



Douglas Partners
Geotechnics | Environment | Groundwater

Report on
Preliminary Site Investigation for Contamination

Proposed Residential Development
45 Mulloway Road, Chain Valley Bay

Prepared for
CorVal Partners Ltd

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Integrated Practical Solutions





Douglas Partners

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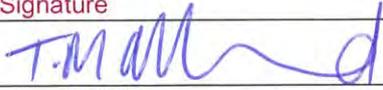
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Executive Summary

This report presents the results of a preliminary site investigation for contamination (PSI) undertaken for a proposed residential development at 45 Mulloway Road, Chain Valley Bay. The investigation was commissioned by CorVal Partners Ltd and was undertaken in accordance with Douglas Partners' proposal CCT180390 dated 1 November 2018.

The objective of the study was to provide an initial assessment of the site's contamination status for due diligence purposes. For the purposes of this investigation, it is understood that future development is likely to comprise residential use (i.e. a land lease community with movable dwellings).

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 the site has been subject to potentially contaminating activities or land uses. Potential contamination sources were identified (refer Table 2 – Section 6); including importation and placement contaminated filling, storage of equipment/materials and the existing buildings.

The site would not be considered compatible (from a site contamination perspective) with the proposed residential land use in its current condition. Further detailed site investigation and potentially remediation and validation works would be required, prior to the site being considered suitable for the proposed residential use.

The preliminary CSM (presented as Table 3) will form the basis for development of a *Sampling and Analysis Quality Plan* (SAQP) prior to the completion of a *Detailed Site Investigation* (DSI).

It is recommended that a combined systematic and judgemental sampling strategy be adopted for a DSI to substantiate DP's assessment of the low to moderate contamination risk at the site. A DSI scope of work could be further developed during the preparation of a Sampling and Analysis Quality Plan with consideration given to the land uses proposed. Furthermore, it is expected that any remedial works are unlikely to prevent redevelopment of the site for the proposed residential uses.

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.

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Report on Preliminary Site Investigation for Contamination Proposed Residential Development 45 Mulloway Road, Chain Valley Bay

1. Introduction

This report presents the results of a preliminary site investigation for contamination undertaken for a proposed residential development at 45 Mulloway Road, Chain Valley Bay. The investigation was commissioned by CorVal Partners Ltd on 1 November 2018, and was undertaken in accordance with Douglas Partners' proposal CCT180390 dated 1 November 2018.

The objective of the study was to provide an initial assessment of the site's contamination status for due diligence purposes. For the purposes of this investigation, it is understood that future development is likely to comprise residential use (i.e. a land lease community with movable dwellings).

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 part of Lot 5 in Deposited Plan 1228880 and has a street address of 45 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) local government area.

The site is currently zoned E3 Environmental Management under Wyong Local Environmental Plan 2013. The site has an irregular shape and comprises an area of approximately 7.3 hectares.

