



**Contaminated Soil
Management Plan**

Transmission Gully Project

Prepared for:
NZ Transport Agency and
Porirua City Council



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1. Introduction

1.1 Purpose

This Contaminated Soils Management Plan (CSMP) (the Plan) forms part of a comprehensive suite of environmental controls within the environmental management plan for the construction phase of the Transmission Gully Highway Project (the Project). The Plan addresses the potential adverse environmental effects of contaminated soil associated with the construction of the Project. These have been assessed using a risk based approach following the NZ Transport Agency (NZTA) Risk Management Process.

The principal purpose of this plan is to provide a description of the minimum standards that must be complied with as well as best practicable options for management of contaminated soil for the Transmission Gully Highway Project. It is intended as a framework for the development of particular contaminated soil control practices and procedures to minimise affects on health and safety and to reduce the impact on the environment.

The CSMP should be considered a living document, as the highway design is finalised and construction planning is further advanced, the document should be re-evaluated and updated. In addition, as remedial actions or mitigation takes place, the plan should be updated to reflect the changes.

1.2 Background

A Stage 1 land contamination assessment was carried out for the Transmission Gully Highway main alignment. Based on the findings of the Stage 1 assessment, a Stage 2 land contamination investigation was conducted. The findings of these land contamination studies are documented in "Contaminated Land Assessment, Transmission Gully Highway" (Aurecon, 2011), hereafter referred to as the "land contamination report". This report should be used in conjunction with the land contamination report which provides detailed results of the investigation and laboratory analytical results.

Laboratory results of soil samples were compared with commercial/industrial human health and commercial/industrial and recreational/parkland ecological risk values. Two sets of ecological risk based guideline values were used because some of the route may be replanted with native vegetation and portions will have a cycleway/walkway present.

The main alignment is primarily comprised of greenfields sites, with some commercial activities present along the route.

The land contamination studies identified several areas where contaminants of concern are present above ecological risk based guideline values. These areas include:

- Sang Sue Market Garden
- Car Haulways
- Golden Coast Nurseries
- Porirua Gun Club
- Pauatahanui Inlet Garden Supplies
- Greater Wellington Regional Council (GWRC) historic sheep dip site
- Former livestock yard near Battle Hill Farm Forest Park

Contaminants of concern were present above human health risk based guideline values across the site at the Porirua Gun Club. Asbestos was detected in building materials at the Golden Coast Nurseries and one shallow soil sample had concentrations of arsenic above the New Zealand National Environmental Standard for Assessing and Managing Contaminants in Soil (NES) Soil Contaminant

Value (SCV). A geophysical survey conducted at MacKays Crossing indicated the presence of possible unexploded ordnance (UXO) along existing State Highway 1 (SH1).

In addition, the studies identified areas where contamination could be present, although the risk is relatively low. Because of the low risk, a detailed investigation was not conducted of these sites. The sites include structures where asbestos, lead-based paint, hazardous materials, or polychlorinated biphenyls (PCBs) may be present. Along the greenfields areas, there is a possibility that offal or rubbish pits, or unidentified livestock dip sites, may be present.

1.3 Scope

The scope of this CSMP is focussed largely on proposed construction activities; however, highway maintenance is also addressed. As indicated above, as highway design and construction plans are developed, this CSMP should be reviewed and amended as appropriate. Section 2 of this report provides an overview of the areas investigated in detail. Section 3 provides guidance related to management of identified and potential contamination along the route. The general requirements for management of soils handling are provided on a site-by-site basis.

Environmental risk associated with contaminated soils on the project have been assessed within the Risk Register for the Project.

Other relevant documents which should be referred to and utilised during construction and maintenance activities include:

- Transmission Gully Project Environmental Management Plan (EMP) (Beca, 2010a)
- Transmission Gully Project Air Quality Management Plan (Beca, 2010b)
- Transmission Gully Work Package 12: Water Quality Measurement, Modelling, Assessment & Mitigation Design, Construction Erosion and Sediment Control (SKM, 2010a)
- Transmission Gully Work Package 12: Water Quality Measurement, Modelling, Assessment & Mitigation Design, Stormwater Management Devices (SKM, 2010b)
- Transmission Gully Project Noise Management Plan (URS, 2010)
- Transmission Gully Project Ecological Management Plan (Boffa Miskell, 2010)
- Site-specific environmental management plans prepared for the Project

1.4 Environmental Performance Standards

The management contaminated soils during the Project shall follow the objectives of the CEMP and be undertaken in accordance with the legislative requirements identified in the EMP and relevant conditions of consent granted for the Project.

1.5 Limitations

Aurecon has prepared this plan (the "Plan") for the use of the NZTA and the Porirua City Council (PCC), collectively referred to as "the Client," for use for inclusion in consent application documentation for the Transmission Gully Project.

The Plan must be read in light of:

- The limited readership and purposes for which it was intended
- Its reliance upon information provided to Aurecon by the Client and others which has not been verified by Aurecon and over which Aurecon has no control

- The limitations and assumptions referred to throughout the Plan and associated land contamination report
- The cost and time constraints imposed on the Plan
- Other relevant issues which are not within the scope of the Plan

Subject to the limitations referred to above, Aurecon has exercised all due care in the preparation of the Plan and believes that the information, conclusions, interpretations and recommendations of the Plan are both reasonable and reliable. Aurecon makes no warranty or representation to the Client or third parties (express or implied) in respect of the Plan, particularly with regard to any commercial investment decision made on the basis of the Plan. Use of the Plan by the Client or third parties shall be at their own risk and extracts from the Plan may only be published with permission of Aurecon.

Soil and rock formations are often variable, resulting in heterogeneous distribution of contaminants across a site. Contaminant concentrations may be estimated at chosen sample locations; however conditions, between sample sites can only be inferred on a basis of geological and hydrological conditions and the nature and the extent of identified contamination. Boundaries between zones of variable contamination are often indistinct, and therefore interpretation is based on available information and the application of professional judgement.

The accuracy with which sub-surface conditions are characterised depends on the frequency and methods of sampling and the uniformity of sub-surface conditions and is therefore limited by the scope of the works undertaken. Without extensive sampling and analysis, contamination cannot be confirmed or refuted. Where additional sampling and analysis (or similar) is recommended in this Plan, it should not be inferred that the site is contaminated or presents a risk to human health or the environment. Analogously, when no additional action is recommended, it should not be inferred that the site is free of contamination.

This Plan has been prepared based Stage 1 and 2 land contamination assessments. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that any party may suffer as a result of using or relying on any such information or recommendations contained in this report, except to the extent Aurecon expressly indicates in this Plan. Should further information become available regarding the conditions at the site, including previously unknown likely sources of contamination, Aurecon reserves the right to review the Plan in the context of the additional information. This Plan does not address remedial action implementation in detail, nor does it detail requirements regarding protection of air, surface water, or groundwater quality. These considerations are addressed in other management plans for the project.

This disclaimer must accompany every copy of the Plan, which is an integral document and this Plan must be read in its entirety.

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2. Summary of land contamination investigation

2.1 Stage 1 assessment

The Stage 1 land contamination assessment was carried out in accordance with Ministry for the Environment Contaminated Land Management Guidelines (MfE CLMG) and the NZTA Draft Contaminated land acquisition protocol (2010). The Stage 1 assessment included:

- Review of historic and current aerial photos
- Review of historic and current land title records
- Review of relevant council records
- Interviews with persons familiar with the site
- Site reconnaissance of the entire route, with detailed inspections of sites where contamination was likely to be present

Based on the information obtained, a preliminary qualitative risk evaluation was conducted, which identified several sites where additional investigation was warranted. These included:

- MacKays Crossing area
- Sang Sue Market Garden
- Car Haulaways
- Golden Coast Nurseries
- Porirua Gun Club
- Pauatahanui Inlet Garden Supplies
- Greater Wellington Regional Council (GWRC) former sheep dip site
- Former livestock yard near Battle Hill Farm Forest Park
- The Mana Coach facility

At MacKays Crossing, historic military operations included firing shells down-range, south of MacKays Crossing. Anecdotal information indicates that mortar and cannon shells may have been fired down-range and that an area up to 1 km south of MacKays Crossing may have been affected. In addition, UXO has been identified at the adjacent Queen Elizabeth II Park. Therefore, a geophysical investigation of the area was recommended.

