



**State Highway 1 North
Canterbury - Woodend Bypass
Project (Belfast to Pegasus)
Ground Contamination Investigation**

Prepared for
Aurecon New Zealand Ltd and New Zealand
Transport Agency Waka Kotahi

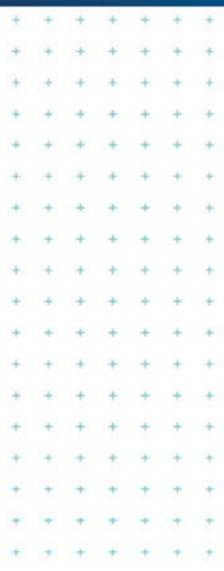
Prepared by
Tonkin & Taylor Ltd

Date
November 2025

Job Number
1095459 Rev F



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Document control

Title: State Highway 1 North Canterbury - Woodend Bypass Project (Belfast to Pegasus) – Ground Contamination Investigation					
File Name: 11320-AUR-0350-PWI-EN-RPT-0006[E]					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
August 2025	Rev A	Draft for NZTA comment prior to consultation	M Morley	P Walker	C Perks
September 2025	Rev B	Draft for pre-lodgement consultation	M Morley	P Walker	C Perks
October 2025	Rev C	Draft for NZTA review prior to lodgement, incorporating consultation feedback	P Walker	L Hine	C Perks
October 2025	Rev D	Final	P Walker	L Hine	C Perks
November 2025	Rev E	Revised to include additional investigation at Gladstone Road Landfill	G Palmer & S Guy	P Walker	C Perks
December 2025	Rev F	Minor revisions to project description	G Palmer & S Guy	P Walker	C Perks

Distribution:

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Acronyms, abbreviations and definitions

Acronym/term	Description
ACM	Asbestos containing material
ADP	Accidental discovery protocol
AST	Above ground storage tank
bgl	Below ground level
BTEX	Benzene, toluene, ethylbenzene and xylene
CLMG	Contaminated Land Management Guidelines
CLWRP	Canterbury Land and Water Regional Plan
CoC	Contaminants of concern
CSM	Conceptual site model
CSMP	Contaminated Site Management Plan
DQO	Data quality objective
Designation	As the context requires: <ul style="list-style-type: none"> Existing: The designation for the Project and State Highway 1 in an operative version of the Waimakariri District Plan. Proposed: The existing designation inclusive of the alterations sought by the NZTA shown in Volume 2C (conditions) and Volume 4D (boundaries) of the SAR.
DSI	Detailed site investigation
ECan	Environment Canterbury (Canterbury Regional Council)
FTAA	Fast-Track Approvals Act 2024
GMP	Groundwater Management Plan
HAIL	Hazardous Activities and Industries List
MfE	Ministry for the Environment
MBGL	Metres below ground level
NES-CS	Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
NoR	Notice of Requirement
NZTA	New Zealand Transport Agency Waka Kotahi
OCP / ONP / OPP	Organo-chlorine pesticides / organo-nitro pesticides / organo-phosphorous pesticides
PAH	Poly-cyclic aromatic hydrocarbons
Project	State Highway 1 North Canterbury – Woodend Bypass Project (Belfast to Pegasus) (the construction, operation and maintenance thereof)
Project Site (or Site)	The land contained within the area delineated as “Project Site” in Volume 4C of the SAR
PSI	Preliminary site investigation
QA/QC	Quality assurance/quality control
RPD	Relative percentage difference
SAR	Substantive Application Report (for the Project)
SAP	Sampling analysis plan

Acronym/term	Description
SCS	Soil contaminant standard
SH1	State Highway 1
SQEP	Suitably qualified experienced practitioner
TPH	Total petroleum hydrocarbons
T+T	Tonkin & Taylor Ltd
UCL	95 % Upper confidence limit
WDC	Waimakariri District Council

Management Plans

Acronym	Full management plan name
CSMP	Contaminated Sites Management Plan
GMP	Groundwater Management Plan

Executive summary

This Ground Contamination Investigation Report supports the Substantive Application Report (**SAR**) for the State Highway 1 North Canterbury – Woodend Bypass Project (Belfast to Pegasus), led by Waka Kotahi NZ Transport Agency (**NZTA**). The Project involves the construction of a 11 km four-lane motorway bypassing Woodend township, with associated infrastructure upgrades and environmental enhancements.

Tonkin & Taylor Ltd (**T+T**) undertook this investigation to assess ground contamination risks across the Project footprint. The investigation was conducted in accordance with Ministry for the Environment Contaminated Land Management Guidelines and by Suitably Qualified and Experienced Practitioners (**SQEPs**).

Building on previous investigations, walkover surveys, and review of historical land use data potential Hazardous Activities and Industries List (**HAIL**) sites have been identified within or adjacent to the Project Designation where the potential for ground contamination implications for the Project exists. Targeted sampling has occurred in two of these potential HAIL sites. For the potential HAIL sites that could either not be accessed, or where investigation is more appropriate after the removal of structures, investigations will be completed prior to construction. Pre-demolition surveys for hazardous substances will be required for buildings within the project designation.

For the majority of the project there is no evidence of contamination above background levels, and in these areas standard earthworks controls are likely to be appropriate. Contaminant concentrations in investigated areas are generally below thresholds for human health and groundwater protection. Soil contamination in the areas yet to be investigated is expected to be shallow and localised.

It is anticipated that contamination-related consents will be required under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 (**NES-CS**) and Canterbury Land and Water Regional Plan (CWLRP) to authorise construction related activities including soil disturbance, soil disposal and soil reuse.

During construction, potential adverse environmental effects associated with ground contamination will largely be mitigated by implementing standard earthworks controls, with additional focus on the segregation of contaminated and uncontaminated soils and management of stockpiles. Limits on the concentration of contaminants within stormwater discharges to surface water are proposed. Pre-construction groundwater sampling will be undertaken to identify what (if any) pre-treatment of dewatering water is required prior to discharge in areas of contamination risk.

Remediation of ground contamination is not expected to be required to enable the construction or use of the future road. Soil reuse within the Project is considered acceptable and will likely provide significant sustainability benefits by reducing soil transport and disposal and reduce the requirement for imported fill. The reuse of soil will be subject to conditions ensuring protection of surface water and groundwater. These conditions include limits on contaminant concentrations in soil, particularly within 20 m of a surface water. The extent to which excavated soils can be reused within the project will be reviewed once the investigation of potential HAIL areas is complete.

Controls and procedures to mitigate contamination-related risks to human health and the environment will be set out in a Contamination Site Management Plan (CSMP) and Groundwater Management Plan (GMP). These plans will also contain procedures to be followed in the event that unexpected contamination is encountered.

1 Introduction

1.1 General

The New Zealand Transport Agency Waka Kotahi (**NZTA**) proposes to construct, operate, and maintain the *State Highway 1 North Canterbury – Woodend Bypass Project (Belfast to Pegasus)* (the **Project**).

The Project will extend the SH1 Christchurch Northern Corridor between Belfast and Pegasus and spans a linear length of approximately 11 kilometres (**km**), commencing from approximately 600 m south of the Kaiapoi River Bridge and ending approximately 700 m north of the Pegasus/Ravenwood intersection. The Project includes upgrades to approximately 4 km of the existing SH1 and a new approximately 7 km bypass of Woodend township. Key features of the Project are shown in Figure 1.1 overleaf.

The purpose of the Project is to provide an efficient and reliable state highway connection between Belfast and Pegasus, while delivering improved access, community safety and public health outcomes, and reduced severance through Woodend.

This Ground Contamination Site Investigation report provides technical support to the Substantive Application Report (**SAR**) for applications made by NZTA under the Fast-track Approvals Act (**FTAA**).

This report summarises ground contamination investigations (current and previous) for the land within the Project, and where relevant for neighbouring properties. This report includes an assessment of ground contamination related implications for the construction of the Project.

This report has been undertaken in general accordance with MfE CLMG No. 1¹ and 5² for a Detailed Site Investigation. The persons preparing, reviewing and approving this report are suitably qualified and experienced practitioners (**SQEP**) as required by the NES-CS³ and defined in the NES-CS Users' Guide (April 2012)⁴.

While this is not a matter before the Environment Court, the authors of this report have each read the Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2023 ('Code'). The authors have each complied with the Code in the preparation of this report.

The data, information, facts and assumptions the authors have each considered as part of this report are set out in this report. The reasons for the conclusions of the report are also set out in this report. Unless stated otherwise, this report is within each of the authors' expertise and the authors have not omitted to consider material facts known to them that might alter or detract from the opinions expressed.

In describing the Project, the conditions observed, assessment of results etc. they are discussed **from south to north**.

¹ Ministry for the Environment (**MfE**) (revised 2021). Contaminated Land Management Guidelines No.1: Guidelines for Reporting on Contaminated Sites in New Zealand.

² MfE. (revised 2021). Contaminated Land Management Guidelines (**CLMG**) No. 5: Site investigation and analysis of soils.

³ Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.

⁴ MfE (2012). User's Guide: National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health.



Figure 1.1: Project alignment and key features of the Project.

1.2 Project description

A more comprehensive background and description of the Project is contained in the Substantive Application Report for the Project (**SAR**); please refer to the SAR for those details.

In summary the Project comprises:

- Existing State Highway 1 (**SH1**) Upgrades – Upgrade SH1 from approximately 600 m south of Kaiapoi River Bridge to the Cam River/Ruataniwha (a total distance of approximately 4 km), including:
 - Additional southbound lane – Between approximately 600 m south of the Kaiapoi River Bridge to the bridge itself. Note: The southbound lane extends beyond the Project Site to approximately 200 m south of the Ohoka Road Overpass, but these works are beyond the scope of the Project.
 - Kaiapoi River Bridge upgrades – Seismic strengthening and widening to provide additional southbound lane.
 - Four-lane upgrades – Upgrade the SH1 carriageway from two lanes to four lanes from Lineside Road Overpass to the Cam River/Ruataniwha.
- Woodend Bypass – A new four-lane motorway, bypassing Woodend township, from the Cam River/Ruataniwha to approximately 700 m north of the Pegasus/Ravenwood intersection (a total distance of approximately 7 km), including:
 - Cam River Bridge upgrades – A new bridge to the east of the current bridge (SH1 and southbound on ramp).
 - Williams Street interchange – A new interchange and SH1 overbridge at the existing intersection of Williams Street and SH1.
 - Quarry lakes embankment and southern remnant lake infilling - A new tiered embankment through two artificial lakes (formed through quarrying), including dynamic compaction. The southern lake created by the causeway will be filled and a wetland constructed in this area. Note: The initial (partial) reclamation is part of the Early Works consenting package.
 - Woodend Beach Road overbridge– A new local road bridge over SH1, including a realignment of and upgrades to Woodend Beach Road.
 - Gladstone Road overbridge – A new local road bridge over SH1, including upgrades to Gladstone Road.
 - Pegasus interchange – Remove existing roundabout at the intersection of SH1 / Pegasus Boulevard / Bob Robertson Drive and replace with a new grade-separated diamond interchange overpass, including traffic signals and local road upgrades including connection of Garlick Street to SH1.
- Project wide – Features and activities applying at various locations along the entire length of the Project (a total distance of approximately 11 km):
 - Stormwater infrastructure – swales, drains, culverts, and stormwater detention and treatment facilities.
 - Watercourse and drainage works – including the permanent realignment and culverting of portions of Waihora Stream, Taranaki Stream and McIntosh Drain.
 - Landscaping and planting – landscape features and planting.
 - Ecological offsetting and compensation – planting and wetland creation.
 - Noise mitigation – earth bunds and acoustic fences.
 - Utilities and services – relocation of existing utilities and installation of new utilities.
 - Road features and furniture – including but not limited to emergency bays, signage, and barriers.

- Construction works include:
 - Bulk earthworks (including cut and fill activities).
- Removal of dwellings and associated structures, removal of a number of agricultural buildings.
 - Ground improvement works.
 - Establishment of bridges, culverts, drainage, stormwater treatment and disposal systems, noise mitigation features, and other structures.
 - Temporary construction yards, buildings, and laydown areas.
 - Temporary haul roads, access points, and traffic management.
 - Temporary drainage and erosion and sediment control measures.
 - Landscaping and planting.
 - Pavements and surfacing.
 - Road furniture and ancillary works.
 - Site reinstatement and rehabilitation activities.

