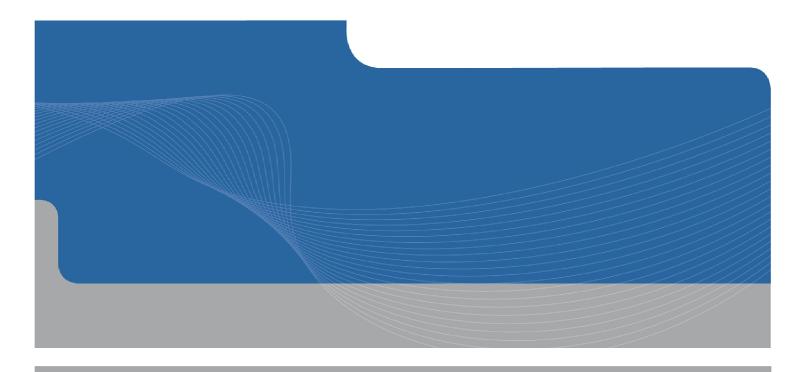


Thakral Holdings Limited

Pacific Bay Western Lands
Remedial Action Plan
March 2009



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Soil and Water Management Plan

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E Calculations

1. Introduction

Coffs Harbour City Council (CHCC) has provided a response to the Draft Planning Studies for Pacific Bay Western Lands (Pacific Bay), Korora Project. This includes the reports by Holmes & Holmes that assessed soil contamination issues. According to the Holmes & Holmes assessments, it has been determined that there is soil contamination that needs to be addressed on Lot 5 DP 820652 (soil contamination at the other lots was not considered to be an issue). The report provided by Holmes & Holmes P/L contained a remediation strategy which was supported by CHCC, however, it was determined by CHCC that additional detail is required to satisfy guideline requirements in terms of the environmental management of the site, validation sampling and reporting.

This remediation action plan (RAP) is an addendum to the remediation strategy proposed by Holmes & Holmes that provides a description of the remediation program, and the procedures and standards which will be followed during the course of the project to protect the environment and human health.

1.1 Objectives

The primary objectives of the site remediation program are:

- To remediate the specified areas of the site to a condition suitable for the proposed residential use of the land:
- ▶ To remove unacceptable risk to human health and/or the environment associated with contaminated material in these areas, based on the proposed site use;
- To identify and obtain necessary approvals or licences from regulatory authorities for handling and disposal of material as required by the selected remediation strategy; and
- ▶ To ensure the protection of the remediation workforce, surrounding community and the environment throughout the remediation works.

1.2 Scope of Remediation and Responsibilities

The general scope of work, as further described in this RAP will comprise the following activities:

- Remediation works: to be undertaken by the Owner (Pacific Bay);
- Supervision and validation of remediation works: by the Environmental Consultant; and
- Documentation of the remedial works and validation: by the Environmental Consultant.



2. Site Location and Description

The property is described as Lot 1 DP 592173, Lot 2 DP 226560, Lot 23 DP 716144, and Lot 5 DP 820652. It is located at Map Reference 514 N 123 E, on the 1:25,000 Coffs Harbour Topographical Map, and is situated 6 km north of Coffs Harbour CBD (Figure 1, Appendix A).

The property extends between Bruxner Park Road, Pacific Highway and West Korora Road with an approximate area of 24.5 ha. A ridge of high ground runs east-west through the northern half of the site with Jordans Creek, parallel to West Korora Road running along inside the southern boundary.

Most of the land has been cleared and is now pasture after being formerly used for bananas and small cropping. In the south west corner and along the creek there is an area of about 4 ha which has not been cleared for agricultural purposes.

Most of the land has slopes of less than 20% but the southern side of the ridge line drops steeply at first, with slopes of up to 35%. The lower flatter slopes to Jordans Creek may potentially have a high water table in wet periods.

2

3. Proposed Development

The central theme of the design concept is to integrate the new development with existing recreational and landscape features on the site. A clear urban structure is defined, linking the development to surrounding green space and the coastline beyond.

The proposed concept is a residential community comprising approximately 200 dwellings which utilise the existing recreational and landscape features of the site. These are linked with a network of landscaped streets, pedestrian pathways and view corridors. There is no development proposed for the areas of the site zoned 7A Habitat and Catchment. These areas will be cleaned up and the vegetation allowed to regenerate. A clear urban structure will be defined, linking the development to surrounding green space and the coastline beyond. Salient features of the proposal include:

- A network of landscaped streets and pedestrian pathways, utilising site topography and aspect;
- Creation of view corridors to coastline and surrounding vistas;
- Utilisation of existing recreational space on site, linked to focal green spaces within the development.

The preliminary development concept is shown in Appendix B.

The proposed development concept provides for a mix of low and medium density dwellings. The low density development comprises single detached dwellings on lots starting in size from 450m^2 . The medium density development will comprise townhouses and up to 3 story residential apartments. It is also envisaged that some lots will include and back onto the vegetated areas of the site.

The proposed road network aims to respect the existing topography of the site by following the general contours, which will also help to emphasize the integration of the development into the surrounding landscape and provide positive visual impacts for the development when viewed from surrounding areas.



4. Assessment Criteria

4.1 Relevant Assessment Guidelines

The NSW Environmental Protection Agency (NSW EPA) now known as the NSW Department of Environment and Climate Change (NSW DECC) released the *Guidelines for Assessing Banana Plantation Sites* (EPA, 1997), to assist in the assessment of former banana plantations. The guidelines provide methodology for site assessment, remediation and validation as well as contaminant threshold concentrations for the primary contaminants found on banana lands.

Additionally, pursuant to CHCC requirements, matrix soil sampling must be undertaken on all land located within the CHCC Local Government Area with a history of banana growing, prior to any dwelling approval. Also, the CHCC Korora Rural Residential Development Control Plan 2004 (DCP) infers that a minimum 1,500 m² building envelope on each created lot must be assessed and remediated (if required) for contaminants associated with former banana plantation sites.

The guidelines used to assess the soil contamination status of the site and remediation options included:

- National Environmental Protection Council (NEPC) (1999) National Environmental Protection (Assessment of Site Contamination) Measure 1999, (NEPM, 1999);
- ▶ NSW Environmental Protection Agency (1995): Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land, (NSW EPA, 1995);
- NSW EPA (1997): Guidelines for Assessing Banana Plantation Sites, (NSW EPA, 1997); and
- Australian and New Zealand Environment and Conservation Council (1992). Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC/NHMRC, 1992).

4.1.1 Soil Investigation Thresholds

The NEPM includes a range of Soil Investigation Levels including Ecological Investigation Levels (EILs) and Health Investigation Levels (HILs). Essentially both EILs and HILs are default values designed to protect the environmental and human receptors respectively.

The NSW EPA (1997) *Guidelines for Assessing Banana Plantation Sites* lists human health investigation thresholds for the primary contaminants found in banana lands. The EILs and HILs for the most likely potential contaminants of concern for the site are shown in Table 1 below.

Table 4-1 Assessment Criteria

Potential	Ecological Investigation	Human Health Investigation
Contaminants	Levels ¹	Thresholds ²
Arsenic	20	100

All units in mg/kg dry weight

- Provisional phytotoxicity-based investigation levels from Guidelines for the NSW Auditor Scheme or equivalent NEPM Schedule B(1) EILs.
- 2. EPA (1997) Threshold Concentrations

The most relevant criteria, in regards to the remediation detailed in this report, is the HIL for arsenic. The HIL values will therefore be used to determine if the site is suitable for the proposed residential purposes. The EIL's have been provided for comparison purposes only.



5. Regulatory Requirements

5.1 Preparation of RAP

This RAP has been prepared with consideration of relevant guidelines and policy, as listed below. Brief discussions of particularly relevant aspects of these guidelines, Acts and regulations are provided in the following sections.

The Owner shall be responsible for ensuring the remediation works are carried out in accordance with these guidelines and policies.

5.1.1 Remediation Notification

The remediation is considered to be category 2, under Clause 14 of SEPP 55 – Remediation of Land, by reason of not being category 1. None of the issues, which would make the remediation category 1 under Clause 9 of SEPP 55, are known to apply to the site. As required by SEPP 55, CHCC should be notified at least 30 days prior to the commencement of remediation.

CHCC should also be notified within 30 days of completion of the remediation works.

5.1.2 Coffs Harbour City Council Requirements

CHCC representatives have indicated to GHD that they have no official Remediation Policy, other than the remediation of lands be carried out in accordance with NSW EPA guidelines, and other relevant NSW State legislation.

5.1.3 Protection Of The Environment Operations Act 1997

Schedule 1 of the POEO Act lists activities that are required to be EPA licensed. The scale of the proposed remediation works is less than that which would require licensing.

The Owner shall be responsible for ensuring the remediation works are carried out in accordance with regulatory requirements such as those arising under the POEO Act 1997.

5.1.4 Waste Classification Guidelines 2008

On 28th April 2008, DECC replaced the Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes (NSW EPA, 1999) with the Waste Classification Guidelines (DECC, 2008).

The Owner shall be responsible for ensuring that all waste generated and disposed of off site is undertaken in accordance with the Waste Classification Guidelines (2008).

5.1.5 Protection of the Environment (Waste) Regulations

The regulations define a "non-licensed waste activity" as an activity that is carried on for business or other commercial purposes, and involves the generating or storage of industrial waste, and is not licensed under the Act.

Sections 16 & 17 of the waste regulations apply to non-licensed waste activities and transporting.

- 1. Generally, these activities must comply with the following environment protection standards to ensure they do not harm the environment:
- 2. The waste must be stored in an environmentally safe manner.
- 3. The waste generator has transport documentation requirements, unless an "authorised contractor" is used to transport the waste from the premises.
- 4. If the waste is transported from the premises, the waste generator must ensure that the waste is transported:
 - to a waste facility that is licensed under the Act; or
 - to a person carrying on mobile waste processing that is licensed under the Act; or
 - to a place that can otherwise lawfully be used as a waste facility for that waste.



Contamination Status and Proposed Remediation Strategy

Previous contaminated land assessments have been undertaken for the Pacific Bay project. These reports contain documentation on the results of the contaminated land assessments carried out on the subject site. This information was used to determine a remediation strategy that has since been approved by CHCC with the provision that additional detail is required to satisfy guideline requirements in terms of the environmental management of the site and the required validation sampling and reporting.

Previous contaminated land investigations within the Study Area include:

- Douglas Partners, 1996, Stage 1 Preliminary Site Investigation Pacific Bay Western Lands
- Holmes and Holmes Pty Ltd, 1999, Report on sampling and testing for primary contaminants at Lot 5 DP820652 and Lot 1 DP592173, Bruxner Park Road, Korora
- Holmes and Holmes Pty Ltd, 1999, Report on sampling and testing for primary contaminants at Lot 2 DP226560 West Korora Road, Korora
- Holmes and Holmes Pty Ltd, 1999, Report on sampling and testing for primary contaminants at Lot 23 DP716144 West Korora Road, Korora

A copy of each of these reports is provided in Appendix C.

6.1 Douglas Partners (1996) Stage 1 Preliminary Site Investigation Pacific Bay Western Lands

The Douglas Partners report conducted a Preliminary Site Investigation that included:

- Identifying past and present potentially contaminating activities;
- Report on current site conditions; and
- Provide a preliminary assessment of the site contamination.

Limited soil sampling was conducted in areas where the historical and site visit indicated the highest potential for contamination. These areas were primarily those indicated by the CHCC "Agricultural and Chemical Residue Policy Map for Banana Lands".

The analystical results indicated that one soil sample contained concentrations of arsenic greater than the acceptable criteria for residential development. The report recommends the extent of the metal contamination be further investigated and a remedial action plan be developed.

6.2 Holmes and Holmes Reports

In 1999, Holmes & Holmes completed three assessments of the primary contaminants identified at the subject property, in accordance with the Draft Guidelines for Former Banana Plantation Sites (1992) and the Draft Guidelines for Vertical Mixing of Former Broad-acre Agricultural Land (1994). Lot 5 DP 820652 was found to have arsenic concentrations in the soil that exceeded the NEPM guidelines due to historical banana cultivation. A summary of the results and

recommendations for this site are provided below. None of the other relevant parcels (Lots 1, 2 and 23) were found to contain concentrations of the parameters analysed greater than the relevant guidelines and are therefore not considered further in this report.

There were 12 locations where arsenic residue exceeded the threshold levels and remediation will be required. The maximum arsenic exceedance was 175 ppm.

According to the Holmes & Holmes report, there was one location where copper residue (170 ppm) exceeds the threshold levels (60 ppm). The NEPM Health Investigation Level for copper has been revised to 1000 ppm since this report was published in 1999 so this exceedance is no longer an issue for residential development.

Due to arsenic contamination, Holmes & Holmes recommended vertical mixing to a depth of 350 mm on two sections in the northeastern portion of the property. The areas recommended to be vertically mixed are presented in Figure 2, Appendix A.

At the location of Sample 1065, Composite AQ, the contamination was found at depth and it was considered that vertical mixing would not be able to effectively reduce the arsenic concentrations to below the threshold level. It was proposed that this area of contamination be further delineated. Once a more accurate extent of contamination is known the soil should be removed and encapsulated below roadworks. It was estimated that 300m³ of soil will need to be encapsulated.

Two of the locations that exceeded the arsenic guidelines occur in the road reserve along the western boundary of the property, as shown in Figure 2, Appendix A. To identify remediation requirements, this boundary will have to be located and additional samples taken from within the residential footprint.

6.3 Contingency

If localised areas containing significantly higher concentrations of contamination are discovered during delineation or validation of the site, GHD suggests another means of remediation may be required for these areas.

As a contingency, procedures for excavation and disposal of contaminated soil have been incorporated into the RAP.



7. Remediation Works Procedures

7.1 Introduction

This section provides a general description of remediation procedures required to protect health and safety during the remediation works. It is the responsibility of the Contractor to undertake a risk assessment and implement safe work procedures before commencing work.

7.2 Scope and Extent of Remedial Works

A summary of steps involved to address the contamination issues at the site is provided below.

Preliminary Work:

- Prepare a site specific Occupational Health and Safety (OH&S) Plan;
- Review utility location information for the site; and
- Undertake additional sampling and analysis to delineate contamination adjacent to the road reserve and at the location of Sample 1065.

Notify CHCC

- Submit a notification letter to CHCC of remediation work proposed for the site;

Site Establishment:

- Ensure site access is restricted;
- Provide site safety; and
- Provide environmental controls (including installation of run-off control) where necessary and in accordance with the site specific Soil and Water Management Plan.

Remediation and Validation Sampling:

- Clearly mark out the nominated remediation areas;
- Complete remediation and validation sampling as described below; and
- Validate in accordance with Section 10.
- **Demobilisation:** Remove site access controls.

Validation Reporting:

 Report on remediation methods/procedures, QA/QC testing and validation sampling of remediated area, as outlined in Section 10 below.

7.3 Site Mobilisation

7.3.1 Site Security

The Contractor shall ensure that the designated work area (remediation zone) remains adequately controlled to prevent unauthorised persons from accessing the area and subsequently gaining direct access to the remediation zone, or to areas of operating machinery.

7.3.2 Site Entry/Exit

Access to the remediation works areas will be strictly controlled and all access points will be subject to prior written approval by the Contractor.

The site entry will be controlled in a manner that will prevent unauthorised personnel/vehicles entering the designated remediation area. All on-site workers will be required to complete a site safety induction and consequently sign the site Health and Safety Plan prior to commencement of the project. Authorised vehicle movements into and out of the designated remediation area will be controlled to prevent migration of contaminated soil.

7.3.3 Plant Use

All equipment activities undertaken during the remediation operation will be carried out according to appropriate practices in order to prevent fuel and waste oil spillage, and ensure all vehicles leaving the site are free of any contaminated material, which may potentially pollute roads etc. Any fuel spillage will be cleaned up immediately by removing stained soils, which must be stored and characterised for appropriate disposal. No re-fuelling or maintenance activities shall be undertaken on-site.

7.4 Contamination Delineation

Holmes & Holmes recommended that the contamination at the location of Sample 1065, and the road reserve be further delineated prior to remediation works proceed.

Soil samples will be collected from around each hotspot location to identify the vertical and lateral extent of impacts. Samples will be collected with a hand auger to a maximum depth of 0.5 m. Samples will be collected from representative undisturbed soils and should generally include 150mm, 300mm and 500mm.

All soil sampling equipment will be decontaminated between sample collection and new disposable gloves will be used for the collection of each soil sample.

Duplicate samples (including blind and split duplicates) will be collected for Quality Control purposes at a rate of 1 in 10 samples. Duplicates will be collected sequentially from the sample location.

Collected soil samples will be immediately transferred to sample containers of appropriate composition which have been pre-treated in a manner appropriate for the laboratory analysis. All sample containers will be labelled with a sample number, sample location, sample depth and sample date. The sample containers will then be transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form will be completed and forwarded with the samples to the testing laboratory.

Soils penetrated during the investigation will be described in accordance with the Unified Soil Classification system, with features such as seepage, decolourisation, staining, odours and other indications of contamination being noted. This information was recorded on the field sheets, completed for the sampling locations.

Samples collected will be analysed for arsenic. Assessment of results will be undertaken in accordance with Section 4 of this RAP.



7.5 Vertical Mixing

7.5.1 Extent of Works

According to Holmes & Holmes, vertical mixing to a depth of at least 350 mm is necessary to reduce the arsenic concentrations to acceptable levels for residential zoning.

Based on trials described in EPA (1995b), suggested methods for vertical mixing include:

- Dozer ripping, with wing tine only (6 passes);
- Dozer ripping with wing tine (2 passes), and mixing with a road stabiliser (3 passes)
 (homogeneous mixing using the rotary hoeing principle); and
- Dozer ripping with standard tine (2 passes), followed by blade mixing (1 pass).

The above list is not exhaustive and other machinery may give equivalent or better vertical mixing results. It should also be noted that the vertical mixing process might need to be repeated to ensure that the mixing is effective and that clean-up goals are attained.

7.6 Excavation

7.6.1 Bulk Excavation Works

The bulk excavation of contaminated soil at Sample 1065 will include the following steps:

- 1. Excavate contaminated soil layer;
- 2. Stockpile excavated soil for characterisation sampling, in order to confirm waste classification in accordance with *Waste Classification Guidelines* (DECC, 2008);
- 3. Transport contaminated material by appropriately licensed waste transporter to an area to be encapsulated below roadworks;
- 4. Validate base of excavations; and
- 5. Reinstate excavation in accordance with requirements for the proposed land use.

7.6.2 Method of Excavation

The relatively shallow position and generally level area will allow an excavator or backhoe to be used for all excavation operations. A "mud bucket" or smooth edged bucket will be used to allow precise excavation of particular strata.

All excavations undertaken within the contaminated zone will be conducted under supervision of an environmental consultant to ensure all contamination is removed and objectives of the RAP are fulfilled. The Environmental Consultant will undertake visual inspection and sampling on completion of the excavations to validate the remediation.

7.6.3 Excavation Procedure

The following sequence of steps should be followed prior to commencing any excavation operations:

1. The Environmental Consultant will brief the plant operator in the field on the following:

- the boundaries of the area to be excavated;
- the expected depth of excavation;
- the manner in which materials are to be excavated and stockpiled; and
- the area where stockpiling of imported fill material can take place.
- 2. Prior to the commencement of excavations in the given area, the contractor shall construct surface run-off protection measures around the immediate area of the excavation in order to prevent surface waters running into or out of the excavation. Further details on surface water controls around excavations are given in Section 8.
- 3. The contractor shall ensure that at all times the sides of the excavation are stable.
- 4. The contractor shall undertake all excavation works in a manner that will minimise the mixing of different material types, i.e. contaminated soil and relatively "clean" material.
- 5. Removal of any in-ground or underground structures should be undertaken in conjunction with, or following excavation of contaminated soil, to avoid potentially mixing of contaminated and uncontaminated areas. Removal of these structures may reveal additional areas of contamination requiring remediation.
- 6. Based on the known hydrogeological characteristics of the site it is not expected that ground water will be encountered. If perched water is encountered the contractor will allow it to naturally drain to a sump located at one corner of the excavation. Samples will be collected from the water within the sump and analysed prior to disposal, with the disposal route being dependent on the concentration of contaminants in the water.
- 7. Upon completion of the excavation the contractor shall ensure that plant and equipment is cleaned and decontaminated.

7.6.4 Validation

The validation sampling protocol for the remedial work is detailed in Section 10.

7.7 Backfill Requirements (Contingency - If required)

On completion and subsequent validation approval, the excavation will be backfilled with validated fill material. Validation requirements for fill are detailed in Section 10.

7.8 Material Tracking Control

A critical aspect of remediation operations is the manner by which materials are controlled throughout all stages of the works.

The following tracking control requirements for each stage shall be implemented to ensure all materials are accounted for:

1. Excavation

- The area to be excavated shall be clearly delineated.
- Qualified supervision shall be used during excavation to ensure that all contaminated materials are removed.
- The final extent of excavation shall be measured and recorded.



2. Stockpiling/Backfilling

 All stockpiling and backfilling operations during the remediation operation will be minimised. Material will only be moved from one location to another when expressly approved by the Environmental Consultant. All such movements shall be clearly documented.

3. Transport

 Transport of contaminated material from the site will be controlled by the system described below.

7.9 Transport Of Material (Contingency – if required)

Transportation of contaminated material shall be undertaken in accordance with the following procedures:

Wastes shall only be removed for off-site treatment or disposal after the material has been classified and written approval has been received for the disposal of the contaminated soil at the nominated treatment or disposal site.

- 1. Waste tracking shall be undertaken in accordance with DECC requirements.
- 2. The Environmental Consultant shall issue an instruction to the contractor to remove the material to the approved destination. The contractor shall record each load of contaminated material leaving the site.
- 3. A copy of the waste depot's weight-bridge docket (and corresponding EPA docket if relevant) for each load delivered shall be given by the contractor to the Environmental Consultant within 2 days of the load being removed from the site. This will ensure material tracking can be maintained.
- All trucks shall have the load securely covered by a tarpaulin with nominal overhang of 200 mm.
- 5. Any vehicles used to transport contaminated materials from the site shall meet NSW EPA licensing requirements for the waste transported.
- 6. All trucks carrying contaminated materials off-site shall have the exterior of the vehicle, including wheels, thoroughly cleaned down by the Owner after it has received its load and prior to the vehicle leaving the site. Only vehicles which have clean exterior bodywork and which will not pollute the off-site transportation corridors shall be permitted to leave the site.
- 7. Excavation and loading out of contaminated material shall allow sufficient time to transport and dispose of this material to the approved treatment or disposal facility on the same day. Contaminated material shall not be permitted to remain in vehicles outside of the working hours designated in Section 8.2, unless it is secured on the site or at the approved disposal facility.

7.10 Remediation Contingency Plan

The site has been investigated for contamination as detailed in Section 6, however, a degree of uncertainty is inherent in any site contamination investigation.

A contingency plan to be followed in the event of unexpected situations is required. The Contractor will be required to follow the contingency plan if unexpected situations are encountered. The following outlines some of the unexpected situations that may arise:

- A higher degree of soil contamination (hotspots) may be encountered than is presently anticipated;
- Contaminants in addition to the type already identified on-site may be encountered;
- ▶ Contaminated material in addition to the type already identified on-site may fail the *Waste Classification Guidelines* (DECC, 2008), and not be acceptable for disposal; and
- ▶ Side effects of remedial works such as unacceptable levels of odour, noise, dust, and surface runoff may be generated.

The contingency plan for each of the above points is discussed below.

Contingencies for "hotspots", if encountered during validation of the site, will be likely to involve delineating the extent of the contamination by an Environmental Consultant and the removal of the contaminated soils for disposal at an appropriately licensed facility.

The presence of previously unidentified types of contaminants may be determined during remedial works by observation of any unusual physical/ sensory characteristics of the impacted soil. If previously unidentified types of contaminants are detected, then the validation criteria may have to be revised to incorporate those contaminants.

In the event that significant additional contaminants are identified, work would cease in the area of concern. The Environmental Consultant at the request of the client would undertake an assessment of the impact of the additional contaminants.

Any potential contaminated solid material in addition to the type already identified will be treated in a method considered suitable for the type of contaminant. At the request of the client, additional sampling and analysis would be undertaken to determine requirements in this respect. Guidance would be sought from the *Waste Classification Guidelines* (DECC, 2008).

The RAP has considered the potential environmental impact of side effects of the remediation works such as noise, odour, dust and surface runoff. However, in the event that unacceptable levels of such effects are detected at the site boundaries during remedial works, the Environmental Consultant will assess the situation and advise the Contractor of corrective action in accordance with Section 4 and current Council and DECC regulations and requirements.

7.11 Long Term Site Management

GHD considers that following successful completion of the remediation, there will be no further management required for the remediated areas of the site, pertaining to the contaminants remediated.

Notation should be made on the s.149 certificates for lots with capped material, to ensure any future works which may disturb this material are undertaken in accordance with appropriate procedures.



8. Protection of the Environment and Community

8.1 Objectives

The remediation operation shall involve the installation and maintenance of environmental protection and pollution control measures as detailed within this section of the RAP. These measures are designed to achieve the following objectives:

- Prevent contaminated soil from leaving the designated remediation areas and polluting surrounding areas;
- Suppress dust generated in the remediation areas;
- Prevent surface water runoff from the remediation areas leaving the sites;
- Minimise nuisance from noise generated from equipment operations during the remediation operation;
- Protect designated vegetation;
- Protect ground water resource; and
- Minimise vibrations.

8.2 Hours Of Operation

All remediation work, including transport, shall be conducted within the following hours:

Monday to Friday 7 am - 6 pm

Saturday 8 am - 1 pm

No work will be undertaken on Sundays or Pubic Holidays.

8.3 Containing Contaminated Material

It shall be the responsibility of the Contractor to ensure all potentially contaminated material is contained on-site within the confines of the designated work areas. This will be achieved by the control of potential pathways capable of moving contaminated material off-site.

These pathways include:

- Vehicle/plant movements;
- Erosion/sediment transport;
- Surface water runoff; and
- Dust generation.

These are addressed in the following sub-sections.

8.4 Soil And Water Management

All remediation works will be undertaken in accordance with a site-specific Soil and Water Management Plan, as shown in Appendix D. The Contractor will provide the equipment for the

erosion and sediment control measures, and will be responsible for their implementation and maintenance throughout the remediation works. A summary of relevant measures is presented below.

8.4.1 Surface Runoff Control

Runoff control measures will be followed as outlined in the Soil and Water Management Plan (Appendix D), and will include silt fences and diversion drains to prevent runoff/ suspended solids entering or leaving remediation areas (if rain is expected).

8.4.2 Stockpiles

- All stockpiles of soil or other materials shall be placed away from drainage lines, or stormwater pits or inlets;
- 2. All stockpiles of soil or other materials likely to generate dust or odours shall be covered; and
- 3. All stockpiles of contaminated soil shall be stored in a secure area and be covered if remaining more than 24 hours. (It is noted that this requirement refers to soil specifically requiring treatment or disposal, and not to general stockpiles of soil which are not likely to contain contaminated material.

8.4.3 Vehicle Access

In relation to vehicle/ plant movement it shall be the responsibility of the Contractor to ensure all vehicles/ plant equipment leaving a designated contaminated work area are free of contaminated material.

8.4.4 Excavation Pump-out

If any water is required to be pumped from excavations, it must be analysed for suspended solids, pH, and arsenic before discharge to the stormwater system or surface drainage channels. The analytical results must comply with the relevant EPA and ANZECC standards for water quality.

Other options for the disposal of excavation water include off-site disposal by a liquid waste transporter for appropriate treatment/disposal.

No surface runoff and/or water from excavations/pits/trenches from the working area of the site is permitted to be discharged to the surrounding environment, except as may be required for dust suppression with the express approval of the Environmental Consultant. In no cases shall this be permitted where such use will impact surface water quality or lead to erosion or sediment migration.

8.4.5 Landscaping

Due care shall be taken to protect any existing vegetation unless removal is required to undertake the remedial works.



8.5 Noise

It shall be the responsibility of the Contractor to minimise noise generated from the remediation operations in accordance with DECC and local council standards.

The remediation works shall comply with the NSW EPA's *Noise Control Guideline: Construction Site Noise* (SPCC, 1985) for the control of noise from construction sites which specifies that:

- For a cumulative period of up to 4 weeks, the noise level as measured by the LA10 (15 minute) emitted by the works to specific residences should not exceed the background noise level, LA 90 (15 minute), by more than 20 dB(A);
- ▶ For a cumulative period of between 4 weeks and 26 weeks, the emitted noise level as measured by the LA10 (15 minute) should not exceed the background noise level, LA 90 (15 minute) by more than 10 dB(A); and
- For a cumulative period of greater than 26 weeks, the emitted noise level as measured by the LA10 (15 minute) should not exceed the background noise level, LA 90 (15 minute), by more than 5 dBA.

