

BEFORE THE QUEENSTOWN LAKES DISTRICT COUNCIL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER Plan Change 50 (Queenstown Town Centre Zone
Extension) to the Queenstown Lakes District Plan

STATEMENT OF EVIDENCE OF GLENN DAVIS

EXECUTIVE SUMMARY

The proposed Lakeview Sub Zone has had a history of activities that have the potential to impact soil quality including the operation of the holiday park workshop, bulk storage of diesel, electrical transformers, and the possible application of persistent pesticides to the former cricket field and maintenance of holiday park camping areas. The development of the site will result in people being exposed to soils during site redevelopment and activities associated with the change in landuse which has the potential to present a risk to human health.

The landuse activities proposed under the Lakeview Sub Zone are consistent with three landuse scenarios set in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES) including high-density residential, parks/recreational and commercial/industrial landuse. The NES has established soil contaminant guidelines for 12 priority contaminants based on the toxicity of the contaminants and assumed exposure scenarios. Based on my experience with the potential contaminants associated with historical activities on the site, observations onsite and no evidence to suggest any significant loss of chemicals have occurred I consider it is highly unlikely the historical activities would have resulted in contaminant concentrations in soils that exceed the relevant NES soil contaminant standards. The Lakeview Sub Zone is therefore suitable for activities that may occur as a result of the plan change.

I recommend that some consideration of contaminant concentrations is undertaken if offsite disposal of soil is required to ensure the soils are disposed of appropriately.

1. INTRODUCTION

- 1.1 My name is Glenn Alister Davis. I am Director and Principal Environmental Scientist of Davis Consulting Group Limited (DCG). I have 18 years' postgraduate work experience in environmental management. I have a BSc in Ecology and MSc in Geography. DCG has been a member of WasteMINZ since 2011.
- 1.2 My experience relevant to the subject of the plan change includes multiple preliminary and detailed site investigations and contaminated sites remedial work throughout New Zealand and internationally for the land development and oil and gas sectors.
- 1.3 An example of my experience specifically relevant to the Lakeview Sub Zone assessment is the completion of a number of detailed site investigations in the Te Anau, Invercargill and Queenstown areas to consider the suitability of former farmland for residential development.
- 1.4 I became involved in the current matter in May 2014 when the QLDC commissioned DCG to undertake a Preliminary Site Investigation on the council owned section of the proposed Lakeview Sub Zone. In July 2014, Brecon Street Partnerships Limited commissioned DCG to undertake a further Preliminary Site Investigation of 34 Brecon Street for inclusion in the proposed Lakeview Sub Zone.
- 1.5 I have read the Code of Conduct for Expert Witnesses outlined in the Environment Court's Consolidated Practice Note and have complied with it in preparing this evidence. I also agree to follow the Code when presenting evidence to the Council. I confirm that the issues addressed in this brief of evidence are within my area of expertise and that I have not omitted to consider material facts known to me that might alter or detract from my opinions.

2. SCOPE OF EVIDENCE

- 2.1 In my evidence today I will present the objectives of Preliminary Site Investigation, detail the statutory provisions that trigger the completion of the Preliminary Site Investigation and detail the key findings of the investigation.
- 2.2 The objective of the Preliminary Site Investigation was to assess the current and historical activities that have occurred at the Lakeview sub zone site to determine if any hazardous activities have occurred that may have impacted soil quality and subsequently present a risk to human health and the wider environment.

- 2.3 In order to meet the objective of the investigation staff under my supervision completed a detailed assessment of the historical activities on the site. The investigation included a review of historic aerial photographs, the Heritage Impact Assessment report (NZ Heritage Properties Ltd, 2014), certificate of titles and records held by the QLDC, Otago Regional Council and the Lakes Museum and interviews with personnel familiar with the historical and current use of the site. Once I had a thorough understanding of the landuse history I directed my staff to undertake an assessment of the hazardous activities conducted on the site and the substances associated with these activities.

