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30 June 2022

Consents Processing Officer
Environment Southland
Corner of North Road and Price Street
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To whom it may concern,

BLUE SKY MEATS (N.Z.) LTD WASTEWATER TREATMENT PLANT OPERATION CONSENTS

1.0 Introduction

This letter report has been prepared on behalf of Blue Sky Meats (N.Z.) Ltd (trading as Blue Sky Pastures (BSP)) by Pattle Delamore Partners Ltd (PDP) to support renewal of resource consents associated with operation of the onsite wastewater treatment plant (WWTP) at BSP's Morton Mains sheep and lamb processing facility. The resource consents discussed in this letter are:

- AUTH-20181973-03 to discharge land drainage water and stormwater to water (expiry 31 December 2022).
- AUTH20181937-02 to take groundwater for the purpose of dewatering a wastewater treatment and storage pond site (expiry 31 December 2022).

PDP prepared Technical Report No. A03220201R001, dated 13 December 2018 and attached to this letter to support the 2018 resource consent applications to Environment Southland for the above consents. Renewal of the above resource consents is now being sought prior to expiry in December 2022. The original Assessment of Environmental Effects (AEE) report remains valid, and the purpose of this letter report is to supplement the previous Technical AEE report and provide updates where applicable for the purpose of reconsenting.

2.0 Background

In 2019, BSP upgraded their onsite WWTP to include two new lagoon based treatment processes:

- A Covered Anaerobic Lagoon (CAL); and
- A Sequencing Batch Reactor (SBR).

These lagoons are additional to a pre-existing irrigation storage lagoon.

The anaerobic lagoon provides substantial removal of organic matter (including fats, oils, and greases) through settling out solids and breaking down organic matter via anaerobic autotrophic bacteria. The main by-product of anaerobic decomposition is biogas, mainly CH_4 and CO_2, which is collected by gas collection pipework under the cover and combusted via a flare. The SBR is an aerated lagoon which uses aerobic heterotrophic bacteria (activated sludge) to reduce contaminants in the wastewater, particularly BOD and nitrogen together with some phosphorus reduction. The addition of these systems in 2019 provided substantial improvement to the performance and environmental sustainability of BSP's existing discharge to land.

During the investigations and design phase for the WWTP upgrades described above, seasonal shallow groundwater was identified as a potential issue affecting construction and operation.

It was determined that the best practicable option was to install subsoil drainage around the proposed lagoon perimeter to lower the groundwater beneath the lagoons permanently and passively. This offered the following advantages:

1. Ensured that all excavations were into dry ground conditions to improve excavation stability and increase opportunities to reuse site won material.
2. Mitigates differential pressures on the lagoon liners that could occur in high groundwater conditions when the lagoons were empty (either as a part of normal operation or maintenance). These differential pressures could cause the liner to lift and damage the lagoon construction.
3. Keeps the lagoon embankments dewatered to improve stability.
4. Avoids groundwater entering the leak detection system, that could make leaks more difficult to identify.

The combination of the above activities required the consents outlined in Section 1.0 for non-agricultural effluent ponds, groundwater dewatering and groundwater/stormwater discharge.

3.0 Description of Activity

Groundwater dewatering beneath the WWTP lagoons occurs via passive drainage via permeable bedding and perforated pipelines in the groundwater dewatering system.

The dewatered groundwater in combination with stormwater from the Covered Anaerobic Lagoon (CAL) cover is then discharged to a nearby surface water drain.

On occasion, if the flux of groundwater exceeds the dewatering drain capacity, groundwater may enter the leak detection system. If this occurs, Blue Sky will need to sample the leak detection manhole (MH2) to confirm that there is no evidence of wastewater contamination via leaking from the lined lagoons. Only once the sampling identifies that there is no contamination of the dewatered groundwater, can the valve be opened for this water to enter the groundwater system.

This system is described the schematic diagram in Figure 1.

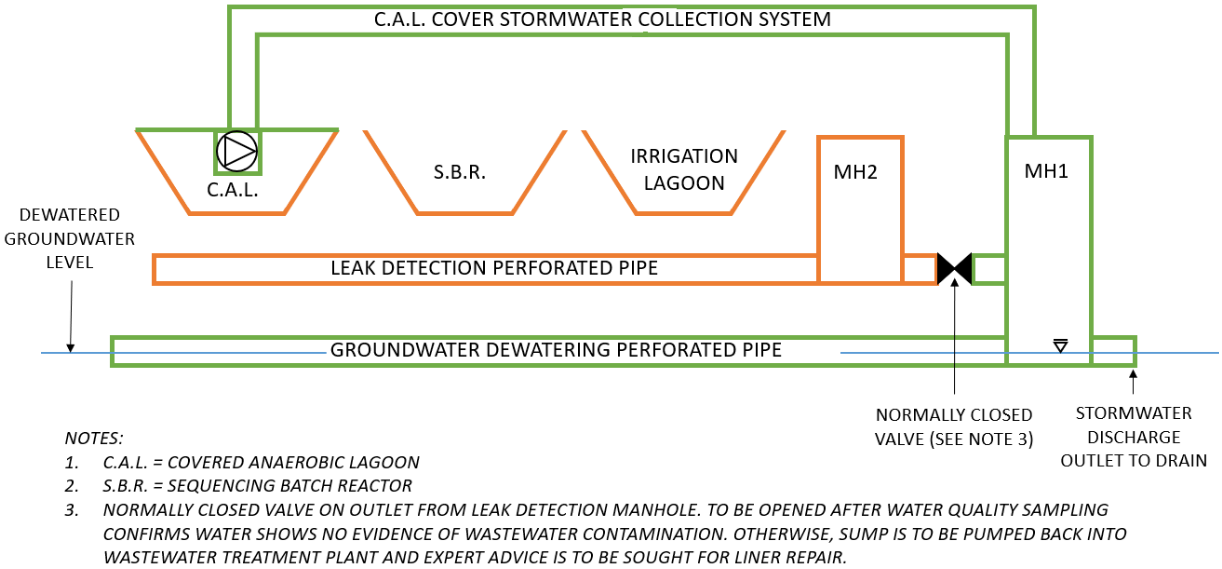

Figure 1: Schematic of Stormwater/Dewatering System

Please note that BSP are currently diverting stormwater from the CAL cover to the wastewater treatment system. This is because pest birds are congregating on the cover and impacting stormwater quality by accumulation of excreta on the cover. However, if the pest problem is fixed in future, it will be appropriate to discharge the CAL cover stormwater directly.

4.0 Updates to the Existing AEE

The previously prepared AEE (Technical Report No. A03220201R001, dated 13 December 2018) is still relevant. In addition, since the original consent application in 2018, monitoring of the intercepted groundwater/stormwater discharge ('SW Discharge') and flows in the receiving stormwater drain approximately 20 m upstream of the discharge location ('Background') has occurred and is summarised in Table 1 below.

Determinands of particular note are:

- Electrical conductivity as an indicator of potential localised land use impacts on water quality.
- Oxidised nitrogen (nitrate and nitrite nitrogen) species as an indicator of potential localised land use impacts on water quality.
- Ammoniacal nitrogen as an indicator of any potential wastewater contamination.
- $cBOD_5$ as an indicator of any potential wastewater contamination.
- E. *coli* as an indicator of any potential wastewater contamination.

Table 1: Summary of Stormwater/Dewatered Groundwater Discharge Monitoring

Parameter	Background Average (Range)	SW Discharge Average (Range)	Trigger Levels	Trigger Level Source
pH	**6.7** (**6.4** - 7.4)	**6.7** (**6.4** - **7.0**)	7.2 - 7.8	*DGVs for Cool Dry Low-elevation*
Electrical Conductivity (mS/m)	84 (29 - **294**)	**130** (81 - **270**)	> 116	*DGVs for Cool Dry Low-elevation*
Total Nitrogen (g/m^3)	**12.4** (0.8 - **24.0**)	**10.4** (**9.0** - **11.8**)	>0.913	*DGVs for Cool Dry Low-elevation*
Ammoniacal Nitrogen (g/m^3)	0.139 (0.010 - **0.490**)	0.033 (0.010 - 0.112)	> 0.24 (0.40)	*NPSFM (2020) national bottom line - median (maximum)*
Organic Nitrogen (g/m^3)	12.0 (0.5 - 23.5)	0.3 (0.2 - 0.4)	N/A	
Nitrite Nitrogen (g/m^3)	0.012 (0.007 - 0.019)	0.014 (0.002 - 0.037)	>0.1	*96 hr LC_{50} for Oncorhynchus mykiss (salmonid; fry) (Camargo & Alonso, 2006).*
Nitrate Nitrogen (g/m^3)	**6.2** (0.0 - **13.2**)	**10.6** (**8.6** - **13.5**)	> 2.4 (3.5)	*NPSFM (2020) national bottom line - median (95th percentile)*
Total Phosphorus (g/m^3)	**0.344** (**0.093** - **1.310**)	**0.024** (0.012 - **0.042**)	>0.014	*DGVs for Cool Dry Low-elevation*
Biochemical Oxygen Demand (g/m^3)	non-detect	non-detect	N/A	
Escherichia coli (cfu/100mL)	**1,086** (60 - **2,400**)	**449** (37 - **1,600**)	< 130 (1,200)	*NPSFM (2020) attribute state C - median (95th percentile)*

Notes:

1. *Values shown in bold indicate an exceedance of the relevant trigger value.*
2. *Data is based on five (5) separate monitoring events*

The stormwater/dewatered groundwater generally is of similar water quality to the receiving environment. This is not surprising as the receiving surface water is largely groundwater fed from the same shallow groundwater. The discharge quality has less variability than the receiving surface water. This could be due to biogeochemical processing that can occur in surface water, as well as the influence of runoff.

There is no indication of direct wastewater contamination of the groundwater discharge (i.e. elevated ammoniacal nitrogen, $cBOD_5$, and *E. coli*).

Notwithstanding, both the surface water and groundwater quality indicate significant impacts of the wider agricultural land use in the area, with high electrical conductivity, high total nitrogen, and high total phosphorus. The background receiving surface water and the dewatered groundwater exceeds the NPSFM (2020) bottom line for nitrate-nitrogen toxicity and *E. coli.* Nitrate-nitrogen is elevated in both the discharge and in the receiving environment, at levels that can cause ecotoxicity effects. Early monitoring indicates that the discharge may increase nitrate levels within the stream.

It is important to consider the impact of the elevated nitrate-nitrogen concentrations in the dewatered groundwater in the wider context of the application. The groundwater dewatering system is an integral part of the BSP WWTP.

The WWTP (recently upgraded) has substantially reduced nitrogen loads from the BSP wastewater discharge. This will significantly reduce nitrogen leaching from BSPs land discharge. Over time, PDP considers this will reduce nitrate-nitrogen concentrations in shallow groundwater. Therefore, in the short-term the dewatering system may be contributing to higher nitrate-nitrogen in the receiving surface water. However, the groundwater dewatering system enables improvements that will ultimately improve shallow groundwater quality and the receiving surface water quality (as the receiving surface water is, in part, groundwater fed).

Further to this, the specific purpose of the groundwater dewatering system is to protect the liner from flotation in high groundwater conditions, which could damage the subgrade and tear the liner. This would likely cause wastewater leakage to groundwater i.e., far greater levels of contamination that may be caused by the elevated nitrate-nitrogen in the dewatered groundwater in the short-term.

5.0 Summary

In conclusion, the previously prepared 2018 Technical AEE is consistent with what has been built on site and is still relevant to the current application.

- The 2018 Technical AEE is supplemented with monitoring data from the stormwater/dewatered groundwater discharge (detailed above). This identified that for all parameters except nitrate-nitrogen there is no adverse effect from the discharge. However, both the discharge and the receiving surface water has elevated nitrate-nitrogen below the national bottom line.
- It is important to consider the impact of the elevated nitrate-nitrogen concentrations in the dewatered groundwater in the wider context of the application:
  - Groundwater dewatering is for BSP’s WWTP; and
  - The WWTP is an essential component in improving groundwater nitrate levels, as the implementation of the WWTP upgrades are responsible for substantial reductions in nitrogen concentrations in the wastewater, therefore reducing nitrogen loading and leaching across the land treatment system.

6.0 Limitations

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Blue Sky Meats Ltd and others (not directly contracted by PDP for the work), including Hill Laboratories and Mitchell Daysh. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Blue Sky Pastures Ltd for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

Yours faithfully

PATTLE DELAMORE PARTNERS LIMITED

Prepared by

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Reviewed and Approved by

Azam Khan
Technical Director – Wastewater

Appendix A: 2018 Operational Consents Application Technical Documents

1. PDP Technical Report No. A03220201R001 (dated 13 December 2018) and titled 'Assessment of Environmental Effects Technical Report - New Wastewater Treatment Plant for Blue Sky Meats, Morton Mains'.
2. PDP Letter Report No. A03220201L001 (dated 15 January 2019) and titled 'RESPONSE TO SECTION 92 REQUEST FOR ADDITIONAL INFORMATION: RESOURCE CONSENT APPLICATION – 2018/53297. REFERENCE 360/10/18/297 KELWYN OSBORN'.

Auckland Tauranga Wellington Christchurch

PATTLE DELAMORE PARTNERS LTD

Assessment of Environmental Effects Technical Report – New Wastewater Treatment Plant for Blue Sky Meats, Morton Mains

Blue Sky Meats (N.Z.) Limited

solutions for your environment

Assessment of Environmental Effects Technical Report - New Wastewater Treatment Plant for Blue Sky Meats, Morton Mains

Prepared for

Blue Sky Meats (N.Z.) Ltd

December 2018

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Quality Control Sheet

TITLE	Assessment of Environmental Effects Technical Report - New Wastewater Treatment Plant for Blue Sky Meats, Morton Mains
CLIENT	Blue Sky Meats (N.Z.) Ltd
VERSION	Final
ISSUE DATE	13 December 2018
JOB REFERENCE	A03220201
SOURCE FILE(S)	A03220201R001_AEE.docx

DOCUMENT CONTRIBUTORS

Prepared by

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Limitations:

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Table of Contents

Table of Tables

Appendices

1.0 Introduction

Blue Sky Meats (N.Z.) Ltd (Blue Sky Meats) own and operate a lamb & sheep processing and an ancillary meat rendering plant at Morton Mains, Southland.

Pattle Delamore Partners Ltd (PDP) has been engaged by Blue Sky Meats to undertake detailed design of a new wastewater treatment plant (WWTP) for the Morton Mains plant. The contract for construction of the new WWTP will be tendered during December 2018 and early-2019.

New resource consents, certificates of compliance, or variations to existing resource consents held by Blue Sky Meats, are required from Environment Southland and Southland District Council (SDC) for discharge and land use activities associated with the new WWTP.

The purpose of this Assessment of Environmental Effects (AEE) technical report is to support resource consent applications to Environment Southland and Southland District Council associated with discharge and land use activities.

1.1 Background

Blue Sky Meats processes up to 5,000 lambs and sheep per day at their Morton Mains plant. The site also undertakes rendering for meat, blood & bone meal and tallow.

Wastewater from the primary slaughterhouse is presently screened before being transferred to a holding pond and combined with untreated wastewater from the rendering plant. Wastewater from the holding pond is transferred into an irrigation storage lagoon which is aerated for storage purposes, however is not necessarily biologically treated. From the aerated irrigation storage lagoon wastewater is irrigated onto pastoral farm land operated as a “zero grazed” system (cut and carry only) under Environment Southland Resource Consent No. 201191.

Managing the nitrogen load presently applied to the irrigation area is constraining the site’s rendering plant operation. An improved wastewater treatment system is required to allow the plant to operate at full capacity, and to reduce nitrogen loading to the irrigation disposal system.

Construction of the new WWTP will involve modifying and building on existing infrastructure to develop a full biological nitrogen removal treatment system. This will include a covered anaerobic treatment lagoon and activated sludge plant operated as a sequencing batch reactor (SBR).

Relevant drawings showing general arrangements of the proposed new WWTP are attached to this report as Appendix A. The general layout of the Blue Sky Meats Site, and of the proposed new WWTP system is shown in Drawings D001 and D002, Appendix A.

2.0 Description of the Environment

2.1 Site Description

The site is located at 729 Woodlands-Morton Mains Rd, Morton Mains, Southland within the land parcel legally described as Lot 1 DP595 owned by Blue Sky Meats (N.Z.) Limited.

The site is presently zoned Rural under the Southland District Plan.

The proposed WWTP will be located adjacent to the existing aerated irrigation storage pond as shown on Drawing D001, Appendix A. The proposed WWTP site is presently stockyards associated with the processing plant and grazing land.

The Blue Sky Meats site is bounded by Woodlands-Morton Mains Road to the south east (approximately 200 m from the proposed WWTP site) and farmland on all other sides. The nearest sensitive receptor (dwelling) to the Blue Sky Meats site is approximately 500 m to the south east. The processing plant and the proposed location of the new WWTP are generally hidden from view from neighbouring properties and from Woodlands-Morton Mains Road by existing mature trees.

The proposed WWTP site slopes in a general north east direction towards the drain shown on Drawing D001, Appendix A. Stormwater runoff from the wider Blue Sky Meats site is also directed to this agricultural drain (PDP site inspection, August 2018), which eventually flows to an unnamed tributary of the Waihopai River.

2.2 Site Geology and Geotechnical Investigation

The GNS Science New Zealand Geology Web Map describes the geology of the site as weathered gravel, sand, silt and mud of alluvial and colluvial origin.

As part of the detailed design phase, four geotechnical test pits were excavated in the location of the proposed WWTP in August 2018. The test pits were excavated to a maximum depth of 3.7 m below ground level (bgl), and encountered ground conditions generally consistent with the GNS geological description. The near surface soil profile encountered in the four test pits is summarised in Table 1.

Table 1: Near Surface Soil Profile

Depth (m bgl)	Geological Description
0 – 0.2 m	Topsoil, Dark brown, loosely packed and friable, dry, slightly plastic.
0.2 – 1.3 to 2.4 m	Silty Clay, light brown, firm, moist, plastic, bedded, alluvial silt/clay.
1.3 to 2.4 – 3.1 to 3.7 m	Gravel in a matrix of light grey to light brown becoming orange brown below 2.5 m silt and clay, dense, slightly plastic, wet. Gravels are sub rounded to rounded, Alluvial gravels.

Notes:
1. *Geotechnical information sourced from email from Gerald Strayton (PDP Technical Director – Geotechnics) to Josh Lotter (PDP Environmental Engineer) dated 28 August 2018.*

In one test pit the gravel layer was not present and a silty sand, white streaked yellow, medium dense and bedded was present to the base of the excavation at 3.7 m bgl.

No fill material was encountered in the four test pits excavated.

2.3 Surface Water

The site is located within the Waihopai River catchment. The Waihopai River drains a north east to south west aligned catchment of approximately 250 km^2 between the Edendale terrace (lower Mataura Valley), and Invercargill. Only the lower catchment is urbanised where the Waihopai River discharges to the New River Estuary at Invercargill. The primary catchment land use is agricultural land, with the catchment classified under the Land Air Water Aotearoa (LAWA) online database as predominantly ‘lowland pastoral farmland’.

Stormwater from the Blue Sky Meats site is presently discharged via the existing surface drain to the north east of the site shown on Drawing D001, Appendix A as a permitted activity. This drain flows on a general north west alignment before turning to the south west and flowing into an upper tributary of the Waihopai River to the south of Woodlands Morton Mains Road.

Water quality sampling is carried out in the lower Waihopai River upstream of Queens Drive, Invercargill where the river enters the urban area. Beacon Environment Southland online GIS and LAWA’s online database report the following water quality states and trends for the Waihopai River at Queens Drive summarised in Table 2.

Table 2: Water Quality Summary Waihopai River at Queens Drive

Water Quality Indicator	5 Year Median Value	State Relative to Like Sites	Trend (10 year)
Bacteria – E. *coli*	330 MPN/100 mL	Worst 25% of like sites	Very likely improving
Clarity - Turbidity	3.4 NTU	Worst 50% of like sites	Not assessed
Nitrogen – Total Nitrogen	2.8 g/m^3	Worst 25% of like sites	Very likely improving
Nitrogen – Ammonia Nitrogen	0.0165 g/m^3	Worst 25% of like sites	Very likely improving
Phosphorus – Dissolved Reactive Phosphorus	0.009 g/m^3	Best 50% of like sites	Very likely improving
Phosphorus – Total Phosphorus	0.028 g/m^3	Worst 50% of like sites	Very likely improving

Notes:

1. *All data sourced from LAWA, 20 November 2018 (https://www.lawa.org.nz/explore-data/southland-region/river-quality/waihopai-stream/waihopai-river-us-queens-drive/).*

Further to Table 2, Environment Southland report that the Macroinvertebrate Community Index (MCI) for the Queens Drive monitoring site is 'Poor' (Beacon GIS, LAWA,).

2.4 Groundwater

Three out of four test pits described in Section 2.2 encountered groundwater seepage into the excavation at approximately 2 to 2.5 m bgl (August).

The Blue Sky Meats site is located within the Waihopai groundwater management zone under both the Southland Regional Water Plan (RWP) and the Proposed Southland Water and Land Plan (pSWLP). Environment Southland's Groundwater Zone Information Sheet includes general groundwater quality information for the Waihopai zone. Groundwater quality in this zone is influenced by nutrient enrichment, however generally remains within the limits set by the Drinking-water Standards for New Zealand 2005 (Revised 2008)[1].

The Waihopai groundwater catchment consists of a relatively thin (<30 m) layer of gravels overlying tertiary sediments (low permeability soils). Recharge to the Waihopai groundwater zone is exclusively from rainfall recharge estimated at 521 mm/year[1].

[1] Environment Southland's Groundwater Zone Information Sheet for the Waihopai zone

Numerous partially incised streams exist across the Waihopai groundwater zone, which forms the rolling topography. The major component of groundwater flow occurs to local rivers and streams. Surface water quality characteristics are therefore expected to reflect groundwater quality.

2.4.1 Nearby Groundwater Bores

Four well records exist at the Blue Sky Meats site associated with onsite water supply bores F46/0517, F46/0518, F46/0561, F46/1128. Details for wells F46/0561 and F46/1128 are available on Environment Southland's Beacon Online GIS. These wells were drilled to depths of 121.8 and 118 m bgl respectively, and are screened near the base. The initial water level readings in these wells were 29 and 26.4 m bgl respectively. As such, these bores are not expected to be influenced by changes in shallow groundwater levels.

There are no other production bores within 1.0 km of the site listed on Environment Southland's Beacon Online GIS. The nearest production bores to the proposed WWTP site, which also draw water from shallow groundwater, are domestic supply wells F46/0376 and F46/0874. These bores are located at Morton Mains approximately 1.2 km from the proposed WWTP site. An initial water level of 1.7 m bgl was recorded in F46/0874.

3.0 Proposed Works

3.1 WWTP System Description

The proposed WWTP is a biological treatment plant utilising both a covered anaerobic treatment lagoon and aerated treatment lagoon operated as a sequencing batch reactor.

The biological treatment plant is proposed to comprise of the following processes:

1. Screened wastewater from the primary slaughterhouse and untreated wastewater from the rendering plant will be discharged to the existing holding pond, which will be converted to a flow equalisation basin.

2. From the flow equalisation basin wastewater will be pumped into a new High Density Polyethylene (HDPE) lined and covered anaerobic lagoon with an active volume of 5,000 m^3 (active storage volume) allowing for biogas management through biogas flaring and a contingency biofilter. These components are shown on D005.

3. Partially treated wastewater from the covered anaerobic lagoon will flow via a gravity transfer into a 6,000 m^3 (active storage volume) HDPE lined aerobic lagoon operated as a sequencing batch reactor (SBR) and optimised for biological nitrogen removal (BNR). 230 kW of aeration in the SBR lagoon will allow for reduction of nitrogen to allow sustainable

land treatment. Further provision is made to increase aeration to 300 kW.

4. Treated wastewater will be discharged via a decant system to the existing irrigation storage lagoon, which may contain some level of mechanical aeration to ensure dissolved oxygen levels are maintained prior to land treatment.

The proposed system is shown in D005, Appendix A. Design of the WWTP has been overseen by suitably qualified and experienced Chartered Professional Engineers (Daniel Garden, PDP, Chartered Professional Engineer 1018789, and Azam Khan, PDP, Chartered Professional Engineer 194400).

3.2 Construction Works

Once consents are granted, Blue Sky Meats propose to carry out the works during early and mid-2019.

The primary components of the construction works (with respect to resource management) will involve:

- Bulk earthworks to form the wastewater lagoons through cut to fill (approximately 5,000 m^3).
- Construction of HDPE liners and HDPE cover on the anaerobic lagoon.
- Installation of a biogas management system including biogas flare unit and contingency biofilter.
- Groundwater dewatering and leak detection systems, as well as stormwater management systems.
- Installation of above and below ground pipelines, pumps, manholes, mechanical pipework, electrical and control systems including control building and other systems associated with operating the WWTP.

3.3 Leak Detection System

It is proposed to install a leak detection underdrainage system below the invert of the lagoons as shown on Drawing D007 and D114, Appendix A. The leak detection system will discharge to a manhole with a closed valve on the outlet.

Blue Sky Meats personnel will periodically inspect the manhole to check for leakage of wastewater. The leak detection system may from time to time intercept groundwater. If this occurs, Blue Sky Meats personnel will confirm that the water present is groundwater in accordance with the site Operation and Maintenance Manual (O&M manual; to be prepared by the Contractor as part of the contract works) and discharge the standing water to the stormwater system.

3.4 Groundwater Management

The seasonal high groundwater level at the construction site may be slightly above the proposed new lagoon invert level (Section 2.2 and Section 2.4). There is a risk that groundwater may be present to this level during construction, and could therefore impact on construction of the new wastewater lagoons.

Seasonal high groundwater is not expected to impact on operation of the WWTP when the lagoons are full.

An existing 160 mm outer diameter groundwater dewatering drain exists in the location of the proposed lagoons. Further 160 mm outer diameter land drains are proposed to be installed at the perimeter of the proposed new wastewater lagoons as shown in Drawing D007, Appendix A.

The proposed dewatering system will discharge to the surface drain to the north east of the existing irrigation lagoon. It is expected that the groundwater dewatering system will only intercept groundwater periodically.

If groundwater is encountered during construction, the contractor may increase the dewatering flowrate by pumping water out of the groundwater dewatering system. This water will be discharged in accordance with the site erosion and sediment control plan (Section 4.2.1) and the Environment Southland Builders Pocket Guide (Practical Advice on Managing Worksites and the Environment, 3rd Edition).

3.5 Stormwater Management

The primary new impervious area associated with the proposed WWTP is the new anaerobic lagoon. Stormwater runoff from the surrounding WWTP site will discharge to the surrounding pervious areas. Roof runoff from the MCC building (Drawing D002, Appendix A) will be discharged to the existing site stormwater system.

Rainfall on the anaerobic lagoon cover will be directed to a sump at the centre of the lagoon via preformed channels as shown on D007, Appendix A. From there, the stormwater will be pumped to MH1, and discharged to the surface drain to the north east of the site.

The stormwater from the anaerobic lagoon cover sump is expected to be pumped at a discharge flowrate of approximately 4.5 L/s. Based on a Rational Method estimate for the pre-developed wastewater lagoon area, this flowrate is less than the 2 year Average Recurrence Interval (ARI) 1 hour rainfall event runoff.

The discharge to the existing stormwater drain will be via a stabilised outlet.

Stormwater runoff from the HDPE cover is expected to contain low levels of stormwater contaminants, similar to roof runoff. The HDPE cover will be fully sealed, and therefore no wastewater, wastewater aerosols or sludge will be entrained in stormwater runoff from the HDPE cover.

3.6 Biogas Management

Biogas is a by-product of anaerobic digestion of wastewater containing organic matter. Biogas consists predominantly of methane (50-60%) and carbon dioxide (40-50%) but also contains very low levels of trace gases such as hydrogen, nitrogen and odour generating hydrogen sulphide. Other than hydrogen sulphide, small amounts of other odour generating compounds are also present.

The proposed covered anaerobic lagoon will have an air-tight gas collection system, which will discharge to a biogas flare to allow combustion of biogas and contingency biofilter treatment system to eliminate the potential environmental and nuisance effects associated with biogas.

3.6.1 Biogas Collection

On average, the biogas production rate from the anaerobic lagoon is estimated to be in the order of 4,500 N m^3/d. This is based on the design carbonaceous Biochemical Oxygen Demand ($cBOD_5$) loading from the processing plant. A peaking factor of 2 provides a conservative estimate for biogas generation during peak production conditions at Blue Sky Meats, corresponding to a peak biogas production rate from the proposed anaerobic lagoon in the order of 9,000 m^3/d.

Windsor Engineering Limited has prepared a preliminary design for the Blue Sky Meats biogas flare system on the basis of the biogas production rates calculated by PDP.

Provision is made in design for at least 1,000 m^3 storage of biogas under the HDPE floating cover at atmospheric pressure.

3.6.2 Biogas Treatment

Burning biogas through the flare system will significantly reduce greenhouse gas emissions from the site. Sulphurous compounds and other gases will be neutralized by the flaring process. The capture and combustion of gases from covered anaerobic lagoon is considered best practice.

Gas flaring will be utilised as the primary treatment system for the biogas. The captured gas is distributed through a collection pipe to the flare, via a fan, to be burnt off. The captured gas is not required to be pressurised or stored in the process.

The flare will operate on a pressure switch; when the pressure reaches the set point, the control valves will open and the flare will operate until pressure reduces below the lower pressure threshold. To minimise any ingress of oxygen from outside the pressure under the cover will not be allowed to reduce below atmospheric pressure.

The flare tip will be shielded to ensure that complete combustion occurs and to provide a wind shield to the naked flame. The flare unit will be maintained with continually cycling electrical auto-ignition unit (no pilot flame requirement).

Odour generating gases will be destroyed during combustion and therefore no objectionable odour will be discharged after the flare unit.

The contingency biofilter will provide for biogas biofiltration in the event the flare or the extraction blower is malfunctioning. A temperature sensor will be installed at the flare tip to identify if the flare is not operating. This will trigger an alarm (electronic notification to the plant operator) and biogas will be diverted to the contingency biofilter.

The design empty bed residence time (EBRT) for the biofilter is 500 seconds, which is a conservative design parameter. The biofilter media will be fine bark/compost overlying a drainage bed. This will be irrigated during extended periods of low rainfall to maintain suitable moisture content. The biofilter will be seeded with material from the existing rendering plant biofilter, and periodic manual diversion of biogas to the biofilter will maintain the required microbiological population in the biofilter media.

While the biofilter will reduce a limited amount of the methane in the biogas, it will reduce odorous hydrogen sulphide levels so that odour discharge will not cause nuisance effects, even during flare malfunction.

During biofilter operation, the odorous gases will be treated to the extent that any objectionable odour will be reduced to low levels at the biofilter.

All condensates (liquids condensing from the biogas stream) from the biogas prior to the flaring unit and the leachate from the biofilter underdrain will be collected and directed into the WWTP influent wastewater stream.

3.6.3 Anticipated Emissions from Flare and Biofilter

Anticipated air discharge volumes and constituents are outlined in Table 3.

Table 3: Anticipated Air Discharge Requirements

Parameter	Flaring	Biofilter
Peak flow rate (N m^3/d)	9,000	9,000
Average flow rate (N m^3/d)	4,500	4,500
Duration (days per year) – Nominal Estimate Only	360	5
Estimate of Bulk Air Discharge Constituents		
Carbon dioxide (and water vapour)	100%	40%-50%
Methane	0%	50%-60%

Notes:

1. *The biofilter is to be operated under contingency only and the discharges through the biofilter is given as maximum values under worst case.*
2. *Both the flare unit and biofilter are sized to handle 9,000 m^3/d of biogas.*

The biofilter emission characteristics will be similar to the biogas constituent, with the exception of hydrogen sulphide and other odour generating gases, which will be significantly reduced by the biofilter prior to discharge.

Carbon monoxide (CO) emissions may be expected as the flare temperature may not necessarily be above 850 °C at all times. Studies based on open landfill flares[2] suggest that carbon monoxide concentration in efficiently operated biogas flares is approximately 3 g/m^3 in exhaust gases.

3.7 Monitoring, Operation and Maintenance

Once operational, the treatment system will require regular monitoring and maintenance. A separate Operation and Maintenance Manual (O&M manual) will be prepared for the system. This O&M manual will include, but not be limited to:

- Health and safety considerations and requirements;
- A description of wastewater treatment system;
- System layout diagrams and drawings;
- Discharge details and criteria;
- Solids management and gas management system details;
- Stormwater and groundwater management system details;
- Process control;
- Operational limits;
- General operation and maintenance details;
- Pipework, pump and valve details;
- Asset resilience and maintenance procedures;
- Equipment schedules;
- Maintenance schedules;
- Contingency measures for pump failures, blockages, chemical spills and System Performance Problems.

3.7.1 Wastewater Solids Management

Microbial solids are a by-product of all wastewater treatment systems. Solids that accumulate in the wastewater treatment system will require periodic removal.

[2] DEP (2010). *Engineering Evaluation/Fact Sheet R13-2592B*, West Virginia Department of Environmental Protection, Division of Air Quality.

For the covered anaerobic lagoon solids accumulation will require a long term management plan (10 year plan or longer). If excavation and removal of anaerobic lagoon solids is required, any associated permits or consents will be sought as required.

Activated sludge from the SBR will be periodically pumped out and mixed with the treated wastewater stream to be irrigated to land under Environment Southland Resource Consent No. 201191. The resulting discharge will be consistent with the existing resource consent conditions.

4.0 Assessment of Environmental Effects

4.1 Positive Impacts

The proposed wastewater treatment plant will have significant environmental benefit by reducing the leachable nitrogen loading to the existing irrigation system. It will also reduce odour associated with the existing land treatment system.

4.2 Construction and Earthworks

The construction works have the potential to cause short-term adverse environmental effects. The following sections assess actual and potential effects on the environment associated with the proposed construction works.

4.2.1 Runoff

Prior to construction the contractor will prepare and give effect to an erosion and sediment control plan (ESCP) in accordance with the Environment Southland Builders Pocket Guide (Practical Advice on Managing Worksites and the Environment, 3rd Edition). The ESCP will include but not be limited to:

- silt fencing around any excavation areas which may generate sediment;
- mitigation of tracking of soil from trucks such as a wheel wash system;
- temporary runoff collection and decanting structures for containment of sediment laden stormwater runoff;
- covering of exposed earth surfaces as soon as is practicable to avoid erosion;
- monitoring of erosion and sediment control devices.

These measures are considered appropriate for the scale of the works and will ensure that sediment laden runoff is contained and or treated prior to discharge.

4.2.2 Vibration

Vibrating rollers and other standard vibro-compaction machinery may be utilised in the works. It is not expected that the short term use of this machinery will have any effect beyond the Blue Sky Meats site.

4.2.3 Construction Noise

Construction noise and hours of work associated with the proposed new WWTP will comply with Southland District Plan limits (Rule NSE.12).

4.2.4 Dust

There is potential for minor dust generation during the construction as the earthworks activity will be limited to excavation of in-situ material and deposition and compaction of material within the proximity of the cut area. Once the earthworks are completed there will be no potential for dust to occur, as all exposed areas will be either under synthetic liner or grassed.

The contractor will have a water cart and water supply available on-site for dust suppression as required. All exposed earth surfaces will be covered as soon as practicable to minimise dust generation potential.

4.2.5 Traffic

There will be some increased vehicle movements to the site during construction of the treatment facility, however once operational, traffic movements associated with ongoing management will be unaffected.

4.3 Discharges to Air and Odour

The collected biogas will destroyed by combustion (thermal oxidation) with the use of a flare system specifically designed for purpose. Thermal oxidation or destruction is considered one of the most effective techniques for odour control because it removes not only hydrogen sulphide but also methyl mercaptan and practically any other objectionable odorous gas that could be present in the biogas. Flaring essentially eliminates all odours.

The discharge of contaminants into the air from the proposed biogas flare system will be combustion by-products, namely carbon dioxide, small amounts of oxides of nitrogen and sulphide and water. There is generally no objectionable odour associated with the combustion of biogas.

A biofilter will also be constructed at the site as a contingency system. Biofilters are a widely accepted method for odour control and all odorous gases are expected to be removed to levels that are deemed no longer objectionable at the site boundaries.

The proposed biogas collection and flaring system has been designed to ensure that the discharge will not result in an objectionable odour effect at or beyond the boundary of the subject property.

From the SBR lagoon, the discharges to air will be carbon dioxide and this presents no odour risk.

Spray drift resulting from the aerator operation in the SBR lagoon will be negligible. The spray zone will be limited to just above the water surface around the aerators in the SBR. The aerators will be located in the middle of the SBR with no potential for aerosols forming to the extent beyond the initial spray zone and the spray drift to occur beyond the edge of the SBR.

Once the WWTP is constructed the irrigation storage lagoon will hold biologically treated wastewater with low BOD_5. It is therefore unlikely that anaerobic conditions would develop, and no perceivable odour discharge is expected from the irrigation storage lagoon.

4.4 Noise

The aerated lagoon will produce minor noise through the use of the aerators. Noise levels at the outer batter of slope are expected to be less than 45 dBA.

4.5 Effects on Groundwater

4.5.1 Groundwater Quantity

The proposed dewatering system will draw the localised groundwater level down by a maximum of approximately 1 - 1.5 m (based on the estimated high groundwater level outlined in Section 2.4). The zone of influence of the groundwater dewatering system is expected to be limited to the immediate area of the WWTP, in the order of 20 m beyond the perimeter of the dewatering drains.

No effects are expected on other groundwater users, as the drawdown effect will be localised, and nearby production bores generally draw water from deeper aquifers (Section 2.4).

4.5.2 Groundwater Quality

The proposed wastewater lagoons will be lined with a 1.5 mm thickness HDPE liner. The liner material will be subject to a manufacturer's guarantee of 20 years minimum design life applicable to water holding applications and use for wastewater containment.

A leak detection system will be installed and monitored to provide first warning of any leakage which may occur in accordance with the site O&M manual.

This containment system is at least equivalent to the industry standard level of groundwater protection for a WWTP of this type and groundwater environment.

4.6 Effects on Surface Water

4.6.1 Groundwater Dewatering

As outlined in Section 2.4, the water quality in the Waihopai River system is expected to reflect shallow groundwater quality, and as such it is not expected that the discharge of groundwater from the proposed groundwater dewatering system will affect surface water quality.

The estimated dewatering flowrate of approximately 1 – 6 L/s (based on nominal aquifer parameters determined from a visual assessment of the site soils) is expected to augment base flows in the surface water system and may provide some ecological enhancement.

4.6.2 Stormwater Discharge

Stormwater discharged to surface water from the aerated lagoon cover is expected to have similar water quality characteristics as roof water runoff, and will contain low levels of typical stormwater contaminants.

Stormwater runoff from gravel, slabs and other surrounding areas of the WWTP is expected to have similar characteristics to runoff from the wider Blue Sky Meats site. There will be no direct pathways for wastewater contamination to occur in routine stormwater discharges. All air valves will be fitted with tubing to direct leakage back into the WWTP.

Any hazardous substances stored at the WWTP site will be contained or kept indoors in accordance with Blue Sky Meats protocol.

Stormwater will be discharged via pumping at a flowrate of approximately 4.5 L/s. This flowrate is expected to be less than the 2 year Average Recurrence Interval (ARI) 1 hour rainfall event runoff for the existing site area.

4.6.3 Wastewater Storage

The crest of the proposed SBR and Anaerobic Lagoon embankments will be approximately 2.5 to 3.0 m above the surrounding ground level (Drawing D002, Appendix A). The WWTP site is located adjacent to an existing farm drain; however is removed from the main floodplain of the Waihopai River and its tributaries. The drain invert is approximately 2-3 m below the ground level in the location of the proposed WWTP. Flooding of this drain, should it occur, is unlikely to reach the WWTP site. It is not expected that floodwater would overtop the lagoon embankments even in severe flood conditions.

The proposed lagoons will not divert any existing floodway or overland flow path.

4.7 Cultural and Archaeological Values

There are no anticipated issues associated with cultural and archaeological values. However, should any archaeological remains be uncovered during the minor excavation works proposed, all work will cease in the vicinity of the discovery and the New Zealand Historic Places Trust (NZHPT) will be contacted so that the appropriate action can be taken before any work continues.

5.0 Mitigation Measures

Adverse effects on the receiving environment associated with the proposal are being minimised and/or eliminated by the following mitigation measures:

i. Use of wastewater treatment technology that will reduce solids, organic and nitrogen loadings discharged to land via irrigation;

ii. Reduction of greenhouse gas emissions by controlled collection and combustion of biogas;

iii. Ensuring a contained physical extent for the wastewater treatment plant, including a site which avoids any negative visual, noise and aesthetic impacts and having the levels generally present prior to development of the wastewater treatment plant;

iv. Significantly reducing the potential for groundwater contamination with the use of a HDPE liner;

v. Minimising and/or controlling any discharges of silt and stormwater run-off during construction;

vi. Eliminating the potential for objectionable odour by collecting all gases generated from the anaerobic treatment facility and controlled thermal destruction of all gases.

vii. Mitigation of potential fugitive dust occurring during construction by applying water or covering exposed earth surfaces.

viii. Restriction of work hours and maintaining acceptable levels of construction noise.

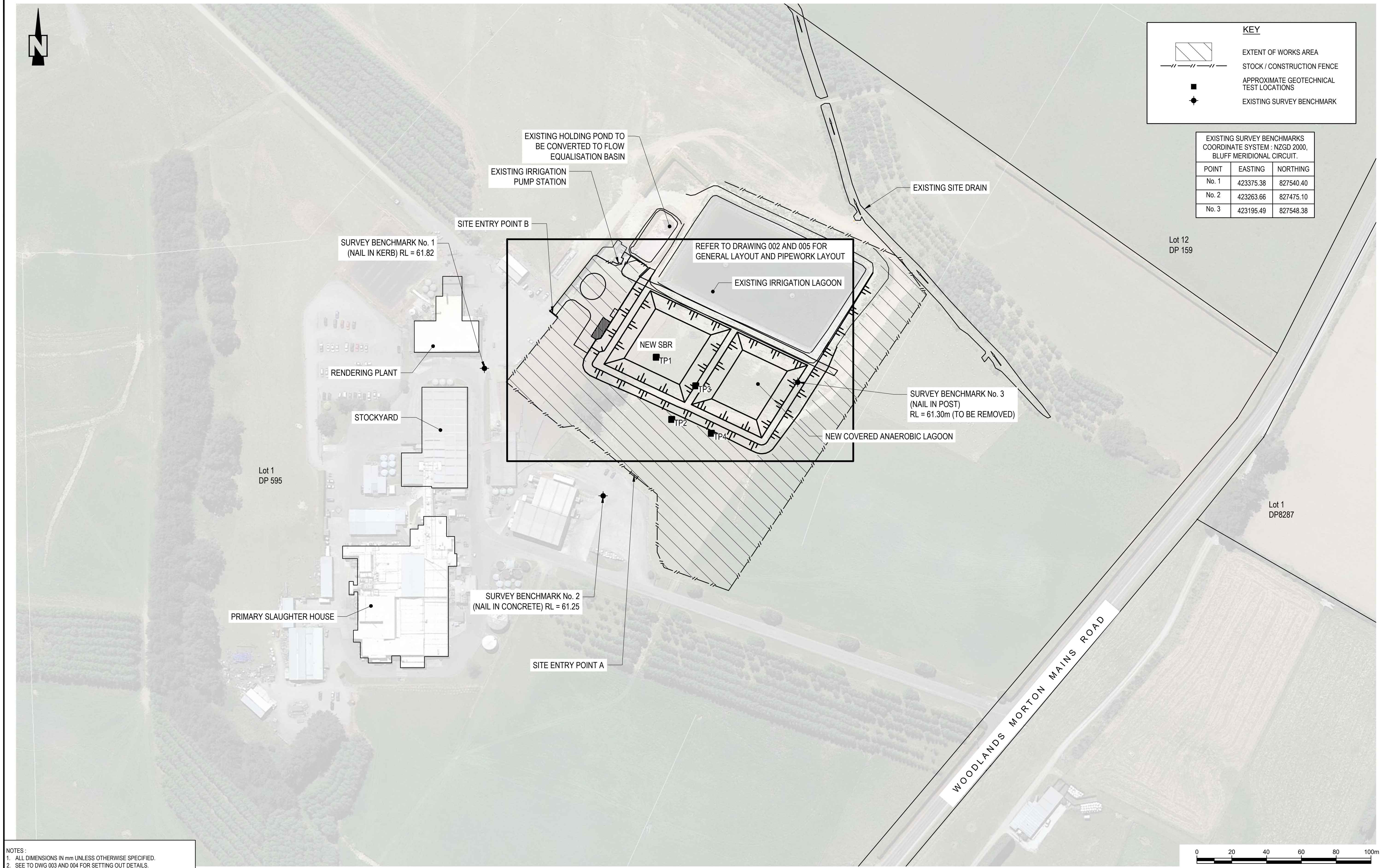
6.0 Concluding Statement

The proposed WWTP will have significant environmental benefit through reducing the leachable nitrogen loading (and other contaminant loadings) discharged to the existing irrigation field.

Potential negative environmental effects associated with the proposal, particularly during the construction phase, will be mitigated and managed as outlined in this report.

Appendix A

PDP WWTP Design Drawings



EXISTING SURVEY BENCHMARKS COORDINATE SYSTEM : NZGD 2000, BLUFF MERIDIONAL CIRCUIT.		
POINT	EASTING	NORTHING
No. 1	423375.38	827540.40
No. 2	423263.66	827475.10
No. 3	423195.49	827548.38

NOTES :
1. ALL DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED.
2. SEE TO DWG 003 AND 004 FOR SETTING OUT DETAILS.
3. COORDINATE SYSTEM: NZGD 2000, BLUFF MERIDIONAL CIRCUIT. LEVEL DATUM: MEAN SEA LEVEL DUNEDIN-BLUFF VERTICAL DATUM 1960
4. THE IDENTITY AND LOCATION OF ANY SERVICES SHOWN ON THIS DRAWING CANNOT BE GUARANTEED TO BE COMPLETE OR ACCURATE.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL SERVICES PRIOR TO UNDERTAKING ANY EXCAVATION.

SOURCE:
1. SURVEY DATA SUPPLIED BY BONISCH CONSULTANTS LTD. 181102 6700 RevB, SURVEYED ON 08/08/2018 AND 26/10/2018
2. AERIAL IMAGERY (FLOWN 01/13/2018) DERIVED FROM GOOGLE EARTH PRO (MAY NOT BE SPATIALLY ACCURATE)

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CLIENT: BlueSkyMeats

PROJECT: NEW WASTEWATER TREATMENT PLANT

TITLE: SITE PLAN

PROJECT NO. : A03220201
SCALE 1:2,000 (A3)
SHEET : OF :
DRAWING NO. : 001
REV : 0

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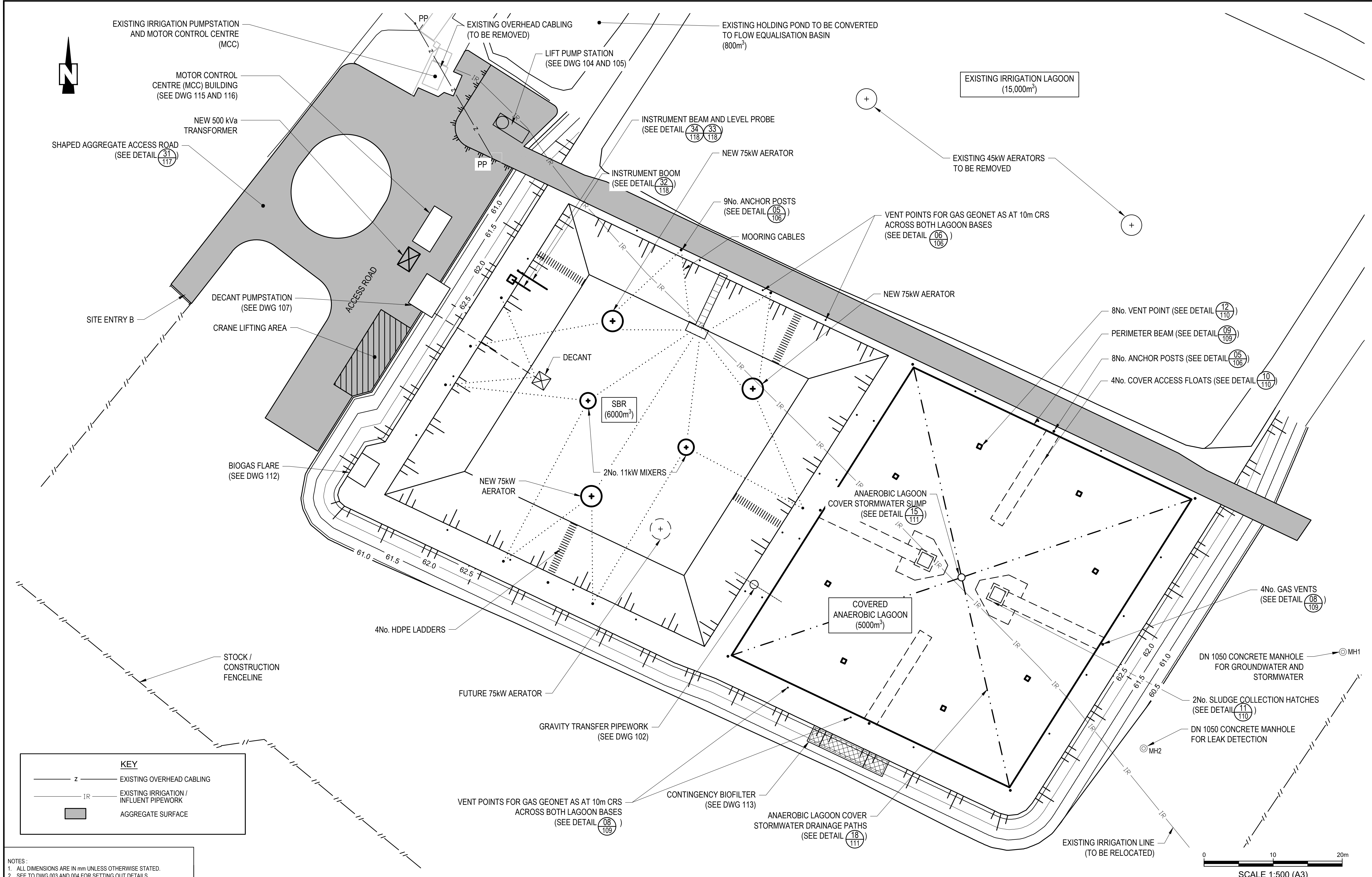

NOTES :
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CLIENT: BlueSkyMeats

PROJECT: NEW WASTEWATER TREATMENT PLANT

TITLE: GENERAL SITE LAYOUT

PROJECT NO. :	SCALE	SHEET : OF :	DRAWING NO. :	REV :
A03220201	1:500 (A3)		002	0

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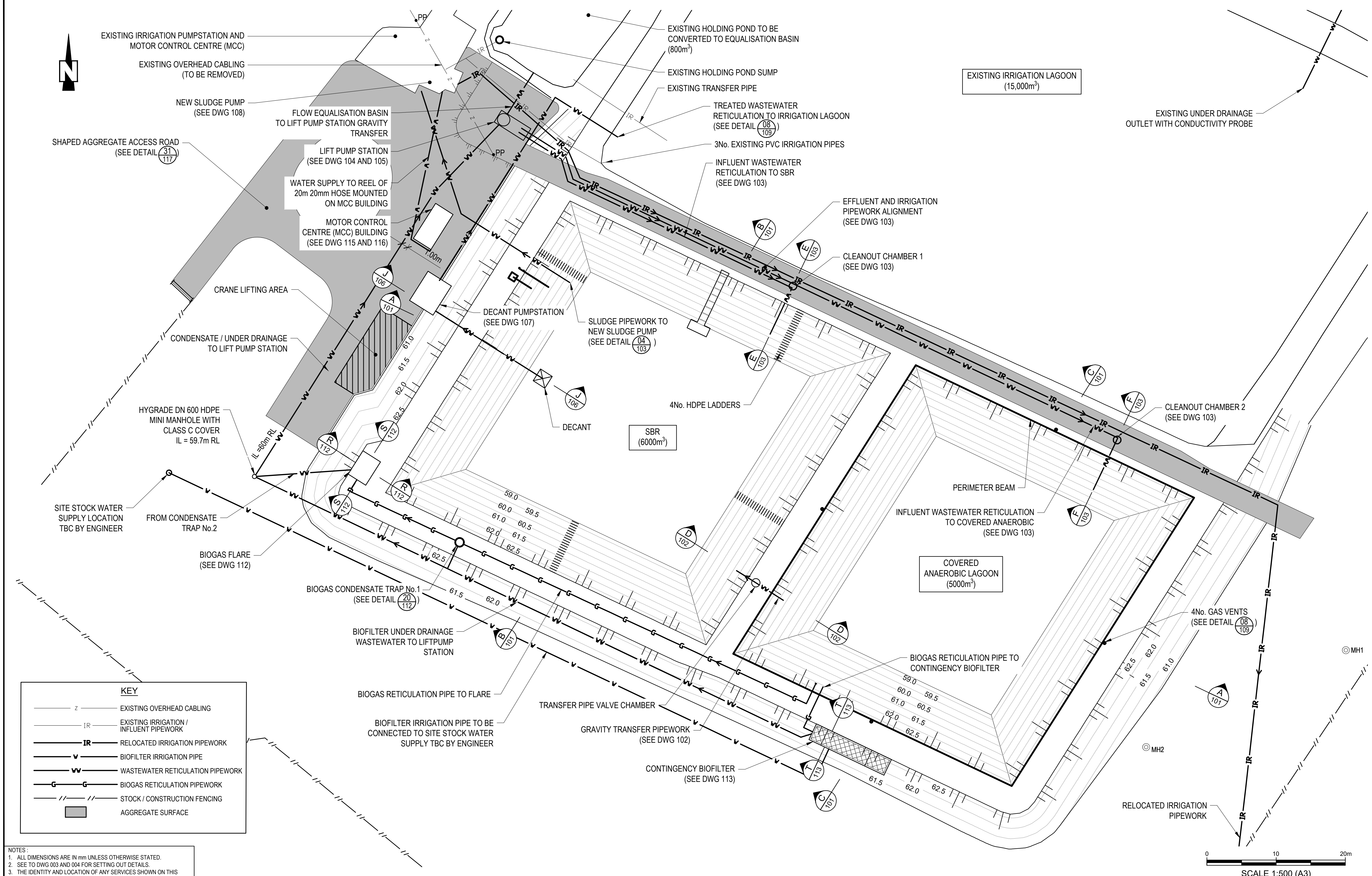

KEY

— Z —	EXISTING OVERHEAD CABLING
— IR —	EXISTING IRRIGATION / INFLUENT PIPEWORK
— IR —	RELOCATED IRRIGATION PIPEWORK
— V —	BIOFILTER IRRIGATION PIPE
— W —	WASTEWATER RETICULATION PIPEWORK
— G —	BIOGAS RETICULATION PIPEWORK
— // —	STOCK / CONSTRUCTION FENCING
▭	AGGREGATE SURFACE

NOTES :
1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
2. SEE TO DWG 003 AND 004 FOR SETTING OUT DETAILS.
3. THE IDENTITY AND LOCATION OF ANY SERVICES SHOWN ON THIS DRAWING CANNOT BE GUARANTEED TO BE COMPLETE OR ACCURATE.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL SERVICES PRIOR TO UNDERTAKING ANY EXCAVATION.

SOURCE:
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CLIENT: BlueSkyMeats

PROJECT: NEW WASTEWATER TREATMENT PLANT

TITLE: PIPEWORK LAYOUT

PROJECT NO. : A03220201 | SCALE 1:500 (A3) | SHEET : OF : | DRAWING NO. : 005 | REV : 0

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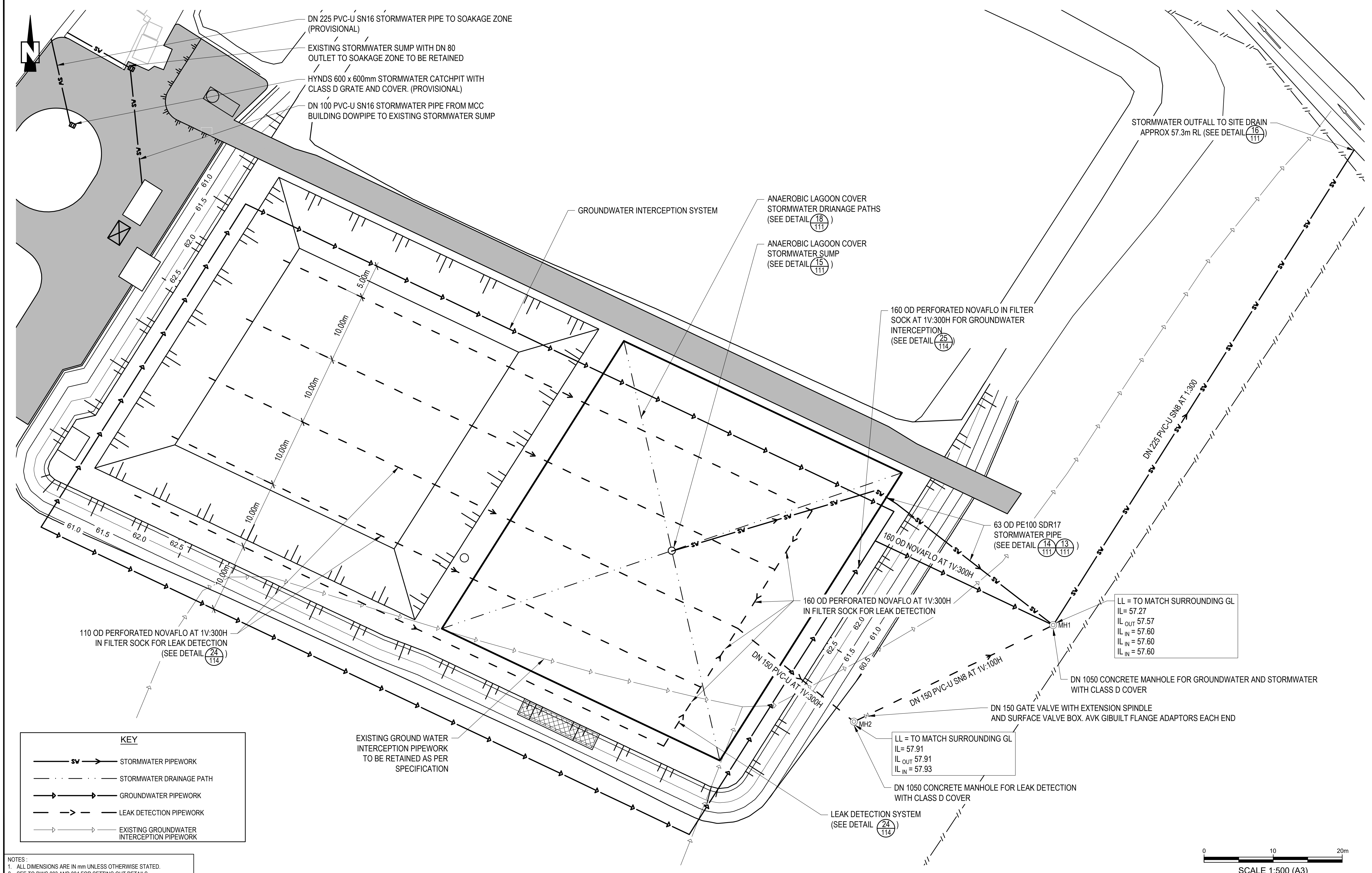

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CLIENT: BlueSkyMeats

PROJECT: NEW WASTEWATER TREATMENT PLANT

TITLE: STORMWATER AND GROUNDWATER LAYOUT

PROJECT NO. : A03220201 | SCALE 1:500 (A3) | SHEET : OF : | DRAWING NO. : 007 | REV : 0

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solutions for your environment

15 January 2019

Kelwyn Osborn
Southland District Council
PO Box 903
INVERCARGILL 9840

Dear Kelwyn

RESPONSE TO SECTION 92 REQUEST FOR ADDITIONAL INFORMATION: RESOURCE CONSENT APPLICATION – 2018/53297. REFERENCE 360/10/18/297 KELWYN OSBORN

1.0 Introduction

Blue Sky Meats (N.Z.) Limited (Blue Sky Meats) has lodged an application for Land Use Consent on 14 December 2018 to construct and operate a new Wastewater Treatment Plant (WWTP) at their meat processing site at 729 Woodlands Morton Mains Road, Morton Mains. Southland District Council has since submitted a request for further information on 9 January 2019, pursuant to Section 92 of the Resource Management Act 1991.

This letter report provides responses to the three items raised within the Section 92 request.

2.0 Response to Items 1-3

1. 'Please provide a description of the planned earthworks – depth of cut and height of fill.'

Section 3.2 of the PDP Assessment of Environmental Affects (AEE) report dated 13 December 2018 highlights the primary components of the proposed construction works. Balanced cut-to-fill earthworks will be carried out to form the two new treatment lagoons (expected to be approximately 5,000 m^3 based on earthworks modelling undertaken by PDP), with part of the resulting water storage volume provided below the existing ground level and part retained above existing ground level.

The proposed finished invert level of the treatment lagoons (58.7 m RL) will be approximately 1.9 m below the average existing surrounding ground level. The maximum excavation depth will be approximately 2.1 m to allow for placement of a 200 mm imported sand layer at the base of the lagoons.

The proposed finished embankment crest level (62.7 m RL) will be approximately 2.1 m above the average existing ground level.

2. 'Will there be any spoil removed from site, or will all the material extracted be used or stored on site.'

It is expected that additional imported good quality earth clean fill may be required to supplement the excavated cut material in the event that unsuitable material is encountered for embankment formation or for blending with the excavated material to achieve the required compaction characteristics. It is not expected that there will be any surplus excavated material. In the unlikely event that surplus excavated material did result from the earthworks, then this material will be used on site.

3. 'Provide an assessment of the soil disturbance in the HAIL site against the NES for Assessing and Managing Contaminants in Soil to Protect Human Health and how Pattle Delamore conclude this complies with activity Rule 8(3).'

Please refer to the accompanying PDP Hail Assessment letter report dated 15 January, 2019.

3.0 Limitations

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Blue Sky Meats (N.Z.) Ltd. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions Blue Sky Meats (N.Z.) Ltd for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

Yours faithfully

PATTLE DELAMORE PARTNERS LIMITED

Prepared by

Josh Lotter
Environmental Engineer

Reviewed by

Andrew Dean
Senior Environmental Engineer

Approved by

Daniel Garden
Technical Director – Water Infrastructure

BLUE SKY MEATS (N.Z.) LTD

MORTON MAINS PROCESSING PLANT

Resource Consent Application and Assessment of Environmental Effects

30 June 2022

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

REPORT INFORMATION

Report Status	Final
Our Reference	MDL000530
File Location	Blue Sky Meats (NZ) Ltd / 000530 Waste Water Consent Strategy / 09 Consent Renewal Application
Author	Nicolai Berry
Review By	Doyle Richardson and Claire Hunter
Version Date	30 June 2022

A

PART A

Resource Consent Application

FORM 9

APPLICATION FOR RESOURCE CONSENT

Sections 88 and 145, Resource Management Act 1991

To **Environment Southland**

1. **Blue Sky Meats New Zealand Limited (BSM) apply for the following types of resource consents:**

All necessary resource consents to authorise the continued operation of the BSM lamb and sheep processing plant, and ancillary meat rendering plant, at 729 Woodlands-Morton Mains Road, Morton Mains, Southland, including, but not necessarily limited to:

Under the Operative Regional Water Plan for Southland:

- A water permit for the abstraction of groundwater from a confined aquifer where the rate of take is greater than 2 litres per second; and
- A discharge permit for the discharge of contaminants or water into water.

Under the Proposed Southland Water and Land Plan:

- A water permit for the abstraction of groundwater from a groundwater management zone at a rate that exceeds the permitted volumes and rates;
- A discharge permit for the discharge of wastewater from industrial premises onto or into land where contaminants may enter water;
- A discharge permit for the discharge of land drainage water and stormwater to water; and
- A water permit for the take of groundwater for the purpose of dewatering

Under the Regional Air Quality Plan for Southland (1999):

- A discharge permit for:
  - The discharge of contaminants to air at a rate of heat release exceeding 5 MW;
  - The rendering of animal matter through the application of heat to animal matter; and
  - The discharge of contaminants to air from foulwater treatment processes with a design capacity population equivalent for Biochemical Oxygen Demand (BOD) of 10,000 people or more.

2. The activity to which the application relates (the proposed activity) is as follows:

BSM owns and operates the lamb and sheep processing plant, and ancillary meat rendering plant located at 729 Woodlands-Morton Mains Road, Morton Mains, Southland.

BSM currently hold nine resource consents issued by Southland Regional Council (**Environment Southland**) to operate the Plant on the Site, of which eight expire on 31 December 2022. This application relates to the renewal of six of those resource consents which relate to the following activities:

- The take of groundwater (for a meat processing plant, and a rendering and blood drying plant);
- The take of groundwater, via the groundwater dewatering system and leak detection system for the wastewater treatment plant;
- The discharge of wastewater and biosolids to land via a spray irrigator (from the meat processing plant, and rendering plant) and the discharge of screened stockyard solids, paunch, and sand and grit to land via a muck spreader;
- The discharge of contaminants to air (from a meat processing plant, wastewater treatment system, rendering and blood drying plant and associated boilers) that combines two existing air discharge consents; and
- The discharge of land drainage water and stormwater to water.

Overall, this Assessment of Environmental Effects (**AEE**) is in support of the applications to renewal the consents for these activities such that the Plant can continue to operate with appropriate environmental controls and contribute in a major way to the social and economic wellbeing of the surrounding community.

BSM are seeking to replace these resource consents for a term of 35 years. This suitably reflects BSM's significant existing investment in the Plant and the recent investment they have committed to the wastewater treatment plant upgrade.

Of note, BSM will continue to reduce environmental effects and emissions through the de-commissioning of one of two coal-fired boilers on the Site by August 2024. This is in accordance with government direction and legislation and will provide decarbonisation benefits and air quality discharge improvements.

3. The site at which the proposed activity is to occur is as follows:

729 Woodlands-Morton Mains Rd, Morton Mains, Southland, within the land parcel legally described as Lot 1 DP 14802, Pt Lot 7 DP 159, Pt Lot 8 DP 159, Lot 1 DP 595 owned by Blue Sky Meats (N.Z.) Limited.

Furthermore, the following third-party owned land will be used for the irrigation of treated wastewater:

- Leonard Donald Ward and Deveron Trustees Limited: Lot 9 DP 159, Lot 12 DP 159, Lot 13 DP 159, Lot 292 DP 155, Lot 293 DP 155;
- David Alan Burnett, Graham Colin Ward, Leonard Donald Ward, Paula Jane Ward and Deveron Trustees Limited: Lot 1 DP 12194; and
- Graham Colin Ward and Vicki Maree Ward: Lot 1 DP 8287

4. The full name and address of each owner or occupier (other than the applicant) of the site to which the application relates are as follows:

The Blue Sky Meats (N.Z.) Limited is the owner and occupier of the land associated with the Morton Mains Plant.

The third-party owned land used for the irrigation of treated wastewater, biosolids, stockyard solids and paunch to land is owned by the following:

- Leonard Donald Ward and Deveron Trustees Limited: Lot 9 DP 159, Lot 12 DP 159, Lot 13 DP 159, Lot 292 DP 155, Lot 293 DP 155;
- David Alan Burnett, Graham Colin Ward, Leonard Donald Ward, Paula Jane Ward and Deveron Trustees Limited: Lot 1 DP 12194
- Graham Colin Ward and Vicki Maree Ward: Lot 1 DP 8287

5. There are no other activities that are part of the proposal to which this application relates.

6. No additional resource consents are needed for the proposal to which this application relates.

7. I attach an assessment of the proposed activity's effect on the environment that—

(a) includes the information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and

(b) addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and

(c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

8. **I attach an assessment of the proposed activity against the matters set out in Part 2 of the Resource Management Act 1991.**

9. **I attach an assessment of the proposed activity against any relevant provisions of a document referred to in section 104(1)(b) of the Resource Management Act 1991, including the information required by clause 2(2) of Schedule 4 of that Act.**

10. **The value of the investment of the existing consent holder is considerable. BSM is a major contributor to the local economy, employing over 350 staff throughout the season and providing an essential service to the local farming community. BSM has invested $40 million into the Processing Plant and surrounding farmland to ensure that an effective and efficient operation is maintained at all times. Between 2018 – 2022 BSM undertook a substantial upgrade of the wastewater treatment plant, consisting of a significant financial investment of $4.7 million.**

11. **I attach all the information required to be included in this application by the Operative Southland Water Plan, the Proposed Southland Water and Land Plan, The Regional Air Quality Plan for Southland, The Resource Management Act 1991, or any regulations made under that Act:**

    - The Assessment of Environmental Effects;
    - Records of Title;
    - Assessment of Effects of the Discharges to Air – Beca;
    - Assessment of the Proposed Discharge of Treated Wastewater, Biosolids, Stockyard Solids and Paunch to Land - Pattle Delamore Partners Limited;
    - Assessment of the Proposed Abstraction and Use of Groundwater at the site - Pattle Delamore Partners Limited;
    - Assessment of Environmental Effects Technical Report – New Wastewater Treatment Plant for Blue Sky Meats, Morton Mains - Pattle Delamore Partners Limited;
    - Blue Sky Meats Ltd Wastewater Treatment Plant Operation Consents - Pattle Delamore Partners Limited;
    - Blue Sky Pastures Energy Transition Accelerator Study Report – Transition Opportunity Assessment for the Morton Mains site – Beca;
    - Blue Sky Meats Morton Mains Processing Plant Resource Consent Applications – Summary Document for Consultation;
    - Public Health Southland Feedback on Summary Document for Consultation; and

Date: 30 June 2022

Signature:

Doyle Richardson, Mitchell Daysh Limited, on behalf of Blue Sky Meats Limited.

Address for Service:	Blue Sky Meats Limited c/- Mitchell Daysh Limited PO Box 489 Dunedin 9054
Contact person:	Doyle Richardson
Telephone:	027 537 8175
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B

PART B

Assessment of Environmental Effects

1 INTRODUCTION

1.1 BLUE SKY MEATS LIMITED

Blue Sky Meats Limited (**BSM**) owns and operates a lamb and sheep processing plant, and ancillary meat rendering plant (together, **the Plant**) located at 729 Woodlands-Morton Mains Road, Morton Mains, Southland (**the Site**), legally described as Lot 1 DP 595. The Site is shown below in **Figure 1**.

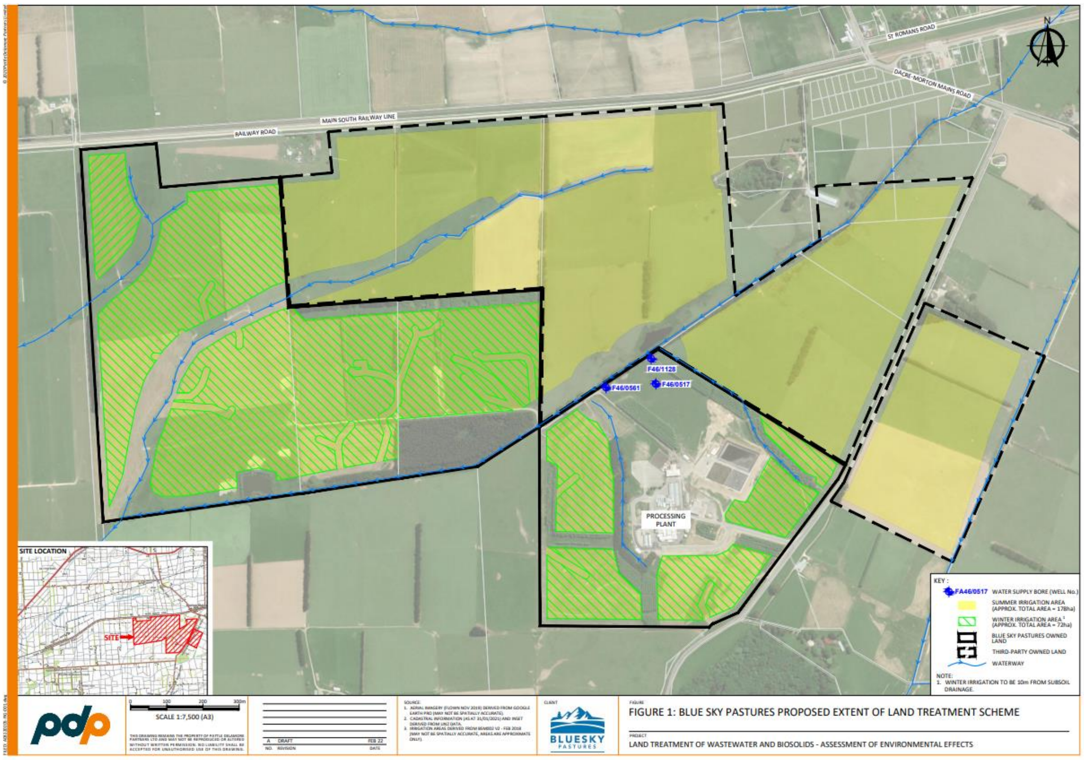

Figure 1: Blue Sky Meats Morton Mains Plant

Operations started in 1987 at the present site, and now 30 years later BSM has gained a strong reputation by providing high-quality primary products to national and international markets.

BSM sources raw material from a network of farmers and the Plant is an essential component supporting these farmers and their families and boosting Southland's agricultural sector. BSM forms an important part of the local, regional, and national economy, employing over 350 people in Southland, with an Auckland based Sales Team of four. During the peak season, the Plant processes up to 27,750 stock units per week and operates for 20 hours a day across a six-day operation during peak periods. The Site also undertakes rendering for meat, blood and bone meal and tallow.

1.2 OVERVIEW OF THE ACTIVITY

BSM currently hold nine resource consents issued by Southland Regional Council (**Environment Southland**) to operate the Plant on the Site, of which eight expire on 31 December 2022. This application relates to the renewal of six resource consents[1] which relate to the following activities:

- The take of groundwater (for a meat processing plant and a rendering and blood drying plant);
- The discharge of wastewater and biosolids to land via a spray irrigator (from the meat processing plant and rendering plant) and the discharge of screened stockyard solids, paunch, and sand and grit to land via a muck spreader to BSM-owned land and third-party owned land;
- The discharge of land drainage water and stormwater to water;
- The take of groundwater, via the groundwater dewatering system and leak detection system, for the wastewater treatment plant; and
- The discharge of contaminants to air (from a meat processing plant, a wastewater treatment system, rendering and blood drying plant and associated boilers) that combines two existing air discharge consents.