The other areas have operations included on the MfE's Hazardous Activities and Industries List (HAIL), including market garden and glasshouse operations, hazardous materials storage, aboveground storage tanks (ASTs), underground storage tanks (USTs), and livestock dipping operations. A sampling and analysis work plan was developed for conducting an intrusive investigation of the sites of interest.

Farms are present along the main alignment. While review of Council records and historic aerial photos did not identify additional livestock dips or pits, it is possible that they are present within the highway footprint. However, these sites were not recommended for intrusive investigation because of the relatively low risk.

At the time the study was completed, it was not clear which buildings beyond those at Car Haulways and Golden Coast Nurseries would be demolished. Some of the buildings are in use or occupied. Therefore, it was not considered appropriate to undertake intensive investigation of potential asbestos-containing material or other hazardous materials (such as lead-based paint) at the facilities at this time. A full investigation should be undertaken prior to building demolition.

2.2 Stage 2 investigation overview

The Stage 2 investigation included a geophysical survey at MacKays Crossing to evaluate the possible presence of UXO, and intrusive sampling with laboratory analysis of soils at the sites of interest.

With the exception of the GWRC former sheep dip site, where test pits were excavated, the samples were utilising hand tools such as trowels and hand augers. Samples were placed in clean laboratory-supplied jars, stored on ice, and shipped to the laboratory under chain of custody. The samples were analysed by RJ Hill Laboratories, an IANZ accredited laboratory.

The sampling was conducted either on a systematic grid-based sampling system or utilising judgemental sampling. At sites where contamination was likely to be widespread across the site, such as the market garden and nursery, a systematic sampling regime was employed. At sites where contamination was more likely to be localised (such as near an AST), judgemental sampling was utilised. At some sites, a combination of systematic and judgemental sampling was used.

Following receipt of laboratory reports, the data were analysed against an established set of risk-based criteria in accordance with MFE’s CLMG No. 2, Hierarchy and Application in New Zealand of Environmental Guideline Values. The GWRC does not have established numerical values which trigger remedial action or additional investigation; instead, GWRC recommends using the MfE CLMG and MfE Environmental Guideline Values (EGV) database. Other MfE guidance documents were also utilised in evaluating data, as applicable to the situation of contaminant. The GWRC’s adopted Wellington regional background values were also utilised for evaluation of data, as was the NES for contaminated soil. A full listing of guidance documents utilised in provided in Section 9, References.

Data were evaluated against risk based guideline values for protection of human health and ecology. With one exception, the most conservative appropriate value was selected from the EVG database. However, in the case of chromium, three risk based guideline values are given in the EVG database: one for protection of plants, one for protection of mammals, and one for protection of birds. The value for protection of plants is the most conservative. However, it was not selected for evaluation of data because it is well below the established Wellington region background range for chromium (URS, 2003). Instead, the value for protection of avian species was selected. At 21 mg/kg, it is slightly above the Wellington regional background upper limit of 16 mg/kg.

Based on the data, the risk at each site was re-evaluated and mitigation and general remedial action requirements were developed. This information is presented in the land contamination report. A summary of the contamination risk for each site is summarized in the table below.

Summary of risk, based on Stage 2 land contamination investigation

Site	Revised Risk Assessment	Comment
MacKays Crossing	Moderate	The geophysical survey noted anomalies which could be UXO. These areas should be considered high risk and investigated in detail prior to construction. Areas where there does not appear to be possible UXO are considered low risk.

Site	Revised Risk Assessment	Comment
Sang Sue Market Garden	Low – Minor	Risk requires re-evaluation if proposed highway alignment includes the market garden sheds. There are detections of metals above ecological risk based guideline values. Therefore, the excavated soil should not be placed in an ecologically sensitive area. The soil could be used under the highway without undue risk to future site workers.
Golden Coast Nursery	Soil: Low – Minor Buildings: Moderate - High	With one exception, laboratory results from soil samples are all below human health risk based values. One sample returned an arsenic concentration above the NES SCV; however, it was only found in surface soil and appeared to be localised (likely the result of a spill). Asbestos was detected in two of the building samples collected. Therefore, the building structure is considered high risk if the buildings are not demolished correctly. The remainder of the site is classified as low risk. Surface soil from the area should not be placed in ecologically sensitive areas as metals were detected that were above ecological risk based guideline values. The soil could be placed under the highway without undue risk to future maintenance workers; however, workers must be informed about the potential risks associated with elevated concentrations of metals and pesticides.
Car Haulaways	Low - Minor	Due to detections of zinc and hydrocarbons, excavated surface soil should not be placed in ecologically sensitive areas. The soil is suitable for use under the highway without undue risk to future site workers.
Pauatahanui Inlet Garden Supplies	Low – Minor	Areas of low to minor risk include the outhouse and possible leachfield associated with the outhouse, areas where timber was burned, the former AST area and areas where waste asphalt was spread across the site.
Porirua Gun Club	Minor – Moderate	Moderate risk areas include: <ul style="list-style-type: none"> • Firing range areas • Drainage ditch

Site	Revised Risk Assessment	Comment
		All other areas at the Porirua Gun Club site are considered minor risk. Remedial action is required for areas with metals and PAH above the NES SCV. Soil with contaminants above ecological risk based values should also be properly managed; it is likely that this soil will be remediated along with the soil with contamination present above human health guideline values.
Mana Coach	Low	Unless there is a significant release at this site, the risk is considered to be low.
GWRC Former Sheep Dip	Minor	It does not appear that the former sheep dip site has contributed to significant contamination within the highway footprint. Dieldrin was detected in two surface soil samples above ecological risk based guideline values. Therefore, the excavated soil should not be placed in an ecologically sensitive area. It is suitable for use under the highway or a structure.
Former stockyard site	Minor	The former stockyard site appears to present minor risk for the presence of contamination. DDT was detected in all samples and zinc was detected above ecological risk based guideline values in one sample. Therefore, the excavated soil should not be placed in an ecologically sensitive area. It is suitable for use under the highway or a structure.
Buildings	Low – High	Buildings constructed after 1990 have a low risk of asbestos. Buildings constructed earlier have a moderate to high risk of asbestos. In addition, hazardous materials may have been stored or spilled in the buildings slated for demolition.
Farm sites	Low	There is a risk that rubbish or offal pits, unidentified livestock dips, or other contaminating activities may exist along the highway route. However, based on available information, the risk is considered relatively low.
Other sites	Low	There is a reported landfill in the plantation forest area near Ribbonwood Tce. The landfill was not located during the

Site	Revised Risk Assessment	Comment
		<p>investigation and persons knowledgeable of the area were not aware of a landfill in this location. However, it is documented in Council records and may exist. The area should be excavated with caution as landfill materials and landfill gas may be present. Alternatively, after the forest is harvested, an investigation (e.g., geophysical survey or test pitting) should be conducted to determine whether the landfill is present.</p> <p>There are transformer sites near the route. While there was no visual evidence of contamination and Transpower indicated that there have been no significant releases, it is possible that a release could occur, resulting in contamination impacting the Main Alignment. A visual inspection should be conducted prior to construction.</p> <p>The Pauatahanui Golf Course was not investigated in detail and is still in operation. The Stage 1 assessment did not indicate that contamination was likely; however, it is possible that contamination could be discovered during construction operations. A more detailed inspection of the areas that may be affected should be conducted prior to construction.</p> <p>Due to adjustments of the Main Alignment following the completion of the Stage 2 investigation, three areas were identified where contamination may be present:</p> <ul style="list-style-type: none"> • Along SH1 where it is to be lowered • Undeveloped area adjacent to Mana Coach • The Lewis's Fabric facility on Kenepuru Road <p>These sites will be investigated and results reported in separate letter reports.</p>

2.2.1 Buildings and farm sites

It is not practical or appropriate to conduct a detailed sampling and analysis programme at regular intervals along the route; this would be extremely costly and difficult to justify on the basis of the low potential risk. However, it is recognised that there could be areas of contamination along the route that were not discovered by this investigation. For example, historic offal pits, rubbish pits, and livestock dips could be present within the construction footprint. While this investigation did include an evaluation of all of the properties along the route with the goal of identifying such activities, it is possible that some were not discovered.

In addition, not all buildings slated for possible demolition were fully investigated with regard to hazardous materials storage and asbestos. Limited investigations were conducted of those buildings which are likely to be demolished, i.e., Car Haulways and Golden Coast Nurseries. However, since the buildings may be utilised for construction related activities prior to demolition and some are currently occupied or in use, detailed asbestos investigations were not conducted as these types of detailed investigations typically result in breaches in roofing materials, walls, and floors. These breaches could result in leakage and mould growth or other building damage. Other buildings along the route may or may not be demolished; therefore, no additional investigation was done at this time.