3. THE PLAN CHANGE

- 3.1 The plan change has been described in detail by Mr Speedy of the Queenstown Lakes District Council for the 34 Brecon Street and Council owned areas of the Lakeview Sub-zone. He has outlined how the site would likely be used. I consider the potential landuse of the site would be consistent with high density residential landuse, parks and recreation and commercial/industrial landuse scenarios. This is relevant to my assessment as the development of New Zealand soil contaminant standards are based on assumptions on the frequency of exposure to contaminants associated with a range of landuses. This is an important point for consideration when assessing the risk to human health from potential contaminants in the site's soils.

4. STATUTORY FRAMEWORK

- 4.1 In preparing this evidence I have had regard to the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES). I prepared the Preliminary Site Investigation report in accordance with the requirements of the Contaminated Land Management Guideline No. 1-Reporting on Contaminated Sites in New Zealand described within regulation 3 of the NES.
- 4.2 I have attached at Appendix A to my evidence extracts of relevant provisions of the Users' Guide to the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (Ministry for the Environment, April 2012):
- 'Soil Contaminant Standards' (Appendix B)
 - 'Hazardous Activities and Industries List (HAIL)' (Appendix C)
 - 'Reporting on contaminated sites under the NES' (Appendix D)

5. KEY FINDINGS

- 5.1 Key findings of my Preliminary Site Investigation for the Proposed Rezoning of Lakeview Queenstown, completed in July 2014 are summarised in the following paragraphs.
- 5.2 The proposed landuse for the proposed Lakeview Sub Zone is consistent with three landuse scenarios set in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES) including high-density residential, parks/recreational and commercial/industrial landuse.
- 5.3 The site is subject to the provisions of the NES due to the presence of activities listed within the NES Hazardous Activities and Industries List (HAIL). These activities include the holiday park workshop, bulk storage of diesel, electrical transformers, historical use of the site as a cricket field and the maintenance of holiday park camping areas.
- 5.4 The key contaminants of concern associated with the HAIL activities that occur or have historically occurred on the site include hydrocarbons associated with the storage of fuel and waste oils, poly-chlorinated biphenols (PCBs) associated with transformer oil and persistent pesticides associated with maintenance of the former cricket field and landscape areas of the holiday park.
- 5.5 Based on my observations onsite and review of the ORC environmental incident information it is my view that hydrocarbon contamination of soils in the vicinity of the bulk fuel storage facility will most likely be localised and associated with small drips and spills from refuelling activities.
- 5.6 The servicing of older transformers on the site may have resulted in small releases of oil containing PCBs to ground, however I expect any impact to be very localised. PCB contaminants are unlikely to be a risk to human health based on the expected high density residential and commercial/industrial landuse activities proposed for the site.
- 5.7 It is my view contaminants such as organochlorine pesticides and heavy metals associated with the maintenance of the former cricket field and landscaped areas of the holiday park are highly unlikely to have accumulated in the site's soils in concentrations that exceed the NES soil contaminant standards for high density residential, parks/recreational and commercial industrial landuse.
- 5.8 It is my view that it is unlikely that contaminants associated with the neighbouring cemetery (nitrates, lead, mercury, formaldehyde and biological hazards) would be present at levels that exceed the NES soil contaminant standards for either the high-

density residential, parks/recreation, or commercial/industrial soil contaminant standards because it is highly unlikely that contaminants associated with the neighbouring cemetery have migrated from the neighbouring cemetery onto the Brecon Street site.

- 5.9 Pipelines, houses and holiday park buildings constructed prior to the 1980s may contain asbestos materials. I understand that human health risks associated with asbestos and PCB contaminated soils from transformer foundations would be managed during demolition and construction according to the provisions of the Building Code (first schedule of the *Building Regulations, 1992*), as well as the relevant provisions of the Health and Safety in Employment Act 1992.
- 5.10 In summary I find that it is highly unlikely there are contaminants in the sites' soils that present a risk to human health from the development and subsequent use of the land for high density residential, parks and recreation or commercial industrial landuse activity.

6. SUBMISSIONS

- 6.1 There were no submissions that raised issues of site contamination.

7. CONCLUSION

- 7.1 For the reasons outlined in my evidence I consider the sites soils are suitable for high density residential, recreational and commercial industrial landuse and I therefore support the proposed plan change.

