Ground Doctor Pty Ltd

Remedial Action Plan

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UPSS Decommissioning and Validation Works
Mt Perisher Triple Chair
Perisher Valley, NS

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On Behalf Of:
Perisher Blue Pty Ltd

NSW GOVERNMENT | Planning, Industry & Environment

Issued under the Environmental Planning and Assessment Act 1979

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Signed MB

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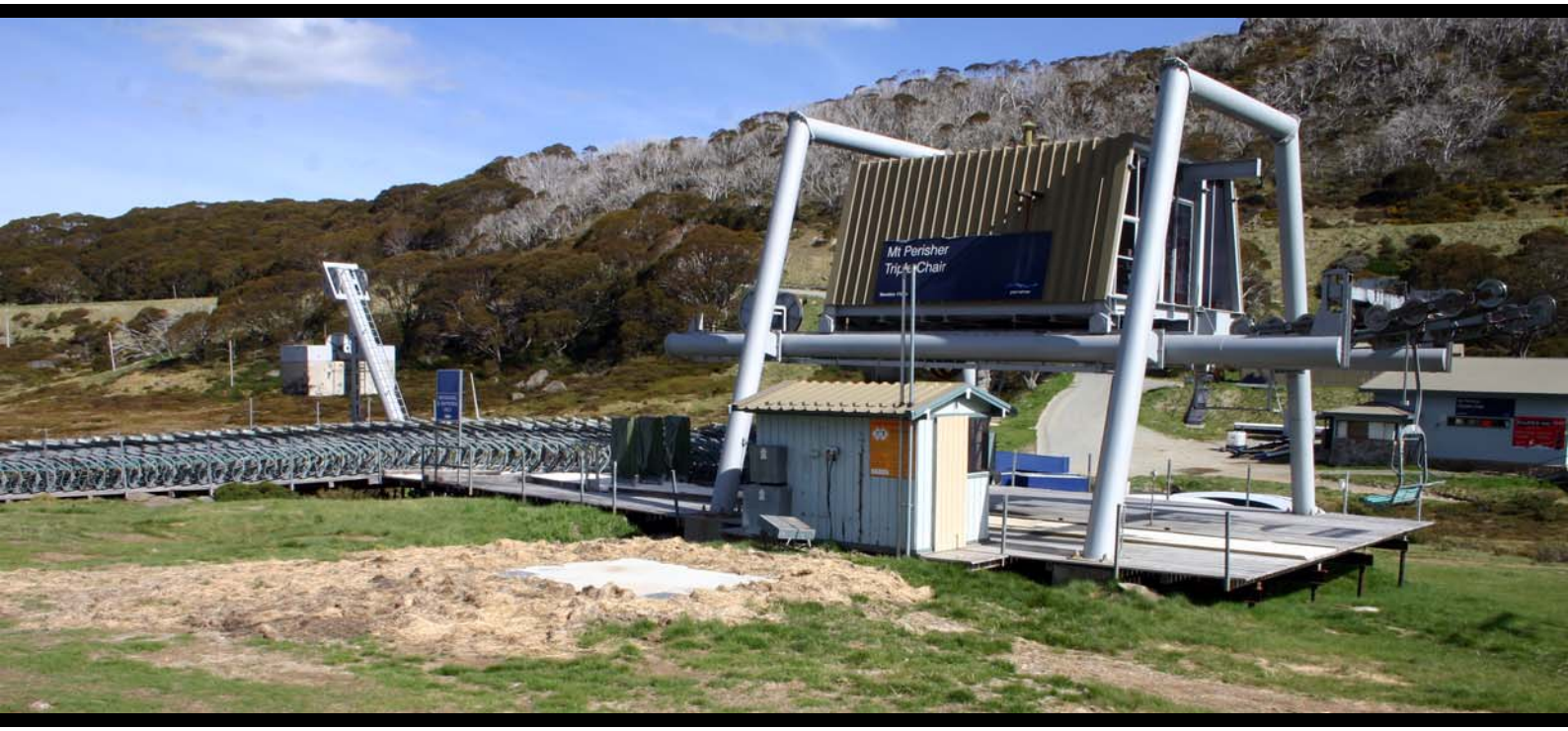

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1 Introduction

Ground Doctor Pty Ltd (Ground Doctor) was engaged by Perisher Blue Pty Ltd (Perisher) to prepare a Remedial Action Plan (RAP) for the proposed decommissioning of an underground petroleum storage system (UPSS) located at the base of the Mt Perisher Triple Chair, Perisher Valley, NSW. This Remedial Action Plan (RAP) outlines the proposed methodology and contingency for the UPSS decommissioning works, associated remediation works and validation assessment.

Perisher propose to install a new chair lift along a similar alignment to the existing Triple Chair. The Triple Chair is to be demolished as part of the proposed chairlift development. A UPSS located adjacent to the base of the Mt Perisher Triple Chair base is to be removed as part of the development.

The UPSS removal works are demolition works, however, remediation of land contamination may form part of the proposed works. State Environmental Planning Policy No. 55 – Remediation of Land classes remediation works that are undertaken within a National Park as Category 1 remediation works. The Mt Perisher Triple Chair is located within Kosciuszko National Park (KNP).

Development consent is required for Category 1 remediation works. This RAP has been prepared to support a development application for the proposed UPSS decommissioning works and any associated remediation works.

1.1 Objectives of this RAP

The objectives of the UPSS decommissioning and validation works are to:

- Remove the UPSS so that it does not pose an ongoing risk to safety, human health or the environment;
- Assess the subsurface adjacent to the UPSS infrastructure for hydrocarbon impacts and quantify potential risks to human health and the environment associated with any identified impacts; and
- Remediate any hydrocarbon impacts to the extent required to render risks to human health and the environment as acceptable.

The objectives of this RAP are to:

- Develop a conceptual site model (CSM) which outlines risk pathways that are relevant at the UPSS site and would be the driver for any remediation work;
- Use the CSM to establish clear data quality objectives (DQOs) prior to the commencement of work, so that remediation strategy chosen was environmentally and economically sustainable; and
- Outline the methodology of possible remediation work that may be undertaken so that it can be undertaken in a safe and environmentally responsible manner.

1.2 Scope of Work

Ground Doctor conducted the following work so that the objectives of the RAP could be met.

- Assessed the site setting using available desktop and preliminary site inspection data.

- Developed a CSM for the UPSS site based on subsurface conditions and the existing and proposed land use at the site. The CSM and relevant NSW EPA endorsed guidance was used to select preliminary remediation goals for the UPSS decommissioning works.

- Outlined the proposed approach to decommission the UPSS and to remediate any hydrocarbon impacted soil adjacent to the UPSS (if present).

- Outlined environmental management controls that should be adopted during the UPSS decommissioning and remediation works;

- Developed contingency plans for the proposed remediation works methodology.

- Developed sampling and analysis plan for validation of the remediation works.

1.3 Requirements of the RAP

NSW EPA (2020) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, outlines that a RAP must address the following. The reporting guidelines are written on the basis that a RAP is prepared to remediate known land contamination. Preliminary environmental data at the Mt Perisher Triple Chair UPSS (see *Section 2.8*) indicates that it is unlikely that unacceptable contamination exists around the UPSS. Some of the listed inclusions of a RAP will are not valid at the UPSS site.

- Summarise the findings of any previous contaminated land assessment.

- Document the identified or potential contamination risks to human health and/or the environment.

- Set remediation objectives that ensure the remediated site will be suitable for its current and/or proposed use and which will result in no unacceptable risk to human health or to the environment and state remediation criteria.

- Define the extent of remediation required across the site.

- Assess options and remedial technologies to achieve the remediation objectives and select and justify a preferred approach, which must include the consideration of the principles of ecologically sustainable development.

- Document in detail all procedures and plans to reduce risks posed by contamination to acceptable levels for the proposed site use.

- Identify the need for and reporting requirements of remedial technology pilot trials (if applicable).

- Establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner, including consideration of the potential for off-site impacts (such as air quality, odour and aesthetics).

- Address contingencies and unexpected finds protocols.

- Identify the necessary approvals and licences required by regulatory authorities including any items contained in development consent conditions.

- Clearly outline waste classification, handling and tracking requirements in accordance with the Guidelines for the NSW Site Auditor Scheme and Waste Classification Guidelines (EPA 2014).

- Ensure remediation is consistent with relevant laws, policies (including planning instruments and policies) and guidelines and reference these in the RAP.

- Identify how successful implementation of the RAP will be demonstrated, for example the validation requirements by documentation of site works and sampling and analysis etc (when sampling and analysis is required, a validation sampling and analysis quality plan must be included.

- identify the need for, and nature of, any long-term management and/or monitoring following the completion of remediation and, if required, provide an outline of an environmental management plan and include this in the RAP.

2 Site Description

2.1 Site Location

The UPSS is situated immediately north of the base of the Mt Perisher Triple Chair. The base of the chairlift is situated within Lot 510 DP 1171964. The UPSS is situated within Kosciuszko National Park (KNP).