BSM are seeking to replace these resource consents for a term of 35 years. Suitably recognising BSM's significant existing investment in the Plant, and the recent investment they have committed to the wastewater treatment plant upgrade, is vital in this context. A long consent term also suitably reflects the significant social and economic benefits this Plant provides in the local area and gives greater certainty that those benefits will endure.

Through the renewal of these resource consents, BSM will continue to reduce environmental effects and emissions through the de-commissioning of one of two coal-fired boilers on the Site by August 2024. This is in accordance with government direction and legislation[2] and will provide decarbonisation and air quality discharge improvements. It should be noted that BSM are applying for an increase in the existing particulate matter emission limits compared to that currently consented due to difficulties in achieving compliance with the existing limits. The discharge of particulate matter from the remaining

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1 The proposed activities can continue without the two other resource consent that are also expiring.

2 The government's preferred approach for existing fossil fuel-fired assets is to phase out coal in existing sites by 2037 for low and medium temperature processes through the consenting process.

boiler will be less than that currently consented for the two coal fired boilers combined after the removal of one of the two coal fired boilers in August 2024.

BSM has also made significant improvements to its infrastructure on site to reduce environmental effects through the upgraded Wastewater Treatment Plant (**WWTP**). Further information on this is provided in the following section.

Overall, this Assessment of Environmental Effects (**AEE**) is in support of the applications to renew the consents for these activities such that the Plant can continue to operate with appropriate environmental controls and contribute in a major way to the social and economic wellbeing of the surrounding community.

The legal descriptions of the various properties associated with the resource consent applications by BSM for the discharge of treated wastewater, biosolids, stockyard solids and paunch to land at the site of 729 Woodlands-Morton Mains Road, Morton Mains are detailed in **Table 1** below.

Table 1: Property Details

Property Owner	Legal Description	Record of Title
BSM-owned land	• Lot 1 DP 14802; • Pt Lot 7 DP 159; • Pt Lot 8 DP 159; and • Lot 1 DP 595;	SL9C/43 SL12A/102
Third-party owned land (L. Ward, Deveron Trustees Limited)	• Lot 9 DP 159; • Lot 12 DP 159; • Lot 13 DP 159; • Lot 292 DP 155; and • Lot 293 DP 155	SLA4/1013
Third-party owned land (D. Burnett, G. Ward, L. Ward, P. Ward, Deveron Trustees Limited)	• Lot 1 DP 12194	SL9C/42
Third-party owned land (G. Ward, V. Ward)	• Lot 1 DP 8287	SL3A/935

The Record of Titles for these properties are provided as **Appendix A** of this AEE.

1.3 KEY SITE IMPROVEMENTS FOR RECONSENTING

Preparation for the renewal of these consents commenced in early 2017 / 2018 when changes to the current wastewater treatment operation at the Site were identified as being necessary. A review of the wastewater system indicated difficulties in adequately managing the nitrogen load within the wastewater that was being applied to the land via irrigation.

In 2019, BSM constructed substantial upgrades to the onsite wastewater treatment facility which was commissioned in January 2020. This upgrade was to allow the Plant to properly operate at full capacity, and to reduce nitrogen loading to the land treatment area.

This WWTP upgrade is a key action to assist in securing new resource consents for the Site, which will provide long-term security for the Site and allow the continuation of necessary investment to be undertaken.

A summary of the pre-2019 and post-2019 wastewater systems and further detail on the upgraded WWTP is provided in Section 2.3 of this AEE.

BSM has also implemented other site improvements including riparian planting to assist in restoring the waterways on the Site and upgrades to the rendering plant ventilation and odour control system since 2019.

1.4 REPORT STRUCTURE

This AEE has been prepared to accompany the resource consent applications by BSM to Environment Southland to enable the ongoing operation and maintenance of the Plant at the Site. This AEE addresses the matters BSM is required to address in these consent applications by Schedule 4 of the Resource Management Act (**RMA**). It is set out in 12 sections as follows:

Section 1 This introduction provides background to the proposal, an introduction to BSM, key site improvements and the structure of this AEE.

Section 2 Provides a description of the Morton Mains Plant and activities.

Section 3 Provides a description of the proposal.

Section 4 Describes the environmental setting for the proposed activities.

Section 5 Sets out the resource consent requirements for the proposal.

Section 6 Provides an assessment of environmental effects associated with the proposal.

Section 7 Provides a summary of the measures proposed by BSM to avoid, remedy or mitigate any actual or potential effects on the environment, and proposed monitoring.

Section 8 Provides an overview of how alternative means of undertaking the proposed discharge activities have been considered and why the proposed discharge activities are considered to be the best practicable option.

Section 9 Details the consultation undertaken by BSM.

Section 10 Sets out the statutory framework within which the resource consent applications have been made and assesses the proposal in relation to the provisions of the RMA and the relevant provisions of the statutory planning documents administered by Environment Southland.

Section 11 Addresses notification matters in accordance with Sections 95A – 95E of the RMA.

Section 12 Provides a concluding statement.

Various technical assessments have been commissioned by BSM to support this AEE. They are appended to this AEE and are referenced throughout this document as necessary.

2. DESCRIPTION OF THE CURRENT MORTON MAINS PLANT ACTIVITIES

This section provides a description of the activities which are undertaken at the BSM Morton Mains Plant.

2.1 OVERVIEW

A range of processes are required to be undertaken by BSM on the Site to support the processing activities – these include a meat processing plant, an animal by-product rendering plant and a blood drying plant. Furthermore, a wastewater treatment plant treats wastewater from the Site before irrigation to BSM and privately owned land around the Plant. These processes as currently being undertaken and as would continue to be undertaken under the new consent are summarised in the sections below.

The site layout with the main process units is shown in **Figure 2** below.

Figure 2: BSM Site Layout

2.2 PRODUCT PROCESSING

As discussed above, the BSM processing plant receives and processes a combination of lamb, sheep, bobby calves, and goats to provide a range of specialist cuts primarily for export. Operations on the Site include:

- Edible product processing, stockyards / holding areas, slaughter and boning processes and chilled and frozen storage;
- On-site rendering, which can process up to 5,750 kg of raw material per hour (the plant typically processes 4,500 kg/hr), with associated blood drying; and
- A skin salting operation.

Current production capacity in peak season can process up to 30,000 stock units per week (20 hours per day for six days per week) and up to 900,000 animals per annum. However, at present, the site is processing up to 27,750 animals per week across a six-day operation during peak periods. In the 2020 / 2021 season, the Site processed a total of 807,160 animals.

Production runs from the end of July to early June each year, with processing typically peaking from January through to May and dropping off in June. In the 2020 / 2021 season, the site moved from a 10-month to an 11-month processing season and is targeting 12-month processing to ensure that global chilled customer demand can be met. The Plant closes for a brief period between Christmas and New Year.

2.3 WASTEWATER TREATMENT PROCESSES

Meat processing wastewater contains diluted blood, protein, and fats and solids which are high in organic material and nutrients (nitrogen and phosphorus). A WWTP treats the meat processing and rendering wastewater prior to irrigation to land.

BSM upgraded the onsite wastewater treatment system in 2019, with the upgraded plant commissioned in January 2020. Refinements to the treatment system continued until January 2021. A summary of the pre-2019 and post-2019 wastewater systems is provided in the sub-sections below.

2.3.1 Pre-2019 Wastewater System

Prior to the upgrades, the wastewater treatment provided on the Site was limited, and was over reliant on land treatment to provide primary, secondary and tertiary treatment functions. As a result, the pre-2019 wastewater system was loading fats, oils, greases and nitrogen at rates higher than the pasture and soil systems could manage. This resulted in unsustainable environmental effects, including:

- Elevated levels of nitrogen into shallow groundwater and the connected surface water; and
- Binding of soil pores with fats, oils and greases to levels that reduced hydraulic capacity and resulted in wastewater runoff.
- Overall, the system was performing poorly.

Figure 3 below illustrates the Pre-2019 Wastewater System.

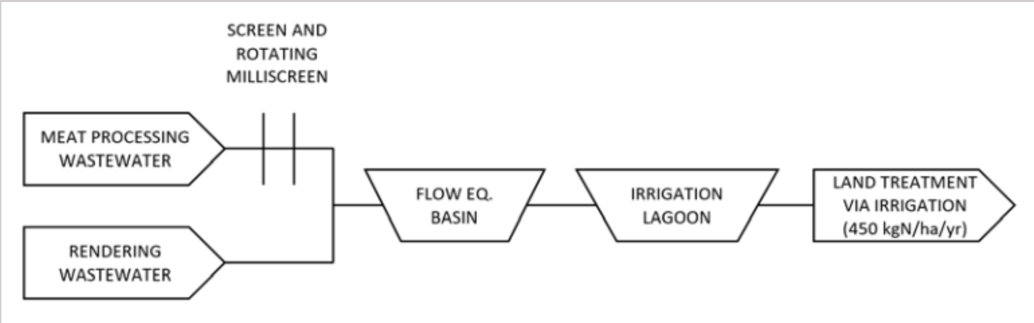

Figure 3: Process Diagram of Pre-2019 Wastewater System

2.3.2 Post-2019 Wastewater System

The post-2019 wastewater treatment system includes primary treatment via a covered anaerobic lagoon and secondary treatment via biological nitrogen removal in a Sequencing Batch Reactor (**SBR**) wastewater treatment plant. This treatment process provides for substantial removal of organic matter (including fats, oils and greases) as biogas via a flare, and substantial removal of nitrogen as inert nitrogen gas.

The upgraded WWTP includes the following components (and is illustrated in **Figure 4** below):

1. Screening of all meat processing wastewaters generated from the site to remove larger solids prior to further treatment;

2. Screened stockyard solids are recovered separately and disposed of onto land as solids. All non-stockyard solids (bone, meat offcuts and marbled fat pieces) recovered from screening processes are incorporated into rendering raw material. Any sand and grit recovered is disposed of onto land;

3. Wastewater storage to help provide consistent flows into the wastewater treatment plant and to assist with spill management;

4. A covered anaerobic lagoon to reduce the loads associated with solids, organic matter and oil and grease. This lagoon also allows for the conversion of organic nitrogen into mineralisable ammoniacal nitrogen which can be treated as discussed below. The lagoon is covered so all biogas and associated odorous gasses produced in the anaerobic lagoon are collected and then combusted in a dedicated biogas flare unit. A contingency biofilter is provided to treat the biogas in the event the biogas flare unit is inoperable, and the biogas requires discharge;

5. A biological nitrogen removal (**BNR**) activated sludge system operated as an SBR. The SBR consists of mechanical aeration supply and assists with reduction of ammoniacal nitrogen generated from the anaerobic treatment processes; and

6. Discharge of SBR decant (wastewater) into a dedicated irrigation holding lagoon that provides for storage of up to 15,000 m^3 of treated wastewater for land treatment. The lagoon is normally operated at a low water level to allow for storage during periods when the land treatment system soils may be too wet to allow discharge to land via irrigation.

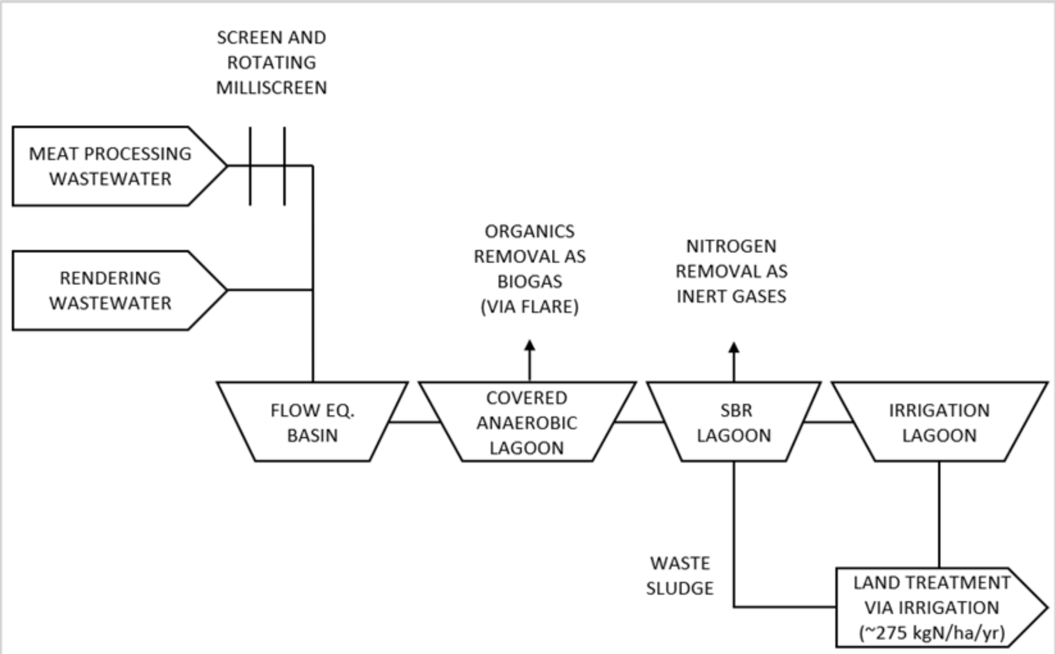

Figure 4: Process Diagram of Post-2019 Wastewater System

Under this system, land treatment is providing a secondary / tertiary polishing treatment function, where the hydraulic, nitrogen and phosphorus loads meet pastoral requirements, and are converted into biomass for export as supplementary feeds off farm (grass silage, hay, etc.).

These wastewater treatment system upgrades have resulted in a significant improvement in the removal of contaminants from the wastewater on site, with **Table 2** below highlighting the improvements for the following key contaminants:

Table 2: Pre and Post-2019 Wastewater Treatment Upgrades Performance

Parameter	Pre-WWTP Upgrade	Post WWTP Upgrade	Percent Removal
Biochemical Oxygen Demand (mg/L)	6,200	62	99%
Total Nitrogen (mg/L)	320	86	73%
Ammoniacal Nitrogen (mg/L)	145	10[4]	93%
Total Phosphorus (mg/L)	36	24	33%[3]
Fats, Oils and Grease (mg/L)	625	12	98%

Notes:

1. *Pre-WWTP upgrade based on average of monthly effluent monitoring concentrations for period 1 January 2013 to 31 December 2018.*
2. *Post-WWTP upgrade concentrations based on average of monthly effluent monitoring concentrations for period 1 July 2020 to 30 June 2021.*
3. *Phosphorus removal is in the wasted bacterial solids (biosolids). BSM recombines the biosolids with the treated wastewater prior to irrigation to the land treatment system via injection into the irrigation line. Therefore, the wastewater treatment system does not reduce phosphorus loading to the land treatment system relative to what has occurred historically.*
4. *BOD is not included in compliance monitoring, so this result is from effluent sampling on 20 October 2021.*

Overall, the WWTP can treat up to approximately 1,000 m^3 of wastewater per day.

Waste biosolids generated in the SBR are also discharged to land.

2.3.3 Groundwater Dewatering

A groundwater dewatering system comprised of subsoil drainage (permeable bedding and perforated pipelines) has been installed around the perimeter of the WWTP lagoons to lower groundwater locally beneath the lagoons permanently and passively. This dewatered groundwater, in combination with stormwater from the covered anaerobic lagoon cover, is then discharged to a nearby surface water drain. A leak detection underdrainage system has also been installed below the base of the WWTP lagoons. This leak detection system discharges to a manhole with a closed valve on the outlet. The leak detection system may intercept groundwater on the rare occasion the flux of groundwater exceeds the dewatering drain capacity. BSM personnel periodically inspect a manhole to check for the leakage of wastewater, and if groundwater is intercepted, this is confirmed in accordance with the site Operation and Maintenance Manual. Once it is confirmed that there is no indication of wastewater leakage, any groundwater intercepted by the leak detection system is discharged to the stormwater system (discussed in Section 3 of this AEE).

2.4 LAND TREATMENT SYSTEM MANAGEMENT

Following the treatment of the wastewater, BSM discharge the treated wastewater, biosolids, stockyard solids and paunch to surrounding pastoral land, comprised of both BSM owned pastoral land and third-party owned and operated farmland.

BSM own 130 ha of pastoral land, with approximately 77 ha of this land suitable for irrigation. This area is predominantly operated as a pastoral cut and carry system, with irrigation on this land proposed to occur year-round.

As discussed in Section 1.2 of this AEE, the BSM-owned land is legally described as the following:

- Lot 1 DP 14802, Pt Lot 7 DP 159, Pt Lot 8 DP 159, Lot 1 DP 595, Lot DP 14802.

BSM has consulted with the owners of, and has access arrangements in place, for 122 ha of third-party owned land. Approximately 101 ha of this land is suitable for irrigation. The area is predominantly operated for pastoral sheep and beef grazing (however the farming operations in this area are outside the direct control of the applicant). Irrigation on this land is proposed to occur during dry periods (October to March inclusive) when the treated wastewater, biosolids, stockyard solids and paunch is beneficial for grass growth.

As discussed, the third-party owned land is legally described as the following:

- Lot 9 DP 159, Lot 12 DP 159, Lot 13 DP 159, Lot 292 DP 155, Lot 293 DP 155 (L. Ward, Deveron Trustees Limited);
- Lot 1 DP 12194 (D. Burnett, G. War, L. War, P. Ward, Deveron Trustees Limited); and
- Lot 1 DP 8287 (G. Ward, V. Ward).

Irrigation during dry periods is preferred for third-party owned land as it:

- Has the least impact on soil drainage rates;
- Avoids exacerbation of pugging (which can occur with saturated ground conditions and heavy stock); and
- Applies the treated wastewater when it is beneficial for pastoral growth.

The land area for discharge of treated wastewater, biosolids, stockyard solids and paunch is illustrated in **Figure 1** above.

2.5 PROCESSES PRODUCING AIR DISCHARGES

The Plant and associated processes undertaken within the Site that produce discharges of contaminants and odour to air are summarised in the sections below.

2.5.1 Boilers

Two coal-fired boilers are operated at the Site to produce steam and hot water:

- A steam boiler (**RSB**) supplies steam to the rendering plant; and
- A hot water boiler (**HWB**) supplies hot water to the processing area for cleansing / sterilising purposes.

Key details of these boilers are outlined in **Table 3** below:

Table 3: Boiler Details

	Steam Boiler	Hot Water Boiler
Dimensions	20 m high with a diameter of 750 mm	18.6 m high with a diameter of 400 mm
Output	4.3 MW output (Although it is designed for 6 MW)	1.9 MW

Coal from Newvale Mine is used to fire the two boilers. This coal has been tested for the 12 months between July 2019 and August 2020, with results showing that the coal quality complies with the existing consent limits.

2.5.2 Salting Shed

Skins from the meat plant are salt cured in the salting shed. Salt is blended in treatment vessels with green sheep or calf skins for a minimum of one hour. Skins are then placed into cages for drainage before being graded and packed out during the following shift. Roughly the same number of skins each day are treated as stock processed at the Plant, with approximately 750,000 skins processed per annum.

2.5.3 Rendering Plant

4,500 kg / per hour (the site has capacity to process 5,750 kg/hr) of inedible animal by-products (meat, bone and offal) is rendered over two shifts for the production of tallow, and high-quality protein meat and bone meal. Additionally, 1000kg / per hour of blood is processed.

The majority of the by-products are generated from the onsite slaughter and boning operations; however, some raw materials (up to 90 tonnes / day) are brought in from other meat processing plants such as Silver Fern Farms Waitane and Finegand. All raw materials from other meat processing plants are processed fresh within 24 hours of kill and are acid dosed to aid in preservation of product before being dispatched from their plants to BSM.

A formal toll processing agreement is in place with Silver Fern Farms / Farm Brands which stipulates that all raw material must be delivered in a fresh state. Inspections by BSM staff are carried out on all raw material received each day. This includes a visual assessment of freshness and a pH test to confirm the material has been acid dosed.

The plant is contained within a purpose-built structure designed to contain odorous contaminants and the building is force-ventilated to comply with existing conditions. Point source vapours produced in meal and tallow cooking process in the rendering plant are collected and directed to plant biofilter with hot point sources passing to the biofilter via a condenser (See Section 2.5.5).

Figure 5: Continuous cooker in rendering plant

2.5.4 Blood Drier

Blood is transported from the slaughter board to the blood processing area. The blood processing system is fully contained with all point source air discharges vented to a condenser before being vented to the rendering plant biofilter. The blood processing room air discharges directly to the biofilter.

Figure 6: Rotary blood drier

2.5.5 Biofilter

The discharges to air from the tallow and meal cooking point sources in the rendering plant room and the blood drier are ducted via a condenser to the biofilter (see **Figure 7** below). Room air from each of the rendering and blood drying rooms is discharged directly to the biofilter.

A micro-organism community is present in the biofilter to remove odorous components from the biogas. The biofilter media consists of fine bark and lime mix. To maximise efficiency, the biofilter must be kept moist and maintained at a pH level of between 6 and 8, with the lime helping to maintain the pH of the media to allow for efficient removal of pollutants.

Figure 7: Plant Biofilter

2.5.6 Stockyards

Stock is transported to the plant in trucks and held in stockyards, then washed prior to slaughter. The stockyards are covered but have open sides to allow natural light and ventilation. The stock holding yards are elevated approximately 1 m above ground level and the stock are held in mesh floor pens, which allows faecal material to drop through onto a concrete slab that is graded and slopes towards a drain. The pens are washed regularly, with faecal material being hosed to the drain. This prevents the accumulation of faecal material under the stock holding area and prevents the onset of anaerobic activity and minimises the production of odours.

The effluent and washdown water from the yards are drained to a screen before being pumped to the WWTP for treatment.

3. DESCRIPTION OF THE PROPOSAL

This section provides a description of the activities for which consent is sought. It includes:

- An overview of the existing resource consents BSM holds to operate and undertake its activities on the Site;
- A description of the proposed take and use of groundwater for the meat processing plant and a rendering and blood drying plant;
- A description of the proposed discharge of treated wastewater, biosolids, stockyard solids and paunch to land;
- A description of the proposed discharge of land drainage water and stormwater to water;
- A description of the proposed take of groundwater for dewatering associated with the WWTP groundwater dewatering system and leak detection system; and
- A description of the proposed discharges to air.

3.1 EXISTING CONSENTS

To operate and undertake its activities, BSM currently hold nine resource consents that have been issued by Environment Southland. Eight of these resource consents expire on 31 December 2022. BSM are seeking to renew six of these resource consents which are summarised in **Table 4**Table 4 below. The proposed activities can continue without the two other resource consents that are also expiring.

Table 4: Existing Blue Sky Meats Consents to be Renewed

Consent No	Purpose
201190-V1	To take groundwater for a meat processing plant and a rendering and blood drying plant.
201191-V1	To discharge meat processing and rendering plant wastewater to land via a spray irrigator.
201193-V5	To discharge contaminants to the air from a meat processing plant, rendering and blood drying plant and associated boilers.
20181937-02	To take groundwater for the purpose of dewatering.
20181937-03	To discharge land drainage water and stormwater to water.
20181937-04	To discharge contaminants to air from a wastewater treatment system.

3.2 PROPOSAL TO RENEW CONSENTS

BSM is seeking to replace these resource consents for a term of 35 years.

The following sub-sections provide an overview of the activities for which consent is required (referred to together as "**the Proposal**").

3.2.1 Abstraction and Use of Groundwater

BSM currently take groundwater for the Plant water supply from three deep bores, with the bores screened within a deep confined aquifer interbedded within the Middle Gore Lignite Measures.

The current consent BSM holds sets out the maximum daily and weekly rates of water take from the three deep bores on the Site. This consent states that the rate of abstraction must not exceed:

- 1,200,000 litres per day; and
- 7,000,000 litres per week.

In seeking a new consent, BSM are proposing the following abstraction rate limits:

- 1,500,000 litres per day; and
- 7,000,000 litres per week.

This change would allow an additional 300,000 litres per day to be taken to meet peaks in processing demand. The inclusion of the same weekly total ensures that the increased take on some days is offset by a reduced take during the same week, and therefore that the longer-term sustainability of the water resource is maintained.

3.2.2 Proposed Discharge of Treated Wastewater, Biosolids, Stockyard Solids and Paunch to Land

BSM propose to discharge the following to BSM owned pastoral land and third-party owned and operated farmland:

- Treated wastewater and biosolids; and
- Screened stockyard solids, paunch, and sand and grit.

These areas of pastoral land are situated south of the intersection of Railway Road and Dacre-Morton Mains Road and adjacent to Woodlands-Morton Mains Road (Refer to **Figure 1** above).

BSM propose to maintain the current irrigation rates to within the measured capacity of the soils on the Site. These limits are proposed as follows:

- The maximum irrigator hydraulic application rate is proposed as 6 mm/hr;

- In the drier periods (October to March inclusive), to a maximum application depth of 35 mm per application event; and
- In the wetter periods (April to September inclusive), to a maximum application depth of 15 mm per application event.

3.2.3 Proposed Take of Groundwater for Dewatering

As discussed in Section 2.3.3 above, a groundwater dewatering system is located around the perimeter of the WWTP lagoons to lower groundwater locally beneath the lagoons on a passive and ongoing basis. A leak detection underdrainage system is also installed below the base of the upgraded WWTP lagoons. The leak detection system may on rare occasions intercept groundwater when the flux of groundwater exceeds the dewatering drain capacity. Any groundwater that is intercepted by this system is discharged to the stormwater system after BSM staff confirm there is no wastewater present.

3.2.4 Proposed Discharge of Land Drainage Water and Stormwater to Water

BSM propose to continue to discharge stormwater and dewatering water from the upgraded WWTP. Details of the groundwater dewatering and leak detection system are provided in Section 2.3.3.

With regards to stormwater, the primary impervious area associated with the upgraded WWTP is the covered anaerobic lagoon. Rainfall on the covered anaerobic lagoon cover is directed to a sump at the centre of the lagoon via preformed channels. From there, the stormwater is pumped to a manhole and discharged to the surface drain to the northeast of the site.

However, whilst consent is sought for the discharge of stormwater outlined above, it is noted that BSM are currently diverting stormwater from the covered anaerobic lagoon to the wastewater treatment system. This is due to pest birds congregating on the cover and impacting stormwater quality by the accumulation of excreta on the cover. If this pest problem is fixed in the future, the discharge of stormwater from the covered anaerobic lagoon to water will be resumed.

3.2.5 Proposed Discharges to Air

As shown in **Table 4** above, the Site currently operates under two consents to discharge combustion contaminants from two coal-fired boilers and to discharge odour from the Site. BSM propose to replace these consents with **one** new air discharge consent which will include all of the discharges to air from the Site, including from:

- Two coal-fired boilers that operate at the Site to produce hot water and steam – emissions from these boilers are predominantly in the form of contaminants such as fine particulate matter (PM_{10}), oxides of nitrogen (NO_X) and sulphur dioxide (SO_2);

- The processing plant: including rendering and skin salting – emissions are predominantly in the form of odorous compounds;
- The biofilter – These filters absorb noxious gases into a biofilm where microorganisms break down the gases into carbon dioxide, water and salts and use the energy and nutrients to grow and reproduce. Emissions are predominantly in the form of carbon dioxide (CO_2), water, salt, minerals and microbial biomass;
- The wastewater treatment plant, including the biogas flare and contingency biofilter – odour compounds may be generated during the treatment, storage and transfer of the wastewater through the anaerobic decomposition of organic material (carbohydrates, fats and proteins); and
- The application of the treated wastewater to land – odour is sometimes associated with the generation of hydrogen sulphide which is formed under anaerobic conditions.

4. ENVIRONMENTAL SETTING

This section of the AEE provides a summary of the environmental setting of the Site and the surrounding area. This description of the existing environment provides the context against which the actual and potential effects of the Proposal have been assessed.

A number of technical assessments have been commissioned by BSM to inform the description of the existing environment. These technical assessments are referenced, as appropriate, in the sections below and are appended to the AEE.

4.1 GENERAL WIDER SETTING

The BSM Site is located 25 km North-East of the Invercargill city centre at 729 Woodlands-Morton Mains Road, Southland (See **Figure 8** below). Key points to note include:

- The Site is presently zoned Rural under the Southland District Plan;
- The Site currently contains the long-standing operations of BSM;
- The Site is bounded by Woodlands-Morton Mains Road to the southeast and farmland on all other sides. The site area immediately surrounding the Plant is agricultural land owned by BSM, with the land use surrounding the BSM Site predominantly pasture;
- There are a number of rural residential properties within 500 m of the irrigation area. The processing plant and upgraded WWTP are generally hidden from view from neighbouring properties and from Woodlands-Morton Mains Road by existing mature trees;
- One dwelling lies approximately 500 m to the southeast of the BSM Plant (across Woodlands-Morton Mains Road), with multiple other dwellings located approximately 800 m to the south and north of the BSM Plant. Several other dwellings are located further to the north / northeast across Dacre-Morton Mains Road. **Figure 9** below shows the location of these dwellings in proximity to the BSM Plant;
- The closest residential zoned land to the Site is located 12 km to the northeast (the ‘Edendale Urban Zone’ under the Southland District Plan); and
- The Site is situated within the Waihopai River catchment.

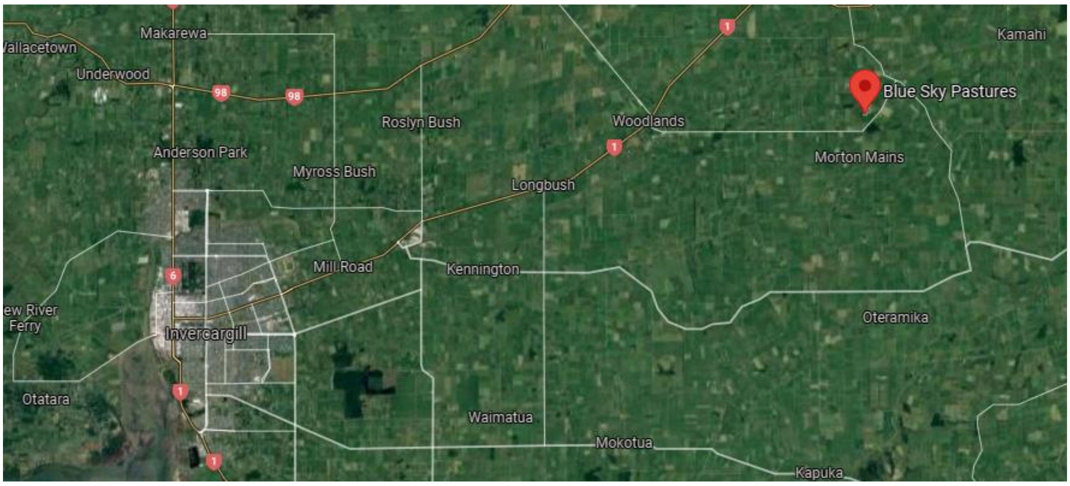

Figure 8: Blue Sky Pastures relative to Invercargill

Figure 9: Location of nearest dwellings to BSM Plant

4.1.1 Land Treatment Area

The majority of the proposed land treatment area (where treated wastewater, biosolids, stockyard solids and paunch are proposed to be discharged) is located between Railway Road and Woodlands-Morton Mains Road, with a small area east of Woodland-Morton Mains Road also utilised (see **Figure 1** in Section 1.1 of this AEE).

As discussed previously in Section 2.4, BSM owns part of the irrigation land with the remainder owned by a third party.

4.1.1.1 BSM-Owned Land

The BSM-owned land is predominately operated as a cut and carry operation, while sheep are grazed to clean up the buffer areas, surplus grass, and maintain pasture quality.

Cut and carry silage operations typically occur from October to April, depending on climate conditions and pasture yield, with three grass cuts usually completed each season. An external contractor is engaged to undertake cut and carry operations and to distribute the resulting silage / baleage to local landowners to be used on other properties.

4.1.2 Third-Party Owned Land

The third-party owned land is a sheep and beef operation with silage making. In 2020 – 2021, 800 ewes and lambs were run and up to 30 head of cattle in November to January.

The surrounding area is used for intensive sheep, dairy, and deer production, with limited cropping.

4.2 TOPOGRAPHY

The topography of the site is flat to gently undulating, and gently graded towards the tributaries which pass through the site. The overall grading is towards the south-eastern corner of the site.

The local topography is unlikely to have any significant effects on local meteorological conditions in the area.

4.3 BACKGROUND AIR QUALITY

Beca have completed an assessment of effects of discharges to air (**Beca Air Discharge Assessment**) (**Appendix B**). This assessment has included a description of the background air quality for the area surrounding the Site. In summary:

- There is currently no appropriate background monitoring data available to use for the consideration of contaminants from background sources. Instead, in accordance with MfE's "*Good Practice Guide for Assessing Discharges from Industry*", default background air quality values provided by Waka Kotahi NZ Transport Agency (**Waka Kotahi**) have been used to provide a conservative estimate of likely background concentrations.
- Furthermore, there are no default background air quality values in the MfE or Waka Kotahi guidance for PM_{10} (annual concentrations), $PM_{2.5}$ or Mercury, therefore:
    - Annual PM10 concentrations were calculated using the power law relationship in accordance with MfE guidance;
    - PM2.5 concentrations are primarily associated with emission combustion sources. Due to the rural nature of the surrounding environment, background

PM2.5 concentrations in the vicinity of the Plant are expected to be relatively low; and

  - The mercury emitted from the boilers is expected to be elemental mercury. Background elemental mercury concentrations around the Site are expected to be comparatively low as there are no known industrial or natural sources of mercury which will contribute to ambient air quality levels (other than the discharges from BSM coal-fired boilers). Therefore, the background concentration of mercury has been assumed to be the global average of 1.5 ng/m3 (i.e., 0.0015 µg/m3).

- Regarding SO_2 concentrations, these are almost solely associated with the combustion of coal. The only significant coal combustion sources in the area are the two boilers operated on site by BSM, therefore, background SO_2 concentrations in the vicinity of the site are expected to be negligible.
- The Site is located outside the Invercargill Airshed as gazetted by the National Environmental Standards for Air Quality (**NES-AQ**).

A summary of the background air contaminant concentrations used in this assessment is shown in **Table 5** below.

Table 5: Summary of Background Air Contaminant Concentrations

Contaminant	Averaging period	Default background concentration (µg/m^3)
PM_{10}	24 hours	19.8
	Annual (calculated)	6.1
NO_2	1 hour	37
	24 hours	23
$PM_{2.5}$	24 hours	13
	Annual (calculated)	4
SO_2	1 hour	0
	24 hours	0
Mercury	Annual	0.0015

4.4 CLIMATE

Pattle Delamore Partners Limited (**PDP**) have completed an assessment of the proposed discharge of treated wastewater, biosolids, stockyard solids and paunch to land (**The PDP Land Discharge Assessment**) (**Appendix C**). This assessment has included a description of the rainfall and potential evapotranspiration conditions of the Site. In summary:

- Daily rainfall data from the nearest gauge (5 km west of the BSM site) was provided by Environment Southland for the period 2011-2021. Annual average rainfall recorded by the gauge is within average regional margins for the Southland Region (between 1,000 – 1,200 mm/yr) (NIWA, 2013);
- Daily potential evapotranspiration (**PET**) data was retrieved from the National Climate database Invercargill Aero station (Agent No. 5814) (25 km southwest of the BSM site) for the period 2011-2021; and
- On a monthly basis, rainfall exceeds PET throughout most of the year (excluding December), and PET reduces to nothing during June and July as ambient air temperatures are cooler and crop growth rates are slower.

Rainfall and PET data is summarised in **Table 6**. Average monthly rainfall and PET are shown in Figure 10.

Table 6: Rainfall and PET (2011-2021)

Parameter	Unit	Annual Average	Range
Rainfall	mm/yr	1,059	873 – 1,215
PET	mm/yr	563	544 – 588

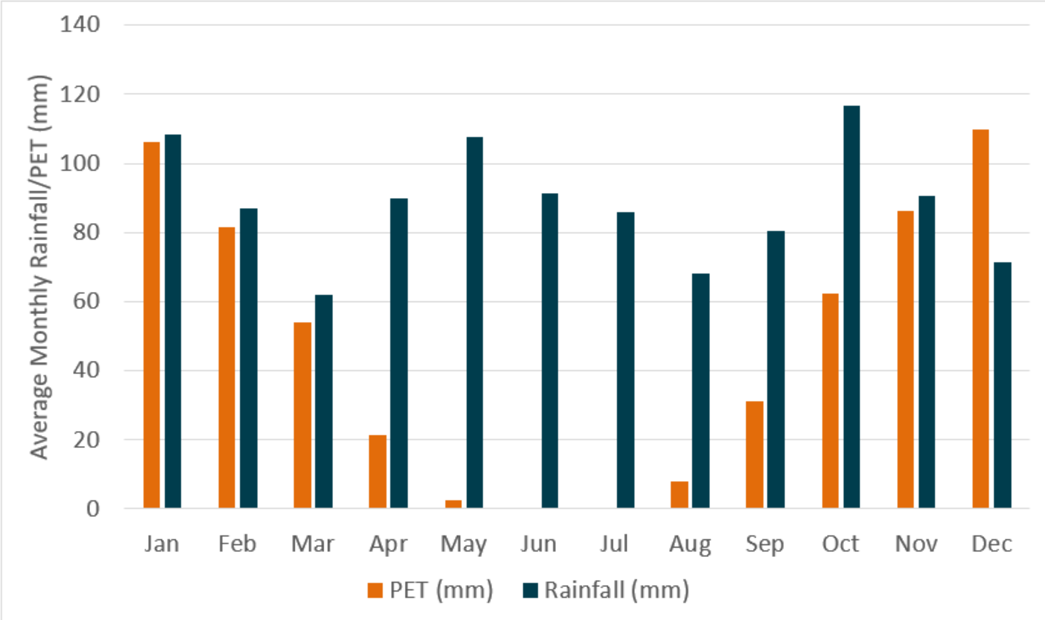

Figure 10: Average Monthly Rainfall and Potential Evapotranspiration

4.5 GEOLOGICAL CONDITIONS

Pattle Delamore Partners Limited (**PDP**) have completed an assessment of the proposed abstraction and use of groundwater at the site (**The PDP Groundwater Assessment**) (**Appendix D**) and the PDP Land Discharge Assessment. These assessments have included a description of the geological conditions of the Site. In summary:

- The unconfined strata near the land surface across and around the Site consists of Middle Pleistocene (Quarternary) river deposits from the ancestral Mataura River, comprised of gravel, sand, silt and clay.
- The zone below the unconfined aquifer consists of a thick sequence of tertiary lignite measure sediments (Gore Lignite Measures) of the East Southland Group. These sediments are comprised of deeper lenses of sandy and gravelly strata interbedded within thick sequences of siltstone / mudstone and other fine grained / low permeability strata such as lignite that occur at varies depths and thicknesses.
- The lignite measure deposits are underlain by sand and shell bed deposits of the Chatton Formation.
- The underlying geology results in soils that are predominantly well-drained, fine-to-coarse textured soils.

4.6 GROUNDWATER CONDITIONS

The PDP Groundwater Assessment and PDP Land Discharge Assessment included a description of the existing groundwater conditions of the Site. In summary:

4.6.1 Hydrogeology

- The Site is underlain by a shallow unconfined aquifer which is formally classified as part of the Waihopai Groundwater Management Zone, along with a deeper confined aquifer (which at depth is interbedded with the Gore Lignite Measures) where the abstraction bores take water from.
- Across the Site the shallow aquifer is approximately 10 m thick and made up of sandy gravels within a matrix of weathered clays. The shallow groundwater on the Site generally flows to the southwest, in a similar direction to the Waihopai River. The tributary streams of the Waihopai River (discussed in Section 4.8 below) have been inferred to be incised into the shallow aquifer and receive groundwater flows at the Site.
- The deeper confined aquifer (utilised by the current and original abstraction bores) consists of a sequence of gravelly strata between 115 m and 121 m in depth. The aquifer is interpreted to be locally recharged primarily through lateral groundwater inputs sourced from rainfall infiltrating to deep strata (primarily upgradient and northeast of the site). However, there is also expected to be a component of vertical recharge via slow leakage through the 105 m thick aquitard at the Site.
- The deep confined aquifer is overlain by a 105 m thick aquitard at the bore locations. This aquitard is comprised of a sequence of silty/clayey strata up to the base of the unconfined aquifer zone.
- The aquifers beneath the Site are located within the mapped oxidising zone under the pSWLP which is characterised by high levels of oxygen within the strata, allowing for nitrogen to accumulate.
- Recent monitoring at the Site has shown the depth to shallow groundwater as between 0.7 and 3.2 m. This depth to groundwater at the Site is shallower than the typically reported depth across the oxidising zone in Southland (between 5 and 10 m).

4.6.2 Groundwater Quality

Six shallow and one deep groundwater monitoring well were installed across the existing land treatment area in November 2020. In summary:

- pH generally falls below the New Zealand Drinking Water Standards (NZDWS) guideline value range, suggesting the groundwater is slightly acidic, however this is a common feature in many shallow unconfined aquifer systems recharged by rainfall infiltration in the Southland Region.
- Total sodium, chloride, nitrate-N, nitrite-N and ammoniacal-N are elevated in downgradient bores relative to the upgradient bores. This is a legacy effect from the currently consented land treatment options and will be present until all impacted

groundwater has moved through the aquifer which will happen with the passing of time.

- Upgradient and downgradient *E. coli* concentrations are often elevated above the NZDWS maximum acceptable value. However, elevated *E. coli* concentrations are more frequently reported in downgradient monitoring wells, indicating the BSM activities are impacting groundwater *E.coli* concentrations.

4.7 SOILS

The PDP land discharge assessment included a description of the soils at the Site. In summary:

4.7.1 Soil Types

The area of the Site where BSM propose to discharge treated wastewater, biosolids, stockyard solids and paunch to land contain two soil orders; brown soils and gley soils, however irrigation will be limited to brown soils only.

The brown soils are the dominant soil classification across the site, with the gley soils not making up a large proportion of the site as they are typically located adjacent to waterways.

The soil mapping for the proposed land treatment system in shown in **Figure 11** below.

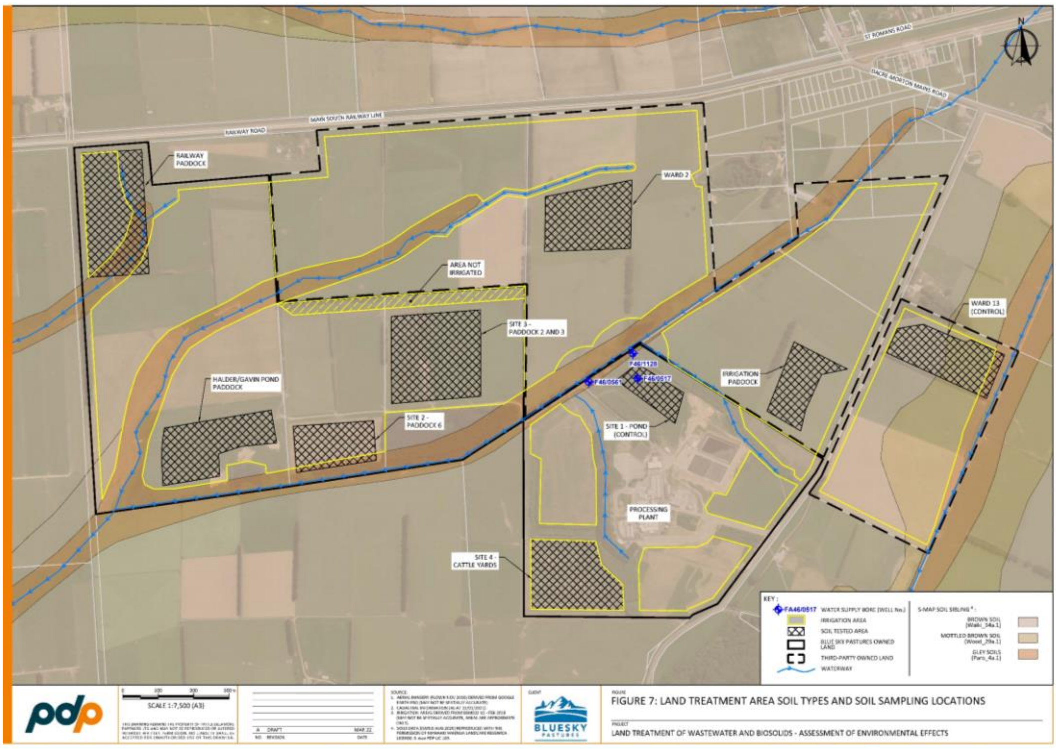

Figure 11: **Land Treatment Area Soil Types and Soil Sampling Locations**

4.7.2 Physiographic Zone

The Site is located within the oxidising physiographic zone, which is characterised by soil water and groundwater that contains high levels of oxygen, which allows nitrogen to accumulate. Due to good internal drainage and relatively low organic carbon content, there is an elevated risk of nutrient leaching.

4.7.3 Soil Nutrients

Soil nutrient sampling undertaken on the Site (on land that is currently irrigated under BSM existing discharge to land consent) has shown that:

- Background soils are generally within the recommended ranges for all parameters tested, except for elevated sulphate sulphur (associated with low pH), slightly low Olsen P and slightly elevated mineralizable nitrogen.
- Soils that have previously been irrigated under BSM existing consent contain various soil nutrient impacts, including a slight increase in pH (but within the recommended range), an increase in Olsen P and sodium, potassium and exchangeable sodium percentage (**ESP**) to above the recommended range.

4.7.4 Soil Infiltration Rates

As part of annual compliance monitoring for BSM operations on the Site, soil infiltration rates have been measured at four areas of the Site that receive frequent wastewater irrigation and one area of the Site that does not receive any wastewater (the control site). In summary:

- The most recent compliance report showed soil infiltration rates across the current wastewater irrigation areas ranged from 4 mm/hr to 257 mm/hr, with the control site ranging from 37 mm/hr to 187 mm/hr. All monitoring sites recorded a large degree of variation with some areas being saturated and others having rapid infiltration.
- Historically, the land treatment area has had issues with poor infiltration rates because of overloading wastewater with a high organic and fat, oil and grease content. The infiltration rates have improved significantly in the last two and a half years following the upgraded WWTP and with corrective actions undertaken by BSM, such as the application of lime and reseeding paddocks.

4.8 SURFACE WATER

The PDP Groundwater Assessment and PDP Land Discharge Assessment included a description of the surface water conditions of the Site. In summary:

4.8.1 Surface Water Flow

Two permanent watercourses flow through the land that is used for the irrigation of treated wastewater on the Site (the 'north' and 'south' branches). These two tributaries are small, first-order tributaries of the Waihopai River and flow from the north-eastern boundary to the south-western boundary of the Site (Refer to Figure 1 in Section 1.1 of this AEE) and converge and join with the Waihopai River approximately 14 km downstream of the confluence point.

These two streams flowing through the Site are fed by surface water runoff and shallow groundwater and subsurface tile drains on the Site. Visual observations and ecological field investigations have stated that the tributaries are characterised by low flows and dry or stagnant conditions can occur.

4.8.2 Surface Water Quality

Overall, the surface water quality in both streams is heavily impacted by local land-use influences which comprises intensive agricultural practice.

Existing BSM consent monitoring and PDP ecological surveys show that both watercourses contain elevated concentrations of plant available nutrients as well as elevated *E. coli* concentrations, with historic activities undertaken by BSM on the Site contributing to these elevated levels.

Table 7 below provides a summary of the key water attributes from the last 10 years of existing consent compliance monitoring on the Site.

Table 7: Surface Water Quality Summary

Parameter	Unit	Upstream (South Branch)		Downstream	
		Median	Maximum (Minimum)	Median	Maximum (Minimum)
DO	mg/L	5.6	(<0.1)	6.7	(<0.1)
DRP	mg/L	0.029	5.2	0.025	0.48
TN	mg/L	1.7	9.3	5.0	163.8
Nitrate-N	mg/L	0.775	2.2	4.8	8.5
Ammoniacal-N	mg/L	0.11	5.0	0.11	8.9

Parameter	Unit	Upstream (South Branch)		Downstream	
		Median	Maximum (Minimum)	Median	Maximum (Minimum)
E. coli	MPN/100mL	338	56,500	374	517,000
pH	Units	6.5	7.4 (6.1)	6.8	7.7 (6.3)
EC	µS/cm	188	371	274	493
Temperature	°C	10.9	16.3 (5.3)	10.8	16.8 (5.3)

Notes:

1. *DO = Dissolved Oxygen; DRP = Dissolved Reactive Phosphorus; TN = Total Nitrogen; EC = Electrical Conductivity*

Refer to the PDP Land Discharge Assessment for a detailed overview of the surface water quality on the Site.

4.8.3 Surface Water Ecology

With regard to pelagic ecology, although the two streams flowing through the BSM site were characterised as being typical of those passing through pastoral land in the area (notably including poor water quality, minimal shading, and dense instream vegetation cover), ecological surveys indicated that the streams are able to support native aquatic species with a conservation threat classification. Assessments of the north and south tributaries have identified three native taxonomic groups, including the invertebrate freshwater kōura, inanga and a separate galaxiid group (likely comprising a combination of small giant kokopu and Gollum galaxias). Generally, the presence of pelagic ecology has been more prevalent in the faster flowing South Branch, which has more suitable instream habitat.

Regarding benthic ecology, Macroinvertebrate Community Index (**MCI**) and Quantitative MCI (**QMCI**) scores (a measure of the level of pollution in a stream based on the presence or absence of pollution-sensitive species) from the ecological assessments show that the ecological health of the north and south tributaries ranges from ‘fair’ to ‘poor’, which suggests that moderate to severe pollution is likely.

4.8.4 Periphyton and Macrophytes

Long term monitoring data of the tributary upstream and downstream of the Site has indicated that the tributary is phosphorus limited. Although water quality assessments indicate the aquatic environment is nutrient (nitrogen and phosphorus) enriched, ecological baseline surveys have shown that periphyton cover has been constantly low (>15% cover at any surveyed reach). This is likely due to the extensive accumulation of fine sediments across most of the stream reaches and absence of hard substrate (which periphyton growth typically attaches to). Additionally, macrophyte growth is also affected by nutrient enrichments and had a notable presence in both ecological baseline surveys (>75% in most surveyed reaches in 2020).

4.8.5 Physical Habitat / Riparian Margins

Key characteristics of the streams on Site are as follows:

- The two streams are typical of those passing through pastoral land and are characterised by strong channelisation and limited shading.
- Stream reaches are generally dominated by instream vegetation which have obstructed flow and caused deep sediment accumulations.; and
- Riparian margins of the streams are characterised by stream-bank erosion and homogenous vegetation, with the waters receiving limited shading.

PDP have undertaken a wetland assessment. This assessment concluded that the Site does not contain any natural inland wetlands in accordance with the definitions of natural wetlands under the National Policy Statement for Freshwater Management 2020 (**NPS-FM**).

4.9 WAIHOPAI RIVER CATCHMENT AND NEW RIVER ESTUARY

The Site is located within the Waihopai River catchment – an area that is approximately 18,300 ha. The Waihopai River is approximately 34 km in length, originating from the gentle rolling hills above the lower Matuara River Valley (to the north of Morton Mains) and draining from intensive farmland in the surrounding area.

The Waihopai River flows into the New River Estuary, a large tidal lagoon type estuary (approximately 4,100 ha in size) near Invercargill. This estuary contains high nutrient levels and is heavily impacted by upstream land uses. However, studies undertaken by Environment Southland in recent years have indicated that the water quality of the Waihopai River is improving.

The closest regionally significant wetland to the Site is Spurhead Swamp about 8.2 km northeast of BSM bores. This swamp is in a separate surface water sub-catchment of the Waihopai River (within the upstream headwaters of the Waihopai River mainstem catchment).

5. RESOURCE CONSENT REQUIREMENTS AND ASSESSMENT MATTERS

5.1 INTRODUCTION

- The continuing operation of the BSM Plant on the site is subject to rules in the following statutory documents:
- The Operative Regional Water Plan for Southland (**Operative Plan**);
- The Proposed Southland Water and Land Plan (**pSWLP**);
- The Regional Air Quality Plan for Southland (1999) (**The Air Plan**);
- The National Environmental Standards for Freshwater (**NES-FW**) (which contains rules governing works in close proximity to wetlands);
- Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (**NES-AQ**);
- Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007 (**NES-DW**); and
- Resource Management (Measurement and Reporting Water Takes) Amendments Regulations 2020 (**Water Measurement Regulations**).

Of note, both the Operative Plan and the pSWLP are relevant for a) the proposed abstraction and use of groundwater, and b) the proposed discharge of land drainage water and stormwater to water as rules relating to those activities are currently under appeal in the pSWLP. In these instances, resource consent will be required under both the Operative and pSWLP.

Analysis of the relevant rules of the statutory documents is provided in the sections below.

5.2 THE OPERATIVE WATER PLAN

As discussed in Section 3 of this AEE, BSM propose to continue to undertake the following activities relevant to the Operative Plan:

- The abstraction and use of groundwater for a meat processing plant and a rendering and blood drying plant with proposed abstraction rate limits of 1,500,000 litres per day and 7,000,000 litres per week; and
- The discharge of stormwater and dewatering water (From the groundwater dewatering system and leak detection system) from the upgraded WWTP to a surface drain located in the northeast of the Site.

Table 8 below identifies the resource consents required from Environment Southland for the proposed activities and the activity status of those consents under the Operative Plan.

Table 8: Resource Consent Requirements and Activity Status under the Operative Regional Water Plan for Southland (Operative Plan)

Activity	Activity Status	Analysis
To take groundwater for a meat processing plant and a rendering and blood drying plant	Discretionary activity[3]	The proposed groundwater take is from a confined aquifer where the rate of take is greater than 2 litres per second. Resource consent is therefore required as a discretionary activity in accordance with Rule 23(d) of the Operative Plan.
To discharge land drainage water and stormwater to land	Discretionary activity[4]	Stormwater and dewatering water will discharge to the existing drain via MH1 and a shared outfall. The discharge of any contaminants or water into water not provided for elsewhere in the Operative Plan is a discretionary activity. Resource consent is therefore required as a discretionary activity in accordance with Rule 3 of the Operative Plan.

5.3 THE PROPOSED SOUTHLAND WATER AND LAND PLAN

As discussed above and in Section 3 of this AEE, BSM propose to continue to undertake the following activities:

- The abstraction and use of groundwater for a meat processing plant and a rendering and blood drying plant with proposed abstraction rate limits of 1,500,000 litres per day and 7,000,000 litres per week;
- The discharge of treated wastewater and biosolids to land via irrigation and the discharge of screened stockyard solids, paunch and sand and grit to land via a muck spreader;

3 Operative Regional Water Plan for Southland – Rule 23(d)

4 Operative Regional Water Plan for Southland - Rule 3.

- The discharge of stormwater and dewatering water (From the groundwater dewatering system and leak detection system) from the upgraded WWTP to a surface drain located in the northeast of the Site; and
- The take of water for the purpose of dewatering. As previously discussed, the groundwater dewatering system will discharge groundwater on a passive and ongoing basis and the leak detection system associated with the upgraded WWTP may on rare occasions intercept groundwater, with the intercepted groundwater discharged to the stormwater system.

Of note is that no works are proposed on the existing flow equalisation basin, SBR lagoon, anaerobic lagoon or irrigation lagoon as part of the operation of the upgraded WWTP and no consent is required to authorise the continued use of those facilities. As per the Commissioners Decision on the Proposed Plan the use of the existing lagoons and storage facilities associated with the WWTP (i.e., non-agricultural effluent storage facilities) remain a permitted land use by virtue of there being no rules restricting the use of land for this purpose.

Table 9 below identifies the resource consents required from Environment Southland for the proposed activities and the activity status of those consents under the pSWLP.

Table 9: Resource Consent Requirements and Activity Status under the Proposed Southland Water and Land Plan (pSWLP)

Activity	Activity Status	Analysis
To take groundwater for a meat processing plant and a rendering and blood drying plant	Discretionary activity[5]	The proposed rate of take exceeds permitted activity conditions to take groundwater. Resource consent is therefore required as a **discretionary activity** in accordance with Rule 54(d) of the pSWLP.
To discharge meat processing and rendering plant treated wastewater and biosolids to land via a spray irrigator and wastewater solids via a muck spreader	Discretionary activity[6]	The proposed discharge of wastewater, sludge or effluent from industrial processes onto or into land in circumstances where contaminants may enter water is a discretionary activity as the upgraded WWTP plant and storage lagoons used to store the wastewater prior to discharge are certified by a Chartered Professional Engineer.

[5] Proposed Southland Water and Land Plan - Rule 54(d).

[6] Proposed Southland Water and Land Plan – Rule 34(a)

Activity	Activity Status	Analysis
		Resource consent is therefore required as a **discretionary activity** in accordance with Rule 34(a) of the pSWLP.
To discharge land drainage water and stormwater to land	Discretionary activity[7]	Stormwater and dewatering water will discharge to the existing drain via MH1 and a shared outfall. The stormwater aspect of the discharge would meet permitted activity rules. However, there is no permitted activity rule which applies to the dewatering water, so resource consent has been sought for this collective discharge as a discretionary activity. Resource consent is therefore required as a **discretionary activity** in accordance with Rule 5 of the pSWLP.
The take of groundwater for the purpose of dewatering (associated with the groundwater dewatering system and leak detection system of the upgraded WWTP)	Discretionary activity[8]	The take of groundwater associated with the groundwater dewatering system and leak detection system is not metered, and therefore BSM cannot confirm that the take will not exceed a duration of 60 days in any 12-month period (Rule 54(ca)(ii)). BSM are therefore conservatively applying for consent. Resource consent is therefore required as a **discretionary activity** in accordance with Rule 54(d) of the pSWLP.

5.4 REGIONAL AIR QUALITY PLAN FOR SOUTHLAND (1999)

As previously discussed, BSM currently operates under two consents to discharge combustion contaminants from two coal-fired boilers and to discharge odour from the Site.

BSM propose to replace these consents with one new air discharge consent which will include all of the discharges to air from the Site, including from the two coal-fired boilers that operate at the Site, the processing plant; the biofilter, the salting shed, the wastewater

7 Proposed Southland Water and Land Plan - Rule 5.

8 Proposed Southland Water and Land Plan – Rule 54(d)

treatment plant (including the biogas flare) and the application of the treated wastewater, biosolids, stockyard solids and paunch to land.

The existing Regional Air Quality Plan for Southland (1999) (**The Air Plan**) is being reviewed in two parts, called Stage 1 and Stage 2:

- Stage 1 contains updated policy framework which proposes new rules for domestic home heating, outdoor burning, the application of agrichemicals and fertilisers, and fire training. Stage 1 replaces Section 6 of the Air Plan through the new Southland Regional Air Plan (2016), which was formally adopted by Environment Southland in October 2016; and
- Stage 2 encompasses the remaining framework from the Air Plan, including all other discharges to air (such as industrial and commercial discharges) which are relevant to this application. The Stage 2 review is yet to be completed; therefore, the existing Air Plan has been used to determine any resource consents required in relation to discharges to air.

Table 10 below identifies the resource consents required from Environment Southland for the proposed activities and the activity status of those consents under the Air Plan

Table 10: Resource consent requirements and activity status under the Regional Air Quality Plan for Southland (1999).

Activity	Activity Status	Analysis
To discharge contaminants to the air from a meat processing plant, rendering and blood drying plant and associated boilers. and To discharge contaminants to air from a wastewater treatment system. and	Discretionary activity[9]	The proposed discharge of air from the two boilers on-site will: • Together burn combustible matter other than refuse or trade waste at a rate of heat release exceeding 5 MW; and • Discharge contaminants to air from the rendering of animal matter through the application of heat to animal matter. The upgraded WWTP will discharge contaminants to air and is considered to have a design capacity population equivalent for BOD of greater than 10,000 people.

[9] Regional Air Quality Plan for Southland (1999) - – Rule 5.5.2 (2)(a), Rule 5.5.2 (4)(a) and Rule 5.5.2 (16).

Activity	Activity Status	Analysis
To discharge contaminants to air from foulwater treatment processes with a design capacity population equivalent for a Biochemical Oxygen Demand (BOD) of 10,000 people or more.		Resource consent is therefore required as a **discretionary activity** in accordance with Rule 5.5.2 of the Air Plan.

5.5 NATIONAL ENVIRONMENTAL STANDARDS FOR FRESHWATER

The NES-FW 2020 outlines resource consent requirements associated with vegetation clearance, earthworks, and the take, use, damming, diversion, or discharge of water in close proximity to natural inland wetlands and / or mangroves.

As detailed in Section 4.8.5 of this AEE, PDP have undertaken a wetland assessment which has confirmed that there are no wetlands located within the BSM site.

5.6 RESOURCE MANAGEMENT (NATIONAL ENVIRONMENTAL STANDARDS FOR AIR QUALITY) REGULATIONS 2004

The NES-AQ sets out the standards to guarantee a minimum level of health protection for all New Zealanders. The NES-AQ specifies ambient air quality standards for common criteria contaminants, including PM_{10}, SO_2, CO_2, NO_2 and ozone, and places restrictions on the ability of Environment Southland to grant resource consents to discharge those contaminants if the relevant air quality standards would not be achieved.

The Beca assessment has concluded that discharges of the primary pollutants from the existing boiler stacks (PM_{10}, $PM_{2.5}$, NO_2, SO_2 and mercury) will comply with the relevant NES-AQ standards for all contaminants, including PM_{10}. Refer to Section 6.7 for further detail.

Overall, resource consent is not required under the NES-AQ.

5.7 RESOURCE MANAGEMENT (NATIONAL ENVIRONMENTAL STANDARDS FOR DRINKING WATER) REGULATIONS 2007

The NES-DW seeks to reduce the risk of contaminating drinking water sources such as rivers and groundwater and requires regional councils to ensure that effects on drinking water sources are considered in decisions on resource consents.

Regulations 7 and 8 of the NES-DW apply to water and discharge permits issued by regional councils. However, due to the absence of any registered drinking water supplies that provide for no fewer than 25 people with drinking water for no less than 60 days each calendar year (Regulation 12), this NES is not considered relevant.

Overall, resource consent is not required under the NES-DW.

5.8 RESOURCE MANAGEMENT (MEASUREMENT AND REPORTING WATER TAKES) AMENDMENTS REGULATIONS 2020

The Water Management Regulations are relevant for the proposed take and use of groundwater associated with the Proposal as the proposed water take rates will exceed 5 litres/second. However, these regulations are not relevant for the take of groundwater for the purpose of dewatering as this take is not for consumptive purposes (in accordance with Section 4(2)) of the Water Management Regulations.

Under these regulations, BSM will be required to install a water meter to measure their water, store these records, and submit the records to Environment Southland.

Whilst no resource consent is required under the Water Management Regulations, the required steps as set out above will be proposed as conditions of this consent.

5.9 SUMMARY

BSM seeks all necessary resource consents from Environment Southland to authorise the continued operation of the Plant on the Site. Overall, it is considered that the following resource consents are required under the various relevant planning documents:

5.9.1 The Operative Regional Water Plan for Southland

- A water permit for a **discretionary activity** for the abstraction of groundwater from a confined aquifer where the rate of take is greater than 2 litres per second[10]; and
- A discharge permit for a **discretionary activity** for the discharge of contaminants or water into water[11]

[10] Operative Regional Water Plan for Southland – Rule 23(d)

[11] Operative Regional Water Plan for Southland – Rule 3

5.9.2 The Proposed Southland Water and Land Plan

- A water permit for a **discretionary activity** for the abstraction of groundwater from a groundwater management zone at a rate that exceeds the permitted volumes and rates;[12]
- A discharge permit for a **discretionary activity** for the discharge of wastewater from industrial premises onto or into land where contaminants may enter water;[13]
- A discharge permit for a **discretionary activity** for the discharge of land drainage water and stormwater to water;[14] and
- A water permit for a **discretionary activity** for the take of groundwater for the purpose of dewatering.[15]

5.9.3 The Regional Air Quality Plan for Southland (1999)

- A discharge permit for a **discretionary activity** for the discharge of contaminants to air at a rate of heat release exceeding 5 MW,[16] for the rendering of animal matter through the application of heat to animal matter[17] and to discharge contaminants to air from foulwater treatment processes with a design capacity population equivalent for Biochemical Oxygen Demand (BOD) of 10,000 people or more.[18]

It is considered that the overall activity status of the application is a **discretionary activity**.

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[12] Proposed Southland Water and Land Plan – Rule 54(d).

[13] Proposed Southland Water and Land Plan – Rule 34(a).

[14] Proposed Southland Water and Land Plan – Rule 5.

[15] Proposed Southland Water and Land Plan – Rule 54(d).

[16] Regional Air Quality Plan for Southland (1999) – Rule 5.5.2 (2)(a).

[17] Regional Air Quality Plan for Southland (1999) – Rule 5.5.2 (4)(a).

[18] Regional Air Quality Plan for Southland (199) - Rule 5.5.2 (16).

6. ASSESSMENT OF ENVIRONMENTAL EFFECTS

6.1 INTRODUCTION

This section of the AEE addresses the actual and potential environmental effects associated with the renewal of resource consents for the BSM processing plant at the Site.

The relevant actual and potential environmental effects of the Proposal are considered to be:

- Positive effects;
- Groundwater effects;
- Effects from the discharge of treated wastewater, biosolids, stockyard solids and paunch to land;
- Effects from the discharge of land drainage water and stormwater to water;
- Effects from the take of groundwater for the purpose of dewatering, via the groundwater dewatering system and leak detection system;
- Effects from the continued use of the WWTP storage ponds; and
- Air quality effects;

When considering the effects of the Proposal, the receiving environment consists of:

- The existing environment and the associated effects from lawfully established activities including implemented resource consents;
- The existing environment as modified by any resource consents granted and likely to be implemented; and
- The environment as likely to be modified by activities permitted by the Operative Plan and pSWLP. The pSWLP have land use controls that restrict future land use, particularly around new dairy farms. The use of land for sheep and beef farming activities are considered a permitted activity under the Operative Plan and pSWLP (Rule 20(a)) provided a range of conditions are met, including:
    - The landholding is less than 20 hectares in area;
    - Intensive winter grazing does not occur on more than 15% of the area of the landholding;
    - A Farm Environmental Plan is prepared and implemented;

- Any stock grazed on sloping ground are to be progressively grazed (break-fed or block-fed) from the top of the slope to the bottom, or a 20 m strip is left at the bottom; and
- A vegetated strip is maintained in, and stock are excluded from, the area between the outer edge of the bed of a lake, river (with the exception of ephemeral streams), artificial watercourse or natural wetland for a distance of at least 5 metres

If BSM discharges to land were discontinued, it is reasonable to expect the land would be used for sheep and beef farming. This has therefore been relied on as the permitted baseline throughout this assessment.

Multiple technical assessments have been commissioned by BSM to inform this AEE. These technical assessments are referenced, as appropriate, in Sections 6.2 to 6.8 below.

6.2 POSITIVE EFFECTS

The proposed activities will enable the Plant to continue to operate on the Site in an effective and efficient manner, making a positive contribution to the social and economic wellbeing of people and communities in the area, including the employment of 350 staff.

The plant pays out $25 million in wages and salaries per annum and spends an estimated additional $87.5 million per annum in the southern region on goods, services and livestock procurement. These are direct economic benefits to the regional economy arising from the operation of the Plant.

6.3 EFFECTS FROM THE TAKE OF GROUNDWATER

The PDP Groundwater Assessment assesses the proposed abstraction and use of groundwater at the site. A summary of the report's key findings is provided below.

6.3.1 Effects on the Groundwater Resource

6.3.1.1 Confined Aquifer Resource

Appendix L.6 of pSWLP states that the primary annual allocation for the confined aquifer, where the current bores take water, is 75% of the throughflow at the well location. Aquifer throughflow on a daily basis for the confined aquifer zone utilised by the Site has been assessed / estimated to range from about 3,630 m^3 per day to 9,770 m^3 per day.

BSM proposed maximum daily take is 1,500 m^3 and is therefore expected to potentially take between approximately 14% and 39% of the throughflow of the aquifer on a daily basis. This will not result in the primary allocation limit being exceeded in terms of the takes individual effect. The two other consented abstractions from bores in this confined aquifer zone are able to take a maximum of 168 m^3 per day and 78 m^3 per day.

The proposed new consent does not seek to alter the currently weekly consented abstraction rate; therefore, the proposed take will not result in any change to the current allocation status of the aquifer.

Furthermore, the three currently used bores have experienced higher static groundwater levels during plant shutdowns in 2019 and 2020 compared to historic static groundwater levels. This suggests there is not a long-term declining trend in groundwater levels or resources occurring in the deep confined aquifer BSM utilise for their water supply.

The assessment concludes that the effects on the confined groundwater resource are expected to be less than minor.

6.3.1.2 Unconfined Aquifer Resource

Regarding any groundwater abstraction from the unconfined aquifer, the Site is in the Waihopai Groundwater Management Zone under both the Operative Plan and the pSWLP.

It has been assessed that the groundwater take should be fully allocated to the deeper, confined groundwater resource with no allocation required from the overlying unconfined aquifer. Therefore, any effects on the unconfined groundwater resource are expected to be less than minor.

6.3.2 Effects on Neighbouring Bores

Figure 12 below shows the location of active neighbouring bores, including those owned by BSM.

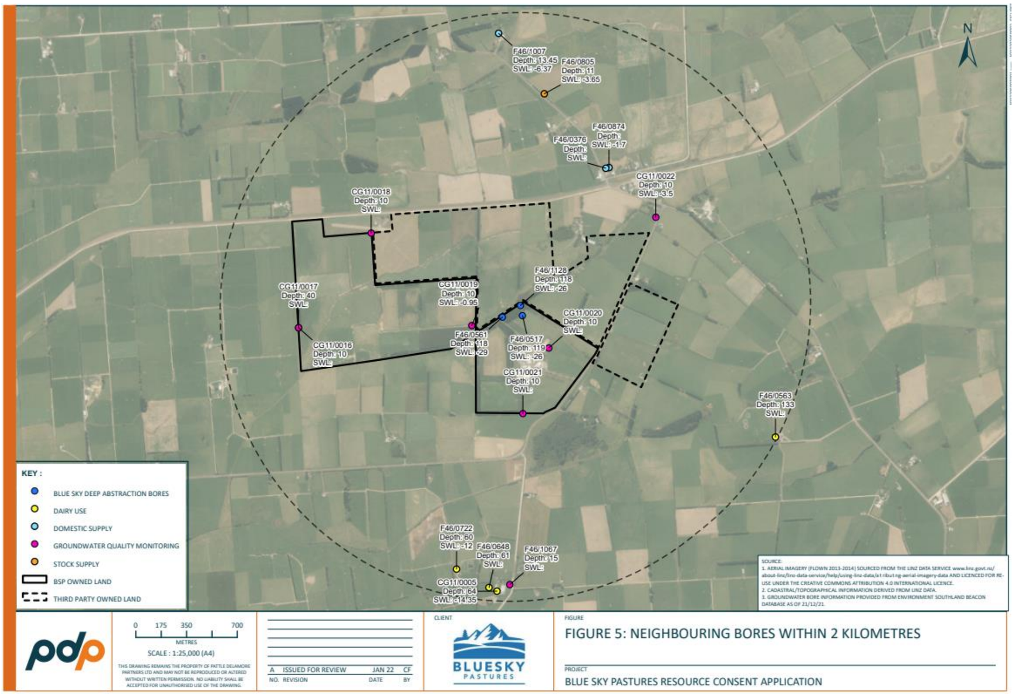

Figure 12: Active Neighbouring Bores

Appendix L.3 of the pSWLP sets the criteria for assessing drawdown interference in neighbouring bores. The criteria states that:

- For any existing bores screened in a confined aquifer, the cumulative drawdown effect should be no more than 50% of the potentiometric head;[19] and
- For any existing shallower bores screened in the unconfined aquifer, the cumulative drawdown effect should be no more than 20% of the available drawdown.[20]

There is one neighbouring bore (F46/0563) within 2 km of the BSM bore in the confined aquifer. The assessment states that the maximum drawdown interference from the BSM groundwater abstraction is estimated to be about 1% to 6% of the possible 86 m potentiometric head, which is acceptable in terms of the pSWLP Appendix L.3 criteria.

There is one shallower confined aquifer bore (intermediate depth) in close proximity to the Site (within 1.8 km of the nearest BSM abstraction bore) consented to take water at a relatively low rate. A highly conservative assessment, in the unrealistic scenario of full lateral connection, states that the maximum drawdown interference from the BSM groundwater abstraction is estimated to be about 15% of the potential 35 m potentiometric head. Despite this conservative scenario assessment, the proposed abstraction is considered acceptable in terms of the pSWLP Appendix L.3 criteria.

The closest neighbouring bores that are likely to be screened in the shallow unconfined aquifer system are a domestic supply bore and a domestic bore approximately 1.1 km to the northeast of one of BSM bores (See Figure 12 above). The Environment Southland database does not have a record of depth for these bores; however, they are located within properties along Dacre-Morton Mains Road near other domestic and stock supply bores which are 11 – 13 m deep, therefore they are expected to be located at similar depths. The assessment conservatively states that any short or long-term drawdown effects on these neighbouring bores will be less than 0.05 m, with an estimated available drawdown of approximately 7 m at these bores. As such, BSM worst-case drawdown effect is a minimal percentage of the estimated available drawdown and is acceptable in terms of pSWLP Appendix L.3 criteria.

Importantly, it is noted that the long term consented interference effect will not change as a result of this new consent, as only a change in the short-term rate of water abstraction is sought, and only very minimal changes could occur in the short term (five-day effect).

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[19] Metres between the mean annual maximum groundwater level and the top depth of the confined aquifer strata.

[20] Metres between the mean groundwater level and the top screened interval.

6.3.3 Effects of Surface Water

A stream depletion assessment was undertaken by PDP in accordance with Appendix L.2 of the pSWLP. This assessment concluded that the estimated stream depletion effect on the closest drain (5 m from the nearest bore) is low due to the depth of the bores and the low aquitard conductance i.e. hydraulic connection between the bores and the surface water.

As discussed, there will be no changes to the effects currently consented as no change in the overall weekly abstraction rate is sought (with the exception of small changes in the short-term to daily abstraction rates).

As discussed in Section 4.8.5 of this AEE, no wetlands have been identified on the Site. Furthermore, according to the Environment Southland database, there are no regionally significant wetlands or sensitive waterbodies that are anticipated to be affected by the proposal.

6.3.4 Other Effects

Additionally:

- Any potential seawater intrusion effects will be less than minor due to the abstraction bores being located approximately 25 km north of the coast;
- Any potential effects on the aquifer stability will be less than minor as the aquifer material is not expected to consolidate due to lowering groundwater pressures; and
- Any groundwater contamination effects will be avoided through the following bore protection measures:
  - The installation of a backflow prevention device to ensure water and/or contaminants cannot return to the water source;
  - Sealing the ground around the bore head to prevent foreign material, surface water, spillage or other leakage entering the space between the casing and the wall of the borehole;
  - Sealing the top of the casing to prevent the entry of contaminants into the casing; and
  - Fencing to prevent stock access.