DATED the 10th day of November 2014

Glenn Davis
Principal Environmental Scientist

Appendix A -

- 'Soil Contaminant Standards' (Appendix B)
- 'Hazardous Activities and Industries List (HAIL)' (Appendix C)
- 'Reporting on contaminated sites under the NES' (Appendix D)

Appendix B: Soil contaminant standards

The five standard land-use scenarios for which soil contamination standards (SCSs) have been derived are contained in Table B1. A summary of the SCSs is presented in Tables B2 and B3. More detailed versions of these tables are contained in Section 7 of the *Methodology*, in which additional residential sub-scenarios have also been derived.

Table B1: Land-use scenarios

Scenario	Description
Rural / lifestyle block	Rural residential land use, including home-grown produce consumption (25 per cent). Applicable to the residential vicinity of farm houses for protection of farming families, but not the productive parts of agricultural land. Note: Consumption of eggs, milk and meat from animals raised on site is excluded. Produce consumption is limited to home-grown vegetables. Sites for which consumption of home-grown eggs, milk or meat is important will need to be evaluated on a site-specific basis.
Residential	Standard residential lot, for single dwelling sites with gardens, including home-grown produce consumption (10 per cent).
High-density residential	Urban residential with limited soil contact, including small ornamental gardens but no vegetable garden (no home-grown produce consumption); applicable to urban townhouses, flats and ground-floor apartments with small ornamental gardens, but not high-rise apartments.
Parks / recreational	Public and private green areas and reserves used for active sports and recreation. This scenario is intended to cover playing fields and suburban reserves where children play frequently. It can also reasonably cover secondary school playing fields but not primary school playing fields.
Commercial / industrial outdoor worker (unpaved)	Commercial / industrial site with varying degrees of exposed soil. Exposure of outdoor workers to near-surface soil during routine maintenance and gardening activities with occasional excavation as part of maintaining subsurface utilities (ie, a caretaker or site maintenance personnel). Also conservatively applicable to outdoor workers on a largely unpaved site.

Table B2: Soil contaminant standards for health (SCS_(health)) for inorganic substances

	Arsenic	Boron	Cadmium (pH 5) ¹	Chromium		Copper	Inorganic lead	Inorganic mercury
				III	VI			
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Rural residential / lifestyle block 25% produce	17	>10,000	0.8	>10,000	290	>10,000	160	200
Residential 10% produce	20	>10,000	3	>10,000	460	>10,000	210	310
High-density residential	45	>10,000	230	>10,000	1,500	>10,000	500	1,000
Recreation	80	>10,000	400	>10,000	2,700	>10,000	880	1,800
Commercial / industrial outdoor worker (unpaved)	70	>10,000	1,300	>10,000	6,300	>10,000	3,300	4,200

Notes: All concentrations refer to dry weight (ie, mg/kg dry weight).

¹ Default value is for soil that is pH 5. Concentrations increase with increasing pH (see *Methodology*).

Table B3: Soil contaminant standards for health (SCS_(health)) for organic compounds

Scenario	BaP ¹	DDT	Dieldrin ²	PCP	Dioxin	
					TCDD	Dioxin-like PCBs
	mg/kg TEQ	mg/kg	mg/kg	mg/kg	µg/kg TEQ	µg/kg TEQ
Rural residential / lifestyle block 25% produce	6	45	1.1	55	0.12	0.09
Residential 10% produce	10	70	2.6	55	0.15	0.12
High-density residential	24	240	45	110	0.35	0.33
Recreation	40	400	70	150	0.6	0.52
Commercial / industrial outdoor worker (unpaved)	35	1,000	160	360	1.4	1.2

Notes: All concentrations refer to dry weight (ie, mg/kg dry weight or µg/kg dry weight).

¹ For benzo(a)pyrene, the equivalent BaP concentration is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-cd)pyrene), multiplied by their respective potency equivalency factors (see table 40 of the *Methodology*).

² The SCS is applicable to either dieldrin or aldrin separately, or to the sum of aldrin and dieldrin if both are involved.

TEQ = Toxic equivalency, an indication of the toxicity of a mixture of compounds.

For dioxins and dioxin-like PCBs the total toxicity is assessed as a toxic equivalency (TEQ) to 2,3,7,8-TCDD using toxic equivalency factors (TEF). The TEQ is defined as the sum of the products of the concentration of each compound multiplied by the value of its TEF (see table 46 of the *Methodology*).