A comprehensive description of the proposed construction methodology is contained in the Construction Methodology Statement (Volume 3A); relevant construction details with regard to this assessment include:

- The Project will be constructed at grade, or on embankments along most of the route; the amount of cut will be limited and likely mostly comprise removal of topsoil.
- Local (existing) roads will be raised (embankments) for bridges over the carriageway.
- At the Gladstone Road Landfill (162 Gladstone Road, Woodend), the fill present above surrounding ground level will be cut. Deeper fill removal and replacement may be undertaken for geotechnical purposes. If deeper fill removal is required, dewatering may be needed. If deeper fill is geotechnically suitable to remain it will be compacted in-situ.
- Cut topsoil will be stockpiled within the designation adjacent to the carriageway, where it is anticipated it will be reused for landscaping purposes (i.e., cut soil is largely going to be reused near where it is cut from). The reuse of material is likely to provide significant sustainability benefits from:
 - Reducing transport of soil from the Project site to disposal facilities;
 - Reducing the use of valuable airspace in disposal facilities; and
 - Reducing the import of fill.
- Dewatering will be required in limited areas primarily for culvert construction.
- Construction activities which, from a ground contamination perspective are associated with the greatest potential for effects include:
 - Earthworks - dust generation, direct exposure to soils;
 - Reuse of contaminated soil - potential exposure of workers, effects on surface water/groundwater;
 - Dewatering - potential effects on receiving water quality; and
 - Retention, compaction works - effects on groundwater quality.

1.3 Investigation approach

This ground contamination site investigation has been undertaken as follows:

- A preliminary site investigation (**PSI**) report for the Project was prepared by Jacobs New Zealand Ltd in 2024 (see Section 3)⁵. This ground contamination site investigation has not duplicated/repeated the scope of the PSI, but it has cross checked aerial photographs and includes walkover observations (to extent accessible) (see Section 4) to identify areas of interest to be investigated.
- This checking process has eliminated some areas of interest previously identified and reported in the PSI by Jacobs, where they are outside of or unlikely to affect the Project. We summarise areas of concern/discounted areas in Section 5.
- Targeted soil and groundwater sampling (access permitting) has been completed in stages by Tonkin & Taylor Ltd (**T+T**) as part of this report (see Section 6).
- Based on available information we have assessed potential development implications, including soil retention/reuse for the Project (Section 8).
- We have also identified where additional investigation is necessary prior to construction to assess contamination conditions in areas that could not be accessed (see Section 8.5).

1.4 Objective and scope of work

This report provides ground contamination related technical support to the SAR for applications made by under the FTAA. It is anticipated that contamination-related consents will be required under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 (NES-CS) and Canterbury Land and Water Regional Plan (**CWLRP**) to authorise construction related activities including soil disturbance, soil disposal and soil reuse. This report provides an assessment of potential contamination-related environmental effects that could result from those activities and how those effects can be mitigated to be no more than minor.

The following tasks have been undertaken:

- Review of PSI information and other previous investigation reports (see Sections 3 and 5).
- Development of sampling and analysis plan (**SAP**), including a summary of areas requiring investigation.
- Targeted investigation works at three sites concurrently with the Project geotechnical investigation, comprising:
 - Observations of ground conditions;
 - Laboratory analysis of soil samples collected in the field for a range of contaminants of concern (**CoC**);
 - Installation of a groundwater monitoring bore at one site and collection of groundwater samples for analysis of potential CoCs; and
 - Assessment of the results recorded against various human health and environmental criteria to identify potential ground contamination related Project implications.
- Based on the investigation findings, and in the context of the proposed design and construction methodology, we have:
 - Updated the Project conceptual site model (**CSM**);

⁵ Jacobs New Zealand Ltd (05 November 2024). Preliminary Site Investigation – Belfast to Pegasus Motorway and Woodend Bypass.

- Assessed implications for the retention/re-use and/or offsite disposal of site soils, controls for construction workers handling them, and contamination-related dewatering effects (construction phase); and
- Summarised the ground contamination related resource consent requirements for the Project earthworks.
- Identified where additional investigation is necessary prior to construction to assess contamination conditions in areas that could not be accessed (see Section 8.5).
- Prepared this report, incorporating the information above.

2 Site description

2.1 Site setting

The Project route is generally flat and comprises predominantly rural land with urban areas at its southern (Kaiapoi) and northern (Woodend, Pegasus and Ravenswood) ends. There is an active quarry (North End Sand & Shingle Supplies) where the route intersects Willams Street, (north) Kaiapoi approximately 3 km north from the start point, this is the only notable industrial activity along the route. There are new commercial properties at the northern end of the route at the entrance into the Ravenswood subdivision.

The route intersects several residential and/or agricultural buildings that will need to be deconstructed as part of the Project (see Section 8.5).

2.2 Geology

The geology of the wider Canterbury Plains and Christchurch area comprises interbedded alluvial gravels and finer sediments deposited during past glacial and inter-glacial periods. The Canterbury Plains have typically been deposited in fluvial environments⁶. Nearer the coastal margins, the geology includes finer sediments associated with marine depositional environments.

The published geology for the Project area⁷ describes the near surface soils as alluvial silt, sand and gravel. Figure 2.1 shows the project alignment superimposed onto the mapped geomorphological units that comprise:

- Holocene aged dune sand described as coastal wind-blown sand of the Christchurch Formation (shown in green) are generally linear features, formed parallel to the coastline. These extend in a north-south orientation from Kaiapoi (Pines Beach) to beyond Pegasus to the north.
- These deposits are bounded by Holocene aged river deposits (shown in yellow) to the east, which comprise variably sorted gravel, sand, silt and clay mixtures. At the north end of the Project, a river channel extending west to east (labelled 'ya2' and 'ya3' in Figure 2.1) is present. This channel was a former flood channel of the Ashley River and in this area, a gravel layer is often observed in the top 3 m – 4 m of the soil profile. Raised river channel sediments and lower lying river sediments are shown adjacent to this channel and in these areas, the soil profile is expected to comprise silts and sands.

⁶ Brown, L.J. 2001. Canterbury groundwater. Chapter 23 in Groundwaters of New Zealand. Eds M.R. Rosen & P.A. White.

⁷ Forsyth, P.J.; Barrell, D.J.A.; Jongens, R. (compilers) 2008: Geological Map of Waitaki. Institute of Geological & Nuclear Sciences 1:250,000 geological map 19. GNS Science.

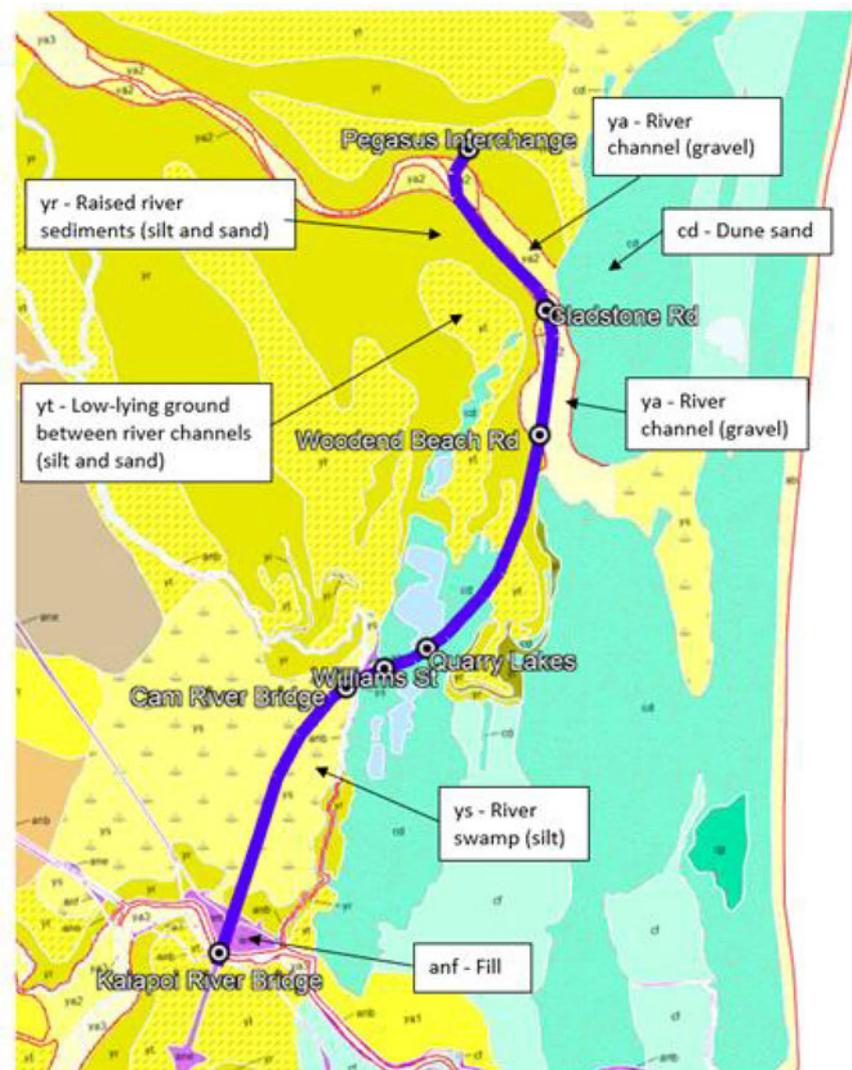


Figure 2.1: Surface geology and geomorphological units of the Project area (refer to Hydrogeology Assessment Volume 3K).

2.3 Hydrology

Several named and unnamed watercourses/surface water bodies intersect the Project route, including (listed from south to north). These are described in detail in the Ecological Impact Assessment (Volume 3I):

- Kaiapoi River
- Cam River/Ruataniwha
- Quarry lakes
- McIntosh Drain
- Waihora Stream
- Taranaki Stream

Along the Project route, surface water bodies have ecological value and in some cases are used for recreational purposes. Therefore, from a contaminated land perspective, surface water is treated as a sensitive receptor.

2.4 Hydrogeology

The Project hydrogeological conditions are detailed the Hydrogeological Assessment (Volume 3K), and in summary comprise:

- Most of the Project overlies the mapped coastal confined gravel aquifer system that consists of a sequence of gravel aquifers of increasing depth, deposited during glacial periods.
- These gravel aquifers are confined by deposits of postglacial and interglacial finer grained sediments which progressively thin inland from the coast.
- In general, the coastal confined aquifer system transitions into the unconfined and semiconfined aquifer system to the west (ranging from approximately <50 m to 2 km from designation). The western edge of the coastal confined system is delineated by the line where sediments of the uppermost overlying confining layer are 3 m thick. The exceptions to this are at the Lineside Road, Smith Street – SH1 intersection, and the quarry lakes (proximity to Pineacres area, William Street, SH1 intersection) where these areas are part of the unconfined system.
- In the Project area, the water table is typically less than 2 m below ground level (**bg**l).
- Regionally, the groundwater flow direction within the gravel aquifers is east, towards the coast. However, there is variation in groundwater flow direction locally across the plains.
- There are two community drinking water protection zones that intersect the designation. They are operated by Waimakariri District Council (**WDC**) and comprise two supply bores at Hakarau Road, south-east of the Lineside Road/Smith Street – SH1 intersection. These bores (Environment Canterbury (**ECan**)) references M35/11908 and M35/11909) are approximately 150 m deep with response zones at >140 mbgl. Due to the depths from which these bores abstract and their locations relative to the Project they will not be affected by shallower Project-related ground disturbance.
- Other research⁸ documents the existence of at least 65 registered bores in a 400 m buffer of the Project route used for water supply purposes (e.g., domestic, community, public, stock, irrigation usage), with depths ranging from 3 to >150 mbgl.

⁸ Pattle Delamore Partners Ltd, 17 April 2025 – Memorandum, PDP to NZTA – Results from bore Use survey along the proposed SH1 Belfast to Pegasus motorway and Woodend bypass alignment.

3 Previous investigations

3.1 MWH (2013)

In August 2013 MWH New Zealand Ltd (MWH) prepared a site investigation report⁹ for the NZTA as part of the Notice of Requirement (**NoR**). The report documents desk-based and soil sampling investigations completed by MWH at 162 Gladstone Road (Gladstone Road Landfill) and 189 Woodend Beach Road (former DJ Elder Blackcurrants).

3.1.1 162 Gladstone Road (Gladstone Road Landfill)

MWH identified that the site was excavated for shingle for local roads in the mid-1930s. The open excavation was reportedly initially used as a local hardfill dump until the early 1970s.

Ten test pits were excavated at the site to a maximum depth of 4 m below ground level (mbgl) (ground level existing at that time). Composite soil samples were collected from each test pits and analysed for a range of contaminants including metals, petroleum hydrocarbons and organochlorine pesticides. Samples were not collected for asbestos analysis.

Site photos at time of investigation show a grassed surface with perimeter raised bund. Some localised fly-tipping is evident. Test pit photos show predominantly soil/sand/gravel material with incidental brick and concrete, metal. Test pit logs indicate presence of road seal, blackened soils, wood, organic matter, plastic, and that fill may be between 1.5 and 3 m deep. MWH reported that the fill material contained less than 5 % waste (which we infer to mean anthropogenic material).

