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MEMORANDUM

Date: 30 October 2025 33205

From: S Finnigan

Subject: Former Tokanui Hospital: Post-Hearing Responses

To: Emily Buckingham (emily.buckingham@slrconsulting.com)

1.0 INTRODUCTION

This memo provides further information in response to comments and/or queries made at the joint WRC/WDC resource consent hearing for the former Tokanui Hospital Remediation and Landfill Upgrade Works projects. It covers the following:

- Compliance with the existing landfill consents.
- Comparison table of the works LINZ would have to do to the Existing Disposal Site (**Disposal Site**) to make it compliant with the current resource consents (due to expire in 2035), versus the works proposed to do to the Disposal Site under the new landfill consent application.
- Further comments on Figure 11 in my evidence and the statement that the Hospital Site (**Site**) is "generally not contaminated".
- Comparison of the site specific remedial standards with NESCS Soil contaminant standards for different land uses.
- Further commentary on whether the landfill extent on AgResearch land should be disposed of offsite.
- Further commentary on the elevated zinc levels in the toilet block area and where this material should be disposed to.

2.0 COMPLIANCE WITH THE EXISTING LANDFILL CONSENTS

An assessment of consent compliance and recommended repair/maintenance works was set out in Section 11 of the FTL Existing Disposal Sites – Intrusive Investigation Report (Appendix C.1 to the Landfill AEE), with an overview of the consents provided in Table 15.

I provide some brief additional comments below.

First, in relation to compliance with Resource Consent AUTH102269.01.01 (discharge leachate into land) I note the following excerpt from the Intrusive Investigation Report:[1]

> *Consent 269, condition 9, refers to a monitoring report being provided to Env-Waikato within three years of granting the consent, that shall include proposals for additional remediation works or monitoring requirements that the consent holder considers necessary in light of the monitoring results. Whilst it is now over 20 years since this consent was granted, ongoing monitoring data, as required under consent 269, condition 7, confirms leachate is entering groundwater and the*

[1] FTL Existing Disposal Sites – Intrusive Investigation Report (Appendix C.1 to the Landfill AEE), p60.

Wharekōrino Stream, with boron being the main contaminant of concern, and that some remedial works would be beneficial to reduce leachate discharges to ground and groundwater.

As explained in paragraph 68(b) of my evidence, whilst some leachate seepage into the stream has been confirmed from regular monitoring, the boron levels in the stream are well within the Australian and New Zealand Environment and Conservation Council (ANZECC) guideline for protection of 95% of aquatic freshwater species (0.37g/m^3 (2000 guideline recently updated in 2021 to 0.94g/m^3) and long-term irrigation trigger values (0.50g/m^3). Hence, the remedial works required under condition 9 of the existing consent would have benefit but are not considered necessary to comply with conservative stream receiving environment criteria.

Second, the Intrusive Investigation Report[2] found that the existing landfill cap in some areas does not comply with the conditions of AUTH102269.01.01 which authorises the discharge of leachate from the landfill. Parts of Areas A and C do not comply with the topsoil and cap depths required by Condition 3, and Part of Area F does not comply with cap depths required by Condition 3 of this consent. Likewise, Parts of Areas B and D do not comply with the topsoil and cap depths specified in Condition 4.

[2] Refer, in particular, to Table 9.

3.0 COMPARISON OF LANDFILL WORKS UNDER EXISTING AND PROPOSED CONSENTS

The following table compares the landfill works that would be required under the existing consents with the landfill works proposed under the new consent.

Table 1: Comparison of Landfill Works under Existing and Proposed Consents

Item	Existing Consents	Proposed Consents	Effect of proposed works compared with existing consents
Improved Capping	Localising patching of existing cap (increasing thickness and/or greater compaction) over Disposal Site areas A1/B/C/D/F.[3] Capping of additional landfill areas A2/H, not covered under existing consent, may also be required.	Recapping of entire landfill with GCL cap on 150-300mm bedding/protection layer, and overlain by 150mm protection layer, 300mm agricultural growth layer and 150mm topsoil.[4]	Existing consent requires a landfill cap of 500-600mm of earth cover with in situ impermeability of $1x10^{-7}$m/s overlain by 100-200mm subsoil/topsoil layer. GCL cap (e.g. Elcoseal 1000) has impermeability of $3x10^{-11}$m/s, some 3,333 times lower (significantly more impermeable) than the current consent requirement. Proposed cap also has greater "productive soil" layer depth which should help promote pasture growth.
Identified localised areas of ponding, settlement/subsidence areas within landfill footprint	Routine, localised repair works.[5]	Proposed recapping will also involve regrading of the landfill surface, addressing these issues at the same time.	Localised repairs are likely to be ongoing, on an 'as and when required' basis under the existing consents. In comparison, the capping works should reduce the frequency and extent of any such occasional works in the future.
Groundwater intercept trench	Not required	Proposed to intercept upgradient groundwater and divert it around landfill	Proposed intercept trench will significantly reduce leachate generation and contaminant migration from landfill to stream. This, combined with improved capping referred to above, is estimated to reduce leachate volumes and contaminant migration by 72-92% with it taking somewhere between 1 month and 7 years for this to be

[3] Conditions 3 & 4 of 102269.01.01

[4] Proposed conditions 7 & 8 of AUTH146952.05.01 (LINZ's closing submissions set - clean)

[5] Condition 5 of 102269.01.01

Item	Existing Consents	Proposed Consents	Effect of proposed works compared with existing consents
			reflected in stream monitoring results, based on estimated groundwater travel times.
Medical Waste Removal (needles, razors, blood bags and bottles as described in section 7.1 of FTL Existing Disposal Sites Intrusive Investigation Report)	Not required	Proposed to remove all medical waste from Area F and in any other areas where it is found during landfill material internal transfer.[6]	Reduction in health and safety risks; removal of culturally offensive material off-site to an approved facility
Grout filling Culvert 3 and new shorter culvert and open stream channel around landfill	Not required	Proposed grout filling of existing culvert and replacement with shorter 41m section of new culvert and ~105m of new stream, running on new alignment around landfill, as much as practicable. This also requires the relocation of ~2,000m^3 of landfill material from Areas A2/H into Area A1 to facilitate these works.	Culvert 3 is estimated to be 44-65 years old and may be affected by differential settlement from landfill activity, causing leaking joints and potential pipe failure, which could result in fill/refuse washout down the stream, representing a significant adverse long-term human health and environmental risk. The proposed works under the new consents would eliminate this significant risk, while this problem will only get worse over time if the culvert was left in place.
Waste from portion of existing landfill located on AgResearch land transferred to within Tokanui Site	Not required	Approximately 373m^3 of contaminated soil/fill and C&D materials to be transferred into Area A1 of landfill, within area under LINZ responsibility, removing these materials from AgResearch land.	Shifting these materials will ensure they will be appropriately encapsulated and capped, reducing rainfall infiltration through them and hence leachate generation, and minimising transport related emissions compared with off-site disposal.
Hospital low-moderate contaminated soil transferred to northern disposal area	Not required	An estimated minimum 3,400m^3 and maximum 7,800m^3 of low-moderate level contaminated soil will be transferred from the Hospital Site into the northern disposal site and be covered with a GCL cap. [7]	Shifting these materials, which have a low leachability risk, will ensure they will be appropriately encapsulated and capped, reducing rainfall infiltration through them and hence leachate generation, and minimising transport related emissions compared with off-site disposal.

[6] Proposed condition 4 of AUTH146952.05.01 (LINZ's closing submissions set - clean)
[7] Proposed conditions 3 & 7 of AUTH146952.05.01 (LINZ's closing submissions set - clean)

Item	Existing Consents	Proposed Consents	Effect of proposed works compared with existing consents
Environmental monitoring	Required[8]	Proposed to continue existing monitoring as per current consent but deleting monitoring point S4 (where PAHs monitoring is currently required), relocating the two groundwater bores to outside the landfill footprint and deleting mercury and PAHs (see note) from the test parameters due to no detects. There are also some other parameters that could potentially be deleted (e.g. total organic carbon and chloride). [9]	Essentially maintaining existing monitoring programme, with some minor changes deleting items that are no longer necessary or add no value, based on analysis of sampling data collected to date. This will ensure that potential/actual environmental effects continue to be monitored.
Riparian planting	Required.[10] According to WRC compliance records (2012), the plan was approved and implemented, and this condition has been met.	Additional riparian planting proposed along length of new stream replacing part of Culvert 3 (105m) and replacing Culvert 2 (~30m), with the latter covered under the remediation consent. Additional planting of ~8,000m^2 is also proposed between Culverts 2 and 3. [11]	New and expanded riparian planting will have amenity, aesthetic and environmental benefits.

