REPORT

Tonkin+Taylor

Coal Stock Yard Air Discharge Permit Renewal

Assessment of Terrestrial Ecological Effects

Prepared for
Lyttelton Port Company Limited
Prepared by
Tonkin & Taylor Ltd
Date
August 2021
Job Number
1014295.0000.v1

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Document Control

Title: Coal Stock Yard Air Discharge Permit Renewal					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
11/08/21	1	Final	Stephanie Angove-Emery	Josh Markham	Jenny Simpson

Distribution:

Lyttelton Port Company Limited	1 electronic copy
Tonkin & Taylor Ltd (FILE)	1 electronic copy

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Executive summary

The Lyttelton Port Company (LPC) currently holds a Discharge Permit (CRC940391) for dust from the coal stock yard, which is due to expire on 19 February 2022. LPC wishes to seek a renewal of its current air discharge permit for a duration of 20 years. There are no planned changes to the stockyard layout or associated infrastructure. This assessment of terrestrial ecological effects report has been prepared in support of the discharge permit renewal.

The site is located within Lyttelton Harbour at the bottom of the Port Hills on the coast of Canterbury. From an ecological perspective, the site and surrounding environment is located within the Port Hills Ecological District of the Banks Ecological Region. The surrounding area has high ecological values as there are multiple 'Threatened' and 'At risk' plant, lizard, bird and invertebrate species present.

A literature review revealed that large volumes of dust can affect the physiological processes of plants, lizards, birds and invertebrates and can affect their habitats and foraging sources as well. However, visual assessments of the surrounding vegetation along Sumner Road indicated negligible amounts of dust accumulation. Furthermore, the highest range of monitored dust deposition levels were substantially lower than the amounts of dust deposition required to negatively affect plant physiology.

Extensive on-site dust management measures are currently being undertaken and will continue to be undertaken with the new consent. Therefore, it is considered that the dust management measures that are outlined manage the effects on the surrounding ecological values, bringing the overall effect for all terrestrial ecological components to low or very low.

1 Introduction

Lyttelton Port Company Limited (LPC; 'the applicant') owns and operates a coal stock yard (the site) at the Lyttelton Port, Christchurch. LPC currently holds a Discharge Permit (CRC940391) for dust generated from activities associated with the site, which is due to expire on 19 February 2022. This assessment of terrestrial ecological effects report has been prepared in support of the renewal of the air discharge permit for a further duration of 20 years. There are no planned changes to the layout of the site or any associated infrastructure.

1.1 Background

The coal stockyard operates 24 hours each day, seven days per week. Since the coal stock yard was established in 1976, the annual throughput has varied depending on overseas demand. At its peak in 2010 annual throughput was 2.5 million tonnes but has since reduced. In the last five years the annual throughput has varied recently between approximately 1 million to 1.5 million tonnes per annum.

At present approximately 35 ships per year arrive at the Port to load coal for export. The amount of coal taken by a ship varies from 38,000 to 65,000 tonnes. The time taken to load the ship depends on the load-rate and the amount of coal the ship is receiving, but usually takes no longer than three days.

The yard can accommodate up to 335,000 tonnes at any one time although in recent times it is in the order of 150,000 to 180,000 tonnes. The main sources of particulates at the existing coal yard and ship loading facilities have been previously identified as being:

- Dust generated at the train unloading hopper when wagons unload;
- Coal dropping onto stockpiles from the stacker;
- Stacking of coal using front end loaders and shaping of stockpiles using a bulldozer;
- The coal conveyors and their transfer points;
- Loading of coal from the stockpiles onto the export conveyors by either the bucket wheel;
- Reclaimer or front-end loaders through receival hoppers;
- Windblown dust from coal stockpiles;
- Windblown dust from coal on surfaces such as roads and yard areas; and
- The ship loader and wharves.

1.2 Coal dust deposition data

Coal deposition monitoring has been undertaken annually during summer months since 2008 at various monitoring locations surrounding the stockyard[1]. Wind speed and direction as well as the topography of the surrounding environment heavily influence the amounts of coal dust deposition. Several of the monitoring locations are in adjacent reserves and native scrub (Figure 1.1).

The amount of coal dust deposition at the monitoring points that are nearest to the stock yard were the highest recorded and reached up to a maximum of approximately 17-18 g/m^2/30 days (Monitoring points 14, 15 & 16 in Figure 1.2). Monitoring points 2, 3 & 4 are directly north of the stockyard, outside of the prevailing wind direction, and have much lower maximum coal deposition values of 7-11 g/m^2/30 days. Monitoring point 17 recorded very low amounts of deposition with values of 0-1 g/ m^2/30 days. The model in Figure 1.3[1] below predicts the spatial pattern of monthly

[1]Chilton, R. Coal Stock Yard Air Discharge Permit Renewal Air Quality Assessment. Prepared by Tonkin & Taylor for Lyttelton Port Company Limited. (2021).

maximum deposition as well as maximum distance that dust is deposited from the site. The dust deposition rates decrease rapidly as distance is increased from the site.