All equipment shall be operated in an efficient manner to minimise noise, and shall be in good working order and fitted with silencers appropriate for the required noise levels.

8.6 Vibration

The use of any plant and/ or machinery shall not cause vibrations to be felt or capable of being measured at any premises.

8.7 Air Quality

8.7.1 Dust and Particulate Control

Dust emissions shall be confined within the site boundary. The following dust control procedures may be employed to comply with this requirement:

- Avoid undertaking earthworks during excessively dry or windy conditions; and
- Use water sprays to suppress dust if required.

Contingency measures (if required) shall include:

- Cover all contaminated soil stockpiles that are to remain for periods longer than 24 hours;
- All truck loads of soil and/or contaminated material leaving the site shall be securely covered with a tarpaulin; and
- ▶ The Contractor shall ensure access to water sufficient to water down the excavation, stockpiles and/ or treatment operations if dust generation becomes significant.

8.7.2 Odour Control

There shall be no odour detectable by sense of smell at any boundary of the property. The following techniques may be employed to comply with this requirement:

- Use of appropriate covering techniques such as plastic sheeting or clean cover material to cover exposed excavation faces or stockpiles;
- Use of fine mist sprays; and
- Adequate maintenance of equipment and machinery to minimise exhaust emissions.

8.8 Contingency Plan

The Owner will follow the contingency plan if unexpected situations are encountered. The following outlines some of the unexpected situations that may arise:

- Dust or noise levels measured at site boundary may exceed acceptable levels.
- Surface runoff may leave the site.

The Owner will have available measures to counter these contingencies.

In such cases the remediation work will cease and appropriate situation specific action will be taken such as reducing dust by further water spraying; reducing machinery on-site to minimise noise; intercepting runoff with diversion drains and pumping system.



Health and Safety

9.1 Occupational Health And Safety

Occupational Health and Safety (OH&S) is a necessity on all remediation projects to ensure the health and safety of all personnel working/visiting the site. Therefore work shall be carried out in accordance with a Site Specific Health and Safety Plan.

It is the responsibility of the Contractor to take all necessary practicable actions to safeguard the safety and health of all employees and subcontractors while they are on the site. The aim of the OH&S Plan shall be to provide and maintain safety standards and practices, which offer the highest practical degree of personal protection, based on current knowledge.

All work undertaken shall be performed in accordance with the provisions of the NSW Occupational Health and Safety Act (2000), OH&S Regulation (2001), and any other relevant regulations or directions issued by regulatory authorities.

The Site Specific Health and Safety Plan shall cover the following aspects:

- Induction of personnel;
- Hazard locations and identification;
- Description of exposure pathways and personnel protection requirements;
- Location of all underground/aboveground services;
- Work practice procedures, within the designated contaminated zones;
- Monitoring protocols to identify a potentially hazardous practice;
- Emergency response information and procedures; and
- Incident reporting.

A number of exposure pathways exist, which could potentially result in on-site workers/ visitors to the site or surrounding residences being exposed to the contamination. These potential exposure pathways include:

- Inhalation of contaminants in the form of dust or vapours;
- Ingestion of contaminated soil; and
- Dermal absorption of contaminants through skin contact.

The Contractor shall ensure that these and any other potential exposure pathways are controlled. As the contaminant levels found on site are less than commercial/industrial HILs, no specific OH&S requirements relating to site contamination are required to protect the remediation workers, beyond measures that would normally apply to earthworks or construction sites.

9.2 Community Health And Safety

To ensure the protection of the local community, the Contractor shall control the exposure pathways identified in Section 9.1 - Occupational Health and Safety.

Control mechanisms will include the following:

- ▶ Site security measures to control direct contact with the contamination;
- Dust suppression measures to control inhalation exposure; and,
- Cleaning and tarping trucks and other equipment to control direct contact from off-site migration of contaminated soils.

These measures are described in Section 8.



10. Validation

10.1 Scope of Validation

Validation will confirm that remediation has been completed in accordance with the RAP and that the concentration of arsenic in the soil is less than the residential health-based investigation thresholds.

The health-based assessment criteria for the identified contaminants on the site are listed in Table 1. Based on consideration of the EPA (1997) guidelines, the site will be deemed successfully remediated if:

- ▶ The 95% UCL_{AV} concentration for arsenic in soils remaining exposed after remediation is less than the residential health-based investigation thresholds; and
- ▶ No single sample concentration is greater than 1.25 times the relevant criteria.

10.2 Validation Methodology

Two validation methods are proposed, due to the two remediation strategies recommended. One validation method is required for the area around Sample 1065 where the recommended remediation is the removal of the soil. The other validation technique is for the areas remediated by vertical mixing. Both methods are outlined below.

10.2.1 Sample Identification

Validation and characterisation soil samples will be identified using a "V" prefix for validation, or a "C" prefix for characterisation.

A detailed sample register will be kept, recording the sample number, date sampled, location, depth interval and field observations (including soil description). Duplicate samples will be recorded in the register, as will subsequent validation samples were these are needed to revalidate an area, which has not met the assessment criteria and has had further remediation.

10.2.2 Validating Remediation by Vertical Mixing

Pacific Bay Western Lands, Korora

Remedial Action Plan

The calculations in Appendix B of the NSW EPA (1997) Guidelines were completed, for Areas A and B, to determine the number of validation sampling locations at each proposed building envelope. However, GHD found that the number of recommended sampling locations subsequently calculated was 2.97 for Area A and 2.28 for Area B. A copy of the calculations is presented in Appendix E. GHD considers this number of validation samples to be insufficient for the areas involved and therefore, recommend using a 25 m grid based sampling methodology as indicated for validating residual soil in NSW EPA (1997).

Based on this approach, the recommended number of sampling locations is 17 in Area A and 6 in Area B, as shown on Figure 2, Appendix A.

Samples will be collected systematically across the remediation area at the required number of sampling locations from two depth intervals, comprising:

Surface soils (0 - 150 mm); and

At the interface between the disturbed and undisturbed layer.

To potentially reduce costs while ensuring that adequate validation is completed, initially, it is recommended that samples collected from both depths at every second soil sample location be analysed for the particular contaminant previously identified as exceeding (or potentially exceeding) assessment criteria in the area of the remediation (i.e. arsenic).

A detailed sample register will be kept, recording the sample number, date sampled, location, depth interval and field observations (including soil description). Duplicate samples will be recorded in the register, as will subsequent validation samples where these are needed to revalidate an area, which has not met the assessment criteria and has had further remediation.

10.2.3 Validation Of Excavations

Validation sampling will be undertaken by the Environmental Consultant to demonstrate that the site has been remediated to a standard that is suitable for the proposed land use.

Validation sampling will generally involve collecting 1 sample per 100 m² from the base of each excavation, with at least 1 base sample from any single excavation. Samples of surface soils (0.0-0.15 m) will be taken from each side of the excavation to validate the horizontal extent of remediation.

Soil samples collected for validation purposes will be analysed for the particular contaminants previously identified as exceeding (or potentially exceeding) assessment criteria in the area of the excavation. Rock samples collected for validation purposes will not be analysed unless the rock is weathered and/or porous.

10.2.4 Characterisation of Excavated Material or Stockpiles

Characterisation sampling of excavated material or stockpiles will involve sample collection and analysis as previously described for the specific areas of remediation. "Procedure B" from the Sampling Design Guidelines (EPA 1995) will be used to assess if the number of samples is adequate to show that the average concentrations of contaminants are below the relevant criteria. Sampling will generally be at a rate of one sample per 25 m³, or a minimum of 3 samples per "batch" of material.

Analysis will be undertaken for the particular contaminants previously identified as exceeding the relevant assessment criteria for the "batch" of material being tested (eg arsenic). If necessary for waste classification purposes or for assessment of potential environmental impacts, a TCLP test for selected parameters will be undertaken in conjunction with total concentration.

10.2.5 Off-site Disposal (Contingency if required)

Waste characterisation is required for all material disposed of offsite. Representative samples shall be collected from each "batch" of material destined for disposal, as described above. (A batch being defined for the purposes of this RAP as a volume of material of similar physical and chemical characteristics generally excavated from a particular area of the site). The material will be deemed to be suitable for disposal if the 95% UCL_{AV} concentration for each contaminant of concern is less than the relevant waste classification criteria.



10.2.6 Imported Fill (Contingency if required)

If imported fill is required, it will be certified clean fill (eg. native quarried material) or validated for suitable for use as fill material at a minimum rate of 1 sample per 100 m³, and at least 3 samples from any particular fill source. In order to avoid importation of contamination to the site, fill judged suitable for use will have TPH, BTEX, heavy metals, OCP/PCBs and PAHs concentrations below the health based standard residential guidelines (HIL A) and EILs.

10.3 Laboratory Analysis

In general, laboratory analysis will be conducted in accordance with the standard test methods outlined in Schedule B(3) of the NEPM, 1999 for soils. The practical quantitation limits (PQLs) will be set at a level below the relevant assessment criteria.

The above documents describe the methods preferred by DECC; however, laboratories in Australia may not all follow these methods precisely. In particular the sample preparation methods may be significantly different. Some analysis methodology may also be slightly different for some of the analyses.

The selected laboratory will be NATA registered for the analyses performed, and NATA registration will take precedence over the laboratory's ability to perform the analyses precisely to the methodology referenced in the above.

11. Quality Assurance/ Quality Control Plan

11.1 Field And Laboratory Quality Assurance Program

Quality Assurance (QA) and Quality Control (QC) practices will be applied to all stages of data gathering and subsequent sample handling procedures. These are designed to provide control over both field and laboratory operations. Additionally, the analytical laboratories will complete their own internal QA procedures (as required by NATA registration) during the analysis of samples. Details of the QA/QC program are described below.

11.1.1 Quality Assurance

All fieldwork will be conducted in general accordance with Standard Field Operating Procedures (FOP). The standard FOP ensure that all environmental samples will be collected by a set of uniform and systematic methods as required by the QA system.

The FOP include descriptions of the following:

- 1. decontamination procedures;
- 2. sample identification procedures;
- 3. information requirements for soil bore logs;
- 4. chain of custody information requirements;
- 5. sample duplicate frequency; and
- 6. field equipment calibration requirements.

Subsurface characteristics and field observations will be fully documented in accordance with the approved sampling and analysis plan. Chain-of-Custody documentation will be prepared for sample transfer from the site to the laboratory. Quality control checks will be conducted both in the field and the laboratory.

All sampling equipment will be thoroughly decontaminated (in accordance with written procedures) to ensure that no carry over of contaminants occurs between sampling events, thereby ensuring that an accurate indication of concentrations of contaminants will be obtained. All samples will be labelled in the field with a unique sample identification code (in accordance with the documented system described previously), with a sample label affixed to the side of the container, and all writing on the label in waterproof indelible ink.

11.1.2 Field Sampling Quality Control

Field QC samples for this study will comprise duplicate samples. Duplicate field samples consist of two samples collected at the same place and time and are intended to represent the same entity as closely as possible.

11.1.3 Laboratory Quality Control

Laboratory quality control procedures typically include analysis of the following:



Laboratory duplicate samples: The analytical laboratory collects duplicate subsamples from one sample submitted for analytical testing at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on analytical batch and the analytical precision (repeatability) of the test result.

Spiked Samples: An authentic field sample is spiked by adding a aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques.

Certified Reference Standards: A reference standard of known (certified) concentration is analysed along with a batch of samples. The Certified Reference Standard provides an indication of the analytical accuracy of the test method.

Surrogate Standard/Spikes: These are organic compounds which are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. These surrogate compounds are spiked into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques before sample extraction. They provide a means of checking that no gross errors have occurred during any stage of the test method leading to significant analyte loss.

Laboratory Blank: Usually an organic or aqueous solution that is as free as possible of analyte of interest to which is added all the reagents, in the same volume, as used in the preparation and subsequent analysis of the samples. The reagent blank is carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.

11.1.4 Methodology Used to Assess Quality Control Results

The results of the field and laboratory quality control samples will be assessed to determine:

- 1. The quality of the data generated;
- 2. If the data meets the objectives of the study; and
- 3. If the data is acceptable for the intended use.

11.1.5 Field QC

Assessment of field quality control duplicate samples will be undertaken by calculating the Relative Percent Difference (RPD) of duplicate samples. Table 9.1 below presents guidelines for assessment of QC results. These guidelines are the same as those provided in the NEPM (1999) as endorsed by the NSW EPA. A result exceeding these guidelines does not necessarily mean the data is invalid, but rather the impact on the data may need to be assessed.

Table 9-1 Guidelines for Assessment of Quality Control Results

Test	Acceptable RPD(%) ¹	
Inorganic	30	

¹ Can be expected to be higher for low concentrations

11.1.6 Completeness

The completeness of the analytical program may be calculated on the basis of the proportion of acceptable data quality indicators, using the assessment of data acceptability resulting from the quality assurance program.

Completeness parameters are generally required to exceed 95%.

11.1.7 Laboratory QC

Assessment of laboratory QC is undertaken internally by the individual laboratories. Duplicates are assessed by calculating the Relative Percent Difference (RPD). Percent Recovery (PR) is used to assess spiked samples and surrogate standards. Acceptable values for RPD and PR can vary depending on the type of analyte tested, concentrations of analytes, and sample matrix.

Certified Reference Standards and Materials are analysed by comparing the test result to the certified concentration plus or minus a certified tolerance. Certified tolerances vary depending on the type of analyte tested and the certified concentration of the analyte.

11.2 Reporting

On completion of the remediation operations, the Environmental Consultant will prepare a remediation/validation report which will summarise the works performed and the validation results, in order to demonstrate compliance with the objectives of the RAP.



12. Conclusions and Recommendations

Holmes & Holmes have proposed a remediation strategy for the arsenic contamination identified at Lot 5 DP592173, Bruxner Park Road, Korora, NSW. GHD have been engaged to provide an addendum to the Holmes & Holmes remediation strategy that details the environmental management of the site and the required validation sampling and reporting. The following conclusions present a brief summary of the information described in this report. The conclusions should be read in the context of the more detailed information presented in the body of this report, the scope of the investigation and the stated limitations.

To reduce the concentration of arsenic to less than the applicable threshold for the proposed residential land use, Holmes & Holmes recommended vertical mixing to a depth of 350 mm in all but one location. In one location, due to the depth of the contamination, Holmes & Holmes recommend the extent of contamination is further investigated and the soil be removed and encapsulated below roadworks.

To demonstrate that the site has been satisfactorily remediated, validation sampling and laboratory analysis of selected soil samples will follow the remediation.

In areas were the soil is removed, validation soil samples from the walls and bottom of the pit should be collected. In areas remediated by vertical mixing twenty-three validation sites (17 in Area A and 6 in Area B) should be sampled on the surface and at the disturbed and undisturbed interface to establish if remediation is successful.

The remediation works should be carried out in accordance with the measures of this RAP, in order to protect the environment and community health. These measures include managing soil and water, minimising noise and vibrations, and maintaining air quality.

On the basis of the proposed remediation, no ongoing management of the sites is considered necessary.

13. Limitations

This RAP addendum has been prepared for the remediation of specific areas identified as being impacted by arsenic contamination, at Lot 5 DP592173, Bruxner Park Road, Korora, NSW. The information contained in this document is project and site specific and may not be appropriate for other remedial projects. Additionally, this RAP addendum has been based on investigation results documented in the previous reports listed previously. The reader is referred to these reports for the limitations of the investigations.

In preparing this RAP addendum, current guidelines for assessment and management of contaminated land were referred to. The RAP addendum has been prepared for use by the client in accordance with GHD's understanding of the client's requirements, and generally accepted practice for environmental consulting.

It is the nature of contaminated site investigations that the degree of variability in site conditions cannot be completely known and no sampling and analysis program can eliminate all uncertainty concerning the condition of the site. Professional judgement must be exercised in the collection and interpretation of the data.

The advice herein relates only to this project and all results, conclusions and the recommendations made, should be reviewed by a competent and experienced person who is experienced in environmental investigations, before being used for any other purpose. GHD accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by GHD, and should not be relied upon by other parties, who should make their own enquires.

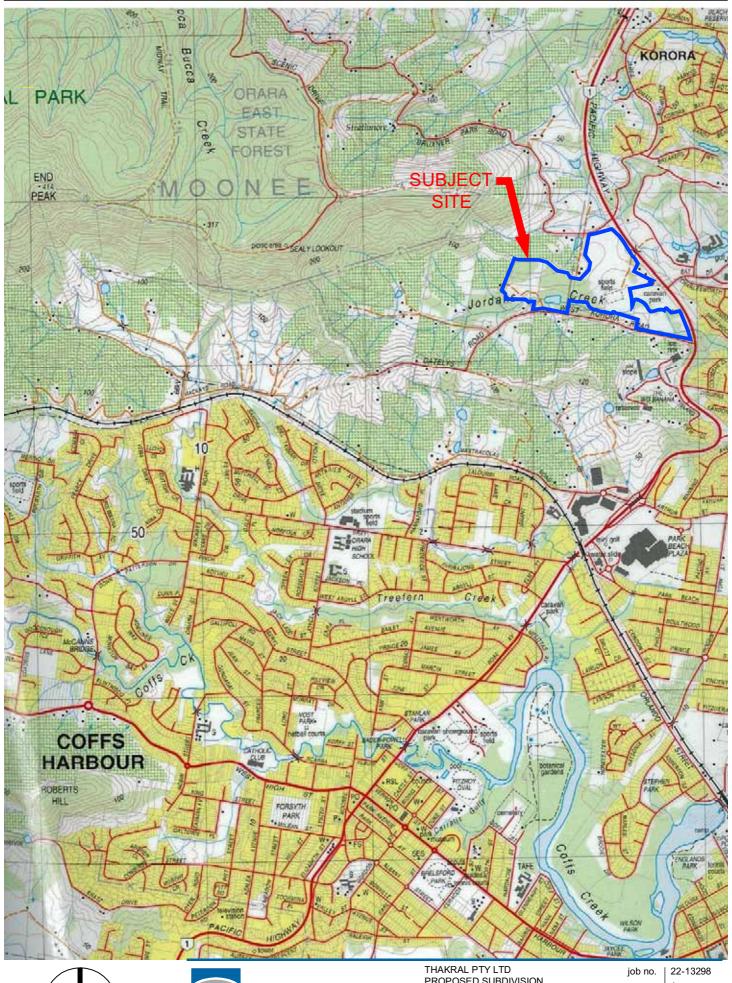


14. References

- ▶ ANZECC 1992: "Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites", ANZECC/NHMRC, 1992.
- ▶ DECC 2008: "Waste Classification Guideline", DECC, 2008.
- ▶ EPA 1995a: "Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land", NSW EPA, 1995.
- ▶ EPA 1995b: "Sampling Design Guidelines", NSW EPA, 1995.
- ▶ EPA 1997: Guidelines for Assessing Banana Plantation Sites", NSW EPA, 1997
- ANZECC 1999: "Guidelines for the On Site Containment of Contaminated Soils", ANZECC/NHMRC, 1999
- ▶ EPA 1998: "Guidelines for the NSW Site Auditor Scheme", NSW EPA, 1998.
- ▶ NEPC 1999: "National Environmental Protection (Assessment of Site Contamination) Measure" (the NEPM), National Environmental Protection Council, 1999.
- NSW Department of Housing 1998: "Managing Urban Stormwater Soils and Construction"
 NSW Department of Housing, 1998
- ▶ SEPP 55 Remediation of Land, Department of Urban Affairs and Planning/EPA 1998.

Appendix A

Figures







PROPOSED SUBDIVISION PACIFIC BAY WESTERN LANDS **REGIONAL LOCATION** scale | NTS | for A4 | date | OCT.2008 rev no. A

Figure 1

INDIVIDUAL SAMPLE TEST FI Scale INTS for A3 date OCT.2008
2715 West High Street Coffs Harbour NSW 2450 Australia T 61 2 6650 6600 F 61 2 6652 6021 E d'small@ghd.com.au www.ghd.com.au

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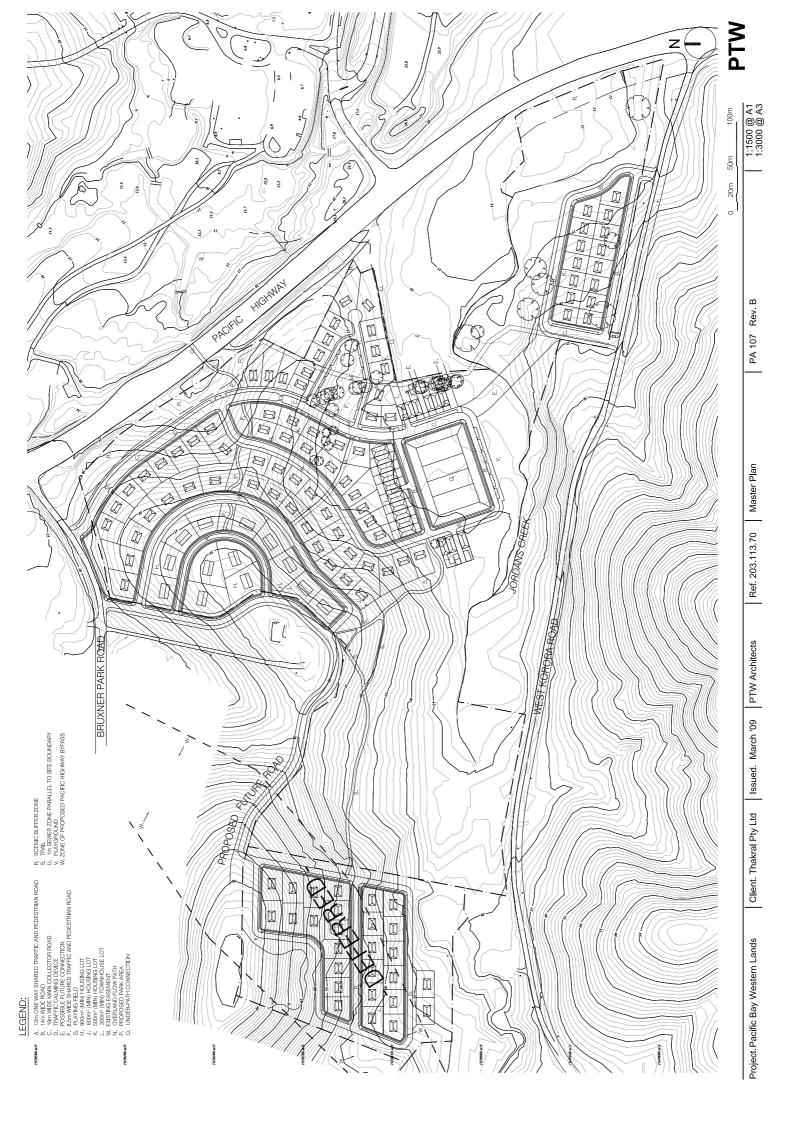
Figure 2

PACIFIC BAY WESTERN LANDS

Packbay 2008 - 11-12 AM Carl File No. (2-12-1) 2280 ADD Drawings (22-13-28-EIC) IRES rium



Appendix B Subdivision Concept



Appendix C Previous Reports



REPORT ON
STAGE 1 PRELIMINARY SITE INVESTIGATION
PACIFIC BAY RESORT
COFFS HARBOUR

PREPARED FOR
THAKRAL OPERATIONS PTY LTD

PROJECT No 18462 JANUARY 1996

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JEFF ACKANDO



18462

REPORT ON

STAGE 1 PRELIMINARY SITE INVESTIGATION

PACIFIC BAY RESORT COFFS HARBOUR

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RLW/SRJ/KP 18462

25 January 1996

REPORT ON STAGE 1 PRELIMINARY SITE INVESTIGATION PACIFIC BAY RESORT COFFS HARBOUR

1. <u>INTRODUCTION</u>

Douglas Partners was retained by Thakral Operations Pty Ltd to conduct a Preliminary Site Investigation (PSI) at the Pacific Bay Resort, Coffs Harbour (Drawing 1). The investigation was requested by Mr. Tony Harvey under written authorisation dated 13 January 1996. The livestigation was conducted according to our proposal dated 12 January 1996, and comprised a "Stage 1"investigation as defined in the NSW EPA "Draft Guidelines for Consultants Reporting on Contaminated Sites (Ref 5).

The following activities were performed during this PSI:

- Identify past and present potentially contaminating activities
- · Report on current site conditions
- Provide a preliminary assessment of site contamination

The study area comprised three main areas (identified based on a site map provided by the client) and subsequently labelled Area A, Area B and Area C (Drawing 2). Area A comprises approximately 50 hectares of developed and undeveloped land (of which approximately 12



hectares have been developed into the current site of the Pacific Bay Resort), Area B comprises approximately 14 hectares of undeveloped land and Area C comprises approximately 30 hectares of undeveloped land. Details of the 3 areas (including approximate boundary maps and Lot numbers) were supplied by Thakral Operations Pty Ltd. Other information, such as a copy of the "Master Plan", was also supplied by Destination Resorts.

2. PAST/PRESENT ACTIVITIES

The following sections describe the past and present activities associated with the Pacific Bay Resort.

2.1 <u>Past Activities</u>

Prior to development, the site conditions consisted of native eucalyptus trees, bushland, a low lying swamp area and beach area. Interviews were conducted with Mr. Geoff Cohen (Site Manager at the Pacific Bay Resort) regarding past historical activities at the site. According to Mr. Cohen, construction of the current Pacific Bay Resort was started in 1988/1989. Material was excavated from the swamp area to construct the current lagoon system. This material was stockpiled along the western portion of the site as uncontrolled fill material. The current buildings (Resort condominiums, tennis courts, Village Centre, and associated roads and landscaping) were built around 1990. Approximately 12 of the 50 hectares of Area A have been developed as the Pacific Bay Resort.

The remainder of Area A and all of Areas B and C have not been developed. Interviews with Mr. Cohen indicated several portions of each Area (A, B and C) were former banana plantations. Review of Coffs Harbour City Council (CHCC) document entitled "Agriculture and Chemical Residue Policy Map for Banana Lands, 1943, 1954, 1964, 1974 and 1984", Map No. 28494.6 (Ref 1), indicated several areas of the study area had "chemical residues associated with banana lands". However, specific information regarding potential chemicals was not available during this review.



Discussions with Mr. Brian Beckett, a former banana farmer who used to grow bananas on portions of the site until the mid-1970's, indicated extensive use of herbicides, pesticides and fungicides were employed in relation to bananas. Specifically, Mr. Beckett indicated that the pesticide Dieldrin was used to control the "beetle bore". He indicated that Dieldrin was used by the Department of Agriculture to control the "beetle bore" in banana stocks.

In addition, Mr. Beckett indicated banana growers in the area made extensive use of arsenic pentoxide. Arsenic pentoxide is commonly used as a herbicide and also as an insecticide. Additionally, an "oil-copper" solution was used by Mr. Beckett as a fungicide. The "oil" portion of the solution was repeatedly vegetable oil.

In March 1995, Slattery de Groot & Partners Pty Ltd conducted a geotechnical investigation regarding the uncontrolled fill material. Fourteen test pits were excavated to assess the depth of the fill material. According to the report, the fill material consisted of clay, silty-clay, rock of approximately 50 mm to 200 mm, gravel, topsoil and organic matter. Depth of the fill material was between 1.4 m and 5.6 m thick (Ref 2). The fill material was reportedly excavated in 1988/1989 during construction of the current lagoon system at the resort.

2.2 <u>Present Activities</u>

The current buildings (Resort condominiums, tennis courts, Village Centre, and associated roads and landscaping) were built around 1990. Approximately 12 hectares of Area A have been developed as the Pacific Bay Resort. Based on information supplied by Mr. Cohen, further development of residential condominiums, townhouses, a resort hotel and golf links has been proposed on the remainder of the study area (Areas A, B and C).

Based on review of this available information, specific areas have a potential for contamination. These area are as follows:

- Northern portion of Area A (former banana plantation)
- Western portion of Area B (former banana plantation)
- Northern portion of Area C (former banana plantation)



3. REPORT ON CURRENT SITE CONDITIONS

A site visit was conducted to visually inspect the site for obvious site features which may indicate contamination. The site visit was conducted by Mr. Randy Wheeler (Douglas Partners) and Mr. Geoff Cohen (Destination Resorts). Each Area (A, B and C) were inspected to assess current conditions. Descriptions for each Area are as follows:

AREA "A"

Area "A" is approximately 50 hectares in size and irregularly shaped. The site is currently zoned "Residential" and is bounded by the Pacific Highway on the west, residential subdivisions to the north and Crown Land on the east. The area is mostly undeveloped land with approximately 12 hectares of developed land (current Pacific Bay Resort) along the southern portion of the site. The undeveloped areas consist primarily of natural vegetation (eucalyptus trees, pine trees, grass etc.) with approximately 5 hectares of uncontrolled fill material along the western boundary. The topography is considered steep with a portion of the site lowland area (former swamp area now the current lagoon area). There is a perennial stream which flows adjacent to the uncontrolled fill material in the western portion of the site and into the lagoon system. Former banana plantations were reported in the northern portion of Area A.