Note: PAHs testing has been done at the "trace" detection level, with none found exceeding the laboratory detection limits for individual PAH species.

In addition to the above, the consents sought in the Remediation Application propose the removal of Culvert 2, which is not required under the existing consents. The removal of Culvert 2 will significantly lower flood levels adjacent to the landfill and restore approximately 30m of stream. This is considered important in relation to recent severe flooding events in New Zealand, increased awareness of climate change issues and associated predicted increases in rainfall, compared with when the existing landfill consents were granted in 2000.

[8] Conditions 7-9 of 102269.01.01
[9] Proposed conditions 11-15 of AUTH146952.05.01 (LINZ's closing submissions set - clean)
[10] Condition 10 of 102269.01.01
[11] Proposed conditions 21-23 of AUTH146952.05.01 (LINZ's closing submissions set - clean)

4.0 FIGURE 11 AND "GENERALLY NOT CONTAMINATED" COMMENT CLARIFICATION

I have been asked to provide more comment in relation to Figure 11 of my evidence and my statement in paragraph 76 that the Site is "generally not contaminated".

The Hospital Site essentially formed its own village spread over 79ha and operated for a period of 86 years from 1912-98, a period over which there was generally low awareness of soil contamination issues.

The comprehensive Preliminary Site Investigation (PSI) undertaken by GHD identified a total of 42 locations[12] on the Hospital Site where HAIL (Hazardous Activities and Industries List) activities potentially or actually occurred on-site, as listed below (with comments in italics indicating the relevant locations):

- A2: Chemical bulk storage – *located in the water treatment plant*
- A5: Dry cleaning plants including dry-cleaning premises or the bulk storage of dry-cleaning solvents – *located in the Laundry*
- A8: Livestock dip – *located in the horticultural area*
- A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glasshouses or spray sheds – *associated with spray sheds, horticultural areas, sports turfs*
- A14: Pharmaceutical manufacture including the blending, mixing or formulation of pharmaceuticals – *associated with the Pharmacy*
- A17: Storage tanks or drums for chemicals or liquid waste – *in various locations; Swimming pool chemical store, water treatment plant, morgues, fuel storage tanks*
- B4: Substations – *eight substations located on Site*
- E1: Asbestos products disposal including sites with buildings containing asbestos products known to be in a deteriorated condition – *associated with current and previously demolished buildings*.
- F4: Motor vehicle workshops – *associated with a vehicle workshop which is part of a fuel station*
- F7: Service stations including retail or commercial refuelling facilities – *two former fuel stations*
- G6: Waste or wastewater treatment – *the incinerator and former hospital waste water treatment plant*
- I – Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment – *Boiler, dentist, fly tipping.*

In addition to the identified HAIL activities, the deterioration or weathering of building fabric may have impacted soils at the Site – this relates primarily to the use of lead-based paint on most buildings on the Site and may also be considered under category I.

Extensive sampling was undertaken across the Site, focusing on the identified potential or actual HAIL areas. The extent of this sampling is captured in the following figures:

- Addendum DSI – Figure 2 (Figure 11 of my evidence is a snip of this plan). In checking this figure as part of preparing this response, I've found that it only contained the soil sampling locations and colour coded results for the additional building related samples collected by FTL/HAIL Environmental as part of the Addendum DSI (Appendix K3 of Remediation AEE) and not all soil sampling across the Site. Hence, it only shows a small proportion of all the sampling undertaken on the Site to date. The sampling locations and extents is captured in the documentation referred to below.
- Additional sampling locations for specific non-building related areas undertaken as part of the Addendum DSI are shown on Figures NBA01 (overview) and in NBA02-07 (sampling locations for each NBA area) of the Addendum DSI.
- Appendix D of the RAP (Appendix K6 of the Remediation AEE) includes figures extracted from other reports done by AECOM, GHD and WSP that show all the earlier sampling locations investigated by these consultants across the Site.

Furthermore, it is important to note that Figure 11 was prepared primarily to give an overview of the additional building related sampling locations and results investigated in the Addendum DSI. Given its low

[12] GHD listed 43 locations as potential/actual HAIL activities, but these included the historical Disposal Site – this has been removed from the above HAIL list as this query relates to the remediation application.

resolution scale, it contains a lot of overlapping samples. When you zoom in on individual samples, the density of samples is much clearer. This is illustrated in Figures 1 and 2 below in relation to Building 11.

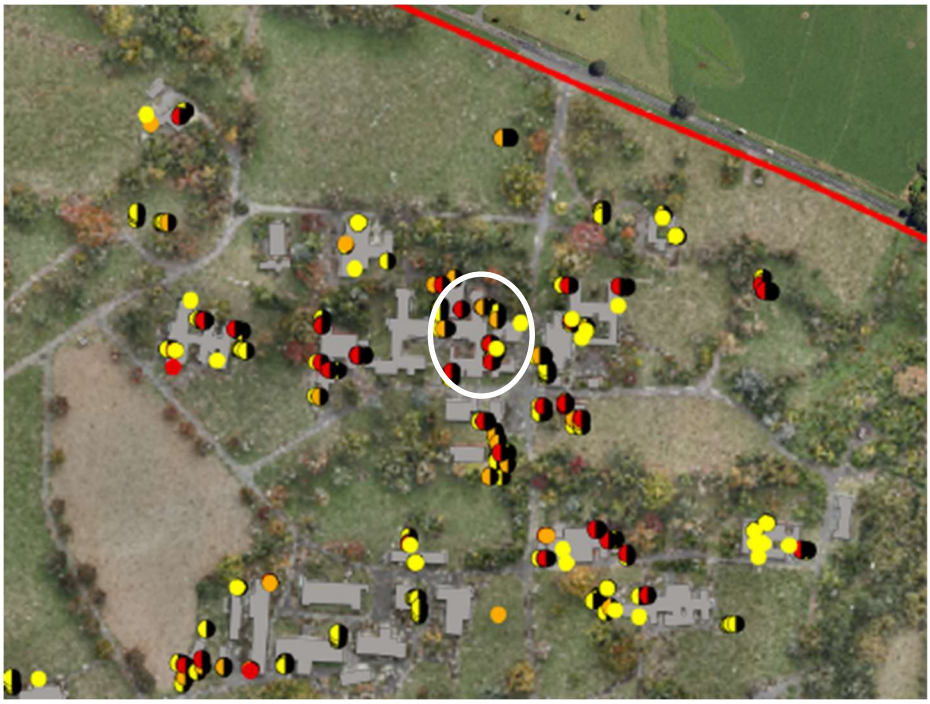

Figure 1: Snip of Finnigan Evidence Figure 11, with Building 11 highlighted.

Figure 2: Snip of Figure 2-4 – Additional Sampling Plan – B11 (with B10 and part of B12 also shown)

From these sampling results, remediation areas were identified for all affected buildings and non-building areas. An overview of the building remediation areas is shown in the RAP in Drawing 33097/R01 and the non-building areas in Drawing 33097/R52 (See Figures 3 and 4).

Comparing the sample location figures (Figures 1 and 2) with the RAP drawings (Figures 3 and 4) shows that the comprehensive sampling undertaken found less contamination than anticipated in terms of quantity (volume), contaminant type and severity (concentration), based on the Site's history and identified potential/actual HAIL activities.

For example:

- In terms of quantity, the confirmed volume of low-moderate level soil contamination around Site buildings was 2,297m^3 (Table 2, Finnigan evidence), which equates to 27m^3 per building, averaged across 84 buildings. Considering many buildings are relatively large and old, this is a small volume of contaminated soil (especially when compared with many residential, commercial or industrial sites FTL have investigated). The extent of these remedial areas is shown in Figure 3 (orange and red colour coding).