6.4 EFFECTS FROM THE DISCHARGE OF TREATED WASTEWATER, BIOSOLIDS, STOCKYARD SOLIDS AND PAUNCH TO LAND

The PDP Land Discharge Assessment assesses the proposed discharge of treated wastewater, biosolids, stockyard solids and paunch to land. A summary of the report's key findings is provided in the sub-sections below.

6.4.1 Effects on Soils

The potential effects on soils as a result of the proposed irrigation of treated wastewater, biosolids, stockyard solids and paunch to land are:

- Irrigating in excess of the soil / pasture system capacity, causing excess ponding, runoff, drainage and damage to the soil structure;
- Impacts on soil chemistry, causing damage to the soil structure; and
- Accumulation of contaminants (e.g. heavy metals) in the soil to toxic levels

6.4.1.1 Hydraulic Loading

To minimise excessive irrigation, BSM propose to maintain the current irrigation rates to within the measured capacity of the soils on the Site. This will ensure that saturated conditions, ponding and runoff are minimised and will not occur as a result of the irrigation activity and that the structure and microbial health of the soil are generally maintained. Limits are proposed as follows:

- The maximum irrigator hydraulic application rate is proposed as 6 mm/hr;
- In the drier periods (October to March inclusive), a maximum application depth of 35 mm per application event; and
- In the wetter periods (April to September inclusive), a maximum application depth of 15 mm per application event.

Additionally:

- The BSM land treatment system includes an irrigation lagoon which provides a water storage volume of 15,000 m^3 – this means treated wastewater can be stored and irrigation can be minimised during wet periods; and
- No irrigation will occur on the gley soils[21] onsite, which have poor drainage and can be more prone to effects from hydraulic loading.

6.4.1.2 Soil Chemistry

The current activities are a substantial improvement relative to the wastewater discharges that were occurring prior to the 2019 WWTP upgrades that adversely impacted the soil chemistry on the Site. These improvements include:

[21] A poorly drained soil with high water logging vulnerability.

- Biological nitrogen removal that significantly reduces the nitrogen loading rate on the irrigated areas so that it closely matches pastoral demand for nitrogen, reducing any effects associated with excess nitrogen.
- Biosolids loading to target paddocks with low Olsen P levels and spreading biosolids loads across all land available for irrigation (including both BSM and third-party owned land).
- Anaerobic digestion to reduce sulphur levels in the wastewater that is applied to land. Whilst no adverse effects are expected to result from the current elevated sulphate sulphur levels on the Site, the anaerobic digestion, in combination with the export of sulphur as supplementary feed or animal biomass, will reduce soil sulphate sulphur levels over time.
- Continuing to manage sodium, potassium and Exchangeable Sodium Percentage (**ESP**). Pre-2019 WWTP upgrade operations resulted in sodium, potassium and ESP levels above the recommended range, however the WWTP upgrades will not provide for any reductions of these nutrients in the treated wastewater. Management of excess sodium, potassium and ESP (which can result in soil dispersion and lower hydraulic conductivities) will be done with the addition of soil additives, e.g. lime or gypsum. These cations can displace sodium and potassium in the soil and can maintain and sometimes restore soil structure. It should be noted that this displaced sodium can leach into groundwater, and the effects of this are discussed in Section 6.4.2.4 below.

With the above mitigations in place, the following impacts on soil chemistry can be expected:

- Plant available nitrogen: According to Overseer modelling undertaken the proposed nitrogen loading rates will closely match pastoral demand for nitrogen. Modelling shows a small deficit of nitrogen shown as a net reduction of nitrogen 'pools' in the model. This is most significant on BSM owned land which operates a cut and carry system. Over time, this is expected to result in a small reduction in plant available nitrogen to below elevated background levels which will assist in reducing nitrogen leaching;
- Olsen P: With the increased irrigation area and proposed management measures, biosolids and wastewater can be applied at rates which means phosphorus will match the agronomic requirements of the farming systems and remove the need for phosphorus fertilisers. Overseer modelling shows that phosphorus loss is consistent with surrounding sheep and beef land use and it is considered that paddocks with elevated Olsen P will see a reduction in these values over time as pastoral growth strip phosphorus from these soils;

- pH: Historical irrigation has shown increases in soil pH, however levels are now within the recommended range and can be managed with monitoring and the addition of soil additives if needed. No adverse effects are expected from the ongoing activities.

6.4.1.3 Heavy Metals Loading and Effects

An assessment of the heavy metal concentrations in the biosolids has been provided against the following guidelines:

- Guidelines for the Safe Application of Biosolids to Land in New Zealand (2003); and
- Guidelines for Beneficial Use of Organic Materials on Productive Land (2017) (a draft for public comment which will supersede the 2003 guidelines once finalised).

Table 11 below shows the results of the assessment:

Table 11: Biosolids Heavy Metal Concentrations

Parameter	Unit	Biosolids (mg/kg)	2003 Grade A Biosolids Limit (mg/kg)	2017 Draft Guidelines Limits (mg/kg)
Arsenic	mg/kg	2	20	30
Cadmium	mg/kg	0.26	1	10
Chromium	mg/kg	10	600	1,500
Copper	mg/kg	40	100	1,250
Lead	mg/kg	8.3	300	300
Nickel	mg/kg	9.9	60	135
Zinc	mg/kg	**430**	300	1,500

This assessment concludes that:

- Biosolid concentrations of heavy metals (arsenic, cadmium, chromium, copper, lead and nickel) all comply with the guidelines outlined above; and
- Zinc levels exceed the limit for the Grade A classification but are well below the compliance limit of the more recent guidelines.

It is considered that the existing guideline for zinc is extremely protective of phytotoxic effects.[22]

BSM will monitor the actual levels of heavy metal accumulation on an ongoing basis by taking representative samples of the heavy metals outlined above after the first full year of irrigation under a new consent, and five-yearly intervals thereafter.

6.4.2 Groundwater Effects

As previously discussed in Section 4, shallow groundwater generally feeds the tributaries on the Site which then enter into the Waihopai River. Potential downstream users or receivers of groundwater include surface water bodies and domestic users downgradient for potable water supply.

The PDP Groundwater Assessment states there is the potential for the following groundwater effects as a result of the proposed discharge of treated wastewater, biosolids, stockyard solids and paunch to land:

- Nutrient leaching;
- Pathogen migration;
- Heavy metals; and
- Sodium and chloride leaching

The following sub-sections will provide a summary of the assessment's conclusions.

6.4.2.1 Nutrient Leaching

The proposed land treatment activity applies up to 200 and 350 kg Nitrogen (**N**)/ha/year, and up to 70 and 110 kg Phosphorus (**P**)/ha/year (depending on if the concurrent land use is stocked or cut and carry, respectively) as residual nutrients in the wastewater and biosolids applied to land. Whilst most of the applied nutrients replaces synthetic or mined fertilisers and is exported as biomass, some of this nitrogen, and small quantities of phosphorus, will be flushed through the soil system and enter groundwater.

Overseer Modelling

The assessment of these effects with Overseer nutrient modelling and groundwater modelling demonstrated that the worst-case proposal by BSM (a modelled loss of 24 kg N/ha/year and 0.3 kg P/ha/year across the whole Site) would result in nutrient losses well below average and median nutrient losses for agricultural land use in the Southland

[22] Phytotoxic effects include any adverse effects on plant growth, physiology, or metabolism caused by a chemical substance.

Region. In addition, modelling has also shown that the current worst-case proposal for nutrient leaching is predicted to be within typical ranges for sheep and beef farming, which could occur on the BSM Site as a permitted activity.

Overall, the Overseer modelling results indicate that even under the worst-case scenario (where BSM lose access to third-party land) there will be no increase in nutrient leaching above what could occur if the land was farmed for sheep and beef.

Groundwater Monitoring

Groundwater monitoring on the Site show a measurable increase in groundwater total oxidised nitrogen (**TON**) (nitrate-N and nitrite-N) in downgradient bores compared to the upgradient bores, which is likely a result of the pre-2019 WWTP operations. The completed WWTP upgrades will significantly reduce nitrogen loading to the soil to a maximum of 350 kg N/ha/year and reduce modelled nitrogen leaching to a maximum of 24 kg N/ha/year. This will reduce the concentrations of TON in the shallow groundwater on the Site over time. This improvement will be seen in the receiving surface water environments once the aquifer ‘flushes’ the legacy impacted groundwater through the aquifer.

Groundwater monitoring on the Site indicates that the existing discharge of wastewater to land had no measurable impact for dissolved reactive phosphorus or total phosphorus on groundwater quality. While the proposed increase in daily water abstraction and use enables an increase in phosphorus loading on a daily basis (water use on a weekly basis will remain unchanged) additional mitigation measures are proposed for phosphorus loss, such as the spreading of irrigated wastewater and biosolids across a larger area, and the capping of the subsoil drainage system. Overall, it is assessed that the activities are expected to have no effect on groundwater concentrations for phosphorus.

BSM will continue quarterly sampling of groundwater bores to confirm this expected improvement in groundwater quality going forward.

6.4.2.2 Pathogen Migration

Groundwater monitoring on the Site shows infrequent increases in groundwater *E. coli* levels in both upstream and downstream wells. The results of this monitoring suggest that BSM activities have an impact on the groundwater *E. coli*, increasing median and maximum *E. coli* concentrations from 2.5 to 10 cfu/100 mL and from 23 to 560 cfu/100 mL, respectively.

The nearest drinking water supply bore to the wastewater irrigation discharge site is approximately 700 m away from the property boundary in the direction of groundwater flow. Environment Southland record this as a domestic supply bore.

As drainage water enters groundwater, any surviving *E. coli* will undergo attenuation as the shallow groundwater flows laterally through the saturated zone. The attenuation rates for relevant aquifers state that a complete *E. coli* die-off should occur within the 700 m between the irrigation system and the closest drinking water supply bore. Therefore, the risk of contamination of the nearest supply bore is considered low.

It should be noted that both upgradient and downgradient shallow groundwater has levels of *E. coli* greater that the New Zealand Drinking Water Standards (**NZDWS**), therefore any shallow groundwater bores in the wider area will likely require disinfection treatment to meet the NZDWS.

BSM propose to undertake monitoring of shallow groundwater for E. *coli* on the Site going forward.

6.4.2.3 Heavy Metals

Wastewater sampling on the Site suggests metal concentrations in groundwater are expected to be low, given that heavy metals are likely to bind to soil. Therefore, it is considered unlikely that heavy metals will migrate to groundwater.

However, to ensure this is the case, BSM propose to test groundwater monitoring wells for heavy metals at five-yearly intervals.

6.4.2.4 Sodium and Chloride Leaching

The proposed activities will increase the total load of sodium and chloride discharged to land, however the loading intensity will decrease by an average of 60% in the dry season and 6% in the wet season compared to the current operations because of the additional third-party land available for discharge.

Should the third-party land no longer be available for land discharge activities, the existing monitoring provides an indication of potential ongoing effects. Groundwater monitoring undertaken shows that the chloride and sodium concentrations measured do not exceed any potable water requirements or pose any human health risk for downstream drinking water users, with the downgradient shallow groundwater concentrations of sodium well below the NZDWS. However, groundwater concentrations of chloride occasionally breach the guideline for ‘aesthetic determinands’ – water that exceeds this guideline is still potable, however it can contribute to taste and corrosion effects.

The proposed decrease in loading intensity will lower overall concentrations of sodium and chloride in the groundwater and instances where the water exceeds the aesthetic chlorine determinands are expected to decrease accordingly. Furthermore, the nearest drinking water bore is located 700 m away from the land treatment system, and it is expected that any exceedances will be sufficiently diluted.

Overall, any potential effects will be negligible, and even the worst-case scenario (with no allowances for dilution or improvement from reduced loading) any effect will be infrequent and aesthetic (taste and corrosion).

6.4.3 Surface Water Effects

The proposed irrigation of treated wastewater may have follow-on effects on surface water via the following mechanisms:

- Phosphorus loss via runoff; and
- The discharge of impacted groundwater with elevated contaminants to surface water (e.g., nitrate-N, sodium, chloride, and E. *coli)*

6.4.3.1 Runoff

Typically, surface water runoff from the irrigated land area is responsible for the loss of phosphorus to the environment as phosphorus binds to the soil particles and is mobilised where overland flow moves soil as suspended sediments. As discussed, the Site's surface water runoff drains to the two unnamed tributaries on the Site either directly, or via onsite drains.

As discussed, the proposed application depths (Refer to Section 6.4.1.1) are within the hydraulic capacity of the soil (even under saturated conditions) and therefore the potential for phosphorus run-off will be minimised. However, PDP state that phosphorus loss can still be exacerbated via a combination of the increase in phosphorus loading and Olsen P levels in soil and an increase in frequency and volume of run-off volumes caused be an increase in soil moisture levels.

To ensure that the Proposal will result in improved phosphorus concentrations in the receiving environment, BSM will establish suitable riparian planting on all streams and drains on their land prior to BSM loading the irrigation land to 110 kg P/ha/yr (if required). This requirement will be included as a condition of consent. PDP conclude that this riparian planting will suitably mitigate the impact of phosphorus loss from the proposed discharges to land.

The Proposal was also compared to sheep and beef farming in the Southland region (Refer to Section 6.1 of this AEE). Modelling undertaken by PDP has shown that phosphorus loss (primarily via runoff into surface water) from the Proposal is at the lower end of typical phosphorus loss from sheep and beef farming.

6.4.3.2 Groundwater Daylighting

When the groundwater discharges into nearby surface waterbodies, any contaminants will potentially enter the surface water which can then result in adverse ecosystem effects. The effects of the activities on groundwater (and therefore any groundwater effects on surface water) are discussed in Section 6.4.2 above.

6.4.4 Ecological Effects

BSM are committed to improving the quality of the waterways on the Site. This has included the implementation of native riparian planting along all watercourses that run through the property – these are expected to provide shading and greater habitat quality in these reaches of the stream.

Furthermore, BSM's upgraded WWTP will further improve these waterways in the following ways:

- Very low nitrate levels in the groundwater (once the historically impacted groundwater passes through the shallow aquifer system), resulting in the reduction of nitrate levels and any potential toxicity effects impacting ecology; and
- Less nitrogen and phosphorus loads entering the aquatic environment, reducing the extent and frequency of nuisance instream plant growth and low dissolved oxygen conditions present in the stream.

These improvements should result in significant improvements in water quality and habitat in the onsite reaches of the stream and downstream from the Site. This will ensure that the instream conditions that currently provide refuge for 'at risk' and 'threatened' aquatic species will continue to do so, and improvements to aquatic ecology will be observed.

BSM propose to monitor instream ecology on a five-yearly basis (as the improvements are expected to occur over a large timescale) to monitor the impacts of the improved discharge.

6.4.5 Wider Effects on the New River Estuary

6.4.5.1 Cumulative Nitrogen Effects

As discussed in the Sections above, the improvements have provided substantial reductions in nitrogen loading with corresponding reductions in nitrogen leaching. This will result in a reduction in cumulative loads of nitrogen flowing into the New River Estuary and therefore improvements in nitrogen loads to the New River Estuary. Furthermore, these nitrogen losses are within typical ranges of sheep and beef farming.

6.4.5.2 Cumulative Phosphorus Effects

As discussed in the Sections above, the improvements and associated mitigation will result in less phosphorus entering nearby waterways, and consequently into the New River Estuary. This will result in improvements in phosphorus loads to the New River Estuary, such that this degraded environment in maintained and enhanced.

6.4.6 Effects on Human Health

The public health risk from microbiological contaminants such as potential pathogens and other micro-organisms of the wastewater can be appropriately managed. However, additional steps to ensure public health risk is minimised will include measures such as:

- Operational management and physical methods used for irrigation/spreading to avoid staff contact with the wastewater;
- Minimising public contact with sprayed wastewater through the use of appropriate buffer zones; and
- Ensuring irrigation does not occur near a downwind boundary during windy conditions.

Based on compliance with standards and guidelines, the effects of the irrigated wastewater on human health will be no more than minor. Furthermore, once irrigated, microbial die-off in the irrigated/spread biosolids will naturally occur as it dries out and is exposed to natural ultraviolet light.

6.4.7 Effects on Stock Health

BSM propose to maintain a minimum stock withholding period of 14 days following wastewater and/or biosolids irrigation. This will allow time for the treated wastewater to dry out and or/the grass to regenerate prior to the return of the stock, ensuring any potential microbial pathogens will have died off, reducing the likelihood of stock coming into direct contact with the treated wastewater. Therefore, the effects on stock health on the Site are considered less than minor.

Potential effects on stock health from bores used for stock supply are also considered less than minor.

6.5 EFFECTS FROM THE TAKE OF GROUNDWATER FOR DEWATERING

In 2018 BSM applied to Environment Southland for resource consent to construct substantial upgrades to their onsite wastewater treatment facility, with the upgrades constructed in 2019 and commissioned in January 2020. To support this application for consent, PDP prepared a technical assessment titled "Assessment of Environmental Effects Technical Report – New Wastewater Treatment Plant for Blue Sky Meats, Morton Mains" dated December 2018 (**Appendix E**) (Referred to as the "**PDP Proposed WWTP Assessment"**).

The PDP Proposed WWTP Assessment provided an assessment of groundwater effects for the take of groundwater for the purpose of dewatering associated with the construction, operation and maintenance of the WWTP. This also included a description of the groundwater dewatering system and leak detection system of the upgrade WWTP (Refer to Section 2.3 of this AEE for further details).

PDP have reviewed the PDP Proposed WWTP Assessment for this AEE and provided an updated letter report / assessment to support this application for consent, titled "Blue Sky Meats Ltd Wastewater Treatment Plant Operation Consents", dated June 2022 (**PDP Letter Report**) (**Appendix F**). The PDP Letter Report provides a description of the existing groundwater dewatering activities (from the WWTP groundwater dewatering system and leak detection system) and confirms that the groundwater assessment provided in the Proposed WWTP Assessment is still relevant.

In summary, the PDP Proposed WWTP Assessment concluded that:

- The proposed dewatering system will draw the localised groundwater level down by a maximum of approximately 1 - 1.5 m and the zone of influence of the groundwater dewatering system is expected to be limited to the immediate area surrounding the WWTP; and
- No effects are expected on other groundwater users, as the drawdown effect will be localised, and nearby production bores generally draw water from deeper aquifers.

6.6 EFFECTS FROM THE DISCHARGE OF LAND DRAINAGE WATER AND STORMWATER TO WATER

As discussed in Section 3 of this AEE, the upgraded WWTP discharges dewatered groundwater from the groundwater dewatering system and leak detection system, and stormwater to the nearby drain via an existing outfall.

The PDP Proposed WWTP Assessment provided an assessment of the effects on surface water from the discharge of land drainage water and stormwater to water. In summary, this assessment concluded that:

- The quality of water in the drain reflects that of shallow groundwater. Further details on actual monitoring undertaken following this assessment is provided below;
- There will be no direct pathways for wastewater contamination to occur in routine stormwater discharges and all hazardous substances will be contained or kept indoors;
- All air valves will be fitted with tubing to direct leakage back into the WWTP;
- The stormwater from the lagoon cover will have similar quality characteristics as roof water runoff, while stormwater runoff from gravel slabs and other surrounding areas of the upgraded WWTP will have similar characteristics to runoff which already enters this as a permitted activity from other areas on site; and

- Discharge rates are expected to be negligible for the leak detection system and approximately 4.5 l/s for the stormwater depending on rainfall. This will be readily accommodated by the drain and does not present any flooding issues.

Furthermore, the PDP Letter Report provides an updated assessment to support this application for consent. Monitoring of the stormwater and land drainage discharge (**The discharge**) and receiving stormwater drain approximately 20 m upstream of the discharge location has been undertaken since the original 2018 application. PDP make the following conclusions on the monitoring results:

- There is no indication of direct wastewater contamination of the groundwater discharge (i.e., elevated ammoniacal nitrogen, carbonaceous biochemical oxygen demand ($cBOD_5$) and *E.coli*);
- The stormwater and dewatered groundwater are generally of similar water quality to the receiving environment, as the receiving surface water is largely groundwater fed from the same groundwater;
- The quality of the surface water and groundwater indicates they have been significantly impacted by the extensive agricultural land uses in the surrounding area, with high electrical conductivity, high total nitrogen, and high total phosphorus. Additionally, the background receiving surface water and the proposed dewatered groundwater exceeds the NPS-FM bottom line for nitrate-nitrogen toxicity and *E. coli*, with nitrate-nitrogen elevated at levels that can cause ecotoxicity effects. The early monitoring undertaken so far indicates that the discharge may increase nitrate levels within the stream;
- However, the groundwater dewatering system is an integral part of the upgraded WWTP, which has substantially reduced nitrogen loads from the BSM wastewater discharge and will significantly reduce nitrogen leaching from the BSM's land discharge;
- PDP considers that this will reduce nitrate-nitrogen concentrations in shallow groundwater. Whilst in the short-term the dewatering system may contribute to higher nitrate-nitrogen in the receiving environment, the groundwater dewatering system enables improvements that will ultimately improve groundwater quality and the receiving surface water quality (as the receiving surface water is largely groundwater fed); and
- The specific purpose of the groundwater dewatering system is to protect the lagoon liners from flotation in groundwater conditions, which could damage the subgrade and tear the liner. This would likely cause wastewater leakage to groundwater at far greater levels of contamination than may be caused by the elevated nitrate-nitrogen in the dewatering groundwater in the short-term.

Overall, PDP conclude that whilst the proposed discharge and the receiving surface water contain elevated nitrate-nitrogen levels within the existing environment, the groundwater dewatering is for the upgraded WWTP which is an essential component in improving groundwater nitrate levels over time.

6.7 AIR QUALITY EFFECTS

The Beca Air Discharge Assessment assesses the effects of the discharges to air from the Site on ambient air quality. A summary of the report's key findings is provided below.

6.7.1 Energy Efficiency and Carbon Reduction

The Government's preferred approach for existing fossil fuel-fired assets is to phase out coal in existing sites by 2037 for low and medium temperature processes through the consenting process.

BSM has completed a study to identify site emissions and assess emission reduction opportunities,[23] with the primary objective to identify a decarbonisation transition pathway for the Site.

The Transition Opportunity Assessment Report (**TOA Report**) (**Appendix G**) identified an opportunity to decommission the existing HWB boiler by August 2024. This will be achieved through improved heat recovery, reduced hot water demand and the installation of a new high temperature electric heat pump.

Furthermore, BSM will seek to replace the RSB boiler when a practicable alternative technology is available (in accordance with carbon reduction requirements). Options for this may include a bio-mass boiler, a tallow-fired boiler or an electric boiler, which would require a significant upgrade to the electricity supply network.

6.7.2 Effects of Combustion Plant (Boilers)

Beca has modelled the dispersion of emissions from the coal fired boiler stacks to demonstrate the effects on ambient air quality in the vicinity of the Plant. The ambient concentrations predicted by the modelling were then compared to the relevant ambient air quality standards and guidelines to assess the potential for adverse health effects on sensitive receptors (nearby dwellings).

Based on the approach outlined in the section above, three emission scenarios were modelled:

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[23] A Transition Opportunity Assessment Report prepared as part of the Energy Efficiency and Conservation Authority (EECA)'s ETA programme.

- **Scenario 1 (Currently consented emissions):** This scenario assumes the HWB and RSB boilers are both in continuous operation at maximum capacity (1.9 MW and 4.3 MW, respectively) and the discharge of Total Suspended Particulates (**TSP**) emitted from the boilers is at the currently allowed discharge concentration (500 mg/m^3 adjusted to 0°C, dry gas basis, 101.3 kPa and 8% oxygen or 12% carbon dioxide).
- **Scenario 2 (Future emissions to August 2024 – High Particulate Emissions):** This scenario assumes the HWB boiler and RSB Boiler are both in continuous operation at maximum capacity. The discharge of TSP emitted from the boilers are assumed to be at 750 mg/m^3 at 12% carbon dioxide for the RSB Boiler and 2,000 mg/m^3 at 12% carbon dioxide for the HWB boiler.
- **Scenario 3 (Future emissions post-August 2024):** This scenario assumes the RSB boiler is in continuous operation at maximum capacity and the HWB boiler has been decommissioned. The discharge of TSP emitted from the RSB Boiler is assumed to be at 750mg/m^3 at 12% carbon dioxide.

For both scenarios, the boilers have been assessed as operating continuously for 24 hours per day for the simulation period. The model's emissions assumptions are therefore conservative and assume the maximum site emissions occur at the same time as worst-case dispersion conditions.

The primary pollutants of concern that have been modelled are:

- Particulate matter with a diameter less than 10 micrometres (**PM_{10}**);
- Particulate matter with a diameter less than 2.5 micrometres (**$PM_{2.5}$**);
- Sulphur dioxide (**SO_2**);
- Oxides of nitrogen (**NO_x.**); and
- Mercury.

While other pollutants will also be discharged (e.g., Carbon Monoxide), the off-site concentrations of these pollutants are expected to be substantially lower that the relevant air quality criteria limits and were not modelled.

Scenarios 1, 2 and 3 are all considered relevant for the modelling of PM_{10} and $PM_{2.5}$. However, for the modelling of SO_2, NO_x and Mercury, only Scenarios 1 and 3 are relevant. This is because the only difference between Scenario 1 and 2 is the consented emissions of particulate matter (Scenario 1) and the future emissions of particulate matter to August 2024 (Scenario 2), with no differences in the emission of SO_2, NO_x and Mercury between these two scenarios.

6.7.2.1 Modelling Results - PM_{10} and $PM_{2.5}$

Table 12 and Table 13 provide a summary of the maximum 24-hour and annual off-site concentrations of PM_{10} and $PM_{2.5}$ for each Scenario outside the site boundary and at dwellings within the vicinity of the Site (Refer to Section 4.1 for details).

Table 12: Summary of Predicted Maximum 24-hour and Annual Off-Site PM_{10} Concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 1	24 hrs	max dwelling	6.4	19.8	26.2	**52.4%**	50
		max off-site	8.3	19.8	28.1	**56.2%**	50
	Annual	max dwelling	1.00	6.1	7.10	**35.5%**	20
		max off-site	1.24	6.1	7.34	**36.7%**	20
Scenario 2	24 hrs	max dwelling	18.8	19.8	38.6	**77.2%**	50
		max off-site	26	19.8	45.8	**91.6%**	50
	Annual	max dwelling	2.8	6.1	8.9	**44.5%**	20
		max off-site	3.5	6.1	9.6	**48.0%**	20
Scenario 3	24 hrs	max dwelling	4.9	19.8	24.7	**49.4%**	50
		max off-site	8	19.8	27.8	**55.6%**	50
	Annual	max dwelling	0.7	6.1	6.8	**34.0%**	20
		max off-site	1.0	6.1	7.1	**35.5%**	20

Table 13: Summary of Predicted Maximum 24-hour and Annual Off-Site $PM_{2.5}$ Concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Draft[24] NESAQ	Draft NESAQ (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 1	24 hrs	max dwelling	1.1	13	14.1	**56.4%**	25
		max off-site	1.4	13	14.4	**57.6%**	25
	Annual	max dwelling	0.17	4	4.17	**41.7%**	10
		max off-site	0.21	4	4.21	**42.1%**	10
Scenario 2	24 hrs	max dwelling	3.3	13	16.3	**65.2%**	25
		max off-site	4.5	13	17.5	**70.0%**	25
	Annual	max dwelling	0.49	4	4.49	**44.9%**	10
		max off-site	0.61	4	4.61	**46.1%**	10
Scenario 3	24 hrs	max dwelling	0.99	13	14.0	**56.0%**	25
		max off-site	1.6	13	14.6	**58.4%**	25

[24] In February 2020, the Ministry for the Environment released the "Proposed Amendments to the National Environmental Standards for Air Quality (Consultation Document)", which proposes the introduction of a new ambient air quality standard for $PM_{2.5}$. The proposal is at the consultation stage and currently does not have any legal status.

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Draft[24] NESAQ	Draft NESAQ (µg/m³)
			Site Contribution	Background Concentration	Total		
	Annual	max dwelling	0.15	4	4.15	**41.5%**	10
		max off-site	0.19	4	4.19	**41.9%**	10

6.7.2.2 Modelling Results - SO2 and NOx

Table 14 and Table 15 provide a summary of the maximum 99th percentile one hour and 24-hour off-site concentrations of SO_2 and NO_x for Scenario 1 (both boilers operating at the consented limit of 500 mg/m³) and Scenario 3 (The RSB boiler only operating at 750mg/m³) outside the site boundary and at dwellings within the vicinity of the Site .

Table 14: Summary of Predicted Maximum 99th Percentile one hour and 24-hour Average Off-Site SO_2 Concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 1	99.9%ile 1 hr	max dwelling	49	0	49	**14.0%**	350
		max off-site	66	0	66	**18.9%**	350
	24 hrs	max dwelling	27	0	27	**22.5%**	120
		max off-site	36	0	36	**30.0%**	120
Scenario 3	99.9%ile	max dwelling	37	0	37	**10.6%**	350

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (µg/m³)
			Site Contribution	Background Concentration	Total		
	1 hr	max off-site	51	0	51	**14.6%**	350
	24 hrs	max dwelling	18	0	18	**15.0%**	120
		max off-site	29	0	29	**24.2%**	120

Table 15: Summary of Predicted Maximum 99th Percentile one hour and 24-hour Average Off-Site NO_x Concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 1	99.9%ile 1 hr	max dwelling	19	37	56	**28.0%**	200
		max off-site	26	37	63	**31.5%**	200
	24 hrs	max dwelling	11	23	34	**34.0%**	100
		max off-site	14	23	37	**37.0%**	100
Scenario 3	99.9%ile 1 hr	max dwelling	14	37	51	**25.5%**	200
		max off-site	20	37	57	**28.5%**	200
	24 hrs	max dwelling	7	23	30	**30.0%**	100
		max off-site	11	23	34	**34.0%**	100

6.7.2.3 Modelling Results - Mercury

Table 16 provides a summary of the maximum annual off-site concentrations of mercury for Scenario 1 (both boilers operating at the consented limit of 500 mg/m^3) and Scenario 3 (The RSB boiler only operating at 750 mg/m^3) outside the site boundary and at dwellings within the vicinity of the Site.

Table 16: Summary of Predicted Maximum Annual Concentrations of Mercury

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (ng/m^3)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (ng/m^3)
			Site Contributio n	Background Concentration	Total		
Scenario 1	Annual	max dwelling	0.36	1.5	1.86	**0.6%**	300
		max off-site	0.44	1.5	1.94	**0.6%**	300
Scenario 3	Annual	max dwelling	0.21	1.5	1.71	**0.6%**	300
		max off-site	0.28	1.5	1.78	**0.6%**	300

6.7.2.4 Modelling Conclusions

The results of the modelling show that discharges of the primary pollutants from the existing boiler stacks (PM_{10}, $PM_{2.5}$, SO_2 and NO_x and mercury) do not exceed any of the relevant air quality criteria limits outside the Site boundary. More specifically:

- With regard to PM_{10}:
  - The maximum cumulative 24-hour concentrations predicted at the nearest dwelling is 52.4% of the NES-AQ criteria for Scenario 1, increasing to 77.2% for Scenario 2 but reducing to 49.4% of the NES-AQ criteria for Scenario 3; and
  - The maximum annual concentrations predicted at the nearest dwelling is 35.5% of the NES-AQ for Scenario 1, increasing to 44.5% for Scenario 2 but reducing to 34% of the NES-AQ criteria for Scenario 3.
- With regard to $PM_{2.5}$:
  - The maximum cumulative 24-hour concentrations predicted at the nearest dwelling is 56.4% of the Draft NES-AQ criteria for Scenario 1, increasing to 65.2% for Scenario 2 but reducing to 56.0% of the Draft NES-AQ criteria for Scenario 3; and

    - The maximum annual concentrations predicted at the nearest dwelling is 41.7% of the Draft NES-AQ for Scenario 1, increasing 44.9% for scenario 2 but reducing to 41.5% of the Draft NES-AQ criteria for Scenario 3.
- With regard to SO_2:
    - The maximum 99th percentile one-hour concentrations predicted at any dwelling is 14.0% of the AAQG criteria for Scenario 1, reducing to 10.6% of the AAQG criteria for Scenario 3; and
    - The maximum 24-hour concentrations predicted at any dwelling is 22.5% of the AAQG criteria for Scenario 1, reducing to 15.0% of the AAQG criteria for Scenario 3.
- With regard to NO_x,:
    - The maximum cumulative 99th percentile one-hour concentrations predicted at any dwelling is 28.0% of the AAQG criteria for Scenario 1, reducing to 25.5% of the AAQG criteria for Scenario 3; and
    - The maximum cumulative 24-hour concentrations predicted at any dwelling is 34% of the AAQG criteria for Scenario 1, reducing to 30% of the AAQG criteria for Scenario 3.
- For mercury, emissions for both Scenarios 1 and 3 are predicted to be about 0.6% of the AAQG criteria and are considered negligible.

Overall, Beca conclude that the results of the modelling indicate the emissions from the existing boilers do not have significant adverse air quality effects beyond the site boundary, except that the ambient particulate concentrations will be near ambient air quality guidelines until the HWB Boiler is decommissioned in August 2024.

The proposed removal of the HWB boiler by August 2024 will result in a reduction in the PM_{10} mass load discharged from the Site and bring about an approximately 6% reduction compared to both boilers operating at current consent limits. Furthermore, the discharges to air of particulate and combustion emissions from the Site sources will be appropriately mitigated through air discharge limits, boiler maintenance and monitoring measures. These are outlined in Section 7 below.

6.7.3 Effects of Odour on Amenity Values

The main potential sources of odour on the Site are from the processing plant, the biofilter and the WWTP. Poor plant performance from these sources can result in the emission of offensive or objectionable odours, complaints from neighbours and non-compliance with consent conditions.

The assessment of effects of odour has therefore focussed on the current performance of these facilities. Discharges of odour to air have been assessed qualitatively based on current performance of the plant (including complaints), as well as existing mitigation measures.

While the plant is located in a rural area that is relatively insensitive to odour, there are a number of residential dwellings in the vicinity of the plant (approximately 500 m – 800 m from the Site) which have a moderate to high sensitivity to odour and site operations have historically resulted in odour effects that were unacceptable to these neighbours.

Process upgrades to the WWTP (refer to Section 2.3 for further details) and processing plants have recently occurred along with fine tuning of odour management and controls. This has included a range of management plans to mitigate the generation of odour from the processing plant, rendering and blood drying the WWTP and wastewater irrigation, including:

- A site Air Discharge Management Plan;
- A WWTP Operations and Maintenance (O&M) Manual; and
- A Wastewater Farm Environmental Management Plan.

Section 7 below provides details on the various odour management and controls measures proposed as part of these plans.

These upgrades have significantly reduced odour beyond the boundary of the Site compared to historical levels, with only one complaint recorded, since upgrades were completed, in May 2020[25] related to the Plant's rendering cooking. This was due to a malfunction with the biofilter air tunnel that was promptly repaired.

Overall, Beca conclude that provided the odours from the plant processes, biofilter and the WWTP are well managed in accordance with the requirements of the Site Air Discharge Management Plan, the WWTP Operations and Maintenance Manual and the Wastewater Farm Environmental Management Plan, odour from the site is unlikely to be offensive or objectionable to the extent that there is an adverse effect on the closest sensitive receivers beyond the site boundary.

6.8 CULTURAL EFFECTS

In order to identify and assess the cultural effects of the activities, BSM requested Te Ao Marama Inc (**TAMI**) to advise on the need to prepare a Cultural Values Report (**CVR**).

[25] An odour complaint was received in September 2020, but this was attributed to a neighboring dairy farm spreading effluent.

BSM hosted TAMI on a site visit in April 2022 and provided them a copy of a Summary Document for Consultation (**Summary AEE**) included as **Appendix H.** The Summary AEE provides a description of the current and proposed BSM activities, the improvements made at the site, the environmental setting, a summary assessment of environmental effects, mitigation and management of adverse effects and a summary of alternatives. considered.

At the time of application, TAMI are yet to advise on the need to provide a CVR.

Hokonui Rūnanga were also approached by BSM but advised that as the activity is outside of their takiwā, they did not wish to provide feedback.

It is acknowledged that it is for the mana whenua of the area to determine and assess the cultural effects of the activities. However, to the extent that cultural values may align with water quality and ecological effects, addressing these matters will to some degree also avoid, remedy or mitigate cultural effects.

7. MITIGATION, MANAGEMENT AND MONITORING OF ACTUAL AND POTENTIAL EFFECTS

As noted above, there are some circumstances where adverse effects will be generated by the Proposal. Where this is the case, recommendations have been made in order to identify how to best avoid, remedy, mitigate or otherwise address such effects. In some instances, monitoring is proposed to confirm the extent of effect arising.

The mitigation, monitoring and management measures that are proposed are summarised in **Table 17** below.

These measures will also be reflected in proposed conditions offered by BSM as part of its applications; and will form part of the key management measures to be included in activity management plans.

Table 17: Summary of the Recommended Mitigation, Management and Monitoring Measures

<table>
<tr><th>Actual or Potential Effect</th><th>Recommended Mitigation / Management</th><th>Recommended Monitoring</th></tr>
<tr><td colspan="3">Effects from the abstraction of Groundwater</td></tr>
<tr><td>Effects on the groundwater resource.</td><td rowspan="4">Groundwater abstraction rates will be limited to:
• 1,500,000 litres per day; and
• 7,500,000 litres per week.
And will be taken from the existing bores.
The abstraction bores will be appropriately protected from groundwater contamination by:
• The installation of a backflow prevention device to ensure water and/or contaminants cannot return to the water source;
• Sealing the ground around the bore head to prevent foreign material,</td><td rowspan="4">• Monitor groundwater levels at each bore once each calendar month; and
• Measure and report the daily and weekly abstraction from the bores in accordance with the Water Measurement Regulations.</td></tr>
<tr><td>Effects on neighbouring bores.</td></tr>
<tr><td>Effects on surface water.</td></tr>
<tr><td>Effects on aquifer stability, seawater intrusion and groundwater quality.</td></tr>
</table>

Actual or Potential Effect	Recommended Mitigation / Management	Recommended Monitoring
	surface water, spillage or other leakage entering the space between the casing and the wall of the borehole; • Sealing the top of the casing to prevent the entry of contaminants into the casing; and • Securing the bore head with stock protection measures e.g., fencing.	
Effects from the discharge of treated wastewater, biosolids, stockyard solids and paunch to land		
Effects on soil.	• Limit the irrigation rates to within the measured capacity of the soils on the site to minimise hydraulic loading effects; • Managing soil chemistry effects by: o Undertaking biosolids loading to target paddocks with low soil fertility and quality indicators (low Olsen P levels); and o Managing excess sodium, potassium and Exchangeable Sodium Percentage (ESP) through soil additives. • Limiting the oil and grease concentration of the treated wastewater discharged to soil to	• Monitoring soil health within the irrigation area and a control site for a range of parameters including nutrients and ESP at least once per year; • Testing soil infiltration rates at least once per year at the same sites as the above; and • Monitoring the actual levels of heavy metal accumulation on an ongoing basis by taking representative samples of the heavy metals outlined above on a five-yearly interval.

Actual or Potential Effect	Recommended Mitigation / Management	Recommended Monitoring
	assist in maintaining soil infiltration rates.	
Effects on groundwater.	• The nitrogen loading rate from wastewater irrigation will be limited; and • Wastewater irrigation application rates will be limited.	• Quarterly sampling of groundwater bores for nitrogen leaching to confirm the expected improvement in groundwater quality; • Ongoing monitoring of shallow groundwater for E.*coli* on the site; and • Testing groundwater monitoring wells for heavy metals at five-yearly intervals.
Effects on surface water.	• The nitrogen and phosphorus loading rates from wastewater irrigation will be limited; • Wastewater irrigation application rates will be limited; • The establishment of riparian planting on all streams and drains on their land to act as a buffer to absorb excess phosphorus; and • Underground drains will be capped within the BSM irrigation area.	• Monthly monitoring of the unnamed tributary of the south branch of the Waihopai River that flows through the wastewater discharge area for physio-chemistry and nutrients; and • To maintain a conductivity meter downstream of the land treatment area to continuously monitor electrical conductivity in the tributary.
Ecological effects.	• The nitrogen and phosphorus loading rates from wastewater irrigation will be limited; • Wastewater irrigation application rates will be limited; and	• Ecological monitoring on a five-yearly basis.

Actual or Potential Effect	Recommended Mitigation / Management	Recommended Monitoring
	• Implementing native riparian planting along all watercourses that run through the property to provide shading and greater habitat quality.	
Effects on human health.	• Operational management and physical methods used for irrigation / spreading to avoid staff contact with the wastewater; • Minimising public contact with sprayed wastewater through the use of appropriate buffer zones; and • Ensuring irrigation does not occur near a downwind boundary during windy conditions.	
Effects on stock health.	• Maintaining a minimum stock withholding period of 14 days following discharge event.	• None required.
Effects from the take of groundwater for dewatering		
Effects on groundwater.	• The groundwater will be taken passively via the installed sub-surface drainage.	• None required.
Effects from the discharge of land drainage water and stormwater to water		
Effects on surface water.	• No adverse effects requiring mitigation identified.	• Annual sampling of land drainage water and water from the drain upstream of the discharge point for contaminants.

Actual or Potential Effect	Recommended Mitigation / Management	Recommended Monitoring
Air Quality Effects		
Carbon emissions from combustion plant (boilers).	• Decommission the existing HWB boiler by August 2024; and • BSM seeking to replace the rendering RSB boiler when a practicable alternative technology is available. A review of this is proposed every five years.	• None required.
Emission of contaminants from the combustion plant (boilers).	• Limiting boiler particulate matter emissions; • Reducing boiler particulate matter emissions with the decommissioning of the existing HWB boiler by August 2024; and • Boiler control and maintenance, including: o 12-monthly servicing of each boiler with reports provided to Environment Southland; o Tuning boilers to ensure optimal fuel combustion, minimum fuel use and minimum particulate emissions; and o Discharging emissions via a 20 m high stack for the RSB and an 18.6 m stack for the HWB to ensure	• Undertaking emissions testing of the RSB boiler once every year for the first three years to ensure compliance with emission limits with reports provided to Environment Southland; • After three continuous years of compliance with the particular matter discharge limit; testing of the RSB will be undertaken every three years; • Undertaking emissions testing of the HWB boiler once every year until it is decommissioned to ensure compliance with emission limits with reports provided to Environment Southland; • Monitoring opacity of emissions to ensure compliance with consent limits; and • Carrying out regular review of the Newvale

Actual or Potential Effect	Recommended Mitigation / Management	Recommended Monitoring
	adequate dilution and dispersion.	coal to ensure compliance.
Emission of objectionable odours from processing plant (rendering and blood drying).	An Air Discharge Management Plan that includes numerous controls and management processes including: • Ensuring material is processed and rendered as soon as practicable; • Collecting all point sources of vapour from the rendering and blood drying plant and venting this to a condenser and then the plant biofilter; • Directing all rendering and blood drying room air to the biofilter for treatment; • Ensuring sufficient changes of rendering building air per hour; • Minimising external door opening times; and • Undertaking daily housekeeping and thorough cleaning;	• Monthly monitoring of moisture and pH conditions to ensure the biofilter health is maintained. • Undertaking daily visual checks of the biofilter; • Checking for signs of biofilter bed degradation e.g. slumping; • Ensuring biofilter bed moisture levels are maintained and applying water to the bed if necessary; • Monitoring inlet humidity and temperature continuously; • Monitoring pressure drop over the biofilter monthly; • Regularly upgrading the biofilter with new bark and regular checking of the air distribution; and • Daily checking downwind for the presence of recognisable rendering odour.
Emission of odour from the Wastewater Treatment and Disposal System.	• An Air Discharge Management Plan to detail actions taken to minimise odour emissions from the site; • Management and monitoring of the creation and discharge of odours from WWTP under the	• Regular inspections and maintenance of equipment in accordance with the Air Discharge Management Plan

Actual or Potential Effect	Recommended Mitigation / Management	Recommended Monitoring
	requirements of the WWTP Operation and Maintenance Manual and Wastewater Farm Environmental Management Plan. This includes management practices such as regular inspections and maintenance of equipment, daily cleaning, contingency methods for plant malfunctions and training procedures; • Operation of the biogas flare as the primary treatment measure for biogas from the anaerobic pond, with a biofilter available for contingency purposes in the event that the flare is not working; and • Utilisation of the Wastewater Farm Environmental Management Plan.	
Emission of odour from wastewater irrigation.	A Wastewater Farm Environmental Plan that includes numerous controls and management processes including: • Twice-daily checks of irrigation operation and maintaining plant equipment to a high standard; and • Appropriately managing the WWTP to ensure the wastewater does not become anaerobic.	• Reviewing prevailing winds directions before irrigating and adjusting irrigator speeds in response to climatic and soil conditions.

8. CONSIDERATION OF ALTERNATIVES AND THE BEST PRACTICABLE OPTION

8.1 INTRODUCTION

Under the RMA, a consideration of alternative locations and methods is relevant in certain respects:

- Where an activity includes the discharge of a contaminant, Schedule 4 imposes an obligation on an applicant to provide a description of any possible alternative methods of discharge, including discharge into any other receiving environment;
- Similarly, section 105 of the RMA requires decision makers to have regard to various matters including “any possible alternative methods of discharge, including discharge into any other receiving environment”; and
- Section 108 of the RMA also sets out that a condition may be imposed on a discharge permit requiring the consent holder to adopt the best practicable option (**BPO**) in order to prevent or minimise any actual or likely adverse effects on the environment of the discharge.

As set out in Section 10.2.2 below, adoption of the BPO is also a key policy directive in the pSWLP for managing the treatment and discharge of contaminants derived from industrial and trade processes and the Southland Regional Policy Statement for improving air quality in the Southland Region.

As defined in section 2 of the RMA, the best practicable option (**BPO**) in relation to a discharge of a contaminant means:

> *The best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—*
>
> *(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
>
> *(b) the financial implications, and the effects on the environment, of that option when compared with other options; and*
>
> *(c) the current state of technical knowledge and the likelihood that the option can be successfully applied.*

Determining what the BPO is in a given circumstance requires a decision maker to weigh competing considerations, including the nature of the discharge, sensitivity of the environment and practicalities of that and any other option. The use of the words "among other things" clearly signals that other factors can also be taken into consideration.

The words ‘BPO’ do not mean the best option, the best technical option, the best economic option, or the best environmental option. Nor do they require adherence to what might be considered "best practice". A judgement needs to be made as to what is practicable and proportionate to the risks likely from a contaminant to be discharged. The key word is 'practicable', and this means not granting consents that require adherence to an option that would be prohibitively expensive or involve procedures that are unnecessarily onerous or impractical.

As part of its resource consent investigations, BSM has undertaken an extensive assessment into the availability and practicalities of alternative methods and technologies in order to minimise any actual or potential adverse effects arising from the proposed discharges to land, water and air. This section of the report summarises these investigations and the determination of the best practicable options available to be implemented now and in the future.

8.2 DISCHARGES TO LAND

As part of the investigation to determine the most suitable treated wastewater discharge option prior to the 2019 upgrade, BSM reviewed multiple options for the Site. These options included:

- Discharge to surface water;
- Combined land and water discharge (dual discharge);
- Discharge to land – physio-chemical treatment;
- Discharge to land – anaerobic treatment and biological nitrogen removal;
- Water re-use for closed loop operations;
- Discharge to trade waste; and
- Managed aquifer recharge.

Further details of the various options are set out in the PDP Land Discharge Assessment.

BSM selected the option to discharge to land with anaerobic treatment and biological nitrogen removal. This option involves complete biological treatment by upgrading the wastewater treatment facility to include:

- An anaerobic treatment process for the removal of solids and organic material; and
- An aerobic treatment process for the biological removal of nitrogen.
- This option was considered the BPO as it:
- Maintains a discharge to land as the preferred option;
- Significantly reduces nitrogen loads to the land treatment system, reducing nitrogen leaching;
- Provides for removal of fats, oils and greases to improve soil infiltration rates;

- Provides for beneficial reuse of nutrients in the pastoral system;
- Provides sufficient capacity to store wastewater during rain events until soil conditions are suitable for irrigation; and
- Reduces reliance on third-party owned farmland, which would have otherwise been required for reducing nitrogen loads per hectare. This in turn provides BSM with certainty that environmental effects are minimised without relying on participation of third parties.

8.3 DISCHARGES TO WATER

After considering the discharges from the land drainage water (from the groundwater dewatering system and leak detection system for the upgraded WWTP) and stormwater to water through the lens of the BPO test described in Section 8.1 above, it is assessed that the following represents the BPO for those discharges:

- Rainfall from the covered anaerobic lagoon cover is directed to a sump at the centre of the lagoon via preformed channels. From there, the stormwater is pumped to a manhole and discharged to the surface drain to in northeast of the site; and
- Land drainage water (groundwater intercepted by the groundwater dewatering system and groundwater intercepted by the leak detection system on rare occasions) is discharged to the stormwater system outlined above.

The proposed option is considered the BPO for the following reasons:

- The discharge is small in scale;
- The quality of the stormwater from the lagoon cover is expected to reflect that of roof run-off and not have any adverse effect on the water quality of any freshwater body;
- The quality of the dewatered groundwater is generally of similar water quality to the receiving environment, as the receiving surface water is largely groundwater fed from the same groundwater. However, the quality of the surface water and groundwater has been impacted by surrounding agricultural land uses, containing elevated levels of contaminants, particularly elevated nitrate-nitrogen levels;
- Whilst the proposed discharge and the receiving surface water contain elevated nitrate-nitrogen levels, and the discharge may increase nitrate-nitrogen levels within the surface water, the groundwater dewatering is an integral part of the upgraded WWTP. The upgraded WWTP has substantially reduced nitrogen loads from the BSM wastewater discharge and will significantly reduce nitrogen leaching from the BSM's land discharge;
- Whilst in the short-term the dewatering system may contribute to higher nitrate-nitrogen in the receiving environment, the groundwater dewatering system enables

improvements from the upgraded WWTP that will ultimately reduce nitrate-nitrogen concentrations in shallow groundwater and improve both groundwater and the receiving surface water quality (as the receiving surface water is largely groundwater fed);

- The purpose of the groundwater dewatering system is to protect the lagoon liners from flotation in groundwater conditions, which could damage the subgrade and tear the liner. This would likely cause wastewater leakage to groundwater at far greater levels of contamination than may be caused by the elevated nitrate-nitrogen in the dewatering groundwater in the short-term; and
- Treatment of the discharge would not result in any environmental benefit such that it would warrant the additional expenditure necessary to provide it.

8.4 DISCHARGES TO AIR

8.4.1 Discharge of Contaminants

After considering the discharges from the two coal-fired boilers through the lens of the BPO test described in Section 8.1 above, it is assessed that the following represents the BPO for those discharges:

- The de-commissioning of the HWB boiler by August 2024 to reduce carbon emissions; and
- Continuing to maintain and operate the RSB Boiler in its current form, with BSM seeking to replace the RSB boiler when a practicable alternative technology is available (in accordance with national carbon reduction requirements). Potential options for this are indicated below.
  - A biomass boiler: There are currently fuel supply security issues;
  - A tallow-fired boiler: This is currently economically unfavourable due to high tallow prices; or
  - An electric boiler: This would require a significant upgrade to the electricity supply network.

These alternative technologies are still emerging and as noted above there are currently economic and infrastructural impediments, meaning that, at this time, they do not represent a practicable alternative for the site.

BSM also considered alternative options as part of the OAR Report prepared by Beca in July 2021 before deciding the proposed upgrades are the preferred way forward in this case. These options included:

- Converting the RSB boiler to burn wood chip which was not recommend due to the age of the RSB boiler; and

- Using biogas generated from the WWTP to fuel the RSB boiler. This was not recommended as there is insufficient biogas available to meet the required demand, however this could be considered in combination with another option in the future when the project economics improve.

The proposed option is therefore considered the BPO for the following reasons:

- The Beca assessment confirmed that the current ambient combustion contaminations (PM_{10}, $PM_{2.5}$, NO_X, SO_2 and mercury) are expected to meet all relevant air quality criteria beyond the site boundary;
- The discharges to air of particulate and combustion emissions from the Site sources will be appropriately mitigated through emission limits and boiler maintenance and monitoring requirements;
- Through the renewal of these resource consents, BSM will reduce its carbon emissions by de-commissioning the HWB boiler by August 2024 (also resulting in a reduction in the PM_{10} mass load discharged from the Site and bringing about an approximately 6% reduction compared to both boilers operating at current consent limits). This will be achieved through improved heat recovery, reduced hot water demand and the installation of a new high temperature electric heat pump;
- Beca consider the methods used to control and manage the emissions from the boilers, process facility, the WWTP and irrigation area are considered to be consistent with industry good practice; and
- BSM will continue to keep abreast of national and regional changes relating to carbon reduction obligations and emerging technologies and respond this assessment during the life of the consent. A condition has been proposed that requires this.

8.4.2 Discharge of Odour

As set out in Section 7 of this AEE, a range of measures are implemented at the BSM Plant to minimise the potential for odour emissions. After considering the discharges from the odour from the plant through the lens of the BPO test described in Section 8.1 above, it is assessed that with the addition of the measures set out in Section 7, the operation of the BSM Plant represents the BPO for its odour discharges for the following reasons:

- Whilst the Plant is located in a rural area that is relatively insensitive to odour, there are a number of residential dwellings in the vicinity of the plant which have a moderate to high sensitivity to odour;
- Potential odours from the Site (Plant processes, rendering processes via the biofilter, the upgraded WWTP and wastewater irrigation) will be mitigated and managed in

accordance with the requirements of numerous management plans[26] to ensure any objectionable or offensive effects are unlikely to occur at the closest sensitive receptors (nearby dwellings etc) outside the site boundary; and

- Only one odour complaint has been recorded following the WWTP upgrades (due to a malfunction with the biofilter that was promptly repaired)[27].

[26] The Site Air Discharge Management Plan, the WWTP Operations and Maintenance Manual and the Wastewater Farm Environmental Management Plan

[27] An odour complaint was received in September 2020, but this was attributed to a neighboring dairy farm spreading effluent.

9. CONSULTATION

9.1 INTRODUCTION

Details of the consultation undertaken in respect of these applications is provided below.

9.2 INTRODUCTION CONSULTATION MEETING

BSM hosted a half day consultation meeting and site visit on 26th January 2021. The meeting included an introduction to the Plant including current and future proposed processes, a plant tour, and a consent renewal presentation. The consent renewal presentation included details about the scope of the technical reports to support the consent application, the proposed consultation process to be followed while preparing the applications and key dates for the reconsenting. This was followed by questions and a general discussion.

Potentially interested parties were invited to the meeting, including:

- Te Ao Marama Inc
- Te Runanga o Ngai Tahu
- Department of Conservation
- Fish and Game
- Public Health South
- Southland District Council
- Hokonui Runanga; and
- Environment Southland.

The majority of the stakeholders attended with the exception of Te Ao Marama Inc, who put in an apology, Hokonui Runanga because the Site is outside their Takiwa and Te Runanga o Ngai Tahu who did not respond to the invite. Southland District Council acknowledged the invitation but declined to join the session due to limited interest in the regional council re-consenting process. Two staff members from Environment Southland were in attendance.

No particular issues were raised during the consultation meeting that were relevant to this application.

A similar session was also held for surrounding neighbours.

9.3 SUMMARY DOCUMENT FOR CONSULTATION

In early May 2022 a Summary AEE was prepared and circulated to potentially interested parties. The Summary AEE included details about:

- Blue Sky Meats;
- The Plant;
- The activities occurring on the plant that are proposed to be reconsented;
- The improvements made at the plant;
- Further improvements proposed as part of this consent application;
- The environmental setting of the Site;
- A summary assessment of environmental effects from the proposed activities;
- Proposed mitigation and management of any actual and potential adverse effects from the proposed activities;
- The alternatives considered; and
- The next steps for the consent application process.

The technical components of the Summary AEE were informed by draft technical reports prepared by PDP and Beca and included the PDP Groundwater Assessment, the PDP land discharge assessment, the PDP Proposed WWTP Assessment and the Beca Air Discharge Assessment.

The Summary AEE was circulated to a range of interested parties, including:

- Te Ao Marama Inc;
- Department of Conservation (**DoC**);
- Fish and Game;
- Public Health South (**PHS**); and
- The 15 closest neighbours to the site.

These parties were invited to provide feedback on the Summary AEE by late May so that any feedback could be considered as part of this consent application. A summary of these parties' feedback, and how it has been addressed, is provided below.

9.3.1 Te Ao Marama Incorporated Limited

A site visit was held with Te Ao Marama Inc on 13 April 2022. The site visit was attended by Stevie-Rae Blair. The site visit involved a drive around the boundary of the farm and the wastewater treatment plant. Particular areas of focus during the visit included the waterways, the riparian planting, the wastewater irritation areas, the wastewater treatment plant and the biofilter.

Feedback during the visit from Te Ao Marama Inc was positive with no immediate concerns raised.

At the time of lodging, BSM are yet to receive feedback from TAMI on the Summary AEE.

9.3.2 Environment Southland

A pre-application meeting was held with Environment Southland on the 23rd of May 2022. This pre-application meeting was attended by:

- Steve West and Andrea Garcia from Environment Southland;
- Jim Goodall and Steve Paynter from BSM; and
- Doyle Richardson and Nicolai Berry from Mitchell Daysh.

A range of issues related to the application were discussed, including:

- Timeframes under s124 of the RMA;
- An overview of the various activities BSM are seeking resource consent renewal for;
- Which technical assessments that have been prepared to support the AEE will require a technical review from Environment Southland;
- BSM approach to greenhouse gas emissions and decarbonisation;
- Consultation that has been undertaken to date and any further consultation that needs to be undertaken;
- The approach to notification; and
- The approach to the utilisation of third-party owns land by BSM.

9.3.3 Department of Conservation

Email correspondence was received from DoC on 16th May 2022 advising that feedback would be available in four to six weeks, meaning it is not able to be included in this application. Feedback from DoC will be considered by BSM when it is received.

9.3.4 Public Health South

PHS provided feedback on 20th May 2022 which is attached as **Appendix I**. A summary of the key areas of feedback and how BSM has addressed this feedback is provided below.

Groundwater bore protection

PHS would like to ensure the bores that the groundwater is abstracted from are properly protected from contamination at the ground surface. BSM has proposed conditions included in **Appendix K**, which require:

- The installation of a backflow prevention device to ensure water and/or contaminants cannot return to the water source;

- A seal, made of concrete or similar material, to be placed at ground level around the outside of the casing. The seal will be sufficient to prevent foreign material, surface water, spillage or other leakage entering the space between the casing and the wall of the borehole;
- The top of the casing to be sealed to prevent the entry of contaminants into the casing; and
- The prevention of stock access to the bores.

Monitoring

PHS are supportive of proposed environmental monitoring of:

- groundwater levels and daily groundwater volume abstraction:
- nitrogen loadings rates:
- groundwater *e. coli*; and
- groundwater heavy metals

PHS have also recommended monitoring for nitrate-nitrogen, dissolved reactive phosphorus, and other pollutants including boron, arsenic, fluoride, and pesticides.

Of these it is proposed that nitrate-nitrogen and dissolved reactive phosphorus are monitored in both the tributary flowing through the Site and groundwater beneath the Site. Monitoring of other pollutants in this list has not been recommended by PDP.

Groundwater nitrate-nitrogen

PHS provided comment on concerns about nitrate-nitrogen in groundwater used for drinking. Nitrate-nitrogen concentrations can be elevated above New Zealand Drinking Water Standards both upgradient and downgradient of the Site, with downgradient bores showing a measurable increase in nitrate-nitrogen concentrations compared to upgradient bores. BSM has recognised the need to reduce the amount of nitrogen discharged from the site to the environment and has made substantial improvements to its WWTP so that can be achieved. As a result of this, over time it is expected that there will be an improvement in groundwater quality and there will not be a significant difference in nitrate-nitrogen concentrations been upgradient and downgradient bores.

PHS also provided comment on the need to improve the environment where it is degraded. As discussed in Section 1.3 of this AEE, BSM have made substantial improvements to its operations to improve environmental outcomes.

Irrigation application rates

PHS has provided comment that the irrigation rates should be limited to no more than 10 mm to minimise the risk of nutrient leaching. The BSM Site operates year-round and in most months throughout the year, rainfall exceeds potential evapotranspiration meaning running an irrigation system only when there is a soil moisture deficit is impractical with a large volume of storage being required that would need to be managed. The proposed irrigation application rates (both hourly and per application event) are designed to minimise the risk of ponding and runoff. The reduction in nutrient leaching is primarily achieved by the improved wastewater treatment and land management, e.g., running a cut and carry operation.

Air discharge

PHS are supportive of the proposed decommissioning of the HWB boiler and were interested to know what might be possible for the remaining RSB boiler. As discussed in Section 8.4.1 above, no decision has been made on the RSB boiler, but a range of options have been considered. Those options that are the most likely, but for which BSM is not able to commit to are:

- a new bio-mass boiler, which has fuel supply security issues;
- a tallow-fired boiler, which is currently economically unfavourable due to high tallow prices; or
- an electric boiler, which would require a significant upgrade to the electricity supply network.

BSM are committed to decarbonisation and improving local air quality as evidenced by engagement with Energy Efficiency Conservation Authority (EECA) Business, which is a Central Government organisation tasked with mobilising New Zealanders to be world leaders in clean and clever energy use.

The TOA report prepared by BSM (included in **Appendix G**) as part of the EECA Business Energy Transition Accelerator programme. Through this programme BSM has committed to the following projects which will reduce demand on the existing coal fired boilers:

- Recovering waste heat, especially from the rendering plant and refrigeration equipment;
- Demand reduction steps including;
  - Installing standby heat exchangers to enable maintenance to reduce scale build-up;
  - Upgrading hose nozzles to reduce flow; and
  - Improved pipe insulation.
- Upgrading knife sterilisers to sensor-activated units; and

- Replacing the HWB boiler with a heat pump driven off the reject heat from the soon-to-be installed refrigeration plant. A heat pump will fall within the current electrical supply capacity.

Biogas

Public Health South have recommended that BSM consider how they might be able to generate and use biogas on the site. An option to use biogas generated from the WWTP to fuel the RSB boiler was considered in the Opportunity Assessment Report. This was not recommended as there is insufficient biogas available to meet the required demand, however this could be considered in combination with another option in the future when the project economics improve.

Consent term

Public Health South would like BSM to consider a shorter consent period to a time when catchment setting limits under the sRLWP have been made and or climate change direction is clearer in relation to the final phasing out of coal fired boilers.

BSM is seeking a 35-year consent term for the replacement consents being sought. A 35-year consent term suitably recognises the existing asset value of the Plant and the significant economic contribution it provides to the Southland Region. A 35-year consent term also means the significant financial investment involved in the upgraded WWTP and the future investment in decarbonisation can be justified and secured over an appropriate timeframe.

It is acknowledged that there is some uncertainty in regard to future central and local government direction on freshwater and climate change, however BSM has already undertaken significant upgrades to its operation which will improve freshwater quality and has made a commitment to reduce carbon emissions to align with current and expected government direction. As such, BSM is of the view that the consent term should reflect these actions and commitments already made.

9.3.5 Fish and Game Southland

A meeting was held between Jacob Smyth from Fish and Game, Steve Paynter from BSM and Doyle Richardson from Mitchell Daysh on 19th May 2022. Following this discussion, Fish and Game provided feedback on 21st June 2022, which is attached in **Appendix J**. Fish and Game advised that their primary interest in these applications for consent relates to the proposed discharge of contaminants to land (treated wastewater, biosolids, stockyard solids and paunch). A summary of the key areas of feedback and how BSM have addressed this feedback is provided below.

Discharges to land

Fish and Game generally considers discharges to land preferable to discharges to surface water and is therefore supportive of the proposed discharge of treated wastewater, biosolids, stockyard solids and paunch to land.

Fish and Game are also supportive of the upgraded WWTP and the associated decrease in the concentration of contaminants, in particular nitrogen, in the wastewater prior to discharge to land.

BSM-owned land vs. Third-party owned land

Fish and Game state that any assessment of effects (i.e., this AEE) should be clear regarding the area of land that will be irrigated with treated wastewater, biosolids, stockyard solids and paunch in order to determine the scale of effects. Furthermore, Fish and Game seek to ensure the Proposal has appropriate arrangements in place to facilitate the proposed discharge to third-party land.

As set out in Section 3 of this AEE, BSM are proposing to discharge treated wastewater, biosolids, stockyard solids and paunch to both BSM-owned land and third-party owned land, with Section 2 of this AEE providing a description of these land areas. Furthermore, the PDP Discharges to Land assessment provides the following key mitigation measures if the third-party owned land is not available for use by BSM:

- BSM will undertake riparian planting on all streams and drains on their land prior to loading the irrigation land to 110 kg P/ha/yr (which would occur if third-party land is no longer available) which will suitably mitigate the impact of phosphorus loss from the proposed discharges to land.

These measures are provided for in the proposed condition set. Overall, if the third-party land is no longer available to BSM for irrigation, this additional measure will suitably address any issues associated with the discharges to land

Irrigation Application Rates

Fish and Game consider that the application rates for any discharges to land should match the ability of the land (including different soil types) to absorb and filter it, and application rates should be guided by onsite soil moisture monitoring, which considers different soil types and any difference in infiltration rates.

As discussed in Section 6.4.1 of this AEE, PDP have provided an assessment of the effects on soils as a result of the proposed discharges to land. BSM propose to maintain the current irrigation rates to within the measured capacity of the soils on the Site, with the proposed limits as follows:

The maximum irrigator hydraulic application rate is proposed as 6 mm/hr;

- In the drier periods (October to March inclusive), a maximum application depth of 35 mm per application event; and
- In the wetter periods (April to September inclusive), a maximum daily application depth of 15 mm per application event.

PDP conclude that these limits will ensure that saturated conditions, ponding and runoff are minimised and will not occur as a result of the irrigation activity and that the structure and microbial health of the soil are generally maintained.

Groundwater and Surface Water

Fish and Game consider it is important that any surface run-off, ponding or contamination of groundwater and surface water as a result of the irrigation of treated wastewater, biosolids, stockyard solids and paunch to land is avoided.

As discussed in Section 6.4.2 and 6.4.3 of this AEE, PDP have provided an assessment of the effects on groundwater and surface water as a result of the proposed discharges to land.

With respect to groundwater, PDP have concluded the following:

- With regard to nutrient leaching, Overseer modelling results indicate that even under the worst-case scenario (where BSM lose access to third-party land) there will be no increase in nutrient leaching above what could occur if the land was farmed for sheep and beef, and the proposed discharge is expected to have no effect on groundwater concentrations for phosphorus;
- With regard to pathogen migration, the risk of contamination of the nearest supply bore is considered low, as any surviving *E.coli* that enters groundwater will undergo attention at rates that should ensure a complete *E. coli* die-off should occur within the 700 m between the irrigation system and the closest drinking water supply bore;
- With regard to heavy metals, wastewater sampling on the Site suggests metal concentrations in groundwater are expected to be low, given that heavy metals are likely to bind to soil, and it is considered unlikely that heavy metals will migrate to groundwater; and
- With regard to sodium and chloride leaching, any potential effects will be negligible, and even the worst-case scenario (with no allowances for dilution or improvement from reduced loading) any effect will be infrequent and aesthetic (taste and corrosion).

With respect to surface water, PDP have concluded the following:

- The proposed application depths (outlined above) are within the hydraulic capacity of the soil (even under saturated conditions) and therefore the potential for phosphorus run-off will be minimised. Furthermore, BSM will undertake riparian planting on all streams and drains on their land prior to loading the irrigation land to 110 kg P/ha/yr (if required), and this will suitably mitigate the impact of phosphorus loss from the proposed discharges to land.

Monitoring

Fish and Game consider that monitoring undertaken on the Site should include monitoring of water quality (representative surface water samples upstream and downstream and groundwater monitoring) and soil nitrogen loads.

As set out in Section 7 of this AEE, BSM propose to undertake a range of monitoring on the Site, including:

- Monitoring soil health within the irrigation area and a control site for a range of parameters including nutrients and ESP at least once per year;
- Testing soil infiltration rates at least once per year at the same sites as the above;
- Monitoring the actual levels of heavy metal accumulation on an ongoing basis by taking representative samples of the heavy metals outlined above on a five-yearly interval;
- Monthly upstream and downstream monitoring of the unnamed tributary of the south branch of the Waihopai River that flows through the wastewater discharge area for physio-chemistry and nutrients; and
- Maintaining a conductivity meter downstream of the land treatment area to continuously monitor electrical conductivity in the tributary.

Consent Term

Fish and Game have advised that Environment Southland are preparing Plan Change Tuatahi, which will be notified in December 2023. This plan change intends to set limits, targets and methods that will help achieve hauora (i.e., a state of healthy resilience), for waterbodies in the Southland Region. Fish and Game have also advised that research recently commissioned (November 2021) by Environment Southland shows that that the following region wide nutrient load reductions are required to achieve bottom lines and hauroa, and therefore BSM should not assume that conditions will not be amended during the life of any discharge consent(s) issued, particularly in response to future plan changes.

BSM acknowledge this, and the upgraded WWTP is expected to make significant contributions to reducing nutrient loads within the Site in the surrounding receiving environment over time.

9.3.6 Local Residents

Feedback was received from one neighbour (Steve O'Neill) in response to the Summary AEE. Mr O'Neill provided comment that a lot of the past issues have been mitigated through work completed to date, however he raised concern about odour from the rendering plant impacting his property. Mr O'Neill identified doors being left open in the rendering plant as the reason for this based on discussions with site staff, however no detail was provided about the frequency of this or when it last occurred. Jim Goodall (BSM CEO) met with Mr O'Neill after receiving the feedback to get more information about his experience. During the meeting Mr O'Neill wasn't able to provide any further details about the timing or frequency of the odour experienced.

While it is not clear that Mr O'Neill is still experiencing odour issues, BSM advised Mr O'Neill that work is continuing to be undertaken to improve the rendering odour management system. Additional work being undertaken at the time involved increasing the number of air inlet ducts into the building to assist with ventilation. This work has since been completed.

10. STATUTORY ASSESSMENT

10.1 INTRODUCTION

The RMA is the principal statutory document governing the use of land, air and water. The purpose of the RMA, as set out in Section 5, is to "*promote the sustainable management of natural and physical resources*". This section of the AEE sets out the statutory framework under the RMA that applies to the resource consents that are being sought from Environment Southland.

As noted in Section 5 of this AEE, the overall activity status of the resource consent applications required for the application is discretionary. As such, it is necessary to consider the resource consent applications under the decision-making framework of Section 104 of the RMA.

10.2 SECTION 104

Section 104 of the RMA sets out the matters to which a consent authority must have regard to, subject to Part 2 of the RMA, when considering an application for resource consent. These are:

(1) When considering an application for a resource consent and any submissions received, the consent authority must, subject to Part 2, have regard to–

(a) any actual and potential effects on the environment of allowing the activity; and

(ab) any measure proposed or agreed to by the applicant for the purpose of ensuring positive effects on the environment to offset or compensate for any adverse effects on the environment that will or may result from allowing the activity; and

(b) any relevant provisions of—

(i) a national environmental standard:

(ii) other regulations:

(iii) a national policy statement:

(iv) a New Zealand coastal policy statement:

(v) a regional policy statement or proposed regional policy statement:

(vi) a plan or proposed plan; and

(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.

(2) When forming an opinion for the purposes of subsection (1)(a), a consent authority may disregard an adverse effect of the activity on the environment if a national environmental standard or the plan permits an

activity with that effect.

...

(3) *A consent authority must not, -*

(a) *When considering an application, have regard to –*

(i) *Trade competition or the effects of trade competition; or*

(ii) *Any effect on a person who has given written approval to the application:*

...

Section 104 of the RMA does not give any of the matters to which a consent authority is required to have regard primacy over any other matter. All of the relevant matters are to be given such weight as the relevant statutory planning documents may direct, and all provisions are subject to Part 2 of the RMA - although it is understood that a consent authority is not required to consider Part 2 of the RMA unless there is uncertainty or invalidity in the relevant statutory planning documents.

The matters for consideration under section 104(1)(a), (ab), (b) and (c) of the RMA are assessed in the sub-sections below.

10.2.1 Actual and Potential Effects

With respect to Section 104(1)(a) of the RMA, the actual and potential effects on the environment associated with the Proposal are summarised in Section 6 of this AEE (with further detail provided in the appended technical assessments). Overall, it is concluded that any actual and potential adverse effects of the Proposal can be appropriately avoided, remedied or mitigated.

Furthermore, and based on the conclusions reached with respect to the actual and potential environmental effects of the Proposal, no additional compensatory or offsetting measures are proposed or considered necessary by BSM in the context of Section 104(1)(ab) of the RMA.

10.2.2 Relevant Statutory Planning Documents

In terms of Section 104(1)(b) of the RMA, the following sub-sections provide an assessment of the application against the:

- The Southland Regional Policy Statement (**RPS**);
- The National Policy Statement for Freshwater Management 2020 (**NPS-FM**);
- Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (**NES-AQ**);
- Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007 (**NES-DW**);

- The Resource Management (Measurement and Reporting Water Takes) Amendments Regulations 2020 (**Water Measurement Regulations**);
- The Operative Regional Water Plan for Southland (**Operative Plan**);
- The Proposed Southland Water and Land Plan (**pSWLP**); and
- The Regional Air Quality Plan for Southland (1999) (**Air Plan**)

An analysis of the Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008: Te Tangi a Tauira - The Cry of The People ("**Te Tangi a Tauira**") is also necessary, and the plan's provisions touch directly on the issues under consideration. Therefore, an analysis of how the iwi management plan speaks to the proposal under consideration is provided.

10.2.2.1 The Southland Regional Policy Statement

The RPS was made operative on 9 October 2017. It outlines objectives, policies and methods, which guide the management of Southland's natural resources. The RPS has the highest rank of any planning document in the Southland Region and Environment Southland's regional plans (the pSWLP, the Operative Plan and the Air Plan) must follow the provisions laid out in this RPS.

When considering the proposed take and discharge activities, the most relevant provisions are contained in:

- Chapter 3: Tangata Whenua;
- Chapter 4: Part A Water Quality;
- Chapter 4: Part B Water Quantity; and
- Chapter 9: Air

Each is addressed in the sub-sections below.

Tangata Whenua

Chapter 3 of the RPS sets out the resource management issues of significance to Ngau Tahu; and sets out the objectives, policies and methods to address those issues.

The objectives and policies that are relevant to the proposed activities state:

> ***Objective TW.2 – Provision for iwi management plans***
>
> *All local authority resource management processes and decisions take into account iwi management plans.*

Objective TW.3 – Tangata whenua spiritual values and customary resources

Mauri and wairua are sustained or improved where degraded, and mahinga kai and customary resources are healthy, abundant and accessible to tangata whenua.

Policy TW.1 – Treaty of Waitangi

Consult with, and enhance tangata whenua involvement in local authority resource management decision-making processes, in a manner that is consistent with the principles of the Treaty of Waitangi/Te Tiriti o Waitangi.

