

SCHEDULE 13

SCHEDULES FOR REPORTING ON CONTAMINATED LAND

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Schedule A1: Site Specific Human Health and Environmental Risk Assessment Report (RA)

The purpose of Schedule A1: Site Specific Human Health and Environmental Risk Assessment Report (RA) is to provide guidance to people submitting risk assessment reports to the Auckland Regional Council (ARC) Contaminated Land Team. It should be clearly recognized that the scale and scope of a particular RA should reflect the scale and complexity of the problem being addressed.

For example, on some sites the RA may be as simple as indicating that a particular potential exposure pathway is not complete such as when a site is underlain by a thick layer of low permeability clay. On other more complex sites, a full scale RA may be appropriate including, pathway analysis, fate and transport modeling and toxicity exposure modeling.

The purpose of an RA is to identify whether a site has the potential to cause significant adverse effects on human health or the receiving environment. An RA can be carried out either separately from or in conjunction with remediation of a site.

The following checklist for preparation of a detailed RA is provided for guidance only and it is acknowledged that an RA for a particular site may require consideration only of some of the checklist items.

Executive Summary

- Background
- Objectives of the risk assessment
- Scope of work to be undertaken
- Summary of conclusions and recommendations

Scope of Work

- A clear statement of the scope of work to be undertaken

Site Identification

- Street number, street name, suburb and town/city
- Legal description with lot, deposited plan and certificate of title number(s)
- Geographic coordinates as per NZ Map Series 260 when dealing with a small part of a larger site
- Current site plan with scale bar showing north direction, local water drainage, and other locally significant features onsite and immediately offsite.

Site History (summary only)

- Summary of information on past uses of site that may have caused contamination onsite or offsite
- Summary of chemical usage and storage onsite including underground and above ground storage tanks
- Records of chemical spills/losses
- Records of known discharges to land, water or air
- Onsite and offsite disposal locations

Environmental Setting (summary only)

- Summary of hydrology including stormwater reticulation
- Summary of hydrogeology including connections between aquifers, marine or freshwater systems.
- Description of the receiving environment
- Location, depth and extent of imported fill
- Locations and depths of wells on and near site

Site Characterisation (summary only)

- Site plan(s) showing the concentrations of contaminants for each different medium (soil, sediment, groundwater, surface water), location and sample depth

Conceptual Model of Exposure Pathways

- Detailed description and prioritization of contaminants of concern including breakdown products
- Identification of all potential contaminant pathways to human and environmental receptors
- Analysis of completeness of each potential contaminant pathway
- Assessment of potential future contaminant pathways and possible completeness of pathways

Fate and Transport Modeling

- Description of model(s) and its appropriateness for the particular site
- Assumptions in the model(s) and the potential effects of the assumptions on model output
- List all model input parameters and potential ranges for each parameter
- Identify whether model input parameters were measured onsite or from the literature
- Carry out model sensitivity analyses on main input parameters

- Use the 95% Upper Confidence Limit (UCL) of the mean contaminant concentrations for each potential exposure area as determined from site investigation

Human Health Risk

- Use methodologies described in Health and Environmental Guidelines for Selected Timber Treatment Chemicals (Ministry for the Environment and Ministry of Health, 1997) to derive health-based soil acceptance criteria and/or to estimate risk. Except that the following two equations need to be substituted for the respective equations in the Timber Treatment Guidelines because the equations have been found to be mathematically incorrect. All the terms used in the equations are defined in the Timber Treatment Guidelines.

$$\text{Inhalation of dust: } \text{CDI} = \text{Cs} \times \text{IH} \times \text{ED} \times \text{EF} \times \text{MF} \times \text{R} / (\text{AT} \times \text{BW} \times \text{PEF}) \quad (4)$$

$$\text{Dermal absorption: } \text{CDI} = \text{Cs} \times \text{CF} \times \text{AR} \times \text{AH} \times \text{AF} \times \text{ED} \times \text{EF} / (\text{AT} \times \text{BW}) \quad (5)$$

- Use default input parameters from above reference unless site specific information available
- Use acceptable cancer risk of 10^{-5}
- Describe and justify the potential human health exposure pathways
- List all exposure equations
- Carry out sensitivity analyses on main input parameters
- Calculate cumulative risk from all potential exposure routes

Environmental Risk

- Describe and justify the selected environmental exposure pathways
- Describe and justify environmental criteria (referencing guidelines)

Conclusions and Recommendations

- Brief summary of all relevant findings
- Assumptions used in making conclusions
- Extent of uncertainties in the results
- A clear statement that the consultant considers the site to be suitable for the current and, where applicable, the proposed use
- Recommendations for further work, if appropriate

Schedule A2: Preliminary Site Investigation Report (PSI)

The purpose of Schedule A2: Preliminary Site Investigation Report (PSI) is to provide guidance to people submitting preliminary site investigation (desk top) reports to the Auckland Regional Council (ARC) Contaminated Land Team. It should be clearly recognized that the scale and scope of a particular PSI should reflect the scale and complexity of the problem being addressed. For example, for some sites a PSI may consist only of a review of relevant Council files (Territorial Authority and Regional), a title search and available aerial photographs. On other more complex sites, a more detailed PSI may be appropriate including summarizing known baseline environmental conditions, listing all potential sources and types of contamination and describing previous site investigations.