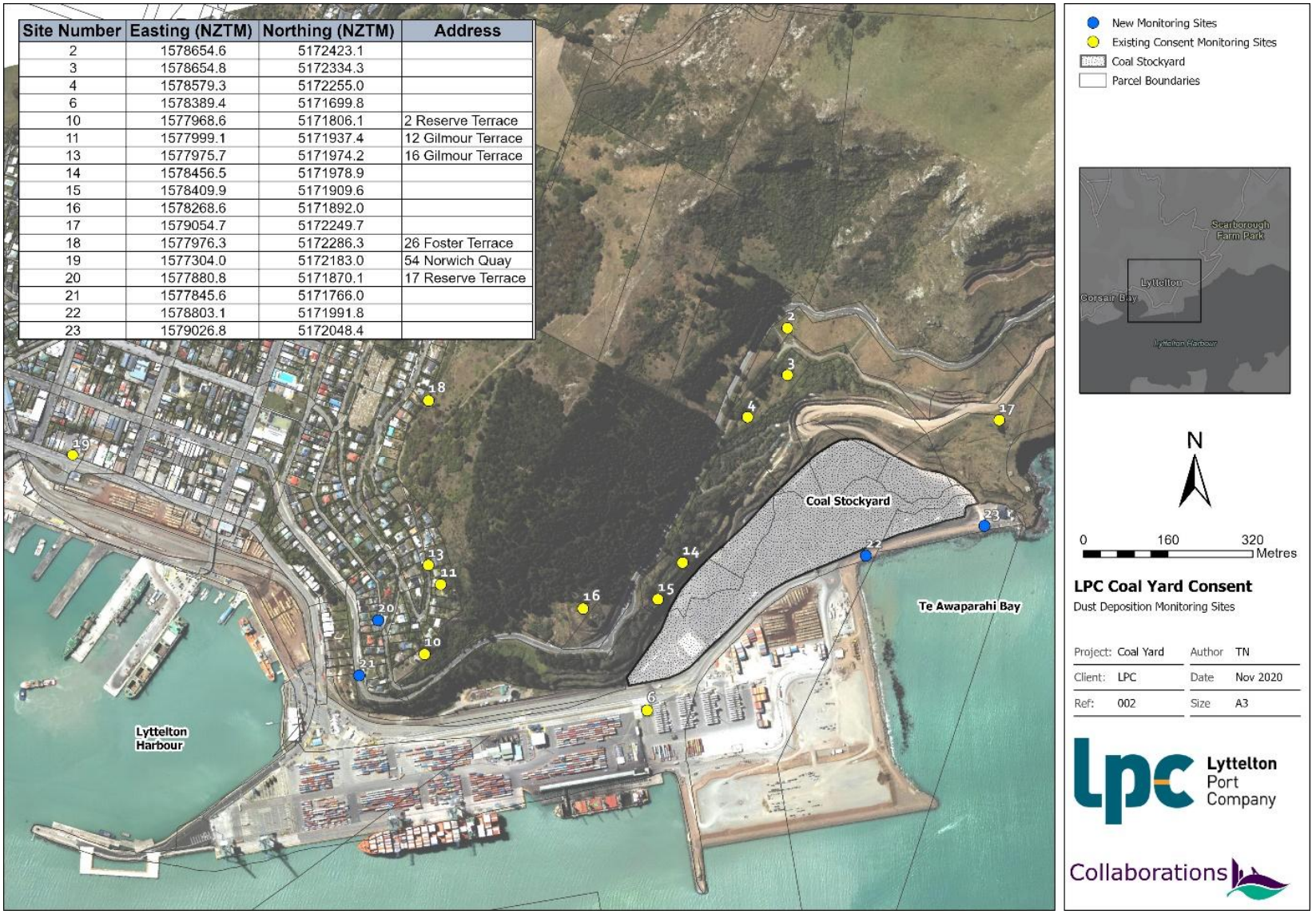

Figure 1.1: Coal dust deposition monitoring locations in surrounding environment.

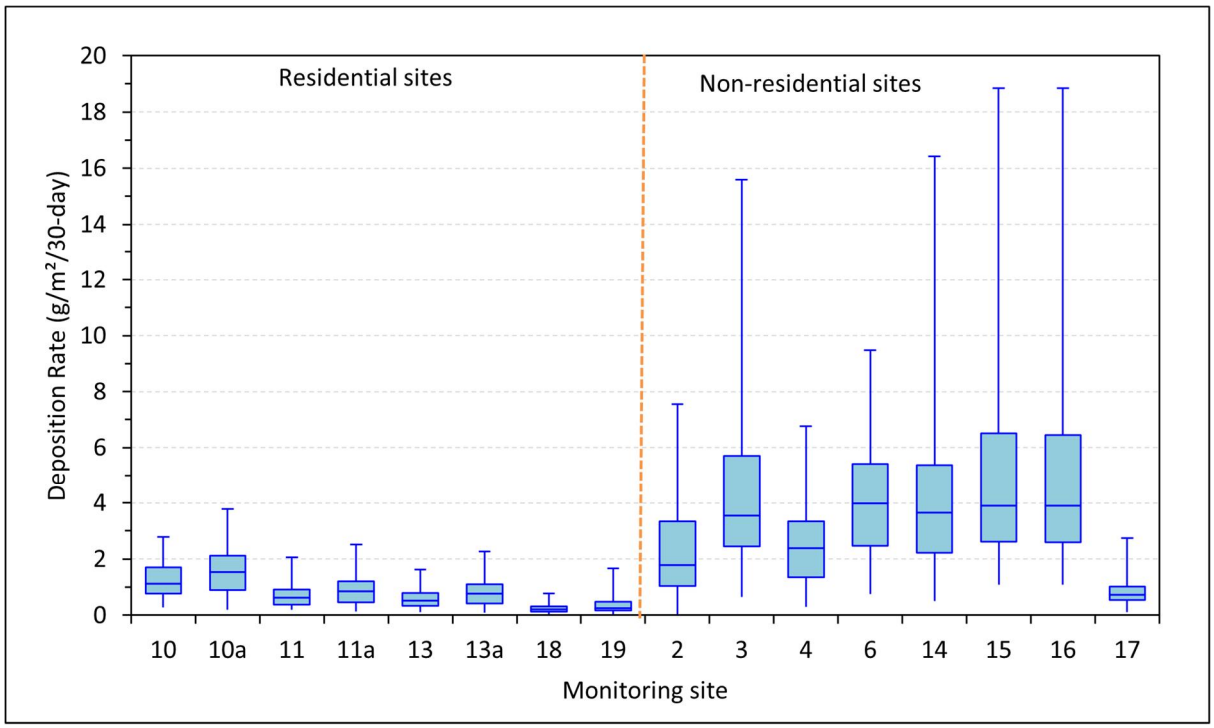

Figure 1.2: Amounts of coal dust deposited per m^2 per month during summer from 2008-2020.

Figure 1.3: Maximum model predicted monthly dust deposition; each contour (yellow) moving in is twice the deposition rate of the outer contour and is used to depict the relative change in deposition rates with distance from the coal stockyard (T+T 2020 air quality assessment) .

2 Site description

The site is located within Lyttelton Harbour at the bottom of the Port Hills on the coast of Canterbury (Figure 2.1) in close proximity to Lyttelton township. From an ecological perspective, the site and surrounding environment is located within the Port Hills Ecological District of the Banks Ecological Region. Geological features such as tors, bluffs and rock outcrops are common in the surrounding environment and Banks Peninsula which provide habitat for highly specialised indigenous plant species, native lizards and invertebrates. The majority of indigenous vegetation in this area has been cleared historically. However, small areas of remnant indigenous vegetation remain in the surrounding environment. Numerous reserves are in the surrounding area with Urumau Reserve and Buckleys Bay Scenic Reserve being the nearest to the site.