Appendix C: Hazardous Activities and Industries List (HAIL)

Current at date of publication of this Users' Guide. Please refer to the Ministry for the Environment website for a current version.

A Chemical manufacture, application and bulk storage

1. Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application
2. Chemical manufacture, formulation or bulk storage
3. Commercial analytical laboratory sites
4. Corrosives including formulation or bulk storage
5. Dry-cleaning plants including dry-cleaning premises or the bulk storage of dry-cleaning solvents
6. Fertiliser manufacture or bulk storage
7. Gasworks including the manufacture of gas from coal or oil feedstocks
8. Livestock dip or spray race operations
9. Paint manufacture or formulation (excluding retail paint stores)
10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds
11. Pest control including the premises of commercial pest control operators or any authorities that carry out pest control where bulk storage or preparation of pesticide occurs, including preparation of poisoned baits or filling or washing of tanks for pesticide application
12. Pesticide manufacture (including animal poisons, insecticides, fungicides or herbicides) including the commercial manufacturing, blending, mixing or formulating of pesticides
13. Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery, reprocessing or recycling petroleum-based materials, or bulk storage of petroleum or petrochemicals above or below ground
14. Pharmaceutical manufacture including the commercial manufacture, blending, mixing or formulation of pharmaceuticals, including animal remedies or the manufacturing of illicit drugs with the potential for environmental discharges
15. Printing including commercial printing using metal type, inks, dyes, or solvents (excluding photocopy shops)
16. Skin or wool processing including a tannery or fellmongery, or any other commercial facility for hide curing, drying, scouring or finishing or storing wool or leather products
17. Storage tanks or drums for fuel, chemicals or liquid waste
18. Wood treatment or preservation including the commercial use of antiseptant chemicals during milling, or bulk storage of treated timber outside

Appendix C: Hazardous Activities and Industries List (HAIL)

Current at date of publication of this Users' Guide. Please refer to the Ministry for the Environment website for a current version.

A Chemical manufacture, application and bulk storage

1. Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application
2. Chemical manufacture, formulation or bulk storage
3. Commercial analytical laboratory sites
4. Corrosives including formulation or bulk storage
5. Dry-cleaning plants including dry-cleaning premises or the bulk storage of dry-cleaning solvents
6. Fertiliser manufacture or bulk storage
7. Gasworks including the manufacture of gas from coal or oil feedstocks
8. Livestock dip or spray race operations
9. Paint manufacture or formulation (excluding retail paint stores)
10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds
11. Pest control including the premises of commercial pest control operators or any authorities that carry out pest control where bulk storage or preparation of pesticide occurs, including preparation of poisoned baits or filling or washing of tanks for pesticide application
12. Pesticide manufacture (including animal poisons, insecticides, fungicides or herbicides) including the commercial manufacturing, blending, mixing or formulating of pesticides
13. Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery, reprocessing or recycling petroleum-based materials, or bulk storage of petroleum or petrochemicals above or below ground
14. Pharmaceutical manufacture including the commercial manufacture, blending, mixing or formulation of pharmaceuticals, including animal remedies or the manufacturing of illicit drugs with the potential for environmental discharges
15. Printing including commercial printing using metal type, inks, dyes, or solvents (excluding photocopy shops)
16. Skin or wool processing including a tannery or fellmongery, or any other commercial facility for hide curing, drying, scouring or finishing or storing wool or leather products
17. Storage tanks or drums for fuel, chemicals or liquid waste
18. Wood treatment or preservation including the commercial use of antiseptics during milling, or bulk storage of treated timber outside

Hazardous Activities and Industries List (HAIL) with hazardous substances

The table below lists hazardous substances that are typically associated with a specific activity or industry. A suitably qualified and experienced practitioner should be consulted when determining the suite of chemicals to be analysed for a detailed site investigation.