The purpose of a PSI is to describe the history and present use of a site to identify the potential for site contamination that may cause significant adverse effects on human health or the environment. If a PSI clearly demonstrates that site activities have been non-contaminating then there is no need for further intrusive investigation or sampling. However, if the PSI demonstrates that contaminating activities have or may have occurred, or if the site history is incomplete, it may be necessary to undertake an intrusive sampling and analysis investigation on the site.

The following checklist for preparation of a detailed PSI is provided for guidance only and it is acknowledged that a PSI for a particular site may only require consideration of some of the checklist items. The checklist is consistent with the Ministry for the Environment guidance document Contaminated Land Management Guidelines No1: Reporting on Contaminated Sites in New Zealand, MfE, 2003.

Executive Summary

- Background
- Objectives of the investigation stage(s) being reported
- Scope of work to be, or which has been, undertaken
- Summary of conclusions and recommendations

Scope of Work

- A clear statement of the scope of work to be, or which has been, undertaken

Site Identification

- Street number, street name, suburb and town/city
- Legal description with lot, deposited plan and certificate of title number(s)
- Geographic co-ordinates as per NZ Map Series 260 when dealing with a small part of a larger site
- Current site plan with scale bar showing north direction, local water drainage and other locally significant features on-site and immediately off-site. The plan should

also show the historical location of structures that may have affected the distribution of contamination (e.g. buildings, underground storage tanks, treatment baths, etc)

- Locality map

Site History

- Chronological list of site ownership and uses (including the relevant HAIL2 codes for those uses) indicating information gaps, unoccupied periods and, if relevant, proposed uses
- An outline of those contaminants commonly associated with each land use
- Zoning – previous, present and, if relevant, proposed, with summary of reasons for changes to zoning that have occurred
- Details of relevant building and related permits, licences, resource consents, approvals and trade waste agreements with records of compliance
- Local usage of ground and surface water resources, including presence, rate and location of **takes** (current and historical)
- Site layout plans showing present and past industrial processes, location of buildings, unsealed areas, waste or chemical storage
- Sewer and services plans identifying active and abandoned services
- Historical uses of adjacent land
- Relevant complaint history
- Local knowledge of site by staff and residents – present and former
- Summary of literature relating to the site, including newspaper articles
- Review of aerial and site photography with date and location (including direction of photography) indicated on site maps
- Description of manufacturing processes
- Inventory of materials and waste products associated with site use and their on-site storage and/or disposal locations
- Details and locations of current and former underground and aboveground storage tanks with details of integrity testing
- Product spill and loss history
- Recorded discharges to land, water and air (authorised and unauthorised)
- On-site and off-site disposal locations
- Contaminant source areas and pathways on-site and off-site
- Integrity assessment (assessment of the completeness and accuracy of the information)
- Source of information used – e.g. topo/geological maps, aerial photos, source of groundwater/surface water/climatic data
- All plans should include, north point, key, title, scale etc

Site Condition and Surrounding Environment

- Topography, means of measurement and site map
- Condition of buildings and roadways, sealed (%), unsealed (%)
- Presence of drums, wastes and fill materials
- Odours
- Visual or quantified details of surface water quality
- surface runoff pathways (historic, existing and proposed)
- Flood potential described or mapped
- Describe and discuss potential for contaminant migration through service trenches, both currently used services and abandoned
- Discuss inverts of services relative to appropriate groundwater levels, map cesspits, soak holes etc
- Conditions at site boundary such as type and condition of fencing, soil stability, erosion, and stormwater discharge
- Visible signs of contamination such as identifiable waste products, discoloration or staining of soil, bare soil patches – on-site and at site boundary
- Visible signs of plant stress
- Produce a map identifying the key pathways for contaminant migration and potential receiving environments
- Details of any relevant local sensitive environment – rivers, lakes, creeks, wetlands, local habitat areas, endangered flora and fauna, groundwater, seeps, harbour, groundwater takes, surrounding bores, neighbouring landuses
- Describe the sensitivity of the receiving environment
- Potential impact of soil, groundwater or other contamination on site uses and sites above plume
- Potential impact of volatiles to air including odour and health effects
- Source of information used – e.g. topo/geological maps, aerial photos, source of groundwater/surface water/climatic data
- All plans should include, north point, key, title, scale etc

Geology and Hydrology (only summary of readily available information)

- Summary of local meteorology
- Description of site geology
- Permeability/ infiltration rate across the site for paved, unpaved areas and different soils.

