Douglas Partners
Geotechnics / Environment / Groundwater

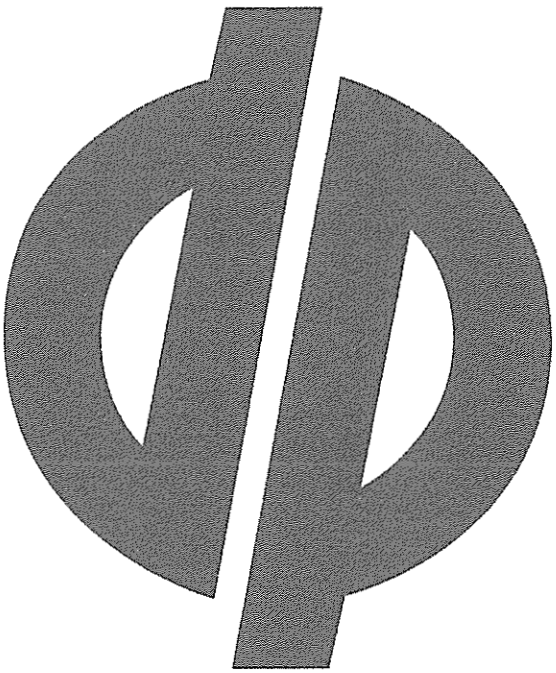
Integrated Practical Solutions

Report on
Preliminary Site Investigation for Contamination

Proposed Rezoning for Residential Development
15 Mulloway Road, Chain Valley Bay

Prepared for
Mr Noel Smith

Project 83024.00
August 2016



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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Executive Summary

This report presents the results of a preliminary site investigation for contamination (PSI) undertaken for a proposed rezoning for residential development at 15 Mulloway Road, Chain Valley Bay. The investigation was commissioned by Mr Noel Smith (authorisation dated 18 May 2016) and was undertaken in accordance with Douglas Partners' proposal WYG160024 dated 28 January 2016.

The objective of the study was to provide an initial assessment of the site's contamination status to support an application to rezone the site. For the purposes of this investigation, it is understood that future development is likely to comprise residential use (i.e. residential subdivision).

This PSI report presents the results of a site history review and a walkover of the site. No intrusive investigation or testing was undertaken for this PSI.

Based on the findings of the desktop review and site walkover, DP considers that there is a low potential for widespread contamination given the past site activities and the existing site conditions. Some localised potential contamination sources were identified (refer Table 2 – Section 6); including storage of debris concentrated in the northern portion of the site, and the former and existing building footprints.

The site would generally be considered compatible (from a site contamination perspective) with the proposed residential land use. The localised potential contamination issues identified can be readily address through investigation and where required localised remediation.

These investigations could initially be limited to targeted sampling of soils in localised areas of environmental concern (i.e. areas of disturbance, former/existing buildings, access tracks, cleared paddocks and dam sediments). These investigations should include an assessment of site soils for chemical and physical characteristics to assess the perceived low risk of contamination.

Prior to completion of the further intrusive contamination investigations it is recommended that a licensed contractor is engaged to remove all debris and waste materials and suspected ACM fragments observed at the ground surface (refer to Drawing 1, Appendix A).

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Report on Preliminary Site Investigation for Contamination
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15 Mulloway Road, Chain Valley Bay

1. Introduction

This report presents the results of a preliminary site investigation for contamination (PSI) undertaken for a proposed rezoning for residential development at 15 Mulloway Road, Chain Valley Bay. The investigation was commissioned by Mr Noel Smith (authorisation dated 18 May 2016) and was undertaken in accordance with Douglas Partners' proposal WYG160024 dated 28 January 2016.

The objective of the study was to provide an initial assessment of the site's contamination status to support an application to rezone the site. For the purposes of this investigation, it is understood that future development is likely to comprise residential use (i.e. residential subdivision).

This PSI report presents the results of a site history review and a walkover of the site. No intrusive investigation or testing was undertaken for this PSI. The PSI was undertaken with respect to the staged investigation approach outlined in State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55 – Ref 1) and the National Environment Protection Council (NEPC) National Environment Protection (Assessment of Site Contamination) Measure 1999 (amended 2013) (NEPC, 2013 – Ref 2).

1.1 Objectives

The objectives of the PSI were to:

- Identify potential sources of contamination and determine potential contaminants of concern;
- Identify areas of potential contamination;
- Identify potential human and ecological receptors;
- Identify potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air);
- Provide a preliminary assessment of the site's contamination status and likely compatibility with a residential use; and
- Assess the need for further investigation and/or site remediation.

1.2 Site Identification

The site is identified as Lot 273 Deposited Plan 755266 and has a street address of 15 Mulloway Road, Chain Valley Bay, NSW. The site is located within the parish of Munmorah, County of Northumberland and in the Central Coast Council (CCC – formerly Wyong Shire Council (WSC)) local government area.

The site is currently zoned E2 Environmental Conservation and E3 Environmental Management under Wyong Local Environmental Plan 2013. The site has an approximate rectangular shape and comprises an area of approximately 16.59 hectares.

Figure 1, is a plan of the local area and shows the site in relation to various local features.