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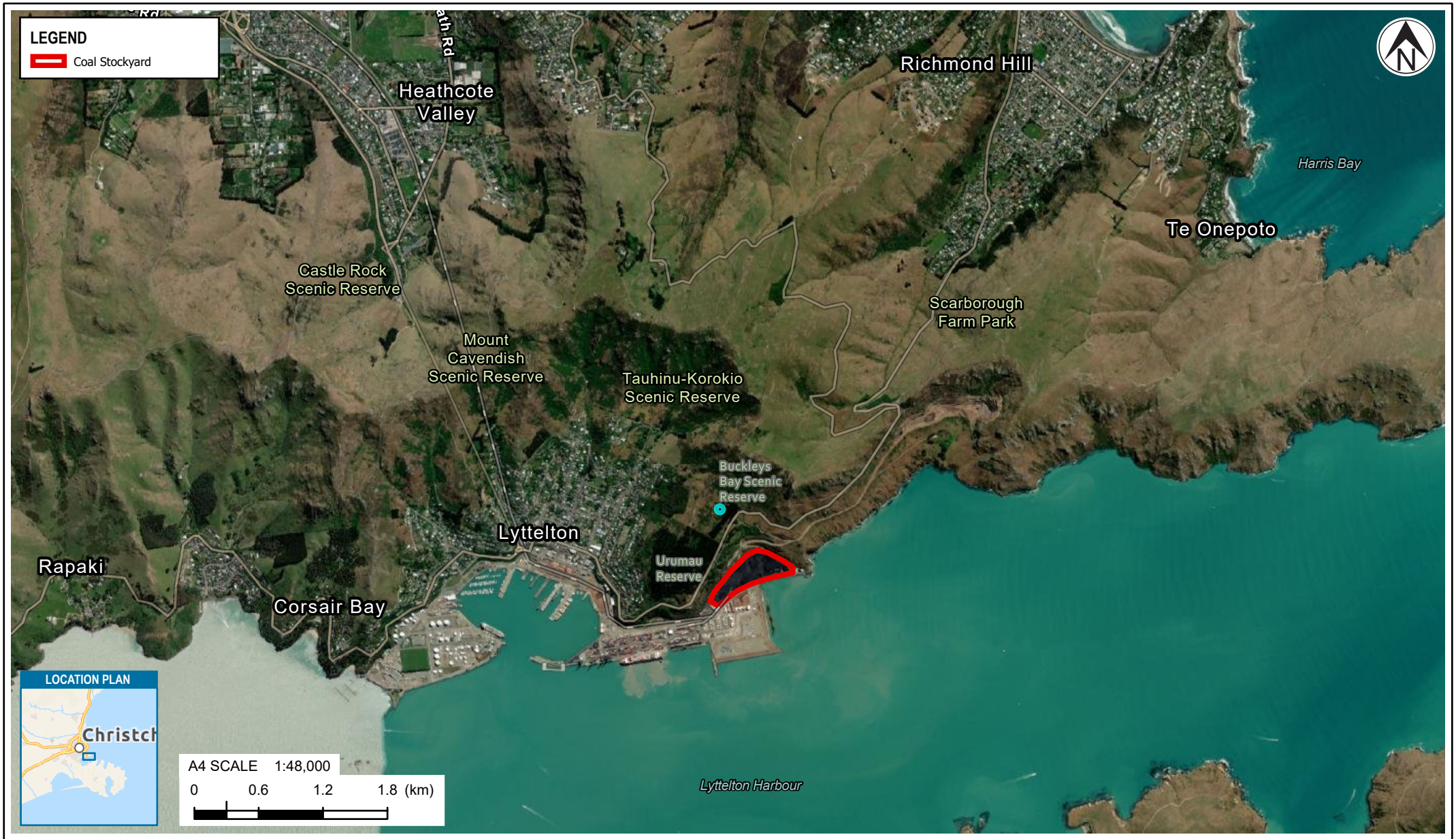

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NOTES:

Hybrid Reference Layer: LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS. NZ Navigation Map: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors.. World Imagery: Maxar

REVISIONS	NO.	BY
First version (25/05/21)	0	STAE

PROJECT No.	1014295	
DESIGNED	STAE	MAY.21
DRAWN	STAE	MAY.21
CHECKED		
APPROVED	DATE	

CLIENT **LYTTELTON PORT COMPANY**

PROJECT **ASSESSMENT OF ECOLOGICAL EFFECTS**

TITLE SITE CONTEXT

SCALE (A4) 1:48,000 FIG No. FIGURE 2.1 REV 0

3 Methods

3.1 Desktop assessment

A desktop assessment of potential terrestrial ecological values was undertaken through a review of:

- Department of Conservation herpetofauna database;
- Reptiles and Amphibians of New Zealand: A Field Guide;
- Department of Conservation bat database;
- iNaturalist (www.iNaturalist.org);
- New Zealand Plant Conservation Network distribution database;
- Auckland Museum Herbarium plant database;
- Manaaki Whenua Landcare Research Land Atlas of New Zealand;
- Google satellite imagery; and,
- Previous ecological assessments and management plans prepared for projects in the surrounding environment:
  - Davis, M., Lettink, M., Patrick, B. Sumner Road Re-opening Project. Assessment of Environmental Effects: Ecology. (January 2014);
  - Jensen, C. The Banks Peninsula Conservation Trust and Lyttelton Port Company Management Plan (September 2016);
  - Lettink, M. Lizard Management Plan for the Sumner Road Re-opening Project Zone 3A Works Packages 2&5, Port Hills, Canterbury. Fauna Finders (June 2015); and
  - Robertson, D. Boffa Miskell, Endangered Plant Survey, Lyttelton Port Company Coal Stockyard Expansion. (Spring 2010).

3.2 Site assessment

A walkover along Sumner Road to the west of the site was undertaken on 17 May 2021 to ground truth the vegetation currently along the buffer of the site in the direction of the prevailing wind. Any settlement of dust and general health of understory plant species was visually assessed during this site walk over.

3.3 Terrestrial values assessment

Terrestrial values were based primarily on the desktop assessment. The criteria ('representativeness', 'rarity/distinctiveness', 'diversity and pattern' and 'ecological context') outlined in the Ecological Impact Assessment Guidelines (EcIAG) published by the Environment Institute of Australia and New Zealand (EIANZ)[2] was used to assess the terrestrial values in the surrounding environment of the site (Appendix A Table 1). The scale of assessment was considered to be the Port Hills Ecological District.

The national conservation status of all identified indigenous species in the general vicinity of the site were identified using the most current Department of Conservation Threatened Species Lists. The conservation status was then used to determine the ecological value of each species (Appendix A Table 2).

[2] Roper-Lindsay, J., Fuller, S.A., Hooson, S., Sanders, M.D., and Ussher, G.T. (2018). Ecological Impact Assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.

3.4 Assessment of effects

The EcIAG were also used to assess the ecological effects of the proposed activities and the Port Hills Ecological District was primarily used as a spatial scale for assessment. By using an industry-standard framework and matrix approach such as this, a consistent and transparent assessment of effects is provided.

Outlined in the following sections, the guidelines have been used to inform the following:

- The magnitude of ecological effect from the continued air discharge on the environment (Appendix A Table 4); and
- The overall level of effect to determine if further measure to address effects are required (Appendix A Table 6).

The framework for assessment provides structure to quantify the level of ecological effects but needs to incorporate sound ecological judgement to be meaningful. Deviations or adaptions from the methodology are identified within each of the following sections as appropriate. Further detail regarding these guidelines is included in Appendix A.