The UPSS area is located within the Snowy Monaro Regional Council local government area. Under the Snowy River Local Environment Plan (LEP) 2013 the site is zoned "E1 – National Parks and Nature Reserves".

The UPSS location is shown in *Figure 1* of *Annex A.* The site details are summarised in *Table 1*.

Table 1: Summary of Site Details

	Description
Street Address:	Via Kosciuszko Road, Perisher Valley, NSW, 2624
Lot and DP Number:	Lot 510 DP 1171964
Local Government Area:	Snowy Monaro Regional Council
Land Zoning	E1 – National Park and Nature Reserves
Land-Use	Open Space - National Park Commercial / Industrial (Future Chairlift Buildings)
Geographical Coordinates (UST):	East 625557 North 5969664 (MGA Zone 55)

2.2 Mt Perisher Triple Chair

The Mt Perisher Triple Chair is a three-seat chairlift forming part of the Perisher Ski Resort lift network. The lift was installed circa 1979.

The base of the chairlift consists of a controller's office, cable supports and counter weights. The lift foundations are built into underlying ground level. An elevated timber deck forms a level surface for access to the controller's office and to provide a level area for chair loading and for marshalling of chair users.

The layout of the Mt Perisher Triple Chair base is shown in *Figure 2* of *Annex A.*

The lift was initially powered by a diesel motor but was later converted to an electric drive.

The UPSS was installed to supply diesel for the former chair lift motor but was later used to fuel snow grooming machinery.

The chairlift base is surrounded by open space which is a mix of grass and alpine heath. The chairlift base is accessed by an unsealed road from Kosciuszko Road.

2.3 UPSS Features

The layout of the Mt Perisher Triple Chair base is shown in *Figure 2* of *Annex A.* The UPSS is comprised of the following features.

- 2 x 10000L underground storage tanks (USTs) used to store diesel fuel.
- One fuel dispenser.
- Two direct fill / dip points.

- Two vent lines.
- Two fuel suction lines.

The USTs are located beneath a concrete slab approximately 5m north of the chairlift controller's office. The USTs are inferred to be approximately 2.2m diameter and approximately 3.2m long. The tanks appear to be situated side by side in a north-south orientation within a common tank pit.

The fuel dispenser is situated approximately 15m to the south of the USTs. The fuel dispenser is mounted on the southern side of the timber deck of the chairlift loading area. The base of the fuel dispenser is suspended approximately 1.5m above ground level.

Fuel suction lines run between the USTs and the fuel dispenser. The fuel lines are buried between the USTs and the northern side of the chairlift base. The fuel lines are above ground beneath the chairlift base. The fuel lines are suspended from the base of the timber decking.

Two vent risers are mounted to the wall in the north west corner of the lift controller's office. Vent lines run from the top of each tank to the vent risers.

The tanks appear to have been filled directly.

The inferred UPSS area layout is shown in *Figure 2* of *Annex A*.

2.4 Adjoining Land Uses

With the exception of ski lift infrastructure discussed in *Section 2.2*, the UPSS surrounds consisted of open space forming part of Kosciuszko Nation Park.

The nearest buildings with residential accommodation were situated more than 370m from the UPSS and were upslope of the UPSS.

2.5 Site Topography and Natural Drainage

The natural ground surface in the vicinity of the UPSS sloped toward the south east with an average gradient of approximately 3-7%.

Topographic information available on the NSW Government Spatial Information Exchange (www.maps.six.nsw.gov.au, 23 November 2020) indicated that the site was situated at an elevation of approximately 1730m AHD.

The site was on the lower slopes of Mt Perisher. Mt Perisher reached a maximum elevation of approximately 2054m AHD approximately 1.25km west of the UPSS. Perisher Creek was the nearest primary drainage and was situated at an elevation of approximately 1725m AHD, approximately 30m to the south west and south, and approximately 80m to the east of the UPSS.

Perisher Creek flows in a north easterly direction toward the Perisher Resort car park before flowing in a northerly direction to the Snowy River.

2.6 Soils and Hydrogeology

The geology map "*Tallangatta 1:250000 Geological Series Sheet SJ 55-3 (1966)"* indicates the site is underlain by granite of the Lower Devonian period. The strata is described as "*granite, granodiorite and tonalite. Mainly gneissic to massive magmatic intrusives*".

The ground elevation is raised approximately 1m above natural surface elevation close to the USTs. It is likely that the USTs were installed into a shallow excavation (possibly limited in depth by the

presence of granite bedrock) and that excavated material was used to raise the ground level over the top of the tanks.

Five groundwater monitoring wells exist in the vicinity of the UPSS. The monitoring wells form part of the leak detection system of the UPSS. *Figure 2* of *Annex A* shows the location of groundwater monitoring wells relative to the UPSS features. Monitoring well TCMW101-TCMW103 were installed by Coffey Environments Pty Ltd (Coffey) in early 2011. Ground Doctor supervised the installation of two additional groundwater monitoring wells (TCMW104 and TCMW105) adjacent to the USTs in November 2015. Soil adjacent to the USTs was predominantly weathered granite to a depth of 3.5 to 4.2m below ground level. Granite bedrock was encountered at a depth of 3.5m in the borehole at TCMW104.

Ground Doctor has conducted six monthly monitoring of groundwater at the UPSS site since November 2012. Groundwater monitoring data indicates that groundwater is typically present approximately 1.5-2.0m below ground level in the vicinity of the UPSS. Groundwater level data indicates that groundwater generally flows in a north to south direction towards Perisher Creek.

Ground Doctor conducted a search of the NSW Department of Primary Industries Water (DPI Water) groundwater works database (http://allwaterdata.water.nsw.gov.au/water.stm, 15 May 2018) for registered groundwater works located within 1000m of the UPSS. No registered groundwater works were identified within the search area.

Groundwater in the vicinity of the former UPSS is known to be good quality and would be suitable for all beneficial uses with respect to dissolved salt concentrations. Ground Doctor has not identified any evidence of hydrocarbon impacts in groundwater within the Mt Perisher Triple Chair UPSS monitoring wells.

2.7 Stormwater Drainage and Underground Services

There was no formal surface drainage in the vicinity of the UPSS. Drainage occurred overland in a general north to south direction towards Perisher Creek.

There were no major underground service conduits in the vicinity of the UPSS features.

2.8 Existing Environmental Data

Six monthly groundwater monitoring has been undertaken in the vicinity of the UPSS features since 2011. Ground Doctor has conducted six monthly monitoring of groundwater at the UPSS site since November 2012.

Ground Doctor has not identified evidence of petroleum hydrocarbon contamination in groundwater during any monitoring event. Ground Doctor supervised the installation of two additional groundwater monitoring wells (TCMW104 and TCMW105) adjacent to the USTs in November 2015. These boreholes were located less than 2m from the USTs and underground sections of fuel lines. Soil cuttings from these boreholes were free of significant petroleum hydrocarbon impacts.

The absence of petroleum hydrocarbon impacts in groundwater and soil around the UPSS features indicates that significant petroleum hydrocarbon impacts are unlikely to exist around the UPSS components.

3 Remediation Data Quality Objectives

The Data Quality Objective (DQO) process is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs. The DQO process was adopted in the development of this RAP to do the following.

- Identify human health and environmental risk pathways at the site. The extent of any remediation undertaken would be based on potential risk to human health and environmental receptors.

- Establish remediation goals and validation requirements. By establishing potential risk pathways at the site prior to the commencement of remediation work Ground Doctor could establish remediation goals and a sampling and analytical plan to validate any works undertaken.

- Ensure that remediation works were not excessive resulting in unnecessary expense to the client and potentially causing more environmental harm than necessary.

The DQOs for the decommissioning of the UPSS and subsequent remediation works are outlined in the following Sections of this report.

3.1 State the Problem

A UPSS has existed and operated at the Mt Perisher Triple Chair for a period of approximately 40 years. It is possible that hydrocarbons stored and distributed from the UPSS have been lost to the environment. Hydrocarbon impacts in surrounding and underlying soil, groundwater and/or soil vapour, may pose an unacceptable risk to human health and/or the environment.

NSW SafeWork recommend that any UPSS that has not been in use for more than 12 months, and that is not planned for future use, should be decommissioned so that it does not pose an explosive hazard and/or risk to the environment.

The NSW Protection of the Environment Operations (UPSS Regulation) 2019 requires assessment of land surrounding a decommissioned UPSS for presence of hydrocarbon impacts. The environmental works are required to assess whether the decommissioned UPSS has resulted in land contamination which has potential to pose an unacceptable risk to human health and/or the environment.

3.1.1 Potential Areas of Concern

Components of UPSS that store or convey fuel have potential leak. Sources at the Mt Perisher Triple Chair UPSS include leaks from underground tanks, leaks from fuel suction lines, leaks beneath the fuel dispenser and spills during tank filling or fuel dispensing.

