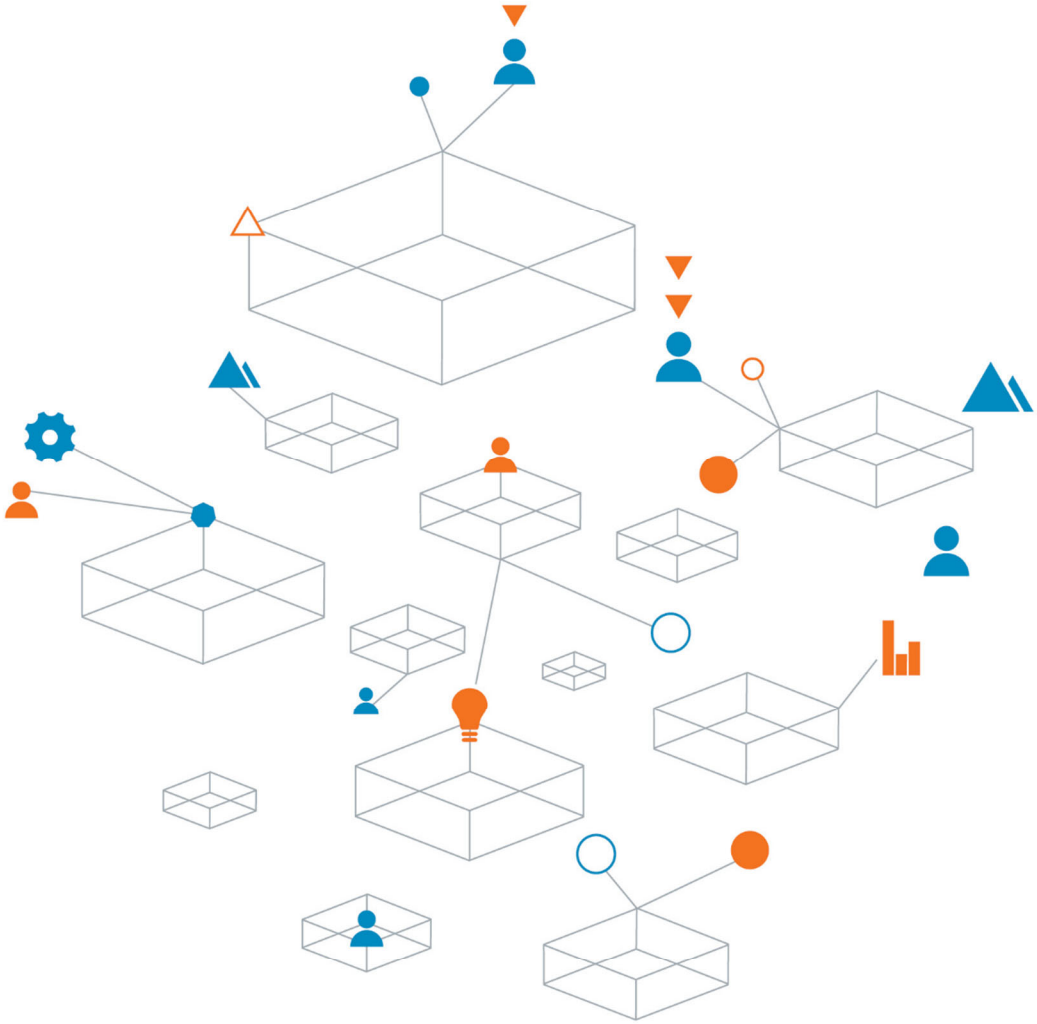
Department of Education, School Infrastructure
Salinity Assessment Report, Mosman High School
SYDGE233510

30 March 2021



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Salinity Assessment Report, Mosman High School

Prepared for
Department of Education, School Infrastructure

Prepared by
Coffey Services Australia Pty Ltd
Level 19, Tower B, Citadel Tower, 799 Pacific Highway
Chatswood
NSW 2067 Australia
t: +61 2 9406 1000 f: +61 2 9415 1678
ABN 55 139 460 521

