29 March 2019

Sydney Water
1 Smith Street
Parramatta NSW 2150

Attention: Amy Dobson

Summary of Contamination Condition
Part of Ashbury Reservoir, 165-169 Holden Street, Ashbury NSW

1. Introduction

Progressive Risk Management Pty Ltd (PRM) is pleased to prepare this summary of contamination condition letter for Sydney Water (the client) in relation to a portion of land within the Ashbury Reservoir located at 165 – 169 Holden Street, Ashbury NSW (the site).

It is understood that a portion of the site, identified as part of lot 1 DP115504 and part of lot 1 DP911478, is proposed for divestment to allow for future residential development to occur.

The regional site location is provided in **Figure 1** and the portion of the site for divestment is delineated in **Figure 2**.

2. Previous Environmental Assessments

The following previous environmental assessments completed for the site have been reviewed and summarised in the following sections:

- Parsons Brinckerhoff (2015) Combined Stage 1 and 2 Detailed Site Investigation: Sydney Water Ashfield Reservoir, 165-169 Holden Street 2201679B-CLM-RPT-1021 RevC (PB, 2015).
- Progressive Risk Management (2018) Data Gap Analysis: 165-169 Holden Street, Ashbury NSW P033725.001 Sydney Water Data Gap Analysis Ashbury Rev4 Final (PRM, 2018).
- Progressive Risk Management (2019) Hazardous Ground Gas and Groundwater Assessment: 165-169 Holden Street, Ashbury NSW P033725.004 Ashbury HGG and GW Assessment VerB Final (PRM, 2019).

This letter should be read in conjunction with the above reports.

PB 2015

PB conducted a combined Stage 1 and 2 Detailed Site Investigation (DSI) at the then proposed divestment area to provide a detailed understanding of potential contamination which would, if required, facilitate a remedial strategy prior to site divestment.

The scope of works comprised a combined desktop study of site history and an undertaking of soil investigations consisting of 15 test pits to depths of between 0.8 and 3.0 mbgl.

A review of the wider reservoir history findings of PB (2015) shows:

- The site has been owned by the client since 1909 and used as a reservoir (WS0003) since at least 1930.
- The site is located adjacent to the former South Ashfield Brickworks which may be the source of identified fill material onsite.
- Historic aerial photographs indicate there were a greater number of building within the investigation area which appear to be a combination of permanent structures (including those remaining onsite) and demountable structures.

- NSW WorkCover licencing information for 1995 - 1996 indicates that petroleum and diesel was stored in cabinets in storage warehouses along the western boundary. Records indicate that up 200L of fuel was stored.

Following subsurface investigation works, selected representative soil samples were collected and analysed for contaminants of potential concern (CoPC) comprising total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylene (BTEX compounds), PAHs, heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos (by quantitative method).

The results of laboratory analysis were compared to human health and ecological site assessment criteria (SAC) for residential land use.

Based on the findings of subsurface investigation works and laboratory analysis, the following conclusions were made:

- Two distinct fill layers were observed during subsurface investigation works. A shallower (generally 0.2 – 0.7 m) fill layer consisting of clays and gravely clays encountered at all 15 testing locations. A deeper sand fill layer was encountered in the southwest corner of the site at TP09 and TP15. A variety of anthropogenic inclusions were observed in both fill layers.
- Benzo(a)pyrene TEQ was found to exceed the site SAC for human health in four samples collected from TP03, TP09, TP12 and TP14. Samples were generally collected in the shallow fill layer with the exception of TP09 where the exceedance was recorded from a sample at 1.0m bgl in the deeper fill layer.
- Benz(a)pyrene exceeded the ecological SAC (0.7mg/kg) in seven samples collected from TP01, TP03, TP09, TP12, TP13 and TP14. Samples were generally collected in the shallow fill layer with the exception of TP09 where the exceedance was recorded from a sample at 1.0m BGL in the deeper fill layer.
- Lead was identified in exceedance of human health SAC at TP12 in the sample collected from fill material at 0.5 – 0.6 mbgl.
- Zinc was identified in exceedance of ecological SAC at TP11 (0.0 – 0.1mbgl) and TP12 (0.5-0.6 mbgl). Both samples were collected from material identified as gravely clay fill. PB considered these elevations limited in nature and it did not pose a significant risk to onsite ecological receptors.
- Asbestos containing material (ACM) in the form of fibre-cement sheet fragments were observed at two locations, TP11 and at TP14. All collected fragments tested positive for asbestos. The calculated concentration of ACM for the sample collected at TP11 (0.0 – 0.1 mbgl) was found to exceed the adopted SAC for residential land use. This also failed to meet the health screening levels given asbestos was identified in the upper 0.1 m of soil. The calculated concentration of ACM for the sample collected at TP14 (0.5 – 0.6 mbgl) was below the adopted health screening levels (HSLs).