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

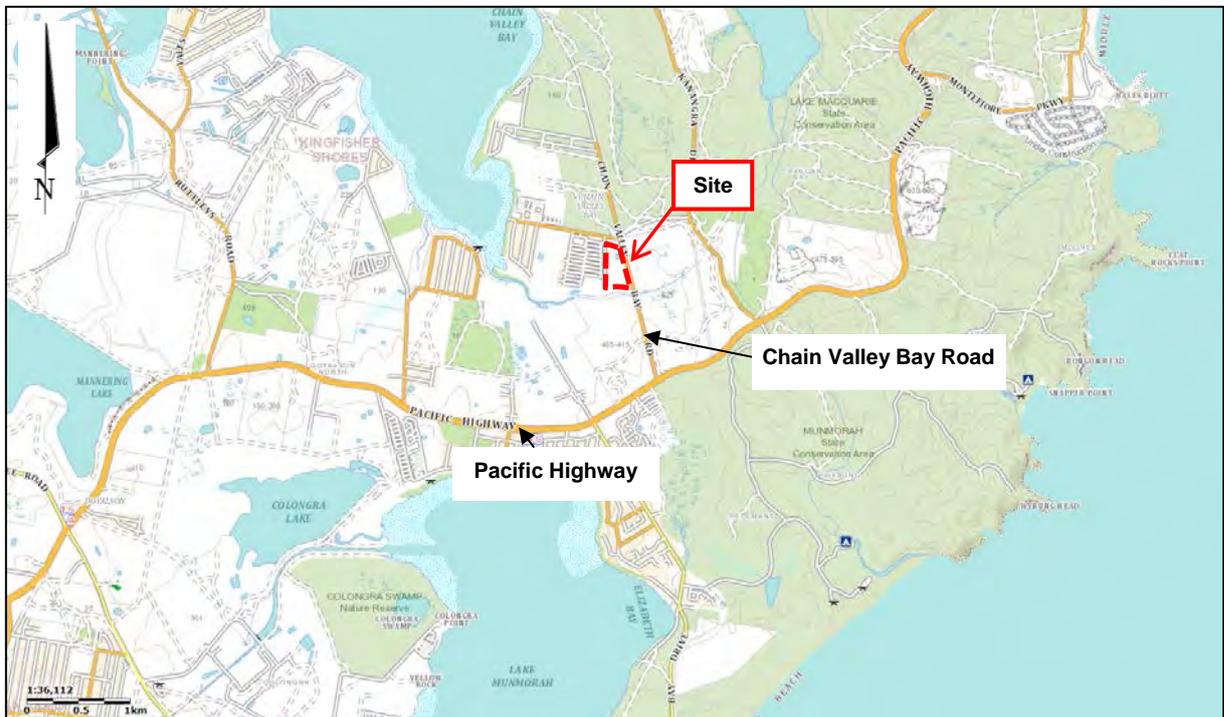


Figure 1: Location of the site within Chain Valley Bay
(image sourced from SIX Maps)

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

At the time of the PSI, the site primarily comprised open grassland (paddocks) with an earth dam in the northern area of the site. Existing development was generally located in the southern area of the site and comprised a fibro cottage, garage and colorbond shed. Other site features are discussed in Section 5.

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



Figure 2 – Aerial view of the site (image sourced from nearmap.com dated 2 October 2018)

2. Scope of Work

The scope of work for the PSI comprised:

- Collation and interpretation of readily available site data from the following sources:
 - o Published public data, including topographical, geological and hydrogeological maps;
 - o Registered groundwater bore licence search;
 - o NSW EPA Contaminated Land and Protection of Environment Operations databases;
 - o CCC Property Enquiry Information; and
 - o Historical aerial photographs; and
 - o 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 and Hydrology

Review of the local topographic mapping and site observations indicated that site is generally sloping down to the south. Surface levels within the site range between approximately RL 23.5 m AHD in the north east and RL 7 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 1,100 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, 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.