Policy TW.3 – Iwi management plans

Take iwi management plans into account within local authority resource management decision making processes.

Policy TW.4 – Decision making

When making resource management decisions, ensure that local authority functions and powers are exercised in a manner that:

(a) recognises and provides for:

- *(i) traditional Māori uses and practices relating to natural resources (e.g. mātaitai, kaitiakitanga, manaakitanga, matauranga, rāhui, wāhi tapu, taonga raranga);*
- *(ii) the ahi kā (manawhenua) relationship of tangata whenua with and their role as kaitiaki of natural resources;*
- *(iii) mahinga kai and access to areas of natural resources used for customary purposes;*
- *(iv) mauri and wairua of natural resources;*
- *(v) places, sites and areas with significant spiritual or cultural historic heritage value to tangata whenua;*
- *(vi) Māori environmental health and cultural wellbeing.*

(b) recognises that only tangata whenua can identify their relationship and that of their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga.

In accordance with the overarching direction in the above provisions, BSM has, and will continue to consult with Te Ao Marama on how the proposed groundwater take and discharge activities may adversely affect mana whenua values, and how any adverse effects can be avoided, remedied or mitigated.

Furthermore, as discussed throughout this AEE, BSM has made significant upgrades to the WWTP. This has resulted in significant improvements to health of the Site and it is expected that this will extend to the wider ecosystem with time.

Water Quality

Chapter 4, Part A of the RPS contains overarching direction for managing water quality in the Region. The objectives and policies most relevant to the proposed discharge activities state:

> ***Objective WQUAL.1 – Water quality goals***
>
> *Water quality in the region:*
>
> *(a) safeguards the life-supporting capacity of water and related ecosystems;*
>
> *(b) safeguards the health of people and communities;*
>
> *(c) is maintained, or improved in accordance with freshwater objectives formulated under the National Policy Statement for Freshwater Management 2014;*
>
> *(d) is managed to meet the reasonably foreseeable social, economic and cultural needs of future Generations*
>
> ***Objective WQUAL.2 – Lowland water bodies***
>
> *Halt the decline and improve water quality in lowland water bodies and coastal lakes, lagoons, tidal estuaries, salt marshes and coastal wetlands in accordance with freshwater objectives formulated in accordance with the National Policy Statement for Freshwater Management 2014.*
>
> ***Policy WQUAL.1 – Overall management of water quality***
>
> *(a) Identify values of surface water, groundwater, and water in coastal lakes, lagoons, tidal estuaries, salt marshes and coastal wetlands, and formulate freshwater objectives in accordance with the National Policy Statement for Freshwater Management 2014; and*
>
> *(b) Manage discharges and land use activities to maintain or improve water quality to ensure freshwater objectives in freshwater management units are met.*
>
> ***Policy WQUAL.2 – All waterbodies***
>
> *Maintain or improve water quality, having particular regard to the following contaminants:*
>
> *(a) nitrogen;*
>
> *(b) phosphorus;*
>
> *(c) sediment;*
>
> *(d) microbiological contaminants.*
>
> ***Policy WQUAL.5 – Improve catchment water quality***
>
> *Improve water quality by:*
>
> *(a) identifying water bodies that are not meeting freshwater objectives, including identifying priority freshwater management units;*

(b) specifying targets to improve water quality within those water bodies within defined timeframes;

(c) implementing management frameworks to meet the targets taking into account;

(i) the values supported by the water body/ies;

(ii) national or legislative standards and requirements;

(iii) the benefits and costs associated with achieving improvement in water quality.

Policy WQUAL.8 – Preference for discharge to land

Prefer discharges of contaminants to land over discharges of contaminants to water, where:

(a) a discharge to land is practicable;

(b) the adverse effects associated with a discharge to land are less than a discharge to water.

Maintaining or improving water quality through the Freshwater Management Unit (**FMU**) processes is an overarching theme of these provisions. A particular focus is placed on nitrogen, phosphorus, sediment and microbial contaminants.

In September 2019, Environment Southland released the Community Values for Southland Freshwater Management Units – Values and Objectives Technical Report. Environment Southland have embarked on a community-involved process to further develop their approach to managing land and water in the region, including the establishment of a community-based group called the Regional Forum, to help Environment Southland explore how to achieve the aspirations of communities for freshwater, with this report summarising the findings.

In November 2020 Environment Southland's Council and the Te Ao Marama Inc Board indicated the desired future environmental state for freshwater and estuaries to be achieved within a generation (25-30 years).

Environment Southland's Council and the Te Ao Marama Board have directed the Regional Forum to assess the implications of achieving the bottom of the hauora envelope within a generation (25-30 years) for all environmental outcomes. The bottom of the hauora envelope reflects a minimum level of healthy resilience while still providing for uses that support the health of people.

Any new rules and requirements developed as part of the FMU process will not have effect until a plan change is notified which is intended to be at the end of 2023.

However, as set out in Sections 2 and 6 of this AEE, the technical assessments have detailed the improvements made by BSM through the upgraded WWTP and proposed riparian planting, including the substantial removal of organic matter (including fats, oils and greases) and nitrogen.

While there is progress being made on the FMU, these FMU's are still yet to be finalised. However, it is anticipated that as a result of the upgraded WWTP plant and other measures proposed by BSM (e.g., further riparian planting) that BSM are not likely to have any issues in terms of compliance with any new limits of the catchments.

The Proposal sits comfortably with Policy WQUAL.8 as the proposed discharge of treated wastewater, biosolids, stockyard solids and paunch is to land. Furthermore, for the reasons set out in Section 8 of this AEE, the discharge of drainage water and stormwater to land is not practicable and the quality of water in the drain is expected to reflect that of shallow groundwater, with the stormwater from the lagoon cover having similar quality characteristics as roof water runoff.

Water Quantity

Chapter 4, Part B of the RPS contains the overarching direction for managing water quantity in the Region. The RPS contains two objectives for water quantity:

> ***Objective WQUAN.1 – Sustainably managing the region's water resources***
>
> *Flows, levels and allocation regimes of surface water and groundwater in the region are developed in accordance with the National Policy for Freshwater Management 2014 to:*
>
> *(a) safeguard the life-supporting capacity of water, catchments and related ecosystems;*
>
> *(b) support the maintenance or improvement of water quality in accordance with Policy WQUAL.1;*
>
> *(c) meet the needs of a range of uses, including the reasonably foreseeable social, economic and cultural needs of future generations;*
>
> *(d) comply with limits or targets set to achieve freshwater objectives.*
>
> ***Objective WQUAN.2 – The efficient allocation and use of water***
>
> *The allocation and use of Southland's water resources:*
>
> *(a) is efficient;*
>
> *(b) recognises and makes provision for the Monowai and nationally significant Manapōuri hydroelectric generation schemes in the Waiau catchment and the resultant modified flows and levels.*

The associated policies contain various directions for achieving these objectives in the Region, most of which are targeted at future regional plan processes and establishing NPS-FM 2020 compliant flow and allocation regimes through the FMU plan changes.

These provisions are not directly relevant to the activities entailing the proposed take and use of groundwater. However, the activity will be undertaken in accordance with the allocation regime proposed as part of this application, which will achieve Objective WQUAN.1. Furthermore, the BSM proposal reflects the efficient allocation and use of Southland's water resources as the proposed maximum daily take from the confined aquifer (and the proposed ongoing passive dewatering of the upgraded WWTP) is a small percentage of the estimated available drawdown and will not result in the primary allocation limit being exceeded. Also, the proposed new consent does not seek to alter the currently weekly consented abstraction rate for the take and use of groundwater.

Air Quality

Chapter 9 of the RPS contains the overarching direction for managing air discharges in the Region. The relevant provisions when considering the proposed air discharges state:

> ***Objective AQ.1 – Discharge of contaminants***
>
> *Enable the discharge of contaminants into air while managing the adverse effects of those contaminants on human health and wellbeing, and the environment.*
>
> ***Policy AQ.1 – Adverse effects of discharges***
>
> *Avoid, remedy or mitigate the adverse effects of discharges of contaminants to air on human health, cultural and amenity values and the environment.*
>
> ***Policy AQ.3 – Areas with poor air quality***
>
> *Improve areas with poor air quality, focusing in particular on reducing the adverse effects of activities that discharge particulate matter.*
>
> ***Policy AQ.4 – Maintain or enhance air quality***
>
> *Maintain or enhance air quality in areas where compliance with national environmental standards or guidelines for ambient air quality has been achieved or surpassed.*
>
> ***Policy AQ.5 – Promote best practicable option***
>
> *Promote and facilitate the adoption of the best practicable option to improve air quality.*

The approach taken by BSM for the long-term operation of the Plant and its boilers was informed by and aligns with these provisions.

With respect to the Plant's discharge of contaminants to air the key points are:

- the current ambient combustion contaminations (PM_{10}, $PM_{2.5}$, NO_X, SO_2 and mercury) are expected to meet all relevant air quality criteria beyond the Site boundary;
- BSM has committed to reducing carbon emissions by de-commissioning the HWB boiler by August 2024 and seeking to replace the RSB boiler when a practicable

alternative technology is available (in accordance with carbon reduction requirements);

- The discharges of particulate and combustion emissions to air from the Site sources will be appropriately mitigated through various boiler emission limits and maintenance and monitoring measures; and
- For the reasons set out in Section 8, the Proposal represents the best practicable option for minimising the effects of the Plant's discharge of contaminants to air.

With respect to the Plant's odour emissions, the key policy direction set out above in Policy AQ.1 is to avoid, remedy or mitigate the adverse effects of the Plant's operation on amenity values. In accordance with this direction a suite of measures to avoid or mitigate odour effects are proposed (as summarised in Section 7 of this AEE), including a site Air Discharge Management Plan, a WWTP Operations and Maintenance (O&M) Manual and a Wastewater Farm Environmental Management Plan.

10.2.2.2 The National Policy Statement for Freshwater Management 2020

The NPS-FM 2020 came into effect on 3 September 2020. It replaced the National Policy Statement for Freshwater Management 2014 (amended 2017) that preceded it, and every local authority is required to give effect to the NPSFM as soon as reasonably practicable.

The fundamental concept of the NPSFM encompasses Te Mana o te Wai, a concept that refers to the fundamental importance of water and recognises that protecting the health of freshwater will protect the health and wellbeing of the wider environment. In effect, the NPSFM seeks to adopt a water-centric approach to freshwater management. The sole objective of the NPSFM follows this concept – and seeks to ensure that natural and physical resources are managed in a way that (i) firstly prioritises the health and wellbeing of water bodies and freshwater ecosystems, (ii) then the health needs of people, and (iii) then the ability of people and communities to provide for their social, economic, and cultural wellbeing.

The policies of the NPSFM of potential relevance to the Proposal relate to:

- The management of freshwater in a way that gives effect to Te Mana o te Wai;[28]
- The active involvement of tangata whenua in freshwater management;[29]

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[28] NPSFM Policy 1.

[29] NPSFM Policy 2.

- The implementation of an integrated freshwater management approach that considers the effects of the use and development of land on a whole-of-catchment basis;[30]
- Management of freshwater through a National Objectives Framework (**NOF**) to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained;[31]
- The habitats of indigenous freshwater species are protected;[32]
- Freshwater is allocated and used efficiently;[33]
- Water bodies and freshwater ecosystems are monitored over time and actions undertaken where freshwater is degraded[34]; and
- Communities are enabled to provide for their social, economic, and cultural well-being in a way that is consistent with the NPSFM.[35]

With respect to these matters, the following points are noted:

- BSM has engaged with Te Ao Marama Inc regarding this application. Te Ao Marama Inc were invited to prepare a Cultural Values Report to support this application, however this assessment was not prepared, and it is not known yet whether one is required as BSM are waiting for advice from Te Ao Marama Inc on this;
- The effects from the proposed discharges to land and water on the wider catchment were considered as part of this application. The upgraded WWTP and riparian planting that have been completed has resulted in reduced nitrogen and phosphorus loads entering the New River Estuary, contributing to the maintenance and enhancement of this degraded environment;

With regards to the proposed discharges to land:

- The Proposal will result in improvements to waterbodies and freshwater ecosystems, particularly within the two tributaries on the Site which then converge and join with the Waihopai River. As discussed in Section 6.4 of this AEE, the Proposal will result in very low nitrate levels in the groundwater (once the historically impacted groundwater

30 NPSFM Policy 3

31 NPSFM Policy 5

32 NPSFM Policy 9

33 NPSFM Policy 11

34 NPSFM Policy 13

35 NPSFM Policy 15

passes through the shallow aquifer system) and substantially less nitrogen and phosphorus loads entering the ground (and eventually the streams). This should result in significant improvements in water quality and habitat and ensure that the instream conditions that currently provide refuge for 'at risk' and 'threatened' aquatic species are maintained and enhanced; and

- Native riparian planting has been undertaken on the Site along all watercourses that run through the property to improve the waterways by absorbing phosphorus run-off – this is expected to provide shading and greater habitat quality for indigenous freshwater species in these reaches of stream.

With regards to the proposed discharge of land drainage water and stormwater:

- As discussed in Section 6.6 of this AEE, the dewatered groundwater is generally of a similar water quality to the receiving environment, as the receiving surface water is largely groundwater fed from the same groundwater. However, the quality of the surface water and groundwater has been impacted by surrounding agricultural land uses, containing elevated levels of contaminants and exceeding the NPS-FM bottom line for nitrate-nitrogen toxicity and *E. coli*, with the proposed discharge potentially increasing nitrate-nitrogen levels within the surface water;
- However, whilst the proposed discharge and the receiving surface water contain elevated nitrate-nitrogen levels, the groundwater dewatering is an integral part of the upgraded WWTP. This has substantially reduced nitrogen leaching from the BSM's land discharge and is an essential component in improving groundwater nitrate levels, and therefore groundwater and surface water quality over time;
- The purpose of the groundwater dewatering system is to protect the lagoons of the upgraded WWTP from damage from flotation in groundwater conditions, with any wastewater leakage likely to cause far greater levels of contamination; and
- The quality of the stormwater from the lagoon cover is expected to reflect that of roof run-off and not have any adverse effect on the water quality of any freshwater body.
- The proposed discharges are associated with food production which in turn are essential to the health and wellbeing of the community;
- As discussed in Section 6.3 of this AEE, the proposed groundwater take is allocated and used efficiently and is well within the primary allocation limit under Appendix L.6 of the pSWLP; and
- As discussed in Section 7 of this AEE, BSM propose to undertake a range of monitoring measures to monitor the condition of the waterway and any potential impacts from the proposed discharges. This includes monitoring instream ecology, nutrients, and physio-chemical conditions in the unnamed tributary of the south branch of the Waihopai River that runs through the discharge area, sampling of groundwater bores for nitrogen leaching, monitoring shallow groundwater for E. *coli*,

monitoring groundwater wells for heavy metals, and monitoring soil health to ensure it is suitable for receiving the discharges.

10.2.2.3 Resource Management (National Environmental Standards for Air Quality) Regulations 2004

The NES-AQ sets out the standards to guarantee a minimum level of health protection for all New Zealanders., The NES-AQ specifies ambient air quality standards for common criteria contaminants, including PM_{10}, SO_2, CO_2, NO_2 and ozone, and places restrictions on the ability of Environment Southland to grant resource consents to discharge those contaminants if the relevant air quality standards would not be achieved.

The Beca assessment has concluded that discharges of the primary pollutants from the existing boiler stacks (PM_{10}, $PM_{2.5}$, NO_2, SO_2 and mercury) will comply with the relevant NES-AQ standards for all contaminants, including PM_{10}.

Therefore, the NES-AQ does not prevent Environment Southland from granting resource consent on the terms sought.

10.2.2.4 Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007

Regulations 7 and 8 of the NES-DW apply to water and discharge permits issued by regional councils. However, due to the absence of any registered drinking water supplies that provide for no fewer than 25 people with drinking water for no less than 60 days each calendar year (Regulation 12), this NES is not considered relevant.

10.2.2.5 The Resource Management (Measurement and Reporting Water Takes) Amendments Regulations 2020

The proposed take and use of groundwater from the groundwater bores will exceed five litres / second and is therefore subject to water metering in accordance with the Water Measurement Regulations.

The proposed conditions of this consent reflect this required metering.

These regulations are not relevant for the take of groundwater for the purpose of dewatering as this take is not for consumptive purposes (in accordance with Section 4(2)) of the Water Management Regulations.

10.2.2.6 The Proposed Southland Water and Land Plan

The pSWLP seeks to address activities which may have the potential to affect water quality. The pSWLP was publicly notified in June 2016. It went through the submissions and hearings process and the decisions version was accepted by Council on 4 April 2018, with numerous parties appealing various parts of the plan to the Environment Court. The pSWLP was made partially operative in January 2021, however one remaining objective, and various policies, rules and appendices are still under appeals that are yet to be resolved. These appeals relate to numerous activities, including the abstraction and use of groundwater, the take of groundwater for the purpose of dewatering and the discharge of land drainage water and stormwater to water. These activities are therefore also assessed against the relevant provisions of the Operative Plans (Refer to Section 10.2.2.7 below).

Abstraction and Use of Groundwater

When considering the proposed abstraction and use of groundwater, the most relevant objectives and policies in the pSWLP are:

> ***Objective 11*** *- The amount of water abstracted is shown to be reasonable for its intended use and water is allocated and use efficiently*
>
> ***Objective 12*** *- Groundwater quantity is sustainably managed, including safeguarding the life-supporting capacity, ecosystem processes and indigenous species of surface water bodies where their flow is, at least in part, derived from groundwater.*
>
> ***Policy 20 – Management of water resources***
>
> *1A. recognise that the use and development of Southland's land and water resources, including for primary production, can have positive effects including enabling people and communities to provide for their social, economic and cultural wellbeing;*
>
> …
>
> 1. *Avoid, remedy or mitigate significant adverse effects from the use and development of groundwater resources on:*
>   - *(a) long-term aquifer storage volumes;*
>   - *(b) the reliability of supply for lawful existing groundwater users, including those with existing, but not yet implemented, resource consents;*
>   - *(c) surface water flows and levels, particularly in spring-fed streams, natural wetlands, lakes, aquatic ecosystems and habitats (including life supporting capacity and ecosystem health and processes of water bodies) and their natural character; and*
>   - *(d) water quality;*
>
> ***Policy 22 – Management of the effects of groundwater and surface water use***
>
> *Manage the effects of surface and groundwater abstractions by:*
>
> 1. *avoiding allocating water to the extent that the effects on surface water flow would not safeguard the mauri of that waterway and mahinga kai, taonga species or the habitat of trout and salmon, in accordance with Appendix K;*
> 2. *ensuring interference effects are acceptable, in accordance with Appendix L.3; and*

3. *utilising the methodology established in Appendix L.2 to:*

   (a) *manage the effects of consented groundwater abstractions on surface water bodies; and*

   (b) *assess and manage the effects of consented groundwater abstractions in groundwater management zones other than those specified in Appendix L.5.*

The assessment of effects from the proposed abstraction of groundwater is provided in Section 6.3 of this AEE. In summary, the proposed groundwater abstraction and use methods and rates are consistent with these provisions for the following reasons:

- The three existing bores on the Site are appropriately designed, constructed and maintained to avoid any adverse effects on groundwater quality and quantity. The proposed abstraction bores will be appropriately protected from groundwater contamination through a number of measures. These include:
  - Sealing the ground around the bore head to prevent any contaminants entering the space between the casing and the wall of the borehole;
  - Sealing the top of the casing to prevent contaminants entering the casing; and
  - Securing the bore head with stock prevention measures e.g. fencing.
- The proposed groundwater take will avoid significant adverse effects on long-term aquifer storage volumes as the proposed daily take is well within the primary allocation limit set out in Appendix L.6 of the pSWLP. Furthermore, the Proposal does not seek to alter the currently weekly consented abstraction rate;
- The proposed groundwater take will avoid significant adverse effects on existing water users as the worst-case estimated maximum drawdown interference in the confined aquifer, the shallower confined aquifer and the shallow unconfined aquifer from BSM proposal is well within the acceptable limits in terms of the pSWLP Appendix L.3 criteria;
- The proposed groundwater take will avoid significant adverse effects on surface water flows and aquatic ecosystem and habitats as any stream depletion effects on the closest drain will be low in accordance with Appendix L.2 of the pSWLP (due to the depth of the bores and the low aquitard conductance); and
- The proposed groundwater take will avoid significant adverse effects on groundwater quality as the proposal is to replace the existing groundwater take consent and the abstraction will not directly result in the discharge of any contaminants.

Discharge of Treated Wastewater, Biosolids, Stockyard Solids and Paunch to Land

When considering the proposed discharge of treated wastewater, biosolids, stockyard solids and paunch to land via irrigation, the most relevant objectives and policies in the pSWLP are:

> ***Policy 14 – Preference for discharges to land***
>
> *Prefer discharges of contaminants to land over discharges of contaminants to water, unless adverse effects associated with a discharge to land are greater than a discharge to water. Particular regard shall be given to any adverse effects on cultural values associated with a discharge to water.*
>
> ***Policy 16A – Industrial and trade processes that may affect water quality***
>
> *Minimise the adverse environmental effects (including on the quality of water in lakes, rivers, artificial watercourses, modified watercourses, wetlands, tidal estuaries, salt marshes and groundwater) by requiring the adoption of the best practicable option to manage the treatment and discharge of contaminants derived from industrial and trade processes.*

In this case the proposed treatment and discharge method sits comfortably with Policy 14 and is considered to be the best practicable option in accordance with Policy 16A, noting that:

- As discussed in Section 2.3 of this AEE, BSM constructed and commissioned substantial upgrades to their onsite wastewater treatment facility in 2019. The upgraded WWTP includes primary treatment via a covered anaerobic lagoon and secondary treatment via biological nitrogen removal in an SBR wastewater treatment plant. The treatment process provides for substantial removal of organic matter (including fats, oils and greases) as biogas via a flare, and substantial removal of nitrogen as inert nitrogen gas;
- The upgraded WWTP has resulted in a significant improvement in the removal of contaminants from the wastewater on site; and
- As discussed in Section 8.2 of this AEE, BSM considered a range of alternative options to discharge the treated wastewater prior to the 2019 upgrade, and the option to discharge to land with anaerobic treatment and biological nitrogen removal (the upgraded WWTP) was considered the best practicable option.

Discharge of Land Drainage Water and Stormwater to Water

When considering the proposed discharge of dewatering and stormwater to the farm drain, the most relevant provisions in the pSWLP are:

> ***Policy 10 – Oxidising***
>
> *In the Oxidising physiographic zone, avoid, remedy, or mitigate adverse effects on water quality from contaminants, by:*

1. *requiring implementation of good management practices to manage adverse effects on water quality from contaminants transported via deep drainage, and overland flow and artificial drainage where relevant;*
2. *having particular regard to adverse effects on water quality from contaminants transported via deep drainage, and overland flow and artificial drainage where relevant when assessing resource consent applications and preparing or considering Farm Environmental Management Plans; and*
3. *decision makers generally not granting resource consents for additional dairy farming of cows or additional intensive winter grazing where contaminant losses will increase as a result of the proposed activity.*

Policy 16A – Industrial and trade processes that may affect water quality

Minimise the adverse environmental effects (including on the quality of water in lakes, rivers, artificial watercourses, modified watercourses, wetlands, tidal estuaries, salt marshes and groundwater) by requiring the adoption of the best practicable option to manage the treatment and discharge of contaminants derived from industrial and trade processes.

The assessment of effects for the discharge of land drainage water and stormwater to water is provided in Section 6.6 of this AEE. In this case the proposed treatment and discharge method is consistent with Policy 10 and is considered to be the best practicable option in accordance with Policy 16A, noting that:

- The discharge is small in scale;
- The quality of the stormwater from the lagoon cover is expected to reflect that of roof run-off and not have any adverse effect on the water quality of any freshwater body;
- The dewatered groundwater is generally of similar water quality to the receiving environment, as the receiving surface water is largely groundwater fed from the same groundwater. However, the quality of the surface water and groundwater has been impacted by surrounding agricultural land uses, containing elevated levels of contaminants, with the proposed discharge potentially increasing nitrate-nitrogen levels within the surface water. Whilst the proposed discharge and the receiving surface water contain elevated nitrate-nitrogen levels, the groundwater dewatering is an integral part of the upgraded WWTP. This has substantially reduced nitrogen leaching from the BSM's land discharge and is an essential component in improving groundwater nitrate levels, and therefore groundwater and surface water quality over time;
- The purpose of the groundwater dewatering system is to protect the lagoons of the upgraded WWTP from damage from flotation in groundwater conditions, with any wastewater leakage likely to cause far greater levels of contamination; and
- Further treatment of the discharge would require additional space and expense and is not justified by the environmental benefit that could result.

The Take of Groundwater for the Purpose of Dewatering

When considering the proposed dewatering as a result of the upgraded WWTP groundwater dewatering system and leak detection system, the most relevant objectives and policies in the pSWLP are:

> ***Objective 12***
>
> *Groundwater quantity is sustainably managed, including safeguarding the life-supporting capacity, ecosystem processes and indigenous species of surface water bodies where their flow is, at least in part, derived from groundwater*
>
> ***Policy 20 – Management of water resources***
>
> *Manage the taking, abstraction, use, damming or diversion of surface water and groundwater so as to:*
>
> ...
>
> 2. *avoid, remedy or mitigate significant adverse effects from the use and development of groundwater resources on:*
>
>   (a) *long-term aquifer storage volumes;*
>
>   (b) *the reliability of supply for lawful existing groundwater users, including those with existing, but not yet implemented, resource consents;*
>
>   (c) *surface water flows and levels, particularly in spring-fed streams, natural wetlands, lakes, aquatic ecosystems and habitats (including life supporting capacity and ecosystem health and processes of waterbodies) and their natural character; and*
>
>   (d) *water quality.*

As discussed in Section 6.5 of this AEE, the proposed passive and ongoing dewatering associated with the groundwater dewatering system is required to keep the upgraded WWTP operational, and the leak detection system is only expected to intercept groundwater on rare occasions. This will only impact on a very localised area of shallow groundwater (as zone of influence is limited to the immediate area surrounding the WWTP) and no effects are expected on other groundwater users, as the drawdown effect is localised. The Proposal is therefore consistent with these provisions.

10.2.2.7 The Operative Regional Water Plan for Southland

The purpose of the Operative Plan is to promote the sustainable management of Southland's rivers, lakes, groundwater, surface water and wetland resources. The Operative Plan seeks to enable the use and development of fresh water where this can be undertaken in a sustainable way, providing a framework for activities, such as discharges to water, taking and using water, and structures and bed disturbance activities in river beds.

As discussed, the pSWLP was made partially operative in January 2021. However, as a result of outstanding appeals on the pSWLP, the relevant objectives and policies of the Operative Plan must also be considered. These relevant provisions are assessed below.

Abstraction and Use of Groundwater

When considering the proposed abstraction and use of groundwater for the meat processing plant and rendering and blood drying plant. The most relevant provisions in the Operative Plan are:

> ***Policy 26 – Adverse effects of bores and wells***
>
> *To avoid the adverse effects on groundwater quality and quantity arising from bores and wells by ensuring that bores and wells are appropriately designed, constructed and maintained in a way that adverse effects are avoided to the extent practicable.*
>
> ***Policy 28 – To manage groundwater abstraction***
>
> *To manage groundwater abstraction to avoid significant adverse effects on:*
>
> - *Long-term aquifer storage volumes*
> - *Existing water users*
> - *Surface water flows and aquatic ecosystem and habitats*
> - *Groundwater quality*
>
> ***Policy 29 – Stream depletion effects***
>
> *(a) Manage the stream depletion effect of any groundwater abstraction with a rate of take exceeding 2 litres per second as follows:*
>
> *i. where there is a direct hydraulic connection between the groundwater source and an adjacent surface water body, the stream depletion effect will be determined as the maximum instantaneous rate of take and will be managed in the same manner as a surface water abstraction for flow and allocation purposes. The abstraction will therefore be subject to any relevant minimum flow regime;*
>
> *ii. where there is a high degree of hydraulic connection between the groundwater source and an adjacent surface water body, the stream depletion effect will be determined as the greater of:*
>
> *1. the effect of 150 days pumping at the continuous pump rate required to deliver the seasonal volume;*
>
> *2. the effect of continuous pumping at the maximum permitted pump rate over the period required to deliver the seasonal volume.*
>
> *The calculated rate of stream depletion will be managed in the same manner as a surface water abstraction for allocation purposes with the remainder of the abstraction included in the allocation volume for the relevant groundwater zone. Where the calculated rate of stream depletion*

exceeds 2 litres per second, the abstraction will be subject to any relevant minimum flow regime;

iii. *where there is a moderate degree of hydraulic connection between the groundwater source and an adjacent surface water body, the stream depletion effect will be determined as the effect of 150 days of pumping at the continuous pump rate required to deliver the seasonal volume. The calculated rate of stream depletion will be managed in the same manner as a surface water abstraction for allocation purposes with the remainder of the abstraction included in the allocation volume for the relevant groundwater zone;*

iv. *where there is a low degree of hydraulic connection between the groundwater source and an adjacent surface water body, the stream flow effect is considered to be minor and the individual abstraction will not be taken into account in determining surface water allocation but will be included in the allocation volume for the relevant groundwater zone.*

(b) Minimise the cumulative stream depletion effect of groundwater abstraction by:

i. *Imposing minimum flows on resource consents for groundwater abstraction where there is a direct or high degree of hydraulic connection and the stream depletion effect exceeds two litres per second in accordance with any relevant surface water minimum flow regime (including those established under any Water Conservation Order);*

ii. *managing the total stream depletion effect of groundwater abstractions greater than two litres per second with a direct, high or moderate degree of hydraulic connection in accordance with any relevant surface water allocation regime (including those established under any Water Conservation Order);*

iii. *ensuring the total stream depletion effect of groundwater abstractions greater than two litres per second with a direct, high or moderate degree of hydraulic connection does not result in surface water flows less than prescribed minimum flows or surface water allocation regimes being exceeded.*

The assessment of effects from the proposed abstraction of groundwater is provided in Section 6.3 of this AEE.

Furthermore, the assessment of the proposed groundwater abstraction and use methods and rates against the relevant provisions of the pSWLP is considered relevant for the Operative Plan provisions and is therefore not repeated here. Refer to Section 10.2.2.6 above for further details.

Discharge of Land Drainage Water and Stormwater to Water

When considering the proposed discharge of land drainage water and stormwater to the farm drain, the most relevant provision is Policy 5 which states:

> ***Policy 5 – Discharges to water in artificial watercourses***
> *Manage discharges to water in artificial watercourses so that any new discharge, in conjunction with existing discharges, does not reduce the water quality of the surface water body into which the artificial watercourse flows below any standards set for the surface water body in Appendix G "Water Quality Standards" following a zone of reasonable mixing from the point of confluence of the artificial watercourse with the surface water body.*

The assessment of effects for the discharge of land drainage water and stormwater to water is provided in Section 6.6 of this AEE. In summary, the proposed discharge is consistent with Policy 5 above as:

- The proposed discharge is small in scale;
- The quality of the stormwater from the lagoon cover is expected to reflect that of roof run-off and not have any adverse effect on the water quality of any freshwater body; and
- The dewatered groundwater is generally of similar water quality to the receiving environment, as the receiving surface water is largely groundwater fed from the same groundwater. Whilst the quality of the surface water and groundwater has been impacted by surrounding agricultural land use and contains elevated levels of contaminants, and the proposed discharge potentially increases nitrate-nitrogen levels within the surface water, the groundwater dewatering is an integral part of the upgraded WWTP. This has substantially reduced nitrogen leaching from the BSM's land discharge and is an essential component in improving groundwater nitrate levels, and therefore groundwater and surface water quality over time; and
- The purpose of the groundwater dewatering system is to protect the lagoons of the upgraded WWTP from damage from flotation in groundwater conditions, with any wastewater leakage likely to cause far greater levels of contamination.

The Take of Groundwater for the Purpose of Dewatering

When considering the proposed dewatering as a result of the upgraded WWTP groundwater dewatering system and leak detection system, the most relevant objectives and policies in the Operative Plan are:

> ***Objective 8 – Drinking Water Standard***
>
> 2. *To maintain groundwater quality in aquifers that already meets the Drinking Water Standards for New Zealand 2020*

Objective 9 – Sustainable abstraction

To ensure that the total volume and rate of groundwater abstraction is sustainable

Policy 28 – To manage groundwater abstraction

To manage groundwater abstraction to avoid significant adverse effects on:

- *Long-term aquifer storage volumes*
- *Existing water users*
- *Surface water flows and aquatic ecosystem and habitats*
- *Groundwater quality*

As discussed in Section 6.5 of this AEE, the proposed passive and ongoing dewatering associated with the groundwater dewatering system is required to keep the upgraded WWTP operational, and the leak detection system is only expected to intercept groundwater on rare occasions. This will only impact on a very localised area of shallow groundwater (as zone of influence is limited to the immediate area surrounding the WWTP) and no effects are expected on other groundwater users, as the drawdown effect is localised. The Proposal is therefore consistent with these provisions.

10.2.2.8 The Regional Air Quality Plan for Southland (1999)

The Air Plan sets out the ways Environment Southland will control and manage discharges of contaminants and odour to air, including those from industrial and trade premises.

There are two parts to the Air Plan:

- Stage 1: Covers emissions from cover emissions from domestic and small-scale heating sources, outdoor burning, application of agrichemicals and fertilisers, and fire training activities; and
- Stage 2: Covers emissions from other activities, including industrial and trade premises.

The Stage 2 provisions are most relevant to the proposed activities, however for completeness, the relevant objectives and policies from both Stage 1 and Stage 2 are addressed below.

With respect to the emission of contaminants to air from the BSM Plant, the key Stage 1 objectives and policies seek:

- To avoid, remedy or mitigate any adverse effects upon the localised air quality environment (including health and amenity effects) from the discharge of contaminants to air;[36]
- To ensure that Maori cultural and traditional beliefs are recognised and provided for when dealing with discharges to air:[37]
- To manage any discharge of odour which is likely to have an offensive or objectionable effect beyond the property boundary such that the effect is suitably avoided, remedied or mitigated; and [38]
- To require any discharges of contaminants to air to avoid, remedy or mitigate adverse effects on:

  (a) the receiving environment;

  (b) human health and wellbeing;

  (c) cultural, spiritual and traditional values;

  (d) water quality;

  (e) navigable airspace.[39]

The relevant Stage 2 objectives and policies contained in Chapter 5 (Discharges of Contaminants into Air from Industrial or Trade Premises) seek to:

- Avoid, remedy or mitigate any adverse effects upon the environment (including the health of people and communities and amenity values) from the discharges of contaminants into air from industrial or trade premises; [40]
- Avoid, remedy or mitigate adverse effects from the discharge of greenhouse gases; and [41]
- Protect the environment from adverse effects from the discharge of contaminants into air from industrial or trade premises. [42]

36 The Air Plan – Objective 2.4.

37 The Air Plan – Objective 2.5, Objective 5.2.2 and Policy 5.3.5.

38 The Air Plan – Policy 3.9.

39 The Air Plan – Policy 3.12.

40 The Air Plan – Objective 5.2.1.

41 The Air Plan – Objective 5.2.4.

42 The Air Plan – Policy 5.3.1.

The assessment of effects from the discharge of contaminants and odour to air is provided in Section 6.7 of this AEE. The Proposal is considered to be consistent with these provisions, noting the following:

- The Beca assessment confirmed that the current ambient combustion contaminations (PM_{10}, $PM_{2.5}$, NO_X, SO_2 and mercury) are expected to meet all relevant air quality criteria beyond the site boundary;
- As set out in Section 7 of this AEE, the discharges to air of particulate and combustion emissions from the Site sources will be appropriately mitigated through boiler discharge limits and boiler maintenance and monitoring measures;
- Through the renewal of these resource consents, BSM will reduce its carbon emissions by de-commissioning the HWB boiler by August 2024. This will be achieved through improved heat recovery, reduced hot water demand and the installation of a new high temperature electric heat pump. BSM will also replace the RSB boiler when a practicable alternative technology is available;
- As set out in Section 9 of this AEE, BSM has consulted with TAMI on the proposed activities and the matters that Policy 5.3.5 directs be taken into account when considering an application for discharges to air.

With respect to the discharge of odour from the BSM Plant, the most relevant objectives and policies are those set out above for industrial and trade premises, and the following contained in Section 7 (Odour) of Stage 2 of the Air Plan. These are as follows:

> ***Objective 7.2.1 Protection of the health of people and communities***
>
> *To protect the health of people and communities from any adverse effects from odour discharges.*
>
> ***Objective 7.2.2 Protection of cultural and amenity values***
>
> *To protect areas of cultural and amenity value from any adverse effects from odour discharges.*
>
> ***Policy 7.3.1 The health of people and communities***
>
> *Avoid, remedy or mitigate the impact on the health of people and communities from offensive or objectionable odours.*
>
> ***Policy 7.3.2 Areas of Cultural or Amenity Value***
>
> *Avoid, remedy or mitigate the impact of offensive or objectionable odours on areas of cultural or amenity value.*

With respect to these matters the following points are noted:

- In accordance with this direction, and as set out in Section 7 of this AEE, a comprehensive suite of measures to avoid or mitigate odour effects are proposed; and
- With those measures in place Beca have assessed the odour effects of the Plant's operation to be less than minor, and to not be objectionable or offensive at or beyond the boundary of the Site.

10.2.3 Clause1(c) – Other Relevant Matters

10.2.3.1 Te Tangi A Tauira – The Cry of the People

In 2008, Te Tangi a Tauira: Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan (**Te Tangi a Tauira**) was published. This Iwi Management Plan consolidates Ngāi Tahu ki Murihiku values, knowledge and perspectives on natural resource and environmental management issues.

Of particularly relevance when considering these consent applications are Ngā Kaupapa – policy in Te Tangi a Tauira which address:

- Wastewater disposal;
- Discharges to water;
- Water quality;
- Water quantity; and
- Air quality

BSM acknowledges that Te Tangi a Tauira is an important planning document designed to assist tangata whenua in carrying out kaitiaki roles and responsibilities, and that tangata whenua are best placed to assess the application against its provisions. However, BSM understands that the following Ngā Kaupapa policy in Te Tangi a Tauira, which address the matters outlined above, are likely to be important when considering effects on cultural values:

Wastewater Disposal

Te Tangi a Tauira includes the following Ngā Kaupapa on wastewater disposal which are relevant to the proposed discharge of wastewater, biosolids, stockyard solids and paunch to land:

> 2. *Ensure that Ngāi Tahu ki Murihiku are provided with the opportunity to participate through pre hearing meetings or other processes in the development of appropriate consent conditions for discharge consents, including monitoring conditions.*

3. *Require that sufficient and appropriate information is provided with applications to allow tangata whenua to assess cultural effects (e.g. nature of the discharge, treatment provisions, assessment of alternatives, actual and potential effects).*

5. *Assess proposed wastewater discharge activities in terms of:*

   a. *type/ nature of the discharge;*

   b. *location and sensitivity of the receiving environment;*

   c. *cultural associations with location of operations;*

   d. *actual and potential effects on cultural values;*

   e. *available best practice technology;*

   f. *mitigation that can occur (e.g. using plants to filter waste, discharging at specific times to minimise impact, treatment options)*

   g. *community acceptability;*

   h. *cost*

6. *Avoid the use of water as a receiving environment for the direct, or point source, discharge of contaminants. Even if the discharge is treated and therefore considered "clean", it may still be culturally unacceptable. Generally, all discharges must first be to land.*

7. *Assess waste disposal proposals on a case by case basis, with a focus on local circumstances and finding local solutions.*

9. *Encourage creative, innovative and sustainable approaches to wastewater disposal that make use of the best technology available, and that adopt principles of waste reduction and cleaner production (e.g. recycling grey water for use on gardens, collecting stormwater for a pond that can then be used for recreation in a new subdivision).*

10. *Require that the highest environmental standards are applied to consent applications involving the discharge of contaminants to land or water (e.g. standards of treatment of sewage).*

15. *Any discharge activity must include a robust monitoring programme that includes regular monitoring of the discharge and the potential effects on the receiving environment. Monitoring can confirm system performance and identify and remedy any system failures.*

16. *Require that large scale wastewater disposal operations (e.g. town sewage schemes, industry) develop environmental management plans, including contingency plans to cope with any faults, breakdowns, natural disasters, or extreme weather events (e.g. cash bonds for liability).*

17. *Duration of consent for wastewater disposal must recognise and provide for the future growth and development of the industry or community, and the ability of the existing operations to accommodate such growth or development.*

18. *Recommend a duration not exceeding 25 years, for discharge consents relating to wastewater disposal, with an assumption that upon expiry (if*

not before), the quality of the system will be improved as technological improvements become available. In some instances, a lesser term may be appropriate, with a condition requiring the system is upgraded within a specified time period.

19. *Require conditions of consent that allow for a 5-year review of wastewater disposal activities. During review, consent holders should be required to consider technological improvements. If improvements are available, but not adopted, the consent holder should provide reasons why.*
20. *Encourage developers and consent applicants to provide site visits for tangata whenua representatives to observe proposed wastewater treatment systems. Site visits enable ngā rūnanga representatives to see what is proposed "on the ground".*

The key directives in these provisions were had regard to when assessing the effects of the proposed discharge, and in determining how the effects of the activities should be avoided, remedied or mitigated through the proposed conditions.

In respect of these provisions, the following is noted:

- In accordance with Policy 2, BSM has engaged with TAMI regarding the proposal. Whilst TAMI are yet to advise on the need to provide a CVR, BSM will seek to continue to engage throughout the consent process and beyond.
- In accordance with Policy 3, this AEE includes information on the nature of the discharges, the treatment provisions, the assessment of alternatives and actual and potential effects.
- All the matters listed in Policy 5 have been considered by BSM in preparing this AEE, and in shaping the nature of the activities for which consent will be sought, including the mitigation measures set out in the proposed conditions.
- The discharge of treated wastewater, biosolids, stockyard solids and paunch to land is consistent with Policy 6.
- With respect to Policy 9, a robust assessment of alternative discharge options has been completed which determined that the upgraded WWTP was the BPO and would significantly reduce the adverse effects of the discharge.
- In accordance with Policy 15, robust monitoring and reporting is required by the proposed conditions (Refer to Section 7 of this AEE for further detail).
- In accordance with Policy 16, BSM manages the discharge of treated wastewater, biosolids, stockyard solids and paunch to land in accordance with a Wastewater Farm Environmental Management Plan which includes contingency planning.
- In accordance with Policy 18, the quality of the wastewater treatment system has been significantly improved through the upgraded WWTP and the preference for a consent

duration no more than 25 years is acknowledged. However, BSM considers a longer consent duration is required to recognise BSM's significant existing investment in the Plant and the recent investment they have committed to the upgraded WWTP. A long consent term also suitably reflects the significant social and economic benefits this Plant provides in the local area and gives greater certainty that those benefits will endure. Furthermore, with regard to Policy 19, the upgraded WWTP was completed in 2020 and this upgrade is considered reflective of modern technology.

- In accordance with Policy 20, and as part of its ongoing engagement process, BSM has invited representatives of TAMI on-site to observe the wastewater treatment system.

Discharges to Water

Te Tangi a Tauira includes the following Ngā Kaupapa on discharges to water:

1. *Avoid the use of water as a receiving environment for the direct, or point source, discharge of contaminants. Even if the discharge is treated and therefore considered "clean", it may still be culturally unacceptable. Generally, all discharge must first be to land. This general policy is a baseline or starting point. From this point, the Rūnanga can assess applications on a case by case basis.*
2. *Assess discharge to water proposals on a case by case basis, with a focus on local circumstances and finding local solutions.*
3. *Consider any proposed discharge activity in terms of the nature of the discharge, and the sensitivity of the receiving environment.*
4. *When existing rights to discharge to water come up for renewal, they must be considered in terms of alternative discharge options.*
5. *When assessing the alternatives to discharge to water, a range of values, including environmental, cultural and social, must be considered in addition to economic values.*
6. *Encourage the establishment of wetland areas, where practical, as an alternative to the direct discharge to water. Discharge to a wetland area allows Papatūānuku the opportunity to filter and clean any impurities.*
7. *Any discharge activity must include a robust monitoring programme that includes regular monitoring of the discharge and the potential effects on the receiving environment.*
8. *Require robust monitoring of discharge permits, to detect non-compliance with consent conditions. Noncompliance must result in appropriate enforcement action to discourage further non-compliance.*
9. *Promote the use of the Cultural Health Index (CHI) as a tool to facilitate monitoring of stream health, and to provide long term data that can be used to assess river health over time.*
10. *Ngāi Tahu ki Murihiku consider activities involving the discharge of contaminants to water a community issue. For this reason, ngā rūnanga*

may, where seen as appropriate, recommend that a consent application be notified.

The key directives in these provisions were had regard to when assessing the effects of the proposed discharge, and in determining how the effects of the activities should be avoided, remedied or mitigated through the proposed conditions.

In respect of these provisions, the following is noted:

- The discharge of treated wastewater, biosolids, stockyard solids and paunch to land is consistent with Policy 1. The discharge of land drainage water and stormwater to water is considered appropriate as the quality of the surface water reflects that of shallow groundwater and the stormwater from the lagoon cover will have similar quality characteristics as roof water runoff. In accordance with Policy 3 and 4, further treatment of the discharge was discounted as the discharge is not considered to have an adverse effect on the receiving environment and it would require additional space and expense that is not justified by the environmental benefit that could result.
- In accordance with Policy 5, that assessment considered a range of values, including environmental, cultural and social values, in addition to economic values. As directed by Policy 3, it also considered the nature of the discharge, and the sensitivity of the receiving environment.
- In accordance with Policies 7 and 8, robust monitoring and reporting is required by the proposed conditions (Refer to Section 7 of this AEE for further detail).
- In regard to Policy 9, stream health monitoring is proposed as part of this application, however it is anticipated that a CVR (if required) will advise if there is a need to undertake Cultural Health Index monitoring as well.
- With respect to Policy 10, BSM has consulted with the local community, including Te Ao Marama, on the proposed discharge activities and expects the applications to be publicly notified.

Water Quality

Te Tangi a Tauira includes the following Ngā Kaupapa on water quality which are relevant to the proposed activities:

1. *The role of Ngāi Tahu ki Murihiku as tangata whenua and kaitiaki of water must be recognised and provided for in all water quality management.*
2. *Strive for the highest possible standard of water quality that is characteristic of a particular place/waterway, recognising principles of achievability. This means that we strive for drinking water quality in water we once drank from, contact recreation in water we once used for bathing or swimming, water quality capable of sustaining healthy mahinga kai in waters we use for providing kai.*

3. *Require cumulative effects assessments for any activity that may have adverse effects of water quality.*
5. *Avoid the use of water as a receiving environment for the direct, or point source, discharge of contaminants. Generally, all discharge must first be to land.*
7. *When assessing the effects of an activity on water quality, where the water source is in a degraded state, the effects should be measured against the condition that the water source should be, and not the existing condition of the water source (see text box on this page).*
10. *Water quality definitions, categories, and standards must be determined, measured, and assessed with cultural values and indicators alongside scientific information. Such indicators and values centre on the ability of the waterway to support life, and the fitness of water for cultural uses.*
11. *Require robust monitoring of discharge permits, to detect non-compliance with consent conditions. Noncompliance must result in appropriate enforcement action to discourage further non-compliance.*

The key directives in these provisions were had regard to when assessing the effects of the proposed discharge, and in determining how the effects of the activities should be avoided, remedied or mitigated through the proposed conditions.

In respect of these provisions, the following is noted:

- In accordance with Policy 1, BSM recognises the role tangata whenua has in its kaitiaki of the Waihopai River and wider Waihopai River catchment and BSM has sought feedback from TAMI and will continue to engage with TAMI in respect of the application.
- With respect to Policies 2, 3 and 7, PDP conclude the following in relation to the discharge of land drainage water:
  - That the dewatered groundwater is generally of similar water quality to the receiving environment, as the receiving surface water is largely groundwater fed from the same groundwater;
  - The quality of the surface water and groundwater has been impacted by surrounding agricultural land uses, containing elevated levels of contaminants, with the proposed discharge potentially increasing nitrate-nitrogen levels within the surface water;
  - However, the groundwater dewatering and associated discharge is an integral part of the upgraded WWTP, which has substantially reduced nitrogen leaching from the BSM's land discharge and is therefore an essential component in improving groundwater nitrate levels, and therefore groundwater and surface water quality over time.

- In summary, whilst in the short-term the dewatering system may contribute to higher nitrate-nitrogen in the receiving environment, the groundwater dewatering system enables improvements that will ultimately improve groundwater quality and the receiving surface water quality (as the receiving surface water is largely groundwater fed);
- With respect to Policies 2, 3 and 7, PDP conclude that the discharge of land drainage water to water may increase nitrate-nitrogen levels and the stormwater from the lagoon cover will have similar quality characteristics as roof water runoff; and
- In accordance with Policy 11, robust monitoring and reporting is required by the proposed conditions (Refer to Section 7 of this AEE for further detail).

Water Quantity

Te Tangi a Tauira includes the following Ngā Kaupapa on water quantity and abstractions which are relevant to the proposed activities:

> 1. *Adopt the precautionary principle when making decisions on water abstraction resource consent applications, with respect to the nature and extent of knowledge and understanding of the resource.*
>
> 3. *Require that scientifically sound, understandable, and culturally relevant information is provided with resource consent applications for water abstractions, to allow Ngāi Tahu ki Murihiku to fully and effectively assess cultural effects.*
>
> 6. *Encourage water users to be proactive and use water wisely. To encourage best practice and efficient use of water, particularly in terms of:*
>   - *sustainable irrigation design, delivery and management;*
>   - *making best use of available water before water levels get too low;*
>   - *reducing the amount of water lost through evaporation by avoiding irrigating on hot windy days.*
>
> 7. *Consideration of consent applications for water abstractions should have particular regard to questions of:*
>   a. *how well do we understand the nature and extent of the water resource;*
>   b. *how well can we monitor the amount of water abstracted;*
>   c. *whether land capability (e.g. soil type, vulnerability of underlying groundwater resources) matches the land use enabled by irrigation;*
>   d. *what might happen in the future (e.g. rainfall and recharge of aquifers, climate change).*
>
> 9. *Applications for water abstractions may be required to justify the quantities of water requested. Information may need to be provided to Te Ao Mārama Inc. regarding the proposed water use per hectare,*

estimated water losses, stocking rates, and the level of efficiency for the scheme. This will enable iwi to put the quantity of water sought in context, and ensure that a test of reasonableness can be applied to consents.

10. *Require catchment based cumulative effects assessments for activities involving the abstraction of water.*
16. *Encourage the installation of appropriate measuring devices (e.g. water meters) on all existing and future water abstractions, to accurately measure, report, and monitor volumes of water being abstracted, and enable better management of water resources.*
17. *Advocate for durations not exceeding 25 years on resource consents related to water abstractions.*
19. *Require that Ngāi Tahu are provided with the opportunity to participate through pre-hearing meetings or other processes in the development of appropriate consent conditions including monitoring conditions to address our concerns.*

The key directives in these provisions were had regard to when assessing the effects of the proposed discharge, and in determining how the effects of the activities should be avoided, remedied or mitigated through the proposed conditions.

In respect of these provisions, the following is noted:

- With respect to Policy 1, the proposed take and use of water is a re-consenting of an existing activity and there is a high degree of certainty about the nature and scale of the resultant effects on the environment. As, there will be no changes to the currently consented overall weekly abstraction rate (with the exception of small changes in the short-term to daily abstraction rates), the effects insofar as these matters are concerned will be negligible. Therefore, there is no need to apply the precautionary principle here.
- In accordance with Policy 3, this AEE includes scientifically sound and understandable information on the proposed activity and its effects.
- In regard to Policies 6 and 9, BSM has to treat raw water to a potable standard before use, heat water for sanitisation purposes and then treat any resultant wastewater to a high standard before it is discharged into the environment. Therefore, it is important that BSM uses water efficiently and minimises waste to assist in ensuring the overall operation is operated efficiently and economically.
- With respect to Policies 7 and 10, the assessment of effects of the proposed groundwater take (including any cumulative effects) prepared by PDP has concluded that the proposal reflects the efficient allocation and use of Southland's water resources. More specifically, the proposed maximum daily take from the confined

aquifer is a small percentage of the estimated available drawdown and will not result in the primary allocation limit being exceeded.

- With respect to Policy 16 and in accordance with the Water Management Regulations, BSM will install a water meter to measure their water use, store these records, and submit the records to Environment Southland.
- With respect to Policy 17, the preference for a consent duration no more than 25 years is acknowledged. However, BSM considers a longer consent duration is required to recognise BSM's significant existing investment in the Plant and the recent investment they have committed to the upgraded WWTP. A long consent term also suitably reflects the significant social and economic benefits this Plant provides in the local area and gives greater certainty that those benefits will endure.
- In accordance with Policy 19, BSM has engaged with TAMI regarding the proposal. TAMI are yet to advise on the need to provide a CVR, BSM will continue to engage on an ongoing basis where relevant.

Air Quality

3.2.1 Discharges to Air

1. *Discourage discharges from industrial and trade premises that will have an impact on mahinga kai, taonga species, biodiversity, wāhi tapu and wāhi taonga.*
2. *Ensure that the processes used during activities that discharge to air are supervised and monitored to ensure that contaminant emissions are minimised.*
3. *Encourage existing activities that emit contaminants to air to evaluate, and where practical implement new technologies to reduce adverse effects on air quality.*

9. *Discourage and prevent discharges to air that will have impacts on cultural well-being and community health.*
10. *Ensure that discharges of contaminants into the air such as dust, smoke and odour do not affect the amenity values of areas which are of cultural and historical significance to iwi.*

12. *Engage Ngāi Tahu ki Murihiku early in the consenting and permitting process for activities whereby there is discharge to air, particularly agrichemical and aerial spraying/topdressing and activities causing offensive odours. Discharges must not cause objectionable or offensive odour to the extent that is causes adverse effects beyond the boundaries of the consent holder's property.*
13. *Advocate for robust consent conditions with a maximum twenty-five years. Changes to consent conditions must be notified to affected parties and all consent conditions monitored routinely.*

3.2.2 Amenity Values

4. Ngāi Tahu ki Murihiku shall provide qualified recommendations with respect to concerns raised related to odour and offensive discharge, from rural, urban and industrial activities.

Of note when considering these matters:

- With respect to Policy 1 and 9, modelling undertaken by Beca shows that discharges of the primary pollutants from the existing boiler stacks do not exceed any of the relevant air quality criteria limits outside the Site boundary and therefore any adverse effect on cultural well-being and community health will be less than minor, with no physical adverse effects on mahinga kai, taonga species or biodiversity.
- In accordance with Policy 2 and 12, robust requirements for supervising activities and monitoring emissions will be required by consent conditions (Refer to Section 7 of this AEE for further detail). Beca conclude that the odours from the site are unlikely to be offensive or objectionable to the extent that there is an adverse effect on the closest sensitive receivers beyond the site boundary provided BSM operate in accordance with the various management plans.
- In accordance with Policy 3, BSM have completed a study to identify site emissions and assess emission reduction opportunities with the primary objective to identify a decarbonisation transition pathway for the Site. As discussed, BSM propose to de-commission the HWB boiler by August 2024 to reduce carbon emissions and will seek to replace the RSB boiler when a practicable alternative technology is available.
- In accordance with Policy 12, BSM has engaged with TAMI regarding the proposal. TAMI are yet to advise on the need to provide a CVR, BSM will continue to engage on an ongoing basis where relevant; and
- With respect to Policy 13 the preference for a consent duration no more than 25 years is acknowledged. However, BSM considers a longer consent duration is required to recognise BSM's significant existing investment in the Plant and the recent investment they have committed to the upgraded WWTP. A long consent term also suitably reflects the significant social and economic benefits this Plant provides in the local area and gives greater certainty that those benefits will endure.

10.2.3.2 Value of Investment of the Consent Holder

When considering the Proposal, the consent authority must have regard to the value of the investment of BSM which is reliant on the proposed activities.

That investment is considerable. BSM are a major contributor to the local economy, employing over 350 staff throughout the season and providing an essential service to the local farming community. BSM has invested $40 million into the Processing Plant and surrounding farmland to ensure effective and efficient operation are maintained at all times. Between 2018 – 2022 BSM undertook a substantial upgrade of the WWTP, consisting of a significant financial investment of $4.7 million.

10.2.4 Section 105 Assessment – Matters Relevant to Discharge Applications

Section 105 of the RMA sets out additional matters which must be considered by a consent authority when considering an application for a discharge permit. Section 105(1) of the RMA states:

> *"If an application is for a discharge permit or coastal permit to do something that would contravene section 15 or section 15B, the consent authority must, in addition to the matters in section 104(1), have regard to—*
>
> *(a) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and*
>
> *(b) the applicant's reasons for the proposed choice; and*
>
> *(c) any possible alternative methods of discharge, including discharge into any other receiving environment.*

These matters are addressed in detail in Section 8, which outlines why the proposed discharge method represents the best practicable option.

10.2.5 Part 2 of the Resource Management Act 1991

It is understood that a consent authority is generally no longer required to consider Part 2 of the RMA beyond its expression in the relevant statutory planning documents, unless it is appropriate to do so. In this case, it is considered that the planning context is clear, and the Proposal aligns well with the various planning directions set out earlier. However, for completeness and in accordance with Schedule 4(2)(1)(f) of the RMA, Part 2 of the RMA is considered in the following paragraphs.

10.2.5.1 Section 5

The purpose of the RMA is to promote the sustainable management of natural and physical resources. With respect to enabling people and communities to provide for their social and economic wellbeing, as set out throughout this AEE, the BSM Plant makes a positive contribution to the social and economic wellbeing of people and communities in the area, including the employment of 350 staff. The operation of the Plant provides direct economic benefit to the regional economy through the payment of wages and salaries and spends an estimated $87.5 million per annum in the Southland region on goods and services. The BSM Plant is reliant on being able to operate under the consents sought in this application, and not granting the resource consents as sought would place the ongoing operation of the Plant in question.

The Proposal will not affect the safeguarding of the life-supporting capacity of air, water, soil and ecosystem. Likewise, as set out in Section 6 of this AEE, a comprehensive assessment of effects of the Proposal on the receiving environment has determined that any adverse effects can be appropriately avoided, remedied, or mitigated. Section 7 of this AEE provides the details of these measures proposed by BSM to avoid, remedy, or mitigate the actual and potential effects of the Proposal on the environment and to manage the effects on the wellbeing of people in accordance with Section 5 of the RMA.

The improvements in the quality of the discharges to land as a result of the upgraded WWTP, and the improvements in quality of the air discharges as a result of the removal of the HWB Boiler by August 2024, will also help contribute to a long-term improvement in the life-supporting capacity of the air, water, soils and ecosystems.

10.2.5.2 Section 6, 7 and of the RMA

Section 6 of the RMA contains matters of national importance that shall be recognised and provided for. With the exception to section 6(e) and section 6(g) of the RMA that relate to Māori values (which are addressed below), it is considered only section 6(a) is expressly relevant:

> *(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development*

With respect to Section 6(a) above the following points are pertinent:

- The technical assessments have indicated that the surface water quality of two watercourses on the Site are heavily impacted by local land-use influences, which comprises intensive agricultural practice;
- The technical assessments have concluded that any adverse effects associated with the Proposal on the two watercourses on the Site (and waterways outside the Site) will be appropriately avoided, remedied, or mitigated. The use of the watercourses on the Site for the Proposal (i.e., the proposed discharge of land drainage water and stormwater to water) is not considered inappropriate in this context;
- Whilst the upgraded WWTP is expected to result in improvements to the quality of the watercourses on the Site (and waterways outside the Site), It is also noted that section 6(a) does not extend to the reinstatement or enhancement of the environment relative to its current state.

Section 7 of the RMA contains other relevant matters to which particular regard must be given. Several of these are relevant to this application, notably:

> *(b) the efficient use of natural and physical resources:*
> *(c) the maintenance and enhancement of amenity values:*
> *(d) intrinsic values of ecosystems:*
> *(f) maintenance and enhancement of the quality of the environment;*

(i) *the effects of climate change.*

In regards to these sub-clauses of Section 7, the following points are pertinent:

- With respect to section 7(b) of the RMA, the continued use of the Plant represents an efficient use of natural and physical resources. The Plant is existing, and there are significant investment costs in the location and equipment at the Site. The Plant has access to a skilled labour force of sufficient scale to ensure that it operates effectively and the Plant is appropriately located to receive livestock that is within the immediate and surrounding area;
- With respect to section 7(d) of the RMA, the technical assessments have given particular regard to the intrinsic values of the ecosystems when describing the environment setting and assessing the effects of the Proposal;
- With respect to section 7(c) and 7(f) of the RMA, the technical assessments have concluded that any adverse effects associated with the Proposal can be appropriately avoided, remedied or mitigated. Furthermore, as a result of the upgraded WWTP, the continued operation of the Plant in accordance with the proposed consent conditions would maintain and enhance amenity values and the quality of the environment; and
- With respect to section 7(i) of the RMA, while not relevant to an assessment the effects of climate change BSM has completed a study to identify site emissions and assess emission reduction opportunities (The TOA Report), with the primary objective to identify a decarbonisation transition pathway for the Site. The TOA Report identified an opportunity to decommission the existing HWB boiler by August 2024 and BSM will seek to replace the RSB boiler when a practicable alternative technology is available (in accordance with carbon reduction requirements).

With respect to the sections within Part 2 of the RMA that relate to tangata whenua, the following points are pertinent:

- In order to identify and assess the cultural effects of the activities, BSM has engaged with TAMI regarding the proposal. Whilst TAMI are yet to advise on the need to provide a CVR, BSM will seek to continue to engage throughout the consent process and beyond;
- Hokonui Rūnanga were also approached by BSM but advised that as the activity is outside of their takiwā, they did not wish to provide feedback;
- The Proposal has been assessed against the key directives in Te Tangi a Tauira – the relevant iwi management plan, with this assessment concluding the Proposal sits comfortably within the provisions; and
- Whilst It is acknowledged that it is for the mana whenua of the area to determine and assess the cultural effects of the activities, to the extent that cultural values may align

with water quality and ecological effects, addressing these matters will to some degree also avoid, remedy or mitigate cultural effects.

10.2.5.3 Summary

Overall, and based on the technical assessments that have bene commissioned by BSM, it is considered that the Proposal will promote the sustainable management of natural and physical resources in accordance with Part 2 of the RMA, noting that Part 2 of the RMA is not being explicitly relied upon given the full coverage of relevant resource management issues provided in the pSWLP, the Operative Plan and the Air Plan.

10.3 SUMMARY

Overall, it is considered that the granting of the resource consents, subject to the imposition of appropriate conditions, would promote the sustainable management of natural and physical resources and ensure that adverse effects on the environment are appropriately avoided, remedied or mitigated.

11. NOTIFICATION

11.1 SECTION 95A PUBLIC NOTIFICATION

BSM has discussed notification with Environment Southland at the pre-application meeting held on 23 May 2022 (Refer to Section 9.3.2 of this AEE for further detail). It was indicated that this might be the preferred option for these applications for both BSM and Environment Southland.

Therefore, pursuant to section 95A(2)(b) of the RMA, BSM formally request that the applications be publicly notified.

12. CONCLUSION

This AEE is in support of applications to 're-consent' the following activities such that the BSM Plant can continue to operate and contribute in a major way to the social and economic wellbeing of the surrounding community:

- The take of groundwater (for a meat processing plant and a rendering and blood drying plant);
- The take of groundwater, via the groundwater dewatering system and leak detection system for the wastewater treatment plant;
- The discharge of treated wastewater and biosolids to land via a spray irrigator (from the meat processing plant and rendering plant); and the discharge of screened stockyard solids, paunch, and sand and grit to land via a muck spreader;
- The discharge of contaminants to air (from a meat processing plant, rendering and blood drying plant and associated boilers) that combines two existing air discharge consents; and
- The discharge of land drainage water and stormwater to water.

BSM is seeking a 35-year consent term for the replacement consents being sought. A 35-year consent term suitably recognises the existing asset value of the Plant and the significant economic contribution it provides to the Southland Region. A 35-year consent term also means the significant financial investment involved in the upgraded WWTP, and the future investment in replacing the two coal-fired boilers, can be justified and secured over an appropriate timeframe.

An assessment of the actual and potential effects of the Proposal on the environment is provided in Section 6 and 7 of this AEE, as well as the various technical assessments commissioned by BSM. In summary, it is considered that the Proposal can be undertaken in a manner that appropriately avoids, remedies or mitigates adverse effects on the environment.

With respect to the statutory planning framework that applies to the applications, it is concluded that the renewal of the resource consents by BSM will align comfortably with the overall management intentions specified in the relevant national and regional planning documents.

Finally, it is noted that BSM has consulted with interested / potentially affected parties with respect to these applications. This consultation has informed the various environmental assessments and will continue throughout the resource consent process and during the subsequent operation of the Plant.

A

APPENDIX A

Records of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **SL12A/102**
Land Registration District **Southland**
Date Issued 21 July 1998

Prior References
SL9A/525

Estate Fee Simple
Area 51.4252 hectares more or less
Legal Description Lot 1 Deposited Plan 14802
Registered Owners
Blue Sky Meats (N.Z.) Limited

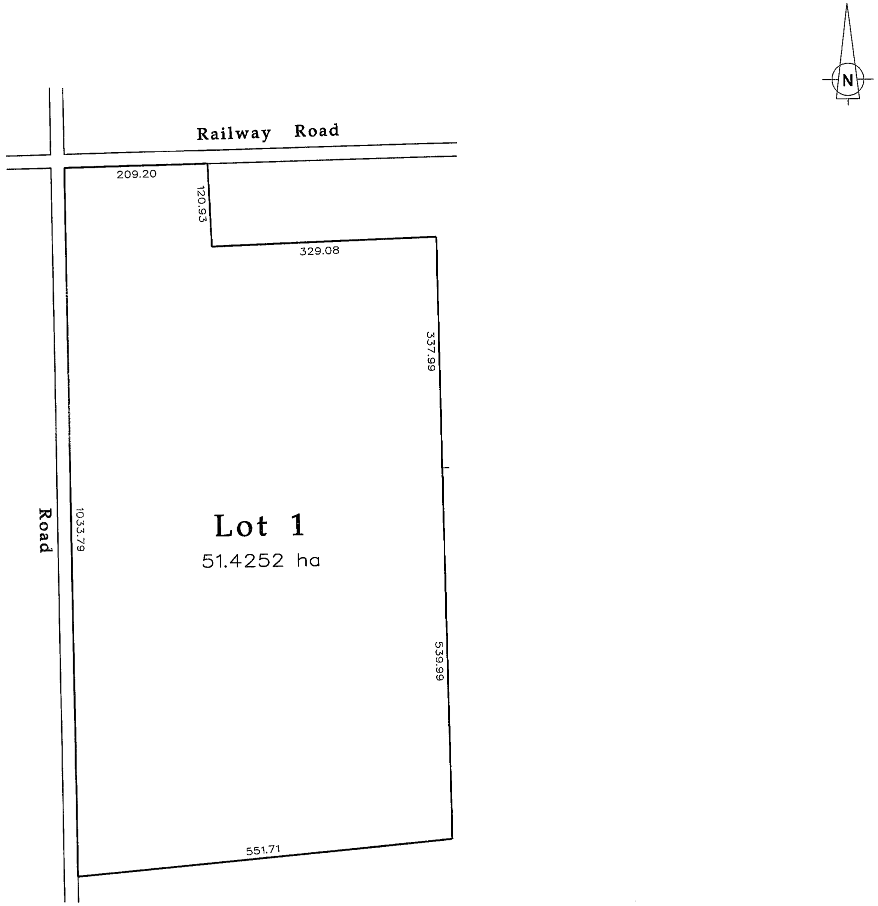
Interests

158702.9 Easement Certificate specifying the following easements

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Convey water and electricity	Lot 1 Deposited Plan 12194 - CT SL9C/42	A DP 12016	Lot 1 Deposited Plan 14802 - herein	

11669070.2 Mortgage to Westpac New Zealand Limited - 24.4.2020 at 2:38 pm

New CT Allocated	
Lot 1	CT 12A/102



Parcel	Formerly	CT Ref
Lot 1	Formerly Pt Lot 1 DP 12016	9A/525 (Part)

Deduced Total Area 51.4252 hectares

Approved for CT Diagram Purposes Only

Deputy Chief Surveyor

Deposited for CT Diagram Purposes Only

This 21 day of July 1998

for Assistant Land Registrar District

Drawn by GW

Checked by KH

DP 14802

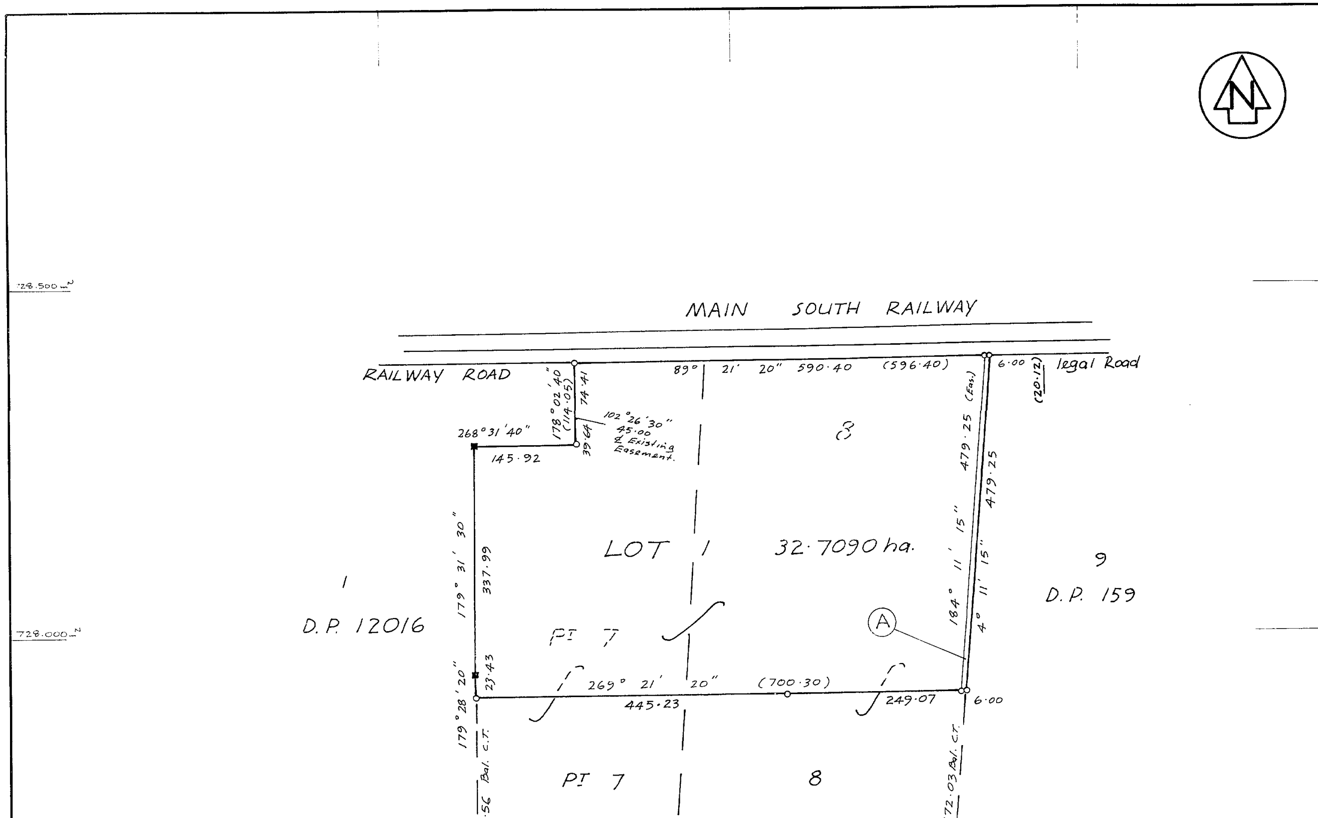
"Approved LM 94/14"

LAND DISTRICT SOUTHLAND
Survey Blk. & Dist. VIII Lothian Hd
NZMS 261 Sheet

Plan of Lot 1 for CT Diagram Purposes

TERRITORIAL AUTHORITY SOUTHLAND DISTRICT
Prepared by TERRALINK NZ LIMITED
Scale Proportional Date 24 March 1998

A.J. BEVIN, SURVEYOR GENERAL, LAND INFORMATION NEW ZEALAND



OPTIONAL EASEMENT			
	SERVIENT TENEMENT		DOMINANT TENEMENT
Nature of Easement.	LOT No	Part Subject to Easement shown hereon by:	LOT No
R.O.W	1	A	PT LOTS 7 & 8, D.P. 159

Approvals:
BLUE SKY MEATS (N.Z.) LTD.
OWNERS.

The Southland County Council certifies that:

(1) This plan of subdivision is approved pursuant to Section 305 (1), of the Local Government Act 1974 under delegated authority pursuant to Section 715, of the Local Government Act 19 ,
Signed on the 8 th day of February 1989 subject to such conditions as are set out in paragraph (3) hereof;

(2) This plan is in accordance with the requirements and provisions of the said Council's operative district planning scheme at that date and that

(3) The conditions referred to in paragraph (1) hereof are:
That Part Lots 7 & 8, DP 159 (CT B1/987) and Lot 1 DP 595 (CT B1/977) be held in one certificate of title (See 149690.1) Nil other conditions hereon and all conditions on the Scheme Plan have been complied with.

IN WITNESS whereof the Common Seal of the said Council was hereunto affixed in the presence of

CHAIRMAN

COUNTY MANAGER

The Common Seal of the Southland County Council

Total Area 32·7090ha.

Comprised in C.T. 9A /524

I, Ralph Moir of INVERCARGILL
Registered Surveyor and holder of an annual practising certificate hereby certify that this plan has been made from Surveys executed by me or under my direction; that both plan and Survey are correct and have been made in accordance with the Survey Regulations 1972 or any Regulations made in substitution thereof.
Dated at INVERCARGILL this 24TH day of JUNE 1988 Signature R. Moir

Field Book p. Traverse Book 129 p. 217-8
Reference Plans
Examined L. Cairns Correct K. Hawkes

Approved as to Survey
4/4/89 Chief Surveyor

Deposited this 20 th day of APRIL 1990
District Land Registrar

LAND DISTRICT SOUTHLAND
SURVEY BLK.& DIST. VIII , LOTHIAN HD
NZMS 261 SHEET No. F46/1·3

Lot 1, Being Subdivision of Pt Lot 7 & Lot 8, D.P. 159, Also Being Part Section 42.