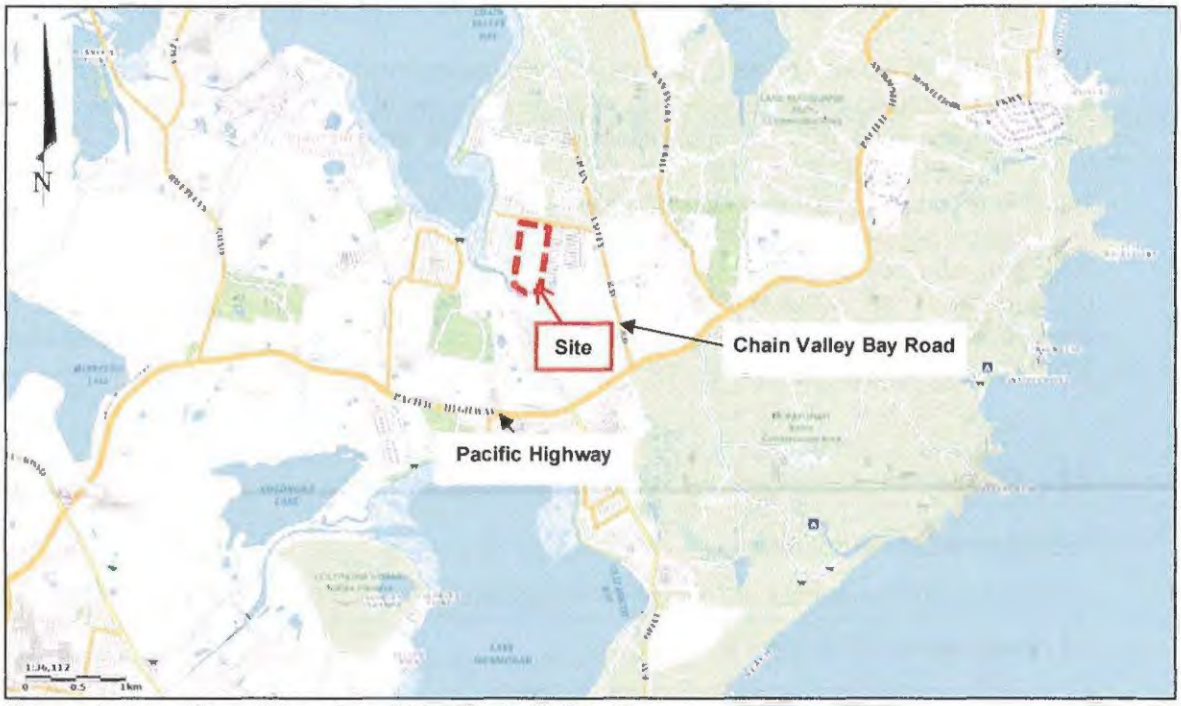


Figure 1: Location of the site within Chain Valley Bay
(image sourced from SIX Maps)

Figure 2, is an aerial view of the local area and shows the site in relation to the nearest cross street.

Figure 2: Location of the site (image sourced from nearmap.com, dated 23 February 2016)

At the time of the PSI, the site primarily comprised bushland, with several clearings and access trails traversing the site. The main site features comprised a single residence and detached shed in the north-west portion of the site and a large dam in the central-west portion of the site. Other site features are discussed in Section 5.

Drawing 1, which is included in Appendix A, shows the existing layout of the site.

2. Scope of Work

The scope of work for the PSI comprised:

- Collation and interpretation of readily available site data from the following sources:
  - Published public data, including topographical, geological and hydrogeological maps;
  - A search of the Registered Groundwater Bore database of the NSW Department of Primary Industries, Office of Water;
  - NSW EPA Contaminated Land and Protection of Environment Operations databases;
  - WSC (now CCC) Property Enquiry Information; and
  - Historical aerial photographs; and
  - Other historical information available for the site.
- Site walkover to provide a visual assessment of potential contamination sources;
- Development of a preliminary conceptual site model (CSM); and

- Preparation of this report outlining the works undertaken and the findings of the PSI.

3. Physical Setting

3.1 Topography

Review of the local topographic mapping and site observations indicated that site is generally sloping down to the south and west. Surface levels within the site range between approximately RL 16 m in the north east and 2 m AHD in the south. Karignan Creek borders the southern boundary of the site which discharges to the west and then north-west into Lake Macquarie, located approximately 400 m to the north-west.

Surface water would generally be expected to infiltrate at the site, however, runoff from the site is generally expected to migrate to the south-west, possibly entering the on-site dam or discharging into Karignan Creek. The final discharge point would most likely be Karignan Creek and Lake Macquarie.

Figure 3 is a plan of the local area and shows the site in relation to surface elevation contours and local watercourses.

