restoration work in area
	S.91	(a) FDC; Littoral Rainforest present (b) BB absent (c) None
	S.92	(a) Littoral Rainforest and other FDC (b) BB absent (c) Lantana
	S.93	(a) FDC; Littoral Rainforest present (b) BB absent (c) None
	S.94	(a) FDC species (post-sandmining regeneration). Littoral Rainforest to east of site and swamp forest to west (b) BB absent (c) Coral Tree
	S.95	(a) FDC species (post-sandmining regeneration). Swamp Oak swamp forest to west of site (b) BB absent (c) Cypress Wattle
	S.96	(a) FDC (b) BB absent (c) Prickly Pear
	S.97	(a) FDC (b) BB absent (c) Prickly Pear
	S.98	(a) Regrowth of White Banksia, Swamp Oak and Brush Kurrajong in former clearing (b) BB absent (c) None
	S.99	(a) FDC (b) BB absent (c) None

	S.100	(a) FDC but 20m or less in width - pasture immediately west (b) BB absent (c) Prickly Pear
	S.101	(a) Littoral Rainforest and other FDC species (b) BB absent (c) Climbing Nightshade
	S.102	(a) FDC but less than 20m wide - pasture immediately west (b) BB absent (c) None
	S.103	(a) FDC but only 20-30m wide-pasture immediately west (b) BB absent (c) Buffalo Grass
	S.104	(a) FDC; rainforest species present - less than 30m wide (pasture immediately west) (b) BB absent (c) None
	S.105	(a) FDC species regeneration following ? sandmining (b) BB absent (c) None
	S.106	(a) FDC, including Littoral Rainforest and Swamp Oak swamp forest (b) BB absent (c) Lantana Buddleia
	S.107	(a) FDC (b) BB absent (c) None
	S.108	(a) FDC, including rainforest species and Swamp Oak swamp forest. EST on west side of island (b) BB absent (c) Lantana
Old Bar - Wallabi Point	S.109	(a) Predominantly EST (b) BB absent (c) Bushy Starwort Kikuyu

S.110
(a) EST and FDC, including Swamp Oak
(b) BB absent
(c) Lantana
Prickly Pear
Five-leaf Morning Glory

S.111
(a) FDC. EST adjoining
(b) BB absent
(c) None

S.112
(a) Disused rubbish tip in Wallum Banksia dry heathland/shrubland
(b) BB absent
(c) Pampas Grass
Wild Tabacco
Oleander
Kikuyu
Coral Tree

S.113
(a) FDC
(b) BB absent at site but approx. 9 plants occur to the NE - they are being treated by M. Booker(pers.comm.).
(c) Prickly Pear

S.114
(a) FDC
(b) BB absent
(c) None

S.115
(a) Disused quarry within FDC
(b) BB absent
(c) None

S.116
(a) FDC
(b) BB absent
(c) None

S.117
(a) FDC - grades into graminoid clay heathland immediately inland
(b) BB absent
(c) None

S.118
(a) Disused rubbish tip in graminoid clay heathland
(b) BB absent
(c) Kikuyu
Cassia
Coral Tree

S.119
(a) FDC; rainforest species present
(b) BB absent
(c) Lantana
Asparagus Vine

S.120

(a) FDC; rainforest species present
(b) BB absent
(c) Lantana
Pampas Grass
Buffalo Grass
Asparagus Vine
Prickly Pear
Winter Senna
White Passionfruit
Blackberry
Coral Tree

S.121

(a) Roadside verge immediately inland of FDC
(b) BB absent
(c) Lantana (recently removed)

S.122

(a) Roadside verge immediately inland of FDC, including rainforest species and Swamp Oak - Broad-leaved Paperbark swamp forest
(b) BB absent
(c) Lantana
Winter Senna
Kikuyu
Vasey Grass
Asparagus Vine
Pampas Grass

S.123

(a) FDC
(b) BB rare - 1 plant observed
(c) Asparagus Vine
Pelargonium

S.124

(a) FDC; rainforest species present
(b) BB absent
(c) Lantana

S.125

(a) FDC regeneration in former clearing
(b) BB absent
(c) None

S.126

(a) Disused quarry in FDC
(b) BB absent
(c) None

S.127

(a) FDC species regeneration. Spiny Paperbark shrubland adjacent on clay soil
(b) BB absent
(c) None

	S.128	(a) FDC and HC (b) BB absent (c) Lantana Kikuyu Prickly Pear Aloe Century Plant
	S.129	(a) FDC (b) BB absent (c) Lantana Prickly Pear Century Plant
	S.130	(a) FDC (b) BB absent, although 1 plant used as brush matting about recently constructed walkway (c) None
	S.131	(a) HC, including Littoral Rainforest (b) BB absent (c) Lantana Asparagus Vine Paramatta Grass Onion Grass
	S.132	(a) FDC, including a Littoral Rainforest remnant (b) BB absent (c) Lantana Cape Ivy Asparagus Vine
Saltwater Beach	S.133	(a) FDC; Tuckeroo present (b) BB absent (c) None
	S.134	(a) FDC (b) BB absent (c) None
	S.135	(a) FDC (b) BB rare - 1 plant observed (c) None
	S.136	(a) FDC (b) BB rare to occasional - 2 plants observed at site, 10 plants observed between sites 136 and 135
	S.137	(a) FDC (b) BB rare - 3 plants observed (c) None

Diamond Beach	S.138	(a) FDC (b) BB occasional, to common in patches- approximately 16 clumps observed between sites 138 and 137 (c) None
	S.139	(a) FDC (b) BB common in patches - approximately 20 clumps observed between sites 139 and 138 (c) None
	S.140	(a) FDC (b) BB common in patches - 5 clumps observed along creek bank between sites 140 and 139; 3 extensive clumps near smaller creek immediately south-giving almost continuous cover beneath White Banksia (c) None
	S.141	(a) FDC & HC; rainforest species present (b) BB occasional - 5 plants observed along beach and beginning of headland (c) Gazania
Red Head - Hallidays Point	S.142	(a) FDC & HC; rainforest species present (b) BB absent (c) Lantana
	S.143	(a) Littoral Rainforest, and other HC species (b) BB absent (c) Lantana
	S.144	(a) HC; rainforest species present (b) BB absent (c) None
	S.145	(a) FDC (b) BB absent (c) Lantana Rhodes Grass Cape Ivy
	S.146	(a) FDC; rainforest species and Flooded Gum present (b) BB absent (c) None
	S.147	(a) FDC; rainforest species present (b) BB absent at site but 1 plant observed immediately south (c) Lantana Asparagus Vine Looking-glass Plant

	S.148	(a) Clearing with regenerating rainforest species (b) BB absent (c) Lantana Kikuyu Paramatta Grass White Clover Looking-glass Plant
	S.149	(a) Littoral Rainforest (b) BB absent (c) Lantana Winter Senna Wild Tobacco Ribwort Scarlet Pimpernel Dandelion Kikuyu Fleabane Cape Ivy White Passionfruit Prairie Grass Weed species largely confined to tracks and disturbed margins of rainforest
	S.150	(a) Littoral Rainforest and other HC and FDC species (b) BB absent - 1 clump of seedlings less than 30 cm high removed (c) Lantana Pennyweed Common Sowthistle Five-leaf Morning Glory Buffalo Grass Catsear Cape Ivy Asparagus Vine
Nine Mile Beach North	S.151	(a) FDC; rainforest species present (b) BB rare - 1 plant observed between sites 151 and 150 (c) Lantana
	S.152	(a) FDC, dominated by Coast Tea-tree (b) BB occasional - 5 clumps observed between sites 152 and 151 (c) None
Nine Mile Beach Middle	S.153	(a) FDC with Saw Banksia forest dominating immediately inland (b) BB common in patches - 25 clumps observed between sites 153 and 152 (c) None

	S.154	(a) FDC with Saw Banksia forest dominating immediately inland (b) BB common, to very common in patches - heaviest infestation occurs at site (c) None
	S.155	(a) FDC with Saw Banksia forest dominating immediately inland (b) BB occasional, to common in patches - 27 clumps observed between sites 155 and 154, with heavier infestations occurring towards site 154 (c) None
Nine Mile Beach South	S.156	(a) FDC (b) BB absent (c) None
	S.157	(a) FDC (b) BB absent (c) None
	S.158	(a) FDC (b) BB absent (c) None
	S.159	(a) FDC - extensive stands of Coast Tea tree in area (b) BB absent (c) None
	S.160	(a) FDC (b) BB rare - 1 plant observed between sites 160 and 159 (c) None
	S.161	(a) FDC with Saw Banksia forest dominating immediately inland (b) BB rare - 1 plant observed immediately south of site (c) None
	S.162	(a) FDC, including small pockets of Littoral Rainforest (b) BB absent (c) Lantana Asparagus Vine
Forster - Cape Hawke	S.163	(a) FDC (principally dune slack species) (b) BB absent (c) Lantana (on headland) Prickly Pear (on headland)

S.164

(a) HC, including rainforest species, and Blackbutt - Saw Banksia forest on sand which mantles the headland
(b) BB absent
(c) Lantana
Prickly Pear
Asparagus Vine
Mother-of-millions

S.165

(a) FDC species
(b) BB absent
(c) None
(d) Area subject to heavy 4WD usage in past

S.166

(a) HC, dominated by Swamp Oak forest; rainforest species present
(b) BB absent
(c) Lantana

S.167

(a) HC; rainforest species present
(b) BB absent
(c) Lantana
Prickly Pear
Buffalo Grass
Paramatta Grass
Quaking Grass
Shivery Grass
Purple-top
Fleabane
Ink-weed
Spear Thistle
Wild Tobacco
Catsear
Ribwort
Cotton Bush

S.168

(a) FDC, including Littoral Rainforest
(b) BB rare - 2 plants observed on beach, both south of the site
(c) None
(d) Dune restoration work along entire length of beach

S.169

(a) HC, including Littoral Rainforest
(b) BB absent
(c) Lantana
Kikuyu
Winter Senna
Cape Ivy
Prickly Pear

	S.170	(a) HC; rainforest species present. Pasture adjoins to the south (b) BB absent (c) Lantana Five-leaf Morning Glory Blackberry
	S.171	(a) HC, including Tuckeroo (b) BB absent (c) Lantana Rhodes Grass Prickly Pear
	S.172	(a) HC; rainforest species present (b) BB absent (c) Lantana
	S.173	(a) HC, including Tuckeroo (b) BB absent (c) Lantana Prickly Pear
	S.174	(a) Clearing about Trig - Littoral Rainforest & Brown Myrtle regrowth surrounds (b) BB absent (c) Lantana
	S.175	(a) HC, with an extensive area of Littoral Rainforest adjacent site (b) BB absent (c) None
	S.176	(a) HC & FDC,including Littoral Rainforest (b) BB absent (c) None
Seven Mile Beach North	S.177	(a) FDC & HC (b) BB common in localised patch about access track (c) Lantana Kikuyu
	S.178	(a) FDC, grading into Cabbage Palm - Swamp Oak swamp forest & Littoral Rainforest inland (b) BB absent (c) Lantana Kikuyu Rhodes Grass
	S.179	(a) FDC (b) BB rare - 1 plant observed (c) None

	S.180	(a) FDC (b) BB rare to occasional, and mainly occurring on windward slope (c) none
	S.181	(a) FDC (b) BB occasional (c) None
	S.182	(a) FDC (b) BB occasional (c) None
	S.183	(a) FDC; Horsetail Oak present (b) BB occasional overall but common in a few small, localised patches (c) Lantana
Seven Mile Beach South	S.184	(a) FDC (b) BB occasional, to common in patches - many small plants, especially beneath Horsetail Oak (c) None (d) Lee of dune apparently free of BB
	S.185	(a) FDC (b) BB occasional, to common in patches at northern end of picnic ground (c) Lantana Looking-glass Plant
	S.186	(a) FDC, including Littoral Rainforest (b) BB common to very common in patches (c) Lantana Whiskey Grass Kikuyu
	S.187	(a) FDC, including Littoral Rainforest & Cabbage Palm swamp forest (b) BB occasional, to common in patches - approximately 45 clumps observed between sites 188 and 187 (c) Lantana Ferny Asparagus Whiskey Grass (d) BB not currently a threat to Littoral Rainforest
	S.188	(a) FDC (b) BB ocasional, to common in patches - approximately 25 clumps observed between sites 188 & 189 (c) none

	S.189	(a) FDC, grading into Littoral Rainforest & Broad-leaved Paperbark - Cabbage Palm swamp forest inland (b) BB common to very common in small patches (c) none
	S.190	(a) FDC (b) BB common to very common in small patches (c) none
	S.191	(a) HC (b) BB occasional - 6 plants observed on cliff face at end of beach (c) none
Booti Hill	S.192	(a) HC (b) BB rare - 2 seedlings removed, 3 more observed between sites 192 & 191 (c) Lantana Common Sowthistle
	S.193	(a) Swamp Oak swamp forest grading into Sclerophyll Forest/Woodland (b) BB occasional (was common in patches but most has been removed) (c) Lantana (d) 1 BB plant observed on point immediately NW of site
	S.194	(a) old clearing in HC (b) BB absent (c) Lantana Paramatta Grass ?Paspalum
	S.195	(a) HC, including Littoral Rainforest - grading into Sclerophyll Forest on western side of ridge (b) BB rare - 1 plant observed through binoculars looking from site 194 (c) Prickly Pear
	S.196	(a) Swamp Oak swamp forest grading into Sclerophyll Forest (b) BB occasional - 1 large clump observed (c) none
	S.197	(a) Swamp Oak swamp forest (b) BB occasional - 1 clump of approximately 5 plants observed (c) none

Elizabeth Beach- Boomerang Beach	S.198	(a) HC (b) BB common in patches (c) Lantana
	S.199	(a) Littoral Rainforest intermixed with Cabbage Palm, Tallowwood & Smooth-barked Apple (b) BB present on margins of stand - refer site 200 (c) Lantana Winter Senna Madeira Vine
	S.200	(a) highly disturbed FDC (b) BB common to very common in patches along beach and on cliff faces north & south of beach (c) Lantana Rhodes Grass Cypress Wattle
	S.201	(a) HC (b) BB common in patches (c) Lantana (d) some BB plants inaccessible
	S.202	(a) FDC, including Littoral Rainforest - grading into Swamp Oak swamp forest & Sclerophyll Forest behind beach (b) BB common in patches but largely confined to windward face of frontal dune (c) none
	S.203	(a) HC (b) BB common in patches (c) Lantana Paramatta Grass (d) some BB plants inaccessible
	S.204	(a) HC (b) BB absent at site, but common in patches between sites 204 and 203 (c) none
	S.205	(a) HC; rainforest species present (b) BB common in patches (c) none
	S.206	(a) HC,and FDC where sand mantles bedrock (b) BB common in patches about site but occasional between sites 206 and 205 (c) none

	S.207	(a) FDC (b) BB common, to very common in patches (c) Cypress Wattle (d) dune restoration work has been undertaken along beach
	S.208	(a) HC and FDC species where sand mantles bedrock; rainforest species present (b) BB occasional, to common in patches (c) Lantana Paramatta Grass (d) experienced difficulty in rating BB abundance as headland recently burnt; some BB plants inaccessible
	S.209	(a) FDC (b) BB very common in one large patch at site (c) none
Blueys Beach-Danger Point	S.210	(a) FDC (b) BB rare - 2 plants observed at site, but appears to be absent between sites 210 and 209 (c) none (d) dune restoration work has been undertaken in area
	S.211	(a) FDC; rainforest species present (b) BB occasional - 6 plants observed between sites 211 and 210 (c) Lantana Winter Senna
	S.212	(a) HC along cliff edge - cleared immediately inland & maintained as pasture (b) BB rare - 3 plants observed (c) Lantana (d) BB plants inaccessible. Extensive areas of Littoral Rainforest and Sclerophyll Forest lie between sites 212 and 213
Sandbar	S.213	(a) HC; rainforest species present (b) BB common in patches (c) Lantana
	S.214	(a) FDC; rainforest species present (b) BB common but confined to erosion escarpment (c) none (d) Littoral Rainforest & Bracelet Honey-myrtle shrubland occurs to the NE of site