4 Terrestrial ecological assessment

4.1 Terrestrial ecosystems

The vegetation in the surrounding environment has been greatly modified since human arrival with the historical clearance of most native forest. There is a buffer of native scrub that borders the western boundary of the site that was planted by LPC in the 1960s-70s. Native species in this area include broadleaf (*Griselinia littoralis*), akiraho (*Olearia paniculata*), mahoe (Melicytus ramiflorus), ngaio (*Myoporum laetum*), ake ake (*Dodonaea viscosa*), cabbage tree (*Cordyline australis*), mountain akeake (*Olearia avicenniifolia),* kohuhu (*Pittosporum tenuifolium),* pohuehue (*Muehlenbeckia australis*), and poroporo (*Solanum laciniatum*). Several other native species were planted in this area that are not indigenous to the area, including hebe (*Veronica parviflora*), *Olearia lineata* cultivar *Dartonii*, flax (*Phormium tenax* (variegated cultivar)), karo (*Pittosporum ralphii),* needle-leaved totara (*Podocarpus acutifolius*), lacebark (*Hoheria populnea*), kowhai (*Sophora* sp.). Several exotic species are present in this area, including madeira vine (*Anredera cordifolia*), tree lucerne (*Chaemaecytisus palmensis*), sycamore (*Acer pseudoplantanus*), briar (*Rosa rubiginosa*), Tasmanian ngaio (*Myoporum insulare*), *Cupressus* sp., *Pinus* sp., and pampas grass (*Cortaderia selloana*). It is considered that this area is not likely to provide suitable habitat for any 'Threatened' plant species[3].

The eastern side of the site is comprised primarily of exotic grassland[4] primarily including cocksfoot (*Dactylis glomerata*), ryegrass (*Lolium* sp.), sweet vernal (*Anthoxanthum odoratum*), ripgut brome (*Bromus diandrus*), soft brome (*B. hordaceus*), Yorkshire fog (*Holcus lanatus*) and barley grass (*Critesion* sp.) (Photograph 4.1 & Photograph 4.2)[3].

Urumau Reserve is the nearest reserve to the site and comprises a pine (*Pinus* sp.) plantation as well as invasive weeds such as gorse (*Ulex europaeus*), wild broom (*Cytisus scoparius*) and boneseed (*Chrysanthemoides monilifera*) (Photograph 4.3). Extensive areas of exotic grassland and rock outcrops comprise the Port Hills as well as blocks of eucalypts (*Eucalyptus* sp.) and wattle (*Acacia*

[3] Boffa Miskell Limited 2014. Lyttelton Port Recovery Plan: Terrestrial Ecology Assessment – Addendum to 2010 Report. Report prepared by Boffa Miskell Limited for Lyttelton Port Company.

[4] Land Atlas of New Zealand. Our Environment Map. Vegetation layer. Manaaki Whenua Landcare Research. (Accessed 10/05/2021).

sp.). Buckleys Bay Scenic Reserve to the north of the site consists of native regeneration and there are also several restoration projects in the area[5],[6] (Photograph 4.4).

Port Saddle is uphill from Urumau Reserve and is LPC-owned land; restoration work in this area comprises of native planting mixes and pest plant and animal control. The exotic forested areas, exotic grassland, rock outcrops and native scrub are all considered to be of high value due to the habitat provided to 'Threatened' and 'At risk' flora and fauna species.

Photograph 4.1: Representative view looking east towards the stockyard. Exotic grassland and mixed native-exotic scrub.

Photograph 4.2: Representative view facing south. Pine plantation, native scrub, exotic grassland.

Photograph 4.3: View of Urumau Reserve from Sumner Road.

Photograph 4.4: Native Scrub and rock outcrops at Buckleys Bay Scenic Reserve.

[5] Jensen, J. The Banks Peninsula Conservation Trust and Lyttelton Port Company Management Plan. (September 2016).
[6] Brailsford, S. Hutchison, M., Patrick, B. Ohinehou/Lyttelton Ecological Restoration Project Plan. (July 2014).

4.2 Threatened plant species

A total of 29 nationally 'Threatened' and 'At risk' plant species[7] have been identified in the surrounding environment (Table 4.1). Eight of the identified species are classified as 'Threatened' and have a very high ecological value; however, it is important to note that two of the species rohutu (*Lophomyrtus obcordata)* and white flowering rata (*Metrosideros diffusa*)) were reclassified from 'Not threatened' to 'Threatened' on a conservative basis in 2018 due to the uncertain effects of myrtle rust (*Austropuccinia psidii*). The remaining species are groundcover species with several that grow around rocky outcrops. Two of the species, fan-leaved mat daisy *(Raoulia monroi*) and Lyttelton forget-me-not (*Myosotis lytteltonensis)*, were recorded within the projected model of dust deposition. Annual fern (*Anogramma leptophylla)*, NZ geranium (*Geranium retrorsum*), pygmy button daisy (*Leptinella nana)* and shrubby tororaro (*Muehlenbeckia astonii*) were all recorded outside of the projected model of dust deposition; however, they were recorded between 1.5-4 km from the site and could be present in the area of interest. The high number of 'Threatened' plant species highlights the ecological value of the surrounding area, and its ability to support a variety of rare indigenous plant communities. There are nine species that are listed as 'At Risk- Declining' and therefore have a high ecological value. The remaining 12 species are classified as 'At risk- Naturally uncommon or Relict', which are considered to be of moderate ecological value.

[7] de Lange, P.J.; Rolfe, J.R.; Barkla, J.W.; Courtney, S.P.; Champion, P.D.; Perrie, L.R.; Beadel, S.M.; Ford, K.A.; Breitwieser,I.; Schonberger, I.; Hindmarsh-Walls, R.; Heenan, P.B.; Ladley, K. 2018: Conservation status of New Zealand indigenous vascular plants, 2017. New Zealand Threat Classification Series 22. Department of Conservation, Wellington. 82 p

Table 4.1: Threatened and At risk plant species identified within 5 km radius of the site.

Scientific name	Common name	Threat status	Recorded within modelled contour of dust deposition	Notes
Anogramma leptophylla	Annual fern	Threatened-Nationally Endangered	No	<1.5 km[8],<3 km[12], Found on clay banks, rock faces, alluvial banks
Aciphylla subflabellata	Spaniard	At Risk- Declining	Yes	<0.5 km[12];<1 km[11]
Anemanthele lessoniana	Gossamer grass	At Risk- Relict	Yes	<0.5 km[12]
Asplenium subglandulosum	Blanket fern	At Risk- Naturally Uncommon	Unknown	Referenced[8,9]
Carex cyanea		At Risk- Declining	Yes	<1 km[11]
Chenopodium allanii		At Risk- Naturally Uncommon	Yes	<0.5 km[10]; <1 km[11]; <1.5 km[8]
Coprosma virescens		At Risk-Declining	Yes	<0.5 km[10]
Coprosma wallii		At Risk-Declining	Yes	<1 km[11]
Daucus glochidiatus	New Zealand carrot	At Risk-Declining	Unknown	Referenced[8]
Discaria toumatou	Matagouri	At Risk- Declining	Yes	<0.5 km[12]

[8] Robertson, D. Boffa Miskell, Endangered Plant Survey, Lyttelton Port Company Coal Stockyard Expansion. (Spring 2010);
[9] Te Papa Museum Collections
[10] Jensen, C. The Banks Peninsula Conservation Trust and Lyttelton Port Company Management Plan (September 2016).