Soil analytical results indicate the presence of metals (principally lead) above published background concentrations but well below commercial/industrial land use standard and ecological assessment criteria (ANZECC 2000 sediment quality guidelines). The soil analysis results should be treated with caution as each sample was a composite of the full depth of the respective test pit, and due to the absence of asbestos analysis (asbestos being a common contaminant in uncontrolled hardfill disposal).

3.1.2 189 Woodend Beach Road

MWH reported that the site was used as horticultural land prior to 1985 and continued to be used as a market garden for the production of blackcurrants at the time of the MWH report preparation.

Four soil samples were collected at 0.1 and 0.5 mbgl from two test pits excavated to 0.5 mbgl within the wider property (locations not specified). All four soil samples were analysed for metals and organochlorine pesticides; contaminants were not detected above published background concentrations.

The soil analysis results should be treated with caution given the limited amount of sampling completed and because the location of sampling with respect to the project is not known.

3.2 Jacobs (2024) PSI

The PSI reported on the Project setting from a contaminated land perspective including (information summarised only):

⁹ MWH New Zealand Ltd. *Woodend Corridor Investigation Site Investigation Reports for Compliance with NES Requirements*. Ref Z1873603. August 2013.

- Based on the review of available historic aerial photographs and review of ECan’s listed land use register (**LLUR**), the PSI reported on activities intersecting or bordering the Project where there was the potential for ground contamination, including waste disposal to land, landfilling, horticulture, graveyards, livestock treatment (list not exhaustive).
- Because of access constraints, no walkover observations were undertaken, and no soil or groundwater sampling was completed.
- A preliminary CSM identified potential human health and/or environmental effects during construction associated with:
 - 1 landfill site and potential presence of asbestos in soils, heavy metals, and hydrocarbon compounds;
 - 1 location associated with storage and use of fuel, motor vehicle workshops and presence of hydrocarbons and heavy metals;
 - 5 locations/activities associated with use of asbestos building products, lead based paints, waste disposal to land and presence of asbestos in soil and heavy metals; and
 - 4 locations associated with horticultural and/or livestock treatment and the use of persistent pesticides.
- The PSI concluded these locations required further investigation to understand the contaminated land related risks for the Project construction and operation.

The Jacobs PSI is included in **Appendix A**.

3.3 Kirk Roberts (2024, 2025) - Gladstone Landfill

3.3.1 DSI December 2024

In December 2024 Kirk Roberts Consulting (Kirk Roberts) was engaged by the owner of the land parcel on which the Gladstone Landfill is located to undertake a Detailed Site Investigation (**DSI**), in response to an abatement notice issued by ECan regarding unauthorised waste disposal and burning at the site.

Kirk Roberts identified that the site had been subject to filling since its acquisition in 2002. The filling reportedly primarily comprised waste material from drains in the district although some stockpiles of hardfill (soil and spoil from building excavations) were also present on site. Kirk Roberts also identified two burn piles, which had reportedly been present on site since 2010 and 2022 respectively. A perimeter bund comprising material placed on site had also been created since 2022, which extended up to 3 m above surrounding ground level in places.

A site investigation comprising the excavation of 22 test pits was completed by Kirk Roberts across the landfill and perimeter bunds. Soil samples were submitted from 16 test pits for laboratory analysis for metals, asbestos, PAH and TPH. In summary the analytical results were:

- Asbestos was not detected in any of the samples analysed.
- Metals were typically detected above background concentrations but below commercial industrial land use standards with the exception of arsenic within samples collected from the two burn pits.
- PAH were detected below published background concentrations, TPHs were detected close to the limit of detection.

Kirk Roberts identified two areas on the landfill, corresponding to the visible extents of the burn pits where soil removal would be required to remove soil from site containing contamination above commercial/industrial land use standards (a requirement of the ECan abatement notice). Based on the sampling results for these areas the depth of removal required was estimated as 0.4 - 0.5 mbgl.

3.3.2 SVR June 2025

Kirk Roberts subsequently observed the excavation and offsite disposal of soils from the two burn pit areas and presented the findings of remedial observations and validation sampling in a Site Validation Report (SVR).

The area of excavation was based on visual observation of burn residue (ash, burnt wood, steel), and each area was excavated to approximately 0.4 mbgl. Soil samples were collected from surface materials remaining within the area of excavation and analysed for arsenic. Arsenic concentrations within the soil samples analysed were below commercial/industrial land use standards. On this basis Kirk Roberts concluded that remediation of the site with respect to compliance with the ECan abatement notice had been achieved.

4 Project walkover

The Project walkover focused on locations/activities of interest reported in the PSI and/or identified from T+T's review of recent aerial images (e.g., Google maps, Google Street View, online historical aerial images¹⁰).

The Project walkover targeted areas of potential contamination (e.g. buildings, areas of ground disturbance). Paddock areas, with a low potential for ground contaminating activities were typically not walked over. Walkover observations included the exterior of buildings (e.g., age, type, uses) and condition, storage/use of hazardous materials, composition/types of stockpiled materials, and evidence of possible ground contamination. T+T's observations of exterior building materials and condition do not constitute an asbestos survey in accordance with the Health and Safety at Work (asbestos) Regulations 2016.

4.1 Observations

Observations of site conditions along the route were undertaken during May and June 2025 and photographs illustrating site conditions are presented in **Appendix B** with Figures 4.1 to 4.4 illustrating key locations/observations including:

- Land use along the Project route is primarily agricultural, with the existing SH1 carriageway present from the Cam River bridge to Kaiapoi River, and quarry lakes at the Williams Street, Kaiapoi intersection (a.k.a. Pineacres).
- There are domestic and agricultural buildings along the route that are constructed with various building materials.
- Based on the age of construction and/or their maintenance/renovation of these buildings, the presence of asbestos containing materials (**ACM**), and/or use of lead-based paints cannot be discounted. Building materials observed include sheet metals, suspected cement sheet ACM, concrete block, and stucco cladding. The buildings were in various states of repair including dilapidated.
- Different types of material were stored/stockpiled at several locations along the route including scrap metal, agricultural equipment, drums (rusted, no labels, empty or contained water), and domestic objects.
- Particular features of note (listed from south to north) and shown in Figures 4.1-4.4:
 - At 176 Woodend Beach Road, and at the footprint of a former dwelling, modern building materials including concrete were observed (dwelling was present from c. 2010 to approximately 2022);
 - Hummocky ground associated with a moto-cross track is present at 167 Gladstone Road, Woodend. Fill material of an unknown origin has been used to form the track, including concrete;
 - There are livestock pens (but not used for dipping/treatment and present since only ~2005) at 189 and 196 Gladstone Road, Woodend;
 - Vegetated soil stockpiles/bunds were observed at 162 Gladstone Road, Woodend (the Gladstone Road Landfill). Additional observations made in this area are detailed in Section 6.5;
 - At 160 Gladstone Road, there is a small (approximately 1,000 L capacity) diesel above ground storage tank (**AST**), located over unsealed ground in front of an agricultural building;

¹⁰ <https://canterburymaps.govt.nz/>

- Stockpiled soils from subdivision earthworks for Woodlands Estate Subdivision at 130B Main North Road, Woodend;
- Historic homestead (dilapidated) in area of dense vegetation at 130B Main North Road (Burnett Family Homestead);
- At 138 Main North Road, Woodend, small (<2 m²) burn pile and stockpiling of domestic materials (e.g., mattress, pieces of whiteware) were present;
- Two service stations at the entrance to the Ravenswood development, Woodend; and
- Pegasus Golf Club borders three parts of the designation, but no greens or fairways coincide with this.

4.2 Inaccessible areas

At the following locations and for the following reasons, access for observations and/or investigation was not possible (at the time of this investigation, but will be granted prior to construction):

- 160 Gladstone Road, Woodend – diesel AST (access to walkover granted, but access for purposes of soil sampling not granted).
- 167 Gladstone Road, Woodend – moto-cross track - fill of unknown origin (access to walkover granted, but access for purposes of soil sampling was not granted).
- 5 Wards Road, Woodend (access (presently) not granted).

4.3 Summary

Walkover observations noted several locations additional to those reported in the PSI where activities could be a source of potential ground contamination. The locations identified in the PSI are included in **Appendix C**. The additional locations identified by T+T are:

- Former agricultural buildings – 788 Main North Road.
- Moto-cross track is present at 167 Gladstone Road, Woodend.
- Diesel AST and associated farm buildings at 160 Gladstone Road, Woodend.
- Existing and former dwellings/buildings at:
 - 130B Main North Road;
 - 1 Fullers Road;
 - 189 Woodend Beach Road; and
 - 176 Woodend Beach Road.
- Stockpiled soils from the Woodlands Estate Subdivision, 130B Main North Road, Woodend.
- Miscellaneous materials stockpiled, burn pits (small, localised, <2 m²), and existing buildings, 138 Main North Road.

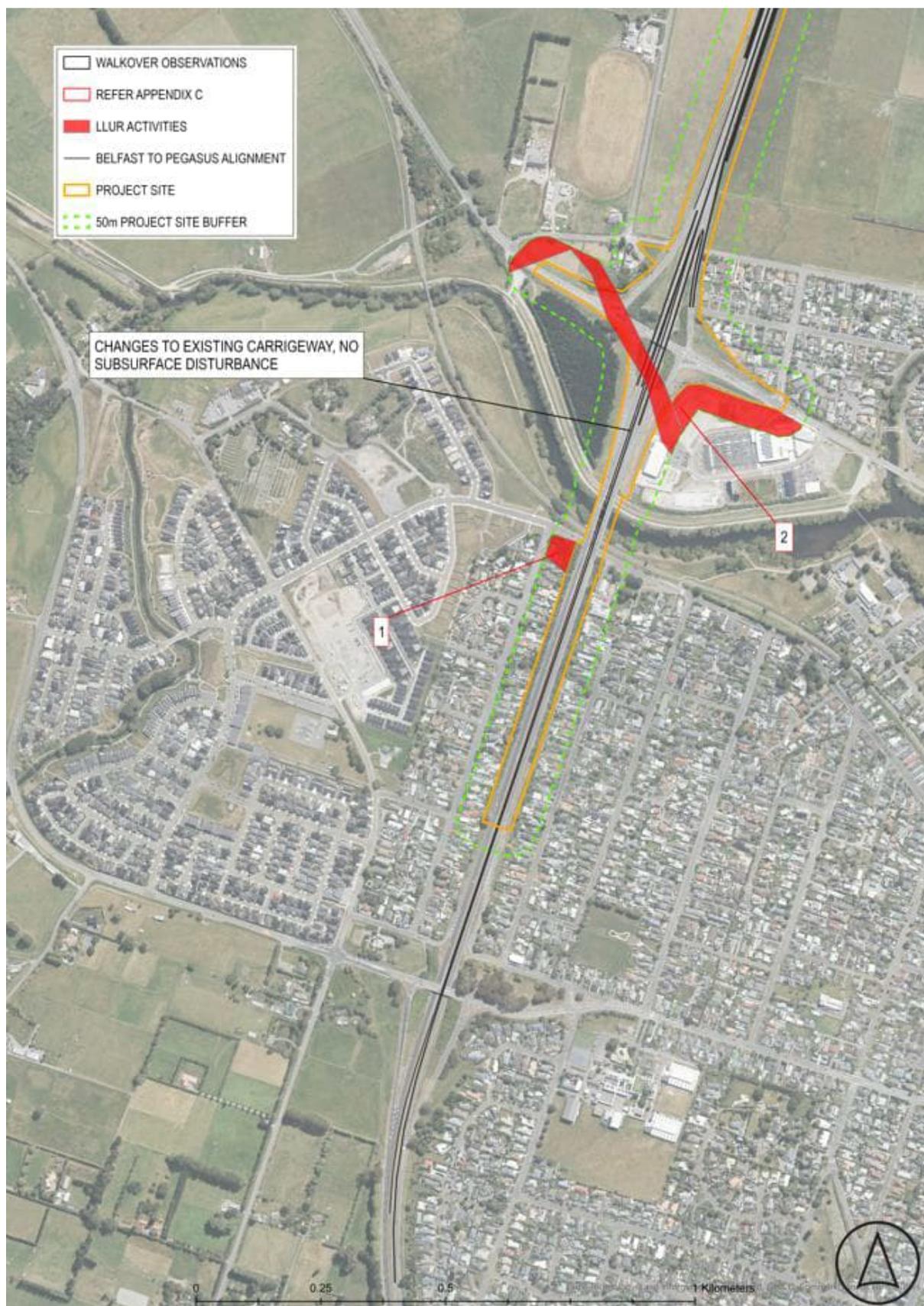


Figure 4.1: LLUR/HAIL activities and walkover observations (1 of 4).



Figure 4.2: LLUR/HAIL activities and walkover observations (2 of 4).