- Map and description of location, design and construction of on-site wells, boreholes and pits
- Reported range of water table depths below ground surface including to any shallow/perched aquifers and the local/regional aquifer system
- Description and location of springs and wells in the vicinity
- Location, depth and extent of imported and locally derived fill
- Direction(s) and rate of groundwater flow including, where applicable, groundwater levels surveyed to a common datum and gradient – provide technical basis for assumptions, sensitivity analysis and information sources
- Groundwater level fluctuations, including tidal, seasonal, **take**, infiltration

Previous Investigation Results (summary only)

- Site plan(s) showing all samples and sampling locations, giving sample identification numbers and sample depth
- Summary of all results in tabular form:
 - identifying essential details such as sample identification numbers and sample depth
 - showing comparison with relevant guideline values
 - highlighting every result exceeding the guideline values
- Summary table of results containing the following statistics: minimum, maximum, arithmetic mean and 95% upper confidence limit on the arithmetic mean for each analyte in accordance with Ministry for the Environment Contaminated Land Management Guideline No.5, in particular Section 5.4 and Appendices B and I
- Site plan showing the extent of soil and/or groundwater contamination exceeding the relevant guideline values for each medium, location and sample depth

Preliminary Site Characterisation

- Assessment of the type of environmental contamination, particularly in soil and groundwater
- Assessment of the extent of soil and groundwater contamination, including identifiable off-site contamination that may cause environmental effects

Conclusions and Recommendations

- Brief summary of all relevant findings
- Assumptions used in making conclusions
- Extent of uncertainties in the results
- A clear statement that the consultant considers the site to be suitable for the current and, where applicable, the proposed use

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- A statement detailing all limitations and constraints on the use of the site (where applicable)
- Recommendations for further work, if appropriate

Schedule A3: Intrusive Site Investigation Report (SIR)

The purpose of Schedule A3: Intrusive Site Investigation Report (SIR) is to provide guidance to people submitting site investigation (intrusive) reports to the Auckland Regional Council (ARC) Contaminated Land Team. It should be clearly recognized that the scale and scope of a particular SIR should reflect the scale and complexity of the problem being addressed. For example, for some sites a SIR may consist only of limited soil sampling and characterization of contamination associated with clearly identified contamination hotspots. On other more complex sites, a more detailed SIR may require detailed sampling and testing of soil, sediment, stormwater and groundwater.

The purpose of a SIR is to describe the extent and severity of contamination associated with a site, including contamination associated with the site that may have moved beyond the boundary of the site, that has the potential to cause significant adverse effects on human health or the environment. If the SIR clearly demonstrates that there is no significant contamination on the site or the contamination on the site is not having a significant adverse effect on the environment then there is no need for further investigation or sampling. However, if the SIR identifies contamination associated with the site (on or adjacent to the site) that may have a significant adverse effect on human health or the environment then a resource consent will be required for the site and either further site investigation, site specific human health and environmental risk assessment, or remediation of the site may be required.

A comprehensive (intrusive) site investigation report should include a summary of the preliminary site investigation report, but should also provide information on:

- the type, extent and level of contamination anticipated;
- the nature of samples collected and the sampling procedures followed, including quality assurance / quality control requirements;
- the analyses undertaken, methodologies used and laboratory quality assurance / quality control procedures.
- the actual extent and concentrations of contaminants in all appropriate media at the site;
- any likely dispersal in air, surface water, groundwater, soil and dust from the detected contaminants;
- where applicable, the location and magnitude of any on-site or off-site impacts on soil, water, sediment and biota;
- any potential significant adverse effects of contaminants on public health, the environment;
- the adequacy and completeness of all information used in decisions on remedial options;
- if remediation, management or ongoing monitoring is intended at the site.

The following checklist for preparation of a detailed SIR is provided for guidance only and it is acknowledged that a SIR for a particular site may only require consideration of some of

the checklist items. The checklist is consistent with the Ministry for the Environment guidance document Contaminated Land Management Guidelines No1: Reporting on Contaminated Sites in New Zealand, MfE, 2003.

Executive Summary

- Background
- Objectives of the investigation stage(s) being reported
- Scope of work to be, or which has been, undertaken
- Summary of conclusions and recommendations

Scope of Work

- A clear statement of the scope of work to be, or which has been, undertaken

Site Identification

- Street number, street name, suburb and town/city
- Legal description with lot, deposited plan and certificate of title number(s)
- Geographic co-ordinates as per NZ Map Series 260 when dealing with a small part of a larger site
- Current site plan with scale bar showing north direction, local water drainage and other locally significant features on-site and immediately off-site. The plan should also show the historical location of structures that may have affected the distribution of contamination (e.g. buildings, underground storage tanks, treatment baths, etc)
- Locality map

Site History (summary only)

- Full site history required if a Preliminary Site Investigation Report for the site is not available.

Site Condition and Surrounding Environment (summary only)

- Full description only required if a Preliminary site Investigation report for the site is not available.

Geology and Hydrology

- Summary of local meteorology
- Description of site geology
- Permeability/ infiltration rate across the site for paved, unpaved areas and different soils.
- Lateral and vertical investigation of site soil and geology to the extent to which any contaminants have potentially migrated.