3.1.2 Potential Analytes of Concern

Human health and environmental risks associated with the storage of petroleum products in the UPSS are characterised by assessing media for the following analytes of concern:

- total recoverable hydrocarbons (TRH);

- benzene, toluene, ethylbenzene and total xylenes (BTEX); and

- polycyclic aromatic hydrocarbons (PAHs).

3.1.3 Conceptual Site Model

3.1.3.1 Soils and Hydrogeology

Soil and geology at the site are described in *Section 2.6* of this report.

3.1.3.2 Fate and Transport

Sources of contamination from a UPSS would be expected to migrate through permeable backfill sands around the tanks and pipework. Hydrocarbons would then be expected to migrate into underlying or surrounding natural soil (weathered granite / sandy, gravelly clay) through the base or walls of pipe trenches and/or tank pit. There is also potential for spills to have occurred at the surface adjacent to tank fill points or within machinery fuelling areas.

Vertical migration of light non-aqueous phase liquids (LNAPLs) contaminants at the UPSS site would be limited due to the relatively shallow (typically less than 2m) water table. If LNAPL has leaked from the UPSS and reached the water table it could potentially remain as a pool of LNAPL above the water table as well as a dissolved phase plume in groundwater that has migrated away from the UPSS area.

Dissolved phase groundwater contamination may also result from infiltration of water from the surface through hydrocarbon impacted soil located within the vadose zone.

Significant hydrocarbon impacts have not been identified in the groundwater monitoring wells surrounding the UPSS features since six-monthly monitoring commenced in 2011. The absence of hydrocarbon impacts in groundwater suggests that if any contamination is present, it will be minor in nature and limited to the immediate extent of the leaking UPSS component.

Ground Doctor did not identify any underground service conduits that could / would act as preferential migration pathways for any hydrocarbons lost from the UPSS components.

3.1.3.3 Existing Land-Uses

The UPSS components are located in public open space that is within KNP.

The base of the Mt Perisher Triple Chair is to be demolished shortly after the UPSS is removed. The base of the new chairlift will be constructed further to the east of the existing base. There will be a buffer of at least 50m between the new lift infrastructure and the UPSS area.

3.1.3.4 Potential Human Health Exposure Pathways

Human health risk pathways relevant to the validation assessments are outlined in *Table 2*.

Table 2: Assessment of Human Health Risk Exposure Pathways

Exposure Pathway	Relevance
Vapour Intrusion	Vapour can be generated from volatile contaminants in soil and/or groundwater and may accumulate in overlying buildings. Not relevant in public open space. Relevant for any contamination that has migrated beneath or close to structures. Existing groundwater data indicates that there is no significant soil or groundwater contamination around the UPSS.
Direct Contact with Soil	Relevant to future users of KNP. Relevant for maintenance workers.
Ingestion, Inhalation or consumption of contaminated soil.	Relevant to future users of KNP. Relevant for maintenance workers.
Consumption of Contaminated Water	No registered bores used for beneficial purposes have been identified within 500m of the UPSS sites. Groundwater contamination (if present) has potential to impact surface water quality in nearby Perisher Creek. Perisher Creek is part of the Snowy River catchment and surface water is used for water supply by rural landholders and downstream local governments. Surface water may be consumed by recreational users of KNP. Existing groundwater data indicates there are no significant groundwater impacts close to the UPSS components.
Explosion	Volatile contaminants in the subsurface can generate explosive gases in underground structures such as basements and enclosed service conduits. This exposure pathway may be relevant if underground structures are present near an impacted area. Underground voids have not been identified around the UPSS.
Aesthetics	Aesthetic impacts would be relevant as the UPSS is located within KNP. Soil in the upper 3m of the subsurface should be free of discolouration and odour, irrespective of analytical data.

3.1.3.5 Potential Environmental Impacts

Environmental risk pathways relevant to the validation assessments are outlined in *Table 3*.

Table 3: Assessment of Environmental Risk Pathways

Exposure Pathway	Relevance
Ecological Impacts	Ecological impacts are relevant as the UPSS is situated within KNP. Ecological impact assessment would typically consider contamination in the upper 2m of the subsurface.
Aquatic Ecosystems	Aquatic ecosystems located down gradient of the UPSS have potential to be impacted by contaminant migration in groundwater. Existing groundwater data indicates there are no significant groundwater impacts close to the UPSS components.

3.2 Identify the Decision

To validate the UPSS decommissioning works Ground Doctor must be satisfied that any hydrocarbon impacts to soil, groundwater and/or soil vapour at the site do not pose an unacceptable risk to human health or the environment.

If contamination is identified in soil and/or groundwater at the site, Ground Doctor must be satisfied that the lateral and vertical extent of hydrocarbon impacts have been delineated. The concentrations of contaminants within soil, groundwater and/or soil vapour need to be well defined so that risks to potential receptors can be adequately assessed.

3.3 Identify Inputs to the Decision

Ground Doctor will need to assess soil located adjacent to the decommissioned UPSS infrastructure for evidence of contamination. This will include visual and olfactory observations during the decommissioning work and by assessing contaminants concentrations in validation samples.

Ground Doctor will also assess groundwater at the existing groundwater monitoring wells.

If contamination is identified it will be necessary to delineate the extent of contamination so that risks to human health and the environment can be properly assessed across the area of impact.

3.4 Define the Study Area Boundaries

The validation assessment is required to assess the extent of any hydrocarbon impacts within and adjacent to the removed UPSS infrastructure. The assessment will aim to delineate the lateral and vertical boundaries of hydrocarbon impacts related to the decommissioned UPSS. The extent of contamination must be known to enable human health and environmental risks to be properly assessed.

3.5 Decision Rule – Assessment Criteria

Soil and groundwater analytical data was assessed against relevant thresholds published in the National Environment Protect Council (NEPC) (1999) National Environment Protection (Assessment of Contamination) Measure (NEPM) (revised April 2013).

3.5.1 National Environment Protection (Assessment of Contamination) Measure

Soil Investigation Levels (SILs) and Groundwater Investigation Levels (GILs) published in the National Environment Protect Council (NEPC) (1999) National Environment Protection (Assessment of Contamination) Measure (NEPM) (revised April 2013) will be used to assess concentrations of chemicals of concern in soil and groundwater.

The NEPM (2013) outlines three levels of Tier 1 assessment of petroleum hydrocarbon impacted soil, groundwater and soil vapour. These include the following criteria which will be applied in the order listed.

1. **Health Screening Levels (HSLs)** for the assessment of potential human health impacts associated with vapour migration from hydrocarbon impacts in soil, groundwater and soil vapour.

2. **Ecological Screening Levels (ESLs)** for the assessment of potential ecological impacts associated with hydrocarbon impacts in soil.

3. **Management Limits** for the assessment of other potential impacts associated with hydrocarbon impacted soil including potential for explosive vapours to accumulate in underground infrastructure, impacts on underground service conduits and infrastructure and the potential for the formation (and potential migration) of light non-aqueous phase liquid (LNAPL).

The NEPM (2013) **Health Investigation Levels (HILs)** and **Ecological Investigation Levels (EILs)** will be adopted to assess concentrations of non-petroleum contaminants of concern in soil.

The adopted NEPM (2013) screening criteria for assessing petroleum hydrocarbons in soil are presented in *Table 4*. The adopted NEPM (2013) screening criteria for assessing petroleum hydrocarbons in groundwater are presented in *Table 5*.

3.5.1.1 Health Screening Levels

The NEPM (2013) HSLs for petroleum hydrocarbons will be used to assess soil and groundwater analytical results collected as part of the validation assessment. The HSLs are used to assess potential vapour intrusion risks associated with subsurface contaminants. That is, to assess whether hydrocarbon vapours from soil and groundwater contamination have potential to migrate into overlying or nearby buildings at an unacceptable concentration. This exposure pathway is not

relevant at the UPSS site, as building will not be located near the former UPSS after the UPSS and nearby chairlift infrastructure is demolished, but will be considered for completeness and conservatism.

Ground Doctor will adopt the most conservative HSL A, which apply to low density residential buildings overlying sandy soil.

3.5.1.2 Ecological Screening Levels

The ESLs are designed to assess potential impacts of petroleum hydrocarbons in soil to flora and fauna The ESLs apply to soil encountered within the upper 2m of the subsurface only.

Ground Doctor will adopt ESLs relevant to ecologically sensitive areas as the UPSS is located within KNP.

3.5.1.3 Management Limits

Results exceeding Management Limits should trigger consideration of other potential risks to human health. These may include, potential for groundwater contamination, potential for free phase LNAPL to be present, potential for vapour to impact underground services or infrastructure and potential for land users, public or maintenance workers to come into direct contact with soil.

Ground Doctor will adopt Management Limits for low density residential land use and public open space.

3.5.1.4 Health Investigation Levels

Ground Doctor will adopt Health Investigation Levels (HILs) outlined in the NEPM (2013) for assessment of non-petroleum hydrocarbon impacts in soil. Ground Doctor will adopt HIL A (low density residential land use) as a conservative preliminary screening criteria. The adopted HILs are presented in *Table 5*.

3.5.1.5 Ecological Investigation Levels

The NEPM (2013) ecological investigation levels (EILs) will be adopted for assessment of lead concentrations in soil.