	S.215	(a) FDC (b) BB common, to very common in patches but confined to erosion escarpment (c) none
	S.216	(a) rubbish tip in Sclerophyll Forest (b) BB very common in 1 patch at site (c) none
	S.217	(a) FDC species regeneration - area previously sandmined (b) BB common but plants small (c) Rhodes Grass
	S.218	(a) FDC (b) BB very common and the main species over large areas of windward face of dune (c) none (d) area disturbed by 4WD vehicles
Smiths Lake-Number one Beach	S.219	(a) FDC (b) BB occasional - 8 plants observed (c) none
	S.220	(a) Kangaroo Grass tussock grassland (b) BB rare - 2 seedlings observed,and removed (c) none (d) midden observed at site
	S.221	(a) Bracelet Honey-myrtle shrubland (b) BB rare - 5 seedlings observed on edge of walking track, and removed (c) none
	S.222	(a) HC, including Bracelet Honey-myrtle shrubland (b) BB rare - 1 plant observed, and removed (c) none
	S.223	(a) FDC and HC, including Littoral Rainforest (b) BB common in patches about site (c) none
	S.224	(a) HC (b) BB rare - 1 large clump observed (c) none (d) midden observed on point immediately south of site

	S.225	(a) HC; rainforest species present (b) BB occasional - 4 large clumps observed (c) none (d) 1 clump of BB inaccessible
Number One Beach-Sugarloaf Point	S.226	(a) HC; rainforest species present. Dry heath species intermix where sand mantles headland (b) BB absent (c) Crofton Weed
	S.227	(a) HC and FDC; rainforest species present (b) BB absent (c) Lantana
	S.228	(a) HC; rainforest species present (b) BB rare - 2 plants observed (c) none
	S.229	(a) HC, including Littoral Rainforest (b) BB occasional - approximately 12 plants observed (c) Lantana Prickly Pear Mother-of-millions Whiskey Grass Kikuyu, and many others in old clearing (? quarry) (d) some BB plants inaccessible
	S.230	(a) HC & FDC; rainforest species present (b) BB absent (c) Lantana Prickly Pear
	S.231	(a) Kangaroo Grass tussock grassland (b) BB occasional - approximately 6 plants observed through binoculars (c) none (d) some BB plants inaccessible
	S.232	(a) predominantly Bracelet Honey-myrtle shrubland (b) BB absent (c) Prickly Pear

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APPENDIX II - PLANT SPECIES RECORDED DURING SURVEY

Nomenclature generally follows that of Jacobs & Pickard, 1981 (Angiosperms), and Clifford and Constantine, 1980 (Ferns) except where a recent revision supersedes their respective works.

* denotes introduced
\+ denotes present

Plant Habit

T= Tree
S= Shrub
H= Herb
V= Vine or liane
E= Epiphyte

Geomorphic Unit

FDC = Frontal Dune Complex
HC = Headland Complex
EST = Estuarine Complex

DIST= Disturbed area (such as a roadside verge, quarry, poorly revegetated sandmining path, pasture, picnic area or camping ground)

Botanical Name	Common Name	Plant Habit	Geomorphic Unit FDC	HC	EST	DIST
Acacia longifolia var. sophorae	Beach Sally Wattle	S	+			+
*A.saligna	Cypress Wattle	T/S	+			+
Acronychia imperforata	Beach Acronychia	T/S	+			
A.oblongifolia	Glossy Acronychia	T/S	+			
A.wilcoxiana	Silver Aspen	T/S		+		
Actinotus helianthi	Flannel Flower	H		+		
Aegiceras corniculata	River Mangrove	S			+	
*Agave americana	Century Plant	H	+			
*Ageratina adenophora	Crofton Weed	H		+		
*A.riparia	Mist Flower	H	+			
Alangium villosum ssp. polyosmoides	Muskwood	T		+		
Alectryon coriaceus	Beach Alectryon	T	+			
Allocasuarina littoralis	Black She-oak	T/S	+	+		
*Aloe sp.	Aloe	H	+	+		
Alphitonia excelsa	Red Ash	T	+			
Alpinia caerulea	Wild Ginger	H		+		
*Ammophila arenaria	Marram Grass	H	+			
Amperea xiphoclada	Broom Spurge	S		+		
*Anagallis arvensis	Scarlet Pimpernel	H				+
*Andropogon virginicus	Whiskey Grass	H	+	+		
Angophora costata	Smooth-barked Apple	T	+	+		

*Anredera cordifolia	Madeira Vine	V	+			
Aphanopetalum resinosum	Gum Vine	V		+		
Apium prostratum	Sea Celery	H		+		
*Arctotheca nivea		H	+			
Aristida warburgii	Threeawn Speargrass	H		+		
Arytera divaricata	Coogera	T	+	+		
*Asparagus densiflorus	Asparagus Vine	V	+			
*A.setaceus	Ferny Asparagus	V	+			
Asplenium australsicum	Bird's Nest Fern	E	+			
A.obtusatum	Shore Spleenwort	E		+		
*Aster subulatus	Bushy Starwort	H			+	+
Avicennia marina var. australasica	Grey Mangrove	T/S			+	
*Axonopus affinis	Narrow-leaved Carpet Grass	H		+		+
Backhousia myrtifolia	Grey Myrtle	T		+		
Bacopa monnieri		H	+		+	
Baloghia lucida	Brush Bloodwood	T	+	+		
Banksia ericfolia var. macrantha	Heath Banksia	S	+			
B.integrifolia var. integrifolia	White Banksia	T/S	+	+		
B.oblongifolia	Swamp Banksia	S		+		
B.serrata	Saw Banksia	T	+	+		
Baumea juncea	Bare Twig-rush	H	+	+		
*Bidens pilosa	Cobbler's Peg	H	+			+
Billardiera scandens	Climbing Apple-Berry	V		+		
Blechnum indicum	Swamp Water Fern	H	+			
Bossiaea ensata	Sword Bossiaea	S		+		
Brachycome sp.		H		+		
Breynia oblongifolia	Breynia	S		+		+
*Briza maxima	Quaking Grass	H				+
*B.minor	Shivery Grass	H				+
*Bromus unioloides	Prairie Grass	H				+
*Cakile edentula	American Sea Rocket	H	+			
Callistemon salignus	Willow Bottlebrush	T/S	+			
Calotis lappulacea		H		+		
Calystegia soldanella		V	+			
Canavalia rosea	Wild Jack-bean	V	+	+		
Capparis arborea	Brush Caper Berry	T/S		+		
Carex pumila		H	+		+	
Carpobrotus glaucescens	Coast Noonflower	H	+			
*Cassia coluteoides	Winter Senna	S	+	+		
*C.didymobotrya	Cassia	S				+
*C.floribunda	Smooth Cassia	S				+
Cassine australis	Red Olive Plum	T/S	+			
Cassytha pubescens	Downy Dodder-laurel	V	+			
C. sp.		V		+		
Casuarina equisetifolia	Horsetail Oak	T/S	+			
C.glauca	Swamp Oak	T/S	+	+		+

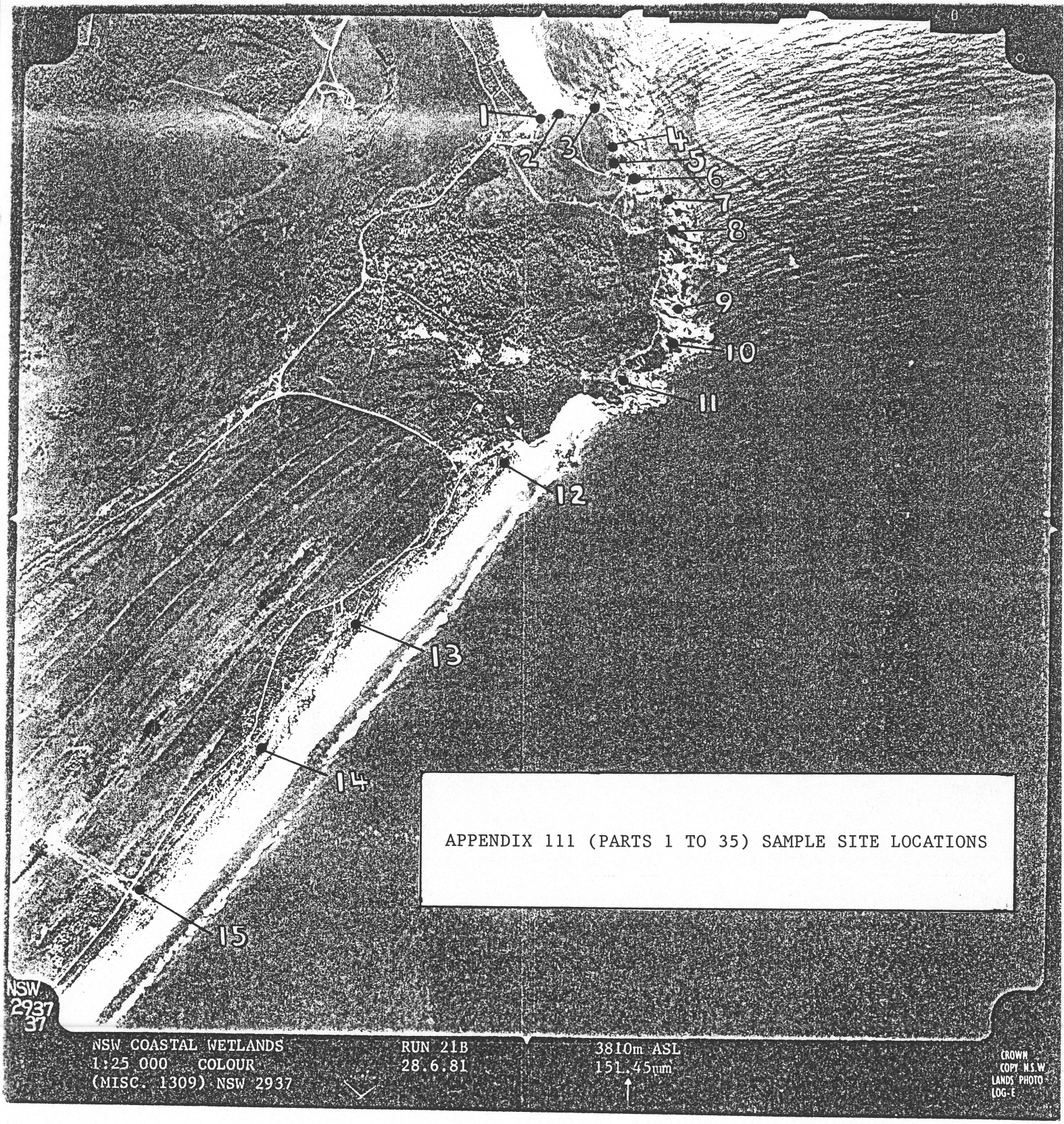
Centella asiatica	Indian Pennywort	H	+		
*Chloris gayana	Rhodes Grass	H	+		
Choricarpia leptopetala	Brown Myrtle	T/S		+	+
*Chrysanthemoides monilifera ssp. rotundata	Bitou Bush	S	+	+	+
Cirsium vulgare	Spear Thistle	H			+
Cissus antarctica	Water Vine	V	+		
C.hypoglauca	Five-leaf Water Vine	V	+		
Citriobatus pauciflorus	Orange Thorn	S		+	
Claoxylon australe	Brittlewood	S	+		
Clerodendrum floribundum	Smooth Clerodendrum	S	+		
Comesperma ericinum		S		+	
Commersonia fraseri	Brush Kurrajong	T/S	+	+	
Convolvulus erubescens	Australian Bindweed	V		+	
*Conyza parva	Canadian Fleabane	H	+		
*C. sp.	Fleabane	H	+		
*Coprosma repens	Looking-glass Plant	S	+	+	+
Correa reflexa	Native Fuschia	S	+		
*Cortaderia selloana	Pampas Grass	H			+
Craspedia uniflora		H		+	
Crassula sieberana		H		+	
Crinum pedunculatum	Swamp Lily	H	+	+	
Croton insularis	Silver Croton	S		+	
Cryptocarya rigida	Rose Maple	T/S		+	
Cupaniopsis anacardioides	Tuckeroo	T	+		
Cynodon dactylon	Common Couch	H	+		+
Cyperus laevigatus		H	+		
*C.papyrus	Papyrus	H			+
C.polystachyos	Bunchy Flat-sedge	H	+		
Dampiera stricta	Blue Dampiera	S		+	
Dianella caerulea	Rough Flax Lily	H	+	+	
Dichondra repens	Kidneyweed	H		+	+
Dioscorea transversa	Native Yam	V		+	
Diospyros australis	Black Plum	T		+	
D.pentamera	Myrtle Ebony	T		+	
Dodonaea triquetra	Hop Bush	S	+		+
Drypetes australasica	Yellow Tulip	T	+	+	
Duboisia myoporoides	Duboisia	S	+		
Dysoxylum fraserianum	Rosewood	T	+		
Einadia nutans ssp. linifolia		H		+	
Elaeocarpus obovatus	Hard Quandong	T	+		
E.reticulatus	Blueberry Ash	T/S		+	
Enchylaena tomentosa var. tomentosa		S		+	
Eriostemon australasius ssp. australius	Pink Wax Flower	S	+		

*Erythrena X sykesii	Coral Tree	T			+	+
Eucalyptus grandis	Flooded Gum	T	+			
E.microcorys	Tallowwood	T	+	+		
E.pilularis	Blackbutt	T	+	+		
E.resinifera	Red Mahogany	T		+		
E.robusta	Swamp Mahogany	T				+
E.tereticornis	Forest Red Gum	T		+		
Euroschinus falcata var. falcata	Ribbonwood	T	+			
Eustrephus latifolius	Wombat Berry	V	+			
Exocarpus cupressiformis	Native Cherry	S	+			
Festuca littoralis		H	+			
Ficus fraseri	Sandpaper Fig	T		+		
F.rubiginosa	Rusty Fig	T	+			
Flagellaria indica	Whip Vine	V	+			
Gahnia aspera	Short Saw Sedge	H		+		
Galeola cassythoides	Climbing Orchid	V		+		
*Gazania ringens	Gazania	H	+	+		
Geranium solanderi	Cut-leaf Cranesbill	H		+		
Glochidion ferdinandi	Cheese Tree	T	+			
Glycine clandestina	Twining Glycine	V	+			
Gomphocarpus sp.	Cotton Bush	H		+		
Goodenia ovata		S		+		
Guioa semiglauca	Guioa	T	+			
Gymnostachyus anceps	Settlers Flax	H		+		
Hakea dactyloides	Finger Hakea	S		+		
H.teretifolia	Dagger Hakea	S		+		
Hardenbergia violacea	False Sarsaparilla	V		+		
Helichrysum bracteatum	Golden Everlasting	H		+		
H.elatum		S		+		
Hemarthria uncinata	Mat Grass	H			+	
Hibbertia dentata		V		+		
H.scandens	Climbing Guinea Flower	V	+	+		
Hibiscus heterophyllus	Native Rosella	S		+		
*Hydrocotyle bonariensis	Pennyweed	H	+	+		
*Hylocereus undatus	Night Blooming Cactus	V		+		
*Hypochoeris radicata	Catsear	H	+			+
Imperata cylindrica var. major	Blady Grass	H		+		+
*Ipomoea brasiliensis	Coast Morning Glory	V	+			
*I.cairica	Five-leaf Morning Glory	V	+	+		
Ischnostemma carnosum	Mangrove Trailer	V		+		
Isopogon anemonifolius		S		+		
Ixora beckleri	Native Ixora	S		+		