- Location, depth and extent of imported and locally derived fill
- Site borehole logs / test pit logs showing stratigraphy using a recognised classification system and depth to groundwater table
- Any subsurface visual staining or odours or evidence of fire/waste materials including on site observations
- Drill sufficient wells to characterise each contaminant source and plume (at least 3 wells needed to determine groundwater flow direction by triangulation)
 - Provide consent reference of drilling permit, and confirm logs have been submitted to the ARC officer issuing the consent
 - Discuss well location and installation strategy, including screen location and length, field observations
 - Method used (with or without water/drilling muds) including reasons for choosing the method i.e. advantages and limitations with regard to data obtained (Drilling to be carried out in accordance with NZS 4411:2001 Environmental Standard for Drilling of Soil and Rock or variations justified)
 - Logs require: lithological log, aquifer/aquitard interpretation, groundwater ingress/loss, static groundwater level, and well construction, sampling locations
 - Well purging – field monitor pH, EC, Temperature, DO, Eh and graph, stabilisation of these parameters. Record the volume purged
 - Well Abandonment
- Description and location of springs and wells in the vicinity
- Direction(s) and rate of groundwater flow including, where applicable, groundwater levels surveyed to a common datum and gradient – provide technical basis for assumptions, sensitivity analysis and information sources
- Magnitude of groundwater level variations/trends and the controls on these changes e.g. natural recharge/discharge, **take**, potential future changes in groundwater regime tidal and seasonal.

Sampling and Analysis Plan and Sampling Methodology

For all sampling

- Sampling and analysis data quality objectives
- Rationale for selection of:
 - sampling pattern, locations and depths (as shown on site maps)
 - sampling density, including estimated size of the residual hotspots that may remain undetected and statistical confidence in the estimate
 - which samples were submitted for analysis and which samples were not analysed
 - analytes for each sample and the analytical methods used
- Description of the sampling methods including:

- sampling devices and equipment type
- sampling containers and the type of seal used
- sample preservation methods and reference from recognised protocols e.g. APHA (1988) or US EPA SW846 (1992)
- sample handling procedures
- equipment decontamination procedures
- Description of any field-screening protocols, methods and equipment, and their calibration

Soil

- Soil sampling – refer to MfE Guideline No.5
- Where site activity information lacking, analysis for common contaminants of concern – metal suite, total petroleum hydrocarbon, semi volatile organic compound, volatile organic compound, pesticides
- Rationale for selection of:
 - sampling pattern, locations and depths (as shown on site maps), including consideration of geology, odour and visual observations
- pH, EC, temperature of the contaminants if significantly changing risk
- Speciation of the contaminants if have a significant risk especially CrIII and CrVI
- Geological log or soil description of soil borings, test pits
- Log showing sample location/ depth of sample
- If exceed guidelines as specified by ALW plan or MfE guideline No. 2 undertake leaching tests to help determine the ability of contaminants to leach to groundwater, and to help determine bio-availability for ecosystems

Surface Water / Sediment

- Justification if not sampling surface water or sediments

Groundwater

- Sound technical justification if not sampling groundwater ie low permeability soils and significant separation between contaminants of concern and groundwater
- Describe equipment/instruments used, cleaning procedures
- Groundwater sampling strategy (refer As standard)
- Where possible, data for at least three rounds of sampling and analysis, at least one summer low and one winter high round.
- Contaminants of concern appropriate to site history - or where site information lacking, confidence that contaminants of concern are identified
- Depth, thickness and justify likely mobility of LNAPL, DNAPL
- Discuss seasonal variation in data

- Describe drilling/logging on site observation e.g. loss core, flushed well, equipment break due to hard ground, etc.

Hydraulic Aquifer/Aquitard Testing

- Provide test methodology (slug tests should be repeated for confidence in results and include insertion and removal of slug)
- Provide static water level data prior to test starting
- Equipment and hydraulic test procedure, and justification for why this type of test chosen (advantages/disadvantages)
- Test interval
- Provide maximum drawdown/ increase
- Provide a linear plot of test data of time vs. drawdown and time vs recharge
- Provide semi-log or log-log plot analysis plot
- Discuss well construction effects and 'skin effects' on data
- Other relevant field data
- How and when measured (season/rainfall events)
- Tidal (continuous monitoring of groundwater) when required
- Reduced level survey by whom and datum

Field Quality Assurance and Quality Control (QA/QC)

- Details of the sampling team, identifying unique initials for each member
- Statement of intended duplicate and blank frequency
- Records for each sample collected, including date, time and location, samplers' initials, duplicate/blank location and type, analyses to be performed, site observations and weather conditions
- Chain of custody, identifying for each sampler, nature of the sample, collection date, analyses to be performed, sample preservation method, departure time from site, dispatch courier used
- Background sample, field blank, trip blank, and rinsafe sample results and laboratory prepared trip spike results for volatile analytes
- Decontamination procedures carried out between sampling events
- Sample-splitting techniques and field instrument calibrations (where used)
- Standard solution, reference sample and check sample (including daily) results
- Laboratory duplicate, blank and standard results

Laboratory QA/QC

- Confirmation that detection limits are lower than guideline values

- Signed laboratory receipt of signed chain of custody form identifying date/time of receipt and identity of samples included in shipment
- Record of holding times where not consistent with method specifications
- Analytical methods used by laboratory and laboratory accreditation for analytical methods used
- Inter-laboratory comparisons for analytical methods used (where available)
- Description of spikes and surrogates used, with percent recoveries
- Instrument, method detection and practical quantification limits
- Standard solution, reference sample and check sample (including daily) results
- Laboratory duplicate, blank and standard results