Activity or industry	Hazardous substances
Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application	Arsenic, lead, copper; wide range of organic agrichemicals including organochlorine pesticides, organophosphate pesticides, herbicides, fungicides, carbamates, and synthetic pyrethroids; compounds may be mixed with diesel before spraying
Chemical manufacture, formulation or bulk storage	Wide range of organic and inorganic compounds
Commercial analytical laboratory sites	Wide range of organic and inorganic compounds including solvents, acids, metals, and mercury
Corrosives including formulation or bulk storage	Mercury, sulphuric, phosphoric, hydrochloric and nitric acids, sodium and calcium hydroxide, ammonia and ammonium hydroxide
Dry-cleaning plants including dry-cleaning premises or the bulk storage of dry-cleaning solvents	Volatile hydrocarbons including trichloroethylene 1,1,1-trichloroethane tetrachloroethene (also known as PCE), and carbon tetrachloride
Fertiliser manufacture or bulk storage	Calcium phosphate, calcium sulphate, copper chloride, sulphur, sulphuric and phosphoric acid, molybdenum, selenium, iron, cadmium, nitrates, and ammonia
Gasworks including the manufacture of gas from coal or oil feedstocks	Polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene and xylenes (BTEX), phenolics, metals (particularly arsenic, lead, copper, chromium), boron, cyanide compounds, sulphides and sulphates, thiocyanates, ammonia, nitrates, and coke
Livestock dip or spray race operations	Arsenic, organochlorines (eg, aldrin, dieldrin, DDT, lindane) and organophosphates, carbamates, and synthetic pyrethroids
Paint manufacture or formulation (excluding retail paint stores)	Solvents, resins, metals including arsenic, cadmium, copper, nickel, lead, zinc, and mercury
Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds	Arsenic, lead, copper, mercury; wide range of organic compounds including acidic herbicides, organophosphates, and organochlorines (eg, endosulfan on golf and bowling greens)
Pest control including the premises of commercial pest control operators or any authorities that carry out pest control where bulk storage or preparation of pesticide occurs, including preparation of poisoned baits or filling or washing of tanks for pesticide application	Arsenic, cyanide, strychnine, mercury, phosphorus, 1080, organochlorines and organophosphates, carbamates, synthetic pyrethroids, and other commercial preparations
Pesticide manufacture (including animal poisons, insecticides, fungicides or herbicides) including the commercial manufacturing, blending, mixing or formulating of pesticides	Wide range of insecticides, herbicides and fungicides, including arsenic, lead, mercury, copper, tin, chromium, organochlorines, organonitrogens, organophosphates, acid herbicides, and carbamates. Dioxin may be present as an impurity
Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery, reprocessing or recycling petroleum-based materials, or bulk storage of petroleum or petrochemicals above or below ground	Hydrocarbons including BTEX, PAHs, and solvents; lead and other metals, particularly if waste oil handled
Pharmaceutical manufacture including the commercial manufacture, blending, mixing or formulation of pharmaceuticals, including animal remedies or the manufacturing of illicit drugs with the potential for environmental discharges	Wide range of chemicals and solvents