LOCAL AUTHORITY SOUTHLAND COUNTY
Surveyed by Ralph Moir & Associates.
Scale 1 - 4000 Date JUNE 1988

File 5/38
Received 29.3.89. K.H.
Instructions

DP 12194

Printed by Littlejohns Instruments Ltd Wellington, New Zealand

I.F. Stirling Surveyor General Department of Lands and Survey, Wellington

P.3 [redacted] [redacted]

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **SLA4/1013**
Land Registration District **Southland**
Date Issued 10 September 1969

Prior References
SL143/56

Estate	Fee Simple
Area	91.8432 hectares more or less
Legal Description	Lot 231-238, Lot 240-241, Lot 256-265, Lot 279-284, Lot 287-293 and Part Lot 285-286 Deposited Plan 155, Lot 9 and Lot 12-13 Deposited Plan 159 and Closed Road Deposited Plan 155

Registered Owners
Leonard Donald Ward and Deveron Trustees Limited

Interests

158702.8 Transfer creating the following easements - 16.1.1989 at 10.45 am

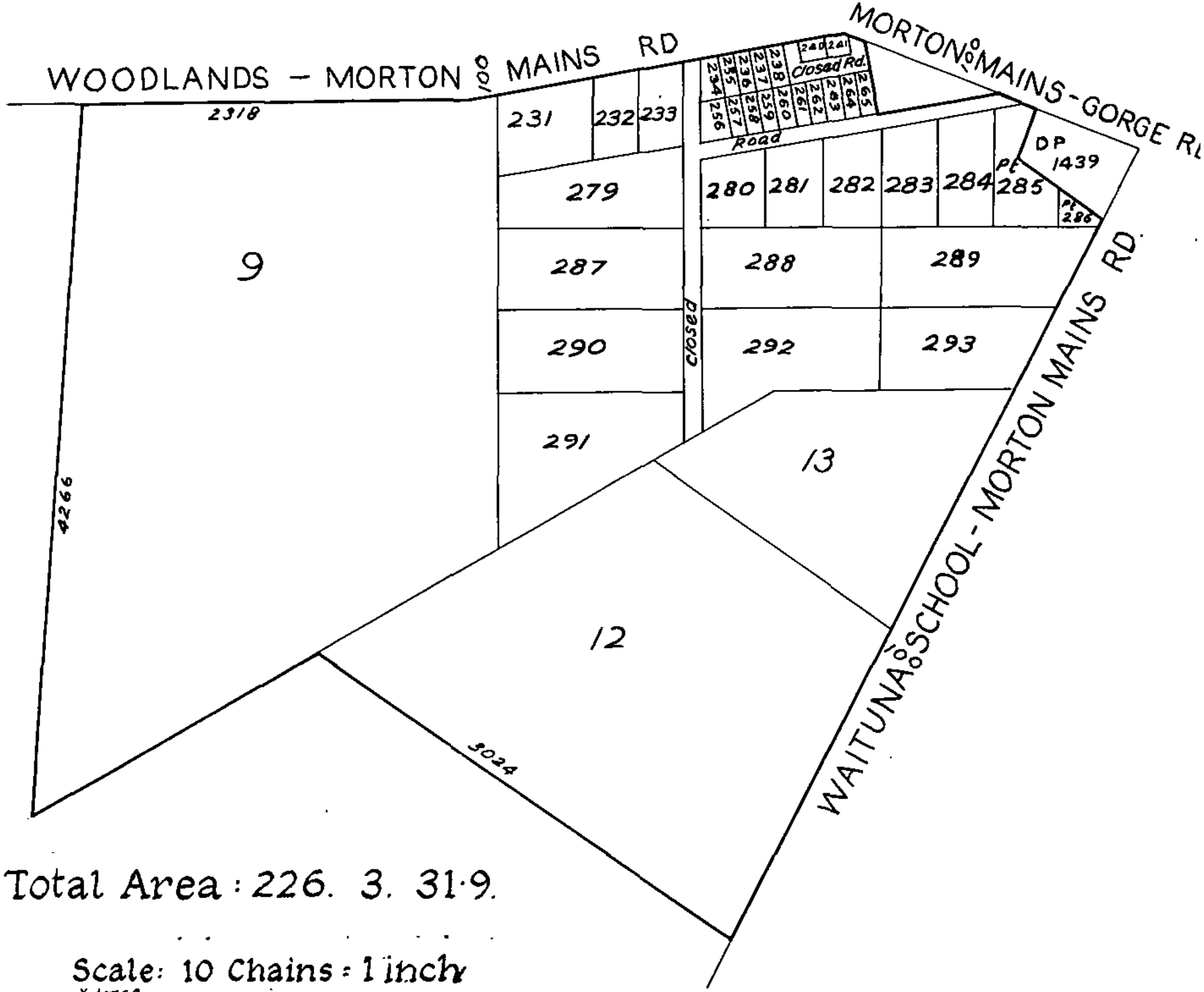
Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 231-238, Lot 240-241, Lot 256-265, Lot 279-284, Lot 287-293 and Part Lot 285-286 Deposited Plan 155, Lot 9 and Lot 12-13 Deposited Plan 159 and Closed Road Deposited Plan 155 - herein	A Transfer 158702.8	Part Lot 7 and Lot 8 Deposited Plan 159 - CT SL9A/524	

5022644.2 Mortgage to Bank of New Zealand - 5.2.2001 at 9:15 am

8151267.1 Variation of Mortgage 5022644.2 - 6.5.2009 at 12:00 pm

9495125.1 Open Space Covenant pursuant to Section 22 Queen Elizabeth The Second National Trust Act 1977 - 22.8.2013 at 3:12 pm.

11002752.1 Variation of Mortgage 5022644.2 - 31.1.2018 at 10:21 am



Total Area: 226. 3. 31·9.

Scale: 10 Chains = 1 inch

XdJCS.

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **SL9C/43**
Land Registration District **Southland**
Date Issued 20 April 1990

Prior References
SL9A/524 SLB1/977

Estate Fee Simple
Area 78.7049 hectares more or less
Legal Description Lot 1 Deposited Plan 595 and Part Lot 7-8 Deposited Plan 159

Registered Owners
Blue Sky Meats (N.Z.) Limited

Interests

159846.1 Fencing Covenant

Subject to Section 308 (4)(5) Local Government Act 1974

158702.8 Transfer creating the following easements

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 9 Deposited Plan 159 - CT SLA4/1013	A Transfer 158702.8	Part Lot 7-8 Deposited Plan 159 - herein	

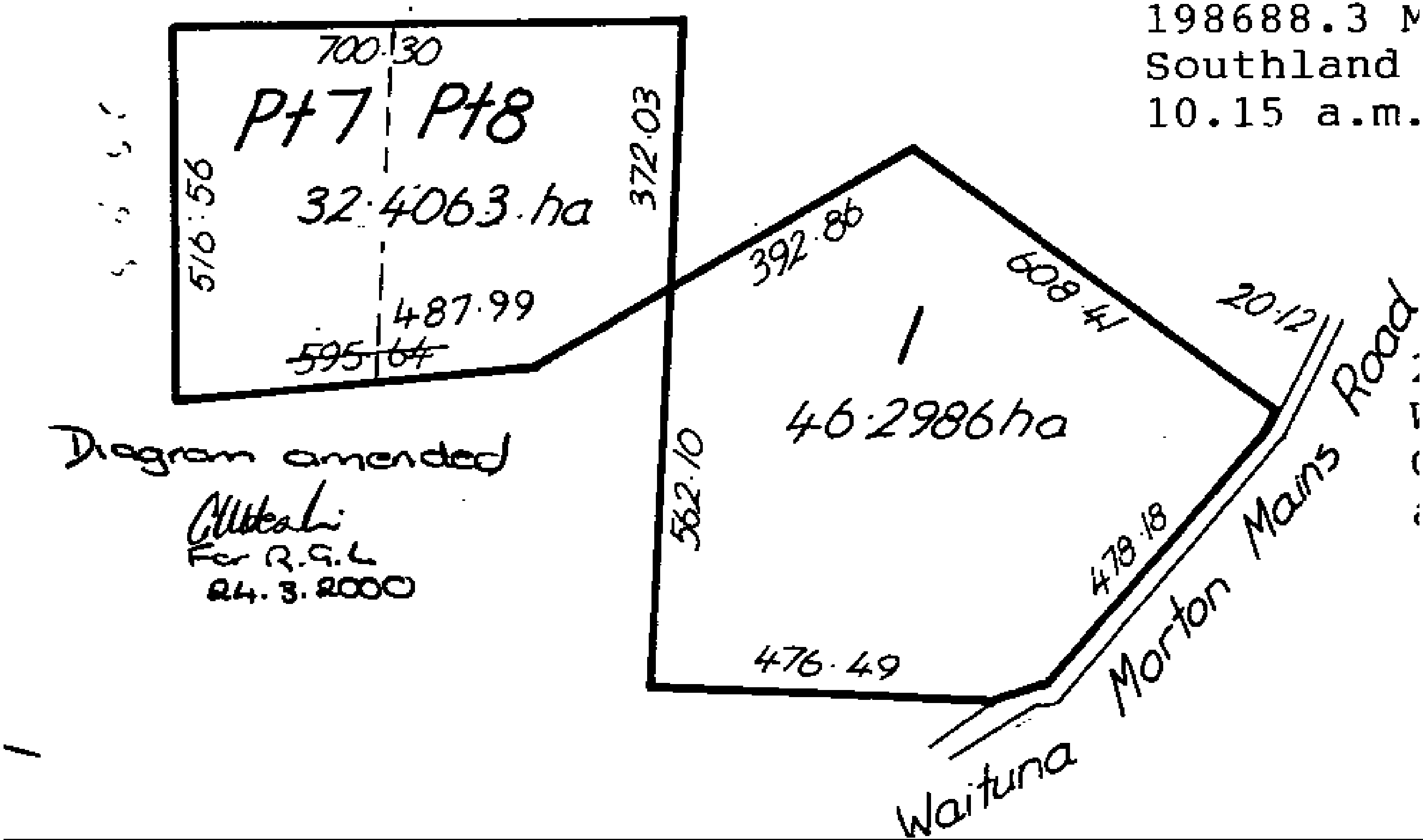
173786.1 Easement Certificate specifying the following easements

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 1 Deposited Plan 12194 - CT SL9C/42	A DP 12194	Lot 1 Deposited Plan 595 and Part Lot 7-8 Deposited Plan 159 - herein	

203807.2 Mortgage to (now) Westpac New Zealand Limited - 19.11.1992 at 11.16 am

11669070.3 Variation of Mortgage 203807.2 - 24.4.2020 at 2:38 pm

198688.3 M
Southland
10.15 a.m.



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **SL9C/42**

Land Registration District **Southland**

Date Issued 20 April 1990

Prior References
SL9A/524

Estate Fee Simple

Area 32.7090 hectares more or less

Legal Description Lot 1 Deposited Plan 12194

Registered Owners

Leonard Donald Ward and Deveron Trustees Limited as to a 1/2 share

Paula Jane Ward and David Alan Burnett as to a 1/6 share

Paula Jane Ward, Graham Colin Ward and David Alan Burnett as to a 1/3 share

---

Interests

Fencing Covenant in Transfer 159846.1

158702.9 Easement Certificate specifying the following easements

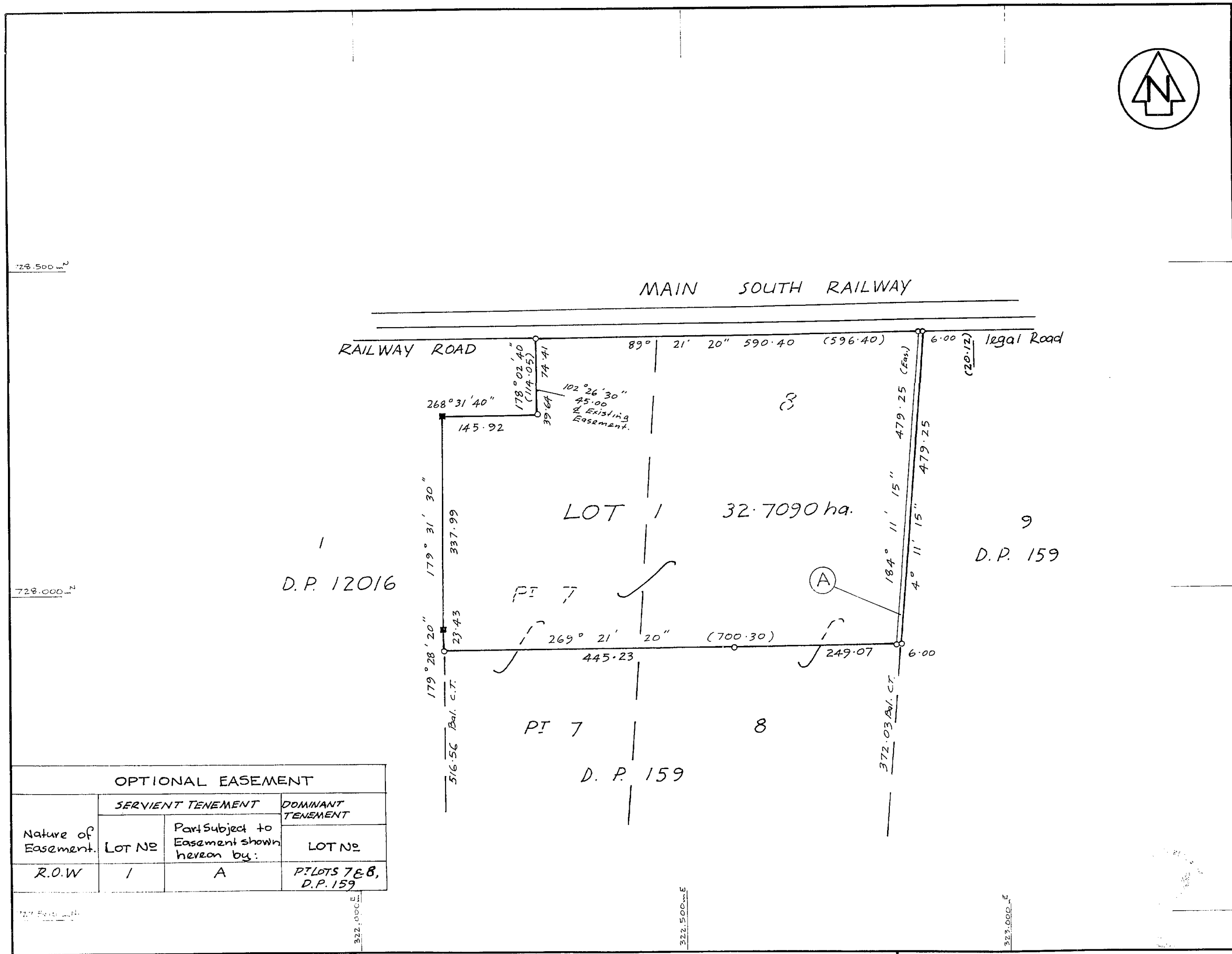
Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Convey water and electricity	Lot 1 Deposited Plan 12194 - herein	A DP 12016	Lot 1 Deposited Plan 12016 - CT SL9A/525	Section 309(1)(a) Local Government Act 1974

158702.8 Transfer creating the following easements

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 9 Deposited Plan 159 - CT SLA4/1013	A Transfer 158702.8	Lot 1 Deposited Plan 12194 - herein	

173786.1 Easement Certificate specifying the following easements - 20.4.1990

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 1 Deposited Plan 12194 - herein	A DP 12194	Part Lot 7 and 8 Deposited Plan 159 - CT SL9C/43	



OPTIONAL EASEMENT			
	SERVIENT TENEMENT		DOMINANT TENEMENT
Nature of Easement.	Lot No	Part Subject to Easement shown hereon by:	LOT No
R.O.W	1	A	PT LOTS 7 & 8, D.P. 159

Approvals:

BLUE SKY MEATS (N.Z.) LTD.

OWNERS.

The Southland County Council certifies that:

(1) This plan of subdivision is approved pursuant to Section 305 (1), of the Local Government Act 1974 under delegated authority pursuant to Section 715, of the Local Government Act 19..,

Signed on the 8th day of February 1989 subject to such conditions as are set out in paragraph (3) hereof;

(2) This plan is in accordance with the requirements and provisions of the said Council's operative district planning scheme at that date and that

(3) The conditions referred to in paragraph (1) hereof are:

That Part Lots 7 & 8, DP 159 (CT B1/987) and Lot 1 DP 595 (CT B1/977) be held in one certificate of title (See 149690.1) Nil other conditions hereon and all conditions on the Scheme Plan have been complied with.

IN WITNESS whereof the Common Seal of the said Council was hereunto affixed in the presence of

J Pleasy CHAIRMAN

COUNTY MANAGER

The Common Seal of the Southland County Council

Total Area 32·7090 ha.

Comprised in C.T. 9A/524

I, Ralph Moir of INVERCARGILL Registered Surveyor and holder of an annual practising certificate hereby certify that this plan has been made from Surveys executed by me or under my direction; that both plan and Survey are correct and have been made in accordance with the Survey Regulations 1972 or any Regulations made in substitution thereof. Dated at INVERCARGILL this 24th day of JUNE 1988 Signature R. Moir

Field Book ...... p. ...... Traverse Book 129 p. 217-8

Reference Plans

Examined L. Cairns Correct K. Hawkes

Approved as to Survey

4/4/89 Chief Surveyor

Deposited this 20th day of APRIL 1990

District Land Registrar

LAND DISTRICT SOUTHLAND SURVEY BLK. & DIST. VIII, LOTHIAN HD NZMS 261 SHEET No. F46/1·3	Lot 1, Being Subdivision of Pt Lot 7 & Lot 8, D.P. 159, Also Being Part Section 42.	LOCAL AUTHORITY SOUTHLAND COUNTY Surveyed by Ralph Moir & Associates. Scale 1 - 4000 Date JUNE 1988

File 5/38
Received 29.3.89. K.H.
Instructions

DP 12194

Printed by Littlejohns Instruments Ltd Wellington, New Zealand

I F Stirling Surveyor General Department of Lands and Survey, Wellington

P.3 [redacted] [redacted]

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

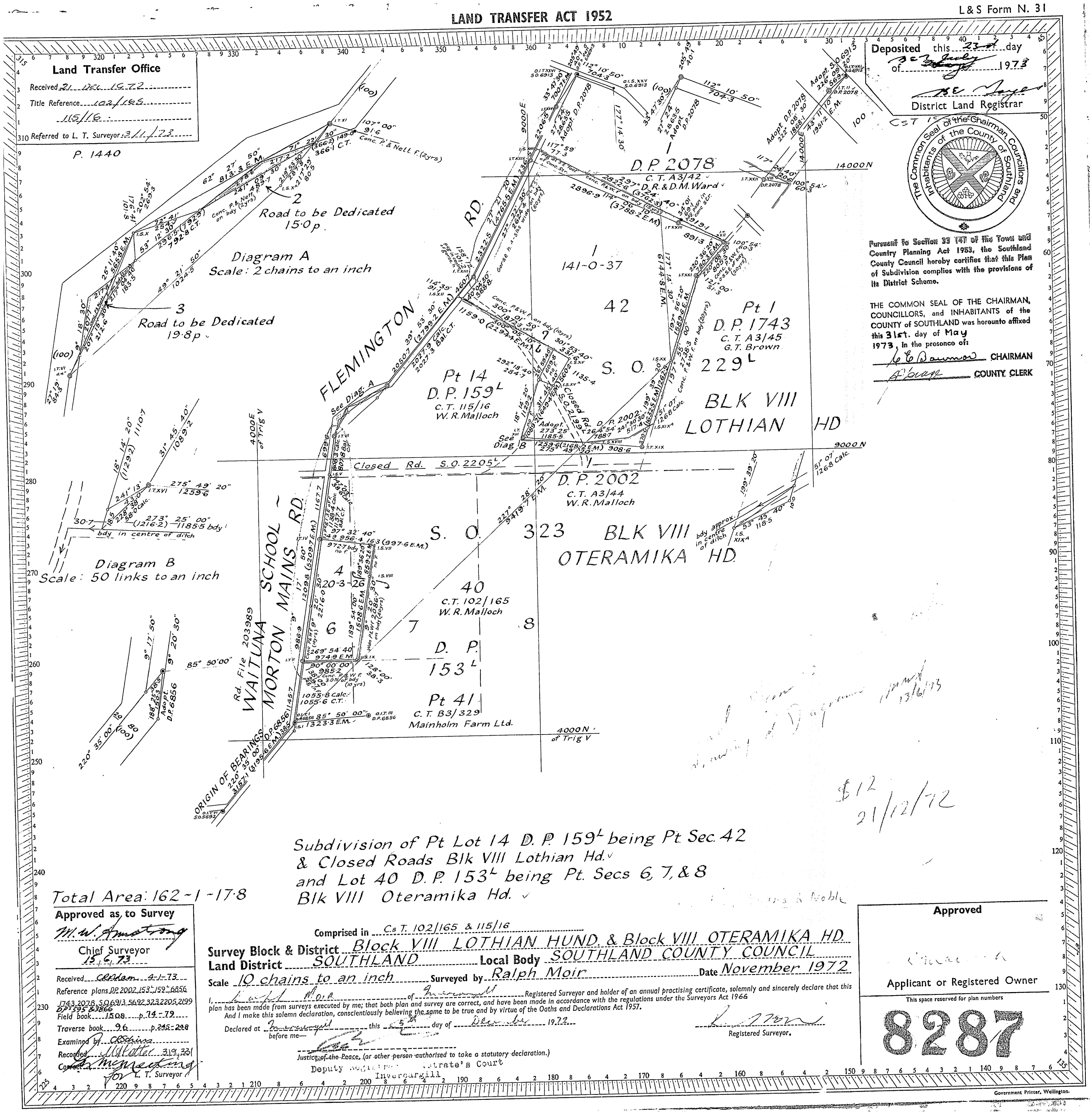
R.W. Muir
Registrar-General
of Land

Identifier **SL3A/935**
Land Registration District **Southland**
Date Issued 23 July 1973

Prior References
SL115/16

Estate Fee Simple
Area 57.1542 hectares more or less
Legal Description Lot 1 Deposited Plan 8287
Registered Owners
Graham Colin Ward and Vicki Maree Ward

Interests
11353669.5 Mortgage to Bank of New Zealand - 24.5.2019 at 1:41 pm



LAND TRANSFER ACT 1952
L & S Form N. 31
Land Transfer Office
Received 21 DEC 1972
Title Reference 102/165
115/16
Referred to L. T. Surveyor 3/1/73
Deposited this 23rd day of July 1973
District Land Registrar
The Common Seal of the Chairman Councillors and Inhabitants of the County of Southland
Pursuant to Section 33 of the Town and Country Planning Act 1953, the Southland County Council hereby certifies that this Plan of Subdivision complies with the provisions of its District Scheme.
THE COMMON SEAL OF THE CHAIRMAN, COUNCILLORS, and INHABITANTS of the COUNTY of SOUTHLAND was hereunto affixed this 31st. day of May 1973, in the presence of:
CHAIRMAN
COUNTY CLERK
P. 1440
Road to be Dedicated 15·0p
Diagram A
Scale: 2 chains to an inch
Road to be Dedicated 19·8p
Diagram B
Scale: 50 links to an inch
D.P. 2078
C.T. A3/42
D.R. & D.M. Ward
1
141-0-37
42
Pt 1
D.P. 1743
C.T. A3/45
G.T. Brown
S. O. 229L
BLK VIII
LOTHIAN HD
FLEMINGTON RD.
Pt 14
D.P. 159L
C.T. 115/16
W. R. Malloch
Closed Rd. S.O. 2205L
D.P. 2002
C.T. A3/44
W.R. Malloch
S. O. 323
BLK VIII
OTERAMIKA HD.
4
20-3-26
6
7
8
40
C.T. 102/165
W. R. Malloch
D. P. 153L
Pt 41
C.T. B3/329
Mainholm Farm Ltd.
SCHOOL RD.
WAITUNA MORTON MAINS RD.
Rd. File 203989
ORIGIN OF BEARINGS
14000N
9000N
4000N of Trig V
9000E
4000E of Trig V
21/12/72
Subdivision of Pt Lot 14 D.P. 159L being Pt Sec. 42 & Closed Roads Blk VIII Lothian Hd. and Lot 40 D.P. 153L being Pt. Secs 6, 7, & 8 Blk VIII Oteramika Hd.
Total Area: 162-1-17·8
Approved as to Survey
M. W. Armstrong
Chief Surveyor
15.6.73
Comprised in Cs T. 102/165 & 115/16
Survey Block & District Block VIII LOTHIAN HUND. & Block VIII OTERAMIKA HD.
Land District SOUTHLAND
Local Body SOUTHLAND COUNTY COUNCIL
Scale 10 chains to an inch
Surveyed by Ralph Moir
Date November 1972
Registered Surveyor and holder of an annual practising certificate, solemnly and sincerely declare that this plan has been made from surveys executed by me; that both plan and survey are correct, and have been made in accordance with the regulations under the Surveyors Act 1966. And I make this solemn declaration, conscientiously believing the same to be true and by virtue of the Oaths and Declarations Act 1957.
Registered Surveyor.
Justice of the Peace, (or other person authorised to take a statutory declaration.)
Deputy Registrar Magistrate's Court Invercargill
Approved
Applicant or Registered Owner
This space reserved for plan numbers
8287
Government Printer, Wellington.

B

APPENDIX B

Assessment of Effects of the Discharges to Air – Beca

Blue Sky Meats – Assessment of Effects of Discharges to Air

Technical Report

Prepared for Blue Sky Meats (N.Z.) Limited

Prepared by Beca Limited

29 June 2022

Creative people together transforming our world

Contents

Figures

Tables

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
1	Prue Harwood, Suzanne Cawood and Rhys Kevern	Draft for initial review	15 November 2021
2	Rhys Kevern, Suzanne Cawood	Second Draft	21 February 2022
3	Rhys Kevern	Final Draft for Mitchell Daysh review	29 April 2022
4	Rhys Kevern	Final Draft for Client Review	23 June 2022
4a	Rhys Kevern	Final	29 June 2022

Document Acceptance

Action	Name	Signed	Date
Prepared by	Prue Harwood, Rhys Kevern, Suzanne Cawood and Graeme Jenner	pp. Rhys Kevern	29 June 2022
Reviewed by	Mathew Noonan		29 June 2022
Approved by	Graeme Jenner		29 June 2022
on behalf of	Beca Limited		

Executive Summary

Blues Sky Meats (BSM) owns and operates a meat processing facility located at 729 Woodlands Morton Mains Road, Morton Mains, Southland. BSM has operated a facility processing mainly lambs and bovine calves at the site since 1987. The site processes include a meat processing plant, an animal by-product rendering plant and a blood drying plant. Two shifts are run on a single chain processing up to 5,000 head per day during peak season.

BSM holds two consents to discharge to air from the processing facility (AUTH-2011193-V5 and AUTH - 20191937-04) which will expire on the 31st December 2022. BSM is applying to Environment Southland to replace these consents with one new air discharge consent, which will include all of the discharges to air from the site.

The meat processing plant typically operates for 20 hours per day, six days a week during peak production. The rendering plant operates for 24 hours per day during peak season. Production runs from the end of July to early June the following year. The plant is targeting 12 month processing to ensure the global chilled customer demand can be met. The plant operates two lignite coal fired boilers - one providing hot water to the processing plant (HWB) and a second providing steam to the rendering plant (RSB).

A wastewater treatment plant treats site wastewater before irrigation to BSM and privately owned land around the plant. Stock yard solids, paunch grass and wastewater sludge are also applied to land.

The dispersion model AERMOD (v21112) was used to assess the effects of emissions from the two existing lignite coal fired boilers. As it has been difficult for the boilers to comply with the particulate matter discharge concentration set in the current consent, the assessment has included scenarios of higher PM_{10} emissions as well as at the consent limits. The peak cumulative ambient PM_{10}, NO_2, SO_2 and Hg concentrations resulting from the site emissions and background concentrations are predicted to remain within the relevant criteria at all locations where people are likely to be exposed and the discharges to air of particulate and combustion emissions from the site sources are appropriately avoided and mitigated.

Discharges of odour to air were assessed qualitatively based on current performance of the plant (including complaints), as well as existing and proposed mitigation measures. The main potential odour sources are the rendering plant, biofilter and wastewater treatment plant. BSM mitigates the potential for odour creation from these sources based on the requirements of an Air Discharge Management Plan.

While the plant is sited in a rural area, there are several sensitive receptors (residences) in the vicinity of the plant and site operations have historically resulted in odour effects that were unacceptable to these neighbours. Process upgrades to the wastewater treatment and processing plants have occurred from September 2019 to January 2020 along with fine tuning of odour management and controls in the following few months. These upgrades appear to have significantly reduced odour beyond the boundary of the site compared to historical levels, and subsequently there has been no complaints received since 7 September 2020 (noting this 7 September 2020 complaint was attributed to a neighbour spreading dairy shed effluent on land).

Overall, the current and proposed processes, controls and management systems at the BSM plant are acceptable for this activity in this location, and with ongoing diligent management, odour from the site is unlikely to be offensive or objectionable to the extent that there is an adverse effect beyond the site boundary. The discharges of products of combustion from boiler stacks are low and will not result in a breach of the relevant guidelines and standards including estimated background concentrations. BSM plans to decommission the HWB by August 2024 which will reduce air emissions from the site and bring the resultant ambient PM_{10} concentrations below the equivalent ambient level for the currently consented boiler particulate concentrations. This will be achieved through improved heat recovery, including the installation of a new heat pump refrigeration system that will enable the rejected heat to heat the hot water. BSM is also planning to remove the RSB when a practicable alternative technology is available (in line with carbon reduction requirements). This overall programme will reduce particulate emissions and other contaminants associated with lignite coal combustion at the site.

Providing BSM continues to operate, monitor and maintain the process emission controls and management practices on site, the discharge of contaminants and odour from the site is considered to be adequately avoided and mitigated to the extent that any adverse effects will be minimal.

1 Introduction

1.1 Overview

Blue Sky Meats (N.Z.) Limited (BSM)owns and operates a meat processing facility located at 729 Woodlands Morton Mains Road, Morton Mains in Southland. BSM holds two air discharge consents for the processing facility (AUTH-2011193-V5 and AUTH-20181937-04) which will both expire on 31 December 2022.

These two consents (attached as **Appendix A**) cover the discharges to air from the following processes:

- A meat processing plant
- A meat rendering plant
- A blood processing and drying plant
- Two coal fired boilers
- A wastewater treatment plant
- Irrigation of treated wastewater onto land
- Offal pits
- Salting shed

BSM has commissioned Beca Limited (Beca) to provide an assessment of the effects of the discharges to air from the site on ambient air quality, to support the application for consent under the fourth schedule of the resource management Act 1991.

Other consents held by BSM, to take groundwater, discharge treated wastewater to land and discharge offal and wool wastes to ground via an offal pit, will also expire on 31st December 2022 but are not discussed further in this report.

1.2 Purpose of Report

The purpose of this report is to provide a technical assessment of the effects of discharges to air from the site which include combustion contaminants from the boilers and the discharges of odour from the site rendering and effluent treatment plant.

This technical report will support a consent application and Assessment of Effects on the Environment (AEE) prepared by Mitchell Daysh to be lodged with Environment Southland.

The report includes the following:

- A brief summary of the proposal where it relates to discharges to air
- A description of the nature of plant operations and the nature of discharges to air
- A description of the receiving environment in terms of the potential influence on the environmental effects of the discharges to air
- A description of the nature of the site air emissions
- A description of relevant air quality standards and guidelines
- A description of discharge sources and mitigation
- A description of modelling methodology
- An assessment of the potential effects of the proposal on the environment
- A summary of conclusions and findings of the investigation.

1.3 Guidance Documents

This report has been prepared in accordance with the guidance provided by the Ministry for the Environment's "*Good Practice Guide for Assessing Discharges to Air from Industry*", 2016 (GPG Industry), *"Good Practice Guide for Assessing and Managing Odour"* (2016[1]) (Odour GPG) and "*Good Practice Guide for Atmospheric Dispersion Modelling",* 2014 (GPG Modelling).

1.4 Limitations

This report has been prepared by Beca for BSM. Beca has relied upon the information provided by BSM in completing this document. Unless otherwise stated, Beca has not sought to independently verify this information as provided. This report is therefore based upon the accuracy and completeness of the information provided and Beca cannot be held responsible for any misrepresentations, incompleteness, or inaccuracies provided within that information. Should any new or additional information become available, this report will need to be reviewed accordingly.

[1] Ministry for the Environment, 2016, *Good Practice Guide for Assessing and Managing Odour*, Wellington: Ministry for the Environment.

2 Project Description

2.1 Overview

The BSM plant has been operating at the site for over 30 years and is primarily a lamb abattoir but also processes bovine calves. The plant processes up to 27,750 stock units per week at peak season[2] but has capacity to process up to 30,000 stock units per week.

Sheep and calves are delivered to site by truck and offloaded into yards. From there, they are processed into carcasses, which are then boned and packed into cartons before being chilled or frozen. BSM processes edible offal for sale. Pelts are collected and salted on-site and on-sold. Cold storage is available on site, with most product being sold frozen and approximately 5% of product sold chilled.

Inedible material is transferred in bins by forklift to the onsite rendering plant. The material is mechanically ground down and water is added to make a slurry. The slurry is cooked in a steam heated vessel to extract the tallow which is then separated off. The remaining material is dried in a steam-heated rotary drier to produce a meat and bone meal which is sold primarily for petfood.

Blood is collected, coagulated and dried. Dried blood is sold for plant fertiliser.

BSM employs more than 350 seasonal staff over two shifts during peak production (season runs from late July to early June each year). There are approximately 60 permanent staff.

A site layout with the main process units is shown in **Figure 2-1**.

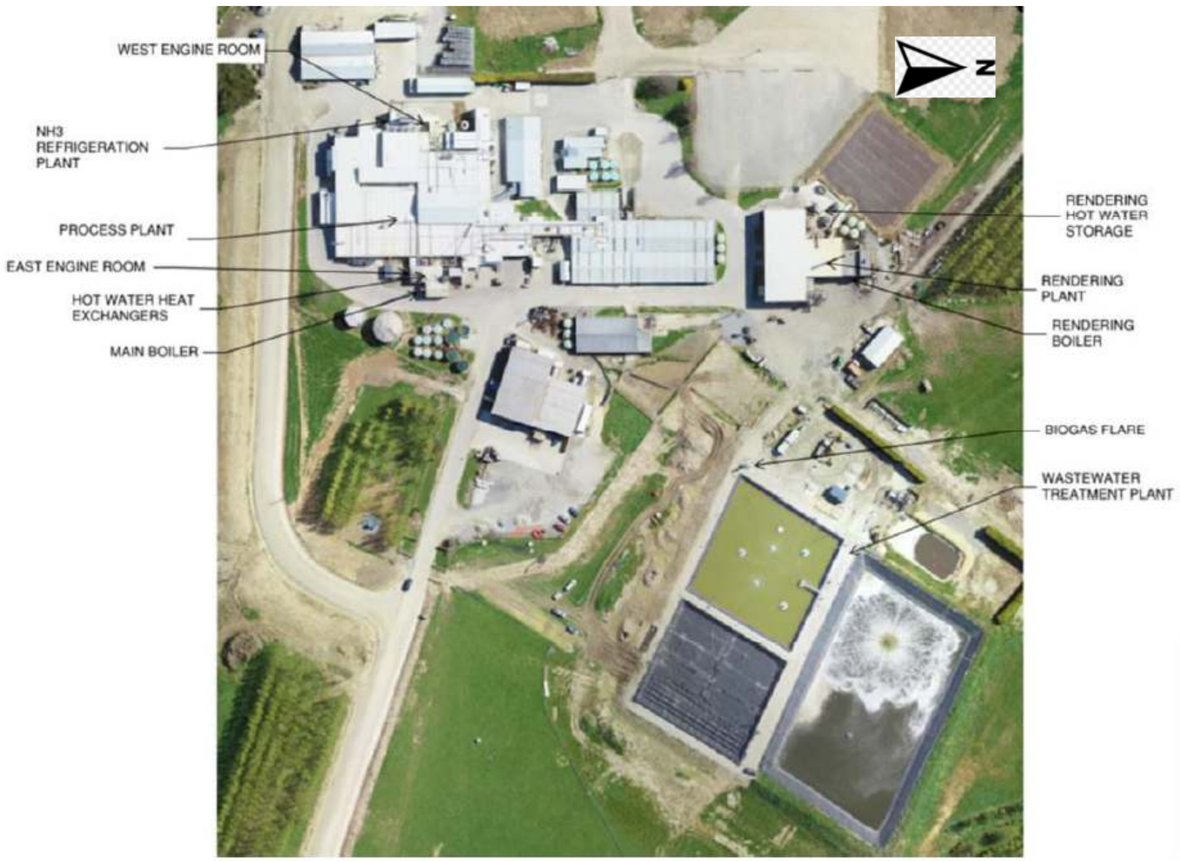


Figure 2-1 BSM site layout

2 WM Compliance Solutions (2021) Wastewater Farm Environmental Management Plan; prepared for BSM Ltd

2.2 Stockyards

Stock is transported to the plant in trucks and held in paddocks or stockyards, then washed prior to slaughter. The stockyards are covered but have open sides to allow natural light and ventilation. The stock holding yards are elevated approximately 1m above ground level and the stock are held in mesh floor pens, which allows faecal material to drop through onto a concrete slab that is graded and slopes towards a drain. The pens are washed regularly, with faecal material being hosed to the drain. This prevents the accumulation of faecal material under the stock holding area and prevents the onset of anaerobic activity and minimises the production of odours.

The effluent and washdown water from the yards are drained to a screen before being pumped to the WWTP. Stock yards solids and paunch grass are applied to land.

2.3 Salting Shed

Skins from the meat plant are salt cured in the salting shed. Approximately the same number of skins each day are treated as stock processed at the plant. Salt is Pacific grade 23 with additives consisting of either boric or citric acid at 1.5% per volume of raw salt, with 0.3% of dichlorophene. Salt is blended in treatment vessels with green sheep or calf skins for a minimum of one hour. Skins are then placed into cages for drainage before being graded and packed out during the following shift.

Approximately 750,000 skins are processed per annum.

2.4 Boilers

2.4.1 Operations

Two Vekos coal - fired boilers are operated at the site to produce hot water and steam. Lignite Coal from Newvale Mine is used to fire the two boilers.

<u>Rendering Steam Boiler</u>

The 4.3 MW Rendering Steam Boiler (RSB) supplies steam to the rendering plant continuously while the rendering process (mainly cooking) is operating. The boiler has been designed to have a maximum continuous rating of 5.6 MW water heating power but has been derated to 4.3 MW and therefore cannot operate at above 4.3 MW in its current configuration. The efficiency of this boiler has been taken as being 75%.

The RSB is currently consented to burn up to 1,350 kg/hr of coal. The average calorific value on an as received basis (gross specific energy) of the Lignite coal, as determined by monthly coal testing, is 15.23 MJ/kg. However, it varies from month to month and has been as low as 14.61 MJ/kg. If 1,350 kg/hr of lignite is burned at 14.61 MJ/kg this equates to 5.5 MW heat input to produce 4.1 MW water heating. To be able to achieve 4.3 MW water heating, burning 1,400 kg of Lignite per hour at 14.61 MJ/kg would be required.

The RSB operation has been assessed as burning 1,400 kg/hr coal. The RSB stack is 20 m high with a diameter of 705 mm.

<u>Hot Water Boiler</u>

The 1.9 MW Hot Water Boiler (HWB) supplies hot water to the processing area for cleaning and sterilising and is currently consented to burn up to 630 kg/hr of Lignite coal. If 630 kg/hr of lignite is burned at 14.61 MJ/kg this equates to 2.6 MW heat input which, at 75% efficiency, equates to 1.9 MW water heating. Once the HWB is up to temperature the boiler uses on-off control to maintain the hot water loop temperature and therefore typically only operates for a few minutes on and then off again for several minutes. The boiler is oversized for continuous operation once the water is up to temperature.

The HWB operation has been assessed as burning 630 kg/hr of coal.

The HWB stack is 18.6 m high with a diameter of 600 mm at the testing location, but it narrows at the top to 400 mm.

Boiler Emission Controls

These boilers operate grit re-firing and are fitted with multicyclones to reduce particulate emissions.

Air Permit AUTH-201193-V5 places some key conditions on the operation of the two boilers which are presented in Table 2-1.

The coal burning rates are set by the boiler coal feed screw rates and therefore the coal burning rates are fixed and do not exceed the limits specified in Condition 3 of the existing consent.

Table 2-1 Current boiler related consent conditions

Condition(s) No.	Parameter	Limit / Requirement
2(f), 3(a)	Coal Burning Rate	4.3 MW boiler: 1,350 kg/hr
2(g), 3(b)		2.0 MW boiler: 630 kg/hr
4	Opacity of Emissions	Ringelmann Shade 1
6	Coal Sulphur	0.5% by weight
6	Coal Ash	7% by weight
6	Fine Particles (< 3.35 mm)	30% by weight
7	Particulate Emissions	500 mg/m^3

Results of testing of Newvale Peas coal by SGS Minerals, for the 12 months from January 2020 to December 2021, is shown in **Table 2-2**. The results show that the coal quality complies with the existing consent limits.

Table 2-2 Results of testing of Newvale Peas coal by SGS Minerals (January 2020 to December 2021)

Month	Gross specific energy as received, MJ/kg	Coal sulphur content %	Ash content %	% of fine particles <3.35mm (<3.15 mm)[a]
January 20	15.10	0.40	4.1	1.2[a]
February 20	15.23	0.44	4.0	1.6
March 20	15.52	0.38	3.1	1.5
April 20	15.03	0.39	3.3	1.7
May 20	15.34	0.43	4.1	1.9
June 20	14.61	0.45	4.5	1.2
July 20	14.63	0.46	4.4	0.9
August 20	14.61	0.43	4.2	1.1
September 20	15.27	0.42	3.7	1.3
October 20	15.50	0.46	4.1	1.2
November 20	15.38	0.43	3.2	1.4
December 20	15.42	0.40	3.3	1.1
January 21	15.68	0.40	3.1	1.2
February 21	15.61	0.41	3.1	0.9
March 21	15.52	0.39	3.2	1.1
April 21	15.39	0.41	3.4	1.0
May 21	15.08	0.36	3.4	1.3

Month	Gross specific energy as received, MJ/kg	Coal sulphur content %	Ash content %	% of fine particles <3.35mm (<3.15 mm)[a]
June 21	15.01	0.38	3.4	1.5
July 21	15.05	0.37	3.2	2.1
August 21	14.88	0.42	3.3	1.8
September 21	15.05	0.34	3.8	1.4
October 21	15.32	0.40	3.1	1.2
November 21	15.32	0.40	3.5	1.3
December 21	15.86	0.37	2.8	1.1

2.4.2 Proposed site energy improvements

BSM completed a study with Beca in July 2021 to identify site energy use and assess energy efficiency opportunities and a pathway to reduce fossil fuel use. A primary objective is to demonstrate a decarbonisation transition pathway for the site as part of the Energy Transition Accelerator (ETA) run by the Energy Efficiency and Conservation Authority (EECA). Addressing and reducing atmospheric emissions of CO_2 as well as contaminants such as particulate matter, SO_2 and NOx, as a result of lower coal usage, is an important component of the overall site environmental strategy.

The proposal is to decommission the Hot Water Boiler by August 2024 which will be achieved through improved heat recovery, reduced hot water demand and the installation of a new high temperature electric heat pump to utilise rejected heat from a new freezer system to heat the water utilised by the current HWB or it could be used to preheat the RSB feed water.

The steam used in the rendering process is currently condensed by a cooling tower. However, there is an opportunity to recover this waste heat by improving the water supply to the rendering area so there is surplus water that can be fed back to the HWB as warm feed water.

The installation of a high temperature heat pump option is currently the preferred option based on a comparison of the economic factors of the alternatives, the risks associated with wood chip supply for a wood-fired boiler and the risks associated with increased power supply to site that would be required for an electric boiler.

The installation of a heat pump will ensure the plant will continue to operate into the future as coal use is phased out.

This project will reduce coal consumption and is projected to reduce carbon emissions by 2,183 tCO_2-e per annum, or 43,670 tCO_2-e over the lifetime of the assets.

2.5 Rendering Plant

Rendering cooks the meat and bone materials to produce tallow and high protein meat and bone meal. The majority of the rendered by-products are sourced on-site but some raw materials are brought in from offsite (i.e. Waitane and other meat processing plants) for rendering. The plant operates over three shifts at a typical rate of 4,500 kg/hr but has the capacity to process up to 5,750 kg/hr and typical daily volumes in mid-2022 are around 60-70 tonnes/day. All materials are processed fresh within 24 hours of kill or have been preserved by chilling or freezing within 24 hours of kill.

Figure 2-2 shows a schematic of a typical continuous rendering plant.

Raw material is collected at various points in the meat processing plant in bins. The bins are transported to the rendering plant building using forklift trucks. The door is closed once the forklift is in the building. Raw materials are unloaded into the raw material bin before passing to the hogger for grinding via a metal detector. Hair and wool covered materials, such as heads and hooves, are pre-treated with caustic in a hydrolyser before they are added to the raw material bin. The hydrolyser is vented to atmosphere via a scrubber which continuously drains and makes up water through it (see **Figure 2-3**).

The ground offal is rendered in a continuous high temperature cooker (Keith Equacooker 900) at a temperature of 121ºC (see **Figure 2-4**). The tallow is separated from the meal in a series of decanters and presses.

The rendering plant ventilation and odour control system has been progressively upgraded since 2019. All point sources of vapours produced in the cooking and meal and tallow processes in the rendering plant are collected and vented directly to a condenser and then to the plant biofilter (see Section 2.5). The rendering room is maintained at a negative pressure and has an automatic closing door which retains the majority of the odorous air within the building. The rendering plant room ventilation rate corresponds to 12 air changes per hour which is directed to the biofilter.

Water separated from various rendering streams including raw tallow is treated in the rendering plant's small, dissolved air flotation (DAF) plant (see **Figure 2-5**) to reclaim any protein remaining in it. Liquids are held in a covered storage tank, pumped through a small screen and then to the DAF plant. Solids from the DAF plant are sent back to the rendering plant and the filtered wastewater goes to the site's wastewater treatment plant (WWTP).

There is a higher risk of offensive odours being generated from the continuous high temperature cooking process when poor quality raw material is processed, or the unit is not well managed. The odour emitted during cooking is composed of a range of different chemical compounds including aldehydes, fatty acids, amines, mercaptans and sulphides. The plant ventilation and odour control system (shown in Figure 2-2 has been progressively upgraded and connected to the biofilter. All point sources of odour in the rendering plant, including the four main rooms, are connected to the biofilter (some via a condenser if they are a hot source).

Air Permit AUTH-201193-V5 places some key conditions on the operation of the rendering and meat processing plants which are shown in the table below:

Condition(s) No.	Parameter	Limit / Requirement
10 (a)	Rendering Plant material	Fresh or suitably preserved material only
10 (b)	Rendering Plant material retention on site	Raw material held for no more than 24 hours
10 (c)	Rendering Plant material	Suitable preserved material must be chilled or frozen within 24 hours of slaughter
11	Rendering Plant building air pressure	Negative pressure at all times and discharge via a biofilter
12	Rendering Plant biofilter air changes	At least 12 air changes per hour
13	Processing and Rendering Plant cleaning	Daily

Blue Sky accepts these controls in the proposed combined consent conditions going forward.

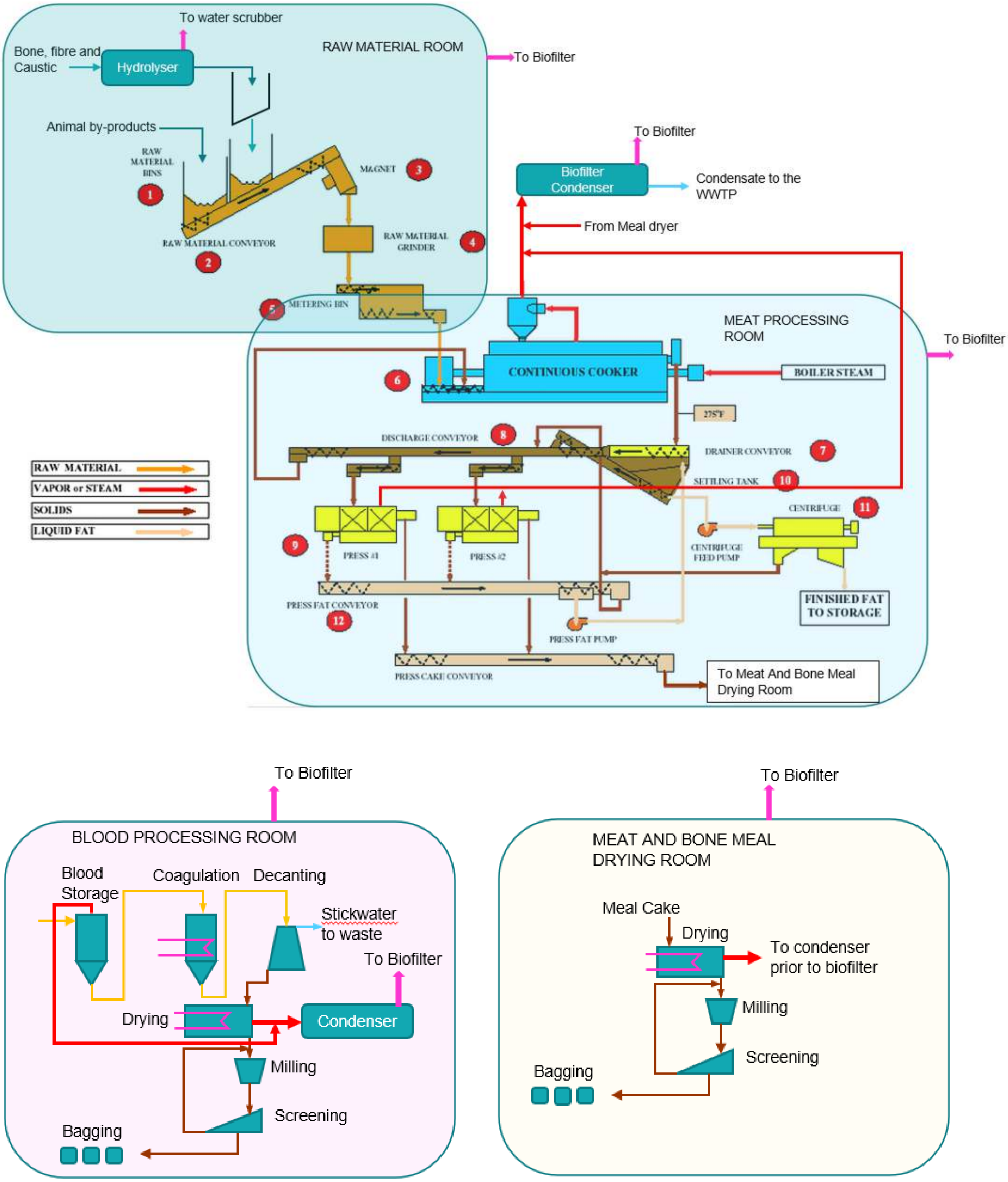


Figure 2-2 Schematic diagram of a typical continuous rendering plant
(modified from http://assets.nationalrenderers.org/essential_rendering_operations.pdf)

Figure 2-3 Hydrolyser scrubber and vent

Figure 2-4 Continuous cooker in rendering plant

Figure 2-5 Rendering plant liquid waste (Stickwater) DAF plant

2.6 Blood Drier

Blood is transported from the sticking area at regular intervals in a sealed container using a forklift truck to the blood processing area. The blood is then drained into one of two stirred holding tanks in the blood processing room and the blood is aged overnight which improves blood yield. The aged blood is pumped to a steam-heated coagulator and then to a decanter centrifuge to separate the solid and liquid phases. The liquid phase is discharged to the drain and the solid phase conveyed to a steam-heated disc dryer (see **Figure 2-6**).

The dried blood is milled prior to bagging and stored in the meal holding area. The water vapour from the blood drier is discharged to the water-cooled condenser before being vented to the rendering plant biofilter.

Figure 2-6 Rotary blood drier

2.7 Biofilter

The discharges to air from all of the point sources in the rendering plant room are ducted via a condenser to the biofilter (see **Figure 2-7**). The rendering plant room air is discharged directly to the biofilter. The biofilter has been designed to provide a surface odour emission rate (SOER) of no more than 1.7 Odour Units per second per m^2 ($OU/s/m^2$) (see table below). The micro-organism community in the biofilter removes odorous components from the rendering discharges. The biofilter media consists of a fine bark and lime mix. The lime helps maintain the suitable pH of the media to allow efficient removal of pollutants as sulphides in the air being treated are converted to sulphuric acid.

The biofilter bark was last replaced in July 2019 and it was cleaned and reinstated in July 2021. The air distribution system was also adjusted in 2019.

To maximise efficiency, the biofilter must be kept moist and maintained at a pH level of between 6 and 8. Hydrated lime can be thinly spread on the surface to maintain pH if required.

The upgraded biofilter (see cross section through the biofilter in **Figure 2-8**) has the following specifications[3]:

Biofilter No.	Length - metres	Width - metres	Area m²	Align to North	SOER - OU/s/m²	Air flow m³/hr
1	32	32	1024	0	1.7	81,200

[3] Pullen D R (2008) *Blue Sky Meats Ltd Rendering Plant Odour Control – Biofilter Design Options*

Figure 2-7 Plant biofilter

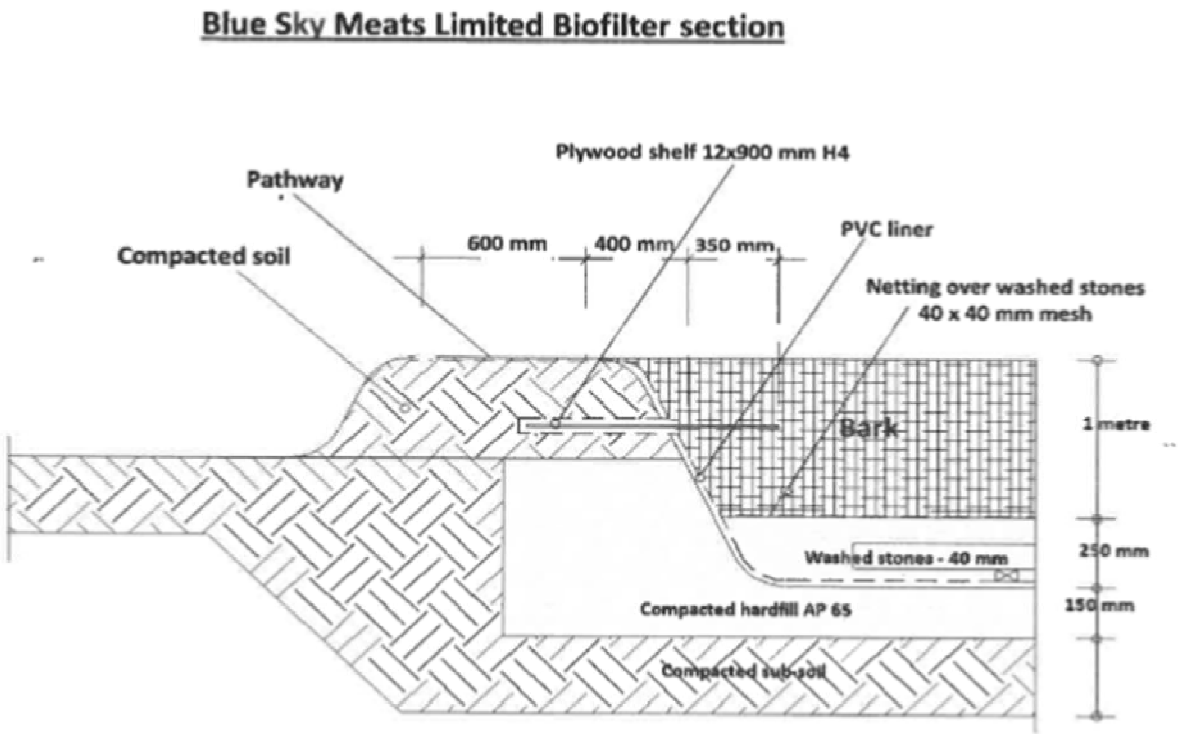


Figure 2-8 Cross section through biofilter

2.8 Wastewater Treatment Plant

2.8.1 Overview

Meat processing wastewater contains diluted blood, protein, fat and solids which are high in carbonaceous organic matter (COD, BOD) and nutrients (nitrogen and phosphorus). The site WWTP treats the meat processing (slaughter room, boning room stockyards) and rendering wastewater prior to irrigation to land. The WWTP, which was upgraded in 2019, has significantly improved the discharge quality of wastewater and also reduced the potential risk of offensive odour creation at the site. The upgrades were constructed by the end of September 2019, with the plant fully commissioned by the end of January 2020. However, ongoing treatment improvement continued until January 2021 as the biological treatment systems were refined.

The upgraded treatment process is summarised as follows (see the layout in **Figure 2-9**):

- Wastewater from the slaughterhouse passes through a 1 mm Contra-shear milliscreen to remove gross solids before entering a Flow Equalisation Basin which is connected to the Lift Pump Station.
- Wastewater from the stock holding yards is discharged to a separate screen prior to being pumped to the Contra shear screen. Wash water from the stock truck unloading areas and other stock holding areas is segregated and discharged to the wastewater surge pond.
- Wastewater is then pumped to the covered Anaerobic Pond before conveyance to the sequencing batch reactor (SBR) lagoon (wastewater from the Lift Station also flows to the SBR during the fill phase).
- Discharge from the SBR is via a decant structure to the existing Irrigation Lagoon before the wastewater is pumped and discharged to land.
- Biogas from the Anaerobic Pond is piped to the flare for combustion. If the flare is not operating, the gas is piped to the contingency WWTP biofilter with condensate returned to the start of the process. A small portion of biogas is sent to the WWTP biofilter continuously to maintain the treatment bacteria.

The WWTP is primarily controlled automatically using a PLC system. Remote monitoring and SCADA access is provided for the treatment and biogas system via Ethernet connection.

The WWTP can treat up to approximately 1,000 m^3/day of wastewater. However, the PLC is programmed such that flows of <1,000 m^3, or up to 1,200 m^3 can also be handled.

An Operation and Maintenance (O and M) Manual for the WWTP has been prepared by Pattle Delamore Partners Ltd[4]. This Manual sets out the procedures for safe and effective operation and compliance of the WWTP with resource consent requirements. The Manual is intended to provide guidance for plant operators.

The recommended WWTP operational limits noted in the Manual are set out in **Table 2-3**.

[4] *Blue Sky Meats – Wastewater Treatment Plant Operation and Maintenance Manual* (February 2020); prepared for Blue Sky Meats Ltd by Pattle Delamore Partners

Table 2-3 Recommended WWTP operational limits (Source: Pattle Delamore Partners)

Parameter	Lower limit	Higher limit
Anaerobic Lagoon Sludge Levels	10%	70%
SBR MLSS	2,000 g/m^3	6,000 g/m^3
Final Effluent		
Peak Daily Flow	-	1,200 m^3/d
Instantaneous Flow	-	90 L/s (from Decant Pump Station)
BOD_5	-	50 g/m^3
pH	6.0	8.0
NH_3-N	-	50 g/m^3
NO_3-N	-	100 g/m^3
TSS	-	150 g/m^3
Biofilter		
Bed Media pH	5.0	8.0
Bed Media Pressure Drop	20 mm	100 mm

Poor plant performance can result in the emission of offensive or objectionable odours, complaints from neighbours and non-compliance with consent conditions. The WWTP O and M Manual provides recommended methods for resolving treatment performance issues if they occur. A summary of these methods/mitigation is included in Section 8.

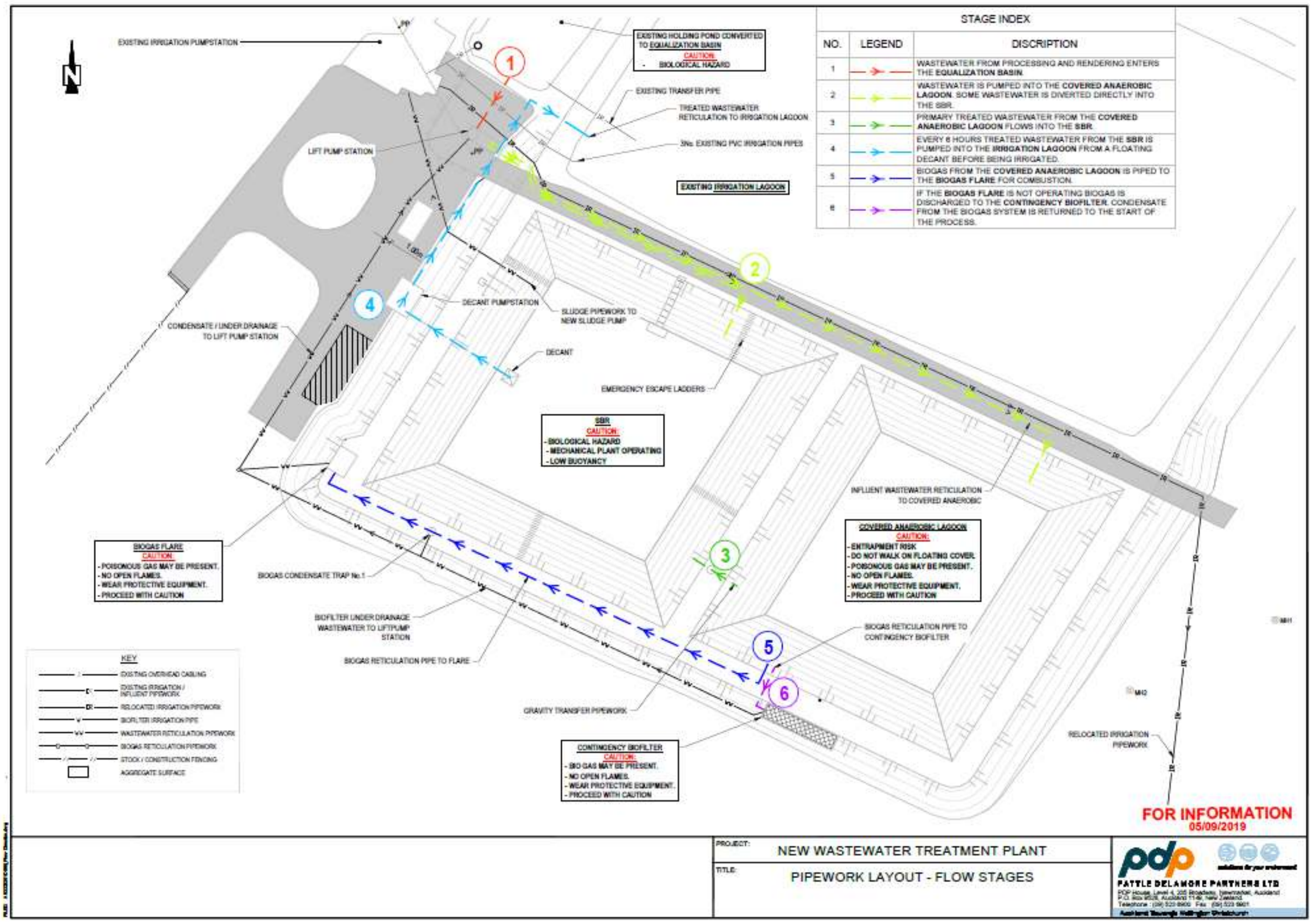


Figure 2-9 Wastewater treatment plant general layout (Source: PDP Ltd)

2.8.2 Flow Equalisation Basin

The clay-lined Flow Equalisation Basin (1 on Fig 2-9) has a capacity of approximately 1000 m^3. All raw wastewater from the site passes through this basin which is connected hydraulically to the Lift Pump Station via an interconnecting polyvinyl chloride (PVC) pipe.

2.8.3 Covered Anaerobic Lagoon

The Covered Anaerobic Lagoon (3 on Fig 2-9) is lined with high density polyethylene (HDPE) and has a capacity of 5,000 m^3 providing an average retention time of approximately 5 days. The HDPE cover provides for biogas collection.

Most of the wastewater solids are settled out and the organic material broken down in the pond by anaerobic decomposition. The design provides for removal of 80-90% of the incoming BOD.

The wastewater from the SBR (4 on Fig 2-9) is intended to have a BOD concentration of <50 g/m^3. This provides a suitable wastewater quality for irrigation and minimises the potential for any generation of odour during irrigation. The BOD effluent target requires that conditions in the Lagoon are conducive to BOD removal including no accumulation of solids above 70% of pond volume, temperature <35ºC and a pH above 6.

If the final BOD is consistently higher than 50 g/m^3, the above parameters in the Lagoon require checking.

The accumulation of the solids in the Lagoon is an essential part of the treatment process. However, in the longer term these solids accumulate and begin to reduce treatment efficiency. At this stage, they will need to be removed and can be disposed of to land.

2.8.4 Biogas management

The main by-product from the Anaerobic Lagoon process is biogas (mainly methane and carbon dioxide) which is collected in the gas collection pipework under the cover. At present, the gas produced from the anaerobic pond is either combusted in the flare (**Figure 2-10**) or is ducted to the WWTP biofilter (6 on Fig 2-9). The biogas flare converts the methane to carbon dioxide and oxidises odorous gases such as hydrogen sulphide to non-odorous compounds.

The design biogas production is 400 Nm^3/hr, with average burn rate of 200 Nm^3/hr (65% methane to 35% CO_2). The net calorific value of biogas is taken from the Engineering ToolBox, (2005). Fuel Gases - Heating Values. [online] to be 23.1 MJ/m^3 (at 15ºC, 101.325 kPa). The Normal Temperature and Pressure related to the gas flow rate are at 20ºC & 101.325 kPa therefore, the flow of biogas at 15ºC would be 197 – 393 m^3/hr at 15ºC. This equates to a heat output of the flare of between 1.26 – 2.52 MW.

The installation consists of a single burner and associated control equipment mounted within its own compound a short distance from the pond site. A purpose designed pipeline and system of collection pipes conveys the gas from the capped pond to the flare skid.

The gas extraction fan blows the gas through the pipework of the flare where it is ignited by a high-voltage spark ignitor. The gas flowrate is controlled to maintain specified gas conditions by slowing down or speeding up the extraction fan. The flame is monitored through an ultraviolet (UV) sensor calibrated for the unique wavelength of methane combustion.

The control system installed is self-diagnostic. Failure of any system that will lead to a shutdown will be indicated by an appropriate alarm. If the flare is not operational, or during routine maintenance, biogas is treated through the site biofilter.

The WWTP Operation and Maintenance Manual includes instructions for the use of the biogas flare system. With all of these controls in place, complete combustion of gas emissions and the significant distance to neighbouring properties, there are not expected to be any off-site effects from the operation of the flare.

Figure 2-10 Biogas flare

2.8.5 Sequencing Batch Reactor

The sequencing batch reactor (SBR) is an aerated HDPE-lined lagoon which uses aerobic bacteria (activated sludge) to treat contaminants particularly biochemical oxygen demand (BOD) and nitrogen.

The lagoon has a capacity of 6000 m^3 and includes three 75 kW floating mechanical aerators and two floating downdraft mixers.

The SBR operates in batch treatment cycles as follows:

- Fill - filling the lagoon while mixing (option to aerate during filling)
- Aerate – aeration and mixing
- Settle – bacterial solids settle to bottom
- Decant – surface water layer is decanted to Irrigation Lagoon for discharge.

The SBR plant operates 24 hours per day based on 4 six-hour cycles.

Regular wasting (or removal) of the waste activated sludge is required to maintain the treatment efficiency of the SBR. This sludge is discharged to land around the plant.

As noted earlier, BOD removal is a key parameter to minimising the potential for odour creation. If the Anaerobic Lagoon is achieving <80% BOD removal, then the SBR operation (including the aerators and Dissolved Oxygen (DO) set points) requires checking.

2.8.6 Irrigation Storage Lagoon

The HDPE-lined Irrigation Storage has a capacity of approximately 15,000 m^3 and provides storage prior to disposal via the Irrigation Pump Station and irrigation pipework and distribution system.

The Lagoon has two large aerators that can be used if required to maintain aerobic conditions. While DO is not currently monitored, this should be installed to help maintain a positive DO in the lagoon. It is recommended that one of the aerators is used all of the time.

2.8.7 Wastewater Irrigation

BSM discharges meat processing and rendering treated wastewater which may include some dilute solids to the Wastewater Farm (BSM and Ward property).

Resource Consent AUTH-201191-V1 currently authorises the discharge of wastewater to land via spray irrigation at a maximum rate of 1000 m^3/d. Discharge occurs onto two properties within close proximity to the BSM Site, (one property is owned by BSM and the other by Leonard Ward). The authorised farm parcels adjoin and are commonly referred to as the Wastewater Farm.

Stock yards solids, paunch grass and wastewater sludge are also discharged to land.

A Wastewater Farm Environmental Management Plan (2021)[5] has been prepared that details the procedures to irrigate treated wastewater in compliance with current consents. The Plan includes regular system checks and maintenance procedures, as well as Incident Response and Complaints processes.

Treated wastewater is pumped from the WWTP balancing pond by up to three Mono type pumps. Each pump supplies treated wastewater through a dedicated underground pipeline to different parts of the scheme. The pumps are fitted with high and low-pressure cut-outs and GPS. The high-pressure cut-out stops the pump in the event of a blockage and the low pressure stops the pumps in the event of a burst irrigation pipe or hose.

Irrigation water is applied using transportable K line Irrigation Pods. Applications of up to 35 mm can be applied during dry weather (October to March) and up to 15 mm (April to September) The pod system is capable of pumping approximately 16.5 m^3/hour.

The current discharge consent has a number of conditions to mitigate the likelihood of odour or other nuisance including, no ponding on site, 14 days separation between applications on the same area and no spray drift within 20m of a property boundary, or 100m of any dwelling. The prevailing wind direction is taken into account before commencing irrigation, particularly when applying wastewater adjacent to Woodlands Morton Mains Road.

Wastewater disposal is the priority use for irrigation land. A cut and carry system is used to remove nitrogen from the site in the form of bailage. BSM re-dresses 1 or 2 paddocks per year to maintain pasture quality and control weeds.

Figure 2-11 shows the Wastewater Farm including setbacks and exclusion areas.

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[5] WM Compliance Solutions (March 2021), *Wastewater Farm Environmental Management Plan*; prepared for Blue Sky Pastures Ltd

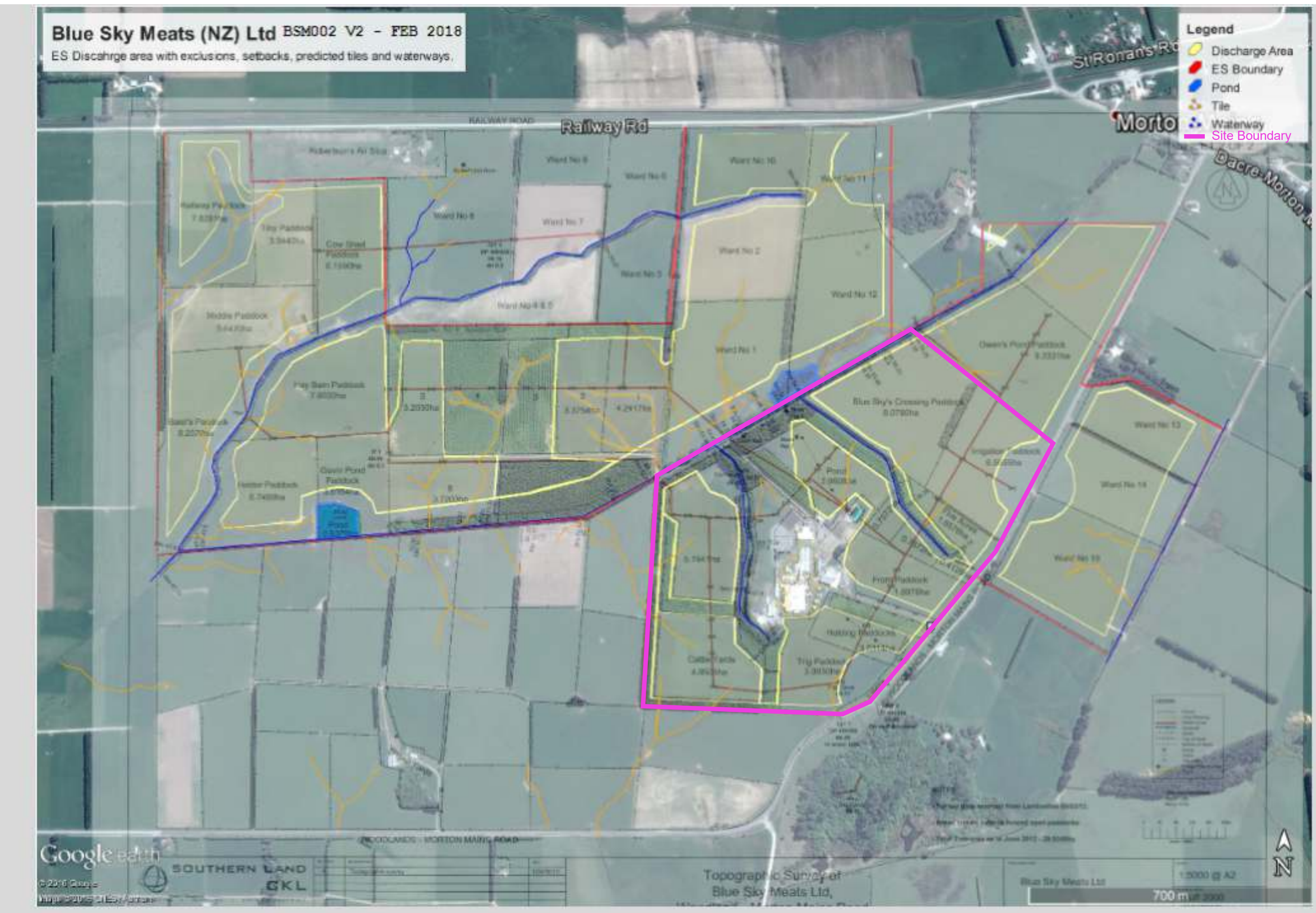

Figure 2-11 BSM Site Boundary and Wastewater Farm including setbacks and exclusion areas.

3 Nature of Emissions

3.1 Overview

The potential sources of emissions to air from the BSM plant include the by-products of combustion (from the coal-fired boilers), as well as odour from plant processes, wastewater treatment and land application areas.

3.2 Emissions from Boilers

3.2.1 Overview

Some of the products of coal combustion can have a detrimental impact on human health. These contaminants include fine particulate matter less than 10 µm[6] diameter (PM_{10}), fine particulate matter less than 2.5 µm diameter, ($PM_{2.5}$), oxides of nitrogen (NOx), comprised primarily of nitric oxide (NO) and nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and mercury.

Particulate discharge consent limits refer to the concentration and emission rate of total suspended particulates (TSP). However, environmental and health-based guidelines and New Zealand specific regulations generally relate to the ground level concentrations of PM_{10}.