AREA "B"

Area "B" is approximately 14 hectares in size and roughly triangular in shape. The site is currently zoned "Residential" and is bounded to the north by Charlesworth Bay Road, residential subdivision to the south and Crown Land to the east. The area is undeveloped land consisting primarily of natural vegetation (eucalyptus trees, pine trees, grass etc.). The western portion of this site was reportedly used for growing bananas. The topography is considered relatively steep with no established streams, buildings or other significant site features.



AREA "C"

Area "C" is approximately 30 hectares in size and irregularly shaped. The site is currently zoned "Agricultural" and is bounded on the south by Jordans Creek, private land and portions of West Korora Road, on the east by portions of the Pacific Highway, private land and a caravan park, and to the west and north by private land. The site is undeveloped land consisting of natural vegetation (eucalyptus trees, pine trees, grass etc.). Jordans Creek flows east towards the Pacific Highway and forms a portion of the southern boundary. The creek was noted to by flowing during the site visit. The northern portion of the site was reportedly used for bananas

No significant site features were noted (such as buildings, fill material or developed land) during the site visit.

4. PRELIMINARY ASSESSMENT OF SITE CONTAMINATION

Limited soil sampling was conducted in areas where the historical survey or the site visit indicated the highest potential for contamination. These areas were primarily those indicated based on review of CHCC "Agriculture and Chemical Residue Policy Map for Banana Lands" (Ref 1). Target areas were those areas identified as being former banana lands. The sampling was intended to provide a preliminary assessment of possible contamination in these areas and not a detailed site characterisation.

During the preliminary assessment of contamination, nine hand auger soil samples (including one QA sample) were collected for chemical testing. Soil samples were submitted to Analabs Laboratory for the following analyses:

- Organochlorine Pesticides
- Organophosphate Pesticides
- Metals (As, Cd, Cu, Pb, Hg, Zn)



Drawing 1 shows the general locations of the soil samples. Soil samples were collected at depths of approximately 0.1 metres below ground surface using a hand auger and transferred into the appropriate sample container. The hand auger was decontaminated between soil samples to reduce cross contamination. Samples were transported to a NATA registered laboratory (Analabs) at less than 4° C in a cooler within the recommended maximum storage times, under DP chain of custody documentation.

Results of the analytical testing indicated non-detect concentrations of organochlorine and organophosphate pesticides in each of the samples analysed.

Results of the metals analysis indicated elevated levels of arsenic in three samples analysed (B2, B5 and B6). Arsenic was reported at 42 mg/kg in B2, 140 mg/kg in B5 and 23 mg/kg in B6. These concentrations of arsenic are above the ANZECC "B" Environmental Investigation criteria of 20 mg/kg. Arsenic in Bore B5 is also above the ANZECC Human Health Investigation Threshold Level of 100 mg/kg for residential development (Ref 3).

Cadmium was also above the ANZECC "B" Environmental Investigation criteria of 3 mg/kg in bore B5 but below the Human Health Investigation Threshold Level of 20 mg/kg for residential development (Ref 3). Chromium was reported at 57 mg/kg from bore B8. The ANZECC "B" criteria for chromium in soil is 50 mg/kg.

All other metals analysed were detected in minor concentrations but were below acceptance criteria (Ref 3 and 4). Table 1 provides a summary of the metals analyses along with a list of acceptance criteria for each metal analysed.

5. RECOMMENDATIONS FOR FUTURE WORK

Analytical results indicate at least three sites (B2, B5 and B6) had elevated levels of arsenic. In bore B5, these levels were above acceptance criteria for residential development. The presence of arsenic can be attributed to the use of the pesticide arsenic pentoxide associated with banana lands. Cadmium and Chromium were also detected in B5 and B8 samples respectively, at levels slightly above ANZECC "B" criteria.



The lateral extent of metals contamination should be further investigated, particularly with respect to areas where residential development is proposed, and should comprise a "Stage 2" investigation as defined in reference 5.. It is considered that soil remediation may be necessary in such areas where arsenic levels exceed established criteria. More detailed soil sampling and testing should be undertaken to assess the extent of remediation required and enable a site remedial action plan to be developed.

DOUGLAS PARTNERS PTY LTD

Reviewed by:

Stephen Jones

Randy L. Wheeler **Environmental Geologist**

Stephen R Jones **Principal**

REFERENCES:

- 1. Coffs Harbour City Council "Agriculture and Chemical Residue Policy Map for Banana Lands, 1943, 1954, 1964, 1974 and 1984", Map No. 28494.6.
- 2. Slattery de Groot & Partners Pty Ltd, "Uncompacted Fill Report For Proposed Residential Area East of The Pacific Highway and North of Charlesworth Bay Road at Pacific Bay Resort, Coffs Harbour, Report No. 7164", March 1995.
- 3. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites. ANZECC/NHMRC, January 1992.
- 4. NSW EPA, Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agriculture Land, January 1995.
- 5. NSW EPA, Draft Guidelines for Consultants Reporting on Contaminated Sites, August 1995.

NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, the S.A.A. Site Investigation Code. In general, descriptions cover the following properties — strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (e.g. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Sitt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

	Undrained
Classification	Shear Strength kPa
Very soft	less than 12
Soft	1225
Firm	25—50
Stiff	50100
Very stiff	100200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q _c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2-5
Medium dense	10-30	5—15
Dense	30-50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descend into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (e.g. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow

sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (e.g. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test F3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

 In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7 blows

 In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40mm

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples

in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test F4.1.

In the tests, a 35 mm diameter rod with a cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is output on continuous chart recorders. The plotted results given in this report have been traced from the original records.

The information provided on the charts comprises:-

- Cone resistance the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower (A) scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main (B) scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

$$q_c$$
 (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

$$q_c = (12 \text{ to } 18) c_u$$

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on

soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two, relatively similar tests are used.

- Perth sand penetrometer a 16 mm diameter flat ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test F 3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test F3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems:

- In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.

- Water table levels will vary from time to time with seasons or recent prior weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (e.g. a three storey building) the information and interpretation may not be relevant if the design proposal is changed (e.g. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions the potential for this will depend partly on bore spacing and sampling frequency.
- changes in policy or interpretation of policy by statutory authorities.
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is

recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assit in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



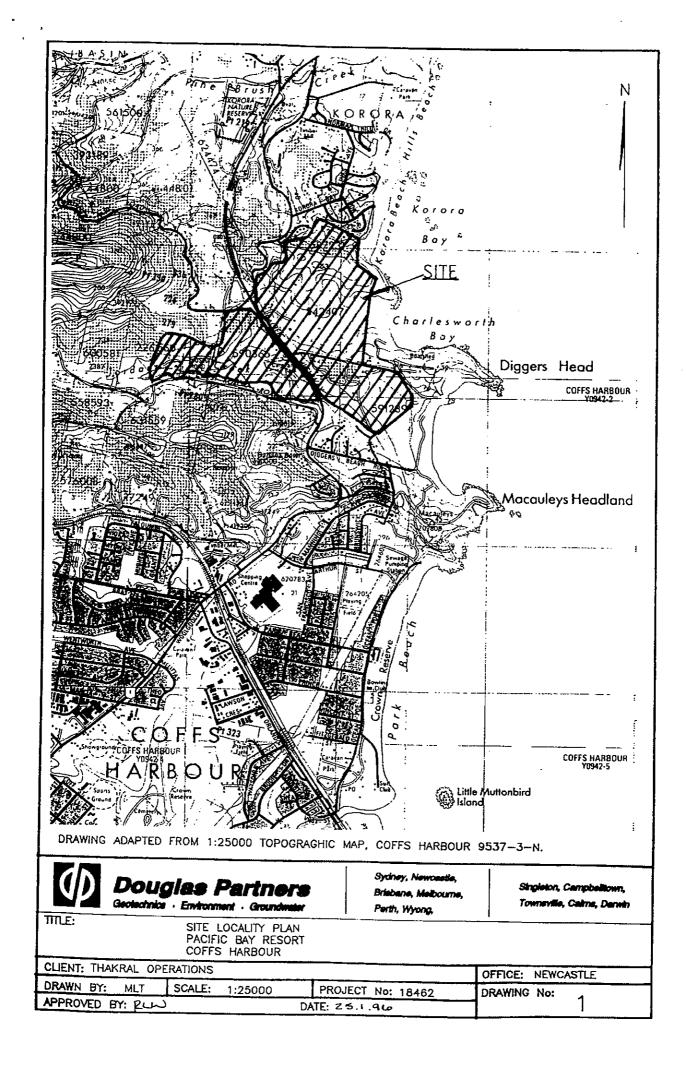
TABLE 1 SUMMARY OF METALS RESULTS (mg/kg) PACIFIC BAY RESORT, COFFS HARBOUR

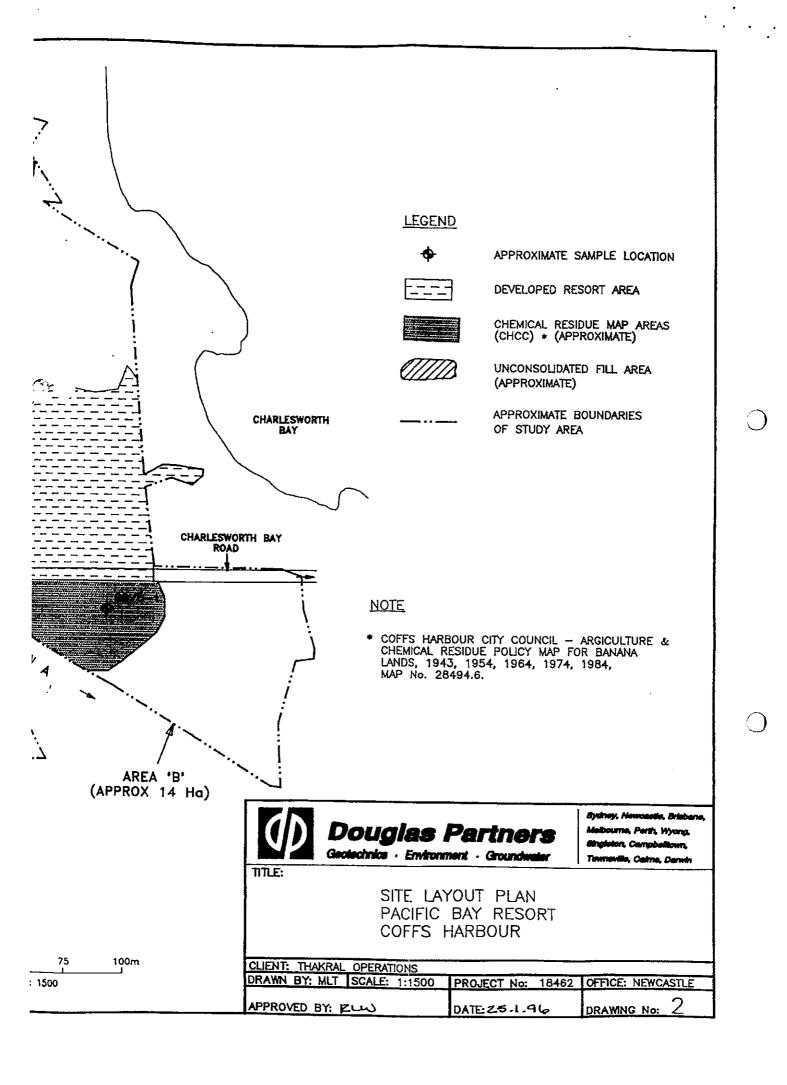
											ANZECC Dutch "B" Criteria for Soils	ch "B" Solls
Bore No:	B1	82	B3	B4	82	98	28	88	10	Investigation	Background	Reference
Constituent Depth:	0.1m	0.1m	0.1m	0.1m	0.1m	0.1m	0.1m	0.1m	B8 dup	Threshold		
Arsenic, As	ທ	24	9	ဖ	140	23	2	\$	Ą.	20 / 100ª	0.2 - 30	ANZECC / NHMRC
Cadmium, Cd	9.0	7	0.8	9.0	5.6	1.3	9.0	9.0	9.0	3/20	0.04 - 2	ANZECC / NHMRC
Chromium, Cr	£	15	15	12	÷	10	48	57	38	50	0.5 - 110	ANZECC / NHMRC
Lead, Pb	56	23	17	7	16	12	13	5	æ	300	<2-200	ANZECC / NHMRC
Zinc, Zn	တ္တ	43	12	80	35	13	. 16	9	o	200	2 - 180	ANZECC / NHMRC
Mercury, Hg	<0.05	<0.05	<0.05	<0.05	0.14	<0.05	<0.05	0.05	<0.05	1.0	0.001 - 0.1	ANZECC / NHMRC

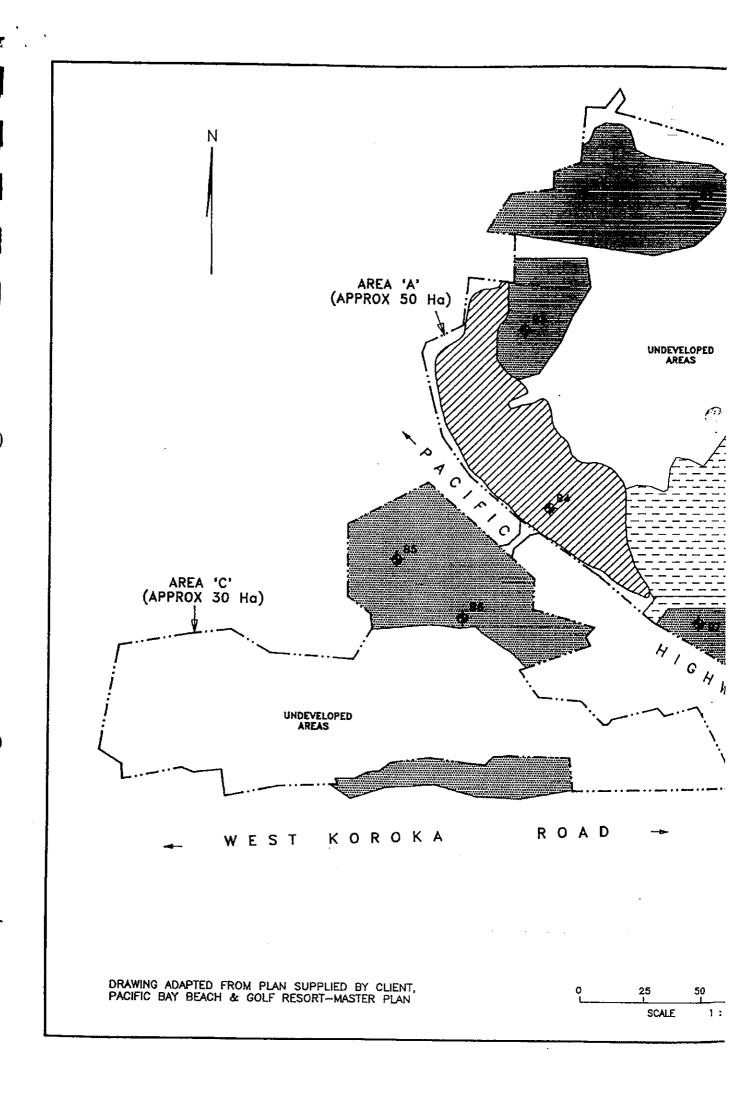
BOLD results indicated concentration exceeds established criteria.

ANZECCINHMRC, 1992. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites.

Note a: ANZECC / NHRMC 1992. Proposed Health Investigation Level Guidelines, Residential Development.







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DOUGLAS (NEWC)

Project: PACIFIC BAY RESORT (18462)

RENCE B1 B1 B2 B3 PE SOIL SOIL SOIL SOIL ss otherwise stated} mg/kg mg/kg mg/kg mg/kg mg/kg d 5 5 42 10 10 d 0.6 0.6 2.0 0.8 15 A 11 12 15 15 A 36 26 20 17 A 36 -43 42 -43 A 0.05 <0.05 <0.05 <0.05	OUR REFERENCE	13687-1	13687-1 RPT	13687-2	13687-3	13687-4	13687-5
Se otherwise stated} mg/kg mg/kg mg/kg mg/kg ss otherwise stated} mg/kg mg/kg mg/kg d 5 42 10 d 0.6 0.6 2.0 0.8 A 11 12 15 15 A 26 26 20 17 A 36 -43 42 A -0.05 <0.05	YOUR REFERENCE	B1	B1	B2	83	B4	82
ss otherwise stated} mg/kg mg/kg mg/kg mg/kg d 5 5 42 10 d 0.6 0.6 2.0 0.8 7 11 12 15 15 3 26 26 20 17 36 36 43 42 <0.05	SAMPLE TYPE	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
5 5 42 10 d 0.6 0.6 2.0 0.8 37 11 12 15 15 26 26 26 20 17 36 36 43 42 <0.05	UNITS (unless otherwise stated)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
d 5 5 42 10 A 0.6 0.6 2.0 0.8 A 11 12 15 15 A 26 26 20 17 A 36 36 43 42 A 43 42 42 A 40.05 <0.05							
d 0.6 0.6 2.0 0.8 7.1 15 15 15 15 15 15 15 15 17 1 17 1 1	Arsenic, As	5	ιĐ	42	10	9	140
11 12 15 15 26 26 20 17 36 36 43 42 <0.05	Cadmium, Cd	9.0	9.0	2.0	0.8	9.0	5.8
26 26 20 17 36 36 43 42 <0.05	Chromium, Cr	11	12	15	15	12	11
36 36 43 42 <0.05	Lead, Pb	26	26	20	17	7	16
<0.05 <0.05 <0.05 <0.05	Zinc, Zn.	36	-36	433	42	ф	35
	Mercury, Hg	<0.05	<0.05	<0.05	<0.05	<0.05	0.14

Method Codes: MEM-010, MEM-005, MEP-001, MEP-020, MEP-014



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YOUR REFERENCE	B1	B2	B3	B4	85	Ba	1000 July 1	1-19061-1
SAMPLE TYPE	SOIL	SOIL	SOI	NOS.	100			2 2
SLINITS	ma lba	malle		100	3 -	SOL	SOIL	SOIL
3110	BY/BIII	(III)/Kg	rng/kg	тд/кд	mg/kg	mg/kg	mg/kg	mg/kg
abhc	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Lindane	<0.1	<0.1	<0.1	<0.1	<0.1	\ 0.0	<0.1	, ,
Heptachlor	<0.1	<0.1	<0.1	<0.1	×0.1	×0.1	<0.1	
Aldrin	<0.1	<0.1	<0.1	<0.1	<0.1	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	40.1	
Heptachlor Epoxide	<0.1	<0.1	<0.1	<0.1	<0.1	×0.1	100	
Oxychlordane	<0.1	<0.1	<0.1	<0.1	<0.1	V0.1	<0.1	2
a-Endo-Sulfan	<0.1	<0.1	<0.1	×0.1	×0,1	V0.	<0.1	- 0
DDE	<0.1	<0.1	<0.1	× 0.1	×0.1	0 7	10,	200
Dieldrin	<0.1	<0.1	<0.1	<0 ×	707		101	
Endrin	<0.1	×0.1	×0 1	V 0 1	100		1000	
B-Endo-Sulfan	<0.1	×0.1	 - 	107	, ,	70	- 0,0	<0.1
מטט	,		; ; ;	5		- I - O - V	<0.1	<0.1
מממ	- ^ O. I	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
וחמ	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychior	<0.1	<0.1	<0.1	<0.1	<0.1	×0.1	<0.1	, e v
Chlordane	<0.1	<0.1	<0.1	<0,1	<0.1	<0.1	<0.1	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
								;

Method Codes: MED-005



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Project: PACIFIC BAY RESORT (18462)

OUR REFERENCE	13687-6	3687-6 13687-7	13687-8	13687-9	SPK.
YOUR REFERENCE	B6	87	88	D1	
SAMPLE TYPE	SOIL	SOIL	SOIL	SOIL	
UNITS (unless otherwise stated)	mg/kg	mg/kg	mg/kg	mg/kg	%Recovery
·					
Arsenic, As	23	5	<5	<5	97
Cadmium, Cd	1.3	9.0	9.0	9.0	104
Chromium, Cr	10	18	57	38	98
Lead, Pb	12	13	10	8	97
Zinc, Zn	13	16	5	6	101
Mercury, Hg	<0.05	<0.05	0.05	<0.05	100

Method Codes: MEM-010, MEM-005, MEP-001, MEP-020, MEP-014



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OUR REFERENCE	13687-8	13687-9	.BLANK	13687-6 SPK
YOUR REFERENCE	B8	D1		B6
SAMPLE TYPE	SOIL	SOIL	SOIL	SOIL
UNITS	mg/kg	mg/kg	mg/kg	%Recovery
aBHC	<0.1	<0.1	<0.1	115
HCB	<0.1	<0.1	<0.1	113
Lindane	<0.1	<0.1	<0.1	112
Heptachlor	<0.1	<0.1	<0.1	111
Aldrin	< 0.1	<0.1	<0.1	113
Heptachlor Epoxide	<0.1	<0.1	<0.1	ŧ
Oxychlordane	<0.1	<0.1	<0.1	1
a-Endo-Sulfan	<0.1	<0.1	<0.1	111
DDE	<0.1	< 0.1	<0.1	109
Dieldrin	<0.1	<0.1	<0.1	110
Endrin	<0.1	<0.1	<0.1	111
8-Endo-Sulfan	<0.1	<0.1	<0.1	106
DDD	<0.1	<0.1	<0.1	113
DDT	<0.1	< 0.1	<0.1	106
Methoxychlor	<0.1	<0.1	<0.1	104
Chlordane	<0.1	<0.1	<0.1	ŧ

Method Codes: MEO-005



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Phone/Fax (066) 53 6457

23rd November 1999 (993 200/A)

REPORT ON SAMPLING AND TESTING FOR PRIMARY CONTAMINANTS AT LOT 5, DP 820 652 AND LOT 1, D.P. 592 173 BRUXNER PARK ROAD, KORORA

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23rd November 1999 (993 200/A)

REPORT ON SAMPLING AND TESTING
FOR PRIMARY CONTAMINANTS
AT LOT 5 D.P. 820 652
AND LOT 1, D.P. 592 173
BRUXNER PARK ROAD, KORORA, COFFS HARBOUR

BACKGROUND

This report has been prepared in order to evaluate the probable extent of soil contamination. posed by primary contaminants, Arsenic, Lead, Copper, Cadmium, Chromium, Organochlorines and Organophosphates, as used on and around former banana growing areas.

The Report has been prepared, at the request of the Owner, Thakral Holdings, in response to a Condition of Approval from the Coffs City Council, and has been conducted in accordance with discussions with Council and the protocol as set out in the Draft Guidelines for Former Banana Plantation Sites (1992) and the Draft Guidelines for Vertical Mixing of Former Broad-acre Agricultural Land (1994).

Council's mapping of present and former banana growing areas has indicated that much of this property was formerly used for the growing of bananas and hence is identified as requiring sampling and testing for possible chemical residues.

Preliminary testing of the site some years ago (by others) indicated that Arsenic, Copper and Chromium residues were present on land worked by the former Owner, and accordingly additional heavy metals were to be included in the screening tests.

Reliable information as to the extent and type of chemicals used, is not available.

Chemical Residue Testing Lots 1 & 5, Bruxner Park Road, Korora

THE SITE

The property, of about 17 Ha. area, is described as Lot 1, D.P.592173 and Lot 5 D.P.820652 Parish of Coffs, County Fitzroy. It is located at Map Reference 514 N 123 E, on the 1:25,000 Coffs Harbour Topographical Map, and is situated 6 km north of Coffs Harbour C.B.D.

The property extends between Bruxner Park Road, Pacific Highway and West Korora Road. A ridge of high ground runs east-west through the northern half of the site with Jordans Creek, parallel to West Korora Road running along inside the southern boundary.

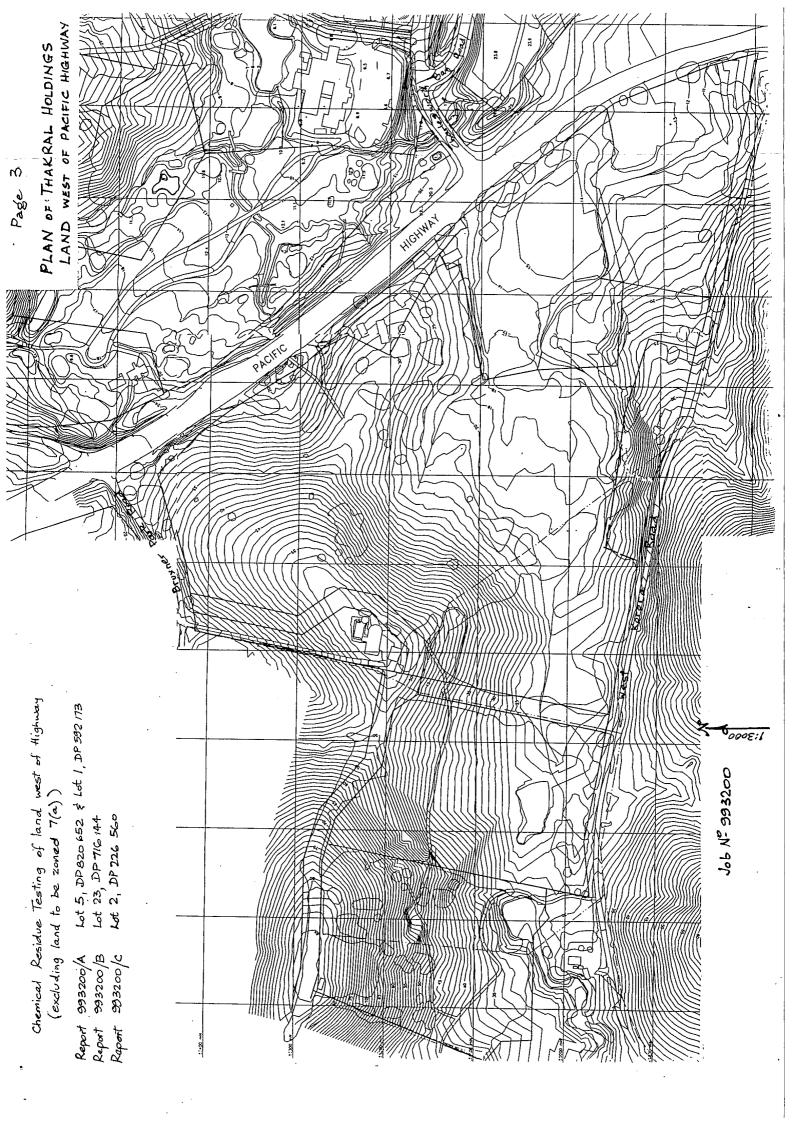
Most of the land has been cleared and is now pasture after being formerly used for bananas and small cropping. In the south west corner and along the creek there is an area of about 4 Ha. which has not been cleared for agricultural purposes. This area is to be rezoned as 7(a) and as such has not been included in the sampling and testing programme.

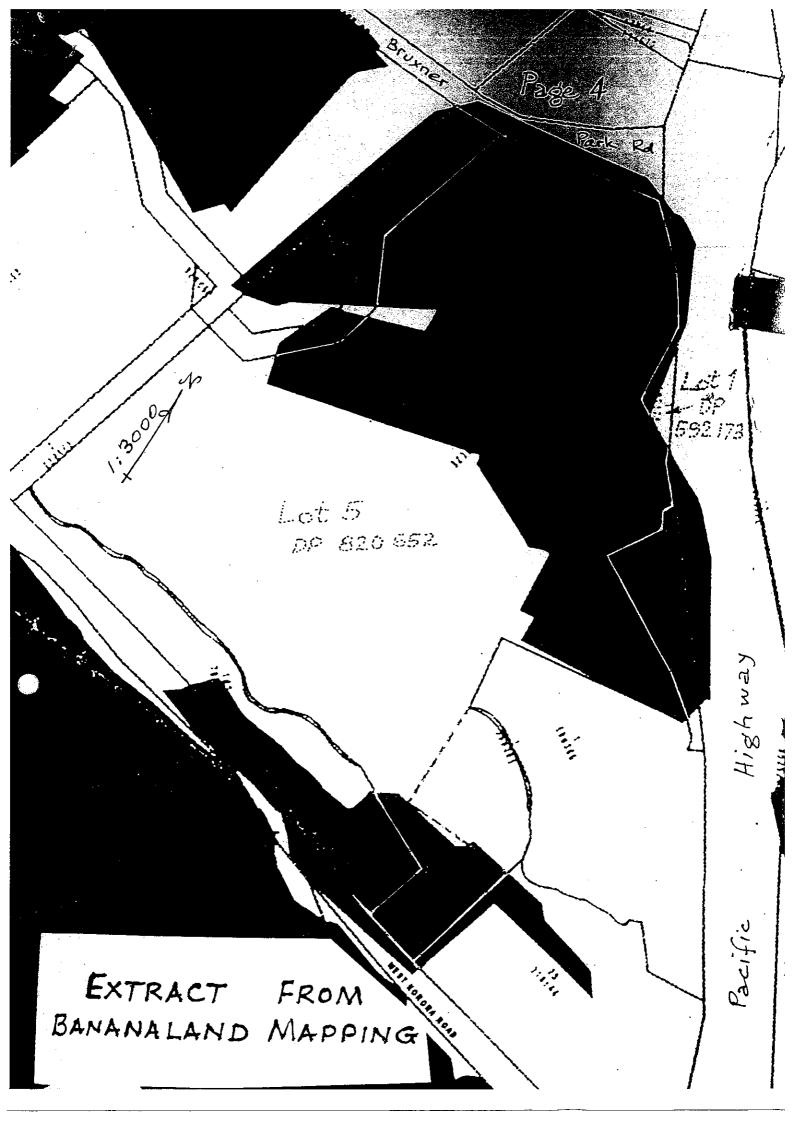
Most of the land has slopes of less than 20% but the southern side of the ridge line drops steeply at first, with slopes of up to 35%. The lower flatter slopes to Jordans Creek will have a high water table in wet periods.