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SYDGE233510

Quality information

Revision history

Revision	Description	Date	Originator	Reviewer
Rev0	Draft	31/07/2020	Laurie Fox	Matthew Locke
Rev0	Final	25/08/2020	Laurie Fox	Matthew Locke
Rev1	Final. Addresses minor change to development.	22/02/2021	Laurie Fox	Matthew Locke
Rev2	Final. Addresses minor change to development description	30/03/2021	Laurie Fox	Matthew Locke

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Table of contents

Tables

Figures

1. Introduction

Coffey Services Australia Pty Ltd (Coffey) was engaged by Schools Infrastructure NSW (SINSW), a division of the Department of Education (DoE), to carry out a site contamination assessment in relation to the proposed redevelopment of Mosman High School located at Military Road, Mosman, NSW (the 'site'). The location and boundaries of the school site are shown on the Location Plan in Figure 1.

It is understood that the DoE propose to redevelop the site and that the investigations are required to inform the concept design of these works. This salinity assessment was carried out in conjunction with a contamination and a geotechnical investigation also completed by Coffey.

1.1. Proposed Development

The scope of the proposed development for the subject State Significant Development Application (SSDA) include:

- Demolition of Building B, Building C and part Building E;
- Removal of existing sports court and surrounding retaining walls and nominated trees;
- Construction of a new part 3/ part 4 storey building plus lift overrun and net enclosure to rooftop multi-court (Building G) on the corner of Military Road and Belmont Road providing:
  - administration and staff facilities;
  - multipurpose gym/hall;
  - library;
  - canteen facilities;
  - general and senior learning units;
  - science learning unit;
  - health / PE and performing arts unit; and
  - learning and admin support unit.
- Associated landscaping works including new outdoor play areas, a rooftop play space and rooftop multi-purpose court; and
- Relocation of the main pedestrian entrance from Military Road to Belmont Road.

1.2. Objectives

The objective of this assessment was to review published information and site specific data to assess the risk to the development from soil salinity.

2. Physical Setting

2.1. Topography

NSW Survey marks around the boundary of the site, indicates that ground elevations at the site range between RL 79 and 81 m AHD, with the regional topography sloping to the west- south west.

2.2. Regional Geology

The Sydney 1:100,000 Geological Sheet 9130 indicates the site is underlain by Hawkesbury Sandstone of the Wianamatta Group, characterised by medium to coarse grained quartz, sandstone, very minor shale and laminite lenses. Hawkesbury Sandstone represents a fresh water, fluvial depositional environment comprising massive facies and cross bedding indicative of broad braided channel environment.