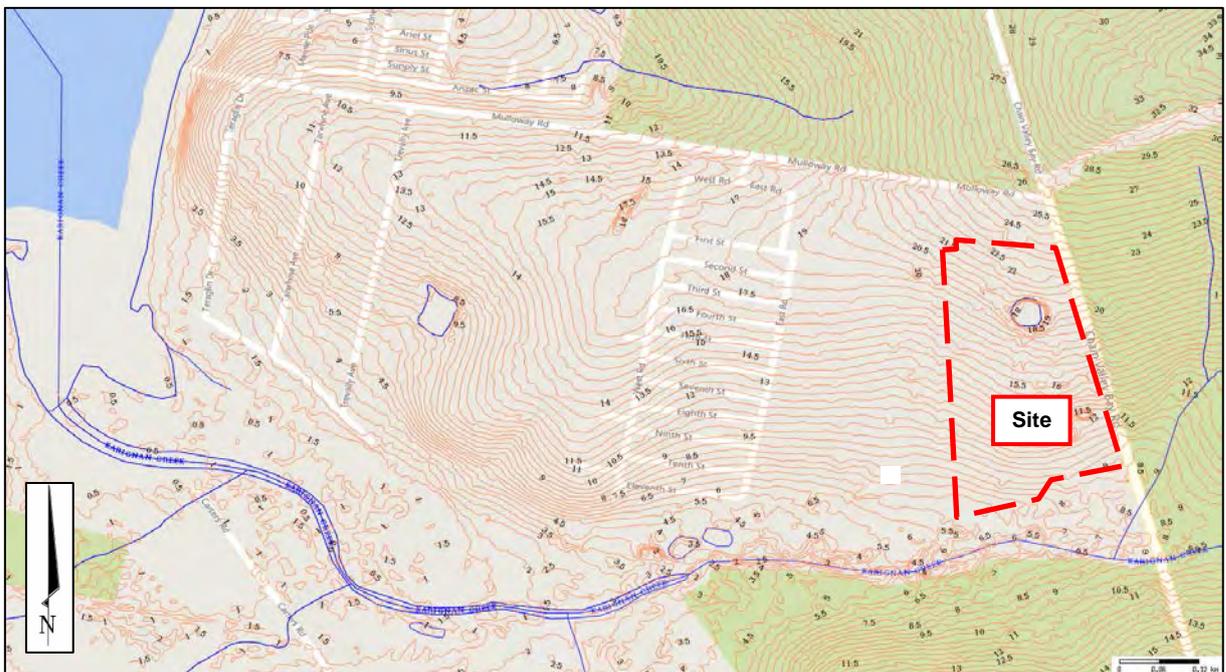


Figure 3: Site Topography
(image sourced from Microsoft Virtual Earth with NSW Contours Hunter and Central Coast Lidar, 0.5 m, overlay)

3.2 Adjacent Site Uses

Surrounding land uses include the following:

- North (up slope) – Existing residential development, Mulloy Road and then undeveloped land;
- East (across and down slope) – Chain Valley Bay Road and then undeveloped land;
- South (down slope) – Karignan Creek and then undeveloped land; and
- West (across and downslope) – Residential properties (Valhalla Village).

The potential for contamination from existing off-site land uses or activities to have impacted the site is considered to be relatively low.

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 mapped as being underlain by the Munmorah Conglomerate (identified as Rnm in Figure 4), however, the southern boundary borders an area 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 indicates that the site typically comprises erosional soils of the Doyalson (do) landscape, however, the south-eastern corner of the site is mapped as comprising the Tacoma Swamp (ts) landscape and the southern boundary borders and area mapped as alluvial soils of the Wyong (wy) landscape.

The mapping indicates that subsurface conditions over the majority 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 Gosford-Lake Macquarie 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 located in an area mapped as having no known occurrence of acid sulfate soils (ASS). However, the mapping suggests that areas mapped as having a high probably of occurrence within 1 m of the ground surface is located approximately 250 m to the south-west

Furthermore, review of the acid sulfate soils planning maps provided by CCC indicates that the majority of the site is located in Class 5 mapped area and further assessment of acid sulfate soil conditions may 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 near the southern boundary 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 sulfate soil management plan (ASSMP).