Scientific name	Common name	Threat status	Recorded within modelled contour of dust deposition	Notes
Festuca actae	Banks Peninsula blue tussock	At Risk- Naturally Uncommon	Yes	<1 km[11]; <1.5 km[8]
Geranium microphyllum	Small-leaved cranesbill	At Risk- Naturally Uncommon	Yes	<1 km[11]
Geranium retrorsum	New Zealand geranium	Threatened- Nationally Vulnerable	No	<1.5 km[12], Short tussock grasslands, rocky coastal headlands
Juncus distegus		At Risk- Naturally Uncommon	Yes	<1.5 km[12]
Leptinella minor	Banks Peninsula button daisy	At Risk- Naturally Uncommon	Yes	<1 km[11], Coastal clifftop grassland
Leptinella nana	Pygmy button daisy	Threatened- Nationally Critical	No	<3km[12]
Linum monogynum	New Zealand linen flax	At Risk- Declining	Yes	<1 km[11]; <2km[12]
Lophomyrtus obcordata	Rohutu	Threatened-Nationally Critical	Yes	<1 km[11]
Metrosideros diffusa	White flowering rata	Threatened-Nationally Critical	Yes	<1 km[11]
Muehlenbeckia astonii	Shrubby tororaro	Threatened- Nationally Endangered	No	<4 km[12], coastal
Myosotis lytteltonensis	Lyttelton forget-me-not	Threatened-Nationally Critical	Yes	<1 km[11]

Scientific name	Common name	Threat status	Recorded within modelled contour of dust deposition	Notes
Olearia fragantissima	Fragrant tree daisy	At Risk-Declining	Yes	<1 km[11]
Pseudopanax ferox	Fierce lancewood	At Risk- Naturally Uncommon	No	<1.5 km[12]
Raoulia monroi	Fan-leaved mat daisy	Threatened- Nationally Vulnerable	Yes	<1 km[11]
Senecio glaucophyllus subsp. basinudus	Yellow rock groundsel	At Risk- Naturally Uncommon	Yes	<1 km[11]
Stellaria decipiens		At Risk- Naturally Uncommon	Yes	<1 km[11]
Tetragonia tetragonoides	Native spinach	At Risk- Naturally Uncommon	Yes	<0.5 km[12]
Veronica lavaudiana	Banks Peninsula sun hebe	At Risk-Declining	Yes	<1 km[11]; <3km[12]
Veronica strictissima	Banks Peninsula hebe	At Risk- Naturally Uncommon	Yes	<1 km[11]; <3km[12]

[11] Davis, M., Lettink, M., Patrick, B. Sumner Road Re-opening Project. Assessment of Environmental Effects: Ecology. (January 2014).
[12] Inaturalist.org

4.3 Terrestrial fauna

4.3.1 Herpetofauna

Four native lizard species were identified within a 5 km radius of the site[13,14] and are summarised in Table 4.2 below. All but one of the species are classified as 'At risk', with one being 'Not threatened'[15]. Most of the records were recorded in the surrounding reserves (Urumau Reserve, Buckleys Bay Scenic Reserve, Port Saddle and Windy Point Reserve. The 'At risk-Declining' herpetofauna are considered as having high ecological value. The surrounding rock outcrops, rank grass and native scrub provide high value habitat for native herpetofauna.

Table 4.2: Lizard species identified within a 10 km radius.

Scientific name	Common name	Threat Status	Location
Naultinus gemmeus	Jewelled gecko	At Risk- Declining	Adjacent-Urumau Reserve
Oligosoma aff. polychroma Clade 5	Southern grass skink	At Risk-Declining	Adjacent-Urumau Reserve
Oligosoma maccanni	McCann's skink	Not Threatened	Adjacent-Urumau Reserve
Woodworthia cf. brunnea	Waitaha gecko, Canterbury gecko	At Risk- Declining	Adjacent-Urumau Reserve

4.3.2 Avifauna

A total of 28 terrestrial avifauna species were identified through database review, which included 15 native species (Appendix B Table 1 & Appendix B Table 2). In general, the terrestrial avifauna community was predominantly comprised of common native and exotic species. Notable records of native 'At risk' species are in Table 4.3 below.

Table 4.3: At risk avifauna recorded in the surrounding area.

Scientific name	Common name	Threat Status	Distance from site	Source
Anthus novaeseelandiae novaeseelandiae	New Zealand pipit	At risk-Declining	1.5 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)
Falco novaeseelandiae novaeseelandiae	New Zealand eastern falcon	At risk-Recovering	3.5 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)

[13] Department of Conservation Herpetofauna Database.
[14] Lettink, M. Lizard Management Plan for the Sumner Road Re-opening Project Zone 3A Works Packages 2&5, Port Hills, Canterbury. Fauna Finders (June 2015).
[15] Hitchmough, R.; Barr, B.; Lettink,M.; Monks, J.; Reardon, J.; Tocher, M.; van Winkel, D.; Rolfe, J. 2016: Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. Department of Conservation, Wellington. 14 p

The surrounding environment provides habitat for both NZ pipit and NZ eastern falcon through the rank grass and sloped rocky outcrops. NZ pipit has a threat status of 'At risk-Declining' and therefore is considered to have high ecological value. NZ eastern falcon has a threat status of 'At risk-Recovering', which translates to a moderate ecological value.

Common native birds which provide key ecological functions include kereru which are important seed dispersers, and tui and bellbird which are key pollinators. Although these species are not threatened, they are considered to have a moderate ecological value.

The remaining avifauna species are considered to be of low ecological value as they are both regionally and nationally common and do not provide substantial ecological services.

4.3.3 Bats

There are no records of bat activity within the Banks Peninsula and the Port Hills area, although numerous surveys have been undertaken historically. The nearest bat record is located approximately 130 km southwest in the Geraldine area[16]. Therefore, it is not likely that long-tailed bats (*Chalinolobus tuberculatus*) or short-tailed bats (*Mystacina tuberculata)* are utilising the site, and will not be discussed further in this assessment.

4.3.4 Invertebrates

Five species of significant rock face moth species were recorded in the area[17]. One is classified as 'At risk-Naturally uncommon', one is endemic and three have restricted distributions. This includes crambid snout moth (*Gadira petraula),* which is only found in three discrete areas nationally, including the Banks Peninsula; this species is currently classified as At risk-Naturally uncommon[18]. *Helastia mutabilis* is patchily distributed from the central North Island to Otago. *Scoriodyta sereinae*, *Dichromodes cynica* and *Kiwaia brontophora* are moth species that have that have restricted distributions and type localities in the Port Hills. The 'At risk' and specialised moth species are considered to be of moderate ecological value.