Detailed walk-through inspections of buildings to evaluate the presence of hazardous materials were not conducted. Where access was possible, an evaluation of hazardous materials was conducted.

2.2.2 MacKays Crossing

The geophysical survey indicated that it is possible that UXO is present in the paddocks adjacent to the existing SH1. While UXO is unlikely to spontaneously explode, certain activities which could create large pressure waves, sudden impact or sparking could cause detonation. This would of course pose a hazard to construction workers and the public. Proper excavation and management/disposal is required for those areas which contain suspect UXO and where construction is slated to be conducted. It is likely that the UXO is present at a depth of less than 1m below ground surface; therefore, extreme caution should be exercised when conducting activities in the area that could lead to vibration or similar disturbance of the UXO.

A protocol for dealing with unexploded ordnance has been developed and is included with this plan as **Attachment A**.

2.2.3 Sang Sue Market Garden

The Sang Sue Market Garden is utilised for growing and selling vegetables. The site consists of vegetable growing areas as well as ancillary buildings for sales and storage of equipment and produce. There are ASTs present and hazardous materials storage was noted. The Transmission Gully Highway Project will affect the area directly adjacent to the existing SH1, which is located in the vegetable growing (horticulture) area. The buildings, ASTs and hazardous materials and equipment storage areas are well beyond the construction footprint. The horticulture area was investigated using a grid-based strategy and one sample was collected from outside the storage shed closest to the highway footprint.

Summary of human health risk

The samples collected across the portions of the site that were sampled returned results well below human health guideline values. However, several metals were present above typical background values (URS, 2003). The results appear to be consistent with application of pesticides, herbicides and fertilisers. While evidence of metals and pesticides was found, the results were below human health risk based guideline values and the risk to construction workers is low.

Summary of ecological risk

Copper was present in one sample above the commercial/industrial ecological risk based guideline value. The sample was located near the existing SH1 and may be the result of run-off from the highway. This appears likely as the copper concentrations are not above guideline values and are consistent across the rest of the site. The copper concentration was 136 mg/kg as compared to a risk based guideline value of 91 mg/kg. These elevated concentrations are not likely to pose a significant risk to local ecology, particularly as the extent is limited.

Several metals, including cadmium and arsenic, are present slightly above typical background concentrations (URS, 2003). The concentrations appear to be consistent with application of herbicides, fertilisers and pesticides. The chromium concentrations are consistently above ecological risk based guideline values for protection of plants; however, the majority of the samples returned concentrations that are consistent with regional background concentrations (URS, 2003). There was no sign of distressed vegetation at the site; the plants in the market garden appeared to be healthy.

During highway construction, the ecological risk is not considered to be significant. The upper layer of soil will be excavated as part of highway construction and by default will be mixed with deeper layers which are not impacted. This will essentially dilute any elevated concentrations. The area is slated to be filled, rather than cut, as part of highway construction. The area with the elevated concentrations of arsenic, copper and zinc will likely be beneath the highway, further limiting exposure. Stormwater runoff from the area will be treated and landscaping is not likely to be affected. Therefore, the post-construction ecological risk is also expected to be low.

While the ecological risk is believed to be low, it would not be prudent to place the excavated soil in an ecologically sensitive environment, such as an area with pristine native bush. It is not likely that the soil would present a hazard, per se, but due to the evidence of anthropogenic activities, the most appropriate course of action would be to place any excavated soil under a road or structure, or in a disposal area that is situated in an area that has previously been disturbed and where stormwater runoff will be treated.

2.2.4 Former Golden Coast Nurseries

The former Golden Coast Nurseries facility was in operation for several years. There are numerous greenhouse structures, including glass houses and structures with framing and netting. There are concrete pathways between tables inside the greenhouse structures, with bare ground beneath the tables. Samples were collected on a grid-based pattern across the site, with locations adjusted as required to avoid the concrete pathways. Samples of building materials were also collected from the largest structure present at the site.

Summary of human health risk

Detectable concentrations of pesticides and higher than background concentrations of metals were detected at former Golden Coast Nurseries. Arsenic was detected in one surface soil sample at a concentration of 100 mg/kg, which is above the NES SCV of 70 mg/kg for commercial/industrial sites. This detection was inside one of the glass houses and appears to be localised in nature. It is likely the result of a past spill of pesticide or similar. Workers should be informed of the potential risk associated with elevated concentrations of arsenic and should take proper health and safety precautions.

Asbestos was detected in two of the building samples collected. The samples collected are indicative that asbestos is present in some of the building materials. Not all building materials were sampled; additional investigation should be conducted prior to building demolition. An asbestos management plan should be developed and implemented prior to disturbing or demolishing any of the structures on site.

Summary of ecological risk

Arsenic, chromium, copper, nickel and zinc concentrations at several locations were well above ecological risk based criteria and several times above expected background concentrations. Pesticides were also detected at numerous locations across the site. The presence of these contaminants is likely due to past site activities.

During highway construction, the upper layer of soil will likely be excavated as part of site clearing and grading. As part of this process, the soil with elevated concentrations of metals will likely be blended with unimpacted soils. This will essentially dilute the concentration of metals present. The majority of the area with elevated metals concentrations will be contained beneath the highway and highway construction will largely be comprised of filling activities (rather than cutting). In addition, stormwater treatment and controls will be in place and have considered the presence of metals and pesticides at the site. These factors should result in a relatively low ecological risk.

While the ecological risk is believed to be low, it would not be prudent to place the excavated soil in an ecologically sensitive environment, such as an area with pristine native bush. It is not likely that the soil would present a hazard, per se, but due to the evidence of anthropogenic activities, the most appropriate course of action would be to place any excavated soil under a road or structure, or in a disposal area that is situated in an area that has previously been disturbed.

In addition, because there are nearby residences, extra precaution should be exercised during construction to minimise dust generation to the greatest extent possible. This site is up slope of the Sang Sue Market Garden and SH1; precautions should be established to prevent impacted soil from leaving the site through stormwater runoff.

2.2.5 Car Haulways

The Car Haulways site was used for the storage of imported vehicles pending their distribution to dealerships across New Zealand. In addition, car haulers were stored at the site. Activities at the site included fueling from a UST and vehicle washing. The UST was removed and replaced with an AST which was situated in a bunded area. A report prepared for Shell Oil by MWH indicated that no contamination above commercial/industrial guidelines remained in place following the UST removal. The AST was removed when the site was vacated. The majority of the site is surfaced with gravel; however, some areas, such as the former UST and AST areas, are paved with asphalt or concrete. There are several small storage buildings and an office building on site.

Soil samples were collected on a judgmental basis, focussing on the storage buildings, former AST area, drainage areas and stained locations across the site. A sample of the building material from the office exterior was also collected.

Summary of human health risk

None of the samples collected at the Car Haulways site returned results above human health risk based criteria. One sample, CH18-0.1, returned a TPH result of 11,600 mg/kg, which is indicative of a hydrocarbon release. However, the sample collected was of visibly stained soil and the detected hydrocarbons were in the C15 – C36 range which is typical of degraded fuel. Sample CH9-0.1 returned a TPH result of 2,200 mg/kg (all in the C15 – C36 range) which is also indicative of a past hydrocarbon release. Based on the overall site results, it appears that the TPH present is from relatively isolated minor hydrocarbon releases (such as leaks from vehicles).

The former UST removal report prepared by MWH indicates that the UST pit was free of contamination above commercial/industrial risk-based guideline values. Clean fill material was noted in the samples collected in the vicinity of the former UST pit.

Summary of ecological risk

Slightly elevated metals concentrations were detected across the site, with zinc above ecological risk based values in three samples analysed for heavy metals. The location of the elevated zinc concentrations indicates that it is likely to be due to the presence of adjacent galvanised structures.

The upper layer of soil will be excavated as part of clearing and grading for highway construction and by default will be blended with deeper soil. This will effectively result in dilution of concentrations of metals detected in the near-surface samples. In addition, much of the site will be covered by the road, which will assist in sequestering any elevated metals concentrations from local ecology. Note that this area will primarily be subjected to fill, rather than cut, activities. The concentrations of metals detected at the site have been considered in stormwater treatment system design. Therefore, the ecological risk is not expected to be significant.