Juncus maritimus	Maritime Rush	H			+	
*Kalanchoe tubiflora	Mother-of millions	H		+		+
Kennedia rubicunda	Dusky Coral-pea	V		+		
*Lantana camara	Lantana	S	+	+		+
Lasiopetalum parviflorum		S		+		
Leptospermum laevigatum	Coast Tea-tree	T/S	+	+		+
Leucopogon parviflorus	Beach Beard Heath	S	+			
Lindsaea linearis	Screw Fern	H		+		
Litsea reticulata	Bolly Gum	T	+			
Livistona australis	Cabbage Palm	T	+	+		
Lobelia alata	Angled Lobelia	H	+			
Logania albiflora	Logania	S		+		
Lomandra longifolia	Flat-leaved Lomandra	H		+		
Lophostemon confertus	Brush Box	T/S		+		
*Lupinus sp.	Lupin	H	+			
Maclura cochinchinensis	Cockspur Thorn	V	+			
Marsdenia rostrata	Smooth Milk Vine	V		+		
Melaleuca armillaris	Bracelet Honey-myrtle	S		+		
M.nodosa	Spiny Paperbark	S	+			
M.quinquenervia	Broad-leaved Paperbark	T	+			
Melanthera biflora	Three-veined Melanthera	H	+			
Melichrus procumbens	Jam Tarts	S		+		
Monotoca elliptica	Tree Broom Heath	S	+	+		+
Myoporum insulare	Boobialla	S	+	+		
Neolitsea australiensis	White Bolly Gum	T/S		+		
*Nerium oleander	Oleander	S				+
*Nicodemia madagascariensis	Buddleia	S	+			
Notelaea longifolia	Large Mock Olive	S	+			
Oenothera sp.	Evening Primrose	H	+			+
Olearia nernstei		S		+		
Opercularia aspera	Thin Stickweed	H		+		
*Opuntia sp.	Prickly Pear	S	+	+		
Oxalis corniculata	Yellow Wood Sorrel	H	+			
Oxylobium ilicifolium		S		+		

Pandanus pedunculatus	Screw Palm	S	+		
Pandorea pandorana ssp. pandorana	Wonga Vine	V		+	
Pararchidendron pruinosum	Snow Wood	T	+	+	
Parsonsia straminea var. straminea	Common Silkpod	V	+	+	
*Paspalum dilatatum	Paspalum	H			+
*P.urvillei	Vasey Grass	H			+
*Passiflora subpeltata	White Passionfruit	V		+	
Pelargonium inodorum		H		+	
*P. sp.	Pelargonium	S			+
Pellaea falcata	Sickle Fern	H	+	+	
*Pennisetum clandestinum	Kikuyu	H	+	+	+
Phebalium squameum	Satinwood	S		+	+
Phragmites australis	Common Reed	H	+		
Phyllota phylicoides	Beaked Parrot-pea	S		+	
*Phytolacca octandra	Ink-weed	H		+	
Pimelea linifolia	Slender Rice Flower	S		+	
*Pinus sp.		T/S	+		+
Pittosporum revolutum	Hairy Pittosporum	S	+		
P.undulatum	Sweet Pittosporum	S		+	
Planchonella australis	Black Apple	T	+	+	
Plantago debilis		H		+	
*P.lanceolata	Ribwort	H			+
Platycerium bifurcatum	Elk's Horn Fern	E	+	+	
P.superbum	Staghorn Fern	E	+	+	
Platylobium formosum		S		+	
Plectranthus parviflorus	Cockspur Flower	H		+	
Poa labillardieri		H	+	+	
Podocarpus elatus	Plum Pine	T	+		
Polyscias elegans	Celery Wood	S	+		
Pomaderris lanigera		S		+	
Poranthera corymbosa		H		+	
P.microphylla	Small Poranthera	H		+	
Pteridium esculentum	Bracken Fern	H	+	+	+
Plilanthelium deustum	Horned Sedge	H		+	
Pultenaea retusa	Blunt Bush-pea	S		+	
P.daphnoides		S		+	
Rapanea howittiana	Brush Muttonwood	S	+		
R.variabilis	Muttonwood	S	+		
Rhagodia candolleana ssp. candolleana		S	+	+	
Rhodamnia rubescens	Scrub Turpentine	T		+	
Rhodomyrtus psidioides	Native Guava	S	+		
Ripogonum album	Prickly Supplejack	V		+	
*Romulea rosea var. australis	Onion Grass	H		+	
Rubus hillii	Molucca Bramble	V		+	
R.parvifolius	Native Raspberry	V	+	+	
*R.vulgaris	Blackberry	V		+	

Samolus repens		H			+	
Sarcocornia quinque-flora	Samphire	H			+	
Sarcostemma australe	Caustic Vine	V	+			
Scaevola calendulacea	Dune Fan-flower	H	+	+		
Scirpus nodosa	Knobby Club Rush	H	+	+		
Scolopia braunii	Flintwood	T	+	+		
Senecio lautus	Variable Groundsel	H	+	+		
S.linearifolius		H		+		
*S.mikanioides	Cape Ivy	V	+			
*Sida rhombifolia	Paddy's Lucerne	S				+
Smilax australis	Austral Sarsaparilla	V	+	+		
S.glyciphylla	Sweet Sarsaparilla	V	+	+		
Solanum densevestitum	Furry Nightshade	S	+			
*S.mauritianum	Wild Tobacco	S		+		+
*S.seaforthianum	Climbing Nightshade	V	+			
*Sonchus oleraceus	Common Sowthistle	H		+		
Sophora tomentosa	Coast Sophora	S	+			
Spinifex hirsutus	Hairy Spinifex	H	+			
Sporobolus africanus	Paramatta Grass	H		+		+
S.virginicus	Sand Couch	H			+	
Stackhousia spathulata	Coast Stackhousia	H	+			
Stenocarpus salignus	Scrub Beefwood	T		+		
*Stenotaphrum secundatum	Buffalo Grass	H	+	+		
Stephania japonica	Snake Vine	V	+			
Suaeda australis	Seablite	H		+	+	
Synoum glandulosum	Scentless Rosewood	S		+		
Syzygium oleosum	Blue Lilly Pilly	T	+	+		
*Taraxicum officinale	Dandelion	H				+
Tetragonia tetragonioides	Warrigal Cabbage	H	+			
Themeda australis	Kangaroo Grass	H		+		
Tricoryne elatior	Yellow Rush-lily	H		+		
*Trifolium repens	White Clover	H		+		
Triglochin striata	Streaked Arrow-grass	H	+		+	
Tristaniopsis laurina	Water Gum	T/S		+		
Typha sp.	Cumbungi	H	+			
*Verbena bonariensis	Purple-top	H				+
Viminaria juncea	Golden Spray	S		+		
Viola betonicifolia	Purple Violet	H		+		
V.hederacea	Ivy-leaved Violet	H	+	+		
Westringia fruticosa	Coast Westringia	S		+		
Wikstroemia indica	Wikstroemia	S	+	+		
Wilkea huegeliana	Veiny Wilkea	S	+			
*Xanthium occidentale	Noogoora Burr	H	+			
Xanthosia pilosa	Wooly Xanthosia	S		+		
Zoysia macrantha	Prickly Couch	H	+			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APPENDIX 111 (PARTS 1 TO 35) SAMPLE SITE LOCATIONS
NSW
2937
37
NSW COASTAL WETLANDS
1:25 000 COLOUR
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151.45nm
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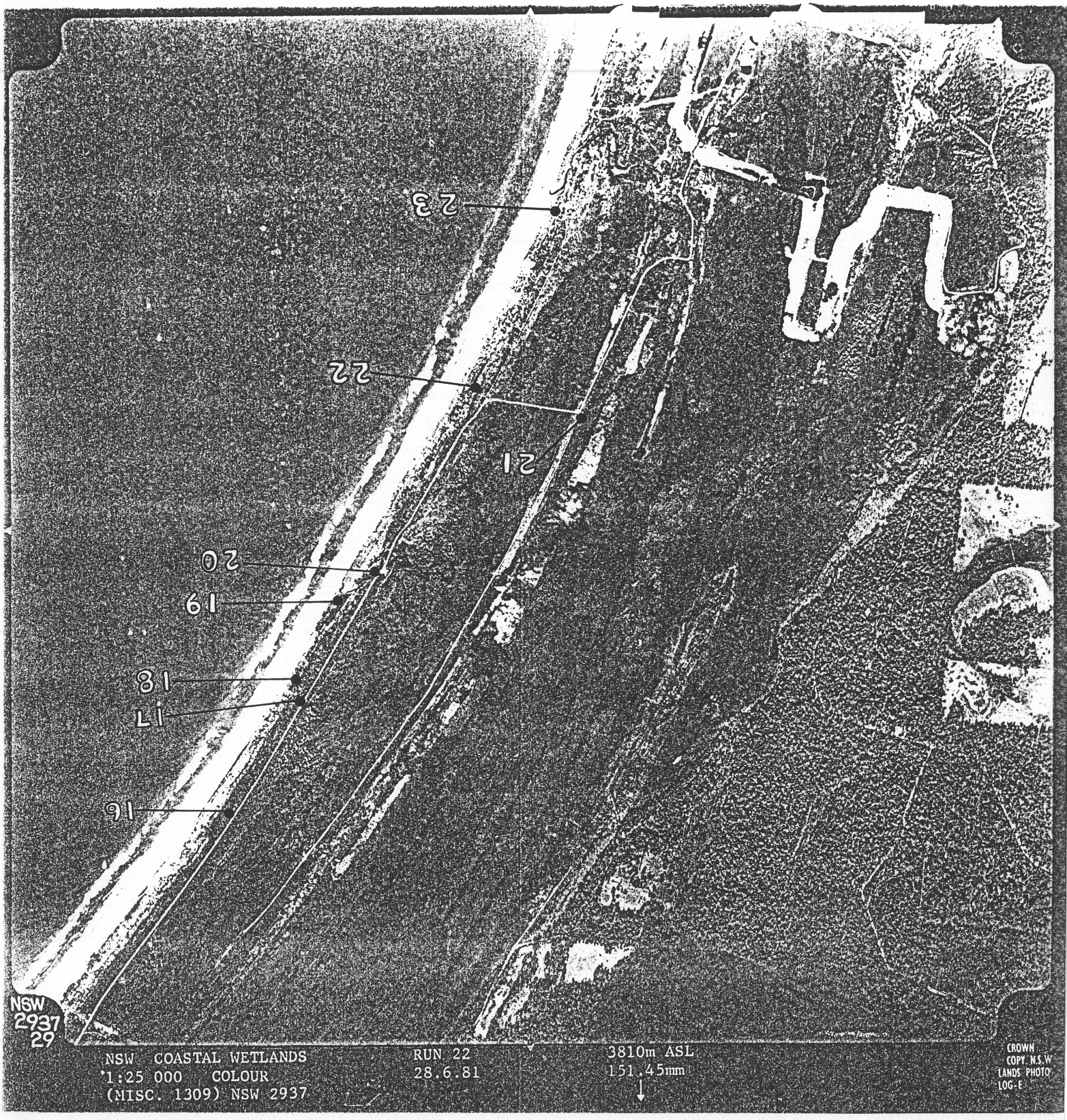
LANDS PHOTO
LOG-E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NSW COASTAL WETLANDS
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RUN 22
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3810m ASL
151.45mm
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COPY. N.S.W
LANDS PHOTO
LOG-E