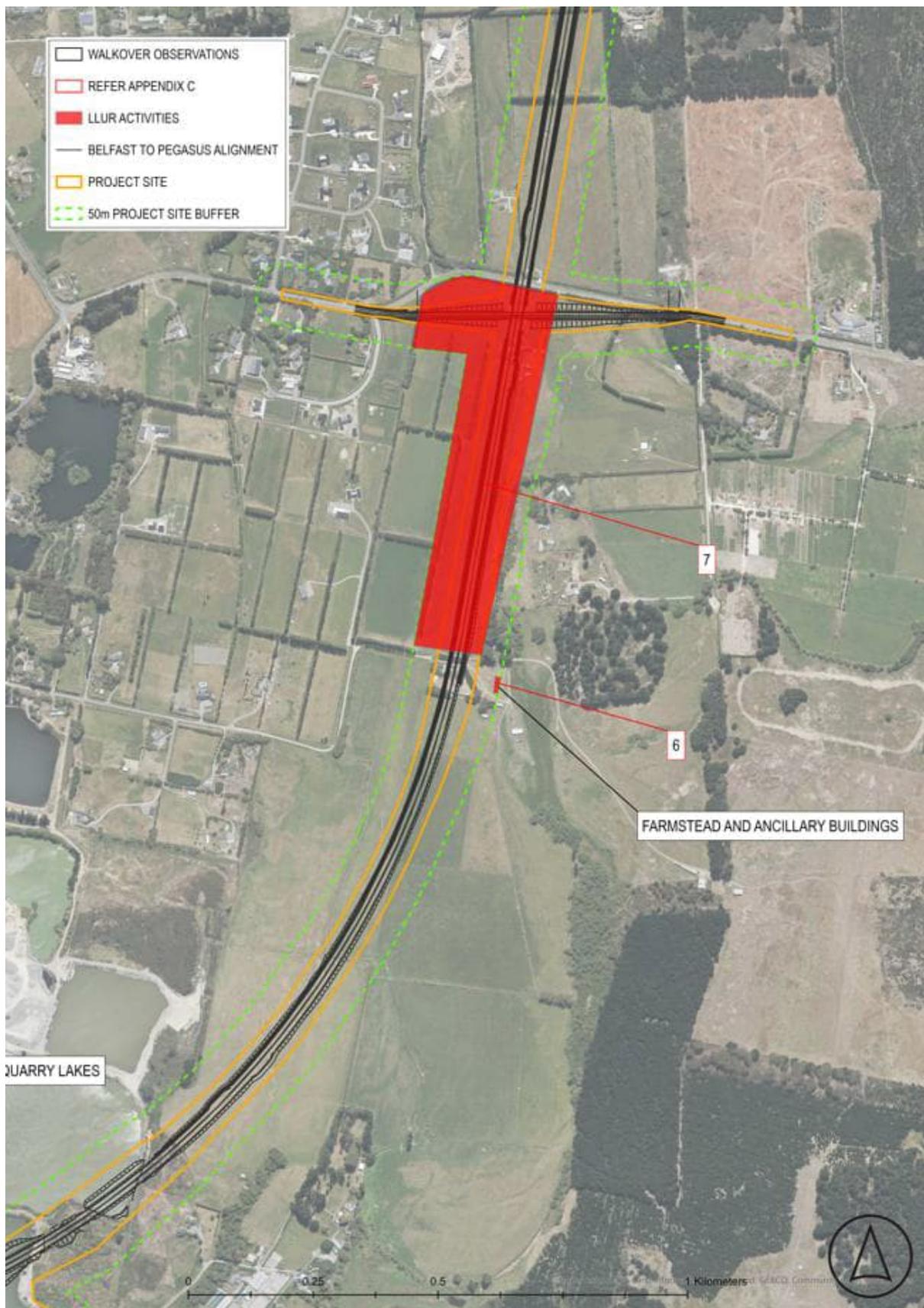


Figure 4.3: LLUR/HAIL activities and walkover observations (3 of 4).

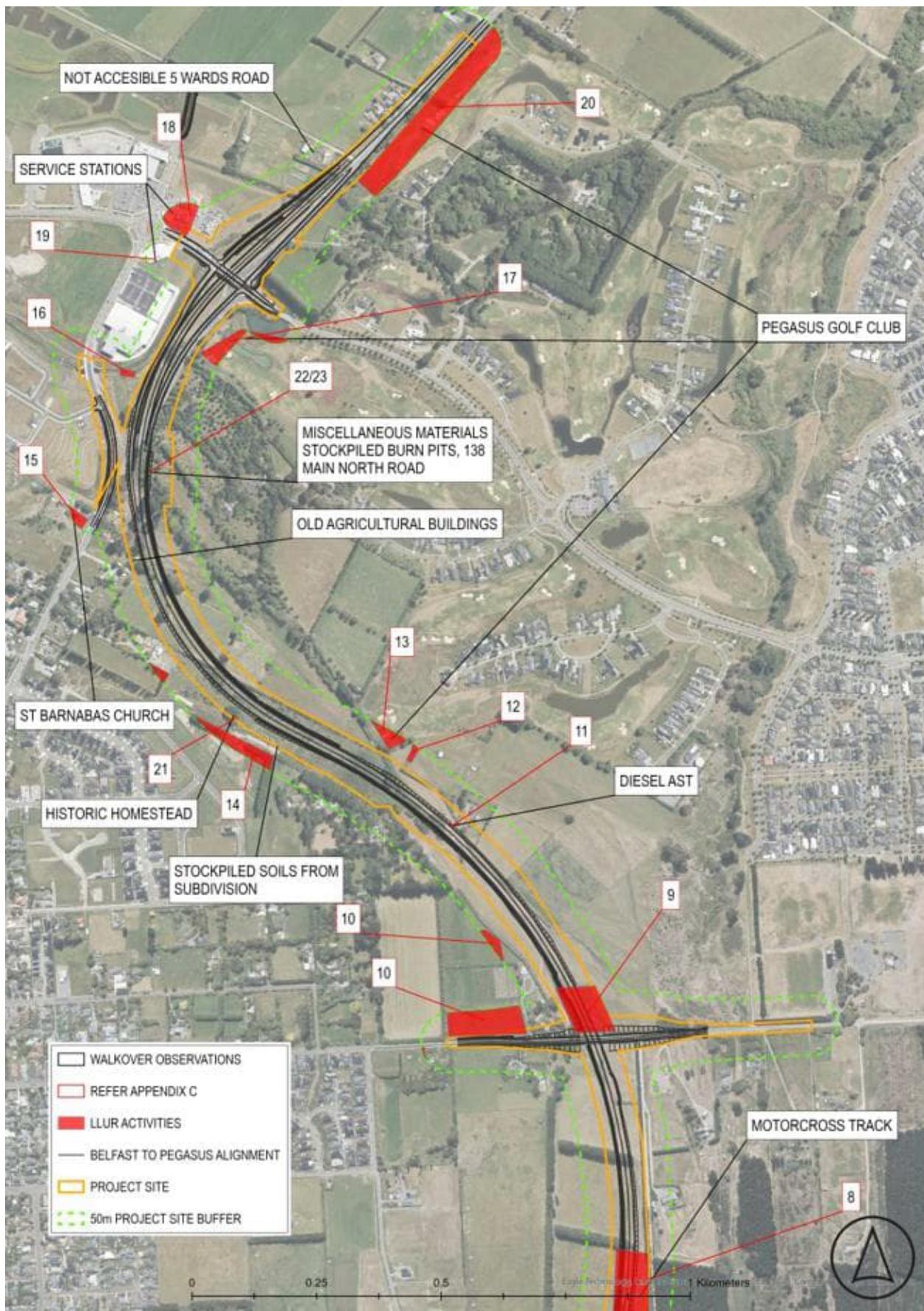


Figure 4.4: LLUR/HAIL activities and walkover observations (4 of 4).

5 Potential sources of contamination

5.1 Locations of interest

Appendix C presents a tabular summary of potential sources/areas of contamination within and in proximity to the Project. This includes potential or known HAIL activities in proximity to the Project that were identified by Jacobs in the PSI, and potential HAIL areas identified by T+T.

T+T has then screened these areas to identify 'Locations of interest' for further investigation. Locations of interest are those where suspected or known ground contamination exists within the designation or within a 50 m buffer of the designation based on our review of available site use information. The 50 m buffer has been selected by T+T as activities further than this from the designation are considered unlikely to have affected soil or groundwater within the designation on the basis that:

- The activity is associated with surficial contamination processes, for example horticultural activities and there is no feasible pathway linking them with the Project.
- Beyond likely effects of spray drift of pesticides.
- The activity is hydro-geologically down or cross gradient of the Project and low likelihood of affecting soil or groundwater quality within the Project earthworks.

Appendix C is colour coded to identify:

- The Locations of Interest which were subsequently investigated (through soil sampling) as part of this investigation.
- The Locations of Interest that could not, for access reasons, be investigated as part of this investigation or were more appropriately investigated following removal of structures and will therefore require investigation prior to construction.
- Areas of potential contamination that are not within 50 m of the Project buffer and therefore not considered further as part of this investigation. Areas excluded include some areas of potential contamination identified in the Jacobs PSI.
- Potential sources of groundwater contamination located up gradient of the Project but in areas where no project dewatering is required or groundwater is too deep to be encountered by workers during construction. These areas are therefore not considered further as part of this investigation.

Figures 5.1 to 5.3 show the Locations of Interest.

5.2 Summary

In summary the following areas/activities are considered to have a potential for ground contamination implications for the Project:

Table 5.1: Locations of interest

Location	Address	Quick reference name	HAIL
4	788 Main North Road, Kaiapoi – livestock dip	Area A	Onsite HAIL A8, intercepted by earthworks.
7	189 Woodend Beach Road, Woodend – former <i>DJ Eder Blackcurrants</i>	Area B	Onsite HAIL A10, intercepted by earthworks.
8	167 Gladstone Road, Woodend - <i>moto-cross track</i>	Moto-cross track	Potential HAIL G5, to be intercepted by earthworks.
9	162 Gladstone Road, Woodend – <i>Gladstone Road Landfill</i>	Area D	Onsite HAIL G3, to be excavated in full or partially as part of the works.
11	160 Gladstone Road, Woodend	Diesel AST and associated buildings	Onsite HAIL A17, intercepted by earthworks. Potential HAIL E1, I to be intersected by earthworks.
14	c/o 70 Parsonage Road, Woodend – <i>Woodlands Estate Subdivision</i>	Woodlands stockpiles	Onsite HAIL A10 and G5, to be intercepted by earthworks.
23	138 Main North Road miscellaneous materials	138 MNR-misc	Potential HAIL G5, E1, I to be intercepted by earthworks.
5, 6, 21, 22	788 Main North Road, Kaiapoi, agricultural buildings, 1 Fullers Road dwelling and associated outbuildings, 130b Main North Road historic homestead, 138 Main North Road buildings	788 MNR buildings, 1FR, 130b MNR, 138 MNR,	Potential HAIL E1, I to be intercepted by earthworks.



Figure 5.1: Locations of interest (1 of 3).