Appropriate management and removal of the asbestos, lead and PAH impacts onsite was recommended to meet the criteria for potential future use if the site is divested.

Based on the preliminary findings it was estimated that the volume of material impacted by asbestos was approximately 1,625 m3. The estimated volume was based on the assumption that the ACM impact is confined to the upper fill material across the entire site area measured by PB (2015) to be 2,708 m2 (noting the difference in proposed divestment areas at the time of PB investigation).

PB noted that some deeper excavation would be required around investigation location TP09 as Benzo(a)pyrene impacts were reported within the underlying sandy fill materials.

A preliminary in situ waste classification was undertaken based on the laboratory results of soil samples collected from the site. PB considered the fill material at the site to be classified as special waste (to be managed as asbestos) and general solid waste, for offsite disposal to an appropriately licensed waste facility. However, PB recommended that additional waste classification testing be undertaken (via excavation, stockpiling and sampling of material ex situ) to confirm waste classification prior to disposing of materials to an offsite waste facility.

PRM 2018

PRM were engaged to undertake a targeted soil investigation as part of a Data Gap Analysis (DGA) with the following objectives:

- Delineate the previously identified areas of concern in PB (2015) at TP14, TP09 and TP03.
- Compare analytical data to waste classification criteria for soils which may require offsite disposal as part of the remedial works.
- Discuss any specific remedial considerations to inform the preparation of a Remediation Action Plan (RAP).

The scope of work for the DGA consisted of nine test pits (TP101 – TP109) ranging in depth from 0.1 – 1.3 mbgl) across the site.

Selected representative soil samples were collected and analysed for CoPC comprising TRH, BTEX, PAHs, heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), OCPs, OPPs, PCBs and asbestos (by quantitative method). In addition, Toxicity Characteristic Leaching Procedure (TCLP) analysis was completed to facilitate the preparation of an insitu waste classification.

Based on the findings of subsurface investigation works and laboratory analysis, the following conclusions were made:

- Following a review of the methodology used by PB (2015) to calculate site specific EILs, it was concluded that additional assessment of the physiochemical properties of site soils should be undertaken to improve the robustness of EILs.
- An adjustment to the SAC used by PB (2015) was also undertaken for assessment of benzo(a)pyrene risk to ecological receptors. Ecological screening levels provided in CRC Care Technical Report No. 39, Risk-based management and remediation guidance for benzo(a)pyrene, 2017 are based on more recent research and viewed as a more appropriate screening level for ecological risk.
- Soil analytical results for the DGA identified:
  - Several PAH concentrations (B(a)P and Total PAH) greater than 250% the adopted human health SAC in the fill material,
  - Exceedances of the ecological SAC for TRH C16-C34
  - Exceedance of the ecological SAC for copper and zinc.
  - No ACM was identified during the DGA site observations, or within any of the 16 soil samples analysed by the laboratory of asbestos.
- Comparison of the data to waste classification criteria indicates the fill material is consistent with General Solid Waste (non-putrescible). This classification requires the adoption of the NSW EPA immobilisation approvals, and subsequently is subject to disposal restrictions.
- With respect to soil/fill quality, the data obtained during the PB (2015) and PRM (2018) investigations, PRM concluded that that the site was not suitable for the proposed divestment for a residential land use in its current condition without remediation and/or management of the identified human health and ecological exceedances in shallow fill/soils.
- The site was also considered to present a risk of unexpected finds relating to asbestos, in particular relating to the building rubble impacted fill towards the southwest and western boundary of the site.

PRM 2019

PRM were further engaged to conduct a Hazardous Ground Gas (HGG) and Groundwater assessment at the site. The requirement for HGG and Groundwater assessment was highlighted in consideration of the neighbouring former brick pit which had been infilled with unknow material following closure.

The objective of the PRM 2019 investigation was to gain sufficient information on the nature and extent of potential HGG and groundwater contamination at the site to assess the suitability of the site for the proposed divestment for a residential land use.

The scope of works included the drilling of nine boreholes to various depths for the installation of nine HGG monitoring wells including three installed as dual-purpose wells to monitoring groundwater.