QA/QC Data Evaluation

- Evaluation of all field and laboratory QA/QC information listed above against the stated data quality objectives, including a discussion of
 - documentation and data completeness
 - data representativeness
 - precision and accuracy for both sampling and analysis for each analyte in each environmental matrix informing data users of the reliability, unreliability or qualitative value of the data
 - Test reliability, the zone of influence of the test, the analysis method (confined/unconfined aquifer system) and significant assumptions in the analysis and method or data input.
- Data comparability checks, which should include bias assessment arising from various sources, including:
 - collection and analysis of samples by different personnel
 - collection and analysis by the same personnel using the same methods but at different times (including seasonal for long-running projects)
 - use of different sampling or analytical methodologies from those stipulated in guideline documents
 - spatial and temporal changes (because of environmental dynamics)
- Relative percent differences for inter- and intra-laboratory duplicates

Basis for Guideline Values

- Table listing all selected guideline values, with references
- Demonstration that selection of guideline values is consistent with the principles of Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values
- Assumptions and limitations of guideline values used

Investigation Results

- Summary of previous results (where applicable)
- Site plan(s) showing all samples and sampling locations, giving sample identification numbers and sample depth
- Summary of all results in tabular form
- identifying essential details such as sample identification numbers and sample depth
- showing comparison with relevant guideline values
- highlighting every result exceeding the guideline values
- A summary table of results containing the following statistics: minimum, maximum, arithmetic mean and 95% upper confidence limit on the arithmetic mean for each analyte in accordance with Ministry for the Environment Contaminated land Management Guideline No.5, in particular Section 5.4 and Appendices B and I
- Site plan showing the extent of soil and/or groundwater contamination exceeding the relevant guideline values for each medium, location and sample depth

Site Characterisation

- Assessment of the type of all environmental contamination, particularly in soil and groundwater
- Characterisation of geological heterogeneity and anisotropy
- Assessment of the extent of soil and groundwater contamination, including identifiable off-site contamination that may cause environmental effects
- A map showing:
 - site cover and buildings current and historic
 - north point, scale, key, title
 - the nature and extent of surface soil/lithology types and contamination plumes
 - the location of soil sampling points/trial pits
 - the lateral extent of the contaminant concentrations
 - the line of the geological cross-section
- A groundwater map for the existing systems and also for the proposed system if potential for significant changes to groundwater regime) showing:
 - the nature and extent of surface soil/lithology types and contamination plumes – free product plumes
 - the location of the wells and RL values, screened interval
 - the aquifer piezometric contours for each aquifer identified may require more than 1 if significant piezo variation (seasonal, tides)
 - the location and type of any aquifer boundaries
 - direction of groundwater flow
 - north point, scale, key
- Provide at least 1 cross-section of the site showing:
 - site soil, geology and lithological variations vertically across the site and location of contaminated soil.
 - the extent of the lateral and vertical contaminant concentrations

- Aquifer(s), aquitard(s) e.g. unconfined, confined, leaky
- depth to shallow/perched and local/regional groundwater system across the site
- show aquifer heterogeneity and anisotropy such as lithological layering and fracture orientation and connectivity
- well locations and screen depths
- base of aquifer if DNAPL
- Assessment of the potential for chemical degradation or interaction products
- Assessment of possible exposure routes and risk to exposed populations (human and ecological risk)
- Numerical/ Analytical Modelling
 - Model objectives
 - List all assumptions of model and relationship to conceptual model
 - Model used and justification
 - Conduct a sensitivity analysis and identify key model inputs
 - Identify whether input parameters measured onsite or estimated
 - Modelling results and description
 - Documentation

Conclusions and Recommendations

- Brief summary of all relevant findings
- Assumptions used in making conclusions
- Extent of uncertainties in the results
- A clear statement that the consultant considers the site to be suitable for the current and, where applicable, the proposed use
- A statement detailing all limitations and constraints on the use of the site (where applicable)
- Recommendations for further work, if appropriate

Schedule A4: Remedial Action Plan (RAP)

The purpose of Schedule A4: Remedial Action Plan (RAP) is to provide guidance to people submitting remedial action plan reports to the Auckland Regional Council (ARC) Contaminated Land Team. It should be clearly recognized that the scale and scope of a particular RAP should reflect the scale and complexity of the problem being addressed. For example, for some sites a RAP may consist only of a brief description of the proposed works, environmental controls and validation sampling to be carried out say for the excavation and offsite removal of a small quantity of contaminated soil. On other more complex sites, a more detailed RAP may require detailed description of remediation processes, environmental controls and validation sampling.

The purpose of a RAP is to document the proposed remediation programme, associated environmental controls and validation testing programme prior to remediation activities commencing. A RAP is required prior to any remediation works taking place because it is important to avoid a site being disturbed and exposed to the elements for any longer than absolutely necessary during remediation works, to ensure involvement of all relevant parties (including relevant regulatory authorities), and to ensure that contingencies are put in place to deal with any problems during remediation.

Once the site has been identified as requiring remediation or management, the RAP should be prepared as follows.

- Set remediation or management goals that ensure the site and any relevant additional land contaminated by site activities will be suitable for its current or proposed land use and will pose no unacceptable risk to human health or the environment, either on-site or off-site;
- Document in detail all risk-reducing procedures and plans to be implemented to achieve an acceptable level of risk for the current or proposed site land use;
- Establish a recording mechanism to ensure activities proceed as detailed in the remedial action plan;
- Establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner;
- Identify and include proof of the necessary approvals, permits or licences required by regulatory authorities to undertake remediation;
- Describe a validation sampling programme.