3.5.1.6 Aesthetics

The NEPM (2013) requires the validation assessment to consider aesthetics. Aesthetic impacts can include discoloured and odorous soil and/or presence of synthetic materials such as ash and building demolition waste. Consideration of aesthetics will take the nature and depth of the aesthetic impacts into consideration.

Table 4: Adopted NEPM (2013) Soil Investigation Levels (SILs)

Analytes	HSLA Sand - 0-<1m	HSLA Sand – 1m-<2m	HSLA Sand - 2-<4m	HSLA Sand – 4m+	ESL/ EILA (Coarse Grain)	Management Limits (Coarse Grain)	HILA
TRH C6 - C10	-	-	-	-	125	700	na
TRH C6 - C10 less BTEX	45	70	110	200	-	-	na
TRH >C10-C16	-	-	-	-	25	1000	na
TRH >C10 - C16 less Naph	110	240	440	NL	-	-	na
TRH >C16-C34	NL	NL	NL	NL	300	2500	na
TRH >C34-C40	NL	NL	NL	NL	2800	10000	na
Benzene	0.5	0.5	0.5	0.5	10	-	na
Toluene	160	220	310	540	10	-	na
Ethylbenzene	55	NL	NL	NL	1.5	-	na
Total Xylenes	40	60	95	170	1.6	-	na
Naphthalene	3	NL	NL	NL	170	na	-
Lead	na	na	na	na	1100	na	300
na – not applicable. NL - non-limiting. The compound(s) do not pose an unacceptable vapour risk, even when NAPL is present.							

3.5.1.7 Groundwater Investigation Levels

Ground Doctor will adopt Groundwater Investigation Levels (GILs) outlined in the NEPM (2013) for assessment of petroleum hydrocarbon impacts in groundwater. The NEPM (2013) refers to the following thresholds.

- NEPM (2013) Health Screening Levels (HSLs) which are relevant for selected volatile contaminants within the analytical suite. The most conservative HSLs will be adopted as a preliminary assessment criteria. These are HSLs applying to residential land with sandy soil where the water table was between 2m and 4m below ground level.

- National Health and Medical Research Council (NHMRC) (2011) *Australian Drinking Water Guidelines,* updated 2019; and

- Default guideline values (DGVs) specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (August 2018) for moderately disturbed fresh water ecosystems (95% protection).

The adopted GILs are presented in *Table 6*.

Table 5: Adopted NEPM (2013) Groundwater Investigation Levels (GILs)

Analytes	NEPM GILs		
	Drinking Water (2011)	Aquatic Ecosystem – DGVs (2018)	HSL A Sand 2-<4m
TRH C6 - C10 less BTEX (F1)	-	-	1000
TRH >C10 - C16 less Naphthalene (F2)	-	-	1000
TRH >C16 - C34	-	-	NL
TRH >C34 - C40	-	-	NL
Benzene	1	950	800
Toluene	800	180	NL
Ethylbenzene	300	80	NL
m+p-xylene	600	75	NL
o-xylene	600	350	NL
Naphthalene	-	16	NL
na – not applicable. NL - non-limiting. The compound(s) do not pose an unacceptable vapour risk, even when NAPL is present.			

3.5.2 Waste Classification

Analytical results for soil requiring off-site disposal will be compared to thresholds published in the NSW EPA (2014) "*Waste Classification Guidelines, Part 1 – Classifying Waste*".

Field observations will also be used to assess whether the soil features inclusions that may deem it a pre-classified waste (e.g. - such as the presence of asbestos containing materials, which would deem the waste "*asbestos containing waste*").

3.5.3 Soil Decision Rule

When assessing point sources of contamination, the contaminant concentrations should not exceed the adopted assessment criteria.

The adopted assessment criteria are not intended to be a validation or clean-up goal for the site. The assessment criteria are intended to provide some preliminary limits which flag areas in which contamination has been identified that may pose an unacceptable risk to human health or the environment.

Results exceeding the adopted assessment criteria should prompt further assessment of the area of concern, or consideration of specific risks associated with the proposed future use of the impacted area.

3.5.4 Groundwater Decision Rule

Results exceeding the adopted assessment criteria should prompt further consideration of specific risks associated with the identified groundwater impacts.

Exceedance of an HSL may indicate unacceptable vapour intrusion risk in an overlying or nearby building. These risks may not be applicable in the impacted area as no buildings are proposed close to the former UPSS.

Exceedance of drinking water thresholds and/or threshold for the protection of aquatic ecosystems would be most applicable immediately upgradient of the nearest groundwater receptor (Perisher Creek).

3.5.5 Waste Classification Decision Rule

The 95% upper confidence limit (95% UCL) of the average contaminant concentration is to be less than the designated waste classification threshold and no single contaminant concentration should exceed the threshold by more than 250%.

3.6 Specify Limits on Decision Errors

Ground Doctor proposes to collect and analyse a number of samples that will be used for quality assurance and quality control (QAQC) purposes. Proposed QAQC sampling and criteria for assessing the quality of analytical data are outlined in the following sections.

3.6.1 Field Duplicates

Field duplicates will be collected at a minimum rate of 1 duplicate sample per 10 primary samples. Field duplicate samples will be labelled blind. Ground Doctor proposes to analyse at least one duplicate sample at the primary laboratory and at least one duplicate sample at a second laboratory. Inter-laboratory and intra-laboratory duplicate samples will be analysed at a minimum rate of 1 per 20 primary samples for both soil and groundwater samples.

Ground Doctor adopts the following criteria with which to assess the results of duplicate sampling:

- Calculated relative percentage difference (RPD) values should be less than 50% where the reported concentrations of analytes are greater than 10 times the EQL;

- Calculated RPD values should be less than 75% where the reported concentrations of analytes are greater than 5 times the EQL but less than 10 times the EQL; and

- Calculated RPD values should be less than 100% where the reported concentrations of analytes are less than 5 times the EQL.

3.6.2 Trip Spikes

A trip spike will be taken into the field to assess potential losses of volatile compounds during sample storage and transport. The trip spike will be analysed for volatile TRH and BTEX compounds only.

The acceptable trip spike recovery for organic compounds will be 60-140%.

3.6.3 Trip Blanks

A trip blank will be taken into the field to assess potential for cross contamination to occur during storage and transport of samples. The blank will be analysed for volatile TRH and BTEX compounds only.

Reported concentrations of all analytes within trip blanks should be less than the estimated quantification limit (EQL).

3.6.4 Rinsate Samples

Soil samples will not come into direct contact with the sampling equipment.

Ground Doctor will use well dedicated sample tubing to sample groundwater monitoring wells.

It will not be necessary to collect a rinsate sample from the excavation equipment.

3.6.5 Holding Times

Ground Doctor will ensure that all soil and water samples analysed as part of the proposed works are analysed within the appropriate technical holding times. Samples will be transported to the laboratory by overnight courier service to minimise transit time and ensure cool temperature is maintained.

3.6.6 Lab Surrogate Recovery

Recovery of surrogates for organic compounds should be between 60-140%. Matrix spike recovery for inorganic compounds should be 70-130%.

3.6.7 Lab Matrix Spikes

Matrix spike recovery for organic compounds should be between 60-140%. Recovery of surrogates for inorganic compounds should be 70-130%.

Ground Doctor will ensure that a matrix spike is analysed from within the samples submitted to the laboratory for analysis.

3.6.8 Lab Method Blanks

Reported concentrations of all analytes within lab blanks should be less than the EQL.

3.6.9 Laboratory Control Samples / Spikes

Recovery of spiked compounds in laboratory control samples and spikes should range between 60-140% for organics and between 70-130% for inorganics.

3.6.10 Laboratory Duplicates

Acceptance criteria for duplicate samples are outlined in *Section 3.6.1*.

3.7 Optimise the Design for Obtaining Data

The design for obtaining data will be developed with consideration to the NEPM (2013) "*Schedule B2: Guideline on Site Characterisation*" and the NSW EPA (2014) "*Technical Note: Investigation of Service Stations*".

3.7.1 UPSS Validation Sampling

Sampling rates that will be adopted by Ground Doctor are summarised in *Table 6*, unless otherwise stated.

Table 6: Minimum Soil Validation Sampling Rates

Location	Sample Requirements
Tank Pits	One sample from each wall and one sample from the base of each tank pit. Where more than one tank is present in a common tank pit, one sample will be collected below the base of each tank. Additional wall samples will be required for each 8.5m length of wall. Additional base samples will be required for every 70m^2 area of base (i.e. – on an 8.5m grid)
Beneath Fuel Lines	One per 5m of underground fuel line. Assuming excavation is less than 1m deep, sampling from the base of the fuel line excavation is sufficient unless there is evidence of lateral migration of contamination away from the former fuel line. Where fuel lines are located above tank pits, sampling conducted from the tank pit will be sufficient to characterise potential leaks from the fuel lines.
Beneath Fuel Dispensers	One beneath each former fuel dispenser location.
Remote Fill Points	One sample beneath each remote fill point, or each cluster of remote fill points for closely spaced points. Remote fill points have not been identified at the UPSS site.
Excavated Spoil for Reuse or Disposal	Excavated spoil will be sampled at a rate of one sample per 25m^3. A minimum of two samples will be required to assess excavated spoil from each UPSS site.
Imported Fill	The source of fill will be assessed. Where soil is purchased from a supplier of VENM and documentation can be provided sampling will not be required. Imported fill will need to be suitable to be brought into KNP.