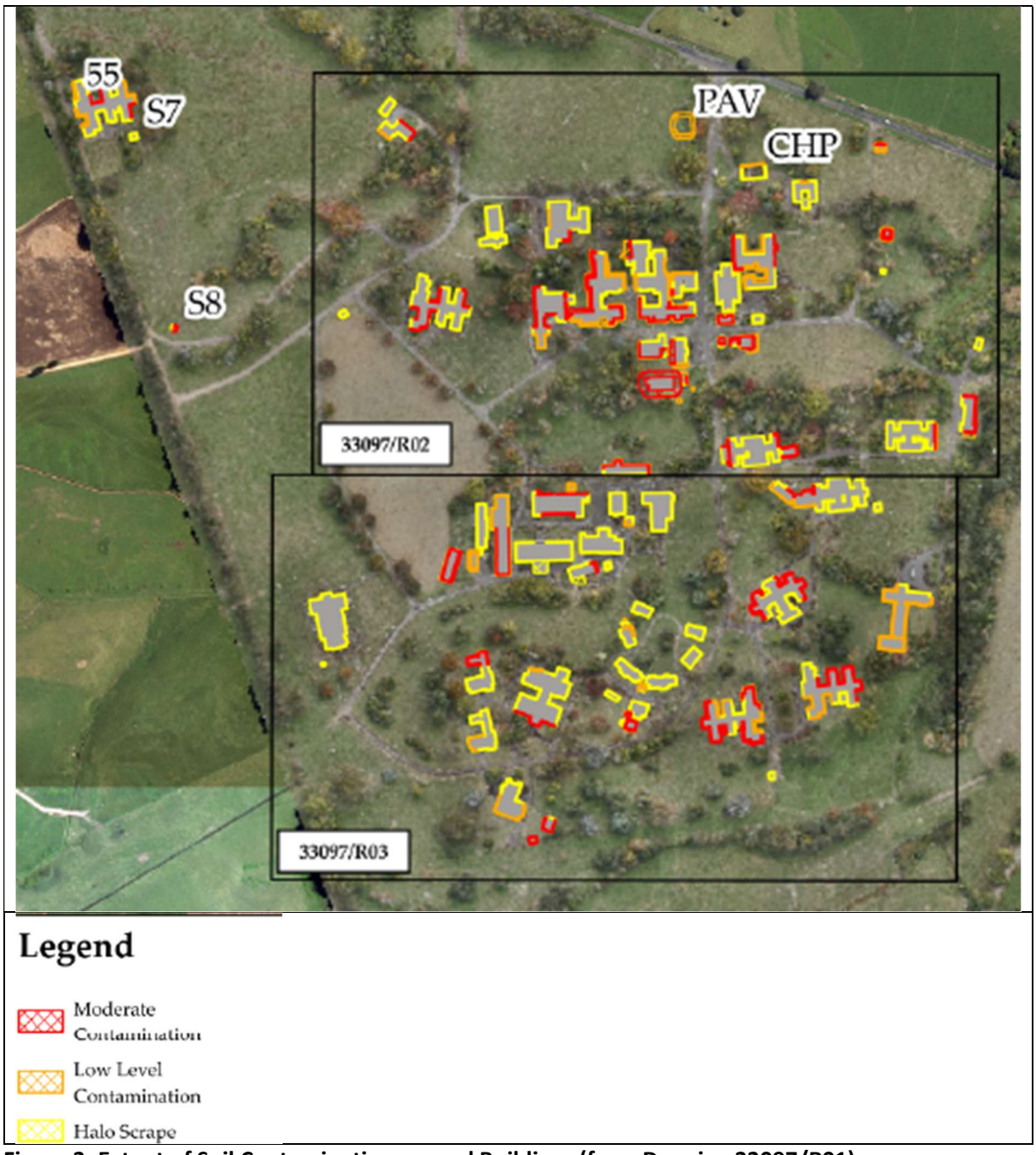

Figure 3: Extent of Soil Contamination around Buildings (from Drawing 33097/R01)

- Drawing 33097/R52 shows confirmed non-building areas with low-moderate level contamination at localised locations within them, as shown by the orange and red colour coding. These areas amount to 2,920m^2, representing 0.37% of the total site area. There are another 11 areas with suspected fill pockets to be checked under the discovery protocols set out in the RAP, which may or may not contain soil contamination. However, these areas also make up a very small proportion of the site. These areas are shown in Figure 4.

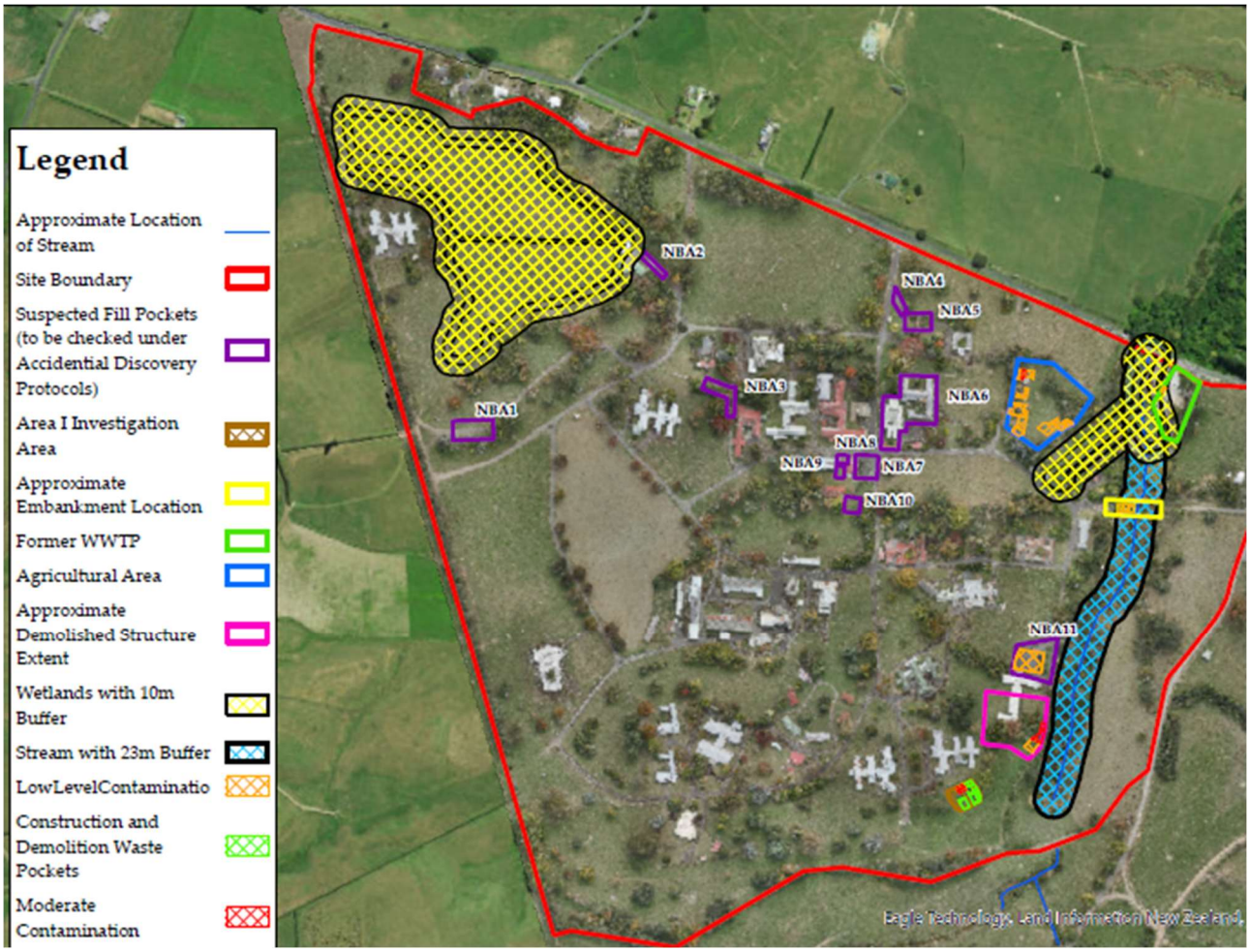

Figure 4: Non-building Remedial Areas (from drawing 33097/R52)

- Contaminant types were generally limited to common urban contaminants – namely asbestos and lead from building materials in localised areas around building halos (perimeters) as well as some localised non-building areas.
- Severity: All identified contamination corresponded to low-moderate contamination, based on the site specific remedial standards adopted.

Overall, my view is that, the Site is generally not contaminated in terms of contamination quantity, type and severity, considering:

- the confirmed volume of low-moderate level soil contamination around Site buildings equates to (an average of) 27m^3 per building which is relatively small when compared with many residential, commercial or industrial sites;
- the confirmed non-building areas with low-moderate level contamination amount to 2920m^2, representing 0.37% of the total Site area;
- while there are another 11 areas which may or may not contain soil contamination, they make up a very small proportion of the Site;
- contaminant types are mainly limited to asbestos and lead and were found in localised areas; and
- all identified contamination corresponded to low-moderate contamination, based on the site specific remedial standards adopted.

In my view, the above findings are especially notable considering the Site's long history and the range of potentially contaminating activities undertaken on it.

5.0 REMEDIAL STANDARDS COMPARISON

The site specific soil contamination standards were developed by Dr Dave Bull of HAIL Environmental Ltd, as explained in the Site Specific Risk Assessment report prepared by them, dated April 2024 (Appendix K4 of Remediation AEE).

The site specific standards are compared with different National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health in Appendix A. The contaminant standards are listed from left to right in order of decreasing strictness, based on the controlling contaminant on the Site being lead (highlighted in blue).