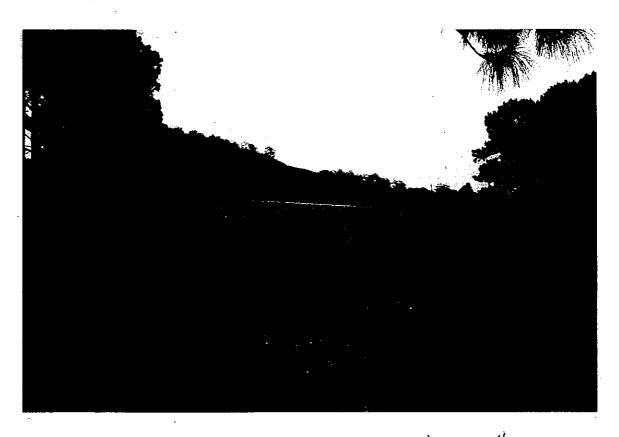
PROPOSED LAND USE

The land is zoned as Rural 1 (a) and it is proposed to re-zone for residential construction, so that most of the property will be used for residential buildings with normal residential activities, including gardening.

The uncleared area in the south west corner of the property and the creek line will be zoned as 7(a) with building work not allowed in these areas.



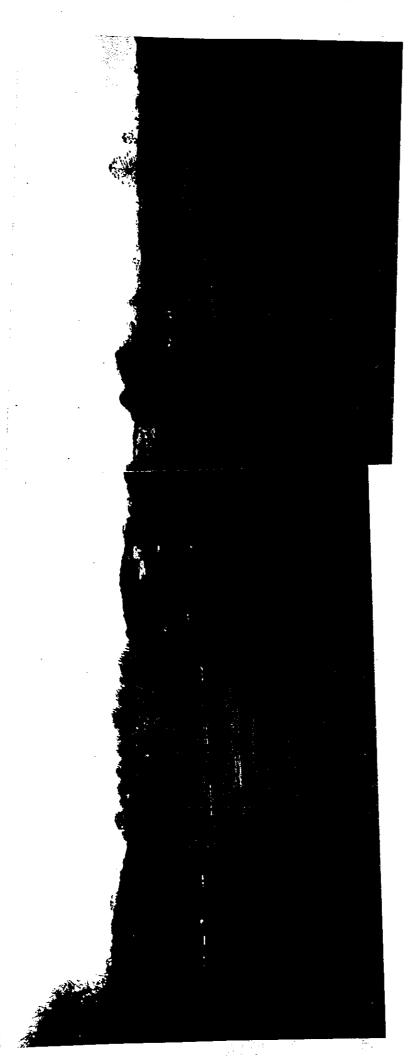




Looking north-westwards across the northern area of Lot 5. Most of the area with elevated arsenic levels is on the slope beyond the foreground trees.

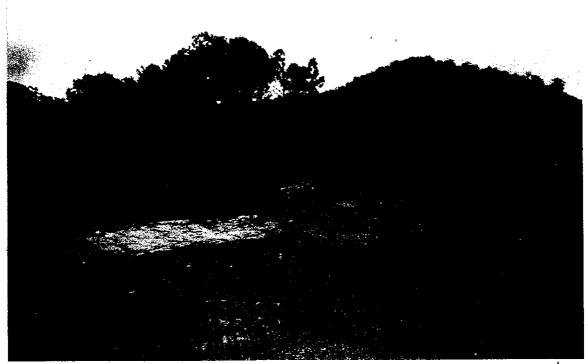
Job Nº 993200/A

Lot 5 DP 820652 Bruxner Park Road.



Looking southeastward to the Highway across the northeastern corner of the property where most of the elevated arsenic levels occur.

Job Nº 393200/A Lot 5 DP 820652 Bruxner Park Road



1 Location of Sample 1126

Location of Sample 1127

View looking westwards up the ridge line in Lot 5. Top of disturbed area on LHS.



View looking up ridge line to existing house on Lot 5 Area of disturbed ground in foreground

JOBN- 993200/A

Lot 5 DP 820 652 Bruxner Park Road

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Chemical Residue Testing Lot 5 & 1 Bruxner Park Road

SAMPLING AND TESTING

The programme for sampling and testing was undertaken in accordance with discussions with Council and the Draft Guidelines for Former Banana Plantation Sites (1992) and for Vertical Mixing of Former Broad-acre Agricultural Land (1994).

Stage One screening composite sampling was undertaken on a 25m grid with samples being tested for heavy metals, arsenic, lead, copper, cadmium and chromium as well as organochlorines and organophosphates.

Because some composites indicated possible elevated levels of arsenic, copper and/or chromium, the individual samples comprising these composites were tested for the specific metals as a Stage 2 testing programme.

With some elevated levels of arsenic and copper indicated by this Stage 2 individual testing, further samples were taken and tested from below these locations to establish the affected depth. This represents a Stage 3 testing programme.

SAMPLING NOMENCLATURE (See Figure 1)

Individual samples are numbered consecutively in this Report, commencing with 1001.

The individual samples have been grouped to form four-part composites, which have been numbered consecutively as AA/3200 to CY/3200.

Where double composite numbers are shown on the Plan, the second number indicates the composite from samples at depth 150mm - 300mm.

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Chemical Residue Testing
Lots 1 & 5 Bruxner Park Road, Korora

SAMPLING SUMMARY

STAGE I

A total of 58 4-part surface composites (00mm - 150mm) and 19 4-part depth composites (150mm - 300mm) were prepared.

The surface composites were tested for arsenic, lead, copper, cadmium, chromium, organochlorines and organophosphates. Whilst the samples at depth were tested for arsenic, lead, organochlorines and organophosphates.

These results are summarised in Table 1.

25 of the surface composites, and two of the composites at depth were found to have residues exceeding the thresholds, indicating possible contamination problems.

STAGE 2

The individual samples from these 27 composites were tested for the specific heavy metals identified in the composite sample tests. These were mainly arsenic and chromium, with three of the composities having high copper levels.

These results are summarised in Table 2 and diagrammatically on Figure 3.

At 12 of the specific locations, levels of arsenic were found to exceed the threshold level (100 p.p.m.) and at one location, copper levels were above threshold (60 p.p.m.).

As indicated on Figure 3, this contamination occurs essentially in the northern half of the property and will require remediation.

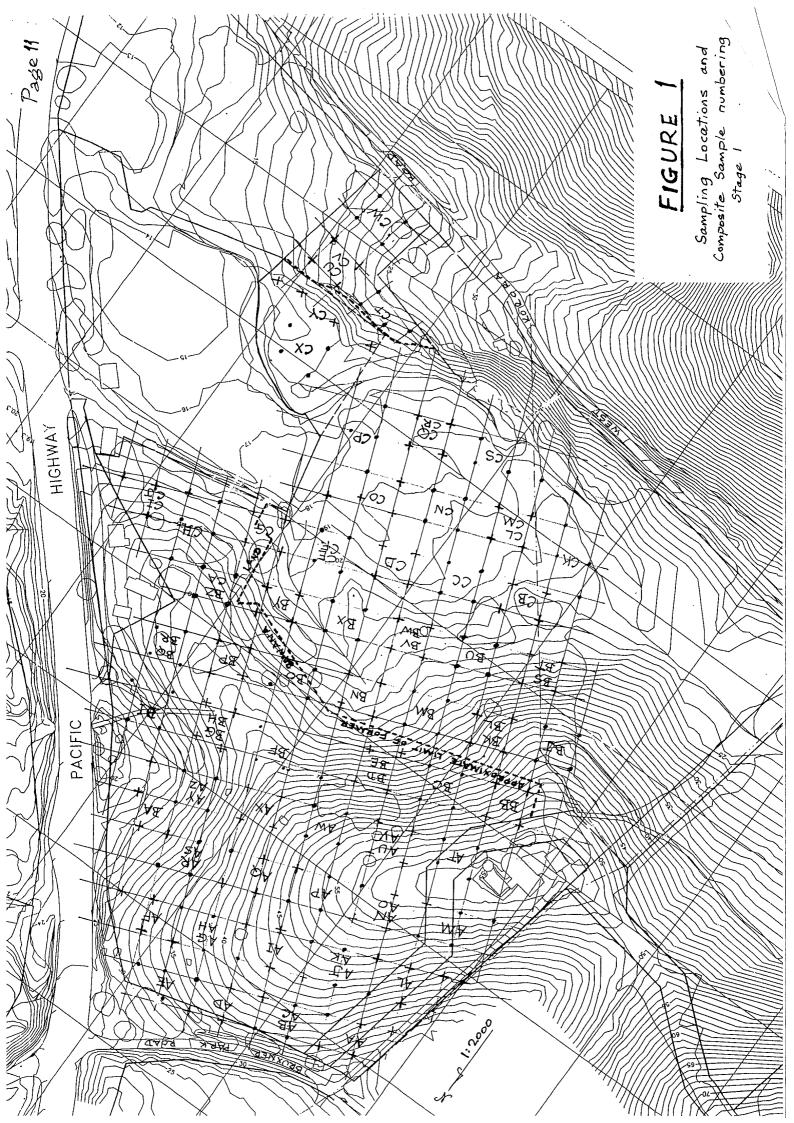
Page Ten

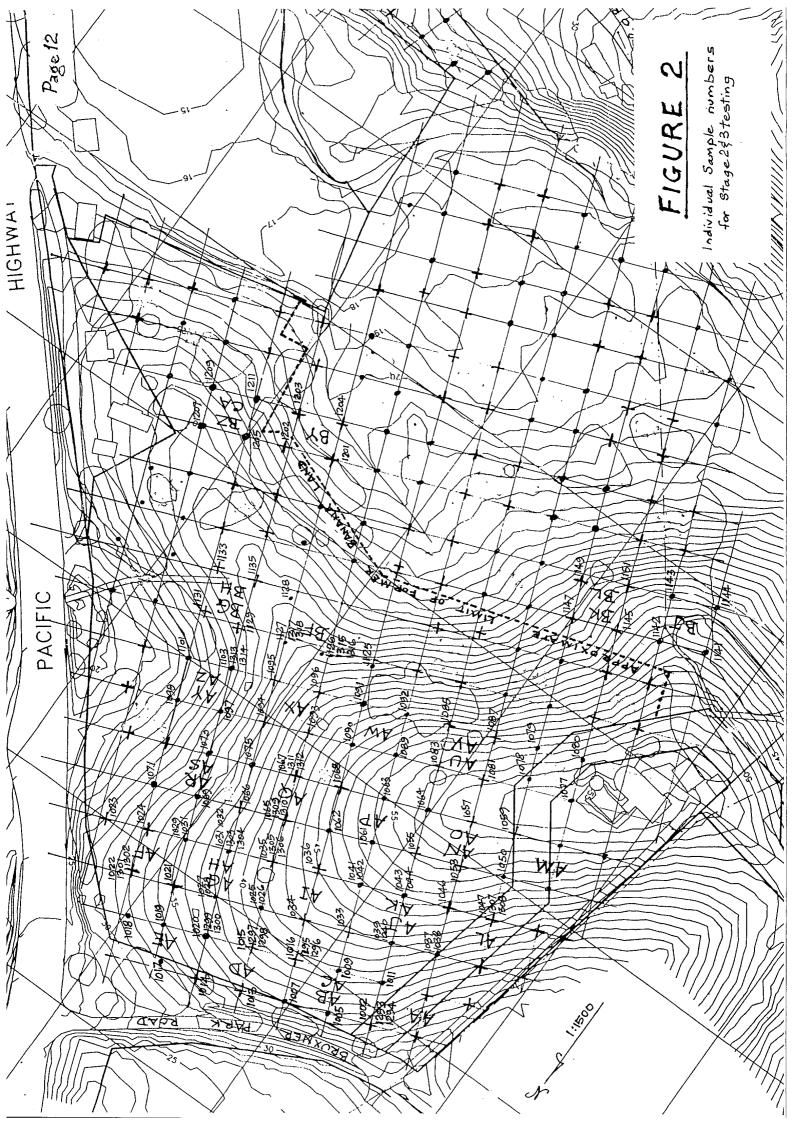
Chemical Residue Testing
Lots 1 & 5, Bruxner Park Road, Korora

STAGE 3

At the thirteen locations where levels of heavy metals have been shown to exceed threshold levels, additional individual samples were taken at extra depths to identify the vertical extent of this contamination.

These results are also summarised in Table 2 and Figure 3 and have been used in preliminary vertical mixing calculations.





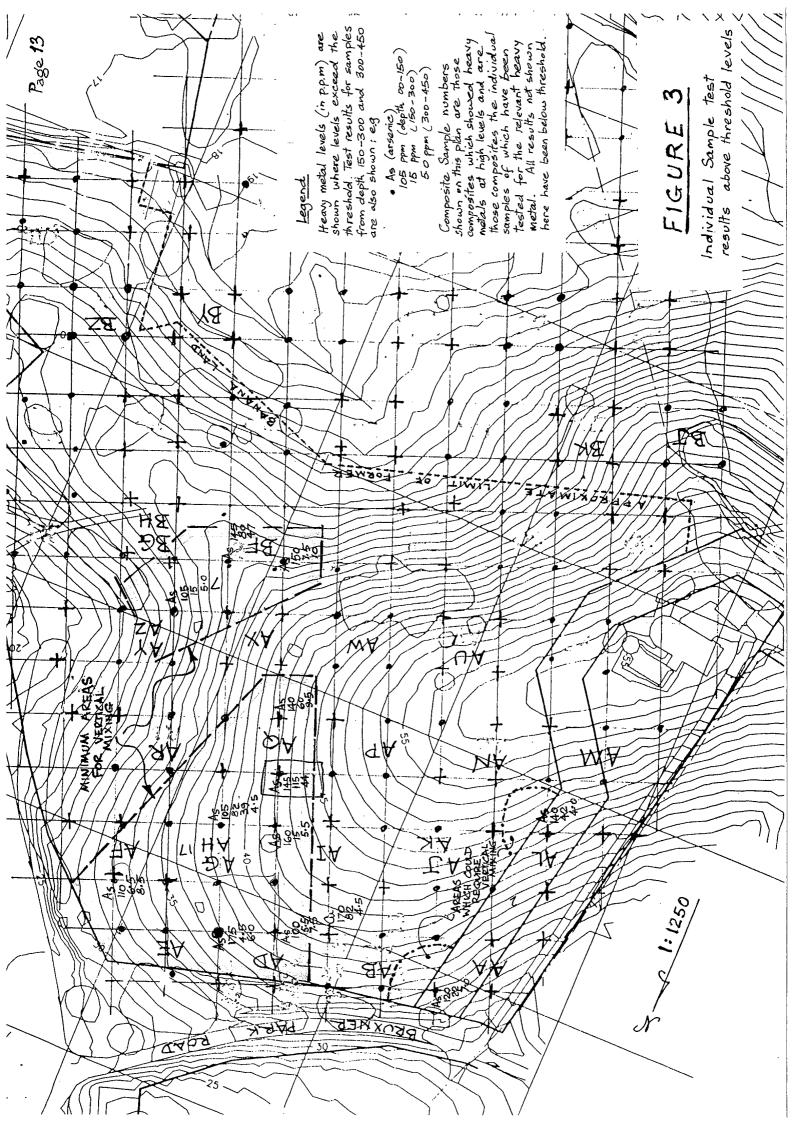




TABLE 1

;										
Stage &	(Conta	ımino	ztion	Le	vels	p.	p.m		Comment
Sample No						Organo	Organ	nochlo	rine	4-part
Sample 113	P_b	As	Cu	Cd	Cr	phosph.		Dieldoin		composite sample
STAGE 1			 		-			,		at depth
AA /3200	15	88	<0.5	< 0.5	15		10.02		<0.02)
AB /3200	16	50	5.0	<0.5	17	3	<0.02	Ö.	<0.02	500-150
AC /3200	13	4.5	NR	NR	NR	P.P	<0.02	ä	<0.02	150 - 300
AD /3200	18	46	40	<0.5	20	1.	<0.02	02	<0.02	
AE /3200	31	84	4.5	0.5	21	0	LO.02	o i	<0.02	700-150
AF /3200	20	87	3. <i>5</i>	<0.5	21		20.02		<0.02	 \
AG /3200	15	8/	1.5	(0.5	20	4	0.03	1	0.03)
AH /3200	12	38	NR	NR	NR	H	20.02	17 17	<i><0.02</i>	150-300
AI /3200	30	90	5.0	<0.5	19		0.11	-	0.11	300-150
AJ/3200	11	35	7.5	<0.5	19	V.	0.03	W	0.03	
AK /3200	13	32	NR	NR	NR	2	0.02	V	0.02	150-300
AL/3200	12	76	2.0	<0.5	19	7	<0.02	7	<0.02	
AM/3200	7.5	50	0.5	<0.5	20		40.02	!	<0.02	00-150
AN /3200	10	28	2.5	<0.5	23	W	0.03	Ш	0.03])
A0/3200	11	19	NR	NR	NR	Q	0.03	Q	0.03	150-300
AP /3200	17	69	11	0.5	23	A	0.11	⋖	0.11])
AQ /3200	19	91	2.0	0.5	28		0.03	-	0.03	00-150
AR/3200	33	43	2.5	<0.5	30	1	<0.02	7	<0.02]_)
AS /3200	14-	7.0	NR	NR	NR	4	20.02	4	<0.02	150-300
THRESHOLD	LEVEL	S					,			
4 or 5 part compasite	100	30	33	1	17		17	3.3		
Individual	300	100	60	3	50 YRD		50 sidue s	10		

N.R Not Required

NRD No Residue Detected.



Stage & Sample Nº	4	~+	•	, .		,			•] . [
		Jonio	חומי	ation	Le	vels	P.	p.m		Comment
	D					organo	Organ	ochlo	rine	4-part composite
/	P_b	As	Cu	Cd	Cr	phosph.	Total	Dieldin	DDE	sample at depth
STAGE 1				,				,		и аери.
AT /3200	9.0	28	l·5	<0.5	24		<0.02	<0.02		00-150
AU/3200	7.5	39	1.5	<0.5	26	ž	<0.02	!	p. 0) 00 = 130
AV /3200	7.5	8.0	NR	NR	NR	P.P	<0.02	<0.02	.A.	150-300
AW/3200	12	18	<0.5	<0.5	25	·	<0.02	<0.0Z	0	
A× /3200	15	G5.	<0.5	0.5	32	0	<0.02	<0.02	ئ	00-150
AY /3200	15	49	0.5	<0.5	25	7	0.04	0.04	-]) '
AZ/3200	/1	10	NR	NR	NR	4	<0.02	<0.02	Ŋ÷	150-300
BA /3200	32	24	4.0	<0.5	5.5	II	<0.02	<0.02	L/A]) i
· BB /3200	14	18	4.5	<0.5	5.0	\ 	<0.02	<0.02	-	00-150
BC /3200	17	19	2.0	⟨0,5	5.0	N	<0.02	<0.02	1.0	
BD/3200	18	13	2.0	<0.5	3.0	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	<0.02	<0.02	. V)])
BE /3200	. 22	8.0	NR	NR	NR	77	<0.02	<0.02	Ħ	150-300
BF/3200	19	105	3.5	<0.5	5.0		<0.02	<0.02	7	00-150
BG/3200	23	50	7.0	40.5	6.5	W	(0.02	<0.02	<u> </u>	
BH /3200	22	14-	NR	NR	NR	Q	<0.02	<0.02	RE	150-300
BI /3200	27	20	11	<0.5	7.5	4	20.02	<0.02	A/])
BJ /3200	17	47	4.0	<0.5	3.0		20.02	<0.02		00-150
3K/3200	21	51	4.0	<0.5	3.0	7	<0.02	<0.02	7])
BL /3200	21	29	NR	NR	NR	4	<0.02	<0.02	4	150-300
THRESHOLD	LEVEL	s								
4 or 5 part compasite	100	30	33	1	17		17	3.3	· .	
Individual	300	100	60	3.	50 IRD	-	50 sidue s	10		



:							. 		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·
Stage &	(Conta	mino	ation	Le	vels	P.	p.m		Comment
Sample No						organo	Organ	nochlor	ine_	4-part
Sample 113	Pb	As	Cu	Cd	Cr	phosph.	Total	Dieldrin	DDE	composite sample
STAGE 1									i	at depth-
BM/3200	18	18	7.5	<0.5	2.0		-			7
BN /3200	18	8.5		<0.5	2.0	\$	ý,			[/
Bo /3200	21	17		<0.5	8.0	P.P	Ø.			00-150
BP /3200	28	12	17	<0.5	6.5	-	0		-	
BQ/3200	41	25.	12	(0.5	7.0	0	Ö			
BR /3200	23	20	NR	NR	NR	7				150-300
BS /3200	31	23	29	<0.5	6.0	4	7			60-150
BT /3200	27	5.0	NR	NR	NR	HI	Ŧ			150-300 ;
· BU /3200	23	14	11	<0.5	7:5					00-150
BV /3200	16	4.0	12	<0.5	3.0	N	N] }
BW/3200	51	4.5	NR	NR	NR	N)	S		<u> </u>	150-300
Bx /3200	26	7.5	31	<0.5	6.0	7	7] }
BY /3200	30	5.5	100	<0.5	4.0					00-150
BZ /3200	66	29	240	<0-5	4.5	W])
CA /3200	24	7.0	NR	NR	NR	Q	W			150 - 300
CB/3200	34	5.0	8.5	<0.5	7.0	4	4			1)
CC/3200	20	12	5.5	< 0.5	5.5					00-150
CD/3200	21	4.0	5.0	10.5	6.0	1	7 7	,		10-150
CE /3200	22	4.5	5.0	<0.5	6.5	4	4			
THRESHOLD	LEVEL	s						:		
4 or 5 part compasite	100	30	33	1	17		17	3.3		
Individual	300	100	60	3	50		50	10		
. N.F	2 Not	Requir	ed		YRD	No Re	sidue -	Detecte	₫,	•



	Ï		· · · · · · · · · · · · · · · · · · ·	1 '					;	
Stage &		Conta	amin	ation	Le	evels	P.	P.M		Comment
Sample Nº	Pb	As	Cu	Cd	Cr	organo	Orga	nochlo	rine	4-part composite
	5	75	Ca	La		Linospa.	Total	Dieldoin	DDE	sample at depth
STAGE 1										
CF /3200	23	3.5	NR		NR					150-300
CG/3200	22	6.0	3.5		4.0	\$	٤	1])
CH /3200	27	22	3.0	7	3.0	P. A	P.17			00-150
CI/3200	28	9.0	5.0	a.	4.0	-	0			
CJ/3200	16	5.5	NR	3	NR	0	Ö	i		150 -300
CK /3200	26	4.0	12	0	7.0	-				17
CL /3200	21	4.0	10		7.0	4	.√ .√			00-150
CM/3200	16	4.5	NR	Z	NR	I	H,		-	150-300 i
·CN /3200	2/	3.5	8.5	77	5.0					00-150
CO/3200	37	4.0	8.0	1	6.0	S	5			80-150
CP/3200	31	4.0	16		7.5	Λ)	Ś			} 00-150
CQ/3200	27	3.0	18	S	9.0	37	7			502730
CR /3200	28	3.5	NR	V)	NR				 -	150-300
CS /3200	26	5.0	17	7	7.0	Z	H			<u> </u>
CT /3200	14	7.5	3.5	-	7.0	Q	d			> 00-150
CU/3200	8.5	i7	3.0	~!	5.5	4	4			
CV/3200	10	6.0	NR	7 \	NR	,]				150-300
CW/3200	15	20	7.0	4	7.5	7 7	7 -			00-150
C X /3200	21	4.0	NR	NR	NR	4	\ \ \	ı		\
CY/3200	26	4.5	NR	HR	NR		:			
4 or 5 part composite	100	30	33	1	17		17	3.3		
Individual	300	100	60	3.	50		50	10		·
N.R	. Not	Require	:d	_ 	IRD	No Res	idue D	etected	<u>. </u>	



A

TESTING OF POSSIBLY CONTAMINATED SITES
TABLE OF RESULTS OF CHEMICAL ANALYSES
FOR Lot 5, DP 820652, Bruxner Park Rd., Korora

TABLE 2

							INDLE	· · · · · · · · · · · · · · · · · · ·
Stage &		Conta	mina	tion	Lev	els	p.p.m	comment
Sample Nº	Cr	As	Си			At c samp	omposite de location	Individual Samples
STAGE 2 \$ 3					-			at depth
1002	NR	120.	NR	<u> </u>)		00-150
1293	NR	22	NR		·	> AA	/3200	150-300
1294	NR	7.0	NR)	, 	300-450
1005	5.0	55	NR).)
1007	5.0	10	NR			AE	3/3200	00-150
1009	10	44	NR	1				
1011	5.5	32	NR					J .
[013	20	8.0	6.5	<u> </u>)		
1014	18	6.5	2.5				•	00-150
+015	20	100.	4.5					
1297	NR	5.5	Ν̈́R			> A.	D/3200	150 -300
.1298	NR	7.5	NR				, 	300-450
. 1016	22	67	170	\ 				00-150
1295	NR	NR	82					150-300
1296	NR	·NR	4.5					300-450
1017	4.0	30	NR	•)) .
1018	6.5	92	NR		,			
-1919-	10	70	NR			AE	/3200	00-150
1020	6.5	175.	NR				/	J
1299 1300	NR NR	4.5 6.0	NR NR		7			150-300 300-450
THRESHOLD	LEVE		ble 6	Orchard	& Marke	t Garde	ns, Technica	d or Dec 95)
4 or 5 part Composite	17	30	<i>3</i> 3					
Individual	.50	100	60					
N.R	Not	Require	d	NF	SD No	Residu	e detected	



					· · · · · · · · · · · · · · · · · · ·					(cont.)
	Stage &		Conta	mina	tion L	eve	els	P.P.	m	Comment
	Sample Nº	Cr	As				At a Samp	empos le loc	ite ation	Individual Samples
	STAGE 2 & 3									at depth
	1021	7.0	84_			-	<u> </u>			00-150
A	1022	8.0	110.				<u> </u>			00-150
	1301-	NR	6.5				LAI	- /32 <i>c</i>	00	150-300
	7302	NR	8.5						·	300-450
	1023	7.5	52					· · · · · · · · · · · · · · · · · · ·		00 - 150
	7024	7.5	60							00-150
	1025	9.0	84	·						00 - 150
	1026	NR.	12	:		-				150-300
	· 1027	6.0	82							00 - 150
	1028	22	23				AG	7/32	00	150-300
	1029	6.5	56				> A	H /32	.00	00 - 150
	1030	ΛK	30				•	J		150 - 300
A	7031	6.0	105.							00 - 150
•	4032	NR	<i>8</i> 2							150-300
	7303	NR	39			**				300-450
	1304	NR	4.5		·					450-600
•					-		•	·		
	1033	4.5	84					-		00 - 150
	1034	4.0	72							00-150
	1036	4,5	32				Ai	[/32	00	00-150
	THRESHOLD	LEVE	-S (TO	ble G	Orchard & M	arke	t Garde	ns, Tec	unical C	pr Dec 95)
	4 or 5 part Composite	17	30	. 3						
	Individual	50	100							
•	N.R	Not	Require	d	NRD	No	residu	e Dete	cted.	•



Stage &		Conta	mina	tion	Lev	els	P.P.	m	Comment
Sample Nº	Cr	As			··	At co samp	empos le loc	ite ation	Individual Samples
STAGE 2 \$ 3									at depth
7035	7.0	160) A	r /320	00	00-150
7305	NR	15		,				· <u> </u>	150-300
1306	NR	5.5				J			300-450
/037	4.0	29						··	00 - 150
1038	NR	65		1	·		**************************************	·	150 - 300
1039	4.5	33							00-150
1040	NR.	39				> AC	T/320	0	150-300
1041	4.0	48				AK	(/320	00	00 - 150
. 1042	NR	36			-				150-300
1043	3.5	27							00-150
1044	NR	8.5				J			150-300
1047	3.5	140.				7	1		00 - 150
1307	NR	42				} AL	320	0	150-300
1308	NR	4.0			-)		-	300-450
1050	7.0	8.5				AM	/320	0	00 - 150
1053	26	NR		•		7	,		<u> </u>
105.5	18	NR				JAN	/320	U	00-150
1057	25.	NR			•		/		
1059	16	NR	,)			J
#	**************************************							··	
THRESHOLD	LEVE	-S (Ta	ble 6	Orchard	& Narke	t Garde	ins, Teci	inical C	or Dec 95)
4 or 5 part Composite	17	30	•						•
Individual	.50	100							
N.R	. Not	Require	d	NR	D No	Residu	e Dete	cted.	