In addition to the primary contaminants, trace amounts of polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) will be discharged from the stack. Based on experience with other similar coal-fired boilers, the effects of the discharges of heavy metals, CO, PAHs and VOCs pose a very low health risk potential compared to pollutants such as PM_{10}, SO_2 and NO_2. The contribution to ambient pollutant levels would not result in the exceedance of any guidelines or standards. Consequently, the effects of CO, PAHs and VOCs have not been discussed further in this assessment.

3.2.2 Current boiler discharge consent limits

The limits on boiler discharges which are included in the current consent AUTH 201193-V5 are as follows:

- The sulphur content of the coal burned shall not exceed 0.5% by weight; and
- The concentration of particulate matter in the combustion gases shall not exceed 500 milligrams per cubic metre adjusted to 0 ºC, dry gas basis, 101.3 kPa and 8% oxygen or 12% carbon dioxide.

3.2.3 Particulate emission test results

Particulate testing for both boiler stacks was carried out by the Verum Group on 22 January 2021 using USEPA Method 201A - Determination of PM_{10} Emissions (Constant Sampling Rate Procedure). This method is accredited by IANZ. The test reports are attached as **Appendix B.**

A summary of the recent particulate testing results is presented in Table 3-1 for the RSB and Table 3-2 for the HWB. The testing determined the concentration of TSP, PM_{10} & $PM_{2.5}$. Note dsm^3 is dry standard cubic metre standardised to 0ºC, 101.325 kPa.

[6] µm = 1/1000th of a millimetre

Table 3-1 Rendering Steam Boiler particulate monitoring results

Parameter	13 October 2020	22 January 2021	26 May 2022
Actual TSP Concentration, mg/dsm^3	460	476	627
TSP Concentration, mg/dsm^3 @ 12% CO_2	480	607	607
TSP emission rate, g/s	0.83	0.86	1.11
TSP emission rate @ TSP consent limit of 500 mg/m^3 12% CO_2, g/s	*0.86*	*0.71*	*0.91*
PM_{10} emission rate, g/s (61% of TSP)	0.51*	0.53	0.40 (36% TSP)
PM_{10} emission rate @ 61 % TSP consent limit of 500 mg/m^3 12% CO_2, g/s	*0.53**	*0.43*	*0.33*
$PM_{2.5}$ emission rate, g/s (12% of TSP)	0.10*	0.11	0.05 (5% TSP)
$PM_{2.5}$ emission rate @ 12% of the TSP consent limit of 500 mg/m^3 12% CO_2, g/s	*0.10**	*0.09*	*0.05*

Table 3-2 Hot Water Boiler particulate monitoring results

Parameter	13 October 2020	22 January 2021	26 May 2022
Actual TSP Concentration, mg/dsm^3	360	719	1950
TSP Concentration, mg/dsm^3 @ 12% CO_2	427	736	1707
TSP emission rate, g/s	0.56	1.05	1.35
TSP emission rate @ TSP consent limit of 500 mg/m^3 12% CO_2, g/s	*0.66*	*0.71*	*0.40*
PM_{10} emission rate, g/s (55% of TSP)	0.31*	0.58	0.36 (27% TSP)
PM_{10} emission rate @ 55% of the TSP consent limit of 500 mg/m^3 12% CO_2, g/s	*0.36**	*0.39*	*0.11*
$PM_{2.5}$ emission rate, g/s (9% of TSP)	0.05*	0.08	0.04 (3% TSP)
$PM_{2.5}$ emission rate @ 9% of the TSP consent limit of 500 mg/m^3 12% CO_2, g/s	*0.06**	*0.06*	*0.01*

*the proportion of TSP emitted in the form of PM_{10} and $PM_{2.5}$ in 2020 has been taken from the January 2021 tests. The proportion of PM_{10} and $PM_{2.5}$ in 2022 was lower than the 2021 testing results so the 2021 proportions have been used in determining the mass emissions of PM_{10} and $PM_{2.5}$ at higher TSP concentrations.

Test results indicate that stack emission rates approach, or can exceed the currently consented 500 mg/m^3 @ 12% CO_2 emission concentration for TSP.

Three emission scenarios have been assessed.

Scenario 1 assumes that TSP discharges from the RSB and HWB are at both at the TSP consent limit of 500 mg/dsm^3 @ 12% CO_2.

Scenario 2 assumes that the TSP discharge from the RSB is 750 mg/dsm^3 @ 12% CO_2 and the HWB RSB is 2,000 mg/dsm^3 @ 12% CO_2 which represents the actual maximum emissions with some buffer allowed.

Scenario 3 represents the future plant configuration and assumes that only the RSB is in operation and TSP discharges from the boiler are 750 mg/dsm^3 @ 12% CO_2.

Only discharges of PM_{10} and $PM_{2.5}$ have ambient air quality criteria concentration limits. There are no criteria for TSP. The derived emission rates are presented in Table 3-3.

Table 3-3 Assessment PM_{10} and $PM_{2.5}$ Scenarios

Scenario	Contaminant	Rendering Steam Boiler, (g/s)	Hot Water Boiler (g/s)
Scenario 1	PM_{10}	0.53	0.39
	$PM_{2.5}$	0.10	0.06
Scenario 2	PM_{10}	0.79	1.57
	$PM_{2.5}$	0.16	0.26
Scenario 3	PM_{10}	0.79	-
	$PM_{2.5}$	0.16	-

Figures 3-1 and **3-2** show the two boiler stack sampling locations although the Hot water boiler stack has been replaced and moved 4 m away from the building.

Figure 3-1 4.3 MW Rendering boiler stack sampling location.

Figure 3-2 2 MW Hot Water boiler stack sampling

3.2.4 Boiler stack parameters

The boiler stack parameters have been taken from the 21 January 2021 particulate matter stack testing report and they are summarised in Table 3-4.

Table 3-4 Boiler stack parameters

Parameter	Unit	Rendering Steam Boiler	Hot Water Boiler
Rated Capacity	MW	4.3	1.9
Coal Usage @ 14.61 MJ/kg, 75% thermal efficiency	kg/hour	1,400	630
Stack Height	m	20	18.6
Stack Diameter	mm	705	600

Parameter	Unit	Rendering Steam Boiler	Hot Water Boiler
Stack Diameter at exit	mm	705	400
Exit Temperature	ºC	199	179
Average Exit Flow Rate, dry standard	m³/hour	6,602	5,235
	m³/s	1.83	1.45
Exit Velocity, actual at test point	m/s	9.1	9.4
Exit Velocity, actual at exit	m/s	9.1	21.2

3.2.5 Nitrogen dioxide emissions

Where emission test results are not available, emissions can be estimated from United States Environmental Protection Agency (US EPA) AP 42 emission factors. The emission rate for NOx has been calculated using emission factors for lignite-fired spreader stoker boilers[7] which is 5.8 lb NOx/ton of lignite burned or 2.9 kg NOx/tonne lignite burned. The fuel usage rates required to achieve the water heating power output assume a 75% efficiency for both boilers and the minimum lignite calorific value of 14.61 MJ/kg.

The modelling has assumed that 5% of the NO_x is emitted in the form of NO_2 and the remaining NOx is emitted as NO. The conversion of the NO to NO_2 in the atmosphere has been simulated in the AERMOD air dispersion model using the Ozone Limiting Method (OLM) detailed in the Modelling GPG[8].

The estimated NOx emission rates are shown in Table 3-5.

Table 3-5 Estimated contaminant emission rates for NO_x

Emission source	Rendering Steam boiler	Hot Water Boiler
Coal usage, kg/hr	1,400	630
Emission factor, kg NOx/T Coal	2.9	2.9
Emission rate, g/s	1.13	0.51

3.2.6 Sulphur dioxide emissions

The emission rates for SO_2 have been calculated using US EPA AP 42 emission factors for lignite coal-fired boilers based on the maximum permitted sulphur content of the coal in the consent (0.5%) and the maximum coal usage rates as discussed in Section 3.2.5. The SO_2 emission factors for lignite-fired spreader stoker boilers is 30x the sulphur content lb SO_2/ton of lignite burned or 7.5 kg SO_2/tonne of lignite burned. The SO_2 emission rates assume that 5% of sulphur present in the lignite is retained in the bottom ash due to alkaline salts being present in the ash and the remaining 95% is discharged to the atmosphere in the form of SO_2 as described in AP-42 Chapter 1.7.

The estimated SO_2 emission rates for both boilers are presented in Table 3-6.

Table 3-6 SO_2 estimated emission rates

Emission source	Rendering Steam boiler	Hot Water Boiler
Coal usage, kg/hr	1,400	630
Sulphur Content, %	0.5	0.5
Emission factor, kg SO_2/T Coal	7.5	7.5
Emission rate, g/s	2.9	1.3

[7] US EPA AP42 Compilation of Emission Factors Chapter 1.7 Lignite Combustion, 1998

[8] Ministry for Environment (2004) "*Good Practice Guide for Atmospheric Dispersion Modelling*" .

3.2.7 Emissions of mercury

The emission rates for mercury have been estimated based on the maximum quantity of lignite coal used and the mercury content of that coal assuming that all mercury is released to the atmosphere in the gaseous elemental form[9].

The average mercury content of New Zealand coals was reported by the MfE in 2008 as 0.13 mg/kg. The United Nations Environment Programme "*Guidance on Best Available Techniques and Best Environmental Practices"* (Minimata Convention BAT) report notes that the mercury content of New Zealand sub-bituminous coals range between 0.062 mg/kg and 0.13 mg/kg and are on average 0.082 mg/kg. No values were provided for lignite.

In 2007, CRL Energy Ltd provided a report to Beca which summarised the concentrations of trace elements in South Island thermal coals[10]. The report included analysis of Ohai and Newvale coals (the latter mine currently supplies the BSM boilers). The concentration of mercury in the Ohai coal was 0.2 mg/kg and Newvale coals is 0.6 mg/kg.

The maximum mercury content of 0.6 mg/kg has been used in this assessment and the maximum consented coal usage rate from the HWB and RSB is 630 and 1,350 kg/hour respectively.

Table 3-7 Estimated Mercury emission rates

Emission source	Rendering Steam boiler	Hot Water Boiler
Coal usage, kg/hr	1,400	630
Mercury Content, mg/kg	0.6	0.6
Emission rate, g/s	0.00023	0.00011

3.3 Odour Emissions from Processing Plant

Odorous compounds may be generated during the operation of the meat processing plant.

The continuous high temperature cooking process in the rendering plant can result in the production of offensive odour. Volatile organic compounds (VOCs) are the primary air pollutants emitted from rendering operations. The resulting odour is a result of the release of a variety of chemical compounds during processing including aldehydes, fatty acids, amines, mercaptans and sulphides.

These VOCs can be a source of odour nuisance for residential areas located close to rendering plants, and emission controls are directed toward odour elimination. The odour detection thresholds for many of these volatile compounds are low; some as low as 1 part per billion (ppb). Of the specific constituents listed, only quinoline is classified as a hazardous air pollutant[11].

Whole blood containing 16 to 18 percent total protein solids is processed and dried to recover protein as blood meal. The blood drier is also a potential source of odorous VOC emissions. Raw material may also be a source of VOC emissions, but if the material is processed in a timely manner, these emissions are minimal.

All point sources of odour in the rendering room and the room air are directly connected to the condenser and biofilter.

Further means of reducing odour include

- Minimising the stock of raw material and storing it in a cold, closed, well-ventilated place.
- Pasteurising the raw material before processing in order to halt biological processes that generate odour.

[9] Pattle Delamore Partners (2009) "*Mercury inventory for New Zealand*"; prepared for the Ministry for the Environment.

[10] CRL Ltd (2007) *Trace elements of concern in South Island thermal coal*"

[11] (USEPA, 1995) Emission Factor Documentation for AP-42 Meat Rendering Plants

- Installing all equipment in closed spaces and operate under partial vacuum.
- Keeping all working and storage areas clean.

3.4 Odour Emissions from the Biofilter

Biofilters are a proven and effective method for reducing odour and other gaseous emissions from mechanically ventilated animal facilities[12].

Biofilters work by absorbing noxious gases into a biofilm where microorganisms break down the gases into carbon dioxide, water and salts and use the energy and nutrients to grow and reproduce. Well-designed and managed biofilters can reduce influent gas odours and hydrogen sulphide (H_2S) by as much as 95% and ammonia (NH_3) by 80%.

End products from the complete bio-oxidation of the input contaminants are carbon dioxide (CO_2), water, mineral salts, and microbial biomass. Biofilters with new media, low air loading rates, or high medium moisture contents generally gave the best odour removal. Different biofilter media gave similar odour reductions at the gas loading rates examined.[13]

3.5 Odour Emissions from Wastewater Treatment Plant

3.5.1 Overview

Odorous compounds may be generated during the treatment, storage and transfer of the wastewater. Odour is generated through the anaerobic decomposition of organic material (carbohydrates, fats and proteins), within the wastewater stream and the sludge generated from the treatment process.

The wastewater generated from meat processing plants generally has a relatively low odour potential when “fresh” and aerobic conditions are maintained, which are the normal operating conditions. However, under some circumstances anaerobic conditions may be triggered, resulting in an increase in the discharge of odour. The main causes of anaerobic conditions potentially developing include:

- Extended storage times for untreated wastewater
- Organic loading exceeding the aeration capacity of the plant resulting in depressed dissolved oxygen concentrations and the development of anoxic and anaerobic conditions
- Storing materials such as treatment plant sludge for too long, typically for more than about two-three days will allow anaerobic conditions to develop. DAF sludge is even more prone to this, and it should be processed daily.
- Other upsets to the WWTP process, (such as loss of aeration, spills) resulting in operations outside biological best practice.

3.5.2 Upset conditions

Higher odour emission rates can occur during abnormal operating conditions. Possible upset events when higher odour emission rates can occur include the following:

- Organic overloading of the biological processes
- Loss of aeration to the biological processes
- Loss of electrical power
- Mechanical failure (such as loss of aeration capacity, loss of sludge processing capacity; failure of anaerobic pond cover)

[12] Janni K A et al (2012) *Biofilters for Odour and Air Pollution*; A review of biofilter use, design and performance factors (University of Minnesota)

[13] Luo J and van Oostrom A (1997) *Biofilters for controlling animal rendering odour- a pilot scale study;* Meat Industry Research Institute of New Zealand; Pure and Appl. Chem Vol 69, pp 2403-2410.

- Spills that are directed to the WWTP.

If the biological process is overloaded or loses aeration for an extended period (e.g. failure of the aeration system or power loss), anaerobic conditions can develop. During these conditions higher odour emission rates are expected from the aerobic processes. The character of the emitted odour is also expected to be more offensive than during normal operating conditions.

An Operations and Maintenance Manual for the WWTP has been prepared by PDP to manage the risk that upset conditions will occur.[14]

3.5.3 Odour from Anaerobic Lagoon/SBR

Odour generation from the SBR can indicate organic overloading from the Anaerobic Pond. The WWTP O and M Manual sets out actions to be carried out if significant odour (i.e. at the boundary) is detected to assess the loading of the SBR and the performance of the Anaerobic Pond. They include

- Stop all flows passing though the Covered Anaerobic Lagoon.
- Assess the DO setpoint and if possible, increase it to 2.5 mg/L.
- If the aerators are unable to provide ongoing maintenance of DO concentrations beyond 0.1 mg/L, then sample the Covered Anaerobic Lagoon effluent from the transfer pipe between the two lagoons.
- If the BOD concentration is above 1,000 mg/L, investigate raw wastewater loads to identify any over-loading issues or performance problems with the Covered Anaerobic Lagoon.

The Manual also sets out a monitoring programme to confirm the satisfactory operation of the WWTP and that the treated wastewater complies with conditions of the consent for final discharge to land.

3.5.4 Emissions from biogas flare

The emission rates of the products of combustion from the biogas flare have been calculated using United States Environmental Protection Agency (USEPA) AP 42 emission factors for natural gas combustion[15]..

NO_x is a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2), with the predominant component NO slowly converted to NO_2 in the air. The US EPA publication AP-42, Fifth Edition, Volume 1 Chapter 1: External Combustion Sources, notes that that typically 5% of NO_x is emitted as NO_2. The estimated contaminant emission rates for the flare are shown in **Table 3-8**.

Table 3-8 Biogas flare emission rates

Contaminant	Mass Emission (kg/hr)
NO_x	0.63
NO_2	0.06
CO	0.53
PM_{10}	0.05

The WWTP O and M Manual provides actions to be followed if significant odour is being generated from the biogas collection and or treatment system (see Section 9.4.2). The biofilter is used as a contingency for the flare if there is a problem with the flare or maintenance is required.

3.6 Odour from Land Application of Treated Wastewater

The WWTP is designed to deliver a highly treated wastewater with low concentrations of organic material. Odour is usually associated with the generation of hydrogen sulphide (H_2S) which is formed under anaerobic

[14] Pattle Delamore Partners (2020) *Blue Sky Pastures – Wastewater Treatment Plant Operation and Maintenance Manual*

[15] US EPA AP42 "Compilation of Emission Factors Chapter 1.4 Natural Gas Combustion", 1998

conditions. The low organic loading and short pumping distances to land areas from the WWTP (such as occurs at the BSM site) is unlikely to be conducive to H_2S creation in pipework.

Maintaining a positive DO, or aerobic conditions in the irrigation pond (as discussed earlier) is important to avoid odour issues during irrigation however as the wastewater has been treated to a high level it would take several days for the DO concentration to reduce and the pond has aerators available.

The WWTP O and M Manual sets out operational limits and actions required if the WWTP is not performing to required specifications. As noted above, the quality of the final discharge is monitored to ensure that it meets performance and consent requirements for land application.

BSM operates the land application system according to the requirements of the Wastewater Farm Environmental Management Plan.

4 Environmental Setting

4.1 Overview

The BSM plant is located approximately 7km east of the small settlement of Woodlands;12 km south-west of Edendale and 19km northeast of Invercargill.

The features of the receiving environment that are of most relevance to the assessment of effects of air discharges from the site are discussed in the following sections.

4.2 Surrounding Zoning and Land Use

BSM owns and occupies the property on which the processing plant, WWTP and the irrigation area are sited.

The site is located within the Rural Zone under the Southland District Plan. The predominant surrounding land use is pasture. The closest residential zoned land to the site is located 12 km to the north-east (the 'Edendale Urban Zone').

However, there are several dwellings (sensitive receptors) closer to the plant (see **Figure 4-1**).

4.3 Sensitive Receptors

Figure 4-1 shows the distances from the plant to the nearest sensitive receptors. The area immediately surrounding the plant is agricultural land owned by BSM. Privately owned farmland surrounds BSM land. A number of privately owned farm buildings are located around the plant. At these locations, people are highly unlikely to be exposed to discharges to air from the plant for any extended period.

The nearest dwelling lies approximately 470 m southeast of the plant/WWTP across Woodlands Morton Mains Rd. Table 4-1 and Figure 4-1 present the locations of residential dwellings.

Table 4-1 Distance to dwellings around the site

Dwellings ID	Distance from the WWTP
Property to the north northeast of the plant (NNE)	900 m
Property to the northeast of the plant (NE)	1141 m
Property to the east of the plant (E)	1760 m
Property to the southeast of the plant (SE)	470 m
Closer property to the south of the plant (S1)	915 m
Farther property to the south of the plant (S2)	1450 m
Property to the southwest of the plant (SW)	1175 m
Property to the west southwest of the plant (WSW)	1873 m

Figure 4-1 Blue Sky Meats and surrounding sensitive receptors (dwellings) (Imagery: GoogleEarth)

4.4 Topography

The topography of an area may influence wind and air flows and therefore the dispersion of emitted contaminants. Local terrain at raised elevations in relation to an emission source may lead to impingement of emission plumes at those locations and a potential for higher contaminant concentrations than at lower elevations.

The local topography is generally flat or rolling and is unlikely to have any significant effects on local meteorological conditions in the area.

4.5 Air Quality Zoning

The BSM site is located outside the Invercargill Airshed as gazetted by the National Environmental Standards for Air Quality (NESAQ). Figure 4-2 shows the boundaries of the Invercargill Airshed. All of the plant and irrigation land are located in the airshed comprised of the remainder of the Southland Region that is not included in a specifically gazetted airshed.

The airshed is not considered to be “polluted” under Regulation 17 of the NESAQ.

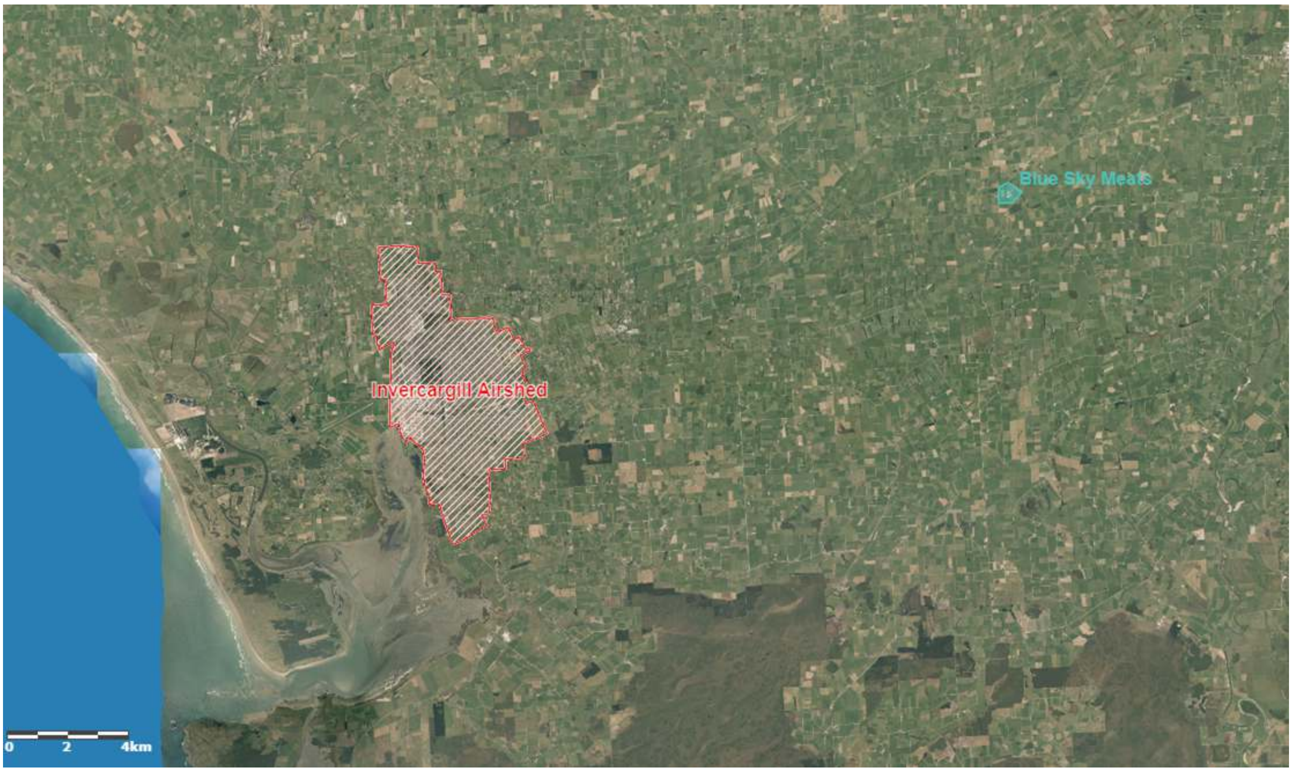

Figure 4-2 Boundaries of the Invercargill Airshed (Source: https://maps.es.govt.nz/)

4.6 Meteorology

Weather conditions influence the dispersion of contaminants discharged from the site and those conditions can be represented by measured meteorological parameters such as wind speed and direction.

The closest meteorological stations to the site are Invercargill Airport, 25 km to the south-west of the site and Gore approximately 36 km to the north-east of the site. While these sites have measured data, their distance from the site and the difference in topographical features indicates that this data may not be representative of that experienced at the BSM site. The Invercargill Airport wind data has a larger land-sea breeze evident in the wind data than would not be expected at the site. While at Gore, the influence of the valley is evident in the wind data, and this topographical influence is not relevant at the site.

Therefore, for this assessment meteorological inputs have been constructed for AERMOD (v21112) using a combination of the associated meteorological modelling programme AERMET View (v9.8.3) and the TAPM (The Air Pollution Model) v4 model.

TAPM is a sophisticated computer model that predicts the three dimensional meteorological and air pollutant concentrations by solving the fundamental fluid dynamic and scalar transport equations. It consists of coupled diagnostic meteorological and air pollution components that predict the air flows important to local scale air pollution, such as sea breezes, against a background of larger scale synoptic meteorological patterns.

Due to the meteorological data assimilation procedure, the meteorological input file is expected to provide a good representation of dispersion conditions.

The predicted wind speed and wind direction frequency at the site (for 2018) are shown in **Figure 4-3**.

TAPM was configured using a 30 x 30 x 25 km grid with nested grid spacings of 30, 10, 3, 1 km and 300 m. The meteorological data input file was developed from the 300 m spaced nested grid. The model was configured using the CSIRO's recommended settings.

AERMET was used to generate the surface and upper air input files for the simulation period of 1 January 2018 to the 31 December 2018. Although meteorological conditions vary between years, the modelled simulation period is considered to be representative of typical dispersion conditions in the vicinity of the site. The simulation period is also expected to incorporate worst-case dispersion conditions.

The AERMET meteorological input files, specifically the hourly meteorological observations for temperature, relative humidity, solar radiation, cloud cover, mixing height, net solar radiation, pressure and rainfall were developed from the 300 m spaced nested TAPM grid.

The predicted AERMET wind data shows a very low percentage of calms i.e. winds below 0.5 m/s (0.32 % of the time). The windrose shows a high frequency of winds from the west (11% pf the time) through the northwest quarter (40% of the time) with lighter winds also being channelled up and down the valley from the southwest (7% of the time) and from the northeast (7% of the time). Winds are strongest from the northwest. Winds from the east, southeast and south are infrequent and generally light.

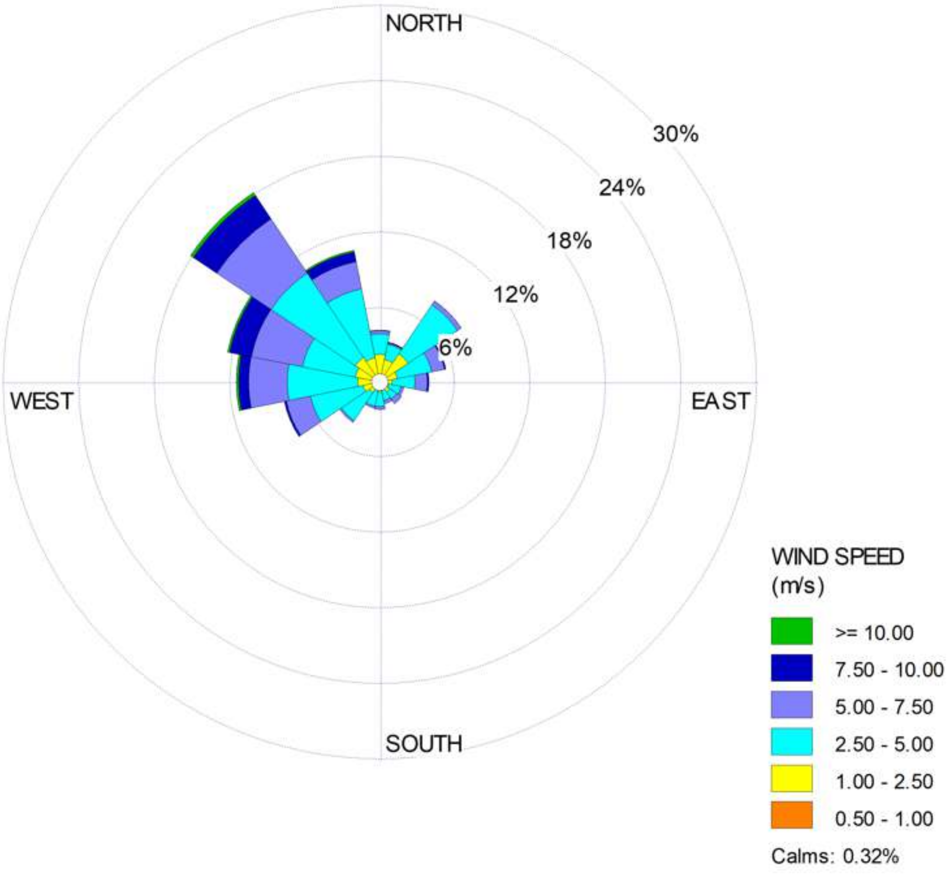

Figure 4-3 Predicted wind speed and wind direction frequency at the BSM site

4.7 Background Air Quality

4.7.1 Overview

For the assessment of air quality effects from emissions, it is necessary to consider the contribution of contaminants from the BSM site as well as background sources to ambient pollutant levels. There is currently no appropriate background monitoring data available.

However, the MfE's "*Good Practice Guide for Assessing Discharges from Industry*"[5] *(GPG Industry)* provides guidance on using default values for background air quality where there is no appropriate monitoring data. The GPG Industry recommends the use of default background air quality values provided by the New Zealand Transport Agency (NZTA). The default values are intended to provide a conservative estimate of likely background concentrations.

The NZTA default PM_{10} and NO_2 values for Waituna and the surrounding rural areas, are shown in **Table 4-2.**

Table 4-2. MfE and NZTA default background PM_{10} and NO_2 concentrations for Waituna and surrounding rural areas

Contaminant	Averaging period	Default background concentration (µg/m³)
PM_{10}	24 hours	19.8
	Annual (calculated)	6.1
NO_2	1 hour	37
	24 hours	23

The GPG Industry does not provide an annual average value for background PM_{10} concentrations. For this assessment, the 24-hour average background concentration for PM_{10} has been estimated using the power law relationship described in the MfE guidance on dispersion modelling for extrapolation of model predictions over different averaging periods. Using this methodology, an annual average PM_{10} background concentration of 6.1 µg/m³ has been calculated and this value has been used in this assessment.

No default background $PM_{2.5}$ concentrations are defined in the GPG Industry, or by NZTA. Ambient $PM_{2.5}$ concentrations are primarily associated with emission combustion sources. Therefore, due to the rural nature of the surrounding environment, background $PM_{2.5}$ concentrations in the vicinity of the plant are expected to be relatively low. For this assessment, background $PM_{2.5}$ concentrations are conservatively assumed to be two thirds of the background PM_{10} concentrations. Therefore, the maximum 24-hour background $PM_{2.5}$ concentration is estimated to be 13.0 µg/m³ and the annual average $PM_{2.5}$ is estimated to be 4.0 µg/m³.

The derived background $PM_{2.5}$ concentration is comparable to that observed at Auckland Council's rural Patumahoe ambient monitoring station.

Background SO_2 concentrations are almost solely associated with the combustion of coal. The only significant coal combustion sources in the area are the two boilers operated on site by BSM. Therefore, background SO_2 concentrations are expected to be negligible in the vicinity of the site.

4.7.2 Mercury

There are no background default background air quality values for mercury in the GPG Industry or generated by NZTA. The mercury emitted from the boilers is expected to be elemental mercury. Elemental mercury has a half-life in the atmosphere of between 0.5 to 2 years, consequently emissions of mercury become part of the global mercury cycle[10]. Globally, background elemental mercury concentrations vary between 0.5 to 2.5 ng[16]/m³. The average global background concentration is approximately 1.5 ng/m³. However, higher background concentrations of 10 - 12 ng/m³, are observed in urban areas impacted by industrial sources.

Background elemental mercury concentrations around the BSM site are expected to be comparatively low. There are no known industrial or natural sources of mercury which will contribute to ambient air quality levels (other than the discharges from the plant's coal fired boilers). Therefore, the background concentration of

[16] 1 ng = a billionth of a gram.

mercury has been assumed to be the global average of 1.5 ng/m^3 (i.e. 0.0015 µg/m^3), or 0.5% of the AAQG and RfC guideline concentration limit.

4.8 Summary of Background Air Quality

A summary of the background air contaminant concentrations used in this assessment are shown in Table 4-3.

Table 4-3 Summary of the background air contaminant concentrations

Contaminant	Averaging period	Default background concentration (µg/m^3)
PM_{10}	24 hours	19.8
	Annual (calculated)	6.1
NO_2	1 hour	37
	24 hours	23
$PM_{2.5}$	24 hours	13
	Annual (calculated)	4
SO_2	1 hour	0
	24 hour	0
Mercury	Annual	0.0015

4.9 Odour

Background odour sources around the BSM site are expected to be those typical of the rural environment (such as emissions from silage or decomposing animal manure).

4.10 Complaints

BSM has regular communication with neighbours and the community.

Prior to installation of the new WWTP, complaints regarding odours (particularly from the WWTP) were regularly received from neighbours beyond the boundary. Since commissioning of the new WWTP, detectable odour near the WWTP has reduced significantly and no complaints regarding odour from the site have been since 7 September 2020 (noting this complaint was subsequently attributed to a neighbour spreading dairy shed effluent on land). The most recent complaint about the site prior to that was 9 May 2020. A discussion of the complaint records is provided in Section 8.3.

5 Air Quality Standards and Guidelines

5.1 Overview

Ambient contaminant concentration predictions may be compared with relevant criteria to assess the potential for adverse health and environmental effects to occur. The MfE *Good Practice Guide for Assessing Discharges to Air from Industry* (GPG Industry) sets out the order of priority for the use of various air quality assessment criteria as follows:

- Air Quality Standards contained in the Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (NESAQ);
- New Zealand Ambient Air Quality Guidelines (AAQG) published by MfE (2002); and
- Regional air quality guidelines and standards.

In the absence of national, regional or World Health Organisation standards or guidelines, the GPG Industry recommends the use of international air quality guidelines.

5.2 National Standards

The NESAQ came into effect in 2004 and among other things, set out ambient air quality standards for common criteria contaminants, including PM_{10}, SO_2 and NO_2. The NESAQ provides for the protection of human health and are mandatory standards, which have an enforceable legal status.

Environment Southland has not specified any specific regional air quality standards or guidelines in the operative Regional Air Plan.

The NESAQ and AAQG are intended to apply where people are likely to be exposed over the relevant assessment period. The relevant ambient air quality assessment criteria for site emissions are described in **Table 5-1**.

5.3 Proposed Amendments to the NESAQ

In February 2020, the Ministry for the Environment released the "*Proposed Amendments to the National Environmental Standards for Air Quality (Consultation Document)*" (NESAQ Consultation Document), which proposes the introduction of a new ambient air quality standard for $PM_{2.5}$ (particulate matter less than 2.5 µm in diameter) and the incorporation of international best practice guidance as a mandatory consideration for Councils when making planning and consenting decisions about the discharges of mercury from Annex D listed sources, which includes coal-fired boilers. The proposal is at the consultation stage and currently does not have any legal status.

Table 5-1 Relevant ambient air assessment criteria for site emissions

Contaminant	Averaging time	Criteria source	Concentration $\mu g/m^3$	Allowable exceedances per year
PM_{10}	24-hour	NESAQ	50	1
	Annual	AAQG	20	N/A
$PM_{2.5}$ (proposed)	24-hour	NEASQ	25	3
	Annual	NEASQ	10	N/A
NO_2	1-hour	NESAQ	200	9
	24-hour	AAQG	100	N/A
SO_2	1-hour	NESAQ	570	0
		NESAQ/AAQG	350	9
	24-hour	AAQG	120	N/A
Mercury (organic)[1]	Annual	AAQG	0.13	N/A
Mercury (inorganic)			0.3	N/A

1 The US EPA Inhalation Reference Concentrations (RFC) are recommended in the GPG Industry for assessing long term non-carcinogenic impacts of air pollutants. RFCs are an estimate of an average life-time exposure to the human population (including sensitive subgroups- that is likely to be without appreciable risk of damaging effects. The RFC for elemental mercury is 0.3 $\mu g/m^3$.

5.4 Guidelines

The Ministry for the Environment (2016) has published guidelines on odour assessment methods. The Ministry's recommended tools for odour assessment include complaint records; industry or regional council experience with the discharge; community consultation; and odour annoyance surveys. Where modifications to an existing site are being made, dispersion modelling of odour emissions may also be appropriate. However, dispersion modelling of odour for this application has been discounted due to the difficulty in characterising emissions and their variable and intermittent nature.

As BSM is applying for consent to discharge from the operations as they currently exist, past experience with the activity and the proposed mitigation processes are key considerations for the odour assessment and this approach complies with the MfE odour guide. The assessment criterion for odour acceptability is a subjective one and generally takes the form as recommended in the odour guide: "*there shall be no objectionable or offensive odour to the extent that it causes an adverse effect at or beyond the boundary of the site*".

Whether an odour objectionable or offensive to the extent there is an adverse effect depends on the frequency, intensity, duration, offensiveness and location of the odour event. These factors are collectively known as the FIDOL factors. This criterion and the general approach of considering FIDOL for assessing odour has been adopted in this report (see **Section 8**).

6 Boiler Emission Assessment Methodology

6.1 Overview

The dispersion of emissions from the two existing boilers was modelled to demonstrate the effects on ambient air quality in the vicinity of the BSM plant. The ambient concentrations predicted by the modelling were then compared to the relevant ambient air quality standards and guidelines to assess the potential for adverse health effects on sensitive receptors (nearby dwellings).

Dispersion of PM_{10}, $PM_{2.5}$, SO_2, NOx and mercury (Hg) emitted from the boiler stacks was modelled, as these are the pollutants of primary concern. While other air pollutants will also be discharged (e.g. CO), the offsite concentrations of these pollutants are expected to be substantially lower than relevant air quality criteria limits. Consequently, the discharges of these other pollutants were not modelled.

6.2 Model Selection

The dispersion model AERMOD (v21112) was used for this assessment. AERMOD is a steady state Gaussian dispersion model that incorporate “state-of-the-art” modelling concepts. The model uses more advanced modelling procedures than the older Gaussian models (such as AUSPLUME and ISC3), to simulate pollutant dispersion. Key differences from other models are the derivation of dispersion curves from micro-meteorological conditions, the improved treatment of terrain effects, the modelling of thermal updraft and downdrafts during daytime convective conditions, and the vertical representation of the atmosphere’s structure.

AERMOD was adopted by the US EPA as its preferred regulatory model in 2005 and replaced AUSPLUME as the regulatory air dispersion model of EPA Victoria, on 1 January 2014.

AERMOD was run using the Lakes Environments graphical user interface AERMOD View (v10.2.0).

The modelling files and the remainder of the modelling results plots are attached as **Appendix C.**

6.3 Terrain and Receptors

Although terrain effects are not expected to have any significant effect on maximum contaminant concentrations predicted outside the site boundary, the effects of terrain were incorporated into the dispersion model using AERMOD’s elevated terrain algorithms.

Receptor points were defined in a cartesian grid pattern every 25 m within approximately 1 km of the site, every 50 m from 1 km to 2 km from the site and every 100 m from 2 km to 5 km from the site. Additional discrete receptors were also defined at the locations of the dwellings located close to the site boundary.

The terrain elevations at each receptor point were derived from the 1-minute Shuttle Radar Topography Mission (STR-1) digital terrain data.

6.4 Meteorological Input File

Accurate atmospheric pollutant dispersion modelling requires good meteorological information that is representative of dispersion conditions near the emission sources, which is then processed into a format that can be used by the dispersion model. The closest meteorological stations to the site are Invercargill Airport, located approximately 25 km to the southwest of the site and Gore located approximately 36 km to the northeast of the site.

However, the wind flows observed at these monitoring stations are not expected to be representative of those which would occur at the site. Meteorological conditions are expected to vary over the distances which separate the monitoring stations from the site. Similarly, topographical effects will influence local wind conditions. For example, the land-sea wind flows observed at the Invercargill Airport are not expected to be present at the site. Similarly, the wind flows observed at the Gore monitoring station that are influenced by station's location in a valley would not be expected to be observed at the site.

Therefore, for this assessment, meteorological inputs have been constructed for AERMOD (v21112) using a combination of the associated meteorological modelling programme AERMET View (v9.8.3) and the TAPM (The Air Pollution Model) v4 model as discussed in section 4.6 of this report.

Due to the meteorological data assimilation procedure, the meteorological input file is expected to provide a good representation of dispersion conditions. The predicted AERMET wind speed and wind direction distribution for 2018 is shown in the windrose in Figure 6-1.

Figure 6-1. Predicted AERMET wind speed and directions for the site

6.5 Conversion of NOx to NO_2

NO_2 is primarily responsible for the adverse health effects associated with combustion-generated NO_x emissions. In addition to the NO_2 content of NO_x emissions, nitrogen oxide (NO), which constitutes the majority of NO_x emissions (typically 90 – 95 %), may be oxidised to NO_2 in the atmosphere in the presence of oxidants such as ozone (O_3).

The proportion of NO_X, which is converted to NO_2, is determined by a number of factors including the following:

- The availability of ozone in the atmosphere to react with NO_2
- The proportion of NO_X which is emitted in the form of NO_2
- The reaction rate of NO and ozone
- The reverse photo-disassociation rate of NO_2 to NO and ozone in the presence of sunlight.

The GPG Modelling recommends that the estimation of NO_2 in ambient NO_x concentrations are calculated in accordance with the Ozone Limiting Method (OLM), unless there is adequate site-specific data to justify an alternative method. The OLM assumes that all NO in NO_x is converted to NO_2 if the total cumulative concentration of NO_x (including background) is less than 35 ppb (or 66 µg/m^3)[17] otherwise the NO_2 concentration is calculated as follows:

$$[NO_{2\ mod}] = 66 + ([NO_{x\ mod}] \times 0.05)$$

$[NO_{2\ mod}]$ = modelled concentration of NO_2 at the receptor point

$[NO_{x\ mod}]$ = modelled concentration of NO_x at the receptor point

The GPG Modelling notes that this method is very conservative, producing results considerably in excess of corresponding monitoring data. The value of 66 in the OLM equation represents the maximum likely oxidation of NO to NO_2 by ozone and is based on the highest ozone concentrations recorded at the monitoring stations located at Baring Head (Wellington) and Musick Point (Auckland). The approach substantially over-estimates ozone concentrations present in the area of the discharge.

The method also assumes that the reaction with ambient ozone is instantaneous. The method therefore also overestimates the amount of NO_2 which can be formed in the plume at locations close to the emission source (due to the short traveling time of the discharged pollutants). This calculation is incorporated into the AERMOD model.

6.6 Building Downwash Effects

Buildings and structures in the vicinity of a discharge can impact on airflow in the area and therefore the dispersion of contaminants within that discharge. This impact is referred to as building "downwash". The effect of building downwash on the dispersion of contaminants emitted from each of the sources at the site has been incorporated into the dispersion model using the PRIME building wake algorithm. The PRIME algorithm is recommended by MfE[7] as being the most appropriate method for simulating building "downwash".

The directional influences of buildings at the site, including any potential buildings and structures, have been determined using the US EPA BPIP (Building Profile Input Program) software. The buildings simulated for the dispersion modelling are shown in **Figure 6-2**.

[17] 35 ppm of NO_2 = 66 µg/m^3 of NO_2 at 25°C.

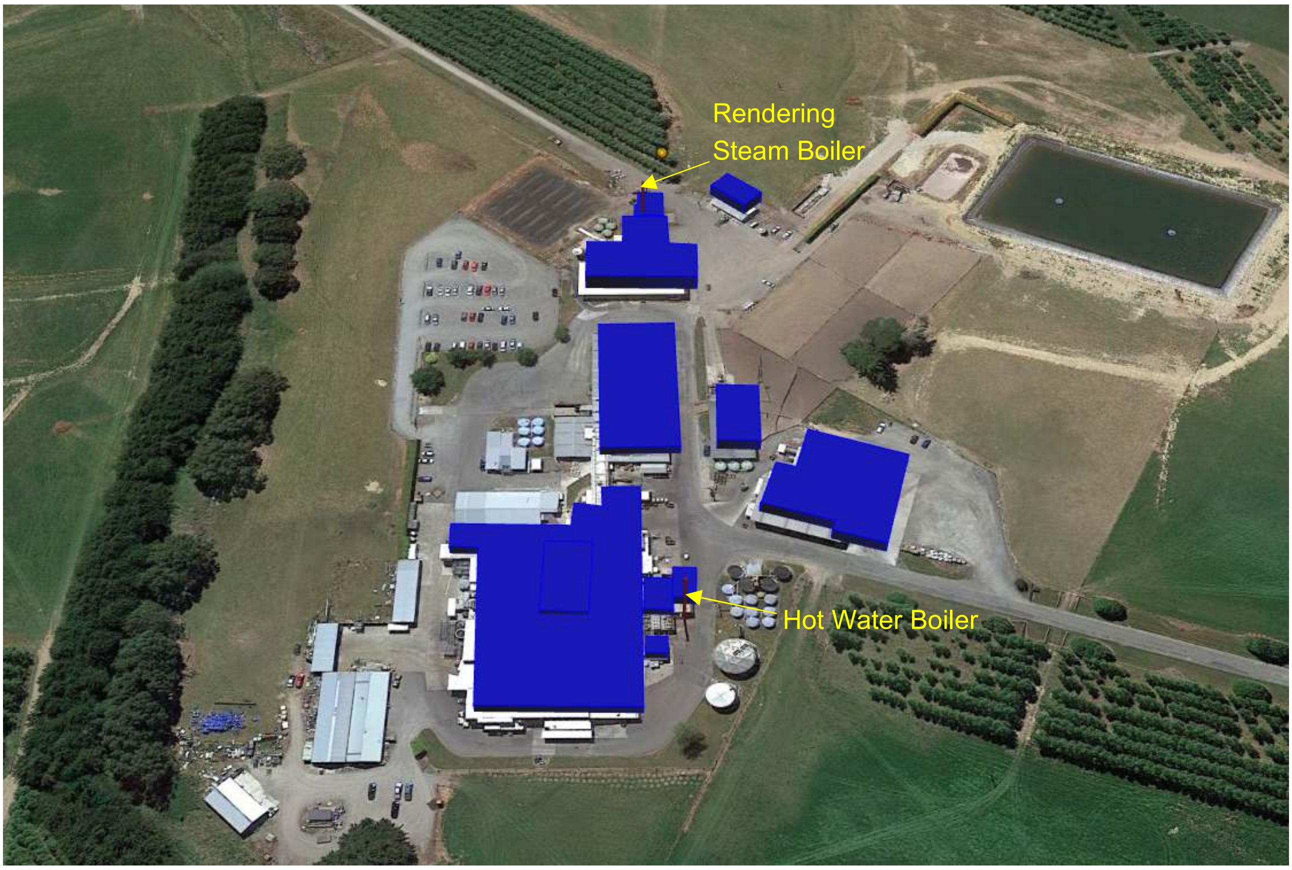

Figure 6-2 Site building structures included in the dispersion model (modelled stacks are indicated in red)

6.7 1-Hour Average Percentile Concentrations

The use of 99.9 percentile, 1-hour averages is a standard dispersion modelling convention used to assess predicted pollutant 1-hour average concentrations. The 99.9 percentile 1-hour average concentration corresponds to the ninth highest 1-hour average concentrations predicted at each receptor point over the simulated meteorological year. The use of the 99.9 percentile, 1-hour average is intended to filter out improbably high concentrations that may be predicted due to extreme meteorological events. The *Good Practice Guide for Atmospheric Dispersion Modelling* (MfE, 2004) advises that the predicted 99.9 percentile concentration is the maximum ground-level concentration that is likely to occur.

6.8 Cumulative Concentrations

Maximum cumulative ground level concentrations (i.e. the sum of background and plant concentrations), have been calculated by adding the background pollutant concentrations, with the concentration predicted by the dispersion modelling.

This approach is conservative as it assumes that the peak background pollutant levels occur during the same meteorological conditions as the peak concentrations predicted for the plant. This is unlikely to be the case as peak background levels generally occur during calm winter nights when there are highly stable atmospheric conditions. In contrast, maximum concentrations associated with the discharges from the BSM plant would be expected to occur during spring under moderate to strong wind flows.

6.9 Emission Scenarios

6.9.1 Overview

Some of the products of coal combustion can have a detrimental impact on human health. The key contaminants include fine particulate matter (PM_{10}), oxides of nitrogen (NO_x, comprised primarily of nitric oxide (NO) and nitrogen dioxide (NO_2)), sulphur dioxide (SO_2) and carbon monoxide (CO).

In addition to these primary contaminants, trace amounts of heavy metals including mercury, polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) will be discharged from the stack. Based on past experience with other similar coal-fired boilers, the effects of the discharges of heavy metals, CO, PAHs and VOCs pose a very low health risk potential compared to pollutants such as PM_{10}, SO_2 and NO_2. The contribution to ambient pollutant levels would not result in the exceedance of any guidelines or standards. Consequently, the effects of CO, PAHs and VOCs have not been included in this assessment. However, the effects of mercury from the combustion of coal have been included in this assessment.

6.9.2 Model scenarios

Three emission scenarios were modelled:

- **Scenario 1 (Consented Emissions):** Assumes the RSB and HWB are both in continuous operation at maximum capacity. TSP emissions from the boilers are assumed to be at the current consent limit and PM_{10} and $PM_{2.5}$ emission rates have been calculated from the TSP results. Other contaminants such as a SO_2, NOx and mercury are at emission rates stated in Section 3 of this report.
- **Scenario 2 (High Particulate Emissions):** Assumes the RSB and HWB are both in continuous operation at maximum capacity. TSP emissions from the RSB boiler is assumed to be 750 mg/dsm^3 @ 12% CO_2 and the HWB is 2,000 mg/dsm^3 @ 12% CO_2 which represents the actual maximum emissions with some buffer allowed. PM_{10} and $PM_{2.5}$ emission rates have been calculated from the TSP results using the proportions from the 2021 round of testing. Other contaminants such as a SO_2, NOx and mercury are at emission rates stated in Section 3 of this report.
- **Scenario 3 (Future Emissions):** Assumes the RSB is in continuous operation at maximum capacity and the HWB has been decommissioned. The TSP concentration from the RSB is assumed to be to be 750 mg/dsm^3 @ 12% CO_2 and PM_{10} and $PM_{2.5}$ emission rates calculated as above. Other contaminants such as a SO_2, NOx and mercury are at emission rates stated in Section 3 of this report.

For all scenarios, the boilers are assumed to operate continuously for 24 hours per day for the simulation period. The model's emissions assumptions are therefore conservative and assume that maximum site emissions occur at the same time as worst-case dispersion conditions.

6.9.3 Efflux velocities and temperatures

The efflux velocity and temperature of gases from a point source such as a boiler can have an impact on the dispersion of the plume and the resulting concentration of contaminants at ground level. The efflux velocities and temperature of the boiler discharges vary within a range determined by the design of the boiler and the operating procedures.

For this assessment, the exit velocity and temperature for the HWB and RSB were taken from the 2021 emission tests.

6.9.4 Modelled emission parameters

The stack parameters and emission rates used for this assessment are summarised in **Table 6-1**.

Table 6-1 Summary of the modelled emission parameters

Parameter	Unit	Rendering Steam Boiler	Hot Water Boiler
Rated Capacity	MW	4.3	1.9
Coal Usage @ 14.61 MJ/kg, 75% thermal efficiency	kg/hour	1,400	630
Stack Height	m	20	18.6
Stack Diameter	mm	705	600
Stack Diameter at exit	mm	705	400
Exit Temperature	ºC	199	179
Average Exit Flow Rate, dry standard	m^3/hour	6,602	5,235
	m^3/s	1.83	1.45
Exit Velocity, actual at test point	m/s	9.1	9.4
Exit Velocity, actual at exit	m/s	9.1	21.2
TSP Emission Rate	kg/hr	3.1	2.6
S1 PM_{10} Emission Rate	g/s	0.53	0.39
S1 PM_{25} Emission Rate	g/s	0.1	0.06
S2 PM_{10} Emission Rate	g/s	0.79	1.57
S2 PM_{25} Emission Rate	g/s	0.16	0.26
SO_2 Emission Rate	g/s	2.9	1.3
NOx Emission Rate	g/s	1.13	0.51
Mercury Emission Rate	g/s	0.00023	0.00011

7 Boiler Emission Modelling Results

7.1 Overview

The predicted contaminant concentrations assume that both boilers are operating continuously at their operating heat output of 1.9 MW for the HWB and 4.3 MW for the RSB for the simulation period. Since the operation of the boilers varies throughout the year in response to processing demands, the modelled emission scenarios are considered conservative. The predicted maximum downwind concentrations including background concentrations are based on the boilers operating at peak capacity during worst case dispersion conditions. The modelled emissions scenarios are therefore expected to overpredict air quality effects.

7.2 Predicted Maximum 24-Hour and Annual Average PM_{10} Concentrations

Table 7-1 summarises the maximum 24-hour and annual PM_{10} off-site concentrations associated with the discharges from the coal fired boilers predicted outside the site boundary and at dwellings in the vicinity. As the ambient standards are based on locations where people may be present for the averaging period the results at dwellings are more relevant in this case as people or not likely to be present at other locations for 24 hours.

The table shows the maximum predicted PM_{10} concentrations for all three Scenarios. Concentration plots of the predicted 24 hour and annual concentrations excluding background for Scenario 1 are presented as Figures 7-1 and 7-2. **Appendix C** presents the Figures for Scenarios 2 & 3.

The predicted concentrations are conservative as they assume peak ambient concentrations occur during worst case dispersion conditions.

Table 7-1 Summary of predicted maximum 24-hour and annual average PM_{10} concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 1	24 hrs	max dwelling	6.4	19.8	26.2	52.4%	50
		max off-site	8.3	19.8	28.1	56.2%	50
	Annual	max dwelling	1.00	6.1	7.10	35.5%	20
		max off-site	1.24	6.1	7.34	36.7%	20
Scenario 2	24 hrs	max dwelling	18.8	19.8	38.6	77.2%	50
		max off-site	26	19.8	45.8	91.6%	50
	Annual	max dwelling	2.8	6.1	8.9	44.5%	20
		max off-site	3.5	6.1	9.6	48.0%	20
Scenario 3	24 hrs	max dwelling	4.9	19.8	24.7	49.4%	50
		max off-site	8	19.8	27.8	55.6%	50
	Annual	max dwelling	0.7	6.1	6.8	34.0%	20
		max off-site	1.0	6.1	7.1	35.5%	20

The maximum cumulative (i.e. including the contribution from background sources) 24-hour average PM_{10} concentration at the most impacted dwelling for both boilers operating at the assumed high TSP discharge concentrations (i.e. Scenario 2), is predicted to be 38.6 µg/m³, or 77.2% of the national ambient air quality standard of 50 µg/m³.

Once the HWB is decommissioned, the maximum 24-hour average PM_{10} concentration at the most impacted dwelling (Scenario 3) is predicted to be 24.7 µg/m³, or 49.4% of the national ambient air quality standard.

This predicted maximum concentration is lower than the maximum predicted concentration of 26.2 µg/m³ for Scenario 1 (both boilers operating at consent limits). The peak concentration is predicted to occur at the dwelling to the SE of the site across the road (approximately 470m from the plant).

The maximum annual PM_{10} concentration at any dwelling occurs for Scenario 2 and is predicted to be 2.8 µg/m³. The maximum cumulative concentration is predicted to be 8.9 µg/m³ or 44.5% of the NESAQ criteria concentration of 20 µg/m³ for an assumed background of 6.1 µg/m³. The peak concentration is predicted to occur at the closest dwelling located to the SE of the site. Once the HWB is shutdown the ambient concentrations would reduce to the Scenario 3 levels of 0.70 µg/m³ or a cumulative 34% of the NESAQ criteria which are less than the Scenario 1 concentrations.

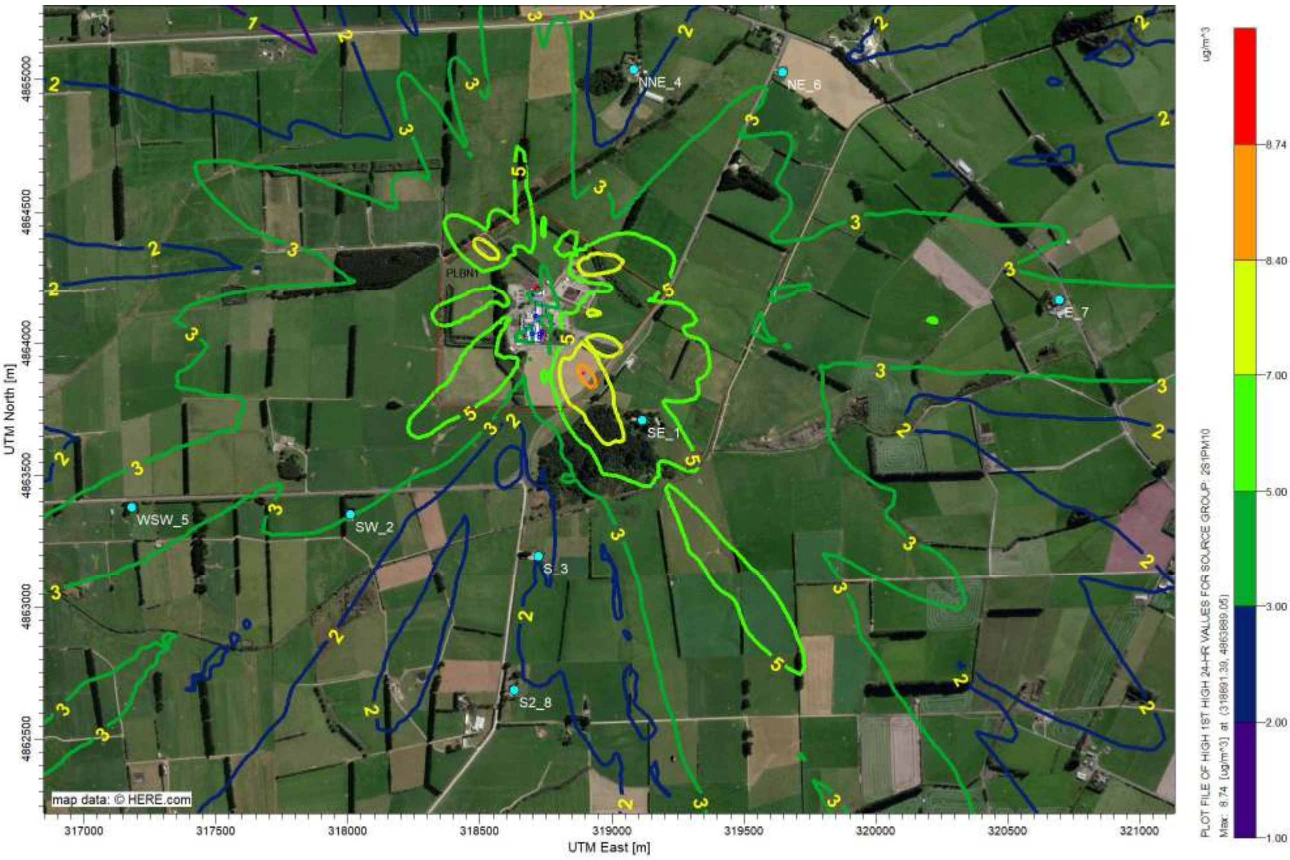

Figure 7-1 Predicted 24-hour Average PM_{10} Concentrations (µg/m³) for Scenario 1

Figure 7-2 Predicted Annual Average PM_{10} Concentrations (µg/m³) Scenario 1

7.3 Predicted Maximum 24-Hour and Annual Average $PM_{2.5}$ Concentrations

Table 7-2 summarises the maximum 24-hour and annual off-site $PM_{2.5}$ concentrations associated with the discharges from the boilers. The table shows the maximum predicted offsite $PM_{2.5}$ concentrations for the three scenarios.

The predicted concentrations are conservative as they assume peak emission conditions occur during worst case dispersion conditions.

Concentration plots of the predicted 24 hour and annual concentrations excluding background for Scenario 1 are presented as Figures 7-3 and 7-4. **Appendix C** presents the Figures for Scenarios 2 & 3.

Table 7-2 Summary of predicted maximum 24-hour average $PM_{2.5}$ concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Draft NESAQ	Draft NESAQ (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 1	24 hrs	max dwelling	1.1	13	14.1	56.4%	25
		max off-site	1.4	13	14.4	57.6%	25
	Annual	max dwelling	0.17	4	4.17	41.7%	10
		max off-site	0.21	4	4.21	42.1%	10
Scenario 2	24 hrs	max dwelling	3.3	13	16.3	65.2%	25
		max off-site	4.5	13	17.5	70.0%	25
	Annual	max dwelling	0.49	4	4.49	44.9%	10
		max off-site	0.61	4	4.61	46.1%	10

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Draft NESAQ	Draft NESAQ (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 3	24 hrs	max dwelling	.99	13	14.0	56.0%	25
		max off-site	1.6	13	14.6	58.4%	25
	Annual	max dwelling	0.15	4	4.15	41.5%	10
		max off-site	0.19	4	4.19	41.9%	10

The maximum cumulative 24-hour average $PM_{2.5}$ concentration at the most impacted dwelling for both boilers operating at the assumed high TSP discharge concentrations (i.e. Scenario 2) is predicted to be 16.3 µg/m³, or 65.2% of the proposed national ambient air quality standard of 25 µg/m³.

Once the HWB is decommissioned, the maximum 24-hour average $PM_{2.5}$ concentration at the most impacted dwelling (Scenario 3) is predicted to be 14.0 µg/m³, or 56.0% of the proposed national ambient air quality standard. This predicted maximum concentration is similar to the maximum predicted concentration of 14.1 µg/m³ for Scenario 1 (both boilers operating at consent limits).

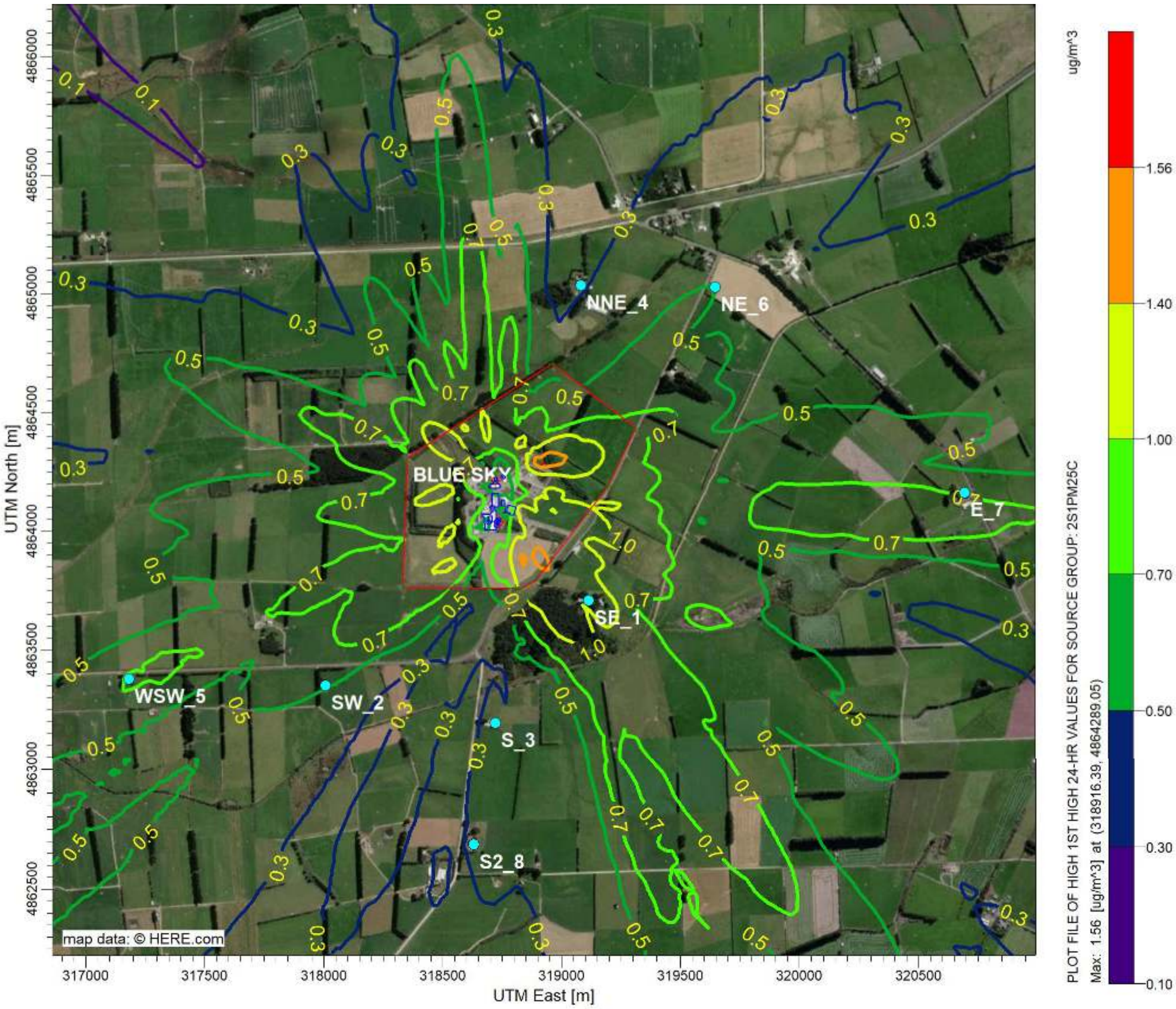

Figure 7-3 Predicted 24-hour Average $PM_{2.5}$ Concentrations (µg/m³) Scenario 1

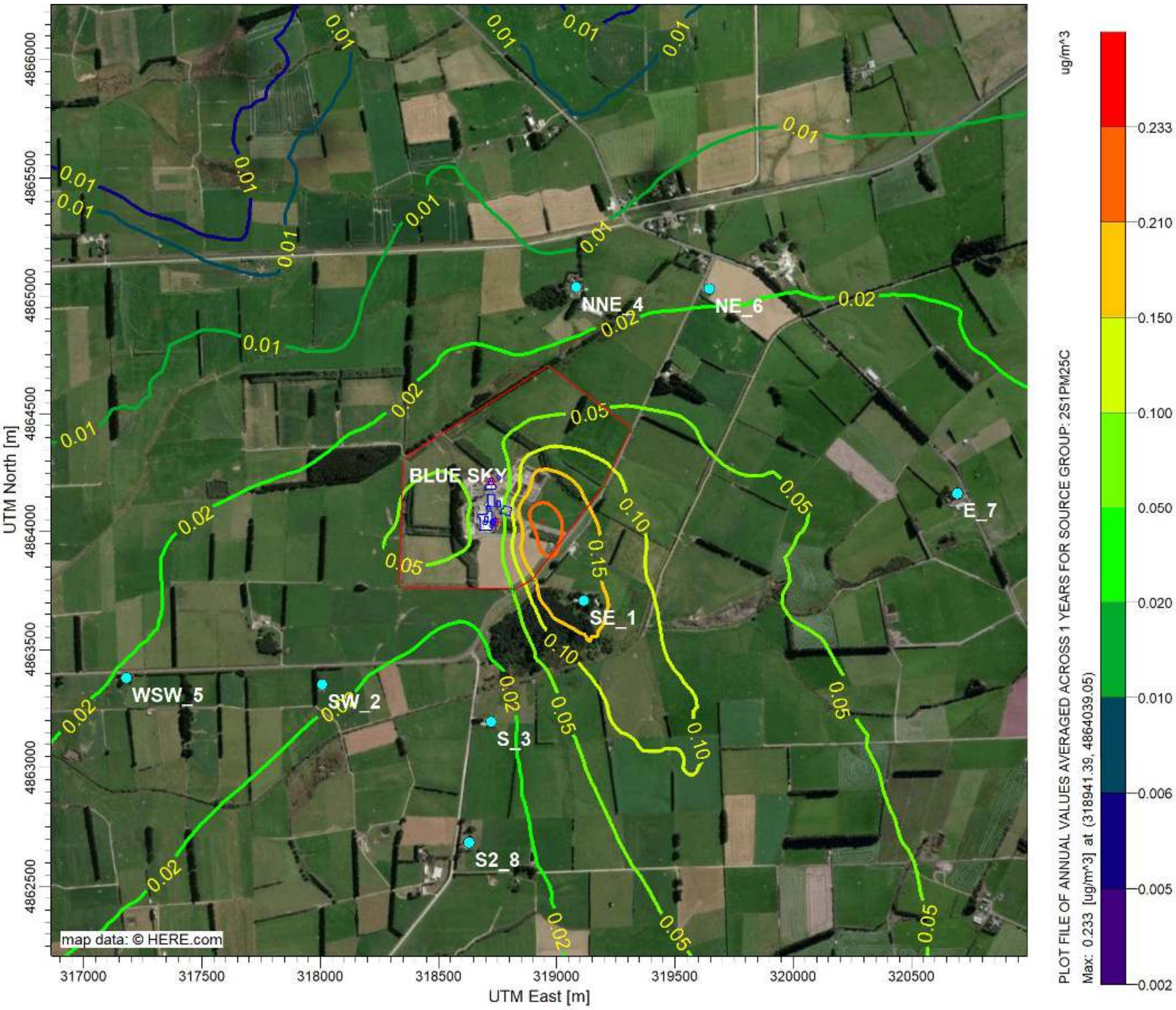

Figure 7-4 Annual Average $PM_{2.5}$ concentrations (µg/m^3) Scenario 1

7.4 SO_2 Modelling results

Table 7-3 summarises the maximum 99.9%ile 1-hour and maximum 24-hour SO_2 off-site concentrations associated with the discharges from the coal fired boilers predicted outside the site boundary and at dwellings in the vicinity for Scenarios 1 & 3.

Concentration plots of the predicted 1-hour and 24-hour concentrations excluding background for Scenario 1 are presented as Figures 7-5 and 7-6. **Appendix C** presents the Figures for Scenario 3.

The predicted concentrations are conservative as they assume peak ambient concentrations occur during worst case dispersion conditions.

Table 7-3 Summary of predicted maximum 99.9%ile 1 hour and maximum 24-hour average SO_2 concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 1	99.9%ile 1 hr	max dwelling	49	0	49	14.0%	350
		max off-site	66	0	66	18.9%	350
	24 hrs	max dwelling	27	0	27	22.5%	120
		max off-site	36	0	36	30.0%	120
Scenario 3	99.9%ile 1 hr	max dwelling	37	0	37	10.6%	350
		max off-site	51	0	51	14.6%	350
	24 hrs	max dwelling	18	0	18	15.0%	120
		max off-site	29	0	29	24.2%	120

The maximum off-site 99.9%ile 1-hour SO_2 concentration for any scenario is predicted to be 66 µg/m³ or 18.9% of the AAQG criteria concentration of 350 µg/m³. The peak concentration is predicted to occur at the southeast boundary of the site. Once the HWB is decommissioned in August 2024, the ambient concentrations would reduce to the Scenario 3 levels where the site contribution will be 37 µg/m³ or 10.6% of the AAQG criteria concentration of 350 µg/m³.

The maximum off-site 24-hour average SO_2 concentration at any dwelling is predicted to be 36 µg/m³ or 30% of the AAQG criteria concentration of 120 µg/m³. The peak concentration is predicted to occur at the SE or NW boundary of the site. Once the HWB is decommissioned, the ambient concentrations would reduce to the Scenario 3 levels where the site contribution will be 29 µg/m³ or 24.2% of the AAQG criteria concentration of 350 µg/m³.

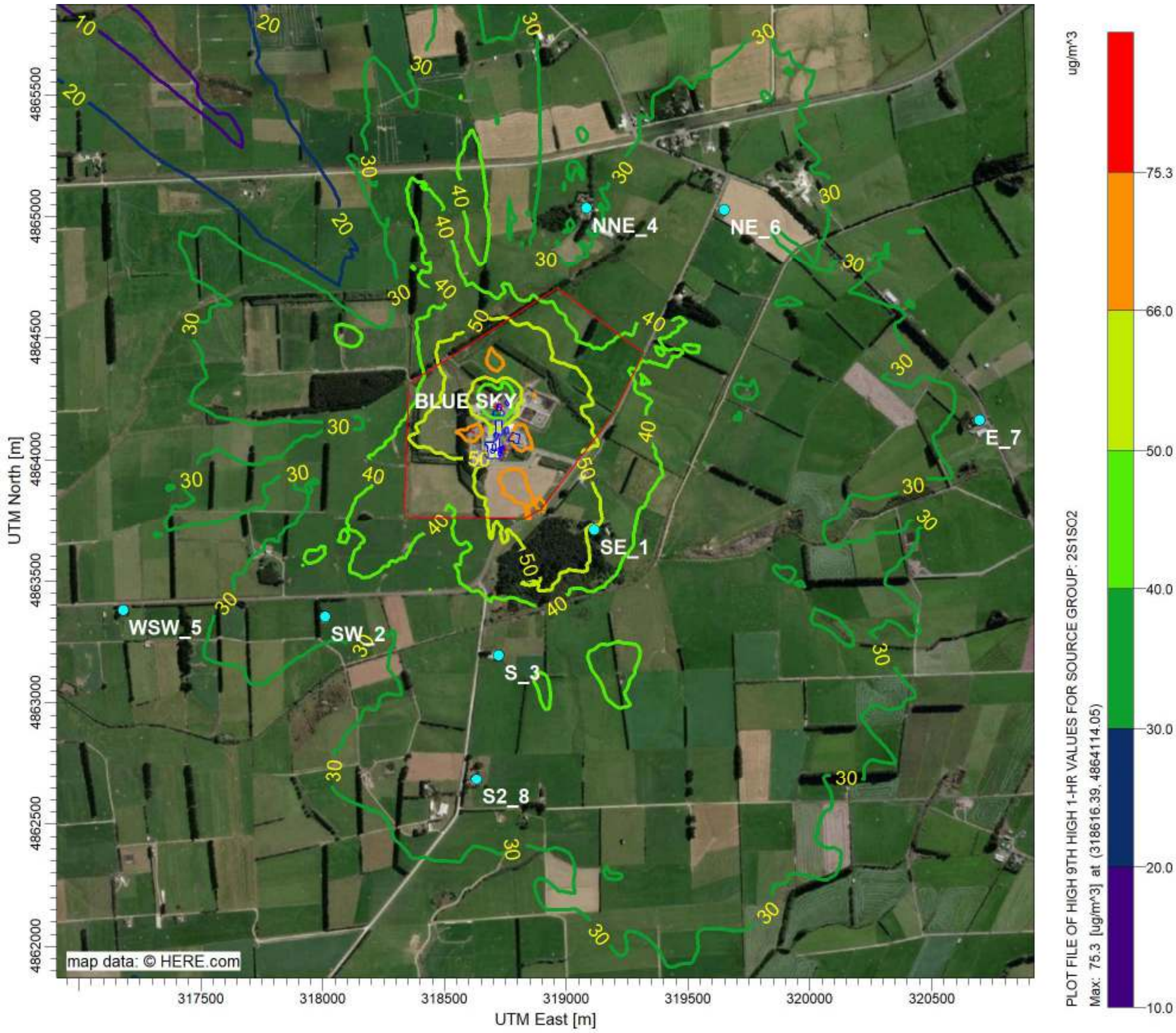

Figure 7-5 Predicted 99.9%ile 1 hour Average SO_2 Concentrations (µg/m^3) Scenario 1

Figure 7-6 Predicted 24-hour Average SO_2 Concentrations ($\mu g/m^3$) Scenario 1

7.5 NO_2 Modelling results

Table 7-4 summarises the maximum 99.9%ile 1-hour and maximum 24-hour NO_2 off-site concentrations associated with the discharges from the coal fired boilers predicted outside the site boundary and at dwellings in the vicinity for Scenarios 1 & 3.