The Site is to be remediated so that all soil containing contaminants exceeding the Site Specific Rural Residential Standards is removed from the Site with low-moderate level contaminated soil being transferred to the on-site Disposal Site and any high-level contaminated soil being disposed of off-site. This means that residual soils left onsite post-completion of the remedial works will be present at concentrations lower than the NESCS soil contaminant standard for rural residential land use with 25% produce consumption[13].

The NESCS Users' Guide[14] explains that the rural residential land use 25% produce consumption guideline[15] is aimed at people living on rural residential land, where home-grown produce grown by the occupant on their land makes up 25% of their produce consumption. The Guideline explains that this is considered applicable to the residential vicinity of farm houses for protection of farming families, as this was considered the highest (i.e. worst case) likely scenario for rural land, giving the most conservative soil contamination standards for all rural land uses.[16]

This means that the Site, post-remediation works, will be remediated to an appropriate – and the most stringent standard, suitable for all rural land uses, even more stringent than the most conservative scenario (25% home grown produce consumption) under the current NESCS guidelines.

The rural residential land use 25% produce consumption guideline is also the most conservative NESCS land use scenario across all land uses. Complying with (and, in fact, in this case going beyond) that guideline means that should the land zoning be changed in the future, to residential, recreational or commercial/industrial, the Site will be suitable for these uses post-remediation works.

6.0 AGRESEARCH AREA

Due to a misalignment between the fence line and legal boundaries, a small area of land formerly utilised as part of the Disposal Site is currently located on land owned and operated by AgResearch Limited (ARL). This area was investigated and reported in a separate report attached to my evidence as Appendix SF3.

[13] Except for cadmium where the site specific rural residential standard is just slightly higher than the corresponding NESCS standard (0.9 vs 0.8mg/kg). However, the NESCS cadmium guideline applies to acidic soils with a pH of 5, and increases significantly with increasing pH, to 1.4mg/kg at pH5.5 and 2.3mg/kg at pH 6.0. The HAIL Environmental Site Specific Risk Assessment advises that based on recent analysis of the Site soils, that it is generally more reasonable to assume slightly acid soils (pH 6) except for the hydric soils of the wetland where pH 5.5 sees most appropriate. Hence, taking likely pH into account, the adopted site specific rural residential cadmium standard is still more conservative than the corresponding NESCS rural residential 25% produce consumption standard at the same pH.

[14] Users' Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health, published 1 April 2012

[15] NESCS Users' Guide Table B1

[16] NESCS Users' Guide Table B2 and Table B3

This separate report recommended that the following soils/fill be transferred to Area A1 of the Disposal Site where they will be placed and capped to a higher standard than at their current location, thus safely containing them going into the future and reducing leaching from them.

Table 2: Proposed Soil/Fill Transfer from AgResearch area into Area A1 of Landfill

Sample Location	Rationale	Area (m^2)	Volume (m^3)
AG14G (0.6-2.0m)	C&D content ~10%	67	94
AG14 (0.7-1.6m)	C&D content ~40%; high boron in 1m depth sample	46	41
Shallow fill materials from AG11 (0-0.2m), AG11D (0-0.5m), AG14D (0-0.1m), AG14F (0-0.3m), AG15 (0-0.25m), and AG15B (0-0.5m)	Contains low-level contamination	476	176
Fill material from location AG14B (0.7-1.0m) and AG14E (1-1.7m)	Contains moderate level contamination and 10% C&D waste (AG14E sample only)	77	42
Fill material from location AG14E (0.7-1.0m) and AG14D (0.1-0.3m depth)	Contains moderate level contamination - high boron concentrations but acceptable SPLP for onsite disposal	75	20
Totals (Net)		666	373

Notes: Total volume and area values reflect net coverage, ensuring no double-counting of shared spatial extents. C&D = construction and demolition waste

During the hearing, the issue was raised of whether the fill material in this area should be transferred into Area A1 of the Disposal Site or disposed of off-site, with Commissioner Cooke raising concerns about PAH levels in this material.

The fill material proposed to be transferred complies with the low-moderate contaminated soil definitions adopted for the Site. This takes into account measured boron SPLP values, as explained in section 8.1 of the Agresearch report and additional lead SPLP testing done for this memorandum (0.193g/m^3 SPLP lab results vs 0.2g/m^3 acceptable limit; refer Appendix B for lab transcript), except for:

- samples TP AG 14 at 0.8m and 1m depths, which contain an estimated 40% C&D waste; and
- TPAG14E (1-1.7m) and TPAG14G (0.6-2.0m), which contain an estimated 10% C&D waste.

The presence of elevated C&D waste content in these samples above the 5% threshold is not considered to warrant their disposal off-site to a Class 1 landfill, as this level of C&D content is consistent with them being "landfill materials" and other areas of the Disposal Site. Nevertheless, shifting the material from its current location (on AgResearch land) will be important to ensure that it is safely contained on LINZ's land, subject to the higher capping standard, and that risk of leaching is therefore reduced. This is discussed more below.

In relation to PAHs, guideline values are usually expressed in terms of BAP(eq), the Benzo-a-pyrene equivalent. BAP(eq) provides an estimate of the overall risk of carcinogenic PAHs by summing individual concentrations of relevant PAH species by potential equivalency factors. In the Agresearch area, BAP(eq) was detected above the lab detection limit in 25 out of 53 samples, with an average concentration of 0.19mg/kg and maximum concentration of 0.75mg/kg. In contrast, the site specific rural residential standard for BAP(eq) is much higher at 6mg/kg. This confirms that PAHs are present at low levels and their presence and concentrations do not warrant this material being disposed of off-site to a Class 1 landfill.

Onsite transfer and disposal is also considered appropriate for the following reasons:

- The contaminated soil/fill material is located on a pocket of the landfill that sits outside the current Site boundary and hence outside of the Disposal Site area that LINZ has responsibility for in perpetuity, based

on property boundaries. Relocating it within the boundary "tidies up" this boundary anomaly and ensures the material can be dealt with appropriately by LINZ under the conditions of its consent.

- This issue has been discussed with AgResearch and they support the transfer of this material off their land.
- Area A1 of the Disposal Site is to have landfill material from Area A2/H transferred into it as part of works relating to Culvert 3 and the new stream reclamation. The nature of the material in the Agresearch area is similar to other existing landfill material in Areas A1/A2/H and hence it makes sense to transfer this material as well. The transferred material will be placed on top of existing landfill material and will sit well above the groundwater table, while the entire A1 area will be capped with an improved landfill cap. This will reduce leachate discharges and the discharges of heavy metals and boron from the landfill into the Wharekōrino Stream.
- If this material was left in the Agresearch area, LINZ would need to seek approval from Agresearch to extend the groundwater diversion trench into their land in order to avoid groundwater passing through this material, which will produce leachate that will ultimately discharge to the Wharekōrino Stream.
- If this material was removed from Agresearch land and taken off-site for disposal to a Class 1 landfill, this would involve an estimated 25 truck and trailer loads, travelling to the nearest Class 1 facility being at Hampton Downs, some 96km away. This would have associated traffic and environmental impacts (e.g. noise, carbon dioxide and particulate emissions).

This approach is also consistent with emerging best practice, as WasteMINZ is advocating for a national framework and greater reuse of soil as a resource, not waste, to reduce landfill disposal and costs in New Zealand. This approach is outlined in a White Paper titled *Reclaiming Resources: Optimising Soil Reuse in Infrastructure and Development*. Best estimates of the Paper's experienced authors are that the actual volume of soil disposed at all landfill classes during the 2022/2023 period was around 4.5M - 7.5M tonnes, roughly equating to an approximate total cost to projects of around $1.35B - $2.25B to dispose these soils. This is discussed further in section 4.5.2 of the FTL Disposal Site Repair and Upgrade Works report (Appendix B of Landfill AEE).

7.0 ZINC IN TOILET BLOCK AREA

Investigations of the toilet block are reported on in the "Additional Structures Memo" attached to my evidence as Appendix SF1. Key findings from this investigation are summarised below, including an explanation of why it is considered feasible to dispose of zinc contaminated soil from the area to the on-site Disposal Site.

The toilet block was observed to be a small building, constructed on a concrete base, with a metal roof and paint coat in a deteriorated condition, while the downpipes had deteriorated completely.

Soil sampling from 4 locations at 4 depths found that zinc concentrations were in the range of 31-400mg/kg in 16 samples but higher concentrations were found in two samples at one location (0-0.3m depth) at 2300mg/kg (0-0.15m depth) and 1420mg/kg (0.15-0.30m depth), and then dropping significantly to 73mg/kg at 0.3-0.5m depth). This is likely due to corrosion of building materials, including the metal roof and gutters. TCLP (toxicity characteristic leaching procedure) analysis of the sample with the highest zinc concentration gave a leaching result of 14.7g/m^3 compared with the Class 1 landfill TCLP limit of 10g/m^3.