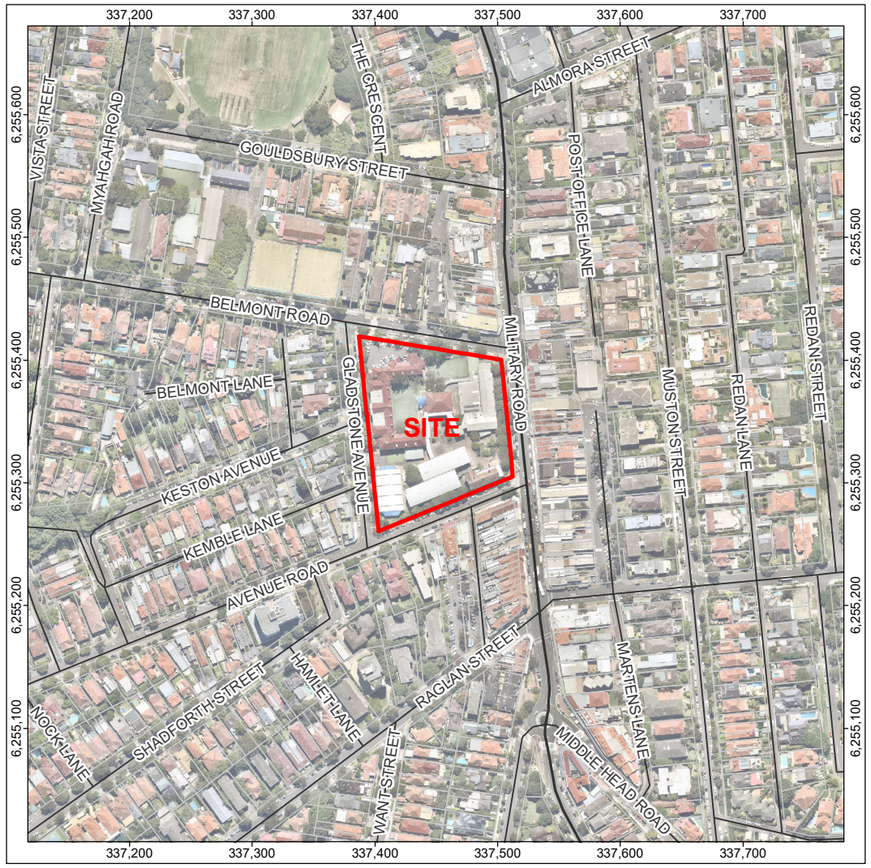
2.3. Groundwater

A search of groundwater bores registered with NSW Office of Water revealed two registered groundwater bores located within 500 m of the site. Bores GW106880 and GW108738 are located 318 m and 352 m respectively to the south east of the site. Both bores were authorised for “household” purposes and extended to depths between 84 m and 107.9 m below ground level.

It is expected groundwater follows the regional topography and flows towards Sydney Harbour to the south to south-west.

GENERAL AREA MAP

REGIONAL AREA MAP © ArcGIS Online



LOCAL AREA MAP © Nearmap (capture date 22-10-2019)

LEGEND

- Major road
- Minor road
- Railway
- Watercourse
- Cadastre
- Site boundary

SCALE 0 0.5 1 1.5 2 KILOMETRES 1:50,000 (A3)

SCALE 0 50 100 150 200 METRES 1:5,000 (A3)

SOURCE:
Site boundary from Coffey.
Cadastre, roads, rail and watercourses from NSW LPI.

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE	GH	ML	30.03.21

Projection: GDA 1994 MGA Zone 56

drawn	GH
approved	ML
date	30.03.2021
scale	AS SHOWN
original size	A3

coffey
A TETRA TECH COMPANY

client: DEPARTMENT OF EDUCATION: SCHOOL INFRASTRUCTURE NSW

project: GEOTECHNICAL AND CONTAMINATION ASSESSMENT
MOSMAN HIGH SCHOOL
745 MILITARY ROAD, MOSMAN, NSW

title: SITE LOCALITY

project no: 754-SYDEN233510-R01 | figure no: FIGURE 1 | rev: A

MXD ref: SYDEN233510_R01_GIS001_v0_2

2.4. Soils

2.4.1. Soil Landscapes

Reference to the NSW Environment website https://www.environment.nsw.gov.au/eSpade2WebApp which has digitised the Sydney Soil Landscape Series Sheet 9130 (4th edition). The soil landscape of the site and its surrounds is classified as a Lambert/Gymea Erosional Landscape. These erosional landscapes comprise undulating to rolling rises and ridge crests on Hawkesbury Sandstone. The Lambert Soil landscape is very similar to Gymea and occurs to the north of Mosman.

The Gymea and Lambert soil landscapes are indicative of undulating and rolling hills, broad convex crests and plateau surfaces with local relief between 20m and 120m on slopes grading between 10% and 25%, derived from Hawkesbury Sandstone. Immediately to the north, west and south of the site is the Hawkesbury Soil Landscape which is indicative of rolling to very steep hills, local relief of 40 to200m with slope gradients between 25% to 70% also on Hawkesbury Sandstone. This landscape has similar soil profiles to Gymea and Lambert, but represents steeper slopes and rocky outcrop, located around the foreshore of Sydney Harbour.

2.4.2. Typical Soil Profiles

As the soils that form within the Lambert, Gymea and Hawkesbury Soil Landscapes are derived from weathering and transport of Hawkesbury Sandstone, the soil profiles are similar and it would also be expected that salinity values would also be similar.