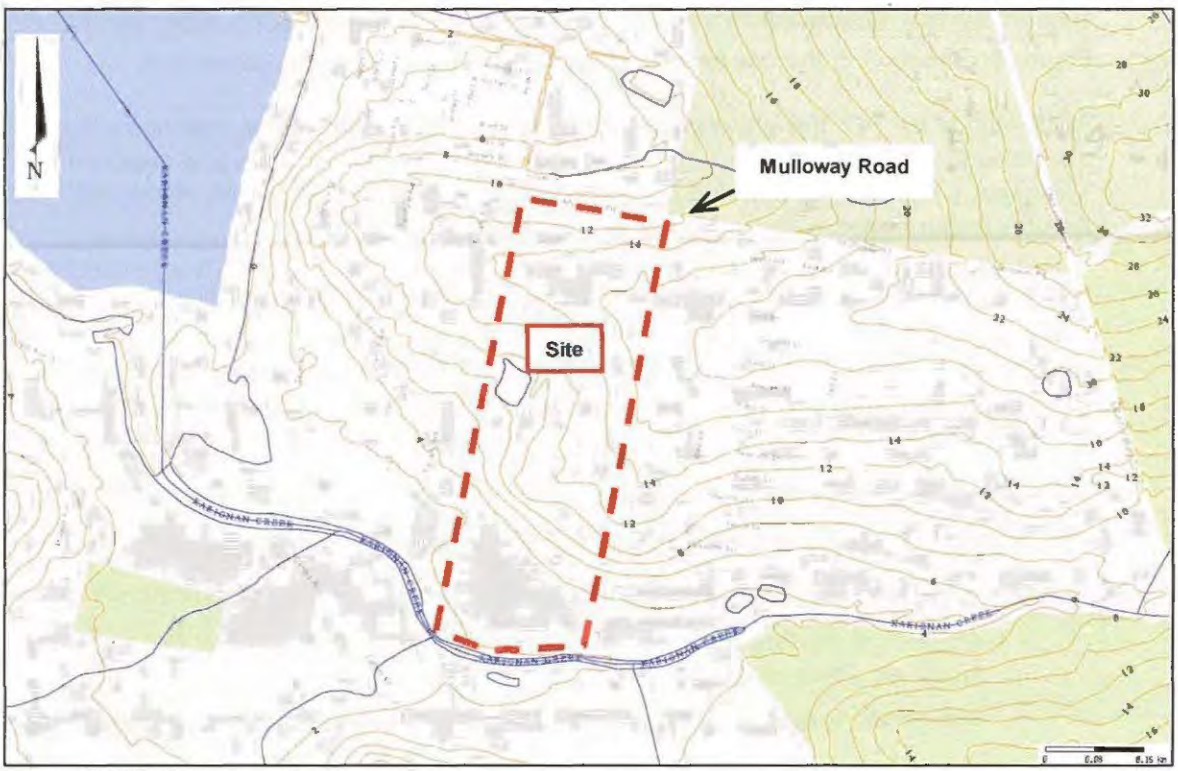


Figure 3: Site Topography
(image sourced from Microsoft Virtual Earth with 2 m elevation contour overlay)

3.2 Adjacent Site Uses

Surrounding land uses include the following:

- North (across and down slope) – Mulloway Road and then residential properties (Teraglin Lakeshore Home Village);
- East (across and up slope) – Residential properties (Valhalla Village);
- South (down slope) – Karignan Creek and then a wholesale nursery (Karignan Plantation – Trees Impact); and
- West (down slope) – Residential properties.

The potential for contamination from existing off-site land uses or activities to have impacted the site is considered to be relatively low. Notably the wholesale nursery use appeared to relate to large trees that would not require intensive management.

A walkover of the adjacent sites was not undertaken as part of this PSI.

3.3 Regional Geology and Soil Landscape

Reference to the local geological mapping indicates that the site is located near the boundary of areas mapped as being underlain by Munmorah Conglomerate (identified as Rnp in Figure 4) and areas mapped as being underlain by Quaternary alluvium (identified as Qa in Figure 4). Munmorah Conglomerate of the Narrabeen Group typically comprises pebbly sandstone, conglomerate, sandstone and claystone. Quaternary alluvium typically comprises an undifferentiated mix of sands, silts and clays.

The local soil landscape mapping confirms that the site is situated near the boundary of two different soil landscapes being the erosional Doyalson soil landscape (identified as do in Figure 5) to the north and alluvial Wyong soil landscape (identified as wy in Figure 5) to the south. The mapping indicates that subsurface conditions in the northern portion of the site may comprise residual clayey soils underlain by weathered Munmorah Conglomerate bedrock, whilst in the southern portion the residual soils maybe overlain by alluvial soils.

The subsurface conditions within the site are likely to be consistent with the local geological and soil landscape mapping based on local knowledge and observations made during the site walkover.

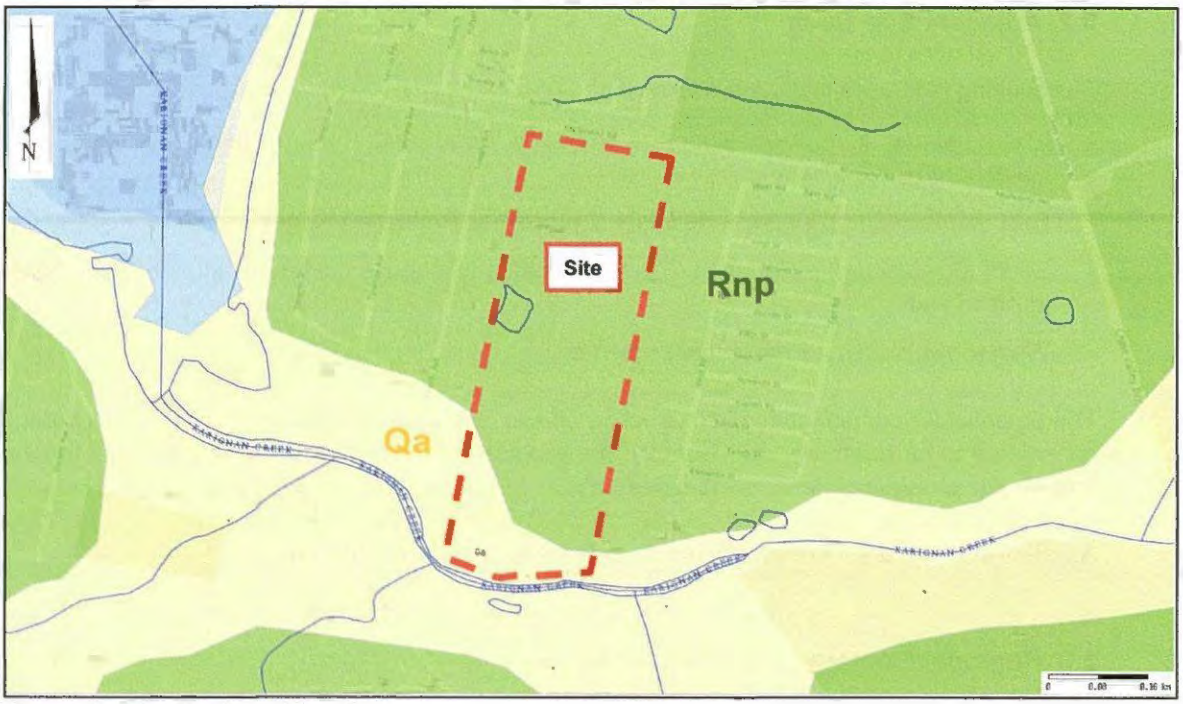


Figure 4: Site Geology Mapping
(image sourced from Microsoft Virtual Earth with Newcastle Coalfields 1:100,000 Geology overlay)