[16] Department of Conservation Bat Database.
[17] Davis, M., Lettink, M., Patrick, B. Sumner Road Re-opening Project. Assessment of Environmental Effects: Ecology. (January 2014).
[18] Hoare, R.J.B., Dugdale, J.S., Edwards, E.D., Gibbs, G.W., Patrick, B.H., Hitchmough, R.A., Rolfe, J.R. Conservation status of New Zealand butterflies and moths (Lepidoptera), 2015.

4.4 Summary of ecological values

Table 4.4 below provides a summary of the ecological values described in the sections above.

Table 4.4: Summary of ecological values.

Ecological feature	Value	Explanation
Exotic mature vegetation	Moderate	Provides low representativeness and diversity habitat for native fauna; however, has moderate rarity and ecological context values as it provides a stepping stone for native avifauna and supports At-risk plant and lizard species in an Ecological District that is depauperate of vegetation.
Exotic grasslands	Moderate	Moderate representativeness as historic vegetation largely comprised of lowland short tussockland; however, botanical species composition is predominantly exotic. Moderate rarity and ecological context values as it provides habitat for 'At risk' lizards, birds, and plant species. Low values for diversity.
Native scrub	Moderate	Given the area is depauperate of native vegetation, the restoration areas of native scrub are considered to have moderate ecological context values; however, have low representativeness and diversity values. Moderate rarity and ecological context values as it provides habitat for 'At risk' lizards, birds, and plant species.
Rock outcrops	High	Moderate representativeness values, high rarity, diversity and ecological context values as they are a major habitat type for the 'Threatened' plants and 'At risk' plants, lizards and moths in the area.
Nationally Threatened plant species	Very High	All nationally 'Threatened' species have an ecological value of 'Very high'.
Nationally At Risk-Declining plant species	High	All nationally 'At risk' species have an ecological value of 'High'.
Nationally At Risk- Naturally uncommon, Relict plant species	Moderate	All nationally 'At risk- Naturally uncommon, Relict' species have an ecological value of 'Moderate'.
Herpetofauna	High	All nationally 'At risk' species have an ecological value of 'High'.
Avifauna (common species)	Low	Nationally and locally common indigenous species have a 'Low' ecological value.
Avifauna (kereru, tui, bellbird)	Moderate	Listed as 'Not threatened' however provide key ecological functions.
NZ pipit	High	All nationally 'At risk-Declining' species have an ecological value of 'High'.
NZ eastern falcon	Moderate	All nationally 'At risk-Recovering' species have an ecological value of 'Moderate'.
Invertebrates	Moderate	All nationally 'At risk-Naturally uncommon' and range restricted species have an ecological value of 'Moderate'.

5 Assessment of ecological effects

5.1 Vegetation effects

Large amounts of dust can adversely impact the physiological processes of plants, including gas exchange, photosynthesis, and water usage[19]. However, there are many variables that are required for consideration. The specific foliar morphology and anatomy of the plant species can affect the capacity of leaves as dust receptors; species-specific characteristics such as leaf orientation (if the leaf is horizontal or vertical) and sessility can also have variable effects on dust deposition. The mineralogy and particle size of the deposited dust can also have variable effects on the physiology of plants. Dust accumulation can damage plant tissue through biochemical reactions caused by direct contact of dust to leaf surface and inhibit growth by plugging stomata openings and decreasing photosynthesis processes causing a decrease in carbon dioxide exchange, carbon assimilation, transpiration, and net photosynthesis[20]. Additionally, coal dust can increase soil surface temperature and pH values, and can negatively affect root growth in plants[21].

A literature review indicated that an estimate of dust deposition amounts greater than 1.0 g/m^2/day would cause the effects listed above[22]. As indicated in Figure 1.2, monitoring point 16 to the west of the site had the highest range of dust deposition with the highest amount recorded being 19.0 g/m^2/30 days. This equates to an average of 0.6 g/m^2/day and is still well below the threshold indicated in the research above that could cause negative physiological effects on plants. Furthermore, monitoring points 2, 3, and 4 to the north of the site showed the highest dust deposition amount recorded was 0.4 g/m^2/day (point 4).

Based on the dust deposition monitoring data, the native scrub that is immediately adjacent to the site is predicted to have the greatest impacts from coal dust settlement. This area is not likely to hold habitat for the threatened plant species identified in the wider area. The visual assessment of vegetation along Sumner Road indicated that dust effects on vegetation were negligible as there was no obvious dust accumulation on the leaves of understorey species or within the rank exotic grasses. Although there was no access to Old Sumner Road, vegetation health along the native/exotic scrub that buffered the site appeared to be in good condition.

5.2 Terrestrial fauna effects

Large amounts of dust can adversely impact terrestrial fauna in adjacent habitats, particularly by accumulating in the interstitial spaces of the rocky outcrops in the area, and also by impacting food sources, such as invertebrates. As stated above, dust can affect vegetation, which provides habitat and foraging resources for native terrestrial fauna. However, the visual assessment of surrounding vegetation and rocky outcrops did not indicate signs of dust deposition on foliage surfaces or on the surfaces of large boulders.

In some cases, the chemicals in dust suppressants/control agents can have a larger effect on herpetofauna than dust itself. For example, hundreds of dead blue-spotted salamander (*Ambystoma laterale*) were found along a forest service road in the United States, due to desiccation from calcium chloride, which was sprayed on gravel roads as a dust-control agent[23]; it is important to note

[19] Lovich, J.E., Ennen, J.R. Wildlife Conservation and Solar Energy Development in the Desert Southwest, United States, BioScience, Volume 61, Issue 12, December 2011, Pages 982-992.
[20] Sett, R. (2017). Responses in plants exposed to dust pollution. *Horticulture International Journal*, *1*(2), 53-56.
[21] Zhan-Yi, W., Jia, H., Jian-Ying, G., Cheng-Jie, W., & Ming-Jiu, W. (2016). Coal Dust Reduce the Rate of Root Growth and Photosynthesis of Five Plant Species in Inner Mongolian Grassland. *Journal of Residuals Science & Technology*, *13*.
[22] Treshow, M. (2010). Terrestrial plants and plant communities. *Department of Biology, University of Utah, Salt Lake City, UT, USA*, 225-236.
[23] deMaynadier, P.G and Hunter, M.L. Road effects on amphibian movements in a forested landscape. Natural Areas Journal 20: pps56-65 (2000).

that salamanders are amphibians and generally have more sensitive skin than reptiles. Vital Bon-Matt CDS 300 is the dust suppressant/veneering agent that is currently being used on site; the suppressant is a permitted substance under the Canterbury Land and Water Regional Plan and is primarily used during the holiday shutdown period in December. The primary ingredients in this product are water, triglyceride, organic gum, and cellulose material. Given that the dust suppressant is targeted to the site only and the chemicals listed above are not desiccants, it is considered unlikely that the dust suppressant will have a negative effect on lizards and invertebrates that are in the wider environment.