3.7.2 Suite of Analysis

Soil and groundwater validation samples will be analysed in a laboratory for the presence of TRH, BTEX and naphthalene. Groundwater will also be analysed for PAHs.

3.7.3 Soil Sampling Methodology

Soil samples from excavations will be collected directly from the excavator bucket for safety reasons. Care will be taken to ensure the sample collected has not been in direct contact with the excavator bucket.

Near surface samples may be collected using hand excavation equipment (shovel, hand auger and/or mattock). In this case the sampler will take care to ensure the soil collected has not come into direct contact with the sampling implement.

The sampler will wear a clean pair of disposable nitrile gloves when collecting each sample. Soil samples will be placed into a 125mL laboratory supplied glass jar marked with the appropriate

identification, and then placed on ice inside an esky. Additional sample will be collected into a plastic snap lock bag for field screening with a photo-ionisation detector (PID). Care will be taken to minimise potential loss of volatile hydrocarbons including collecting the least disturbed sample, minimising head space in the sample container and storing samples on ice immediately after collection.

Soil samples will be logged in the field to include a description of soil type, soil colour, inclusions, the presence of odours or staining and the headspace screening result.

3.7.4 Soil Sample Depths

Soil samples will be collected at depths and locations which best characterise the UPSS infrastructure being assessed. For example, samples collected from the walls of a tank pit should be collected from the lower part of the wall unless contamination is obvious in shallow soils due to a change in soil permeability or a shallow water table.

Where hydrocarbon impacts are identified, the sampler will consider the adopted NEPM (2013) assessment criteria when selecting appropriate sampling depths. For example, where hydrocarbon impacts are identified at depths greater than 2m below ground level there would be value in collecting soil from the deeper impacted layer as well as clean soil at a depth of 2m. This would demonstrate that the upper 2m of the subsurface was free of contaminants, which is important when applying the NEPM (2013) assessment criteria.

3.7.5 Groundwater Sampling Methodology

Groundwater samples will be collected from five existing groundwater monitoring wells that were installed for the purposed of leak monitoring from the UPSS to be decommissioned.

Prior to sampling Ground Doctor will gauge each well with an interface meter to measure the depth to water below the top of the PVC casing, and whether any NAPL was present at the water table. All wells will be gauged at the same time to ensure consistency.

A PID will be used to assess headspace in each monitoring well at the time of gauging. The PID inlet will be placed inside the well casing immediately after the well cap and was left in place for approximately 20 seconds. The peak PID reading in this period will be recorded.

Ground Doctor will assess relative groundwater elevation data to infer the direction of groundwater flow.

Groundwater monitoring wells will be sampled using a low flow sampling method.

Dedicated well tubing will be used in each well to minimise potential cross contamination between sampling locations. The inlet of the sample tubing will be placed adjacent to the documented water bearing zone within each monitoring well.

A flow cell will be established at the outlet of the pump and field water quality parameters and the standing water level in the monitoring well will be monitored at 5 minute intervals to establish when the pumped water is representative of conditions in the aquifer adjacent to the well screen. Each well will be sampled after field parameters had changed from the initial readings and then stabilised, which will indicate that inflow to the well is representative of groundwater from the surrounding formation.

Groundwater samples will be collected into appropriate sample bottles marked with relevant ID and sample details. The samples to be analysed for dissolved lead will be filtered in the field using well dedicated disposable 45µm filters.

3.7.6 Sample Storage and Transport

Samples will be placed on ice inside an esky immediately after collection to minimise the potential loss of volatiles during storage and transport. The esky will be maintained to ensure samples are not flooded with melt water from the ice.

Samples will be sent to the analytical laboratory using an overnight courier service. Samples will be left at the courier in the afternoon to minimise time samples spent in transit.

3.7.7 Analytical Laboratory

Envirolab Services (Sydney) will be used as the primary analytical laboratory. Inter-laboratory duplicate samples will be analysed by Europhins (Sydney). Both laboratories have National Association of Testing Authorities (NATA) accreditation for the proposed suite of analytes and use analytical methods which comply with the NEPM (2013) guidelines.

4 Remedial Action Plan

4.1 Remediation Methodology

Ground Doctor proposed the following remediation plan:

- Remove all components of the UPSS and dispose off-site.
- Excavate backfill sand from adjacent to the UPSS infrastructure and collect representative samples to assess suitability for reuse on-site, or to classify for off-site disposal.
- Inspect natural soil located adjacent to removed UPSS infrastructure for evidence of hydrocarbon impacts.
- Remove any hydrocarbon impacted soil to the extent practicable given site constraints and stockpile separately or load for off-site disposal.
- Collect soil samples from UPSS excavations in accordance with the minimum sampling rates outlined in *Table 6*.
- Partially reinstate the UPSS excavations with excavated soil pending results of laboratory analysis.
- If soil is found to be suitable to remain on-site surrounding soil will be used to level the former UPSS excavations level with the surrounds.
- Collect water samples from UPSS leak monitoring groundwater monitoring wells for laboratory analysis.
- Evaluate field observations and laboratory analytical data. Prepare validation report if no unacceptable hydrocarbon impacts are identified. Where hydrocarbon impacted soil and/or groundwater is identified, but cannot be removed in full, additional assessment may be required to validate the UPSS decommissioning work. This may include assessment of groundwater and/or soil vapour.

4.2 UPSS Removal

UPSS decommissioning works will be performed by Perisher. Ground Doctor will observe and document the decommissioning works.

UPSS decommissioning works will proceed in general accordance with the following.

- Concrete above the UPSS components will be broken and removed.
- Soil above UPSS components will be removed with care to establish the orientation of tanks and pipework. Once the orientation of a tank has been established, pipework will be disconnected from the top of the tanks and the remaining soil overlying the tanks will be removed.
- Once the tanks are opened they will be gauged for the presence of liquid. A liquid waste contractor will be engaged to remove and dispose of remnant liquid from each tank prior to decommissioning.
- A narrow trench will be excavated around the sides so that the tanks becomes loose. The UST will then be removed from the excavation and stored adjacent to the work area temporarily.

- Once the USTs have been removed, accessible parts of the UPSS pipework (the fuel lines and vent lines) will be removed and stored on site for later disposal.

- All components of the UPSS will be loaded onto a truck and transported to an appropriately licenced disposal or recycling facility.

4.3 Soil Excavation

After each UPSS component has been removed, the surrounding backfill sand will be excavated to allow assessment of the surrounding natural soil on the walls and base of the tank pits and beneath fuel lines.

Backfill sand will be inspected for evidence of hydrocarbon impacts. Odorous or discoloured soil will be separated from soil that appears to be free of hydrocarbon impacts.

Natural soil on the walls and base of UPSS excavations will be inspected for the presence of hydrocarbon impacts. Impacted soil will be removed to the extent practicable.

Excavated soil will be placed back into the excavation pending analytical data and subsequent waste classification assessment. Hydrocarbon impacted soil not suitable to remain at the site will be disposed off-site at a licenced waste management facility.

4.4 Soil Validation Sampling

Soil validation will be undertaken to verify that soil to be left on site does not pose an unacceptable risk of harm to human health or the environment or to characterise soil that is re-used as backfill on-site. The proposed validation sampling design and sampling methodology is detailed in *Section 3.7*.

Where hydrocarbon impacted soil cannot be remediated in full, samples will be collected to characterise the remaining contamination. Results would be used as input to a detailed risk assessment, the design of further remediation work and/or implementation of a risk management strategy.

4.5 Reinstatement of Excavations

Excavations will be backfilled as soon as possible after the collection of validation samples to minimise safety and environmental risks associated with open excavations.

Excavations will be reinstated with soil that is assessed (in the field) as suitable for re-use at the site. This will be soil that is free of hydrocarbon odour and/or staining.

The UST area is raised above the surrounding natural ground level. Perisher intend to leave the former UPSS area level and may borrow excess soil from the immediate surrounds to achieve a level surface.

Imported fill is not expected to be required. If imported fill is required, it will be obtained from a recognised quarry and certification will be obtained to confirm that it is VENM.

As outlined in *Section 3.7*, excavated spoil that is reused at the site, will be sampled prior to filling and analysed in a laboratory to confirm its suitability for use at the site. The fill will also be inspected to ensure it does not contain other potentially hazardous substances such as asbestos.

Fill will be placed in layers, wet and compacted using excavation equipment.

Excavations will be reinstated level with the surrounding natural surface elevation.