NSW COASTAL WETLANDS
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(MISC. 1309) NSW 2937
RUN 22
28.6.81
3810m ASL
151.45mm
CROWN COPY N.S.W LANDS PHOTO LOC:E
NSW 2937 3f
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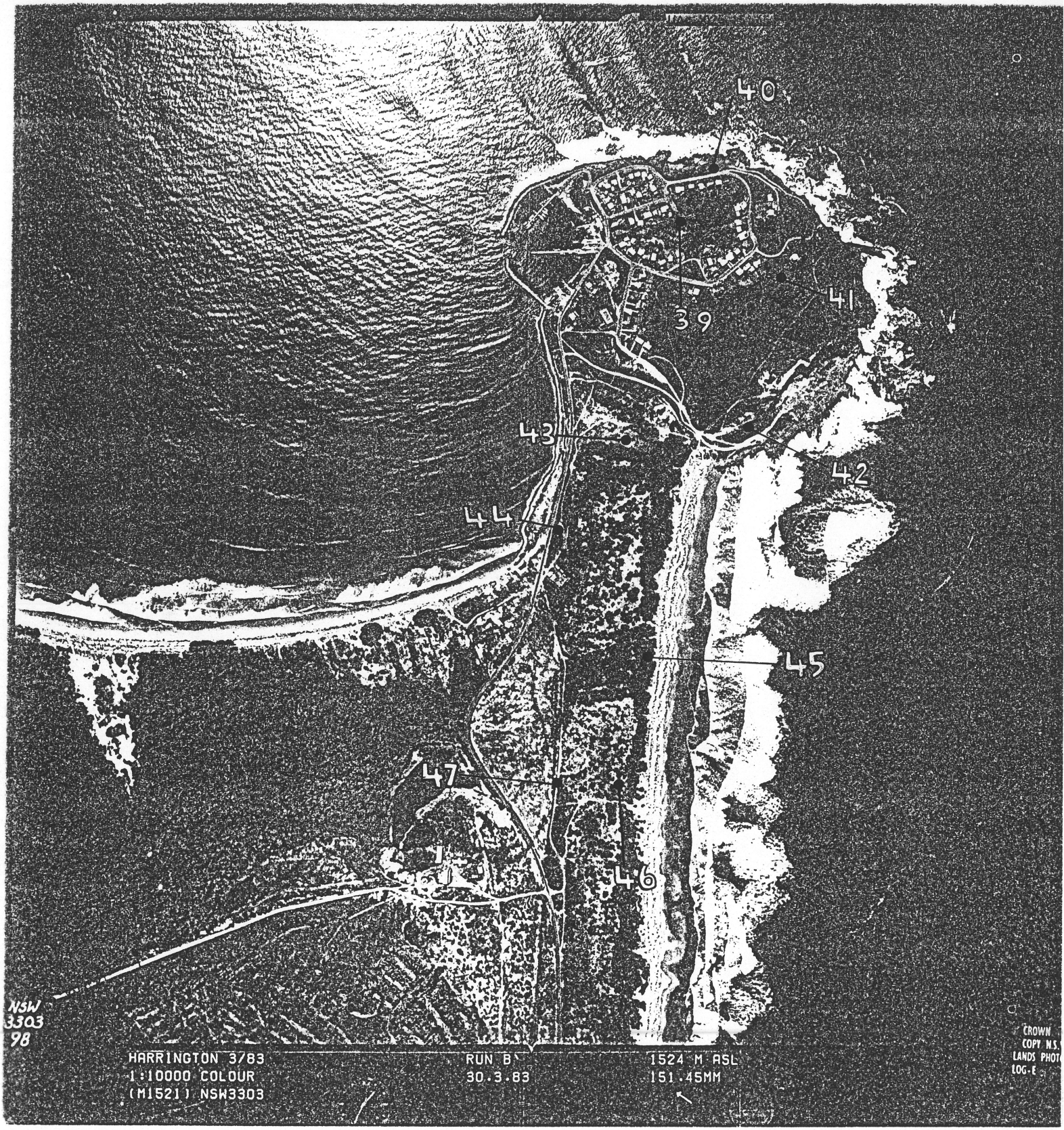
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3303
98
HARRINGTON 3/83
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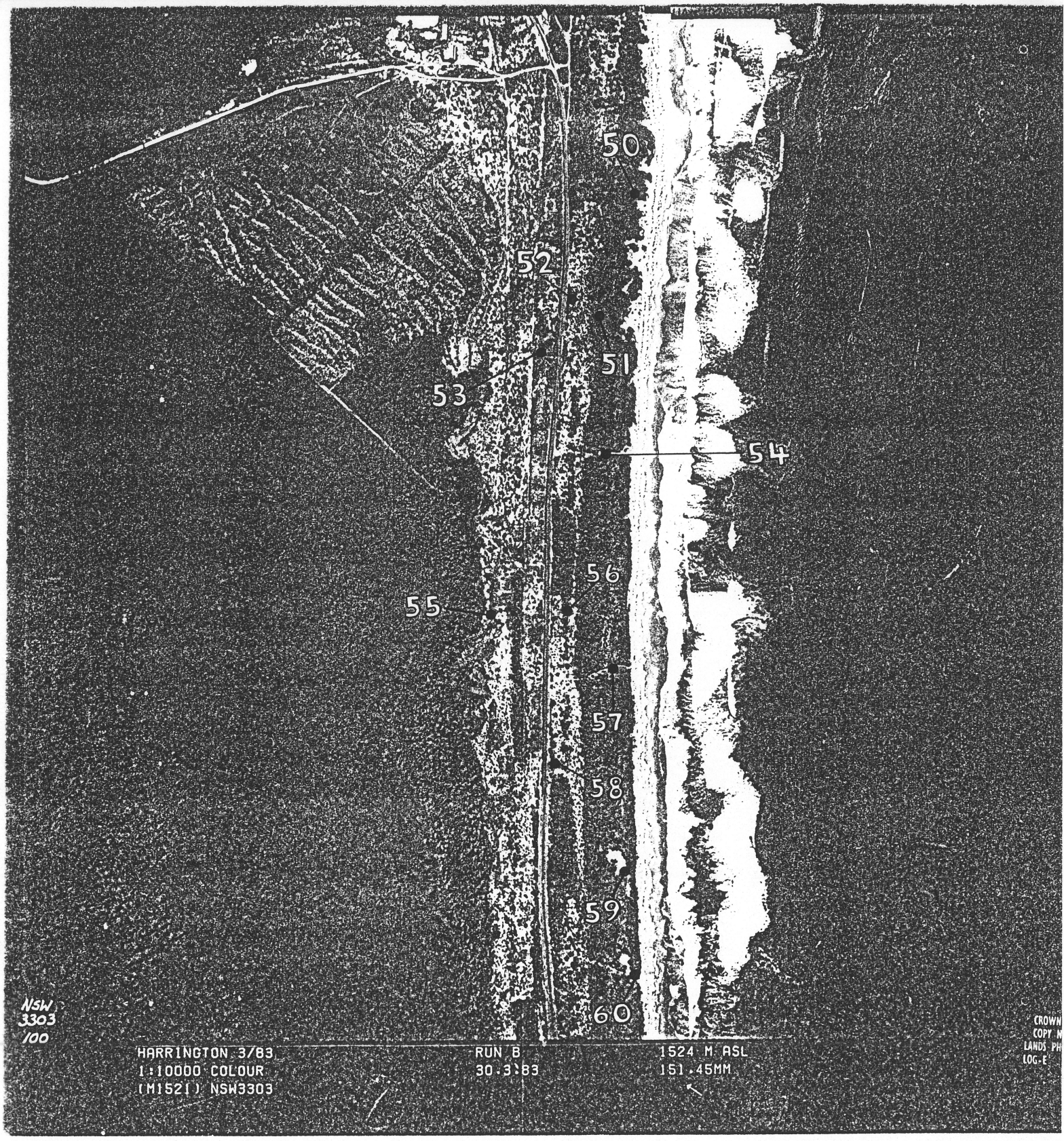
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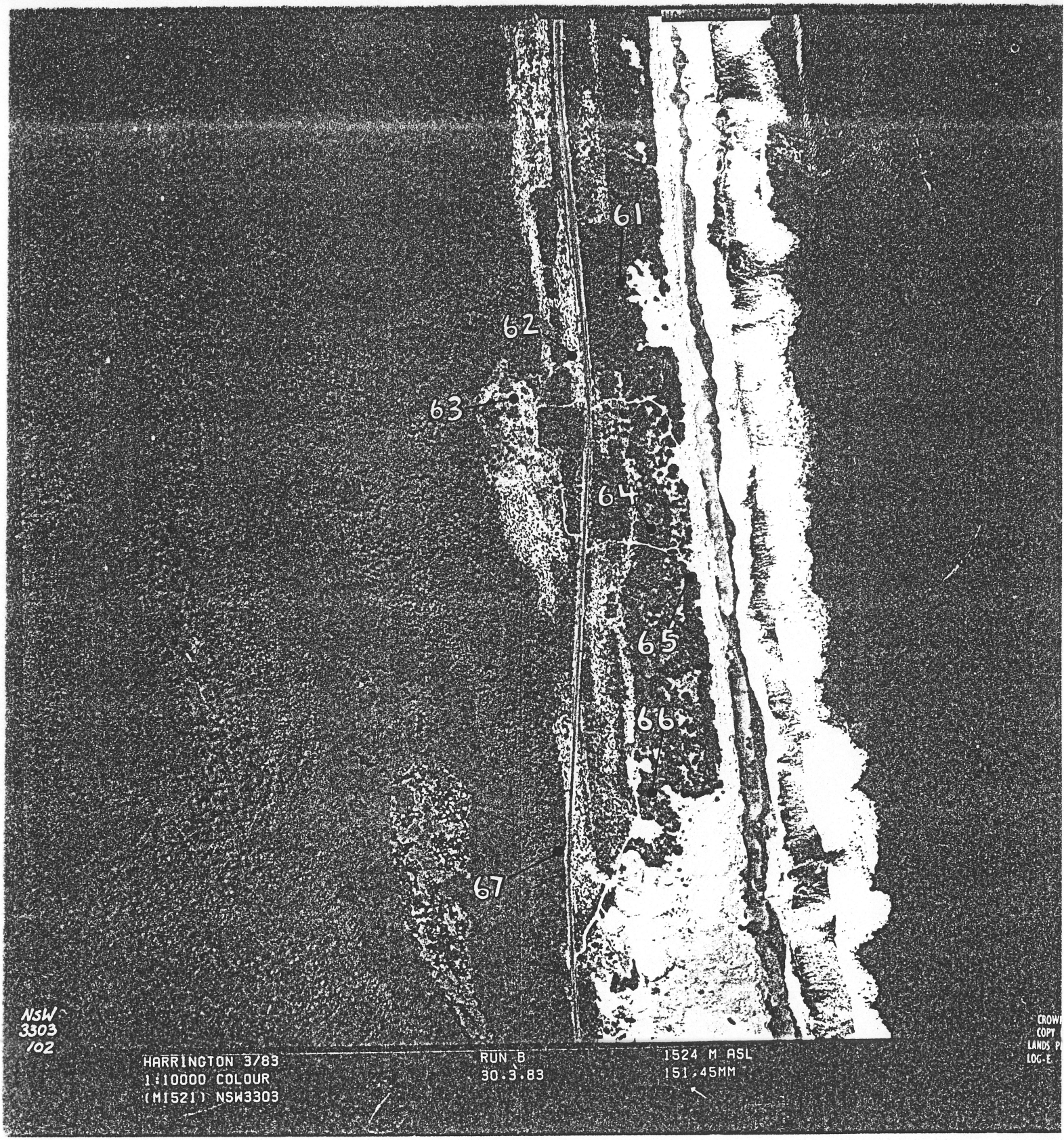
LOG-E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HARRINGTON 3/83
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(MI521) NSW3303
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1524 M ASL
151.45MM
CROW
COPY
LANDS P
LOG-E


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NSW
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104
HARRINGTON 3/83
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(M1521) NSW3303
RUN B
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151.45MM
CROWN
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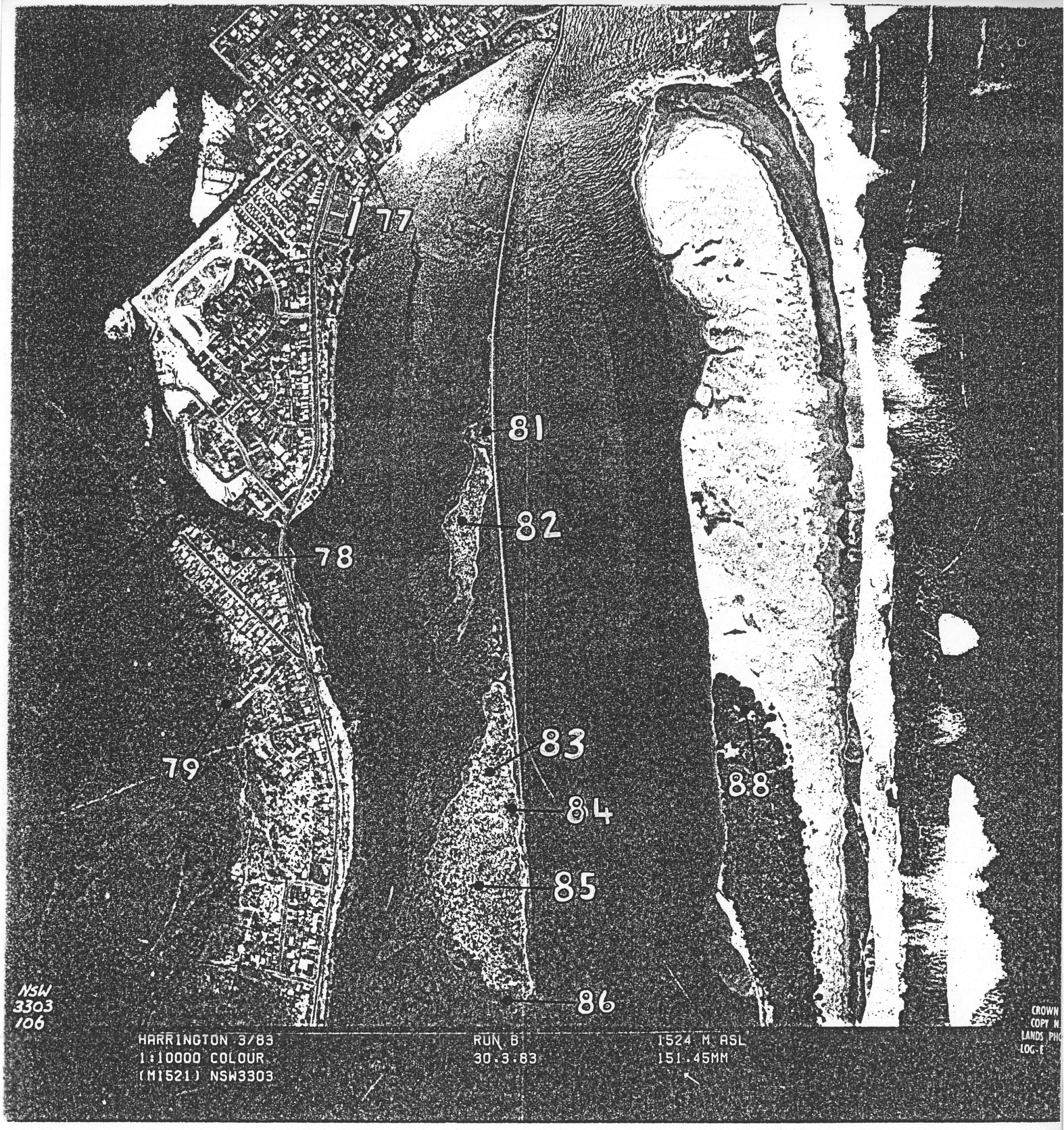
LOG-E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RUN 8
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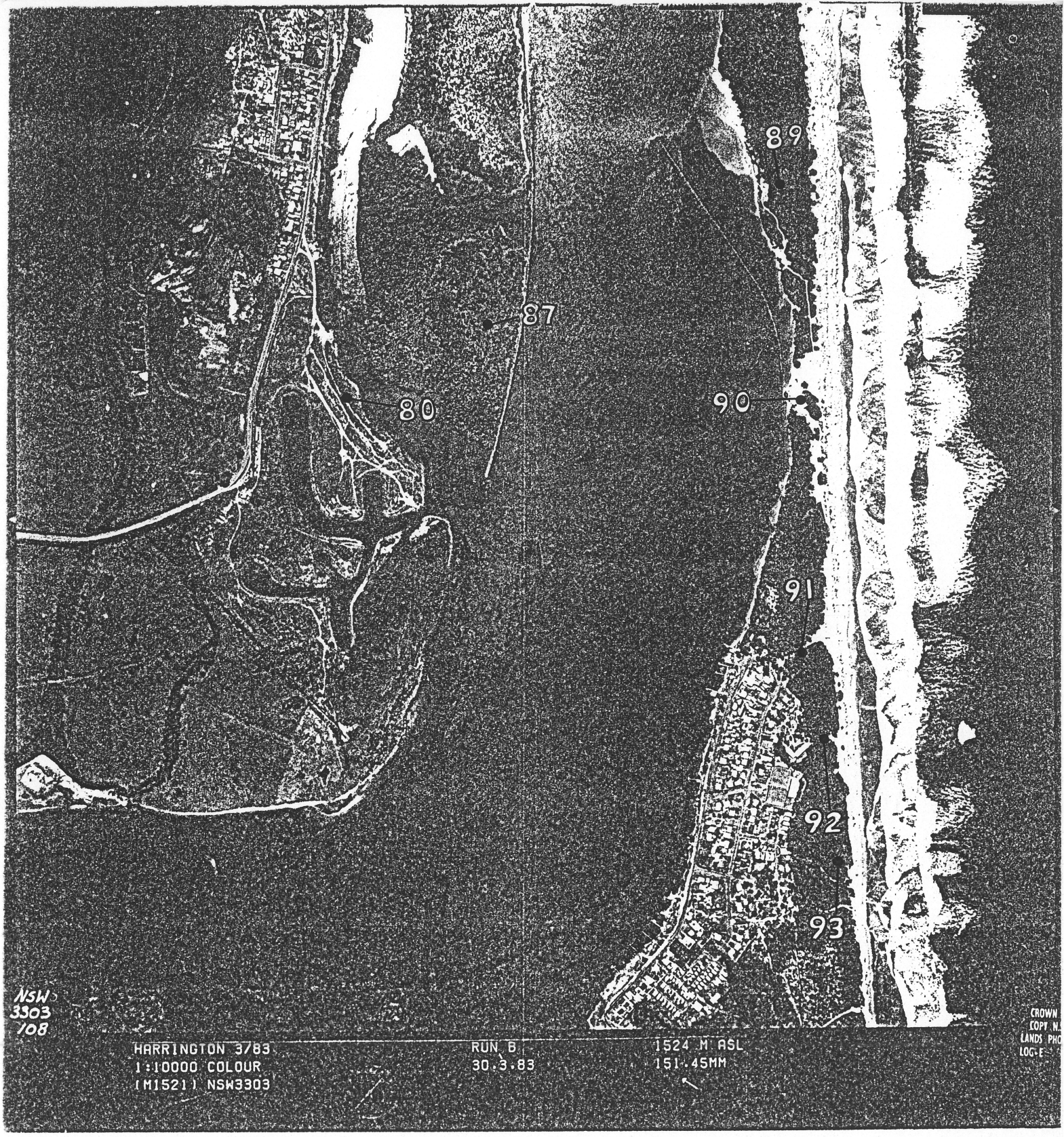
COPY N
LANDS PHO
LOG-E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1524 M ASL
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CROWN
COPY N.
LANDS PHO
LOG-E