While the ecological risk is believed to be low, it would not be prudent to place the excavated soil in an ecologically sensitive environment, such as an area with pristine native bush. It is not likely that the soil would present a hazard, per se, but due to the evidence of anthropogenic activities, the most appropriate course of action would be to place any excavated soil under a road or structure, or in a disposal area that is situated in a previously disturbed area.

2.2.6 Porirua Gun Club

The Porirua Gun Club is a facility utilised for target practice with both stationary targets and clay targets (i.e., skeet shooting). The lower portion of the range is primarily used for pistols and shotguns and the upper portion is primarily used for rifles. Waste ammunition is burned in a pit at the site and there is a wastewater/leachfield area present that supports the facility's septic tank system. In addition, there is a storage shed, rubbish disposal area and a drainage ditch present.

Samples were collected on a judgmental basis at the ammunition burn pit, wastewater area, storage shed, rubbish disposal and drainage ditch. A generalised grid-based sampling programme was implemented for the shooting ranges.

Summary of human health risk

At the Porirua Gun Club, numerous near-surface samples in the firing range areas returned results above the NES SCV for lead and benzo(a)pyrene. Several of the corresponding deeper samples were analysed; all but one returned results below the NES SCV of 3,300 mg/kg for lead.

Based on the potential risk to human health, remedial action is recommended.

Summary of ecological risk

The ecological risk based guideline values for antimony, lead, copper, zinc and PAH were exceeded in numerous locations across the site. Because human health guideline values are also exceeded for lead, copper and PAH, remedial action in the form of soil removal and/or treatment is recommended (see Section 8.2). Because the elevated concentrations of antimony, copper and zinc generally are collocated with the concentrations of lead that are above human health guideline values, the remedial action will address potential ecological risk concurrently with addressing the human health risk.

2.2.7 Pauatahanui Inlet Garden Supplies

The Pauatahanui Inlet Garden Supplies facility took green waste and composted it for sale as garden supplement material. In addition, the facility sold bark and decorative rock. An AST had been located at the site and a long-drop toilet was also present at the site. Spillage was noted in the form of stained soil around the site. There were several berms present, comprised primarily of waste soil, timber, concrete and similar debris. Storage bins were also present when the business was in operation. The site is adjacent to a stream and is subject to flooding.

Samples were collected on a judgmental basis at areas where spillage had been noted (i.e., stained soil) and where the AST had been located. Samples were also collected along the stream bank to determine whether it had been impacted by site activities. A surface water grab sample was collected in an area where the site appeared to drain to the stream to help qualitatively evaluate whether site activities were directly impacting the stream. Samples were also collected at pseudo-random locations across the site and two off-site soil samples were collected for comparison purposes.

Summary of human health risk

Hydrocarbons were present at the AST and spillage areas. One of the stream bank samples also contained detectable hydrocarbons. However, all samples were well below human health risk based criteria.

Both 4,4'-DDE and 4,4'-DDT were detected in the background samples collected; but not in the samples collected from the stream bank. Total DDT concentrations were well below the NES SCV. Slightly elevated zinc concentrations were detected in some of the samples from around the AST area, but the concentrations were below human health risk based guideline values.

After completion of the intrusive investigation, NZTA was notified that the tenant at the site had brought treated timber to the site to be stored, used and possibly burned. It is not known what timber treatment method was used, if any.

On 21 August 2010, a follow up inspection was conducted. The tenant had vacated the site and the bins and other facilities that had previously been at the site were absent. There was evidence of burned wood; a wood pile was present and some of the wood was charred. While it is not possible to determine what timber treatment method was used (if any) based solely on visual inspection, the wood did not have the dark stained appearance that is typical of pentachlorophenol or creosote treatment. The timber appeared relatively fresh and was comprised of round logs which had been cut to length.

Other site features of note included large piles of soil and debris, general site debris, an excavator, a outhouse which drains to the ground and an empty storage shed. There was also what appeared to be waste asphalt spread across the site, as well as some gold coloured gravel. Poned water was apparent, but no hydrocarbon sheen was noted.

While the timber, charred wood, debris, outhouse, storage shed and waste asphalt are not likely to present a significant risk to human health, they should be cleared from the site and properly disposed of at a licensed facility. Verification sampling following removal of these features may be warranted (see **Appendix I**). There may be a leachfield present (associated with the outhouse); this could contain biological constituents and the area should be treated with appropriate caution and personal protective equipment worn when handling. While faecal coliforms typically present little or no risk after six to eight months, viruses can linger for several years. Therefore, appropriate precautions should be taken when excavating the area.

The surface water sample had no contaminants of concern present above laboratory reporting limits. Additional sampling of the stream was conducted as part of the water quality portion of this project; more detailed information is available in the water quality report.

Summary of ecological risk

Two zinc results (270 mg/kg and 320 mg/kg) were above the recreational/parkland ecological guideline value of 200 mg/kg. The zinc appears to be associated with the adjacent galvanised structure. The isolated elevated concentrations of zinc are not believed to present a significant threat to local ecology. The area is slated for development first as a construction office area and then as a roundabout. The construction planned is primarily fill (rather than cut) activities.

While there is not believed to be significant ecological risk, several features at the site may present a minor degree of risk to human health and the environment. These features should be properly addressed during enabling works to reduce potential risk to construction and maintenance workers as well as to local ecology and the adjacent stream.

2.2.8 Mana Coach

The Mana Coach facility is used for parking and maintenance of buses and related vehicles. The portion of the facility closest to the link road is the bus parking area, which is paved with asphalt and surrounded by a curb. There is significant staining present in the parking lot, but it appears confined to the asphalted area. There are maintenance facilities and current and former UST present at the site. However, these features are downgradient of the link road alignment. Soil samples were collected from two edges of the parking area to determine whether the observed vehicle leakage had migrated beyond the curb.

Summary of human health risk

The samples collected from the edges of the Mana Coach bus parking area returned results below human health guideline values.

Summary of ecological risk

All results were below ecological guideline values. There is staining apparent on the adjacent asphalt parking lot; the purpose of obtaining samples from the outer perimeter of the bus parking area was to determine whether contaminants of concern were migrating off-site either through the soil or from stormwater runoff. Based on the sampling conducted, it appears that the hydrocarbon releases have not impacted the area on the southern side and south-western corner of the parking area. Therefore, the site does not appear to present a risk to local ecology.

2.2.9 GWRC former sheep dip site

The GWRC former sheep dip site is part of Belmont Regional Park and is situated uphill and upgradient of the highway route. The actual highway will be constructed in an area of plantation forest; however, this area was not readily accessible. Therefore, samples were collected from test pits between the former sheep dip site and the highway route to determine whether pesticides had migrated downgradient and could impact the highway. Three test pits were excavated and samples collected from three depths in each test pit.

Summary of human health risk

At the area downgradient of the GWRC former sheep dip site, all samples returned results below human health guideline values. Two samples returned zinc results slightly above typical background levels. These samples also had detections of dieldrin; however, the values were well below the human health risk based guideline value.

Summary of ecological risk

No metals were present above ecological risk based guideline values; however, all metals except lead returned results slightly above the typical Wellington regional background range (URS, 2003). Dieldrin was present above ecological risk based guideline values in two surface soil samples, but was below laboratory detection limits in the remaining samples.

While dieldrin is present above ecological risk based guideline values, it appears to be limited to the near surface. Highway construction will result in the excavation of soil and, by default, surface soil will be mixed with deeper soil and concentrations of detected constituents will be diluted. Because of the limited extent of the dieldrin and because the soil containing the dieldrin will be mixed with other soil, it is not believed to present a risk to local ecology. In addition, the stormwater treatment plan has taken the potential presence of contamination into consideration to further limit the possibility of ecological damage.

While the ecological risk is believed to be low, it would not be prudent to place the excavated soil in an ecologically sensitive environment, such as an area with pristine native bush. It is not likely that the soil would present a hazard, per se, but due to the evidence of anthropogenic activities, the most

appropriate course of action would be to place any excavated soil under a road or structure, or in a disposal area that is situated in a previously disturbed area.

2.2.10 Former stockyard site

The former stockyard site was initially identified as a site of concern because it was reportedly a sheep dip site. However, further information indicated that it had not contained a sheep dip facility, but had housed cattle, deer and sheep in holding pens. Soil samples were collected from within and around the pens to evaluate the potential presence of pesticides and metals. Samples were collected based on a judgmental sampling strategy within and around the pens.

Summary of human health risk

All soil samples analysed returned results below human health risk based guideline values for all constituents of concern.