4.6 Treatment of Hydrocarbon Impacted Soil

Hydrocarbon impacted soil (if encountered) will be removed to the extent practicable. During excavation of the UPSS, soil suspected of being impacted will be stockpiled separately from soil that is free of hydrocarbon odour and staining.

Hydrocarbon impacted soil will require off-site disposal at an appropriate waste management facility as there are no suitable landfarming areas in the vicinity of the UPSS area.

Soil samples will be collected and analysed for waste classification purposes as required. Any hydrocarbon impacted soil will be placed back into the UPSS excavation pending analytical results to control potential sedimentation of down gradient water bodies.

4.7 Validation Assessment Report

Field observations and the results of soil and groundwater validation sampling and analysis will be assessed against the adopted assessment criteria (see *Section 3.5*). If available data indicates that there are no unacceptable risks to human health or the environment a validation report will be prepared for the UPSS decommissioning works.

The validation report will detail the works performed, outline the validation methodology and present the results of the validation sampling. The report will be prepared in accordance with:

- NSW EPA (2020), "*Contaminated Land Guidelines – Consultants Reporting on Contaminated Land*"; and
- NSW Department of Environment, Climate Change and Water (2010), "*UPSS Technical Note: Site Validation Reporting*".

4.8 Further Risk Assessment

If field observations or the results of validation sampling indicate that human health or environmental risks may be unacceptable then additional assessment may be required.

Existing groundwater data from the network of UPSS monitoring wells indicates that significant contamination does not exist around the UPSS so further risk assessment is unlikely to be required.

5 Regulatory Requirements and Approvals

5.1 State Environment Planning Policy No. 55

Under the definitions outlined in SEPP 55 the proposed works would be classed as Category 1 remediation works as the site is located within a National Park. Development consent is required for Category 1 remediation works.

5.2 Protection of Environment Operations Act 1997

The requirements of the Protection of the Environment Operations (POEO) Act 1997, and associated schedules and regulations, are relevant to the proposed remediation works.

The POEO Act 1997 aims to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development. The Act includes requirements not to pollute waters, to prevent or minimise air pollution, to maintain and operate plant in a proper and efficient condition/manner, to deal with materials in a proper and efficient manner, to minimise noise impacts, and to minimise and manage wastes. The Act also requires notification to the NSW EPA when a pollution incident occurs that causes or threatens material harm to the environment.

The environmental management measures outlined in *Section 6* should be adopted so that remediation works comply with the requirements of the POEO Act 1997.

The POEO Act 1997 is also relevant to the disposal of soil and other waste to a licensed landfill.

6 Remediation Works Management Plan

6.1 Relevant Standards

The UPSS decommissioning work will be undertaken by Perisher in accordance with the following Australian standards and guidelines.

- Australian Standard AS 1940–2004, The Storage and Handling of Flammable and Combustible Liquids.
- Australian Standard AS 4976–2008, The Removal and Disposal of Underground Petroleum Storage Tanks
- SafeWork NSW safety alert WC01188, Potential risks when removing underground storage tanks.

6.2 Timing

The UPSS decommissioning works will be completed prior to demolition of the Mt Perisher Triple Chair base.

The UPSS removal works and associated soil validation assessment are expected to be completed over a single day. Tanks and pipework will be uncovered, pumped free of liquid and removed prior to off-site disposal. Once validation samples have been collected from the walls and base of UPSS excavations and from excavated soil (see *Section 3.7*), all excavated material will be placed back into the UPSS excavations pending laboratory analytical data.

If it is necessary to dispose of any contaminated soil at a later stage the contaminated soil will be excavated and transported off-site for disposal.

6.3 Safety, Health and Environmental Management

The Perisher site supervisor will induct all personnel at the commencement of the project. A toolbox talk will be held at the commencement of each day's work, or when a new hazard is identified, to address site or time specific hazards.

Works will be undertaken in accordance with safe work method statements (SWMSs) for the tasks that form the UPSS decommissioning and validation. All persons working on the project will be required to review and sign the relevant SWMSs for tasks that they are performing. Work methods will be reviewed and amended to account for site specific or time specific hazards.

6.4 Site Demarcation and Access

The UPSS area is not within an area of high pedestrian activity.

The perimeter of the work area (including a safety buffer) will be marked with high visibility bollards and hazard tape. Persons required to enter the marked work area will be required to be inducted by the Perisher site supervisor.

Perisher do not propose to leave any excavations open and unattended. Of for unforeseen reasons a n excavation must be left open appropriate fencing will be installed around the fence to keep pedestrians and wildlife out of the excavation.

Perisher will erect appropriate signage around the work area which will include the following.

- Minimum personal protective equipment (PPE) requirements to enter the site marked work area.

- The name of the Perisher site supervisor and a 24hr contact phone number.
- Appropriate 'Danger' signs adjacent to any open excavation or combustible materials.

6.5 Clearing / Mapping Site Services

Perisher will identify and locate underground services in the vicinity of the UPSS priror to commencing mechanical excavation.

6.6 Water Management, Erosion and Sediment Control

Prior to commencing ground disturbance works, Perisher will install silt fencing down gradient of the disturbance area to capture any suspended sediment leaving the worksite.

It is anticipated that the excavation required to remove the USTs and validate the surrounding soil will be less than 5m wide x 4m long by 2.8m deep.

Works will be completed during fine weather only and will be completed over a single day. The UPSS excavations will only remain open for long enough to allow inspection and sampling of soil from the base and walls of the excavations. Once these tasks have been completed, any excavated material will be placed back into the excavation and the excavation will be reinstated, such that it cannot fill up with stormwater.

In the event of unforeseen heavy rainfall during the short interval that the excavation will be open, open excavations will be backfilled to the extent practicable and works ceased until fine conditions return. This will minimise the potential for water to accumulate in excavations. It will also contain excavated material so that it cannot run offsite. A small bund can be constructed on the upslope side of any open excavation to prevent storm water runoff from entering the open excavation.

Sediment controls are not proposed around stockpiles of excavated as these will be temporary only. Where possible, excavated material will be stockpiled on previously disturbed areas to minimise the disturbance footprint.

6.7 Noise Control

The proposed work area is located at least 370m from the nearest receptor that is not part of Perisher Resort.

Noise will be generated by the excavator and trucks used during UPSS decommissioning and remediation works. Noise from plant is not expected to be excessive. It is anticipated that an excavator will operate for a single day only. There will be less than 5 truck movements required to complete the works and these will occur on one day.

The USTs are situated in a previously excavated tank pit. The subsurface is expected to be soft. Hydraulic hammering will only be required to break a small area of surface concrete located directly over the top of the USTs. The remainder of the UPSS area is unsealed.

All work will be conducted between the hours of 7 am and 7 pm, Monday to Saturday, or as approved by NSW NPWS.

All machinery will be kept in good working order and will comply with noise attenuation standards.

6.8 Dust and Odour Control

The proposed work area is located at least 370m from the nearest receptor that is not part of Perisher Resort.

Remediation works will be performed in a manner which minimises the generation of dust and fugitive emissions. Significant dust is unlikely to be generated during the works. The UPSS is within a high rainfall area where soil remains damp for a significant part of the year. The water table is present less than 2m below ground level within the work area.

All contractors working on the site will be reminded of the need to keep dust generation to a minimum. This can be achieved by careful handling of materials and application of controls where possible.

Where visual inspection indicates that unacceptable concentrations of dust are being generated, work will cease until measures have been undertaken to reduce dust, or until weather conditions are more suitable. The former may involve the use of water sprays, tarpaulins or alteration of work practices. The Perisher supervisor will make such decisions based on the conditions and nature of the works.

Existing groundwater data indicates that significant hydrocarbon impacts doo not exist at the UPSS site. In the unlikely event that odorous soil is encountered, the hazard will be controlled by minimising the time excavated soil is left exposed at the ground surface. Soil will be placed back into the excavation immediately after validation sampling.

Ambient volatile organic compound (VOC) monitoring will be conducted if strong hydrocarbon odours are present. If persistent VOC concentrations are present in the work area temporary controls (e.g. wearing respiratory protection) will be adopted by those in the work area whilst odour is being generated.

6.9 Traffic

Formal traffic management is not proposed.

Trucks and plant will be required to enter each work area from Kosciuszko Road via the Mt Perisher Triple Chair access road. Minimal vehicle movements will be required over the short duration of works.

The Mt Perisher Triple Chair access road is not a public road.

6.10 Working Hours

All work will be conducted between the hours of 7 am and 7 pm, Monday to Saturday, or as approved by NSW NPWS.

6.11 Emergency Contacts

A list of emergency contact numbers will be kept at the work site during the proposed works. This list will include numbers of all relevant local utilities, National Parks, emergency services and the pollution line of the NSW EPA.

6.12 Site Diary and Materials Tracking

The Perisher site supervisor will maintain a site diary to record:

- Details of any unusual materials or odours encountered during excavations and details of any associated actions taken;
- Details of any accidents, incidents or near misses which may have resulted in injury;
- Details of any visitors to the site; and

- Soil volumes excavated, truck movements, soil movements and volumes of material removed from, or imported to the site.