1062 5 1063 4 1064 5 1065 6 1302 N 1310 N 1066 4	2r As 29 0 92 29 0 46 145		tion	Leve		.p.m posite location 200	Comment Individual Samples at depth 00-150
STAGE 2 \$ 3 1061 3. 1062 5. 1063 4. 1064 5. 1065 6 1302 N 1310 N 1066 4. 1067 9 1311 N	.5 29 .0 92 .5 29 .0 46 .5 145. R 115.).		Samples at depth
1061 3. 1062 5. 1063 4. 1064 5. 1065 6 1302 N 1310 N 1066 4. 1067 9 1311 N	.0 92 .5 29 .0 46 .5 145 R 115). (AP/3	200	at depth
1062 5. 1063 4. 1064 5. 1065 6 1302 N 1310 N 1066 4. 1067 9 1311 N	.0 92 .5 29 .0 46 .5 145 R 115). AP/3	200	00-150
1063 4. 1064 5. 1065 6 1302 N 1310 N 1066 4. 1067 9 1311 N	.5 29 .0 46 .5 145. R 115.				(AP/3	200	00-150
1064 51065 6 -1302 N1310 N -1066 41067 9 -1311 N	·0 46 ·5 145 R 115				<u> </u>		
-1065 6 +302 N +310 N -1066 4 -1067 9 +311 N	·5 145· R 115·)		
+302 N +302 N -1310 N -1066 4 -1067 9 +311 N	R 115			. 1	J		
7310. N -1066- 4. -1067- 9 1311- N)		60-150
-1066 4. -1067 9 -1311 N	R 44	1.					150-300
- 1067 9 1311 N							300-450
1311- N	.0 42.				> AQ/3	200	00-150
	.0 140.				/		00-150
-/312 N	R 60						150-300
	R 9.5		•				300-450
1068 7	<i>,5</i> 33						00-150
-1069 6	0 23)		
1071 7	10 47				AR/3	200	00-150
1073 4	.5 57		· · · · · ·			·	
	0 52		•				J .
	6 NR)		
	6 NR				(AT/	3200	00-150
	1 NR		 		7	· · · · · · · · · · · · · · · · · · ·	7
•	O NR						
	VELS (TO	ble 6	Orchard	& Marke	t Gardens,	Technical C	or Dec 95)
4 or 5 part	7 30			,			
Individual 5	0 100				residue.		



TABLE 2 (cont.)

Stage & Sample Nº	<u></u>	Conta	mina	tion	Lev	01-	~ ~		1
,	Cr					レ!	P.P.	מי	Comment
STACE 262		As				At a Samp	empos le loc	ite ation	Individual Samples
31 MGE C 5 3									at depth
1081	3.5	65							
1083	2.5	17		Ì		LA	J/32	00	00-150
1085	4.0	10					/		
1087	3.5	39							
1089	30	NR							
1090	31	NR		,		AV	v /32	00	00-150
1091	36	NR					/		
1092	33	NR)
. 1093	5.5	50				7)
1094	5.0	64				(4)	× /320	00	,00-150
1095	4.5	88					/ -		(
4036	3.0	57							
1097	3.0	36				7			
1099	2.5	47							00 - 150
1101	4.0	. 12				AY	/320	O	
7103-		105.					/	·) .
7313	NR	15							150 - 300
-13.14	NR	5.0							300-450
						-			<u> </u>
						· · ·			
THRESHOLD	LEVE	- S (TZ	ble 6	Orchard	& Marke	t Garde	ns, Tec	unical C	or Dec 95)
for 5 part Composite	17	30	-		i		ļ i		·
Individual	50	100							·



				- 704		(cont.)
Stage &	Conta	minatio	n Leve	uls p.	o.M	Comment
Sample Nº	As			At compo sample lo	site ecation	Individual Samples
STAGE 2 \$ 3						at depth
1125	27		·	1.		00-150
1126	150.			<u> </u>		00-150
1315	7.5					150 - 300
1316	10			BF/E	3200	300 - 450
4127	145.			/		00-150
-1317	80					150 - 300
1318	47					300-450
1128	72			<u> </u>		00-150
-1129	42)
1131	21			BG/3	3200	00-150
// 33	34			/		
//35	50)	.	
1141	18		<u> </u>)	· 	
/142	49			BJ/	3200	50-150
1143	49			. (
1144	7.0	·	•	<u>J</u>	•	J ·
- 1145	64)		
1147	32			BL/3	200	00-150
1149	16			(
1151	27			<u> </u>		
THRESHOLD	LEVELS (TO	ble 6 orc	hara & Marke	+ Gardens, T	Technical C	or Dec 95)
4 or 5 part Composite	30	·				
Individual	. 100					



TABLE 2 (cont.)

•									(65/161)
Stage &		Conta	mina	tion	Lev	els	P.P.	m	Comment
Sample Nº			Си			At c Samp	ompos ple loc	ite ation	Individual Samples
STAGE 2 & 3									at depth
1201			3.5			<u> </u>)
1202	ļ		13		 	B	Y/32	.00	00-150
1203	ļ		2-5					<u> </u>	
1204	<u>-</u>		9.5)
1205			·28	<u> </u>)		<u> </u>	
1207			11			B	Z/32	00	C 00-150
1209			6.5						
1211			3.5]}			
				-			-		
				-					
					 ' 				
				·····	<u> </u>				,
				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			 		
							,		·
	, a.				· · · · · · · · · · · · · · · · · · ·		<u> </u>		•
THRESHOLD	LEVE	-S (Ta	ble 6	Orchard	& Narke	t Gard	ens, Tec	unical C	or Dec 95)
for 5 part Composite			3 3						
Individual		·	60						

NON No posiduo Detected

Page Twenty Five

Chemical Residue Testing
Lots 1 & 5, Bruxner Park Road, Korora

DISCUSSION OF RESULTS

In accordance with the Draft Guidelines, four-part composite samples from the surface (00mm - 150mm) were taken from the area of the property to be zoned for residential use. The individual sampling points were set out on a 25m grid pattern. In addition, depth samples (150mm-300mm) were taken at one third of the locations to provide composites at depth.

The surface composites were tested for arsenic, lead, copper, cadmium, chromium, organochlorines and organophosphates.

The depth composites were tested for arsenic, lead, oganochloines and organophosphates.

STAGE 2 (Composite sample testing, Table I)

The composite sample testing has been used to screen out chemicals and areas where no further testing was required. The results indicate;-

LEAD In the composite samples lead levels vary generally between 7.5p.p.m. and 28p.p.m..which from experience in the Coffs Harbour area is indicative of background levels. There are eleven composite samples distributed of a wide area of the site with levels of more than 28p.p.m., the highest being 66p.p.m.

This possibly indicates low level use of lead-based pesticides, but with all levels well below the threshold (100p.p.m.) no further testing for lead has been undertaken.

Con	ti	กน	ed			٠	٠	•	

Page Twenty Six

Chemical Residue Testing
Lots 1 & 5, Bruxner Park Road, Korora

ARSENIC In the composite samples, high levels of arsenic were recorded over most of the northern area of the site, where Council Mapping indicates bananas have been grown. This includes the north facing slope down to Bruxner Park Road and the north-east facing slope down to the Highway. Arsenic-based pesticides also appear to have been used over the crest of the ridge onto the top of the southern slopes.

Testing of the individual samples of some 22 composites for arsenic levels was required to identify areas with above threshold levels.

Twelve individual locations were identified as having arsenic levels above threshold (100p.p.m.) and hence will require remediation.

COPPER The composite sample results suggest an irregular occurence of elevated copper levels, with three composites warranting individual sample testing to determine actual levels. With a background level of about 10p.p.m., it appears that possible low level contamination occurs on parts of the areas used for small cropping and in the former banana areas.

However, a high level of copper occurs at one location near the northern boundary on the north-facing slope. This location will require remediation.

CADMIUM With the highest level of cadmium in the composite samples at 0.5p.p.m. (threshold lp.p.m.) elevated levels of this metal apparently do not occur and no further testing has been undertaken.

CHROMIUM In the composite samples, high levels of chromium were recorded over most of the northern area of the site, with a similar distribution to the elevated arsenic levels.

Testing of the individual samples of some 18 composites for chromium levels was required to identify possible above threshold levels. Since none of these individual sample tests showed levels above threshold (50p.p.m.) no further testing or remediation was required.

Page Twenty Seven

Chemical Residue Testing. Lots 1 & 5, Bruxner Park Road, Korora

ORGANOCHLORINES Most of the composite samples failed to record the presence of organochlorine residues. However, small quantities of D.D.E. and Dieldrin were detected in the northern area of the property. This includes the north-facing slope down to Bruxner Park Road and the north-east facing slope down to the Highway, being areas of former banana plantations.

D.D.E, maximum level of 0.11p.p.m. (threshold of 17p.p.m.) was detected in eight composite samples.

Dieldrin, level 0.04p.p.m. (threshold 3.3) was detected in one composite sample only.

These results indicate that organochlorine residues are present at very low levels in the northern area of the property. With levels well below the Guideline thresholds, no further testing was undertaken.

ORGANOPHOSPHATES Residues of organophosphates were not found at detectable levels and hence no further testing was undertaken.

STAGE 2 (Individual Sample Testing, Table 2)

The appropriate individual samples were tested for arsenic, chromium and copper as indicated by the composite test results.

This testing has enabled the identification of twelve locations where the arsenic levels are 100p.p.m. or more (the maximum being 175p.p.m.) and one location where the copper level is above 60p.p.m.(170p.p.m. being recorded). These locations are shown diagrammatically on Figure 3.

There are another 21 locations where arsenic levels exceed 50p.p.m. indicating widespread use of this chemical in the area of former banana plantations, but at levels not exceeding the threshold of 100p.p.m.

Page Twenty Eight

Chemical Residue Testing Lot 1 & 5, Bruxner Park Road

STAGE 3 (Individual Sample Testing at depth)

Additional samples were taken below each of the samples with a heavy metal level above threshold. The levels established for these extra samples can be use to calculate vertical mixing depths for remediation of these areas.

The lateral extent of such remediation work may need to be determined at some future date, unless the former banana plantation area is to be vertically mixed throughout.

It is noted that two of the high arsenic locations occur just within the proposed road reserve up the western boundary from Bruxner Park Road. To identify remediation requirements, this boundary will have to be located and additional samples taken from within the actual residential area.

Page Twenty Nine

Chemical Residue Testing
Lots 1 & 5, Bruxner Park Road

SUMMARY & CONCLUSIONS

- The land has been used for banana growing and small cropping, and the results of composite sample testing confirm that some chemical residues are present. In most cases the level found was below the relavent threshold, but individual sample testing has identified thirteen locations where heavy metal residues exceed threshold levels and remediation will be required.
- 2) The levels of lead shown in the test results are below threshold levels accepted by the E.P.A., but some are considered to be above background level and could indicate the use of lead-based pesticides at low concentrations.
- Asenic-based pesticides have been used over much of the property, and elevated levels (maximum 175p.p.m.) were found at thirteen locations within the former banana plantation area. These areas will require remediation before the property can be used for residential living.
- Copper residues appear irregulary over the former banana plantation area. One location has been identified where the level (at 170p.p.m.) indicates that remediation is required.
- The levels of cadmium shown in the test results are below threshold levels accepted by the E.P.A., and are considered to be of background levels only.

Continued.....

Page Thirty

Chemical Residue Testing Lot 1 & 5, Bruxner Park Road, Korora

The levels of chromium shown in the test results for the composite samples from the former banana plantation area suggest slightly elevated levels of chromium. Individual sample testing verified that the levels are all below the threshlod accepted by the E.P.A.

Chromium, at low levels, appears to have been introduced onto the former banana plantation, possibly in fertilizers.

- Organochlorine residues as Dieldrin and D.D.E. were detected in nine of the composite samples from the former banana plantation area. The levels are well below threshold levels accepted by the E.P.A., and indicate very low levels of residues of these chemicals.
- 8) Organophosphate residues were not found at detectable levels.

The following section details a remediation strategy for the areas affected by elevated levels of heavy metals. These occur in the former banana plantation area. This programme is based on the vertical mixing of the surface layer as a first stage of the development of the subdivision.

When this strategy has been implemented and validated, the property will be considered safe for residential use within the framework laid down in the Guidelines, recognising that because of the statistical nature of sampling, no absolute guarantee can be given that contamination levels in excess of those measured, could not occur at other locations on the property.

Page Thirty One

Chemical Residue Testing
Lots 1 & 5, Bruxner Park Road, Korora

PROPOSED REMEDIATION STRATEGY

This investigation indicates that widespread low level contamination with arsenic occurs over most of the land formerly used for the growing of bananas. Calculations based on the Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land indicate that vertical mixing to a depth of 300-350mm will effectively reduce the arsenic levels to less than threshold level (100p.p.m.) in all but one location.

It is proposed that a vertical mixing remediation programme will be undertaken to a depth of 350mm in the north-eastern area of the property, as outlined on Figure 3.

At the location of Sample 1065, Composite AQ, a surface level of 145p.p.m., underlain successively by levels of 115p.p.m. and 44p.p.m. were recorded. This represents a deeply affected localised area.

It is proposed that this area be defined by further sampling and testing. The affected soil will then be removed and encapsulated at a suitable depth below roadworks at a location to be defined by survey. At this stage, it is estimated that up to 300 cu.m of soil could be involved.

Likewise, the area identified as having elevated levels of copper (at Sample 1016 in Composite AD) is a localised, contaminated area which should be further defined and subsequently encapsulated as above. A similar quantity of soil may be involved.

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23rd November 1999 (993 200/C)

REPORT ON SAMPLING AND TESTING FOR PRIMARY CONTAMINANTS AT LOT 2, D.P. 226 560 WEST KORCRA ROAD, KCRORA COFFS HARBOUR

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PROPOSED LAND USE	2
PLAN THAKRAL HOLDINGS LAND	3
EXTRACT FROM PANANA MAPPING	4
PHOTOGRAPHS	5
SAMPLING AND TESTING	7
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TABLE 1 (Summary of Tests)	10
TABLE 2	12
DISCUSSION OF RESULTS	13
SUMMARY & CONCLUSIONS	15
APPENDIX - LABORATORY TEST SHEETS (attached as separate Report 9932	200/D)



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23rd November 1999

REPORT ON SAMPLING AND TESTING FOR PRIMARY CONTAMINANTS AT LOT 2, DP 226 560 WEST KORORA ROAD, KORORA COFFS HARBOUR

BACKGROUND

This report has been prepared in order to evaluate the probable extent of soil contamination posed by primary contaminants, Arsenic, Lead, Organochlorines and Organophosphates, as used on and around former banana growing areas.

The Report has been prepared, at the request of the Owner, Thakral Holdings, in response to a Condition of Approval from the Coffs City Council, and has been conducted in accordance with discussions with Council and the protocol as set out in the Draft Guidelines for Former Banana Plantation Sites (1992) and the Draft Guidelines for Vertical Mixing of Former Broad-acre Agricultural Land (1994).

Council's mapping of present and former banana growing areas has indicated that most of this property was formerly used for the growing of bananas and hence is identified as requiring sampling and testing for possible chemical residues.

There is a stand of trees in the north west corner of the property, and the creek line and dam area on the southern boundary which have been identified as not having been used for banana growing. It is proposed that these areas be re-zoned as 7(a) (Environmental Protection).

Reliable information as to the extent and type of chemicals used, is not available.

Chemical Residue Testing Lot 2, West Korora Road

THE SITE

The property, of about 4.5 Ha., is located on the northern side of West Korora Road about 4.5 km from Coffs Harbour C.B.D. The property is located at 1:25000 Topographical Map Coffs Harbour Reference 119E 512N and is described as "Lot 2, DP 226 560, Parish of Moonee, County Fitzroy".

The land slopes down from a ridge line along the northern boundary. Gradients are generally 15% to 20% with localised steeper areas in gullies and an easing of the slope at the bottom of the hill. Most of the land has been cleared and was used as a banana plantation, but is now becoming overgrown and regrowth is occuring.

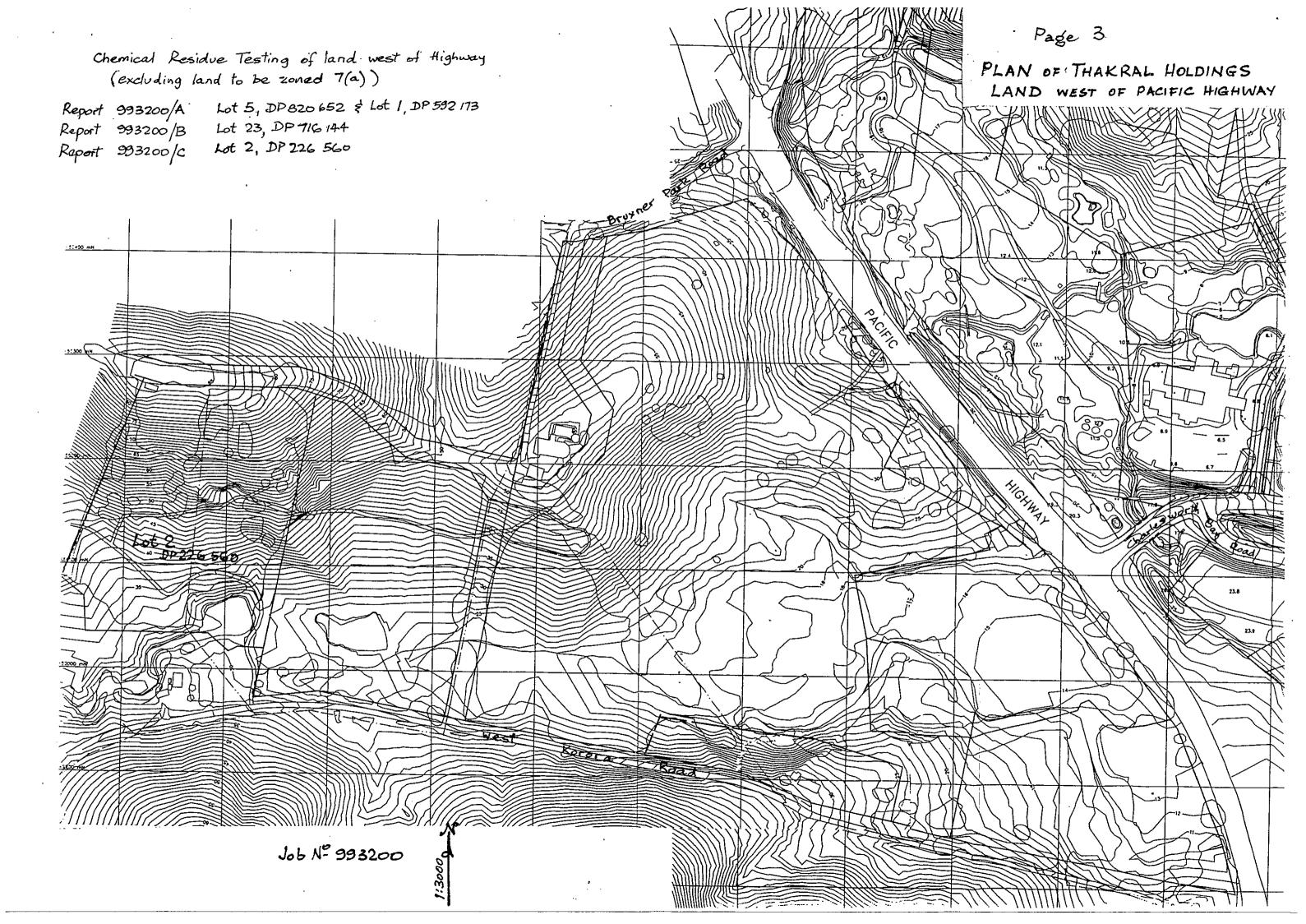
The property has been fenced, but most of the fence is in disrepair. There is a large excavation site about in the middle of the property. It appears to have been a borrow pit or else a proposed house site.

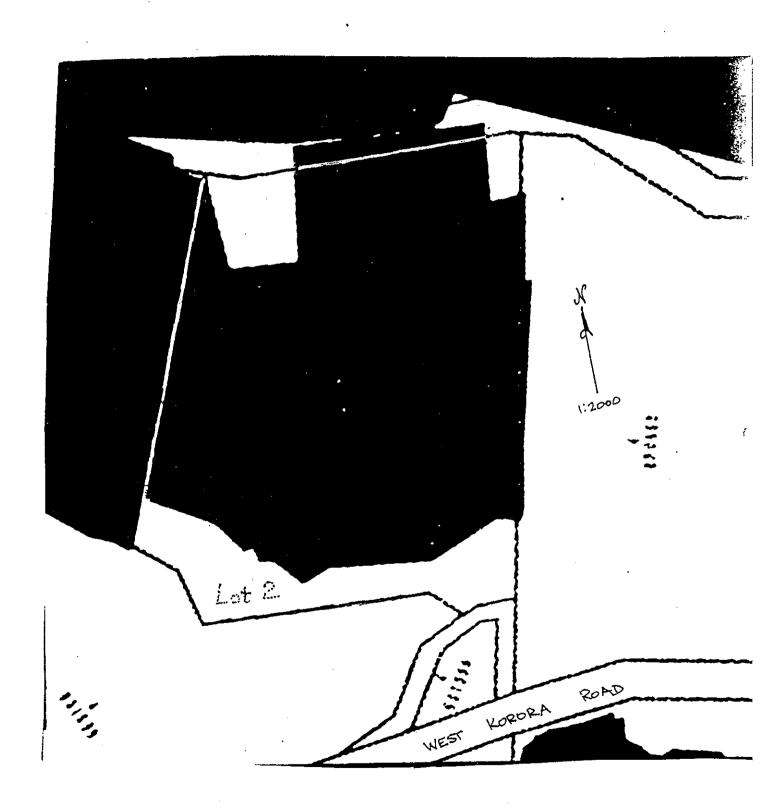
There is a dam in the south east corner of the site and an access road running through the property to the western neighbour.

PROPOSED LAND USE

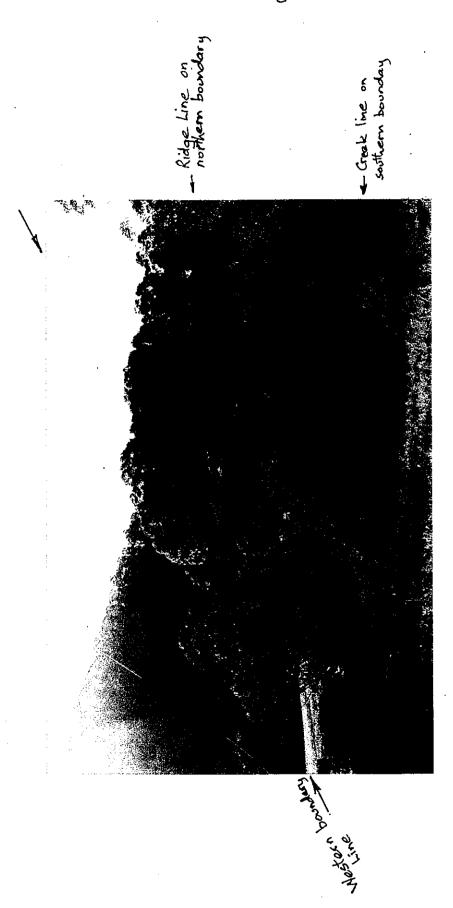
The land is zoned as Rural 1 (a1) and it is proposed to subdivide into three Rural Residential Lots. It is anticipated a residence will be constructed on each Lot and that the area will be used for normal residential use, including gardening.

It is proposed that the area along the creek line (southern boundary) and the stand of timber in the north west corner will be zoned as 7(a), with building works not allowed in these areas.





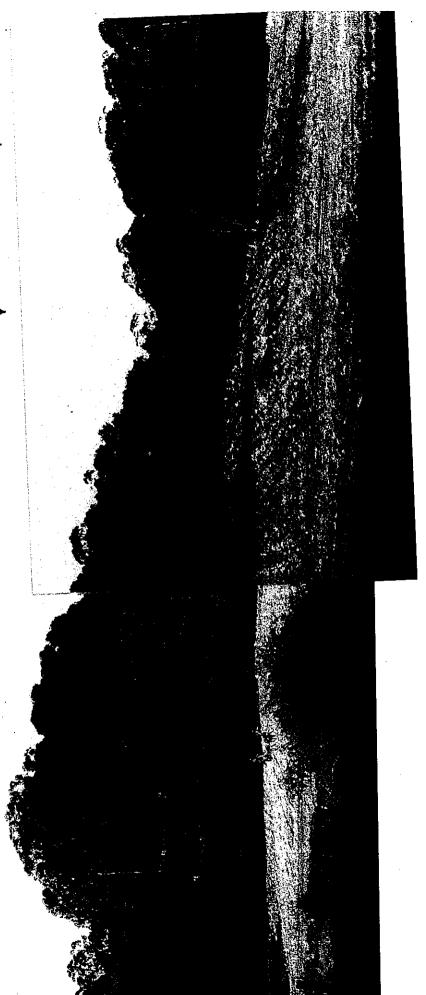
EXTRACT FROM BANANA LAND MAPPING.



General view of Lot 2 from West Korora Road

Execution area.

Stand of timber proposed as 7A



View looking northwards from Southwest corner of property

Chemical Residue Testing
Lot 2 West Korora Road

SAMPLING AND TESTING

The programme for sampling and testing was undertaken in accordance with discussions with Council and the Draft Guidelines for Former Banana Plantation Sites (1992) and for Vertical Mixing of Former Broad-acre Agricultural Land (1994). and was as follows:-

STAGE I (see Figure 1)

A 25m grid was established on site to enable the former plantation area to be sampled for testing of four part composite samples each representing about 2500 sq.m. area. Some sampling locations were adjusted according to terrain, proximity of disturbed ground (access tracks etc.) and vegetation.

Sixteen, 4-part composites were made up from samples taken from $00-150\,\mathrm{mm}$ depth. Samples were taken at $150\,\mathrm{mm}$ - $300\,\mathrm{mm}$ depth at five of these composites to make up composites at depth.

The twenty-one composites were tested for Arsenic, Lead, Organophosphates and Organochlorines.

The results of these tests are summarised in Table 1, and indicate levels (in all but two of the composites) of these chemicals below the threshold levels identified in the above Draft documents.

In the case of the two surface composites EI/3200 and EJ/3200, the level of arsenic was above threshold level, and hence a Second Stage testing was undertaken.

Page Eight

Chemical Residue Testing Lot 2, West Korora Road

STAGE 2

With levels of arsenic in two composites E1/3200 and EJ/3200 above the threshold of 30 p.p.m. the eight individual samples comprising these two composites were tested for arsenic.

The results are tabulated in Table 2 and indicate all eight samples are below the individual threshold of 100 p.p.m.