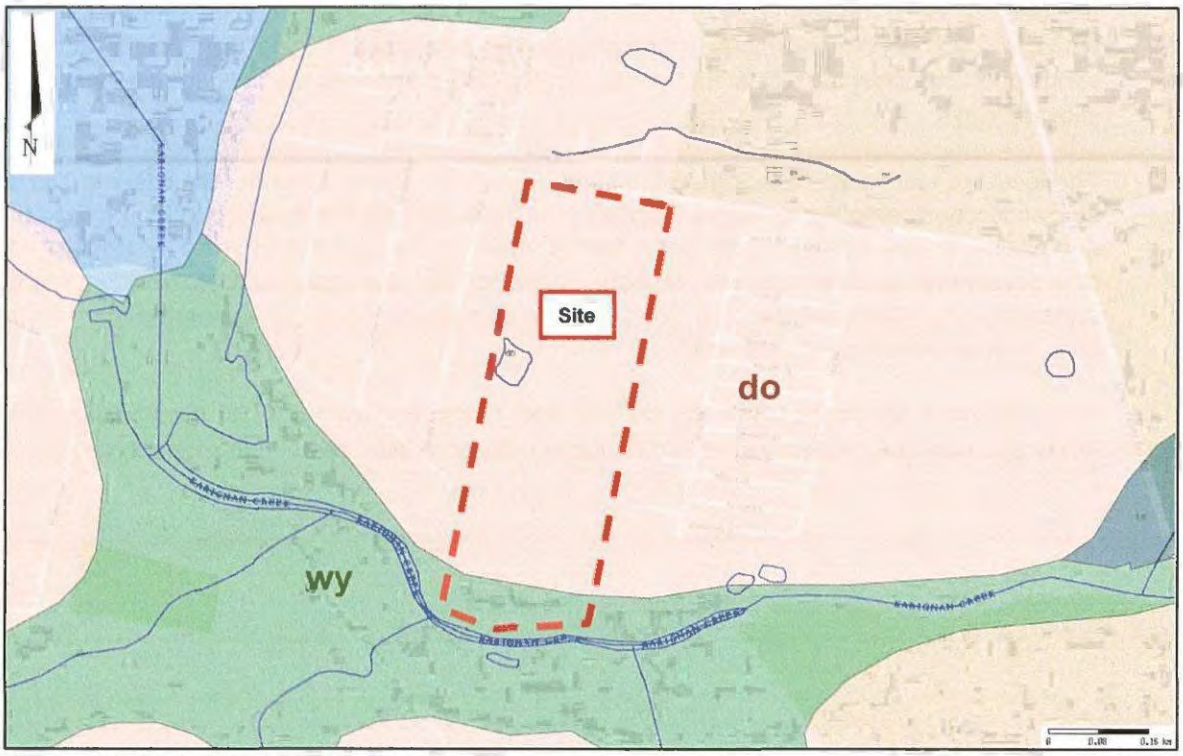


Figure 5: Site Soil Landscape Mapping
(image sourced from Microsoft Virtual Earth with Gosford-Lake Macquarie 1:100,000 Soil Landscapes Sheet overlay)

3.4 Acid Sulfate Soils

The local acid sulfate risk mapping indicates that the site is generally located in an area mapped as having no known occurrence of acid sulfate soils (ASS). However, the southern portion of the site borders areas mapped as having a high probably of occurrence within 1 m of the ground surface.

Furthermore, review of the acid sulfate soils planning maps provided by WSC (now CCC) indicates that the site is located in a Class 2 and Class 5 mapped area. Both of these classes indicate that further assessment of acid sulfate soil conditions is likely to be required by council as part of the planning approvals process.

The acid sulfate soil risk mapping is consistent with the mapped subsurface conditions and site elevations indicating that assessment for acid sulfate soil is warranted if soils in the southern third of the site are likely to be disturbed as part of the proposed development activities.

It is noted that the possible presence of ASS does not preclude future site development. If ASS are found to be present they can be effectively managed through investigation and a site specific acid sulphate soil management plan (ASSMP).