Activity or industry	Hazardous substances
Printing including commercial printing using metal type, inks, dyes, or solvents (excluding photocopy shops)	Solvents, acids, alkalis, and metals
Skin or wool processing including a tannery or fellmongery, or any other commercial facility for hide curing, drying, scouring or finishing or storing wool or leather products	Chromium (including hexavalent Cr), manganese, copper, ammonia, nitrite, sulphides, acids, sodium hydroxide, lime, formaldehyde, solvents, cyanide, detergents, pesticides, and bleaching agents (eg, hydrogen peroxide)
Storage tanks or drums for fuel, chemicals or liquid waste	Wide range of chemicals (organic and inorganic), and biological hazards
Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside	Pentachlorophenol (PCP), copper, arsenic, chromium, boron, PAHs, phenolics (creosote), antisapstain, organochlorine pesticides, fungicides, and tributyltin (TBT)
Batteries including the commercial assembling, disassembling, manufacturing or recycling of batteries (but excluding retail battery stores)	Metals (lead, mercury, zinc, cadmium, nickel, antimony, silver, and manganese), and sulphuric acid
Electrical transformers including the manufacturing, repairing or disposing of electrical transformers or other heavy electrical equipment	Polychlorinated biphenyls (PCBs), hydrocarbons, copper, tin, lead, and mercury
Electronics including the commercial manufacturing, reconditioning or recycling of computers, televisions and other electronic devices	Metals (eg, copper, tin, lead, mercury, cadmium, nickel, silver, zinc, and beryllium), solvents, and PCBs
Power stations, substations or switchyards	PCBs, asbestos, metals including boron, arsenic (in fly ash), water treatment chemicals (thermal stations), and hydrocarbons (eg, diesel in generators)
Explosive or ordinance production, maintenance, dismantling, disposal, bulk storage or re-packaging	Acetone, nitric and sulphuric acid, ammonium nitrate, PCP, nitroglycerine, lead, mercury, copper, aluminium, silver, sodium hydroxide, and explosives; fuel oils, solvents and metals (associated with workshops)
Gun clubs or rifle ranges, including clay targets clubs that use lead munitions outdoors	Metals (lead, antimony, copper, zinc, tin, and nickel)
Training areas set aside exclusively or primarily for the detonation of explosive ammunition	Explosives, lead, copper, arsenic, antimony (firing ranges), and hydrocarbon storage
Abrasive blasting including abrasive blast cleaning (excluding cleaning carried out in fully enclosed booths) or the disposal of abrasive blasting material.	Metals (iron, lead, chromium, aluminium, zinc). Dependent on material being removed and substrate
Foundry operations including the commercial production of metal products by injecting or pouring molten metal into moulds	Metals, particularly iron, aluminium, lead, zinc, copper, tin, nickel, chromium and oxides, chlorides, fluorides and sulphates of these, acids, coke, and fuel oils
Metal treatment or coating including polishing, anodising, galvanising, pickling, electroplating, or heat treatment or finishing using cyanide compounds	Metals (zinc, aluminium, cadmium, chromium, lead, copper, and tin), acids (sulphuric, nitric, hydrochloric, and phosphoric), cyanide; fluorine and barium (from Al processing)
Metalliferous ore processing including the chemical or physical extraction of metals, including smelting, refining, fusing or refining metals	Metals and associated oxides, fluorides and chlorides; cyanide compounds
Engineering workshops with metal fabrication	Metals and oxides of iron, nickel, copper, chromium, magnesium and manganese; range of organic compounds used for cleaning including BTEX, solvents
Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition	Asbestos
Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant)	Petroleum hydrocarbons and PAHs
Cement or lime manufacture using a kiln including the storage of wastes from the manufacturing process	Lime, calcium hydroxide, alkalis; boron and arsenic in fly ash

Appendix D: Reporting on contaminated sites under the NES

A number of the key building blocks for implementing the NES are the reports described in *CLMG No.1* and *CLMG No.5*. These are summarised here, and shown in Figure 9.

Preliminary site investigation: The main objective of the preliminary site investigation (PSI) is to provide background information in support of a decision regarding the suitability of a site for its current or intended land use, and whether a detailed site investigation is required. It involves gathering and compiling information on the present and past uses of the site to identify the nature of potential contaminants, their likely location and significance, and potential pathways for migration within the site or off-site to form the initial conceptual site model. Ideally, the PSI involves a preliminary site inspection (a walk-over), but does not usually involve soil sampling.

Conceptual site model: A conceptual site model is a system diagram identifying contaminant sources, routes of exposure (pathways), and the receptors that are affected by contaminants moving along those pathways. The conceptual site model, which should be developed as part of the preliminary site investigation, and before undertaking a detailed site investigation, identifies the zones of the site with different contamination characteristics (eg, whether contaminants in the soil are likely to be on the surface or at depth, distributed over an entire area or in localised 'hot spots'). Exposure pathways and receptors should be identified for both current and future uses of the site (where appropriate). The model should be used to design the detailed site investigation and may be updated if new information is gathered during the subsequent investigation phases.

Detailed site investigation: A detailed site investigation involves intrusive techniques to collect field data and soil samples for analytical testing to determine the concentrations of contaminants of concern. Soil samples should be analysed for contaminants identified on the basis of the preliminary site study and/or preliminary site inspection. Samples may initially be analysed for a broad screen of contaminants which, based on experience, have typically been found on similar sites.

Before undertaking the physical works of the detailed site investigation, the potential hazards at the site should be assessed and appropriate health and safety precautions taken. Any authorisation required (such as resource consents) should be obtained before work begins.

Figure 9: Reporting stages for activities under the NES