A total of six HGG spot monitoring events over a two-month period were undertaken and supplemented with continuous HGG monitoring in selected monitoring wells over a four-week period using GasClams™.

Groundwater samples were collected from three wells over one monitoring event and analysed for CoPC comprising TRH, BTEX, PAHs, heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), volatile organic compounds (VOCs), ammonia and dissolved methane.

The HGG and groundwater investigation results returned the following:

- Laboratory analysis of site groundwater identified concentrations of heavy metals (cadmium, copper, nickel and zinc) above the adopted ecological Site Assessment Criteria (SAC). The identified exceedances were considered likely to be indicative of background/ natural water quality in the underlying shale aquifer.
- The Gas Screening Values (GSV) for the site were characterised as a Characteristic Gas Situation (CS) of CS1 (very low risk).

3. Summary of contamination

Based on the findings of the HGG and groundwater assessment and previous fill/soil investigations completed at the site, the following conclusions were made with regard to the contamination status of the site:

- With respect to HGG and groundwater quality, the site is considered suitable for the proposed divestment as residential land use with accessible gardens.
- With respect to soil/fill quality, the data obtained during the PB (2015) and PRM (2018) investigations indicate that the site is not suitable for the proposed divestment for a residential land use in its current condition without remediation and/or management of the identified human health and ecological exceedances in shallow fill/soils.

4. Conceptual Site Model

The Conceptual Site Model (CSM) aims to provide an understanding of the potential for exposure to site Contaminants of Potential Concern (CoPC) and land use exposure scenarios at the site. The CSM enables an assessment of the potential source – pathway – receptor (SPR) linkages. In developing this CSM, PRM have relied on information provided in the previous environmental assessments for the site summarised in **Section 2** of this letter. The CSM is detailed in **Table 1.**

Table 1: Conceptual Site Model

Source	CoPC	Pathway	Receptor	Summary Findings
Wide-spread fill material consisting of elevated concentrations of heavy metals (copper, lead and zinc), TRH[1], PAHs and Asbestos were identified at the site.	• Heavy Metals • TRH/BTEX • PAH • Asbestos	• Ingestion/Inhalation of soil derived dust and/or fibres. • Dermal contact with site soils • Direct exposure to plants and animals	• Construction / maintenance workers involved in site development or works or future, post development maintenance works. • Future residents. • Future ecological receptors which may be present in any future vegetated areas of the site.	The assessment of soil/fill quality at the site was completed by PB (2015) and PRM (2018). The investigations concluded that fill soils at the site were not suitable for a residential land use as the identified source-pathway-receptor linkages have the potential to be complete in the future without further management and/or remediation.
Secondary source: Potentially contaminated groundwater from impacted fill identified at the site.	• Heavy Metals • TRH/BTEX • PAH	• Leaching of contaminants to shallow groundwater • Uptake of contaminated groundwater by ecological receptors • Direct contact	• Construction / maintenance workers involved in site development or works or future, post development maintenance works. • Future residents. • Groundwater dependent ecosystems	PRM (2019) investigation results indicate the potential source does not require further consideration.

[1] TRH concentrations identified in fill at the site exceeded ecological screening criteria only. The concentrations identified are not considered indicative of significant vapor risk

Table 1: Conceptual Site Model				
Source	**CoPC**	**Pathway**	**Receptor**	**Summary Findings**
Offsite: Uncontrolled filling from unknown sources at the former Ashfield Brickworks neighbouring the site to the west, with potential impacts including contaminated groundwater and HGG migrating to the site.	• Heavy metals • TRH/BTEX • PAH • VOCs • Ammonia • Dissolved methane. PCoC in HGG are considered to include: • Methane • Carbon Dioxide/ Carbon Monoxide • Hydrogen Sulphide	• Inhalation of vapours or gases • Exposure to low oxygen or potentially explosive environments as a result of HGG. • Direct contact with groundwater.	• Construction / maintenance workers involved in site development or works or future, post development maintenance works. • Future residents. • Future ecological receptors which may be present in any future vegetated areas of the site. • Potential offsite receptors such as site users of the surrounding residential land. • Groundwater dependent ecosystems.	PRM (2019) investigation results indicate the potential source does not require further consideration.