- Unusual odours or material encountered during excavation works;

The Ground Doctor representative shall keep the following records, which will form part of the validation report.

- Details of any of the above.

- PID calibration.

- Results and times of air monitoring with the PID (if required).

- Photographic records of excavations, stockpiles and soil relocation.

- Details of any environmental issues that may be of concern, and associated corrective measures.

- Details of all soil validation sampling and excavation locations illustrated on a site plan.

7 Occupational Health and Safety

7.1 Chemicals of Concern

Potential hydrocarbon impacts in soil and/or groundwater at the site are associated with loss of leaded petrol, unleaded petrol, kerosene and/or diesel from the former UPSS.

These products are made up of many different organic compounds and contain many additives. Current understanding of potential health impacts associated with exposure to petroleum hydrocarbons indicates that the following compounds are most easily measured in a laboratory and are the best indicators of potential human health effects.

- Benzene
- Toluene
- Ethylbenzene
- Meta – para and ortho xylene
- Naphthalene
- Petroleum Hydrocarbons

The compounds all occur within petroleum hydrocarbons and are typically found together. Diesel typically contains little or no aromatic compounds (BTEX).

7.2 Symptoms of Exposure

Exposure is classed as either acute or chronic. Acute effects occur due to exposure to relatively high dose of a chemical over a short period of time. Chronic effects occur due to prolonged exposure to a lower chemical dose. Both acute and chronic exposure to petroleum related contaminants can result in severe biological harm or death.

Symptoms of exposure to petrol or diesel include:

- Eye irritation;
- Skin irritation;
- Irritation of the mucous gland;
- Dermatitis;
- Headache;
- Weakness, tiredness and/or exhaustion;
- Blurred vision;
- Dizziness;
- Slurred speech;
- Confusion,
- Convulsions;

- Chemical pneumonitis; and
- Liver and Kidney damage and/or cancer.

7.3 Potential Exposure Pathways

People may be exposed to petrol or diesel in the following ways:

- Direct contact with skin and subsequent skin adsorption;
- Direct ingestion of hydrocarbons that enter the mouth; and
- Inhalation of hydrocarbon vapours.

7.4 Chemical Exposure Controls

General hydrocarbon exposure controls are as follows:

- Avoid skin contact with hydrocarbon impacted soil and groundwater;
- Avoid direct ingestion of hydrocarbon impacted soil and groundwater; and
- Avoid inhalation of hydrocarbon vapours.

Personnel undertaking remediation works should use the hierarchy of controls to minimise potential for harmful exposure to petrol and diesel. That is elimination, substitution, isolation, engineering controls, administrative controls and personal protective equipment (PPE).

In the case of the proposed remediation works it is not possible to eliminate the potential hazard. Direct human contact can be minimised by using an excavator to conduct remediation works where possible. The excavator operator can be isolated from the exposure hazard by working within a sealed air conditioned cab – provided air conditioning is not drawing air from outside the cabin. Excavated contaminated soil can be positioned downwind of the work area and covered to minimise generation of chemical vapour. The number of people working within the remediation area can be kept to a minimum and remediation staff can be rotated to avoid lengthy exposure.

Where potential exposure cannot be controlled by any other means PPE should be used. All personnel working on the remediation site should wear fully enclosed shoes, long sleeve shirts and long pants or overalls, when working in an area where they may come into contact with hydrocarbon impacted soil.

If workers are required to come into contact with soil they should also wear non-permeable gloves (eg. nitrile gloves) and protective glasses or goggles.

If air monitoring indicates vapour concentrations exceed the recognised workplace thresholds it may be necessary for workers to use respiratory protection. Information on air monitoring thresholds and appropriate respiratory protection is provided in *Section 7.5*.

7.5 Air Monitoring

A photo-ionisation detector (PID) can be used to monitor the concentrations of volatile organic compounds (VOCs) within the atmosphere and potential for explosive atmospheres.

Commonly available PIDs detect total VOCs only. Benzene has the lowest exposure thresholds and occupational health and safety exposure guidelines of the main components and additives of petrol. A conservative approach is to assume any VOC detected by the PID is benzene and compare PID readings with guidelines for benzene in air within the breathing zone at the worksite.

At the time this RAP was prepared occupational air quality standards were published by the United Stated Department of Labor, Occupational Safety and Health Administration (OSHA) (www.osha.gov). The published standards for benzene were as follows.

- The Time Weighted Average (TWA) for an 8 hour work shift for benzene was 1ppm.
- The short term exposure limit (STEL) for benzene was 5ppm. The STEL is calculated based on readings taken over a 15 minute period.

If air monitoring results exceed either threshold then respiratory protection is recommended for remediation personnel. A properly fitted half face respirator fitted with a clean organic vapour cartridge should be appropriate for mitigating any vapour inhalation risk.

Air monitoring will also be applicable to ensure works are not conducted within potentially explosive atmospheres. The lower explosive limit (LEL) for petrol vapour is 1.1% or 1100ppm. **In order to minimise the potential for an explosion to occur at the remediation site works should cease where air monitoring indicates VOC concentrations exceed 10% of the LEL**. That is where the PID monitoring ambient air VOC concentrations reads in excess of 110ppm.

The Ground Doctor representative will conduct air monitoring if there is evidence of potential hydrocarbon vapour exposure. Air monitoring should be undertaken in the following circumstances.

- At any time when hydrocarbon impacted soil is being excavated or handled at the site and hydrocarbon odour is evident.
- At the completion of remediation works to ensure air quality is not being effected by generation of vapours from backfilled excavations.

The person conducting air monitoring will be responsible for:

- Calibrating the PID as required (at least once per day) and maintaining PID calibration records;
- Recording air monitoring results; and
- Alerting remediation personnel of potential exposure hazards and recommending use of respiratory protection where necessary.

8 Contingency Plan

8.1 Purpose

The purpose of the contingency plan is to make provision for unexpected situations that may occur during the remediation works, and to specify procedures that can be implemented to manage such situations, ensure remediation works are successful and to prevent adverse impacts to human and environmental health.

Potential situations that have been identified include:

- Encounter LNAPL in shallow soils;
- Generation of unacceptable concentrations of dust;
- Generation of unacceptable odours;
- Generation of unacceptable noise and/or vibration; and
- Spills and leaks of hazardous materials as a result of remediation works or machinery undertaking remediation works.

8.2 Dust

Excessive dust generation will be controlled by the following measures:

- Water spraying;
- Covering stockpiles and truck loads;
- Reduction of disturbed surface areas;
- Conducting work in more favourable weather conditions;
- Modification of work practices;
- Consolidation of soil stockpiles; and
- Modification of equipment operation.

8.3 Odours

Excessive odour generation will be controlled by the following measures:

- Spraying with mix of water and surfactant odour suppressant such as “Biosolve”;
- Covering stockpiles and truck loads;
- Placement of non-odorous material over odorous material;
- Reduction in the area of disturbed surfaces;
- Conducting work in more favourable weather conditions; and

- Modification of work practices.

8.4 Noise and Vibration

Excessive noise and vibration shall be controlled by the following measures:

- Modification of work methods;
- Modification of work schedules;
- Modification of equipment and stockpile location; and
- Modification of equipment operation.

8.5 Spills and Leaks

Spills and leaks shall be controlled by the following measures:

- Maintaining on-site emergency spill containment kits;
- Containment of the spill as soon as possible and separation of impacted soil or water as soon as practicable; and
- Assessment of potential impacts in down gradient areas.

8.6 Hydrocarbon Impacted Liquid or LNAPL

If hydrocarbon impacted liquid or LNAPL is identified in any remediation excavation it will be removed from the site and disposed at an appropriately licenced facility.

8.7 Other Contaminants

If contaminants other than those associated with the UPSS are identified during the remediation works the RAP may need to be amended to account for the unexpected condition. The Ground Doctor representative has over 20 years of experience in the assessment of contaminated land and is qualified to amend the proposed work plan based on the presence of other potential contaminants of concern.

8.8 Unexpected Conditions

Unexpected site conditions may include inclement weather, fire, explosion, medical emergency, identification of unexpected contamination (e.g. asbestos containing materials) or unexpected environmental impacts.

In the event of an unexpected find, the Perisher site supervisor should stop all work. A toolbox talk should be held to address the unexpected condition. The condition should be stabilised if it is safe to do so. Controls should be developed to address any risk to human health and/or the environment. Work should only continue once the SWMS has been amended to deal with any previously undocumented risks and control measures.

9 Conclusion

The RAP outlined in this report is based on a sound conceptual understanding of the site conditions and potential human health and environmental receptors of contamination that may be present within the UPSS area. Outlining DQOs for the proposed remediation works prior to commencement provides clear objectives for those supervising remediation works and should ensure remediation and validation works are undertaken in a cost effective manner.

10 Limitations of this RAP

The recommended remediation strategy outlined in this RAP was based on Ground Doctor's conceptual understanding of site conditions at the time the RAP was prepared. Ground Doctor prepared this RAP in a manner consistent with the normal level of care and expertise exercised by members of the environmental consulting profession. No warranties, express or implied are made.