Soils from location TBW 0.5 contain moderate to high-level zinc contamination exceeding the Class 1 Landfill TCLP acceptance criteria. Hence, the Structures Memo concluded that soils from 0-0.3m depth in this location are unsuitable to be moved into Area D/E/F of the Tokanui Hospital Disposal Site in their current form. These soils should be mixed and blended with other 'less contaminated soils', and then moved into the Disposal Site. If this is not possible, these soils will require disposal off-site to an approved facility due to leachability issues, and would require mixing with other soils with lower zinc levels to comply with Class 1 landfill waste acceptance criteria.

It is important to note that the single TCLP result represents a worst case result. In reality, during remediation of this area, soils will be mixed together and then loaded into a truck for transfer to the Disposal Site. If a

TCLP analysis was undertaken of the mixed soil, it would be expected to give a much lower result and most likely be within Class 1 Landfill TCLP acceptance criteria.

Furthermore, the TCLP test is designed to mimic Municipal Solid Waste landfill conditions, where the pH is typically more acidic than normal rainfall, due to the decomposition of organic materials in the landfilled material. The complementary SPLP (synthetic precipitation leaching procedure) test gives a more reliable result for leaching under normal rainfall conditions, which is considered more suitable to check likely leachability if these soils were transferred to Area D/E/F, due to the lack of biodegradable material in contaminated soil from the Site.

In the Addendum DSI, SPLP testing was undertaken on a range of samples with varying zinc concentrations. This testing (Figure 4) found there was a strong correlation between the total recoverable and the SPLP leachable zinc. When the intercept was set to zero, the regression slope was 0.00005 and the correlation coefficient (R2) was 0.83.

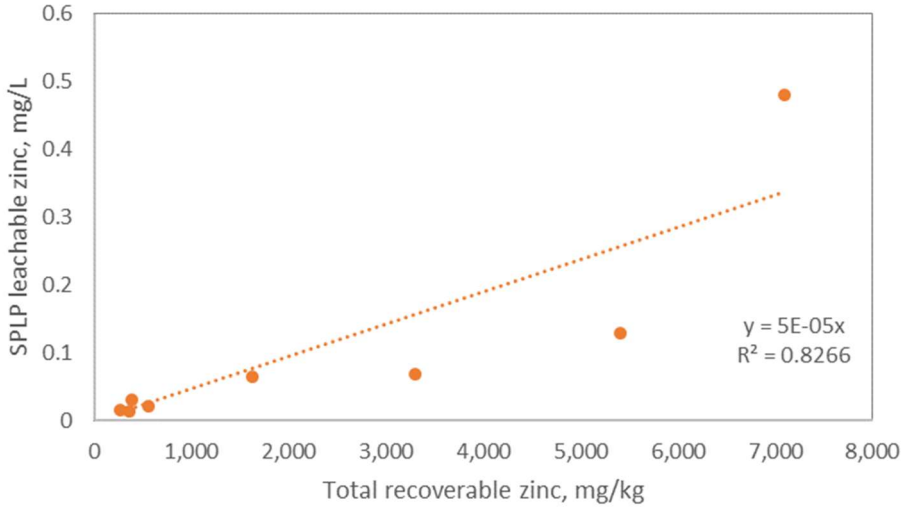

Figure 4: SPLP leachable soil zinc around buildings with high-lead paints (Addendum DSI, Figure 8)

For the toilet block, where the highest measured zinc concentration was 2300mg/kg, the above graph shows that the expected SPLP zinc leachability would be approximately 0.1mg/L (0.1g/m^3).

The results of this analysis were compared with a target leachate concentration value for zinc, taking into account groundwater and surface water migration pathways, with appropriate dilution and attenuation factors (DWSNZ = 20x, ANZECC = 100x), as per the methodology outlined in the WasteMINZ Technical Guidelines for Disposal to Land (Revision 3.1 – 2023), giving a value of 0.8g/m^3. Hence, it is expected that the contaminated soil from the toilet block area would comply with the adopted definition of low-moderate level contaminated soil, taking into account that the soil with the elevated zinc concentrations is very localised, small in quantity and likely of low leachability.

Again, the proposed approach of transferring this material to the existing on-site Disposal Site with mixing occurring during the loading, unloading and placement processes is also consistent with emerging best practice in New Zealand, that promotes greater reuse of soil as a resource, as explained in Section 6 above.

Appendix A

Soil Contaminant Standards Comparison

Sample Date Sample Name Sample Depth (m) Lab Number Heavy Metals (mg/kg dry weight)	Background Concentrations [1] 95% upper limit for background (mg/kg)	Site-specific Rural Residential Remedial Standards for Tokanui [2]	NES:CS SCS for Rural Residential (25% Produce) Land Use [3]	NES:CS SCS for Residential (10% Produce) Land Use [3]	Site-Specfic Managed Remedial Standards for Tokanui [2]	NES:CS SCS for High density residential Land Use [3]	NES:CS SCS for Recreational Land Use [3]	NES:CS SCS for Commercial/ Industrial Land Use [3]	Waste Acceptance Criteria		
									WRC Cleanfill Criteria	Managed Fill (Enviro South)	WasteMINZ Class 1 Landfill (maximum allowable limit without TCLP)
Arsenic	6.8	9	17	20	70	45	80	70	17	70	100
Boron	6.7	Not derived	>10,000	>10,000	Not derived	>10,000	>10,000	>10,000	15	260	500
Cadmium	0.22	0.9	0.8	3	10	230	400	1300	0.8	1.2	20
Chromium	30	150	290	460	150	1,500	2,700	6300	56	362	100
Copper	25	280	>10,000	>10,000	280	>10,000	>10,000	>10,000	120	107	200
Lead	20	120	160	210	460	500	880	3300	78	210	200
Mercury	0.23	3	200	310	3	1,000	1,800	4,200	1	1	4
Nickel [4]	7.6	Not derived	400	400	Not derived	1,200	1,200	6,000	33	320	200
Zinc [4]	53	350	7,400	7,400	450	30,000	60,000	400,000	175	1160	500
OCPs											
Total DDT	-	2	45	70	2	240	400	1000	0.5	12	500
Dieldrin	-	-	1.1	2.6	-	45	70	160	0.05	0.02	8
TPH											
(C7 - C9)	-	-	2,700	2,700	-	-	-	8,800	120	2,700	-
(C10 - C14)	-	-	560	560	-	-	-	1,900	58	2,000	-
(C15 - C36)	-	-	-	-	-	-	-	NA	-	20,000	-
PAHS											
BAP (Eq)	-	6	6	10	35	24	40	35	2	35	200
Asbestos (SQ)											
AF/FA % [5]	ND	0.001	0.001	0.001	0.001	0.001	0.001	0.001	ND	AF/FA Only	Accepted
% ACM [5]	ND	0.01	0.01	0.01	0.01	0.04	0.02	0.05			

Notes:

1. Upper limit background concentrations for selected elements in soil of the Waikato region, acid recoverable data, sourced from: https://www.waikatoregion.govt.nz/services/regional-services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

2. Site Specific Remedial Standards as presented in HAIL Environmental Ltd Site Specific Risk Assessment, Version 3.2, dated Feburary 2024

3. Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulation 2012 (NES:CS) - Soil contaminant standards (SCS) applicable to stated land uses, except for Nickel and Zinc. See note 4

4. National Environment Protection (Assessment of Site Contamination) Measure, amended 2013

5. BRANZ 2017 Asbestos in Soil guidelines of 0.05% w/w % ACM or 0.001% w/w for % FA & AF fraction (Commercial/Industrial guidelines applied to assess risk to Remedial workers)

Appendix B

SPLP Lab Transcript

(see highlighted result on pg 7 – all other test results relate to previous Agresearch area work)

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Certificate of Analysis

Client:	Fraser Thomas Limited	**Lab No:**	3892810 SPv4
Contact:	Elliot Bish	**Date Received:**	20-May-2025
	C/- Fraser Thomas Limited	**Date Reported:**	30-Oct-2025 **(Amended)**
	PO Box 204006	**Quote No:**	92882
	Highbrook	**Order No:**	PO001344
	Auckland 2161	**Client Reference:**	33097
		Submitted By:	Ben Laing-McConnell