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HARRINGTON 3/83
1:10000 COLOUR
(M1521) NSW3303
RUN B
30.3.83
1524 M ASL
151.45MM
CROWN
COPY. N.S.
LANDS PHOT
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112
HARRINGTON 3/83
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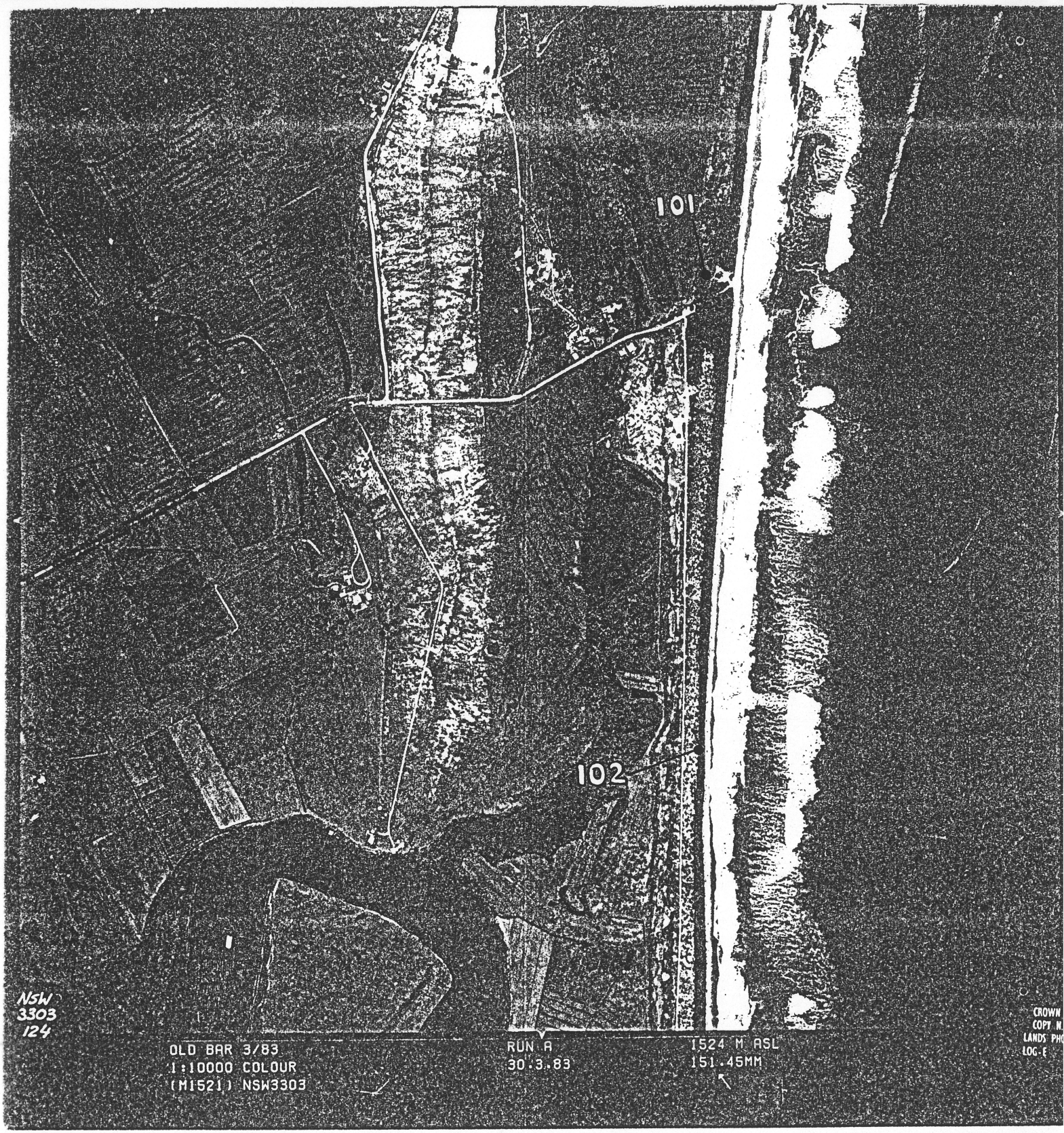
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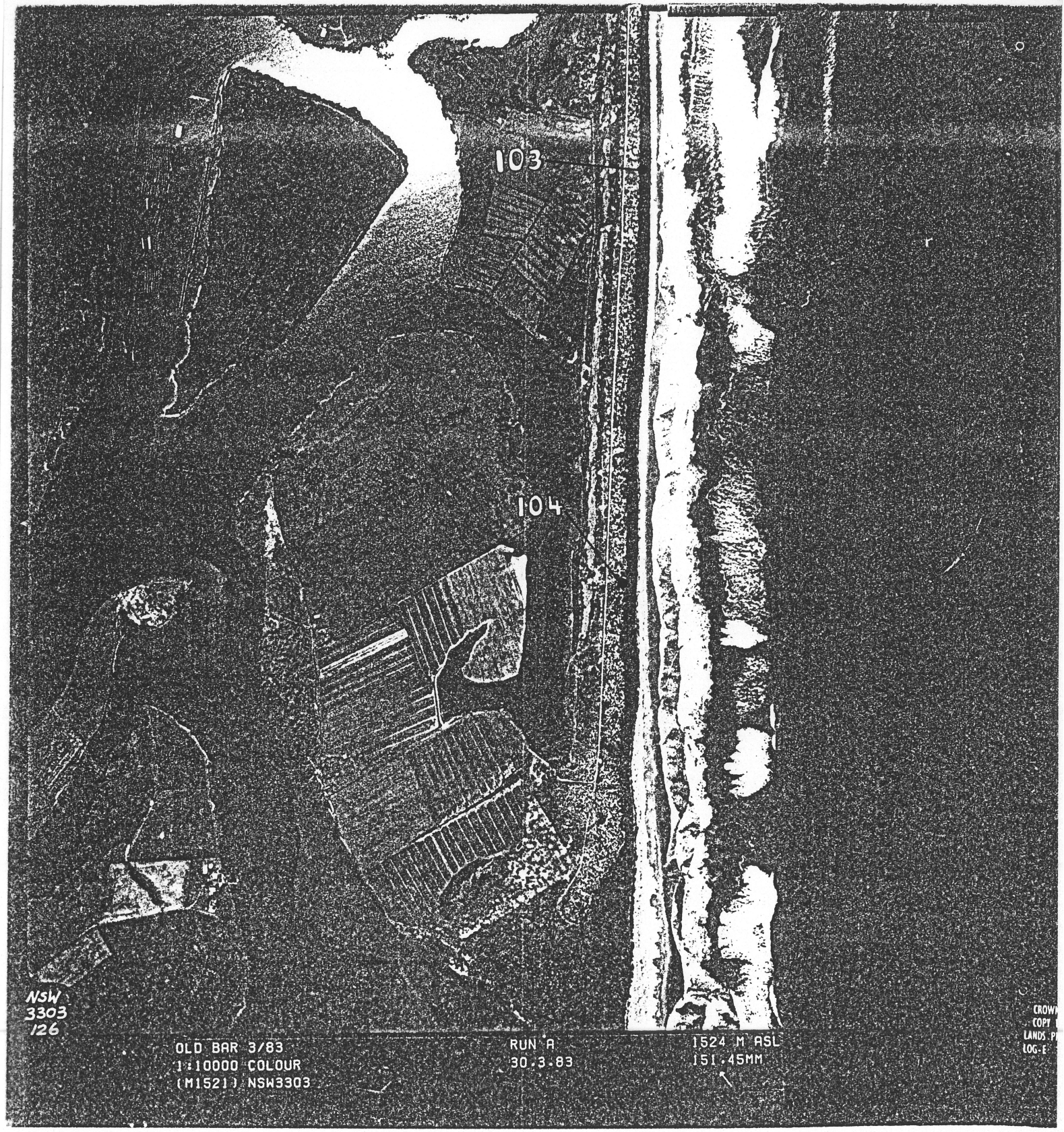
LOG-E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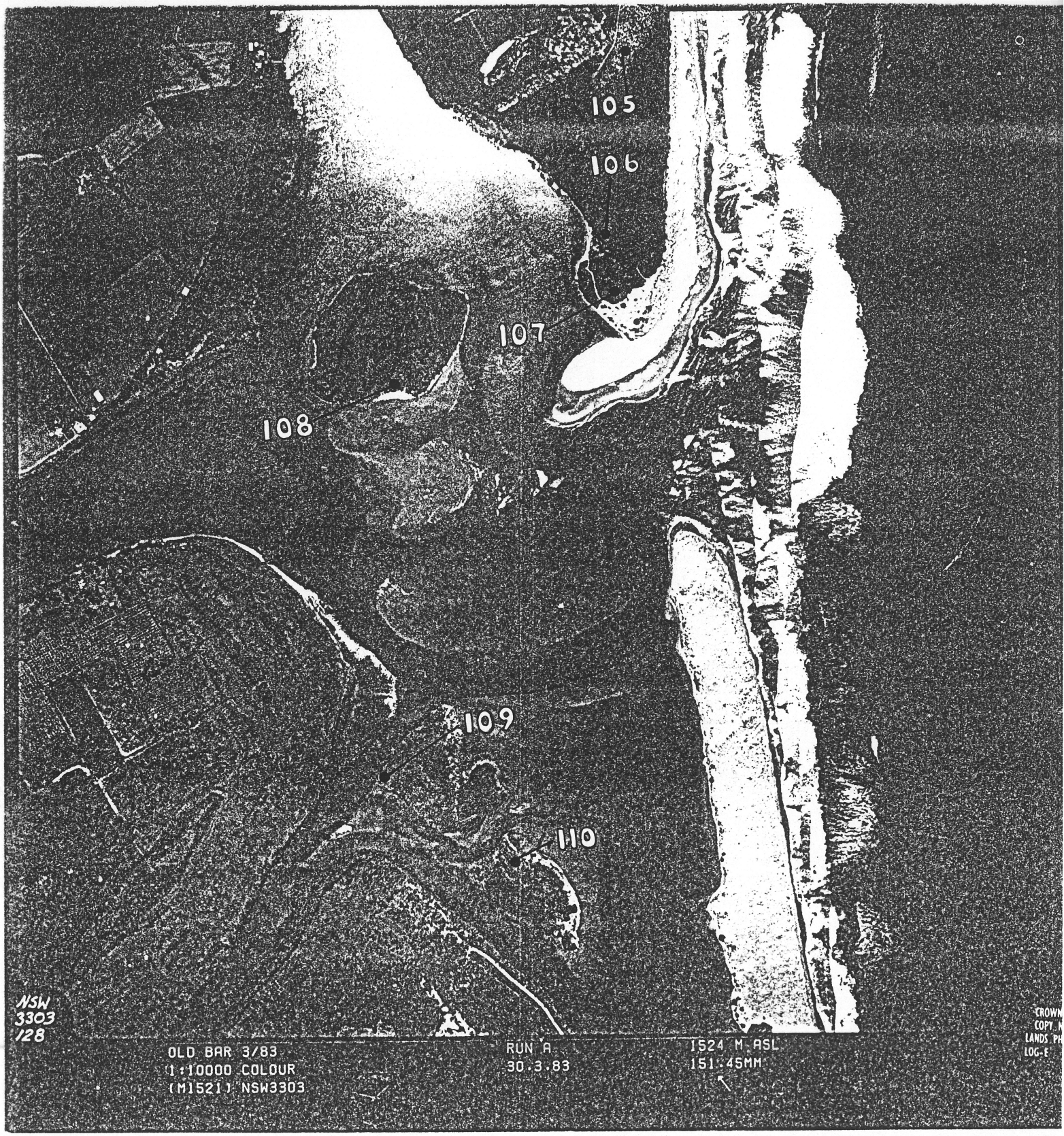
151.45MM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1:10000 COLOUR
(M1521) NSW3303
RUN A
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1524 M ASL
151.45MM
CROWN
COPY
LANDS PH
LOG-E