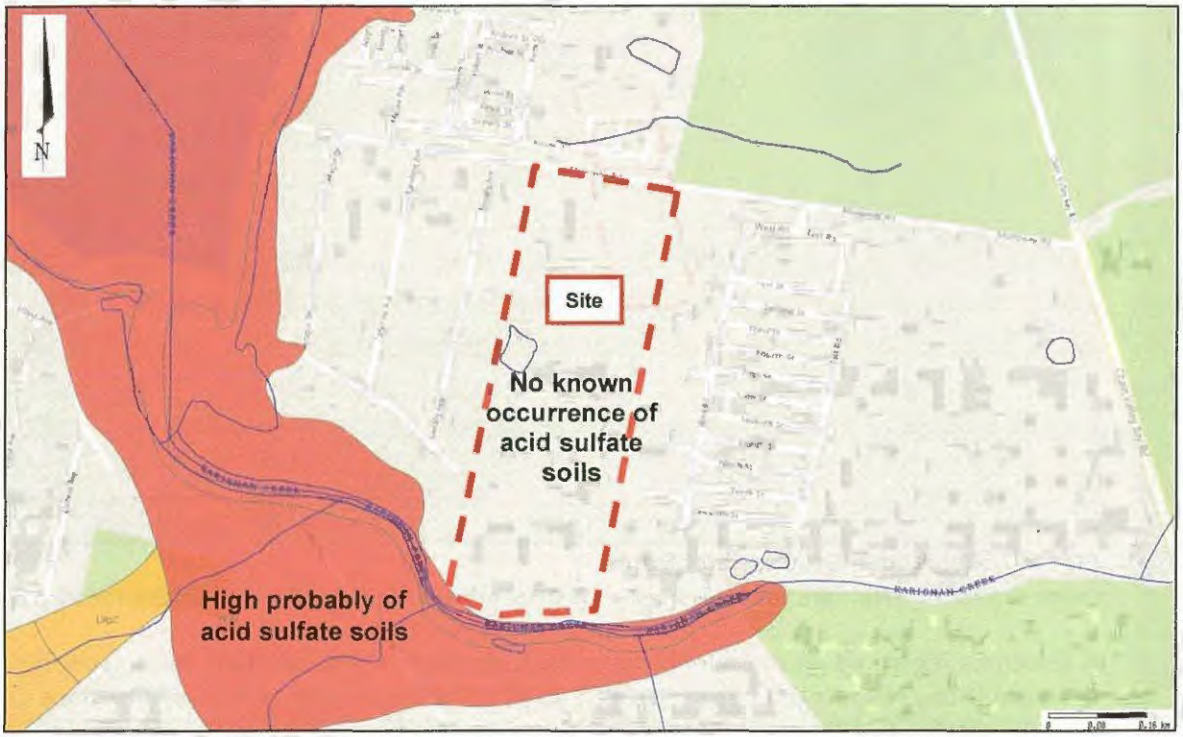


Figure 6: Acid Sulfate SoilSite Soil Landscape Mapping
(image sourced from Microsoft Virtual Earth with Gosford-Lake Macquarie 1:100,000 Soil Landscapes Sheet overlay)

3.5 Groundwater

Given the site's topography and geology, it is considered likely that a permanent groundwater table is present at relatively shallow depth (i.e. less than 4 m depth), particularly within the southern portion of the site which borders Karignan Creek. The shallow groundwater table within the northern portion of the site may be limited to intermittent seepage at the interface of permeability boundaries (i.e. sandy – clayey soils or the soil – weathered rock interface) or be present at greater depths within the rock profile. It should be noted that groundwater levels are potentially transient and can be affected by factors such as soil permeability and recent weather conditions.

Figure 6 is a street map of the local area and shows the site in relation to the local registered groundwater bores.

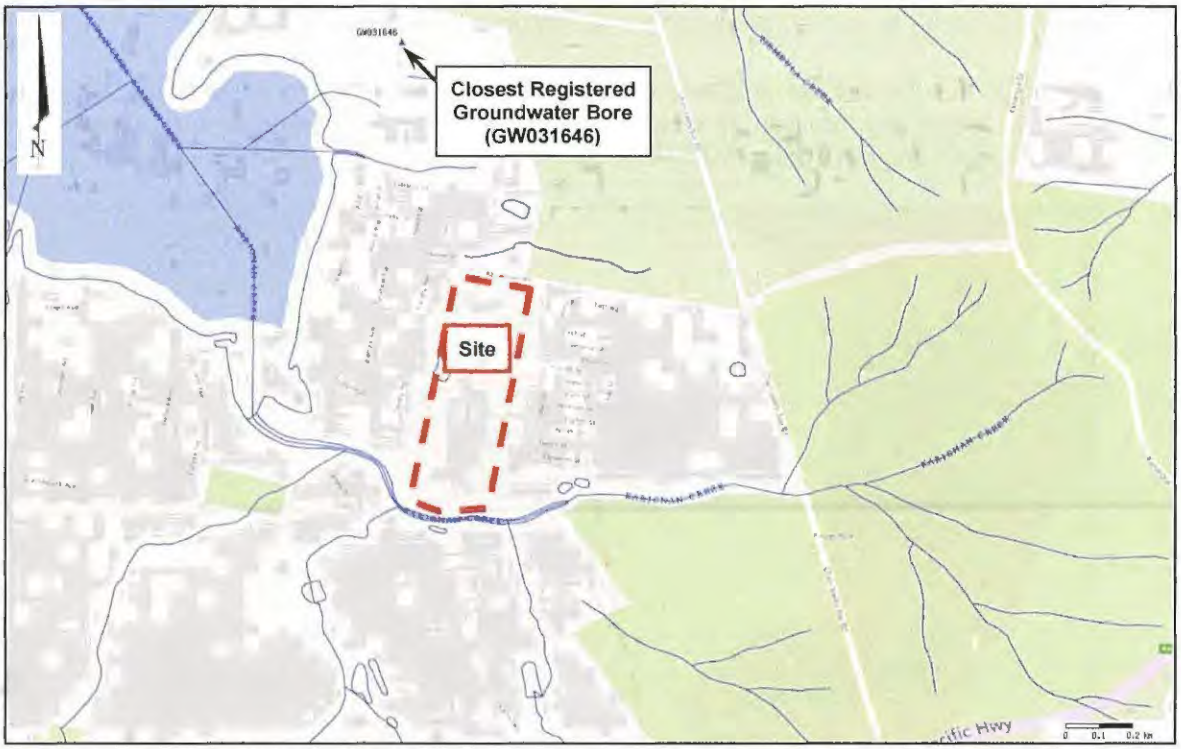


Figure 7: Registered Groundwater Bores
(image sourced from Microsoft Virtual Earth with NSW Office of Water Registered Groundwater Bore location overlay)

A search for registered groundwater bores in the Department of Natural Resources groundwater bore database [Note: this function has been taken up by NSW Department of Primary Industries Office of Water] indicated that there are no registered groundwater bores within a 500 m radius of the site. Furthermore, no registered bores were located between the site the Karignan Creek (suspected primary groundwater discharge point).