Sample Type: Soil

Sample Name:		TPAG14B 0-0.15m 12-May-2025	TPAG14B 0.15-0.7m 12-May-2025	TPAG14B 0.7-1.0m 12-May-2025	TPAG14C 0-0.15m 12-May-2025	TPAG14C 0.15-0.45m 12-May-2025
Lab Number:		3892810.1	3892810.2	3892810.3	3892810.4	3892810.5
Individual Tests						
Dry Matter	g/100g as rcvd	77	87	75	77	84
TCLP Weight of Sample Taken	g	-	-	50	-	-
TCLP Initial Sample pH	pH Units	-	-	7.7	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	-	1.7	-	-
TCLP Extractant Type*		-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-
TCLP Extraction Fluid pH	pH Units	-	-	5.0	-	-
TCLP Post Extraction Sample pH	pH Units	-	-	5.1	-	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	4	4	5	4
Total Recoverable Boron	mg/kg dry wt	< 20	82	21	< 20	< 20
Total Recoverable Cadmium	mg/kg dry wt	0.17	0.10	0.72	0.26	0.11
Total Recoverable Chromium	mg/kg dry wt	14	24	7	13	23
Total Recoverable Copper	mg/kg dry wt	27	21	27	34	18
Total Recoverable Lead	mg/kg dry wt	29	23	620	54	26
Total Recoverable Nickel	mg/kg dry wt	10	15	4	10	11
Total Recoverable Zinc	mg/kg dry wt	77	76	320	101	67
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	1.3	1.9	< 0.4	2.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.012	< 0.014	< 0.013	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.012	< 0.014	< 0.013	< 0.012
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.012	< 0.014	< 0.013	< 0.012
Acenaphthene	mg/kg dry wt	< 0.013	< 0.012	< 0.014	< 0.013	< 0.012
Anthracene	mg/kg dry wt	0.013	0.044	< 0.014	0.035	< 0.012
Benzo[a]anthracene	mg/kg dry wt	0.098	0.156	< 0.014	0.169	< 0.012
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.137	0.153	< 0.014	0.22	< 0.012
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.20	0.23	< 0.032	0.32	< 0.029
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.199	0.23	< 0.032	0.32	< 0.029
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	0.163	0.186	< 0.014	0.26	0.012
Benzo[e]pyrene	mg/kg dry wt	0.080	0.092	< 0.014	0.136	< 0.012
Benzo[g,h,i]perylene	mg/kg dry wt	0.089	0.090	< 0.014	0.141	< 0.012
Benzo[k]fluoranthene	mg/kg dry wt	0.067	0.086	< 0.014	0.101	< 0.012
Chrysene	mg/kg dry wt	0.090	0.138	< 0.014	0.196	< 0.012
Dibenzo[a,h]anthracene	mg/kg dry wt	0.019	0.023	< 0.014	0.033	< 0.012
Fluoranthene	mg/kg dry wt	0.184	0.36	< 0.014	0.36	0.013

Sample Type: Soil						
Sample Name:		TPAG14B 0-0.15m 12-May-2025	TPAG14B 0.15-0.7m 12-May-2025	TPAG14B 0.7-1.0m 12-May-2025	TPAG14C 0-0.15m 12-May-2025	TPAG14C 0.15-0.45m 12-May-2025
Lab Number:		3892810.1	3892810.2	3892810.3	3892810.4	3892810.5
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Fluorene	mg/kg dry wt	< 0.013	< 0.012	< 0.014	< 0.013	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.092	0.090	< 0.014	0.140	< 0.012
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.07	< 0.07	< 0.06
Perylene	mg/kg dry wt	0.032	0.034	< 0.014	0.046	< 0.012
Phenanthrene	mg/kg dry wt	0.057	0.166	< 0.014	0.130	< 0.012
Pyrene	mg/kg dry wt	0.179	0.31	< 0.014	0.34	0.014

Sample Name:		TPAG14C 0.45-0.85m 12-May-2025	TPAG14D 0-0.1m 12-May-2025	TPAG14D 0.1-0.3m 12-May-2025	TPAG14D 0.3-0.55m 12-May-2025	TPAG14E 0-0.15m 12-May-2025
Lab Number:		3892810.6	3892810.7	3892810.8	3892810.9	3892810.10
Individual Tests						
Dry Matter	g/100g as rcvd	75	68	68	74	79
SPLP Sample Weight	g	-	50	-	-	-
SPLP Extractant Type*		-	De-ionised Water, pH 5.8 +/- 0.4	-	-	-
SPLP Final pH	pH Units	-	9.0	-	-	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	3	6	9	2	6
Total Recoverable Boron	mg/kg dry wt	< 20	480	2,300	41	33
Total Recoverable Cadmium	mg/kg dry wt	0.25	0.36	0.24	0.21	0.35
Total Recoverable Chromium	mg/kg dry wt	6	13	19	5	13
Total Recoverable Copper	mg/kg dry wt	16	50	41	16	34
Total Recoverable Lead	mg/kg dry wt	71	45	19.8	17.1	62
Total Recoverable Nickel	mg/kg dry wt	3	35	65	3	11
Total Recoverable Zinc	mg/kg dry wt	77	132	230	89	119
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	1.9	< 0.4	< 0.4	3.7
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.015	< 0.015	< 0.014	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.015	< 0.015	< 0.014	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.015	< 0.015	< 0.014	0.018
Acenaphthene	mg/kg dry wt	< 0.013	< 0.015	< 0.015	< 0.014	< 0.013
Anthracene	mg/kg dry wt	< 0.013	0.019	< 0.015	< 0.014	0.050
Benzo[a]anthracene	mg/kg dry wt	< 0.013	0.146	< 0.015	< 0.014	0.28
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.013	0.193	< 0.015	< 0.014	0.34
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.032	0.29	< 0.035	< 0.033	0.51
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.031	0.28	< 0.035	< 0.033	0.51
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.013	0.23	< 0.015	< 0.014	0.41
Benzo[e]pyrene	mg/kg dry wt	< 0.013	0.123	< 0.015	< 0.014	0.21
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.013	0.130	< 0.015	< 0.014	0.24
Benzo[k]fluoranthene	mg/kg dry wt	< 0.013	0.099	< 0.015	< 0.014	0.169
Chrysene	mg/kg dry wt	< 0.013	0.140	< 0.015	< 0.014	0.25
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	0.028	< 0.015	< 0.014	0.052
Fluoranthene	mg/kg dry wt	0.024	0.29	< 0.015	< 0.014	0.61
Fluorene	mg/kg dry wt	< 0.013	< 0.015	< 0.015	< 0.014	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.013	0.136	< 0.015	< 0.014	0.24
Naphthalene	mg/kg dry wt	< 0.07	< 0.08	< 0.08	< 0.07	< 0.07
Perylene	mg/kg dry wt	< 0.013	0.048	< 0.015	< 0.014	0.072
Phenanthrene	mg/kg dry wt	0.024	0.059	< 0.015	< 0.014	0.166
Pyrene	mg/kg dry wt	0.022	0.29	< 0.015	< 0.014	0.56

Sample Type: Soil						
Sample Name:		TPAG14E 0.15-0.7m 12-May-2025	TPAG14E 0.7-1.0m 12-May-2025	TPAG14E 1.0-1.7m 12-May-2025	TPAG14E 1.7m + 12-May-2025	TPAG14F 0-0.15m 12-May-2025
Lab Number:		3892810.12	3892810.13	3892810.14	3892810.15	3892810.16
Individual Tests						
Dry Matter	g/100g as rcvd	87	76	74	68	76
SPLP Sample Weight	g	-	50	50	-	-
SPLP Extractant Type*		-	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	-	-
SPLP Final pH	pH Units	-	8.4	8.4	-	-
TCLP Weight of Sample Taken	g	-	50	50	-	-
TCLP Initial Sample pH	pH Units	-	8.9	7.8	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	4.1	1.8	-	-
TCLP Extractant Type*		-	NaOH/Acetic acid at pH 4.93 +/- 0.05	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-
TCLP Extraction Fluid pH	pH Units	-	5.0	5.0	-	-
TCLP Post Extraction Sample pH	pH Units	-	6.8	5.1	-	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	8	5	3	6
Total Recoverable Boron	mg/kg dry wt	< 20	3,200	139	67	560
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.27	0.62	< 0.10	0.19
Total Recoverable Chromium	mg/kg dry wt	21	23	10	7	19
Total Recoverable Copper	mg/kg dry wt	22	34	20	15	32
Total Recoverable Lead	mg/kg dry wt	22	14.4	4,200	19.2	27
Total Recoverable Nickel	mg/kg dry wt	11	16	6	5	33
Total Recoverable Zinc	mg/kg dry wt	67	31	340	51	98
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.6	< 0.4	< 0.4	< 0.4	1.1
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.013	< 0.014	< 0.015	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.013	< 0.014	< 0.015	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.013	< 0.014	< 0.015	< 0.013
Acenaphthene	mg/kg dry wt	< 0.011	< 0.013	< 0.014	< 0.015	< 0.013
Anthracene	mg/kg dry wt	< 0.011	< 0.013	< 0.014	< 0.015	0.014
Benzo[a]anthracene	mg/kg dry wt	0.047	< 0.013	0.015	< 0.015	0.077
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.052	< 0.013	< 0.014	< 0.015	0.102
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.070	< 0.031	< 0.032	< 0.035	0.152
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.069	< 0.031	< 0.032	< 0.035	0.150
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.060	0.016	0.032	< 0.015	0.124
Benzo[e]pyrene	mg/kg dry wt	0.030	< 0.013	0.022	< 0.015	0.066
Benzo[g,h,i]perylene	mg/kg dry wt	0.032	< 0.013	0.015	< 0.015	0.069
Benzo[k]fluoranthene	mg/kg dry wt	0.029	< 0.013	< 0.014	< 0.015	0.050
Chrysene	mg/kg dry wt	0.045	< 0.013	0.034	< 0.015	0.072
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.013	< 0.014	< 0.015	0.015
Fluoranthene	mg/kg dry wt	0.122	0.025	0.037	< 0.015	0.160
Fluorene	mg/kg dry wt	< 0.011	< 0.013	< 0.014	< 0.015	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.031	< 0.013	0.016	< 0.015	0.071
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	< 0.07	< 0.08	< 0.07
Perylene	mg/kg dry wt	< 0.011	0.043	< 0.014	< 0.015	0.025
Phenanthrene	mg/kg dry wt	0.027	0.017	0.021	< 0.015	0.052
Pyrene	mg/kg dry wt	0.108	0.024	0.043	< 0.015	0.152