Systematic and clear plans should be made of remedial work to be undertaken, ensuring among other things that dates, quantities, sampling, excavation and disposal locations will be recorded. Such data and records of any management or regulatory decisions made during or following the remedial process will be required for subsequent reporting stages.

Changes may need to be made to a RAP during site remediation to accommodate unexpected site conditions or events. Any significant variations to the original RAP should

be recorded and explained in a site validation report (SVR) prepared following completion of site remediation.

The following checklist for preparation of a detailed RAP is provided for guidance only and it is acknowledged that a RAP for a particular site may only require consideration of some of the checklist items. The checklist is consistent with the Ministry for the Environment guidance document Contaminated Land Management Guidelines No1: Reporting on Contaminated Sites in New Zealand, MfE, 2003.

Executive Summary

- Background
- Objectives of the investigation stage(s) being reported
- Scope of work to be, or which has been, undertaken
- Summary of conclusions and recommendations

Scope of Work

- A clear statement of the scope of work to be undertaken

Site Identification

- Street number, street name, suburb and town/city
- Legal description with lot, deposited plan and certificate of title number(s)
- Geographic co-ordinates as per NZ Map Series 260 when dealing with a small part of a larger site
- Current site plan with scale bar showing north direction, local water drainage and other locally significant features on-site and immediately off-site. The plan should also show the historical location of structures that may have affected the distribution of contamination (e.g. buildings, underground storage tanks, treatment baths, etc)
- Locality map

Site History (summary only)

- Site layout plans showing present and past industrial processes, location of buildings, unsealed areas, waste or chemical storage
- All plans should include, north point, key, title, and scale

Site Condition and Surrounding Environment (summary only)

- All plans should include, north point, key, title, and scale

Basis for Guideline Values (summary only)

- Table listing all selected guideline values, with references
- Demonstration that selection of guideline values is consistent with the principles of Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values
- Assumptions and limitations of guideline values used

Investigation Results (summary only)

- Summary of previous results where applicable
- Site plan showing the extent of soil and/or groundwater contamination exceeding the relevant guideline values for the medium, location and sample depth

Site Characterisation (summary only)

- Assessment of the extent of soil and groundwater contamination, including identifiable off-site contamination that may cause environmental effects

Remedial Actions

- Description of Remediation goal(s)
- Discussion of the remedial options available, including the status quo, identifying the means of risk reduction proposed for each option
- Rationale for selection of the recommended remedial option
- Discussion of the extent of remediation required to achieve the remedial goal(s)
- Identification of regulatory requirements such as permits, licences and approvals
- Pre-remediation site management plan (e.g. fencing, warning signs, stormwater diversion etc.)
- Methods proposed to minimise effects on groundwater from remedial works
- Methods proposed to minimize effects on air quality from remedial works
- Names and phone numbers of appropriate personnel to contact during remediation
- Demonstration of the disposal route for any material to be disposed off-site
- Remediation schedule, including proposed hours of operation
- Proposed testing to validate the site during and on-completion of the remedial activities including any post-remediation monitoring required to demonstrate compliance with the remedial goals
- Contingency plan if remedial strategy fails to reach the remediation goals
- Staged progress reporting (for long-running projects)

Site Management Plan

- Operational remediation site management plan including (where applicable):

- suggested trigger levels for each contaminant of concern for soil, sediment, groundwater and storm water;
- predicted changes of groundwater due to site redevelopment, both during and after;
- effects of any groundwater diversion or other effects on groundwater flow;
- future uses and expected development/ excavation;
- stormwater controls proposed, especially during earth working;
- any requirements for groundwater diversion consent;
- contact at city/district council;
- community relations;
- stormwater and soil management;
- noise and odour control;
- dust control (including wheel wash);
- contingency plans to respond to site incidents to obviate potential effects on the surrounding environment and community;
- proposed long-term site management;
- occupational safety and health issues and measures.

Conclusions and Recommendations

- Brief summary of all relevant findings
- Assumptions used in making conclusions
- Extent of uncertainties in the results
- Where remedial action has been taken, a list summarising the activities and the physical changes to the site
- A statement detailing all limitations and constraints on the use of the site (where applicable)
- Recommendations for further work, if appropriate, including requirements for site validation, management and monitoring

Schedule A5: Site Validation Report (SVR)

The purpose of Schedule A5: Site Validation Report (SVR) is to provide guidance to people submitting site validation reports to the Auckland Regional Council (ARC) Contaminated Land Team. It should be clearly recognized that the scale and scope of a particular SVR should reflect the scale and complexity of the problem being addressed. For example, for some sites a SVR may consist only of a brief description of soil validation sampling and the disposal location of contaminated soil following excavation and offsite removal of a small quantity of contaminated soil. On other more complex sites, a more detailed SVR may require detailed description of the validation sampling strategy and programme, confirmation that the remediation programme followed the detail set out in the remedial action plan, documentation of the handling and final disposal of any material (soil, sediment, water, etc) removed from the site during the remediation programme, and confirmation that the remedial goals (as set out in the remedial action plan) have been met.