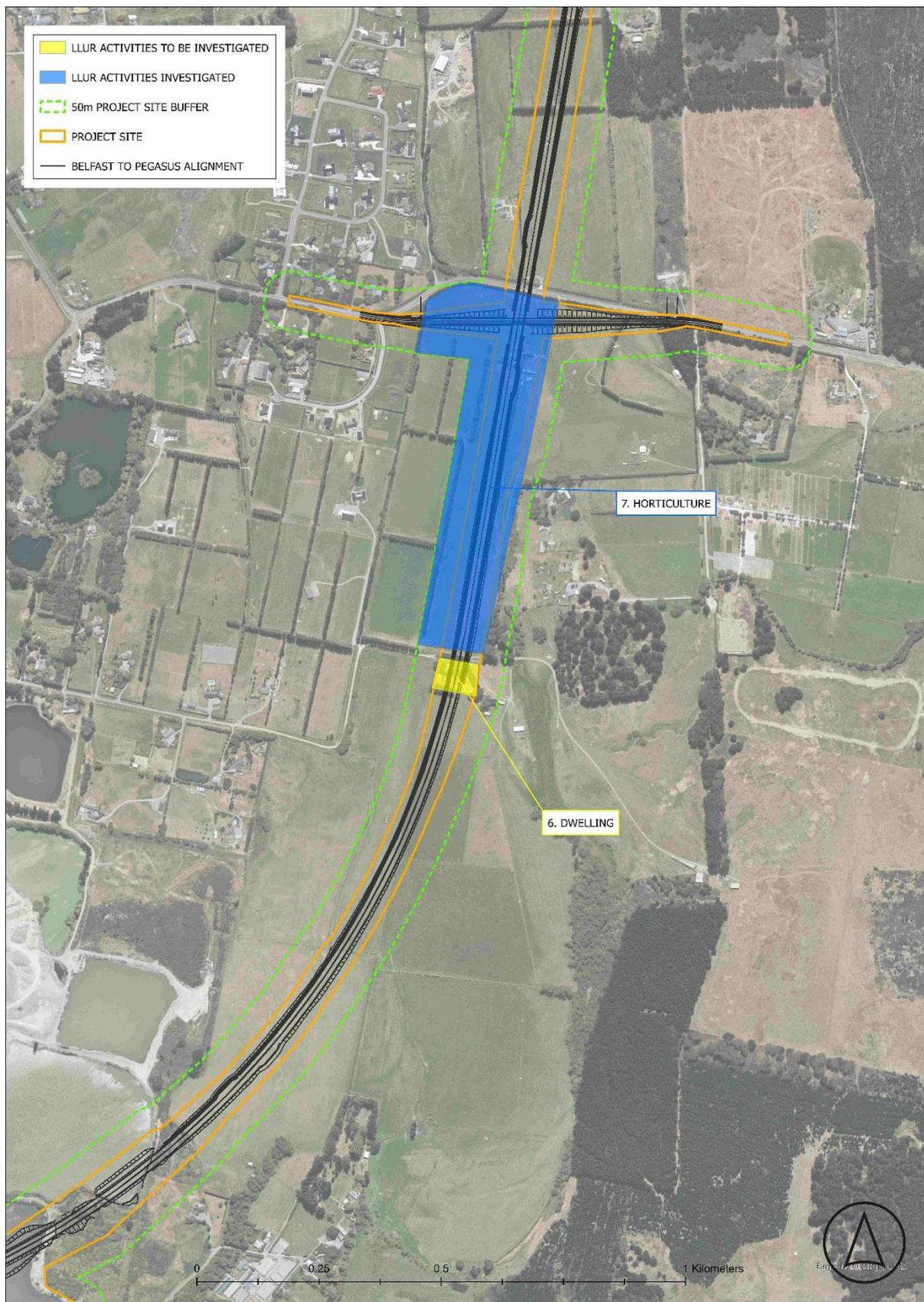


Figure 5.2: Locations of interest (2 of 3).

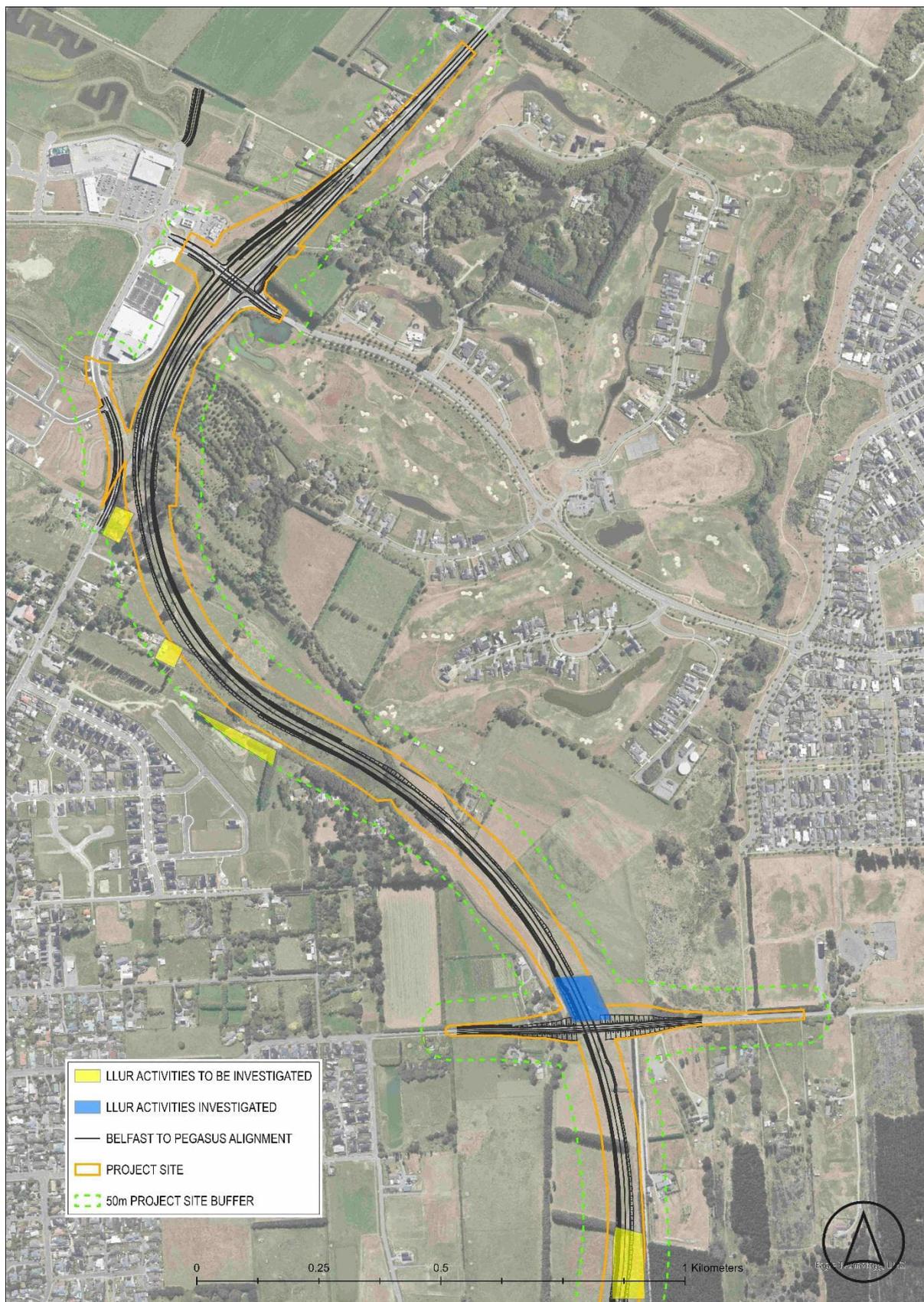


Figure 5.3: Locations of interest (3 of 3).

6 Site investigation

6.1 Introduction

Using the information sources and rationale detailed in Sections 3, 4, 5 and Appendix C, Locations of Interest were identified as requiring investigation to characterise contaminant conditions.

Investigations were undertaken at three Locations of interest:

- Area A – livestock dip (788 MNR) – soil sampling from 9 hand dug test pits/augers to 0.3 to 1 mbgl.
- Area B – 189 Woodend Beach Road (formerly DJ Elder Blackcurrants) – soil sampling from 10 hand dug test pits to 0.3 mbgl.
- Area D – Gladstone Road Landfill (162 GR) – soil sampling from seven machine dug test pits/boreholes/trenches and three hand augers, to up to 5.8 mbgl, and water sampling from one groundwater monitoring bore.

Table 6.1 summarises the investigation rationale and scope for each of these Locations of Interest.

Investigation of other areas of interest were either not possible due to access constraints (e.g. Moto-cross track) or were deferred to following clearance of structures (e.g. where dwellings/farm structures are present).

Table 6.1: Investigation locations

Location of Interest	HAIL	CoC(s)	Potential extent	Investigation type, depth
Investigated as part of this DSI				
788 Main North Road, Kaiapoi Area A	A8 – livestock dip	<ul style="list-style-type: none"> • heavy metals¹ • pesticide screen² 	In soil – surficial and/or at base of former dip (depth unknown). Decreasing contamination with depth (unless soils have been disturbed)	Test pits (hand dug), target depth 1 mbgl
189 Woodend Beach Road, Woodend – former DJ Elder Blackcurrants Area B	A10 – horticulture, persistent pesticides	<ul style="list-style-type: none"> • heavy metals • pesticide screen 	In soil – surficial, decreasing contamination with depth unless soils have been disturbed)	Test pits (hand dug), target depth 0.3 mbgl

Location of Interest	HAIL	CoC(s)	Potential extent	Investigation type, depth
162 Gladstone Road, Woodend – Gladstone Road Landfill Area D	G3 – Landfill	<ul style="list-style-type: none"> heavy metals pesticide screen hydrocarbons³ asbestos 	In fill soil and underlying natural soil. In groundwater – if high levels of contamination in soil is identified in soil and if shallow groundwater is encountered.	Test pits and boreholes (machine dug), target depth – natural ground. Trenches (machine dug), target depth – ground level. Hand augers, target depth - 0.2 mbgl. Groundwater sampling from one borehole.

Notes

¹ Arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

² Organo-chlorine pesticides (OCP), organo-nitro pesticides (ONP), organo-phosphorous pesticides (OPP).

³ Total petroleum hydrocarbons (TPH) and poly-cyclic aromatic hydrocarbons (PAH).

6.2 Sampling analysis plan, data quality objectives

The DSI's data quality objectives (DQO) are discussed in Table 6.2.

Table 6.2: Data quality objectives for investigated areas

Data objective	Discussion	Investigation rationale action
Investigation and sampling density/location – address variable distribution of contamination in soil	<p>Areas A and B</p> <ul style="list-style-type: none"> Principal sources of on-site contamination are from a livestock dip and horticultural land uses/activities. Contamination associated with horticultural activities primarily in surface soils. Contamination associated with livestock dip may be at surface and in subsurface depending on point of loss from dip. <p>Area D</p> <ul style="list-style-type: none"> Source of contamination is uncontrolled filling including potential waste materials. Contamination extent not fully investigated, and some CoCs not analysed previously. 	<ul style="list-style-type: none"> General coverage where activity and designation coincide. For Area D, investigation targets areas/depths and CoCs not assessed in previous investigations done by others. Where possible, locations coincide with geotechnical investigation locations. Samples to be collected and analysed at selected depths at each of the locations to reflect different material types encountered. For Area D, samples collected at a variety of depths to characterise the fill. At Area D, groundwater samples collected across two days to assess to potential for groundwater contamination. Analysis for CoCs.
Data assessment	<ul style="list-style-type: none"> Appropriate assessment of laboratory data for the project. 	<ul style="list-style-type: none"> Use of NES-CS soil contaminant standards (SCS) and guidelines incorporated by reference and selected environmental criteria based on primary ecological receptors.

6.3 Methodology

6.3.1 Areas A, B and D

Ground investigation and soil samples were undertaken and collected in general accordance with CLMG No.05, with soil samples collected according to the following procedures:

- The materials encountered during intrusive investigations were logged in general accordance with the NZ Geotechnical Society 'Guidelines for the classification and field description of soils and rocks for engineering purposes'.
- Freshly gloved hands were used to collect soil samples from the test pit side walls, hand auger.
- Samples were placed immediately into laboratory supplied glass jars or plastic containers.
- Non dedicated sampling equipment used (with the exception of the excavator bucket) was decontaminated between sample locations using potable water (from the reticulated supply) and Decon 90 (a phosphate-free detergent). For samples collected from machine-excavated soils, care was taken to collect soil that had not come into direct contact with the excavator bucket or previously excavated material.
- Samples were shipped in chilled containers to Hill Laboratories, Christchurch under chain of custody documentation.

6.3.2 Area D

In addition to the methodology described above, the following procedures were also followed for the investigation in Area D:

- Groundwater samples were collected from one groundwater monitoring bore (BH38) over two days (five days apart) using a peristaltic pump and freshly gloved hands.
 - Volatile contaminants were tested when opening the bore cap using a photoionisation detector (PID);
 - The groundwater well was dipped prior and post sampling; and
 - Field parameters (pH, electrical conductivity, dissolved oxygen, redox, and temperature) were monitored until they stabilised.
- Samples were placed immediately into laboratory supplied bottles and delivered in chilled containers to Hill Laboratories, Christchurch under chain of custody documentation.

6.4 Assessment criteria

Soil analytical results have been assessed against the following human health and environmental assessment criteria:

Construction and future maintenance worker¹¹ exposure criteria:

- Commercial/ industrial land use NES-CS SCS and guideline values incorporated by reference (as a conservative proxy for outdoor worker protection). These have been selected on the basis of the future land use being a road, with human exposure to contaminants in soils only occurring during construction and maintenance activities.

To assess applicability of NES-CS:

- Published background¹² and adopted ambient concentrations for the Christchurch area.

¹¹ e.g., landscaping and excavation activities (e.g., replacing manhole).

¹² ECan GIS, Trace Elements Level 2.

Offsite disposal criteria:

- Published background and adopted ambient concentrations to provide an initial assessment of the potential for surplus soil to be disposed of as cleanfill.
- Acceptance criteria for local managed fill facilities as potential locations for the offsite disposal of material surplus to the project.