The information available suggests that the closest bore was installed approximately 700 m to the north-west and was installed for coal exploration, however, has a domestic stock authorised purpose. The bore was drilled to 277 m depth, however no well construction details were provided. A copy of the search result is provided in Appendix B. Given the site topography and proximity of watercourse to the south, it is considered unlikely that potential groundwater contamination from the site would impact the nearest registered groundwater bore.

4. Site History

4.1 Regulatory Notices Search

The NSW EPA Register of Contaminated Land was searched for Regulatory Notices that may be current on the site issued under the *Contaminated Land Management (CLM) Act* 1997 and Section 308 of the *Protection of the Environment Operations (POEO) Act* 1997. The information obtained at the time of preparing this report indicated that no current or previous Licences, Notices or Orders were applicable for the site.

4.2 Council Enquiry Information

An enquiry was made through Wyong Shire Council's (WSC now CCC) web site. The enquiry identified that only applications from a lodgement date of 1 January 2007onwards are listed. Two applications are listed and both pertain to construction of a shed in 2012. A detached metal shed was observed during the site walkover.

No other applicable information was obtained from WSC. A copy of the WSC Property Report is provided in Appendix B.

4.3 Historical Aerial Photographs

Historical aerial photographs were reviewed dating back to the earliest available record (1954) and approximately every 10 to 20 years thereafter to assess possible changes to the site and surrounding areas during this period. The following historical aerial photographs were reviewed:

- Photograph – Lake Macquarie NSW 8/403 Run 4L, dated 07.03.1954;
- Photograph – Lake Macquarie NSW 2315 24 Run 3, dated 28.05.1975;
- Orthophotomap – Vales Point NSW U4527-9, photograph dated 23.11.1986;
- Photograph – Lake Macquarie NSW 3730 103 Run 9, dated 25.04.1990;
- Photograph – Lake Macquarie NSW 4309 Run 14, dated 29.05.1996;
- Photograph – Google Earth Image, dated 22.04.2005; and
- Photograph – Google Earth Image, dated 10.1.2016.

Extracts of the 1954, 1975, 1990 and 1996 historical aerial photographs are included as Drawing 2 in Appendix B. Table 1 summarises the observations made during the aerial photograph review.

Table 1: Aerial Photograph Review

Year	Site	Surrounding Land Use
1954	The site appears to be generally vegetated with bushland, except for an access track extending from Mulloway Road south and linking four probably grass surfaced paddocks that match the approximate location of the existing open grassed surfaced areas at the site.	Surrounding areas appear to comprise mostly bushland with some areas cleared and appear to have a grass surface cover. No intensive rural activities (i.e. orchards, market gardens or poultry) were identified on the adjacent properties.
1975	The site generally appears to be in a similar condition to the 1954 photograph. Major changes appear to comprise construction of the existing residence, detached shed and access driveway in the northern portion of the site, and the existing dam located centrally along the western site boundary.	Surrounding areas appear generally partially cleared and in-part under development for probably residential uses. No specific rural uses were identified on nearby properties.
1986	No significant changes were observed.	Properties to the west appear to be largely developed for residential uses. The property to the east appears to have a semi-rural residential use (possibly a grazing use). No other significant changes were observed.
1990	No significant changes were observed.	Further residential development appears to be in progress to the north and east. No other significant changes were observed.
1996	No significant changes were observed.	The property to the south across Karignan Creek appears to be developed for the wholesale nursery use (i.e. row of plants visible). No other significant changes were observed.
2005	No significant changes were observed.	Further residential development appears to be in progress to the north (extension to Teraglin Lakeshore Home Village). No other significant changes were observed.
2016	The site generally appears to be in a similar condition to the 1975 photograph. Minor changes to the site conditions observed comprise the previously identified shed has probably been demolished and a larger shed has been constructed slightly to the east. The area immediately to the south of the residence appears to be disturbed (surface vegetation disturbed) and some materials appear to be stored in this area.	No significant changes were observed.

4.4 Other Historical Information

The Planning Consultant (Optima Developments Pty Ltd), as part of the initial information package, supplied a desktop (planning) assessment report, dated November 2009, identified that the land use at the time of the assessment report comprised a single detached dwelling with livestock (including pigs, cattle and horses – small scale only) under the supervision of a caretaker. Furthermore, the Google Earth web images identified that the site was operated as Chain Valley Creek Guided Trail Rides.

Mr Noel Smith (Client) stated that he had owned the property for at least ten years and that the property was currently tenanted. A brief interview with the current tenant indicated that a former tenant left remnant materials scattered in the locality of the residence. These materials are identified in the site walkover (Section 5). The current tenant also indicated that the site was used as a horse riding trail in the past.

5. Site Walkover / Observations

A site walkover was undertaken on 28 July 2016 by a Senior Environmental Engineer (Mr Brent Kerry). The site features observed during the walkover are summarised below. The general site topography was consistent with that described in Section 3.1.

The site layout appears to have remained unchanged from the March 2015 aerial photograph (refer to Drawing 1, Appendix A). The following features were observed during the walkover:

Figure 8 – Photograph from Mulloway Road showing bushland vegetation with single driveway access into site – looking south.


Figures 9 and 10 – Photograph of access driveway into site from Mulloway Road with some recycled aggregate materials used to surface the driveway. Photograph of residence and detached shed. The shed was used to house several cats, with a tractor parked under the attached awning.