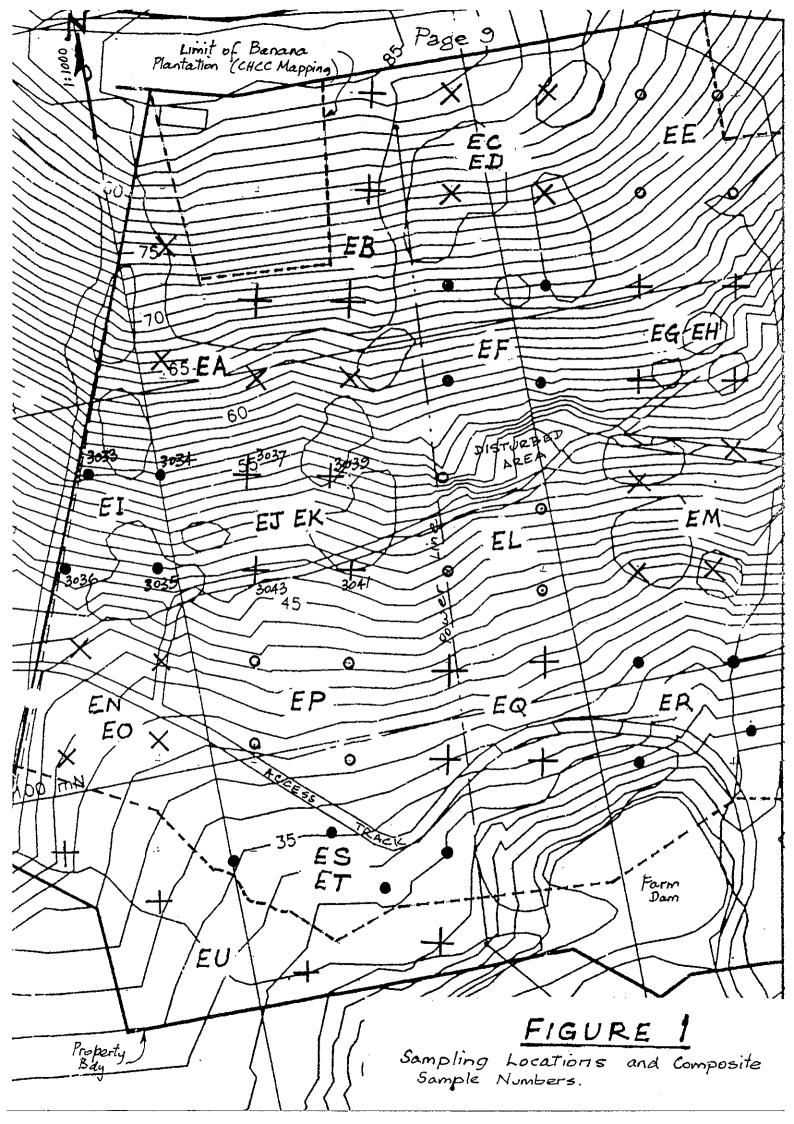
Accordingly no further sampling or testing was carried out.

SAMPLE NOMENCLATURE (See Figure 1)

The Job Number for Thakral Holdings is 993200 Individual samples are numbered consecutively in the Report, commencing with 3001

The individual samples have been grouped to form four-part composites, which are numbered consecutively as EA/3200 up to EU/3200

The individual sampling points and composite identifications are shown on Figure 1, using identifable symbols to indicate the locations associated with the composite numbering. Where double composite numbers occur, the second number indicates the composite from samples at depth (150-300mm)





TESTING OF POSSIBLY CONTAMINATED SITES

TABLE OF RESULTS OF CHEMICAL ANALYSES

FOR Lot 2, DP226560 West Korora Road, Korora.

TABLE 1

i							· 		
Stage &				tion Levels p.p.m					comment
Sample Nº	P_{b}	A	Organo phosph.	01	gano	4 - part			
CY: 05 1	В		<i>y y</i>	Total	Die klrin	DDT	DDE	DDD	composite Sample S
STAGE 1									at depth
EA/3200	23	9.0	20.1	<0.02					00-150
EB/3200	15	4.5	<0.1	20.02					00-150
EC /3200	18	6.0	<0.1	<0.02					00-150
ED/3200	リフ	6.5	<0.1	<0.02					150-300
EE /3200	18	5.5	<0.1	0.26	<0.02	0.14	0.12	<0.02	00-150
EF /3200	15	4.0	<0.1	<0.02					00-150
EG/3200	17	4.5	<0.1	<0.02	,				00-150
EH/3200	17	5.5	<0.1	<0.02					150-300
EI/3200	19	42	<0.1	<0.02					00-150
EJ/3200	19	40	<0.1	<0.02					00-150
EK/3200	22	5.5	<0.1	<0.02					150 - 300
EL/3200	19	14	<0.1	<0.02					00 - 150
EM/3200	17	18	<0.1	<0.02					00- 150
EN/3200	26	18	<0.1	<0.62					00 - 150
E0/3200	26	5.5	<0.1	<0.02					150-300
THRESHOLD	Level	.s					:		·
4 or 5 part. compasite	100	30		17	3.3				
Individual	300	100		50	10			cted	

N.R Not Required

NRD No Residue Detected.



TESTING OF POSSIBLY CONTAMINATED SITES
TABLE OF RESULTS OF CHEMICAL ANALYSES
FOR Lot 2, DP226560 West Korora Road, Korora.

					•				(2011).
Stage &		Contamina			Leve	comment			
Sample Nº	1	Λ	Organo			4 - part			
'	P_b	As	phosph.	Total	Diektrin	$\mathcal{D}\mathcal{D}\mathcal{T}$	DDE	DDD	composite Samples
STAGE 1			•	-					at depth
EP/3200	25	24	<0.1	<0.02	· · · · · · · · · · · · · · · · · · ·				00-150
EQ/3200	26	9.0	<0.1	<0.02					00-150
ER /3200	21	22	<0.1	<0.02	· · · · · · · · · · · · · · · · · · ·				00-150
ES /3200	33	4.5	<0.1	<0.02					00-150
ET /3200	22	3.0	€0.1	(0.02		<u></u>			150-300
EU /3200	19	3,5	<0.1	0.02	<0.02	0.02	<0.02	<0.02	60 - 150
							_		
							· · ·		
							<u> </u>		
·					:				
THRESHOLD	LEVEL	s					٠,		
4 or 5 part. compasite	100	30		17	3.3				
Individual	300	100		50	10				
N.R Not Required NRD No Residue Detected.									



TESTING OF POSSIBLY CONTAMINATED SITES TABLE OF RESULTS OF CHEMICAL ANALYSES FOR Lot 2, DP 226 560 West Korora Road, Korora

TABLE 2

•									
Stage &		Conta	amina	tion	Leve	els	P.P.	M	Comment
Sample Nº	D. 1		Organo	01	gano Dialdi	chlo	rines		Individual
	Pb	As	phosph	Total	Die ldrin	$\mathcal{D}\mathcal{D}\mathcal{T}$	DDE	DDD	Samples at depth
STAGE 2			·						i acp
3200/3033	NR	40	NR	NR	NR	NR	NR	NR	00-150
3200/3034		18		From	n site ple E				00-150
3200 3035		15		Sam	ple E	<u>[/320</u>	0		00-150
3200/3036		12							60-150
3200/3037		32		From	 				00-150
3200 / 3039		36		Comoo	site.	J /320	0		00-150
3200/3041		37					<u></u>		00-150
3200/3043		14							00- 150
							-		
	<u> </u> 								
į.		<u> </u> 							
,				٠ .		· 			
Threshold	LEVEL	s					: .		
4 or 5 part compasite	100	30		17	3.3				
	300	100		50	10				
L	l		<u>:</u> ,			<u> </u>	a Data	+-1	

N.R Not Required

NRD No residue Detected.

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Chemical Residue Testing
Lot 2, West Korora Road

DISCUSSION OF RESULTS

In accordance with the Draft Guidelines, fourpart composites of samples from an approximate 25m grid at depth 00-150mm were sampled and tested for Arsenic, Lead, Organochlorines and Organophosphates. At one third of these composites, samples were also taken at depth 150-300mm for testing as four-part composites.

In this Stage I testing, the following results have been established:-

a) The highest level of lead was 33 p.p.m. (threshold is 100 p.p.m.)

The level of lead found is considered to be indicative of background level only.

b) Levels of Arsenic of 40 & 42 p.p.m. were found in two of the surface composites (threshold is 30 ppm In all other samples the level was below threshold.

In most samples, the level of Arsenic found is considered to be indicative of background level only.

- c) Organophosphate residues were not found at detectable levels.
- d) Organochlorine residues were detected in two of the surface composite samples with levels of total organochlorines of 0.02 p.p.m. and 0.26 p.p.m. The organochlorines include D.D.T. and its derivatives. The Vertical Mixing Guidelines (1994) provide a threshold of 17 p.p.m. (one third of 50) for composite samples, and hence the detected levels are well below threshold.

Page Fourteen

Chemical Residue Testing Lot 2 West Korora Road

In Stage 2 testing, the eight individual samples comprising the composites with high arsenic levels were tested for arsenic only. The results of this testing indicate levels ranging from 12 p.p.m.to 40 p.p.m. (threshold 100 p.p.m.) These levels are considered to be three or four times background levels and confirm the use of arsenic compounds at low dosages. The area affected appears to approximate to the area between RL 35 and RL 60.

It would appear that chemicals (in any significant quantities) have not been used on this property, although low level use of arsenic is evident on the lower areas of the property, the individual sample with the highest level having 40 p.p.m. (threshold 100 p.p.m.)

There is also evidence of the use of organochlorines at levels which do not exceed the A.N.Z.E.C.C. Health Investigation levels for residential purposes.

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Chemical Residue Testing. Lot 2, West Korora Road

SUMMARY & CONCLUSIONS

- 1) The land has been used for banana growing, but the results of sample testing confirm chemical residues present are below threshold levels.

 Hence no further testing has been undertaken.
- 2) The levels of lead shown in the test results are below threshold levels accepted by the E.P.A., and are considered to be indicative of background levels only.
- The levels of arsenic shown in the test results are below threshold levels accepted by the E.P.A., and are considered to be about three times background levels in some areas.
- 4) Organophosphate residues were not found at detectable levels.
- Organochlorine residues were detected in two of the composite samples, as DDT and DDE. The levels in both samples were found to be less than the threshold level set in the Vertical Mixing Guidelines (1994) (A.N.Z.E.C.C. Health Investigation Levels for Residential Purposes)
- Because of the statistical nature of sampling no absolute guarantee can be given that contamination levels in excess of those measured, could not occur elsewhere on the Lot. However, within the statistical framework provided by the Draft Guidelines, it is our opinion that sufficient test results are available to indicate that contamination levels beyond the Guidelines do not occur on this Lot.

It is recommended that, in the light of present knowledge, this Lot be considered safe for the proposed development as rural residential land.

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23rd November 1999 (993 200/B)

REPORT ON SAMPLING AND TESTING FOR PRIMARY CONTAMINANTS
AT LOT 23, DP 716 144
WEST KORORA ROAD, KORORA, COFFS HARBOUR

BACKGROUND	1.	
SITE	2	
PROPOSED LAND USE	2	
PLAN OF THAKRAL HOLDINGS LAND	3	
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PHOTOGRAPHS	5	
SAMPLING AND TESTING	7	
FIGURE 1	8	
TABLE 1 (SUMMARY OF TESTS)	9	
DISCUSSION OF RESULTS	10	
SUMMARY & CONCLUSIONS	11	
APPENDIX - LABORATORY TEST SHEETS (attached as separate Report 993200	/D)



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CHARTERED ENGINEERS (AUSTRALIA)



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23rd November 1999 (993 200/B)

REPORT ON SAMPLING AND TESTING
FOR PRIMARY CONTAMINANTS
AT LOT 23, DP 716 144
WEST KORORA ROAD, KORORA, COFFS HARBOUR

BACKGROUND

This report has been prepared in order to evaluate the probable extent of soil contamination posed by primary contaminants, Arsenic, Lead, Organochlorines and Organophosphates, as used on and around former banana growing areas.

The Report has been prepared, at the request of the Owner, Thakral Holdings, in response to a Condition of Approval from the Coffs City Council, and has been conducted in accordance with discussions with Council and the protocol as set out in the Draft Guidelines for Former Banana Plantation Sites (1992) and the Draft Guidelines for Vertical Mixing of Former Broad-acre Agricultural Land (1994).

Council's mapping of present and former banana growing areas has indicated that some of this property was formerly used for the growing of bananas and hence is identified as requiring sampling and testing for possible chemical residues.

There is a creek line and associated bank vegetation running through this Lot, and it is proposed that these areas be rezoned as 7(a) (Environmental Protection).

Reliable information as to the extent and type of chemicals used, is not available.

Chemical Residue Testing Lot 23 West Korora Road, Korora

THE SITE

The property of about 3 Ha., is located on the northern side of West Korora Road about four kilometres from Coffs Harbour C.B.D. The property is located at 1:25000 Topographical Map Reference 128E 511N and is described as Lot 23 DP 716144 Parish of Coffs, County Fitzroy.

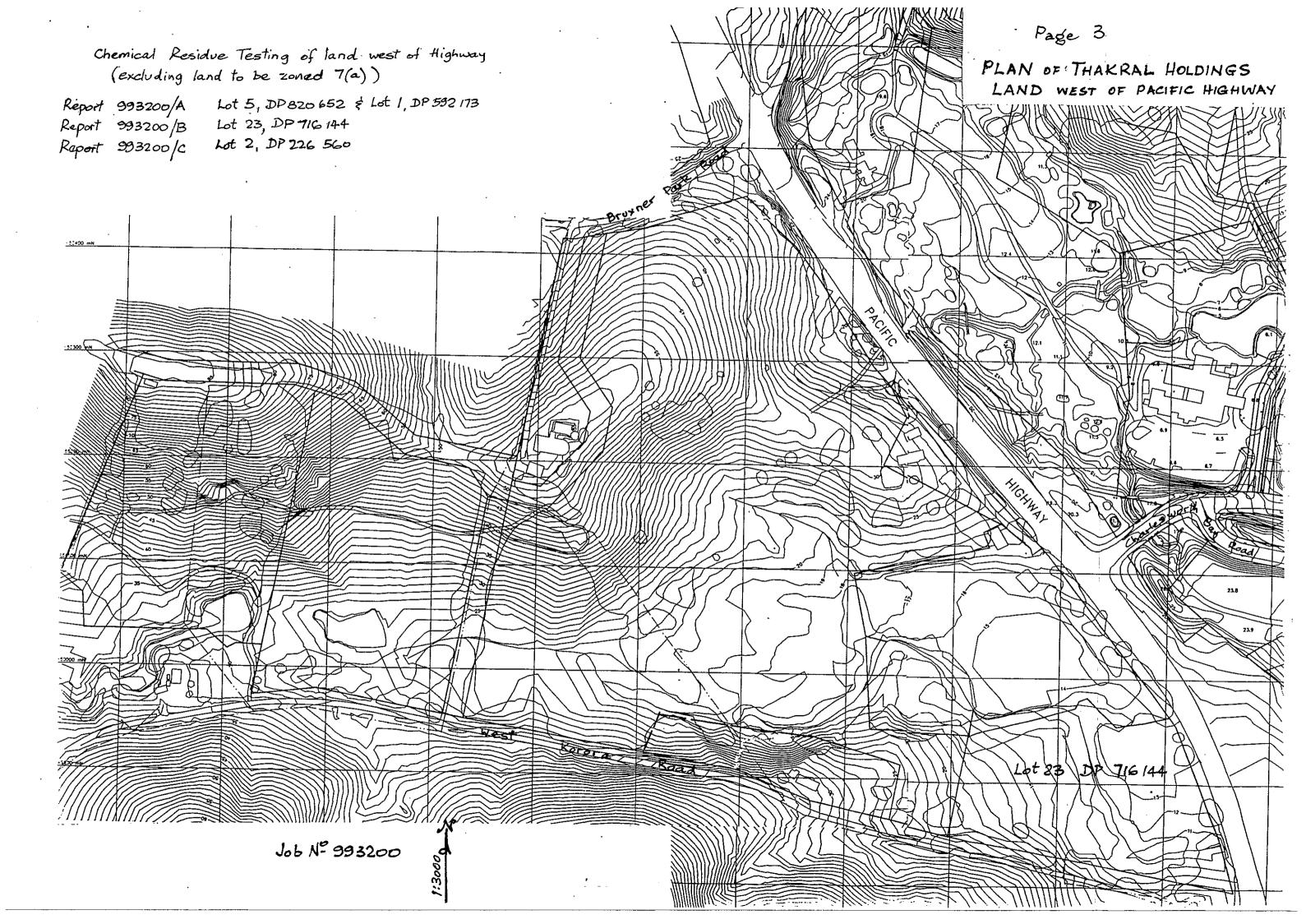
The land is gently undulating and low lying, with several creek lines disecting the property. This creates two cleared areas; one adjacent to the Highway, and a second off West Korora Road. Some of this latter area has been identified as having been used for banana growing.

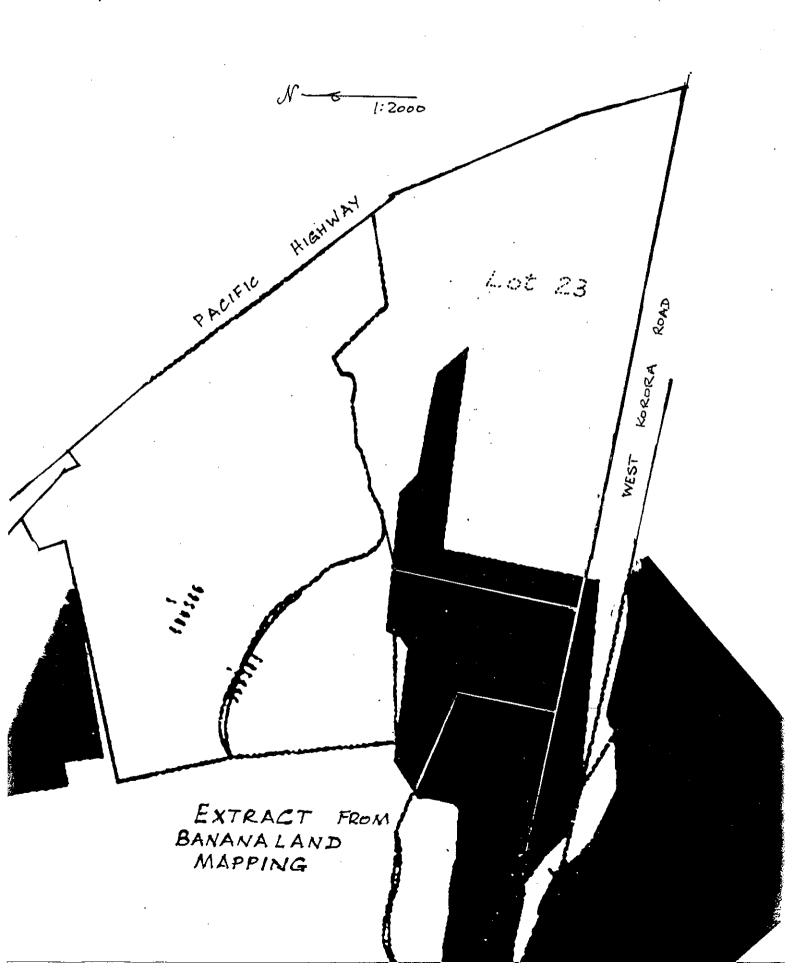
PROPOSED LAND USE

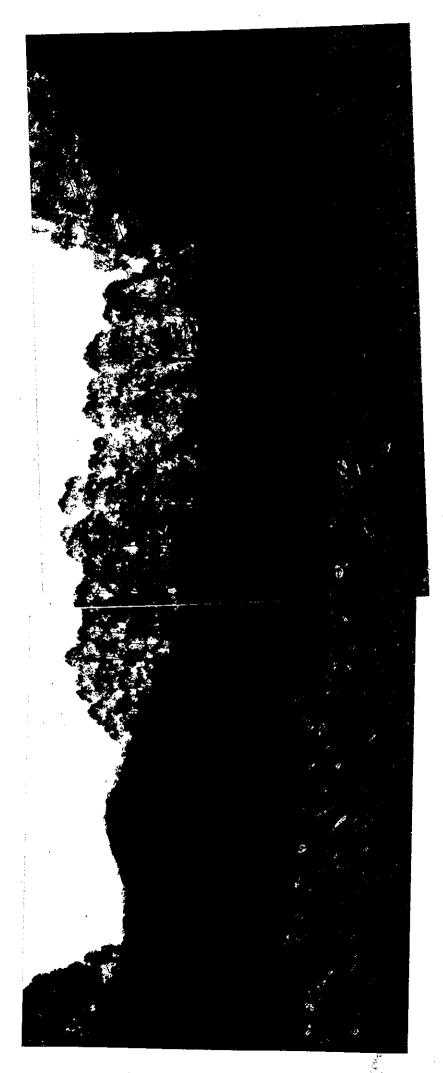
The land is zoned as Rural l(al) and it is proposed to rezone and subdivide into a number of residential Lots and a Neighbourhood Centre (adjacent to the Highway).

It is anticipated a residence will be constructed on each Lot and that the area will be used for normal residential use, including gardening.

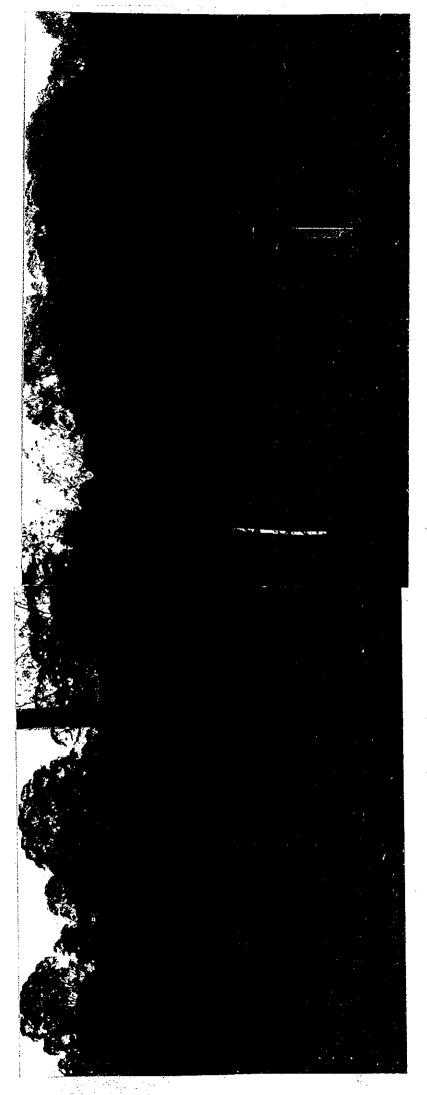
It is proposed that the area along the main creek line will be zoned as 7(a), with building work not allowed in these areas.







Looking across western half of Lot 23 from West Korora Road. Tree lined area is proposed (a) zone



Looking into the proposed neighbourhood centre area in Lot 23, from the Pacific Highway. Tree lined area is proposed 7(a) zone

Page Seven

Chemical Residue Testing Lot 23 West Korora Road, Korora

SAMPLING AND TESTING

The programme for sampling and testing was undertaken in accordance with discussions with Council and the Draft Guidelines for Former Banana Plantation Sites (1992) and for Vertical Mixing of Former Broad-acre Agricultural Land (1994). and was as follows:-

STAGE I (see Figure 1)

A 25m grid was established on the areas to be developed, including the area formerly used as a banana plantation, to enable the sampling and testing of four-& five-part composite samples, each representing about 2500 sq.m. areas. Some sampling locations were adjusted according to terrain, proximity of disturbed ground and vegetation.

Seven composites were made up from samples taken from 00 - 150mm depth. Samples were taken at 150mm - 300mm depth at three of these composites to make up composites at depth.

Two individual samples were taken from areas of fill material which were found spread on the site.

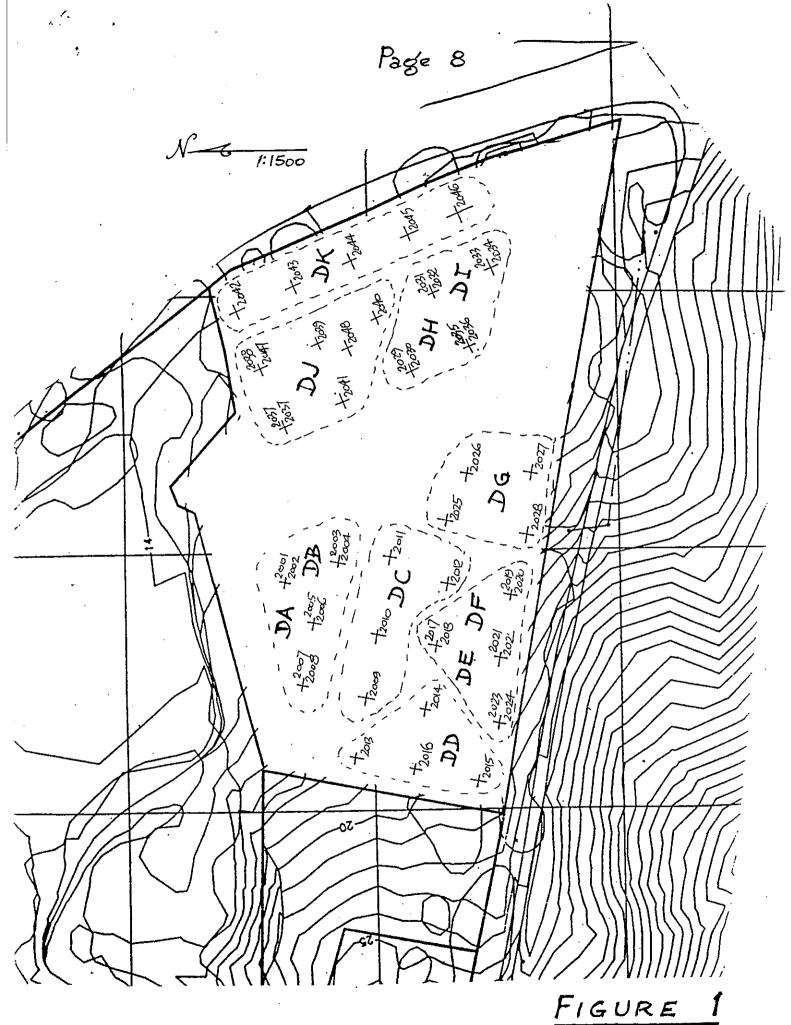
The ten composites and two individual samples were tested for Arsenic, Lead, Organophosphates and Organochlorines.

The results of these tests are summarised in Table 1, and indicate levels (in all samples) of these chemicals below the threshold levels identified in the above Draft documents.

Accordingly no further sampling or testing was carried out.

SAMPLING NOMENCLATURE (See Figure 1)

Individual samples are numbered consecutively in this Report, commencing with 2001. The individual samples have been grouped to form four-& five-part composites, which are numbered consecutively as DA/3200 up to DK/3200. Where double composite numbers are shown on the Plan, the second number indicates the composite from samples at depth 150mm - 300mm.