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NSW
3303
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OLD BAR 3/83
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(M152I) NSW3303
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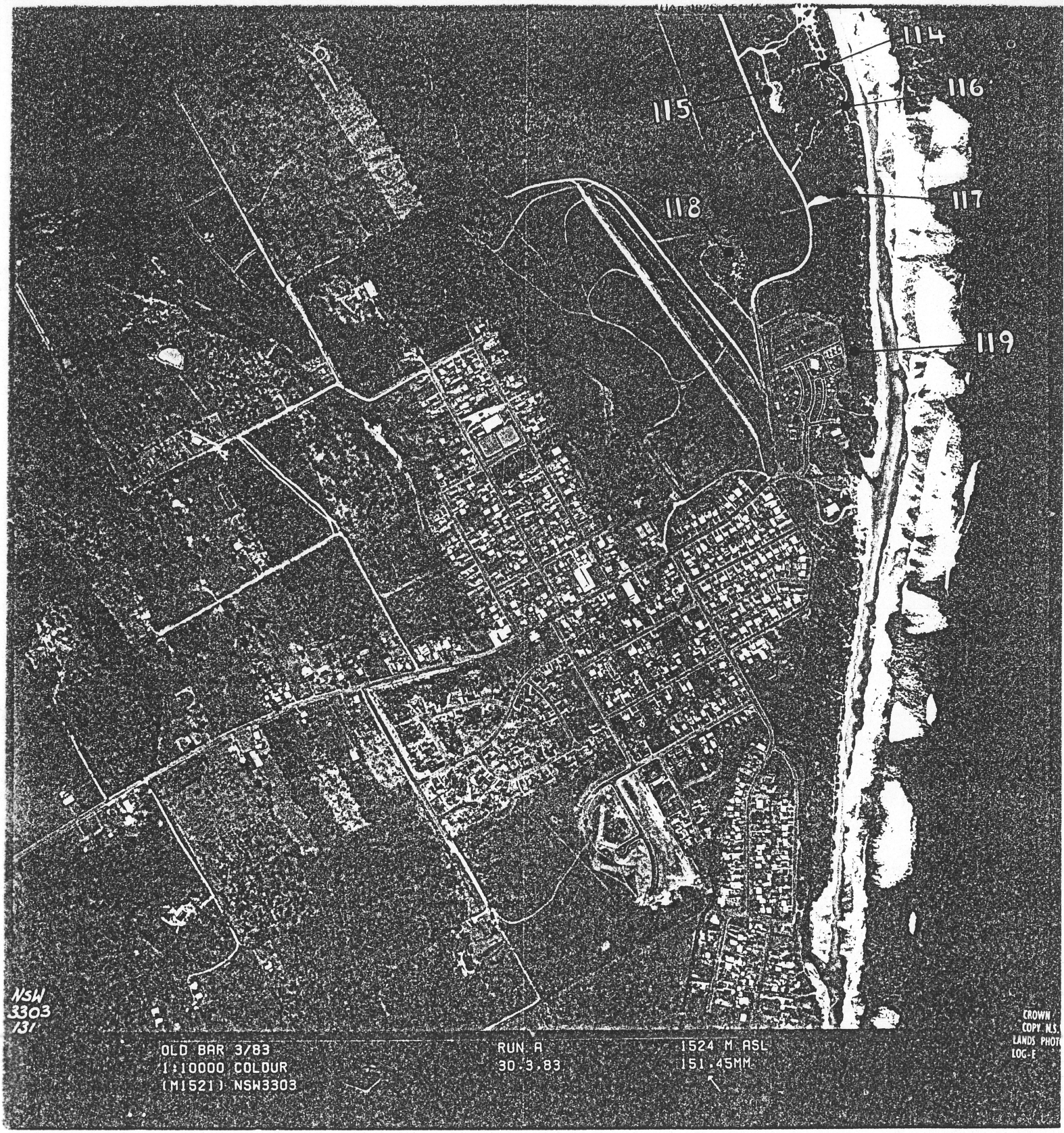
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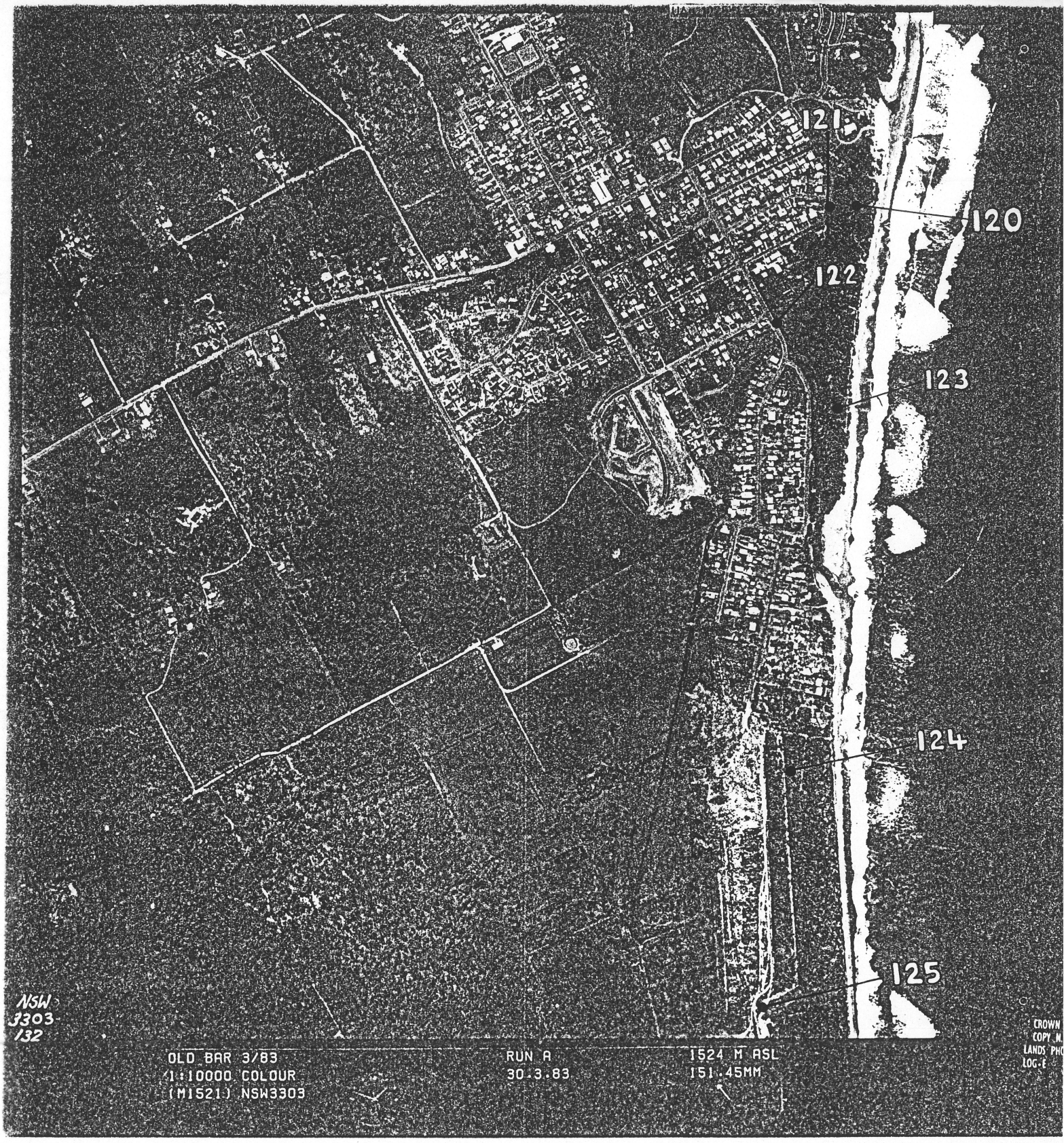
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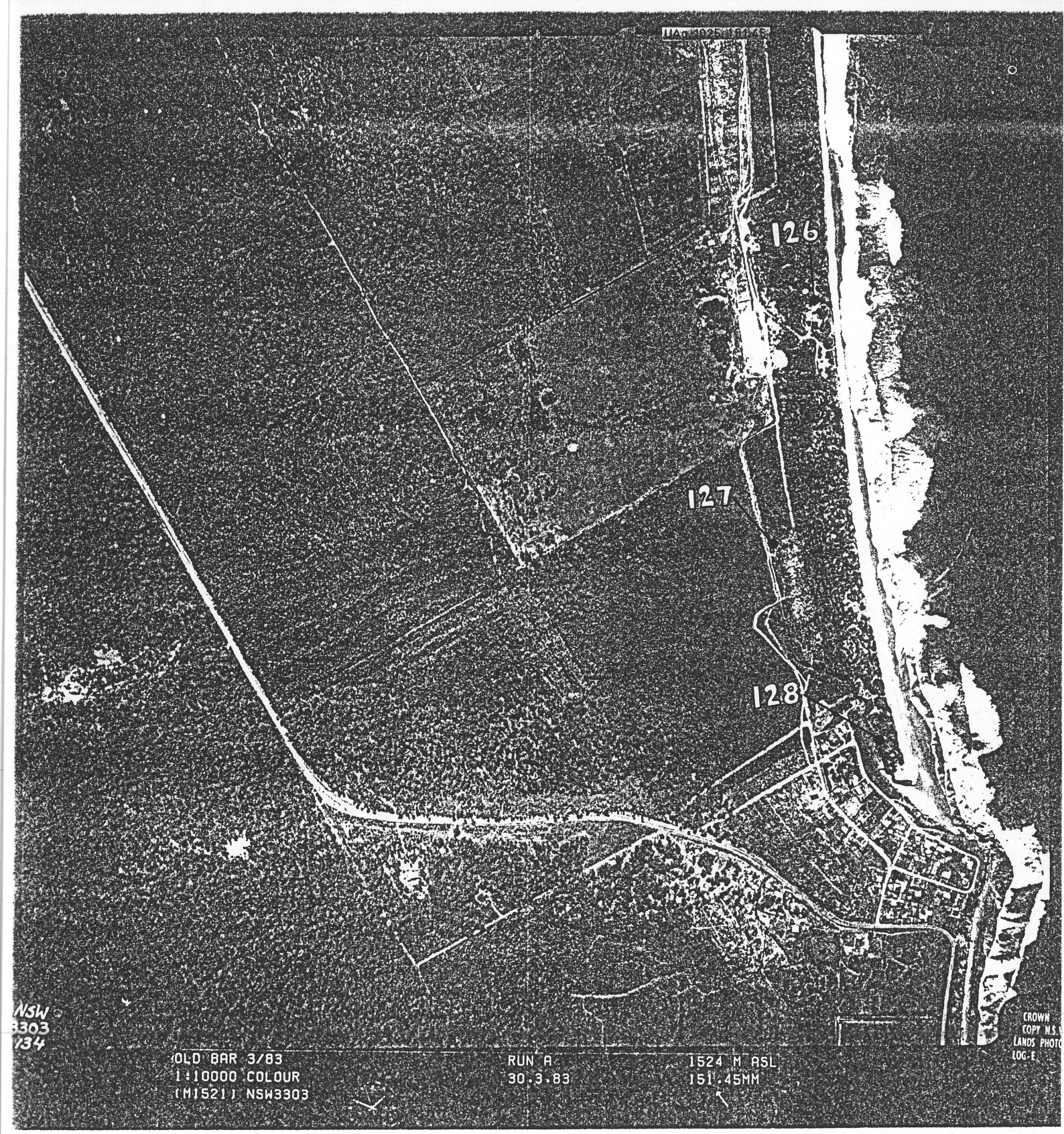
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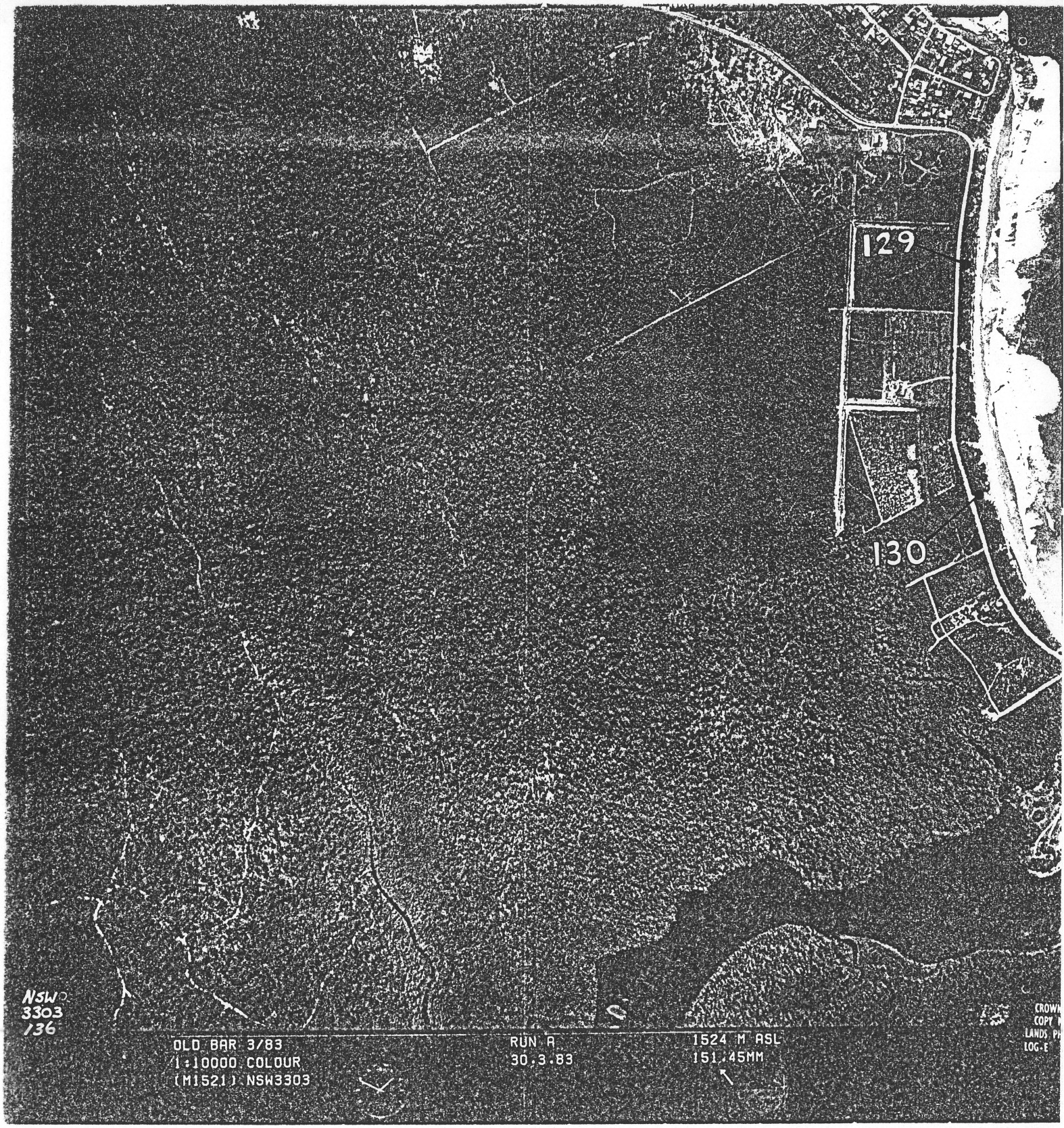
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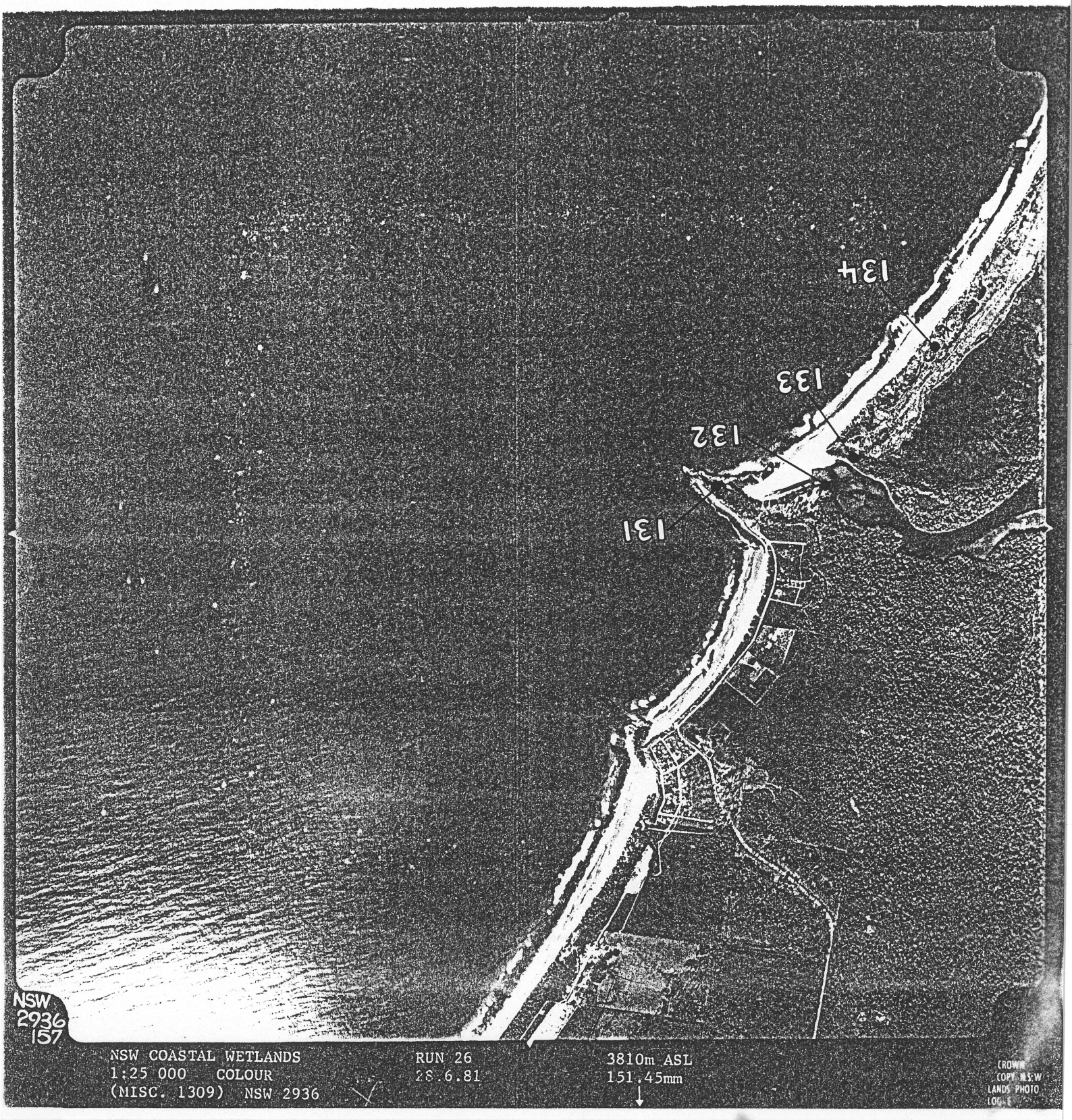
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3810m ASL
151.45mm
CROWN
COPY. N.S.W.
LANDS PHOTO



NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936

RUN 27
13.6.81

3810m ASL
151.45mm

CROWN
COPY. N.S.W
LANDS PHOTO
LOG-E

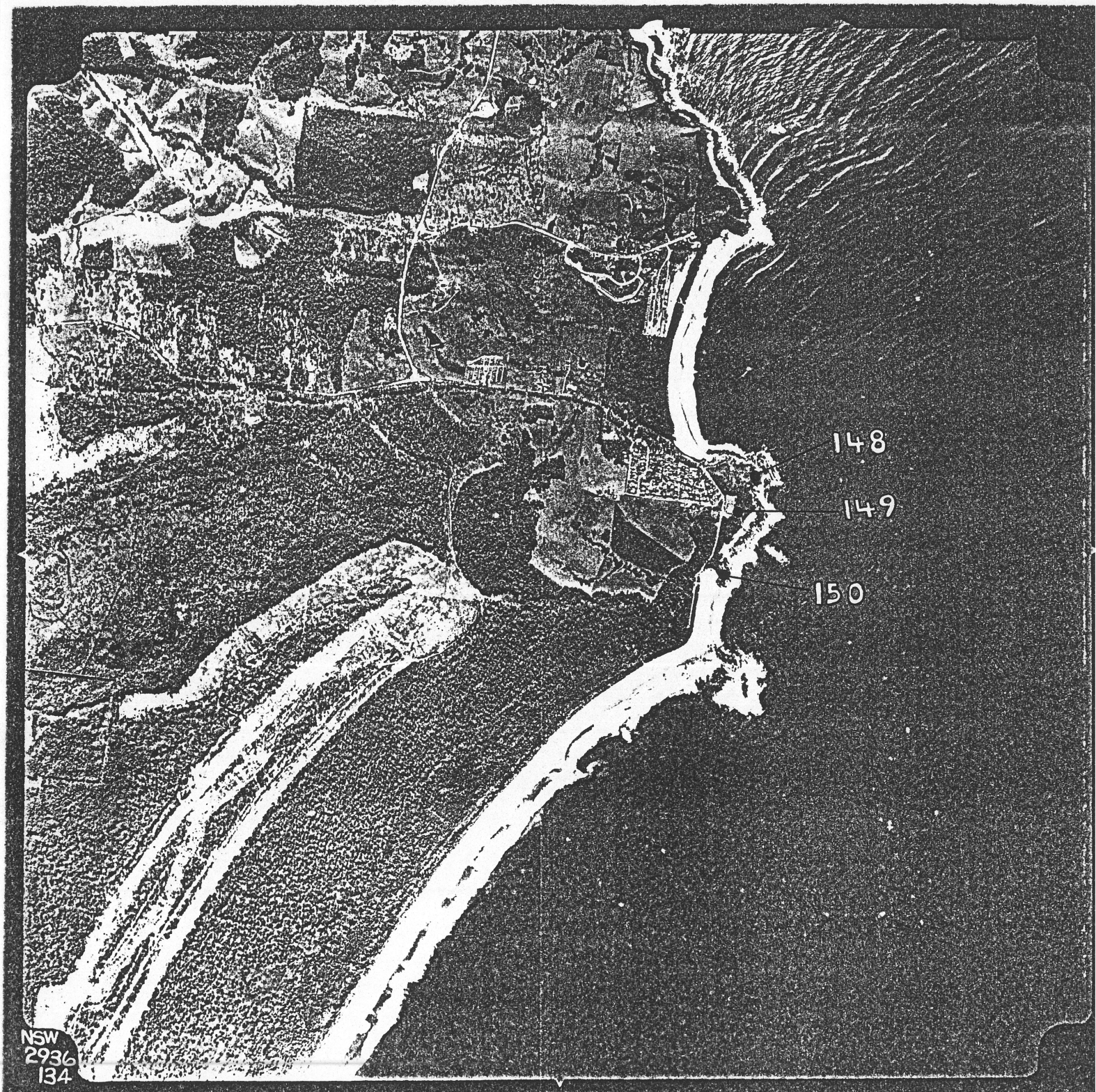


NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936

RUN 27
13.6.81

3810m ASL
151.45mm

CROWN
COPY N.S.W
LANDS PHOTO
LOG-E

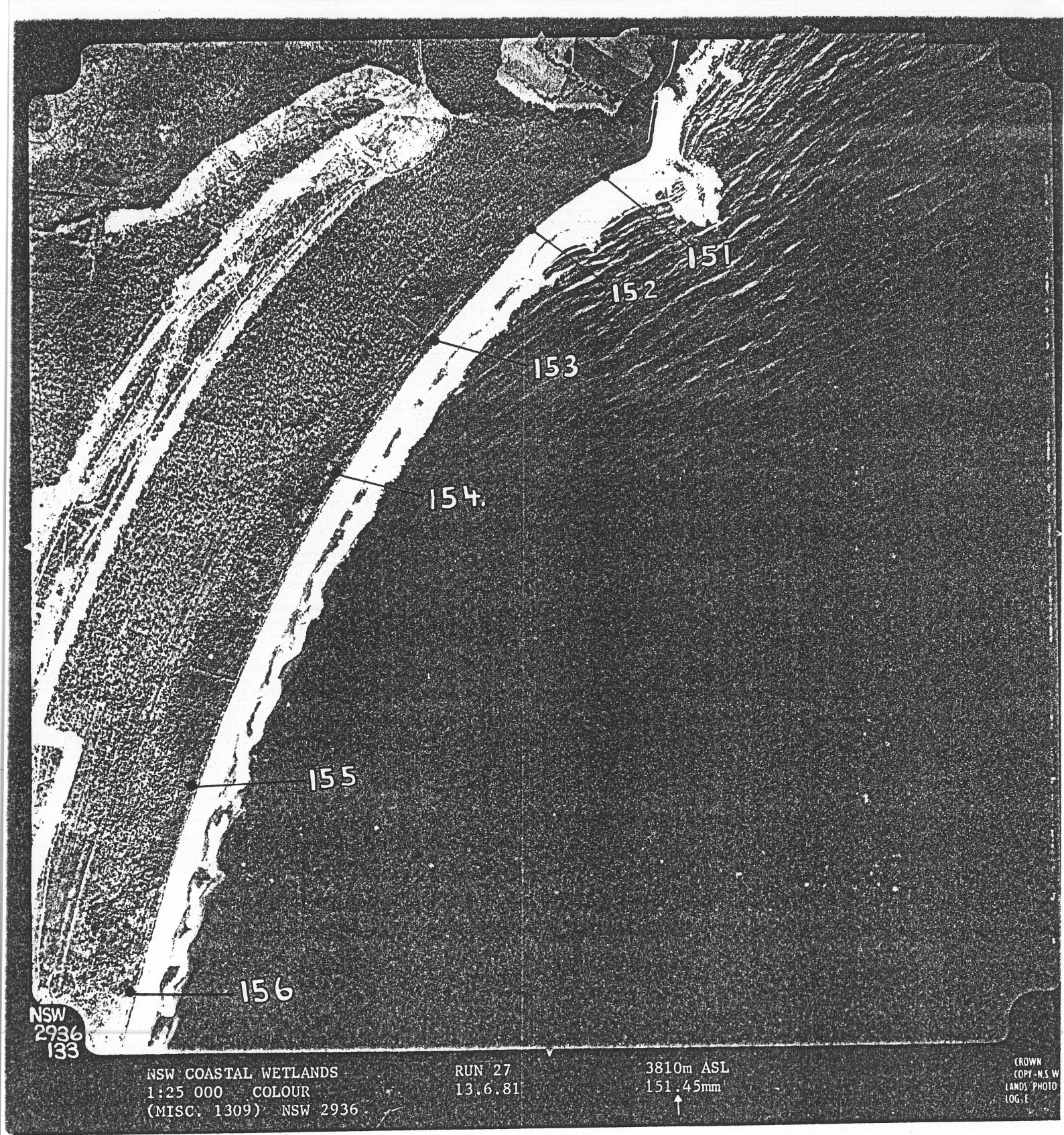


NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936

RUN 27
13.6.81

3810m ASL
151.45mm

CROWN
COPY N S W
LANDS PHOTO
LOG-E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1:25 000 COLOUR
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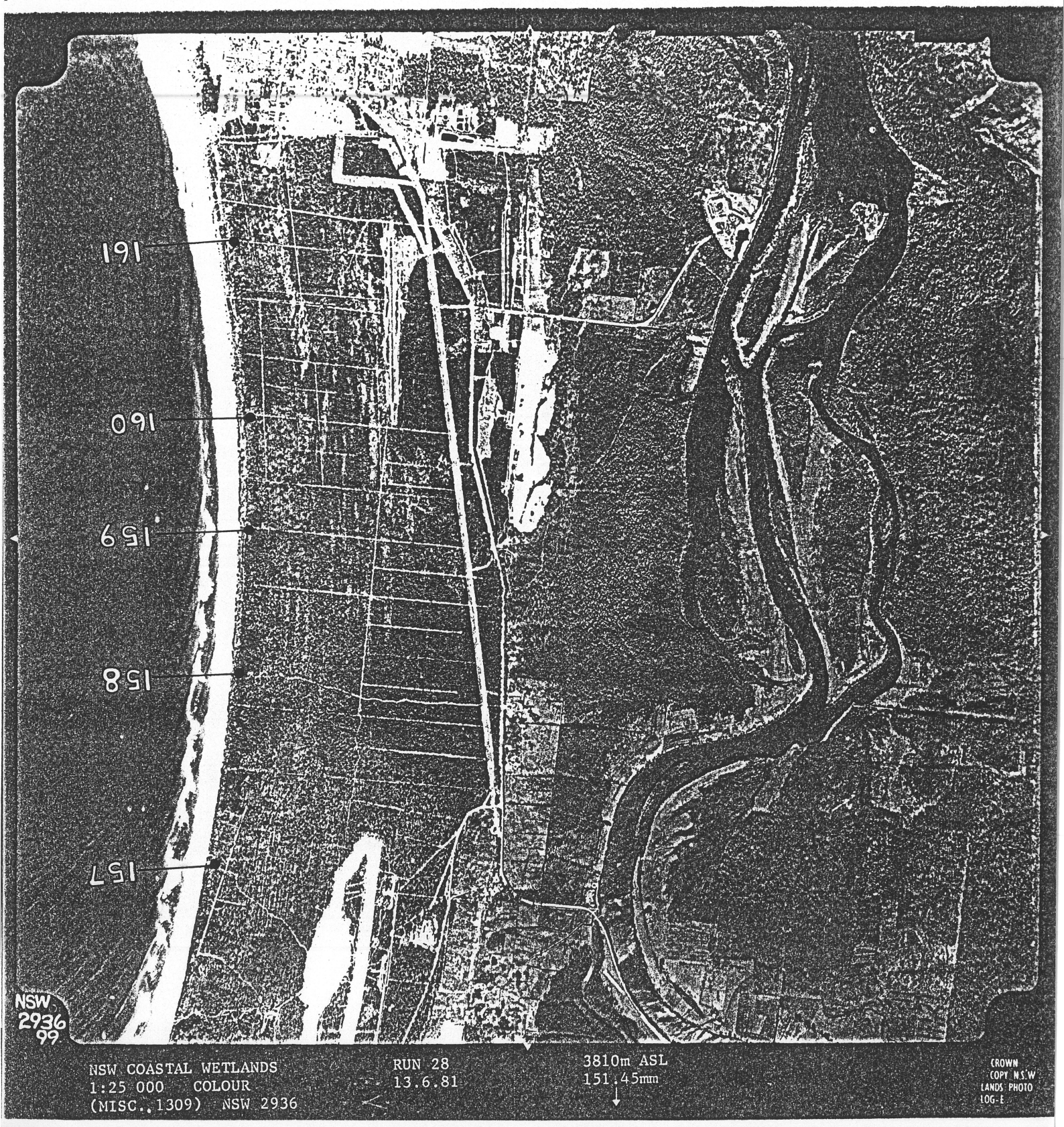
RUN 27
13.6.81
3810m ASL
151.45mm
CROWN
COPY-N.S.W
LANDS PHOTO
LOG.E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(MISC.,1309) NSW 2936
RUN 28
13.6.81
3810m ASL
151.45mm
CROWN
COPY N.S.W
LANDS PHOTO
LOG-E