Figures 11 and 12 – Inspection of the general site conditions in the locality of the residence indicated that the area immediately to the south was cleared with a scattered grass/weed cover. Surface soils appeared to have been disturbed in the past possibly as a result the livestock known to occupy the site. Various materials and debris (i.e. mix of metal, timber, plastic, concrete and foam) were stored in this portion of the site.


Figures 13 and 14 – Photograph of various materials and debris were stored in general locality of the residence (refer to Drawing 1, Appendix A). Materials observed comprised a mix of metal, timber, plastic, concrete and foam, a derelict truck, tractor and trailer, and small quantities of suspected asbestos-containing-material (ACM) fragments were observed at the ground surface (refer to Figure 13) at three locations.


Figures 15 and 16 – Remaining portions of the site comprised bushland with several grass surface clearings linked with typically unsurfaced access tracks. No obvious signs of widespread filling were identified during the walkover, however, isolated areas on the tracks appeared to have been resurfaced with concrete rubble. Small stockpiles of building waste materials (i.e. mix of brick, concrete, tiles and metal - refer to Figure 16), soils and timber logs (suspected to be sourced from fallen trees) were observed during the walkover. No additional suspected ACM fragments were observed at the surface of the stockpiles.

6. Preliminary Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or in the future i.e. it enables an assessment of the potential source – pathway – receptor linkages (complete pathways).

6.1 Potential Contamination Sources and Contaminants of Concern

Table 2 summarises the potential sources of contamination and associated contaminants of concern that have been identified at the site.

Table 2: Potential Contamination Sources and Contaminants of Concern

Potential Contamination Source/Activity	Description of Potential Contaminating Activity	Primary Potential Contaminants of Concern
Storage of debris, waste materials, minor spills/leaks from derelict equipment and contaminated filling	Importation of substantial filling is unlikely likely based on site history and observations. Any spills/leaks from equipment are likely to be localised. However, localised filling and storage/dumping of materials was observed at the site.	Various - Common contaminants associated with filling are metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), TRH, BTEX, PAH, PCB, OCP and asbestos
Former and existing building footprints	Site historical review identified a residence and two sheds (one former and one existing). The older buildings may contain hazardous building materials or have been treated with chemical that could contaminate the soil.	Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), OCP and asbestos

Notes:
As = arsenic, Cd = cadmium, Cr = chromium, Cu = copper, Pb = lead, Hg = mercury, Ni = nickel and Zn = zinc
TRH = total recoverable hydrocarbons, BTEX = benzene, toluene, ethylbenzene and xylene, PAH = polycyclic aromatic hydrocarbons, PCB = polychlorinated biphenyls, OCP = organochlorine pesticides

For the purpose of developing a conceptual site model, the potential sources (S) of contamination are summarised as:

- S1 - Storage of debris (waste materials, spills/leaks and potentially contaminated filling); and
- S2 - Former and existing building footprints.

6.2 Potential Receptors of Concern

The potential receptors of potential contamination sourced from the site are considered to be:

- R1 - Site users (future residential users);
- R2 - Adjacent site users (residential);
- R3 - Construction and maintenance workers;
- R4 - Surface water (nearby intermittent watercourse);
- R5 - Terrestrial ecology; and
- R6 - Property (future).

Groundwater is not considered a potential receptor of concern given the potential contamination sources and site conditions identified. This should be reassessed based on the results of future investigations recommended at the site.

6.3 Potential Contamination Migration Pathways

The pathways by which the potential sources of contamination could reach potential receptors are described below:

- P1 - Ingestion and dermal contact;
- P2 - Inhalation of dust and / or vapours;
- P3 - Surface run off; and
- P4 - Direct contact with terrestrial ecology /.property.

6.4 Conceptual Site Model

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human, water or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways. The possible pathways between the above sources (S1 and S2) and receptors (R1 to R6) are provided in Table 3 below.

Table 3: Conceptual Site Model

Potential Source	Pathway	Receptor
S1 - Storage of debris. (Metals, TRH, BTEX, PAH, PCB, OCP and asbestos)	P1 – Ingestion and dermal contact	R1 – Site users R3 –Construction & maintenance workers.
S2 - Former and existing building footprints. (Metals, OCP and asbestos)	P2 – Inhalation of dust and / or vapours	R1 – Site users R2 – Adjacent site users R3 – Construction & maintenance workers.
	P3 – Surface run off	R4 –Surface water.
	P4 – Direct contact with terrestrial ecology / property	R5 – Terrestrial ecology R6 – Property

7. Conclusions and Recommendations

Based on the findings of the desktop review and site walkover, DP considers that there is a low potential for widespread contamination given the past site activities and the existing site conditions. Some localised potential contamination sources were identified (refer Table 2 – Section 6); including storage of debris concentrated in the northern portion of the site, and the former and existing building footprints.

The site would generally be considered compatible (from a site contamination perspective) with the proposed residential land use. The localised potential contamination issues identified can be readily address through investigation and where required localised remediation.

These investigations could initially be limited to targeted sampling of soils in localised areas of environmental concern (i.e. areas of disturbance, former/existing buildings, access tracks, cleared paddocks and dam sediments). These investigations should include an assessment of site soils for chemical and physical characteristics to assess the perceived low risk of contamination.

Prior to completion of the further intrusive contamination investigations it is recommended that a licensed contractor is engaged to remove all debris and waste materials and suspected ACM fragments observed at the ground surface (refer to Drawing 1, Appendix A).

8. References

1. Department of Urban Affairs and Planning, Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land, 1998.

2. National Environment Protection Council (NEPC), National Environment Protection (Assessment *of Site Contamination) Measure 1999* (amended 2013), 2013.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at 15 Mulloway Road, Chain Valley Bay in accordance with DP's proposal WYG160024, dated 28 January 2016 and acceptance received from Mr Noel Smith dated 18 May 2016. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Mr Noel Smith for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

DP's contamination assessment is necessarily based on the result of a desktop site historical search and site inspection only and did not include surface or subsurface sample screening and/or chemical testing. DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site.