Environmental criteria for soil reuse/retention:

- Freshwater/terrestrial effects
 - Default Guideline Values (DGVs) for toxicants in sediment¹³. These criteria have been selected in preference to values protection of terrestrial ecology as sediment quality guidelines are lower than those for terrestrial receptors and therefore likely to be protection of both terrestrial and freshwater receptors (both via leachate discharge and sediment discharge to surface water).
- Protection of groundwater quality
 - Leaching to water criteria derived for a Class 4 fill facility¹⁴ have been used to assess potential effects on groundwater quality from contaminants in soil. These have been selected as they are derived from New Zealand Drinking Water Standards¹⁵ for a fill facility where there is no requirement for engineered containment and limited restrictions on siting. These criteria assume a 20-fold pore water dilution of leachate generated from the infiltration of rainfall through contaminated soils.

Note that the 'adopted' Waste Acceptance Criteria (WAC) in the WasteMINZ Technical Guidance for a Class 4 fill facility have not been selected as assessment criteria as they are typically based on protecting human health in a residential land use scenario or terrestrial ecology, neither of which are considered key receptors within the Project site.

Groundwater analytical results have been assessed against the following human health and environmental assessment criteria, to assess the magnitude of groundwater contamination (if any) and to assess controls for dewatering, if required:

- New Zealand Drinking Water Standards - Maximum Acceptable Values (MAVs) for the protection of human health.
- Default Guideline Values (DGVs) for 90 % and 95 % protection of freshwater species¹⁶, applicable for assessing groundwater quality for the purpose of dewatering and discharge to the environment.
- Environment Canterbury water quality limits for groundwater¹⁷, applicable for assessing groundwater quality.

¹³ Australian and New Zealand default guideline values for toxicants in sediment. <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/sediment-quality-toxicants>

¹⁴ WasteMINZ NZ: Technical Guidelines for Disposal to Land. September 2023.

¹⁵ Water Services (Drinking Water Standards for New Zealand) Regulations 2022.

¹⁶ Australian and New Zealand Water Quality Guidelines - default guideline values for 95 % and 90 % protection of freshwater receptors.

¹⁷ Environment Canterbury Regional Council. Canterbury Land and Water Regional Plan, Volume 1, 2025. Water Quality Limits and Targets for Groundwater (Table 8i), based on the NZ drinking water standards MAVs.

6.5 Field observations

6.5.1 Area A

The livestock dip at Area A was investigated 05 May 2025, prior to sampling, the approximate footprint of the area was set out based on co-ordinates taken from historical aerial images. Investigation locations are shown on Figure 6.1 and illustrated in Photographs 6.1 and 6.2.

Observations include:

- There is some concrete in situ, but no other evidence of the livestock dip visible (e.g., no fences, concrete slab/pad).
- At the inferred footprint of the livestock dip ground conditions comprised:
 - Fill (variable thickness, 0.1 to 0.4 m) consisting of silt, sandy gravel and/or sandy gravel; overlying;
 - Sand (not fully penetrated by investigation);
 - Man-made materials were locally encountered including string and brick (locations HA-A1-07 and HA-A1-08; and
 - At investigation location HA-A1-09 at 0.5 mbgl a fragment of potential cement sheet ACM was encountered (approximately 50 mm x 50 mm).
- There is a wedge of fill material lying over the southern and eastern parts of the footprint. Of variable composition, this material could originate from the adjacent quarry operations (e.g., overburden).
- No other indicators of possible ground contamination were observed (e.g., staining, odour).
- Groundwater was not encountered during this investigation work.



Photograph 6.1: Area A looking south-east. Approximate sheep dip footprint denoted with red dashed line, wedge of surficial fill denoted with blue dashed line.



Photograph 6.2: Area A looking east, with in-situ concrete in foreground.



Figure 6.1: Area A investigation locations.

6.5.2 Area B

Area B was investigated on 21 May 2025, investigation locations are shown on Figure 6.2, and the area is illustrated in Photograph 6.3.

Ground conditions comprised sandy silt overlying sand. No evidence of the former blackcurrant farm activity was observed.



Photograph 6.3: Area B looking northerly.



Figure 6.2: Area B investigation locations.

6.5.3 Area D

The landfill was investigated between August and September 2025, commencing with a detailed site walkover on 13 August 2025. Investigation locations are shown on Figure 6.3, and observations are illustrated in Photographs 6.4 and 6.5.

Observations from the detailed walkover include:

- The majority of the investigation area of Area D comprised bare soil with evidence of recent vehicle tracking, and vegetated soil bunds around the perimeter.
- Three small stockpiles (< 5 m³) stockpiles of soil and two piles of wood and timber were present on the site. One wood pile comprised branches and wood only, while the other comprised burned wood, timber, steel and concrete. No structures were observed.

- Minor refuse was observed across the surface, consisting of wood, timber, glass, plastic, bricks, and fragments of concrete, cement boards and tiles. One large concrete slab was present leaning on the western bund.
- No other indicators of possible ground contamination were observed during the walkover (e.g. staining, odour).

During the intrusive investigations test pits were machine-excavated to attempt to reach natural ground. Following test pit excavation, boreholes were drilled overtop or immediately adjacent to the test pits, and continued into natural ground. The following observations were made:

- Fill was observed across the site surface and in all investigation locations, to depths of up to 5.35 mbgl (in TP_91/BH41).
 - In the test pits into the perimeter bunds (TR01 to TR03, excavated to ground level), fill consisted of sand with minor silt and organic material, and trace refuse.
 - o Refuse was observed in all three bund test pits, comprising wood, plastic, steel, concrete and bricks.
 - o Fibrous material (suspected ACM) was observed in one test pit (TR_02).
 - In the test pits/boreholes excavated into the landfill (TP_88 to TP_91, excavated to at least natural ground), fill consisted of sand, silt, or gravel with variable amount of refuse observed at all locations.
 - o Refuse comprised a combination of wood and logs, brick and concrete fragments, plastic, geofabric, glass, steel rebar, rope, charcoal, and tyres.
 - o Large concrete slabs were identified in one test pit (TP_89) at 2.2-2.7 mbgl.
 - o Suspected ACM in the form of fibre cement sheet fragments were identified in one test pit (TP_89) at 3.0 mbgl.
 - o Fragments of black, glossy material with a burnt odour (suspected bitumen or asphalt) was observed at 3.4-3.9 mbgl in TP_88.
- The immediately underlying natural material comprised sandy gravel, underlain by silt, sand and peat layers.
- Groundwater was encountered at depths of between 3.53 and 5.30 mbgl in all the four boreholes within the landfill.



Figure 6.3: Area D investigation locations.



Photograph 6.4: Area D looking approximately north from the south-eastern corner of the site.



Photograph 6.5: Wood and burn pile on the eastern side of Area D, looking towards Gladstone Road.

6.6 Data quality

Table 6.3 summaries the investigations data quality.

Table 6.3: Data quality

Data Objective	Comment
Investigation and sampling density/location – address variable distribution of contamination in soil	<ul style="list-style-type: none"> Investigation at Areas A, B and D provided sufficient spatial coverage of the subject areas. Samples collected from variable locations and depths and analysed for relevant CoCs in accordance with sampling objectives (refer Section 6.2).
Field QA/QC: Sample collection and storage	<ul style="list-style-type: none"> Soil samples collected following standard procedures with dedicated and/or decontaminated equipment. Samples collected in laboratory supplied containers and dispatched to laboratory and analysed within holding times. Field duplicate analysis of soils conducted for Areas A and B. Duplicate concentrations to be within 50 % relative percentage difference (RPD). (see Appendix D) RPDs (in soil) of field duplicate sample are less than 50 % and based on these results, adjustment of laboratory results when comparing against assessment criteria has not been undertaken.

Laboratory analysis QA/QC	<ul style="list-style-type: none"> • Analysis undertaken at an IANZ accredited laboratory following prescribed testing methodology with use of spikes, laboratory duplicates. • Laboratory reported no issues with their receipt and/or analysis of the samples.
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6.7 Analytical results

The assessment of the laboratory results is discussed in the following sub-sections and Project implications in Section 8.

6.7.1 Area A

Laboratory transcripts and the summary assessment table for Area A are presented in **Appendix E**.

The assessment of the data indicates:

- The fragment of cement sheet materials recovered from HA-A1-09 at 0.5 mbgl detected chrysotile and amosite forms of asbestos (white and brown respectively).
- No result recorded exceeded the commercial/industrial land use standards.
- Individual concentrations and the mean for one or more of the metals analysed for exceed their published background level.
- Except for the following, no results detected exceeded the sediment quality guidelines:
 - Arsenic recorded in a sample of sand (natural ground) recovered from location HA-A1-06 at 0.3 mbgl.
 - Lead was detected at up to 116 mg/kg.
 - Zinc detected in a sample of silty sand (fill) recovered from location HA-A1-06 at 0.1 mbgl.
 - Total DDT and dieldrin were detected at or slightly above the sediment quality guidelines in one and two soil samples, respectively. In addition, the laboratory limit of reporting (**LoR**) at the standard level of analysis is above the sediment quality guidelines and so the possibility that other samples contain DDT above the ecological criteria cannot be ruled out. We also note however that detected DDT concentrations and the DDT LoR is well below the ECan adopted ambient concentration of 0.431 mg/kg and is therefore considered to be of acceptable risk.
- No contaminant was detected above protection of groundwater quality criteria.
- Mean concentrations of metals are below sediment criteria.
- Based on the concentrations and inorganic and organic pesticides detected, and because a dip structure is likely to have been present in this location, we assess that HAIL activity A7 has more likely than not occurred in this area.

6.7.2 Area B

Laboratory transcripts and summary assessment table for Area B are presented in **Appendix F**.

The assessment of the data indicates:

- No detected concentration exceeded the commercial/industrial land use criteria.
- Except for recorded concentrations for cadmium, no results exceed published background or adopted ambient levels.
- The cadmium 95 % UCL calculated for Area B also exceeds its published background level.

- No results exceed the applicable criteria for the protection of groundwater.
- Individual samples contained pesticides, but not at concentrations exceeding ambient, land use or protection of groundwater criteria. Detected concentrations of total DDT in 3 individual samples exceeded the ecological criteria. As with Area A, the LoR for pesticides in soils at the standard level of analysis is above the ecological protection criteria and so the possibility that other samples contain DDT above the ecological criteria cannot be ruled out. We also note however that detected DDT concentrations and the DDT LoR is well below the ECan adopted ambient concentration of 0.431 mg/kg and is therefore considered to be of acceptable risk.
- Given that other metals (such as arsenic, a typical component of inorganic pesticides) were not detected at above background concentrations we assess that the cadmium concentrations detected are actually representative of local background concentrations, and not associated with HAIL activity A10. In addition, although pesticides have been detected in individual soil samples, concentrations do not exceed adopted ambient concentrations and have not been consistently detected in all locations, which does not indicate widespread use. On this basis we assess that HAIL activity A10 has not occurred in this area.

6.7.3 Area D

Laboratory transcripts and the summary assessment tables (which include the results from the previous MHW and Kirk Roberts investigations, where relevant) for Area D are presented in **Appendix G**.

The assessment of the soil sampling data indicates:

- No results exceeded the commercial/industrial land use criteria for the protection of human health.
- The fragment of suspected ACM cement sheet recovered from 3.0 mbgl at TP_89 contained chrysotile and amosite forms of asbestos (white and brown respectively). Asbestos was also detected in soil at this location, at trace level (<0.001 % w/w as asbestos fines/fibrous asbestos) and below land use assessment criteria. Asbestos was not detected in the remaining locations or materials tested, including the fibrous material in TR02.
- Individual OCP, ONP and OPP compounds were not detected in any of the 11 samples analysed.
- TPH was detected in five fill samples with up to a maximum of 580 mg/kg (C7-C36) detected at TP88/BH40, above the ecological protection criterion.
 - This sample was collected from a layer of fill (3.2 mbgl) that contained a large amount of waste material. The underlying fill contained lower concentrations of TPH below the ecological protection criterion.
 - The remaining TPH detections were recorded below the ecological protection criterion.
- Individual PAH compounds were detected in eight of 14 samples analysed, generally at trace levels. One sample (TP_88/BH40) contained elevated naphthalene in exceedance of the published background concentration.
 - This sample was collected from a fill layer (at 4.2 mbgl) containing suspected asphalt or bitumen fragments. The underlying natural material contained lower concentrations, below the laboratory reporting limit.
- Heavy metal concentrations were variable across the site, with approximately 54 % of the samples tested exceeding background concentrations for between one and up to six heavy metals.