Summary of ecological risk

With one exception, metals were not present above ecological risk based guideline values in all samples analysed and most of the samples were in the range of typical Wellington background values (URS, 2003). Zinc was present in one sample at a concentration of 210 mg/kg, which is slightly above the recreational/parkland ecological risk based concentration of 200 mg/kg. While the recreational/parkland ecological risk based concentration is slightly exceeded, it appears to be localised and is likely due to the presence of galvanised structures at the site.

Total DDT recreational/parkland ecological risk based guideline values were exceeded in six near-surface samples; however, concentrations were well below commercial/industrial ecological guideline values. DDT was detected in all of the samples collected from across the site and is likely to be the result of past application of the pesticides in the general area. While the ecological guideline is exceeded, the risk is likely to be low for local ecology (i.e., grazing land).

The majority of the site will be covered by the highway and during excavation (i.e., this area will be filled), the shallow soil will be blended with deeper soil, diluting the concentration of zinc. Therefore, this slight exceedance is not believed to pose a threat to local ecology.

While the ecological risk is believed to be low, it would not be prudent to place the excavated soil in an ecologically sensitive environment, such as an area with pristine native bush. It is not likely that the soil would present a hazard, per se, but due to the evidence of anthropogenic activities, the most appropriate course of action would be to place any excavated soil under a road or structure, or in a disposal area that is situated in an area that has previously been disturbed. The CSMP (**Appendix I**) provides additional details on soil management.

3. Classification of materials

3.1 Preliminary Soil Classification

Preliminary soil classification at each soil sample location has been completed based on comparison of laboratory results with risk based guideline and Wellington regional background values, as well as investigation observations.

These observations and results were obtained from discrete locations based on systematic grid sampling and judgmental sampling. These results are representative but cannot be guaranteed to identify all areas of contamination that may be encountered across the site at other than these locations.

The actual characteristics of the subsurface materials may vary significantly between adjacent test points and sample intervals and at locations other than where observations, explorations and investigations have been made. Subsurface conditions, including groundwater levels and contaminant concentrations can change over a short distance. This should be considered when classifying soils for disposal.

The assessment of soils for reuse within the construction footprint, or disposal to a licensed facility, is based around the standard classification of soils into cleanfill, managed fill or contaminated fill; a brief definition of each is given below.

3.2 Contaminated fill

Contaminated fill in the context of this assessment constitutes:

- Hazardous materials in the form of household and industrial waste, organic waste or asbestos containing material.
- Soil with contamination present above human health guideline values (e.g., Porirua Gun Club soil in target and firing range areas).

3.3 Managed fill

Managed fill comprises:

- Soil containing metal contaminants above Wellington regional background concentrations (URS, 2003).
- Soil containing detectable hydrocarbon compounds.
- Soil containing contaminants of concern above ecological risk based guideline values.
- Soil that does not contain hazardous substances or materials in the form of household and industrial waste, organic waste or asbestos containing material.

3.4 Cleanfill

Cleanfill is defined by reference to the MfE document, "A Guide to the Management of Cleanfills" (2002) as:

“..material that when buried will have no adverse effect on people or the environment; and includes virgin materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of:

- Combustible, putrescible, degradable or leachable components
- Hazardous substances
- Products or materials derived from hazardous waste treatment, hazardous waste stabilization or hazardous waste disposal practices
- Materials that may present a risk to human health
- Liquid waste.”

In simpler terms cleanfill includes materials such as uncontaminated soils, cured asphalt, bricks, unreinforced concrete, fibre cement building products (excluding asbestos) and glass. Non cleanfill materials would include soils with analytical results showing detectable hydrocarbon compounds and/or exceedance of Wellington regional background concentrations of metals, asbestos containing materials, asphalt (new), greenwaste and household refuse.

The following sections provide details of the proposed approach to management of identified contaminated materials and information regarding accidental discovery of contaminated materials.

4. Contaminated soil management

4.1 Introduction

Contaminated soil is defined as soil that has constituents of concern present above background or risk based guideline values. It should be noted that many of the risk based guideline values are not concrete limits, but are trigger values that indicate that additional investigation and evaluation is required. In some instances, the guideline values are considered remedial action goals or are indicative that soil management is required.

With regard to soil, there are four basic categories:

- Contamination present above human health guideline values
- Contamination present above ecological guideline values
- Possible contamination present above guideline values
- No contamination present above guideline values

Management of each is addressed below on a site-by-site basis.

4.2 Contamination greater than human health guideline values

Soil contamination was present above NES SCV at the Porirua Gun Club and in one sample from the former Golden Coast Nurseries. Asbestos was identified in building materials samples collected from the former Golden Coast Nurseries.

4.2.1 Porirua Gun Club

Lead and benzo(a)pyrene are present at the Porirua Gun Club above the NES SCV in the firing range and target areas. With the exception of one sample location, the high concentrations are limited to the upper 0.3m of soil. Elevated concentrations of lead were also detected in the drainage channel on the site. A wastewater treatment area (leachfield) is present, as is an ammunition burn pit. While biological agents and dioxins/furans were present below risk based guideline values, their presence warrants consideration with regard to protection of human health and the environment.

At the time this report was developed, the Gun Club was still in operation. Therefore, the extent of contamination may be greater at the time of highway construction that was seen during this investigation. A two-step process is recommended for the Gun Club.

First, an evaluation of contamination should be made once operations cease to determine whether the extent of contamination has increased. This may take the form of a visual inspection or additional sampling and analysis.

Second, a remedial action plan should be developed that details the steps to be taken to manage the soil. Because of the high concentrations of contaminants, soil treatment, such as stabilisation with concrete or microencapsulation, will likely be required. The soil may be stabilised and reused on site (if practicable) or transported off-site to a licensed landfill. Note that if the soil is removed from the site and disposed of or re-used elsewhere, consent will be required. The remedial action plan should address protection of human health and the environment and should include:

- An evaluation of remedial action alternatives so that the most appropriate and cost effective method of remediation is selected.
- A worker health and safety plan.

- Requirements for air quality management during remediation to ensure that employee exposures and environmental degradation do not occur. This is particularly important as there are nearby residences.
- Requirements for erosion control and stormwater management to ensure that stormwater run-off does not leave the site and that stormwater run-on does not travel over contaminated soil.
- Requirements for soil excavation, treatment and disposal.
- A plan for verification sampling following completion of remediation.

4.2.2 Former Golden Coast Nurseries

Arsenic was detected above the NES SCV in one surface soil sample collected from the interior of one of the glass houses. The underlying deeper sample returned an arsenic result below the NES SCV, as did surrounding samples. Therefore, the arsenic contamination appears to be localised and is likely the result of a chemical spill (e.g., pesticides containing arsenic) during past operations. Because the contamination is localised, site remediation is not warranted. However, care must be taken in placing and managing the soil and workers must be informed of the potential risk. The soil samples collected from the same glass house had concentrations of various metals above ecological risk based guideline values; therefore, the management requirements for contaminated soil outlined below apply and are considered adequate for protection of human health and the environment.

Asbestos was detected in two of the building samples obtained from the largest structure at the Golden Coast Nurseries site. The asbestos sampling conducted was limited in nature and should not be considered comprehensive. Prior to building demolition, a detailed asbestos survey should be conducted and an asbestos management plan developed. The plan should be followed during building demolition to ensure that asbestos does not adversely affect human health or the environment.

4.3 Contamination greater than ecological guideline values

Contamination at concentrations greater than ecological risk based guideline values was detected at all sites except the Mana Coach site. Each site is discussed below.

4.3.1 Sang Sue Market Garden

One soil sample collected at the Sang Sue Market Garden has been identified as having copper present above ecological risk based values. Metals were also present above background concentrations. Pesticide residue was also present at the site.

Therefore, soil excavated from the site should be utilised as part of construction or disposed of in an area which has already been disturbed. Because there are metals and pesticides present above background concentrations, placement of excavated soil in an ecologically sensitive area is not recommended. In addition, the soil should not be used in an area where stormwater runoff from the soil could lead to ecological damage, such as in an infiltration basin or stormwater pond. Instead, the soil can be reused at the site, such as for fill beneath the highway or structure. Alternatively, it may be left on site, provided that clean topsoil is placed over the impacted soil next to existing SH1.

4.3.2 Golden Coast Nurseries

Detectable concentrations of pesticides and higher than background concentrations of metals were found at Golden Coast Nurseries. As noted above, one sample had arsenic present above the NES SCV for protection of human health. Operations at the site have ceased and new releases are not anticipated.