It is noted that this assessment does not constitute a hazardous material building assessment. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report. This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the environmental components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Suspected asbestos has been detected by observation on the surface of the site. Building demolition materials, such as concrete were also located in other areas of the site and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos. It is therefore considered possible that HBM, including asbestos, may be present in unobserved parts of the site, and hence no warranty can be given that asbestos is not present.

Douglas Partners Pty Ltd

Appendix A

About This Report
Drawings 1 and 2

About this Report

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

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

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report 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 or excavation. 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 and test pits 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 or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole 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 weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements 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.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP 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 conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

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

About this Report

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, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

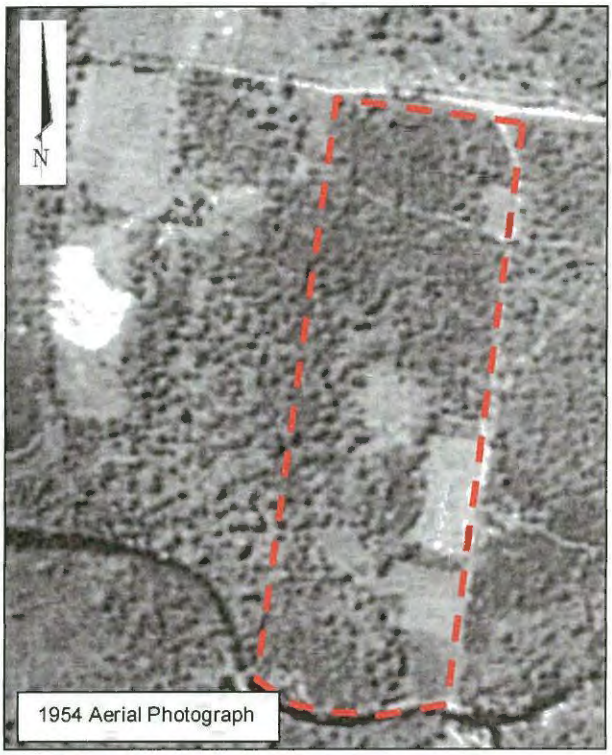
Information for Contractual Purposes

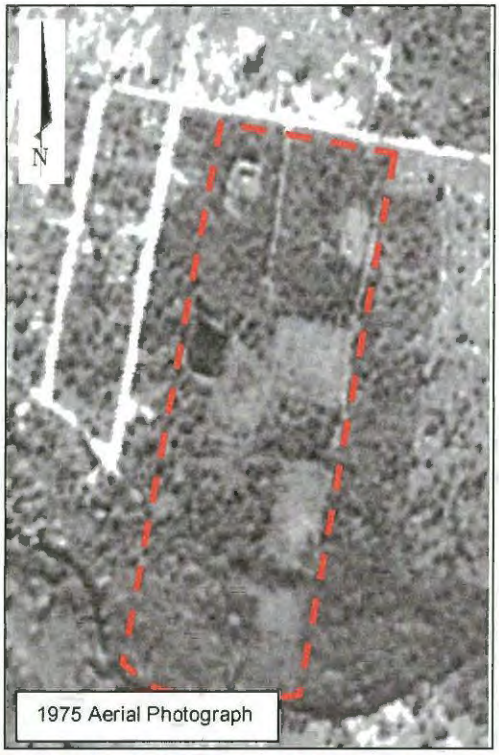
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

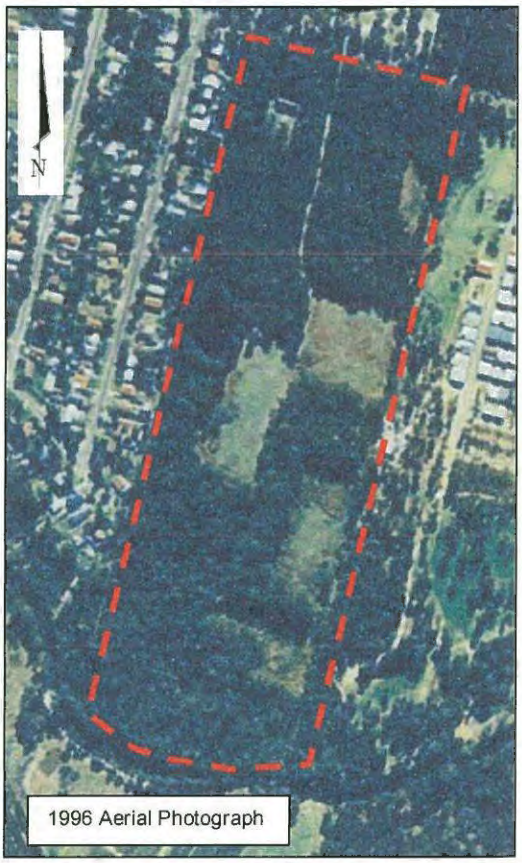
Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental 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.

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT:	Mr Noel Smith	TITLE:	Existing Site Layout	PROJECT No: 83024.00
	OFFICE:	Central Coast	DRAWN BY: BJK	Preliminary Site Investigation for Contamination	DRAWING No: 1
	SCALE:	NTS	DATE: August 2016	15 Mulloway Road, Chain Valley Bay	REVISION: 0







Douglas Partners
Geotechnics | Environment | Groundwater

Historical Aerial Photographs	PROJECT:	83024.00
Preliminary Site Investigation for Contamination	DWG No:	2
15 Mulloway Road, Chain Valley Bay	REV:	0
CLIENT: Mr Noel Smith	DATE:	Aug 2016