Concentration plots of the predicted 1-hour and 24-hour concentrations, excluding background, for Scenario 1 are presented as Figures 7-7 and 7-8. **Appendix C** presents the Figures for Scenario 3.

The predicted concentrations are conservative as they assume peak ambient concentrations occur during worst case dispersion conditions.

Table 7-4 Summary of predicted maximum 99.9%ile 1 hour and 24-hour average NO_2 concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (µg/m³)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (µg/m³)
			Site Contribution	Background Concentration	Total		
Scenario 1	99.9%ile 1 hr	max dwelling	19	37	56	28.0%	200
		max off-site	26	37	63	31.5%	200
	24 hrs	max dwelling	11	23	34	34.0%	100
		max off-site	14	23	37	37.0%	100
Scenario 3	99.9%ile 1 hr	max dwelling	14	37	51	25.5%	200
		max off-site	20	37	57	28.5%	200
	24 hrs	max dwelling	7	23	30	30.0%	100
		max off-site	11	23	34	34.0%	100

The maximum cumulative 99.9%ile 1-hour NO_2 concentration predicted outside the boundary is 63 µg/m³ or 31.5% of the AAQG criteria concentration of 200 µg/m³. The peak concentration is predicted to occur at the southeast boundary of the site. Once the HWB is decommissioned in August 2024, the cumulative ambient concentrations would reduce to the Scenario 3 levels of 57 µg/m³ or 28.5% of the AAQG criteria concentration of 200 µg/m³.

The maximum cumulative 24-hour average NO_2 concentration predicted at any dwelling is 34 µg/m³ or 34% of the AAQG criteria concentration of 100 µg/m³. The peak concentration is predicted to occur at the dwelling to the southeast of the site. Once the HWB is decommissioned, the cumulative ambient concentrations would reduce to the Scenario 3 levels of 30 µg/m³ or 30% of the AAQG criteria concentration of 100 µg/m³.

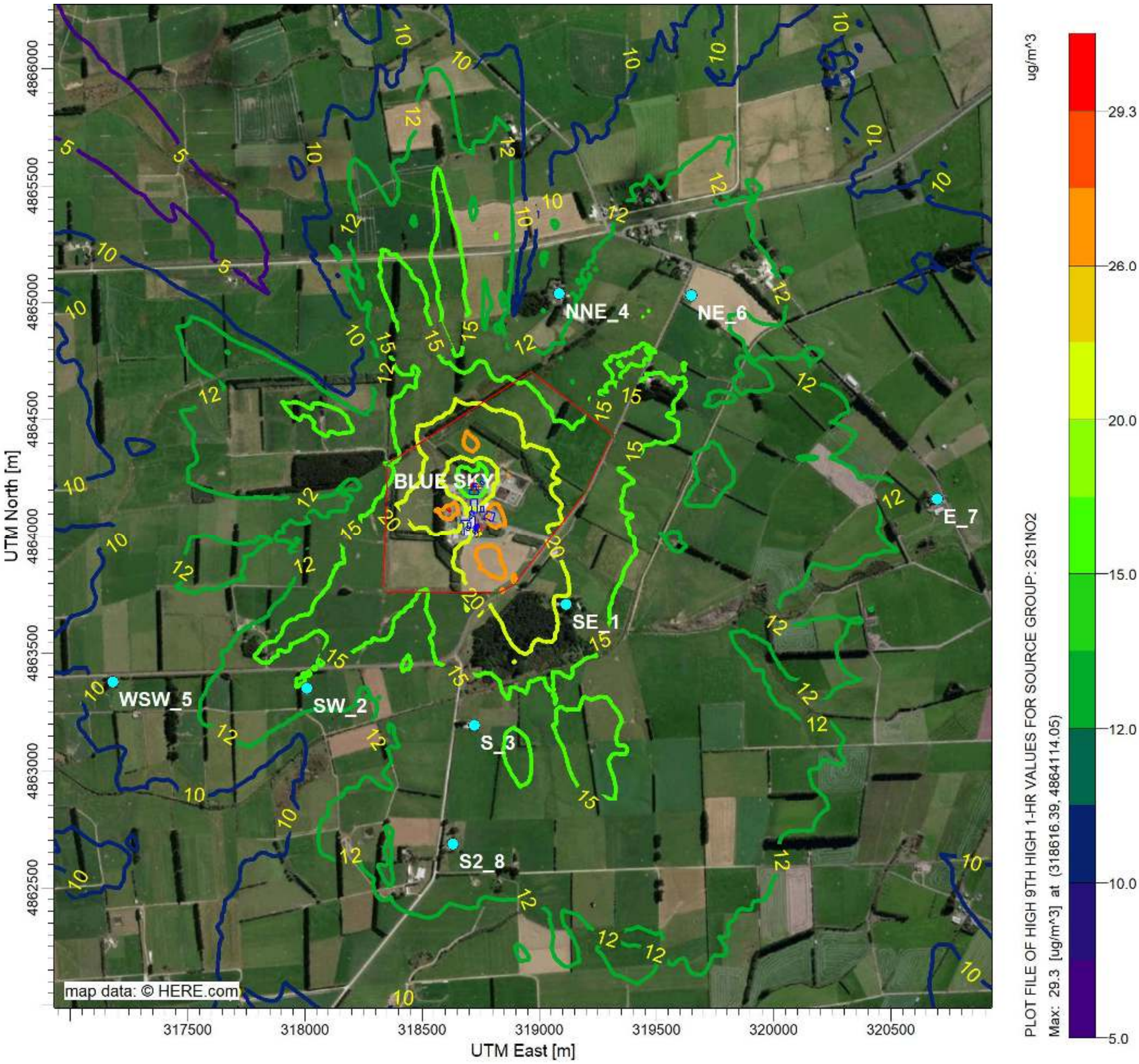

Figure 7-7 Predicted 99.9%ile 1 hour Average NO_2 Concentrations (µg/m^3) Scenario 1

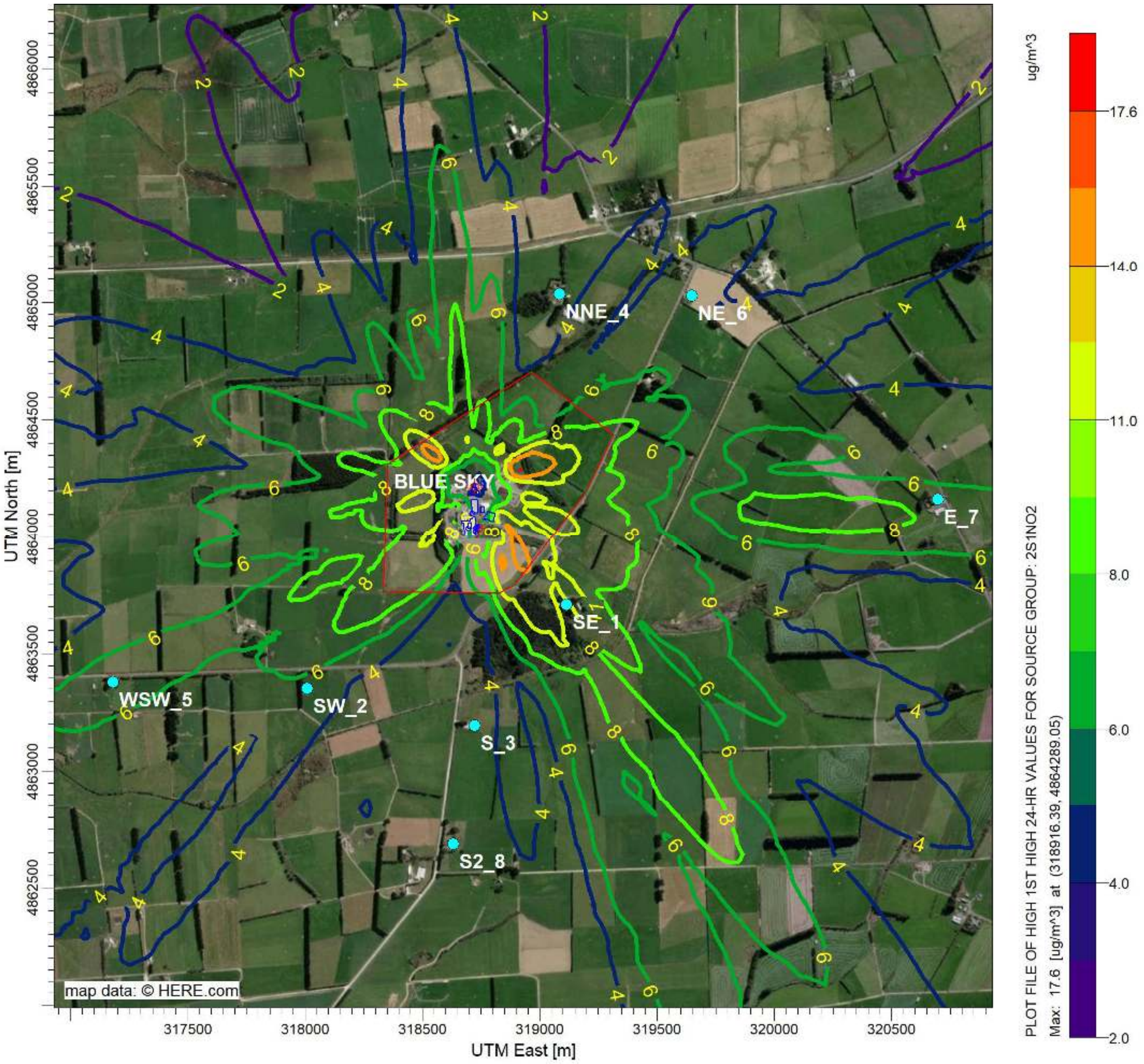

Figure 7-8 Predicted 24-hour Average NO_2 Concentrations (µg/m^3) Scenario 1

7.6 Mercury Modelling results

Table 7-4 summarises the maximum annual mercury off-site concentrations associated with the discharges from the coal fired boilers predicted outside the site boundary and at dwellings in the vicinity for Scenarios 1 & 3. As the ambient standards are based on locations where people may be present for the averaging period, the results at dwellings are more relevant in this case as people or not likely to be present at other locations for extended periods

Concentration plots of the predicted annual average concentrations excluding background for Scenario 1 are presented as Figure 7-9. **Appendix C** presents the Figure for Scenario 3.

The results show that the cumulative concentration is predicted to be approximately 0.6% of the air quality guideline of 0.3 µg/m^3 (or 300 ng/m^3). The predicted concentrations are conservative as they assume peak ambient concentrations occur during worst case dispersion conditions.

Table 7-5 Summary of predicted maximum annual average mercury concentrations

Scenario	Operating Schedule	Receptor	Maximum Predicted Off-Site Concentration (ng/m^3)			Total Ambient conc. as % of Air Quality Criteria	Air Quality Criteria (ng/m^3)
			Site Contribution	Background Concentration	Total		
Scenario 1	Annual	max dwelling	0.36	1.5	1.86	0.6%	300
		max off-site	0.44	1.5	1.94	0.6%	300
Scenario 3	Annual	max dwelling	0.21	1.5	1.71	0.6%	300
		max off-site	0.28	1.5	1.78	0.6%	300

For all Scenarios, the emissions are predicted to be about 0.6% of the guideline and are considered negligible.

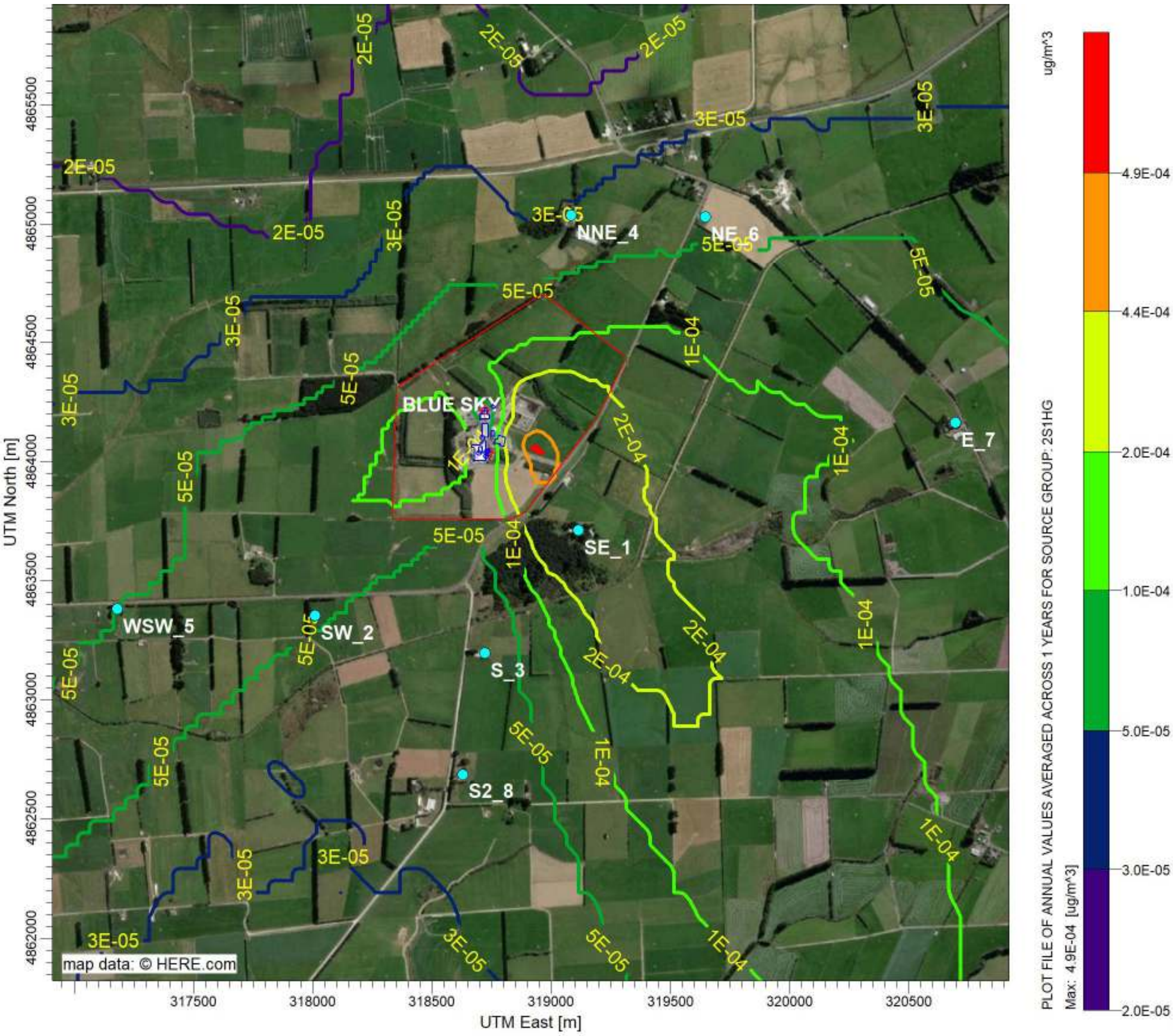

Figure 7-9 Annual Average Mercury Concentrations (µg/m^3) Scenario 1

7.7 Energy Efficiency and Carbon Reduction

The government's preferred approach for existing fossil fuel-fired assets is to phase out coal in existing sites by 2037 for low and medium temperature processes through the consenting process.

As noted in Section 2.5.2, BSM has completed a study to identify site emissions and assess emission reduction opportunities. A primary objective is to demonstrate a decarbonisation transition pathway for the site to support the application for a new air discharge consent. Addressing and reducing atmospheric emissions of CO_2 as well as contaminants such as particulate matter, SOx and NOx, particularly as a result of lower use of coal, is an important component of the overall site environmental strategy.

The proposal is to decommission the HWB by August 2024 which will be achieved through improved heat recovery, reduced hot water demand and the installation of a new high temperature electric heat pump.

This project will reduce coal consumption and is projected to reduce carbon emissions by 2,183 tCO2-e per annum, or 43,670 tCO2-e over the lifetime of the assets.

7.8 Conclusions

The results of the modelling show that discharges of the primary pollutants from the existing boiler stacks (PM_{10}, $PM_{2.5}$, NO_2, SO_2 and mercury) do not exceed any of the relevant air quality criteria limits outside of the BSM site boundary.

The results of the modelling indicate the emissions from the existing boilers do not have significant adverse air quality effects beyond the site boundary, except that ambient particulate concentrations will be close to ambient air quality guidelines until the HWB is decommissioned in August 2024.

The proposed removal of the plant boiler by August 2024 will result in a significant reduction in the PM_{10} mass load discharged from the site and bring about an approximately 6% reduction in ambient PM_{10} concentrations compared to both boilers operating at current consent limits. The other contaminant discharges from the boilers will also reduce as a result of decommissioning the HWB.

8 Effects of Odour on Amenity Values

8.1 Overview

The BSM meat processing plant at Morton Mains Road is an existing and long-established operation. Therefore, current experience at the site in respect of the effects of odour is the best indicator of likely future performance. This approach is consistent with the Ministry for the Environment's *Good Practice Guide for Assessing and Managing Odour in New Zealand (2016)*

The main potential sources of odour are the processing plant, biofilter and WWTP. The assessment of the effects of odour has therefore largely been based on current performance of these facilities (including any complaints), as well as proposed mitigation practices (see Section 9).

For an odour discharge to create an adverse effect, it needs to be established that it is offensive or objectionable to an "ordinary person". It is usually insufficient for an odour discharge simply to be detected, at or beyond the boundary of a site, for it to be considered to have caused an adverse effect.

The effects of odour discharges depend on a number of features of the odour exposure which are collectively known as the "**FIDOL**" factors:

- **F**requency - How often an individual is exposed to odour
- **I**ntensity - The strength of the odour or the concentration
- **D**uration - The length of a particular event
- **O**ffensiveness/character - The character relates to the "hedonic tone" of the odour, which may be pleasant, neutral or unpleasant
- **L**ocation - The type of land use and the nature of human activities in the vicinity of an odour source.

As part of the "location" factor, the sensitivity of the receiving environment must be considered.

Different combinations of these factors are significant when assessing adverse effects. Depending on the severity of an event, one single occurrence may be significantly adverse, and this is known as an "acute" effect. However, in other situations, where there is a higher frequency of events, the threshold level would be lower. This longer-term impact is known as a "chronic" effect.

Different locations have different sensitivities to odour and can be classified as having "high", "moderate" or "low" sensitivity. The degree of sensitivity in any location is based on the characteristics of the land use, including the time of day and the reason people are at the particular location (e.g for work, home or recreation). In a residential area, an acceptable odour is likely to be much lower than would be acceptable in a rural or industrial area.

8.2 Sensitivities of Nearby Receptors to Odour

8.2.1 Sensitivity to odour in rural environments

People living in and visiting rural-zoned areas typically have a higher tolerance for rural activities and their associated effects. However, in rural-residential areas, sensitivities can be higher, particularly as people often move into these areas for lifestyle reasons and can be particularly sensitive to amenity issues. People can be present at rural dwellings at all times of the day and night, both indoors and outdoors, but the population density is relatively low. Therefore, the opportunity for people to be adversely affected is also relatively less than in residential areas. The Ministry for the Environment's good practice guides for assessing odour and dust (GPG Odour and GPG Dust[18]) recommends that dwellings in rural areas should be considered as having a "moderate" to "high" sensitivity to odour.

8.2.2 Sensitivity to odour in areas surrounding the BSM Plant

The closest areas to the BSM site with a "moderate" to "high" sensitivity to odour are individual dwellings. Table 4-1 and Figure 4-1 show the locations of the nearest neighbours.

Rural areas surrounding the site are considered to have a "low" sensitivity to potential odours from the site.

8.3 Complaints History and Procedures

BSM maintains a record of the complaints received and the site's compliance with resource consent requirements. In the past, there were often strong odours associated wastewater treatment. However, since the upgraded WWTP has been operating no complaints regarding odour from the site have been received. Complaints received since 2018 are presented in Table 8-1.

Table 8-1 Odour Complaints Received by BSM Since 2018

Complaint Date	Time
26/01/2018	7:16am
30/01/2018	7:49am
9/03/2018	7:40am
22/03/2018	11:48am
11/09/2018	8:35am
20/09/2018	8:15am
18/10/2018	18:35am
20/10/2018	20:35am
26/10/2018	21:05am
26/10/2018	9:00am
13/11/2018	9:30am
30/01/2019	2.44pm
25/07/2019	10:40am
21/01/2020	8:35am
23/04/2020	9:20am
9/05/2020	8:40am
7/9/2020	-

BSM is committed to operating as a responsible member of the community and will continue to operate an "open door" policy and encourage neighbours to contact the plant directly regarding any air emission issues or concerns.

If BSM receives any complaints from neighbours regarding excessive odours from its operations, an investigation is initiated, as soon as practicable, into the cause of excessive odours. Appropriate measures are then undertaken to ensure that the adverse effects of such odours are avoided or mitigated. BSM use a complaint form to guide its response and investigation and copies of any completed forms are provided to Environment Southland with the annual BSM Environmental Monitoring Report.

[18] Ministry for the Environment (2016) *Good Practice Guide for Assessing and Managing Odour*

8.4 Odour Effects

8.4.1 Worst case conditions for odour effects

The most important meteorological conditions affecting dispersion of odour are wind speed and direction, and atmospheric stability. For emissions occurring close to ground level, such as those from the WWTP, calm (wind speeds of less than 0.5 m/s) and low wind speeds (less than about 1.5 m/s) tend to result in the highest concentrations of odour downwind. During calm wind conditions, odour may accumulate on-site and when the wind speed increases, the accumulated envelope of odour can move off-site and can cause adverse odour effects in the downwind receiving environment. This phenomenon is particularly prevalent during inversion conditions, which can be experienced at night in cold, clear, still weather conditions. In these conditions, cool air is overlain by warmer air and odour can be trapped close to the ground as convection currents are less effective.

Low wind speeds tend to result in odours being noticeable at greater downwind distances than higher wind speeds, as less mixing occurs at low wind speeds and consequently, the odour plume can travel downwind with little dilution and dispersion.

Calm wind conditions (i.e. wind speeds <5m/s) as predicted by AERMET occurred for 0.32% of the time at the site. Low wind speeds (i.e. <1.5m/s) occurred for approximately 1.5% of the time. The predicted wind data shows a high frequency of winds from the northwest quarter (~40% of the time) with wind also being channelled up and down the valley from the southwest and northeast (~7% of the time in both directions).

The strongest winds are from the north-westerly quarter.

Winds from the northwest quarter have the potential to blow odours generated at the BSM site towards the nearest dwelling located approximately 470 m to the southeast across Morton Mains Rd. Winds from the north would blow any odour towards the dwelling located approximately 900 m to the south on Waituna Morton Mains Rd. Winds from the south would blow any odour towards the dwelling located approximately 900 m to the north of the plant.

Calm and low wind speeds from the northwest quarter, which are most conducive to transporting odour longer distances would blow towards the nearest dwelling in the southeast approximately 0.3 and 6.24% of the time respectively – which is relatively infrequently. However, the majority of cold clear conditions with calm winds are likely to occur in the winter months of the year when plant production is low, or the plant is shut down.

8.4.2 Separation distances

Comparison of the separation distances that exist between the odour sources and sensitive receptors with relevant guidance on odour separation distances published by regulatory, or industry bodies can be used to inform an assessment of the potential for adverse odour impacts.

While there are no relevant New Zealand guidelines, the Western Australia and South Australia Environment Protection Authorities have published separation distances for meat processing plants which include wastewater treatment and disposal facilities[19][20]. Both authorities recommend a separation distance of at least 1000m between the plant and sensitive receptors. The South Australian EPA document notes that odour produced during rendering and the treatment of wastewater are the main potential impacts from meat processing plants. The document notes that the use of appropriate odour removal technologies is effective in reducing the potential for adverse odour effects.

[19] Western Australia Environmental Protection Authority "*Guidance for the Assessment of Environmental Factors Separation Distances between Industrial and Sensitive Land Uses No. 3"* June 2005.

[20] South Australia Environment Protection Authority "*Evaluation Distances for effective air quality and noise management",* August 2016

It is important to note that buffer distances are intended to protect neighbours from the effects of process upsets and equipment breakdowns. It is therefore possible to have sensitive receptors within these distances if there are tight controls in place to minimise the risk that such abnormal conditions will occur.

The receptors that are the most sensitive to odours from the BSM plant and WWTP are the dwellings located approximately 470 m to the southeast, as well as approximately 900 m to the north and south. These receptors are located within the guideline separation distance recommended by the Australian authorities.

8.5 Consideration of FIDOL Factors

8.5.1 Intensity

The odour generated from the BSM process plant and WWTP is expected to be of a reasonably low intensity during normal operation to the extent that is unlikely to be discernible beyond the boundary of BSM's property. While localised odour may increase during process upsets, the separation distance of at least 470m between the WWTP and nearest sensitive receptors is considered sufficient to mitigate any potential adverse odour nuisance effects at these locations if an abnormal emission should occur. Any emitted odour is expected to be well diluted and dispersed before reaching these locations, however low-level odour may still be detected on occasions.

BSM has developed operational procedures for the handling of solids and to avoid process upsets which are included in the Operations and Maintenance Manual developed for the WWTP. The plant has been designed to minimise plant overloads and storage times of unprocessed wastewater and solids. Dissolved oxygen concentrations are continuously monitored and kept at sufficient levels to ensure aerobic conditions are maintained in the SBR plant. Consequently, the risk of upset conditions occurring are reduced as far as practicable and providing the plant continues to be appropriately operated and maintained upset events are expected to occur rarely and to be of short duration.

A site Air Discharges Management Plan has also been developed that provides operational procedures to mitigate the generation of odour from plant processes.

8.5.2 Frequency and duration

Odour emissions will be continuous when the plant and WWTP are operating but may vary with production rates and activities such as if rendering plant doors are open or upsets occur at the WWTP. Regardless, odour emissions beyond the boundary of the site are expected to be limited given the reasonably low intensity of emissions during normal operation and the distance separating the odour sources from sensitive receptors. Abnormal conditions are expected to occur infrequently and be transitory in nature given the management processes in place.

The frequency and duration of conditions when odour may be detected beyond the boundary of the site are also influenced by meteorological factors. The influence of meteorological conditions on odour dispersion is discussed in Section 7.4.1.

8.5.3 Offensiveness

The offensive or hedonic tone of an odour is a subjective issue, and the perception of that odour varies from person to person. The character of the odour will vary with the specific chemical characteristics of the odour. While odour from rendering and wastewater treatment facilities (in the absence of mitigation) has a strongly negative hedonic tone, the degree of "offensiveness" experienced at the nearest sensitive receptor beyond the boundary will depend on the treatment and controls provided at source, dilution and dispersion after discharge and an individual's perception, or sensitivity to that particular odour.

A low population density, as occurs around the BSM site, means that the opportunities for sensitive people to be exposed to odours is lower. People living in and visiting rural areas generally have a high tolerance for rural-type odours. Some odours such as silage are offensive to some people and pleasant to others. Although these people can be desensitised to rural-type odours, they can still be sensitive to different types of odour (such as an industrial odour). Rural communities may be more tolerant of rural-type odours but may be highly sensitive to non-rural-type odours (e.g rural residents are not likely to be any more tolerant of rendering plant odours than those living in large metropolitan areas).

While neighbours closest to the BSM site are expected to have a “moderate” to “high” sensitivity to odour, there may be a degree of desensitisation to the occasional presence of odours as a result of the normal operation of the plant. However, strong odours arising from ongoing upset conditions at either the rendering plant or WWTP would likely be considered offensive.

8.5.4 Location

The plant is located in a rural area with Woodlands the nearest small settlement (7 km east of the site). The nearest dwellings are separated from the plant and WWTP by at least 470 m of BSM land and farmland. The land application system is located closer to these dwellings in the north of the site.

These dwellings are located within the guideline separation distance recommended by the Australian authorities for meat processing plants. While minimum guideline buffer distances are greater than currently exists at the BSM site, these are more appropriate to the location of a new plant. The existing plant has operated for over 30 years at the site and the presence (and possible encroachment) of sensitive development around it cannot be easily controlled. The existing 470 m minimum separation to the nearest dwelling provides a reasonable buffer from the BSM site under normal operating conditions, with the appropriate odour management controls in place.

8.5.5 Summary of odour effects

In summary, while the rural receiving environment surrounding the plant and WWTP is relatively insensitive to odour, there are several dwellings that lie between approximately 470 – 900 m from the site that will have a greater degree of sensitivity. These distances provide reasonable separation between potential odour sources and the nearest sensitive receptors providing the appropriate odour management controls are carried out. The mitigation controls set out in Section 9 and the Site Air Discharge Management Plan describe the controls necessary to minimise the risk of offensive or objectionable odour occurring beyond the site boundary.

Historically, the plant (especially the WWTP) has caused odour at these locations under light downwind conditions. However, since the upgrading of the WWTP, only one complaint has been received by BSM since July 2020, which was on 7 September 2020, but was not associated with BSM’s operations. Providing the plant and WWTP continues to be operated and maintained appropriately by BSM (see Mitigation in Section 9), the risk of offensive or objectionable odour occurring beyond the boundary of the site and at sensitive locations further afield is expected to be low. Furthermore, having appropriate management responses to any potential odour incidents will also aid in determining the cause and resolution in a timely manner.

The Site Air Discharge Management Plan, WWTP Operations and Maintenance Manual and Wastewater Farm Environmental Management Plan provide a good basis for minimising the likelihood of odour generation at the site and the risks of offensive or objectionable odour occurring beyond the boundary.

9 Mitigation Methods

9.1 Overview

This section of the report provides an overview of the methods used by BSM to mitigate the discharges to air on the site.

New Zealand does not have any guidance on good practice emission control techniques or emission limits for discharges to air from industry, however there is some guidance available from Australia, United Kingdom and the European Union, which has been referenced in this discussion.

9.2 Combustion Plant (Boilers)

9.2.1 Energy efficiency and carbon reduction

An Opportunity Assessment Report[21] has been prepared as part of the Energy Efficiency and Conservation Authority (EECA)'s ETA programme. This report provides a preliminary indication of energy efficiency and energy-related carbon reduction opportunities for BSM.

The report found that BSM has a pathway to reduce coal use and carbon emissions in the order of 85% through:

- Recovering waste heat, especially from the rendering plant.
- Some demand reduction steps, such as upgrading hose nozzles and improved pipe insulation.
- Replacing the HWB with a heat pump driven off the reject heat from the soon-to-be installed refrigeration plant. A heat pump will fall within the current electrical supply capacity.
- Replacing the RSB with a technology which is yet to be determined. Options include:
    - Bio-mass fired boiler
    - Electric boiler (this would require a significant upgrade to the electricity supply network)
    - Tallow-fired boiler.

BSM plans to decommission the HWB by August 2024. This will be achieved through improved heat recovery, the installation of a new heat pump and reductions in hot water demand. BSM is also planning to remove the RSB when a practicable alternative technology is available (in line with carbon reduction requirements).

9.2.2 Emission controls, maintenance and monitoring

A number of boiler control, maintenance and monitoring measures are carried out to mitigate the impacts of any air emissions from the operation of the boiler as follows:

- Carrying out 12 monthly servicing of each boiler with reports provided to Environment Southland. The boilers are inspected and serviced by a qualified consultant. This servicing includes calibration, internal cleaning and replacement or repair of damaged equipment and services if necessary and, adjustment of the air to fuel ratio to optimise energy efficiency and to minimise the emission of produces of incomplete combustion.
- Tuning the boilers to ensure optimal fuel combustion, minimum fuel use and minimum particulate emissions.
- Ensuring the optimal operation of the grit arrestor system.

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[21] Beca Ltd (20201) *Blue Sky Meats Energy Transition Accelerator (ETA) Study Report*

- Emptying ash on a weekly basis.
- Setting coal burning rates to ensure compliance with consent limits.
- Reviewing Newvale Mine coal analyses monthly to ensure compliance with sulphur (0.5%), ash (7%) and fine particle composition <3.35 mm (<30%) consent limits and provide results with annual report to Environment Southland.
- Discharging emissions via the 20 and 18.7 m stacks to ensure adequate dilution and dispersion.
- Observing the opacity of emissions during daily duties to ensure compliance with consent limits as specified in Condition 4 (specifically Ringelmann Shade 1 except for start-up conditions or short periods).

9.3 Odour from Processing Plant (rendering and blood drying)

A number of controls and management processes are covered in the site management plan. These are utilised to mitigate the potential for odour creation from the processing plant (rendering and blood drying) as follows:

- Processing fresh material as soon as practicable or storing it chilled.
- Conveying rendering raw material from meat processing departments into the rendering building as soon as practicable.
- Maintaining the rendering room at a negative pressure at all times which, with the automatic closing door, will retain the majority of the odorous air within the building.
- Collecting all point sources of vapours produced in the cooking and meal and tallow processes in the rendering plant and venting directly to a condenser and then to the plant biofilter.
- Ensuring 12 changes of rendering building air per hour discharged to the biofilter. The building is force-ventilated to comply with existing consent conditions and best practice.
- Minimising external door opening times particularly during operation of the cookers.
- Undertaking daily housekeeping and thorough cleaning of the process units and surrounding areas.
- Maintaining and replacement of the sock type air filter on the blood mill exhaust.

It is noted that the biofilter air extraction fan is interlocked into the rendering process i.e. the rendering process cannot operate without the biofilter extraction fan operating.

9.3.1 Biofilter

All rendering/blood drying building ventilation air and non-condensable gases from the condenser are directed to an odour control biofilter. The specifications of the biofilter were approved by Environment Southland prior to construction. Construction of the biofilter as specified ensures that key aspects of the odour control capacity of the biofilter are met.

The biofilter is a primary site odour management system and ongoing monitoring and maintenance is a critical aspect.

Ongoing monitoring and regular maintenance includes:

- Undertaking daily visual checks of the biofilter to ensure even distribution of the exit gases.
- Checking for signs of biofilter bed degradation e.g slumping.
- Ensuring biofilter bed moisture levels are maintained and applying water to the bed if necessary. Water should be routinely irrigated to its surface, at least three 4-hour periods a week over the entire biofilter during extended periods with no rain.
- Maintaining a pH level of between 6 and 8 (monthly check). Hydrated lime can be thinly spread on the surface to maintain pH if required).
- Monitoring the inlet humidity and temperature of the biofilter continuously.
- Monitoring the pressure drop over the media on a monthly basis to maintain it less than about 1-1.5 kPa (100 – 150 mm water gauge).

- Regularly upgrading the biofilter with new bark and regular checking of the air distribution system.
- Weekly checking downwind of the biofilter for the presence of recognisable rendering odour.

9.4 Odour from Wastewater Treatment and Disposal System

9.4.1 Treatment plant

The WWTP is operated predominantly by an automatic control system and must be well managed so that the treated effluent quality remains within the limits set out by resource consents and the risks of odour creation remains low. Possible sources of odours include biogas emissions from the Anaerobic Lagoon and discharges to air from the SBR.

BSM monitors and manages the creation and discharge of odours from the WWTP under the requirements of the WWTP Operation and Maintenance Manual. This document is intended to be utilised by the system operators to assist with general plant operation.

Odour control from the WWTP is based on the following management practices and principles:

- Regular inspections and maintenance of equipment including cleaning of sumps during the off-season shutdown.
- Daily cleaning (hosing) to remove any accumulated biodegradable material.
- Contingency methods for plant malfunctions.
- Complaint investigation follow-up and resolution procedures.
- Training procedures for operators regarding the methods to be used to control odours.
- A requirement for an annual review of the O and M Manual.

9.4.2 Biogas flare

The biogas collection system operates on pressure as well as timer control. When the pressure under the lagoon cover rises, due to biogas production, the biogas blower starts and operates the biogas flare. When the pressure under the cover reaches a set vacuum pressure the biogas blower and biogas flare stop and will not start again until the pressure rises to the restart pressure and the pre-set time delay has elapsed. If the pressure under the cover gets too high an alarm is triggered. If the biogas flare fails to ignite, biogas will be re-directed to the biofilter. The manual valve on the biogas pipework allows the biogas to be directed to only the biofilter so that maintenance or repair work can be undertaken on the biogas flare.

9.4.3 Sequencing Batch Reactor

Significant odour generation from the SBR can be an indication that the treatment system is being overloaded. In this case, a loading assessment of the SBR Lagoon is conducted, along with an investigation into the treatment performance of the Covered Anaerobic Lagoon.

The WWTP O and M Manual sets out a number of actions if significant odour from the SBR is detected as follows:

- Stop all flows passing though the Covered Anaerobic Lagoon
- Assess the DO setpoint and if possible, increase it to 2.5 mg/L.
- If the aerators are unable to provide ongoing maintenance of a DO concentrations above 0.1 mg/L, then sample the Covered Anaerobic Lagoon effluent from the transfer pipe between the two lagoons.
- If the BOD concentration is above 1,000 mg/L, investigate raw wastewater loads to identify any over-loading issues or performance problems with the Covered Anaerobic Lagoon.

9.4.4 Contingency management

The risk of abnormal operating conditions occurring at the WWTP is further mitigated by the following:

- The plant is sized to avoid overloading and includes system redundancy.
- Operators are fully trained.
- The plant is regularly maintained and managed including contingency planning.
- Aerators are controlled by in-line automated dissolved oxygen monitors.
- Biomass to influent BOD loading ratio is monitored and controlled to ensure the treatment plant is not overloaded.
- Emergency power supply is available to provide power to the aerators.

9.4.5 Wastewater irrigation

BSM has a number of controls to minimise and manage potential odour sources beyond the site boundary under the requirements of a Site Wastewater Farm Environmental Management Plan:

- Maintenance of plant equipment to a high engineering standard including monthly checks of parts and cut-off systems.
- Management of the WWTP in accordance with standard operating procedures (SOP) and good management practices. This ensures that wastewater in the plant does not become anaerobic (use of aerators to maintain minimum dissolved oxygen (DO) concentrations and wastewater storage times are minimised.
- Use of small impact K line pods sprinklers to reduce spray drift.
- Twice daily check of irrigation operation including hoses and couplings.
- Adjustment of irrigator speed and return period in response to climatic and soil conditions.
- Maintenance of the following separation distances to mitigate odour and spray drift
  - 20 m from any water course
  - 20 m from any property boundary
  - 100m from any residence potable water sources.
- Review of prevailing wind direction before irrigating in paddocks adjacent to Woodlands Morton Mains Road.
- Odour in irrigation areas is monitored by observation, interaction with neighbours and feedback from community stakeholders. Where odour related issues are identified causes are identified and appropriate mitigation is implemented.
- Shelterbelts are grown on some boundaries where appropriate and will be maintained unless requested by neighbours.

9.5 Air Discharges Management Plan

An overall site Air Discharges Management Plan has been developed for the site by BSM[22]. The plan fulfils the requirements of Condition 16 of existing Consent AUTH-201193-V5 and details actions to be taken to minimise odour and particulate matter emissions from the site. The Plan also provides guidance for staff to ensure compliance with consent conditions. Separate Standard Operating Procedures (SOPs) have also been prepared by BSM and are included in the relevant Departmental SOP Manuals.

9.6 Summary of Mitigation and Best Practicable Option

Overall, the methods used to control and manage the emissions from the boilers, process facility, the WWTP and irrigation area are considered to be consistent with industry good practice. Taking this into account, along with the consideration of alternatives described in the application documentation it is considered that the mitigation carried out at the BSM site represents the best practicable option.

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[22] *BlueSky Pastures – Air Discharges Management Plan* Version 2 April 2021

10 Proposed Consent Conditions

It is recommended that the conditions of Auth AUTH-2011193-V5 and AUTH - 20191937 – 04 be amalgamated into one consent, with updating and amendments to reflect the current air discharge consenting environment.

There are some more substantive changes which are described below.

A complete set of proposed conditions is contained in **Appendix D**.

11 Conclusions

The conclusions drawn from this assessment of the actual and potential effects of the emissions to air from the BSM meat processing plant are summarised as follows:

- The main contaminants discharged to air from the site are combustion products (particulate matter and sulphur dioxide) from the coal-fired boilers and odours from the plant, biofilters and wastewater treatment plant.
- The site and surrounding area are predominantly rural (and relatively insensitive to contaminants emitted from the site), apart from a number of residences that are assessed as being sensitive to these contaminants (particularly odour). The site has however been established in this location for many years and forms part of local environment.
- The results of dispersion modelling indicates that ambient combustion contaminants (SO_2, TSP, NO_X) are expected to meet all relevant air quality criteria beyond the site boundary. Following the decommissioning of the HWB there will actually be a net reduction in emissions over the current consented levels.
- Providing the odours from the plant processes, biofilter and the WWTP are well managed in accordance with the requirements of the Site Air Discharges Management Plan, the WWTP Operations and Maintenance Manual and the Wastewater Irrigation Plan, objectionable and offensive odours are unlikely to occur at the closest sensitive receptors outside the site boundary.
- The emission controls used at the site are consistent with good industry practice and representative of the best practicable option.
- There is no impediment to the granting of a new site air discharge consent under the NESAQ regulations.

Provided the mitigation measures and emission controls continue to be implemented as described in this assessment and the recommended conditions are complied with, the discharge of contaminants to air from the BSM site will be appropriately avoided or mitigated such that any residual adverse effects beyond the site boundary will not result in any exceedances of the NESAQ or AAQG and will not be offensive or objectionable.

A

Appendix A – Existing Air Discharge Consents

AUTH-201193-V5

Cnr North Road and Price Street
(Private Bag 90116)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Air Discharge Permit

Pursuant to Section 105(1) of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Blue Sky Meats (NZ) Ltd** (the "consent holder") of **Morton Mains, R D 1, Invercargill** from 23 May 2003.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge contaminants to the air from a meat processing plant, rendering and blood drying plant and associated boilers
Location	- site locality	Morton Mains
	- map reference	F46:745:195
	- receiving environment	Air
Legal description of land at the site:		Lot 1 DP 595 and Pt Lots 7 & 8 DP 159 being Pt Sec 42 Blk VIII Lothian HD; Lots 9, 12 and 13 DP 159 and Lots 292 and 293 DP 155 being Sec 42 Blk VIII Lothian HD; Lot 1 DP 12016 being Pt Sec 12 Blk VIII Lothian HD; Lot 1 DP 8287 and Lot 1 DP 12194
History of Amendments:		Conditions amended on 22 April 2009,8 June 2015, and 30 March 2016 as follows. Consent varied on 22 November 2018. Conditions amended on 28 February 2019
Expiry date:		31 December 2022

Schedule of Conditions

General

1. This resource consent shall expire on 31 December 2022.

2. This consent allows the discharge of contaminants from the applicant's industrial premises at Morton Mains from the following sources, as described in the original application; the variation application dated 5 March 2015 and further information dated 14 May 2015 and 27 May 2015, and the application for variation to the refrigerant system dated 13 December 2018, subject to the conditions set out in this document:

   (a) A rendering plant processing up to 5,750 kg of raw material per hour;
   (b) A blood processing and drying operation;
   (c) A meat processing plant;
   (d) Collection and treatment of wastewater from rendering and meat processing, until the date that the wastewater treatment system described in the 13 December 2018 application is commissioned;
   (e) Irrigation onto land of up to 1000 cubic metres per day of wastewater;
   (f) One 4.3 MW coal-fired boiler;
   (g) One 2 MW coal-fired boiler;
   (h) Offal pits;
   (i) Salting shed

Boilers

3. (a) The maximum coal burning rate in the 4.3MW boiler shall not exceed 1350 kilograms of coal per hour.
   (b) The maximum coal burning rate in the 2MW boiler shall not exceed 630 kilograms of coal per hour.

4. The opacity of emissions from the chimney stacks of the coal-fired boilers shall not be darker than Ringelmann Shade 1 as described in New Zealand Standard 5201:1973 except:

   (a) in the case of a cold start, for a period not exceeding 30 minutes in the first hour of operation; and
   (b) for a period not exceeding a total of four minutes in each succeeding hour of operation.

5. (a) The discharge into air from the 4.3MW boiler shall occur via a stack at a height of at least 20 metres above ground level and at least 9 metres above the roof ridgeline of any adjacent building.

   (b) The discharge into air from the 2MW boiler shall occur via a stack at a height of at least 19 metres above ground level and at least 10 metres above the roof ridgeline of any adjacent building.

(c) The discharges shall be directed vertically into air and shall not be impeded by any obstruction above the stack which decreases the vertical efflux velocity.

6. The sulphur content of a representative sample of the coal burned shall not exceed 0.5 percent by weight. The ash content of that sample shall be less than 7 percent by weight. The sample shall contain less than 30 percent by weight of fine particles having a diameter of less than 3.35 millimetres.

7. (a) The concentration of particulate matter in combustion gas discharged from the coal-fired boiler chimney stacks shall not exceed 500 milligrams per cubic metre adjusted to 0 degrees Celsius, dry gas basis, 101.3 kilopascals, and 8 percent oxygen or 12 percent carbon dioxide.

(b) Any measurement to confirm compliance with the particulate concentration limit shall occur when the tested boiler is operating at greater than 75 percent of the maximum continuous rating. The method of sampling and analysis shall comply with ISO 9096:1992(E), and may include methods BS 6069: 1992, ASTM D3685-78, ASTM D3685M-92, AS 4323.2-1995, US EPA Method 5, US EPA Method 17 or an equivalent method that complies with the fundamental sampling requirements of ISO 9096:1992(E).

8. The boiler stacks shall be fitted with source emission test ports and safe access for testing, to the satisfaction of Environment Southland.

9. The coal-fired boilers shall be serviced and maintained to ensure compliance with Conditions 4 and 7(a) at all times. Service reports shall be prepared and retained, and copies shall be provided to Environment Southland on request.

Rendering and Meat Processing

10. (a) Only fresh raw material or suitably preserved material shall be processed in the rendering plant.

(b) Raw material for rendering shall not be held on-site for more than 24 hours.

(c) Suitably preserved material shall be material that is chilled or frozen and is derived from cutting, boning or further processing of animal tissue that has been chilled or frozen within 24 hours of the time of slaughter.

11. The air within the rendering plant building shall be maintained at negative pressure at all times during processing such that all ventilation air is discharged via a biofilter, as described in the application.

12. The rendering plant biofilter shall be capable of treating at least 12 air changes per hour and shall contain filter media to a depth of at least 1 metre. Design plans of the biofilter shall be provided to Environment Southland for approval, prior to construction.

13. Processing areas, collection sumps and traps in the meat processing plant and rendering plant shall be cleaned at least daily to minimise odour emissions.

Wastewater Treatment and Irrigation

14. (a) Wastewater shall be maintained in an aerobic condition using two Apex 45 aerators in order to minimise odour, as described in the application to vary the consent lodged on 1 March 2016. Wastewater shall not be held in the storage pond for a continuous period of more than 2 days unless aerated to avoid the onset of anaerobic conditions.
    (b) The consent holder shall notify the consent authority in writing (email: escompliance@es.govt.nz) upon commission of the wastewater treatment system described in the resource consent application dated 13 December 2018
    (c) Condition 14(a) shall cease to have effect from the date that the wastewater treatment system is commissioned, and after that date the emissions from the treatment and storage of wastewater on the site shall be authorised under Resource Consent AUTH-20181937-04, or other rule or resource consent.

15. Wastewater shall not be irrigated onto land within 20 metres of any property boundary. There shall be no spray drift beyond that property boundary.

Site Management Plan

16. Management Plan:

    (a) By the 31st of December 2015, an updated site management plan shall be prepared and provided to the Consent Authority for approval. This management plan shall detail all actions to be taken to minimise odour and particulate matter emissions from the plant and to ensure compliance with the conditions of this consent. The plan shall address:

    (i) Wastewater collection and treatment, including maximum holding times;
    (ii) Wastewater irrigation procedures and minimum setback distances; and
    (iii) Boiler plant maintenance.

    (b) Within three months of commissioning of the rendering plant, an update of the plan shall be submitted to the Council's Manager of Environmental Compliance. The update shall include the above matters and the following:

    (i) Biofilter maintenance requirements;
    (ii) Operating procedures to minimise odour emissions from the rendering and blood-drying plant.

    (c) The management plan shall state the name and contact telephone number of all persons responsible for each action described in the plan and shall be updated at least annually to include staff changes. The plan shall be available for inspection at the consent holder's property at all times.

Odour Conditions

17. The discharges shall not cause odour that is offensive or objectionable to such an extent that it has an adverse effect on the environment beyond the boundary of the property on which the consent is exercised.

18. A record of any complaints relating to odour shall be kept, and shall include:

    (a) the location where the effect was detected by the complainant;
    (b) the date and time when the effect was detected;
    (c) a description of the wind speed and wind direction when the effect was detected by the complainant;
    (d) the most likely cause of the effect detected; and
    (e) any corrective action undertaken by the consent holder to avoid, remedy or mitigate the effect detected by the complainant.

    This record shall be provided to Environment Southland annually and otherwise on request.

19. Should, in the opinion of the Council's Manager of Environmental Compliance, odour complaint records indicate that discharges from the consent holder's activities are causing odour nuisance, the consent holder shall instigate a systematic odour diary programme during the subsequent year to establish the characteristics of odour impacts caused by the discharges. The design of the odour diary programme shall be in accordance with recognised good practice and shall be to the satisfaction of Environment Southland. Results of the odour diary programme shall be reported to Environment Southland within two months of completion of the programme. The report shall include an assessment of the need for mitigation of any adverse effects identified.

Administration Conditions

20. The consent holder shall pay an annual administration charge to the Southland Regional Council, collected in accordance with Section 36 of the Resource Management Act, payable in advance on the first day of July each year. The charge shall include the cost of two inspections of the effluent discharge area by Council officers each year.

21. The Southland Regional Council may serve notice, as a result of information received, in accordance with the conditions of this permit, and in accordance with Sections 128 and 129 of the Act, in the period May to September each year, of its intention to review the conditions of the consent for the purposes of:

    (i) dealing with any adverse or cumulative effects on the environment which may arise from the exercise of this consent;

(ii) addressing monitoring requirements; or
(iii) complying with the requirements of a regional plan.

22. The consent holder may apply to the Council for the change or cancellation of any of the conditions of this consent, other than Condition 1, in accordance with Section 127 of the Resource Management Act, during the period May to September each year.

Reissued 28 February 2019 after changes to Condition 2

for the **Southland Regional Council**

Aurora Grant
Consents Manager

environment SOUTHLAND
REGIONAL COUNCIL
Te Taiao Tonga

Cnr North Road and Price Street
(Private Bag 90116
DX YX20175)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Discharge Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Blue Sky Meats (NZ) Ltd** of **729 Woodlands Morton Mains Road, RD 1, Morton Mains, Invercargill 9871** from **28 February 2019.**

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge contaminants to air from a wastewater treatment system
Location	- site locality	729 Woodlands Morton Mains Road, Morton Mains
	- map co-ordinates	NZTM2000 1,264,980E 4,857,710N
	- airshed	Southland
Legal description of land at the site:		Lot 1 DP 595
Expiry date:		**31 December 2022**

Schedule of Conditions

General conditions

1. This resource consent authorises the emission of contaminants to air from a wastewater treatment process, as described in the resource consent application dated 13 December 2018 (ES Objective references A442772 & A442771).

2. The discharge shall not cause odour or spray drift that is offensive or objectionable to such an extent that it has an adverse effect on the environment beyond the boundary of Lot 1 DP 595.

3. The Consent Holder shall ensure that biogases generated from any anaerobic treatment facility are combusted via a flare or an energy recovery system at all times except under the following circumstances:

   a. in the event of a combustion equipment failure; or

   b. for combustion equipment maintenance purposes; or

c. for periodic venting of biogases via the flare blower as part of the routine maintenance programme; or

d. during commissioning of the new anaerobic treatment facility when a continuous discharge to the biofilter, may be required until such time as the thermal destruction is self sustaining; or

e. for purposes of supplying a continuous supply of small amounts of biogases from the covered anaerobic treatment facility to enable maintenance of the biofilter.

4. Under the circumstances where biogases are not flared and/or utilised for energy recovery then biogases shall be vented to the contingency biofilter. If use of the biofilter is required for more than 20 days in any calendar year ended 31 December, the Consent Holder shall within 60 days provide Environment Southland with a report which details the reason for the use of the biofilter during the year.

5. The consent holder shall maintain a diary of odour and spray drift complaints.
   a. The diary shall record:
      - the effect observed by the complainant;
      - the date and time of each complaint;
      - weather conditions (such as wind direction, approximate wind speed, temperature);
      - location of the complaint;
      - nature and intensity of the odour or spray drift; and
      - the action taken in response to the complaint.

      (Note: This condition does not require the consent holder to take action over every complaint but it does require that that decision be recorded.)

   b. The consent holder shall provide a record of the complaints diary to the Southland Regional Council on request

6. The consent holder shall maintain an after-hours contact number for the receipt of complaints and concerns about dust emissions. This contact number shall be listed on the consent holder's website (https://bluesky.co.nz).

7. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of this consent during the period 1 February to 30 September each year, or within two months of any enforcement action being taken by the Consent Authority in relation to the exercise of this consent, for the purposes of:
   a. Determining whether the conditions of this permit are adequate to deal with any adverse effect on the environment, including cumulative effects, which may arise from the exercise of the permit, and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the permit;
   b. Ensuring the conditions of this consent are consistent with any National Environmental Standards Regulations, relevant plans and/or the Environment Southland Regional Policy Statement;
   c. Amending the monitoring programme to be undertaken;
   d. Adding or adjusting compliance limits;
   e. Requiring the Consent Holder to adopt the best practicable option to remove or reduce any adverse effect on the environment arising as a result of the exercise of this permit.

for the **Southland Regional Council**

Aurora Grant
Consents Manager

Notes:

1. *The Consent Holder shall pay an annual administration and monitoring charge to the Consent Authority, collected in accordance with Section 36 of the Resource Management Act, 1991, payable in advance on 1 July each year.*

2. *In accordance with Section 125(1)(a) of the Resource Management Act, this consent will lapse after a period of five years after the date of commencement unless it is given effect to or an application is made to extend the lapse period before the consent lapses.*

3. *In accordance with section 126 of the Resource Management Act, 1991, this consent may be cancelled by the Consent Authority if not exercised for a continuous period of 2 years or more.*

4. *The Consent Holder is reminded that they may apply at any time under Section 127 of the Act to have any condition of this consent changed except that which specifies the expiry date of this consent.*

5. *If you require a replacement permit upon the expiry date of this permit, any new application should be lodged at least 6 months prior to the expiry date of this permit. Applying at least 6 months before the expiry date may enable you to continue to exercise this permit until a decision is made, and any appeals are resolved, on the replacement application.*

B

Appendix B – 2021 and 2022 Particulate Test Results

Particulate Emission Report

Total Suspended Particulates (TSP) PM_{10} and $PM_{2.5}$

4.3 MW Vekos Packaged Boiler

Author(s):	H.Jones
Ref Number:	I12-20-0016.1
Consent Number:	AUTH-201193-V3
Client Name:	Blue Sky Meats
Client Address:	Morton Mains RD1 Invercargill
Date of Issue:	29 January 2021
Signature: ***Name & Designation:***	Harry Jones Air Quality Analyst
Approved: ***Name & Designation:***	Andy Englefield Air Quality Analyst
Distribution: ***(other than client)***	Nil

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Table of Contents

Verum Group

Particulate Emission Report
Blue Sky Meats

Verum Group

Introduction

Verum Group was engaged by Blue Sky Meats to perform particulate testing on 4.3 MW Vekos Packaged Boiler. The purpose of the monitoring was to satisfy the conditions of Resource Consent AUTH-201193-V3. Testing was carried out on 22 January 2021.

Methodology

The method used was USEPA Method 201A - Determination of PM_{10} Emissions (Constant Sampling Rate Procedure). This method is accredited by IANZ under Verum Group Christchurch's scope of accreditation.

Results

The results are not within the air discharge limits set out by the resource consent. The average particulate concentration and emission rate from testing, as well as the resource consent limit are summarised below:

Actual concentration of total particulate matter	476	mg/dsm^3
Concentration of total particulate matter corrected to 12% CO_2	607	mg/dsm^3
Total particulate emission rate	3.1	kg/hr
Percentage of PM_{10} particulates	61	%
Concentration of PM_{10} particulates at 12% CO_2	370	mg/dsm^3
Emission rate of PM_{10} particulates	1.9	kg/hr
Percentage of $PM_{2.5}$ particulates	12	%
Concentration of $PM_{2.5}$ particulates at 12% CO_2	74	mg/dsm^3
Emission rate of $PM_{2.5}$ particulates	0.4	kg/hr
Resource Consent limit - Total particulate matter corrected to 12% CO_2	500	mg/dsm^3

Test 1 Summary

Site	Blue Sky Meats	Ref #	I12-20-0016.1	Date of Test	22 January 2021

Plant Description

Boiler:	4.3 MW Vekos Packaged Boiler	
Firing System:	Overfeed Screw Stoker	
Emission Control:	Mutlicyclones	
Load:	75% MCR	
Stack Diameter:	0.705	m

Fuel Analysis (as received basis)

Moisture:	44.0	%
Ash:	3.4	%
Calorific Value:	14.2	MJ/kg
Type:	Lignite	

Method Details

Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate Procedure).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Flat Filter - glass microfibre size 63mm
Leakage Tests Performed By:	ATE/HJJ

Sampling Start Time:	9:01 AM	Total Sample Time:	24 mins	Sample Time at Each Point:	2 mins (avg)

Stack Gas Conditions at Sample Point

Stack Gas Pressure:	99.42	kPa
Stack Gas Density:	0.732	kg/m^3
Average Temperature:	199	°C
Average Velocity:	9.1	m/s
Dry Gas Volumetric Flow Rate:	6633	dsm^3/hr

For conditions at the sampling plane see figures 1 & 2

Conditions of Sampling

Nozzle Internal Diameter:	6.520	mm
Isokinetics:	102.1	%
Gas Meter START Reading:	213.918	m^3
Gas Meter STOP Reading:	214.169	m^3
Gas Meter Static Pressure:	0.02	kPa
Gas Meter Temperature:	22	°C
Dry Gas Volume Sampled:	0.2287	dsm^3
Particulate Matter Collected:	117.60	mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	10.8	10.9	%
Carbon Dioxide content*:	9.2	12.9	%
Carbon Monoxide content (*ppm dry*):	*1181.2*	*0.10*	%
Nitrogen content#:	79.9	70.9	%
Gas Moisture content:	8.3	5.2	%

Results

Actual Concentration of Total Particulates:	**516**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**672**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**3.42**	**kg/hr**
Percentage of PM_{10} Particulates:	**64**	**%**
Concentration of PM_{10} Particulates at 12% CO_2:	**432**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**2.20**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**17**	**%**
Concentration of $PM_{2.5}$ Particulates at 12% CO_2:	**117**	**mg/dsm^3**
Emission Rate of $PM_{2.5}$ Particulates:	**0.60**	**kg/hr**

Notes

* CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

\# Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

Test 2 Summary

Site	Blue Sky Meats	Ref #	I12-20-0016.1	Date of Test	22 January 2021

Plant Description

Boiler:	4.3 MW Vekos Packaged Boiler	
Firing System:	Overfeed Screw Stoker	
Emission Control:	Mutlicyclones	
Load:	75% MCR	
Stack Diameter:	0.705	m

Fuel Analysis (as received basis)

Moisture:	44.0	%
Ash:	3.4	%
Calorific Value:	14.2	MJ/kg
Type:	Lignite	

Method Details

Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate Procedure).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Flat Filter - glass microfibre size 63mm
Leakage Tests Performed By:	ATE/HJJ

Sampling Start Time: 9:53 AM   Total Sample Time: 24 mins   Sample Time at Each Point: 2 mins (avg)

Stack Gas Conditions at Sample Point

Stack Gas Pressure:	99.52	kPa
Stack Gas Density:	0.735	kg/m^3
Average Temperature:	199	°C
Average Velocity:	9.0	m/s
Dry Gas Volumetric Flow Rate:	6580	dsm^3/hr

For conditions at the sampling plane see figures 1 & 2

Conditions of Sampling

Nozzle Internal Diameter:	6.520	mm
Isokinetics:	103.0	%
Gas Meter START Reading:	214.191	m^3
Gas Meter STOP Reading:	214.443	m^3
Gas Meter Static Pressure:	0.02	kPa
Gas Meter Temperature:	23	°C
Dry Gas Volume Sampled:	0.2290	dsm^3
Particulate Matter Collected:	111.60	mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	10.5	10.7	%
Carbon Dioxide content*:	9.4	13.2	%
Carbon Monoxide content (*ppm dry*):	*1001.8*	*0.09*	%
Nitrogen content[#]:	79.9	71.0	%
Gas Moisture content:	8.1	5.0	%

Results

Actual Concentration of Total Particulates:	**489**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**623**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**3.22**	**kg/hr**
Percentage of PM_{10} Particulates:	**61**	**%**
Concentration of PM_{10} Particulates at 12% CO_2:	**381**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**1.97**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**11**	**%**
Concentration of $PM_{2.5}$ Particulates at 12% CO_2:	**66**	**mg/dsm^3**
Emission Rate of $PM_{2.5}$ Particulates:	**0.34**	**kg/hr**

Notes

* CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

[#] Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

Test 3 Summary

Site	Blue Sky Meats	Ref #	I12-20-0016.1	Date of Test	22 January 2021

Plant Description

Boiler:	4.3 MW Vekos Packaged Boiler	
Firing System:	Overfeed Screw Stoker	
Emission Control:	Mutlicyclones	
Load:	75% MCR	
Stack Diameter:	0.705	m

Fuel Analysis (as received basis)

Moisture:	44.0	%
Ash:	3.4	%
Calorific Value:	14.2	MJ/kg
Type:	Lignite	

Method Details

Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate Procedure).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105℃
Particulate Separator:	Flat Filter - glass microfibre size 63mm
Leakage Tests Performed By:	ATE/HJJ

Sampling Start Time: 10:40 AM Total Sample Time: 24 mins Sample Time at Each Point: 2 mins (avg)

Stack Gas Conditions at Sample Point

Stack Gas Pressure:	99.52	kPa
Stack Gas Density:	0.733	kg/m^3
Average Temperature:	199	℃
Average Velocity:	9.1	m/s
Dry Gas Volumetric Flow Rate:	6594	dsm^3/hr

For conditions at the sampling plane see figures 1 & 2

Conditions of Sampling

Nozzle Internal Diameter:	6.520	mm
Isokinetics:	103.9	%
Gas Meter START Reading:	214.471	m^3
Gas Meter STOP Reading:	214.726	m^3
Gas Meter Static Pressure:	0.02	kPa
Gas Meter Temperature:	23	℃
Dry Gas Volume Sampled:	0.2315	dsm^3
Particulate Matter Collected:	97.70	mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	10.3	10.4	%
Carbon Dioxide content*:	9.7	13.4	%
Carbon Monoxide content (*ppm dry*):	*839.8*	*0.07*	%
Nitrogen content[#]:	80.0	70.6	%
Gas Moisture content:	8.8	5.5	%

Results

Actual Concentration of Total Particulates:	**423**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**526**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**2.79**	**kg/hr**
Percentage of PM_{10} Particulates:	**56**	**%**
Concentration of PM_{10} Particulates at 12% CO_2:	**296**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**1.57**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**8**	**%**
Concentration of $PM_{2.5}$ Particulates at 12% CO_2:	**40**	**mg/dsm^3**
Emission Rate of $PM_{2.5}$ Particulates:	**0.21**	**kg/hr**

Notes

* CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

[#] Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

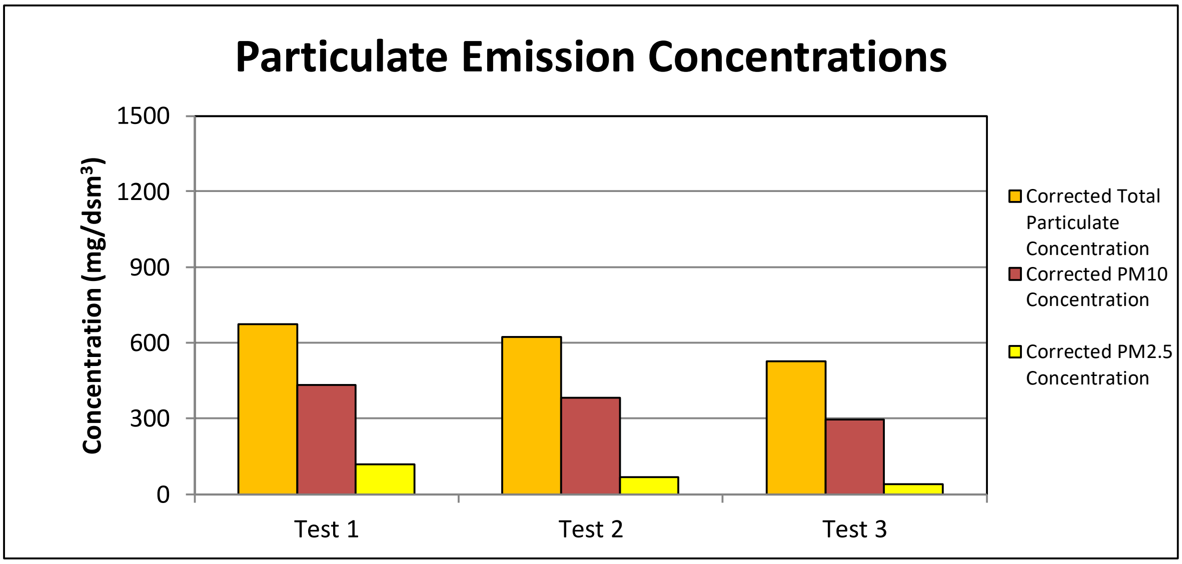
All gas volumes are expressed at 273 K and 101.325 kPa.

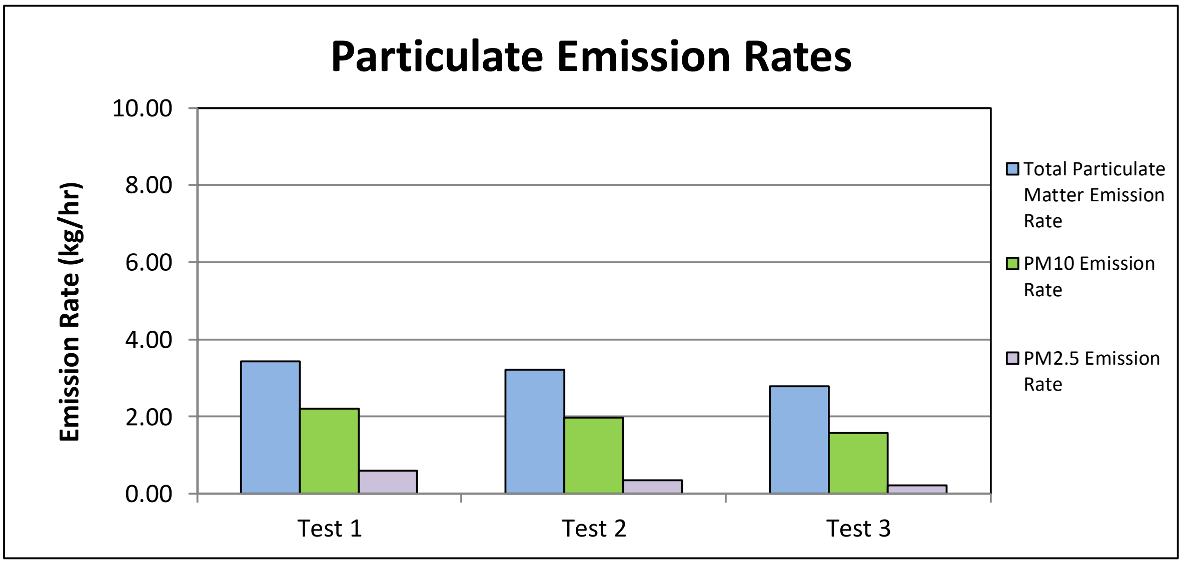
dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

Summary of Results

4.3 MW Vekos Packaged Boiler

	Test 1	Test 2	Test 3	Average	Units
Actual concentration of total particulates	516	489	423	476	mg/dsm^3
Concentration of total particulate matter at 12% CO_2	672	623	526	607	mg/dsm^3
Total particulate matter emission rate	3.42	3.22	2.79	3.14	kg/hr
Percentage of PM_{10} particulates	64	61	56	61	%
Concentration of PM_{10} particulates at 12% CO_2	432	381	296	370	mg/dsm^3
Emission rate of PM_{10} particulates	2.20	1.97	1.57	1.91	kg/hr
Percentage of $PM_{2.5}$ particulates	17	11	8	12	%
Concentration of $PM_{2.5}$ particulates at 12% CO_2	117	66	40	74	mg/dsm3
Emission rate of $PM_{2.5}$ particulates	0.60	0.34	0.21	0.38	kg/hr





This report must be quoted in full except with permission from Verum Group Ltd.

Figure 1. Photo of the sampling location

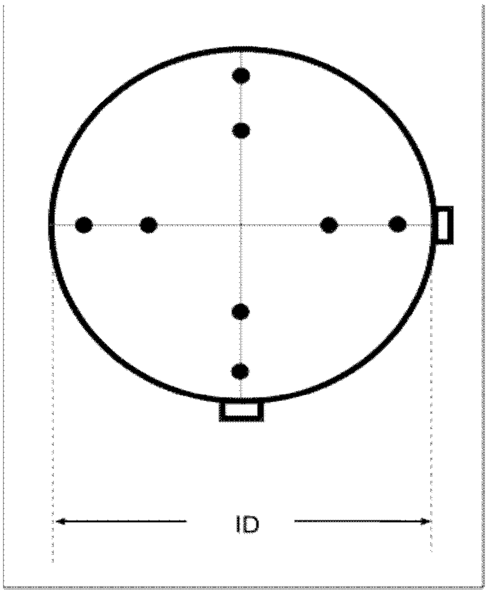


Figure 2. Diagram of the sampling plane

This report must be quoted in full except with permission from CRL Energy Ltd.