Sample Name:		TPAG14F 0.15-0.3m 12-May-2025	TPAG14F 0.3-0.5m 12-May-2025	TPAG14G 0-0.15m 12-May-2025	TPAG14G 0.15-0.6m 12-May-2025	TPAG14G 0.6-2.0m 12-May-2025
Lab Number:		3892810.17	3892810.18	3892810.19	3892810.20	3892810.21
Individual Tests						
Dry Matter	g/100g as rcvd	86	74	76	84	77
SPLP Sample Weight	g	50	-	-	-	-

Sample Type: Soil						
Sample Name:		TPAG14F 0.15-0.3m 12-May-2025	TPAG14F 0.3-0.5m 12-May-2025	TPAG14G 0-0.15m 12-May-2025	TPAG14G 0.15-0.6m 12-May-2025	TPAG14G 0.6-2.0m 12-May-2025
Lab Number:		3892810.17	3892810.18	3892810.19	3892810.20	3892810.21
Individual Tests						
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	-	-	-	-
SPLP Final pH	pH Units	9.4	-	-	-	-
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	3	4	3	4
Total Recoverable Boron	mg/kg dry wt	640	78	20	< 20	40
Total Recoverable Cadmium	mg/kg dry wt	0.12	0.26	0.15	< 0.10	0.16
Total Recoverable Chromium	mg/kg dry wt	12	6	10	24	8
Total Recoverable Copper	mg/kg dry wt	21	29	21	17	19
Total Recoverable Lead	mg/kg dry wt	53	30	36	17.7	52
Total Recoverable Nickel	mg/kg dry wt	23	4	7	10	6
Total Recoverable Zinc	mg/kg dry wt	84	96	67	63	75
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.4	< 0.4	1.0	< 0.3	0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.012	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.012	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.012	< 0.013
Acenaphthene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.012	< 0.013
Anthracene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.012	< 0.013
Benzo[a]anthracene	mg/kg dry wt	0.024	< 0.013	0.075	< 0.012	0.028
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.032	< 0.013	0.099	0.018	0.040
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.043	< 0.032	0.146	< 0.028	0.053
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.042	< 0.032	0.144	< 0.028	0.053
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.037	< 0.013	0.118	0.019	0.047
Benzo[e]pyrene	mg/kg dry wt	0.022	< 0.013	0.063	0.013	0.026
Benzo[g,h,i]perylene	mg/kg dry wt	0.025	< 0.013	0.067	0.020	0.032
Benzo[k]fluoranthene	mg/kg dry wt	0.016	< 0.013	0.048	< 0.012	0.019
Chrysene	mg/kg dry wt	0.027	< 0.013	0.071	0.012	0.027
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.013	0.014	< 0.012	< 0.013
Fluoranthene	mg/kg dry wt	0.051	< 0.013	0.152	0.025	0.055
Fluorene	mg/kg dry wt	< 0.012	< 0.013	< 0.013	< 0.012	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.025	< 0.013	0.068	0.019	0.030
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	< 0.07	< 0.06	< 0.07
Perylene	mg/kg dry wt	0.018	< 0.013	0.022	< 0.012	< 0.013
Phenanthrene	mg/kg dry wt	0.025	< 0.013	0.040	< 0.012	0.022
Pyrene	mg/kg dry wt	0.055	< 0.013	0.149	0.024	0.057

Sample Name:		TPAG14G 2.0-3.0m 12-May-2025	TPAG15A 0-0.4m 12-May-2025	TPAG15A 0.4m + 12-May-2025	TPAG15B 0-0.1m 12-May-2025	TPAG15B 0.1-0.5m 12-May-2025
Lab Number:		3892810.22	3892810.23	3892810.24	3892810.25	3892810.26
Individual Tests						
Dry Matter	g/100g as rcvd	64	70	75	76	72
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	4	3	4	6	8
Total Recoverable Boron	mg/kg dry wt	62	< 20	< 20	< 20	45
Total Recoverable Cadmium	mg/kg dry wt	0.39	< 0.10	0.29	0.66	0.35
Total Recoverable Chromium	mg/kg dry wt	12	6	8	10	6
Total Recoverable Copper	mg/kg dry wt	30	14	20	32	55
Total Recoverable Lead	mg/kg dry wt	58	14.2	88	142	53
Total Recoverable Nickel	mg/kg dry wt	12	3	4	10	7
Total Recoverable Zinc	mg/kg dry wt	189	37	82	148	81

Sample Type: Soil						
Sample Name:		TPAG14G 2.0-3.0m 12-May-2025	TPAG15A 0-0.4m 12-May-2025	TPAG15A 0.4m + 12-May-2025	TPAG15B 0-0.1m 12-May-2025	TPAG15B 0.1-0.5m 12-May-2025
Lab Number:		3892810.22	3892810.23	3892810.24	3892810.25	3892810.26
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.4	0.3	0.9	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	< 0.013	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	< 0.013	< 0.014
Acenaphthylene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	< 0.013	< 0.014
Acenaphthene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	< 0.013	< 0.014
Anthracene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	< 0.013	< 0.014
Benzo[a]anthracene	mg/kg dry wt	< 0.016	< 0.015	0.024	0.067	< 0.014
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.016	< 0.015	0.033	0.083	0.015
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.038	< 0.035	0.049	0.124	< 0.033
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.038	< 0.034	0.049	0.122	< 0.032
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.016	< 0.015	0.039	0.102	0.017
Benzo[e]pyrene	mg/kg dry wt	< 0.016	< 0.015	0.021	0.052	< 0.014
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.016	< 0.015	0.024	0.057	< 0.014
Benzo[k]fluoranthene	mg/kg dry wt	< 0.016	< 0.015	0.018	0.042	< 0.014
Chrysene	mg/kg dry wt	< 0.016	< 0.015	0.024	0.063	< 0.014
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	< 0.013	< 0.014
Fluoranthene	mg/kg dry wt	< 0.016	< 0.015	0.045	0.146	0.021
Fluorene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	< 0.013	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.016	< 0.015	0.023	0.055	< 0.014
Naphthalene	mg/kg dry wt	< 0.08	< 0.08	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	0.018	< 0.014
Phenanthrene	mg/kg dry wt	< 0.016	< 0.015	< 0.014	0.040	0.015
Pyrene	mg/kg dry wt	< 0.016	< 0.015	0.050	0.143	0.023