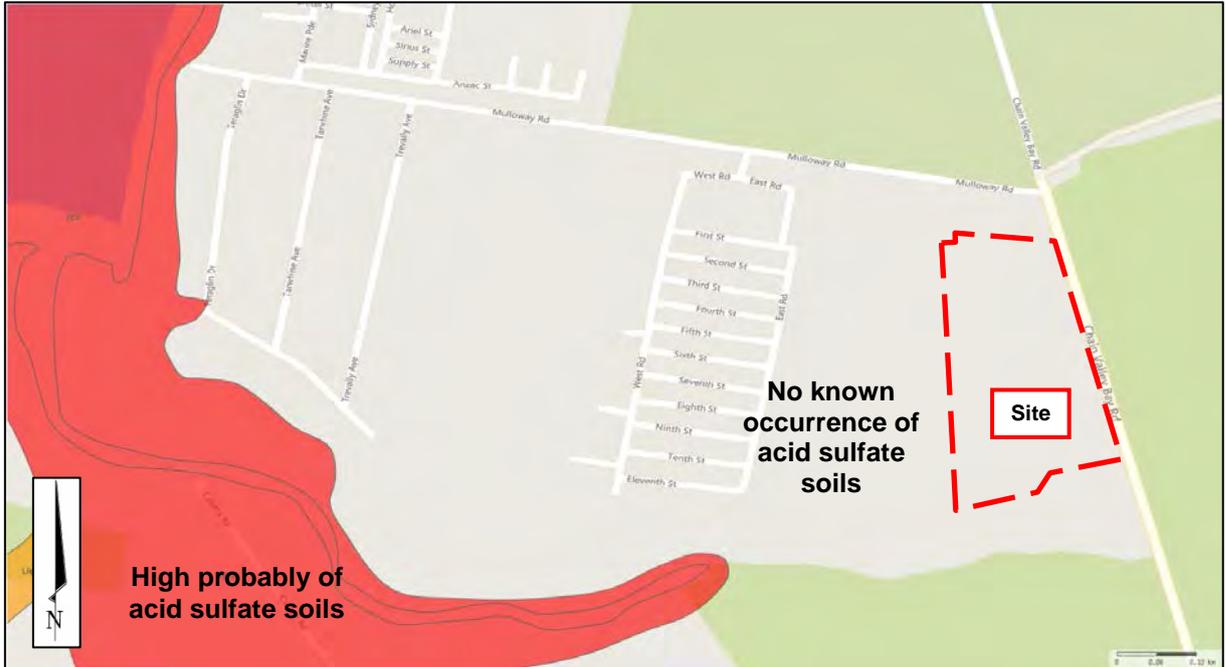


Figure 6: Acid Sulfate Soil
(image sourced from Microsoft Virtual Earth with Gosford-Lake Macquarie 1:100,000 Soil Landscapes Sheet overlay)