Because samples did return results for metals well above ecological risk based guideline values and above typical background concentrations, the upper layer of soil from the site should not be placed in an area where ecologically sensitive receptors are present or where stormwater runoff could lead to

ecological damage. The soil could be re-used on site, such as fill beneath a roadway or structure, or placed in an appropriate area where stormwater treatment has considered the presence of metals and pesticides. Alternatively, it could be left in place provided that clean fill material is placed on top.

The areas in the greenhouses, near the northern boundary of the site, where heavy metal concentrations were up to an order of magnitude greater than background concentrations should receive additional consideration when the soil is utilised or placed. Management of this soil should be conducted to ensure that stormwater run-off will not result in environmental degradation. Particular attention should be paid to erosion control in this area so that stormwater runoff does not impact on the Sang Sue Market Garden, which is downgradient of the former Golden Coast Nurseries and across existing SH1. Dust management systems should be established so that dust generated from removal of the upper 0.3 m of soil does not impact on adjacent or nearby properties, such as the Sang Sue Market Garden or nearby residences.

4.3.3 Car Haulaways

While hydrocarbons above laboratory reporting limits were found in some of the samples at Car Haulaways, none were above human health risk based guideline values. The hydrocarbons detected appeared to be consistent with minor past releases from vehicles. The zinc exceedances are likely due to the presence of galvanised structures at the site. Chromium is also present at concentrations above expected background concentrations in two locations. Operations at the site have ceased and continued releases are not anticipated.

The risk of the presence of contamination above human health risk based guideline values is low; however, this potential risk is addressed in the contaminated soils management plan (**Appendix I**).

Because there are ecological risk based guideline value exceedances for zinc, it is recommended that the soil be used beneath a roadway or structure. Placement of the soil in an ecologically sensitive area is not recommended. Stormwater runoff should be managed so that contaminants do not leave the site and air quality management practices should be employed to minimise dust to the greatest extent practicable.

4.3.4 Porirua Gun Club

Heavy metals and benzo(a)pyrene are present above ecological risk based guideline values at this site. However, they are also present above the NES SCV in several areas and remedial action is required. The ecological guideline value exceedances should be considered when planning the remedial action, as described in Section 4.2. The precautions described in Section 4.2 of this CSMP should be employed to mitigate potential future environmental risk and ecological damage.

4.3.5 Pauatahanui Inlet Garden Supplies

Zinc was present in two samples above the recreational/parkland ecological risk based guideline value of 200 mg/kg with concentrations of 270 and 320 mg/kg, as compared to a recreational/parkland guideline value of 200 mg/kg. Copper also exceeded the parkland/recreational guideline value of 63 mg/kg, with a concentration of 87 mg/kg. The contamination appears to be localised and is not likely to pose a threat to local ecology, particularly as this area is planned as a construction project yard.

However, there is presence of charred wood, waste asphalt, and a long-drop outhouse. A digger is also present at the site, along with debris and mounds of soil. While there is no confirmed threat to ecology from these features, there is a possibility that contamination above guideline values is present at the site. In February 2011, the site was cleared of debris.

Based on sampling conducted at the site, it appears likely that the contamination (if present) would be confined to the shallow soil (i.e., less than 0.2m deep). If still present, the outhouse should be properly removed and disposed of in accordance with good practice guidelines. There is a potential that biological pathogens (such as faecal coliforms) are present; personnel remove the outhouse should take appropriate precautions. It is not known if there is a leachfield associated with the outhouse;

however, appropriate precautions should be taken during site excavation. Soil that remains on site may be used under structures or as fill under the highway, but should not be placed in ecologically sensitive areas or used for construction of erosion control ponds or wetlands.

4.3.6 GWRC former sheep dip site

While pesticides were detected in samples collected during the investigation of this site, they were present in relatively shallow samples. Therefore, it is most likely that they are residual pesticides that may have dripped from livestock or were sprayed in the area for pest control. The detections of pesticide were slightly above ecological risk based guideline values. However, the contamination appears to be localised and relatively shallow. Because of the relatively low risk, no remedial action is recommended at this time. However, in the interest of being conservative, soil excavated from this area should be placed in areas beneath roads or structures. The soil from this area should not be used for construction of erosion control ponds and should not be placed in an ecological sensitive area.

4.3.7 Former stockyard site

As the majority of the samples returned relatively low pesticide (DDT) concentrations, it is not considered likely that this area was a sheep dip site. One zinc detection slightly above ecological guideline values is not considered to present a significant risk to local ecology because it is likely that the DDT has been present for many years and local ecology does not appear to be adversely effected. On this basis, no remedial action is recommended for this site. However, soil excavated from this area should be placed in areas beneath roads or structures or used as fill material. Alternatively, clean fill could be emplaced over this soil to effectively cap it on site. Dust and erosion control measures should be employed to minimise migration of any surface contamination.

4.4 Possible contamination present

No land contamination investigation can guarantee the absence of contamination. Accidental discovery of contamination is always a possibility during any construction project. In addition, spills, leaks, and releases can occur after the land contamination investigation has been completed. While the investigation has been thorough, there is still a possibility that contamination will be encountered, including in areas that have been investigated.

Areas of possible contamination include greenfields sites where rubbish or offal pits, livestock dips, USTs, past ASTs, or hazardous materials storage could have led to contamination. Buildings can also be a source of contamination, with the presence of asbestos, lead-based paint, PCB-containing light ballasts or other equipment, and hazardous materials storage.

Sites where operations are still ongoing could also be subject to spills, leaks, and releases that had not occurred at the time the investigation was completed.

There is a reported landfill in the plantation forest area near Ribbonwood Tce. Interviews with persons knowledgeable of the area and review of historic aerial photos did not reveal the presence of a landfill; however, it is recorded in Council records. It is possible that once the plantation forest is cleared and the area is excavated, the landfill could be discovered.

The MacKays Crossing may have UXO present. If UXO is present and is detonated in place, residual hazardous materials could impact the soil. A sampling and analysis plan for evaluating potential residual explosives will be required, and remedial action may also be required.

4.5 No contamination present

The sampling conducted at the Mana Coach site did not reveal the presence of contamination above human health or ecological risk based guideline values. Other sites have a very low risk of contamination being present. Where no apparent or verified contamination is present, and no past

HAIL activities were conducted, the soil may be considered cleanfill, as defined in Section 3 of this Plan.

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5. Soil quality monitoring

Soil quality monitoring is required to cover three key aspects as related to the effective management of contaminated and potentially contaminated materials associated with the Project works, including:

- *Verification testing*: targeted at the management of materials removed from site to a controlled/consented disposal site.
- *Validation testing*: targeted at documenting the concentrations of contaminants within the materials underlying the excavation works that remain in situ.
- *Discovery testing*: in response to “unknown” or unexpected contamination.

An explanation of each type of testing is provided below.

5.1 Soil Verification Testing

Contaminated soil assessments, where soil contaminant concentrations have been compared to accepted soil contaminant assessment criteria, have been undertaken to give an indication of the occurrence of contamination along the main alignment. Because operations are still ongoing at some sites, not all sites are secure and may be subject to illegal dumping, and the final earthworks design is not complete, additional assessment may be required to confirm the lateral and vertical extent of contamination once the full extent and staging of the earthworks is finalised.

Soil testing should be conducted in accordance with MfE CLMG. Samples may be collected on either a systematic (grid-based) or judgemental basis, depending on the requirements for the particular site. Analytes should be selected based on the potential contamination present. All samples will be analysed by an IANZ accredited laboratory, and results compared with appropriate risk based human health and ecological guideline values.

5.2 Soil Validation Testing

At any location where contaminated soils have been excavated, samples of material will be collected at the base (along the centreline) and the sides of the excavation. The samples will be submitted for targeted chemical characterisation according to the nature of the contamination as defined in the land contamination report. This sampling and testing would provide validation of removal of any contamination of in situ soils underlying and surrounding the excavation works.

The testing of material being left in situ located at the subgrade layer may, in some locations, indicate that such materials are contaminated. It is noted that it is not intended that the works aim to remediate any such soils. It is recognised that if the soil quality at the subgrade depth indicates that contamination above risk based guideline values is left in place, a Long Term Management Plan (LTMP) may be required for these soils. The LTMP will address worker and environmental protection during maintenance operations that may disturb the in situ contaminated soils.

In the case of the Porirua Gun Club, the remedial action plan should specifically address soil validation sampling requirements. Note that it may be possible to utilise field instruments, such as XRF, to screen the site for lead contamination. However, validation samples should be collected to verify the field readings.