The purpose of a SVR is to confirm that a site has been remediated according to the approved remedial action plan for the site.

The SVR must assess the results of the post-remediation testing against the clean-up criteria stated in the remedial action plan. Where clean-up criteria have not been achieved, the reasons for this must be stated and additional site work proposed to achieve the specified remedial action plan objectives. If any contingency plans were detailed in earlier reports, they should have been implemented before the site validation report is submitted.

The SVR should also include, where possible, information confirming that all the requirements of regional council, unitary and territorial authority or other planning authority licences or permits have been met. In particular, documentary evidence should be included to show that any disposal of contaminated material off-site has been done in accordance with the remedial action plan, and with the requirements of the disposal site and the relevant local authority.

The following checklist for preparation of a detailed SVR is provided for guidance only and it is acknowledged that a SVR for a particular site may only require consideration of some of the checklist items. The checklist is consistent with the Ministry for the Environment guidance document Contaminated Land Management Guidelines No1: Reporting on Contaminated Sites in New Zealand, MfE, 2003.

Executive Summary

- Background
- Objectives of the investigation stage(s) being reported
- Scope of work which has been undertaken
- Summary of conclusions and recommendations

Scope of Work

- A clear statement of the scope of work which has been undertaken

Site Identification

- Street number, street name, suburb and town/city
- Legal description with lot, deposited plan and certificate of title number(s)
- Geographic co-ordinates as per NZ Map Series 260 when dealing with a small part of a larger site
- Current site plan with scale bar showing north direction, local water drainage and other locally significant features on-site and immediately off-site. The plan should also show the historical location of structures that may have affected the distribution of contamination (e.g. buildings, underground storage tanks, treatment baths, etc)
- Locality map

Site History (summary only)

- Site layout plans showing present and past industrial processes, location of buildings, unsealed areas, waste or chemical storage
- All plans should include, north point, key, title, scale etc

Validation Sampling and Analysis Plan and Sampling Methodology

- Sampling and analysis data quality objectives
- Rationale for selection of:
 - sampling pattern, locations and depths (as shown on site maps)
 - sampling density, including estimated size of the residual hotspots that may remain undetected and statistical confidence to the estimate
 - which samples and/were submitted for analysis and which samples are/were not analysed
 - analytes for each sample and the analytical methods used
- Detailed description of the sampling methods including:
 - sampling devices and equipment type
 - sampling containers and the type of seal used
 - sample preservation methods and reference to recognised protocols e.g. APHA (1988) or US EPA SW846 (1992)
 - sample handling procedures
 - equipment decontamination procedures
- Detailed description of any field-screening protocols, methods and equipment, and their calibration

Field Quality Assurance and Quality Control (QA/QC)

- Details of the sampling team, identifying unique initials for each member

- Statement of intended duplicate and blank frequency
- Records for each sample collected, including date, time and location, samplers' initials, duplicate/blank location and type, analyses to be performed, site observations and weather conditions
- Chain of custody, identifying for each sampler, nature of the sample, collection date, analyses to be performed, sample preservation method, departure time from site, dispatch courier used
- Background sample, field blank, trip blank, and rinsafe sample results and laboratory prepared trip spike results for volatile analytes
- Decontamination procedures carried out between sampling events
- Sample-splitting techniques and field instrument calibrations (where used)

Laboratory QA/QC

- Confirmation that detection limits are lower than guideline values
- Signed laboratory receipt of signed chain of custody form identifying date/time of receipt and identity of samples included in shipment
- Record of holding times where not consistent with method specifications
- Analytical methods used by laboratory and laboratory accreditation for analytical methods used
- Inter-laboratory comparisons for analytical methods used (where available)
- Description of spikes and surrogates used, with percent recoveries
- Instrument, method detection and practical quantification limits
- Standard solution, reference sample and check sample (including daily) results
- Laboratory duplicate, blank and standard results

QA/QC Data Evaluation

- Evaluation of all field and laboratory QA/QC information listed above against the stated data quality objectives, including a discussion of
 - documentation and data completeness
 - data representativeness
 - precision and accuracy for both sampling and analysis for each analyte in each environmental matrix informing data users of the reliability, unreliability or qualitative value of the data
 - Test reliability, the zone of influence of the test, the analysis method (confined/unconfined aquifer system) and significant assumptions in the analysis and method or data input.
- Data comparability checks, which should include bias assessment arising from various sources, including:
 - collection and analysis of samples by different personnel

- collection and analysis by the same personnel using the same methods but at different times (including seasonal for long-running projects)
- use of different sampling or analytical methodologies from those stipulated in guideline documents
- spatial and temporal changes (because of environmental dynamics)
- Relative percent differences for inter- and intra-laboratory duplicates

Basis for Guideline Values (summary only)

- Table listing all selected guideline values, with references

Investigation Results (summary only)

- Site plan(s) showing all samples and sampling locations, giving sample identification numbers and sample depth
- Summary of all results in tabular form:
 - identifying essential details such as sample identification numbers and sample depth
 - showing comparison with relevant guideline values
 - highlighting every result exceeding the guideline values
- A summary table of results containing the following statistics: minimum, maximum, arithmetic mean and 95% upper confidence limit on the arithmetic mean for each analyte in accordance with Ministry for the Environment Contaminated Land Management Guideline No.5, in particular Section 5.4 and Appendices B and I
- Site plan showing the extent of soil and/or groundwater contamination exceeding the relevant guideline values for the medium, location and sample depth