5. Conclusions

The field observations and data collected during the previous environmental investigations (outlined in Section 2), support the following conclusions:

- Benzo(a)pyrene TEQ was found to exceed the site SAC for human health in four samples collected from PB 2015 investigation (TP03_0.0-0.1, TP09_1.0-1.1, TP12_0.5-0.6 and TP14_0.5-0.6) and three samples collected from the PRM 2018 investigation (TP103_0.3-0.4, TP103_0.6-0.7, and TP107_0.1-0.2).
- Total PAHs were found to exceed the site SAC for human health in one sample collected from the PRM 2018 investigation (TP103_0.3-0.4).
- TRH C16-C34 was found to exceed the site ecological SAC in two samples collected from PRM 2018 investigation (TP103_0.3-0.4 and TP107_0.1-0.2).
- Benzo(a)pyrene was found to exceed the site ecological SAC in one sample collected from PRM 2018 investigation (TP103_0.3-0.4).
- Zinc was found to exceed the site ecological SAC in two samples collected from PB 2015 investigation (TP11_0.0 – 0.1 and TP12_0.5-0.6) and one sample collected from the PRM 2018 investigation (TP109_0.0-0.1). Copper was also found to exceed the site ecological SAC in the same sample (TP109_0.0-0.1) collected for the PRM 2018 investigation.
- Asbestos containing material (ACM) in the form of fibre-cement sheet fragments were observed at two locations, TP11 and at TP14. All collected fragments tested positive for asbestos. The calculated concentration of ACM for the sample collected at TP11 (0.0 – 0.1) was found to exceed the adopted SAC for residential land use. This also failed to meet the health screening levels given asbestos was identified in the upper 0.1 m of soil. The calculated concentration of ACM for the sample collected at TP14 (0.5 – 0.6) was below the adopted health screening levels.

Based on the above exceedances the site is not suitable for the proposed divestment for a residential land use without management and/or remediation of the identified human health and ecological exceedances.

6. Recommendations

In order to facilitate the proposed divestment of the site, a Remediation Action Plan (RAP) should be prepared and remedial works undertaken. The most effective strategy for the remediation of the identified contamination in fill soils would be the excavation and offsite disposal of all impacted fill from the site.

Alternatively, the identified contamination in fill soils could be notified to potential purchasers prior to sale and managed/remediated prior to and/or during, site development works.

Limitations

This report is confidential and has been prepared by Progressive Risk Management Pty Ltd (PRM) for Sydney Water (the client). This report may only be used and relied upon by the client and must not be copied to, used by or relied upon by any person other than the client. If a third party (limited to only the first purchaser of the property from Sydney Water) wishes to rely on this report, they will need to enter into a Third Party Reliance Deed with PRM.

This report is limited to the observations made by PRM during the Contamination Assessment, and was limited to the assessment of contamination in soils only, as detailed in the Scope of Works.

All results, conclusions and recommendations presented should be reviewed by a competent person before being used for any other purpose. PRM accepts no liability for use of, interpretation of or reliance upon this report by any person or body other than the client. Third parties must make their own independent inquiries.

This report should not be altered amended or abbreviated, issued in part or issued incomplete without prior checking and approval by PRM. PRM accepts no liability that may arise from the alteration, amendment, abbreviation or part-issue or incomplete issue of this report. To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by PRM and this report are expressly excluded (save as agreed otherwise with the client).

PRM shall bear no liability in relation to any change to site conditions after the date of this report. This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope and limitations defined herein (Scope of Works). Should information become available regarding conditions at the site including previously unknown sources of contamination, PRM reserves the right to review the report in the context of the additional information.

Document Control

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Version A 29/03/2019	G. Fletcher	J. Coffey	J. Coffey	Sydney Water	Original draft of report.

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PRM 2018 DGA Figures

Figure 1: Regional Site Location

Figure 2: Site Layout

Project Reference	P033725
Report Name	Data Gap Analysis
Client	Sydney Water

165 - 169 Holden Street
Ashbury, NSW

Site Location Plan
Figure 1

PROGRESSIVE RISK MANAGEMENT

Scale: 1:5000

Coor. Sys: GDA 1994 MGA Zone56

Legend

Approx. Disposal Area Boundary

Image Source: Sixmaps (2017)

Project Reference	P033725
Report Name	Data Gap Analysis
Client	Sydney Water

165 - 169 Holden Street
Ashbury, NSW

Site Testing Plan
Figure 2

PROGRESSIVE RISK MANAGEMENT

Scale: 1:450

Coor. Sys: GDA 1994 MGA Zone56

Legend

- PB Testpit Locations (2015)
- PRM Testpit Location
- Approx. Disposal Area Boundary
- Approx. Sydney Water Property

Image Source: Sixmaps (2017)