The RAP addresses the decommissioning and subsequent validation assessment of UPSS components only. The proposed validation sampling and analysis strategy is based on assessing potential contaminants associated with the UPSS only. The absence of the analytes of concern in soil samples will not be a guarantee that such materials, or other potentially toxic or hazardous compounds, do not exist at the site or in off-site areas that have been assessed.

11 References

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- CRC-CARE (Friebel, E. and Nadebaum, P.) (2011), *Technical Paper No 10 - Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater*, September 2011.
- Snowy River Local Environment Plan 2013.
- National Environment Protect Council (NEPC) (1999) *National Environment Protection (Assessment of Contamination) Measure* (NEPM) (revised April 2013).
- NEPM (2013) "*Schedule B1: Guideline on Investigation Levels for Soil and Groundwater*".
- NEPM (2013) "*Schedule B2: Guideline on Site Characterisation*".
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Annex A

Figures

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Project Name:	Remedial Action Plan UPSS Decommissioning and Validation Assessment Mt Perisher Triple Chair
Project Number:	2020-GD020

Figure 1

Mt Perisher Triple Chair UPSS Location and Setting

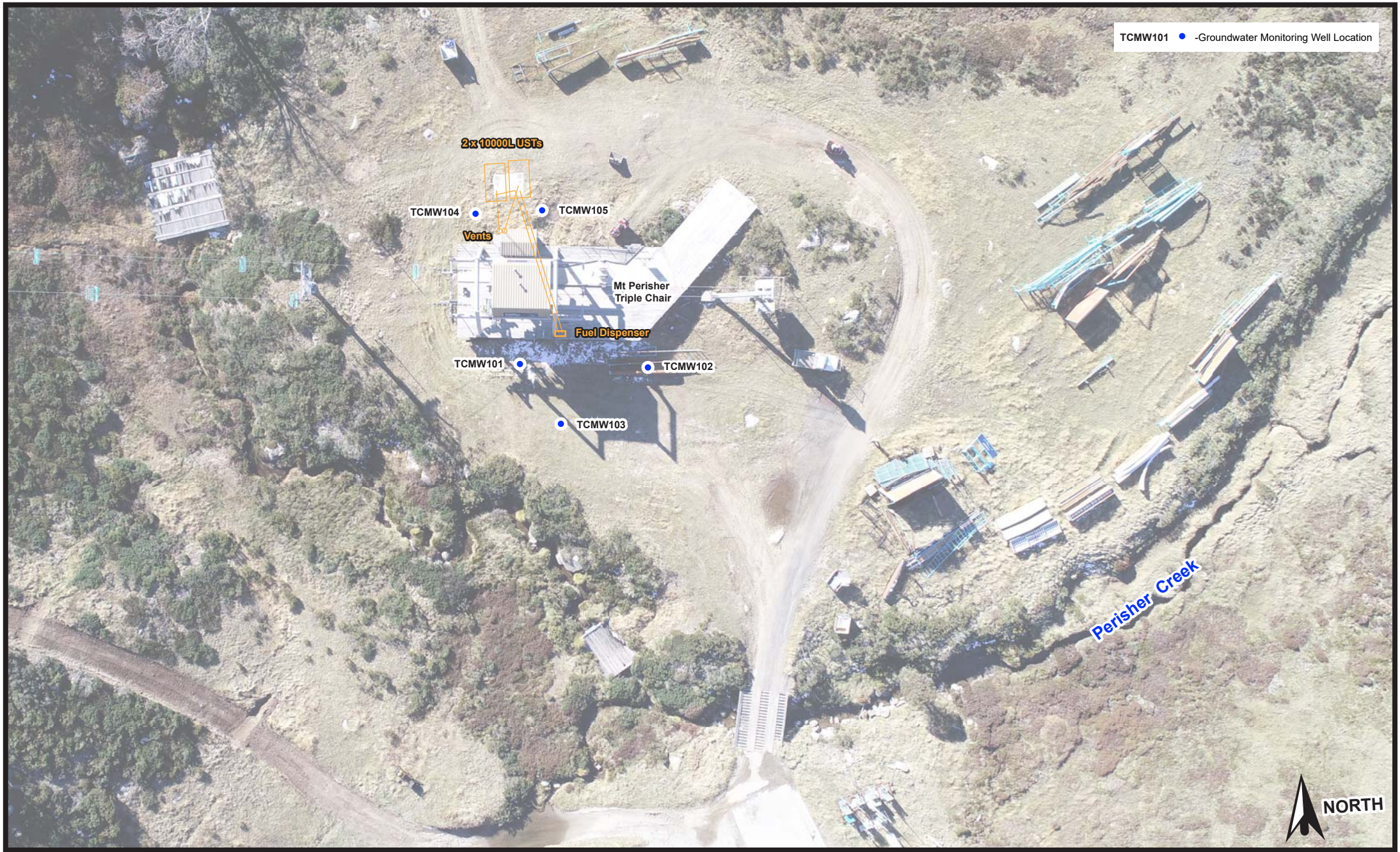

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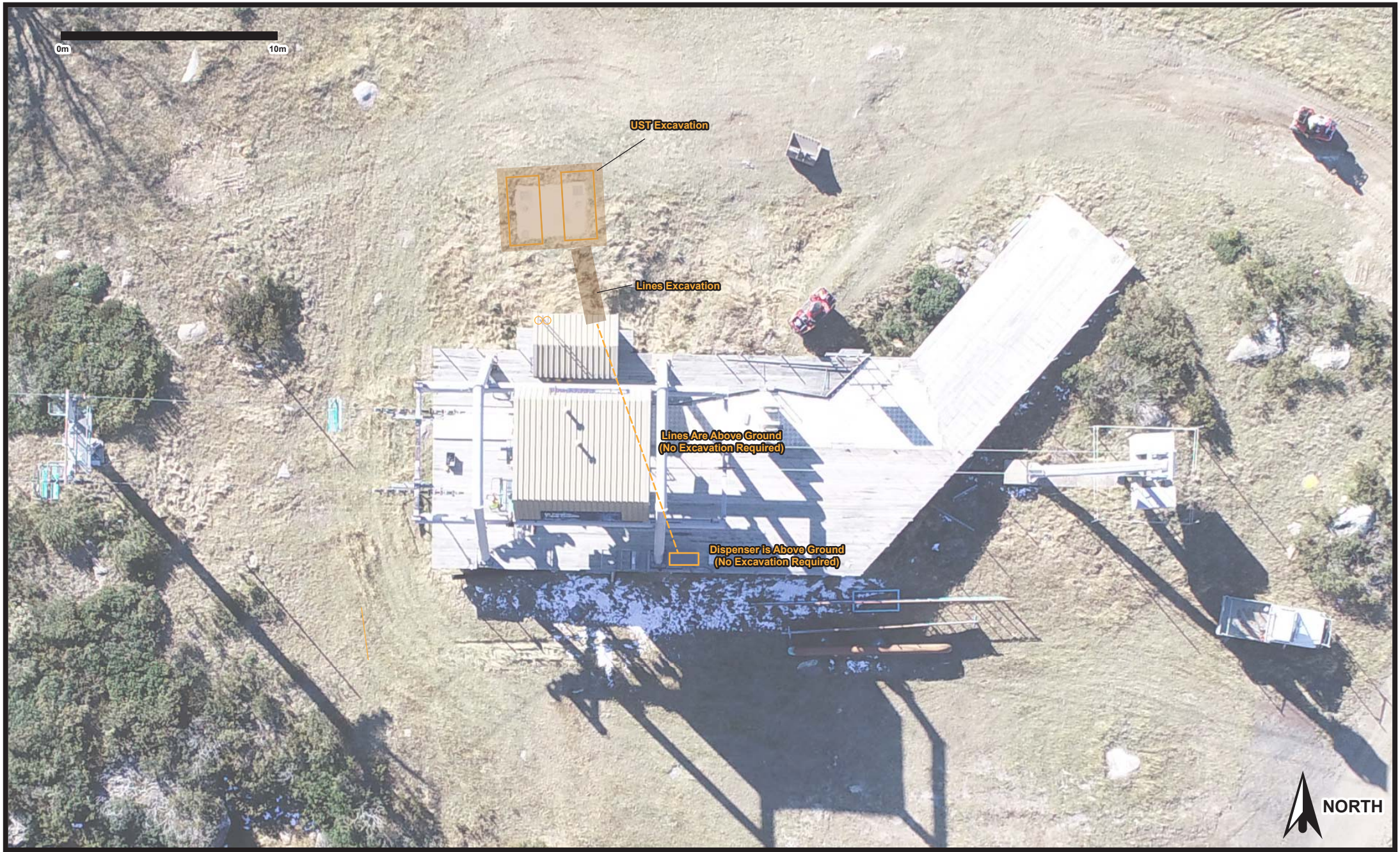
Figure 2

Mt Perisher Triple Chair UPSS Layout and Groundwater Monitoring Well Locations



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