Sample Name:		TPAG15B 0.5-0.7m 12-May-2025	TPAG15C 0-0.1m 12-May-2025	TPAG15C 0.1-0.3m 12-May-2025	TBE 0.5 A 12-May-2025	TBE 0.5 B 12-May-2025
Lab Number:		3892810.27	3892810.28	3892810.29	3892810.30	3892810.31
Individual Tests						
Dry Matter	g/100g as rcvd	73	87	79	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	4	3
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	0.27	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	-	-	9	8
Total Recoverable Copper	mg/kg dry wt	-	-	-	18	14
Total Recoverable Lead	mg/kg dry wt	-	-	-	33	17.7
Total Recoverable Nickel	mg/kg dry wt	-	-	-	4	3
Total Recoverable Zinc	mg/kg dry wt	-	-	-	103	46
7 Heavy metals plus Boron						
Total Recoverable Arsenic	mg/kg dry wt	< 2	5	5	-	-
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.21	0.14	-	-
Total Recoverable Chromium	mg/kg dry wt	7	10	9	-	-
Total Recoverable Copper	mg/kg dry wt	5	22	15	-	-
Total Recoverable Lead	mg/kg dry wt	14.6	73	41	-	-
Total Recoverable Nickel	mg/kg dry wt	2	12	4	-	-
Total Recoverable Zinc	mg/kg dry wt	27	109	76	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.3	< 0.3	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Acenaphthene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-

Sample Type: Soil						
Sample Name:		TPAG15B 0.5-0.7m 12-May-2025	TPAG15C 0-0.1m 12-May-2025	TPAG15C 0.1-0.3m 12-May-2025	TBE 0.5 A 12-May-2025	TBE 0.5 B 12-May-2025
Lab Number:		3892810.27	3892810.28	3892810.29	3892810.30	3892810.31
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Anthracene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.014	0.016	< 0.013	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.032	< 0.028	< 0.030	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.032	< 0.028	< 0.030	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.014	0.018	< 0.013	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.014	0.011	< 0.013	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Chrysene	mg/kg dry wt	< 0.014	0.012	< 0.013	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Fluoranthene	mg/kg dry wt	< 0.014	0.015	0.016	-	-
Fluorene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.014	0.012	< 0.013	-	-
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.07	-	-
Perylene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Phenanthrene	mg/kg dry wt	< 0.014	< 0.012	< 0.013	-	-
Pyrene	mg/kg dry wt	< 0.014	0.018	0.013	-	-

Sample Name:		TBW 0.5 A 12-May-2025	TBW 0.5 B 12-May-2025	TBS 0.5 A 12-May-2025	TBS 0.5 B 12-May-2025	TBN 0.5 A 12-May-2025
Lab Number:		3892810.32	3892810.33	3892810.34	3892810.35	3892810.36
Individual Tests						
TCLP Weight of Sample Taken	g	50	-	-	-	-
TCLP Initial Sample pH	pH Units	7.2	-	-	-	-
TCLP Acid Adjusted Sample pH	pH Units	1.7	-	-	-	-
TCLP Extractant Type*		NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-	-	-
TCLP Extraction Fluid pH	pH Units	5.0	-	-	-	-
TCLP Post Extraction Sample pH	pH Units	5.1	-	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	16	5	7	5	5
Total Recoverable Cadmium	mg/kg dry wt	0.42	0.26	0.57	0.33	0.44
Total Recoverable Chromium	mg/kg dry wt	13	8	10	11	8
Total Recoverable Copper	mg/kg dry wt	31	12	36	25	23
Total Recoverable Lead	mg/kg dry wt	250	48	110	84	53
Total Recoverable Nickel	mg/kg dry wt	16	3	5	8	4
Total Recoverable Zinc	mg/kg dry wt	2,300	1,420	400	159	188

Sample Name:		TBN 0.5 B 12-May-2025	BG01 0-0.15m 12-May-2025	BG02 0-0.15m 12-May-2025	BG03 0-0.15m 12-May-2025	BG04 0-0.15m 12-May-2025
Lab Number:		3892810.37	3892810.38	3892810.39	3892810.40	3892810.41
Individual Tests						
Dry Matter	g/100g as rcvd	-	73	69	76	72
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.26	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	7	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	18	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	22	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	5	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	72	-	-	-	-

Sample Type: Soil						
Sample Name:		TBN 0.5 B 12-May-2025	BG01 0-0.15m 12-May-2025	BG02 0-0.15m 12-May-2025	BG03 0-0.15m 12-May-2025	BG04 0-0.15m 12-May-2025
Lab Number:		3892810.37	3892810.38	3892810.39	3892810.40	3892810.41
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	5	5	7	35
Total Recoverable Cadmium	mg/kg dry wt	-	0.31	0.23	0.30	0.44
Total Recoverable Chromium	mg/kg dry wt	-	9	7	8	9
Total Recoverable Copper	mg/kg dry wt	-	16	16	19	23
Total Recoverable Lead	mg/kg dry wt	-	21	18.5	22	30
Total Recoverable Mercury	mg/kg dry wt	-	0.12	< 0.10	0.12	0.11
Total Recoverable Nickel	mg/kg dry wt	-	4	5	4	5
Total Recoverable Zinc	mg/kg dry wt	-	61	76	68	117
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
alpha-BHC	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
beta-BHC	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
delta-BHC	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
gamma-BHC (Lindane)	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
cis-Chlordane	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
trans-Chlordane	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
2,4'-DDD	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
4,4'-DDD	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
2,4'-DDE	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
4,4'-DDE	mg/kg dry wt	-	< 0.014	< 0.014	0.013	0.031
2,4'-DDT	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
4,4'-DDT	mg/kg dry wt	-	< 0.014	< 0.014	0.015	0.021
Total DDT Isomers	mg/kg dry wt	-	< 0.09	< 0.09	< 0.08	< 0.08
Dieldrin	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Endosulfan I	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Endosulfan II	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Endosulfan sulphate	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Endrin	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Endrin aldehyde	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Endrin ketone	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Heptachlor	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Heptachlor epoxide	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Hexachlorobenzene	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014
Methoxychlor	mg/kg dry wt	-	< 0.014	< 0.014	< 0.013	< 0.014

Sample Type: Aqueous						
Sample Name:		TPAG14B 0.7-1.0m [TCLP extract]	TPAG14E 0.7-1.0m [TCLP extract]	TPAG14E 1.0-1.7m [TCLP extract]	TPAG14E 0.7-1.0m [SPLP extrcat]	TPAG14D 0-0.1m [SPLP extract]
Lab Number:		3892810.42	3892810.43	3892810.44	3892810.45	3892810.46
Individual Tests						
Total Boron	g/m³	-	28	-	16.2	0.33
Total Lead	g/m³	0.081	-	6.2	-	-

Sample Name:		TPAG14F 0.15-0.3m [SPLP extract]	TBW 0.5 A [TCLP extract]	TPAG14E 1.0-1.7m [SPLP Extract]
Lab Number:		3892810.47	3892810.48	3892810.49
Individual Tests				
Total Boron	g/m³	0.72	-	-
Total Lead	g/m³	-	-	0.193
Total Zinc	g/m³	-	14.7	-

Analyst's Comments

Amended Report: This certificate of analysis replaces report '3892810-SPv3' issued on 27-Jun-2025 at 3:30 pm.
Reason for amendment: Additional SPLP added.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed).	-	1-10, 12-41
Total of Reported PAHs in Soil	Sonication extraction, GC-MS/MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-10, 12-29
Dry Matter	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-10, 12-29, 38-41
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.024 mg/kg dry wt	1-10, 12-29
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.024 mg/kg dry wt	1-10, 12-29
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. US EPA 200.2 (modified), APHA 3125 B: Online Edition.	0.10 - 4 mg/kg dry wt	30-37
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. US EPA 200.2 (modified), APHA 3125 B: Online Edition.	0.10 - 4 mg/kg dry wt	38-41
7 Heavy metals plus Boron	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. US EPA 200.2 (modified), APHA 3125 B: Online Edition.	0.10 - 20 mg/kg dry wt	1-10, 12-29
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD analysis. Tested on as received sample. In-house based on US EPA 8081.	0.010 - 0.06 mg/kg dry wt	38-41
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.010 - 0.05 mg/kg dry wt	1-10, 12-29
SPLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1312.	-	7, 13-14, 17
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311.	-	3, 13-14, 32
SPLP Profile			
SPLP Sample Weight	Gravimetric. US EPA 1312.	0.1 g	7, 13-14, 17
SPLP Extractant Type*	US EPA 1312 (Modified for New Zealand conditions to use De-ionised Water unless otherwise specified).	-	7, 13-14, 17
SPLP Final pH	pH meter. US EPA 1312.	0.1 pH Units	7, 13-14, 17
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	3, 13-14, 32
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	3, 13-14, 32
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	3, 13-14, 32
TCLP Extractant Type*	US EPA 1311.	-	3, 13-14, 32
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	3, 13-14, 32
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	3, 13-14, 32

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	42-49
Total Boron	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.63 g/m^3	43
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.063 g/m^3	45-47
Total Lead	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.0021 g/m^3	42, 44
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00011 g/m^3	49
Total Zinc	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.053 g/m^3	48

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 23-May-2025 and 30-Oct-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Ara Heron BSc (Tech)
Client Services Manager - Environmental