6 Management of effects

6.1 Dust management

The current dust management methods are described below and are further detailed in the Air Quality Assessment report written by Tonkin & Taylor Ltd (T+T).

Water is the primary means to manage coal dust. The site has fifteen fixed high spray water towers, three fixed low sprayers, two semi-mobile high towers and one low mobile spray unit as well as a water cart with spray cannons.

The fixed spray towers are located around the perimeter of the coal stockpiles and can be individually controlled. The sprinklers on the upwind side of the stockpiles are used so that the wind assists blowing the water mist over the stockpile. This increases the coverage of the water and reduces the amount of water wasted as overspray.

The water cart is available all year round and operates when required by weather conditions require. A second, smaller truck can be bought on site if there is equipment breakdown.

The water cart can also apply a dust suppressant (veneer) to the stockpiles during the Christmas break or any other time when the stockpile is not going to be disrupted. The dust suppressant is a biodegradable product that coats the coal and binds the dust particles.

There is a network of weather stations around the Port that enables the site staff to forecast when to use the fixed spray towers or the water cart. This includes a station on site that measures the speed and direction of the wind.

There are also a number of other measures used to manage coal dust in accordance with the existing dust management (note: these are described in more detail in the Air Quality Assessment):

- The load-out conveyors have top covers along the majority of their length;
- The coal drop-height onto conveyors is minimised;
- Water spray is used on the load-in conveyor feeding the gantry stacker;
- Scrapers are used to clean belts, and coal is picked up off the ground using a suction truck or sweeper;
- The wharf is regularly cleaned; and
- Vehicle speeds are regulated to reduce dust.

6.2 Magnitude and overall level of effect with management

It is considered that the continued operation of the coal stockyard with appropriate dust management measures will have a negligible or low magnitude of effect on the ecological values in the surrounding environment of the site as indicated in Table 6.1 below. This is primarily supported by the published research indicating a that a 1.0 g/m^2/day threshold is necessary to start affecting physiological processes in plants, and the monitored dust accumulation is much lower than this

amount. This is equivalent to a dust deposition rate of 30 g/m^2/30-days. As shown in Figure 1.2, deposition rates have been consistently well below this value at the monitoring sites. The overall effects are outlined in Table 6.2, with the proposed continuation of activities having a very low or low effect on all identified ecological features.

Table 6.1: Magnitude of ecological effect *with management*.

Ecological feature	Magnitude of effect	Explanation
Exotic mature vegetation	Negligible	Dust effects on the mature pine blocks, eucalypts and wattles are considered to be negligible, due to their relatively large and established stature and adaptive growth in New Zealand conditions.
Exotic grasslands	Negligible	The exotic grasslands are extremely exposed but are composed of resilient exotic species that are not likely to be greatly affected by dust deposition. With the dust management measures in place, it is considered that there will be a negligible magnitude of effect on the exotic grasslands in the wider environment.
Native scrub	Low	Most of the areas of native scrub are outside of the predicted modelled dust deposition contours. However, the planted scrub on the western boundary of the site is considered to have a low magnitude of effect, due to proximity and prevailing wind direction.
Rock outcrops	Negligible	Although the outcrops are a habitat for several at risk and threatened species, the dust would not affect the outcrops themselves, and therefore, the magnitude of effect is considered to be negligible.
Nationally Threatened plant species	Negligible	Although no threatened plant species survey has been undertaken within the dust deposition modelled zone, the published amounts of dust that could have negative effects on the physiology of plants is much higher than the monitored dust deposition levels. Therefore, the magnitude of effect with dust management measures is considered to be negligible.
Nationally At Risk-Declining plant species	Negligible	Same as above.
Nationally At Risk-Recovering, Naturally uncommon, Relict plant species	Negligible	Same as above.
Herpetofauna	Low	There is a lack of published research available on dust effects on herpetofauna. It is considered that the managed dust deposition will have a low effect on the local

Ecological feature	Magnitude of effect	Explanation
		population due to physiological effects as well as low effects on foraging resources.
Avifauna (common species)	Negligible	It is considered that effects on common avifauna species will be negligible as they are classified as 'Not threatened' species and therefore more likely to be adaptable to disturbances.
Avifauna (kereru, tui, bellbird)	Negligible	Same as above
NZ pipit	Low	As the primary nesting habitat for NZ pipit in the proximity of the stockyard is rank grass and most of this habitat is within the areas that have lower monitored dust depositions, it is considered that there will be a low effect on the local population.
NZ eastern falcon	Low	As the primary nesting habitat for NZ falcon is likely to be within the rocky outcrops, it is considered that low amount of dust will be deposited within this habitat and therefore there will be a low effect on the local population.
Invertebrates	Low	Again, there is a lack of research on the effects of dust on invertebrates. However, with the dust management measures, it is considered that there will be a low effect on the local population.

Table 6.2: Overall level of effect *with management*

Ecological feature	Value	Magnitude of effect	Overall level of effect
Exotic mature vegetation	Moderate	Negligible	Very low
Exotic grasslands	Moderate	Negligible	Very low
Native scrub	Moderate	Low	Low
Rock outcrops	High	Negligible	Very Low
Nationally Threatened plant species	Very High	Negligible	Low
Nationally At Risk-Declining plant species	High	Negligible	Very Low
Nationally At Risk-Recovering, Naturally uncommon, Relict plant species	Moderate	Negligible	Very Low
Herpetofauna	High	Low	Low
Avifauna (common species)	Low	Negligible	Very Low
Avifauna (kereru, tui, bellbird)	Moderate	Negligible	Very Low
NZ pipit	High	Low	Low
NZ eastern falcon	Moderate	Low	Low
Invertebrates	Moderate	Low	Low

7 Conclusion

LPC is proposing to renew the air discharge permit for the coal stock yard located at Lyttelton Port within the Port Hills, Christchurch which has been established since 1976. Coal dust deposition monitoring has been undertaken in summer months since 2008 and indicates that the areas to the northwest of the site have the greatest amounts of dust deposition. There are several reserves in the area that hold high ecological value through 'threatened' and 'at risk' plant, bird, lizard and invertebrate species; however, dust accumulation was not observed on the surrounding habitat types during the visual assessment. Furthermore, the highest range of monitored dust accumulation levels were substantially lower than the amounts of dust deposition required to negatively affect plant physiology.

The current dust management control measures and deposition limits appear to be effective at controlling dust deposition in the surrounding environment and will continue to be undertaken with this consent along with further control measures that are recommended in the Air Quality Assessment report. Therefore, the overall level of effect on the surrounding ecological values with the management measures above is considered to be very low or low.

8 Applicability

This report has been prepared for the exclusive use of our client Lyttelton Port Company Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Christchurch City Council as the consenting authority will use this report for the purpose of assessing that application.

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Appendix A Ecological impact assessment guidelines

Appendix A Table 1: Criteria to consider when assigning ecological value or importance to a site or area of vegetation/habitat/community (Chapter 5-Table 4, EIANZ, 2018).