NSW
2936
101

NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936

RUN 28
13.6.81

3810m ASL
151.45mm

CROWN
COPY N.S.W
LANDS PHOTO
LOG-E



NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936

RUN 27
13.6.81

3810m ASL
151-45mm

CROWN
COPY. N.S.W
LANDS PHOTO
LOG-E

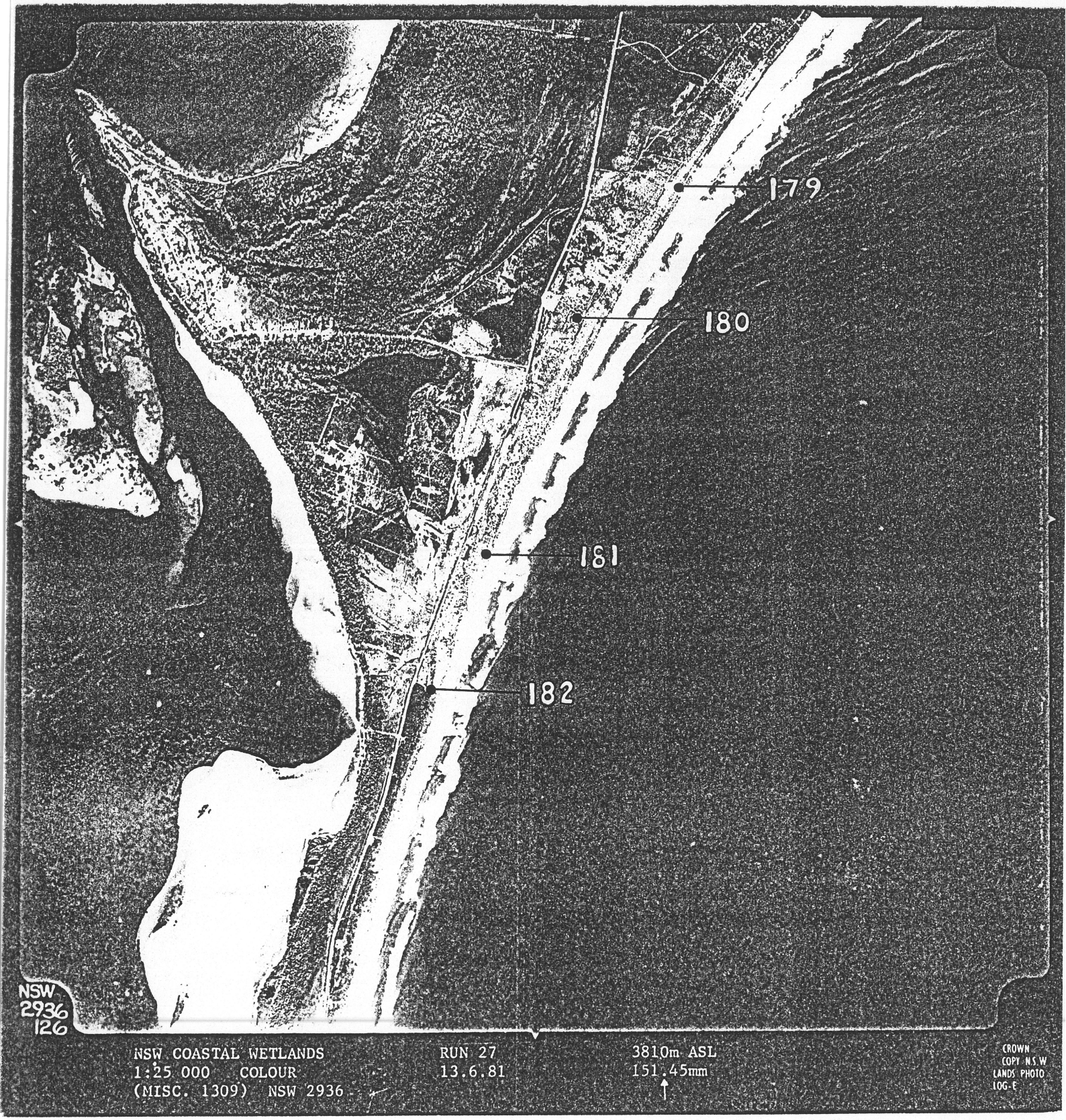


NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936

RUN 27
13.6.81

3810m ASL
151.45mm

CROWN
COPY N.S.W.
LANDS PHOTO
LOG-E



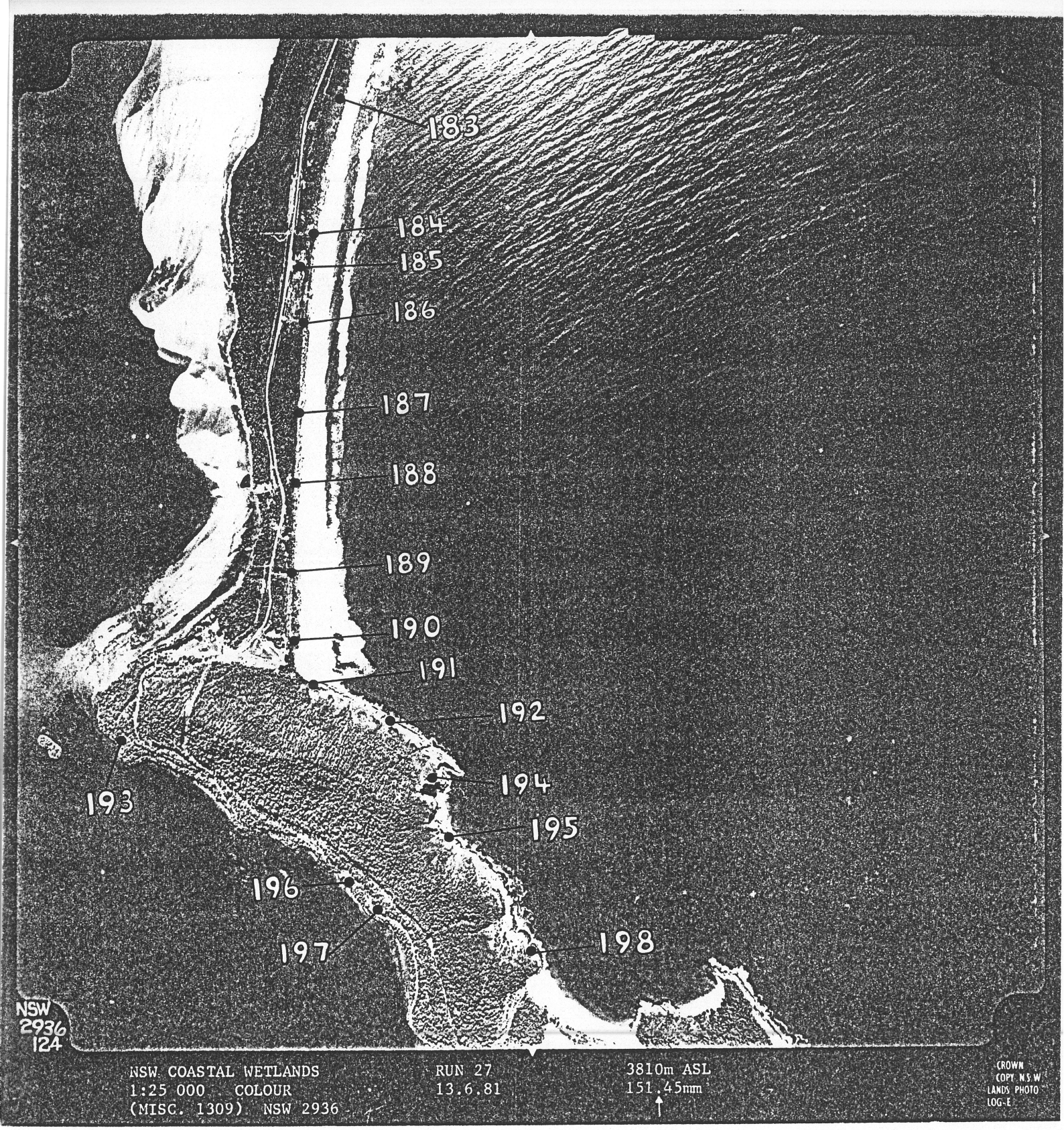
NSW
2936
126

NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936

RUN 27
13.6.81

3810m ASL
151.45mm

CROWN
COPY N.S.W
LANDS PHOTO
LOG-E



NSW COASTAL WETLANDS
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(MISC. 1309) NSW 2936

RUN 27
13.6.81

3810m ASL
151.45mm

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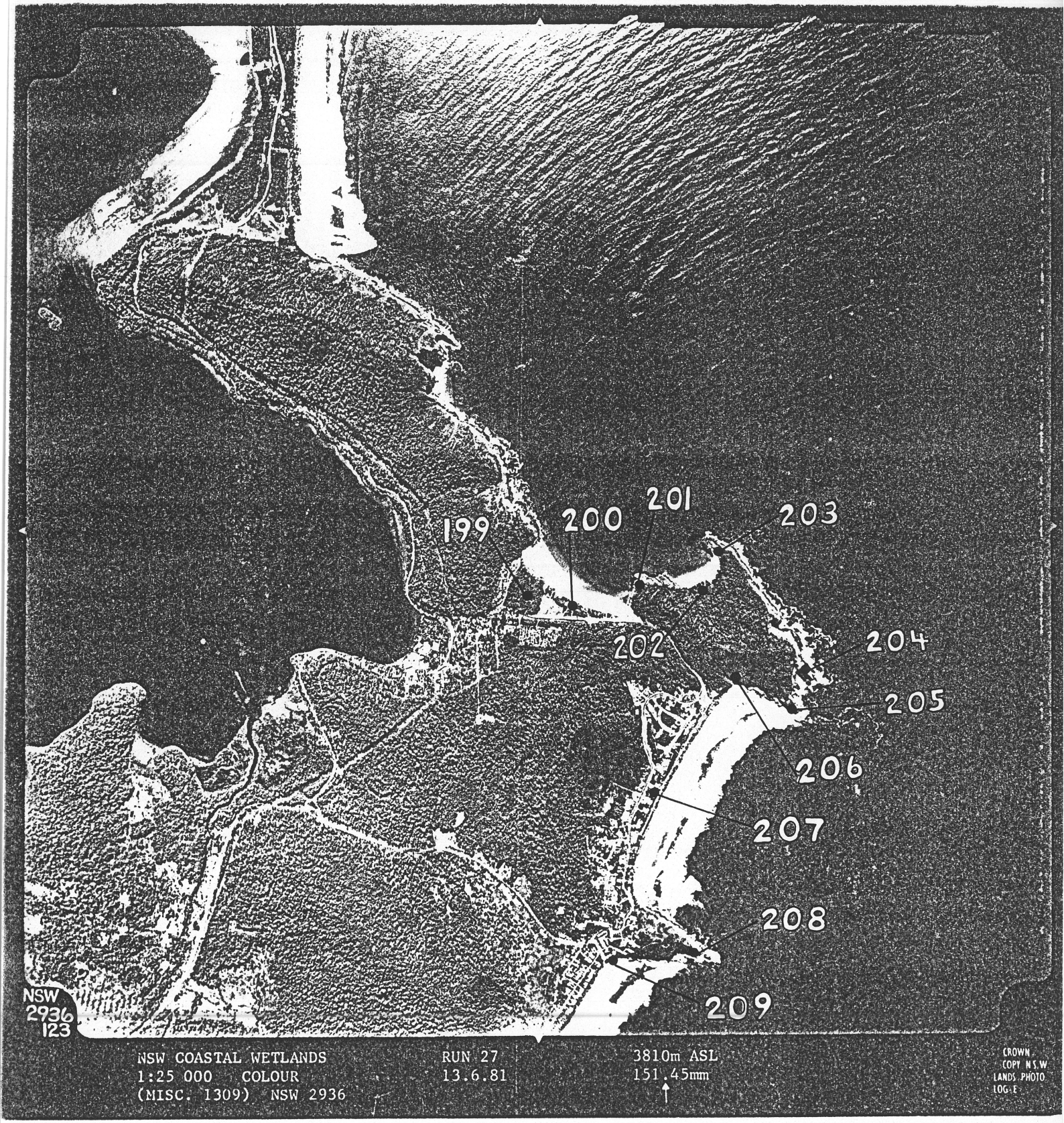

NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936

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13.6.81

3810m ASL
151.45mm

CROWN
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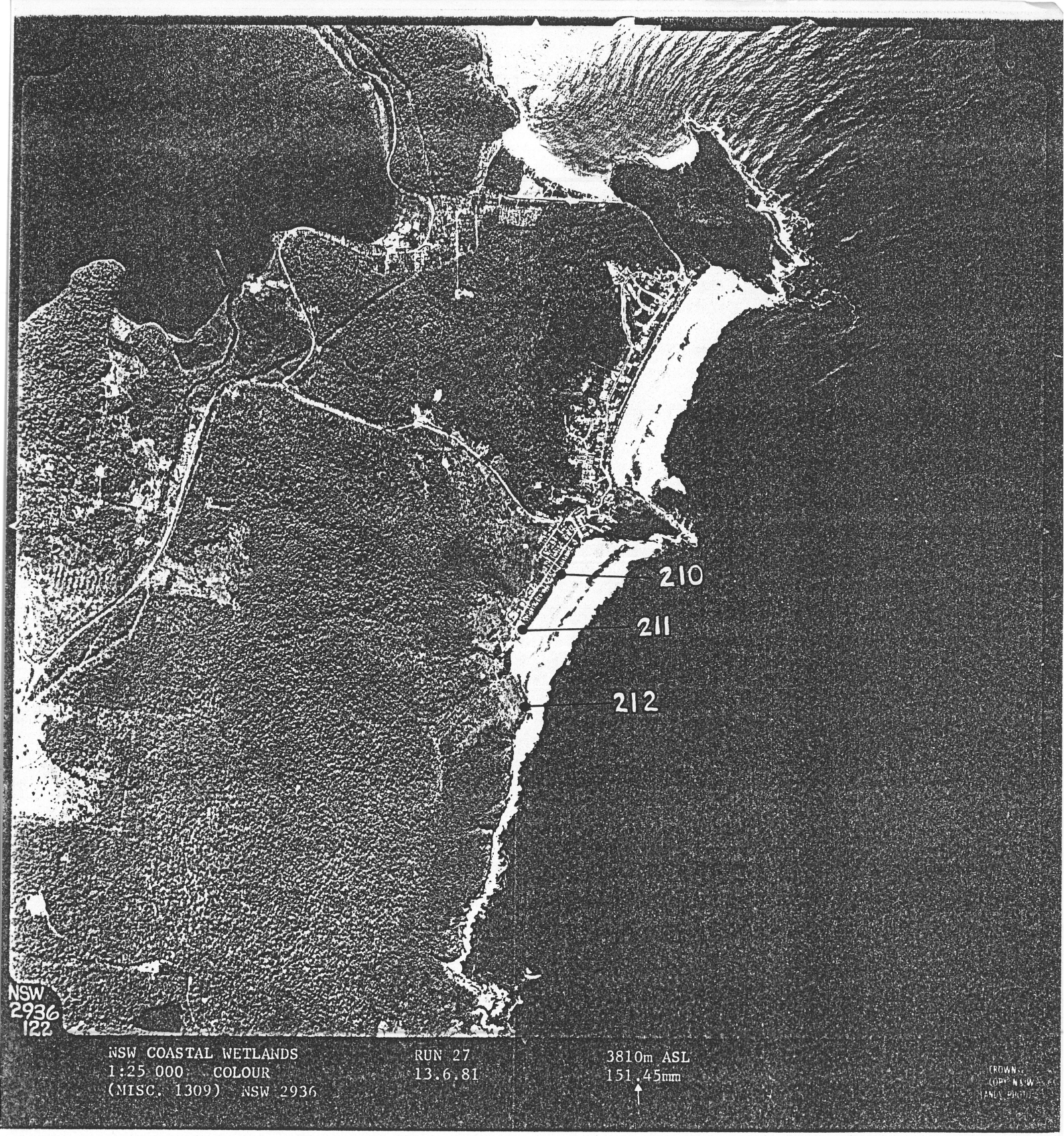
210
211
212
NSW
2936
122
NSW COASTAL WETLANDS
1:25 000 COLOUR
(MISC. 1309) NSW 2936
RUN 27
13.6.81
3810m ASL
151.45mm



NSW COASTAL WETLANDS
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NSW COASTAL WETLANDS
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(MISC. 1309) NSW 2936
RUN 28
13.6.81
3810m ASL
151.45mm
CROWN COPY. N.S.W LANDS PHOTO LOG-E
NSW 2936 III
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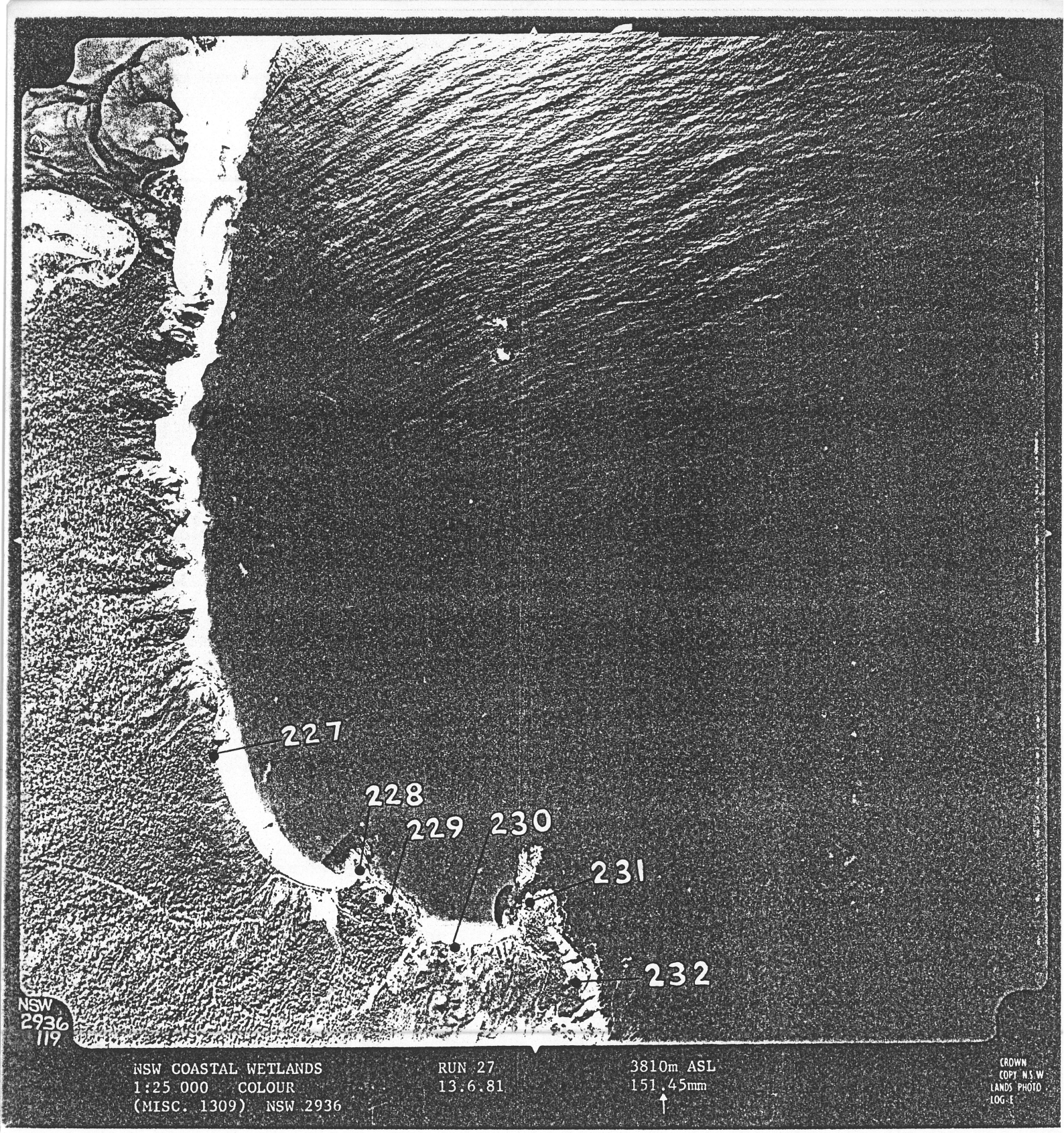

NSW COASTAL WETLANDS
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(MISC. 1309) NSW 2936

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