5.3 Soil Discovery Testing

If during the excavation works “unexpected” or “unknown” contamination is encountered, additional chemical testing may be warranted. Such a decision will be made in consultation with the project contaminated land specialist (CLS) (or equivalent position with contaminated land expertise). This response is analogous to that required for archaeological discovery.

A pre-earthworks site meeting will be held and attended by the Contractor, the CLS, and personal involved with the earthworks to discuss the risks and site procedures for handling contaminated materials and/or potentially contaminated material located along the route.

The CLS will be available on site during excavation works and will be responsible, based upon the demarcation of fill and natural ground, for defining which materials are cleanfill, managed fill or contaminated fill. This process will enable material to be loaded directly onto trucks and immediately taken to the appropriate location (cleanfill, managed fill or landfill as appropriate).

6. Methods for Unexpected Contamination and Hazardous Materials

Available information indicates that the majority of the material to be excavated will be cleanfill or managed fill. However, due to the heterogeneous nature of the soil material on site, it is possible that unexpected contaminated soil or hazardous materials could be discovered during the excavation works. These may include but are not limited to the following:

- Intact or broken drums and containers.
- Unusual odours.
- Discoloured or stained water seeps and soils.
- Hydrocarbon contaminated soil and/or free product.
- Liquid waste, putrescible waste, household refuse and any material that normally would be sent to a licensed landfill.
- Gas bubbles or sheen on standing/pooled water.
- Fibrous material (such as asbestos).
- Evidence of offal pits, rubbish pits, storage tanks, or livestock dips.

During the excavation works on site, the Contractor and CLS shall actively monitor for the conditions/materials specified above. In the event that one of these is identified, the Contractor shall take the following actions:

- Stop all earthworks within a 10m radius of the area where the suspect material, emission, or discharge has been recorded.
- Immediately notify the site supervisor.
- Cordon off the area as practicable with a suitable barrier.
- Contact the NZTA Project Environmental Manager who will advise on the appropriate course of action in consultation with the CLS.
- The CLS shall notify NZTA and the regulatory authorities (GWRC and the appropriate District or City Council).
- Work shall not resume or commence within a 10m radius of the area unless authorised by the NZTA Project Environmental Manager and CLS.
- Record all details on an incident form, including GPS of location.
- If the CLS considers it appropriate, the suspected contaminated material may be excavated into a covered bin to allow works to continue with minimum delay.

- If excavation into a covered bin is inappropriate, construction work should proceed to an area clear of contamination indicators until material testing as necessary defines the material characteristics.
- When the material characteristics have been established, unsuitable material will be directly loaded into trucks for disposal at a licensed landfill, assuming it can be accepted without prior stabilisation.
- All appropriate information such as location, quantity and off-site weighbridge dockets must be recorded.
- Should asbestos be observed or suspected during the excavation works, all work shall cease and Guidelines for the Management and Removal of Asbestos (revised 1999) for the Department of Labour, and the Health & Safety in Employment (Asbestos) Regulations (1998) will be followed. Works can recommence once all asbestos has been removed safely. Any such asbestos works (assessment, delineation, removal and verification) would be undertaken by a specialist asbestos contractor.

Stockpiling of contaminated material should be avoided if at all possible. If stockpiling of contaminated materials cannot be avoided, the following steps should be taken:

- Samples of the soil underneath the proposed stockpile area shall be collected for contamination testing to determine any baseline levels of contamination.
- The stockpiled material should be placed on plastic sheeting, such as HDPE or similar, to prevent contamination of underlying material.
- The stockpile shall be covered at all times except when material is being added to prevent dust and odour emissions and rainfall contact.
- A berm shall be installed around the stockpile to prevent runoff from leaving the area and stormwater from other areas entering the stockpile area.
- Stockpiles shall not be placed near drains or watercourses.
- At the end of the project works the area under the stockpile shall be reinstated.
- The soil underneath the stockpile areas shall be tested to verify that the stockpiling activities have not caused ground contamination

7. Methods for Handling and Disposal of Potentially Contaminated and Contaminated Materials

Actions to be taken to manage issues associated with potentially contaminated or contaminated material include:

- The Contractor shall prepare a site-specific Health and Safety Plan for the earthworks. The Health and Safety plan shall address worker health and safety in regard to hazardous materials, as well as to related construction hazards.
- Access to the site shall be restricted to authorised personnel, following appropriate site induction procedures.
- Dust suppression, erosion and sediment controls will be installed prior to earthworks commencing.
- All staff involved in the excavation works shall immediately report to the CLS any visual or olfactory evidence of previously unidentified contamination.
- The Contractor shall maintain daily records of where excavations have occurred, the type and volume of material excavated and where the material has been disposed of, stored or stockpiled.
- The CLS and NZTA Project Environmental Manager will consult when evidence of contaminated material is reported and decide on the best option for managing these materials.
- Stockpiling of excavated material, with appropriate erosion and sediment controls, shall be limited to confirmed cleanfill to the greatest extent possible.
- Contaminated materials should be either loaded directly into trucks for off-site disposal or loaded into a covered bin, designed to prevent rainfall contact with the material, for later disposal. If stockpiling of contaminated soil is required, stormwater run-off/run-off control (such as a berm) will be put in place around the stockpile areas. Samples of the soil underneath the proposed stockpile area shall be collected for contamination testing to determine any baseline levels of contamination. Heavy duty plastic (such as HDPE) will be placed on a prepared area prior to placing stockpiled material. The stockpile will be kept covered at all times except when material is being added. Dust control measures will be put in place to assure that contaminated dust does not travel off-site or present a potential risk to human health or the environment. Additions to the stockpile will not be made during high wind events. When the stockpile is removed, the plastic will be properly disposed of and validation sampling of the underlying soil will be conducted.
- Material disposed at a landfill must be to a facility licensed to accept such material.
- Contaminated material (such as that above ecological risk based guideline values) will be properly dispositioned so that it does not present a threat to the environment. For example, it may be placed under a roadway or structure, or in a fill disposal area where it can be covered with fill material known to be clean so that it is essentially capped. When utilised or disposed in this manner, the contaminated material is classified as managed fill. The material will be managed in a manner that stormwater run off is properly treated in accordance with the Stormwater Treatment Devices and Erosion Control plans.

- The Contractor shall maintain a register of landfill disposal activities and record the location of excavation, disposal location, quantity of material and off-site weighbridge documents.
- The Contractor shall maintain a register of disposition of managed fill and will record the location of excavation, disposal location, quantity of material, and any off-site weighbridge documents.
- Upon completion of excavation works, all plant and equipment shall be cleaned and decontaminated in an appropriate manner. Water from wheel washes shall be collected and disposed of appropriately.
- Any fill from unknown sources that has not been certified clean that is imported to reinstate the site shall be tested at a rate of one sample per 1,000 m³ of fill for an appropriate suite of contaminants to demonstrate that it is acceptable as cleanfill.
- The CLS (or equivalent position) will be responsible for compliance with all landfill disposal permit requirements prior to excavation works commencing.
- If additional property acquisitions take place prior to or during construction, the NZTA Contaminated Land Acquisition Protocol (2010a) will be followed. If hazardous or contaminated materials spills or releases occur, the NZTA Standard Operating Procedure, Response to Spills Arising from Transport Incidents on the State Highway Network (2010b) will be followed.

8. Plan Review

This Plan will be reviewed by the contractor upon award of the Project (prior to commencement of construction) and at least annually. If changes are warranted, the Contractor will record decisions and rationale for the decisions and will make subsequent changes to the Plan. After revision, this Plan will be submitted for signoff by appropriate NZTA representatives and the approval authority. The Project team will be informed of any changes to this Plan through the regular project communications processes. The review will consider the following:

- Any significant changes to construction activities or methods.
- Key changes to roles and responsibilities within the project.
- Changes in industry best practice standards or recommended pollution controls.
- Changes in legislative or other requirements (social and environmental legal requirements, NZTA objectives and relevant policies, plans, standards, specifications and guidelines.
- Results of inspection and maintenance programmes, and logs of incidents, corrective actions, internal or external assessments.
- Remedial and mitigation actions that could change the contamination status of a site.

The Plan will also be updated to include information regarding placement of managed fill and any required precautions to be taken during site maintenance at locations where managed fill was placed.

As the Project progresses and contamination is remediated or mitigated, the Project Risk Register should also be updated.