Matters	Attributes to be considered
Representativeness	Criteria for representative vegetation and aquatic habitats: · Typical structure and composition; · Indigenous species dominate; · Expected species and tiers are present; and · Thresholds may need to be lowered where all examples of a type are strongly modified. Criteria for representative species and species assemblages: · Species assemblages that are typical of the habitat; and · Indigenous species that occur in most of the guilds expected for the habitat type
Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats: · Naturally uncommon, or induced scarcity; · Amount of habitat or vegetation remaining; · Distinctive ecological features; and · National priority for protection. Criteria for rare/distinctive species or species assemblages: · Habitat supporting nationally Threatened or At Risk species, or locally uncommon species; · Regional or national distribution limits of species or communities; · Unusual species or assemblages; and · Endemism.
Diversity and pattern	· Level of natural diversity, abundance and distribution; · Biodiversity reflecting underlying diversity; · Biogeographical considerations – pattern, complexity; and · Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation.
Ecological context	· Site history, and local environmental conditions which have influenced the development of habitats and communities; · The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA); · Size, shape and buffering; · Condition and sensitivity to change; · Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material; and · Species role in ecosystem functioning – high level, key species identification, habitat as proxy.

Appendix A Table 2: Factors to consider in assigning value to terrestrial species (Chapter 5-Table 5, EIANZ, 2018).

Determining factors	Values
Very High	Nationally Threatened - Endangered, Critical or Vulnerable.
High	Nationally At Risk – Declining.
Moderate	Nationally At Risk - Recovering, Relict or Naturally Uncommon.
Moderate	Not Nationally Threatened or At Risk, but locally uncommon or distinctive species
Low	Not Threatened Nationally, common indigenous species
Exotic species, including pests, species having recreational value	Negligible

Appendix A Table 3: Scoring for sites or areas combining values for four criteria (Chapter 5-Table 6, EIANZ, 2018).

Determining factors	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in Table 4. Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder, or Area rates High for 1 of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
Moderate	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Low	Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

Appendix A Table 4: Criteria for describing the magnitude of effect (adapted from EIANZ, 2018).

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features/ of the existing baseline[1] conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate-	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature

[1] Baseline conditions are defined as 'the conditions that would pertain in the absence of a proposed action' (Roper-Lindsay et al., 2018).

Appendix A Table 5: Timescale for duration of effect (adapted from EIANZ, 2018).

Timescale	Description
Permanent	Effects continuing for an undefined time beyond the span of one human generation (taken as approximately 25 years)
Long-term	Where there is likely to be substantial improvement after a 25 year period (e.g. the replacement of mature trees by young trees that need > 25 years to reach maturity, or restoration of ground after removal of a development) the effect can be termed 'long term'
Temporary[1]	· Long term (15-25 years or longer – see above); · Medium term (5-15 years); · Short term (up to 5 years); and · Construction phase (days or months)

[1]Note that in the context of some planning documents, 'temporary' can have a defined timeframe.

Appendix A Table 6: Criteria for describing overall levels of ecological effects (adapted from EIANZ, 2018).

	Ecological value				
Magnitude	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Appendix A Table 7: Interpretation of assessed ecological effects against standard RMA terms (adapted from EIANZ, 2018).

Level of ecological effect	RMA interpretation	Description
Very high	Unacceptable adverse effects	Extensive adverse effects that cannot be avoided, remedied or mitigated.
High	Significant adverse effects that could be remedied or mitigated	Adverse effects that are noticeable and will have a serious adverse impact on the environment but could potentially be mitigated or remedied.
Moderate	More than minor adverse effects	Adverse effects that are noticeable and may cause an adverse impact on the environment, but could be potentially mitigated or remedied.
Low	Minor adverse effects	Adverse effects that are noticeable but that will not cause any significant adverse impacts.
Very low	Less than minor adverse effects	Adverse effects that are discernible from day to day effects but which are too small to adversely affect the environment.
Negligible	Nil effects	No effects at all.

Appendix B Avifauna species records in the area.

Appendix B Table 1: Native avifauna within 5 km radius of the site.

Scientific name	Common name	Threat Status	Distance from site	Source
Anthornis melanura melanura	Bellbird	Not threatened	<1 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)
Anthus novaeseelandiae novaeseelandiae	New Zealand pipit	At risk-Declining	1.5 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)
Chrysococcyx lucidus lucisdus	Shining cuckoo	Not threatened	<1 km	Inaturalist.org
Circus approximans	Swamp harrier	Not threatened	<1 km	Inaturalist.org
Egretta novaehollandiae novaehollandiae	White-faced heron	Not threatened	<1 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)
Falco novaeseelandiae novaeseelandiae	New Zealand falcon	At risk-Recovering	3.5 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)
Gerygone igata	Grey warbler	Not threatened	<1 km	Inaturalist.org
Hemiphaga novaeseelandiae	Kereru	Not threatened	<1 km	Inaturalist.org
Poryphyrio melanotus melanotus	Pukeko	Not threatened	<1 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)
Prosthemadera novaeseelandiae novaeseelandiae	Tui	Not threatened	<1 km	Inaturalist.org
Rhipidura fuliginosa fuliginosa	South Island fantail	Not threatened	<1 km	Inaturalist.org
Tadorna variegata	Paradise shelduck	Not threatened	<1 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)
Todiramphus sanctus vagans	Kingfisher	Not threatened	<1 km	Inaturalist.org
Zosterops lateralis lateralis	Silvereye	Not threatened	<1 km	Inaturalist.org, ebird.org (Lyttelton-town and waterfront checklist)

Appendix B Table 2: Exotic avifauna within a 5 km radius of the site.

Scientific name	Common name	Threat Status	Distance from site	Source
Acanthis cabaret	Redpoll	Introduced and naturalised	<1 km	Inaturalist.org
Alauda arvensis	Skylark	Introduced and naturalised	<1 km	Inaturalist.org
Callipepla californica	California quail	Introduced and naturalised	<1 km	Inaturalist.org
Chloris chloris	Greenfinch	Introduced and naturalised	<1 km	Inaturalist.org
Columba livia	Rock pigeon	Introduced and naturalised	<1 km	Inaturalist.org
Emberiza citrinella	Yellowhammer	Introduced and naturalised	<1 km	Inaturalist.org
Fringilla coelebs	Chaffinch	Introduced and naturalised	<1 km	Inaturalist.org
Gymnorhina tibicen	Magpie	Introduced and naturalised	<1 km	Inaturalist.org
Passer domesticus	House sparrow	Introduced and naturalised	<1 km	Inaturalist.org
Prunella modularis	Dunnock	Introduced and naturalised	<1 km	Inaturalist.org
Sturnus vulgaris	Starling	Introduced and naturalised	<1 km	Inaturalist.org
Turdus merula	Eurasian blackbird	Introduced and naturalised	<1 km	Inaturalist.org
Turdus philomelos	Song thrush	Introduced and naturalised	<1 km	Inaturalist.org

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