Sampling Locations and Composite Sample Numbers



TESTING OF POSSIBLY CONTAMINATED SITES

TABLE OF RESULTS OF CHEMICAL ANALYSES

FOR Lot 23, DP 716144, West Korora Road, Korora

TABLE 1

	1							
. (Conta	mina	tion	Leve	els	p.p.1	ท	Comment
D	Λ	Organo	or	gano	chloi	rines		4 or 5 part
Ъ	A5	phosph.	Total	Dieldrin	$\mathcal{D}\mathcal{D}\mathcal{T}$	$\mathcal{D}\mathcal{D}\mathcal{E}$	DDD	composite
		•						samples at depth
22	5.0	<0.1	<0.02					00-150
23	4.5	<0.1	<0.02					150 - 300
25	5.5	<0.1	L0.02				·	00-150
25	4.5	<0./	<0.02	· · ·				00-150
18	4.0	<0.1	<0.02					00-150
18	5.0	<0.1	<0.02					150 - 300
26	6.0	<0.1	<0.02	··-				00-150
24	5.5	<0.1	<0.02					00-150
23	5.5	<0.1	<0.02			ν.		150 - 300
23	5.0	<0.1	<0.02	-	:			00-150
27	6.0	<0.1	0.74	0.27	<0.02	<0.02	<0.02	00-150
val &	samp.	les f	rom	FILL	MAT	ERIAL	- on s	ite.
24	5.0	<0.1	0.02	0.02	<0.02	<0.02	<0.02	
23	5.0	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	
î eve	c		* inclu	des o.	47 ppm	Aldri	0	
			,,	2 2				
100	00		- / /	2.2				<u> </u>
300	100		50	10			<u> </u>	
	Pb 22 23 25 18 18 26 24 23 27 24 23 LEVEL 100	Pb As 22 5.0 23 4.5 25 5.5 25 4.5 18 4.0 18 5.0 26 6.0 24 5.5 23 5.5 23 5.0 27 6.0 24 5.0 27 6.0 24 5.0 27 6.0 21 Samp 24 5.0 23 5.0	Pb As Organo phosph. 22 5.0 <0.1 23 4.5 <0.1 25 5.5 <0.1 25 4.5 <0.1 18 4.0 <0.1 18 5.0 <0.1 24 5.5 <0.1 23 5.5 <0.1 23 5.0 <0.1 23 5.0 <0.1 27 6.0 <0.1 27 6.0 <0.1 24 5.0 <0.1 27 5.0 <0.1 23 5.0 <0.1 24 5.0 <0.1 25 5.0 <0.1 26 5.0 <0.1 27 5.0 <0.1	Pb As Organo Or Total 22 5.0 <0.1 <0.02 23 4.5 <0.1 <0.02 25 5.5 <0.1 <0.02 25 4.5 <0.1 <0.02 18 4.0 <0.1 <0.02 18 5.0 <0.1 <0.02 24 5.5 <0.1 <0.02 23 5.5 <0.1 <0.02 24 5.5 <0.1 <0.02 23 5.0 <0.1 <0.02 23 5.0 <0.1 <0.02 23 5.0 <0.1 <0.02 23 5.0 <0.1 <0.02 24 5.0 <0.1 <0.02 27 6.0 <0.1 <0.02 27 6.0 <0.1 <0.02 27 6.0 <0.1 <0.02 27 6.0 <0.1 <0.02 28 5.0 <0.1 <0.02 29 5.0 <0.1 <0.02 20 5.0 <0.1 <0.02 21 5.0 <0.1 <0.02 22 5.0 <0.1 <0.02 23 5.0 <0.1 <0.02 24 5.0 <0.1 <0.02	Pb As Organo Organo Phosph. Total Dieklin 22 5.0 <0.1 <0.02 23 4.5 <0.1 <0.02 25 5.5 <0.1 <0.02 25 4.5 <0.1 <0.02 18 4.0 <0.1 <0.02 26 6.0 <0.1 <0.02 27 5.5 <0.1 <0.02 27 5.5 <0.1 <0.02 27 6.0 <0.1 <0.02 27 6.0 <0.1 <0.02 27 6.0 <0.1 <0.02 27 5.0 <0.1 <0.02 28 5.0 <0.1 <0.02 29 5.0 <0.1 <0.02 20 5.0 <0.1 <0.02 21 5.0 <0.1 <0.02 22 5.0 <0.1 <0.02 23 5.0 <0.1 <0.02 24 5.0 <0.1 <0.02 25 5.0 <0.1 <0.02 26 5.0 <0.1 <0.02 27 5.0 <0.1 <0.02 28 5.0 <0.1 <0.02 29 5.0 <0.1 <0.02 20 5.0 <0.1 <0.02 20 5.0 <0.1 <0.02 20 5.0 <0.1 <0.02 20 5.0 <0.1 <0.02 20 5.0 <0.1 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.0	Pb As Organo Organochlor Total Dieldrin DDT 22 5.0 <0.1 <0.02 23 4.5 <0.1 <0.02 25 5.5 <0.1 <0.02 25 4.5 <0.1 <0.02 18 4.0 <0.1 <0.02 26 6.0 <0.1 <0.02 27 5.5 <0.1 <0.02 23 5.5 <0.1 <0.02 24 5.5 <0.1 <0.02 23 5.0 <0.1 <0.02 27 6.0 <0.1 <0.02 24 5.0 <0.1 <0.02 25 5.0 <0.1 <0.02 26 5.0 <0.1 <0.02 27 6.0 <0.1 <0.02 28 5.0 <0.1 <0.02 <0.02 29 5.0 <0.1 <0.02 <0.02 20 5.0 <0.1 <0.02 <0.02 21 5.0 <0.1 <0.02 <0.02 <0.02 22 5.0 <0.1 <0.02 <0.02 <0.02 23 5.0 <0.1 <0.02 <0.02 <0.02 24 5.0 <0.1 <0.02 <0.02 <0.02 25 5.0 <0.1 <0.02 <0.02 <0.02 26 5.0 <0.1 <0.02 <0.02 <0.02 27 5.0 <0.1 <0.02 <0.02 <0.02 28 5.0 <0.1 <0.02 <0.02 <0.02 29 5.0 <0.1 <0.02 <0.02 <0.02 20 5.0 <0.01 <0.02 <0.02 <0.02 20 5.0 <0.01 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.01 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.01 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.01 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02 20 5.0 <0.02 <0.02	Pb As Organo Organochlorines Total Diektrin DDT DDE 22 5.0 <0.1 <0.02	Pb As prophosph. Total Dieklim DDT DDE DDD 22 5.0 <0.1 <0.02

N.R Not Required

NRD No Residue Detected.

Chemical Residue Testing Lot 23 West Korora Road, Korora

DISCUSSION OF RESULTS

In accordance with the Draft Guidelines, four-& five-part composites of samples from an approximate 25m grid at depth 00 - 150mm were sampled and tested for Arsenic, Lead, Organochlorines and Organophosphates. At one third of these composites, samples were also taken at depth 150mm - 300mm for testing as fourpart composites.

In this Stage I testing, the following results have been established:-

- a) The highest level of lead was 26p.p.m. (threshold is 100 p.p.m.)
 - The level of lead found is considered to be indicative of background level only.
- b) The highest level of Arsenic was 6.0p.p.m. (threshold is 30 p.p.m.).
 - The level of Arsenic found is considered to be indicative of background level only.
- c) Organophosphates were not found at detectable levels.
- Organochlorine residues were detected in two of the samples, with the level of total organochlorines being 0.74p.p.m. and 0.02p.p.m. The organochlorines included Dieldrin and Aldrin. The Vertical Mixing Guidelines (1994) provide a threshold of 3.3 p.p.m. (one third of 10 p.p.m.) for composite samples, and hence the detected levels are well below threshold.

It would appear that chemicals (in any significant quantities) have not been used on this property, although there is evidence of the use of organochlorines at levels which do not exceed the A.N.Z.E.C.C. Health Investigation levels for residential purposes.

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Chemical Residue Testing. Lot 23 West Korora Road, Korora

SUMMARY & CONCLUSIONS

- 1) Some of the land has been used for banana growing, but the results of composite sample testing confirm chemical residues present are below threshold levels. Hence no further sampling or testing has been undertaken.
- 2) The levels of lead shown in the test results are well below threshold levels accepted by the E.P.A., and are considered to be indicative of background levels only.
- The levels of arsenic shown in the test results are below threshold levels accepted by the E.P.A., and are considered to be indicative of background levels only.
- 4) Organophosphate residues were not found at detectable levels.
- Organochlorine residues were detected in two of the composite sample, as Dieldrin & Aldrin. The levels in both samples were found to be less than the threshold level set in the Vertical Mixing Guidelines (1994) (A.N.Z.E.C.C. Health Investigation Levels for residential purposes.)
- Because of the statistical nature of sampling no absolute guarantee can be given that contamination levels in excess of those measured, could not occur elsewhere on the property. However, within the statistical framework provided by the Draft Guidelines, it is our opinion that sufficient test results are available to indicate that contamination levels beyond the Guidelines do not occur on this property.

It is recommended that, in the light of present knowledge, this property be considered safe for the proposed development as residential land and a Neighbourhood Centre.

W. H. G. HOLMES, B.E., MIE(AUST) HOLMES & HOLMES PTY. LTD.



HOLMES & HOLMES PTY. LTD.

CHARTERED ENGINEERS (AUSTRALIA)
AC.N. 001 266 271



P.O. Box J 159, Coffs Harbour Jetty, 2450 Reg. Laboratory No. 5702 40 Rippingale Road, Korora, 2450 Phone/Fax (066) 53 6457

22nd November 1999 (993 200/D)

APPENDIX TO CHEMICAL RESIDUE ASSESSMENT
OF THAKRAL HOLDINGS PROPERTIES
WEST OF PACIFIC HIGHWAY, KORORA
COFFS HARBOUR

This Appendix contains the Laboratory test results for chemical residue testing undertaken in 1999 for the proposed development of properties owned by Thakral Holdings.

These results are summarised in three Reports submitted as :-

Report No. 993200/A Lot 5 DP 820652 and Lot 1 DP 592173, Bruxner Park Road.

Report No. 993200/B Lot 23 DP 716144
West Korora Road

Report No. 993200/C Lot 2 DP 226560 West Korora Road

These are shown on the attached Plan.

The nomenclature used for sampling numbers is described as follows :-

Individual soil samples are numbered consecutively in order of sampling.

Numbers 1001-1318 have been used for Report A. Numbers 2001-2048 have been used for Report B Numbers 3001-3084 have been used for Report C.

The samples are grouped together to form four (or five) part composites for the initial screening tests. Composite sample numbers are consecutive using a double alphabetical prefix.

Page Two

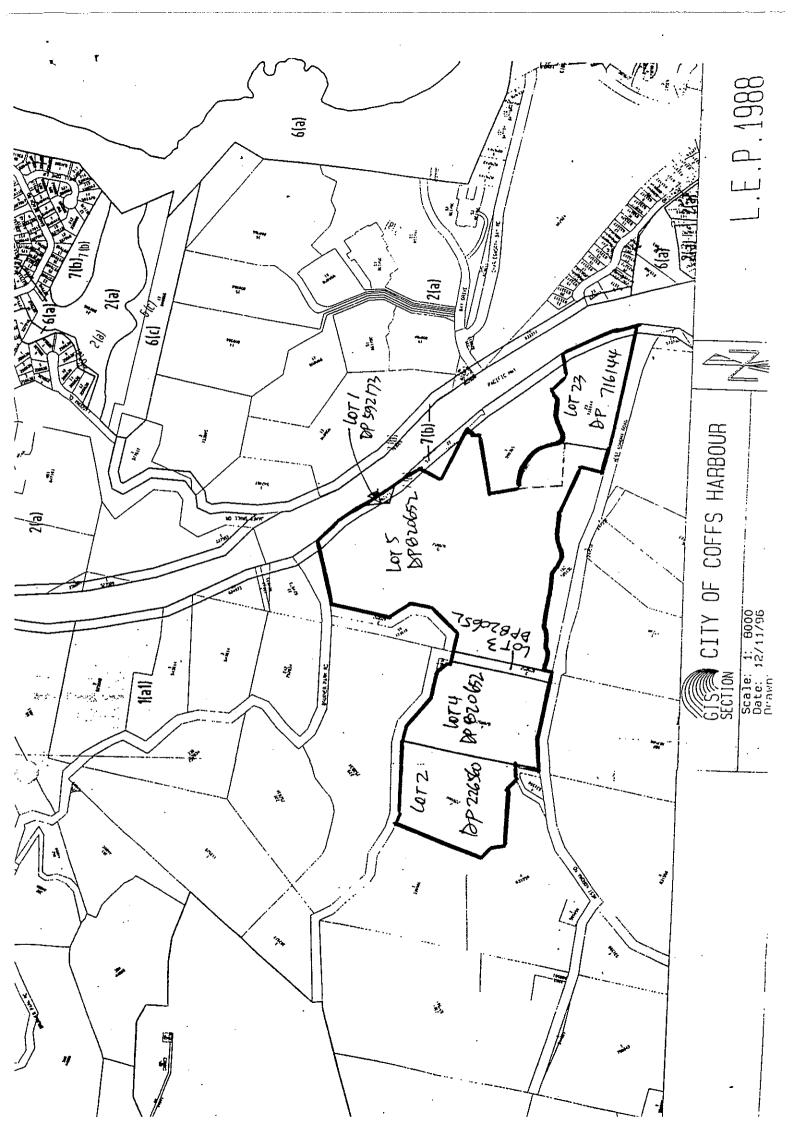
Appendix to Chemical Residue Assessment Thakral Holdings Properties, Korora

Composites AA/3200 to CY/3200 have been used for Report A.

Composites DA/3200 to DK/3200 have been used for Report B.

Composites EA/3200 to EU/3200 have been used for Report C.

Composite samples are tested first, so that areas of low level of residues can be eliminated. Individual sample testing is then undertaken from composite samples indicating possible high levels of the particular residue.



Office: PO BOX 48 ERMINGTON NSW 2115

Laboratory:
1/4 ABBOTT ROAD
SEVEN HILLS NSW 2147
Telephone: (02) 9838 8903
Fax: (02) 9838 8919
A.C.N. 003 614 695
NATA Reg. 1884

ANALYTICAL REPORT for:

HOLMES & HOLMES PTY LTD

PO BOX J159 COFFS HARBOUR JETTY 2450

ATTN: R.HOLMES

JOB NO:

SAL7907

CLIENT ORDER:

3200

DATE RECEIVED:

06/07/99

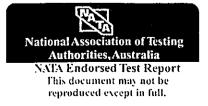
DATE COMPLETED:

19/08/99

TYPE OF SAMPLES: SOILS

NO OF SAMPLES:

241



Issued on 23/08/99 Lance Smith (Chief Chemist)

ANALYTICAL REPORT

SAMPLES	Cu	Pb	Cd mg/kg	Cr mg/kg	As mg/kg
	mg/kg	mg/kg	mg/kg	mg/kg	mg/ kg
1 AA/3200	<0.5	15	<0.5	15	88
2 AB/3200	2.0	16	<0.5	17	50 4 E
3 AC/3200	4.0	13 18	<0.5	20	4.5 46
4 AD/3200 5 AE/3200	40 4.5	31	0.5	21	84
6 AF/3200	3.5	20	<0.5	21	87
7 AG/3200	1.5	15	<0.5	20	81
8 AH/3200		12	.0 #	1.0	38 90
9 AI/3200	5.0	30	<0.5 <0.5	19 19	35
10 AJ/3200	7.5	11 13	<0.5	13	32
11 AK/3200 12 AL/3200	2.0	12	<0.5	19	76
13 AM/3200	0.5	7.5	<0.5	20	50
14 AN/3200	2.5	10	<0.5	23	28
15 AO/3200		11	0 5	23	19 69
16 AP/3200	11	17 19	0.5 0.5	23 28	91
17 AQ/3200 18 AR/3200	2.0 2.5	33	<0.5	30	43
19 AS/3200	2.5	14			7.0
20 AT/3200	1.5	9.0	<0.5	. 24	28
21' AU/3200	1.5	7.5	<0.5	26	39
22 AV/3200		7.5	۸۸ E	25	8.0 18
23 AW/3200	<0.5	12 15	<0.5 Q.5	32	65
24 AX/3200 25 AY/3200	<0.5 0.5	15	<0.5	25	49
26 AZ/3200	0.5	11	• -		10
27 BA/3200	4.0	32	<0.5	5.5	24
28 BB/3200	4.5	14	<0.5	2.0	18
29 BC/3200	2.0	17	<0.5	2.0 3.0	19 13
30 BD/3200	2.0	18 22	<0.5	3.0	8.0
31 BE/3200 32 BF/3200	3.5	19	<0.5	5.0	105
33 BG/3200	7.0	23	<0.5	6.5	50
34 BH/3200		22			14
35 BI/3200	11.	27	<0.5	7.5 3.0	20 47
36 BJ/3200	4.0	17 21	<0.5 <0.5	3.0	51
37 BK/3200 38 BL/3200	4.0	21	70.5	. 3.0	29
39 BM/3200	7.5	18	<0.5	2.0	18
40 BN/3200	4.0	18	<0.5	2.0	8.5
MDL	0.5	0.5	0.5	0.5	0.5
Method Code	Ml	M1	M1	M1	M7
Preparation	Р3	Р3	Р3	Р3	Р3

ANALYTICAL REPORT

SAMPLES	Cu mg/kg	Pb mg/kg	Cd mg/kg.	Cr mg/kg	As mg/kg
41 BO/3200 42 BP/3200	9.0 17	21 28	<0.5 <0.5	8.0 6.5	17 12
43 BQ/3200 44 BR/3200 45 BS/3200	12 29	41 23 31	<0.5 <0.5	7.0 6.0	25 20 23
46 BT/3200 47 BU/3200	11	27 23	<0.5	7.5	5.0 14
48 BV/3200 49 BW/3200 50 BX/3200	12	16 21 26	<0.5 <0.5	3.0 6.0	4.0 4.5 7.5
51 BY/3200 52 BZ/3200	. 100 240	30 66	<0.5 <0.5	4.0	5.5 29 7.0
53 CA/3200 54 CB/3200 55 CC/3200	8.5 5.5	24 34 20	<0.5 <0.5	7.0 5.5	5.0 12
56 CD/3200 57 CE/3200	5.0 5.0	21 22 23	<0.5 <0.5	6.0 6.5	4.0 4.5 3.5
58 CF/3200 59 CG/3200 .60 CH/3200	3.5 3.0	22 27	<0.5 <0.5	4.0	6.0 22
61 CI/3200 62 CJ/3200	5.0 12	28 16 26	<0.5 .<0.5	7.0	9.0 5.5 4.0
63 CK/3200 64 CL/3200 65 CM/3200	10	21 16	<0.5	7.0	4.0 4.5
66 CN/3200 67 CO/3200 68 CP/3200	8.5 8.0 16	21 37 31	<0.5 <0.5 <0.5	5.0 6.0 7.5	3.5 4.0 4.0
69 CQ/3200 70 CR/3200	18	27 28	<0.5	9.0	3.0 3.5
71 CS/3200 72 CT/3200 73 CU/3200	17 3.5 3.0	26 14, 8.5	<0.5 <0.5 <0.5	7.0 7.0 5.5	5.0 7.5 17
74 CV/3200 75 CW/3200	7.0	10 15 22	<0.5	7.5	6.0 20 5.0
76 DA/3200 77 DB/3200 78 DC/3200	•	23 25			4.5 5.5
79 DD/3200 80 DE/3200		25 18			4.5
MDL	0.5	0.5	0.5 M1	0.5 M1	0.5 M7
Method Code Preparation	M1 P3	M1 P3	P3	P3	P3

ANALYTICAL REPORT

SAMPLES	Cu	Pb	Cr	As
	mg/kg	mg/kg	mg/kg	mg/kg
81 DF/3200 82 DG/3200 83 DH/3200 84 DI/3200 85 DJ/3200 86 DK/3200 87 3200/2047 88 3200/2048 89 1013 90 1014 91 1015 92 1016 93 1053 94 1055 95 1057 96 1059 97 1077 98 1078 99 1079 100 1080 101 1089 102 1090 103 1091 104 1092 105 1201 106 1202 107 1203 108 1204 109 1205 110 1207	6.5 2.5 4.5 170 3.5 13 2.5 9.5 28 11 6.5	18 26 24 23 23 27 24 23	20 18 20 22 26 18 25 16 26 24 20 30 31 36 33	5.0 6.5 5.0 6.0 5.0 6.0 6.0 6.0 6.0 6.0 6.0
111 1209 112 1211 113 1002 114 1026 115 1028 116 1030 117 1032 118 1038 119 1040 120 1042	3.5		,	120 12 23 30 82 65 39 36
MDL	0.5	0.5	0.5	0.5
Method Code	M1	M1	M1	M7
Preparation	P3	P3	P3	P3

ANALYTICAL REPORT

SAMPLES	Cr mg/kg	As mg/kg
121 1044 122 1129 123 1131 124 1133 125 1135 126 1141 127 1142 128 1143 129 1144 130 1145 131 1147 132 1149 133 1151 134 1125 135 1126 136 1127 137 1128 138 1005 139 1007 140 1009 141 1011 142 1017 143 1018 144 1019 145 1020 146 1021 147 1022 148 1023 149 1024 150 1025 151 1027 152 1029 153 1031 154 1033 155 1034 156 1035 157 1036 158 1037 159 1039 160 1041	5.0 5.0 5.0 5.0 6.0 6.0 7.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6	8.5 42 21 34 50 18 49 7.64 32 16 27 150 145 27 150 142 30 270 175 84 110 56 84 72 160 32 160 32 160 32 160 32 160 32 160 32 360 360 360 360 360 360 360 360 360 360
MDL Method Code Preparation	0.5 M1 P3	, M7 P3

ANALYTICAL REPORT

JOB NO: SAL7907 CLIENT ORDER: 3200

	SAMPLES	Pb mg/kg	Cr mg/kg	As mg/kg
161 162 163 164 165 1667 1690 177 177 177 177 177 177 177 177 177 17	1043 1046 1047 1050 1061 1062 1063 1064 1065 1066 1067 1073 1073 1075 1081 1083 1085 1087 1099 1101 1103 CX/3200 EA/3200 EA/3200 ED/3200 EF/3200 EF/3200 EJ/3200 EJ/3200 EJ/3200 EJ/3200	21 26 23 15 18 17 18 15 17 17 19	3.50 3.05	27 18 140 29 29 465 29 29 465 29 40 32 47 52 561 57 561 57 57 57 57 57 57 57 57 57 57 57 57 57
	od Code paration	0.5 M1 P3	0.5 M1 P3	0.5 M7 P3

ANALYTICAL REPORT

	SAMPLES	Cu mg/kg	Pb mg/kg	As mg/kg
201 202 203 204 205 206 207 209 210 211 213 214 215 217 218 220 221 222 223 223 233 233 233 234 235 237 238 238 239 241 241	EK/3200 EL/3200 EM/3200 EN/3200 EO/3200 EO/3200 EQ/3200 EX/3200 EX/3200 EX/3200 EX/3200 EX/3200 3200/3033 3200/3035 3200/3035 3200/3037 3200/3039 3200/3041 3200/3039 3200/3041 3200/1293 3200/1294 3200/1295 3200/1296 3200/1297 3200/1298 3200/1297 3200/1298 3200/1301 3200/1301 3200/1302 3200/1303 3200/1304 3200/1305 3200/1307 3200/1308 3200/1309 3200/1311 3200/1311 3200/1311 3200/1313 3200/1314	824.5	22 19 17 26 26 25 26 21 33 22 19	5.5 18 18 18 5.24 9.22 4.03 4.05 4
	od Code aration	0.5 M1 P3	0.5 M1 P3	0.5 M7 P3

ANALYTICAL REPORT

JOB NO: SAL7907 CLIENT ORDER: 3200

SAMPLES	Cu mg/kg	Pb mg/kg	Cd mg/kg	Cr mg/kg	As mg/kg
DUPLICATES: 20 AT/3200 45 BS/3200 65 CM/3200 85 DJ/3200	1.0	10 29 16 25	<0.5 <0.5	22 6.5	30 22 4.5 4.5
105 1201 125 1135 145 1020 165 1061 185 1097 205 EO/3200 230 3200/1303	4.0	24		7.0 4.0 3.0	47 165 · 29 40 6.5 41
BCSS-1/1 BCSS-1/2 BCSS-1/3 BCSS-1/4 BCSS-1/5 BCSS-1/6 BCSS-1/7 BCSS-1/7 BCSS-1/8 BCSS-1/9 BCSS-1/10	18 17 20 18 20	24 24 23 21 21	<0.5 <0.5 <0.5	90 87 82 82 91 88 85	13 12 11 13 11 12 13 10 12 13
MDL Method Code Preparation	0.5 M1 P3	0.5 M1 P3	0.5 M1 P3	0.5 M1 P3	0.5 . M7 P3

RESULTS ON DRY BASIS

LABORATORY DUPLICATE REPORT

JOB NO: SAL7907 CLIENT ORDER: 3200

Sample Number	Analyte	Units	MDL	Sample Result	Duplicate Result	%RPD
AT/3200 BS/3200 1201	Copper Copper Copper	mg/kg mg/kg mg/kg	0.5 0.5 0.5	1.5 29 3.5	1.0 27 4.0	38 7 13
AT/3200 BS/3200 CM/3200 DJ/3200 EO/3200	Lead Lead Lead Lead Lead	mg/kg mg/kg mg/kg mg/kg mg/kg	0.5 0.5 0.5 0.5	9.0 31 16 23 26	10 29 16 25 24	11 7 0 8 8
AT/3200 BS/3200	Cadmium Cadmium	mg/kg mg/kg	0.5 0.5	<0.5 <0.5	<0.5 <0.5	0 0
AT/3200 BS/3200 1020 1061 1097	Chromium Chromium Chromium Chromium Chromium	mg/kg mg/kg mg/kg mg/kg mg/kg	0.5 0.5 0.5 0.5	24 6.0 6.5 3.5 3.0	22 6.5 7.0 4.0 3.0	9 8 7 13 0
AT/3200 BS/3200 CM/3200 DJ/3200 1135 1020 1061 1097 EO/3200 3200/1303	Arsenic	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	28 23 4.5 5.0 50 175 29 36 5.5 39	30 22 4.5 4.5 47 165 29 40 6.5 41	7 4 0 10 6 6 0 11 17 5

Acceptance criteria:

RPD <50% for low level (<20xMDL)
RPD <30% for medium level (20-100xMDL)
RPD <15% for high level (>100xMDL)
No limit applies at <2xMDL

MDL = Method Detection Limit

All results are within the acceptance criteria

CERTIFIED REFERENCE MATERIAL

JOB NO: SAL7907 CLIENT ORDER: 3200

				•		
CRM Number	Analyte	Units	CRM Result	Certified Value	%Recovery	Acceptance Criteria %
BCSS-1/1 BCSS-1/2 BCSS-1/3 BCSS-1/5 BCSS-1/6 BCSS-1/10	Copper Copper Copper Copper Copper	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	18 17 20 18 20 17	18.5 18.5 18.5 18.5 18.5 18.5	97 92 108 97 108 92	90-115 90-115 90-115 90-115 90-115 90-115
BCSS-1/1 BCSS-1/2 BCSS-1/3 BCSS-1/4 BCSS-1/9 BCSS-1/10	Lead Lead Lead Lead Lead Lead	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	24 24 23 21 21 24	22.7 22.7 22.7 22.7 22.7 22.7	106 106 101 93 93 106	90-110 90-110 90-110 90-110 90-110 90-110
BCSS-1/1 BCSS-1/2 BCSS-1/3	Cadmium Cadmium Cadmium	mg/kg mg/kg mg/kg	<0.5 <0.5 <0.5	0.25 0.25 0.25	- - 	· - - -
BCSS-1/1 BCSS-1/2 BCSS-1/3 BCSS-1/5 BCSS-1/7 BCSS-1/8 BCSS-1/9	Chromium Chromium Chromium Chromium Chromium Chromium Chromium	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	90 87 82 82 91 88 85	123 123 123 123 123 123 123	73 71 67 67 74 72 69	60-80 60-80 60-80 60-80 60-80 60-80
BCSS-1/1 BCSS-1/2 BCSS-1/3 BCSS-1/4 BCSS-1/5 BCSS-1/6 BCSS-1/7 BCSS-1/7 BCSS-1/9 BCSS-1/10 BCSS-1/11	Arsenic	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	13 12 11 13 11 12 13 10 12 13	11.1 11.1 11.1 11.1 11.1 11.1 11.1 11.	117 108 99 117 99 108 117 90 108 117	90-120 90-120 90-120 90-120 90-120 90-120 90-120 90-120 90-120 90-120

All results are within the acceptance criteria

Note: The hot acid digest does not always determine 'total' metals. Refractory elements such as Iron and Aluminium and some base metals (particularly Chromium) show lower recoveries depending on their form within the sample matrix. Silicates and oxides are normally less soluble than elements in metallic or salt forms. The acceptance criteria for this reference material is based on histories of analyte recoveries using the

ANALYTICAL REPORT

JOB NO: SAL7907 CLIENT ORDER: 3200

METHODS OF PREPARATION AND ANALYSIS

The tests contained in this report have been carried out on the samples as received by the laboratory.