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

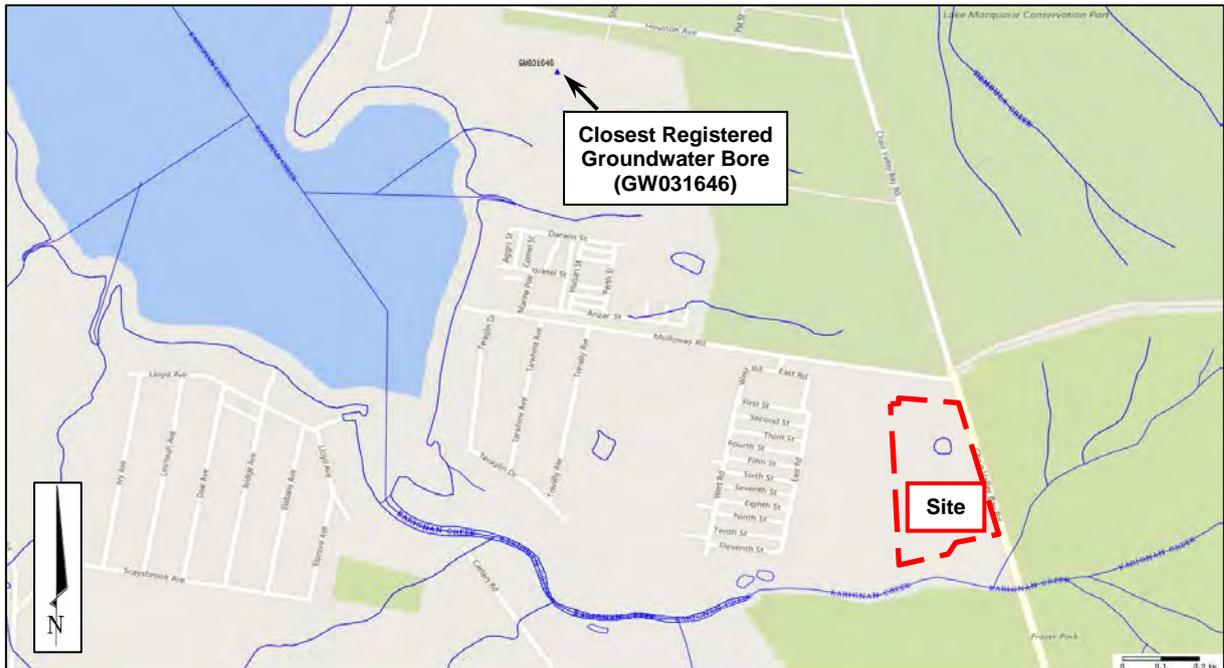


Figure 7: Registered Groundwater Bores

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

A search for registered groundwater bores in the Water NSW groundwater bore database 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 1,200 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 C. 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 to Central Coast Council which identified applications for the following:

- Dwelling and garage in 1989;
- Sign in 2011;
- Shed in 2013 and 2016; and
- Dwelling, pool and deck in 2016.

No other applicable information was obtained from CCC. It is suspected that most of the above applications relate to the northern portion of Lot 5 (which is not part of the current site area), except for possibly the application for a shed in 2016.

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 – Nearmap Image, dated 22.9.2018.

Extracts of the 1954, 1975, 1990 and 2005 historical aerial photographs / images are included as Drawing 2 in Appendix A. 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 access tracks extending from Mulloway Road and Chain Valley Bay. Some disturbance / land clearing is visible within the south-western corner of the site.	Surrounding areas appear to comprise mostly bushland with some cleared areas likely to be vegetated with a grass surface cover. No intensive rural activities (i.e. orchards, market gardens or poultry) were identified on the adjacent properties.
1975	Further clearing apparent in the southern and central areas of the site. A suspected dwelling is also present within the southern area of the site.	No significant changes were observed. Some clearing observed in the western corner of the property adjacent to the northern boundary of the site.
1986	Image only covers northern and western portion of the site and shows the site to be generally in a similar condition to the 1975 photograph. Major changes appear to comprise further clearing and construction of the existing dam at the northern end of the site.	The property to the west appears to have a semi-rural residential use (possibly a grazing use). No other significant changes were observed.
1990	The site generally appears to be in a similar condition to the 1986 photograph, noting that the construction of the dam in the southern area of the site is now visible.	Further clearing in property to the north. No other significant changes were observed.
1996	No significant changes were observed.	Construction of dwelling and shed in the northern portion of Lot 5. No other significant changes were observed.
2005	The site generally appears to be in a similar condition to the 1996 photograph, however, further clearing appears to have been undertaken in the central-western area of the site. Grass covered fill mound also now visible in the southern area of the site.	No significant changes were observed.
2018	Numerous changes / development at the site including: <ul style="list-style-type: none"> • Storage of caravans, vans and boats within the central-western area of the site with gravel access track; • Stockpiles of filling present across the site; • Shed and filled platform present in southern area of the site; and • Southern dam filled. 	Site to the west has been developed for residential use (Valhalla Village) and construction of new shed in property to the north. No other significant changes were observed.

4.4 Other Historical Information

Discussion with the tenant occupying the dwelling in the southern area indicated that the shed development in the southern area of the site is recent and the stockpiles of fill material present surrounding the shed will be removed from the site.

5. Site Walkover / Observations

A site walkover was undertaken on 14 November 2018 by a Senior Environmental Engineer. The site features observed during the walkover are summarised below. The general site topography was consistent with that described in Section 3.1.

The following features were observed during the walkover:

- Existing development at the site comprised a fibro cottage, garage, attached shed and detached colorbond shed in the southern area of the site. It appeared that the cottage was connected to effluent absorption trench that showed signs of possible failure;
- An areas adjacent to the western site boundary was being used primarily for the storage of caravan, campers, trailers and boats.
- Filling appeared to have been carried out in the southern area of the site to provide a level building platform for the colorbond shed;
- Filling has been undertaken to fill the former small dam in the southern area of the site;
- Numerous stockpiles of soils and building waste (metal, tyres, asphalt, PVC and concrete) were present at the site. It is noted that some stockpiles comprised fragments of fibrous cement sheeting, possibly containing asbestos. Possible asbestos containing material (ACM) was also present at the ground surface at some locations, including the filling material placed for the building platform of the shed and in the northern portion of the site;
- Evidence of past stockpiling activities was also observed in the central eastern portion of the site, with minor debris (including concrete and brick fragments) observed at the ground surface;
- An existing dam is located in the northern area of the site, which appears to have been created by cut to fill operations. The dam walls were estimated to be in the order of 2 – 3 m high;
- The site was generally grass covered with some scattered trees. A gravel access track is also present along the western boundary in the northern area of the site;
- The southern area of the site was being used for horse paddocks;
- A timber structure (old farm shed) was located in the north-western corner of the site; and
- Oil containers were present in the shed in the southern area of the site, and were also stacked adjacent to a shed in the adjacent property to the north.

Photoplates showing existing site features are provided in Appendix B.

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
Importation and placement of contaminated filling	Importation of substantial filling is likely in the southern area of the site based on site history and observations. Localised filling and storage/dumping of materials were observed throughout 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
Storage of equipment, building materials, minor spills/leaks from equipment	Storage and stockpiling of equipment and building materials in numerous locations across the site. Any spills/leaks from equipment are likely to be localised.	Various - Common contaminants associated with filling are metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), TRH, BTEX, PAH, PCB, phenol, OCP and asbestos
Existing building footprints	Existing development (i.e. fibro cottage and shed) 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 - Importation and placement of contaminated filling;
- S2 - Storage of equipment, materials and spills/leaks; and
- S3 - Existing building footprints.

6.1 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 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.

6.2 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.

6.3 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 – Importation and placement of contaminated filling	P1 – Ingestion and dermal contact	R1 – Site users R3 – Construction & maintenance workers.
S2 - Storage of equipment, materials and spills/leaks	P2 – Inhalation of dust and / or vapours	R1 – Site users R2 – Adjacent site users R3 – Construction & maintenance workers.
S3 - Existing building footprints	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 the site has been subject to potentially contaminating activities or land uses. Potential contamination sources were identified (refer Table 2 – Section 6); including importation and placement contaminated filling, storage of equipment/materials and the existing buildings.

The site would not be considered compatible (from a site contamination perspective) with the proposed residential land use in its current condition. Further detailed site investigation and potentially remediation and validation works would be required, prior to the site being considered suitable for the proposed residential use.

The preliminary CSM (presented as Table 3) will form the basis for development of a *Sampling and Analysis Quality Plan* (SAQP) prior to the completion of a *Detailed Site Investigation* (DSI).

It is recommended that a combined systematic and judgemental sampling strategy be adopted for a DSI to substantiate DP's assessment of the low to moderate contamination risk at the site. A DSI scope of work could be further developed during the preparation of a Sampling and Analysis Quality Plan with consideration given to the land uses proposed. Furthermore, it is expected that any remedial works are unlikely to prevent redevelopment of the site for the proposed residential uses.

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.

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 Chain Valley Bay in accordance with DP's proposal CCT180390 dated 1 November 2018 and acceptance received from CorVal Partners Ltd dated 1 November 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of CorVal Partners Ltd 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

Douglas Partners



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.

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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.



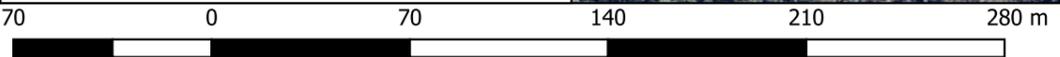
Stockpiles of soil and building waste observed throughout the site

Stockpiled soils with possible ACM observed

Exsiting Cottage and Shed

Filled building platform with possible ACM observed

Legend
 - - - Approximate Site Boundary
 - - - Approximate Location of Former Dam