Site Characterisation (summary only)

- Assessment of the type of all environmental contamination
- Assessment of the extent of site contamination, including identifiable off-site contamination

Validation

- Rationale and justification for the validation strategy, including:
 - clean-up criteria selected
 - statistically based decision-making methodology
 - validation sampling and analysis plan
- Details of statistical analysis of validation results and evaluation against the clean-up criteria
- Verification of compliance with regulatory requirements set by all relevant local authorities
- Documentation demonstrating that any material moved off-site has been received at point of disposal

Conclusions and Recommendations

- Brief summary of all relevant findings
- Assumptions used in making conclusions
- Extent of uncertainties in the results
- A clear statement that the consultant considers the site to be suitable for the current and, where applicable, the proposed use
- A statement detailing all limitations and constraints on the use of the site (where applicable)
- Recommendations for further work, if appropriate

Schedule A6: Management and Monitoring Plan (MMP)

The purpose of Schedule A6: Management and Monitoring Plan (MMP) is to provide guidance to people submitting management and monitoring plans to the Auckland Regional Council (ARC) Contaminated Land Team. It should be clearly recognized that the scale and scope of a particular MMP should reflect the scale and complexity of the problem being addressed. For example, for some sites a MMP may consist only of a brief description of the future inspection and maintenance of an impervious covering layer and precautions to be taken if the impervious layer is disturbed in the future. On other more complex sites, a more detailed MMP may require description of monitoring of stormwater and groundwater and more detailed description of management and maintenance of the site.

A monitoring programme should detail the proposed monitoring strategy, what will be monitored, the location and frequency of monitoring, and the reporting requirements (format, content and frequency). It should also state the proposed period for reviewing the monitoring and management plan.

Where a management plan is used as the primary means of managing potential significant adverse effects on human health or the environment, its application and effectiveness must be reported on regularly to the ARC and relevant local authority.

The following checklist for preparation of a detailed MMP is provided for guidance only and it is acknowledged that a MMP for a particular site may only require consideration of some of the checklist items. The checklist is consistent with the Ministry for the Environment guidance document Contaminated Land Management Guidelines No1: Reporting on Contaminated Sites in New Zealand, MfE, 2003.

Executive Summary

- Background
- Objectives of the monitoring and management provisions
- Scope of work to be undertaken
- Summary of conclusions and recommendations

Scope of Work

- A clear statement of the scope of work to be undertaken

Site Identification

- Street number, street name, suburb and town/city
- Legal description with lot, deposited plan and certificate of title number(s)
- Geographic co-ordinates as per NZ Map Series 260 when dealing with a small part of a larger site

- Current site plan with scale bar showing north direction, local water drainage and other locally significant features on-site and immediately off-site. The plan should also show the historical location of structures that may have affected the distribution of contamination (e.g. buildings, underground storage tanks, treatment baths, etc)
- Locality map
- Site layout plans showing present and past industrial processes, location of buildings, unsealed areas, waste or chemical storage (All plans should include, north point, key, title, and scale).

Site Characterization (summary only)

- Assessment of the extent of soil and groundwater contamination, including identifiable off-site contamination that may cause environmental effects

Remedial Actions (summary only)

- Methods proposed to minimise effects on groundwater from remedial works
- Demonstration of the disposal route for any material to be disposed off-site
- Staged progress reporting (for long-running projects)

Site Management Plan

- Operational remediation site management plan including (where applicable):
 - suggested trigger levels for each contaminants of concern for soil, sediment, groundwater and storm water;
 - predicted changes of groundwater due to site redevelopment, both during and after;
 - effects of any groundwater diversion or other dangers to groundwater flow;
 - future uses and expected development/ excavation;
 - stormwater controls proposed, especially during earth working;
 - any requirements for groundwater diversion consent;
 - contact at city/district council;
 - community relations;
 - stormwater and soil management;
 - noise and odour control;
 - dust control (including wheel wash);
 - contingency plans to respond to site incidents to obviate potential effects on the surrounding environment and community;
 - proposed long-term site management;
 - occupational safety and health issues and measures.

Ongoing Site Monitoring

- Proposed ongoing site monitoring requirements (if any), including monitoring locations, parameters and frequency

- Results of monitoring analyses, including all relevant QA/QC requirements stated above
- Ongoing site or plant maintenance (e.g. containment cap integrity, etc) or contingency plans
- On-going monitoring to ensure effectiveness of the remediation process
- Details of those responsible for the maintenance/monitoring programme(s)
- Details to be included in the annual MMP report, including:
 - any changes to site owner or occupier
 - any changes to activities undertaken on-site
 - any changes to the physical layout of the site
 - any incidents where the management plan has had to be implemented (subsurface plan has had to be implemented (subsurface works, site development, etc)

Conclusions and Recommendations

- Brief summary of all relevant management and monitoring requirements
- Where remedial action has been taken, a list summarising the activities and the physical changes to the site
- A statement detailing all limitations and constraints on the use of the site (where applicable) including contingency plans if implemented