P3	Sample dried, jaw crushed and sieved at 2mm
M1	Base Metal - Digestion Method 3050 (HNO3/H2O2) Element determined by APHA 3111B (Flame AAS)
M7	Hydride Element - Digestion Method 7061 (HNO3/H2SO4) Element determined by APHA 3114B (Hydride Generation AAS)

A preliminary report was faxed on 19/08/99



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PAGE 2 OF 2 ORDER NO. S. 0/49 NUMBER OF BAGS

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space provided, and this original document RETURNED to Holmes & Holmes Pty. Ltd. (P.O. Box J159 Coffs Harbour Jetty) with the test results.
ORDER NO. S. 0150 NUMBER OF BAGS
SAMPLING SOIL / WOTER TOTAL 30 SAMPLES
SAMPLED AT
SAMPLED AT
SAMPLED BY R. M. Malman. DESPATCHED BY R. M. Malm
DESPATCH COURIER NAME. SIGNATURE.
LABORATORY Received by P. Meg. P. MAGRO
at\$.15.15hours on 3./2./99
Laboratory SYDNEY ANALYTICAL LABURATURIES
Address 4 ABBUTT ST SEVEN HILLS
THIS DOCUMENT AUTHORISES THE FOLLOWING TESTING:-
cation Sample No Depth As Pb Cd Cr Cic
A/3223 60-150 V V
B/3223 150-300 V
3223/A1 00.3cc /
3223/C4-co-150 V

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CHAIN OF CUSTODY DOCUMENT

ORDER NO. 50 150 NUMBER OF BAGS PAGE 2 OF 2

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ORDER NO. 5/5/ NUMBER OF BAGS ONE

PAGE 2 OF 2

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A.C.N. 001 266 271

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1079 1080 Phone/Fax (066) 53 64

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Sheet 1063

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	ORDER N	05.	0/5	3	NUM	BER OF	BAGS.	• • • • • •	
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DE	SPATCH C	OURIER	NAME.	Fortesta	~ /°/	SIG	NATURE		
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poratory entification	H&H Sample Nº 1013 - 1014-	<u> </u>	As V	Cr	Cu				
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~	1053	00-150		V					
	1057	1 20-150		1	1	1	<u> </u>	<u>. </u>	



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CHAIN OF CUSTODY DOCUMENT

ORDER NO. S. O. /5.3 NUMBER OF BAGS PAGE 2 OF 3

Laboratory	Holmes & Holmes	Depth	Te	sting Req	uired			
Identification	Sample Number	<u> </u>	As	Cr	Cu			
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	1207	700-150	: 		<u> </u>			1
	1209	<u> </u>	:	 	-			1
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CHAIN OF CUSTODY DOCUMENT

PAGE 3 OF 3 ORDER NO. SO 153 NUMBER OF BAGS

Laboratory	Holmes & Holmes	Depth	7	esting Re	equired			
Identification	Sample Number	<u>. </u>	As			<u> </u>		
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	3223 /33	150-350	/	<u>:</u>			<u>!</u>	
~~	3223/05	200-350		<u> </u>	<u> </u>	- 		
	3273/66	350-500						
	3223 /07	05-150						
_	3223 /DE	150-300	/	· .	<u>:</u>		<u> </u>	
	3223/ES	00-150	1/		:			
	3223 /E/O	150-300	! /					
	1125	<u> </u>	<u> </u>		-!			
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	1128	<u>'</u>	 / _				1	
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CHAIN OF CUSTODY DOCUMENT

Sheet 18/3

cust samp spac Holm	ody of the less are the provided esserting in the less of the less	the accretive and Ltd. (ompany d by t	ing sa the Lab origin	mples. orator al doc	The y is t ument	date o be RETURN	and record ED to	time led in Holmes	the the &
	ORDER N	io. S	0154	· · · · · ·	NUM	BER OF	BAGS.	.1		
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	1070			v			<u> </u>	<u> </u>		-



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50154

CHAIN OF CUSTODY DOCUMENT

ORDER NO 50154 NUMBER OF BAGS

PAGE 2 OF 3

aboratory	Holmes & Holmes	Depth	Te	sting Requ	iired			
dentification	Sample Number		As	Col		-		
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	10:27	<u> </u>	- 7 -				<u> </u>	<u> </u>
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CHAIN OF CUSTODY DOCUMENT

NUMBER OF BAGS

PAGE 3...OF 3....

Laboratory	Holmes & Holmes	Depth	Te	sting Requ	iired	,		
Identification	Sample Number		A5	C-				
	1073)	5	· 6/			<u> </u>	
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	1036 (037	<u> </u>			<u> </u>	 		-
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SOIL (1877) 23 composite Samples SAMPLE NO. C.X/3200. C.Y/3200 EA to EU/3200 SAMPLED BY WHITELE DESPATCHED BY WHITELE

DESPATCH SIGNATURE..... COURIER NAME.....

Received by. #

at.....on.....hours on.....

Laboratory SYDNEY ANALYTICAL LABORATORIES Address . 1/4 ABBOTT ST SEVEN HILLS

FOLLOWING TESTING: -DOCUMENT AUTHORISES THE THIS

HAH Laboratory Depth Ac Sample Nº Identification CX/3200 3200



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ORD	DER NO. ∤	0/5 Q N	IUMBER OF B	AGS	• • •
SAMPLI	NG SOIL / \$	IATE R	(8N2 inch	vidual Sample	9
	SAMPLE N	No. 3200/.3033,	3:34 3055	3036,3037,3039,	.3041 E 302
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DESPATO	<u>:H</u>	AME FASTAWAY	CICNA	TIPE A	TO "
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	at. /5.0∂	hours on	11.8.99		
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	Address	4 ABBOTT S	T SEVER	1 thicks.	
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Laboratory H& H Identification Sample	e No Depth	As			
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32c / 3	3035 0-150	V			
	3636 0-150	<i>-</i>		- - - - - - - - - - 	
	3037 0-150				
	13039 0-150				
32cc/	3041 0.150				
3260/	3043 0-130				
i i					



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	ORDER NO. S. 0.157 NUMBER OF BAGS									
<u>s</u>	AMPLING	SOIL /	/ WATER	200/	1293.	10 32	00/13	14-incl	22 Nº2 Somples 30ST. 1999	
•	SAM SAM	IPLED AT	r. 16.		Ques.	HRS.	ON	3TH AUG	505T. 1999 Klum	
DE	<u>SPATCH</u>	COURIER	name./.	ps:~	ny	SIC	SNATURI	E/.		
<u>LA</u>	at.	eived 1	00	hours	on	.17.(8	7. (29.			
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	TH	s DOC	UMENT	AUTHO	RISES	THE	FOLLO	WING	TESTING: -	
Laborationy Identification	H&H Sample Nº	Depth		As	Cu					
	3200 / 1293	150-300					<u> </u>	 		
	· 1294	300-450					ļ			
	1295	150-300			V		-			
	1296	380-450			V	<u> </u>		- 		
	1297	150-300	:			 		_		
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		300 -450	11	<u></u>		 		- 		
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	1305	150-300	<u> </u>	V	 	 	 			



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CHAIN OF CUSTODY DOCUMENT

PAGE .2... OF .. 2... ORDER NO. S. 0/57 NUMBER OF BAGS .../....

Laboratory	Holmes & Holmes	Depth	Te	sting Rec	quired				
Identification				As	<u> </u>				
	3200 / 1307	150 - 300	i	V		_			
 .		300- 450	i 1	V	<u> </u>		<u> </u>	<u> </u>	
	/309	150 - 300	i 	V					
	1310	300-450		1			<u> </u>		
	/3//	150-300	_	V	-	}			
	1312	300-450		1	<u> </u>				
	1313	150-300		1	 				
	1314	30 - 450 150 - 300 300 - 450	<u>, </u>	V	 		<u> </u>		<u> </u>
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SYDNEY ANAĒŸTICAL LABORATORIES

Office: PO BOX 48 ERMINGTON NSW 2115

Laboratory: 1/4 ABBOTT ROAD SEVEN HILLS NSW 2147 Telephone: (02) 9838 8903

Fax: A.C.N. (02) 9838 8919

NATA Req.

003 614 695 1884

ANALYTICAL REPORT for:

HOLMES & HOLMES PTY LTD

PO BOX J159 COFFS HARBOUR JETTY 2450

ATTN: R.HOLMES

JOB NO:

SAL8195

CLIENT ORDER:

S0161

DATE RECEIVED:

13/10/99

DATE COMPLETED:

19/10/99

TYPE OF SAMPLES: SOILS

NO OF SAMPLES:

National Association of Testing Authorities, Australia NATA Endorsed Test Report This document may not be

reproduced except in full.

Issued on 25/10/99 Lance Smith (Chief Chemist)

SYDNEY ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB NO: SAL8195 CLIENT ORDER: S0161

	SAMPLES	As mg/kg	Pb mg/kg
1 2 3 4	3200/1315 3200/1316 3200/1317 3200/1318	7.5 10 80 47	15
-5-	-л/3290 -в/3290		18
-0 -	BCSS-1	12	23
	od Code aration	0.5 M7 P3	0.5 M1 P3

RESULTS ON DRY BASIS

SYDNEY ANALYTICAL LABORATORIES

CERTIFIED REFERENCE MATERIAL

JOB NO: SAL8195 CLIENT ORDER: S0161

CRM Number	Analyte	Units	CRM Result	Certified Value	%Recovery	Acceptance Criteria %
BCSS-1	Arsenic	mg/kg	12	11.1	108	90-120
BCSS-1	Lead	mg/kg	23	22.7	101	90-110

All results are within the acceptance criteria

Note: The hot acid digest does not always determine 'total' metals. Refractory elements such as Iron and Aluminium and some base metals (particularly Chromium) show lower recoveries depending on their form within the sample matrix. Silicates and oxides are normally less soluble than elements in metallic or salt forms. The acceptance criteria for this reference material is based on histories of analyte recoveries using the nitric acid based digestion procedures.

S Y D N E Y A N A L Y T I C A L L A B O R A T O R I E S

Page 4 of 4

ANALYTICAL REPORT

JOB NO: SAL8195 CLIENT ORDER: S0161

METHODS OF PREPARATION AND ANALYSIS

The tests contained in this report have been carried out on the samples as received by the laboratory.

P3 Sample dried, jaw crushed and sieved at 2mm

M7 Hydride Element - Digestion Method 7061 (HNO3/H2SO4)
Element determined by APHA 3114B (Hydride Generation AAS)

M1 Base Metal - Digestion Method 3050 (HNO3/H2O2)
Element determined by APHA 3111B (Flame AAS)

A preliminary report was faxed on 19/10/99



NSW AGRICULTURE DIAGNOSTIC & ANALYTICAL SERVICES Environmental Centre of Excellence, Wollongbar/Lismore

RB:DMP

Our reference: Your reference: 99/522 CRL 99/50/2 Chemical Residue Laboratories P.O. Box 285 LISMORE 2480

Phone:(02) 66 212632 Fax: (02) 66 214319

Holmes & Holmes PO Box J 159 **COFFS HARBOUR JETTY NSW 2450**

Analysis of Soil Sample

Sampled:

02 & 03-07-99

Received:

07-07-99

The samples submitted in connection with the above have been analysed with the following results. Samples are analysed as received by the laboratory and no responsibility is taken for sampling.

					DDE	Diel	OΒ
I	ab.No.	Sample ID	Method	OC	DDE	prer	OP
1	955	Soil A A / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
	956	Soil A B / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
	957	Soil A C / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
	958	Soil A D / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
	959	Soil A E / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
	960	Soil A F / 3200	SOP2625	<0,02	< 0.02	< 0.02	< 0.1
	961	Soil A G / 3200	SOP2625	< 0.02	0.03	< 0.02	< 0.1
1	962	Soil A H / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
	963	Soil A I / 3200	SOP2625.	< 0.02	0.11	< 0.02	< 0.1
1	964	Soil A J / 3200	SOP2625	< 0.02	0.03	< 0.02	< 0.1
	965	Soil A K / 3200	SOP2625	< 0.02	0.02	< 0.02	< 0.1
	966	Soil A L / 3200	SOP2625	< 0.02	< 0.02	< 0.02	<0.1
	967	Soil A M / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
1	968	Soil A N / 3200	SOP2625	< 0.02	0.03	< 0.02	< 0.1
	969	Soil A O / 3200	SOP2625	< 0.02	0.03	< 0.02	< 0.1
1	970	Soil A P / 3200	SOP2625	< 0.02	0.11	< 0.02	< 0.1
1	971	Soil A Q / 3200	SOP2625	< 0.02	0.03	< 0.02	< 0.1
	972	Soil A R / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
1	973	Soil A S / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
1	974	Soil A T / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
1	975	Soil A U / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
1	976	Soil A V / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
1	977	Soil A W / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
1	978	Soil A X / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1
	.979	Soil A Y / 3200	SOP2625	< 0.02	< 0.02	0.04	< 0.1
3	.980	Soil A Z / 3200	SOP2625	< 0.02	< 0.02	< 0.02	< 0.1



Diel = Dieldrin

Results in mg/kg
Minimum level of reporting for OC's is 0.02 mg/kg in soil
Minimum level of reporting for OP's is 0.1 mg/kg in soil
No other pesticides occurred above reportable levels for chemicals screened in the attached list

Robert Black A/Chemist

15 July, 1999



Accreditation No. 3735. This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of accreditation. This document shall not be reproduced except in full.



HOLMES & HOLMES PTY. LTD. CHARTERED ENGINEERS (AUSTRALIA)

AC.N. 001 266 271

NUMBER OF BAGS.....

P.O. Box J 159, Coffs Harbour Jetty, 2450

ORDER NO. # C 0/3/

Phone/Fax (066) 53 6

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DIAGNOSTIC & ANALYTICAL SERVICES Environmental Centre of Excellence,

IS:JRS

Our reference:

Your reference: C0132

CRL 99/523

99/50/2

Chemical Residue Laboratories

PO Box 285 LISMORE 2480

Phone: 02 6621 2632 Fax: 02 6621 4319

Holmes & Holmes Pty Ltd PO Box J159 COFFS HARBOUR JETTY 2450

Analysis of Soil Samples

Sampled

05-&06-07-99

Received

08-07-99

The samples submitted in connection with the above have been analysed with the following results. As samples were not taken by the laboratory no responsibility is accepted for sampling.

Lab.No.	Sample Identification	OC's	OP's
-1981 -	- Soil-A/3223	<0.02	<0.1
1982	-soil-B/3223 150 300		
1983	Soil 3223/A1 0-300	₹0.02	<0.1
1984	-soil 3223/C4 0-150	- <0:02	
1985	Soil BA/3200	<0.02	<0.1
1986	Soil BB/3200	<0.02	<0.1
1987	Soil BC/3200	<0.02	<0.1
1988	Soil BD/3200	<0.02	<0.1
1989	Soil BE/3200	<0.02	<0.1
1990	Soil BF/3200	<0.02	<0.1
1991	Soil BG/3200	<0.02	<0.1
1992	Soil BH/3200	<0.02	<0.1
1993	Soil BI/3200	<0.02	<0.1
1994	Soil BJ/3200	<0.02 ·	<0.1
1995	Soil BK/3200	<0.02	<0.1
1996	Soil BL/3200	<0.02	<0.1
1997	Soil BM/3200	<0.02	<0.1
1998	Soil BN/3200	<0.02	<0.1
1999	Soil BO/3200	<0.02	<0.1
2000	Soil BP/3200	<0.02	<0.1
2001	Soil BQ/3200	<0.02	<0.1
2002	Soil BR/3200	<0.02	<0.1
2003	Soil BS/3200	<0.02	<0.1
2004	Soil BT/3200	<0.02	<0.1
2005	Soil BU/3200	<0.02	<0.1
2006	Soil BV/3200	<0.02	<0.1
2007	Soil BW/3200	<0.02	<0.1
2008	Soil BX/3200	<0.02	<0.1
2009	Soil BY/3200	<0.02	<0.1
2010	Soil BZ/3200	<0.02	<0.1

Method is SOP2625

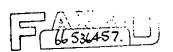
Results in mg/kg

Results are reported on a dry matter basis.

Minimum level of reporting for OC is 0.02 mg/kg in soil

Minimum level of reporting for OP is 0.1 mg/kg in soil

No other pesticides occurred above reportable levels for chemicals screened in the attached list.



21 July 1999



HOLMES & HOLMES PTY. LTD.

CHARTERED ENGINEERS (AUSTRALIA)
AC.N. 001 268 271

P.O. Box J 159, Coffs Harbour Jetty, 2450

Phone/Fax (066) 53 64

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	ORDER 1	NO. C.	0/32	2	NUN	BER OF	BAGS.	.1	• • • • •	
<u>.</u>	SAMPLING SAMPLING	SOIL SAMPL MPLED A	E NO.A		TOTAL 3223 3 A/328 mas				9 Ho	July 9
<u>D1</u>	ESPATCH (COURIER	NAME.	FAST	~^7	SIG	NATURE		3	• •
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DIAGNOSTIC & ANALYTICAL SERVICES Environmental Centre of Excellence, Wollongbar/Lismore

c/msword/ocresult

IS:JRS

Our reference:

CRL 99/531

99/50/2

Chemical Residue Laboratories

PO Box 285 LISMORE 2480

Your reference: C0133

Phone: 02 6621 2632 Fax: 02 6621 4319

Holmes & Holmes Pty Ltd PO Box J159 COFFS HARBOUR JETTY 2450

Analysis of Soil Samples

Sampled

06 & 08 & 09-07-99

Received

12-07-99

The samples submitted in connection with the above have been analysed with the following results. As samples were not taken by the laboratory no responsibility is accepted for sampling.

Lab.No.	Sample Identification	OC's	OP's
-2044	-Soil A/3224 0-150		- <0:1
2045	-Soil B/3224 150-300	<0.02	 <0.1
2046	-soil-c/3224 0-150	<0.02	
2047	Soil CA/3200	<0.02	<0.1
2048	Soil CB/3200	<0.02	<0.1
2049	soil CC/3200	<0.02	<0.1
2050	Soil CD/3200	<0.02	<0.1
2051	Soil CE/3200	<0.02	<0.1
2052	Soil CF/3200	<0.02	<0.1
2053	Soil CG/3200	<0.02	<0.1
2054	soil CH/3200	<0.02	<0.1
2055	Soil CI/3200	<0.02	<0.1
2056	soil CJ/3200	<0.02	<0.1
2057	soil CK/3200	<0.02	<0.1
2058	Soil CL/3200	<0.02	<0.1
2059	Soil CM/3200	<0.02	<0.1
2060	Soil CN/3200	<0.02	<0.1
2061	Soil CO/3200	<0.02	<0.1
2062	Soil CP/3200	<0.02	<0.1
2063	Soil CQ/3200	<0.02	<0.1
2064	Soil CR/3200	<0.02	<0.1
2065	Soil CS/3200	<0.02	<0.1
2066	Soil CT/3200	<0.02	<0.1
2067	Soil CU/3200	<0.02	<0.1
2068	Soil CV/3200	<0.02	<0.1
2069	Soil CW/3200	<0.02	<0.1

. Method is SOP2625

Results in mg/kg reported on a dry matter basis.

Minimum level of reporting for OC is 0.02 mg/kg in soil

Minimum level of reporting for OP is 0.1 mg/kg in soil

No other pesticides occurred above reportable levels for chemicals screened in the attached list.

6 536457D

Dr Ian Stiff Chemist 27 July 1999



HOLMES & HOLMES PTY. LTD. CHARTERED ENGINEERS (AUSTRALIA)

AC.N. 001 266 271

P.O. Box J 159, Coffs Harbour Jetty, 2450

Phone/Fax (066) 53 6

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ORDER	NO. C.13	3.3		NUMI	BER OF	BAGS	OH.E.	• • • •	
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Laboratory H&H Identification Sample 1	e Depth	00	OP		ı				
2044 A/322	4 0-150	V	/						<u> </u>
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NSW Agriculture Wollongbar/Lismore

DIAGNOSTIC & ANALYTICAL SERVICES Environmental Centre of Excellence, Wollongbar/Lismore

IS:JRS

c:/msword/ocresult

Our reference:

CRL 99/545 99/50/2

Your reference: C0134

Chemical Residue Laboratories PO Box 285 LISMORE 2480

Phone: 02 6621 2632 Fax: 02 6621 4319

Holmes & Holmes Pty Ltd PO Box J159 COFFS HARBOUR JETTY 2450

Analysis of Soil Samples

Sampled

13-07-99

Received

15-07-99

The samples submitted in connection with the above have been analysed with the following results. As samples were not taken by the laboratory no responsibility is accepted for sampling.

				Other		
Lab.No.	Sample Identi:	fication	Aldrin	OC's	Dieldrin	OP's
2110	Soil DA/3200	0-150	<0.02	<0.02	<0.02	<0.1
2111	Soil DB/3200	150-300	<0.02	<0.02	<0.02	<0.1
2112	Soil DC/3200	0-150	<0.02	<0.02	<0.02	<0.1
2113	Soil DD/3200	0-150	<0.02	<0.02	<0.02	<0.1
2114	Soil DE/3200	0-150	<0.02	<0.02	<0.02	<0.1
2115	Soil DF/3200	150-300	<0.02	<0.02	<0.02	<0.1
2116	Soil DG/3200	0-150	<0.02	<0.02	<0.02	<0.1
2117	Soil DH/3200	0-150	<0.02	<0.02	<0.02	<0.1
2118	Soil DI/3200	150-300	<0.02	<0.02	<0.02	<0.1
2119	Soil DJ/3200	0-150	<0.02	<0.02	<0.02	<0.1
2120	Soil DK/3200	0-150	0.47	<0.02	0.27	<0.1
2121	Soil 3200/204		<0.02	<0.02	0.02	<0.1
	Soil 3200/204 Soil 3200/204		<0.02	<0.02	<0.02	<0.1
2122	SOLT 3200/204	o titi	\J.UZ	70.00		

Method is SOP2625

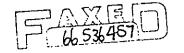
Results in mg/kg reported on a dry matter basis.

Minimum level of reporting for OC is 0.02 mg/kg in soil

Minimum level of reporting for OP is 0.1 mg/kg in soil

No other pesticides occurred above reportable levels for chemicals screened in the attached list.

Dr Ian Stiff
Chemist
27 July 1999





HOLMES & HOLMES PTY. LTD.

CHARTERED ENGINEERS (AUSTRALIA)

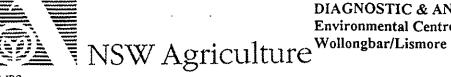
P.O. Box J 159, Coffs Harbour Jetty, 2450

Phone/Fax (066) 53 6

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2112	DC/	90-150	✓ .	/		<u> </u>	ļ	<u> </u>		
2113	DD/	00-150					 	-		
2114	DE/	00-150				 	<u> </u>	-		<u> </u>
2115	DF/_	150-300	~			ļ				
2116	DG	60-150				· · · · · · · · · · · · · · · · · · ·				-
2117	DHI	00-150								+
2118	DI/	150-300	<u> </u>	-			- 			
2119	DI/	00-150		/		 	 		_	
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DIAGNOSTIC & ANALYTICAL SERVICES Environmental Centre of Excellence, Wollongbar/Lismore

IS:JRS

·/msword/ocresult

Our reference:

Your reference: C0136

CRL 99/589

99/50/2

--

Chemical Residue Laboratories

PO Box 285 LISMORE 2480

Phone: 02 6621 2632 Fax: 02 6621 4319

Holmes & Holmes Pty Ltd PO Box J159 COFFS HARBOUR JETTY 2450

Analysis of Soil Samples

Sampled:

30-07-99 & 03-08-99

Received:

04-08-99

The samples submitted in connection with the above have been analysed with the following results. As samples were not taken by the laboratory no responsibility is accepted for sampling.

Lab.No.	Sample Identification	DDE	DDT	Total DDT	Other OC's	OP's
2236	CX/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2237	CY/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2238	EA/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2239	EB/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2240	EC/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2241	ED/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2242	EE/3200	0.12	0.14	0.26	<0.02	<0.1
2243	EF/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2244	EG/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2245	EH/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2246	EI/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2247	EJ/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2248	EK/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2249	EL/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2250	EM/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2251	EN/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2252	EO/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2253	EP/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2254	EQ/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2255	ER/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2256	ES/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2257	ET/3200	<0.02	<0.02	<0.02	<0.02	<0.1
2258	EU/3200	<0.02	0.02	0.02	<0.02	<0.1

Method is SOP2625

Results in mg/kg reported on a dry matter basis.

Minimum level of reporting for OC is 0.02 mg/kg in soil

Minimum level of reporting for OP is 0.1 mg/kg in soil

No other pesticides occurred above reportable levels for chemicals screened in the attached list.

Robert Black Acting Chemist 12 August 1999

653457



HOLMES & HOLMES PTY. LTD.

CHARTERED ENGINEERS (AUSTRALIA)

P.O. Box J 159, Coffs Harbour Jetty, 2450

Phone/Fax (066) 53 6

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-	ORL	ER NO.	C.01	36		NUM	BER OF	BAGS		• • • •	
	SAMPLI	SAMPLI	AMPLE ED AT	NO. C	×/37.0	o. C.Y	/3200 IRS. (EA on 34	ite 5 7 \$ 3/8	0/328 8/9 7	72- 20
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99	589	THIS	DOCU	JMENT	AUTHO	RISES	THE_	FOLLOW	ING T	ESTING	:-
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823	+2-	3200		V	/						
933	58 EU/ (in	3200 chin	~e)	~	<u> </u>						
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				:							
				<u> </u>							

CHEMICAL RESIDUE LABORATORIES:

PESTICIDES TESTED IN OC AND OP SCREEN - GENERAL TESTING

Organochlorine Insecticides

Aldrin

BHCs

Lindane

Heptachlor and its epoxide

Chlordanes

Dieldrin

DDT's

HCE

Endrin

Endosulfan (α , β and sulphate)

Organophosphorus Insecticides

Bromophos Ethyl

Carbophenothion

Chlorfenvinphos

Chlorpyrifos

Chlorpyrifos-methyl

Diazinon

Dichlorvos

Dioxathion

Ethion

Ethyl Fenthion

Fenitrothion

Fenthion

Methylparathion

Parathion

Pirimiphos-methyl



Appendix D Soil and Water Management Plan

Soil and Water Management Plan

Surface Runoff Control

Erosion and sediment control measures are to be implemented during the remediation works. Drainage works are to be installed as necessary for the control of soil erosion and mitigation of pollution by sediment and other materials downslope of the remediation areas.

Erosion Control

Diversion drains should be used to intercept concentrated surface or subsurface flows and convey them to a suitable outlet. "Clean" run-on water from upslope should be intercepted to prevent this water entering the remediation areas whilst work is in progress. Water diversion structures can be constructed from a wide range of materials. This may include compacted earth, plastic sheeting, shotcrete, asphalt and pipes. The following recommendations apply to diversion structures:

- 1. Water should be directed across the site at non-erodible velocities in the design storm event.
- 2. Structures should be stabilised immediately and downstream flow changes need to be carefully assessed.

Sediment Control

General recommendations with regards to sediment control are outlined below:

- 1. Structures should be designed to minimise land disturbance.
- 2. Any sediment-laden stormwater runoff should be passed through a trap or basin designed to minimise pollution to lands, waterways and services placed further down slope. Sediment should be kept as close to its source as possible.
- 3. Design should ensure that water is not diverted from its intended flow path if the drain becomes full with sediment during the design storm event.

Silt fences and diversion drains will be required to prevent storm water runoff, laden with suspended solids, entering or leaving remediation areas. Protection of the remediation from run-on water can be achieved by placing diversion banks upslope of the remediation. The installation of the banks will divert flow from upslope lands away from the site and reduce slope length. Sediment control structures should be placed immediately downstream to protect other lands and waterways from sediment pollution. Sediment control structures may include sediment retention traps or fences, filter strips and sediment retention basins. Sediment retention traps (also called "sediment fences") are temporary measures used in mitigation of sediment pollution to down slope lands and waterways. These structures are simple to construct, relatively inexpensive and easily moved as development proceeds. For this reason sediment retention fences are ideal for use in controlling sediment down slope of a remediation area. Materials used in the construction of sediment fences may include one or more of straw bales, woven geo-textile, earth, rock or suitable crushed concrete products. Straw bales should not be used where they cannot be properly embedded in the ground unless alternative measures are taken to prevent polluted water passing under them. Details of the sediment fence design are shown in Standard Drawing 6-7.

Vehicle Access

Where possible movement of equipment and trucks to and from the site should be minimised to reduce the potential for erosion. Access to sites should be stabilised to reduce the likelihood of vehicles tracking



soil materials onto public roads and ensure all-weather entry/exit. The following must also be considered with regards to vehicle access areas:

- 1. Surface water flows are to be diverted from the area.
- 2. Access areas are to be maintained in an effective condition through removal of sediment.
- 3. Equipment wash down areas require collection and treatment of waste water.
- 4. Access is ideally suited on level areas.
- 5. Supplementary street sweeping on adjacent roads may still be required.

Revegetation and Landscaping

All exposed areas should be progressively stabilised and revegetated on the completion of remediation works. Stabilisation is essential on disturbed areas to mitigate sediment pollution to downslope lands and waterways. Where possible works should be staged so that:

- » Minimal lands are exposed to the forces of soil erosion at any one time; and
- » Site stabilisation measures are progressively implemented throughout the development phase.

Successful revegetation of lands requires:

- 1. Availability of acceptable soil materials;
- 2. Correct site preparation;
- 3. Selection of the most suitable establishment technique;
- 4. Selection of appropriate plant species, fertiliser(s) and ameliorant(s);
- 5. Application of sufficient water for germination and to sustain plant growth if rainfall is insufficient; and
- 6. An adequate maintenance program.

Areas resulting in unsatisfactory revegetation should be investigated to determine the reason for failure followed by appropriate remedial action, including replacing any lost topsoil and re-sowing the site. Erosion and sediment control structures should be maintained until all earthworks are completed and the site rehabilitated.

Appendix E Calculations



The recommended calculation for determining the number of samples needed for validation is presented below.

$$n = 6.2 (o)^{2}$$

 $(C_s - u)^{2}$

n = number of samples needed

o = estimated standard deviation

u = estimated average concentration in sampling area

C_s = acceptable limit

Area A

0 = 28.4

u = 59

 $C_{s} = 100$

$$n = \underline{6.2 (28.4)^2}$$
$$(100 - 59)^2$$

Area B

o = 24.1

u = 60.3

 $C_s = 100$

$$n = \underline{6.2 (24.1)^2}$$
$$(100 - 60.3)^2$$

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¹ USEPA (1989) *Attainment of Clean-up Standards*, Box 6.3 Chapter 6 (EPA 230/02-89-042), Office of Policy, Planning and Evaluation,

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