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Attachment A

Protocol for unexploded ordnance discovery

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**Attachment 1, Appendix 16.1
Protocol for Unexploded
Ordnance
Transmission Gully Highway
Project, Technical Report #16
NZ Transport Agency**

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1. Overview

1.1 Introduction

Past military activities in the vicinity of MacKays Crossing may have resulted in the presence of unexploded ordnance along the path of the proposed Transmission Gully Highway.

Investigations in the nearby Queen Elizabeth II Park have discovered various mortar shells and other unexploded ordnance in the area. Historic records indicate that in the World War II era, mortar shells and other large ordnance may have been fired from MacKays Crossing down-range, in a path approximately 500m wide by 1km long toward the south, generally following State Highway 1 (SH1). The area was not known to be a small arms firing range; the ordnance discovered to date has been larger ordnance.

Aurecon New Zealand Limited (Aurecon) was commissioned by the NZ Transport Agency (NZTA) to conduct an investigation into potential contamination along the proposed Transmission Gully Highway preferred designation. As part of this scope of work, an investigation into possible unexploded ordnance was recommended by Aurecon and authorised by NZTA.

1.2 Transmission Gully Highway

The Transmission Gully Highway preferred designation generally follows SH1 from MacKays Crossing to the south for approximately 1.5 km, when it veers toward the southeast. The portion of the Transmission Gully Highway preferred designation that parallels SH1 from MacKays Crossing to the south is within the pathway of potential unexploded ordnance.

While unexploded ordnance is not likely to spontaneously detonate, certain activities which could create large pressure waves or sparking could cause detonation. This would pose a hazard to construction workers and the public.

1.3 Potential unexploded ordnance evaluation overview

The area at and south of MacKays Crossing has been disturbed by construction and agricultural activities over time. Some of the ordnance may have been deliberately buried; other ordnance could be covered with windblown material or construction fill that was placed next to the existing highway. Because the area has been highly disturbed, it is likely that if any ordnance is present that it will be underground and not visible at the surface.

Geophysical surveys are typically utilised to identify areas where unexploded ordnance could be present. The geophysical survey is a non-intrusive survey, using radar, electromagnetic waves, or similar, to located underground anomalies. These anomalies could represent unexploded ordnance, areas of fill with a high metallic content, landfills, underground storage tanks, or similar subsurface features. Based on the location, depth, and size of the anomaly detected, it can be theorised what is represented by the anomaly.

2. Geophysical survey

2.1 Overview

In order to evaluate the possible presence of unexploded ordnance, a geophysical survey has been conducted of the area around and south of MacKays Crossing. The geophysical survey was utilised to investigate, detect, and plot the location of any anomalies that are considered possible unexploded ordnance.

GPR Geophysical Services conducted a geophysical survey of the designated area in and around MacKays Crossing using time domain electromagnetic induction (EMI) to characterise possible unexploded ordnance.

2.2 Survey findings

The geophysical survey indicated that unexploded ordnance may be present, particularly in the paddocks adjacent to SH1. The GPR Geophysical Services report, included in the Transmission Gully Highway Stage 1 and 2 Land Contamination Assessment and Investigation Report (Technical Report #27), should be referred to prior to any excavation taking place along SH1 from MacKays Crossing to the northern end of the Sang Sue Market Garden. The survey findings are summarised below. The surveyed area was divided into eight areas.

The results of the EM61 survey show that the large areas immediately adjacent to SH1 appear to be generally clear of metallic anomalies that might be indicative of UXO. Local cultural effects due to metal crash barriers, metal fence wires and metal gates are considered to have caused the majority of the anomalies detected in these areas (Areas 1, 5, 6 and 7). The exception is Area 8 which appears to have a significant number of buried metallic anomalies in addition to the effects of local cultural features.

By contrast the currently farmed paddock areas on the west side of SH1 (Areas 2, 3 and 4) exhibit a significant number of detected metallic anomalies which are considered possible UXO.

With reference to the annotated and marked up geo-referenced figure provided in the GPR Geophysical Services report, a summary of the results from each area searched is as follows:

Area 1 – Considered to be clear of any buried metallic anomalies that might be UXO.

Area 2 – This farmed paddock has two suspected underground services crossing the paddock in a NW to SE direction and these can be seen on the resultant plotted results. There are also a number of small response buried metallic anomalies evident. These would have to be taken as possible UXO and treated as such.

Area 3 – This farmed paddock shows indications of a number of buried metallic anomalies which are considered to be possible UXO and should be treated as such. The four (4) larger responses seen are suspected as possibly due to agricultural buried waste such as rolls of buried fence wire and/or pieces of roofing iron. However at this stage they would of course need to be treated as possible UXO and treated as such.

Area 4 - This farmed paddock shows indications of a large number of buried metallic anomalies and is the 'busiest' looking paddock of all the areas searched. It is considered that all of the detected anomalies are possible UXO and should be treated as such.

Area 5 – This area, adjacent to the current sealed farm access road, shows evidence of a few buried metallic anomalies, however the larger anomalies are most likely due to local cultural effects such as metal fence wire and metal gates. The anomalies considered due to cultural effects are noted on

figures provided in the report. It is considered that all of the smaller response detected anomalies are possible UXO and should be treated as such.

Area 6 – This area shows two areas with large metallic anomalies which are considered due to local cultural features such as metal fence wire and metal gates. The area is considered clear of detected anomalies that are possible UXO.

Area 7 – Although there are a large number of significant size anomalies indicated in this area these anomalies are considered due to local cultural effects and this has been noted as such on the figures provided in the GPR Geophysical Services report.

Area 8 – In a similar manner to Area 7 above there are a large anomalies in this area which are considered due to local cultural effects and these have been noted as such in the GPR Geophysical Services report. There are also however, some small to medium response detected anomalies, which are possible UXO and should be treated as such.

3. Management requirements

3.1 Buried unexploded ordnance disposition

If buried suspect unexploded ordnance is found within the area to be disturbed by construction it is likely to require disposal. The New Zealand Police Force, Kapiti Police Station, should be notified. They can be contacted at (04) 296 6800. The Police Force will determine what actions are appropriate. The Police Force may contact the NZ Army to provide munitions experts to excavate the ordnance and arrange for disposal. The Police Force will also take steps necessary to secure the scene.

3.2 Construction precautions

While the geophysical survey has a high degree of accuracy, it is possible that unexploded ordnance may be present and not identified by the survey. Contractors working on this portion of the highway should be notified about the possibility of unexploded ordnance being present and precautions should be addressed in the contractor's health and safety plan. Vibrating compaction equipment should be avoided in the area where unexploded ordnance may be present until the area has been verified free of unexploded ordnance.

If unexploded ordnance is discovered during construction, work within a 100m radius of the discovery will stop immediately. The construction supervisor will take immediate steps to secure the site to ensure that the ordnance remains undisturbed and the site is safe. The construction supervisor must immediately notify NZ Police at (04) 296 6800 and the NZTA Project Manager.

If additional ordnance is found outside the 100m radius zone around the original discovery, NZTA will adopt a precautionary approach and halt all work on the project construction site in the MacKays Crossing area until consultation with NZ Police has taken place.

NZTA will take steps to help ensure that the NZ Police respond in a timely manner and that the ordnance is dealt with in a safe manner. NZTA will also liaise with adjacent landowners as appropriate to notify them of the situation and planned actions.

The Project Risk Register will be updated as appropriate throughout the process.

3.3 Communication with external agencies and stakeholders

With the exception of notification of NZ Police as described above, communication with external agencies and stakeholders will be conducted in accordance with NZTA communication protocols. All communication with regard to unexploded ordnance will be recorded on the Communication Register.

4. Accidental Discovery

It is possible that unexploded ordnance is present that was not identified by the survey.

The location of any unexploded ordnance found on the surface will be recorded using Global Positioning System equipment. The findings will be verbally reported to the NZTA Project Manager immediately. The NZ Police will also be immediately contacted for an evaluation of the situation. The Kapiti Police Station is the appropriate contact: (04) 296 6800. They will take steps to secure the area and arrange for appropriate disposition of the ordnance.

Note that the NZ Police will determine the appropriate disposition of the ordnance. The NZ Army would be called in by the NZ Police if the NZ Police felt this was the appropriate action.

In any event, the ordnance should not be disturbed in any way. Stakes should not be driven to mark the location, any equipment that could cause vibration should be immediately shut off, and steps should be taken to cordon off the area until the NZ Police arrive and take control of the situation. While it is unlikely that the ordnance would spontaneously explode, this is always a possibility and appropriate caution must be exercised.