A summary of the soil profiles given within the Gymea, Lambert and Hawkesbury Soil Landscape are presented in Table A

Table A: Summary of Soil Typical Soil Profiles

Soil Profile	Typical Soil Type	Description
A1 Horizon	Loose stony coarse sandy Loam and Loose quartz sand (Hawkesbury only)	Sandy porous and earthy fabric, pH varies from 4.0 to 6.0, sandstone fragments, water repellent
B Horizon	Earthy yellowish brown clayey sand grading to fine sandy clay loam and medium clay (puggy clay)	Earthy fabric to massive structure, pH varies from 3.3 to 5.5, sandstone and ironstone fragments
B/C Horizon	Earthy yellow clayey sand, sandy clay and pedal yellow brown clay	Earthy fabric to massive structure, pH varies from 4.0 to 6.5, sandstone and ironstone fragments

2.4.3. Limitations

The Gymea, Lambert and Hawkesbury soil landscapes note similar limitations, namely:

- High permeability
- Stoniness
- Low fertility
- Strongly acid
- high to very high aluminium toxicity

3. Soil Salinity Processes and Indicators

3.1. Soil Salinity Processes

Soil salinity refers to the build up of water soluble salts within the soil profile. These salts are mainly sodium, calcium and magnesium occurring as chlorides, sulfates or carbonates (Hazelton and Murphy 2016).

NSW Department of Industry and Development (2009) list the following potential salt sources in an urban environment:

- wind borne salt from ocean spray or sedimentary deposits such as dune sands,
- cyclic salt from ocean spray or pollution dissolved in rain water;
- connate or fossil salt in marine sediments; and
- rock weathering.

The movement of salt through the landscape depends on complex processes and the interaction of geology, groundwater, climatic conditions, water balance and vegetation. In natural systems a balance is often reached between water movement and salt accumulation (DLWC 2002).

Urban development over saline soils can upset the natural balance and alter the movement of surface water and groundwater and cause salts to mobilise. In urban environments, increased leakage from buried utilities can lead to hydrological imbalance and the rise of the water table, dissolving salts on the way (DII 2009).

This mobilisation can move salts to the surface and potentially affect surface water quality, plant growth as well as soil structure and chemistry. Urban salinity has also been known to affect construction materials such as bitumen, concrete, masonry and metal and lead to increased costs of management and maintenance of infrastructure. (DLWC 2002, DII 2009).

3.2. Indicators of Soil Salinity

Electrical conductivity (EC) of soil or water is influenced by the concentration of dissolved salts within the sample. Salts increase the ability of a solution to conduct an electrical current, therefore a high EC value indicates a high salinity value.

The standard measurement for EC is deci-seimens per metre (dS/m) measured on 1:5 soil water suspension. These measurements are converted to an EC equivalent (ECe) by taking into account the water holding capacity of soil based on texture (DLWC, 2002 and Hazelton and Murphy, 2016).

Table B below is based on DLWC (2002) Table 6.2 and Table 5.31 in Hazelton and Murphy (2016). Table C , also from DLWC and Hazelton and Murphy, show the multiplier factors based on soil texture. These two Tables will form the basis of the current salinity assessment at the site.

Table B: Salinity Ratings for Soil based on ECe

Rating	ECe dS/m	Effect on Plants
Non Saline	<2	Salinity Effects are mostly negligible
Slightly Saline	2-4	Yields of sensitive crops are affected
Moderately Saline	4-8	Yields of many crops are affected
Highly Saline	8-16	Only tolerant crops yield satisfactorily
Extremely Saline	>16	Only very tolerant crops yield satisfactorily

Table C: Multiplier Factors for Converting EC1:5 (ds/m) to ECe (dS/m)

Soil Texture	Multiplier Factor
Sand, loamy sand, clayey sand	23
Sandy loam, fine sandy loam, silty loam, sandy clay loam	14
Loam, fine sandy loam, silty loam, sandy clay loam	9.5
Clay loam, silty clay loam, fine sandy clay loam, sandy clay, silty clay, light clay	8.6
Light medium clay	8.6
Medium clay	7.5
Heavy Clay	5.8
Peat	4.9

4. Assessment of Salinity

4.1. Desktop Review

A desk top review of published information related to salinity within the site and its surrounds was carried out. The website https://www.environment.nsw.gov.au/eSpade2WebApp# was researched with Figure 2 detailing the results of EC modelling that covers the Gymea, Lambert and Hawkesbury Soil Landscapes.