- With the following exceptions, all heavy metal concentrations were detected below the ecological protection criteria and criteria for the protection of groundwater. Exceedances were detected in samples at a range of depths, generally collected from fill material.
 - The highest concentrations of cadmium, lead and zinc detected at the site, above the ecological protection criteria, were recorded in fill collected at depth (~5.0 mbgl) in TP_89/BH38. The fill at this depth was saturated and included trace charcoal, metal and concrete. Zinc also exceeded the criteria for the protection of groundwater at this location.
 - o Underlying *natural* material contained significantly lower concentrations of heavy metals, all below the criteria for the protection of groundwater, although ecological protection criteria was still exceeded for zinc. Groundwater samples collected from this location are discussed below.
 - The highest concentrations of arsenic, chromium and copper detected at the site, above the ecological protection criteria, were recorded in surface fill collected directly beneath the wood/burn pile observed on the eastern side of Area D, indicating that the concentrated heavy metals may be related to the storage or burning of CCA-treated timber. While not delineated, contamination at this location is expected to represent a ‘hotspot’ of contamination from the burning and leaching of timber at the site, and is expected to decrease with depth and distance away from the wood/burn pile.
 - At three additional locations (Stockpile04, TP91/BH41, and TP88/BH40) lead or zinc exceeded the ecological protection criteria in fill at 1-2 depths. These samples exceeded the criteria by up to 10 % only, and were not associated with exceedances of the criteria for other heavy metals. At TP91/BH41 and TP88/BH40, underlying *natural* material contained significantly lower concentrations of heavy metals, all below the criteria for ecological protection criteria.
- Across the site, the mean concentrations of heavy metals (including the 95 % UCL for fill remaining on site) are below ecological protection criteria and criteria for the protection of groundwater. While isolated exceedances for lead, zinc, arsenic, and cadmium were recorded, these were limited to specific samples and are associated with visible waste material or stockpiles.

The assessment of the groundwater sampling data indicates:

- Only very trace (0.2 ppm) volatiles were detected by the PID during groundwater monitoring/sampling.
- No exceedances of the New Zealand Drinking Water MAVs or the ECan water quality limits for groundwater were recorded.
- Hydrocarbons (TPH and PAH) and pesticides (ONP, OPP and OCP) were not detected above the LoR for both samples. We note that for a number of individual compounds, the laboratory LoR (for trace detection analysis) is higher than their assessment criteria.
- Copper and zinc exceeded the DGVs for 90 and 95 % species protection criteria for both samples. All other dissolved heavy metals were detected below the DGVs for 95 % species protection, with a number of metals below the laboratory LoR.

7 Project ground contamination conditions – updated

Table 7.1 below summarises the known or anticipated ground contamination conditions for the Project. Distinction is made between:

- 1 Non-HAIL areas (i.e. the portions of the Project that are not 'Locations of Interest').
- 2 Locations of Interest (i.e. potential HAIL areas) that have been investigated to a level to characterise contaminant conditions.
- 3 Locations of Interest for which no soil contaminant data is currently available (though will be obtained prior to construction).

Table 7.2 provides an updated conceptual site model for the Project.

Table 7.1: Summary of known or suspected ground contamination conditions

Project Area		Summary of known or suspected ground contamination conditions
Non HAIL areas		<ul style="list-style-type: none"> No evidence of potential HAIL activities. Contaminant concentrations likely at or below background. Unexpected contamination may be present but can be managed through accidental discovery protocols.
Locations of interest (investigated)	Area A – livestock dip	<ul style="list-style-type: none"> Heavy metals, including arsenic lead and zinc detected above background. Pesticides detected close to the limit of detection and below ambient concentrations. No contaminant exceeded human health assessment criteria (commercial/industrial land use standards) or protection of groundwater quality criteria. Arsenic, lead, zinc, total DDT and dieldrin above ecological criteria (sediment quality guidelines). Area of impact potentially 400 m² and to a depth of 1 mbgl. Arsenic DDT and dieldrin contamination likely to be associated with livestock dip activity – on which basis HAIL A7 is assessed to have occurred. A single fragment of ACM was encountered though there is no evidence to indicate that the presence of ACM is widespread.
	Area B – Horticultural	<ul style="list-style-type: none"> All contaminants of concern below background or ambient concentrations with exception of cadmium. All contaminants of concern are below human health and groundwater protection criteria. Cadmium concentrations are constantly within the uncertainty of measurement (UoM) of background. As all other metals in the analytical suite are below background detected cadmium concentrations are considered representative of local background and not consistent with HAIL A10. Total DDT concentrations exceed sediment quality guidelines in individual samples, but DDT does not appear widespread. Although DDT has been detected above sediment quality guidelines the concentrations detected are below adopted ambient concentrations, and we therefore assess that HAIL activity A10 does not apply to this area.

Project Area		Summary of known or suspected ground contamination conditions
	162 Gladstone Road, Woodend – Gladstone Road Landfill	<ul style="list-style-type: none"> • Above background concentrations of metals and hydrocarbons have been detected in the existing perimeter bund material, and in site wide fill, based on the combined results of historic and recent investigations. • Asbestos was detected in fibre cement and at trace level in soil at one location. There is no evidence to indicate that the presence of asbestos contamination is widespread. • Historic results indicate that Dieldrin was present at one location, marginally above criteria for the protection of groundwater quality. There is no further evidence, including results investigation results, to indicate pesticide contamination at the site. • Detected concentrations are below commercial/industrial land use criteria. Mean concentrations of contaminants are below ecological criteria and protection of groundwater quality criteria. • Concentrations did not exceed the Drinking Water standards, or ECan groundwater quality limits.
Locations of interest (un-investigated)	788 Main North Road agricultural buildings	<ul style="list-style-type: none"> • Potential for metals and asbestos in shallow (0 to ~0.3 m deep) soils beneath and in 'halo' around buildings.
	1 Fuller Road dwellings and associated outbuildings	<ul style="list-style-type: none"> • High likelihood of above background concentrations. Moderate likelihood of concentrations above ecological criteria. Low likelihood of concentrations above commercial/industrial land use criteria.
	167 Gladstone Road, Woodend - moto-cross track	<ul style="list-style-type: none"> • Moderate likelihood that mean concentrations of contaminants are below ecological criteria and protection of groundwater quality criteria.
	130b Main North Road historic homestead.	
	138 Main North Road buildings	<ul style="list-style-type: none"> • Potential for metals, hydrocarbons and asbestos in shallow (0 to ~0.3 m deep) soils beneath and in 'halo' around buildings.
	138 Main North Road miscellaneous	<ul style="list-style-type: none"> • High likelihood of above background concentrations. Moderate likelihood of concentrations above ecological criteria. Low likelihood of concentrations above commercial/industrial land use criteria. • Moderate likelihood that mean concentrations of contaminants are below ecological criteria and protection of groundwater quality criteria.
	c/o 70 Parsonage Road, Woodend – Woodlands Estate Subdivision	<ul style="list-style-type: none"> • Potential for metals and persistent pesticides to be present in shallow soils.

Project Area		Summary of known or suspected ground contamination conditions
		<ul style="list-style-type: none"> High likelihood of above background concentrations. Moderate likelihood of concentrations above ecological criteria. Low likelihood of concentrations above commercial/industrial land use criteria. Moderate likelihood that mean concentrations of contaminants are below ecological criteria and protection of groundwater quality criteria.
	160 Gladstone Road, Woodend	<ul style="list-style-type: none"> Potential for metals, hydrocarbons and asbestos in shallow (0 to ~0.3 m deep) soils beneath and in 'halo' around buildings. High likelihood of above background concentrations. Moderate likelihood of concentrations above ecological criteria. Low likelihood of concentrations above commercial/industrial land use criteria. Moderate likelihood that mean concentrations of contaminants are below ecological criteria and protection of groundwater quality criteria.

Table 7.2: Updated conceptual site model

Area	Source(s)	Pathway(s)	Receptor(s)	Comment (see notes)
Non-HAIL areas	No evidence of contamination being present that could present an unacceptable risk to human or environmental receptors.			
Locations of interest (investigated)	Area A - Livestock Dip – persistent organic and inorganic pesticides above ecological criteria in individual samples.	Direct soil exposure, dust.	Construction workers, public adjacent to earthworks.	Incomplete – contaminant concentrations below human health standards.
		Leaching/runoff to surface water.	Surface water.	Potentially complete – concentrations above sediment quality guidelines, potential for adverse effects on surface water if sediment runoff not managed.
		Leaching to groundwater.	Groundwater, groundwater users.	Incomplete – concentrations below groundwater protection criteria.

Area	Source(s)	Pathway(s)	Receptor(s)	Comment (see notes)
	Area B – Horticultural - persistent organic and inorganic pesticides present at background concentrations.	Direct soil exposure, dust.	Construction workers, public adjacent to earthworks.	Incomplete – concentrations considered to be at background.
		Leaching/runoff to surface water.	Surface water.	
		Leaching to groundwater.	Groundwater, groundwater users.	
	Gladstone Road Landfill – heavy metals and hydrocarbons above soil background concentrations across the site, and above environmental criteria (in soil) in individual samples. Mean concentrations are below environmental criteria. Heavy metals slightly above water quality guidelines in groundwater.	Direct exposure to soil, dust, contaminated water, refuse.	Construction workers, public adjacent to earthworks.	Incomplete – contaminant concentrations below human health standards.
		Leaching/runoff to surface water.	Surface water – not present within vicinity of the landfill,	Incomplete surface water not present
		Leaching to groundwater.	Groundwater, groundwater users.	Incomplete – Groundwater quality not above drinking water standards or ECan gw quality limits.
Locations of interest (un-investigated) – refer Table 1, site # 8, 11, 14, 23, 5, 6, 21, 22.	Potential HAIL activities including waste disposal to land, bulk fuel storage, also potential for localised contamination associated with buildings. Concentrations uncertain but likely vertically and laterally localised.	Direct soil exposure, dust.	Construction workers, public adjacent to earthworks.	Likely incomplete – investigation required to confirm current assumptions regarding contamination concentrations.
		Leaching/runoff to surface water.	Surface water.	
		Leaching to groundwater.	Groundwater, groundwater users.	

Notes:

Incomplete – means source-pathway receptor is unlikely to be complete and therefore likelihood of receptor being adversely affected by contamination is low.

Potentially complete - means source-pathway -receptor linkage may be complete under certain conditions.

Likely incomplete – means it is unlikely that a complete source-pathway -receptor linkage exists, but further investigation is required to confirm this.

8 Contamination-related Project implications

8.1 Potential environmental effects of ground contamination

8.1.1 Soil disturbance, reuse and retention - non-HAIL Areas

Non-HAIL areas are not expected to contain soil contamination above background concentrations. Project earthworks in these areas and the use of soil derived from these areas would not be expected to have contamination-related adverse effects on human health or the environment.

It is possible that unforeseen ground contamination may be encountered during construction. Accidental Discovery Protocols (**ADP**) will be included within a Contamination Site Management Plan (**CSMP**) for the Project, which would be proposed as a condition of consent. The protocols will provide guidance on the management of unexpected contamination in order to minimise the potential for human health and environmental effects. ADP will include how suspected contaminated materials are segregated, contained, investigated and reused/disposed.

8.1.2 Soil disturbance, reuse and retention - Gladstone Road Landfill

The Gladstone Road Landfill is the largest HAIL activity within the Project site.

At the Gladstone Road Landfill, fill materials that are present above the surrounding ground level will be cleared (circa 14,000 m³). Deeper excavation of the landfill may occur either to allow for compaction and retention of the materials prior to fill and road construction, or to facilitate excavation to the full landfill depth. The selection of the option to take forward is dependent on the geotechnical suitability of the materials. Even with full depth dig out, it is probable that some deeper landfill material will remain outside the footprint of the alignment. Excavation for installation of services will occur in the southern edge of the landfill. Available information indicates that shallow groundwater would not be encountered in Gladstone Road Landfill other than if the full vertical extent of fill in the road footprint requires removal.

Contaminants have been detected in soil at concentrations that exceed surface water and groundwater quality protection criteria (Section 6.4). However, the mean for concentrations detected to date (including the 95 % UCL for heavy metals) for the fill material proposed for excavation comply with these criteria.

Potential environmental effects associated with earthworks in contaminated soil arise from the generation and offsite discharge of dust, discharge of sediment offsite by tracking on plant or through sediment runoff, and the exposure of soils to rainfall and the potential for contaminants to leach to groundwater and surface water.

Managing dust during construction activities is a standard requirement, and the available information, including recent investigation findings, does not indicate that elevated dust management controls would be required to protect human health during earthworks in the Gladstone Road Landfill.

Soil contaminants (typically metals) within the Gladstone Road Landfill that are likely to be disturbed by construction earthworks or left undisturbed in situ generally have low solubility, with concentrations generally complying with those described in Section 6.4 that are protective of groundwater quality. Subject to erosion and sediment controls, disturbance of shallow soils or retention in situ is therefore unlikely to increase the potential for contaminants to enter groundwater or surface water, beyond that which currently exists given the Project area is predominantly unsealed at present.

Because contaminant concentrations are likely to comply with groundwater protection criteria, and because the proportion of fill material present below groundwater is anticipated to be small, deeper excavation is unlikely to have a more than a short-term adverse effect (if any) on shallow groundwater quality beneath Gladstone Road Landfill. The potential for short-term adverse effects on shallow groundwater quality associated with deeper excavation at the Gladstone Road Landfill can be mitigated by minimising the extent and duration of ground disturbance and backfilling excavations as promptly as practicable.