Drawing adapted from Nearmap Image, dated 22 September 2018



1954 Aerial



1975 Aerial



1990 Aerial



2005 Aerial



Appendix B

Site Photographs



Photo 1: North-western area of the site, looking southeast



Photo 2: Northern area of the site, looking west

	Photoplates		PROJECT:	83444
	Proposed Residential Development		Plate	1
	45 Mulloway Road, Chain Valley		REV:	A
	Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 3: North-eastern corner of the site, looking east



Photo 4: Existing dam, looking north-west



Photoplates		PROJECT:	83444
Proposed Residential Developm		Plate	2
45 Mulloway Road, Chain Valley		REV:	A
Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 5: Stockpiles of soil in northern area of the site



Photo 6: Stockpiles of building waste in northern area of the site

	Photoplates		PROJECT:	83444
	Proposed Residential Developm		Plate	3
	45 Mulloway Road, Chain Valley		REV:	A
	Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 7: Stockpiles of soil in northern area of the site



Photo 8: View of central area of site, looking north



Photoplates		PROJECT:	83444
Proposed Residential Development		Plate	4
45 Mulloway Road, Chain Valley		REV:	A
Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 9: View of colorbond shed and stockpiles fill material in southern area of the site



Photo 10: Existing development in southern area of the site, looking east

	Photoplates		PROJECT:	83444
	Proposed Residential Development		Plate	5
	45 Mulloway Road, Chain Valley		REV:	A
	Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 11: Existing development in southern area of the site, looking west



Photo 12: View of south-eastern corner of site, looking east



Photoplates		PROJECT:	83444
Proposed Residential Development		Plate	6
45 Mulloway Road, Chain Valley		REV:	A
Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 13: Fill material in southern area of site, looking north



Photo 14: Stockpiles of soil and building waste in southern area of the site



Photoplates		PROJECT:	83444
Proposed Residential Developm		Plate	7
45 Mulloway Road, Chain Valley		REV:	A
Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 15: Stockpiles of soil and building waste in southern area of the site



Photo 16: Shed with oil containers in property adjacent to northern boundary



Photoplates		PROJECT:	83444
Proposed Residential Developm		Plate	8
45 Mulloway Road, Chain Valley		REV:	A
Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 17: Fill pad in southern area of site



Photo 18: Scrap metal in northern area of site



Photoplates		PROJECT:	83444
Proposed Residential Developm		Plate	9
45 Mulloway Road, Chain Valley		REV:	A
Client	Corval Partners Pty Ltd	DATE:	27.08.2018



Photo 19: Contents of shed in southern area of the site



Photo 20: Possibkle former poultry shed



Photoplates		PROJECT:	83444
Proposed Residential Developm		Plate	10
45 Mulloway Road, Chain Valley		REV:	A
Client	Corval Partners Pty Ltd	DATE:	27.08.2018

Appendix C

Background Information

NSW OFFICE OF WATER Work Summary

GW031646

Converted From HYDSYS

Licence :20BL024637

Licence Status : Active

Authorised Purpose(s)

DOMESTIC

STOCK

Intended Purpose(s)

COAL EXPLORE

Work Type :Bore open thru rock

Work Status :(Unknown)

Construct. Method :(Unknown)

Owner Type :Private

Commenced Date :

Final Depth : 277.50 m

Completion Date :01-Feb-1960

Drilled Depth : 0.00

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

Standing Water Level :

GWMA :603 - SYDNEY BASIN

Salinity :

Excellent

GW Zone : -

Yield :

Site Details

Site Chosen By

County
Form A :NORTHUMBERLAND
Licensed :NORTHUMBERLAND

Parish
WALLARAH
WALLARAH

Portion/Lot DP
143
143

Region :20 - HUNTER

CMA Map :9231-4S

CATHERINE HILL BAY

River Basin :211 - MACQUARIE - TUGGERAH LAKES

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6329317

Latitude (S) :33° 10' 0"

Elevation Source :(Unknown)

Easting :366742

Longitude (E) :151° 34' 15"

GS Map :0055C1

MGA Zone :56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	(Unknown)	0.00	16.70		76		(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
3.00	10.60	7.60	(Unknown)	3.00		0.13			Excellent

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
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Remarks

*** End of GW031646 ***