Quality Assurance

Company	Blue Sky Meats
Date of Test	22 January 2021
Reference Number	I12-20-0016.1
Plant Description	4.3 MW Vekos Packaged Boiler

Variation from Isokinetic

	% Variation	Pass or Fail
Test 1	2.1	**Pass**
Test 2	3.0	**Pass**
Test 3	3.9	**Pass**

Leakage Test

		Gas Meter Reading (m^3)			Leak	Test Flowrate	% Leak	Pass or
		Start	End	Difference	(l/min)	(l/min)	Flowrate	Fail
Test 1	Pre Leak	213.9181	213.9182	0.0001	0.1	10.4	0.96	**Pass**
	Post Leak	214.1744	214.1744	0.0000	0.0	10.4	0.00	**Pass**
Test 2	Pre Leak	214.1909	214.1909	0.0000	0.0	10.5	0.00	**Pass**
	Post Leak	214.4495	214.4495	0.0000	0.0	10.5	0.00	**Pass**
Test 3	Pre Leak	214.4711	214.4711	0.0000	0.0	10.6	0.00	**Pass**
	Post Leak	214.7328	214.7328	0.0000	0.0	10.6	0.00	**Pass**

* Any leak must be less than either 0.5663 l/min or 4% of the average sample flow over the test run (whichever is less)

Cut Diameter of the PM_{10} and $PM_{2.5}$ Particulate

	PM_{10} Cut (µm)	Pass or Fail? (9 <> 11)	$PM_{2.5}$ Cut (µm)	Pass or Fail? (2.25 <> 2.75)
Test 1	10.28	**Pass**	2.444	**Pass**
Test 2	10.30	**Pass**	2.449	**Pass**
Test 3	10.15	**Pass**	2.391	**Pass**

Additional Information

Fuel Composition	New Vale
Max Capable Rating (MCR)	6.8 TPH
Activities During Testing	Rendering
MW Output of Appliance	4.3 MW
Plant Load During Testing	5.1 TPH
% of MCR During Testing	75% MCR

PARTICULATE EMISSIONS TEST SHEET Test 1

Verum Group

Ref #	I12-20-0016.1	Site	Blue Sky Meats							
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp in (°C)	DGM Temp out (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	2.00	0.03	0.14	10.4	20.8	21.1	197	10.9	1199	-10
2	4.00	0.05	0.15	10.4	20.8	21.0	198	10.6	1120	-10
3	6.00	0.08	0.15	10.4	20.8	21.0	198	10.6	1097	-10
4	8.00	0.12	0.16	10.4	20.9	21.2	199	10.6	1123	-10
5	10.00	0.18	0.17	10.4	21.0	21.4	200	10.2	929	-10
6	12.00	0.25	0.19	10.4	21.2	21.6	200	10.3	953	-10
7	14.00	0.45	0.22	10.4	21.4	21.7	200	10.2	945	-10
8	16.00	0.53	0.20	10.4	21.6	22.0	201	11.2	1530	-10
9	18.00	0.58	0.21	10.4	21.8	22.2	200	11.7	1566	-10
10	20.00	0.62	0.18	10.4	21.9	22.3	199	11.2	1324	-11
11	22.00	0.66	0.16	10.4	22.0	22.4	199	10.9	1221	-11
12	24.00	0.68	0.16	10.4	22.0	22.4	198	10.8	1167	-11
Averages			0.17	10.4	21.4	21.7	199	10.8	1181	-10

Plant Description	4.3 MW Vekos Packaged Boiler	Test Date	22 January 2021
		Start Time	9:01 AM
Firing System	Overfeed Screw Stoker	End Time	9:25 AM
Emission Control	Mutlicyclones	Test Time	24
Load	75% MCR	Trv. Pnts	12

GAS METER		LEAK TEST		
Start	213.918	Test done by	ATE/HJJ	
Half Way	n/a		Start	Stop
Stop	214.169	Pre	213.9181	213.9182
Factor	1.002	Post	214.1744	214.1744

GENERAL DETAILS			
Pitot Constant	0.84	Filter No.	T20-209
Static ("WG)	0.10	Filter Mass (g)	0.1176
Atmos Press (kPa)	99.4	Asmd Duct Moisture %	9
Nozzle ϕ (mm)	6.520	Balance Check (+/-)	0
Stack ϕ (m)	0.705	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	459.5	472.8
CV (MJ/kg)	14.18	No. 2 (g)	485.1	485.1
Fuel Type	Lignite	No. 3 (g)	414.9	415.9
Fuel Composition	New Vale	Silica (g)	674.0	676.4

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PARTICULATE EMISSIONS TEST SHEET

Test 2

Ref #	I12-20-0016.1	Site	Blue Sky Meats							
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp in (°C)	DGM Temp out (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	1.80	0.03	0.14	10.5	22.1	22.6	199	11.1	1446	-13
2	3.66	0.05	0.14	10.5	22.1	22.7	199	11.0	1397	-13
3	5.52	0.08	0.16	10.5	22.2	22.7	199	10.9	1324	-14
4	7.44	0.12	0.17	10.5	22.2	22.8	199	10.4	1014	-14
5	9.42	0.18	0.17	10.5	22.3	22.9	199	10.3	1002	-15
6	11.52	0.25	0.18	10.5	22.4	22.9	199	10.3	998	-16
7	13.77	0.45	0.20	10.5	22.4	23.0	200	10.5	967	-17
8	15.92	0.53	0.20	10.5	22.5	23.1	199	10.6	974	-17
9	18.12	0.58	0.19	10.5	22.4	23.2	198	10.7	1096	-18
10	20.16	0.62	0.17	10.5	22.3	23.2	197	10.5	662	-18
11	22.08	0.66	0.16	10.5	22.4	23.2	197	10.2	597	-18
12	24.00	0.68	0.16	10.5	22.5	23.3	197	10.0	545	-19
Averages			0.17	10.5	22.3	23.0	199	10.5	1001.83	-16

Plant Description	4.3 MW Vekos Packaged Boiler	Test Date	22 January 2021
		Start Time	9:53 AM
Firing System	Overfeed Screw Stoker	End Time	10:17 AM
Emission Control	Mutlicyclones	Test Time	24
Load	75% MCR	Trv. Pnts	12

GAS METER		LEAK TEST		
Start	214.191	Test done by	ATE/HJJ	
Half Way	n/a		Start	Stop
Stop	214.443	Pre	214.1909	214.1909
Factor	1.002	Post	214.4495	214.4495

GENERAL DETAILS			
Pitot Constant	0.84	Filter No.	T20-129
Static ("WG)	0.10	Filter Mass (g)	0.1053
Atmos Press (kPa)	99.5	Asmd Duct Moisture %	9
Nozzle ϕ (mm)	6.520	Balance Check (+/-)	0
Stack ϕ (m)	0.705	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	472.8	485.1
CV (MJ/kg)	14.18	No. 2 (g)	485.1	485.4
Fuel Type	Lignite	No. 3 (g)	415.9	415.9
Fuel Composition	New Vale	Silica (g)	676.4	679.9

PARTICULATE EMISSIONS TEST SHEET

Test 3

Verum Group

Ref #	I12-20-0016.1	Site	Blue Sky Meats							
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp in (°C)	DGM Temp out (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	1.82	0.03	0.13	10.6	22.3	23.4	197	10.7	956	-9
2	3.64	0.05	0.14	10.6	22.3	23.3	198	10.7	934	-11
3	5.58	0.08	0.19	10.6	22.4	23.3	198	10.6	921	-12
4	7.58	0.12	0.19	10.6	22.4	23.2	198	10.2	824	-13
5	9.59	0.18	0.23	10.6	22.3	23.2	198	10.1	835	-14
6	11.65	0.25	0.20	10.6	22.2	23.3	199	10.0	814	-16
7	13.82	0.45	0.20	10.6	22.3	23.3	200	10.3	878	-16
8	15.99	0.53	0.19	10.6	22.4	23.2	201	10.5	890	-17
9	18.11	0.58	0.17	10.6	22.5	23.4	201	10.2	803	-18
10	20.11	0.62	0.16	10.6	22.6	23.4	201	10.0	764	-19
11	22.06	0.66	0.15	10.6	22.6	23.3	200	10.1	733	-19
12	24.00	0.68	0.14	10.6	22.5	23.5	200	10.0	725	-19
Averages			0.17	10.6	22.4	23.3	199	10.3	840	-15

Plant Description	4.3 MW Vekos Packaged Boiler	Test Date	22 January 2021
		Start Time	10:40 AM
Firing System	Overfeed Screw Stoker	End Time	11:04 AM
Emission Control	Mutlicyclones	Test Time	24
Load	75% MCR	Trv. Pnts	12

GAS METER		LEAK TEST		
Start	214.471	Test done by	ATE/HJJ	
Half Way	n/a		Start	Stop
Stop	214.726	Pre	214.4711	214.4711
Factor	1.002	Post	214.7328	214.7328

GENERAL DETAILS			
Pitot Constant	0.84	Filter No.	T20-207
Static ("WG)	0.10	Filter Mass (g)	0.1177
Atmos Press (kPa)	99.5	Asmd Duct Moisture %	9
Nozzle ϕ (mm)	6.520	Balance Check (+/-)	0
Stack ϕ (m)	0.705	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	485.1	496.1
CV (MJ/kg)	14.18	No. 2 (g)	485.4	488.2
Fuel Type	Lignite	No. 3 (g)	415.9	419.6
Fuel Composition	New Vale	Silica (g)	679.9	680.4

Particulate Emission Report

Total Suspended Particulates (TSP) PM_{10} and $PM_{2.5}$

2 MW Vekos Packaged Boiler

Author(s):	H.Jones
Ref Number:	I12-20-0016.2
Consent Number:	AUTH-201193-V3
Client Name:	Blue Sky Meats
Client Address:	Morton Mains RD1 Invercargill
Date of Issue:	29 January 2021
Signature: ***Name & Designation:***	Harry Jones Air Quality Analyst
Approved: ***Name & Designation:***	Andy Englefield Air Quality Analyst
Distribution: ***(other than client)***	Nil

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Table of Contents

Verum Group

Particulate Emission Report
Blue Sky Meats

Verum Group

Introduction

Verum Group was engaged by Blue Sky Meats to perform particulate testing on 2 MW Vekos Packaged Boiler. The purpose of the monitoring was to satisfy the conditions of Resource Consent AUTH-201193-V3. Testing was carried out on 22 January 2021.

Methodology

The method used was USEPA Method 201A - Determination of PM10 Emissions (Constant Sampling Rate Procedure). This method is accredited by IANZ under Verum Group Christchurch's scope of accreditation.

Results

The results are not within the air discharge limits set out by the resource consent. The average particulate concentration and emission rate from testing, as well as the resource consent limit are summarised below:

Actual concentration of total particulate matter	719	mg/dsm^3
Concentration of total particulate matter corrected to 12% CO_2	736	mg/dsm^3
Total particulate emission rate	3.8	kg/hr
Percentage of PM_{10} particulates	55	%
Concentration of PM_{10} particulates at 12% CO_2	407	mg/dsm^3
Emission rate of PM_{10} particulates	2.1	kg/hr
Percentage of $PM_{2.5}$ particulates	9	%
Concentration of $PM_{2.5}$ particulates at 12% CO_2	62	mg/dsm^3
Emission rate of $PM_{2.5}$ particulates	0.3	kg/hr
Resource Consent limit - Total particulate matter corrected to 12% CO_2	500	kg/hr

Test 1 Summary

Site	Blue Sky Meats	Ref #	I12-20-0016.2	Date of Test	22 January 2021

Plant Description

Boiler:	2 MW Vekos Packaged Boiler
Firing System:	Overfeed Screw Stoker
Emission Control:	Mutlicyclones
Load:	75% MCR
Stack Diameter:	0.600 m

Fuel Analysis (as received basis)

Moisture:	44.0	%
Ash:	3.4	%
Calorific Value:	14.2	MJ/kg
Type:	Lignite	

Method Details

Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate Procedure).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Flat Filter - glass microfibre size 63mm
Leakage Tests Performed By:	ATE/HJJ

Sampling Start Time: 12:25 PM Total Sample Time: 24 mins Sample Time at Each Point: 3 mins (avg)

Stack Gas Conditions at Sample Point

Stack Gas Pressure:	99.50	kPa
Stack Gas Density:	0.775	kg/m^3
Average Temperature:	179	°C
Average Velocity:	9.4	m/s
Dry Gas Volumetric Flow Rate:	5232	dsm^3/hr

For conditions at the sampling plane see figures 1 & 2

Conditions of Sampling

Nozzle Internal Diameter:	6.520	mm
Isokinetics:	95.2	%
Gas Meter START Reading:	214.814	m^3
Gas Meter STOP Reading:	215.069	m^3
Gas Meter Static Pressure:	0.00	kPa
Gas Meter Temperature:	22	°C
Dry Gas Volume Sampled:	0.2323	dsm^3
Particulate Matter Collected:	179.40	mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	8.0	8.1	%
Carbon Dioxide content*:	11.7	16.3	%
Carbon Monoxide content (*ppm dry*):	*210.6*	*0.02*	%
Nitrogen content#:	80.2	71.0	%
Gas Moisture content:	7.4	4.6	%

Results

Actual Concentration of Total Particulates:	**775**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**795**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**4.05**	**kg/hr**
Percentage of PM_{10} Particulates:	**48**	**%**
Concentration of PM_{10} Particulates at 12% CO_2:	**378**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**1.93**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**9**	**%**
Concentration of $PM_{2.5}$ Particulates at 12% CO_2:	**74**	**mg/dsm^3**
Emission Rate of $PM_{2.5}$ Particulates:	**0.38**	**kg/hr**

Notes

* CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

\# Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

Test 2 Summary

Site	Blue Sky Meats	Ref #	I12-20-0016.2	Date of Test	22 January 2021

Plant Description		**Fuel Analysis** (as received basis)		
Boiler:	2 MW Vekos Packaged Boiler	Moisture:	44.0	%
Firing System:	Overfeed Screw Stoker	Ash:	3.4	%
Emission Control:	Mutlicyclones	Calorific Value:	14.2	MJ/kg
Load:	75% MCR	Type:	Lignite	
Stack Diameter:	0.600 m			

Method Details

Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate Procedure).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Flat Filter - glass microfibre size 63mm
Leakage Tests Performed By:	ATE/HJJ

Sampling Start Time: 1:06 PM Total Sample Time: 24 mins Sample Time at Each Point: 3 mins (avg)

Stack Gas Conditions at Sample Point			**Conditions of Sampling**		
Stack Gas Pressure:	99.40	kPa	Nozzle Internal Diameter:	6.520	mm
Stack Gas Density:	0.773	kg/m^3	Isokinetics:	94.5	%
Average Temperature:	179	°C	Gas Meter START Reading:	215.088	m^3
Average Velocity:	9.4	m/s	Gas Meter STOP Reading:	215.340	m^3
Dry Gas Volumetric Flow Rate:	5197	dsm^3/hr	Gas Meter Static Pressure:	0.00	kPa
			Gas Meter Temperature:	22	°C
For conditions at the sampling plane see figures 1 & 2			Dry Gas Volume Sampled:	0.2291	dsm^3
			Particulate Matter Collected:	138.10	mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	8.0	8.1	%
Carbon Dioxide content*:	11.7	16.3	%
Carbon Monoxide content (*ppm dry*):	*208.3*	*0.02*	%
Nitrogen content[#]:	80.3	70.9	%
Gas Moisture content:	7.8	4.8	%

Results

Actual Concentration of Total Particulates:	**605**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**618**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**3.14**	**kg/hr**
Percentage of PM_{10} Particulates:	**59**	**%**
Concentration of PM_{10} Particulates at 12% CO_2:	**363**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**1.85**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**10**	**%**
Concentration of $PM_{2.5}$ Particulates at 12% CO_2:	**62**	**mg/dsm^3**
Emission Rate of $PM_{2.5}$ Particulates:	**0.31**	**kg/hr**

Notes

* CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

[#] Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

Test 3 Summary

Site	Blue Sky Meats	Ref #	I12-20-0016.2	Date of Test	22 January 2021

Plant Description

Boiler:	2 MW Vekos Packaged Boiler	
Firing System:	Overfeed Screw Stoker	
Emission Control:	Mutlicyclones	
Load:	75% MCR	
Stack Diameter:	0.600	m

Fuel Analysis (as received basis)

Moisture:	44.0	%
Ash:	3.4	%
Calorific Value:	14.2	MJ/kg
Type:	Lignite	

Method Details

Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate Procedure).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Flat Filter - glass microfibre size 63mm
Leakage Tests Performed By:	ATE/HJJ

Sampling Start Time: 1:45 PM   Total Sample Time: 24 mins   Sample Time at Each Point: 3 mins (avg)

Stack Gas Conditions at Sample Point

Stack Gas Pressure:	99.40	kPa
Stack Gas Density:	0.775	kg/m^3
Average Temperature:	180	°C
Average Velocity:	9.4	m/s
Dry Gas Volumetric Flow Rate:	5276	dsm^3/hr

For conditions at the sampling plane see figures 1 & 2

Conditions of Sampling

Nozzle Internal Diameter:	6.520	mm
Isokinetics:	92.9	%
Gas Meter START Reading:	215.361	m^3
Gas Meter STOP Reading:	215.613	m^3
Gas Meter Static Pressure:	0.00	kPa
Gas Meter Temperature:	23	°C
Dry Gas Volume Sampled:	0.2287	dsm^3
Particulate Matter Collected:	177.00	mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	8.0	8.1	%
Carbon Dioxide content*:	11.7	16.4	%
Carbon Monoxide content (*ppm dry*):	*245.1*	*0.02*	%
Nitrogen content#:	80.2	71.4	%
Gas Moisture content:	6.7	4.1	%

Results

Actual Concentration of Total Particulates:	**776**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**795**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**4.10**	**kg/hr**
Percentage of PM_{10} Particulates:	**60**	**%**
Concentration of PM_{10} Particulates at 12% CO_2:	**479**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**2.47**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**6**	**%**
Concentration of $PM_{2.5}$ Particulates at 12% CO_2:	**49**	**mg/dsm^3**
Emission Rate of $PM_{2.5}$ Particulates:	**0.25**	**kg/hr**

Notes

* CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

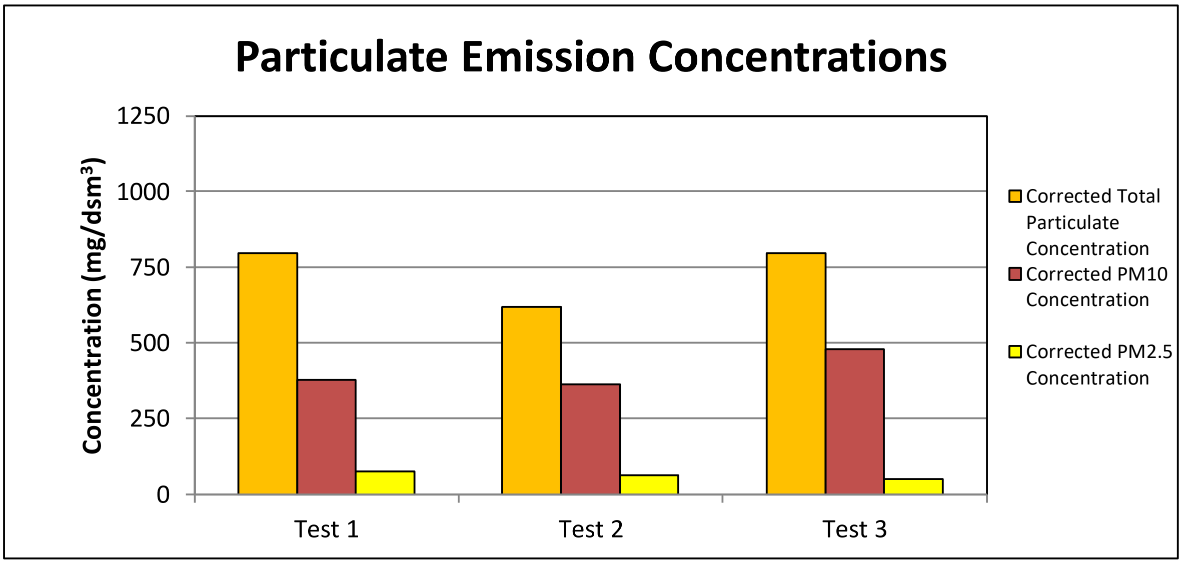
\# Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

	Test 1	Test 2	Test 3	Average	Units
Actual concentration of total particulates	775	605	776	719	mg/dsm^3
Concentration of total particulate matter at 12% CO_2	795	618	795	736	mg/dsm^3
Total particulate matter emission rate	4.05	3.14	4.10	3.76	kg/hr
Percentage of PM_{10} particulates	48	59	60	55	%
Concentration of PM_{10} particulates at 12% CO_2	378	363	479	407	mg/dsm^3
Emission rate of PM_{10} particulates	1.93	1.85	2.47	2.08	kg/hr
Percentage of $PM_{2.5}$ particulates	9	10	6	9	%
Concentration of $PM_{2.5}$ particulates at 12% CO_2	74	62	49	62	mg/dsm3
Emission rate of $PM_{2.5}$ particulates	0.38	0.31	0.25	0.32	kg/hr



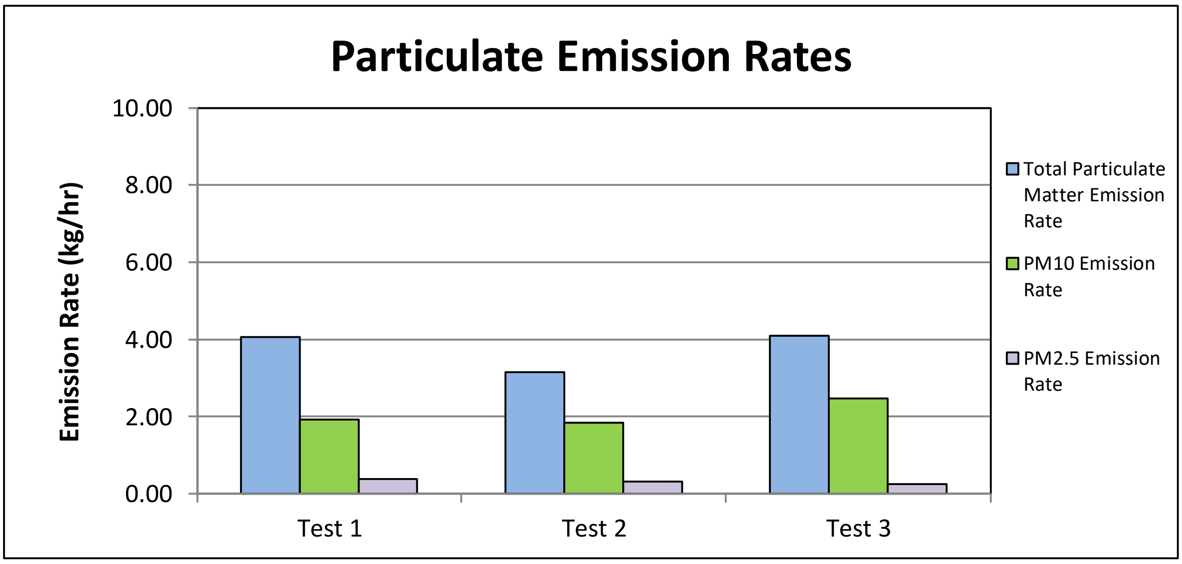


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Figure 1. Photo of the sampling location

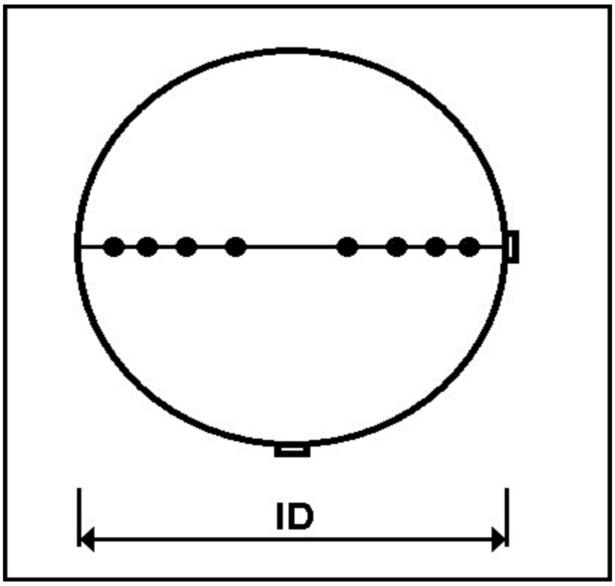

Figure 2. Diagram of the sampling plane

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Quality Assurance

Company	Blue Sky Meats
Date of Test	22 January 2021
Reference Number	I12-20-0016.2
Plant Description	2 MW Vekos Packaged Boiler

Variation from Isokinetic

	% Variation	Pass or Fail
Test 1	-4.8	**Pass**
Test 2	-5.5	**Pass**
Test 3	-7.1	**Pass**

Leakage Test

		Gas Meter Reading (m^3) Start	End	Difference	Leak (l/min)	Test Flowrate (l/min)	% Leak Flowrate	Pass or Fail
Test 1	Pre Leak	214.8135	214.8135	0.0000	0.0	10.7	0.00	**Pass**
	Post Leak	215.0741	215.0741	0.0000	0.0	10.7	0.00	**Pass**
Test 2	Pre Leak	215.0874	215.0875	0.0001	0.1	10.5	0.95	**Pass**
	Post Leak	215.3520	215.3520	0.0000	0.0	10.5	0.00	**Pass**
Test 3	Pre Leak	215.3606	215.3606	0.0000	0.0	10.5	0.00	**Pass**
	Post Leak	215.6189	215.6189	0.0000	0.0	10.5	0.00	**Pass**

* Any leak must be less than either 0.5663 l/min or 4% of the average sample flow over the test run (whichever is less)

Cut Diameter of the PM_{10} and $PM_{2.5}$ Particulate

	PM_{10} Cut (µm)	Pass or Fail? (9 <> 11)	$PM_{2.5}$ Cut (µm)	Pass or Fail? (2.25 <> 2.75)
Test 1	10.21	**Pass**	2.378	**Pass**
Test 2	10.28	**Pass**	2.406	**Pass**
Test 3	10.40	**Pass**	2.450	**Pass**

Additional Information

Fuel Composition	New Vale
Max Capable Rating (MCR)	3.1 TPH
Activities During Testing	Steam Production
MW Output of Appliance	2 MW
Plant Load During Testing	2.3 TPH
% of MCR During Testing	75% MCR

PARTICULATE EMISSIONS TEST SHEET Test 1

Verum Group

Ref #	I12-20-0016.2		Site	Blue Sky Meats						
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp in (°C)	DGM Temp out (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	3.00	0.02	0.17	10.7	21.4	22.0	178	8.1	204	-13
2	6.00	0.06	0.16	10.7	21.4	22.0	178	8.1	206	-13
3	9.00	0.12	0.19	10.7	21.5	22.1	178	8.0	214	-14
4	12.00	0.19	0.22	10.7	21.5	22.2	179	8.1	217	-14
5	15.00	0.41	0.25	10.7	21.5	22.2	179	8.2	207	-14
6	18.00	0.48	0.20	10.7	21.6	22.2	180	8.0	211	-15
7	21.00	0.54	0.18	10.7	21.6	22.3	180	7.9	210	-15
8	24.00	0.58	0.20	10.7	21.6	22.3	180	7.9	216	-16
Averages			0.20	10.7	21.5	22.2	179	8.0	211	-14

Plant Description	2 MW Vekos Packaged Boiler	Test Date	22 January 2021
		Start Time	12:25 PM
Firing System	Overfeed Screw Stoker	End Time	12:49 PM
Emission Control	Mutlicyclones	Test Time	24
Load	75% MCR	Trv. Pnts	8

GAS METER		LEAK TEST		
Start	214.814	Test done by	ATE/HJJ	
Half Way	n/a		Start	Stop
Stop	215.069	Pre	214.8135	214.8135
Factor	1.002	Post	215.0741	215.0741

GENERAL DETAILS			
Pitot Constant	0.84	Filter No.	T20-208
Static ("WG)	0.00	Filter Mass (g)	0.1174
Atmos Press (kPa)	99.5	Asmd Duct Moisture %	8
Nozzle ϕ (mm)	6.520	Balance Check (+/-)	0
Stack ϕ (m)	0.600	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	465.2	475.6
CV (MJ/kg)	14.18	No. 2 (g)	475.2	475.9
Fuel Type	Lignite	No. 3 (g)	419.6	419.2
Fuel Composition	New Vale	Silica (g)	680.4	684.7

PARTICULATE EMISSIONS TEST SHEET Test 2

Verum Group

Ref #	I12-20-0016.2		Site	Blue Sky Meats						
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp in (°C)	DGM Temp out (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	2.80	0.02	0.18	10.5	21.7	22.3	178	8.0	202	-15
2	5.51	0.06	0.15	10.5	21.8	22.4	179	8.0	199	-15
3	8.47	0.12	0.19	10.5	21.9	22.5	179	8.0	210	-15
4	11.66	0.19	0.22	10.5	21.9	22.4	179	7.8	208	-16
5	15.05	0.41	0.21	10.5	21.9	22.6	179	8.1	207	-16
6	18.08	0.48	0.23	10.5	22.0	22.5	180	8.1	206	-16
7	20.96	0.54	0.20	10.5	22.1	22.5	180	8.0	214	-16
8	24.00	0.58	0.18	10.5	22.2	22.6	181	7.9	220	-17
Averages			0.20	10.5	21.9	22.5	179	8.0	208.25	-15.75

Plant Description	2 MW Vekos Packaged Boiler	Test Date	22 January 2021
		Start Time	1:06 PM
Firing System	Overfeed Screw Stoker	End Time	1:30 PM
Emission Control	Mutlicyclones	Test Time	24
Load	75% MCR	Trv. Pnts	8

GAS METER		LEAK TEST		
Start	215.088	Test done by	ATE/HJJ	
Half Way	n/a		Start	Stop
Stop	215.340	Pre	215.0874	215.0875
Factor	1.002	Post	215.3520	215.3520

GENERAL DETAILS			
Pitot Constant	0.84	Filter No.	T20-204
Static ("WG)	0.00	Filter Mass (g)	0.1172
Atmos Press (kPa)	99.4	Asmd Duct Moisture %	8
Nozzle ϕ (mm)	6.520	Balance Check (+/-)	0
Stack ϕ (m)	0.600	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	475.6	487.4
CV (MJ/kg)	14.18	No. 2 (g)	475.9	475.9
Fuel Type	Lignite	No. 3 (g)	419.2	419.3
Fuel Composition	New Vale	Silica (g)	684.7	688.3

PARTICULATE EMISSIONS TEST SHEET — Test 3

Verum Group

Ref #	I12-20-0016.2	Site	Blue Sky Meats							
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp in (°C)	DGM Temp out (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	2.89	0.02	0.16	10.5	22.4	22.7	181	8.2	223	-16
2	5.52	0.06	0.17	10.5	22.4	22.8	180	8.0	237	-16
3	8.49	0.12	0.16	10.5	22.5	22.8	180	8.0	245	-16
4	11.68	0.19	0.25	10.5	22.6	22.8	181	8.1	256	-16
5	14.80	0.41	0.26	10.5	22.7	22.7	180	8.1	261	-17
6	18.07	0.48	0.24	10.5	22.7	22.8	180	8.0	254	-17
7	21.11	0.54	0.17	10.5	22.6	22.9	180	7.8	244	-18
8	24.00	0.58	0.18	10.5	22.6	22.9	181	7.9	241	-18
Averages			0.20	10.5	22.6	22.8	180	8.0	245	-17

Plant Description	2 MW Vekos Packaged Boiler	Test Date	22 January 2021
		Start Time	1:45 PM
Firing System	Overfeed Screw Stoker	End Time	2:09 PM
Emission Control	Mutlicyclones	Test Time	24
Load	75% MCR	Trv. Pnts	8

GAS METER		LEAK TEST		
Start	215.361	Test done by	ATE/HJJ	
Half Way	n/a		Start	Stop
Stop	215.613	Pre	215.3606	215.3606
Factor	1.002	Post	215.6189	215.6189

GENERAL DETAILS			
Pitot Constant	0.84	Filter No.	T20-205
Static ("WG)	0.00	Filter Mass (g)	0.1173
Atmos Press (kPa)	99.4	Asmd Duct Moisture %	8
Nozzle ϕ (mm)	6.520	Balance Check (+/-)	0
Stack ϕ (m)	0.600	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	487.4	497.7
CV (MJ/kg)	14.18	No. 2 (g)	475.9	475.4
Fuel Type	Lignite	No. 3 (g)	419.3	419.1
Fuel Composition	New Vale	Silica (g)	688.3	691.8

ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Particulate Emission Report

Total Suspended Particulates (TSP) PM_{10} and $PM_{2.5}$

Blue Sky Pastures Boiler 1

Author(s):	C. Henderson
Ref number:	J000042.1
Consent Number:	AUTH-201193-V3
Client Name:	Blue Sky Meats
Client Address:	Morton Mains RD1 Invercargill
Date of Issue:	11 April 2022
Signature: ***Name & Designation:***	CHenderson Cameron Henderson Air Quality Analyst
Approved: ***Name & Designation:***	William Porter Air Quality Analyst
Distribution: ***(other than client)***	Nil

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Table of Contents

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Particulate Emission Report

Blue Sky Meats

Introduction

Verum Group was engaged by Blue Sky Meats to perform particulate testing on 4.3 MW Vekos Packaged Boiler. The purpose of the monitoring was to satisfy the conditions of Resource Consent AUTH-201193-V3. Testing was carried out on the 29 March 2022.

Methodology

The method used was USEPA Method 201A - Determination of PM10 and PM2.5 Emissions (Constant Sampling Rate Procedure) which included USEPA Methods 1 - 5. These methods are accredited by IANZ under Verum Group Christchurch's scope of accreditation.

Results

The results are not within the air discharge limits set out by the resource consent. The average particulate concentration and emission rate from testing, as well as the resource consent limit are summarised below:

Actual Concentration of Total Particulates	1727	mg/dsm^3
Concentration of Total Particulate Matter Corrected to 12% CO_2	2063	mg/dsm^3
Particulate Matter Emission Rate	11.86	kg/hr
Percentage of PM_{10} Particulates	73	%
Concentration of PM_{10} Particulates Corrected to 12% CO_2	1500	mg/dsm^3
Emission Rate of PM_{10} Particulates	8.63	kg/hr
Percentage of $PM_{2.5}$ Particulates	59	%
Concentration of $PM_{2.5}$ Particulates Corrected to 12% CO_2	1220	mg/dsm^3
Emission Rate of $PM_{2.5}$ Particulates	7.03	kg/hr
Resource Consent Concentration Limit Corrected to 12% CO_2	500	mg/dsm^3

Test 1 Summary

Site	Blue Sky Meats	Ref:	J000042.1	Date of Test	29 March 2022

Plant Description		**Fuel Analysis** (as received basis)	
Plant Description	4.3 MW Vekos Packaged Boiler	Moisture:	44.0 %
Firing System	Overfeed Screw Stoker	Ash:	3.4 %
Emission Control	Multicyclones	Calorific Value:	14.2 MJ/kg
Load	75% of MCR	Type:	Lignite
Stack Diameter:	0.705 m		

Method Details

Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Glass microfiber thimble filter (30mm x 80mm)
Leakage Tests Performed By:	AGA/CH

Sampling Start Time: 8:44 am Total Sample Time: 24 mins Sample Time at Each Point: 2 mins (avg)

Stack Gas Conditions at Sample Point		**Conditions of Sampling**	
Stack Gas Pressure:	101.33 kPa	Nozzle Internal Diameter:	6.20 mm
Stack Gas Density:	0.755 kg/m^3	Isokinetics:	110.5 %
Average Temperature:	198 °C	Gas Meter START Reading:	43.952 m^3
Average Velocity:	9.0 m/s	Gas Meter STOP Reading:	44.201 m^3
Dry Gas Volumetric Flow Rate:	6796 dsm^3/hr	Gas Meter Static Pressure:	0.00 kPa
		Gas Meter Temperature:	19 °C
For conditions at the sampling plane see figures 1 & 2		Dry Gas Volume Sampled:	0.233 dsm^3
		Particulate Matter Collected:	404.2 mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	9.9	10.1	%
Carbon Dioxide content[#]:	10.3	14.4	%
Carbon Monoxide content (ppm dry):	*683.9*	*0.06*	%
Nitrogen content*:	79.7	71.0	%
Gas Moisture content:	7.1	4.4	%

Results

Actual Concentration of Total Particulates:	**1740**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**2030**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**11.83**	**kg/hr**
Percentage of PM_{10} Particulates:	**71**	**%**
Concentration of PM_{10} Particulates Corrected to 12% CO_2:	**1450**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**8.43**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**59**	**%**
Concentration of $PM_{2.5}$ Particulates Corrected to 12% CO_2:	**1190**	**mg/dsm^3**
Emission Rate of $PM_{2.5}$ Particulates:	**6.93**	**kg/hr**

Notes

[#] CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

* Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

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Test 2 Summary

Verum Group

Site	Blue Sky Meats	Ref:	J000042.1	Date of Test	29 March 2022

Plant Description		**Fuel Analysis** (as received basis)	
Plant Description	4.3 MW Vekos Packaged Boiler	Moisture:	44.0 %
Firing System	Overfeed Screw Stoker	Ash:	3.4 %
Emission Control	Multicyclones	Calorific Value:	14.2 MJ/kg
Load	75% of MCR	Type:	Lignite
Stack Diameter:	0.705 m		

Method Details	
Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Glass microfiber thimble filter (30mm x 80mm)
Leakage Tests Performed By:	AGA/CH

Sampling Start Time:	9:19 am	Total Sample Time:	24 mins	Sample Time at Each Point:	2 mins (avg)

Stack Gas Conditions at Sample Point		**Conditions of Sampling**	
Stack Gas Pressure:	101.33 kPa	Nozzle Internal Diameter:	6.20 mm
Stack Gas Density:	0.753 kg/m^3	Isokinetics:	106.1 %
Average Temperature:	199 °C	Gas Meter START Reading:	44.236 m^3
Average Velocity:	9.4 m/s	Gas Meter STOP Reading:	44.484 m^3
Dry Gas Volumetric Flow Rate:	7045 dsm^3/hr	Gas Meter Static Pressure:	0.00 kPa
		Gas Meter Temperature:	19 °C
For conditions at the sampling plane see figures 1 & 2		Dry Gas Volume Sampled:	0.232 dsm^3
		Particulate Matter Collected:	369.0 mg

Gas Composition at Sample Point	% Dry (vol.)	% Wet (mass)	
Oxygen content:	10.0	10.2	%
Carbon Dioxide content#:	10.2	14.3	%
Carbon Monoxide content (ppm dry):	*737.7*	*0.07*	%
Nitrogen content*:	79.7	71.1	%
Gas Moisture content:	7.1	4.4	%

Results		
Actual Concentration of Total Particulates:	**1600**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**1880**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**11.27**	**kg/hr**
Percentage of PM_{10} Particulates:	**73**	**%**
Concentration of PM_{10} Particulates Corrected to 12% CO_2:	**1370**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**8.24**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**61**	**%**
Concentration of $PM_{2.5}$ Particulates Corrected to 12% CO_2:	**1150**	**mg/dsm3**
Emission Rate of $PM_{2.5}$ Particulates:	**6.90**	**kg/hr**

Notes

CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

* Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

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Test 3 Summary

Site	Blue Sky Meats	Ref:	J000042.1	Date of Test	29 March 2022

Plant Description		**Fuel Analysis** (as received basis)	
Plant Description	4.3 MW Vekos Packaged Boiler	Moisture:	44.0 %
Firing System	Overfeed Screw Stoker	Ash:	3.4 %
Emission Control	Multicyclones	Calorific Value:	14.2 MJ/kg
Load	75% of MCR	Type:	Lignite
Stack Diameter:	0.705 m		

Method Details	
Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Glass microfiber thimble filter (30mm x 80mm)
Leakage Tests Performed By:	AGA/CH

Sampling Start Time: 9:55 am Total Sample Time: 24 mins Sample Time at Each Point: 2 mins (avg)

Stack Gas Conditions at Sample Point		**Conditions of Sampling**	
Stack Gas Pressure:	101.33 kPa	Nozzle Internal Diameter:	6.20 mm
Stack Gas Density:	0.755 kg/m^3	Isokinetics:	109.5 %
Average Temperature:	197 °C	Gas Meter START Reading:	44.521 m^3
Average Velocity:	9.0 m/s	Gas Meter STOP Reading:	44.768 m^3
Dry Gas Volumetric Flow Rate:	6778 dsm^3/hr	Gas Meter Static Pressure:	0.00 kPa
		Gas Meter Temperature:	19 °C
For conditions at the sampling plane see figures 1 & 2		Dry Gas Volume Sampled:	0.230 dsm^3
		Particulate Matter Collected:	422.5 mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	10.5	10.8	%
Carbon Dioxide content[#]:	9.7	13.6	%
Carbon Monoxide content (ppm dry):	*859.3*	*0.08*	%
Nitrogen content*:	79.7	71.1	%
Gas Moisture content:	7.2	4.5	%

Results

Actual Concentration of Total Particulates:	**1840**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**2280**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**12.47**	**kg/hr**
Percentage of PM_{10} Particulates:	**74**	**%**
Concentration of PM_{10} Particulates Corrected to 12% CO_2:	**1680**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**9.22**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**58**	**%**
Concentration of $PM_{2.5}$ Particulates Corrected to 12% CO_2:	**1320**	**mg/dsm3**
Emission Rate of $PM_{2.5}$ Particulates:	**7.25**	**kg/hr**

Notes

[#] CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

* Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

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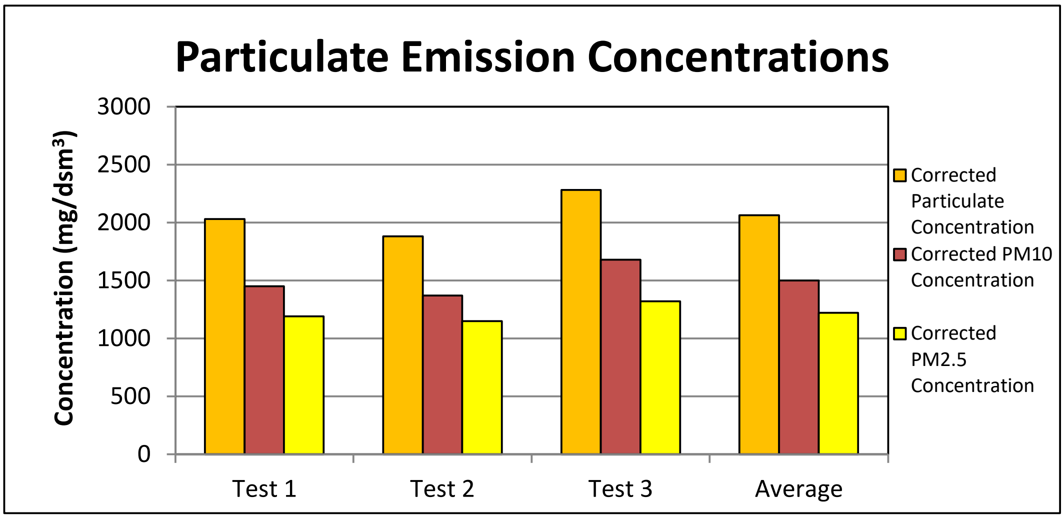
Summary of Data

Blue Sky Pastures Boiler 1

	Test 1	Test 2	Test 3	Average	Units
Actual concentration of total particulates:	1740	1600	1840	1727	mg/dsm^3
Concentration of total particulates at 12% CO_2:	2030	1880	2280	2063	mg/dsm3
Total particulate matter emission rate:	11.83	11.27	12.47	11.86	kg/hr
Percentage of PM_{10} particulates:	71	73	74	73	%
Concentration of PM_{10} particulates at 12% CO_2:	1450	1370	1680	1500	mg/dsm3
Emission Rate of PM_{10} particulates	8.43	8.24	9.22	8.63	kg/hr
Percentage of $PM_{2.5}$ particulates:	58.60	61.25	58.18	59.34	%
Concentration of $PM_{2.5}$ particulates at 12% CO_2	1190	1150	1320	1220	mg/dsm3
Emission Rate of $PM_{2.5}$ particulates	6.93	6.90	7.25	7.03	kg/hr



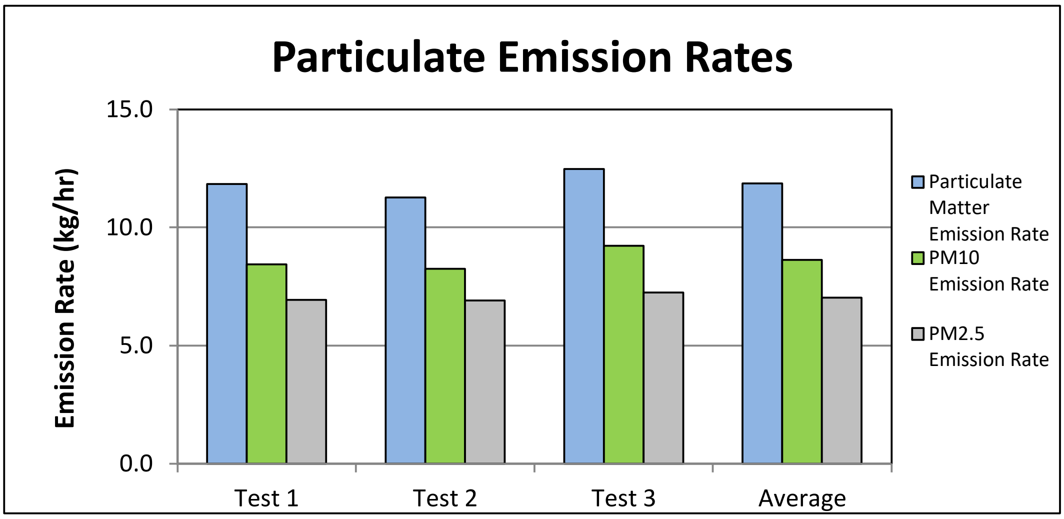


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Figure 1. Photo of sampling location

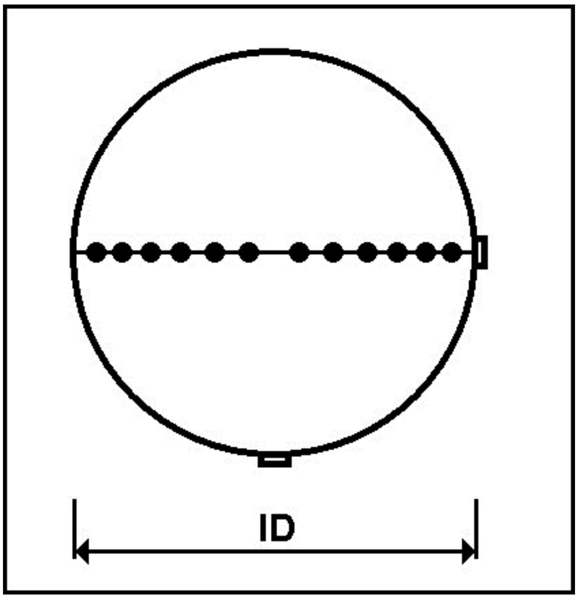

Figure 2. Diagram of the sampling plane

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PARTICULATE EMISSIONS TEST SHEET   Test   1

Ref	J000042.1		Site	Blue Sky Meats					
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	02:13	0.025	0.22	10.4	19	197	10.2	698	-5
2	04:07	0.047	0.16	10.4	19	197	10.5	621	-5
3	06:07	0.083	0.18	10.4	19	197	11.5	884	-5
4	08:11	0.125	0.19	10.4	19	197	11.5	1294	-5
5	10:08	0.176	0.17	10.4	19	197	10.0	742	-8
6	11:54	0.251	0.14	10.4	18	198	8.8	523	-8
7	13:55	0.454	0.18	10.4	19	199	8.7	664	-8
8	15:59	0.529	0.19	10.4	19	199	8.5	437	-8
9	18:06	0.580	0.20	10.4	19	199	8.2	357	-8
10	20:09	0.622	0.19	10.4	19	199	9.5	508	-8
11	22:06	0.658	0.17	10.4	19	199	10.6	712	-8
12	24:00	0.680	0.16	10.4	19	199	10.9	767	-8
Averages			0.18	10.4	19	198	9.9	684	-7

Plant Description	4.3 MW Vekos Packaged Boiler	Test Date	29 March 2022
Firing System	Overfeed Screw Stoker	Start Time	8:44 am
Emission Control	Multicyclones	End Time	9:08 am
Load	75% of MCR	Test Time	24

GAS METER		LEAK TEST		
Start (m^3)	43.952	Test done by	AGA/CH	
Half Way (m^3)	n/a		Start (m^3)	Stop (m^3)
Stop (m^3)	44.201	Pre	43.9518	43.9519
Factor	0.998	Post	44.2268	44.2270

GENERAL DETAILS			
Pitot Constant	0.83	Filter No.	P21-172
Static ("WG)	0.11	Friter Mass (g)	0.1658
Atmos Press (kPa)	101.3	Asmd Duct Moisture %	9
Nozzle ϕ (mm)	6.20	Balance Check (+/-)	0
Stack ϕ (m)	0.705	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	464.7	470.1
CV (MJ/kg)	14.18	No. 2 (g)	479.6	481.8
Fuel Type	Lignite	No. 3 (g)	402.3	402.5
Fuel Composition	New Vale	Silica (g)	640.4	646.9

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PARTICULATE EMISSIONS TEST SHEET

Test 2

Ref	J000042.1		Site	Blue Sky Meats					
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	01:56	0.025	0.18	10.3	19	198	10.1	824	-5
2	03:59	0.047	0.20	10.3	19	198	9.4	601	-5
3	05:51	0.083	0.17	10.3	19	198	9.1	550	-5
4	07:41	0.125	0.16	10.3	19	198	8.9	513	-5
5	09:40	0.176	0.19	10.3	19	198	11.1	880	-5
6	11:33	0.251	0.17	10.3	19	199	11.3	1091	-7
7	13:26	0.454	0.17	10.3	19	199	11.5	1137	-7
8	15:22	0.529	0.18	10.3	19	199	10.7	923	-7
9	17:27	0.580	0.21	10.3	19	200	9.8	672	-7
10	19:44	0.622	0.25	10.3	19	200	9.5	571	-7
11	22:04	0.658	0.26	10.3	19	201	9.3	553	-7
12	24:00	0.680	0.18	10.3	19	201	9.1	537	-7
Averages			0.19	10.3	19	199	10.0	738	-6

Plant Description	4.3 MW Vekos Packaged Boiler	Test Date	29 March 2022
Firing System	Overfeed Screw Stoker	Start Time	9:19 am
Emission Control	Multicyclones	End Time	9:43 am
Load	75% of MCR	Test Time	24

GAS METER		LEAK TEST		
Start (m^3)	44.236	Test done by	AGA/CH	
Half Way (m^3)	n/a		Start (m^3)	Stop (m^3)
Stop (m^3)	44.484	Pre	44.2358	44.2358
Factor	0.998	Post	44.5025	44.5026

GENERAL DETAILS			
Pitot Constant	0.83	Filter No.	P21-159
Static ("WG)	0.11	Frilter Mass (g)	0.1672
Atmos Press (kPa)	101.3	Asmd Duct Moisture %	9
Nozzle ϕ (mm)	6.20	Balance Check (+/-)	0
Stack ϕ (m)	0.705	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	470.1	475.5
CV (MJ/kg)	14.18	No. 2 (g)	481.8	483.9
Fuel Type	Lignite	No. 3 (g)	402.5	402.7
Fuel Composition	New Vale	Silica (g)	646.9	653.4

PARTICULATE EMISSIONS TEST SHEET — Test 3

Verum Group

Ref	J000042.1	Site	Blue Sky Meats						
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	02:01	0.025	0.18	10.3	19	198	11.5	858	-5
2	04:05	0.047	0.19	10.3	19	197	11.6	909	-5
3	06:09	0.083	0.19	10.3	19	195	12.1	1245	-5
4	08:20	0.125	0.21	10.3	19	195	10.2	854	-8
5	10:34	0.176	0.22	10.3	19	196	9.3	601	-8
6	12:44	0.251	0.21	10.3	19	197	9.0	541	-8
7	14:42	0.454	0.17	10.3	19	197	8.3	377	-8
8	16:32	0.529	0.15	10.3	20	197	9.3	432	-8
9	18:11	0.580	0.12	10.3	20	197	11.8	1137	-8
10	20:12	0.622	0.18	10.3	20	198	11.8	1343	-8
11	22:10	0.658	0.17	10.3	20	198	11.3	1190	-8
12	24:00	0.680	0.15	10.3	20	198	10.3	825	-8
Averages			0.18	10.3	19	197	10.5	859	-7

Plant Description	4.3 MW Vekos Packaged Boiler	Test Date	29 March 2022
Firing System	Overfeed Screw Stoker	Start Time	9:55 am
Emission Control	Multicyclones	End Time	10:19 am
Load	75% of MCR	Test Time	24

GAS METER		LEAK TEST		
Start (m^3)	44.521	Test done by	AGA/CH	
Half Way (m^3)	n/a		Start (m^3)	Stop (m^3)
Stop (m^3)	44.768	Pre	44.5212	44.5213
Factor	0.998	Post	44.7894	44.7895

GENERAL DETAILS			
Pitot Constant	0.83	Filter No.	P21-139
Static ("WG)	0.11	Friter Mass (g)	0.1689
Atmos Press (kPa)	101.3	Asmd Duct Moisture %	9
Nozzle ϕ (mm)	6.20	Balance Check (+/-)	0
Stack ϕ (m)	0.705	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	475.5	480.9
CV (MJ/kg)	14.18	No. 2 (g)	483.9	486.1
Fuel Type	Lignite	No. 3 (g)	402.7	403.0
Fuel Composition	New Vale	Silica (g)	653.4	659.9

Quality Assurance

Company	Blue Sky Meats
Date of Test	29 March 2022
Reference Number	J000042.1
Plant Description	Blue Sky Pastures Boiler 1

Variation from Isokinetic

	% Variation	Pass or Fail
Test 1	10.5	**Pass**
Test 2	6.1	**Pass**
Test 3	9.5	**Pass**

Leakage Test

		Gas Meter Reading (m^3)			Leak	Test Flowrate	% Leak	Pass or
		Start	End	Difference	(l/min)	(l/min)	Flowrate	Fail
Test 1	Pre Leak	43.9518	43.9519	0.0001	0.1	10.4	0.97	**Pass**
	Post Leak	44.2268	44.2270	0.0002	0.2	10.4	1.93	**Pass**
Test 2	Pre Leak	44.2358	44.2358	0.0000	0	10.3	0.00	**Pass**
	Post Leak	44.5025	44.5026	0.0001	0.1	10.3	0.97	**Pass**
Test 3	Pre Leak	44.5212	44.5213	0.0001	0.1	10.3	0.97	**Pass**
	Post Leak	44.7894	44.7895	0.0001	0.1	10.3	0.97	**Pass**

* Any leak must be less than either 0.5663 l/min or 4% of the average sample flow over the test run (whichever is less)

Cut Diameter of the PM_{10} and $PM_{2.5}$ Particulate

	PM_{10} Cut (µm)	Pass or Fail? (9 <> 11)	$PM_{2.5}$ Cut (µm)	Pass or Fail? (2.25 <> 2.75)
Test 1	10.41	**Pass**	2.461	**Pass**
Test 2	10.45	**Pass**	2.476	**Pass**
Test 3	10.49	**Pass**	2.493	**Pass**

Stack details

Shape:	Circular
Stack orientation:	Vertical
No of sampling traverses:	1
Angle of gas flow:	10.0000

Sampling point

Approximate diamaters upstream:	8
Approximate diamaters downstream:	8

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IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Particulate Emission Report

Total Suspended Particulates (TSP) PM_{10} and $PM_{2.5}$

Blue Sky meats Boiler 2

Author(s): C.Henderson

Ref number: J000042.2

Consent Number: AUTH-201193-V3

Client Name: Blue Sky Meats

Client Address: Morton Mains
RD1
Invercargill

Date of Issue: 11 April 2022

Signature:
Name & Designation: Cameron Henderson
Air Quality Analyst

Approved:
Name & Designation: William Porter
Air Quality Analyst

Distribution: Nil
(other than client)

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Table of Contents

Particulate Emission Report
Blue Sky Meats

Introduction

Verum Group was engaged by Blue Sky Meats to perform particulate testing on 2 MW Vekos Packaged Boiler. The purpose of the monitoring was to satisfy the conditions of Resource Consent AUTH-201193-V3. Testing was carried out on the 29 March 2022.

Methodology

The method used was USEPA Method 201A - Determination of PM10 and PM2.5 Emissions (Constant Sampling Rate Procedure) which included USEPA Methods 1 - 5. These methods are accredited by IANZ under Verum Group Christchurch's scope of accreditation.

Results

The results are not within the air discharge limits set out by the resource consent. The average particulate concentration and emission rate from testing, as well as the resource consent limit are summarised below:

Actual Concentration of Total Particulates	1723	mg/dsm^3
Concentration of Total Particulate Matter Corrected to 12% CO_2	1777	mg/dsm^3
Particulate Matter Emission Rate	8.85	kg/hr
Percentage of PM_{10} Particulates	35	%
Concentration of PM_{10} Particulates Corrected to 12% CO_2	613	mg/dsm^3
Emission Rate of PM_{10} Particulates	3.06	kg/hr
Percentage of $PM_{2.5}$ Particulates	14	%
Concentration of $PM_{2.5}$ Particulates Corrected to 12% CO_2	240	mg/dsm^3
Emission Rate of $PM_{2.5}$ Particulates	1.20	kg/hr
Resource Consent Concentration Limit Corrected to 12% CO_2	500	mg/dsm^3

Test 1 Summary

Site	Blue Sky Meats	Ref:	J000042.2	Date of Test	29 March 2022

Plant Description		**Fuel Analysis** (as received basis)	
Plant Description	2 MW Vekos Packaged Boiler	Moisture:	44.0 %
Firing System	Overfeed Screw Stoker	Ash:	3.4 %
Emission Control	Multicyclones	Calorific Value:	14.2 MJ/kg
Load	75% MCR	Type:	Lignite
Stack Diameter:	0.600 m		

Method Details

Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Glass microfiber thimble filter (30mm x 80mm)
Leakage Tests Performed By:	AGA/CH

Sampling Start Time: 10:41 am Total Sample Time: 24 mins Sample Time at Each Point: 3 mins (avg)

Stack Gas Conditions at Sample Point		**Conditions of Sampling**	
Stack Gas Pressure:	101.30 kPa	Nozzle Internal Diameter:	6.20 mm
Stack Gas Density:	0.843 kg/m^3	Isokinetics:	103.8 %
Average Temperature:	151 °C	Gas Meter START Reading:	44.837 m^3
Average Velocity:	8.6 m/s	Gas Meter STOP Reading:	45.086 m^3
Dry Gas Volumetric Flow Rate:	5186 dsm^3/hr	Gas Meter Static Pressure:	0.00 kPa
		Gas Meter Temperature:	22 °C
For conditions at the sampling plane see figures 1 & 2		Dry Gas Volume Sampled:	0.230 dsm^3
		Particulate Matter Collected:	420.7 mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	8.4	8.5	%
Carbon Dioxide content#:	11.7	16.3	%
Carbon Monoxide content (ppm dry):	*282.8*	*0.03*	%
Nitrogen content*:	79.9	70.7	%
Gas Moisture content:	7.2	4.4	%

Results

Actual Concentration of Total Particulates:	**1830**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**1880**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**9.49**	**kg/hr**
Percentage of PM_{10} Particulates:	**35**	**%**
Concentration of PM_{10} Particulates Corrected to 12% CO_2:	**660**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**3.32**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**13**	**%**
Concentration of $PM_{2.5}$ Particulates Corrected to 12% CO_2:	**250**	**mg/dsm^3**
Emission Rate of $PM_{2.5}$ Particulates:	**1.24**	**kg/hr**

Notes

\# CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

* Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

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Test 2 Summary

Site	Blue Sky Meats	Ref:	J000042.2	Date of Test	29 March 2022

Plant Description		Fuel Analysis (as received basis)	
Plant Description	2 MW Vekos Packaged Boiler	Moisture:	44.0 %
Firing System	Overfeed Screw Stoker	Ash:	3.4 %
Emission Control	Multicyclones	Calorific Value:	14.2 MJ/kg
Load	75% MCR	Type:	Lignite
Stack Diameter:	0.600 m		

Method Details	
Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Glass microfiber thimble filter (30mm x 80mm)
Leakage Tests Performed By:	AGA/CH

Sampling Start Time: 11:15 am Total Sample Time: 24 mins Sample Time at Each Point: 3 mins (avg)

Stack Gas Conditions at Sample Point		Conditions of Sampling	
Stack Gas Pressure:	101.30 kPa	Nozzle Internal Diameter:	6.20 mm
Stack Gas Density:	0.822 kg/m^3	Isokinetics:	106.3 %
Average Temperature:	162 °C	Gas Meter START Reading:	45.125 m^3
Average Velocity:	8.7 m/s	Gas Meter STOP Reading:	45.379 m^3
Dry Gas Volumetric Flow Rate:	5118 dsm^3/hr	Gas Meter Static Pressure:	0.00 kPa
		Gas Meter Temperature:	24 °C
For conditions at the sampling plane see figures 1 & 2		Dry Gas Volume Sampled:	0.233 dsm^3
		Particulate Matter Collected:	374.0 mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	8.5	8.6	%
Carbon Dioxide content#:	11.7	16.2	%
Carbon Monoxide content (ppm dry):	*306.8*	*0.03*	%
Nitrogen content*:	79.9	70.8	%
Gas Moisture content:	7.2	4.4	%

Results

Actual Concentration of Total Particulates:	**1610**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**1660**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**8.24**	**kg/hr**
Percentage of PM_{10} Particulates:	**34**	**%**
Concentration of PM_{10} Particulates Corrected to 12% CO_2:	**560**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**2.81**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**14**	**%**
Concentration of $PM_{2.5}$ Particulates Corrected to 12% CO_2:	**240**	**mg/dsm3**
Emission Rate of $PM_{2.5}$ Particulates:	**1.18**	**kg/hr**

Notes

CO_2 is calculated in accordance with M(1-O_2/20.9) where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

* Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

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Test 3 Summary

Site	Blue Sky Meats	Ref:	J000042.2	Date of Test	29 March 2022

Plant Description		**Fuel Analysis** (as received basis)	
Plant Description	2 MW Vekos Packaged Boiler	Moisture:	44.0 %
Firing System	Overfeed Screw Stoker	Ash:	3.4 %
Emission Control	Multicyclones	Calorific Value:	14.2 MJ/kg
Load	75% MCR	Type:	Lignite
Stack Diameter:	0.600 m		

Method Details	
Measurement Standard:	USEPA Method 201A - Determination of PM_{10} and $PM_{2.5}$ Emissions (Constant Sampling Rate).
Sampling Method:	Cumulative sampling
Suction Nozzle Type:	Sharp-edged stainless steel nozzle
Equipment Arrangement:	Water removal upstream of the gas meter
Particulate Drying:	Washing with Acetone, evaporating at clean ambient condition, drying in oven at 105°C
Particulate Separator:	Glass microfiber thimble filter (30mm x 80mm)
Leakage Tests Performed By:	AGA/CH

Sampling Start Time: 11:48 am Total Sample Time: 24 mins Sample Time at Each Point: 3 mins (avg)

Stack Gas Conditions at Sample Point		**Conditions of Sampling**	
Stack Gas Pressure:	101.30 kPa	Nozzle Internal Diameter:	6.20 mm
Stack Gas Density:	0.816 kg/m^3	Isokinetics:	104.8 %
Average Temperature:	165 °C	Gas Meter START Reading:	45.408 m^3
Average Velocity:	8.7 m/s	Gas Meter STOP Reading:	45.657 m^3
Dry Gas Volumetric Flow Rate:	5090 dsm^3/hr	Gas Meter Static Pressure:	0.00 kPa
		Gas Meter Temperature:	24 °C
For conditions at the sampling plane see figures 1 & 2		Dry Gas Volume Sampled:	0.228 dsm^3
		Particulate Matter Collected:	393.6 mg

Gas Composition at Sample Point

	% Dry (vol.)	% Wet (mass)	
Oxygen content:	8.6	8.7	%
Carbon Dioxide content[#]:	11.6	16.1	%
Carbon Monoxide content (ppm dry):	*295.5*	*0.03*	%
Nitrogen content*:	79.9	70.9	%
Gas Moisture content:	7.0	4.3	%

Results

Actual Concentration of Total Particulates:	**1730**	**mg/dsm^3**
Concentration of Total Particulate Matter Corrected to 12% CO_2:	**1790**	**mg/dsm^3**
Total Particulate Matter Emission Rate:	**8.81**	**kg/hr**
Percentage of PM_{10} Particulates:	**35**	**%**
Concentration of PM_{10} Particulates Corrected to 12% CO_2:	**620**	**mg/dsm^3**
Emission Rate of PM_{10} Particulates:	**3.05**	**kg/hr**
Percentage of $PM_{2.5}$ Particulates:	**13**	**%**
Concentration of $PM_{2.5}$ Particulates Corrected to 12% CO_2:	**230**	**mg/dsm3**
Emission Rate of $PM_{2.5}$ Particulates:	**1.17**	**kg/hr**

Notes

[#] CO_2 is calculated in accordance with $M(1-O_2/20.9)$ where M is the theoretical maximum CO_2 content for a given fuel when combusted with no excess air.

* Dry N volume by difference

Allowable variation from isokinetic conditions is 80 to 120%

All gas volumes are expressed at 273 K and 101.325 kPa.

dsm^3 = dry standard cubic metre (273 K, 101.325 kPa)

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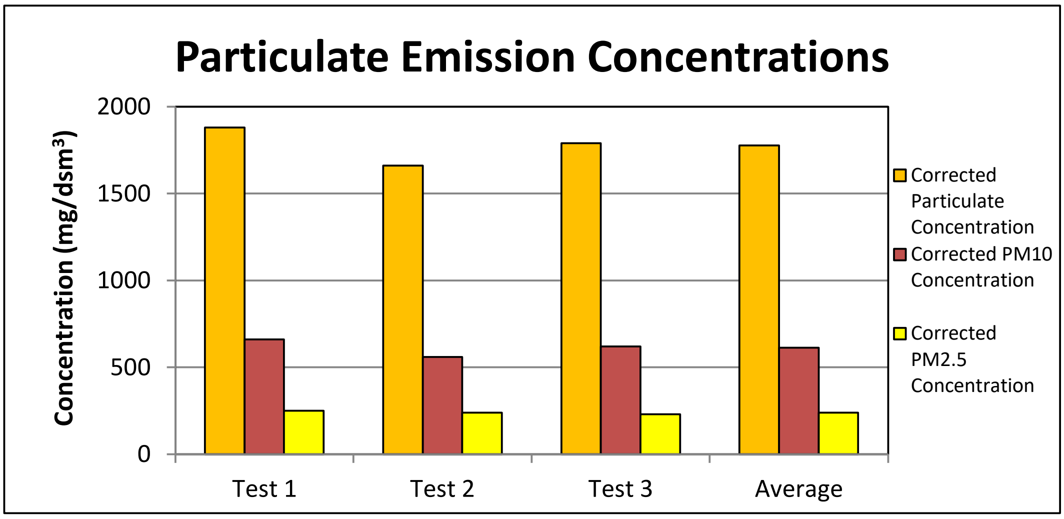
Summary of Data

Blue Sky meats Boiler 2

	Test 1	Test 2	Test 3	Average	Units
Actual concentration of total particulates:	1830	1610	1730	1723	mg/dsm^3
Concentration of total particulates at 12% CO_2:	1880	1660	1790	1777	mg/dsm3
Total particulate matter emission rate:	9.49	8.24	8.81	8.85	kg/hr
Percentage of PM_{10} particulates:	35	34	35	35	%
Concentration of PM_{10} particulates at 12% CO_2:	660	560	620	613	mg/dsm3
Emission Rate of PM_{10} particulates	3.32	2.81	3.05	3.06	kg/hr
Percentage of $PM_{2.5}$ particulates:	13.08	14.49	13.06	13.54	%
Concentration of $PM_{2.5}$ particulates at 12% CO_2	250	240	230	240	mg/dsm3
Emission Rate of $PM_{2.5}$ particulates	1.24	1.18	1.17	1.20	kg/hr



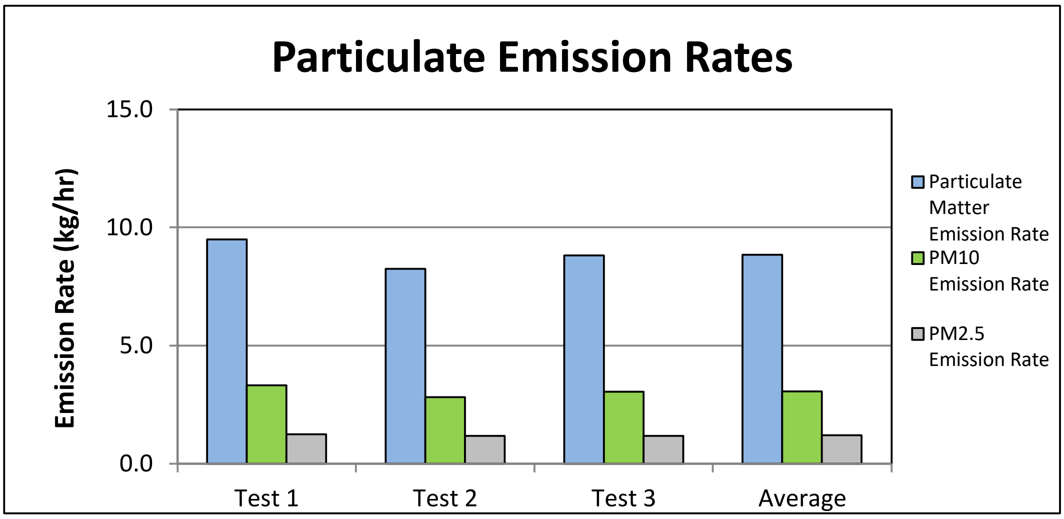


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Figure 1. Photo of sampling location

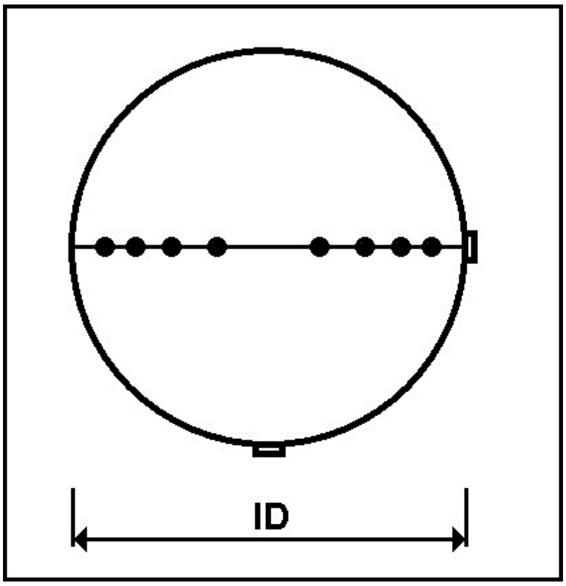

Figure 2. Diagram of the sampling plane

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PARTICULATE EMISSIONS TEST SHEET Test 1

Verum Group

Ref	J000042.2	Site	Blue Sky Meats						
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	03:00	0.019	0.18	10.4	22	138	8.7	240	-5
2	06:05	0.063	0.19	10.4	23	146	8.3	241	-5
3	08:55	0.116	0.16	10.4	23	149	8.2	259	-5
4	11:40	0.194	0.15	10.4	23	150	8.5	280	-5
5	14:45	0.406	0.19	10.4	22	152	8.3	295	-5
6	17:45	0.484	0.18	10.4	21	154	8.6	321	-5
7	20:45	0.537	0.18	10.4	20	157	8.4	313	-5
8	24:00	0.581	0.21	10.4	20	159	8.5	313	-5
Averages			0.18	10.4	22	151	8.4	283	-5

Plant Description	2 MW Vekos Packaged Boiler	Test Date	29 March 2022
Firing System	Overfeed Screw Stoker	Start Time	10:41 am
Emission Control	Multicyclones	End Time	11:05 am
Load	75% MCR	Test Time	24

GAS METER		LEAK TEST		
Start (m^3)	44.837	Test done by	AGA/CH	
Half Way (m^3)	n/a		Start (m^3)	Stop (m^3)
Stop (m^3)	45.086	Pre	44.8368	44.8368
Factor	0.998	Post	45.1008	45.1008

GENERAL DETAILS			
Pitot Constant	0.83	Filter No.	P21-158
Static ("WG)	0.01	Friter Mass (g)	0.1657
Atmos Press (kPa)	101.3	Asmd Duct Moisture %	8
Nozzle ϕ (mm)	6.20	Balance Check (+/-)	0
Stack ϕ (m)	0.600	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	480.9	486.4
CV (MJ/kg)	14.18	No. 2 (g)	486.1	488.3
Fuel Type	Lignite	No. 3 (g)	403.0	403.2
Fuel Composition	New Vale	Silica (g)	659.9	666.4

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PARTICULATE EMISSIONS TEST SHEET Test 2

Verum Group

Ref	J000042.2		Site	Blue Sky Meats					
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	02:50	0.019	0.16	10.5	28	155	8.3	258	-8
2	05:45	0.063	0.17	10.5	26	159	8.0	264	-8
3	09:00	0.116	0.21	10.5	25	162	8.4	265	-8
4	11:45	0.194	0.15	10.5	23	161	9.4	406	-8
5	14:45	0.406	0.18	10.5	24	162	8.3	324	-8
6	17:45	0.484	0.18	10.5	23	164	8.6	325	-8
7	20:41	0.537	0.17	10.5	23	164	8.3	306	-8
8	24:00	0.581	0.22	10.5	23	166	8.3	306	-8
Averages			0.18	10.5	24	162	8.5	307	-8

Plant Description	2 MW Vekos Packaged Boiler	Test Date	29 March 2022
Firing System	Overfeed Screw Stoker	Start Time	11:15 am
Emission Control	Multicyclones	End Time	11:39 am
Load	75% MCR	Test Time	24

GAS METER		LEAK TEST		
Start (m^3)	45.125	Test done by	AGA/CH	
Half Way (m^3)	n/a		Start (m^3)	Stop (m^3)
Stop (m^3)	45.379	Pre	45.1251	45.1251
Factor	0.998	Post	45.3987	45.3987

GENERAL DETAILS			
Pitot Constant	0.83	Filter No.	P21-156
Static ("WG)	0.01	Frilter Mass (g)	0.1657
Atmos Press (kPa)	101.3	Asmd Duct Moisture %	8
Nozzle ϕ (mm)	6.20	Balance Check (+/-)	0
Stack ϕ (m)	0.600	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	486.4	491.9
CV (MJ/kg)	14.18	No. 2 (g)	488.3	490.5
Fuel Type	Lignite	No. 3 (g)	403.2	403.4
Fuel Composition	New Vale	Silica (g)	666.4	673.0

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PARTICULATE EMISSIONS TEST SHEET Test 3

Verum Group

Ref	J000042.2		Site	Blue Sky Meats					
Traverse Point	Time (min)	Sample Point (m)	Velocity Pressure ("WG)	Rota-meter Setting (l/min)	DGM Temp (°C)	Stack Temp (°C)	O_2 (%)	CO (ppm)	VAC (kPa)
1	02:45	0.019	0.15	10.4	23	160	8.5	302	-8
2	05:36	0.063	0.16	10.4	24	162	8.7	268	-8
3	08:46	0.116	0.20	10.4	23	163	9.1	322	-8
4	12:02	0.194	0.21	10.4	24	165	8.2	308	-8
5	15:03	0.406	0.18	10.4	24	168	8.5	256	-8
6	17:53	0.484	0.16	10.4	25	168	8.4	298	-8
7	20:59	0.537	0.19	10.4	26	168	8.6	275	-8
8	24:00	0.581	0.18	10.4	26	168	8.4	335	-8
Averages			0.18	10.4	24	165	8.6	296	-8

Plant Description	2 MW Vekos Packaged Boiler	Test Date	29 March 2022
Firing System	Overfeed Screw Stoker	Start Time	11:48 am
Emission Control	Multicyclones	End Time	12:12 pm
Load	75% MCR	Test Time	24

GAS METER		LEAK TEST		
Start (m^3)	45.408	Test done by	AGA/CH	
Half Way (m^3)	n/a		Start (m^3)	Stop (m^3)
Stop (m^3)	45.657	Pre	45.4078	45.4079
Factor	0.998	Post	45.6851	45.6852

GENERAL DETAILS			
Pitot Constant	0.83	Filter No.	P21-160
Static ("WG)	0.01	Frilter Mass (g)	0.1681
Atmos Press (kPa)	101.3	Asmd Duct Moisture %	8
Nozzle ϕ (mm)	6.20	Balance Check (+/-)	0
Stack ϕ (m)	0.600	Duct (d x w)	x

FUEL DETAILS		IMPINGER WEIGHTS		
Moisture %	44		Start	Stop
Ash %	3.4	No. 1 (g)	491.9	501.2
CV (MJ/kg)	14.18	No. 2 (g)	490.5	492.1
Fuel Type	Lignite	No. 3 (g)	403.4	403.5
Fuel Composition	New Vale	Silica (g)	673.0	675.8

Quality Assurance

Company	Blue Sky Meats
Date of Test	29 March 2022
Reference Number	J000042.2
Plant Description	Blue Sky meats Boiler 2

Variation from Isokinetic

	% Variation	Pass or Fail
Test 1	3.8	**Pass**
Test 2	6.3	**Pass**
Test 3	4.8	**Pass**

Leakage Test

		Gas Meter Reading (m^3)			Leak	Test Flowrate	% Leak	Pass or
		Start	End	Difference	(l/min)	(l/min)	Flowrate	Fail
Test 1	Pre Leak	44.8368	44.8368	0.0000	0	10.4	0.00	**Pass**
	Post Leak	45.1008	45.1008	0.0000	0	10.4	0.00	**Pass**
Test 2	Pre Leak	45.1251	45.1251	0.0000	0	10.5	0.00	**Pass**
	Post Leak	45.3987	45.3987	0.0000	0	10.5	0.00	**Pass**
Test 3	Pre Leak	45.4078	45.4079	0.0001	0.1	10.4	0.96	**Pass**
	Post Leak	45.6851	45.6852	0.0001	0.1	10.4	0.96	**Pass**

* Any leak must be less than either 0.5663 l/min or 4% of the average sample flow over the test run (whichever is less)

Cut Diameter of the PM_{10} and $PM_{2.5}$ Particulate

	PM_{10} Cut (µm)	Pass or Fail? (9 <> 11)	$PM_{2.5}$ Cut (µm)	Pass or Fail? (2.25 <> 2.75)
Test 1	10.40	**Pass**	2.384	**Pass**
Test 2	10.34	**Pass**	2.378	**Pass**
Test 3	10.51	**Pass**	2.447	**Pass**

Stack details

Shape:	Circular
Stack orientation:	Vertical
No of sampling traverses:	1
Angle of gas flow:	10.0000

Sampling point

Approximate diamaters upstream:	8
Approximate diamaters downstream:	8