Based on the contaminant concentrations detected to date, mean contaminant concentrations in material excavated from Gladstone Road Landfill are likely to comply with criteria for the protection of surface water and groundwater quality. As such, we consider that reusing excavated fill soils in a non-structural capacity such as noise bunds or form embankment landscaping would not result in more than minor adverse environmental effects. The reuse of excavated material or retention of in situ material within the project area is likely to have significant sustainability benefits as it will reduce the volume of material being disposed to off-site disposal facilities and the volume of imported material. Large refuse materials such as metal bars, tyres and concrete should be screened out and disposed of off-site prior to reusing excavated fill.

The investigations carried out to date at the Gladstone Road Landfill have identified that the site is predominantly filled with soil and gravel, with minor demolition material and wastes such as tyres, concrete, wood, and plastic, and trace amounts of other waste materials. The soil contains low-level contaminant concentrations (on average below environmental protection criteria). However, given the nature of the site, there is the potential for higher concentrations of contaminants to be present, particularly in deeper fill. To address this uncertainty, we propose that soil reuse within the Project site would be subject to the following conditions of consent to mitigate potential effects on human health and environmental receptors:

- **Where used within 20 m of a surface water feature or wetland:** mean concentrations not to exceed the lower of Default Guideline Values (DGVs) for toxicants in sediment¹³ and leaching to water criteria derived for a Class 4 fill facility¹⁴. A 20 m setback for the use of soil containing contaminants above DGVs/leaching to water criteria near a waterway is considered practical and provides for adequate protection of surface water given the relatively flat topography of the project site and surrounds and limited potential for overland flow generation, particularly when combined with sediment control measures.
- **Used elsewhere within the Project:** mean concentrations not to exceed Leaching to water criteria derived for a Class 4 fill facility²⁴.

We also propose as a condition of consent, however, that the retention of soils containing asbestos may also be considered, providing that:

- Controls to minimise risk to human health are implemented during earthworks/handling and stockpiling.
- They are appropriately contained.
- Are subject to long term management controls.

8.1.3 Soil disturbance, reuse and retention - other known or potential HAIL areas

A confirmed HAIL area is located at 788 Main North Road, associated with a former livestock dip. Potential HAIL areas not already investigated will be investigated prior to construction. Available information indicates the potential for elevated concentrations of metals, hydrocarbons and soils in these areas. Our experience indicates that contaminated soils in such areas are likely to be shallow (less than 300 mm deep) and localised (in close proximity to buildings). Retention of such material in situ would be unlikely to result in adverse environmental effects given that they would be capped by

the road. The reuse of excavated material or retention of in situ material within the project area is likely to have significant sustainability benefits as it will reduce the volume of material being disposed to off-site disposal facilities and the volume of imported material.

Until these areas are investigated, there is uncertainty regarding the nature and extent of contamination in these areas. Subject to the findings of these investigations, it is anticipated that standard controls for the management of soil contamination (segregations, dust control, stockpile control) would be sufficient to mitigate adverse effects from earthworks in these areas on surface and groundwater quality, and human health.

In terms of the potential reuse of material excavated from these areas, in addition to undertaking further investigation, to address this uncertainty we propose that reuse within the Project site would be subject to the following conditions of consent to mitigate potential effects on human health and environmental receptors:

- **Where used within 20 m of a surface water feature or wetland:** mean concentrations not to exceed the lower of Default Guideline Values (DGVs) for toxicants in sediment²³ and Leaching to water criteria derived for a Class 4 fill facility¹³. A 20 m setback for the use of soil containing contaminants above DGVs/leaching to water criteria near a waterway is considered practical and provides for adequate protection of surface water given the relatively flat topography of the project site and surrounds and limited potential for overland flow generation, particularly when combined with sediment control measures at the site boundary.
- **Used elsewhere within the Project:** mean concentrations not to exceed Leaching to water criteria derived for a Class 4 fill facility¹⁴.
- **In all cases:** mean concentrations not to exceed land use standards for Commercial/Industrial land use.

We also propose as a condition of consent, however, that the retention of soils containing asbestos may also be considered, providing that:

- Controls to minimise risk to human health are implemented during earthworks/handling and stockpiling.
- They are appropriately contained.
- Are subject to long term management controls.
- The locations of reuse are recorded and provided in GIS format at the conclusion of the project.

8.1.4 Dewatering

With the exception of the Gladstone Road Landfill and where culverts are to be installed, earthworks are anticipated to be shallow and well above groundwater.

Dewatering may be required if a full depth dig out of Gladstone Road Landfill is required. Discharge of dewatering water is expected to be to land, and the discharge will be required to meet the provisions of the CLWRP. Analysis of groundwater at the Gladstone Road Landfill indicates that groundwater quality does not present a risk for groundwater users. Groundwater quality near the landfill is expected to be of similar quality and the effects of discharge to land on groundwater quality via discharge to land is expected to be low to negligible.

The analysis of groundwater quality indicates that dissolved copper and zinc exceed surface water quality assessment criteria. No surface water is present close to the landfill however there is a wetland to the northeast. Discharge to land should be controlled to avoid water entering the wetland, without additional assessment or treatment.

Dewatering controls for potential disposal options will be documented within the CSMP, which is proposed as a condition of consent.

The construction methodology is still in development, and once the need for dewatering in the landfill, and other dewatering locations are confirmed, these will be reviewed to identify the need for groundwater quality sampling and pre-treatment. Such controls will be documented in the Groundwater Management Plan (**GMP**) for the Project, which is proposed as a condition of consent.

8.1.5 Ground improvement

Ground improvement (likely comprising compaction) may occur at the Gladstone Road Landfill. Available information indicates that ground improvement in the Gladstone Road landfill is unlikely to have a more than short term and minor adverse effect on groundwater because:

- The majority of fill material is above groundwater.
- The contaminants present are generally not mobile and not present at concentrations exceeding groundwater quality criteria.
- Compaction and road construction will likely reduce infiltration through fill compared to current conditions.

8.1.6 Operational phase stormwater

The management of operational phase stormwater discharges to ground is a consideration where contaminated soils are to be retained.

Whilst the currently available information indicates that it is unlikely that soil contamination will be present above criteria that are protective of groundwater quality, it is prudent to avoid discharge into contaminated soils where possible. This would include avoiding discharges into the following areas (unless contaminated soils fully removed):

- The livestock dip area at 788 Main North Road.
- Gladstone Road Landfill.
- Currently un-investigated potential areas of contamination (subject to investigation results).

8.2 Offsite disposal of excess soil

Where offsite disposal is required, disposal can only occur to a suitably licensed facility. A number of local options exist for the off-site disposal of excess soil. Facility operators will likely require confirmation that the material to be disposed complies with the waste acceptance criteria of the facility. This may require the completion of additional sampling and analysis.

Segregation of less/more contaminated soils could be considered to reduce disposal costs. This could mean that areas of soil contamination are excavated for disposal prior to excavating remaining materials to stockpile for reuse.

Alternatively, on the assumption that (with the exception of the Gladstone Road landfill) soil contamination is surficial, segregation may not occur, but with the result that excavation and mixing to stockpile may result in a reduction of mean concentrations.

At the Gladstone Road Landfill, soil contamination is present throughout fill materials including above ground level (in the perimeter bunds), and to depths of more than 5 mbgl in some locations. Below ground level, fill is generally heterogenous, and segregation is not practicable. Some segregation may occur, for example, the perimeter bund fill and the in-ground fill.

Guidance regarding the required sampling and analysis works required for the segregation and removal of contaminated soils versus the disposal of soils from a mixed stockpile will be provided in a CSMP, which is proposed as a condition of consent.

8.3 Contamination-related health and safety considerations

Current information indicates that soil contamination is unlikely to be present at concentrations that would require contamination-related health and safety controls to protect those involved in construction or future maintenance activities that would involve soil disturbance.

It is acknowledged, however that several potential areas of contamination within the Project are yet to be investigated. The need for contamination-related health and safety controls will need to be reviewed once those investigations are completed. If necessary, contamination-related health and safety controls will be documented within the CSMP, which is proposed as a condition of consent.

8.4 Regulatory

8.4.1 NES-CS

The NES-CS applies when soil disturbance, soil disposal and change of land use activities are undertaken on a 'piece of land', where 'piece of land' is one where it is 'more likely than not' that a HAIL has or is taking place.

Two confirmed HAIL activities are present within the Project: the livestock dip at 788 Main North Road and the Gladstone Road Landfill. A number of additional potential HAIL activities are located elsewhere within the Project (Figures 5.1-5.3), and their actual HAIL status will be confirmed through investigation once access is agreed. At this stage the confirmed HAIL areas and the potential HAIL areas are considered to be 'pieces of land' with respect to the NES CS. The remainder of the Project Site is not a piece of land, and in these areas the NES CS does not apply.

A detailed assessment of the Project's regulatory status under the NES-CS is provided in the SAR, and in summary:

- NES-CS consent is likely to be required for soil disturbance on and soil disposal from confirmed HAIL areas and may be required for areas currently identified as potentially HAIL activities. This is on the assumption that soil disturbance and/or soil disposal volumes will exceed the limits for a permitted activity based on the area of land.
- An NES CS consent will be applied for in advance of the investigation of the potential HAIL areas. Consent will need to be sought for a discretionary activity as a DSI of the entire project area has not yet been completed until those investigations are completed.
- The Project does not involve 'changing use' as the change of use to state highway is to a less sensitive activity that is not reasonably likely to harm human health as per Regulation 5(6).

8.4.2 CLWRP

Owing to the presence of above background concentrations of contaminants and uninvestigated HAIL, areas of the site would meet the definition of 'potentially contaminated land' as currently interpreted by ECan. This means that resource consent under the CLWRP is required for activities undertaken in these areas including:

- Construction phase stormwater discharges to ground.
- Operational phase stormwater discharges to ground.
- The take and discharge of dewatering water.

Some fill materials at Gladstone Road Landfill are likely to remain onsite at completion of the works. Based on the current understanding of the contaminant conditions in the landfill materials, it is unlikely that resource consent under rule 5.187 for the ongoing discharges of contaminants will be required.

The reuse of soil containing above background concentrations of contaminants will require consent for discharge of contaminants to ground where they could enter groundwater in accordance with rule 5.98.

A detailed assessment of the Project's regulatory status under the CLWRP is provided in the SAR.

8.5 Further investigations

A number of areas of potential contamination were identified during the T+T site walkover that could not be investigated prior to the preparation of this report owing to access constraints, or which are more appropriately investigated following the removal of buildings. These areas will require investigation well in advance of construction activities in order to confirm (or otherwise) assumptions made in this report regarding the nature and extent of contamination in these areas. Pre-demolition surveys for hazardous substances will also be required (where appropriate).

Appendix G provides a rationale and indicative investigation scope for each potentially contaminated area.

8.6 Contamination Site Management Plan

A CSMP is proposed as a condition of consent to assist in the mitigation of contamination-related construction effects. The CSMP would be expected to include:

- A summary of known contaminant conditions.
- Contamination-related training requirements for project staff.
- Soil management procedures including segregation, stockpiling and reuse, and offsite disposal.
- Remediation requirements (should additional testing indicate remediation is actually required).
- Contamination-related health and safety controls.
- Accidental discovery protocols.
- Contamination-related complaints and incident management.
- Site validation testing and report (if required).
- Record keeping and works completion reporting.

9 Applicability

This report has been prepared for the exclusive use of our client Aurecon New Zealand Ltd and New Zealand Transport Agency Waka Kotahi, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that NZTA will submit this report as part of an application under the Fast-Track Approvals Act 2024 and the appointed panel will use this report for the purpose of assessing that application.

This report has been prepared in accordance with our sub consultancy agreement to “Belfast to Pegasus Motorway & Woodend Bypass pre-implementation & MSQA Professional services contract number 11320”, dated 20 May 2025.

Recommendations and opinions in this report are based on data from discrete observations, sampling locations and sampled materials and reflect the conditions at the time of sampling. The nature and continuity of conditions away from the reported locations are inferred and it must be appreciated that actual conditions could vary from the assumed model.

In accordance with your instructions, in carrying out our services we have relied upon, and presumed accurate, the information in the following documents which you have provided us (“Existing Information”) (see Sections 1.3, 2.3, 2.4, 5.1).

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:



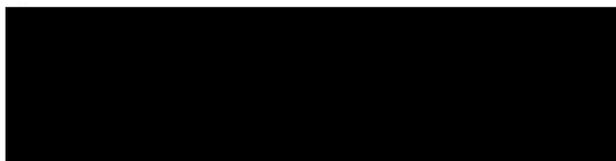
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Appendix A Jacobs PSI