Figure 2 shows that the soils from 0.0m to 0.3m at the site are mapped in a low salinity area with salinity values ranging between >0.05 and 0.1 dS/cm. Similar salinities were modelled for the depth range of 0.3m to 0.6m.

There were no specific soil profiles within the immediate vicinity of the site. The green dots in Figure 2 below indicate surrounding soil profiles within the Lambert and Hawkesbury Soil landscapes. These soil profiles identified 'no salting evident'. The two red dot soil profiles in Figure 2 below are indicative of tidal flats and are not considered relevant to the study site.

Figure 2: EC Modelling 0-30 cm

4.2. Site Specific data

Three soil aggressivity tests (Chloride, Conductivity, Resistivity, pH, Sulfate SO_4) have been carried out at the site with the results reported in the Geotechnical Investigation Report) reference SYDGE233510-R04 dated 18 November 2019). A summary of the results is provided below.

Table D: Summary of Site Specific Data

Sample ID	Description	EC (dS/m)	pH	Chloride	Sulfate
BH1 0.8-1.0m	Sand fine to medium grained grey to dark grey	0.041	8.1	<10	<10
BH3 0.2-0.4	Sand medium grained yellow orange and red clayey sand	0.084	9.4	13	130
BH5 0.8-1.0m	Clayey sand fine grained orange brown fine to coarse gravel	0.039	6.0	12	79

The EC values for each sample collected at the site are slightly lower to that as shown in the EC modelling (ie >0.05 and 0.1 dS/cm) presented in Figure 2. The pH values also seem high relative to the published data although further investigation is beyond the scope of this assessment.

4.3. Salinity Rating

Table E details the salinity ratings based on the site specific data, and the information contained in Tables 2 and 3 in Section 3.2.

Table E: Salinity Ratings

Sample	EC dS/m	Multiplier[1]	Ece	Salinity Rating[2]
BH1	0.041	23	0.943	Negligible
BH3	0.084	23	1.932	Negligible
BH5	0.039	14	0.546	Negligible

Notes:

[1] Multiplier based on Table 5.32 Hazelton and Murphy (2016)

[2] Salinity rating based on Table 5.31 Hazelton and Murphy (2016) and Table 6.2 DLWC 2002

5. Conclusion

Based on the desktop study results carried out for EC modelling in addition to the site specific data, the salinity rating for the site soils is considered to be negligible. Based on this assessment no special salinity precautions or management procedures are considered necessary for this site.

6. References

- Bannerman S.M. and Hazelton P.A. (1990) Soil Landscapes of the Penrith 1:100,000 Sheet map and report, Soil Conservation Service of NSW, Sydney.
- Clark N.R. and Jones D.C. (1991) Sydney 1:100 000 Geological Sheet 9130, 1st edition. Geological Survey of New South Wales, Sydney.
- Coffey Services Australia Pty Ltd Site Contamination Assessment SYDGE233510-R02 dated 15 June 2019
- Coffey Services Australia Pty Ltd Geotechnical Investigation Report SYDGE233510-R04 dated 18 November 2019
- Hazelton and murphy 2016 Interpreting Soil Test Results What Do all the Numbers Mean? Third Edition CSIRO Publishing
- NSW Department of Land and Water Conservation (DLWC) Local Government Salinity Initiative 2002 Site Investigations For Urban Salinity
- NSW Department of Industry and Investment (2009) Prime Facts – Dryland salinity – Causes and Effects prepared by the Advisory Officer Natural Resources Advisory Services Wagga Wagga

Important information about your **Coffey** Environmental Report

Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but

steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

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Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

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